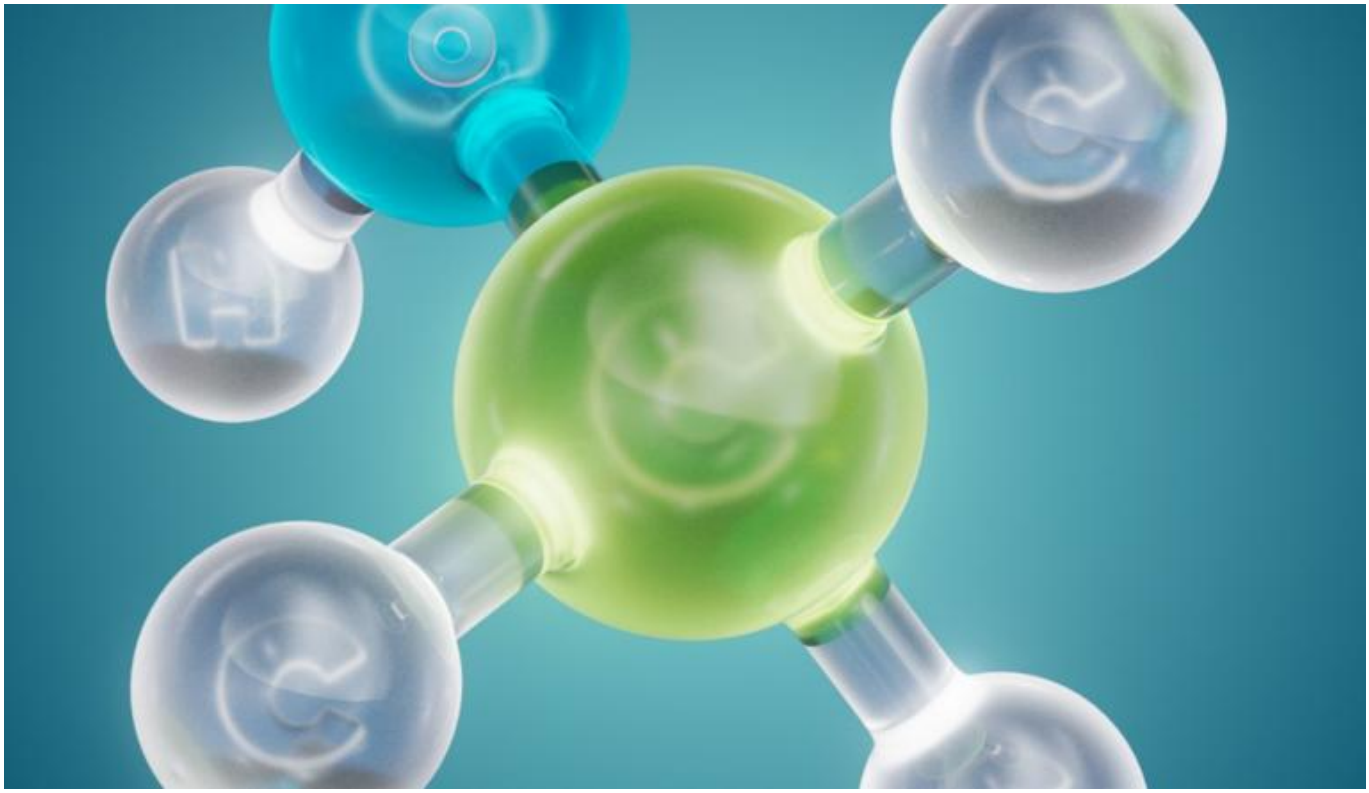

Transition Industries LLC

Mexinol Project, Mexico

Environmental and social impact assessment report

P81276

September 2025

SEPTEMBER 2025

Confidential

RSK GENERAL NOTES

Project No.: P81276-04

Title: Mexinol Project, Mexico – Environmental and Social Impact Assessment Report

Client: Transition Industries LLC

Date: Revised September 25, 2025

Office: Helsby

Status: Final

Author	Various	**Technical reviewer**	[redacted]
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This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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GLOSSARY OF ACRONYMS AND KEY TERMS

Term	Definition
A	
AIS	alien invasive species
ALARP	as low as reasonably practicable
AoI	area of influence: defined as the area likely to be affected by a development. A separation is made between the direct AoI where Project related impacts such as noise or habitat loss occur, and the indirect AoI where indirect or induced effects may occur such as in-migration of people in search of jobs.
AOO	area of observation
AQG	air quality guidelines
AQS	air quality standards
ASU	air separation unit
ATR	auto thermal reformer
B	
B+F	Bustamante + Freyre
BBS	behaviour based safety
BMP	biodiversity management plan
BOD	biological oxygen demand
BTEX	benzene, toluene, ethyl benzene, and xylenes
BWM	International Convention for the Control and Management of Ships' Ballast Water and Sediments
BoQ	bill of quantities
C	
CAPEX	capital expenditure
CAT	Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment
CCKP	climate change knowledge portal
CCRA	climate change risk assessment
CCTV	closed-circuit television
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CEMP	Construction Environmental Management Plan
CENACE	National Centre for Energy Control
CFE	Federal Electricity Commission (Comisión Federal de Electricidad)

Term	Definition
CH	critical habitat
CHA	critical habitat assessment
CHMP	cultural heritage management plan
CIA	cumulative impact assessment
CITES	Convention on International Trade in Dangerous Species of Wild Fauna and Wild Flora
CLOs	Community Liaison Officers
CMIP6	Coupled Intercomparison Project Phase 6
CML	cold methanol loop
CMP	conservation management plan
CO	carbon monoxide
COD	chemical oxygen demand
CO_2	carbon dioxide
CODESIN	Council for the Economic Development of Sinaloa *(Consejo para el Desarrollo Económico de Sinaloa)*
CONAGUA	Water Comission *(Comisión Nacional del Agua)*
CONALEP	National College of Professional Technical Education *(Colegio Nacional de Educación Professional Técnica)*
CONAP	National comission of natural protected areas *(Comisión Nacional de Áreas Naturales Protegidas)*
CR	Critically Endangered (IUCN Red List species threat level category)
CRC	Convention on the Rights of the Child
CRE	Regulatory Energy Commission *(Comisión Reguladora de Energía)*
D	
DAS	detection acoustic sense
Dou	ultimate oxygen demand
DCS	distributed control system
DDP	daily dialogue on prevention
DEFRA	Department for Environment, Food and Rural Affairs *(..)*
DGIRA	General Directorate of Environmental Impact and Risk *(Direción General de Impacto y Riesgo)*
DMP	Dust Management Plan
DOPP	Dropped Object Protection Plan
DOR	development opportunity ranking
E	
EAAA	ecologically appropriate area of analysis
EAP	emergency action plan
EBRD	The European Bank for Reconstruction and Development

Term	Definition
EDI	electrode ionization
EHS	environmental, health, and safety
EIA	environmental impact assessment
Jadamarie	a member of a communal land ownership scheme known as *ejido*
Ejido	an area of communal land used for agriculture in which community members have usufruct rights rather than ownership rights to land, which in Mexico is held by the Mexican state
EN	Endangered (ICUN Red List species threat level category)
ENOE	Nacional Ocupación and Emplomen Surrey (Encuesta Nacional de Ocupación y Empleo)
EOO	extent of occurrence
EOR	end-of-run
EP4	Equator Principles IV
EPC	engineering, procurement and construction
EPFI	Equator Principles financial institution
EPUK	Environmental Protection UK
EPRP	emergency preparedness and response plan
E&S	environmental and social
ES	ecosystem services
ESD	emergency shutdown system
ESIA	environmental and social impact assessment
ESMMP	environmental and social management and monitoring plan
ESMP	environmental and social management plan
ESMS	environmental and social management system
EU	European Union
F	
FDI	foreign direct investment
FGD	focus group discussion
FID	financing investment decision
FPIC	free, prior, and informed consent
G	
GBVH	gender based violence and harassment
GDP	gross domestic product
GHG	greenhouse gas
GIIP	good international industry practice
GIS	geographic information system
GPH	good practice handbook
GPO	Western Gas and Petrochemicals *(Gas y Petroquímica de Occidente)*

Term	Definition
GRM	Grievance Redress Mechanism
GWP	global warming potential
H	
HAZID	hazard identification
HAZCOM	hazard communication
HDD	horizontal directional drilling
HDPE	high-density polyethylene
HGV	heavy goods vehicle
HRI	heat-related illness
HSE	Health and Safety Executive
HSSE&SP	health and safety, security, environment and social performance
H_2S	hydrogen sulphide
H_2	hydrogen
H&S	health and safety
I	
IAQM	Institute of Air Quality Management
IBA	Important Bird and Biodiversity Area
IBM	inspection based maintenance
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, Social and Cultural Rights
ICMW	International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families
ICP	informed consultation and participation
IEMA	Institute of Environmental Management and Assessment
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
IFI	International Finance Institution
ILO	International Labour Organisation
IMPLAN	Municipal Planning Instituto of Ahome *(Instituto Municipal de Planeación de Ahome)*
IMSS	Mexicana Social Security Instituto *(Instituto Mexicano de Seguro Social)*
INAH	National Institute on Anthropology and History
INECC	Mexico's Ecology and Climate Change Institute
INEGI	National Institute of Statistics and Geography *(Instituto Nacional de Statistical y Geografia)*
INPI	National Institute of Indigenous Peoples *(Instituto Nacional de los Pueblos Indigenas)*
IPCC	Intergovernmental Panel on Climate Change

Term	Definition
IPCC AR6	Intergovernmental Panel on Climate Change Sixth Assessment Report
IPP	Indigenous Peoples Plan
ISO	International Organisation for Standardisation
ISSSTE	Institute for Social Security and Social Services of the workers of the States*(Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado)*
IUCN	International Union for Conservation of Nature
J	
JAPAMA	Council for Drinking Water and Drainage
JPDA	Joint Project Development Agreement
K	
KPI	key performance indicator
L	
LC	Least Concern (ICUN Red List species threat level category)
LCA	landscape character area
LDAR	leak detection and repair
LGBTQ+	Lesbian, Gay, Bisexual, Transgender, Queer (or Questioning), and others
LRP	Livelihood Restoration Plan
LNG	liquefied natural gas
LOC	loss of containment
LVOC	large volume petroleum-based organic chemicals
M	
MARPOL	International Convention for the Prevention of Pollution from Ships
MIA	environmental impact assessment report *(Manifestación de Impacto Ambiental)*
MP	Mexinol Plant
MXN	Mexican Peso
N	
NAAQS	National Ambient Air Quality Standard
NCC	national climate commitments
NDC	nationally determined contributions
NDP	National Development Plan
NDT	non-destructive testing
NGO	non-government organisation
NOM	Official Mexican Standards *(Normas Oficiales Mexicanas)*
NO_2	nitrogen dioxide
NOx	nitrogen oxides
NSR	noise sensitive receptor

Term	Definition
NT	Near-threatened (ICUN Red List species threat level category)
NTS	Non-technical Summary
O	
OECD	Organisation for Economic Co-operation and Development
OSHA	Occupational Safety and Health Administration (US Department of Labor)
O&M	operation and maintenance
OHS	occupational, health and safety
O_3	ozone
OPEX	operational expenditure
P	
PACs	project affected communities
PCS	pre-construction survey
PEM	Proton Exchange Membrane
PEMEX	Mexican Petroleum *(Petróleos Mexicano's)*
PIG	pipeline inspection gauge
PLC	Programmable Logic Controllers
PM	particulate matter
PM_{10}	particulate matter of size fraction approximating to <10µm diameter
$PM_{2.5}$	particulate matter of size fraction approximating to <2.5µm diameter
POX	partial oxidation
PPA	power purchase agreement
PPE	personal protective equipment
PSA	Pressure Swing Adsorption
PSMP	Project Security Management Plan
PTW	permit to work
PWMP	Project Waste Management Plan
Q	
QA/QC	quality control and quality assurance
QRA	Quantitative Risk Assessment
R	
RAM	risk assessment matrix
RAP	Resettlement Action Plan
RCP	Representative Concentration Pathway
RES	Regional Environmental System
RHP	Priority Hydrological Region
RO	reverse osmosis

Term	Definition
RoW	right-of-way
RSK	RSK Environment Ltd
RTP-22	Topolobampo-Caimanero Marshes
S	
SCC	security control centre
SCFI	Ministry of Commerce and Industrial Promotion (*Secretariat de Comercio y Fomento Industrial*)
SCI	source of cumulative impacts
SCT	Ministry of Communications and Transportation (*Secretariat de Comunicaciones y Transports*)
SEDE	Ministry of Energy (*Secretariat de Energía*)
SEMAR	Ministry of Navy
SEMARNAT	Ministro of Envaronen and Natural Rezurces (***Se**cretaría del **M**edio **A**mbiente y **R**ecursos **Nat**urales*)
SEP	stakeholder engagement plan
SIMOPS	simultaneous operations
SLIP	Supplementary Lenders Information Package
SLR	SLR Consulting Limited
SMR	Steam Methane Reforming
SOR	start-of-run
SO_2	sulphur dioxide
SRA	security risk assessment
SSA	Ministry of Health *(Secretariat de Salud)*
SSP	Shared Socioeconomic Pathway
STPS	Mexican Ministry of Labour and Social Welfare *(Secretariat del Trabajo y Prevision Social)*
SUMMA	Municipal Emergency and Medical Cervices of Ahome *(Servicios de Urgencias Médicas Municipales de Ahome)*
T	
TCFD	Task Force on Climate-Related Financial Disclosure
TCLP	Toxicity Characteristic Leaching Procedure
TTT	Topolobampo Transoceanic Terminal
Transition Industries	Transition Industries LLC
U	
UAIM	Autonomous Indigenous University of Mexico *(Universidad Autónoma Indígena de México)*
UDHR	Universal Declaration of Human Rights
UK	United Kingdom
UN	United Nations

Term	Definition
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNGPs	United Nations Guiding Principles on Business and Human Rights
USA	United States of America
USD	United States Dollar
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
V	
VEC	valued environmental and social component
VOCs	volatile organic compounds
VPSHR	Voluntary Principles on Security and Human Rights
VRU	vapour recovery unit
W	
WBG	World Bank Group
WHO	World Health Organisation
WRB	World Reference Base
WRI	World Resources Institute
WTP	water treatment process
WWTP	wastewater treatment plant
Unit	**Definition**
°C	degree Celsius
dB	decibel
dBA	A-weighted decibel
GWh	Gigawatt-hour
ha	hectare
kg	kilogram
km	kilometre
km/h	kilometres per hour
kV	kilovolt
kVA	kilo volt amperes
Laeeq	A-weighted, equivalent continuous sound level (in decibels)
Laeeq, T	A-weighted Lea, measured over a specified period of time (T) (in decibels)
m	metre
m^2	square metre
m^3	cubic metre

Term	Definition
mogul	metres below ground level
mm	millimetres
mm/yr	millimetres per year
MT	metric tons
mated	metric tons per day
MWh	Megawatt-hr
ppm	parts per million
%	percentage
>	greater than
<	less than
”	inch
µg/m^3	micrograms per cubic metre
tCO_2e	tonnes of CO_2 equivalent

1 INTRODUCTION

1.1 Background

Transition Industries LLC (Transition Industries) - the Project's proponent based in Houston, Texas, is a developer of methanol and hydrogen projects in North America to address climate change and promote environmental and social (E&S) sustainability.

Transition Industries is developing a 6,130 metric tons per day (mtpd) methanol production unit in the municipality of Ahome, northern Sinaloa, Mexico. Pacifico Mexinol ("Mexinol" or "the Project") is a subsidiary of Transition Industries. The Project will utilise AdWinMethanolZero® Technology, which supports the Project's objective of achieving the lowest lifecycle greenhouse gas emissions intensity, targeting less than 0.2 tonnes of CO_2e per tonne of methanol produced – significantly lower than the industry average based on cradle-to-gate assessments in accordance with ISO 14040/44 standards on lifecycle analysis. The final product from the production plant, methanol, will be transferred through a dedicated pipeline to an existing jetty in the Port of Topolobampo for export, with an estimated throughput of 2.24 million tons/year.

The Mexican-legislated environmental impact assessment (EIA) process for the Project began with the development of the 'environmental impact statement (*Manifestación de Impacto Ambiental-MIA* in Spanish which is the equivalent of an environmental and social impact assessment - ESIA), which was submitted to the Secretariat of Environment and Natural Resources (SEMARNAT) on 19 August 2021. Additional clarifications were sought by the General Directorate of Environmental Impact and Risk (DGIRA in Spanish), the directorate in SEMARNAT that oversees the ESIA process. Mexinol submitted the additional information in the MIA Addendum of May 26th, 2022. The MIA was made publicly available for feedback in SEMARNAT's ecological gazette (*gazeta ecologica*) from July 7th to August 4th, 2022. The ESIA was approved on November 8th, 2023, through the issuance of an environmental permit (permit number: SRA/DGIRA/DG-04243-23) from SEMARNAT Section 2.3 provides additional information about permits and licenses relevant to the Project.

In mid-2021, an international sustainability firm, SLR Consulting Limited (SLR) was commissioned by Transition Industries to develop a supplemental lenders information package (SLIP) to complement the MIA (SLR, 2022) for the purpose of assessing the Project E&S aspects in line with good international industry practice (GIIP), specifically the KfW- IPEX GmBH[1] Bank Guidelines for environmentally and socially sound financing. The SLIP was prepared based on a review of existing data and a six-day site visit by SLR specialists. The SLIP comprises nine volumes which include an environmental and social impact assessment (ESIA), critical habitat assessment (CHA), climate change risk assessment (CCRA), stakeholder engagement plan (SEP) and a cumulative impact assessment (CIA).

On December 7, 2023, Transition Industries signed a Joint Project Development Agreement (JPDA) with the International Finance Corporation (IFC), a member of the World Bank Group, to assess and monitor throughout the project lifecycle Mexinol's compliance with the IFC Performance Standards on Environmental and Social Sustainability (IFC PS) and leverage IFC expertise to support the Project financing.

[1] *Gesellshaft mit Beschrankter Haftung (company with limite liability)*

This ESIA report has been developed to provide an updated assessment of the E&S impacts, mitigations and management plans for the Project in compliance with GIIP as described in Section 2, including the Equator Principles 4 (2020) and the IFC PS.[2]

A 43 km power transmission line will be constructed to support the Project. As an associated facility[3] for the Project, it falls outside the scope of this ESIA, as such a preliminary impact assessment exercise has been conducted based on the most recent route alignment and available information. The result of this initial analysis is presented in Chapter 10. A separate IFC-aligned ESIA process will start later in 2025 once the transmission line's route, design and engineering are finalised and key financing milestones reached.

1.2 Project rationale

With an anticipated 30-year operational period, the methanol production plant is expected to be the largest single ultra-low carbon chemicals facility in the world, producing approximately 300,000 metric tons (MT) of green methanol from captured carbon and green hydrogen and 1.8 million MT of blue methanol per year from natural gas using AdWinMethanolZero® carbon capture technology (IFC, 2023).

Methanol is a highly sought-after chemical because of its wide-ranging applications. For example, it can be used as a solvent, antifreeze, and additive, and is also used in the manufacture of many products such as synthetic fuels (Dilge, 2023).

Methanol is primarily produced using natural gas and coal, which leads to the emission of greenhouse gases (GHG). However, with the use of AdWinMethanolZero® technology and green hydrogen, the facility is expected to have net zero GHG emissions.

Additionally, the Project is expected to reduce natural gas flaring, utilise treated wastewater, diversify Mexico's chemicals capacity, increase exports, and generate employment opportunities (IFC, 2023).

1.3 ESIA consultant

RSK Environment Limited (RSK), a subsidiary of RSK Group, has been appointed by Transition Industries to prepare this ESIA report.

RSK is working with its chosen in-country partner, Bustamante + Freyre (B+F) to complete the ESIA study. B+F form over 80 professionals with over 15 years of experience in environmental, energy and social issues and working to IFC standards. They have offices located in Mexico City, Cancun, Guadalajara, Los Cabos, Mérida, Monterrey, Reynosa, and Veracruz. They have conducted over 70 social impact assessments and over 400 environmental impact and risk authorisations in line with IFC PSs. B+F have expert in-country knowledge of the status of environmental, social and socio-economic features which could be affected by the proposed

[2] This updated ESIA is required under the JPDA and incorporates relevant information from the MIA. However, it should not be considered a replacement for the MIA, as the MIA is a mandatory process under Mexican law. Although this ESIA does not replace the MIA as the official local permitting document, it is a standalone document that can be read independently, as it consolidates all pertinent information where applicable.

[3] Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable as per paragraph 8 of IFC Performance Standard 1.

Project. Neither RSK nor B+F has any commercial interests or other interest in the Project's outcomes.

1.4 Scoping stage

RSK was commissioned by Transition Industries and IFC to conduct an ESIA scoping study prior to undertaking the ESIA study. The objectives of the scoping study were to:

- identify and prioritise issues of importance for the ESIA
- define the approach for the rest of the ESIA process and the terms of reference
- identify any practical challenges for the ESIA in terms of data availability and meeting Mexican and international standards, and to propose solutions for addressing these, and
- define the approach for stakeholder engagement to ensure stakeholders understand how they will be affected, could express their opinions and that their concerns are reflected in the ESIA.

Given that the Project had already received the MIA permit from SEMARNAT at the scoping stage, the presentation of the scoping report to this institution was not required. The ESIA Scoping Report was submitted to Transition Industries and IFC for review in April 2024. Following their feedback, it was agreed that - subject to the incorporation of comments received - the proposed approach to the scoping process was acceptable, enabling the study to progress to the ESIA stage.

The scoping report found additional desk-based and primary data needed to complete a comprehensive baseline for the ESIA along with a plan to collect this information - beyond what is required for the regulatory process and MIA permitting. It also helped identify potentially significant impacts that are the primary focus of this ESIA.

Based on the results of the E&S scoping analysis, it was concluded that the circumstances requiring free, prior and informed consent (FPIC) are not present for the Project's components covering this ESIA (which excludes the transmission line), as no adverse impacts on Indigenous Peoples (IP) are anticipated as part of this project. Specifically, the Project will not: affect lands or natural resources under traditional ownership or customary use; result in the relocation of Indigenous People from such lands or resources; or cause significant impacts on critical cultural heritage or involve proposed commercial use of cultural heritage.

In accordance with IFC PS 1, an informed consultation and participation (ICP) process for the current project is being conducted with affected communities, this is detailed in chapter 6 as well as in the Stakeholder Engagement Plan (SEP) found in Appendix 2.

As mentioned previously, the Transmission Line (TL) of 43 km is considered as an Associated Facility to the current Project and as such will have its own ESIA process. Chapter 10 includes a preliminary E&S risk screening assessment of the TL and outlines the structure of an IPF. As noted in this chapter, the triggering of IFC PS7 on Indigenous Peoples, need for an Indigenous Peoples Plan and the applicability of FPIC will be determined during the scoping phase of the TL-specific ESIA. An IPP may be needed, should adverse impacts on IPs be anticipated and this irrespective of whether or not a formal FPIC process is needed. Applicability of FPIC will be determined at the scoping stage of the TL-ESIA.

At this stage, micro-adjustments to the TL route are still ongoing, and there is not yet sufficient information on the socio-economic context and the presence or collective attachment of IPs within the TL's area of influence. A full baseline assessment will be conducted as part of the future ESIA

process for the TL, at which point the necessity of an IPP—and whether FPIC requirements under PS 7 are triggered—will be determined based on more comprehensive and culturally appropriate engagement and data.

Land Acquisition and Indigenous Peoples were studied in more detail in the ESIA process and are covered in the following sections.

- *Section 5. 4.3.15 Land use, land ownership and land impacts baseline*
- *Section 8.3.5 Land ownership and livelihoods impact assessment*
- *Section 5. 4.3.21 Indigenous Peoples baseline*
- *Section 8.3.1.1 Indigenous Peoples (Crosscutting issues) impact assessment*

Based on the analysis presented in these sections, it was determined that the Project does not require the preparation of a Resettlement Action Plan (RAP) or a Livelihood Restoration Plan (LRP) as no physical or economic displacement – as defined under PS5- occurred or during the previous land acquisition which was carried out through a willing buyer -willing seller process, nor is such displacement expected in the future. This conclusion applies to both permanent and temporary impacts of the Project, with no displacement expected even in relation to temporary impacts. More details behind this rationale identified in the scoping stage and confirmed in the ESIA stage are provided in Table 1.1 and Table 1.2 below. Furthermore, Table 5.55a in Section 5.4.3.15 provides a summary of IFC PS5 criteria and associated assessment details (e.g., mapping, interviews, baseline conditions) that were utilised to further validate the lack of physical and economic displacement.

However, potential risks and impacts related to land ownership, livelihoods and resettlement associated with the Project's associated facility (the transmission line) are addressed separately in Chapter 10. The need for a RAP and a LRP for the transmission line along with the applicability of an IPP and the FPIC process will be assessed during the scoping phase of the dedicated ESIA for the TL.

Table 1.1: RAP/LRP Scoping Table for the Project (excluding the transmission line)

Criteria	Determination	Project Justification
Are physical and/or economic displacement expected to result from land rights/land use rights bought through **expropriation** or other compulsory procedures?	<u>If yes:</u> RAP/LRP is needed. <u>If no:</u> No RAP/LRP is required.	NO. All land acquisition transaction transactions were conducted under the **"willing seller" and "willing buyer" premise**, and the compensation processes for all project's components, except the JAPAMA pipeline, have concluded successfully with no ongoing grievances. **<u>At this project stage</u>**, the land acquisition process for the Council for Drinking Water and Drainage (JAPAMA) raw and reject water transfer pipeline has not been completed. The Project is committed to following the same **"willing seller" and "willing buyer" premise** followed for previous ejido land acquisitions, and paying at or above market price (plus transaction costs), when purchasing this land. **<u>To date for the JAPAMA pipeline,</u>** there are **no cases of economic displacement,** as the land bought for the Project did **not** equate to the temporary or permanent loss of assets, land, or access to assets/land that results in the **loss of income or livelihood**. No assets or structures, or investments on Ejidal land will be affected as the lands are **fallow, dryland areas** of limited agricultural value. **<u>To date for the JAPAMAP pipeline,</u>** there are **no cases of physical displacement**. ***Note:*** *In the event that land acquisition for the pipeline results in physical or economic displacement* ***permanent and/or temporary****, the Project will prepare a RAP and/or a Livelihood LRP in accordance with IFC PS 5.*
Are physical and/or economic displacement expected to result from land rights/land use rights bought through **negotiated**	<u>If yes:</u> RAP/LRP is needed. <u>If no:</u> No RAP/LRP is needed.	NO. **No expropriation** has taken place since expropriation is not a legally available option to project. To date, all bought private or Ejidal lands have been compensated via direct payments and agreements with **willing-to-sell landowners**. The Project paid **above market rate** for the land considering replacement value.

Criteria	Determination	Project Justification
settlements with property owners or those with legal rights to the land if **failure to reach a settlement** would have resulted in **expropriation ?**		**When failure to reach a settlement happened, the project design was altered rather than looking to use expropriation.** The JAPAMA raw and reject water transfer pipeline would be **rerouted should any landowner decide they do not wish to sell.**
Are there **involuntary restrictions on land use and/or access rights to natural resources** of a community or groups that have **traditional or recognisable usage rights?**	<u>If yes:</u> RAP/LRP is needed. <u>If no:</u> No RAP/LRP is needed.	NO. The land bought for the Project (including the methanol and JAPAMA pipelines) is **not** identified as **owned or under customary use by of Indigenous Peoples**[4] and does not have **resources** known to be of importance to the identity of **Indigenous Peoples, or any other groups.**
Are there any planned **evictions** of people occupying land **without** formal, traditional, or recognisable usage rights?	<u>If yes:</u> RAP/LRP is needed. <u>If no:</u> No RAP/LRP is needed.	NO. There are **no planned evictions.** To date, all land bought by the Project was held by **recognised landowners**. There were no land occupants without formal, traditional, or recognisable usage rights.

[4] The term Indigenous People here is refer as the definition presented in PS7 and refer to a distinct social and cultural group possessing the following characteristics in varying degrees: i) Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; ii) Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; iii) Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or iv) distinct language or dialect, often different from the official language or languages of the country or region in which they reside.

Criteria	Determination	Project Justification
Is access to land or use of **communal property and natural resources** restricted?	<u>If yes:</u> RAP/LRP is needed. <u>If no:</u> No RAP/LRP is needed.	NO. Access to land or use of communal property and natural resources **will not be restricted.** The land bought for the project plant footprint was **not** under **communal property**. It was a private property owned by a project partner. When it comes to the methanol and JAPAMA pipelines, **no communal property or natural resources** will be affected as the lands were **fallow, dryland areas** of limited agricultural value.

Table 1.2: IPP Scoping Table for the Project (excluding the transmission line)

Criteria	Determination	Project Justification
Are Indigenous Peoples (as defined by national laws and regulations, the IFC Performance Standards and/or for those who have self-identified under international protections) found in the project study area?	<u>If yes:</u> *Proceed to #2.* <u>If no:</u> No IPP is needed.	YES. While there are no indigenous communities or titled/asserted indigenous lands found within the Direct AoI, there are indigenous communities within the Indirect AoI – including across the Bay of Ohuira.
Is the project expected to result in potential adverse economic, social, cultural (including cultural heritage) and environmental impacts to Indigenous Peoples?	<u>If yes:</u> IPP is needed. <u>If no:</u> No IPP is needed.	NO. No economic, social, cultural (including cultural heritage) or environmental impacts on IPs are expected.

1.5 Report objectives

The goals of this ESIA report are to:

- Describe the Project infrastructure and activities including the methanol production plant, related facilities (such as water treatment, electrolysers, pipelines) and associated facilities (e.g. transmission line) in sufficient detail to support environmental and social risk assessment
- Quantify expected resource use and environmental outputs including consumption of water and energy, emissions to air, discharges to land and water and wastes (hazardous and non-hazardous)

- Analyse feasible alternatives including location, design, technology, and operational options, in accordance with good international industry practice, with a focus on avoiding or minimizing adverse environmental and social impacts
- Establish and update the E&S baseline conditions for the Project's primary and secondary AoIs covering the full Project footprint and associated facilities. This includes a justified delineation of the AOIs and a clear rationale for inclusion or exclusion of Project affected communities (PACs).
- Ensure meaningful, inclusive, and ongoing stakeholder engagement by identifying and engaging PACs, other relevant stakeholders and vulnerable groups throughout the ESIA process. This includes:
    - Ensuring stakeholder engagement is culturally appropriate, gender inclusive, accessible, and tailored to the needs of disadvantaged or vulnerable individuals or groups.
    - Facilitating timely disclosure of relevant project information in an understandable format.
    - Documenting stakeholder concerns and demonstrating how their views and inputs have been considered in project design, impact mitigation, and environmental and social management plans, consistent with IFC PS1 requirements on stakeholder engagement.
- Identify and assess potential E&S risks and impacts including direct; indirect; permanent; temporary; permanent, cumulative; and residual; impacts on disadvantaged or vulnerable groups, across all phases of the Project (construction, commissioning, operation, and decommissioning).
- Recommend mitigation measures and management plans in accordance with the PS 1 mitigation hierarchy (anticipate and avoid or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities and the environment) aiming to reduce residual impacts to a level that is As Low As Reasonably Practicable (ALARP) and propose monitoring programs to ensure effectiveness.
- Conduct quantitative risk assessments (QRA) for the methanol pipeline and any on-site storages of hazardous materials (including toxic or explosive substances) and perform Occupational Health and Safety hazard analyses where applicable.
- Demonstrate compliance with IFC Performance Standards particularly PS 1 on Assessment and Management of Environmental and Social Risks and Impacts to support project financing by IFC and other International Financial Institutions (IFIs), and obtain ESIA approval from Transition Industries, IFC, and other potential lenders.

1.6 Report structure

Table 1.3 outlines the ESIA report structure

Table 1.3: ESIA report structure

ESIA structure	Content
Executive summary	Presents the non-technical summary of the ESIA

ESIA structure	Content
Chapter 1: Introduction	Introduces the background, rationale, and objective of this ESIA report
Chapter 2: Regulatory Framework	Provides an overview of the applicable legislation, standards and guidelines governing Transition Industries' operations
Chapter 3: Project Description	Provides an overview of the Project location and site description, Project phases (construction and commissioning, operation, and decommissioning), utilities, resource consumption, transport, workforce, security, Project schedule, emissions, waste, and other environmental issues, and associated facilities
Chapter 4: Project Alternatives	Provides an analysis of the technical alternatives considered for the Project, and the reasons for selecting the chosen options
Chapter 5: Environmental and Social Baseline Conditions	Defines the geographical area that may be affected by the Project's activities (within the AoIs), and presents the physical, biological, and socioeconomic baseline prevailing in the Project AoI at the time of writing, including the findings of primary fieldwork undertaken to fill data gaps
Chapter 6: Stakeholder Engagement	Details the planned engagement activities to be undertaken with stakeholders and highlights key stakeholder discussion points that have arisen during the preparation of this ESIA. Includes details about the ESIA public consultation and disclosure process
Chapter 7: ESIA Methodology	Presents the scope and method for assessing potential E&S impacts, from planned activities and unplanned events
Chapter 8: Impact Assessment	Provides the identification and assessment of E&S impacts of the Project before and after the application of mitigation measures
Chapter 9: Climate Change Risk and Greenhouse Gas Assessment	Provides an update of the existing climate change risk assessment including alignment with nationally determined contributions (NDCs), double materiality assessment and specific adaptation measures embedded into the E&S management plan. Additionally, a greenhouse gas (GHG) assessment has been undertaken to address emissions sources not previously found or quantified
Chapter 10: Cumulative Impact Assessment	Presents the potential cumulative impacts between the Project and ongoing and future activities associated with third-party projects, businesses, and organisations within the AoI of the Project
Chapter 11: Environmental and Social Management Framework (ESMF)	Provides an overview of the Project-specific plans that will be developed by Transition Industries and their contractor(s) to ease implementation, tracking, and reporting of the mitigation and monitoring measures found in this ESIA report
Chapter 11: References	Lists the references used in preparation of the ESIA report
Appendices	1. Biodiversity Management Plan (BMP) 2. SEP 3. Indigenous Peoples Planning Framework 4. Supplemental Land Document

2 REGULATORY FRAMEWORK

The proposed Project will be carried out following the E&S requirements of:

- legislative requirements of Mexico and Official Mexican Standards
- applicable international/regional conventions, protocols, and agreements
- IFC Performance Standards
- World Bank Group/IFC Environmental, Health, and Safety Guidelines:
    - General EHS Guidelines, dated 2007
    - Natural Gas Processing, dated 2007
    - Large Volume Petroleum-based Organic Chemicals Manufacturing (methanol only), dated 2007
- Equator Principles IV (EP4)
- international good industry practice (GIIP).

2.1 Relevant national legislation and applicable standards

This section presents a summary of national legislation, regulations and standards relevant to the Project, provided in Table 2.1.

Table 2.1: Relevant legislation and standards

Topic	Law/Regulation/Standard	Purpose
National Law/Regulation		
EIA	Political Constitution of the United Mexican States *(Constitución Política de los Estados Unidos Mexicanos)*	This Constitution is an expression of the Mexican People's will to create a democratic, social, secular nation organised as a republic and in accordance with the principles of sovereignty, freedom, justice, equality, fairness, dignity, and legal certainty. This Constitution requires developers to conduct an EIA prior to beginning construction to determine environmental impacts and mitigations.
	Regulations of the General Law on Ecological Equilibrium and Environment Protection on Environmental impact *(Ley General del Equilibrio Ecológico y la Protección al Ambiente y su reglamento en Materia de Evaluación de Impacto Ambiental)*	Regulates the General Law of Ecological Equilibrium and Environment Protection in terms of environmental impact assessment at a federal level.
Environment	General Law on Ecological Equilibrium and Environment Protection *(Ley General del Equilibrio Ecológico y la Protección al Ambiente y su Reglamento)*	Regulates the provisions of the Political Constitution of the United Mexican States that refer to the preservation and restoration of the ecological balance as well as the protection of the environment.
	Regulations of the General Law of Ecological Equilibrium and Environmental Protection in matters of Protected Natural Areas *(Ley General de Equilibrio Ecológico y Protección al Ambiente en Materia de Areas Naturales Protegidas*	Aims to regulate the General Law of Ecological Equilibrium and Environmental Protection about the establishment, administration, and management of protected natural areas under the competence of the federation.
	General Law of Sustainable Forest Development and its Regulations *(Ley General de Desarrollo Forestal Sustentable y su Reglamento)*	Regulates and promotes the sustainable management of forest territories; conservation; protection; restoration; production; management; cultivation; and exploitation of Mexico's forest ecosystems and its resources.

Topic	Law/Regulation/Standard	Purpose
	Federal Environmentalnmental Liability Act *(Ley Federal de Responsabilidad Ambiental)*	Regulates environmental liability arising from damages caused to the environment, as well as the reparation and compensation of such damages when needed through the federal judicial process.
	Law on the promotion and development of bioenergetics *(Ley de Promoción y Desarrollo de los Bioenergéticosos)*	Aims to promote the development of bioenergetics to contribute to energy diversification and sustainable development as conditions that guarantee support to the Mexican countryside.
Air quality	Regulations of the General Law on Ecological and Environment Protection on the Prevention and Control of the Atmosphere *(Ley General del Equilibrio Ecológico y la Protección al Ambiente y su Reglamento en materia de prevención y control de la contaminación de la atmósfera)*	Regulations related to the prevention and control of atmospheric pollution. It includes provisions to monitor and regulate emissions and the transfer of pollutants. The developer must comply with the largest permissible limit of emissions, as set up in the applicable environmental regulation, as well as to monitor emissions (i.e., an emissions inventory) through a monitoring programme. The Project's Annual Operating Certificate is presented annually.
Waste	General Law for the Prevention and Comprehensive Management of Waste *(Ley General para la Prevención y Gestión Integral de los Residuos y su Reglamento)*	Provides regulation of the provisions of the Political Constitution of the United Mexican States that refer to the protection of the environment in terms of prevention and comprehensive waste management, in the national territory.
	Regulations of the General Law for the Prevention and Comprehensive Management of Waste *(Ley General para la Prevención y Gestión Integral de los Residuos y su reglamento)*	Regulates the General Law for the Prevention and Comprehensive Management of Waste and governs throughout the national territory and areas where the nation exercises its authority. Includes provisions that set up the right for a healthy, robust environment; promoting sustainable development through waste management (hazardous waste, municipal solid waste, and specially managed waste).
Water	National Water Law and its Regulations *(Ley de Aguas Nacionales y su Reglamento)*	Regulates the exploitation or use of water, its distribution and control, as well as the preservation of quantity and quality to achieve sustainable development. This

Topic	Law/Regulation/Standard	Purpose
		law applies to all national waters, including surface and subsoil water resources.
Security	Federal Law for the Control of Chemical Substances Susceptible to Diversion for the Manufacture of Chemical Weapons *(Ley Federal Para el Control de Sustancias Químicas Susceptibles de Desvío Para la Fabricación de Armas Químicas)*	Applicability of this law will depend on the CAS amount of methanol.
Climate / GHG	General Law on Climate Change *(Ley General del Cambio Climático (LGCC))*	Establishes provisions to address the adverse effects of climate change through the regulation of greenhouse gas (GHG) emissions, considering, were proper, the United Nations Framework Convention on Climate Change. The developer will report at least annually on direct and indirect GHG emissions.
	Regulations of the General Law on Climate Change regarding the National Emissions Registry *(Reglamento de la Ley General de Cambio Climático en Materia del Registro Nacional De Emisiones)*	Provides a general observance throughout the national territory, with the purpose to regulate the General Law on Climate Change regarding the National Emissions Registry.
	Energy Transition Law *(Ley de Transición Energética)*	Regulates the sustainable use of energy as well as the obligations in terms of clean energies and the reduction of polluting emissions from the electricity Industry, keeping the competitiveness of the productive sectors.
	Federal Law on Metrology and Standardisation and its Regulations *(Ley Federal Sobre Metrología y Normalización y su Reglamento)*	Governs standardisation, accreditation, conformity assessment, and metrology activities in Mexico.
Biodiversity	General Wildlife Law and its Regulations *(Ley General de Vida Silvestre y su reglamento)*	Relates to the conservation and sustainable use of wildlife and its habitat in the territory of the Mexican Republic and in the areas where the nation exercises its authority. The sustainable use of timber and non-timber forest resources, as well as aquatic species, is regulated by this forestry and

Topic	Law/Regulation/Standard	Purpose
		fisheries law (except for threatened and/or endangered species).
Social	Social Security Law and its Regulations *(Ley del Seguro Social y su Reglamento)*	Governs social security in Mexico. Requires all employers in Mexico to register their employees in the Mexican Social Security Institute.
	General Law of Human Settlements, Territorial Planning and Urban Development *(Ley General De Asentamientos Humanos, Ordenamiento Territorial Y Desarrollo Urbano)*	Establishes basic rules and management instruments to regulate land use and human settlements in Mexico.
Infrastructure	General Law of Human Settlements, Territorial Planning and Urban Development *(Ley General De Asentamientos Humanos, Ordenamiento Territorial Y Desarrollo Urbano)*	Establishes basic rules and management instruments to regulate land use and human settlements in Mexico.
Labour, occupational health and safety (OHS)	Federal Labour Law *(Ley Federal del Trabajo)*	Governs all aspects of the employer-employee relationships, including collective bargaining, the right to strike, minimum wage rates, work hours, compensation, and occupational health and safety.
Emergency response	General Civil Protection Law and its Regulations *(Ley General de Protección Civil y su Reglamento)*	Set of legal provisions, measures, and actions intended for disaster prevention, and the aid and recovery of the population in case of a disaster.
OHS	Federal Regulations on Safety and Health at Work, of November 13, 2014 *(Reglamento Federal de Seguridad y Salud en el Trabajo, del 13 de noviembre de 2014)*	Aims to set up the necessary measures to prevent accidents and diseases in addition to ensuring safe and healthy working conditions for workers.
Oficial Mexicana Standard (NOM) (Normas Oficiales Mexicanas)		
Biodiversity	NOM-022-SEMARNAT-2003	Establishes the specifications governing the preservation, conservation, and sustainable use in and restoration of coastal wetlands, including mangroves, to prevent their

Topic	Law/Regulation/Standard	Purpose
		deterioration, encouraging their conservation and, where appropriate, restoration.
	NOM-059-SEMARNAT-2010	Identifies the species or populations of native wild flora and fauna at risk in the Mexican Republic, through the integration of the corresponding lists, as well as to establish the criteria for inclusion, exclusion or change of risk category for the species or populations, through a method of assessing their risk of extinction and is mandatory throughout the National Territory.
Air quality	NOM-041-SEMARNAT-2015	Establishes the largest permissible limits for emissions of polluting gases from motor vehicles that use gasoline as fuel.
	NOM-043-SEMARNAT-1993	Establishes the maximum permissible levels of emissions into the atmosphere of solid particles from fixed sources.
	NOM-045-SEMARNAT-2017	Establishes the maximum permissible levels of smoke opacity from the exhaust of motor vehicles in service that use diesel as fuel.
	NOM-050-SEMARNAT-2018	Sets maximum permissible emission limits for hydrocarbons, carbon monoxide and nitrogen oxides; as well as the minimum and largest limit of the sum of carbon monoxide and dioxide and the Lambda Factor for vehicles in circulation that use liquefied petroleum gas, natural gas or other alternative fuels.
	NOM-085-SEMARNAT-1994	Establishes the maximum permissible emission levels of indirect heating combustion equipment and its management.
	NOM-085-SEMARNAT-2011	Aims to establish the maximum permissible emission levels of smoke, particulate matter, carbon monoxide (CO), sulphur dioxide (SO_2) and nitrogen oxides (NOx) from indirect heating combustion equipment using conventional fuels or their mixtures, to protect air quality.
	NOM-021-SSA1-1993	Sets the criteria to evaluate the quality of ambient air, with respect to CO.

Topic	Law/Regulation/Standard	Purpose
	NOM-020-SSA1-2014	Sets the criteria to evaluate the quality of ambient air, with respect to ozone.
	NOM-022-SSA1-2010	Sets the criteria to evaluate the quality of ambient air, with respect to SO_2.
	NOM-023-SSA1-1993	Sets the criteria to evaluate the quality of ambient air, with respect to nitrogen dioxide (NO_2).
	NOM-025-SSA1-2021	Sets the criteria to evaluate the quality of ambient air, with respect to suspended particles, PM_{10} and $PM_{2.5}$.
	NOM-026-SSA1-1993	Sets the criteria to evaluate the quality of ambient air, with respect to lead.
Energy use	NOM-001-SEDE	Responds to the regulation of the technical needs for the use of electrical energy in electrical installations throughout the country.
Water	NOM-001-SEMARNAT-1996	Establishes largest permissible limits of contamination by discharge of wastewater into national waters.
	NOM-002-SEMARNAT-1996	Establishes largest permissible limits of contaminants in the discharge of wastewater to urban or municipal sewage systems.
	NOM-003-SEMARNAT-1997	Establishes the largest permissible limits of contaminants for wastewater treated and reused in public services.
Hazardous materials management	NOM-007-SCT-2-2022	Its goal is to establish the characteristics and specifications to be met for construction (manufacture), UN marking and the tests to be carried out on packaging/packaging, intermediate bulk containers and large packaging intended for the transport of dangerous goods transiting the general means of communication of federal authority.
	NOM-001-SECRE-2010, Natural Gas Specifications	Establishes the specifications that shall be met by the natural gas handled in the transportation, storage, and distribution systems, to preserve the safety of people, the environment, and facilities.

Topic	Law/Regulation/Standard	Purpose
	NOM-018-STPS-2015	Harmonised system for the identification and communication of hazards and risks due to dangerous chemical substances in the workplace.
	NOM-014-CRE-2016	Establishes the quality specifications that petrochemicals must meet at each stage of the production and supply chain in national territory.
	NOM-052-SEMARNAT-2005	Establishes the characteristics, procedure for identification, classification and lists of hazardous waste.
Noise	NOM-080-SEMARNAT-1994	Establishes the largest permissible limits for noise emissions from the exhaust gases of motor vehicles, motorcycles, and motorised tricycles.
	NOM-081-SEMARNAT-1994	Establishes the largest permissible limits of noise emission generated by the operation stationary sources and the measurement method which their level emitted into the environment is decided.
Noise, OHS	NOM-011-STPS-2001	Establishes the requirements for health and safety conditions in the workplace related to noise.
Vibration, OHS	NOM-024-STPS-2001	Establishes the requirements for health and safety conditions in the workplace related to vibrations.
Hazardous waste	NOM-052-SEMARNAT-2005	Establishes the characteristics, procedure for identification, classification and lists of hazardous waste.
	NOM-053-SEMARNAT-1993	Establishes the procedure for carrying out “extraction tests” to determine the components of hazardous waste that are toxic to the environment.
	NOM-054-SEMARNAT-1993	Establishes the procedure to determine the incompatibility between two or more wastes considered dangerous by the Official Mexican Standard NOM-052-SEMARNAT-1993.
	NOM-161-SEMARNAT-2011	Establish the criteria for deciding the special handling wastes that will be subject to a waste management plan and the list thereof.
	NOM-001-ASEA-2019	Establishes the criteria for the classification of Special Management Waste of the hydrocarbon sector, to establish

Topic	Law/Regulation/Standard	Purpose
		the criteria for determining waste subject to management plan and the listing thereof, and to establish the elements for the formulation and management of waste management plans of the hydrocarbon sector.
Hazardous waste, OHS	NOM-005-STPS-1998	Establishes health and safety conditions and procedures to prevent risks to workers and avoid damage to the workplace due to the handling of dangerous chemical substances or their mixtures.
Standards	NOM-008-SCFI-2002	Establishes the definitions, symbols and writing rules of the units of the International System of Units and other units outside this System that the CGPM accepts, which together constitute the General System of Measurement Units, used in the different fields of science, technology, industry, education and commerce.
Emergency response, OHS	NOM-002-STPS-2010	Establishes requirements for fire prevention and protection in workplaces.
OHS	NOM-001-STPS-2008	Establishes the safety conditions of buildings, premises, facilities, and areas in work centres for their proper functioning and conservation, to prevent risks to workers.
	NOM-004-STPS-1999	Establishes safety conditions and protection systems and devices to prevent and protect workers against occupational risks generated by the operation and maintenance of machinery and equipment.
	NOM-006-STPS-2014	Establishes occupational health and safety conditions that must be met in workplaces to avoid risks to workers and damage to facilities due to material handling and storage activities, using machinery or manually.
	NOM-010-STPS-1999	Establishes health and safety conditions in the workplace where chemical substances capable of generating

Topic	Law/Regulation/Standard	Purpose
		contamination are handled, transported, processed, or stored
	NOM-010-STPS-2015	Establishes processes and measures to prevent health risks to personnel occupationally exposed to chemical contaminating agents in the work environment.
	NOM-015-STPS-2001	Establishes safety and hygiene conditions, the maximum permissible levels, and times of exposure to extreme thermal conditions, which due to their characteristics, type of activities, level, time and frequency of exposure, can alter the health of workers.
	NOM-017-STPS-2008	Establishes the smallest requirements for the employer to select, buy and provide its workers with the corresponding personal protective equipment to protect them from agents in the work environment that may harm their physical integrity and health.
	NOM-019-STPS-2011	Establishes the requirements for the constitution, integration, organisation and operation of safety and hygiene committees in workplaces.
	NOM-020-STPS-2011	Establishes safety requirements for the operation of pressure vessels, cryogenic vessels and steam generators or boilers in workplaces, to prevent risks to workers and damage to facilities.
	NOM-021-STPS-1994	Establishes the requirements and characteristics of reports of work risks that occur, so that labour authorities keep national statistics on them.
	NOM-030-STPS-2009	Establishes the functions and activities that preventive health and safety services at work must carry out to prevent accidents and work-related illnesses.

Topic	Law/Regulation/Standard	Purpose
	NOM-031-STPS-2011	Establishes the occupational health and safety conditions at construction sites, to prevent occupational risks to workers.

2.1.1 Impact assessment process

In Mexico, the Environmental Impact Statement Authorization (*Manifestation de Impacto Ambiental – MIA*) is the primary environmental permit required for infrastructure projects. This authorization is typically issued by the Federal Environmental Authority (SEMARNAT) through its General Directorate of Environmental Impact and Risk (DGIRA). The Project falls within the remit of Articles 28 and 30, section 5 of the General Law of Ecological Equilibrium and Environmental Protection.

This Project falls within the remit of Articles 28 and 30, in Section 5, of this law.

The following timeline outlines the key milestones and decision points in the EIA process for the Project, demonstrating full compliance by the Project's proponent with all applicable legal and regulatory requirements:

Submission and Public Disclosure:

26 May 2022

Initial submission of the MIA and ERA to DGIRA (a directorate within SEMARNAT) which was numbered 25SI2022I0020

27 May 2022

Publication of the Project summary in *El Debate*, a major daily newspaper in Sinaloa, in both print and digital formats.

9 June 2022

Submission of an addendum with additional information requested by DGIRA.

9 June 2022

The MIA was made publicly available at the Environmental Management Information Center in the Álvaro Obregón mayoral office and on SEMARNAT's website.

16 June 2022

DGIRA listed the Project (Mexinol) in the *Ecological Gazette* among projects under review.

Institutional Review and Technical Feedback:

21 June 2022

DGIRA formally requested technical opinions from key institutions:

- Municipality of Ahome – On land use compatibility per the Topolobampo Urban Development Master Plan 2009–2030.
- Undersecretariat of Sustainable Development of the State of Sinaloa (*Subsecretary de Desarrollo Substantiable del Estado de Sinaloa*) – Consistency with regional land use plans.
- National Commission for the Knowledge and Use of Biodiversity *(CONABIO)* – On potential impacts to critical ecosystems including RAMSAR sites and priority hydrological and terrestrial regions such as 'Bahía de Ohuira – Ensenada del Pabellón,' the Priority Terrestrial Region 'Marismas Topolobampo–Caminero,' the RAMSAR site 'Lagunas de Santa María–Topolobampo–Ohuira,' and the wetlands existing within the project area.

- General Directorate of Environmental Policy & Ecological Zoning *(Direction General de Political Ambiental e Integracion Regional y Sectorial y Direction de Ornamentor Ecologica*) – On alignment with the Marine Ecological Zoning Program of the Gulf of California.
- Directorate of Forest and Soil Management (Direction General de Gestion Forestal y de Suelos) – On land cover, identifying Xerophilous Shrubland and Hydrophilic Vegetation.
- Directorate of Wildlife (Direction General de Vida Silvestre) – On potential negative effects due to proximity to mangrove vegetation.

Public Consultation Process:

5 July 2022

DGIRA received the original project extract publication in "El Debate" newspaper to disseminate the public consultation process of the Mexinol project.

7 July 2022

DGIRA formally opened the public consultation process through publication in the *Ecological Gazette*.

8 July – 4 August 2022

The MIA was made available for public review at SEMARNAT's Sinaloa office (as well as on the institution's website) and at the Information Center of Environmental Management in the Álvaro Obregón mayoral office. The public was invited to submit feedback, suggestions for mitigation measures, and other comments.

4 August 2022

Deadline for public comments. No opinions or observations were submitted by citizens during the consultation period.

Indigenous Consultation Process:

26 June 2022

DGIRA informed the proponent of the presence of Yoreme-Mayo Indigenous communities in the municipality of Ahome. The Project's proponent was instructed to coordinate with INPI, the Social Engagement, Human Rights, and Transparency Coordinating Unit (UCVSDHT), and local authorities to carry out a free, prior, and informed consultation, in compliance with national protocols.

26 July 2022

DGIRA requested further clarifications and additional information regarding the MIA, including whether the proponent has initiated any coordination mechanism with INPI and the Coordinating Unit for Social Linkage, Human Rights and Transparency (UCVSDHT) from SEMARNAT as well as the competent local authority to carry out the indigenous consultation regarding the project.

16 August 2022

The project proponent submitted copies of correspondence with:

- The Directorate of Indigenous Participation and Consultation (INPI)
- The Social Participation and Transparency Unit of SEMARNAT

- The Director of Indigenous Peoples of SEMARNAT

28 November 2022

DGIRA received comments issues by INPI regarding the Indigenous Consultation process.

30 November 2022

DGIRA received comments from the UCVSDHT regarding the Indigenous consultation.

Authorization and Final Determinations

8 November 2023

SEMARNAT issued the MIA resolution, authorizing the project subject to conditions, including:

- Condition 3(g): Requiring the proponent to complete a free, prior, and informed consultation with Indigenous communities before beginning construction.

13 June 2024

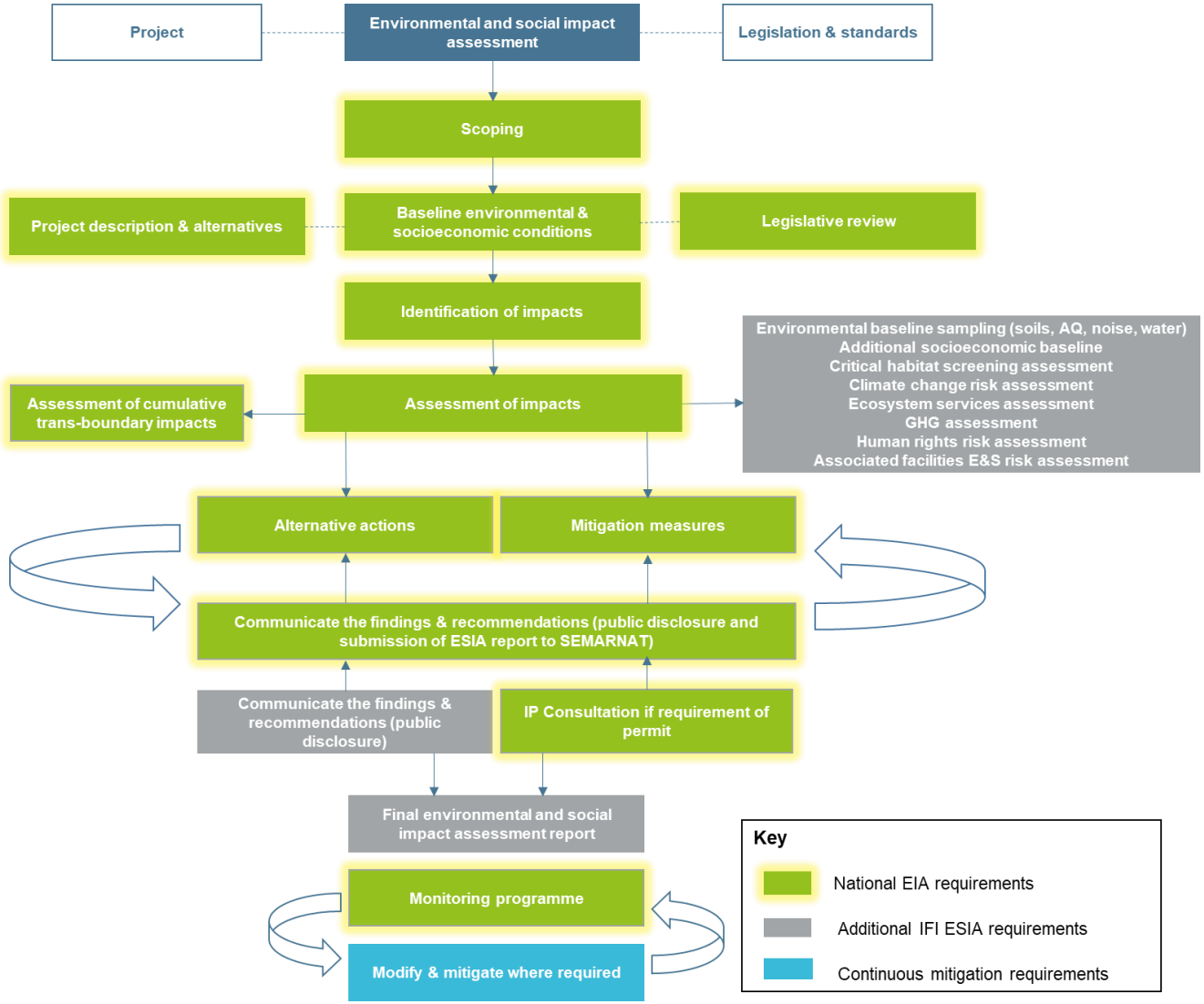
DGIRA receives Official Letter from the UCVSDHT dated June 12, 2024, by which it informs the response obtained from INPI regarding the matter of verifying the presence of Indigenous Communities within the project's environmental impact area. In this regard, the INPI stated, "No indigenous communities are identified in the project's environmental [affected] impact area".

10 July 2024

Based on INPI's and UCVSDHT's response obtained, **DGIRA issued an official exemption to the proponent from complying with Condition 3(g),** regarding the Indigenous consultation requirement, stating "Since no collective subject of the right to consultation has been identified in the project environmental impact area, implementing the free, prior, and informed consultation process is not possible." Therefore, the proponent is not obliged to present the results of the indigenous consultation.

The Mexinol Project has adhered fully to all procedural steps, including stakeholder engagement, institutional coordination, public disclosure, and Indigenous consultation protocols, as required by SEMARNAT and Mexican environmental legislation**.**

Figure 2.1 summarizes the elements of the EIA process required by the national law (highlighted in yellow). Additional ESIA studies and assessments that have been conducted to meet the international ESIA requirements are shown in grey.



Figur.1: Schematic of the impact assessment process

Source: RSK

2.1.2 State regulatory requirements

Table 2.2 presents a summary of key regulatory requirements in the State of Sinaloa.

Table 2.2: Key state regulatory requirements

Permit/License	Applicability
Environmental Law for the Sustainable Development in the State of Sinaloa *(Ley Ambiental para el desarrollo sustentable del Estado de Sinaloa)*	This law regulates all relevant environmental requirements in the State of Sinaloa. Relevant in relation to emissions from backup generators and construction residues, special managed wastes.
Ordinance Law for Urban Development of the State of Sinaloa *(Ley de Ordenamiento territorial y desarrollo urbano del Estado de Sinaloa)*	This law regulates the planning, administration, promotion, and control of the territorial planning of human settlements and the urban development of population centres in Sinaloa.
Waste Law of the State of Sinaloa *(Ley de residuos del Estado de Sinaloa)*	This law regulates the prevention and management of specially managed wastes and urban solids, as well as remediation of sites contaminated with this type of waste, in Sinaloa.
State Law on Climate Change *(Ley Estatal de Cambio Climático)*	This law establishes the actions to adapt and mitigate the effects on global warming in the state of Sinaloa.
Law that determines the catalogue of peoples and indigenous communities in the state of Sinaloa *(Ley que establece el catálogo de pueblos y comunidades indígenas en el estado de Sinaloa).*	This law establishes the criteria to determine peoples and indigenous communities in the state of Sinaloa.
Law on the rights for the peoples and indigenous communities for the state of Sinaloa *(Ley de los derechos de los pueblos y comunidades indígenas para el estado de Sinaloa).*	This law regulates the content of articles 13 BIS of the State Constitution and aims to protect, preserve and promote the development of the peoples and indigenous communities.
Waste Law of the State of Sinaloa *(Ley de Agua Potable y Alcantarillado).*	This law regulates the prevention and management of specially managed wastes and urban solids, as well as remediation of sites contaminated with this type of waste, in Sinaloa.
State Law on Sustainable Transportation *(Ley de Movilidad Sustentable para el estado de Sinaloa).*	This law among, other aspects, regulates the transit of pedestrians, passengers and drivers of vehicles circulating on public roads.
State Law on Civil Protection *(Ley de Proteccion Civil para el estado de Sinaloa).*	This law among, other aspects, regulates the actions to implement and protect the population of the state, its goods, and surroundings.
State Regulations on Civil Protection *(Reglamento de la Ley de Proteccion Civil para el estado de Sinaloa).*	These regulations provide specifics on the rights and obligations established in the state law.

Source: B+F (2024)

2.1.3 Other national regulations

2.1.3.1 Federal, state, and municipal protected natural areas

In the State of Sinaloa, there are three federally protected natural areas: Cacaxtla Platuea, Ceuta Beach, and El Verde Beach; three state protected natural areas: Navachiste, Our Lady Candelaria, and the Islands of Mazatlan; and one municipal protected natural area: Ejido Topo Viejo (bat cave). As described in Chapter 3 of the MIA (Mexinol, 2021) and verified by the SLR's (2024b) CHA, the Project will not affect any federal or state protected natural areas.

2.1.3.2 Nationally protected species

Five species recorded in the Project's ecological AoI are listed as protected under the NOM-059-SEMARNAT-2010 list of protected species namely black mangrove (*Avicennia germinans*; LC), red mangrove (*Rhizophora mangle*; LC), white mangrove (*Laguncularia racemose*; LC), and Guayacan (*Guaiacum coulteri*; VU) and button mangrove (*Conocarpus erectus*; LC). Refer to Table 2.1 for information on NOM-059-SEMARNAT-2010.

2.1.3.3 Biodiversity offsetting / compensation

While the project will affect critical habitat, the impact is not considered significant and therefore does not trigger the need for an offset. Instead, residual impacts will be addressed through targeted conservation programs to be implemented within the affected Key Biodiversity Area (KBA) and RAMSAR site, in accordance with the requirements of Performance Standard 6, Paragraph 20.

However, there is a requirement from SEMARNAT to provide compensation for the benefit of the wetland equating to an area that is at least 10% of the Project footprint, even if the impacted/lost habitat type is less than this. These measures are expected to include approximately 6 ha of reforestation (i.e., scrubbing) and cactus planting, plus 6 ha of mangrove restoration. As no mangrove habitat is expected to be affected by the Project, the mangrove restoration is therefore considered to be an additionality (SLR Consulting Limited, 2024). The reforestation/restoration locations are yet to be determined and sent to SEMARNAT for approval.

2.2 International conventions and agreements

Table 2.3 presents the relevant conventions and agreements that have been ratified by Mexico.

Table 2.3: International conventions and agreements

International Convention or Agreement	Date of ratification
United Nations Educational, Scientific and Cultural Organisation (UNESCO) Convention on Wetlands of World Importance Primarily as Waterbird habitats (Ramsar, February 2, 1971)	04.11.1986
Convention on International Trade in Dangerous Species of Wild Fauna and Wild Flora (CITES) (Washington, March 3, 1973)	30.09.1991
UN Basel Convention on the Control of Transboundary Movements and Disposal of Hazardous Wastes (Basel, March 22, 1989)	22.02.1991

International Convention or Agreement	Date of ratification
International Convention on Biological Diversity (Rio, June 5, 1992)	11.03.1993
International Convention on Civil Liability for Oil Pollution Damage (CLC) (Brussels, November 29, 1969)	13.05.1994
United Nations Convention on the Law of the Sea (UNCLOS) (Jamaica, December 10, 1982)	18.03.1983
International Convention for the Prevention of Pollution from Ships (MARPOL) (London, February 17, 1978)	23.04.1992
International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) (London, February 12, 2004)	18.03.2008
Indigenous and Tribal Peoples Convention C169 (Geneva, 27 June 1989)	05.09.1990
UN Framework Convention on Climate Change (Kyoto Protocol, 1992)	03.12.1992
Paris Agreement (Paris, April 22, 2016)	21.09.2016
International Labour Organisation (ILO) (82 Conventions and one protocol ratified, 64 in force, 5 have been denounced, and 14 have been abrogated). The nine fundamental conventions are included below:	Various
ILO CO29: Forced Labour Convention, 1930 / Protocol of 2014	12.05.1934 / 11.6.2023
ILO CO87: Freedom of Association and Protection of Right to Organise, 1948	01.04.1950
ILO CO98: Right to Organise and Collective Bargaining, 1949	23.11.2018
ILO CO100: Equal Renumeration, 1951	23.08.1952
ILO CO105: Abolition of Forced Labour, 1957	01.06.1959
ILO CO111: Discrimination (Employment and Occupation), 1958	11.09.1961
ILO CO138: Minimum Age (15 years), 1973	10.06.2015
ILO CO155: Occupational Safety and Health Convention, 1981	01.02.1984
ILO CO182: Worst Forms of Child Labour, 1999	30.06.2000

2.3 Permit and licenses

Following Mexican regulations, the following permits and licenses are relevant to the construction and commissioning of the Project (see Table 2.4).

Table 2.4: Permits and licenses for the Project

Permit, license, or approval	Authority	Legislation	Status (as of end of 3Q2024)
Environmental Impact and Risk Authorisation	SEMARNAT	General Law on Ecological Equilibrium and Environmental Protection and its Regulations	Permit Received November 8, 2023; all permit conditions regarding the construction have been met in order to begin Early Works in late 2024
Forestry Land Use Change Authorisation	SEMARNAT	General Law on Sustainable Forestry Development and its Regulations	Not required.
Environmental Unique License	SEMARNAT	General Law on Ecological Equilibrium and Environmental Protection and its Regulations	TI, during first year operation
Program to Prevent Accident	SEMARNAT	General Law on Ecological Equilibrium and Environmental Protection and its Regulations	TI before operation (application and plan at 95% for submittal)
Water supply concession / Agreement with supplier	National Waters Commission (CONAGUA) / Supplier	Law on National Waters and its Regulations	EPC prior to construction
Waste water permit / Agreement with supplier	National Waters Commission (CONAGUA) / Supplier	Law on National Waters and its Regulations	EPC prior to construction
Notice to use water for hydrostatic testing	CONAGUA	Law on National Waters and its Regulations	EPC during construction
Notice to discharge hydrostatic testing water	CONAGUA	Law on National Waters and its Regulations	EPC during construction
Concession to build/operate marine installations	Ministry of Navy (SEMAR)	Law of Ports	EPC prior to construction

Permit, license, or approval	Authority	Legislation	Status (as of end of 3Q2024)
Archaeological Remains clearance	National Institute on Anthropology and History (INAH)	Federal Law on Monuments and Archaeological sites.	Official authorization obtained June 18, 2025.
Generation permit / Agreement with supplier	Regulatory Energy Commission (CRE) / Supplier	Law on the Electrical Industry and its Regulations	Prior to operations; RIC Energy
Transportation permit for natural gas	CRE	Law of Hydrocarbons and its regulations	Prior to operations; RIC Energy
Qualified user title, if the Project will buy electricity from the market.	CRE	Law on the Electrical Industry and its Regulations	Prior to operations; RIC Energy
Indicative study System Impact study Installation study (These 3 are pre-requisite for the interconnection) Interconnection permit / Agreement with supplier	National Centre for Energy Control (CENACE)	Law on the Electrical Industry and its Regulations	Prior to operations; RIC Energy
Petroleum, petroleum products, petrochemicals and bioenergetics storage permit	CRE	Law on Hydrocarbons and its Regulations	TI, prior to operations
Application for natural gas, oil and petrochemical trading permits	CRE	Law on Hydrocarbons and its Regulations	TI, prior to operations
Building Permit from the National Waters Commission for crossings	CONAGUA	Law on National Waters and its Regulations	TI, application ready for submittal

Permit, license, or approval	Authority	Legislation	Status (as of end of 3Q2024)
If needed crossing of pipelines	Mexican Petroleum (PEMEX)	Law on National Goods and State own company PEMEX directives.	EPC if needed
If needed crossing of transmission lines	Federal Electricity Commission (CFE)	Law on National Goods and State own company CFE directives.	EPC if needed
If needed crossing of optic fibre cables	Cable companies	Private agreements.	EPC if needed
If needed crossing of aqueducts	Irrigation District	Law on National Waters and its Regulations.	EPC if needed
If needed crossing of federal roads	Ministry of Transport and Communications and Concessionary	Federal Road on Highways and Bridges and its Regulations on RoW.	EPC if needed
If needed crossing of state roads	State Roade Commission	Law that establishes the RoW for state roads and local roads.	EPC if needed
If needed crossing of municipal roads	Municipality of Ahome	Law that establishes the RoW for state roads and local roads.	EPC if needed
If needed crossings with the railroad	Ministry of Transport and Communications and Concessionary	Regulations on the Railroad Service	EPC if needed
Permit to transport diesel, gasoline and other fuels	Ministry of Transport and Communications	Federal Road on Highways and Bridges	EPC, Prior to construction
Sanitary License	Ministry of Health	General Law on Health	TI, during first year of operation
Permit for medical facilities	Federal Commission to protect sanitary risks	General Law on Health	EPC, during construction

Permit, license, or approval	Authority	Legislation	Status (as of end of 3Q2024)
Registration of safety and hygiene commission	Registration of safety and hygiene commission	Registration of safety and hygiene commission	EPC for the construction TI for operation
Registration of the Mix Commission on Training	Ministry of Labour and Social Prevision (STPS)	Federal Labour Law and its Regulations	EPC for the construction TI for operation
Urban Impact Statement	State Government	State Law on Urban Development	TI, Once the Land Use License is obtained
Land Use License	Municipal Government	Regulations on Urban Development	TI application sent (expected by September 2025)
Zoning Certificate if the rustic plot does not have a formal registration.	Municipal Government	Regulations on Urban Development	Not applicable because we have a rustic plot
Building Permit for all the Project components	Municipal Government	Regulations on Urban Development	TI, once the Land Use License is obtained
Conclusion of works notice	Municipal Government	Regulations on Urban Development	TI, at the end of the construction phase
Operation license	Municipal Government	Regulations on Urban Development	TI, before operation
Approval of the firefight system	Municipal Government	Civil Protection and its Regulations	TI, before operation
Authorisation for noise generation	Municipal Government	Regulations on Environmental protection for the municipality of Ahome	TI, before operation
Demolition permit	Municipal Government	Construction Regulations of the Municipality of Ahome (Article 145)	TI, before decommissioning
Interconnection to the water municipal network during construction	Municipal entity for water and sewage JAPAMA	Regulations on Environmental protection for the municipality of Ahome	EPC, before construction

Permit, license, or approval	Authority	Legislation	Status (as of end of 3Q2024)
Civil Protection Permit	State Government	State Law on Civil Protection and its Regulations	EPC, before construction TI, before operation
Vulnerability and Risk Assessment	State Government	State Law on Civil Protection and its Regulations	EPC, before construction TI, before operation
Generator of hazardous waste registration	SEMARNAT	General Law for the Prevention and Integral Management of Waste and its Regulation	EPC, during construction TI, during operation (once TI knows how much HW the operation generates)
Hazardous waste plan registration (only if the Project will produce more than 10 tons per year).	SEMARNAT	General Law for the Prevention and Integral Management of Waste and its Regulation	EPC, during construction TI, during operation (once TI knows how much HW the operation generates)
Generator of special management waste	State Government	Waste Law of the State of Sinaloa	EPC, during construction TI, during operation
Registration of the Plan for special waste management	State Government	Waste Law of the State of Sinaloa	EPC, during construction TI, during operation
Registration/agreement to collect common waste, if needed	Municipal Government	Regulations on Environmental protection for the municipality of Ahome	TI, before operation

2.4 International good practice

The Project is committed to complying with the pertinent E&S guidelines and requirements of the IFC Performance Standards (PS) on Social and Environmental Sustainability (2012), the relevant IFC Environmental, Health and Safety (EHS) Guidelines and Policies, the United Nations Guiding Principles on Business and Human Rights, the International Labour Organisation (ILO) Fundamental Principles and Rights at Work, and the Equator Principles. Meeting these standards will also be needed to satisfy international lenders requirements. In addition, the Project is committed to following Good International Industry Practice (GIIP) and sector-specific technical guidelines, where appropriate.

2.4.1 IFC Performance Standards

The IFC PS are an international benchmark for identifying and managing E&S risk and have been adopted by many organisations as a key part of their E&S risk management. The PSs are designed to help avoid, mitigate, and manage environmental, health, safety and social risks and impacts while also establishing requirements for stakeholder engagement and information disclosure at the Project level. The IFC requires its clients to carry out an ESIA following PS 1 and to apply additional standards (PS 2-8) as relevant to the specific characteristics of the Project.

This assessment has evaluated the applicability of each PS. The aims of each of these standards are summarised in Table 2.5.

Table 2.5: IFC Performance Standards

Performance Standard	Objectives
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	• To identify and assess E&S risks and impacts of the Project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment. • To promote improved E&S performance of clients through the effective use of management systems. • To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. • To promote and provide means for adequate engagement with Affected Communities throughout the Project cycle on issues that could potentially affect them and to ensure that relevant E&S information is disclosed and disseminated.
Performance Standard 2: Labour and Working Conditions	• To promote the fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain and improve the worker-management relationship. • To promote compliance with national labour and employment laws. • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and health of workers. • To avoid the use of forced labour.
Performance Standard 3: Resource Efficiency and Pollution Prevention	• To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from Project activities. • To promote more sustainable use of resources, including energy and water. • To reduce Project-related greenhouse gas (GHG) emissions.
Performance Standard 4: Community Health, Safety and Security	• To anticipate and avoid adverse impacts on health and safety of the Affected Community during the Project life from both routine and non-routine circumstances. • To ensure that the safeguarding of personnel and property is carried out following relevant human rights principles and in a manner that avoids or minimises risks to the Affected Communities.
Performance Standard 5: Land Acquisition and Involuntary Resettlement	• To avoid or, when avoidance is not possible, minimise displacement by exploring alternative Project designs. • To avoid forced eviction.

Performance Standard	Objectives
	• To anticipate and avoid or, where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. • To improve, or restore, the livelihoods and standards of living of displaced persons. • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	• To protect and conserve biodiversity. • To maintain the benefits from ecosystem services. • Promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.
Performance Standard 7: Indigenous Peoples	Performance Standard 7 recognises Indigenous Peoples, as social groups with identities that are distinct from dominant groups in national societies. • To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimise and/or compensate for such impacts. • To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. • To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a Project throughout the Project's life cycle. • To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. • To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
Performance Standard 8: Cultural Heritage	• To protect cultural heritage from the adverse impacts of Project activities and support its preservation. • To promote the equitable sharing of benefits from the use of cultural heritage

2.4.2 IFC EHS guidelines and policies

The IFC EHS Guidelines have the performance levels and measures that are normally acceptable to IFC and are considered to be achievable in new facilities at reasonable costs by existing technology. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC, become Project- or site-specific requirements.

When host country regulations differ from the levels and measures presented in the EHS guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific Project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should show that the choice for any alternate performance levels is protective of human health and the environment. The relevant IFC guidelines and policies are presented below in Table 2.6.

Table 2.6: Relevant IFC guidelines

Policies and guidelines	Description and potential relevance to the Project
General Environmental, Health and Safety Guidelines (2007)	These guidelines are technical reference documents with general and industry-specific examples of good international industry practice. When one or more members of the World Bank Group are involved in a Project, these EHS guidelines are applied as required by their respective policies and standards. These general EHS guidelines are designed to be used together with the relevant industry-sector EHS guidelines.
EHS Guidelines for Natural Gas Processing (2007)	These guidelines include information relevant to EHS aspects of methanol energy facilities. These guidelines should be applied to methanol energy facilities from the earliest feasibility assessments, and from the time of the environmental impact assessment, and continue to be applied throughout the full life cycle of the Project. These guidelines detail industry-specific impacts and management for environmental and occupational and community health and safety aspects, as well as performance indicators and monitoring, including emissions and effluent guideline values.
EHS Guidelines for Ports, Harbors and Terminals (2017)	These guidelines include information relevant to EHS aspects of marine ports, harbour, and terminal infrastructure facilities. These guidelines should be applied to marine infrastructure facilities from the earliest feasibility assessments, and from the time of the environmental impact assessment, and continue to be applied throughout the full life cycle of the Project. These guidelines detail industry-specific impacts and management for environmental and occupational and community health and safety aspects, as well as performance indicators and monitoring, including suggested monitoring parameters for water and sediment quality. The applicability of the EHS guidelines should be tailored to the hazards and risks established for each Project based on the results of an environmental assessment in which site-specific variables, such as host country context, assimilative ability of the environment, and other Project factors, are considered.

Policies and guidelines	Description and potential relevance to the Project
EHS Guidelines for Electric Power Transmission and Distribution (2007)	These guidelines include information relevant to EHS aspects of electric power transmission and distribution. They cover habitat protection, hazardous materials management, waste disposal, air emissions control, electrical safety, working at heights, managing electromagnetic field exposure, public safety, and emergency preparedness. These guidelines aim to protect human health and the environment through good industry practices and regular compliance monitoring.
Large Volume Petroleum-based Organic Chemicals Manufacturing (methanol only) (2007)	These guidelines include information relevant to EHS aspects of large volume petroleum-based organic chemicals (LVOC) projects and facilities. They cover the following products: lower olefins, aromatics, oxygenated compounds, nitrogenates compounds and halogenated compounds. The applicability of these guidelines to the Project should be tailored to the production of methanol.
IFC Access to Information Policy (2012)	This policy reflects the various abilities that IFC operates, the nature of the information that it receives and prepares in connection with those diverse activities, and the level of disclosure applicable to diverse types of information. As part of the process of managing the risks and impacts of their investment projects, IFC requires its clients to engage with communities affected by their projects, including through the disclosure of information, in a manner that is consistent with IFC's Policy and Performance Standards on Environmental and Social Sustainability.

2.4.3 Equator Principles

The Equator Principles are a risk management framework, adopted by financial institutions for determining, assessing, and managing E&S risk in projects. The latest iteration of the Equator Principles is EP4, which came into effect on 1 October 2020. The Equator Principles are summarised in Table 2.7.

Table 2.7: Equator Principles

Equator Principle	Summary
Principle 1: Review and Categorisation	The EP financial institution (EPFI) is required to conduct a preliminary assessment of the level of E&S risks associated with a Project that is within the scope of the EP III, and to categorise that risk as either Category A (significant risks), B (limited risks) or C (minimal or no risks).
Principle 2: Environmental and Social Assessment	An ESIA (taking a variety of possible forms from full-scale to limited ESIA or compliance audit) must be developed by the Project proponent for all Category A and B projects, providing an evaluation of the E&S risks of the Project, including human rights, and proposing measures to minimise, mitigate and offset adverse impacts of the proposed project.
Principle 3: Applicable Environmental and Social Standards	For projects in non-designated countries, the assessment process evaluates compliance with host country laws, regulations and permits and IFC Performance Standards and

Equator Principle	Summary
	World Bank EHS Guidelines. These standards must be met "to the EPFI's satisfaction", with any deviation justified.
Principle 4: Environmental and Social Management System and Equator Principles Action Plan	For Category A and B projects, the project proponent must develop and keep an environmental and social management system (ESMS) and an environmental and social management plan (ESMP) to address issues raised in the assessment process and incorporate actions needed to follow the applicable standards. An EP action plan, agreed between the EPFI and the Project proponent, would outline gaps and commitments to meet EPFI requirements.
Principle 5: Stakeholder Engagement	For Category A and B projects, project proponents must show effective stakeholder engagement with affected communities and other stakeholders starting early in the impact assessment process, and to conduct an informed consultation and participation process where there is the potential for significant adverse impacts on communities.
Principle 6: Grievance Mechanism	For Category A and appropriate B projects, the Project proponent must operate a grievance mechanism to receive and ease resolution of concerns and grievances about the Project's E&S performance. The grievance mechanism should also include workers as a stakeholder category.
Principle 7: Independent Review	For Category A and appropriate B projects, an independent review is needed to aid the EPFI's due diligence, assess EP compliance and propose a suitable action plan capable of bringing the Project into compliance with the EP or to show if compliance is not possible.
Principle 8: Covenants	The Project proponent covenants to follow all relevant host country E&S laws, regulations and permits, as well as the ESMPs and EPs in the case of Category A and B projects, in all material respects.
Principle 9: Independent Monitoring and Reporting	An independent consultant or the Project proponents qualified and experienced external experts should assess Project compliance with the EPs and ongoing monitoring and reporting.
Principle 10: Reporting and Transparency	In addition to the disclosure requirements of Principle 5, at a minimum, a summary of the ESIA is to be accessible and available online. GHG emission reporting is needed for projects emitting over 100,000 tonnes of CO_2 equivalent annually. EPFIs must report on their implementation of the EP III framework.

3 PROJECT DESCRIPTION

3.1 Overview

Transition Industries is acting as the developer, in partnership with the IFC, to construct a methanol production plant on previously used agricultural land in the industrial corridor of the municipality of Ahome, northern Sinaloa, Mexico. The Project is now entering the development phase and plans to produce 6,130 mtpd of methanol.

Mexinol Project will utilise AdWinMethanol Zero® technology, which is the most advanced technology in terms of energy use with no GHG emissions. The Mexinol Plant will be the first net zero facility of its kind and scale globally.

With the AdWinMethanol Zero® technology, CO_2, NOx, and other emissions are reduced to nearly zero (less than 0.2 tonnes of CO_2e per tonne of methanol produced). – This is carried out by replacing the typical fuel gas fire heaters by electric heaters, and by taking all the CO_2 generated within the plant from the natural gas feed and converting it into methanol. To do so, extra hydrogen is needed, which will be generated with a water electrolysis facility utilising electric energy.

The design rate for natural gas stream feed to the process is 176406 Nm^3/h (158 mmscfd). The design rate for water supply flow is up to 400 litres/second (1440m^3/h). A more precise estimate will be decided during the advanced engineering stage.

AdWinMethanol Zero® requires approximately 450 MWh of electrical power. The Mexinol Plant will be connected to the Mexican national electrical grid via a 400 kVA power transmission line with over 99.3% reliability.

That 400 kVA system is connected to a substation that has several power generation plants with combined capacity of over 1000 MWh. The electricity will be under a Power Purchase Agreement (PPA) with a local contractor (energy wholesaler), who will handle ensuring continuous power availability. Electricity will be sourced either by generation of direct renewable energy or purchasing clean energy certificates to guarantee a low carbon footprint. The renewable energy provided through the agreement will likely come from a mix of sources such as solar, wind, or hydroelectric power.

The onsite Project components include the following:

- methanol processing plant
- wastewater treatment plant (WWTP)
- air separation unit (ASU)
- hydrogen production plant (electrolyser)
- power supply and distribution system (including substation)
- building infrastructure (including the following: administrative building, control room, warehouse, workshop, laboratory, security building, fire equipment room and engine control centre)
- bunded storage tanks (three high purity methanol storage tanks, two verification methanol storage tanks, one off-spec methanol storage tank)
- plant storm drainage system
- perimeter fence – to be built around the northern portion of the Project site.

The offsite Project components include:

- main and secondary access roads
- Approximately 10Km long JAPAMA pipelines (24” and 16”) for pre-treated water transfer and return of the rejected water and the JAPAMA pre-treated water transfer pumping station
- 10.3 km 28” methanol transfer pipeline, the 8” pipeline for vapour recovery and fibre optic cables
- connection to the existing TC Topolobampo natural gas pipeline located parallel to the project site and installation of a meter on the site
- upgrading of the existing jetty at the Port of Topolobampo to allow the methanol loading operations.

The Project will have one associated facility – a 43 km long transmission line and 40 kV substation – which will be constructed by a third party (refer to Section 3.13 for added detail).

3.2 Project location and site description

3.2.1 Location

The Project site is in the municipality of Ahome, on the west coast of the Gulf of California in the state of Sinaloa, Mexico. The area is close to major highways, as well as the Port of Topolobampo. Figure 3.1 below presents the Project location.

3.2.2 Site description

The total area occupied by the Project will be approximately 152 ha including the main process and utilities plant, the port facilities for methanol export, the temporary and permanent right-of-way (RoW), and additional areas used for the construction of the methanol export and vapour recovery pipelines to the port, and the pipelines for JAPAMA water supply. Figure 3.1 and Figure 3.2 below respectively present an overview of the Project’s main components and associated facilities.

Figure 3.1: Project location

Source: RSK

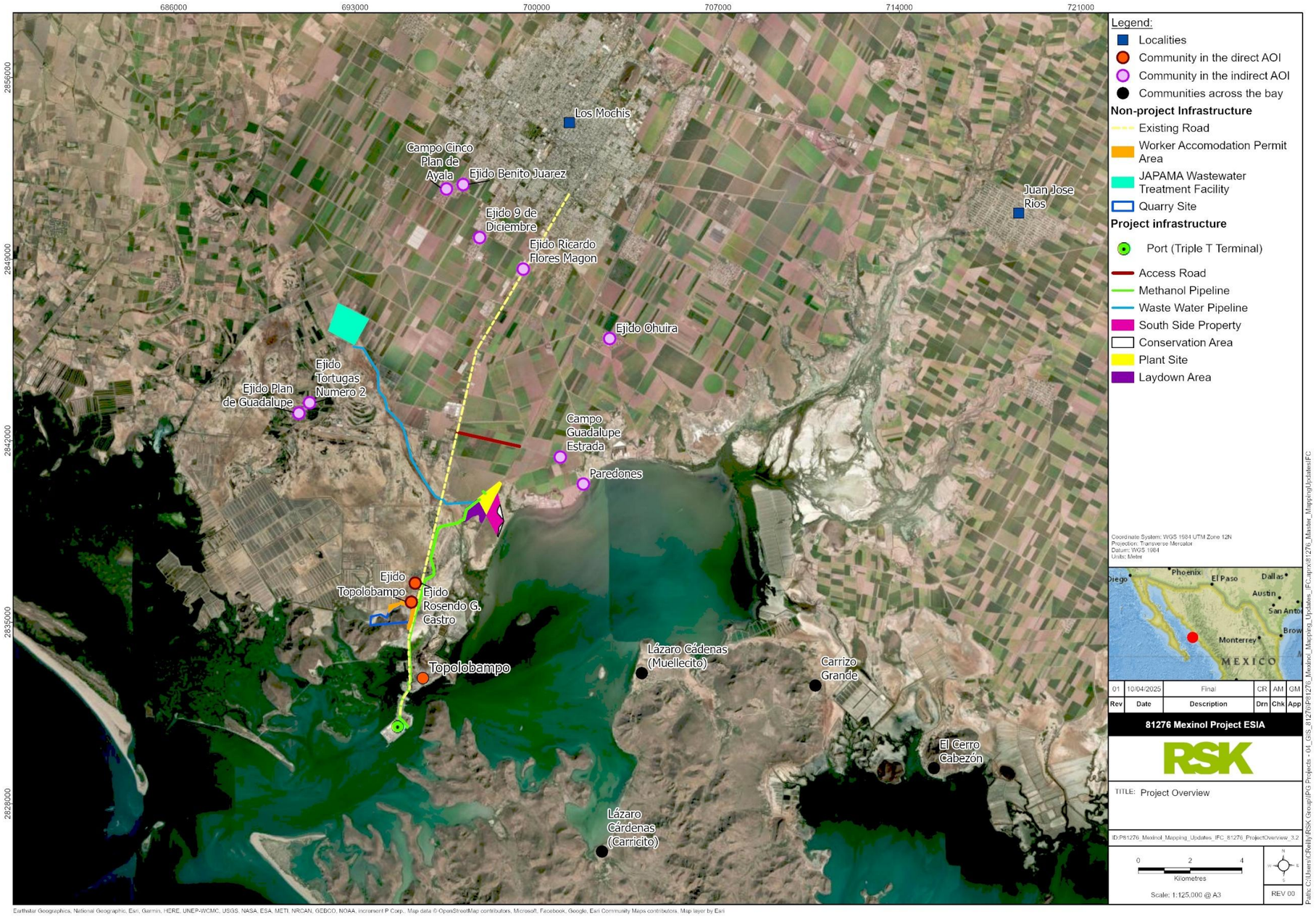


Figure 3.2: Project overview

Source: RSK

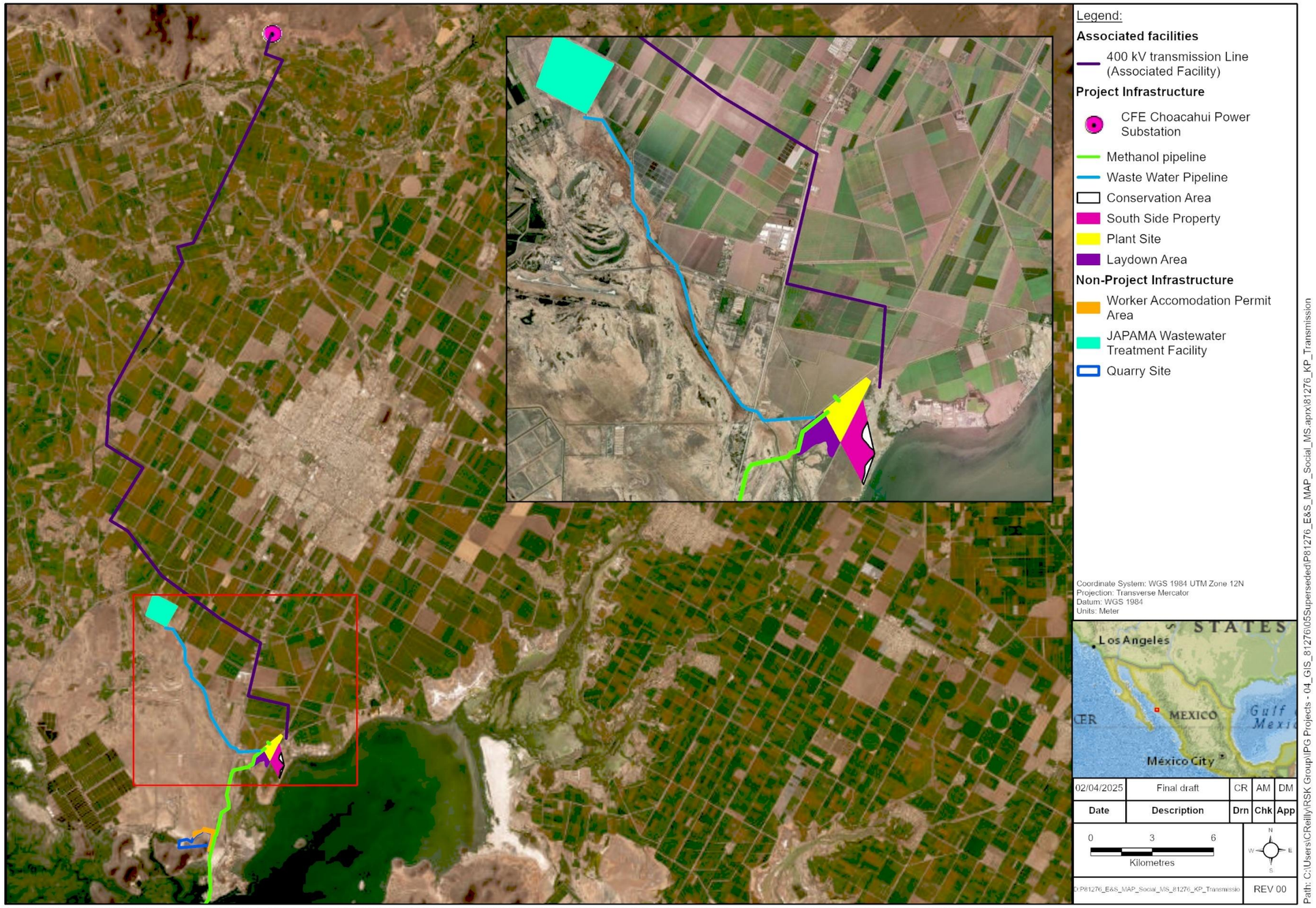


Figure 3.3: Location of the transmission line (associated facility)

3.2.3 Land use

The Project site (area and components are detailed throughout this chapter) is in an unpopulated, primarily agricultural area of the municipality. All land that will be used for the Project has been bought by the Project in individual private land purchase agreements or leases as per local and Mexican law.

The land which will be occupied by the Mexinol plant itself and road corridor, includes irrigated agricultural land (modified habitat). The construction access road route is found within the project land (that has already been bought) and along an existing road so will only require surfacing. Potential temporary impacts on land access due to the construction of the access road will be managed accordingly (e.g. any clearance of topsoil during site preparations, will be transported and deposited on the agricultural area of the southern part of the site, and subsequently reused for agriculture. No soil will be deposited in the laydown or conservation areas).

Construction will require the clearance of approximately 129 ha of land (from the 203.82 ha of land required) in total, comprising ~ 27 ha within the 27 m wide methanol pipeline construction footprint (of which 14 m width is permanent and 13 m width is temporary use), ~5 ha within the 2.46 km long (20 m wide) road construction footprint, the ~44 ha methanol production plant of which 44 ha of former agricultural land is estimated to require clearance, ~ 40 for the laydown areas, and ~ 4 for the HDD locations and ~8 ha for the JAPAMA pipelines (see Table 3.1 below).

To date the project has acquired 192.72 ha consisting of 99.99 ha for the project site footprint, 52.15 ha for methanol pipeline RoW, and 40.58 for the laydown areas. Final negotiations and purchases of the water pipeline route of 10.2 ha are awaiting final approvals. The total land to be acquired for the project is 203.82 ha. In addition, the project has signed a total 22 lease contracts for the methanol pipeline RoW with landowners that preferred not to sell their land. The project is in the process of finalizing two contracts for 0.278 ha of land for the gas pipeline and waiting on final HDD design to finalize contracts for 0.6224 ha at the entrance to the port; and negotiating approximately 10.2 ha of land for the wastewater pipeline.

Detail on land acquisition and land use are provided in section 5.3 and Appendix 4.

A total of 93,000 m^3 of soil is estimated to require removal and storage from the construction areas.

Table 3.1 shows the Project's estimated onshore land area needed for construction and operations, along with the corresponding habitat types as defined under PS6. See Section 5.4.3.15 for additional details on land use and ownership as values in Table 3.1 are based on potential use of each project area using GIS and are not indicative of the actual land bought.

Table 3.1: Type of habitats of each project components

Habitat status	Methanol pipeline (27 m wide RoW)	Access road (20 m wide RoW)	Methanol production plant including WWTP	Laydown areas	HDD locations	JAPAMA pipelines (10 m wide RoW)	Total ha per habitat
	hectares (ha)						
Natural[5]	7.72	-	0.04	1.39	1.39	7.92	18.46

[5] 'Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition' (IFC, 2012).

Habitat status	Methanol pipeline (27 m wide RoW)	Access road (20 m wide RoW)	Methanol production plant including WWTP	Laydown areas	HDD locations	JAPAMA pipelines (10 m wide RoW)	Total ha per habitat
	hectares (ha)						
Modified[6]	19.11	4.95	43.86	39.19	2.79	0.56	110.46
Totals	26.83	4.95	43.90	40.58	4.18	8.48	128.92

Source: Adapted from SLR Consulting Limited (2024b)

3.2.4 Local communities

Communities found in and around the Project activities (as defined in Section 5.4) are described in Table 3.2 below and shown in Figures 3.3-3.9 below.

Table 3.2: Communities located near Project activities

Community name	Methanol production plant	Methanol pipeline	JAPAMA pipelines	Port
	Approximate distance (km) from each project component			
Paredones	3.6	4.6	4.5	-
Campo Guadalupe Estrada	3.2	3.6	3.8	-
Ejido Rosendo G Castro	4.3	0.3	3.3	-
Ejido Topolobampo	4.9	0.3	4.0	-
Ejido Ohuira	7.7	8.1	7.4 / 10.1	-
Carrizo Grande	14.4	-	-	-
El Cerro Cabezón	20	-	-	-
Lázaro Cadena (Muellecito)	8.8	9.2	-	-
Lázaro Cadena (Carricito)	14.2	8.9	-	8.9
Ejido Ricardo Flores Magon	9	9	7.5 / 7.1	-
Ejido Tortugas Numero 2	-	-	2 / 3.4	-

[6] 'Modified habitats are defined by IFC as areas of land that support a large proportion of flora and/or fauna species that are non-native in origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition' (IFC, 2012).

Community name	Methanol production plant	Methanol pipeline	JAPAMA pipelines	Port
	Approximate distance (km) from each project component			
Ejido Plan de Guadalupe	-	-	2 / 3.4	-
Campo Cinco Plan de Ayala	-	-	6.5	-
Ejido Benito Juarez	-	-	5.9	-
Ejdio 9 de Diecembre	-	-	7.1	-

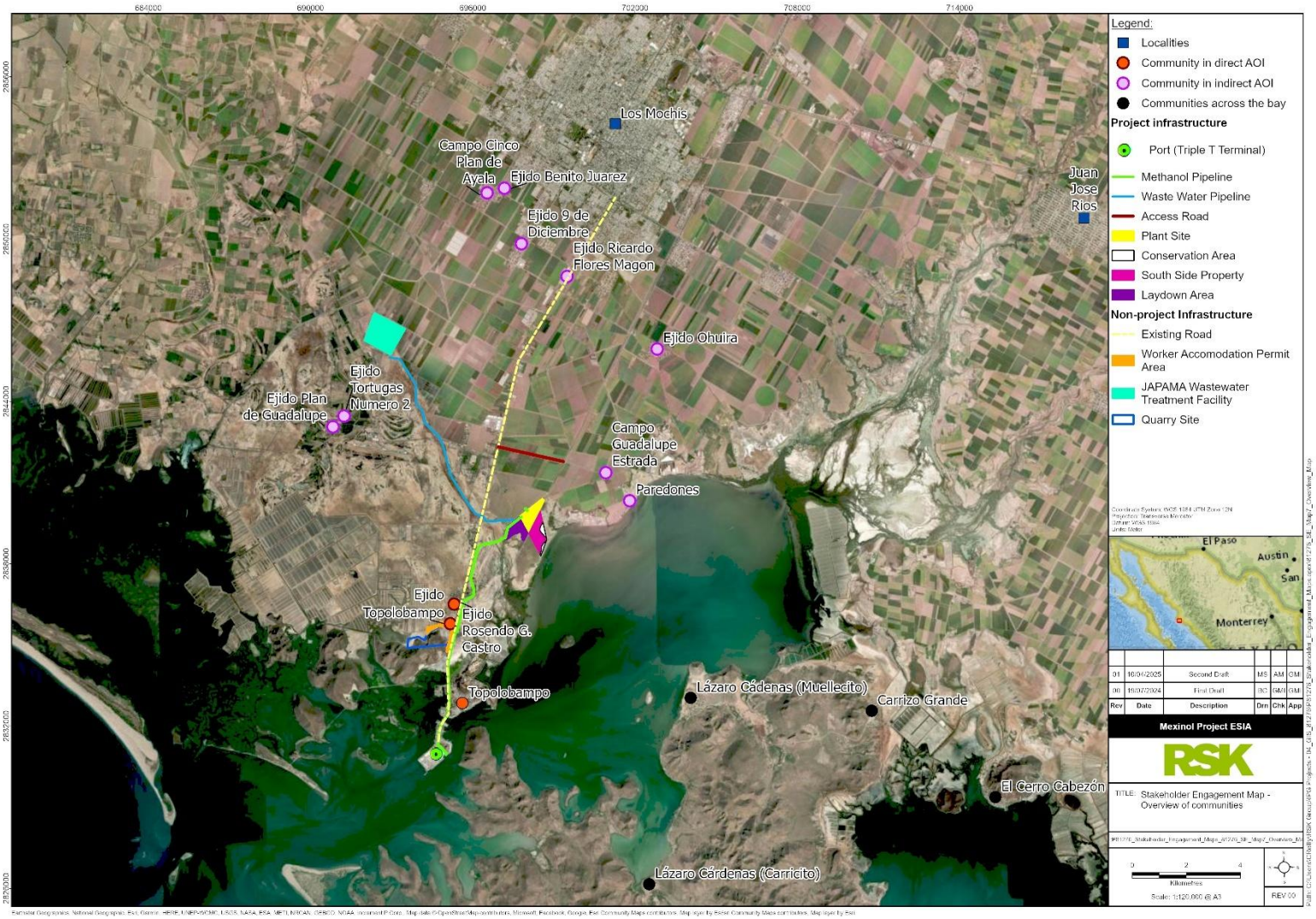


Figure 3.4: Overview of local communities

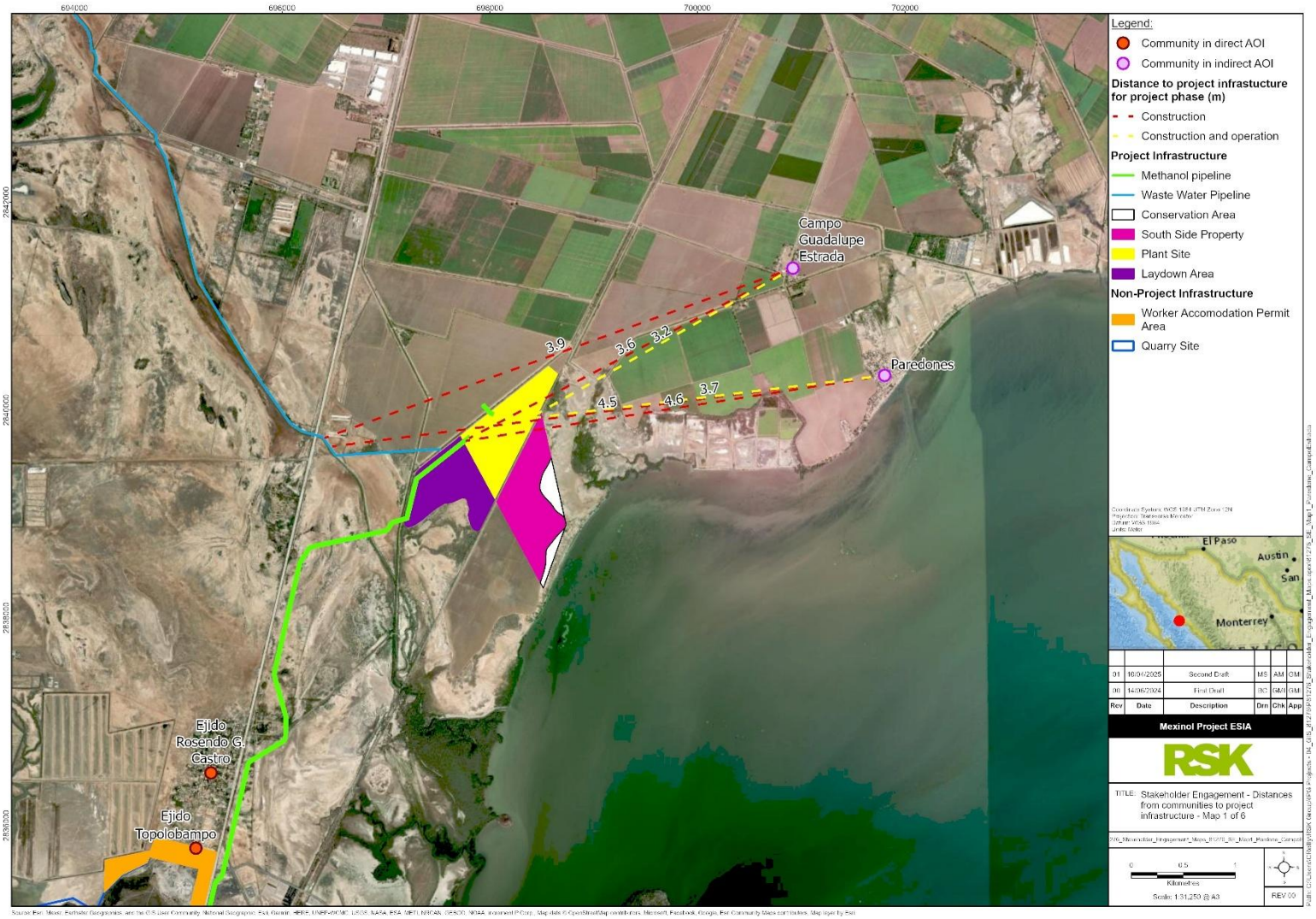


Figure 3.5: Distances from communities to Project infrastructure – Paredones and Campo Guadalupe Estrada

Figure 3.6: Distances from communities to Project infrastructure – Ejido Rosendo G Castro

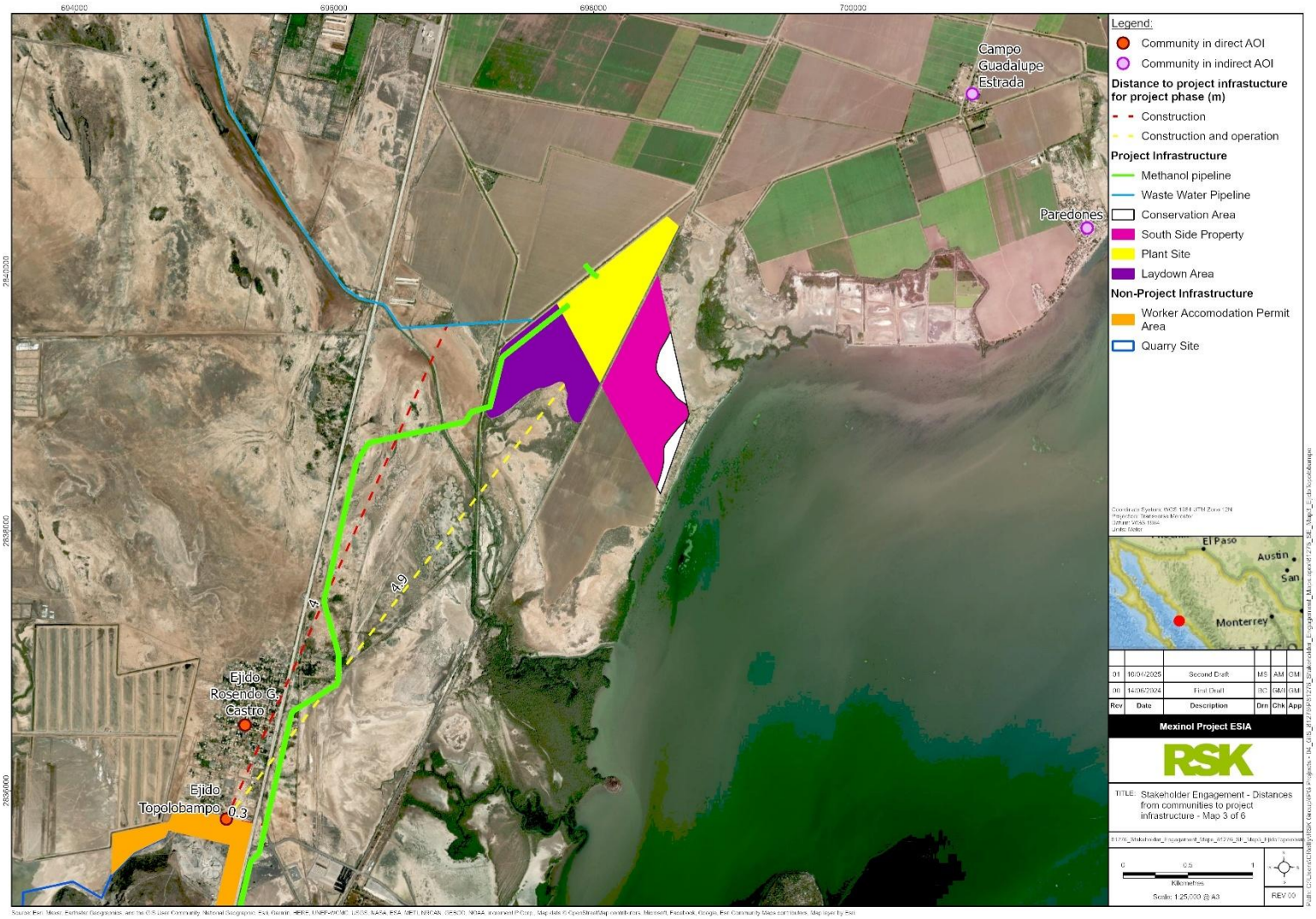


Figure 3.7: Distances from communities to Project infrastructure – Ejido Topolobampo

Figure 3.8: Distances from communities to Project infrastructure – Ejido Ohuira

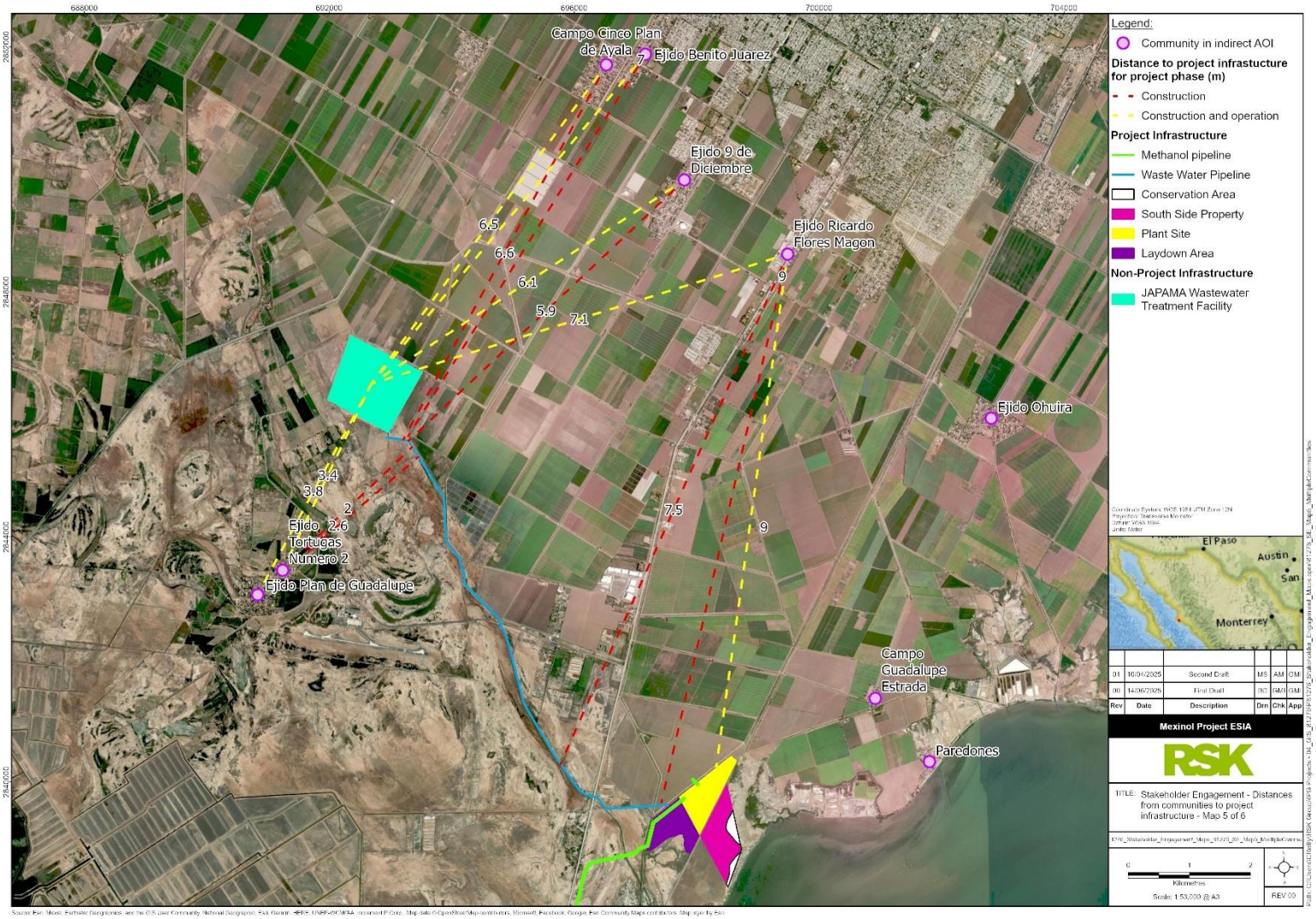


Figure 3.9: Distances from communities to Project infrastructure – multiple communities

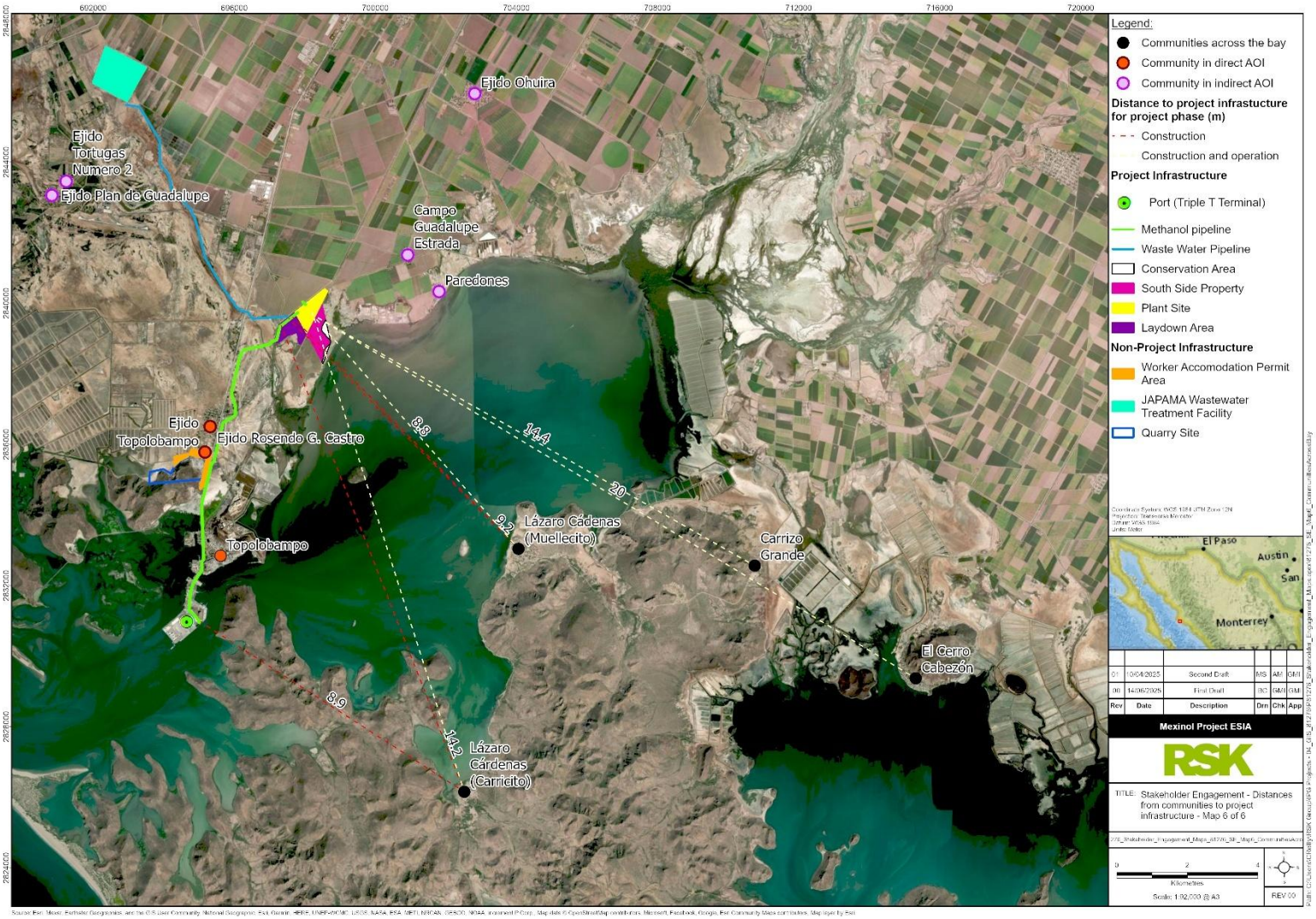


Figure 3.10: Distances from communities to Project infrastructure – communities across the bay

3.3 Process description

There are two major process steps for conversion of natural gas to methanol:

1. Conversion of natural gas (mostly methane, CH_4) to syngas (a mix of CO_2, CO and H2) in a Catalytic partial oxidation reactor (POX) Auto Thermal Reformer (ATR)
2. Conversion of syngas to methanol in a synthesis reactor.

In the ATR, methane and hydrocarbons react with steam to produce H_2, CO and CO_2. Steam must be added more than the stoichiometric requirements to minimise the reactor residual methane content in the outlet gas and to prevent carbon deposition within the pores of the catalyst. The reaction product is called synthesis gas (syngas) or reformed gas. The main reforming reactions taking place in the ATR are summarised in the following reaction equations:

- Methane reforming: $CH_4 + H_2O \leftrightharpoons CO + 3\ H_2$
- Hydrocarbon reforming: $C_nH_m + n\ H_2O \leftrightharpoons n\ CO + 0.5\ (2n + m)\ H_2$
- Water gas shift reaction: $CO + H_2O \leftrightharpoons H_2 + CO_2$.

In the methanol synthesis reaction, a copper oxide, zinc oxide and alumina-based catalyst is used. The methanol forming reactions are exothermic and the conversion of CO and CO_2 to methanol is favoured by increasing pressure. Main reactions taking place in the synthesis reactors are described by the following reaction equation

- $CO_2 + 3\ H_2 \leftrightharpoons CH_3OH + H_2O$
- $CO + 2\ H_2 \leftrightharpoons CH_3OH$
- $CO + H_2O \leftrightharpoons CO_2 + H_2$.

AdWinMethanol® technology was the basis for Mexinol's first design. It is estimated that AdWinMethanol® achieves a CO_2 reduction of between 66% and 78% compared to today's best-performing plants worldwide. To reduce GHG emissions to almost zero, Mexinol has amended the process to incorporate AdWinMethanolZero® technology with the following improvements:

- Replace fired heaters with electric heaters.
- Capture and recycle the residual gases of the methanol synthesis process, which would otherwise be burned in the fired heaters and emitted as CO_2.
- Combine recovered CO_2 and hydrogen with the synthesis gas produced in the ATR to produce more methanol. Added hydrogen is produced through a water electrolysis process and added to the synthesis gas to keep the ideal composition of the synthesis gas.
- Eliminate the need to continuously run the backup boiler. The ASU unit will incorporate a larger oxygen tank, eliminating the need to run the auxiliary boiler continuously, since a larger oxygen tank provides the necessary operations flexibility to mitigate any eventuality that puts the oxygen availability from the ASU at risk.

By routing captured CO_2 to the synthesis gas stream and repurposing natural gas that was used in fired heaters, production capacity is increased to 6,130 mtpd.

With the replacement of fired heaters with electric heaters and the elimination of continuous auxiliary boiler operations, GHG emissions from the plant are virtually eliminated.

3.3.1 Carbon Balance

More than 99% of carbon entering AdWinMethanolZero® will be converted to methanol. The carbon balance is presented in Table 3.3 for start-of-run (SOR) and end-of-run (EOR). All carbon input is included in the natural gas feed supply. All carbon output is in the produced methanol and PSA purge stream to flare emissions. Based upon a 94% online stream factor, SOR process CO_2 emissions are 24,763 tons/yr and EOR process CO_2 emissions are 17,771 tons/yr, calculated as follows.

- (kmole/hr) (44 g/mole) (8760 hr/yr) (0.94)/ (1000 kg/ton).

The average Scope 1 GHG emissions are 21,267 tCO_2e per year.

Table 3.3: Carbon balance

Carbon balance	Start-of-run (kmol/yr)	Start-of-run (kmol/h)	End-of-run (kmol/yr)	End-of-run (kmol/h)
Carbon in natural gas feed	66201917.94	8039.6772	66201917.94	8039.6772
Carbon in methanol production plant	65746463.64	7984.36603	65917749.45	8005.16728
Carbon in PSA purge to flare emission	562798.4686	68.3472346	403895.1815	49.0497403
Carbon conversion product	0.99312023	0.99312023	0.99570755	0.99570755
Carbon conversion emission	0.00850124	0.00850124	0.00610096	0.00610096

Source: GasConTec Information Package on AdWinMethanol Zero Dated February 2022 Ref#P202109.

To produce methanol via AdWinMethanol® technology, natural gas passes through a process of pretreatment, (ATR) with catalytic pre-oxidation, synthesis gas compression, methanol synthesis, and distillation. To achieve near-zero GHG emissions, the AdWinMethanolZero® technology being employed by Mexinol incorporates additional process elements. Processing steps are illustrated in Figure 3.11.

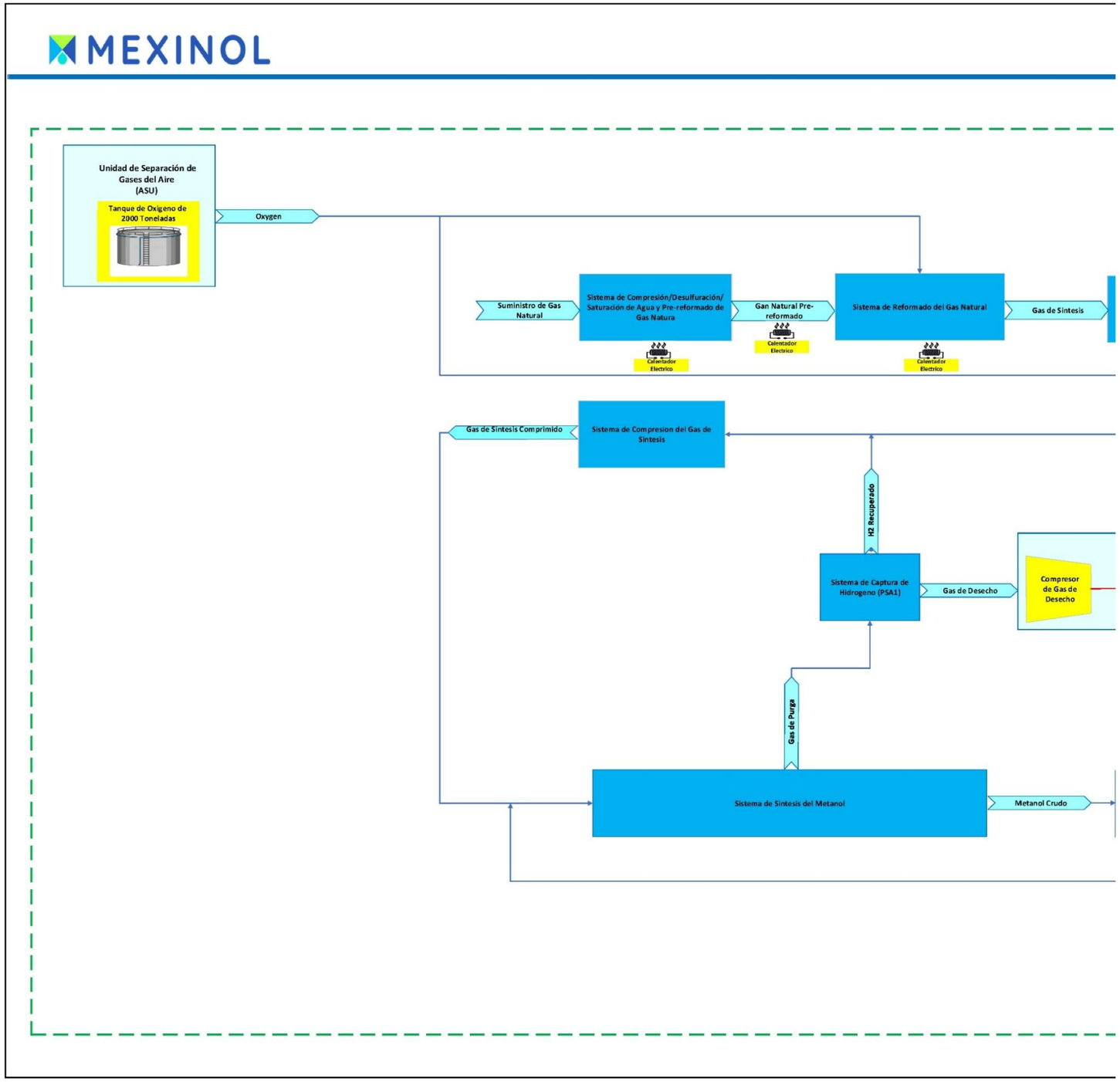


Figure 3.11: Process block flow diagram (Part A)

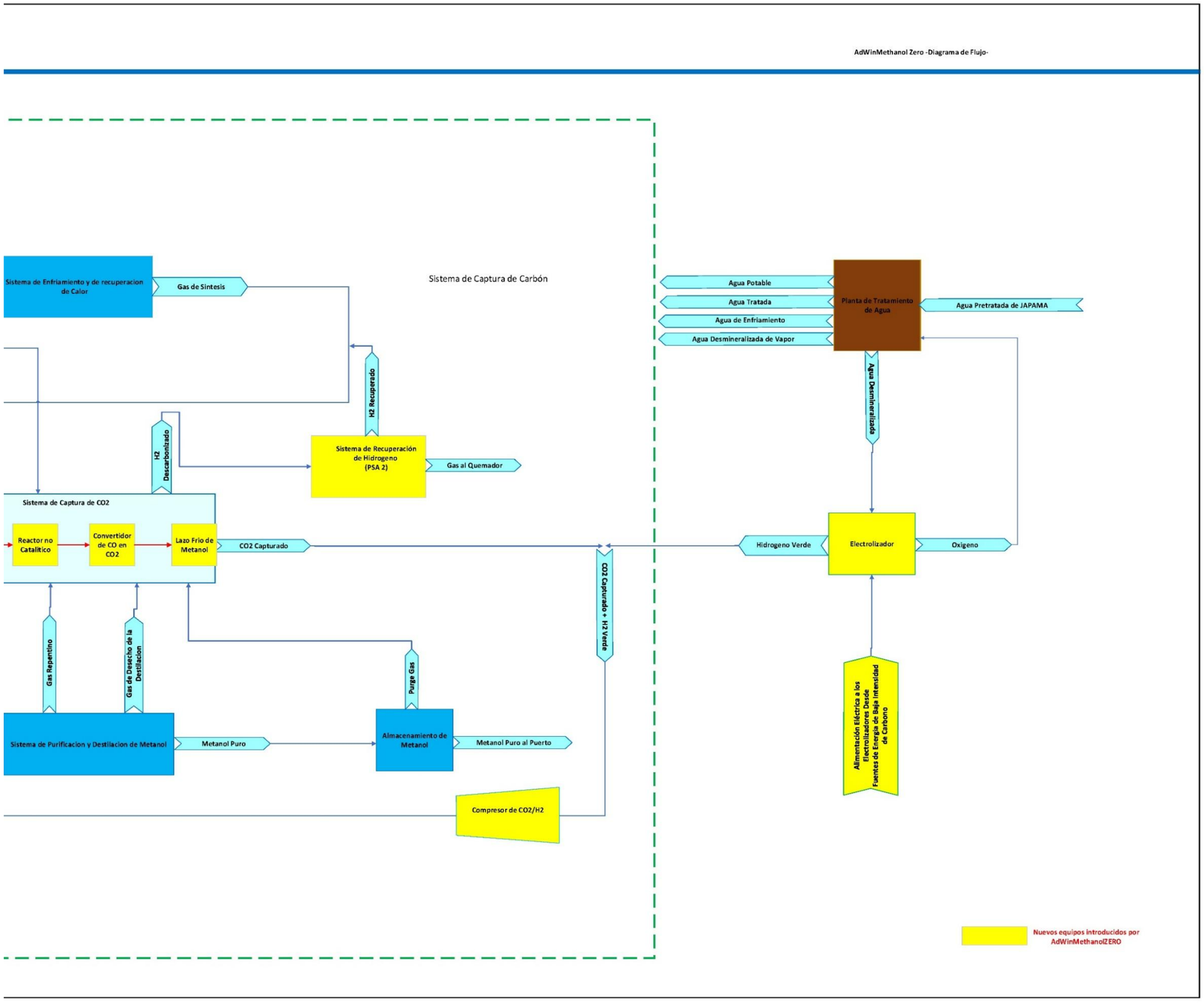


Figure 3.11: Process block flow diagram

(Part B)

AdWinMethanol® process steps are illustrated in blue. AdWinMethanolZero® process additions are illustrated in yellow.

With the AdWinMethanolZero® technology CO_2 emissions are avoided as far as possible and reduced to nearly zero compared to the common classic AdWinMethanol® technology which has already low CO_2 emissions. With AdWinMethanolZero® nearly all CO_2 generated in the plant from the natural gas feed will be converted into methanol. This is achieved by replacing the fuel gas fired heaters by electrical heaters for which renewable energy sources can be used. The thereby avoided CO_2 emissions from the flue gas can now be used to produce added methanol. The supplemental required hydrogen will be generated in a water electrolysis using electrical energy, also from renewable energy sources.

This means that all off gases that were previously burned in the fired heaters, especially the off gas from the Pressure Swing Adsorption (PSA), which treats the purge gas from the methanol synthesis, will be processed in such a way that no carbon or hydrogen is lost and at the same time, the buildup of nitrogen and argon in the process, which would interfere with the methanol synthesis. However, mixtures of nitrogen, methane, carbon monoxide and argon are extremely difficult to separate physically due to their similar molecular properties. This problem is solved by feeding the off gas mixture to a non-catalytic POX, where the hydrocarbons are converted into additional synthesis gas, a mixture of CO, H_2 and CO_2. To reduce the high CO content, the gas leaving the POX passes an isothermally operating CO Shift, where CO with water is converted to H_2 and CO_2. The shifted gas is then routed to a cold methanol loop (CML) where CO_2 is separated. The captured CO_2 is then mixed with hydrogen from the electrolysis and fed back to the methanol synthesis loop via a recycle compressor.

Hydrogen production from electrolysis is routed directly to the process to provide required supplemental hydrogen to the syngas stream with no inventory or storage.

The decarbonised hydrogen from the CML is fed to a 2nd PSA, in which the impurities are separated from the hydrogen. The purified hydrogen is then fed back into the synthesis loop.

The PSA off gas from the 2nd PSA has the complete amount of nitrogen and exceedingly small slips of CO, methane, and CO_2 from earlier process steps. Also, a part of argon is routed to incineration with this stream so that no substantial accumulation of argon can take place in the synthesis loop. The PSA off gas from the 2nd PSA to the flare is the only point source emission in the facility. Annual operational scope 1 and 2 emissions total 24,109 tCO_2e per year which is categorised as small (see Section 9.2).

To keep the required stoichiometric composition of syngas for the methanol production, added hydrogen from electrolysis is fed back into the synthesis loop together with the captured CO_2 and captured hydrogen.

3.3.2 Oxygen

The oxygen venting in the vicinity of the electrolysers is 1000.7 Nm3/h (1.01 m3/sec). At this project stage, it is too early to perform oxygen vent dispersion modelling, as the technology provider choice is not yet finalised and engineering details, including the oxygen venting system are not yet designed. The preferred electrolysis technology supplier has provided the following safety and design guidelines and design standards:

- CGA G-4.4: Guidelines for the safe design and operation of oxygen piping systems.

- CGA G-5.5: Safety standards for hydrogen vent systems to mitigate risks due to flammability.

Vent elevation, location and size are specified during detailed design, following relevant design standards, to ensure safety. Safe venting design considerations include keeping safe concentration on platforms and decks where people work, keeping safe distance from combustible materials to avoid fire hazard, and not venting near structures to avoid down washing.

In addition to the oxygen venting from the hydrogen unit, venting will occur at the Air Separation Unit (ASU). The total vented volume will be quantified during the detailed design phase. This process will ensure compliance with relevant regulations and risk analyses.

Under normal operating conditions, an ASU needs constant oxygen venting from the low-pressure liquid oxygen storage tanks. The accumulation of oxygen vapor could trigger the safety systems of these tanks. Therefore, to keep low internal pressure, this venting must be allowed, and it is a natural loss associated with oxygen storage.

One of the conditions for commissioning and start-up is that the 2,000-ton oxygen tank from the ASU must be fully filled and available to ensure the supply of oxygen to the methanol production process in case of an ASU failure. The stored oxygen will provide continuous supply for 12 hours, which is considered sufficient time to restart the ASU, resume oxygen production, and replenish the oxygen in the tank.

To fill the oxygen tank before the methanol plant becomes operational, the ASU will run in a production mode that maximises the transfer of oxygen to the tank. However, it is important to note that, in the absence of the methanol process during this period, a larger quantity of oxygen will be vented to the atmosphere. This is because the liquid oxygen produced in the distillation column, which is typically sent to the methanol process, normally transfers its cooling capacity to the incoming air stream. This cooled air eases internal distillation within the column. Consequently, venting becomes mandatory and may continue for an extended period while the tank is being filled.

The exact quantities and duration of oxygen venting are currently unknown but will be decided during the engineering phase of the ASU. A comprehensive risk analysis and a dispersion study will be conducted as part of this process. It is also noted that these are typical procedures for this type of air separation plant, and the systems are designed to handle such situations effectively.

3.4 Schedule

An indicative development schedule, outlining the sequence of major activities and the time needed for mobilisation and site preparation, is outlined in Figure 3.12 and Table 3.4 below.

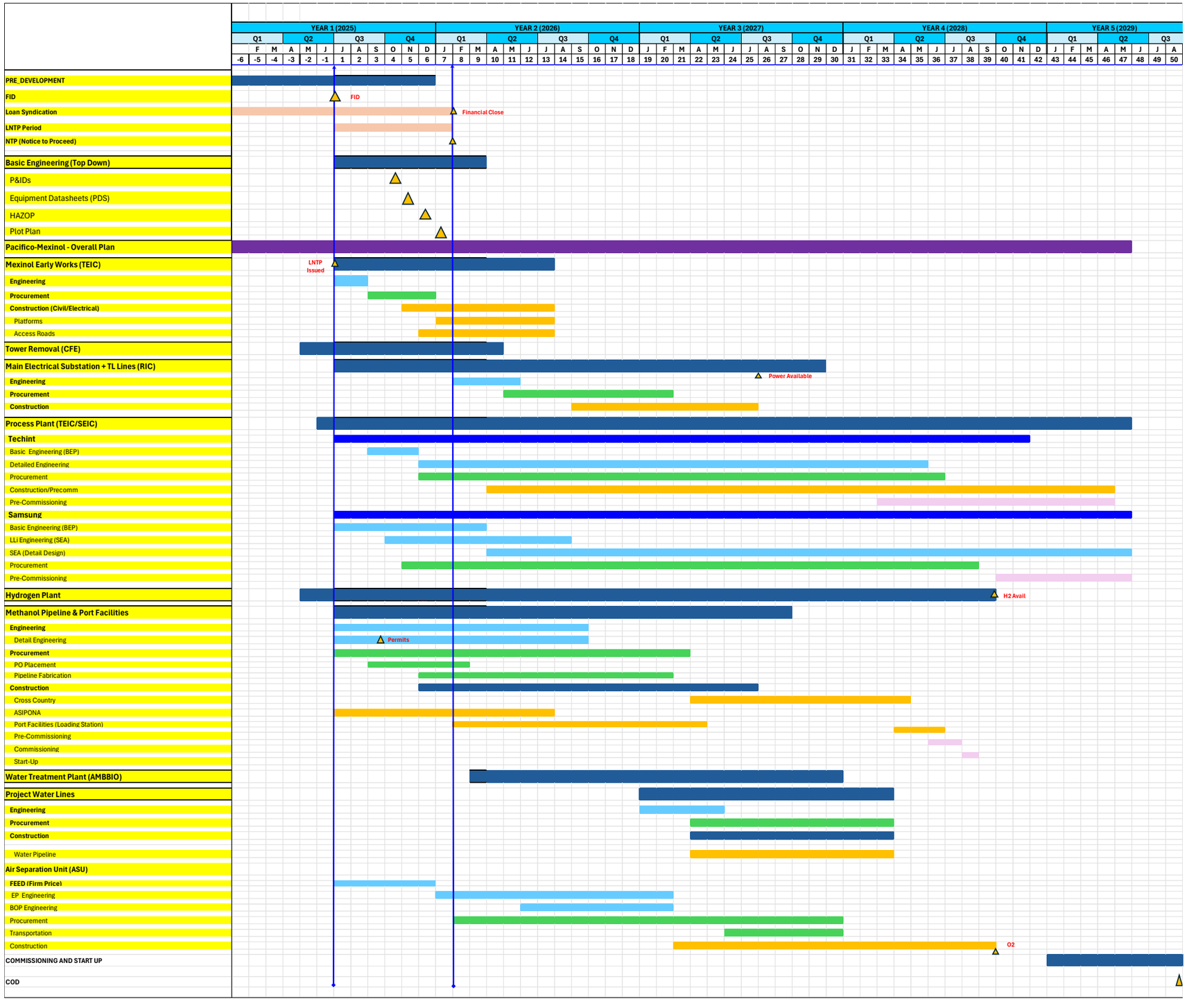


Figure 3.12: Project schedule

Table 3.4: Project development schedule

Key milestone	Dates
Mobilisation and site preparation	Late-2025 to Mid-2026
Construction - Pre-commissioning	Mid-2026 to Late-2028
Commissioning and testing	Late-2028 to Mid-2029
Commercial operation	Mid-2029

Source: Transition Industries (April 2025)

3.5 Project phases

The Mexinol Project follows the engineering, procurement, and construction (EPC) approach, which ensures a streamlined and efficient process from start to finish. The engineering phase focuses on the planning and design of the plant, ensuring all technical and regulatory requirements are met. The procurement phase involves sourcing and buying all necessary materials, equipment, and services, emphasizing prompt delivery and quality. The construction phase includes the actual building and assembly of the plant, adhering to strict safety and quality standards. Together, these EPC phases ensure the Mexinol Project is completed on time, within budget, and to the highest operational standards. All contractual agreements with the respective EPCs includes requirements to abide by IFC PS and WBG relevant EHS guidelines.

The EPC will be executed by EPC contractors, as described below.

- An EPC consortium between Techint and Samsung will handle the methanol processing plant, building infrastructures and utilities.
- Bonatti will be the EPC responsible for:
    - The pipeline for JAPAMA pretreated water supply and rejected water
    - The JAPAMA water pumping station
    - The Mexinol port facilities
    - The 10.3 km long, 28” underground pipelines to transfer methanol from Mexinol storage tanks to the port and the 8” underground pipeline to recover vapour produced during ships loading.
- An EPC for the hydrogen production unit (TBD)
- An EPC for the Mexinol water treatment plant (TBD).

3.5.1 Construction and mechanical completion

3.5.1.1 Early works

Early works are expected to commence at FID (late-2025) and expected to last approximately 8 months encompassing both dry and wet months due to Mexico’s climatic conditions during this period. The early works will be carried out by a local subcontractor under the management of Transition Industries, and is expected to include the following activities:

- water course filling
- water pumping

- vegetation clearance
- earthworks (>110,000 m2)
- clearing, levelling, and compacting of the Project site
- platform structure conformation
- soil excavation and relocation
- relocation of eight overhead power lines (see Figure 3.13) to become pole structures and run parallel to the road on the project site to avoid any impacts (under approval process by regional electricity power authority, CFE, through their selected subcontractor).

Figure 3.13 below shows overhead power lines to be moved by CFE during early works.

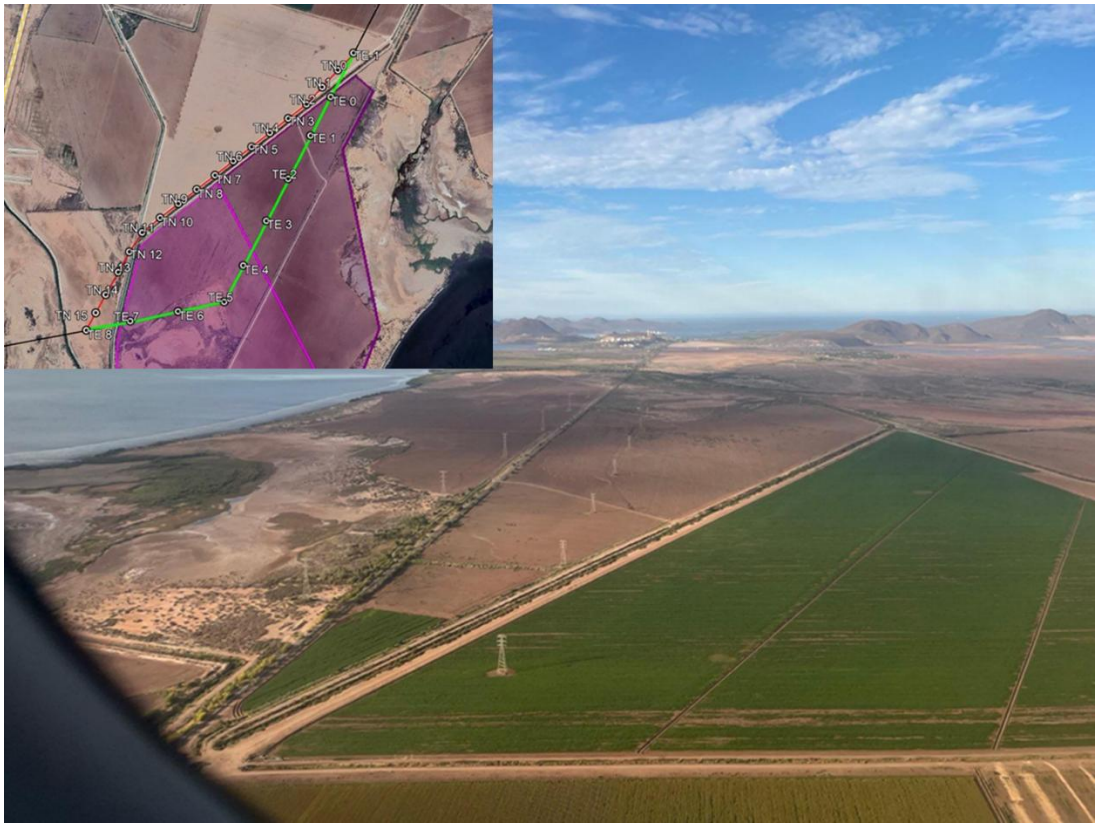


Figure 3.13: Overhead power lines to be relocated during early works

Source: Transition Industries (2025)

3.5.1.2 Construction

The construction period is expected to begin by mid-2026 at the completion of the early works, starting with the process of installing piles. The construction stage will last approximately 36 months (with peak constructed expected to last 24 months) and will occur in various phases depending on the Project part, as described in the schedule (Figure 3.12). Construction will finish after completion of the plant and systems pre-commissioning once Mechanical Completion is achieved.

Methanol production unit

The main activities for the construction of the methanol production facility are expected to include:

- piles installation
- installation of all underground systems such as firefighting ring network, cooling water system and equipment foundations
- backfilling all the sitework until reaching the desired plot plan ground level
- unloading, unpacking, transportation and installation of all Project materials and equipment
- land preparation prior to the pouring of concrete, and verification that the bolts and support levelling supplements have been installed correctly.
- piping systems construction and installation
- welding, following relevant procedures to ensure the safety of personnel and equipment
- steel structures erection including pipe-racks modules transportation and installation
- tanks construction and testing
- underground and above ground electrical and instrument cables installation
- assembly of the construction materials and equipment e.g., couplings, charging lubricant, auxiliary pipes and their complementary elements in their corresponding bases or structures
- final alignment and levelling tests / adjustments with of equipment and systems.
- buildings construction
- testing and flushing of all piping systems
- fencing, paving, grading and internal roads construction
- pre-commissioning of the process plant and systems.

Methanol production unit design

Design of the methanol production unit was based on geotechnical assessments and studies following the MOC-15 code ensuring compliance with structural safety requirements for facilities found in a moderate seismic hazard zone. This classification means the plant must be designed to withstand significant earthquake forces while keeping structural integrity and operational safety. This will be achieved by identifying and implementing the most effective foundation system and key seismic resilience measures.

Preliminary geotechnical studies found that the site is characterised by medium dense to dense granular soils or stiff cohesive soils, which influence how seismic waves travel through the ground. Given the types of soil and the potential to lead to severe structural instability, including settlement or tilting of foundations, the foundation system of the plant incorporates specialised reinforcement measures. These measures include deep pile foundations to transfer structural loads to more stable layers beneath the liquefiable zone. Alternatively, a combination of soil improvement techniques may also be employed to increase soil strength and prevent liquefaction. The final decision on the most effective foundation system will be made based on comprehensive pile testing during the initial stages of project execution. This testing will provide critical data on soil behaviour, load-bearing capacity, and settlement characteristics, ensuring that the chosen solution is both technically and economically optimal.

In addition to foundation reinforcement, the structural design incorporates key seismic resilience measures. The plant's framework will be engineered to absorb and dissipate seismic energy efficiently, reducing the impact of ground motion. The design considers factors such as structural flexibility, controlled deformation, and energy dissipation to prevent catastrophic failure during an earthquake. Overstrength and redundancy are also built into the design to provide an added safety margin beyond minimum code requirements. Further geotechnical studies will be conducted as necessary in detailed design and engineering.

Methanol and vapour recovery pipelines

Two pipelines—a 28" methanol pipeline and an 8" vapor recovery pipeline—will be installed in a shared trench spanning approximately 10.3 km. In addition, two fibre optic cables will be laid in the same trench to enable communication between the methanol production facility and the port.

Pipeline installation will require a 27-meter-wide right-of-way (RoW) during construction, consisting of a 14-meter permanent corridor and a 13-meter temporary work area. Following construction, all temporarily affected areas will be restored or rehabilitated.

In total, approximately 129 hectares of land will be cleared for construction activities, including about 28 hectares within the pipeline RoW and 5 hectares for a 2.46-km-long, 20-meter-wide access road.

To reduce impacts on biodiversity, Horizontal Directional Drilling (HDD) techniques will be used along select segments of the pipeline route.

Two pipelines, a 28" methanol pipeline and an 8" vapour recovery pipeline, will be installed in the same trench, with a length of 10.3 km. Two fibre optic cables will also be installed in the same trench to establish communication between the methanol production facility and the port. A 27 m (14 m permanent, 13 m temporary) RoW for pipeline construction will be in place during the construction phase, after which the area will be restored/rehabilitated. It is important to note that construction will require the clearance of approximately 130 ha of land in total, comprising approximately 28 ha within the 27.4 m wide methanol pipeline construction footprint (of which 14.4 m width is permanent and 13 m width is temporary use), and 5 ha within the 2.46 km long (20 m wide) access road. HDD procedures will be used for some segments of the construction of the pipelines to minimise the impact to biodiversity.

Upgrading of access roads

As part of the site preparation (early works), an existing road (2.46Km) will be upgraded by increasing its width from 6 m to 9 m, so that it is suitable for use by heavy trucks. This road is located within the project land which had already been secured. As of July 2025, all private and Ejidal land transactions required for the plant and methanol pipeline had been concluded with the exception of two agreements that remain pending finalization. Further details on land acquisition are provided in section 5.4.3.15.3.Installation of security provision

A Security Management Plan for the Project has been developed. Security provision will include typical physical security measures for a Project of this scope and size, including closed-circuit television (CCTV), perimeter walls, access control points and lighting (facing into the facility as to not disturb fauna or people).

3.5.1.2.1 Construction of the plant and utilities

Port facilities

The EPC contractor for the port site improvements will conduct an extensive review of the existing harbour and jetty facilities currently used for loading and unloading ships by the Topolobampo

Transoceanic Terminal (TTT) company. The EPC company will also perform detail design and execution of the construction, pre-commissioning, commissioning, start-up, and performance tests needed to make port improvements suitable to load ships with the liquid methanol produced by Mexinol.

No dredging will be needed for the port or associated with the port.

The scope for the new yard at the port covers the following items:

- The connection to a 4" potable water supply line that currently feeds the main ASIPONA aerial tank, with the aim of extending service to meet the needs of the new Mexinol port facilities. The primary use of potable water will be to fill and sustain the water level in the firewater tank, provide water for safety showers, and serve as a water supply for the operator service room found in the local control room.
- The construction of the firefighting system consisting of firewater pumping system, the foam system and the firewater tank with a volume intended to support four (4) hours of continuous operation at the maximum pumping rate. Initially, the tank has been preliminarily sized to accommodate 3760 m^3.
- Construction of the port site control and the electrical room house critical operational systems, ensuring uninterrupted power supply and centralised process control.
- Two new 12” standardised loading arms for methanol transferring to cargo ship, which will include a subsystem to transfer all vapours to a vapour recovery subsystem. The loading arms will be provided with an emergency release system and quick connect/disconnect couplings.
- The Vapour Recovery Unit gathers the methanol vapour produced while cargo ships are loaded. Recovered vapour is liquefied and reinjected back to the methanol loading line, while the recovered nitrogen which has a small amount of methanol (traces), is sent back to the main plant through an 8” vapour return line for further recovery.
- Installation of the methanol metering skid to measure the flow of methanol loaded to cargo ship during the loading process. It will be a modular design package with all on skid instruments and accessories installed.
- Installation of the nitrogen will be used as instrument driving gas, instead of using instrument air. The concept includes a membrane nitrogen generation package which will supply instrument-grade nitrogen as a driving gas instead of compressed air, enhancing system reliability.
- Installation of the pipeline inspection gauge (PIG) launchers and PIG receivers for the 28” methanol and the 8” vapour recovery pipelines. These systems will enable routine pipeline inspection, cleaning, and maintenance, ensuring long-term operational integrity.
- Installation of two fibre optical cables needed for communication and control of the Mexinol port facilities.
- Connection of new 28” methanol transfer and 8” vapour recovery underground high-grade steel pipelines.

Wastewater treatment plant (WWTP) and pipelines

A WWTP will be constructed on site to bring the water to the quality required by the methanol production process. Pre-treated water supply to the Project's WTTP will be delivered via a water pipeline ("JAPAMA pipeline") measuring 28" in diameter and approximately 10.5 km long. The pipeline will be made of high-density polyethylene (HDPE). This pipeline originates at the settling ponds of JAPAMA and extends to the battery limit of the methanol production plant.

An 18" diameter HDPE pipe, approximately 10.8 km long, is needed to convey reject water from the Project's WWTP back to the settling ponds of JAPAMA. The reintroduction of reject water into the mentioned ponds is to occur at a location near the JAPAMA pond inlet.

In addition to the raw and reject water transmission pipelines, the water intake and conveyance system will also comprise a corrugated HDPE pipeline (1.22 m diameter) to transport water from the Los Mochis JAPAMA oxidation ponds to the pumping station site; pipeline protection components (e.g. valves, air-release and air-admission valves, drainage boxes and control enclosures); aerial crossings, and directional crossings at major roads.

Civil works must be carried out on an area next to the settling ponds of JAPAMA to facilitate the installation of a water pumping system made of reinforced concrete. This system includes six (6) water pumps that will feed water to the 28" pipeline. The purpose of this system is to convey pre-treated water to the methanol production plant.

The following control, monitoring and safety systems will also be installed for the WWTP facility:

- Flow Measurement System: Installation of a 28" electromagnetic flow meter to monitor the volume of water pumped from the pumping station to Mexinol facilities.
- Instrumentation and Control System: Deployment of an HMI-based control system for real-time monitoring and automation of the pumping station.
- Surveillance System: Installation of a CCTV monitoring system at the pumping station for security and operational supervision.
- Operational Facilities: Construction of and operation control room and Motor Control Centre (MCC) room.
- Emergency Power Supply: Installation of an emergency power plant at the pumping station, ensuring four (4) hours of autonomous operation during power outages.

A fibre optic communication and commissioning system, including a 2" fibre optic conduit (connecting PTAR Los Mochis to Mexinol facilities) for real-time communication and data transmission will also be installed.

Leak-tightness tests for the pumping station, raw water, and reject water pipelines will be conducted to ensure structural integrity before the WWTP is commissioned.

The work scope described here will be executed through an EPC contract. The construction of the WWTP will occur simultaneously with the methanol production facility and electrolysers.

A detailed description along with a block flow diagram is provided below.

Wastewater treatment process

The Project's planned water treatment process is depicted in Figure 3.14 and described below.

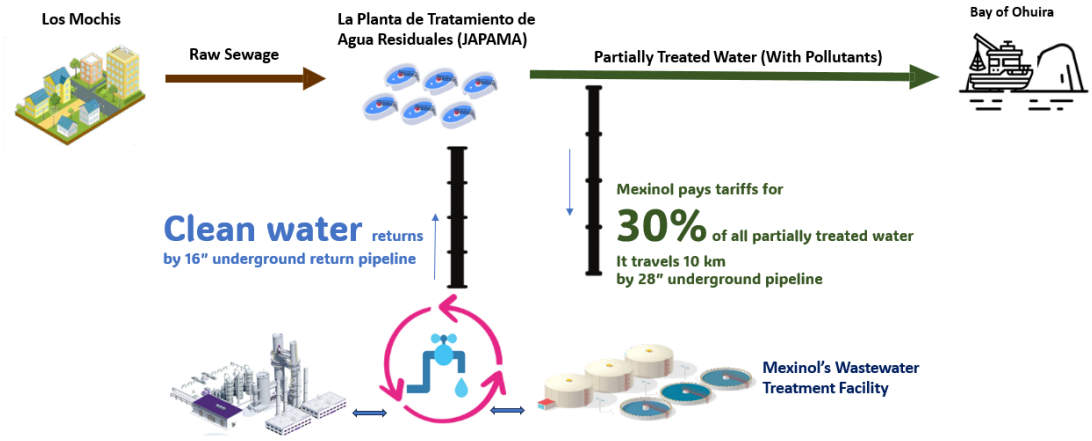


Figure 3.14: Wastewater treatment process

Existing JAPAMA Operations:

Step 1: Screening

A part of the wastewater generated by the neighbouring community (Los Mochis) is channelled to a JAPAMA treatment facility. Here, it goes through screening where grates or sieves remove large solid waste, such as plastics, paper, and rags.

Step 2: Transfer to Settling Ponds

The wastewater is pumped to JAPAMA's settling ponds or stabilisation lagoons. In these lagoons, the water receives a natural treatment that includes sedimentation, biological oxidation, and photosynthesis. Retention time in the ponds is approximately 28 days. The outflow is discharged to a canal that flows to the Bay of Ohuira.

Mexinol Water Treatment Elements:

Step 1: Pumping raw water to Mexinol's treatment plant

30% of the water treated in the JAPAMA's settling ponds will be transferred via a new pumping station to the Mexinol WWTP, 10 km, through a 28" diameter underground pipeline.

Step 2: Treatment in Mexinol WWTP

The treated water from Mexinol's WWTP will be stored in a tank divided into two sections. The lower section of the tank will hold a volume of 10,000 m^3 of water to supply the fire-fighting system pumps. The upper section of the tank will feed other plant water systems, such as the demineralised water system (boiler feed water), the potable water system and the cooling towers.

Step 3: Cooling system

90% of the treated water will be used in the plant's cooling system, compensating for the evaporated water and blowdown to prevent buildup of dissolved particles. Blowdown water will be treated to regulate its acidity (pH) and to follow applicable standards before being returned to the JAPAMA settling ponds, via a 16" diameter underground return water pipeline to be found in the same RoW as the water supply line.

Step 4: Ultrafiltration and reverse osmosis

10% of the treated water from the Mexinol WWTP will be directed to ultrafiltration and reverse osmosis modules for demineralisation and polishing. The discharge water from the cooling tower, combined with the discharge from the second stage of reverse osmosis, will undergo added treatment to ensure compliance with the Chemical Oxygen Demand (COD) limits specified by the IFC standards. The combined effluent stream will first pass through a tertiary treatment process designed to reduce COD levels. This may involve an advanced oxidation process to remove organic compounds and other contaminants contributing to COD. Once the pre-treated effluent meets the required IFC and international standards, it will be discharged into the oxidation pond managed by JAPAMA. The water resulting from the ultrafiltration and polishing process will be stored in the polished water tank to be used to produce high, medium, and low-pressure steam.

Step 5: Potable water production

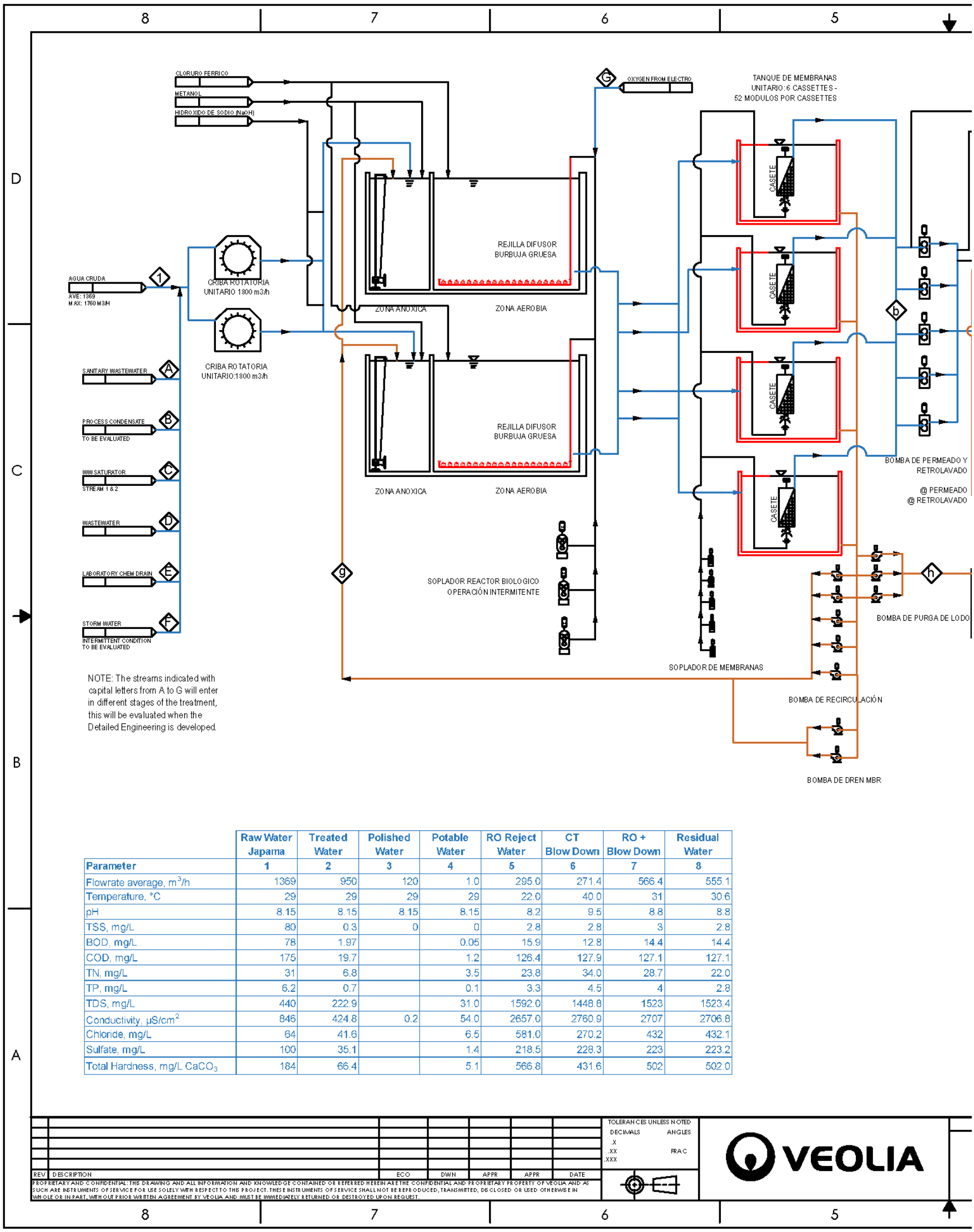
A stream of water after ultrafiltration will go through a reverse osmosis process to produce potable water. This water will be used for general services such as showers and in laboratories following quality standards. Wastewater from general services applications will be recycled to the Mexinol WWTP for treatment.

A water balance and simplified block flow diagram is presented in Table 3.5 and a more detailed block flow diagram is presented in Figure 3.15 below.

Table 3.5: Project water balance

	Raw Water Japama	Treated Water	Polished Water	Potable Water	RO Reject Water	CT Blow Down	RO + Blow Down	Residual Water
Parameter	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Flowrate, m^3/h	1369	950	120	1.0	295.0	271.4	566.4	555.1
Temperature, C	29	29	29	29	22.0	40.0	31	30.6
pH	8.15	8.15	8.15	8.15	8.2	9.5	8.8	8.8
TSS, mg/L	80	0.3	0	0	2.8	2.8	3	2.8
BOD, mg/L	78	1.97		0.05	15.9	12.8	14.4	14.4
COD, mg/L	175	19.7		1.2	126.4	127.9	127.1	127.1
TN, mg/L	31	6.8		3.5	23.8	34.0	28.7	22.0
TP, mgL	6.2	0.7		0.1	3.3	4.5	4	2.8
TDS, mg/L	440	222.9		31.0	1592.0	1448.8	1523	1523.4
Conductivity, $\mu S/cm^2$	846	424.8	0.2	54.0	2857.0	2760.9	2707	2706.8
Chloride, mg/L	64	41.6		6.5	581.0	270.2	432	432.1
Sulphate, mg/L	100	35.1		1.4	218.5	228.3	223	223.2
Total Hardness, $CaCO_3$ (mg/L)	184	66.4		5.1	566.8	431.6	502	502.0

Source: Transition Industries (August 2024)



NOTE: The streams indicated with capital letters from A to G will enter in different stages of the treatment, this will be evaluated when the Detailed Engineering is developed.

	Raw Water Japama	Treated Water	Polished Water	Potable Water	RO Reject Water	CT Blow Down	RO + Blow Down	Residual Water
Parameter	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Flowrate average, m^3/h	1369	950	120	1.0	295.0	271.4	566.4	555.1
Temperature, °C	29	29	29	29	22.0	40.0	31	30.6
pH	8.15	8.15	8.15	8.15	8.2	9.5	8.8	8.8
TSS, mg/L	80	0.3	0	0	2.8	2.8	3	2.8
BOD, mg/L	78	1.97		0.05	15.9	12.8	14.4	14.4
COD, mg/L	175	19.7		1.2	126.4	127.9	127.1	127.1
TN, mg/L	31	6.8		3.5	23.8	34.0	28.7	22.0
TP, mg/L	6.2	0.7		0.1	3.3	4.5	4	2.8
TDS, mg/L	440	222.9		31.0	1592.0	1448.8	1523	1523.4
Conductivity, $\mu S/cm^2$	846	424.8	0.2	54.0	2657.0	2760.9	2707	2706.8
Chloride, mg/L	64	41.6		6.5	581.0	270.2	432	432.1
Sulfate, mg/L	100	35.1		1.4	218.5	228.3	223	223.2
Total Hardness, mg/L $CaCO_3$	184	66.4		5.1	566.8	431.6	502	502.0

Figure 3.15: Water balance and block flow diagram

(Part A)

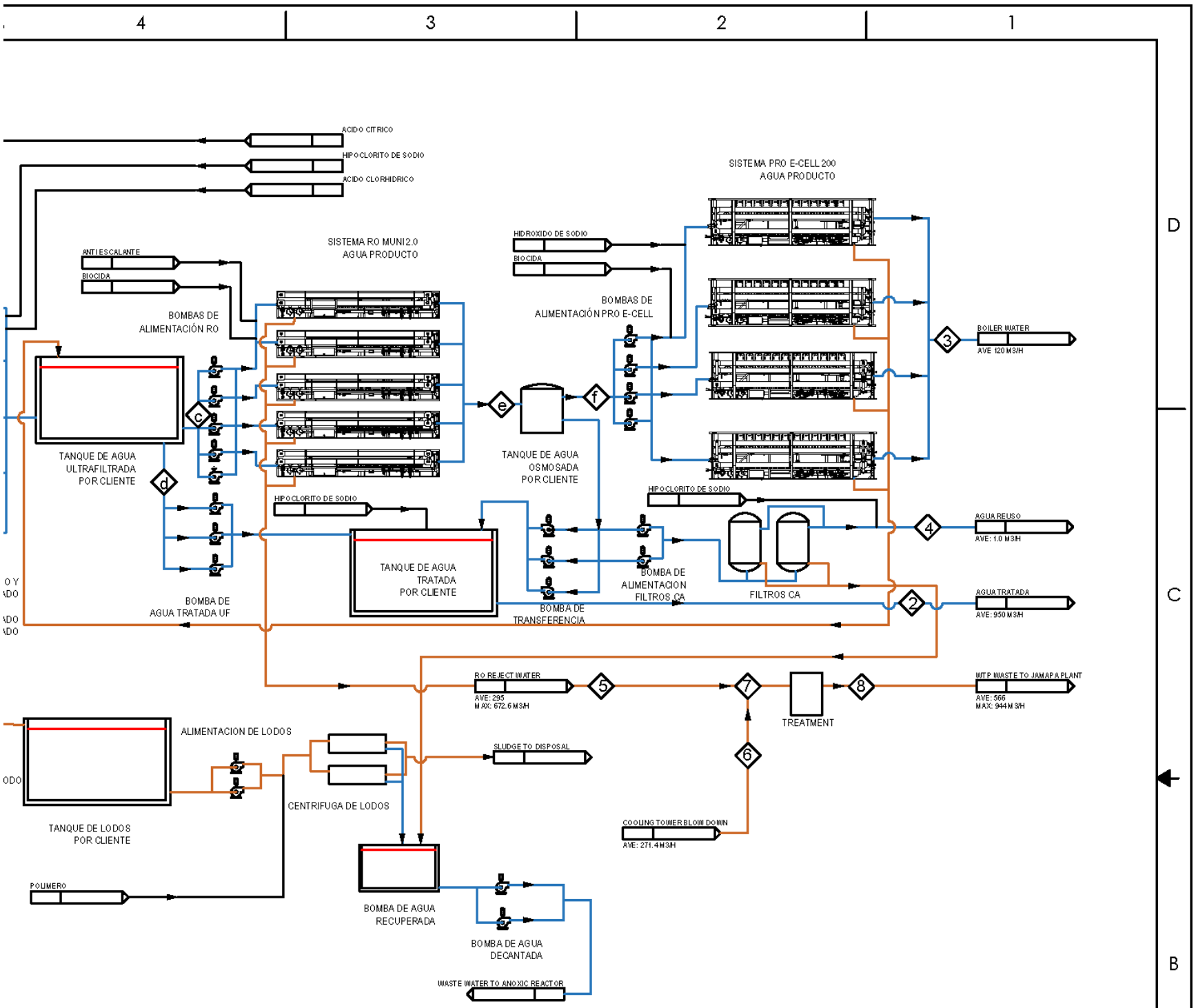


Figure 3.15: Water balance and block flow diagram

(Part B)

At the Mexinol WWTP, water will undergo primary and secondary treatment to reach the required quality levels.

This process will generate two waste streams: activated sludge and water to be returned to Japama's treatment facility (see Stream 8).

The activated sludge will be dewatered and managed as a waste stream. The water that will be returned to JAPAMA will be a combination of cooling tower blowdown water and reverse osmosis treatment reject water. These streams will be combined and neutralised before returning to Japama. The return effluent quality stream will be fully compliant with WBG General EHS Guidelines -Wastewater and ambient water quality (Table 1.3.1 – Indicative values for treated sanitary sewage discharges) as well as those of the official Mexican standards (NOM-001-SEMARNAT-2021 and NOM-002-SEMARNAT-1996). NOM-001-SEMARNAT-2021 would be applicable if Mexinol discharged directly to the Bay of Ohuira (and is provided for comparison purposes only). NOM-002-SEMARNAT-1996 is applicable for discharges to municipal treatment facilities. Reject water design parameters are presented in Table 3.6 to these standards.

Table 3.6: Reject water design parameters

Parameter	Reject water	World Bank General EHS Guidelines - Wastewater and ambient water quality *(Table 1.3.1 - Indicative values for treated sanitary sewage discharges)*	NOM-001-SEMARNAT-2021		NOM-002-SEMARNAT-1996	
			M.A	D.A	M.A	D.A
Flowrate (m^3/h)	555.1	-	-	-	-	-
Temperature (C)	30.6	40	35	35	40	40
pH	8.8	6-9	6-9	6-9	5.5-10	5.5-10
TSS (mg/L)	2.8	50	60	72	60	72
Oil and Grease (mg/L)	-	10	15	18	50	75
Cadmium (mg/L)	-	0.1	0.2	0.3	0.5	0.75
Total Residual Chlorine (mg/L)	-	0.2	-	-	-	-
Chromium (total) [mg/L]	-	0.5	1	1.25	0.5	0.75
Copper (mg/L)	-	0.5	4	5	10	15
Iron (mg/L)	-	3	-	-	-	-
Zinc (mg/L)	-	1	10	15	6	9
Cyanide (free) [mg/L]	-	0.1	-	-	-	-

Parameter	Reject water	World Bank General EHS Guidelines - Wastewater and ambient water quality *(Table 1.3.1 - Indicative values for treated sanitary sewage discharges)*	NOM-001-SEMARNAT-2021		NOM-002-SEMARNAT-1996	
			M.A	D.A	M.A	D.A
Cyanide (total) [mg/L]	-	1	1	2	1	1.5
Lead (mg/L)	-	0.1	0.2	0.3	1	1.5
Nickel (mg/L)	-	1.5	2	3	4	6
Heavy metals total (mg/L)	-	5	-	-	-	-
Phenol (mg/L)	-	0.5	-	-	-	-
BOD (mg/L)	14.4	50	-	-	-	-
COD (mg/L)	127.1	125	150	180	150	180
TN (mg/L)	22	10	25	30	-	-
TP (mg/L)	2.8	2	15	18	-	-
TDS (mg/L)	1523.4	-	-	-	-	-
Conductivity ($\mu S/cm^2$)	2706.8	-	3500	3500	-	-
Chloride (mg/L)	432.1		1000	1000	-	-
Sulphate (mg/L)	223.2	-	-	-	-	-
Total Hardness $CaCO_3$ (mg/L)	502	-	-	-	-	-

Note: M.A = monthly average, D.A = daily average

Source: Transition Industries (2024)

WWTP process description

The excess oxygen generated by the hydrogen plant will be utilised in the Mexinol wastewater treatment process (WWTP), specifically within the activated sludge system. This process involves the biochemical oxidation of organic and nitrogenous materials by microorganisms. Initially, these microorganisms use the organic matter for growth, consuming oxygen in the process. As the available organic matter decreases, the microorganisms then oxidise their own cellular material. The entire process ensures that the oxygen is effectively used for these microbial activities, minimising any residual oxygen emissions into the atmosphere.

The main goal of an activated sludge process is the removal of organic matter and nitrogenous material. The mechanism by which these materials are removed is through microbial oxidation, which is divided into two main stages as described below.

Stage 1: Biochemical oxidation of carbonaceous material

Initial stage-predominance of synthesis (anabolism): Initially, the organic matter present is used by microorganisms for their metabolic activities, for their growth, and for energy conversion. Thus, activities related to synthesis prevail. This phase results in oxygen consumption and growth of the microbial population. This process can be represented by the following generic equation. In this equation, organic matter is represented as H_2O, and cellular material is represented as $C_5H_7NO_2$.

$$8CH_2O + NH_3 + 3O_2 \rightarrow C_5H_7NO_2 + 3CO_2 + 6H_20 + Energy$$

Organic matter — *Cellular matter*

Next stage-predominance of endogenous respiration (catabolism): When the organic matter originally present in the wastewater is mostly removed, the second phase of oxidation predominates. At the beginning of this phase, the population of microorganisms is at its peak, and due to the limited availability of substrate in the medium, their own cellular plasma becomes the main food source. Therefore, in this phase, the self-oxidation or endogenous respiration mechanism predominates. The simplified representative equation for this phase is:

$$C_5H_7NO_2 + 5O_2 \rightarrow 5CO_2 + NH_3 + 2H_20 + Energy$$

Cellular matter

The total oxygen consumption of both phases is defined as the ultimate oxygen demand (DBOu). The addition of the earlier equations leads us to obtain the simplified equation for the oxidation of organic matter:

$$CH_20 + O_2 \rightarrow CO_2 + H_20 + Energy$$

Stage 2: Oxidation of nitrogenous material

The nitrogenous material present in wastewater is composed of:

- Organic nitrogen
- Ammoniacal nitrogen.

The oxidation mechanism of these compounds begins with the process of ammonification (conversion of organic nitrogen to ammoniacal nitrogen), and after the bio-oxidation of ammoniacal nitrogen to nitrates. This latter process is carried out in two stages. In a simplified manner, the oxidation process unfolds as follows:

Oxidation of Ammonia (Nitrification):

- First stage (oxidation of ammonium to nitrites):

Nitrosoma

$$2NH_4^+ + 3O_2 - - \rightarrow 2NO_2^- + 4H^+ + 2H_2O$$

- Second stage (oxidation of nitrites to nitrates):

Nitrobacter

$$Total\ process:\ 2NO_2^- + O_2 \ - - - \rightarrow \ 2NO_3^+ + NH_4^+ + 2O_2 \rightarrow NO_3^- + 2H^+ + H_2O$$

The oxygen requirement for the above processes can be met through the injection of atmospheric air or oxygen. However, it is possible to meet the oxygen demand by injecting high-purity oxygen (>90%). The use of a high-purity oxygen stream has the following advantages:

- Minimises the production of filamentous microorganisms (these microorganisms cause severe problems in sludge-water separation and generate unpleasant foam).
- Reduces the production of biological sludge.
- Reduces the required volume of the biological reactor.
- Increases the solubility of oxygen in wastewater.
- Increases the efficiency of oxygen transfer.

The primary disadvantage of using oxygen for treating wastewater is the high associated cost. However, in the case of the Mexinol project, this issue is mitigated by the availability of excess oxygen from the Hydrogen Plant that otherwise would be vented. The Mexinol WWTP will use this oxygen as its main source. Additionally, the WWTP will include an air injection system as a backup. This backup ensures that if the Hydrogen Plant is ever out of service and unable to produce the necessary oxygen, the WWTP can still process and treat the JAPAMA water effectively using the air injection system.

About atmospheric emissions, there is no significant difference when using oxygen instead of air. To verify this, the biological process was simulated using both atmospheric air and 98% pure oxygen. Table 3.7 is a comparison of the off-gas characteristics from each process. The compositions are similar, but the off-gas flow is significantly lower when using 98% oxygen.

Table 3.7: Off-gas comparison

	Activated sludge process using atmospheric air	Activated sludge process using 98% oxygen
Required Flow (m^3/h) @ 20 C and 1 atm	2,500	94.16
Air composition	• O_2 = 20.95% • CO_2 = 0.04% • N_2 = 79%	• O_2 = 98% • CO_2 = N/A • N_2 = N/A
Off-gas composition flowrate (m^3/h)	2,574	18.56
Off-gas composition	• O_2 = 17.9% • CO_2 = 1.48% • N_2 = 80.6%	• O_2 = 19.77% • CO_2 = 15.15% • H_2 = 0.23% • N_2 = 74.85%

Source: Transition Industries (2024)

WWTP initial design parameters

Veolia WT has proposed a water treatment process design consisting of the following treatment stages:

- Reception of raw water and solid separation via fine screening
- Removal of organic matter and nutrients using an MBR-type activated sludge process

- Removal of dissolved salts through a first-pass reverse osmosis (RO) for treated water
- Polishing of the water using a second-pass RO, electrode ionization (EDI), for polished water
- Potable water treatment using activated carbon filters for service water.

Based on JAPAMA's average raw water inflow of 1,394 m³/hr, the expected plant outlet figures are presented in Table 3.8.

Table 3.8: Expected WWTP outlet

Treatment stage	Expected outlet (m_3/h)
Treated water capacity (supply at Mexinol WWTP battery limit)	• Normal: 950 • Maximum: 1230
Polished water capacity (supply at Mexinol battery limit)	• Normal: 120 • Maximum: 140
Service water capacity (supply at Mexinol battery limit)	• Normal: 1 • Maximum: 6

Source: Transition Industries (2024)

Veolia WWTP main equipment design will consist of:

- Biological Reactor: Due to the low alkalinity in the feed water (85 mg $CaCO_3$/L) and high phosphorus levels, the addition of a coagulant such as ferric chloride is considered necessary. Given the low organic matter content (BOD) compared to nitrogen, an external carbon source is needed for the denitrification process and consequent nitrogen removal. Therefore, a carbon source such as methanol or molasses may need to be added.
  The design of the bioreactor and MBR membrane tanks has considered that their construction will be in concrete (outside the scope of WTS), with a total wall height of up to 8.0 meters and an operational level between 6.5 and 7.6 meters. Due to the seismological conditions of the area, construction with steel plates coated may also be considered.
- RO and EDI: To achieve the treated water specifications for "polished water" and "potable water" for boilers, it is necessary to treat the effluent from the MBR biological system with a double-pass RO system and EDI, according to each system's needs:
- Treated Water: The sodium specification is the most restrictive parameter, requiring the first-pass RO to treat 63% of the flow, which will then be mixed with 37% of the permeate flow from the MBR. This approach optimises equipment and consumables (chemicals, energy, and others). In the mixing tank, "Treated Water Tank" (provided by others), chlorine dosing is needed to meet the residual requirement.

- Potable Water: A stream of the permeate from the first-pass RO will be fed into an activated carbon filter and then chlorinated in the storage tank (provided by others).
- Polished Water: The effluent or permeate from the first-pass RO system will be the influent for a second-pass RO and will undergo polishing through an EDI process to meet the required quality specifications.

Air separation unit

The ASU unit to produce oxygen and nitrogen, necessary for the methanol production process, will include the following subsystems: air compression, air cooling, water absorption, distillation cold box, process nitrogen compression, nitrogen expansion, oxygen and liquid nitrogen storage and oxygen and nitrogen vaporisation and delivery.

Contract negotiations are ongoing with the Responsible Party. No further details are currently available; however, construction of the ASU will occur simultaneously with the methanol production facility and electrolysers.

Hydrogen generation unit

Electrolysis is a process that uses electricity to split water (H_2O) into its basic elements: oxygen (O_2) and hydrogen (H_2). In the Mexinol project, the chosen technology for producing green hydrogen is the Proton Exchange Membrane (PEM) electrolysis. This green hydrogen will serve as a key feedstock for the green methanol production process. Alongside hydrogen, a significant amount of oxygen is also generated.

The high purity hydrogen production from electrolysis is routed directly to the process to provide required supplemental hydrogen to the syngas stream with no inventory or storage.

The design philosophy is to minimise waste and make the most of valuable byproducts. Rather than simply venting the by-product oxygen into the atmosphere, a part will be routed the WWTP biological reactor, where it can be effectively utilised. Use of this oxygen in that application is explained above.

To ensure the safety of the hydrogen production unit, a cold vent stack is necessary to vent the excess by-product oxygen. This stack will be appropriately sized to handle the total volume of oxygen produced, including the excess that needs to be vented. This vent stack will be erected 5-7 m above the highest point of the hydrogen buildings (with the louvre height being approximately 10 m from ground level). The venting will be directed to a safe location, considering the prevailing winds and the proximity of other structures to prevent potential oxygen-enriched zones. Initial simulations write down that a flow rate of 1000.7 Nm³/hr of 98% pure oxygen will be vented to atmosphere through the vent stack and approximately 534 m³/hr, will be utilised in the Mexinol WTP's biological reactor process.

Construction of the hydrogen generation unit will occur simultaneously with the methanol production facility and electrolysers.

3.5.1.2.2 Construction of the methanol and vapour recovery pipelines and HDD

A pipeline corridor will be constructed from the methanol production plant to the Port of Topolobampo (ASIPONA) facilities, with a total length of 10.3 km. The corridor will consist of two underground ducts found in the same trench, spaced 2 meters apart:

- A 28” diameter duct for methanol transport

- An 8” diameter duct for vapour recovery.

The total RoW will be 27 m wide of which 14 m will be permanent, and 13 m will be temporary used during the construction phase, as shown in the Figure 3.16 below.

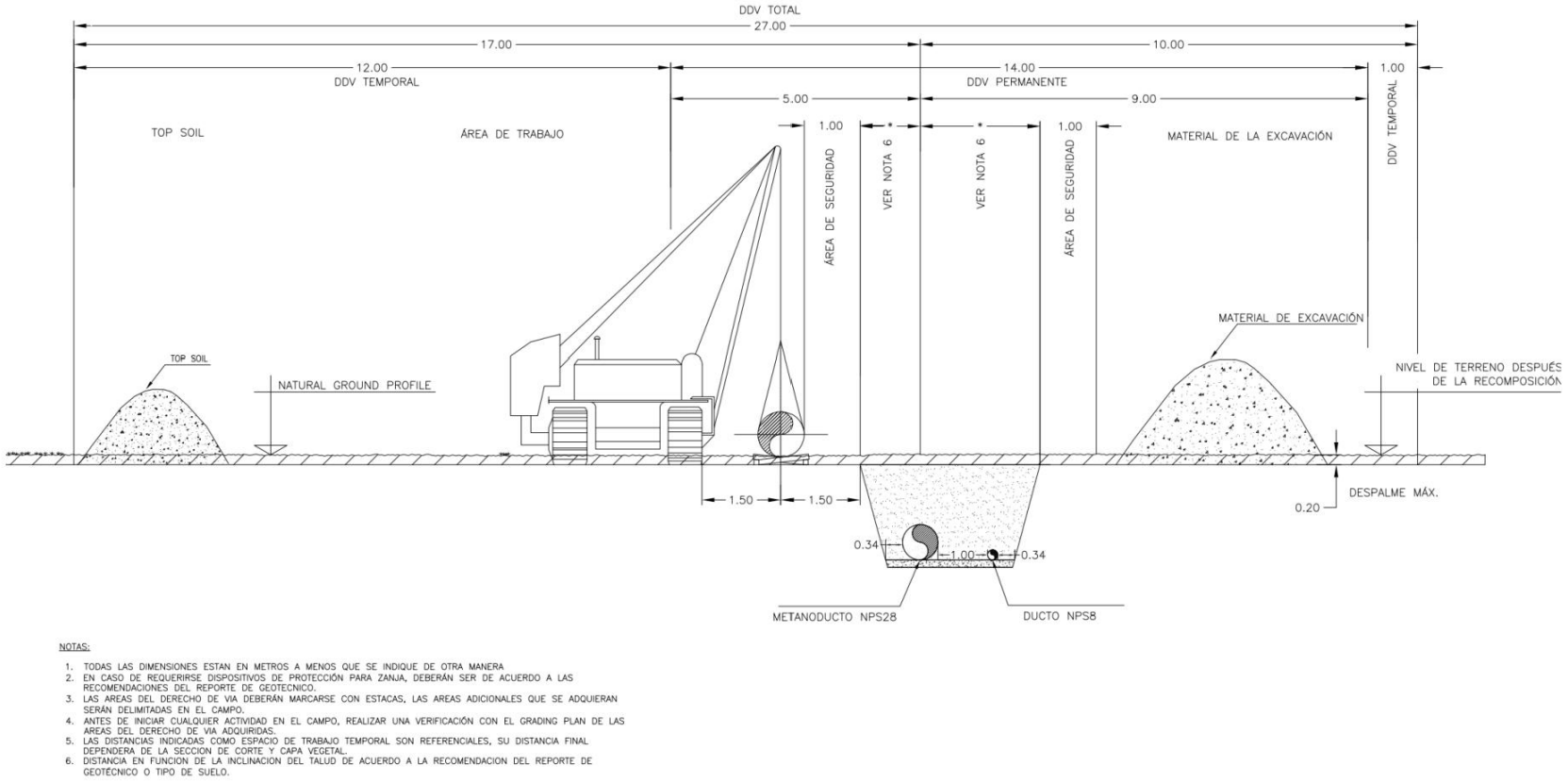


Figure 3.16: Methanol and vapour recovery pipelines RoW

In the same trench, fibre optic cables will also be installed to establish communication and control between the production plant and the port facilities.

Additionally, thirteen temporary areas will be chosen for use only during the construction phase to store materials and equipment needed for crossing irrigation channels, roads, etc. It is important to note that a horizontal drilling (HDD) (see Figure 3.17 below) procedure will be used to pass the ducts under areas with natural vegetation to avoid any environmental impact. Figure 3.20 shows the HDD locations along the methanol pipeline route.

For a better comprehension of the methanol and vapour recovery pipelines construction process, the pipelines route was divided in segments.

- Within the segment 1-2, which has a length of 1,248.83 m, there is an irrigation channel which can be either closed or diverted to allow for pipeline crossing construction. The pipelines will also cross a secondary road in this segment.
- Segment 2-3 includes an irrigation channel and existing flora that will be crossed by HDD method to avoid disturbing the ecosystem. The length of the segment is 718.72 m.
- Segment 3-4 has a stream crossing that will be carried out with an open cut crossing during the dry season. The length of the segment is 681.27 m
- Segment 4-5, within its length of 1,166.22 m crosses a secondary road. The crossing will be open cut method.
- Segment 5-6 includes one secondary road that will be crossed by open cut method. This segment has a length of 244.85 meters.
- Segment 6-7 with a length of 1.697.76 m includes a boring drilling to cross a paved road. Also, within this segment there is a secondary road which will be crossed by open cut method.
- Segment 7-8 includes a secondary road which will be crossed by open cut method. Also, this segment has a paved road (Adolfo Lopez Mateos which intersects with the Los Mochis-Topolobampo highway) which will be crossed using boring drilling method. Also in this segment is the start the lagoon that will be crossed by open cut method during the dry season. The length of this segment is 1,051.84 m.
- Segment 8-9 has a length of 299.04 m. It will be crossed by open cut method during the dry season.
- Segment 9-10, with a length of 283.87 m, ends the lagoon crossing and will be crossed by open cut method during the dry season.
- Segment 10-11 includes a paved road that will be crossed by open cut method. This segment has a length of 162.25 m.
- Segment 11-12 includes railroad tracks that will be crossed by boring drilling method. The length of this segment is 15.67 m.
- Segment 12-13 has a length of 709.74 m.
- Segment 13-14 includes crossing railroad tracks and the Los Mochis-Topolobampo highway with boring drilling method. The pipeline will be buried under concrete in this segment with a length of 49.13 m.

- Segment 14-15 is along the Los Mochis-Topolobampo highway, and the pipeline will be buried under the concrete of the highway in all the segment which has a length of 1,478.10 m.
- Segment 15-16 is 50.67 m. In this segment there are two railway lines that will be crossed using the boring drilling method. At the reception point there will be a PIG receiver.

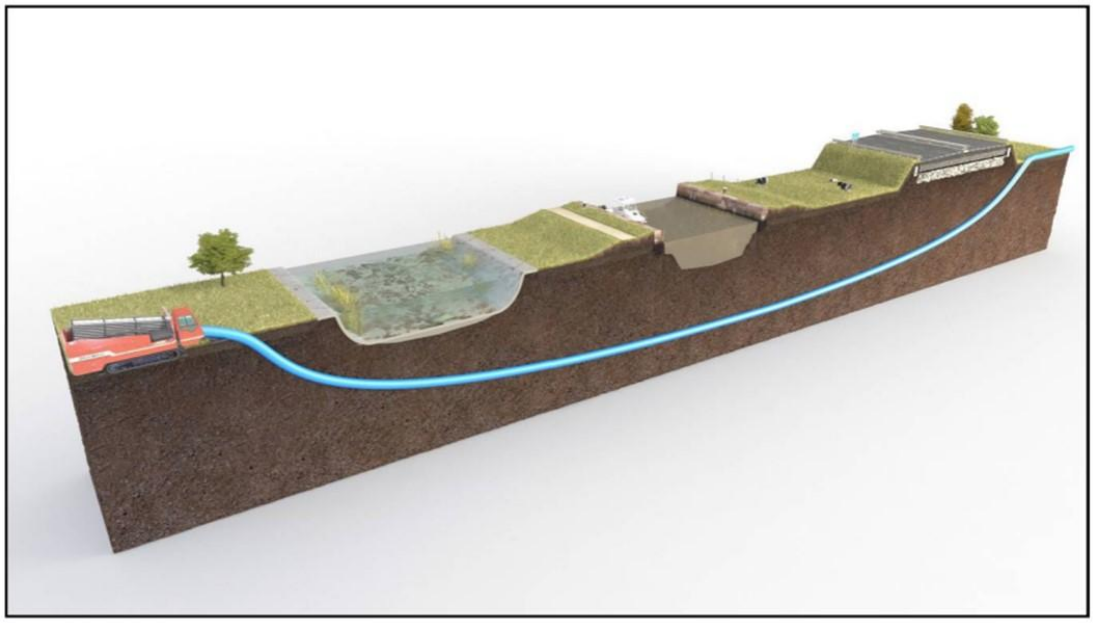


Figure 3.17: Horizontal directional drilling schematic

Figure 3.18: Micro tunnelling schematic

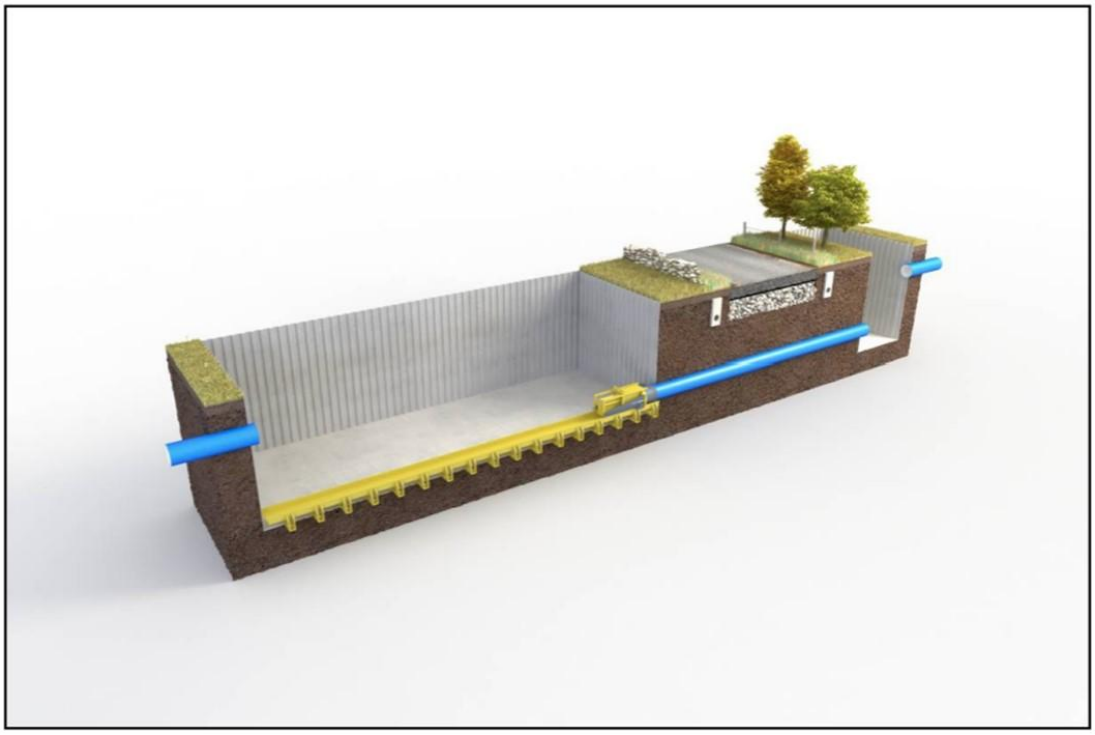


Figure 3.19: Auge boring schematic

Figure 3.20: HDD locations for methanol pipeline construction

3.5.1.3 Pre-commissioning and mechanical completion

3.5.1.3.1 Pre-commissioning

The pre-commissioning stage of the Mexinol Project is a vital phase that prepares the methanol production plant for the actual commissioning and later operations. This stage involves a series of systematic and thorough checks, tests, and activities to ensure that all systems, components, and equipment are installed correctly and are in best condition. The pre-commissioning process aims to find and resolve any issues before the plant enters the commissioning stage, thereby ensuring a smooth transition to full operational readiness.

Site inspection and verification

The first step in the pre-commissioning stage involves a detailed inspection and verification of the plant site. This includes:

- Visual Inspections: Conducting comprehensive visual inspections of all equipment, structures, and installations to check for any visible defects, damages, or discrepancies
- Verification Against Design Specifications: Ensuring that all installations conform to the design specifications, engineering drawings, and manufacturer recommendations.

Mechanical completion checks

Mechanical completion checks are essential to confirm that the installation of all mechanical components is complete. This involves:

- Punch List Preparation: Creating a punch list of any incomplete tasks or issues identified during the inspections.
- Punch List Clearance: Addressing and resolving all punch list items to ensure all mechanical systems are fully installed and operational.

System cleaning and flushing

To prevent contamination and ensure the cleanliness of the systems, the following activities are performed:

- Pipeline Flushing: Flushing pipelines with water, air, or inert gas to remove any debris, dirt, or construction materials.
- Chemical Cleaning: Using chemical agents to clean the interior surfaces of process equipment and pipelines to remove any residual contaminants or corrosion.

Pressure testing and leak detection

Pressure testing is conducted to ensure the integrity and leak-tightness of all piping and vessels. This includes:

- Hydrostatic Testing: Filling pipelines and vessels with water and pressurizing them to check for leaks and ensure they can withstand operating pressures.
- Pneumatic Testing: Using compressed air or inert gas to pressurise systems where hydrostatic testing is not feasible.

Instrumentation and control system checks

Ensuring the proper functioning of all instrumentation and control systems is critical. This involves:

- Calibration of Instruments: Calibrating all sensors, gauges, and instruments to ensure correct readings and measurements.
- Loop Checks: Verifying the proper functioning of control loops by testing the signal transmission from field instruments to the control system and back.
- Control System Configuration: Configuring and testing the Distributed Control System (DCS) and Programmable Logic Controllers (PLCs) to ensure they run as intended.

Electrical system checks

Electrical systems are tested to confirm their safety and reliability. This includes:

- Insulation Resistance Testing: Measuring the insulation resistance of electrical cables and equipment to ensure there are no faults.
- Continuity Testing: Verifying the electrical continuity of circuits and connections.
- Functional Testing of Electrical Equipment: Testing motors, transformers, switchgear, and other electrical equipment to ensure they run correctly.

Safety system verification

Ensuring the readiness of all safety systems is paramount. This involves:

- Emergency Shutdown System (ESD) Testing: Testing the ESD system to verify its ability to safely shut down the plant in an emergency.
- Fire and Gas Detection System Testing: Ensuring that fire and gas detectors are correctly installed, calibrated, and operational.
- Personal Protective Equipment (PPE) and Safety Gear: Verifying the availability and condition of all PPE and safety gear needed for plant operations.

Documentation and handover preparation

Accurate documentation is essential for a smooth transition to commissioning. This includes:

- Compilation of Test Reports: Collecting and compiling all test reports, certificates, and inspection records.
- As-Built Drawings: Updating engineering drawings to reflect any changes made during the construction phase.
- Pre-Commissioning Checklists: Completing pre-commissioning checklists to ensure all activities have been performed and documented.

3.5.1.3.2 Mechanical completion

Mechanical completion is a milestone where all mechanical installations are verified as complete and ready for commissioning. This involves:

- Punch List Creation: Finding and documenting any incomplete work or discrepancies that need to be addressed.

- Punch List Clearance: Completing all punch list items to ensure all systems are fully functional and meet quality standards.

3.5.1.3.3 Post-construction clean-up and restoration

The post-construction cleanup and restoration phase of the Project ensures the Project site is safe, clean, and restored/rehabilitated to its intended state. This phase involves systematic removal of construction debris, environmental restoration, and final inspections to confirm that all Project requirements and regulatory standards have been met. Below are the key activities involved in this phase.

- Site Cleanup: Effective site cleanup is essential to remove any remaining construction materials, debris, and waste. This involves:
    - Debris Removal: Collecting and properly disposing of construction waste, including scrap metal, packaging materials, and general refuse.
    - Hazardous Material Disposal: Safely handling and disposing of any hazardous materials, following local regulations and environmental guidelines.
    - Equipment and Material Removal: Clearing the site of all construction equipment, temporary facilities, and unused materials.
- Environmental Restoration: Restoring the natural environment to minimise the Project's impact and follow environmental regulations. Key activities include:
    - Soil Remediation: Treating and restoring any contaminated soil to its original condition to prevent environmental damage.
    - Vegetation Restoration: Replanting native vegetation and landscaping disturbed areas to promote ecological recovery.
    - Watercourse Rehabilitation: Restoring any altered irrigation canals or area drainage systems (if impacted) to ensure they function correctly and support local ecosystems.
- Infrastructure Restoration: Restoring infrastructure affected by construction activities ensures the site is functional and safe. This includes:
    - Road and Pathway Repair: Repairing any damaged roads, pathways, and access routes used during construction to their original or improved condition.
    - Utility Restoration: Ensuring that all utilities, such as water, electricity, and communication systems, are restored and functioning properly.
- Structural Restoration: Repairing any structural damage (should it occur, although there are no structures found in the Project area) to existing buildings or infrastructure that occurred during construction.
- Final Inspections and Compliance: Final inspections and compliance checks are conducted to verify that all post-construction activities meet Project specifications and regulatory requirements. This involves:
    - Quality Inspections: Conducting thorough inspections to ensure all cleanup and restoration work meets the Project’s quality standards.
- Regulatory Compliance: Ensuring all activities follow local, state, and federal environmental regulations and obtaining necessary certifications or approvals.

- Handover Documentation: Compiling and sending all required documentation, including inspection reports, environmental compliance certificates, and as-built drawings.
- Safety and Final Site Walkthrough: Ensuring site safety and conducting a final walkthrough with stakeholders confirms that the site is ready for operational use. Key steps include:
- Safety Checks: Performing comprehensive safety checks to find and mitigate any potential hazards left by construction activities.
    - Stakeholder Walkthrough: Conducting a final walkthrough with Project stakeholders, including clients, regulatory authorities, and community representatives, to ensure satisfaction with the cleanup and restoration efforts.
- Sign-off and Handover: Obtaining final signoffs from all relevant parties and formally handing over the site for operational use.

3.5.1.4 Commissioning

Commissioning is expected to occur during late-2027 to early 2028 and will be undertaken by a separate contractor and managed by Transition Industries. Commissioning will include operational testing of the new equipment and systems to verify that the Project components are fit for purpose and that the overall process, output, quality, and performance meet the design specifications.

The commissioning phase of the Mexinol Project ensures all systems, equipment, and components of the methanol production plant are fully operational and meet the desired performance criteria. This phase focuses on the detailed testing, fine-tuning, and validation of the plant to ensure it is ready for continuous, safe, and efficient operation. Below are the key activities involved in this phase.

3.5.1.4.1 System commissioning

System commissioning involves the thorough testing and verification of individual systems within the plant. This phase ensures that each system functions correctly and integrates seamlessly with the overall plant operations.

- Dry Commissioning: Conducting tests on individual systems and components without introducing process fluids. This includes verifying control logic, testing electrical systems, and running motors and drives to ensure proper operation.
- Wet Commissioning: Introducing process fluids and testing systems under operational conditions. This step verifies that pumps, compressors, and other equipment run correctly with actual fluids and achieve the required flow rates and pressures.

3.5.1.4.2 Functional testing

Functional testing ensures that all systems and subsystems work together as designed. This phase includes:

- Integrated System Testing: Conducting tests on combined systems to ensure they function correctly when running together. This includes testing control systems, safety interlocks, and communication networks.

- Operational Readiness Testing: Simulating normal operating conditions to verify that the plant can keep stable and reliable operations. This includes running the plant at different loads and verifying performance under various scenarios.

3.5.1.4.3 Performance testing

Performance testing assesses the plant's ability to meet its design specifications and production targets. This involves:

- Capacity Testing: Running the plant at full capacity to ensure it can produce the desired output of methanol. This includes verifying feedstock input rates, production rates, and product quality.
- Efficiency Testing: Evaluating the plant's operational efficiency, including energy consumption, raw material usage, and process yields. This step ensures that the plant runs at best performance levels.

3.5.1.4.4 Safety system validation

Validating the safety systems is critical to ensure the plant can run safely under all conditions. This includes:

- ESD Testing: Testing the ESD system to ensure it can safely shut down the plant in case of an emergency. This includes simulating emergency scenarios and verifying system response.
- Fire and Gas Detection System Testing: Ensuring that fire and gas detection systems are fully operational and can promptly detect and respond to hazardous conditions.

3.5.1.4.5 Operator training and handover

Proper training of plant operators is essential for safe and efficient plant operation. This phase includes:

- Operator Training Programs: Conducting comprehensive training sessions for plant operators and maintenance personnel. This includes hands-on training, simulation exercises, and safety drills.
- Operational Documentation: Providing detailed operation and maintenance manuals, safety procedures, and troubleshooting guides to the operations team.
- Handover Process: Formally handing over the plant to the operations team, including the transfer of all relevant documentation, certifications, and keys. This step ensures that the operations team is fully prepared to take over and manage the plant.

3.5.1.4.6 Initial startup and ramp-up

The final stage of commissioning involves starting up the plant and gradually increasing production to full capacity. This phase includes:

- Initial Startup: Carefully starting up the plant and monitoring all systems to ensure smooth operation. This includes verifying that all equipment operates correctly and that there are no unexpected issues.

- Ramp-Up to Full Production: Gradually increasing production rates while closely monitoring performance. This step ensures that the plant can handle the increased load and keep stable operations.

3.5.2 Operation and maintenance

The Mexinol Methanol Production Plant is expected to remain in operation for at least 30 years and will be run by Transition Industries. The facility will run continuously which means that there will be three work shifts for operations and maintenance staff. Each shift will be 8 hours, and the operations and maintenance staff will work for 40 hours each week, following the current labour law. Refer to Section 3.9.2 for more information on the required workforce during the operations phase.

The operational phase involves continuous monitoring, optimisation, and management of all processes to ensure efficient, safe, and environmentally compliant production while adhering to net-zero carbon emission goals. Key activities include process control, maintenance, safety management, environmental compliance, and performance optimisation.

- Process Control and Monitoring: Efficient and sustainable operation of the methanol production process is at the core of the plant's activities. Key aspects include:
- Real-Time Monitoring: Using advanced control systems and sensors to monitor process parameters such as temperature, pressure, flow rates, and chemical compositions in real-time.
- Automated Control Systems: Utilising DCS and PLCs to automatically adjust process conditions, ensuring optimal and stable operations.
- Data Analysis and Reporting: Continuously analysing process data to find trends, optimise performance, and generate comprehensive reports for management and regulatory compliance, with a focus on sustainability metrics.
- Maintenance and Reliability: Regular maintenance and proactive management are critical to ensuring plant reliability and minimising downtime. This includes:
    - Preventive Maintenance: Scheduling and performing routine maintenance activities, such as lubrication, calibration, and part replacements, to prevent equipment failures.
    - Predictive Maintenance: Implementing advanced diagnostics and condition-monitoring tools to predict and address potential issues before they lead to equipment breakdowns.
    - Corrective Maintenance: Rapidly responding to and repairing any equipment malfunctions or failures to minimise production disruptions and ensure continuous operation.
- Safety Management: Safety is paramount in the operation of the methanol production plant. Key activities to ensure a safe working environment include:
- Emergency Response Planning: Keeping and regularly updating emergency preparedness and response plans to handle potential incidents such as leaks, fires, or explosions.

- Safety Drills and Training: Conducting regular safety drills and training sessions for all plant personnel to ensure they are prepared to respond effectively to emergencies.

- Hazard Analysis and Risk Assessment: Continuously performing hazard analysis and risk assessments to find and mitigate potential safety hazards.
- Environmental Compliance: Running the plant in compliance with environmental regulations is crucial for minimizing environmental impact. Key activities include:
- Emissions Monitoring and Control: Continuously monitoring and controlling emissions of CO_2 and other pollutants, ensuring compliance with environmental standards, and using carbon capture technologies to achieve net-zero emissions.
    - Waste Management: Implementing effective waste management practices to handle and dispose of solid, liquid, and gaseous wastes generated during production.
- Water and Energy Efficiency: Improving water and energy usage to reduce the plant's environmental footprint, employing renewable energy sources, and enhancing overall sustainability.
- Product Quality Assurance: Ensuring the production of high-quality methanol is critical for meeting market and regulatory standards. This involves:
- Quality Control Systems: Implementing rigorous quality control systems to monitor and ensure the purity and specifications of the methanol produced.
    - Regular Testing and Analysis: Conducting regular laboratory tests and analyses of methanol samples to verify product quality and consistency.
    - Compliance with Standards: Ensuring that the methanol produced meets industry standards and customer specifications.
- Performance Optimisation: Continuous improvement and optimisation of plant operations are essential for keeping competitiveness and efficiency. This includes:
- Process Optimisation: Analysing operational data to find opportunities for improving process efficiency, reducing costs, and enhancing production yields, with a focus on sustainability.
- Innovation and Upgrades: Implementing modern technologies and process improvements to stay ahead of industry trends and improve overall plant performance.
    - Operational Excellence Programs: Engaging in continuous improvement initiatives and operational excellence programs to drive performance enhancements and operational efficiencies.

3.5.2.1 Production plant operation

To obtain methanol, natural gas will go through the following processes:

- Purification of the natural gas
- Saturation with water of the gas
- Pre-reformed heating of the natural gas
- ATR with catalytic pre-oxidation to produce synthesis gas
- Heat optimisation to recover the heat generated at the reforming process

- Steam generation through the boilers at the process plant to be used as driver for main steam turbines of compressors and pumps as well as stream to saturate with water the syngas streams.
- Synthesis gas compression to increase its pressure to best conditions
- Methanol synthesis through the methanol reactor processing
- Hydrogen recovery through the PSA to be reinjected into the main synthesis gas stream
- Carbon capture through the POX, CML, and CO_2 conversion
- Hydrogen production through electrolysis process
- Mixing Hydrogen and CO_2 and recompression to increase production
- Distillation of the raw methanol to obtain pure methanol
- Methanol storage and transferring to the port

3.5.2.2 Plant maintenance

Maintenance ensures the reliability, efficiency, and sustainability of the Mexinol methanol production plant, which employs AdWinMethanolZero© technology. This stage encompasses proactive measures to uphold equipment integrity, prevent downtime, and support the plant's goal of achieving net-zero carbon emissions. The maintenance activities are designed to optimise performance, enhance safety, and adhere to environmental standards while using advanced technologies and GIIP.

- Preventive Maintenance: Preventive maintenance plays a key role in minimizing unplanned downtime and keeping equipment reliability. Key activities include:
- Routine Inspections: Conducting scheduled inspections of machinery, piping, and instrumentation to find potential issues before they escalate.
- Lubrication and Fluid Analysis: Consistently applying lubricants and conducting fluid analysis to ensure best equipment performance and longevity.
    - Equipment Cleaning: Periodically cleaning equipment and components to prevent corrosion, fouling, and operational inefficiencies.
- Predictive Maintenance: Using predictive maintenance techniques helps expect equipment failures and take pre-emptive actions. Activities include:
    - Condition Monitoring: Using advanced sensors and monitoring systems to track equipment performance indicators such as vibration, temperature, and pressure.
    - Data Analysis: Analysing collected data to detect trends, predict potential failures, and schedule maintenance interventions accordingly.
    - Predictive Analytics: Applying predictive analytics to optimise maintenance schedules, improve equipment reliability, and reduce operational risks.
- Corrective Maintenance: Promptly addressing equipment failures or malfunctions is essential to minimise production disruptions. Key actions include:
    - Root Cause Analysis: Investigating the underlying causes of equipment failures to prevent recurrence.

- Emergency Repairs: Mobilizing resources quickly to address critical failures and restore equipment functionality.
- Parts Replacement: Replacing worn-out or damaged components with genuine parts to ensure equipment reliability and performance.

- Safety-Critical Maintenance: Ensuring the safety of personnel and the environment is paramount during maintenance activities. This involves:
  - Lockout-Tagout Procedures: Implementing strict lockout-tagout procedures to isolate energy sources and prevent accidental equipment activation.
  - Safety Inspections: Performing safety inspections before and after maintenance tasks to verify equipment integrity and compliance with safety standards.
  - Training and Awareness: Providing continuous training and promoting safety awareness among maintenance personnel to mitigate risks and prevent incidents.

3.5.2.3 Operation of port facilities

The port site of the Mexinol Project is a critical hub where methanol will be transferred for cargo loading through an existing jetty. This site is equipped with various systems and equipment essential for the safe and efficient handling of methanol. Operations at the port site will be coordinated through a dedicated control room with the capability for remote management from the Mexinol main control room. Key activities at the port site include the operation and maintenance of the loading arms, the firefighting system, the vapour recovery unit, the nitrogen generation system, methanol metering skid, and other essential electrical, instrumentation, and control systems.

- Control Room Operations: The port site's control room is the nerve centre for local operations, ensuring seamless coordination and management of methanol transfer activities. Key functionalities include:
- Local Control and Monitoring: Operators can manage and monitor all port site activities, ensuring real-time response to operational needs and emergencies.
  - Remote Control Capability: The port site's systems are integrated with the Mexinol main control room, allowing for centralised control and oversight. This redundancy enhances operational security and flexibility.
  - Data Logging and Reporting: Continuous data logging and reporting ensure that all operations are recorded and analysed for performance optimisation and regulatory compliance.
- Methanol Transfer and Loading Operations: Efficient and safe transfer of methanol from the production plant to cargo vessels is a primary activity at the port site. This involves:
  - Pipeline Transfer Systems: Ensuring the integrity and operation of pipelines that transport methanol to the loading area.
  - Loading Arms and Systems: Managing the loading arms that connect to vessels for methanol transfer, ensuring they are correctly positioned and secured.

- Safety and Compliance Checks: Conducting pre-loading safety checks to follow environmental and safety regulations.
- Firefighting System: The firefighting system at the port site is critical for ensuring safety in case of emergencies. Activities include:
- System Readiness and Maintenance: Regularly inspecting and keeping firefighting equipment, such as pumps, hoses, and sprinkler systems, to ensure they are in working order.
- Drills and Training: Conducting regular fire drills and training sessions for port personnel to ensure they are prepared to respond effectively in an emergency.
    - Compliance with Regulations: Ensuring the firefighting system meets all relevant safety and environmental regulations.
- Vapour Recovery Unit (VRU): The vapour recovery unit is essential for minimizing emissions during methanol transfer. Key activities include:
- Operational Monitoring: Continuously monitoring the VRU to ensure it effectively captures and recycles vapours, reducing environmental impact.
- Maintenance and Inspections: Performing regular maintenance and inspections to ensure best performance and compliance with environmental standards.
    - System Upgrades and Improvements: Implementing upgrades and improvements as needed to enhance efficiency and effectiveness.
- Nitrogen Generation System: The nitrogen membrane system is used to provide inert gas for various operations, enhancing safety and product quality. Activities include:
- System Operation: Ensuring the nitrogen membrane system runs correctly to produce the required nitrogen purity levels.
- Maintenance and Servicing: Regularly keeping the system to prevent breakdowns and ensure continuous availability of nitrogen.
- Safety Checks: Performing routine safety checks to ensure the system runs safely and efficiently.
- Methanol Metering Skid: Accurate measurement of methanol is critical for operational efficiency and regulatory compliance. Key activities include:
    - Calibration and Verification: Regularly calibrating and verifying the accuracy of the metering skid to ensure precise measurement of methanol quantities.
    - Maintenance and Inspection: Conducting routine maintenance and inspections to prevent faults and ensure reliable operation.
    - Data Integration and Reporting: Integrating metering data with the control systems for real-time monitoring and reporting.
- Electrical, Instrumentation, and Control Systems: These systems are fundamental to the operation and safety of the port site. Activities include:
    - Electrical System Maintenance: Ensuring the reliability and safety of electrical systems through regular maintenance and inspections.
- Instrumentation Calibration: Regularly calibrating instruments to ensure accurate readings and control.

- Control System Monitoring: Continuously monitoring control systems to ensure they function correctly and make necessary adjustments.

3.5.2.4 Pipeline operations and maintenance

The pipeline system for transferring methanol from the main Mexinol process plant to the port includes two main pipelines: a 28” pipeline for methanol transfer and an 8” pipeline dedicated to vapour recovery from the port back to the main process plant. These pipelines are equipped with robust protective measures to ensure safe and efficient operation.

Both pipelines are safeguarded with cathodic protection systems, which prevent corrosion by applying a low-voltage electrical current to the pipelines. This method significantly extends their operational lifespan and reduces the risk of structural degradation due to corrosion.

In addition to cathodic protection, the pipelines feature an advanced leak detection system using fibre optic cables for continuous monitoring. This system detects even minor leaks promptly, allowing for swift response and mitigation measures to keep operational integrity and safety.

To uphold mechanical integrity and ensure long-term reliability, the pipelines undergo comprehensive monitoring and inspection protocols. Every 10 years, an intelligent PIG tool is deployed through dedicated PIG launcher and receiver equipment installed along the pipeline route. This intelligent tool assesses the pipelines' internal condition, finding potential defects, anomalies, or degradation that may compromise their structural integrity. During the PIG operations, an external and specialised contractor will be engaged to supply nitrogen, which is used to drive the PIG through the 10.3 km pipeline. This procedure is crucial for ensuring the thorough inspection and assessment of the pipeline's internal condition.

The PIG tool is an advanced inspection device that travels through the pipeline, collecting data on the pipeline’s internal integrity, including detecting corrosion, cracks, and other potential issues. The use of nitrogen as a driving force is preferred due to its inert nature, ensuring that the inspection process does not introduce any reactive or hazardous elements into the pipeline.

Moreover, the wall thickness of the methanol transfer pipeline is calculated with a significant safety margin and overdesign. This approach not only ensures compliance with safety standards but also enhances durability, resilience, and operational reliability under varying operational conditions and environmental factors.

Overall, the pipeline system for methanol transfer and vapour recovery between the Mexinol process plant and the port is engineered with ultramodern technologies and stringent safety measures. These initiatives underscore Mexinol's commitment to keeping high standards of operational safety, environmental responsibility, and long-term infrastructure integrity in its methanol production and distribution operations.

In addition to the robust protective measures and inspection protocols mentioned earlier, it is important to note that methanol, the substance being transported through the pipelines from the Mexinol process plant to the port, is non-corrosive in nature. This characteristic significantly reduces the risk of corrosion within the pipelines, thereby enhancing their durability and longevity.

Upon completion of loading operations at the port, the methanol pipeline stays filled with liquid methanol. This operational practice is kept because methanol does not evaporate easily at underground temperatures. This continuous liquid fill ensures that the pipeline stays stable and minimises the potential for internal corrosion or other operational challenges during idle periods between loading operations.

Similarly, the vapour recovery pipeline, responsible for transporting vapours back to the main process plant, is designed to remain pressurised with nitrogen during standby periods. This inert gas environment serves to prevent ingress of external contaminants and keeps pipeline integrity while awaiting vapour recovery operations. The pressurisation with nitrogen also contributes to the overall safety and reliability of the vapour recovery system, ensuring prompt and efficient operation when needed.

These operational strategies underscore Mexinol's commitment to keeping the efficiency, safety, and environmental sustainability of its methanol transportation infrastructure. By using the non-corrosive nature of methanol and implementing controlled operational procedures such as continuous liquid fill and nitrogen pressurisation, Mexinol ensures best performance and longevity of its pipeline systems throughout the methanol production and transportation process.

3.5.3 Decommissioning

The decommissioning of the Mexinol methanol production plant is expected to span 24 months. This process aims to safely dismantle the facility while minimizing environmental impact and ensuring compliance with all regulatory requirements.

The decommissioning phase will begin with a comprehensive assessment of the site, finding all assets, infrastructure, and potential hazards. This first evaluation will guide the development of a detailed decommissioning plan, outlining the necessary steps and procedures for safely shutting down the plant.

One of the first steps in the decommissioning process will be the safe shutdown of all operational systems. This involves depressurizing and purging all process equipment, pipelines, and storage tanks to remove residual methanol and other chemicals. Specialised teams will clean and decontaminate these components to ensure they are safe for dismantling. Concurrently, hazardous materials will be found, handled, and disposed of following stringent environmental regulations to prevent any risk of contamination.

Once the plant is safely shut down and decontaminated, the physical dismantling of infrastructure will begin. This phase will involve the systematic disassembly of equipment, structures, and utilities. Heavy machinery and cranes will be used to dismantle large components, while smaller equipment and materials will be manually disassembled and sorted for recycling or disposal. Special attention will be given to the proper handling of recyclable materials, such as metals and concrete, to maximise the recovery of valuable resources and minimise waste.

The decommissioning process will also include the remediation of the site to restore/rehabilitate it to a safe and environmentally stable condition. Soil and groundwater assessments will be conducted to identify any contamination resulting from long-term industrial activities. Remediation efforts, such as soil excavation, bioremediation, or groundwater treatment, will be implemented to address any identified

contamination. The goal of these efforts will be to ensure the site meets environmental standards and can potentially be repurposed for future use.

Throughout the decommissioning process, Mexinol will keep close communication with regulatory authorities and local communities to ensure transparency and address any concerns. Detailed documentation and reporting will be provided to show compliance with all legal and environmental requirements. Additionally, safety will remain a top priority, with strict protocols in place to protect workers and the surrounding environment from any potential hazards associated with the decommissioning activities.

The 24-month duration for the decommissioning process allows for a systematic and thorough approach, ensuring that each phase is conducted safely and efficiently. This timeline includes not only the physical dismantling and remediation efforts but also the necessary planning, coordination, and regulatory compliance activities. By adhering to this comprehensive plan, Mexinol aims to responsibly conclude its operations, leaving a positive legacy and a site that is safe and prepared for future use.

3.6 Utilities

3.6.1 Power supply

3.6.1.1 Construction and pre-commissioning

The required electricity expected during the construction phase will be supplied either locally by introducing power generators or by making interconnection to the closest electrical system administered by CFE.

3.6.1.2 Commissioning and operations phase

The methanol production unit will be connected to the Mexican national grid through a 400 kVA, 43 km power transmission line (as shown in Figure 3.2) which is considered an associated facility of this Project. Mexinol will not be generating power locally within its facility. Mexinol will secure its electricity supply through a Power Purchase Agreement (PPA) with a local energy wholesaler, who will ensure continuous availability of power. Electricity will be sourced either through the direct generation of renewable energy or via the purchase of Clean Energy Certificates, thereby maintaining a low carbon footprint.

The renewable energy supplied under the PPA is expected to come from a diversified mix of sources, such as solar, wind, and hydroelectric power. The contracted third-party energy provider will oversee the full procurement and trading process within the Mexican energy market and will ensure delivery through the national grid.

To avoid dependence on a single supplier and to promote market resilience, Mexinol plans to establish PPAs with multiple renewable energy providers. This approach ensures that no individual supplier is solely dependent on Mexinol, and Mexinol is not reliant on a single project for its energy needs. These arrangements are therefore neither mutually exclusive nor interdependent.

The PPA strategy is designed to guarantee a reliable, long-term renewable power supply for Mexinol's operations while aligning with national sustainability goals and supporting Mexico's energy transition**.**

3.6.1.3 *Emergency shutdown*

In case of a power failure the plant's emergency diesel-fired generating system will be engaged and the plant shut down procedures will be started.

3.6.2 Water supply

3.6.2.1 *Construction and commissioning phase*

Purified drinking water will be provided in a jug to construction workers and will be sourced from local businesses. Mexinol will adhere to the OHSA guidance for water intake under high heat. This guidance stipulates that workers should drink 0.95 liters of cool water per hour of work. It is then estimated that everyone will consume approximately 8 liters in an eight-hour working day, meaning that the total volume of water needed will depend on the number of workers.

Water will also be needed for hydrostatic testing, which will be sourced from supply systems of surrounding towns, irrigation systems, authorised suppliers and/or, where appropriate, from natural water sources (dependant on water quality and availability).

3.6.2.2 *Operations phase*

Process water needed for the Project will be sourced from the effluent of the JAPAMA municipal wastewater treatment lagoons. This water will be treated on-site to the necessary quality standards for the methanol production process using the Project's own wastewater treatment facility. The treated water will be utilised for cooling, steam generation, hydrogen production via electrolysis, and potable water for general services. Drinking water for human consumption and sanitary purposes will be supplied by an external source.

3.7 Resource consumption

Table 3.9 and Table 3.10 below show the quantities of resources to be used during the construction and commissioning phase and during the operations phase, respectively.

Table 3.9: Indicative quantities of resources to be used during the construction and commissioning phase

Resources	Use	Quantity
Diesel	Construction vehicles and machinery	780,000 litres
Cement	Foundations, piles, pavement	197,205 m^3
Reinforcing steel bars	Structure, equipment, supports, piping	124,724 m^3
Stone material (gravel, sand, etc.)	Pavement, site preparation, back filling	2,110,718 m^3

Source: Transition Industries Engineering Team, December 2024

Natural gas, water, and electricity usage during operations are provided in Section 3.7.

Table 3.10: Indicative quantities of resources to be used during the operation phase

Resources	Use	Quantity
Diesel	Vehicles and machinery	2,000 litres per year
Lubricant oils	Project operation and maintenance activities	3,599 litres per year
Lubricating greases	Project operation and maintenance activities	100 kg per year
Degreasers	Project operation and maintenance activities	1,200 litres per year

Source: Transition Industries Engineering Team, December 2024

3.8 Transport

Personnel, equipment, and materials will be transported between the Project sites during the construction and commissioning, and operations phases of the Project. During early works, all fill material will come from the quarry found across the Los Mochis-Topolobampo highway from the Project site.

A logistics assessment will be undertaken by the EPC to define the vehicle type and number for the Project, and transport routes for the various Project requirements will be surveyed. Detailed information will be provided in the EPC's Transport Management plan.

Construction materials will be brought on site by truck, via the Port, the Los Mochis-Topolobampo highway and site access roads. Additionally, the Los Mochis-Topolobampo highway will be used to transport goods and people during construction and operations phase.

3.9 Workforce

3.9.1 Construction and commissioning phase

For the facility construction, the Project will employ an average of up to 1,500 workers over the approximately 24 months construction period with 3,336 workers during the peak construction period in month 22) (see Figure 3.21). These workers will be contracted by the EPC (i.e., contractors, subcontractors, suppliers). Approximately 70 added workers will be contracted by the pipeline construction contractor specifically for pipeline installation. An estimated 100 more workers are expected to be engaged for other components of the Project, including the wastewater treatment plant (WWTP).

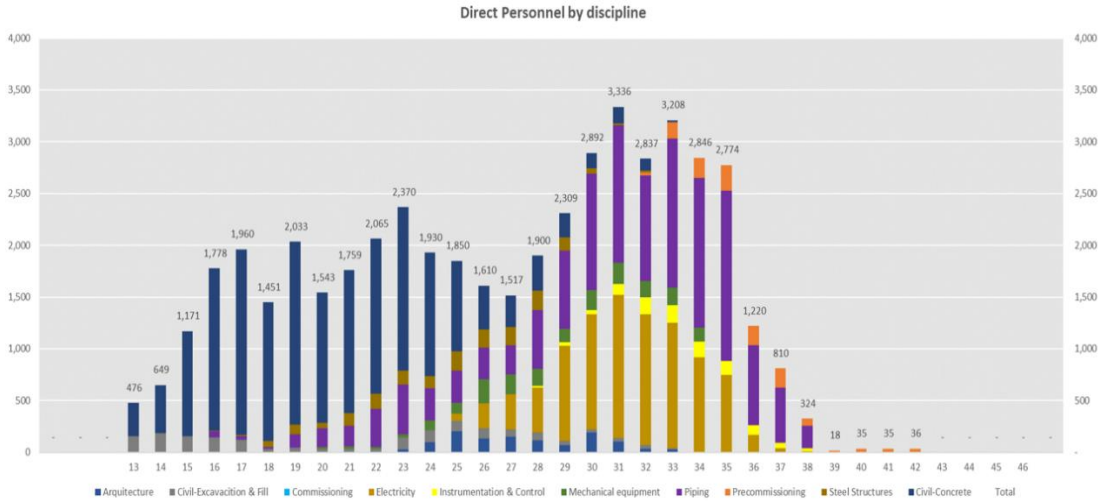


Figure 3.21: EPC facility workforce estimations

During the construction phase, the Project will optimise the use of local content, with a target of over 90% of the workforce to include Mexican labour, with up to 500 locals (from Ahome) wherever possible and where experience and skills are compatible with Project needs. Techint has a Local Content Plan to meet personnel needs, which includes the following tiered actions for recruitment:

- Local personnel available in the region who can fill the positions
- Disaffected personnel (Mexican personnel demobilised from other Techint projects upon completion) who have worked on earlier projects and who have good evaluations.
- Techint Mexican employees who are available or about to leave Techint projects and who have good evaluations.
- National market personnel, personnel who previously worked at Techint E&C or any of the group companies will be subject to background and reference checks.
- Permanent and/or temporary personnel of other nationalities and/or projects outside Mexico, other regions of Techint E&C, who are available for expatriation.
- Personnel from the foreign market (who do not work at TEI&C) who meet and qualify with the required experience without exception.

3.9.2 Operations phase

The Project will employ up to 160 full-time workers during the operations phase to fulfil the following roles:

- Plant Manager
- Administrative and Human Resources Assistants
- Environment, Health and Safety Manager and Coordinators
- IT Coordinators
- Document Managers
- Physical and Asset Security Leader
- Plant Superintendents

- Engineers
- Plant Operators
- Maintenance Technicians
- Warehouse Specialists
- Support Staff.

Additionally, it is likely that up to 250 to 300 employees will be contracted to deliver services such as security, food preparation, routine maintenance, and cleaning. It should be noted that the total number of direct and contracted workers may change as engineering is completed. It is likely that shift work will apply to the jobs in the operations phase.

During the operations phase, the proportion of local content used is expected to increase over time, as local capabilities are expanded.

3.10 Ancillary facilities

The Project will require a variety of temporary and permanent ancillary facilities to provide access to, or to support, construction activities, including a worker camp, and infrastructure/road upgrades. Some of these facilities will be temporary (i.e., worker accommodation only needed during construction), and some – such as infrastructure/road upgrades – will remain in place after Project construction is complete. These ancillary facilities are described below.

3.10.1 Workers' accommodation

The Project is considering alternatives for accommodating non-local workers during construction, including housing up to 200 to 300 staff in existing lodging (rental houses, hotels) and 1,220 workers in a worker camp.

Techint/Samsung completed an accommodation inventory and found easy availability to rent up to 70 houses (each to be occupied by 1 to 3 people) for staff, management, and administrative personnel during the construction period. Hotels will also be used for staff coming to the Project site on a temporary basis and/or for workers when the worker accommodation camp may be at capacity. Hotels and lodgings will be controlled through the Techint General Services team and assigned by Human Resources.

The accommodation study found that a 1,220-worker accommodation camp would be sufficient for the average number of non-local workers expected, including at peak periods of construction (considering other alternatives available and the potential for an expansion of the worker camp if needed). The worker camp (Project component) is likely to be installed on the property in an industrial area, adjacent to the existing quarry which has necessary land permits (land is owned by the owner of the quarry) and regulatory requirements to house a worker accommodation (as the quarry has permitted an area for a worker accommodation). Mexinol will set up an agreement with the quarry owner to use the site for the workers' camp. The total footprint of the camp will be completed prior to construction, once the preferred accommodation options for workers have been decided. The proposed area is zoned for industrial use; the site is currently vacant and is suitable for temporary accommodation infrastructure. The area is found to the east of Los Mochis, near the Topolobampo bypass road, and 8 km from the Project site, with a travel time of

10 minutes. The existing area offers the ability to rent open land where access roads (dirt or gravel), fences or walls, lighting, and security can be provided. It should be noted that the worker accommodation location has yet to be finalised.

Techint will oversee the management, obtaining and maintenance of the permits, such as the permits related to the construction and operation of its temporary facilities, as well as the interaction with other stakeholders as waste management service providers, Municipal Permits (Use of land for temporal facilities, Construction permit for temporal), CFE Permits (Electricity Federal Commission), etc.

In addition to providing housing, the workers' camp would also provide sanitation facilities, a cafeteria, cooking and laundry facilities, recreation centre, medical clinic, office and other support facilities. These structures would be prefabricated and placed on a concrete pad. The worker camp would be designed to follow international worker accommodation standards (Workers' Accommodation: Process and Standards (IFC and EBRD, 2009). Table 3.11 summarises the facilities that would be provided at the worker camp and Figure 3.22 presents the proposed camp layout.

Table 3.11: Worker camp elements

Worker camp element	Facility requirements
Total area	4.5 ha
Camp capacity	1,220 with the ability to expand if needed
Accommodations	9 accommodation modules with capacity for 100 people and 4 modules with capacity for 80 people. Air conditioned. In line with IFC and EBRD guidance on Workers' Accommodation Processes and Standards - a minimum of 4 square meters per person for sleeping will be provided as well as separated and secured sleeping and sanitary facilities for women.
Sanitation facilities	Separate modules baths and showers with 16 services per module
Cafeteria, , cooking and laundry facilities	624-person capacity canteen for 3 meals per day. Supply and operation of the laundry service offered for personal and/or work clothes. Bed linen and other household linens will be serviced weekly
Recreation facilities	Retail store selling non-alcoholic drinks and miscellaneous items; soccer field, basketball field, break rooms
Medical facilities	On-site first aid room to address non-emergency incidents to follow the Workers' Accommodation: Process and Standards (IFC and EBRD 2009)
Security	Unarmed security to follow Workers' Accommodation: Process and Standards (IFC and EBRD 2009) and assessing and managing the Risks and Impacts of the Use of Security Personnel (World Bank 2018). Perimeter fencing to be installed around camp
Access	Access from the Los Mochis-Topolobampo highway. A bus arrival zone will be built with a capacity of 32 buses
Power	Solar energy, Medium and low voltage installations, power and lighting circuits, aerial and underground connections (transformation centres/substations/GE)
Water	Drinking water will be provided in large water bottle (19-litre), and coolers/dispensers will be available in all facilities as needed
Wastewater	Plumbing network/supply network, sanitation/rainwater network, wastewater treatment (WWTP, septic tank), water storage systems
Internet	Internet access will be provided from a local provider

Source: Transition Industries (June 2024)

Figure 3.22: Proposed camp layout

The transfer of personnel to the Project site will be carried out in buses with capacities of 40 passengers and / or vans of 20 passengers. Those coming from Los Mochis area will have travel times of 20 km or 30 minutes and will be allowed round-trip travel per day from the hotel/single house where they are staying to the Project site.

For the workers at the worker camp, there will be round-trip bus services from the camp to the Project site. When they arrive at the Los Mochis area, they will be taken directly to the camp for onboarding by Human Resources. This includes:

- Induction Talks
- Competency Assessments
- Training in specific activities
- Certification for drivers and operators of equipment and machinery
- Contract Signing
- Signing of the "General Regulations for the Use of Facilities Belonging to the Camp and Hotels assigned to Project workers." (Camp Behaviour Regulations/Worker Code of Conduct)
- Talks on Good Coexistence at Work, Camp and Local Society, etc.

The camp will not allow any unauthorised visitors to the site. However, it has not yet been decided if the camp will be considered a closed camp and what prohibitions workers may have in being able to leave camp during their off hours.

The impacts and mitigation measures associated with the failure of contractors and sub-contractors to provide adequate accommodation (potential human rights impact) are described in *section 8.3.4 Working Conditions* and *8.3.9 Human Rights,* while the ones linked to the increased pressure on local infrastructure and services are found in *section*

8.3.8 Social Infrastructure and services. The project has a Human Rights Policy and EPC Worker Accommodation Plan to mitigate these impacts. The overburden on social services and infrastructure due to worker influx and in-migration was included as a cumulative impact (see *section 10.3.4.3 Infrastructure and Services*).

Increased Gender-Based Violence and Harassment (GBVH) is a project impact covered in detail in sections *5.4.3.23 Gender-Based Violence and Harassment*, and *8.3.6 Community, health, safety, security, and welfare*, and as a cumulative impact in section *10.3.4.4 Community health, safety, and security.*

3.10.2 Access road

The original proposed primary access road for the Mexinol Project utilises a part of the existing "Paredones" road, which would require upgrades to accommodate heavy trucks and construction traffic. If selected as a primary access road, the road improvements would include paving the relevant section of dirt road and enhancing drainage systems to support the increased load and prevent wear and tear.

At the time of writing, other alternative roads for primary and secondary access were under evaluation as part of the logistics assessment. It was decided that alternative routes could provide added flexibility and redundancy in transportation logistics, helping to avoid or mitigate any unforeseen disruptions on the primary route. According to Transition Industries, a road choice south of the Project was under consideration as offering potential for use as the primary access road, considering there are no communities in the vicinity, and thereby cutting the need for most of the construction-related traffic to use the Paredones road.

During the construction phase, the transportation of large equipment and modules will primarily occur via the main highway "Los Mochis-Topolobampo highway." This route has been thoroughly studied to account for all aspects of transportation from the Port of Topolobampo to the Mexinol site. The study includes assessments of road conditions, traffic patterns, and logistical challenges to ensure a smooth and safe transportation process.

Overall, the access road strategy for the Mexinol Project includes upgrading existing infrastructure, evaluating alternative routes (where communities are not affected), and the potential to use temporary roads to support the transportation of heavy equipment and modules. No added land acquisition will be bought for this purpose, as the project access road is found within the boundaries of land already secured for the Project.

3.11 Security

The Company has a Security Management Team with whom the Contractor's security representative will be working in close coordination. Security provision will include typical physical security measures for a project of this scope and size, including closed-circuit television (CCTV), perimeter walls, access control points and lighting (facing into the facility as to not disturb fauna or people). A Security Control Centre (SCC) will be set up during construction with the aim of ensuring the entrance to the plant, personnel and vehicles are controlled and verified, and that visitors are properly controlled or instructed to respect the norms and security standards applicable within the site.

A Project Security Management Plan (PSMP) is also in place, which includes a Security Risk Assessment (SRA; discussed in more detail below). The SRA includes a thorough examination of all potential security threats and vulnerabilities that could impact the project; including risks related to theft, vandalism, sabotage, espionage, cyber-attacks, natural disasters, civil unrest, and regulatory non-compliance. It evaluates the likelihood and potential impact of each identified risk based on historical data, expert judgement, and industry benchmarks. Risks are prioritised and a risk register is developed and includes risk mitigation strategies and contingency plans.

3.11.1 Security risk assessment

The SRA was completed by a reputable Mexican Security Consultancy, Grupo Atalaya, in March 2024. The PSMP was developed by Mexinol's Country and Site Security Managers based on the SRA and shared with the EPCs to follow with their SMPs. According to the SRA, Ahome is a medium-low risk municipality. Two geographic factors contribute to keeping the security situation stable: the port of Topolobampo does not have elevated levels of trade with Asia and the existence of alternative highways to Federal Highway 15. This means that Ahome and its municipal capital, Los Mochis, are not central logistical nodes for drug trafficking to the United States. The occurrence of events associated with organised crime takes place outside the dynamics of the organised cartel structures, i.e., they are individuals who act independently, or who impersonate members of a cartel. Given their volume and modus operandi, they can be considered isolated events.

In terms of high-impact crimes, in 2023 to mid-2024, there were no reported cases of kidnapping and only several reported cases of extortion. The rate of intentional homicides with firearms is one of the lowest in the country, and in general, there have been no significant variations over the same period. Vehicle theft has kept the same trend, with an average of 32 incidents per month, which are mostly focused on specific areas of the urban zone of Ahome.

In terms of common crimes, the most worrisome, and the main risk area found in the SRA, is residential burglary, which has been on an upward trend since 2022, with cases having been recorded in subdivisions that were traditionally considered safe; there are also a considerable number of business robberies. Although the total crime graph shows an upward trend, this is due to the increase in cases of domestic violence and injuries, which do not affect Mexinol's activity in the area.

For the above reasons, the SRA does not foresee criminal actions directed at the company's facilities in the medium term as an elevated risk. Drug dealing, which occur would occur within the camps during the construction phase, are the highest potential risk.

The SMP ensures standards of private security provision aligns with industry regulations and GIIP such as those specified by the Voluntary Principles on Security and Human Rights (VPSHR). At this time, the exact security provisions (including hiring of local security guards and requirement for armed guards) had yet to be decided. However, the SMP includes screening measures for human rights violations for prospective security personnel during the recruitment processes for the Project, including contractors. GBVH training programs are included alongside Human Rights training for all security personnel,

as well as the recruitment of female security guards. These references can be found in sections 3.11 Security, 8.3.9 Human Rights and 8.3.1.3 Gender.

It should be noted that security and safety at the Port of Topolobampo is controlled by SEMAR, as it is across maritime and port facilities. Security measures at the Project jetty will be controlled by private security with input from the SEMAR and other Port of Topolobampo authorities.

3.12 Emissions, waste and other environmental considerations

3.12.1 Air emissions

3.12.1.1 Construction and commissioning phase

3.12.1.1.1 Construction dust and particulate matter

Construction works for the Project have the potential to lead to the release of fugitive dust and particulate matter. An assessment of the likely significant effects of construction phase dust and particulate matter at sensitive receptors has therefore been undertaken following the Institute of Air Quality Management (IAQM), UK's construction dust guidance.

Three separate dust impacts were considered:

- Disamenity to dust soiling
- The risk of health effects due to an increase in exposure to PM_{10}
- Harm to ecological receptors.

To assess the potential impacts of construction, activities are divided into four types:

- Demolition (relocation of transmission towers only)
- Earthworks
- Construction
- Trackout[7].

The risk of dust and PM_{10} arising to cause disamenity and/or health or ecological impacts was based on an assessment of emissions size and the sensitivity of the surrounding environment. The risk category may be different for each of the four 'construction' activities.

3.12.1.1.2 Emissions to air from construction traffic and plant

Exhaust emissions from construction phase vehicles and plant may have an impact on local air quality next to the routes used by these vehicles to access the Project site and in the vicinity of the Project site itself. Therefore, a qualitative impact assessment has been undertaken based on professional judgement and considering the following factors:

- The duration of the construction phase
- The potential number and type of construction traffic and plant that could be needed

[7] Trackout is defined as the transport of dust and dirt from the construction / demolition sites onto public road network, where it may be deposited and then re-suspended by vehicles using the network.

- The number and proximity of sensitive receptors to the Project site and along the construction vehicle routes.

3.12.1.2 Commissioning phase

Emissions during the commissioning phase occur from start-up, shutdown and testing activities. Due to the limited duration of these activities and testing under a controlled environment, no significant short-term impacts are expected. The long-term air quality impacts are not relevant to the commissioning phase.

3.12.1.3 Operations phase

Fossil fuel fired heater emission sources normally associated with methanol production operations will be replaced in Mexinol's AdWinMethanol Zero® technology with electric powered heaters. Point source emissions are limited to the PSA2 off-gas flare used to prevent build-up of inert gas as well as in case of emergency. The flare is sized to handle emergencies.

There will also be fugitive emissions, unintended release from pressurised equipment, during operations. Unlike emissions controlled through outlets like stacks or vents, fugitive emissions occur through leaks, faulty seals, broken gaskets, or other unintentional release points in equipment such as valves, pipelines, and storage tanks. To prevent and minimise fugitive emissions, Mexinol has implemented comprehensive fugitive emission mitigation design and running criteria, aligning with its core value of environmental responsibility:

- Customised piping class and material choice
- Material compatibility: Ensuring flange materials are resistant to corrosion and compatible with the substances they meet.
- Correct flange type: Choosing proper flange types (e.g., slip-on, weld-neck) based on pressure, temperature, and environmental conditions.
- High-quality gaskets: Selecting gaskets compatible with process fluids, capable of withstanding operational conditions.
- VRU design: For the methanol loading system at the port, a vapor recovery system is in place to capture vapours generated during the loading process. These vapours are directed to a VRU, where methanol is condensed and pumped back to the ship. The nitrogen, which may still have traces of methanol, is returned to the main plant via the 8" pipeline, where the methanol is separated and recovered, and the nitrogen is then vented
- Process compressor: Process compressors will use of dry gas seals systems with nitrogen as sealing fluid, so leakages are controlled to avoid process gas to be released to atmosphere.
- Methanol storage tanks: Methanol is stored in floating roof tanks, where nitrogen is introduced between the floating roof and the external dome to create an inert atmosphere. This nitrogen may have trace amounts of methanol vapor, which is then recovered. After methanol recovery, the nitrogen is safely vented to prevent any potential hazards and to keep environmental safety.

- Leak detection system and Intruder detection in pipelines: The scope of telecommunication systems involves CCTV, PAGA, UHF Radio, intrusion, and leak detection along ducts (28” and 8”).
- Flange management:
    - Controlled bolt tightening: Adhering to precise torque specifications to ensure uniform gasket compression and prevent leaks.
    - Hydraulic tensioning: Using hydraulic tensioning tools for critical flanges to provide consistent tightening.
    - Leak testing: Before introducing the feedstocks into the piping system during the commissioning stage, a rigorous leak testing process using nitrogen, or other inert gases will be conducted. This procedure is essential for detecting any potential leak points at flanges or connections, ensuring the integrity and safety of the system before it becomes operational.
- Pipeline Leak Detection System: A 12-wire single-mode fibre optic cable will be installed along the pipelines that will serve as communication to the Mexinol Plant. Fiber optics will be the transmission medium where telecommunications systems will be interconnected. The intrusion and leak detection system will be based on Detection Acoustic Sense (DAS) technology with detection algorithms capable of preventing intrusion attacks and with the ability to detect the exact point of leak along the pipeline.
- Operations and Maintenance:
    - Leak Detection and Repair (LDAR) Programs.
    - Routine Inspections: Regular visual inspections and non-destructive testing (NDT) to detect early signs of wear, corrosion, or misalignment in flanges.
    - Flange Protection Systems:
        - Flange Covers: To shield flanges from environmental damage.
        - Encapsulation: Encapsulating flanges in areas prone to chemical exposure or severe weather conditions to prevent corrosion.
    - Programmed PIG of the methanol pipeline
- Mechanical integrity program by using the inspection-based maintenance (IBM) philosophy
    - Predictive Maintenance Implementation.

This structured approach not only enhances environmental compliance but also improves safety and operational efficiency by preventing leaks and reducing repair costs.

3.12.2 Noise emissions

3.12.2.1 Construction and commissioning phase

The following activities are identified as potentially noise generating during the construction phase:

- Excavation and earthworks.
- Superstructure build

- Use of heavy machinery and equipment.
- Platform, gravel columns, and piles.
- Upgrading of access road.
- Construction camp noise.

In addition, the impact of construction vehicles has also been assessed, accounting for the increase in movements above the existing baseline scenario. The assessment considers the following.

Computer noise modelling has been undertaken in order to predict the construction noise levels using internationally recognised modelling software (SoundPLAN) and widely accepted modelling algorithms (British Standard 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Noise'), with comparison against the relevant Project guidelines for such activity.

The assessment considers the following:

- Construction phase plant items, numbers of plant and positioning
- Phasing and timings of the proposals
- The potential number and type of construction traffic and routing
- The number and proximity of sensitive receptors to the Project site and along the construction vehicle routes.

In terms of vibration, construction generated vibration has been calculated, following BS 5228-2:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites – Vibration'*. The following construction methods have been accounted for:

- High energy compaction
- Large scale piling
- Rock breaking.

3.12.2.2 Operations phase

The following Project components are expected to produce noise-generating impacts during the operational phase:

- Operation of the Mexinol Plant – including compressors, turbines, air coolers, fans, primary reformer, pumps, and flares
- Marine traffic
- Operation of the methanol loading jetty.

Computer noise modelling has been undertaken using internationally recognised modelling software (SoundPLAN) and widely accepted modelling algorithms (ISO 9613-2:2024 'Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation'). The computer noise model output will provide site wide noise contour plots for the defined study area. These contour plots will visually depict how the noise will attenuate and provides an investigative tool to decide noise mitigation options, whilst ensuring noise control is best and efficient.

Once the level of impact has been decided, then site specific mitigation proportionate to the likely impact can be found. Operational vibration has been scoped out given the Project components and distance to nearest sensitive receptors.

3.12.3 Waste

3.12.3.1 Construction and commissioning phase

3.12.3.1.1 Non-hazardous waste management

The main waste streams for the Project are expected to be domestic solid waste, cutting and excavation waste, reusable waste, and recyclable waste. Non-hazardous waste generated will be temporarily stored onsite in suitable and secure containers before it is collected and transferred to a warehouse or temporary waste collection. The waste will then be transported for final disposal, in one of the various waste disposal facilities, as described in Table 3.13. Predicted waste volumes are summarised in Table 3.12.

Table 3.12: Predicted non-hazardous waste volumes during construction phase

Waste type	Volume	Disposal
Fertile soil	Approximately 93,000 m^3	Fertile soil will be removed from the northern part of the Project site and will be deposited in the southern part of the site for preservation and to prevent mixing with interfile materials.
Domestic solid waste	Approximately 711 tons is expected to be generated each year during construction	This waste will be placed in labelled containers with lids and will be placed visibly and strategically at the generation sites. These containers will be periodically collected for final disposal at an approved site.
Reusable and recyclable waste (e.g., paper, plastic, aluminium cans, metal etc.)	To be confirmed	Waste will be separated according to the type of material or the use they will be given and will be deposited where showed by the authority.
Construction waste	Anticipated to include 10% of the materials used	Waste will be transported to an authorised waste management facility.

Source: Transition Industries (August 2024)

Table 3.13: Waste management facilities

Company	Location	Waste or activity
Grupo Asfálticos Procesados, S.A. de C.V.	Sinaloa	Used oils
Ambiental Tek Resources, S.A. de C.V.	Sinaloa	Lubricating oils used for alternative fuel production
Petro Químicos Aspen, S.A. de C.V.	Sonora	Used or spent lubricating oils and contaminated hydrocarbons, such as

Company	Location	Waste or activity
		gasoline, diesel, fuel oil (liquids and sludge with 10% solids) and gasoline; contaminated solvents; used or out of specifications, such as ketones, alcohols, acetates, aromatics, aliphatics and glycols, for alternative fuel production
Cemex, S.A.B de C.V. (antes Cemex México, S.A. de C.V.) (Planta Monterrey)	Nuevo Leon	Energy recycling and co-processing of hazardous waste as formulated or recovery fuels
Bravo, Energy México, S. de R.L de C.V.	Queretaro	Hazardous waste: plastics contaminated with oil and grease; cardboard and paper contaminated with oil and grease; rags and protective equipment contaminated with oil and grease; automotive oil filters
Gen Industrial, S.A. de C.V.	San Luis Potosí	Industrial wastewater with acidic or alkaline pH; with insoluble hydrocarbons; contaminated with soluble oils and refrigerants, paints, and inks. Water contaminated with paint, fluorescent lamps. Sludge that is acidic or alkaline; has soapy substances; with cellulose, metal, and electroplating content; oily sludge; WWTP sludge and paint sludge
Ecotemesa del Pacifico, S.A. de C.V.	Sinaloa	Collection and transportation
Tecnología Ambiental Especializada, S.A. de C.V.	Coahuila	Confinement
Sociedad Ecológica Mexicana del Norte, S.A. de C.V.	Coahuila	Confinement
Veolia Soluciones Industriales México, S.A. de C.V. (antes Residuos Industriales Multiquim, S.A. de C.V.)	Nuevo León	Confinement

Source: Transition Industries (August 2024)

A waste management database will be kept for the Project and will include monthly logs of data about the entry and exit of different waste streams from the Project site.

3.12.3.1.2 Hazardous waste management

Predicted waste volumes for hazardous waste over a period of 36 months (122,055 kg total or 40,685 yearly) are summarised in Table 3.14 and the management of waste is provided below.

Table 3.14: Predicted hazardous waste volumes during construction phase

Waste type	Estimated Amount (kg) over 36 months
Spent hydraulic oils	22,680
Solids with hydrocarbons	8,862
Solids with paint.	3,752
Rags contaminated with hydrocarbons	1,260
Soil contaminated with hydrocarbons	45,710
Spent automotive batteries	2,380
Filters contaminated with oil	3,682
Biological-infectious medical care waste (gauze, bandages and used cotton)	18
Empty containers that contained chemicals (paint, solvent, hydraulic oil)	15,239
Fluorescent lamps	42
Spent alkaline batteries	46
Solvent-based paint waste	280
Solids contaminated with hydraulic oil	2,205
Biological-infectious sharps	9
Oily waters	980
Spent lubricating oils	7,175
Water contaminated with hydrocarbons	5,600
Organic solvents	280
Oil maintenance solids waste	1,855
Total	122,055

Source: Transition Industries (2024)

The management of hazardous waste will be carried out under common practices following national laws and standards, as well as good international industry practice (GIIP) and based on the following aspects:

- Facilities: SEMARNAT will provide the Registry of Hazardous Waste Companies for each category that are licensed and in compliance at the time of the construction phase.
- Generation: The activities where this type of waste could be generated are found, such as the daily activities of the project, e.g. the maintenance of the diverse types of machinery, some accidental spills, activities related to health, etc.,
- Identification and classification: Each of the wastes is correctly found and classified under an analysis called CRETIB which is the acronym for classification of the characteristics to be found in hazardous waste, and which means: corrosive, reactive, explosive, environmental toxic, flammable and biological-

infectious. This to correctly manage hazardous waste to decide the proper handling it requires, at this point it will be found which waste will be subject to recovery and its recycling, use, reuse, treatment, co-processing or if it will be sent to final confinement or incineration is decided.

- Temporary Storage: Hazardous waste is collected in a warehouse (complying with the provisions of Article 82 of the Regulations of the General Law for the Prevention and Comprehensive Management of Waste) within the Project facilities, which will have technical characteristics specified in local regulations which will allow safe and separate storage from other types of waste, avoiding leaks and spills.
- Off-site transport and storage: Once the service providers related to the management of these have been found and evaluated (See Source: Transition Industries (August 2024)
- Table 3.13), the transport is carried out in specialised vehicles that follow the established environmental and safety standards, it is verified that all the vehicle units used to collect the Project's waste are listed within their respective authorisations in the matter. Waste is sent to intermediate collection facilities where it is separated into two categories: those that will go to treatment facilities and those that will go to final confinement and/or destruction facilities (biological-infectious).
- Treatment: The waste that can be recycled and/or formulated for energy recycling in cement kilns are those established in the Official Mexican Standard NOM-052-SEMARNAT-2005, as well as mixed materials that, due to their characteristics, cannot be used for the purpose for which they were made or their quality does not allow them to be used in the process that generated them. There are some wastes that, even if they could be reused in some process, are not reused given their characteristics (polychlorinated biphenyls, radioactive waste, heavy metals, etc.). All waste to be considered recyclable once formulated must follow the specific physicochemical characteristics established in the applicable standards.
- Final Disposal: The final disposal of hazardous waste that couldn't be reused will be carried out in specially designed confinement sites, which guarantee the containment and isolation of contaminants, just like any other suppliers, the quality of its facilities and their conditions must be evaluated, as well as the permits and what are the wastes that they are allowed to store.

3.12.3.1.3 Wastewater

During the construction phase, approximately 65 m^3 of wastewater will be generated each day from the sanitary services (i.e., portable bathrooms) provided for the workforce. This wastewater will be managed and disposed of by an authorised company (see Table 3.13).

An estimated 25,000 m^3 of testing water will also be generated because of construction activities. This testing water is expected to be transported to one of the available storage tanks and then, eventually transferred to the methanol production site water treatment plant for recycling.

3.12.3.2 Operations phase

Non-hazardous waste

During the operations phase, it is expected that 12 tons/day of wet sludge will be generated, which will be reduced due to 40-50% water evaporation to 5-6 tons/day of dry matter. An external provider will be hired for transportation, handling, and final disposal of the sludge.

The sludges must be analysed under the following official Mexican standards:

- NOM-004-SEMARNAT-2002, Environmental Protection – Sludge and Biosolids – Specifications and Maximum Permissible Limits of Contaminants for Use and Final Disposal. This standard establishes the specifications and largest permissible limits of contaminants in sludge and biosolids from the desilting of urban or municipal sewerage systems, water treatment plants and wastewater treatment plants to enable their use or final disposal and protect the environment and human health.
- NOM-052-SEMARNAT-2005, which establishes the characteristics, the procedure for identification, classification and lists of hazardous wastes, as well as the characteristics that make them considered as such.

Additionally, it is expected that approximately 60 tons of solid waste will be generated each year because of the operations workforce being on site. This waste will be placed in labelled containers with lids and will be placed visibly and strategically at the generation sites. These containers will be periodically collected for final disposal at an approved site.

Hazardous waste

Hazardous waste generated during the operations phase is expected to include oil filters, rags, absorbent materials, and waste contaminated with greases and oils. Every four years, major plant maintenance will be carried out, which is expected to generate 250,000 litres of lubricating oil waste.

Distillation column bottoms (process water) are routed back to the saturator and therefore the water is recycled into the process. Therefore, there is no hazardous waste associated with distillation column bottoms.

Hazardous waste will be managed following the provisions of the Regulations of the General Law for the Prevention and Comprehensive Management of Waste, and all personnel with the responsibility of managing hazardous waste will be appropriately trained. Hazardous waste will be stored in a specific warehouse prior to collection and final disposal by an authorised company (see Table 3.13).

Wastewater

During the operations phase, process wastewater will be generated at an estimated volume of 277 m^3/hr. This wastewater will be returned to the JAPAMA wastewater treatment facility to be treated.

A summary of predicted liquid waste volumes during the operations phase is presented in Table 3.15 below.

Table 3.15: Predicted liquid waste generation during operations phase

Equipment	Liquid type	Source	Volume (m^3/h)	Disposal
Methanol Slop Drum 4711D001	Methanol slop	Unplanned / shutdown	To be confirmed	Normally slop fluid is routed back to Offspec Tank 8101T003. Local disposal only in cases where slop fluid cannot be processed again.
Cooling Tower System Supply Header	Cooling Tower blow down	Normal operations	271.4	Blow down from Cooling Tower Supply Header routed to the water treatment plant
Cooling Tower Side Stream Filtration 8881U003	Wastewater	Normal operations	52	Figure to be confirmed by PU vendor during D.E. Wastewater to be sent to the water treatment plant
Non contaminated rainwater pits, all areas	Storm water	Rain	1532	Water treatment plant
Accidentally contaminated rainwater from pits, all areas	Contaminated storm water	Rain	300	Disposed to the water treatment plant
Sanitary waste, water treatment plant buildings	Sanitary waste	Normal operations	15.5	Disposed to the water treatment plant
Wastewater (laboratory chemical drainage)	Wastewater	Normal operations	15.5 (to be confirmed)	Disposed to the water treatment plant
Methanol Slop Drum 9531D001	Methanol slop	Unplanned / shutdown	To be confirmed	Local disposal. Normally slop fluid is routed back to Offspec Tank 8101T003 or to MeOH Slop Drum 4711D001.
Methanol Slop Drum 8101D001	Methanol slop	Unplanned / shutdown	To be confirmed	Local disposal. Normally slop fluid is routed back to Offspec Tank 8101T003 or to MeOH Slop Drum 4711D001.
Process condensate, purified from 4031E055 (Downstream Process Condensate Stripper 4031C002)	Purified process condensate	Normal operations	135.5	Purified process condensate. Intended to be used in demineralised water

Equipment	Liquid type	Source	Volume (m^3/h)	Disposal
Process condensate, contaminated from 4041E005 (Downstream Process Condensate Stripper 4041C001)	Contaminated process condensate	Normal operations	33.5	Process condensate from POX route. Intended to be used in wastewater treatment
Boiler Blow Down Water from 4821E002	Boiler blow down water	Normal operations	8.1	Boiler blow down water intended for use in Demineralisation and polishing unit
Firefighting water for firefighting activities	Contaminated firefighting water	Unplanned / fire case	1300 max	Firefighting wastewater from MeOH Process Plant is routed to pit 56 in located in MeOH storage area. After testing, firefighting wastewater is routed to JAPAMA wastewater treatment facility

Source: Transition Industries (2024)

3.13 Associated facilities

According to IFC PS1 (assessment and management of E&S risks and impacts), the definition of associated facilities is *'facilities that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without which the Project would not be viable'* (IFC, PS 1 paragraph 8, 2012).

The interconnection to the 400 kva National Transmission Grid will need:

- Installation of a 43 km high voltage 400MVA transmission line between the Choacahui Substation and new Methanol Production Plant substation
- Installation and commissioning of two power switches and associated primary equipment within the Choacahui Substation
- Installation and commissioning of a 400 kV substation at the methanol production plant.

The RoW for the transmission line will be 36 m wide covering an estimated total area of approximately 154.8 hectares.

All connection and reinforcement work will be carried out as required by the national energy control centre or El Centro Nacional de Control de Energía (CENACE). Any upgrades at Choacahui Substation are yet to be fully determined but typically include expanding the substation bay and replacing interrupters and electrical breakers. No expansion of the Choacahui Substation overall developed area is expected. The entire scope of this development will be handled by RIC Energy and its contractors.

An Associated Facilities preliminary ESIA exercise has been developed following IFC Performance Standards and the Equator Principles and is included in Chapter 10.

3.14 Transboundary impacts

Transboundary impacts are defined as cross-border Project-related impacts (i.e., impacts that would occur outside Mexico's geopolitical boundaries). As described in Chapter 8, the extents of all potential impacts from planned and unplanned Project activities are expected to occur entirely within Project's AoIs. Additionally, as described in Section 5.1.1, the Project's AoIs are contained within Mexico's geopolitical boundaries; therefore, no Project activities are expected to result in transboundary impacts.

4 PROJECT ALTERNATIVES

4.1 Introduction

In this Chapter, the critical technical alternatives selected for the Project are found and the justification for their choice detailed. Alternatives analysis for the associated facilities is discussed in Chapter 10.

4.2 Location alternatives

In the primary stages of the Project feasibility study, it was recognised that west coast North American locations provided transportation advantages for a methanol production facility. The site selection criteria included available export infrastructure, the absence of any environmentally sensitive areas, and the proximity to a gas supply pipeline. This screening, which took place in 2019, led to the identification of the Topolobampo area of Mexico.

The first search criteria looked at flat, accessibly agricultural land outside the Ramsar Zone and away from the Bay of Ohuira coastline to minimise impact on ecological systems. The area also needed to be close to a gas supply connection, with port, rail, and highway access. Additionally, the area needed to include a buffer from residential and commercial community development, and industrial land use consistent with regional land use development planning. This led to the choice of the site and later site land acquisition, which included a transfer of private land to Mexinol by the primary local Project shareholders as part of Project ownership. Further to this, port utilisation agreements were established which secured the Project's rights to use the port for export. The Project site area, including the laydown area and southern property area were transferred by the Project shareholder in 2019.

The original design of the Project in 2020 to 2021 involved use of Project land nearer to the Bay of Ohuira (in the southern property area). In continuous discussions with local landowners, Indigenous leaders, and local community members at that time, the Project understood that the Bay of Ohuira was a sensitive resource for Indigenous groups as well as local fisherfolk. It was decided to change the design and move the site to the northern part of the 99.99 ha site. The southern part of the land would form a protective boundary, and the Project further committed to choosing this as a conservation area (see Figure 3.2).

4.3 Development concept and design alternatives

The Mexinol Project has been designed to minimise its impact on the surrounding area, in respect to environmental, social and biodiversity impacts.

During design development, pipeline routing and construction methods were established to minimise the impact on the Ramsar Zone, existing natural vegetation and habitats. To avoid any potential impacts to vegetation and to ease canal crossings, the design incorporated HDD into pipeline construction planning.

Additionally, to minimise the plant's overall environmental footprint, the site choice was made outside of the Ramsar Zone, on agricultural arable land (requiring no resettlement),

and not within any internationally recognised site to respect environmentally sensitive areas. The 1.4 km section of the Ramsar/Important Bird Area (IBA) which the pipeline crosses was selected because the habitats there are devoid of vegetation, having been previously affected by the construction of industrial facilities, quarrying operations and the building of a highway to the port. These man-made installations have significantly altered the surface hydrology of the surrounding area, leading to the complete loss of mangrove swamp/lagoon to the east of the highway. It is through this area that the pipeline will be routed, to cause minimal impact to an area devoid of vegetation.

The site also makes use of an existing port and jetty, and high voltage lines running through the site, providing direct access to infrastructure, and avoiding dredging and minimising potential environmental impacts. Various routing pathways of the pipeline were studied. The methanol pipeline route selected runs next to an existing RoW of the TransCanada natural gas pipeline. The pipeline then runs parallel to the highway (bar a slight diversion around a cemetery) so that it is always found on disturbed ground and causes least environmental/biodiversity impact.

The Project began the land acquisition process for the methanol pipeline RoW during the Project's feasibility stage. Much of the required land was secured in 2021 and 2022, during the basic design and engineering phase, following the decision to move the facility to the northern part of the site. In 2022, the design and engineering team revised the methanol pipeline route to avoid a privately owned parcel following the landowner's decision not to sell. A combination of design approaches for reducing or preventing air pollution include enhancing energy efficiency, process modification, and application of emissions control techniques. To reduce GHG emissions, options include alternative process design, adoption of renewable or low carbon energy source, and proper waste management practices.

The routing of the water pipeline was carefully studied to prioritize avoidance of physical and economic resettlement, cultural heritage sites, and sensitive biodiversity areas, in line with the mitigation hierarchy. In early December 2024, the Project identified that the proposed right-of-way (RoW) near Highway 22 could potentially overlap with a planned industrial development park, raising concerns that landowners might be unwilling to sell.

The design and engineering team redesigned the water pumping system to eliminate the need for electrical towers which then allowed the pipeline to be rerouted nearer to the airport (see Figure 3.2). This was the original preferred route from design, engineering, and land use perspectives, as it is parallel to an existing wastewater canal on already affected land. However, it took additional time and resources to design the technical solution (water pumping system) to allow for the ideal pipeline to be used.

4.4 Technology and process alternatives

4.4.1 Water use

The Project is committed to aligning with IFC Performance Standard 3 by implementing sustainable water management practices that promote efficiency, conservation, and pollution prevention. In line with the PS3 mitigation hierarchy, the Project has prioritized avoiding the use of natural water sources, such as bays, rivers, canals, and groundwater, for process, cooling, and potable water needs.

Instead, the Project will use alternative, non-traditional water sources to avoid contributing to regional water stress or competing with other users. Specifically, the facility will source treated wastewater from JAPAMA, the municipal wastewater treatment provider in Los Mochis, for its industrial processes—including cooling and steam generation—and will return treated effluent to the same facility for further treatment and discharge.

This approach demonstrates a resource-efficient and circular water strategy, whereby the Project avoids abstraction from freshwater ecosystems and reduces discharge into natural water bodies. The initiative stands for a first-of-its-kind industrial water reuse model in the region, helping to minimize water-related impacts and safeguard local water availability for other users and ecosystems.

Transition Industries is implementing a water management approach that sets a new standard for industrial sustainability in the region. By avoiding the widespread practice of freshwater extraction and untreated wastewater discharge—frequent environmental concerns in similar projects—Transition Industries will reduce its water-related environmental footprint, resulting in the following key benefits:

- No extraction from or discharge to the Bay of Ohuira, thereby preserving the ecological balance and water quality of this sensitive marine environment.
- Significantly reduces the volume of wastewater that JAPAMA discharges into the Bay, which is typically high in biological oxygen demand (BOD), nitrogen, and phosphorus—key contributors to eutrophication and aquatic ecosystem degradation.
- Self-sufficient potable water generation, eliminating reliance on municipal or natural freshwater sources.
- Treatment and reuse of all domestic (human) wastewater within the facility, ensuring a closed-loop sanitation system.
- In-house treatment of process water, preventing industrial pollutants from entering public or natural water systems.
- Capture, storage, and treatment of both clean and contaminated water, enabling efficient water reuse across multiple processes and minimizing overall consumption.
- Discharge water returned to JAPAMA will meet or exceed international wastewater quality standards and will be cleaner than current municipal effluent being released into the Bay of Ohuira.

4.4.2 This integrated and circular water strategy not only avoids environmental harm but also contributes positively to regional water quality and **availability. This demonstrates a commitment to sustainable resource management fully aligned with the principles of IFC PS 3. Energy use**

The Project will be the first world-scale methanol facility with net-zero emissions. The selected technology was the AdWinMethanolZero® process, combined with carbon capture equipment via AdWinCC® and the reintegration of CO_2 into the methanol production process. This avoids approximately 1,400,000 MT of CO_2 equivalent emissions annually compared to conventional Steam Methane Reforming (SMR) methanol technology. In comparison to coal-based methanol production, Mexinol can avoid more than 3,000,000 MT of CO_2 equivalent emissions annually.

The Project will also apply GIIP to resource efficiency requirements and will adopt measures to optimise energy usage to achieve net zero emissions. To achieve this,

Transition Industries plans to buy green power which will be sourced by either direct renewable generation or by buying clean energy certificates.

AdWinMethanolZero® technology is based on state-of-the-art process design principles being utilised in proven conventional plants running world-wide. All equipment and process steps are based on proven technology. The process design offers significant benefits compared to other available methanol technologies. The Project has undergone an independent technology assessment by a recognised expert firm which concluded that AdWinMethanolZero®, based on proven design/practices in the methanol industry, offers reduced capital expenditure (CAPEX) and operational expenditure (OPEX), as well as not having any specific additional risks compared to other established conventional technologies.

4.4.3 Management of hazardous and non-hazardous waste

The Project will minimise the generation of waste, and reuse, recycle and recover waste in a manner that is safe for human health and the environment. The elevated level of process integration allows for the reduction of emissions, effluents and wastes at the source.

The municipal wastewater currently discharged into the Bay of Ohuira has a high content of nitrogen, phosphorous, and suspended and dissolved solids, which negatively impacts wildlife and the fishing activities of local communities. The Project will not add to the level of pollutants entering the Bay of Ohuira and will not negatively impact the local ecosystem. In fact, by treating, consuming, and recycling municipal wastewater, the Project estimates a reduction of water contamination into the Bay of Ohuira.

4.5 'Do nothing' scenario

The 'do nothing' scenario is a hypothetical alternative conventionally considered in ESIAs as a basis for comparing the development proposal under consideration. In this situation, the do-nothing scenario would include not developing the methanol production facility.

Methanol is a versatile and essential compound used in everyday industrial and consumer products as well as energy-related applications. Additionally, it is an economical alternative with low production costs and significantly less need to retrofit vessels to process and use methanol as a marine fuel.

The global methanol demand is growing and the policy push for decarbonisation is generating new applications due to its emissions benefits, generating further demand. Global methanol growth is expected to increase in the long-term, driven by the move by countries in the Pacific Basin toward cleaner energy through methanol use, and will require unprecedented levels of incremental supply capacity additions to meet global demand growth.

The world market for methanol will continue to grow at a rate that supports an addition of two world-scale methanol plants per year. Without the Project, this demand growth will be satisfied by the development of projects with more environmentally adverse impacts. Alternative methanol projects may not adopt "zero impact/positive impact" GHG emissions and water solutions. Furthermore, alternative projects could have higher transportation distances to reach Pacific markets and therefore greater transport-

associated emissions. This Project will enter the market in the top quartile in production costs of the existing methanol production plants.

Additionally, the Project will have benefits to local employment, as the Project intends to provide up to 3,500 jobs during construction peak and over 400 direct and contract jobs during operations.

5 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

5.1 Introduction

This Chapter of the ESIA presents the results of both desk-based studies and field surveys carried out to find the baseline conditions in the Project area and develop proper mitigation measures.

5.1.1 Area of influence

5.1.1.1 Environmental AoI

The AoIs used for air quality; noise and vibration; soils; landscape and visual amenity; geology, geomorphology and geohazards; soils, hydrogeology and hydrology are individually described in sections 5.2.1-5.2.7 below.

5.1.1.2 Biodiversity AoI

The AoI for biodiversity (ecological AoI) encompasses both the area physically affected by Project activities and the adjacent areas affected by dust, noise, traffic and increased human presence. The ecological AoI is described in further detail in Section 5.3.1

5.1.1.3 Socioeconomic AoI

The Project's social AoI is divided into three areas: a Direct AoI, a secondary Indirect AoI and a Regional / National AoI. These are described in further detail in Section 5.4.1.1.

5.2 Physical environment baseline

The physical environment baseline addresses the following topics:

- air quality
- noise and vibration
- landscape and visual amenity
- geology, geomorphology and geohazards
- soils
- hydrogeology
- hydrology.

5.2.1 Air quality

5.2.1.1 Introduction

The full baseline conditions of ambient air quality are provided in this chapter alongside the assessment in Chapter 8 for ease of reference.

The Project site is in a rural agricultural area in the municipality of Ahome, state of Sinaloa, Mexico. The site is found outside of Topolobampo but is near major highways,

the Port of Topolobampo and the PEMEX export facility. All land that will be used for the Project has been bought by the Project in individual private land purchase agreements or leases as per local and Mexican law (SLR Consulting Limited 2022).

5.2.1.2 Physical environment

5.2.1.2.1 Meteorological conditions

Temperature

Mexico has a semi-arid to arid desert climate. The country's temperatures range from 26°C to 39°C. The average annual rainfall in Mexico is at around 191 mm. In recent years, a general warming trend has been experienced throughout the country.

Wind

Data from the National Oceanic and Atmospheric Administration meteorological database for Los Mochis met station (Lat: 25.8, Long: -109.1, Elevation 45 m) were reviewed from 1st January 2019 to 31st December 2023 to produce a windrose plot as seen in Figure 5.1. The prevailing wind direction recorded is from the northwest with lower occurrences from the southwest and east. The average wind speed during this period was recorded as 4.7 m/s.

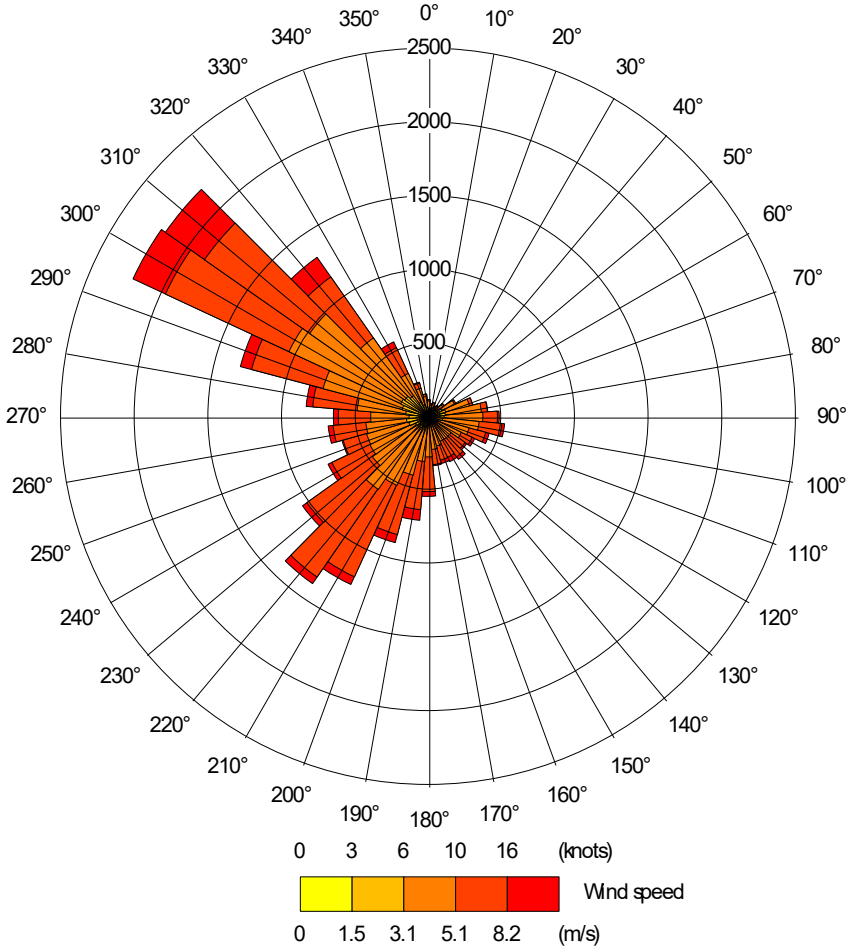


Figure 5.1 Windrose for the period 1 January 2019 to 31 December 2023 for Los Mochis

Precipitation

Rainfall is low in Mexico with the 2023 annual average rainfall of 191 mm. Table 5.1 shows that rain events occur from June to November. The months with the highest precipitation are June to August and September to November with 366.74 mm and 262.27 mm precipitation, respectively.

Table 5.1 2023 annual average rainfall

Annual average 2023				
Units: mm	**DJF**	**MAM**	**JJA**	**SON**
Mexico	58.45	75.9	366.74	262.27

According to the meteorological data collected between 2019 and 2023, the average humidity was 54.2 % and wind speed of 4.7 m/s. A summary of temperature, humidity, wind speed, and precipitation data across the five-year study period is provided in Table 5.2.

Table 5.2 Meteorological Data at Los Mochis from 2019 to 2023

Temperature (°C)			Relative Humidity (%)		Wind Speed, m/s				Precipitation Avg (mm)
Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	
5	25.8	39	7	54.2	100	0	4.7	16.4	191

5.2.1.3 Potential Impacts

The IAQM has published guidance on the assessment of air quality impacts from construction operations and suggests fugitive dust impacts are unlikely to occur at receptors more than 250 m from construction sites, therefore an AoI for fugitive emissions from construction activities of 250 m from the site boundary is considered reasonable.

Construction activities can be a significant source of particulate matter (PM) into the atmosphere, and they can have a significant temporary influence on ambient air quality. Land clearance, ground excavation, cut and fill activities, and the construction of a specific facility may all be associated with PM emissions during construction.

The principal impacts on ambient air quality during the construction phase are likely to be:

- fugitive emissions of dust and particulate matter from construction activities of pipeline to an existing jetty in the Port of Topolobampo for export
- fugitive emissions from quarrying, size reduction and movement of materials from the Quarrying site near location 8 (Avenida 6 de Enero)
- exhaust emissions of combustion gases from plant and vehicles on site and on the local road network to Port of Topolobampo.

5.2.1.4 Area of influence and study area

The AoI of the Project is the geographical area in which impacts may occur and therefore includes the site itself and the surrounding area.

Fugitive emissions of dust to air from construction sites can occur during the preparation of the land, extraction, processing, handling, and nearby traffic. Emissions can vary from day to day, depending on the level of activity, the specific operations being undertaken, and the weather conditions. The scale of these impacts depends on the dust suppression and other mitigation measures applied.

The IAQM has published guidance on the assessment of air quality impacts from construction operations and suggests fugitive dust impacts are unlikely to occur at receptors more than 250 m from construction sites, therefore an AoI for fugitive emissions from construction activities of 250 m from the site boundary is considered reasonable.

Existing or baseline ambient air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural, and natural sources.

5.2.1.5 Emission sources and key air pollutants

The application site is next to Los Mochis-Topolobampo highway in the northwest. As a result, transport emissions from local traffic are expected to be the primary source of pollution at the site.

The principal pollutants relevant to this assessment are nitrogen oxides, nitrogen dioxide, ozone, hydrogen sulphide and sulphur dioxide, regarded as the most significant air pollutants released by vehicular combustion processes or subsequently generated by vehicle emissions in the atmosphere through chemical reactions.

5.2.1.6 Monitoring locations

5.2.1.6.1 Macro-scale Locations

Monitoring was carried out at locations selected to represent exposure to potential construction and operation emissions from the Project. The receptors are listed in Table 5.3 and Figure 5.2, below. A specific location at each site was chosen for both short-term and long-term monitoring.

Diffusion tube monitoring was undertaken between May 1st and May 30th, 2024. Approximately 1 hour dust monitoring each site was carried out twice as a set of two rounds. The first round was carried out between May 1st and 2nd 2024, while the second round was carried out between May 29th and 30th, 2024. The same monitoring locations were used for both short-term monitoring and long-term diffusion tube monitoring.

Table 5.3: Monitoring Locations

Location Reference	Grid References	Receptor Name/ Location
MP1	25.698933ºN;109.092747ºW	Calle Cástulo Almada Ayala
MP2	25.691583ºN;109.081678ºW	Carrera Aeropuerto Road 1 near Los Mochis International Airport
MP3	25.686347ºN;109.052487ºW	Carrera Aeropuerto Road 2
MP4	25.672264ºN;109.008142ºW	Field near Campo Guadalupe Estrada
MP5	25.662508ºN;109.045027ºW	Carretera Topolobampo
MP6	25.643997ºN;109.033940ºW	Near Cell phone tower, Topolobampo
MP7	25.637259ºN;109.051677ºW	Highway Los Mochis to Topolobampo
MP8	25.631423ºN;109.058558ºW	Avenida 6 de Enero
MP9	25.604154ºN;109.060793ºW	Cetmer
MP10	25.604523ºN;109.054008ºW	Calle Licenciado Benito Juárez
MP11	25.600052ºN;109.052583ºW	Boulevard Adolfo López Mateos
MP12	25.594432ºN;109.059950ºW	Near Transoceanic terminal Topolobampo

Figure 5.2: Monitoring locations

5.2.1.6.2 Micro-scale siting of monitors

BS EN 13528-3:2003 makes the following general points about micro-siting of diffusion tubes, however they are also relevant to other monitoring techniques and will be applied for all parameters in this study:

- Ideally, sampling points should be at least 1 m away from buildings or other major obstructions to avoid local perturbation effects.
- The measuring height should be between 1.5 m and 4.0 m. Heights > 2.5 m will discourage theft and vandalism.
- The immediate vicinity of trees, bushes, etc. should be avoided to minimise the influence of the local environment or to minimise effects from troublesome insects.

5.2.1.7 Monitoring methods

Ambient concentrations of nitrogen oxides, nitrogen dioxide, ozone, hydrogen sulphide and sulphur dioxide were sampled using passive diffusion tubes, transported, deployed, and analysed following BS EN 13528 :2002. Diffusion tubes were supplied and analysed by an accredited laboratory in the UK.

Travel (field) blanks were deployed onsite for quality control and quality assurance (QA/QC) purposes and were analysed at an accredited laboratory as per the widely accepted guidance (for example, the guidance provided by the Department for Environment, Food and Rural Affairs (DEFRA), UK). Laboratory blanks were kept as per the QA/QC standards. Tubes were deployed in duplicate.

Particulate matter was monitored using a TSI 'DustTrak' nephelometer optical particle monitor which is capable of measuring indicative concentrations of PM_{10} and $PM_{2.5}$, particulate matter simultaneously. The TSI DustTrak is not a 'reference equivalent' method for the determination of airborne particulates; however, it provides indicative continuous data that may capture short-term events and may be fitted with an in-line filter which can be analysed gravimetrically in the laboratory and the results used to adjust the optically based data. These instruments are powered by batteries do not require an external power supply.

These data are a limited dataset, of day-time measurements and are therefore likely to be broadly representative of the 24-hour mean guideline but are likely to overestimate the annual mean. The periods monitored are substantially less than a full year and therefore are not appropriate for formal comparison with the WHO annual mean guideline, nevertheless the data represent evidence that the existing, 'baseline' concentrations of PM_{10}, $PM_{2.5}$ particulate matter are consistent with the expected range of Mexico Air Quality Standards and United States Environmental Protection Agency (USEPA)'s National Ambient Air Quality Standard (NAAQS).

Ambient air quality and the concentrations of some pollutants can show natural seasonal variation, e.g. sunlight intensity strongly affects ozone formation and concentrations of airborne particulate matter may be greater during periods of dry weather.

5.2.1.8 *Baseline monitoring data*

The ambient air quality monitoring was carried out in twelve monitoring locations within the proposed Mexinol plant and dedicated pipeline to an existing jetty in the Port of Topolobampo. The weather during sampling was dry and sunny. Nearby vehicle activity was present on the existing road network. During the site visit, weather conditions and nearby influences were noted. The baseline monitoring was carried out twice during the monitoring period for the following parameters:

- Particulate matter (PM), including PM_{10} and $PM_{2.5}$;
- (Nitrogen Dioxide) NO_2;
- Ozone (O_3);
- Hydrogen Sulphide (H_2S);
- Sulphur Dioxide (SO_2);
- Carbon Monoxide (CO);
- Vapour phase volatile organic compounds (VOC) (at selected locations).

The short-term monitoring was carried out for Particulate matter (PM), including PM_{10}, $PM_{2.5}$ and CO and the long-term monitoring was carried out for Nitrogen Oxides (NO_x) (Nitrogen Dioxide) NO_2, Ozone (O_3), Hydrogen Sulphide (H_2S), Sulphur Dioxide (SO_2), Vapour phase VOC.

The first round was carried out on May 1st and 2nd, 2024, while the second round was carried out on May 29th and 30th, 2024. The same monitoring locations were used for both short-term monitoring and long-term diffusion tube monitoring.

It is noted that most of the monitoring location were dusty as the site is found outside of Topolobampo but is in the proximity to major highways, the Port of Topolobampo and the PEMEX export facility.

The monitoring location 8 was found near to the existing quarrying site and this causes the potential to exceed the dust level. Also, all other monitoring location were realistically dusty as it is closer to the Los Mochis-Topolobampo highway, and the terrain was dry, and it was windy.

There are no data available for the long-term monitoring as it normally takes 2 weeks from the date of submission of the tubes to lab which we sent on 3rd June 2024.

A review of the monitoring data available from the ambient air quality monitoring carried out at twelve monitoring locations within the proposed Mexinol plant and dedicated pipeline to an existing jetty in the Port of Topolobampo suggests that PM_{10} and $PM_{2.5}$ levels monitored at 12 automatic monitors don't exceed the 24-hour Mexico Air Quality standards (AQS). However, there are baseline exceedances of the 24-hour WHO 2021 Air Quality guideline (AQG) values at locations 7, 9 and 11. Although, it should be noted that because of the significant contribution of natural sources of these pollutants these AQGs maybe not be suitable and the WHO interims targets (see Table 8.3) may be more appropriate.

With respect to road transportation, the road transportation network in the vicinity of the Project, specifically the Topolobampo to Los Mochis Highway (I-22) already shows high frequency of vehicle traffic, especially during peak daylight hours as it is the primary road leading to the Port. However, it is considered that the Project's committed embedded

controls and mitigation measures (e.g., Traffic Management Plan) has considered for this possibility and are designed to minimise the Project's contribution to traffic emissions.

It is noted that most of the monitoring locations were dusty as the site is found outside of Topolobampo but is in the proximity to the Los Mochis-Topolobampo highway and surface roads, the Port of Topolobampo and the PEMEX export facility. The monitoring location 8 was found near to the existing quarrying site and this causes the potential to exceed the dust level. Also, all other monitoring location were realistically dusty as it is closer to Los Mochis-Topolobampo highway, the terrain was dry, and it was windy during sampling. The monitoring results are shown in Table 5.4.

5.2.1.9 Round one: PM_{10}, $PM_{2.5}$ and CO monitoring, 1st, and 2nd May 2024

The first round for PM_{10}, $PM_{2.5}$ and CO monitoring was carried out between 1st and 2nd May 2024 in the various monitoring locations. During the site visit our RSK site personnel has noticed that the monitoring locations terrain was very dusty, and the weather was hot and temperature measured 32ºC.

The PM_{10} results do not exceed the 24-hour Mexico or WHO AQS/AQG values at any of the monitoring locations. The maximum PM_{10} concentration was identified as 28.6µg/m^3 at monitoring location 7, with the maximum $PM_{2.5}$ concentration identified as 28.3 µg/m^3. This does not exceed the 24-hour Mexico $PM_{2.5}$ AQG value but does exceed the 24-hour WHO AQG value, as well as WHO interim target 4. Both elevated concentrations are due to its proximity to the Los Mochis-Topolobampo highway and surrounding residential properties.

The CO level did not exceed the WHO 1-hour CO AQG value at any of these monitoring locations. The maximum CO level identified in location 1, 9 and 10 with the recorded values being 4.91, 4.65, 4.89 ppm, with the WHO AQG being 30.5 ppm These locations are near the residential areas, and it suggest that household appliances, including gas stoves and ovens, can also contribute if they are used without proper ventilation. Vehicle emissions, particularly from cars idling in garages or near open windows, may be another reason.

The monitoring results are shown in Table 5.4, Figure 5.3, and Figure 5.4.

5.2.1.10 Round two: PM_{10}, $PM_{2.5}$ and CO monitoring, 29th and 30th May 2024

The second round of PM_{10}, $PM_{2.5}$ and CO monitoring was carried out between 29th and 30th May 2024 in the various monitoring locations. During the site visit, our RSK site personnel noticed that the monitoring location's terrain was very dusty, and the weather was hot and the temperature measured 34ºC.

The maximum PM_{10} was identified as 39.9 µg/m^3 at the monitoring location 11. The maximum $PM_{2.5}$ was identified as 40 µg/m^3 at location 11. In general, the PM_{10} results did not exceed the 24-hour Mexico or WHO AQS/AQG at any of the monitoring locations. However, the concentrations did exceed the 24-hour $PM_{2.5}$ WHO AQG value and WHO interim targets 3 and 4 at locations 9 and 11, with no exceedances of the $PM_{2.5}$ 24-hour Mexico AQS reported.

The CO level does not exceed the WHO 1-hour CO AQG value in any of the monitoring locations. The CO level recorded as negligible in monitoring Location 1 to 8. The largest CO recorded as 7.62 ppm at location 12. These locations are near residential areas, and

it suggest that household appliances, including gas stoves and ovens, can also contribute if they are used without proper ventilation. Vehicle emissions, particularly from cars idling in garages or near open windows, may be another reason. The monitoring results were shown in Table 5.4, Figure 5.5 and Figure 5.6.

Table 5.4 PM_{10}, $PM_{2.5}$ and CO monitoring results for the two monitoring periods

Monitoring Location	Parameter	Round 1 Monitoring (1-hour average)	Round 2 monitoring (1-hour average)	Air Quality Standards	Notes
Location 1: Calle Cástulo Almada Ayala	PM_{10}, µg/m³	3.6	5.13	24-hr: 75 µg/m³ (Mexico AQS), 24-hr: 45 µg/m³ (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 1st May 2024, time 09:28-10:27. CO monitoring was undertaken on 1st May 2024, time 09:30-10:30. Round 2 Dust monitoring was undertaken on 30th May 2024, time 15:03-15:17. CO monitoring was undertaken on 30th May 2024, time 15:03-15:17. **Note: Monitoring is done in between location 1 and 2. Therefore consolidated value has been taken.**
	$PM_{2.5}$, µg/m³	3.53	4.60	24-hr: 45 µg/m³ (Mexico AQS), 24-hr: 15 µg/m³ (WHO 2021 AQG)	
	CO, ppm	4.91	Negligible	1-hr:35 mg/m³ (30.5 ppm) (WHO 2021 AQG),	
Location 2: Carrera Aeropuerto Road 1 near Los Mochis International Airport	PM_{10}, µg/m³	9.03	5.13	24-hr: 75 µg/m³ (Mexico AQS), 24-hr: 45 µg/m³ (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 1st May 2024, time 10:46-11:45. CO monitoring was undertaken on 1st May 2024, time 10:45-11:45. Round 2 Dust monitoring was undertaken on 30th May 2024, time 15:03-15:17. CO monitoring was undertaken on 30th May 2024, time 15:03-15:17.
	$PM_{2.5}$, µg/m³	9.02	4.60	24-hr: 45 µg/m³ (Mexico AQS), 24-hr: 15 µg/m³ (WHO 2021 AQG)	
	CO, ppm	4.12	Negligible	1-hr:35 mg/m³ (30.5 ppm) (WHO 2021 AQG),	
Location 3: Carrera Aeropuerto Road 2	PM_{10}, µg/m³	2.24	4.40	24-hr: 75 µg/m³ (Mexico AQS), 24-hr: 45 µg/m³ (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 1st May 2024, time 11:55-12:55 CO monitoring was undertaken on 1st May 2024, time 11:55-12:55. Round 2 Dust monitoring was undertaken on 30th May 2024, time 14:43-14:57. CO monitoring was undertaken on 30th May 2024, time 14:43-14:57.
	$PM_{2.5}$, µg/m³	2.24	3.60	24-hr: 45 µg/m³ (Mexico AQS), 24-hr: 15 µg/m³ (WHO 2021 AQG)	
	CO, ppm	3.8	Negligible	1-hr:35 mg/m³ (30.5 ppm) (WHO 2021 AQG)	

Monitoring Location	Parameter	Round 1 Monitoring (1-hour average)	Round 2 monitoring (1-hour average)	Air Quality Standards	Notes
Location 4: Field near Campo Guadalupe Estrada	PM_{10}, µg/m^3	10.61	11.70	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 08:07-09:06 CO monitoring was undertaken on 23rd September 2023, time 14:42-15:42. Round 2 Dust monitoring was undertaken on 30th May 2024, time 15:19-16:19. CO monitoring was undertaken on 30th May 2024, time 15:03-15:17.
	$PM_{2.5}$, µg/m^3	10.58	11.33	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	3.35	Negligible	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	
Location 5: Carretera Topolobampo	PM_{10}, µg/m^3	1.61	4.11	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 1st May 2024, time 13:19-14:18. CO monitoring was undertaken on 1st May 2024, time 13:19-14:18. Round 2 Dust monitoring was undertaken on 30th May 2024, time 14:23-14:40. CO monitoring was undertaken on 30th May 2024, time 14:23-14:40 **Note: Monitoring is done in between location 1 and 2. Therefore consolidated value has been taken.**
	$PM_{2.5}$, µg/m^3	1.58	3.67	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	1.57	Negligible	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	
Location 6: Near Cell phone tower, Topolobampo	PM_{10}, µg/m^3	2.55	4.11	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 08:52-09:51 CO monitoring was undertaken on 2nd May 2024, time 08:52-09:51 Round 2 Dust monitoring was undertaken on 30th May 2024, time 14:23-14:40. CO monitoring was undertaken on 30th May 2024, time 14:23-14:40
	$PM_{2.5}$, µg/m^3	2.48	3.67	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	2.6	Negligible	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	

Monitoring Location	Parameter	Round 1 Monitoring (1-hour average)	Round 2 monitoring (1-hour average)	Air Quality Standards	Notes
Location 7: Highway Los Mochis to Topolobampo	PM_{10}, µg/m^3	28.6	5.37	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 09:45-10:45 CO monitoring was undertaken on 2nd May 2024, time 09:45-10:45 Round 2 Dust monitoring was undertaken on 29th May 2024, time 10:37-11:07. CO monitoring was undertaken on 30th May 2024, time 10:37-11:07 **Note: Monitoring is done in between location 1 and 2. Therefore consolidated value has been taken.**
	$PM_{2.5}$, µg/m^3	28.27	5.03	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG),	
	CO, ppm	1.65	Negligible	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	
Location 8: Avenida 6 de Enero	PM_{10}, µg/m^3	9.5	5.37	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 10:46-11: 46. CO monitoring was undertaken on 2nd May 2024, time 10:40-11:40. Round 2 Dust monitoring was undertaken on 29th May 2024, time 10:37-11:07. CO monitoring was undertaken on 29th May 2024, time 10:37-11:07
	$PM_{2.5}$, µg/m^3	9.4	5.03	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	1.6	Negligible	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	
Location 9: Cetmer	PM_{10}, µg/m^3	12.8	19	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 12:19-13: 18. CO monitoring was undertaken on 2nd May 2024, time 12:20-13:19. . Round 2 Dust monitoring was undertaken on 29th May 2024, time 11:15-11:54. CO monitoring was undertaken on 29th May 2024, time 11:15-11:54
	$PM_{2.5}$, µg/m^3	12.5	16.34	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	4.65	1.42	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	
Location 10: Calle Licenciado Benito Juárez	PM_{10}, µg/m^3	6.48	6.84	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 12:27-13:28.

Monitoring Location	Parameter	Round 1 Monitoring (1-hour average)	Round 2 monitoring (1-hour average)	Air Quality Standards	Notes
	$PM_{2.5}$, µg/m^3	6.45	6.10	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	CO monitoring was undertaken on 2nd May 2024, time 12:27-13:19. Round 2 Dust monitoring was undertaken on 29th May 2024, time 12:33-13:03. CO monitoring was undertaken on 29th May 2024, time 12:33-13:03.
	CO, ppm	4.89	2.22	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG),	
Location 11: Boulevard Adolfo López Mateos	PM_{10}, µg/m^3	8.6	39.89	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 2nd May 2024, time 13:55-14: 59. CO monitoring was undertaken on 2nd May 2024, time 14:00-15:00. Round 2 Dust monitoring was undertaken on 29th May 2024, time 13:09-14:21. CO monitoring was undertaken on 29th May 2024, time 13:09-14:21
	$PM_{2.5}$, µg/m^3	8.5	40.03	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	2.35	0.15	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	
Location 12: Near Transoceanic terminal Topolobampo	PM_{10}, µg/m^3	12.2	14.67	24-hr: 75 µg/m^3 (Mexico AQS), 24-hr: 45 µg/m^3 (WHO 2021 AQG)	Round 1 Dust monitoring was undertaken on 3rd May 2024, time 11:04-12: 03. CO monitoring was undertaken on 3rd May 2024, time 11:04-12:06. Round 2 Dust monitoring was undertaken on 29th May 2024, time 11:58-12:23. CO monitoring was undertaken on 29th May 2024, time 11:58-12:23.
	$PM_{2.5}$, µg/m^3	12.2	13.03	24-hr: 45 µg/m^3 (Mexico AQS), 24-hr: 15 µg/m^3 (WHO 2021 AQG)	
	CO, ppm	2.55	7.62	1-hr:35 mg/m^3 (30.5 ppm) (WHO 2021 AQG)	

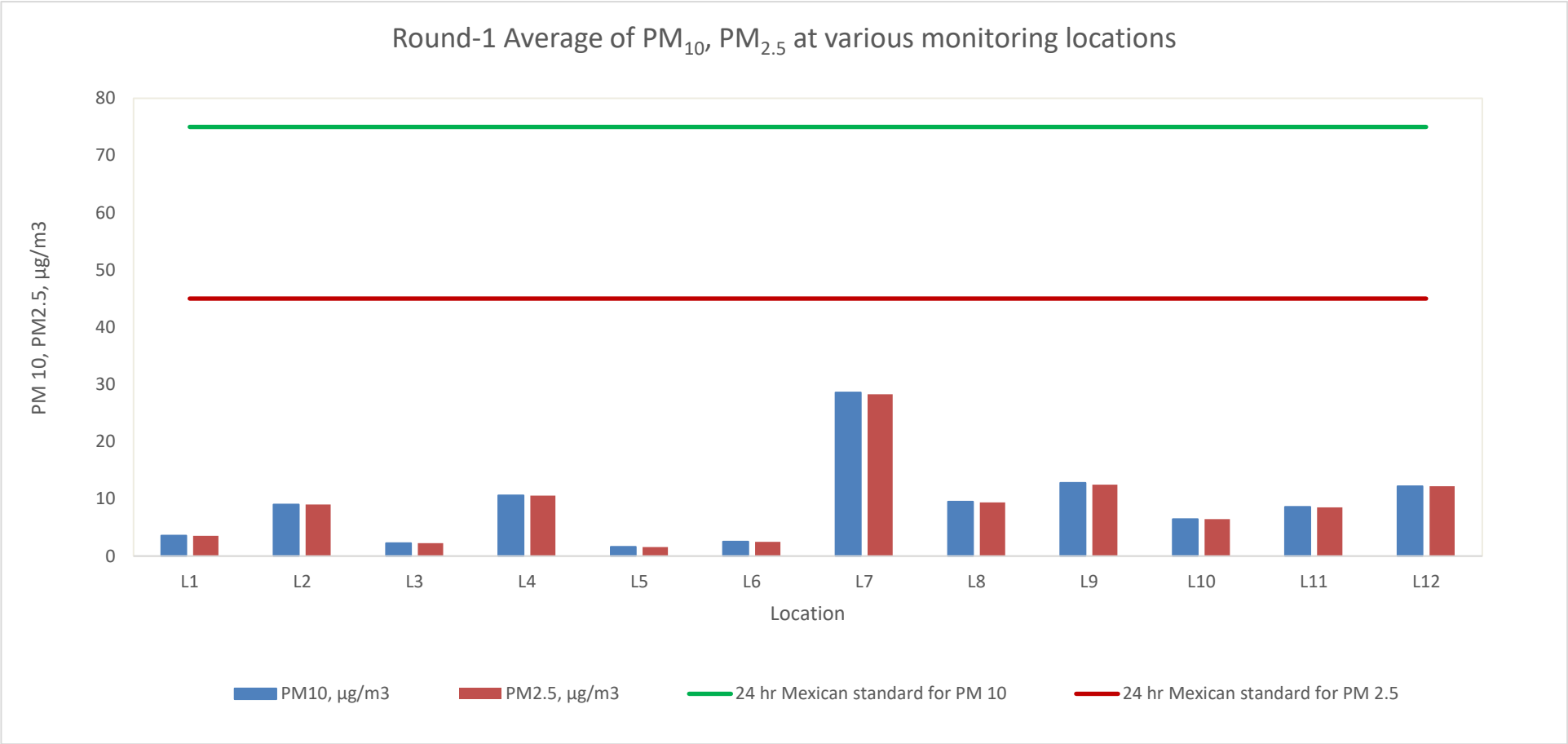


Figure 5.3 Round one PM_{10} and $PM_{2.5}$ monitoring at various monitoring locations, 1st and 2nd May 2024

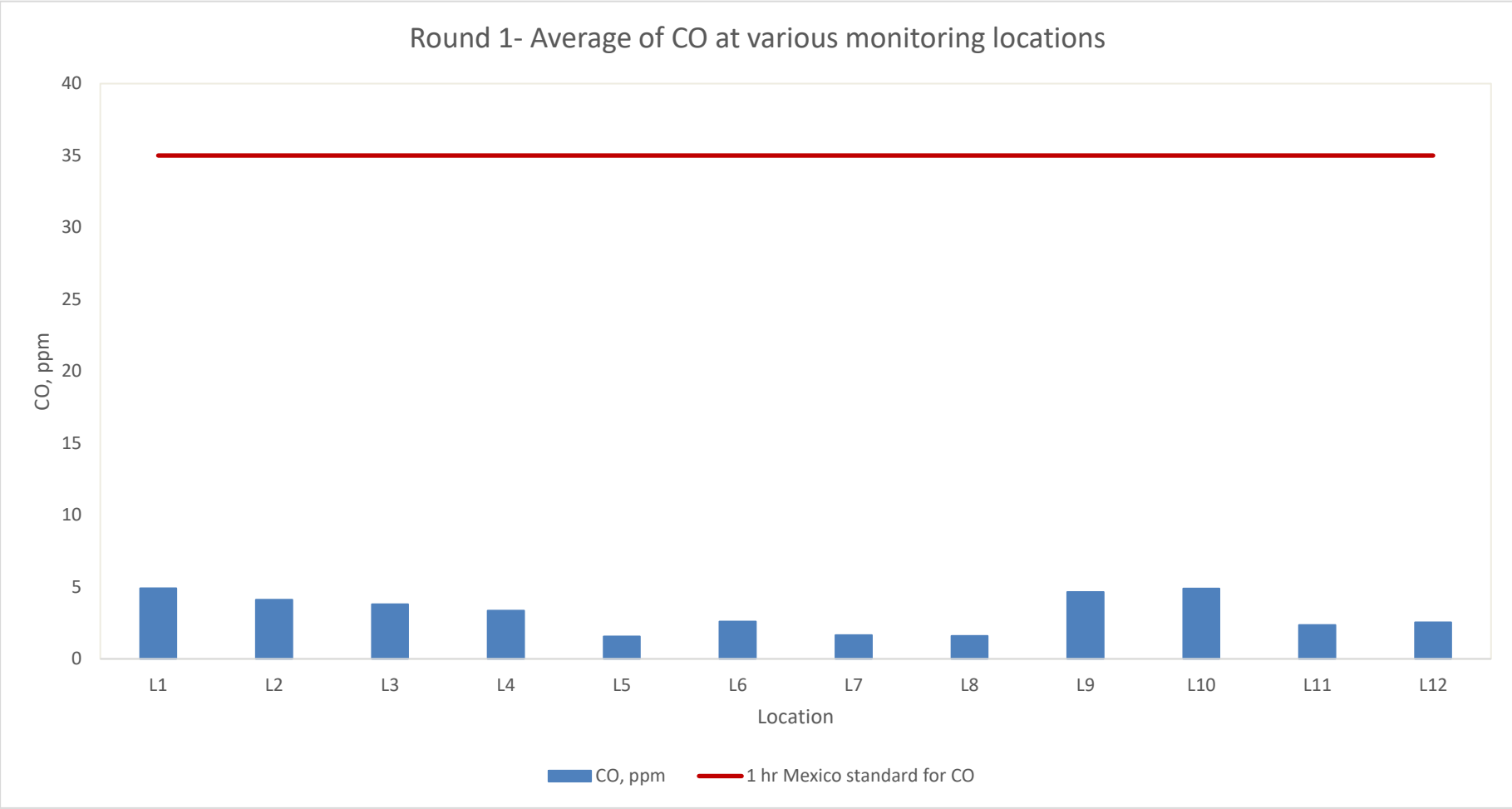


Figure 5.4 Round one CO monitoring at various monitoring locations, 1st and 2nd May 2024

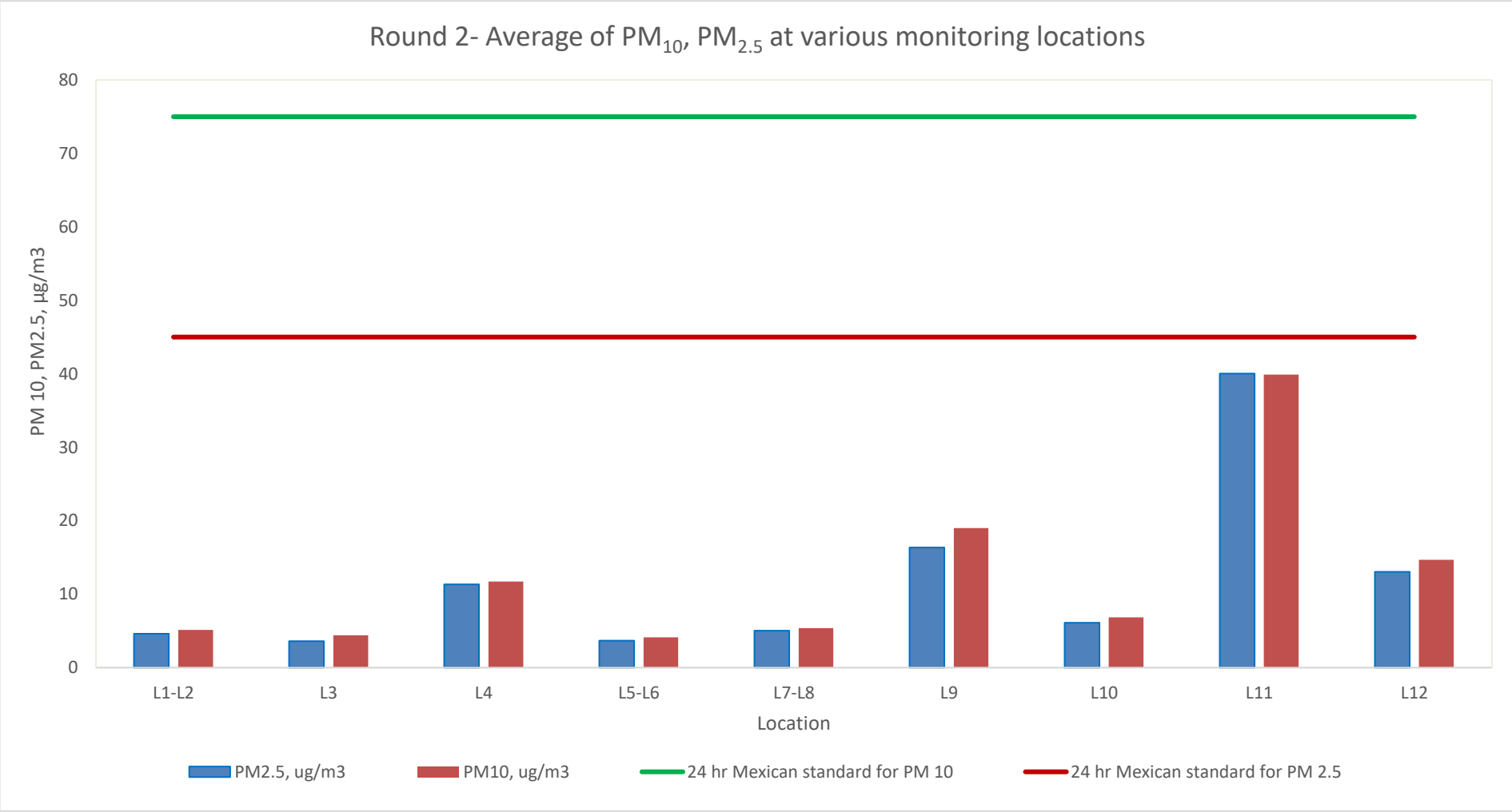


Figure 5.5 Round two PM_{10}, $PM_{2.5}$ monitoring at various monitoring locations, 29th & 30th May 2024

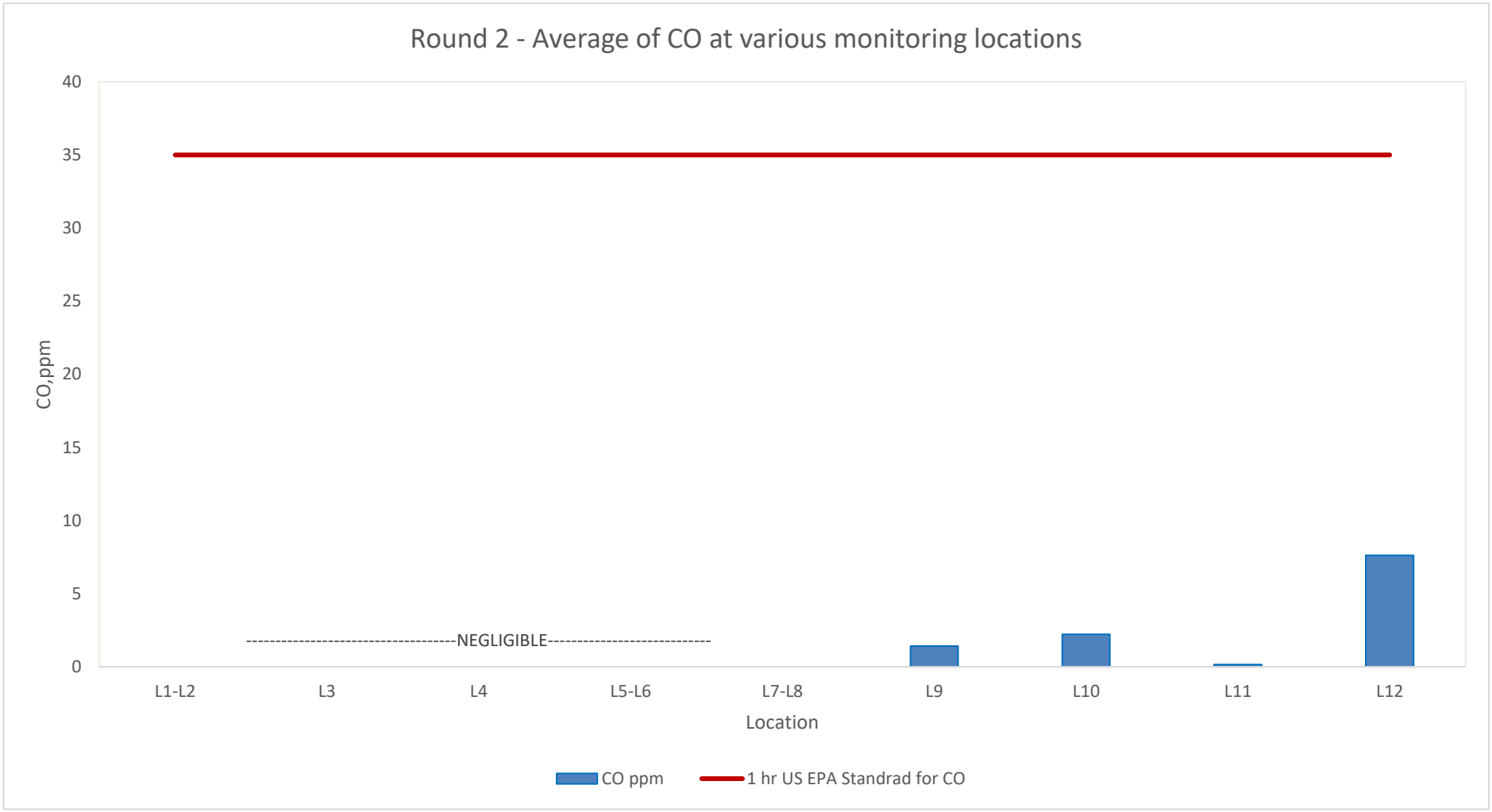


Figure 5.6 Round two CO monitoring at various monitoring locations, 29th & 30th May 2024

5.2.1.11 Nitrogen dioxide (NO_2) monitoring

Passam passive sampler (NOx and NO_2) diffusion tube monitoring is an effective technique for measuring NO_2 concentrations in the ambient air.

There are 12 diffusion tubes placed at various strategic locations at the Mexinol plant and dedicated pipeline to an existing jetty in the Port of Topolobampo during the monitoring period of 1st May 2024 to 30th May 2024.

The diffusion tube monitoring results in Table 5.5 suggest that no exceedance of NO_2 at any of the monitoring locations and it is well below the Assessment Criteria of 40 µg/m^3.

The maximum and minimum NO_2 recorded were 11µg/m^3 and 3.5µg/m^3 during the monitoring period 1st May 2024 to 30th May 2024.

Table 5.5 NO_2 monitoring at the Mexinol Plant, 1st May to 30th May 2024

Location	Nitrogen dioxide (NO_2), µg/m^3
MP1 Farm	3.5
MP2 Aeroporto	4.9
MP3 Road near airport	6.1
MP4 Railway area	5.0
MP5 Road to Topolobampo	6.1
MP6 Mexinol land south	3.7
MP7 Houses near Topolobampo	6.8
MP8 Near quarry	4.7
MP9 Topolobampo School	5.5
MP11 Hotel Marina	8.8
MP10 Topolobampo	11.0
MP12 Topolobampo post	5.9
Blank (1)	-
Blank (2)	-
Annual mean µg/m^3 WHO 2021 Interim Target 1/Air Quality Guideline Value	**40 µg/m^3/10 µg/m^3**

5.2.1.12 Sulphur dioxide (SO_2) monitoring

SO_2 diffusion tube monitoring is an effective technique for measuring sulphur dioxide (SO_2) concentrations in the ambient air.

There are 12 diffusion tubes placed at various strategic locations at the Mexinol plant and dedicated pipeline to an existing jetty in the Port of Topolobampo during the monitoring period of 1st May 2024 to 30th May 2024.

The diffusion tube monitoring results in Table 5.6 suggest that no exceedance of SO_2 at any of the monitoring locations and it is well below the SO_2 Mexico AQS 24-hour mean of 215.93 µg/m^3 and WHO AQG of 40 µg/m^3.

The maximum and minimum SO_2 recorded were 4.33 µg/m^3 and 0.14 µg/m^3 during the monitoring period 1st May 2024 to 30th May 2024.

Table 5.6 SO_2 monitoring at the Mexinol Plant, 1st May to 30th May 2024

Location	Sulphur dioxide (SO_2), µg/m^3
MP1 Farm	2.01
MP2 Aeroporto	3.17
MP3 Road near airport	2.08
MP4 Railway area	<1.64
MP5 Road to Topolobampo	4.33
MP6 Mexinol land south	1.66
MP7 Houses near Topolobampo	1.71
MP8 Near quarry	<1.58
MP9 Topolobampo School	2.15
MP11 Hotel Marina	1.94
MP10 Topolobampo	<1.58
MP12 Topolobampo post	<1.64
Blank (1)	0.14
Blank (2)	0.51
24-hour mean Mexico AQS/WHO AQG	**215.93 µg/m^3/ 40 µg/m^3**

5.2.1.13 Hydrogen sulphide (H_2S) monitoring

There are 12 diffusion tubes placed at various locations at the Mexinol plant and dedicated pipeline to an existing jetty in the Port of Topolobampo during the monitoring period of 1st May 2024 to 30th May 2024.

The diffusion tube monitoring results in Table 5.7 suggest that no exceedance of H_2S at any of the monitoring locations and it is well below the H_2S WHO/2000 AQGs 150 µg/m^3

The maximum and minimum H_2S recorded were 0.15 µg/m^3 and 0.10 µg/m^3 during the monitoring period 1st May 2024 to 30th May 2024.

Table 5.7 H_2S monitoring at the Mexinol Plant 1st May to 30th May 2024

Location	H_2S, µg/m^3
MP1 Farm	0.11
MP2 Airport	0.15

Location	H_2S, µg/m^3
MP3 Road from airport	<0.10
MP4 North Mexinol proposal	0.12
MP5 Road to Topolobampo	<0.10
MP6 South of Mexinol land	<0.10
MP7 Highway	<0.10
MP8 Near quarry	<0.10
MP9 School Marina Topolobampo East	<0.10
MP11 Topolobampo	<0.11
MP10 Hotel Marina	<0.10
MP12 Post	<0.11
Blank (1)	0.08
Blank (2)	0.09
H_2S WHO/2000 AQGs (24-hour mean)	**150 µg/m^3**

5.2.1.14 Ozone (O_3) monitoring

There are 12 diffusion tubes placed at various strategic locations at the Mexinol plant and dedicated pipeline to an existing jetty in the Port of Topolobampo during the monitoring period of 1st May 2024 to 30th May 2024.

The diffusion tube monitoring results in Table 5.8 suggest that no exceedance of O_3 at any of the monitoring locations and it is below the O_3 Mexico AQS 8 hour mean criterion of 137.41 µg/m^3 and the WHO AQG of 100 µg/m^3.

The maximum and minimum O_3 recorded were 103.6 µg/m^3 and 52.7 µg/m^3 during the monitoring period 1st May 2024 to 30th May 2024.

Table 5.8 O_3 monitoring at the Mexinol Plant 1st May to 30th May 2024

Location	Ozone, O_3, µg/m^3
MP1 Farm 1/5	82.1
MP2 Opposite airport 1/5	69.5
MP3 Airport Rd 1/5	79.9
MP4 Mexinol Farmland North Rail 2/5	103.6
MP5 Topolobampo Rd 1/5	75.9
MP6 South Mexinol land rail area 1/5	89.2
MP7 Village off highway 2/5	77.4
MP8 Near quarry 2/5	83.8

Location	Ozone, O_3 , µg/m^3
MP9 School Topolobampo 2/5	93.1
MP11 Marina Hotel	85.3
MP10 Topolobampo Road by quarry	69.1
MP12 Portside harbour	52.7
Blank	1.82
Ozone Mexico AQS/WHO AQG (8-hour)	**137µg/m^3/100µg/m^3**

5.2.1.15 Volatile Organic Compound

The concentrations of the benzene, toluene, ethyl benzene, and xylenes ('BTEX') measured during the monitoring period are summarised below in Table 5.9Table 5.9Table 5.9.

Several non-BTEX compounds were detected in the 'top 5 most abundant non target' screen. Several of the compounds were present in many of the samples, for example hexanedioic acid. This compound is components of plastics and re likely to be contaminants from the air-tight plastic containers used to transport the tubes and prevent hydrocarbon contamination in transit. Benzaldehyde, acetic acid and nonanal were detected in several samples. These compounds are likely to be artefacts generated by the reaction between the TENAX sorbent and ozone and are not likely to be bona-fide pollutants of ambient air at the sites.

Concentrations of BTEX sampled were low and below the assessment criteria.

Table 5.9 BTEX VOC concentrations, µg/m^3

Location	Compound	Concentration, µg/m^3	Assessment Criteria, µg/m^3
MP1 Farm 1/5	Benzene	0.73	5 (U.K. AQS)
	Toluene	0.37	260 (WHO 2000/U.K. EAL[8])
	Ethylbenzene	<0.054	4410 (U.K .EAL[4])
	m/p-Xylene	<0.12	4410 (U.K .EAL[4])
	o-Xylene	<0.059	4410 (U.K .EAL[4])
MP2 Opposite airport 1/5	Benzene	0.21	5
	Toluene	0.96	260

[8] UK Environmental Assessment Level (EAL). Used by the UK Environment Agency to regulate bespoke emissions not captured by national standards.

Location	Compound	Concentration, µg/m^3	Assessment Criteria, µg/m^3
	Ethylbenzene	0.11	4410
	m/p-Xylene	0.43	4410
	o-Xylene	0.18	4410
MP3 Airport Rd 1/5	Benzene	0.2	5
	Toluene	0.85	260
	Ethylbenzene	0.081	4410
	m/p-Xylene	0.3	4410
	o-Xylene	0.13	4410
MP4 Mexinol Farmland North Rail 2/5	Benzene	0.19	5
	Toluene	0.99	260
	Ethylbenzene	0.073	4410
	m/p-Xylene	0.29	4410
	o-Xylene	0.12	4410
MP5 Topolobampo Rd 1/5	Benzene	0.15	5
	Toluene	0.90	260
	Ethylbenzene	0.059	4410
	m/p-Xylene	0.28	4410
	o-Xylene	0.13	4410
MP6 South Mexinol land rail area 1/5	Benzene	0.091	5
	Toluene	1.0	260
	Ethylbenzene	<0.054	4410
	m/p-Xylene	0.22	4410
	o-Xylene	0.11	4410
MP7 Village off highway 2/5	Benzene	0.36	5
	Toluene	1.1	260
	Ethylbenzene	0.28	4410
	m/p-Xylene	0.71	4410
	o-Xylene	0.29	4410
MP8 Near quarry 2/5	Benzene	0.22	5
	Toluene	3.7	260

Location	Compound	Concentration, µg/m^3	Assessment Criteria, µg/m^3
	Ethylbenzene	0.70	4410
	m/p-Xylene	1.0	4410
	o-Xylene	0.39	4410
MP9 School Topolobampo 2/5	Benzene	0.22	5
	Toluene	0.73	260
	Ethylbenzene	0.20	4410
	m/p-Xylene	0.71	4410
	o-Xylene	0.28	4410
MP11 Marina Hotel	Benzene	0.28	5
	Toluene	0.73	260
	Ethylbenzene	0.20	4410
	m/p-Xylene	0.71	4410
	o-Xylene	0.28	4410
MP10 Topolobampo Road by quarry	Benzene	0.31	5
	Toluene	1.3	260
	Ethylbenzene	0.44	4410
	m/p-Xylene	2.0	4410
	o-Xylene	0.73	4410
MP12 Portside harbour	Benzene	0.47	5
	Toluene	0.41	260
	Ethylbenzene	0.10	4410
	m/p-Xylene	0.43	4410
	o-Xylene	0.18	4410

5.2.2 Noise and vibration

5.2.2.1 Receptor Identification

The area immediately surrounding the site is predominantly rural, in an unpopulated, agricultural area of Topolobampo. Several isolated or small groupings of dwellings is located at varying distances from the primary onsite and offsite components of the Project.

A summary of the nearest identified noise sensitive receptors compared to the Project is provided in Table 5.10 below.

Table 5.10: Noise sensitive receptors

Noise Sensitive Receptor (NSR)	Receptor Description	Receptor Sensitivity	Position (UTM)	
			E	N
NSR1	Isolated dwelling – 3.8 km east of Ampliacion Nuevo Bachomobampo Nuero Dos	High (4)	691004	2847748
NSR2	Isolated dwelling – 900 m north-east of Ejido Tortugas Numero 2	High (4)	691875	2844118
NSR3	Semi residential area off Carrera Aeropuerto – 4.8 km east of Ejido Plan de Guadalupe	High (4)	695731	2842413
NSR4	Isolated dwelling – 600 m south-west of Campo Guadalupe Estrada	High (4)	700351	2840997
NSR5	Semi-residential area - Paredones	High (4)	701628	2840399
NSR6	Semi-residential area - Ejido Rosendo G. Castro	High (4)	695599	2836958
NSR7	La Curva – north-west region of Topolobampo	High (4)	695052	2833376
NSR8	Pesquera - south-west region of Topolobampo	High (4)	695174	2832431
NSR9	Octava Zona Naval – south-west region of Topolobampo	Medium (3)	694688	2831455

For purpose of this document, existing receptors are referred to as “off-site” receptors; with potential workforce accommodation discounted at this stage. While these have been used to find assessment points, the location found may represent multiple properties / buildings in the area.

5.2.2.2 Monitoring methodology

An attended baseline noise survey was carried out by B + F between 10 May and 14 May 2024 to characterise the existing acoustic environment at noise sensitive receptors surrounding the development site. Where not possible to monitor directly next to noise sensitive receptors, alternative monitoring locations were selected which are considered to suitably represent the noise levels and sources incident upon each receptor location.

The baseline monitoring was undertaken via individual attended measurements, conducted at various times of the daytime (07:00-22:00) and night (22:00-07:00) on a rotational basis prescribed within the World Bank Group (WBG)/International Finance

Corporation (IFC) 2007 *'General EHS Guidelines: Environmental Noise Management'* document. This approach is recommended as it allows for the variability of the existing ambient noise environment which would usually occur at various times of the day or night. Monitoring durations consisted of 3 x 1-hour measurements (with 15-minute logging periods) during the daytime, and 1 x 1-hour measurement (with 15-minute logging periods) conducted at night.

All measurements were undertaken in free field conditions, with the microphone position greater than 3.5 metres from any significant reflective surfaces other than the ground.

The sound level meters used for the survey conformed to the Class 2 requirements of IEC 61672-1:2013 *'Electroacoustics - Sound level meters - Part 1: Specifications'*. The calibrator used conformed to the requirements of IEC 60942:2018 *'Electroacoustics - Sound calibrators*. The calibration of the sound level meters was field checked prior to beginning measurements and prior to removing the equipment from site upon completion; no significant calibration drift was seen i.e., within a +/- 0.5 dB tolerance.

The instruments were set up to log in 15-minute intervals, with A-weighting and 'fast' response time.

Weather conditions were noted throughout each period throughout the monitoring. Temperatures ranged between 20º and 34º Celsius, with wind speeds ranging between 1 ms^{-1} and 5 ms^{-1}. Conditions were considered conducive for monitoring purposes.

5.2.2.3 Monitoring positions

Most of the monitoring locations were situated in rural environments, next to isolated dwellings, with three of the eight locations positioned within the nearest town of Topolobampo. Those positions outside of Topolobampo, are primarily next to agricultural farmland.

Each location was sited within the municipality of Ahome, state of Sinaloa as presented in Table 54 and Figure 5.7 below.

Table 5.4: Noise monitoring positions

Monitoring Position	Position	Position (UTM)	
		E	N
MP1	Isolated dwelling – 1.5 km north-east of Ejido Plan de Guadalupe	691850	2844173
MP2	Semi residential area off Carrera Aeropuerto – 4.8 km east of Ejido Plan de Guadalupe	695636	2842403
MP3	Isolated dwelling – 600 m south-west of Camp Guadalupe	700516	2840518
MP4	Semi-residential area off Rufino Munoz – 600 m south-west of Paredones	701200	2839805
MP5	Semi-residential area off the Los Mochis-Topolobampo highway – 300 m north of Ejido Rosendo G. Castro	695615	2837117
MP6	Residential area off the Los Mochis-Topolobampo highway – 900 m north-west of Topolobampo centre	695159	2833540
MP7	Residential area off Pesquera da Topolobampo – 750 m south-west of Topolobampo centre	695230	2832340
MP8	Mixed use area off the Los Mochis-Topolobampo highway within port region – 1.1 km south-west of Topolobampo centre	694806	2832492

Figure 5.7: Noise sensitive receptors and noise monitoring positions

5.2.2.4 *Monitoring results*

A summary of the attended noise measurements taken are presented in Table 5.11 below.

Table 5.11: Noise monitoring results

Location	Period	Date	Measured Noise Level, dB [1]			
			$L_{Aeq,T}$	$L_{A90,T}$	$L_{A10,T}$	$L_{Amax,T}$
MP1	Day	10/05/24 & 11/05/24	45	36	46	72
	Night	11/05/24	38	37	39	54
MP2	Day	10/05/24 & 11/05/24	48	39	48	78
	Night	11/05/24	48	43	51	69
MP3	Day	10/05/24 & 11/05/24	40	28	34	66
	Night	10/05/24	37	31	39	61
MP4	Day	11/05/24 & 12/05/24	38	31	37	64
	Night	10/05/24	40	36	43	56
MP5	Day	12/05/24 & 13/05/24	57	47	59	79
	Night	12/05/24	58	43	62	77
MP6	Day	12/05/24 & 13/05/24	59	48	61	84
	Night	12/05/24	59	48	61	83
MP7	Day	12/05/24 & 13/05/24	53	44	54	80
	Night	13/05/24	49	39	52	78
MP8	Day	14/05/24	57	45	57	88
	Night	14/05/24	53	43	55	76

[1] $L_{Aeq,T}$ value is the logarithmic average of $L_{Aeq,15min}$ samples, $L_{A90,T}$ is the arithmetic average of $L_{A90,15min}$ samples

The main noise-generating activities in the vicinity of each measurement include transportation sources such as motorcycles, cars, trucks and the passing of trains, activities associated with ship movements (including engine and sounding of horns), farming and livestock keeping, domestic activities such as gardening, and natural sources such as bird song and animals.

Noise levels were higher at monitoring positions MP5 to MP8, due to the proximity to the noise sources, particularly the Los Mochis-Topolobampo highway and operations associated with the Port of Topolobampo.

5.2.3 Landscape and visual amenity

5.2.3.1 Introduction

An overview of the baseline study results is provided in this chapter with the full baseline description of the individual landscape and visual receptors being provided alongside the assessment in Chapter 8 for ease of reference.

This section finds those landscape and visual receptors which merit detailed consideration in the assessment of effects, and those which are not taken forward for further assessment as effects "*have been judged unlikely to occur or so insignificant that it is not essential to consider them further*".[9]

5.2.3.2 Study Area

It is accepted practice within landscape and visual assessment work that the extent of the study area for a development proposal is broadly defined by the visual envelope of the Project.

In this case a study area of 8 km has been used (as shown by Figure 5.8) for the on-site Project components, found within the main development site ('plant site'). This acknowledges the potential visibility of the vertical elements such as Flare, Boiler Stack, HP Methanol Column, with heights up to 79.4 m above main sea level, and potential impacts on the wider landscape character of the area. A smaller study area of 1 km has been used for the off-site components, given these will be generally buried or be a modification of existing facilities.

This study area is adequate to find all non-negligible effects on landscape and views.

5.2.3.3 Distances

Where distances are given in the assessment, these are approximate distances between the nearest part of the site and the nearest part of the receptor in question, unless explicitly stated otherwise.

5.2.3.4 Uncertainties

The Landscape and Visual baseline have been informed by desk studies and site photography provided by the client team. No site surveys have been undertaken by the Landscape Architect.

5.2.3.5 Visual Envelope

Given the scale of the on-site components and the prevailing open and flat nature of the landscape, views of the Project could arise throughout the study area.

Localised higher ground at once north of Topolobampo would have a substantial effect on visibility therefore effects on landscape or visual receptors in this settlement would be negligible and are not assessed in detail.

[9] Landscape Institute and Institute of Environmental Management and Assessment, Guidelines for Landscape and Visual Impact Assessment Third Addition (GLVIA3), paragraph 3.19

Likewise, any views from over 5 km of the on-site components and 1 km of the off-site components would not be considered as particularly prominent and are not considered in detail.

5.2.3.6 Landscape character

There are no existing landscape character assessments of the study area. Therefore, the study area has been divided into Landscape Character areas (LCAs) using available data and site photography.

These LCAs "*identify and describe the individual elements and aesthetic and perceptual aspects of the landscape, particularly emphasising those that are key characteristics contributing to the distinctive character of the landscape (and) indicate the condition of the landscape, including the condition of elements or features such as buildings hedgerows or woodland*" (GLVIA3, paragraph 5.33).

The following LCAs are illustrated in Figure 5.8.

Figure 5.8: Landscape Character Areas and Viewpoints

Source: RSK

5.2.3.6.1 Arid Scrub LCA

This LCA extends from the plant site west towards Los Mochis airport and along the Ohuira Bay coastline both to the north and south. It is characterised by a weak landscape pattern, eroded by influences of historical agriculture and significant infrastructure. It is a large scale, open, textured, vacant and fragmented landscape. Key characteristics:

- Flat, unenclosed arid plain, dominated by sporadic Xerophytic vegetation interspersed with bare ground and drainage ditches
- Areas of annual and semi-permanent irrigated agriculture (including the plant site, pipeline route and access road)
- Infrastructure including the Los Mochis-Topolobampo highway, billboards, road lighting, railway, and frequent telegraph poles, electricity pylons and associated overhead lines cross the landscape, focussed in the area at once south of the plant site
- Prominent industry including the major PEMEX Export facility and adjacent Proman-GPO Petrochemical facility in the south, and Los Mochis airport to the northwest
- Isolated settlements at Ejido Rosendo G Castro between the Los Mochis-Topolobampo highway and aquaculture farms to the southwest of the plant site, and Paredones on the lagoon coast to the northeast
- Agricultural coastal lagoon edge, with a discrete area of mangrove, offering distant views to rugged, elevated coastline peaks enclosing the lagoon and landscape to the south and east

5.2.3.6.2 Arable Plain LCA

This LCA lies between the Arid Scrub LCA and Los Mochis, occupying most of the northern part of the study area. This is a flat, open, and large-scale arable landscape, defined by uniform structure of rectilinear fields. Key characteristics:

- Irrigated annual and semi-permanent agriculture
- Scrub and isolated trees associated with field margins and highway / property boundaries
- Frequent infrastructure dominates the corridor between Los Mochis and Topolobampo, including the Los Mochis-Topolobampo highway, billboards, road lighting, railway, and frequent telegraph poles, electricity pylons and associated overhead lines crossing the landscape
- Minor settlements and frequent isolated farms, businesses, and residential properties, focussed along main transport routes
- Distant views to the south of the rugged, elevated coastline peaks

5.2.3.6.3 Ohuira Bay Lagoon LCA

This large, calm lagoon extends across the east of the study area. It is an area of contrasting textures, with the smooth flat lagoon enclosed to the south and southwest by a dramatic peninsula of rocky peaks clothed with cacti scrub. This peaceful, attractive lagoon is a wildlife haven, with settlement confined to the indigenous village at Lázaro Cárdenas. Key characteristics:

- Coastal lagoon and islands
- Frequent small boats associated with fishing and wildlife tourism
- Distant views to the mainland and plant site, which includes a narrow strip on the horizon. Pylons and overhead wires are noticeable vertical features on the horizon from closer views from lagoon islands including Isla de Patos
- A rugged, elevated coastline encloses the lagoon to the south (opposite Topolobampo), dominated by cacti scrub, forming a dramatic and complex series of rounded peaks and ridges
- Part of an Area of Protection of Flora and Fauna "Islas del Golfo de California", a World Heritage natural site and UNESCO Biosphere Reserve. Ramsar Site no. 2025.

5.2.3.6.4 Aquaculture LCA

This highly modified landscape is associated with production of shrimp, oysters, clams, etc. Located to the southwest of the plant site this area is sandwiched between the Arid Scrub LCA and Mangrove Swamp LCA. Key characteristics:

- Uniform, open, expanse of aquaculture pools formed within a network of engineered rectilinear earthwork bunds, access tracks and irrigation ditches
- Stark contrast between the flat farming land and craggy peaks of the islands in Topolobampo Bay to the immediate south
- Activity associated with intensive aquaculture – workers, vehicle movements etc.

5.2.3.6.5 Mangrove Swamp LCA

This area is in the tidal zones along the margins of the Santa Maria Bay and Topolobampo Bay. This enclosed, impenetrable maze of woody vegetation and wetlands provides a complex ecosystem and habitat for various species that contrasts strongly with the simple and open character areas that lie to north within the study area.

This area lies beyond the study area boundary and as such is not considered any further within this assessment.

5.2.3.7 Visual receptors

Visual receptors are "*the different groups of people who may experience views of the development*" (GLVIA, 3rd edition, para 6.3). To find those groups who may be significantly affected a baseline desk study has been used.

The diverse types of groups assessed within this report encompass local residents; people using key routes such as roads; people within accessible or recreational landscapes; or people visiting key viewpoints. In dealing with areas of settlement and local roads, receptors are grouped into areas where effects might be expected to be broadly similar, or areas which share particular factors in common.

Representative viewpoints have been selected to aid the assessment of effects on visual receptors.

5.2.3.7.1 Baseline visual environment

As shown on Figure 5.8, the plant site is found on a flat, open farmland plain. It is dominated by a broad horizon, reinforced by extended linear infrastructure in the forms

of the Los Mochis-Topolobampo highway, railway, and overhead lines, and punctuated by the vertical forms of telegraph poles and electricity pylons. The landscape is a patchwork of intersecting irrigated fields and arid bare ground, with field boundaries formed either by scrubby vegetation or irrigation ditches. Built form is generally absent, other than an isolated poultry farm sheds to the east and distant views to the industrial plants to the south. Due to the flatness of the landscape, the lagoon to the west is not apparent, but the rugged, elevated coastline peaks form a distinctive horizon to the south.

5.2.3.7.2 Visual receptor groups

The following visual receptor groups are found within the study area and are likely to have visibility of the Project, and are considered further in Section 8:

- Poultry Farm – 1 km[10], W
- Campo Guadalupe Estrada, 2.4 km, NE
- Paredones – 3 km, NE
- Ejido Rosendo G. Castro, Cemetery and Ejido Topolobampo – 3.3 km, SW
- Parque Industrial Topolobampo – 2.1 km, NW
- Isla de Patos – 4.1 km, SE
- PROMAN GPO – 4.2 km, S.

There are also several receptor groups which are excluded from the detailed assessment, on the basis that visual effects are likely to be negligible, for the reasons showed below.

The following receptor groups are all found 5-8 km from the plant site, with visibility limited by a combination of intervening vegetation and distance:

- Ejido Plan de Guadalupe and Ejido Tortugas Numero 2 – minor settlements near the airport, NW
- Los Mochis International Airport, NW
- Properties alongside the Los Mochis-Topolobampo highway, north of Parque Industrial Topolobampo
- Ejido Ohuira, minor settlement to the NE
- Lazaro Cardenas, indigenous settlement on the opposite side of Ohuira Bay, E
- Aquaculture farms, SW.

Topolobampo

It is noted that Topolobampo, the main settlement in the study area, would not have a view of the plant site due to the intervening distinct hill formation lying between the settlement and industrial sites immediately to the north. This landform effectively screens most of the town, marina, and port areas.

It is recognised that a residential area within the town extends up the south-facing slope along José Maria Morelos y Pavón, to a ridge lying between the two high points of this landform. Whilst it is possible that there may be views of the plant site from properties along the very top of the ridge, these will be at a distance of over 6 km, filtered by

[10] Where distances are given in the assessment, these are approximate distances between the nearest part of the site and the nearest part of the receptor in question, unless explicitly stated otherwise.

vegetation growing along the ridgeline, and seen in the context of the PEMEX and PROMAN industrial sites in the fore-mid ground.

Furthermore, any views of the methanol pipeline would be limited to the construction phase only (as the pipeline will be buried), limited to commercial receptors situated alongside the existing rail and the Los Mochis-Topolobampo highway routes and viewed in the context of an existing busy transportation corridor. Even during the construction phase, potential receptors (people) would be focussed on their work and are therefore less susceptible to changes in view. Views from residential receptors within the settlement would be limited by the intervening urban form.

Therefore, effects overall would be negligible, and this receptor group is not considered further in this assessment.

5.2.3.7.3 Key routes

As shown on Figure 5.8, the following longer distance routes lie within the study area:

Roads and rail

- Railway – 0 km, E. A railway bisects the study area in a broadly NE-SW direction, connecting the Port of Topolobampo and industrial sites with Los Mochis and beyond. The plant site will be constructed next to the railway, over a length of approximately 1.3 km. This is understood to be primarily a freight route, and whilst views of the plant site will be clear for train staff, their attention would be focussed on their work and are therefore less susceptible to changes in view. Effects would be negligible, and this receptor is therefore not considered further in this assessment.
- The Los Mochis-Topolobampo highway – 1.4 km, W. The Los Mochis-Topolobampo highway runs broadly parallel with the rail line, bisecting the study area in an NNE-SSW direction. This route is considered further in Chapter 8.
- Carrera Campo Guadalupe Estrada – 1.4 km, N. This minor road connects from the Los Mochis-Topolobampo highway at Parque Industrial Topolobampo, travelling in a broadly E-W direction towards Campo Guadalupe Estrada and Paredones. It is understood to be primarily used for local journeys and is therefore considered as part of the receptor groups.
- Carrera Aeropuerto – 2.8 km, NW. This road connects from the Los Mochis-Topolobampo highway at Parque Industrial Topolobampo, travelling in a broadly E-W direction towards Los Mochis International Airport and the settlements of Ejido Plan de Guadalupe and Ejido Tortugas Numero 2 beyond. Visibility of the plant site is likely to be limited to distant views of the upper sections of the tallest components with the plant site (e.g. flare, HP Methanol Column), seen above the tops of roadside vegetation, buildings, and billboards. Effects would be negligible, and this receptor is therefore not considered further in this assessment.

Recreational routes

Although informal walking tracks are available within the hilly coastal areas in the south of the study area, no formal recreational routes have been found.

Specific viewpoints

It is likely that there will be informal viewpoints associated with the recreational routes referred to above. However, these would be focussed on the coastal landscape and wider Topolobampo Bay to the south, in the opposite direction to the Project. Effects would be negligible and therefore specific viewpoints are not considered further in this assessment.

5.2.4 Geology, geomorphology and geohazards

Sinaloa is found within the "Pacific Coastal Plain" physiographic province, one of the smallest provinces in Mexico. This region is characterised by its flat relief, consisting of a narrow, elongated coastal plain covered mostly by alluvium deposited by rivers descending from the Sierra Madre Occidental (INEGI, 2008). Typical landforms in this area include dunes and alluvial fans, typical of depositional dynamics.

It is important to note that the study area is found within the Laramide deformation, which moderately affected the oldest rocks of the Lower Volcanic Complex (~101 to ~89 Ma) in Sinaloa (Ferrari et al., 2005). In addition to sedimentary material, such as alluvium and polymict conglomerate sandstone, basaltic-basalt breccias, rhyolitic-ignimbrite tuff and andesite-toba andesite are also found (SGM, 2000). The local geology as well as the geological column showing their chronological order, is depicted in Figure 5.9 below, which illustrates the geology in the Project area.

According to the results of the initial geotechnical study (IGA, 2021), there are no geological or geotechnical risks such as: failures or fractures, however, there is the presence of compressible materials that could generate differential settlements in the structures, which require the design of a deep foundation or subsoil improvement to avoid project risk.

Figure 5.9: Geology map of the Project area

Source: SGM (2000)

5.2.4.1 Seismicity

The high seismicity in Mexico is related to the interaction between the North American, Cocos, Pacific, Rivera, and Caribbean plates, as well as local faults that cross several states, the latter being less dangerous. The North American plate separates from the Pacific plate, rubs against the Caribbean plate, and collides with the Rivera and Cocos plates, which explains the incidence of earthquakes.

As described in the Project's first geotechnical study (IGA, 2021), according to CENAPRED (the national agency for the prevention of disasters), Sinaloa is within an intermediate zone of lower risk where earthquakes are registered but not as often as other regions within Mexico.

According to the National Seismological Service during the period between March 2019 and March 2024, 471 earthquakes were recorded in the state of Sinaloa. An earthquake was recorded at a distance of 7.23 km from the Project with a magnitude of 2.8 on the Richter scale on 3 March 2024. Figure 5.10 below shows the distribution of epicentres in Sinaloa.

Figure 5.10: Distribution map of earthquake epicentres in Sinaloa

Source: SSN (2024)

5.2.4.2 *Mines and quarries*

The diversity of existing deposits is located in metamorphic, intrusive igneous, volcanic, and sedimentary rocks ranging in age from the Upper Triassic to the Tertiary. It is in these lithological environments where the mineralised structures are emplaced, and where the mining districts are formed; it is in these same areas where the gold placer deposits are found.

The desk study (www.geomaticaportal.semarnat.gob.mx) results showed that there are no mining operations south of Los Mochis; two sites were found north of Los Mochis which are related to the use of aggregate material.

A quarry for aggregate material is found within the Project area of study immediately to the west of the Los Mochis-Topolobampo highway north of the town of Topolobampo (coordinates 695003.42 m E 2835434.01 m N (UTM12N)).

5.2.5 Soils

5.2.5.1 *AoI*

The soil AoI are based on the Project footprint, and construction and operation of:

- methanol production plant
- WWTP
- the JAPAMA pipelines (24” and 16”) for pre-treated water transfer and return of the rejected water and the JAPAMA pre-treated water transfer pumping station.
- the 28” methanol transfer pipeline, the 8” pipeline for vapour recovery and Fiber Optic Cables.
- the Mexinol new port site and facilities to allow the methanol loading operations
- construction camps and facilities (assuming they will be found within the AoI)
- access roads.

5.2.5.2 *Contaminated land desk study*

A desk study was conducted to identify potential sources of land contamination. Sources of data comprised:

- (www.geomaticaportal.semarnat.gob.mx); it is a website of the Ministry of Environment and Natural Resources that provides updated information from 2008 to 2022 on contaminated and remediated sites listed according to the types of contaminants, causes, and a record of remediation completed.
- a municipal government website (www.implanahome.gob.mx) based on a geographic information system related to environmental problems. It contains information on specific territorial planning programmes, socioeconomic and industrial information, natural and health risks, and a directory of economic units through interactive maps and geographic information systems.
- Centre for Statistical and Geographic Information of the State of Sinaloa website (www.estadisticas.sinaloa.gob.mx) that presents statistical and geographic data to for the development of planning programmes and public actions from official data obtained through surveys and records.

The data obtained from this search provided information on:

- contaminated and remediated soil sites
- potential sources of soil and surface water contamination
- use or sale of chemical products
- fuel retail stations
- metal recycling facilities
- mining activity and mines
- sites where ammonia is used
- cow, poultry, and pig slaughter sites.

The data showed the presence of three contaminated sites in the vicinity of the Project components but outside the AoI. Figure 5.11 shows these sites (site 7, 8 and 9). They are found at distances of approximately 2.7 km, 2.5 km and 3.0 km from the methanol plant. A description on the sites is presented in Table 5.12. The other sites/activities are not in the vicinity of the Project components.

Table 5.12 Contaminated sites

Location	Description of the contamination	Source of contamination	Location	Year when contamination was identified	Coordinates UTM zone 12	
					X	Y
7	Spills and/or leaks of hydrocarbons and petroleum products	Airports and Auxiliary Services: services related to air transportation	Los Mochis to Topolobampo Highway, km 12.5, municipality of Ahome	2015	696075.02	2842519.98
8	Spill of hydrocarbons and petroleum products	Pemex Refining: oil refining, processing, and transportation by pipeline of petroleum products and derivatives	Km 007+800 of the RoW of the 10" Ø Topolobampo-Culiacán pipeline	2015	700899.74	2840739.42
9	Spill of hydrocarbons and petroleum products	Pemex Refining: oil refining, processing, and transportation by pipeline of petroleum	Km 000+050 of the 24" Ø Topolobampo-Culiacán fuel pipeline, in the port of Topolobampo	2011	696930.98	2835024.41

Location	Description of the contamination	Source of contamination	Location	Year when contamination was identified	Coordinates UTM zone 12	
					X	Y
		products and derivatives				

5.2.5.3 Walkover survey

A walkover survey was conducted by RSK's partners B + F during the first week of May 2024. Observations were made on the following basis:

- visual or olfactory (odours) evidence of existing soil or ground contamination such as hydrocarbon, chemical or fuel spills or leaks (or stains on ground).
- existing sources of potential contamination such as above-ground or below-ground fuel storage tanks, fuel refilling areas, oil drums, storage areas for fuel or chemicals, vehicle parking and maintenance areas, solid waste, liquid effluent, etc.

In addition, drone imagery was recorded for all Project components. The results show that there are no contaminated sites within the AoI.

Following the walkover survey and drone imagery data collected in May 2024, the results show that there are no potential sources of contamination or evidence of existing soil contamination in the AoI of the Project components. In addition, the contaminated land desk study results do not show any registered contaminated land sites/events in the AoI.

5.2.5.4 Field survey

To further characterise the soil quality in the AoI a soil sampling program was undertaken in June 2024 within the methanol production plant site boundaries and at other selected locations. The samples were collected using a hand auger at depths of 0.20 m to 0.50 m bgl. The locations are listed in Table 5.13 and presented in Figure 5.12.

All samples were transported to an accredited laboratory for testing for inorganics, metals, and total petroleum hydrocarbons. The results are presented in Table 5.14. The results were screened against local Mexican soil standards (NOM-138-SEMARNAT/SSA1-2012 and NOM-147-SEMARNAT/SSA1-2004). No exceedances were seen for any parameters.

Table 5.13 Soil sampling locations

Sample location identifier	X	Y	Location
PM-BL-S-01	698387	2839172	Conservation Area
PM-BL-S-02	698468	2839495	Conservation Area
PM-BL-S-03	698286	2839957	Methanol plant site area
PM-BL-S-04	698488	2840232	Methanol plant site area
PM-BL-S-05	698036	2839773	Methanol plant site area

PM-BL-S-06	698041	2839519	Methanol plant site area
PM-BL-S-07	697832	2840259	Mexinol 2 area
PM-BL-S-08	698209	2840522	Mexinol 2 area
PM-BL-S-09	695117	2833566	Topolobampo entrance

Figure 5.11: Contaminated sites

Source: www.geomaticaportal.semarnat.gob.mx

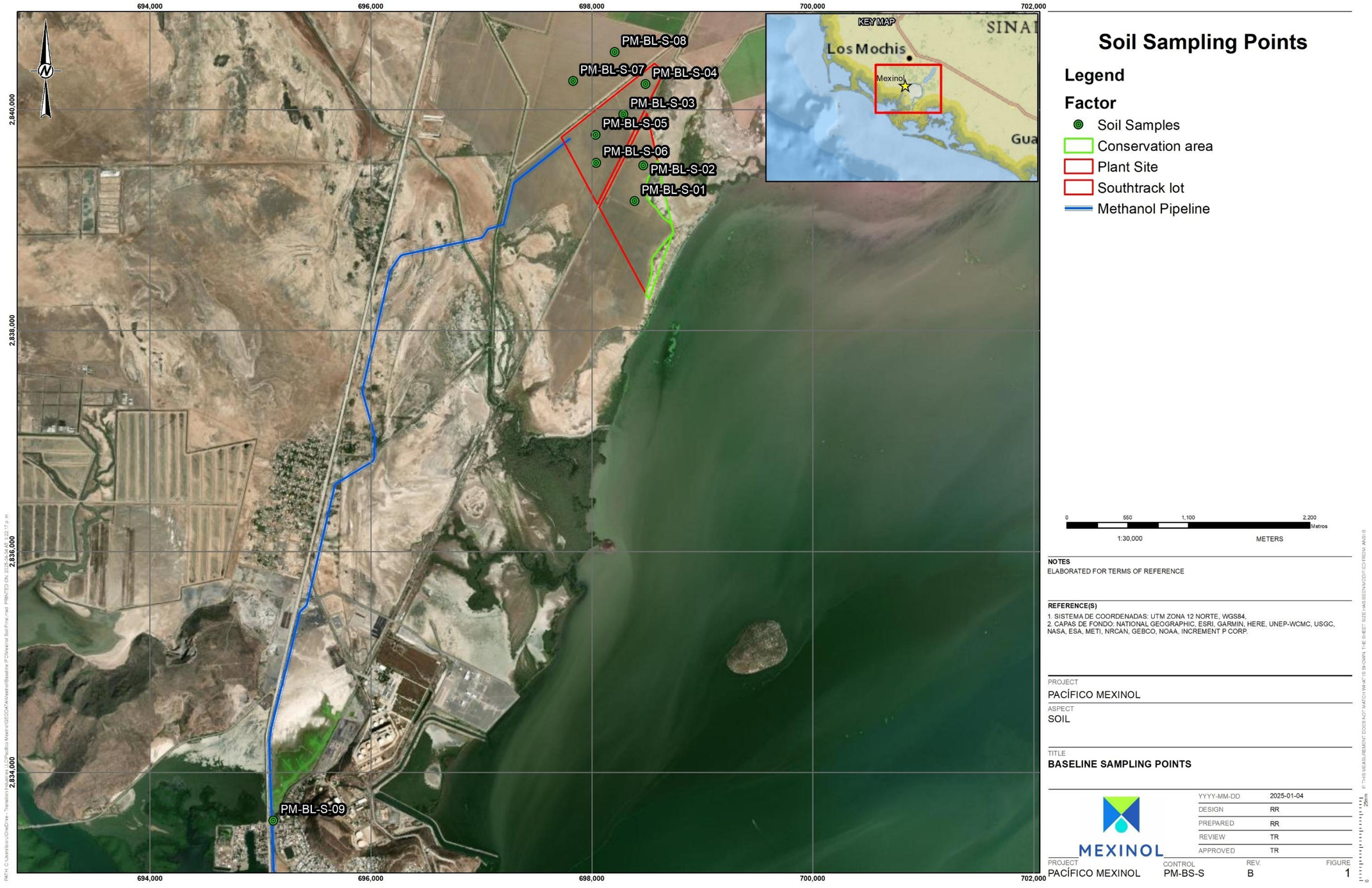


Figure 5.12 Soil sampling locations

Table 5.14: Soil sampling results

Parameter	Unit	PM-BL-S-01	PM-BL-S-01 Duplicate	PM-BL-S-02	PM-BL-S-03	PM-BL-S-04	PM-BL-S-05	PM-BL-S-06	PM-BL-S-07	PM-BL-S-08	PM-BL-S-09	Blank	Mexican standards *
pH	pH	7.16	7.33	7.49	7.74	7.19	7.18	7.85	8.04	7.96	7.89	7.07	-
Humidity	%	17.26	13.24	18.86	17.51	15.76	16.07	14.48	17.5	18.78	1.16	19.99	-
Electrical Conductivity	µS/cm	74.1	37	20.6	28	100.9	100.4	125.4	55.9	24.3	54.4	10.3	-
Organic matter (%)	%	1.9	1.4	3.1	2.2	3.1	2.6	2.1	2.2	2.6	0.6	1.8	-
Organic carbon (%)	mg/kg	1183.33	1183.333	2903.37	853.13	949.04	1084.23	698.53	762.7	2470.61	696.7	926.38	-
Oils and fats	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-
Percentage of exchangeable sodium	%	4.52	7.92	4.51	4.66	4.56	0.06	4.43	4.58	0.02	0.51	1.70	-
Cation Exchange capacity	Cmol(+)/Kg	28.3	26.5	26.5	53.9	30.7	37.2	41.8	60.4	92.4	11.6	79.4	-
Total Petroleum Hydrocarbons (TPH)	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	200 – 3000 (light – heavy fractions)
Metals													
Iron (Fe)	mg/kg	5038.43	4226.39	5651.44	6004.72	7579.42	5182.77	5134.49	243.14	4081.04	4711.46	5050.73	-
Zinc Total (Zn)	mg/kg	27.91	22.5	24.6	26.59	30.09	29.95	24.37	27.93	26.9	43	21.24	-
Cadmium (Cd)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	450
Lead (Pb)	mg/kg	24.2	25.32	21.74	21.29	22.45	19.33	23.23	25.62	24.88	37.92	24.31	800
Copper (Cu)	mg/kg	14.64	13.6	12.57	13.44	13.25	13.56	13.8	11.76	12.61	14.18	10.75	-

Parameter	Unit	PM-BL-S-01	PM-BL-S-01 Duplicate	PM-BL-S-02	PM-BL-S-03	PM-BL-S-04	PM-BL-S-05	PM-BL-S-06	PM-BL-S-07	PM-BL-S-08	PM-BL-S-09	Blank	Mexican standards *
Cromo Total (Cr)	mg/kg	9.27	7.11	10.27	11.77	13.47	12.58	12.14	13.84	14.04	11.07	8.01	-
Mercurio (Hg)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	310
Nickel (Ni)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	20000
Cobalt (Co)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Vanadium (V)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-
Silver (Ag)	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	5100
Barium (Ba)	mg/kg	353.6	113.68	148.61	145.07	183.8	153.1	146.82	110.48	100.48	26.46	293.01	5400
Manganeso (Mn)	mg/kg	324.46	360.74	411.58	412.86	424.31	390.16	382.17	463.36	444.08	211.82	471.43	-
Molibdeno (Mb)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-
Selenium (Se)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	5100
Tin (Sn)	mg/kg	84.18	71.38	61.63	54.76	75.83	94.86	88.75	107.43	102.68	99.17	89.1	-

*NOM-138-SEMARNAT/SSA1-2012and NOM-147-SEMARNAT/SSA1-2004

5.2.5.5 *Soil quality*

Based on the analysis of the soil quality data from ten sampling points (as presented in Table 5.14), the soils within the study area are generally characterized by neutral to slightly alkaline pH levels (ranging from 7.16 to 8.04), with moderate humidity and low electrical conductivity, showing non-saline conditions. Organic matter content varies between 1.4% and 3.1%, suggesting moderate soil fertility.

Contaminant levels are notably low, with concentrations of total petroleum hydrocarbons (TPH), oils and fats, and heavy metals such as cadmium, mercury, nickel, and lead all well below the applicable Mexican standards (NOM-138-SEMARNAT/SSA1-2012) for agricultural and industrial soils. In particular, TPH levels were consistently below 100 mg/kg, which is significantly under the threshold of 200–3000 mg/kg for various hydrocarbon fractions.

The cation exchange capacity (CEC), an indicator of the soil's ability to retain and supply nutrients, ranges from 26.5 to 92.4 Cmol(+)/kg, reflecting good nutrient retention capacity in most samples. Metals such as iron, manganese, and barium are present in varying concentrations but remain within safe limits.

Overall, the soil quality is suitable for industrial use, with no evidence of exceedance of regulatory soil quality thresholds.

5.2.5.6 *Soil types*

The MIA shows that eight soil types are recorded according to INEGI's mapping. Vertisols (46.6%) and solonchak (29.965%) predominate and are distributed over most of the plain. Leptosol is in the area corresponding to the sierra, while arenosol is found in the bar. The northern site where the Project site will be built has vertisol soils, while the pipeline, for most of its route, will be in solonchack soil.

Table 5.15 displays the diverse types of soils found in the study

Table 5.15: Soil types in the Project area

Key	Name
CMca+VRmzcr/2	Cambisol calcaric + Vertisol mazic chromic
CMslca+FLeu+VRcr/2	Cambisol siltic calcaric + Fluvisol eutric + Vertisol chromic
CMszwso+SCsow+PHszwca/2	Cambisol salic sodic + Solonchak sodic – Phaeozem salic calcaric
FLeu+FLmo+PHha/2	Fluvisol eutric + Fluvisol mollic + Phaeozem haplic
LPmosk+PHlvlep+RGeulep/2R	Leptosol mollic skeletic + phaeozem luvic epileptic + Regosolol eutric epileptic
PHha+VRcr/2	Phaeozem haplic + Vertisol chromic
PHlen+RGeulen/2	Phaeozem endo leptic + Regosol eutric endo leptic
PHlvvr/2	Phaeozem luvic vertic

Key	Name
PHskp+RGeuskp+LVha/2r	Phaeozem epi skeletic + Regosol eutric + luvisol haplic
SCarsoh+RGszwso/2	Solonchak arenic sodic + Regosol salic sodic
SCglso/3	Solonchak gleyic sodic
VRcrccw+PHcrvr/3	Vertisol chromic calcic + Phaeozem chromic vertic
VRmzlep+PHvrlep/3	Vertisol mazic epileptic + Phaeozem vertic epilectic
VRsklep+CMcrlep/3R	Vertisol skeletic epileptic + Cambisol chromic epilectic

A description of the reference soil groups in the area of interest is provided below based on the WRB (2015).

5.2.5.6.1 Cambisols

Cambisols are soils that show at least an incipient subsurface horizon in their formation. This transformation of the parent material is shown by the appearance of structures and a mainly brownish coloration, an increase in clay content, and/or the removal of carbonates.

5.2.5.6.2 Fluvisols

Fluvisols are soils found in fluvial, lacustrine, or marine deposits and are genetically young. Although their name suggests an exclusive association with fluvial sediments (from the Latin "fluvius", meaning river), they are also found in marine and lacustrine deposits.

5.2.5.6.3 Leptosols

Soils characterised by being very thin and overlaying continuous rock, as well as having a high concentration of coarse fragments. These soils are particularly common in mountainous regions.

5.2.5.6.4 Phaeozems

This group includes soils present in relatively humid grasslands and forest regions in moderately continental climates. Phaeozems share similarities with Chernozems and Kastanozems but undergo more intense leaching. As a result, they have a dark, humus-rich surface horizon, although less rich in bases compared to Chernozems and Kastanozems. Phaeozems lack secondary carbonates, or these are found only at greater depths. All these soils have a high base saturation in the soil surface layer.

5.2.5.6.5 Solonchak

Soils with a high concentration of soluble salts at some time of the year. They are mainly found in arid and semi-arid climatic zones, as well as in coastal regions in all types of climates.

5.2.5.6.6 Vertisols

Vertisols are soils primarily composed of heavy clays with a high proportion of expandable clays. These soils are characterised by developing deep and wide cracks from the surface downwards when they dry, a phenomenon occurring in most years. The name "Vertisols" (derived from the Latin "vertere", meaning to turn) refers to the constant internal movements of soil material saw in this soil type. This soil type predominates in the study area, coinciding with a broad floodplain corresponding to the Río Fuerte River.

Figure 5.13 below shows the soil types across the Project area.

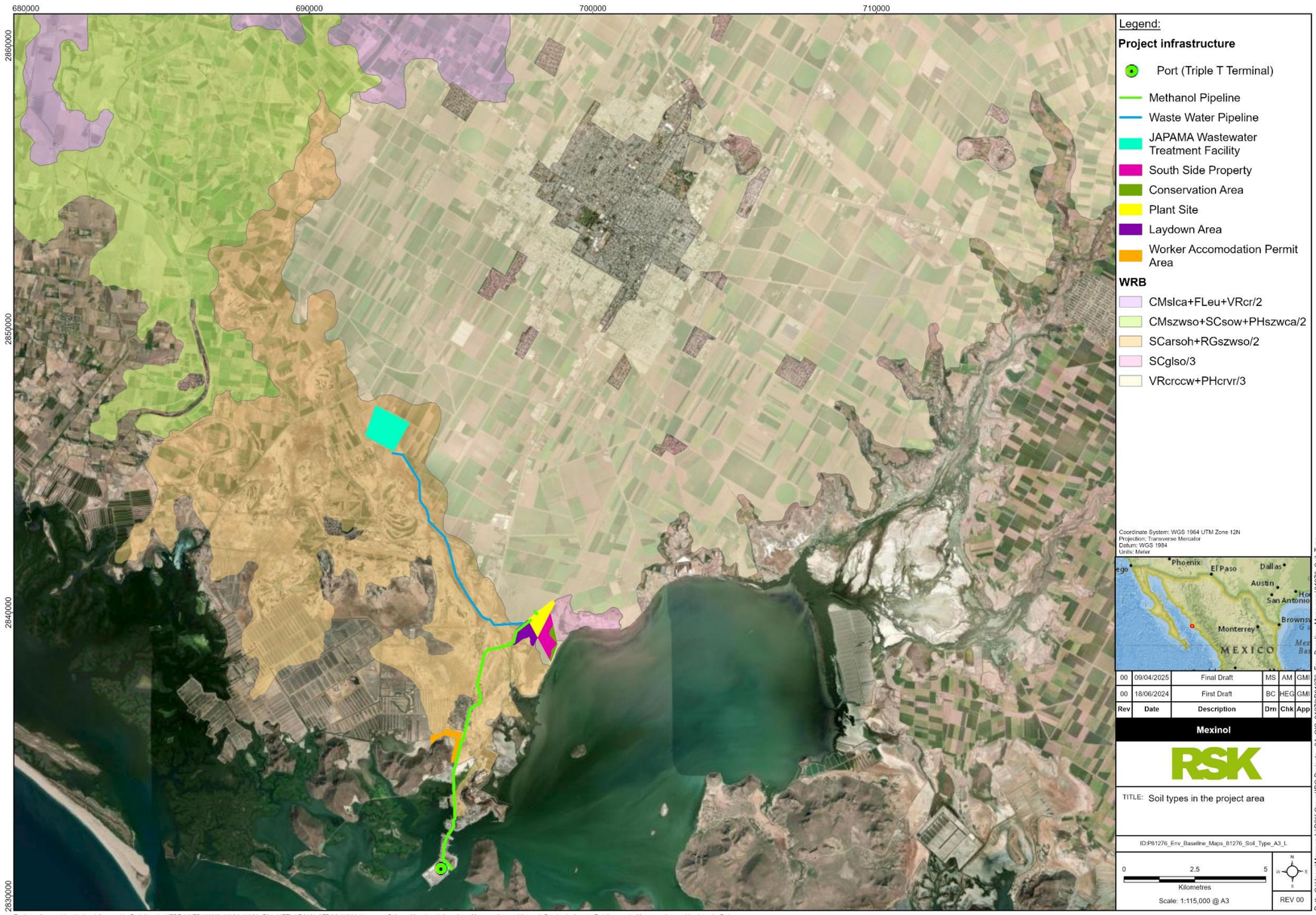


Figure 5.13: Soil types in the Project area

Source: INEGI (www.inegi.org.mx)

5.2.6 Hydrogeology

5.2.6.1 AoI

The groundwater AoI during the Project construction will encompass aquifers:

- that may be affected by planned discharges and accidental spills and leaks of fuels and chemicals by the Project
- crossed by any of the pipelines' RoW; potential impacts may be due to the excavation of trenches and/or horizontal directional drilling.

The groundwater AoI during the operational phase will encompass aquifers:

- that may be affected by planned discharges and accidental spills and leaks of fuels and chemicals by the Project
- crossed by any of the pipelines' RoW.

5.2.6.2 Aquifer conditions

The Project area lies above the Río Fuerte aquifer (Quaternary alluvium) with code 2501 (CONAGUA, 2024). The data available from CONAGUA in 2022 shows that the water table is shallow in the local area with approximate depths of between 2.7 m below ground level (mbgl) and 6.2 mbgl.

5.2.6.3 Desk study

A desk study was undertaken to identify groundwater abstraction points in the study area. In addition, the RSK social team collected data on water sources during their field survey (see Section 5.4 for more details). The nearest wells were found to be north and northwest of Los Mochis; all these wells abstract water from the Rio Fuerte aquifer. These wells are most likely used for crop irrigation. The water quality in these wells is generally good with a few exceptions where levels of arsenic, coliforms, fluoride, iron and manganese are slightly above the Mexican water quality standards (National Water Commission, 2024). No wells were identified in the area south of Los Mochis in the vicinity of the methanol plant and the JAPAMA WWTP.

5.2.6.4 Field survey

Groundwater monitoring wells were installed in May 2024; samples were collected in May 2024 from 5 locations as listed below. The locations are presented in Figure 5.16. On-site measurements of temperature, pH and conductivity were undertaken at each location. All samples were transported to an accredited laboratory for testing for a suite of inorganics, metals and total petroleum hydrocarbons. The results of the testing are presented in Table 5.19.

Table 5.16 Groundwater sampling locations

Sample location identifier	X	Y	Location
PM-BL-GW-01	698088	2840140	Northwest of the methanol plant site (upstream)
PM-BL-GW-02	698649	2840428	Northeast of the methanol plant site (upstream)

Sample location identifier	X	Y	Location
PM-BL-GW-03	697807	2839462	Southwest of the methanol plant site (downstream)
PM-BL-GW-04	698495	2839158	Southeast of the methanol plant site (downstream)
PM-BL-GW-05	695123	2833581	Topolobampo entrance

5.2.7 Hydrology

5.2.7.1 AoI

The AoI for the construction phase includes:

- the Project footprint at the location where any pipelines or new/upgraded access roads cross a watercourse or waterbody; this includes the 28” methanol pipeline and the JAPAMA pipelines.

The AoI for the operation phase includes:

- the Project footprint at the location where any pipelines or access road crosses a watercourse or waterbody.

5.2.7.2 General

The Fuerte River is the largest surface water body in the Project area; it flows through the Project area towards the coast and discharges into Topolobampo Bay. The Mexinol (2021) Hydrology and Marine report indicates that the month with the highest runoff is August and the month with the least runoff is May. The river receives runoff through numerous canals and irrigation ditches and shrimp farms. In addition, there are three drains for sewage and industrial waste, two of them coming from the City of Los Mochis and the other from the City of Juan José Ríos. Discharge from the drains and canals increase considerably during the summer season due to rainfall.

5.2.7.3 Desk study

A desk study (www.inegi.org.mx) was conducted to identify existing surface water features in the Project area of study including:

- aqueducts
- stormwater runoff channels
- irrigation channels and ditches
- water storage reservoirs and ponds
- aquaculture production (shrimp, oysters, clams, etc.)
- sedimentation
- salt production (known locally as salineras).

Stormwater runoff channels are presented in Figure 5.14 below. This water is also used for irrigation of crops.

5.2.7.4 Walkover survey

A walkover survey was conducted by RSK's partners B + F during the first week of May 2024. Observations were made on the following basis:

- Identify any surface water features that are crossed by the JAPAMA pipeline and any new access roads in the Project area of study, and record general observations (width, depth, source of water, direction of flow) general quality (turbidity and sediment content, odours, solid waste)
- Identify any surface water features (channels/drainage ditches) within 500 m of the Project components and to record observations as stated above.

The survey indicates that several surface water features are crossed by the JAPAMA pipeline route and the methanol pipeline route. The locations are presented in Figure 5.15 below.

5.2.7.5 JAPAMA water quality monitoring

Water quality monitoring continues where the wastewater exits the ponds into the canal towards the Bay of Ohuira. Laboratory testing results for the JAPAMA discharge to the Mexinol Plant are collected two times per month for 12 months to collect baseline data. The latest available data from May and September 2024 is provided in Table 5.17.

All water being sent back to JAPAMA will meet the appropriate standards.

Table 5.17: Effluent quality monitoring

Parameter	Unit	2 May 2024	3 June 2024	7 July 2024	24 July 2024	28 July 2024	4 August 2024	13 August 2024	18 August 2024	25 August 2024	1 September 2024	8 September 2024
pH	pH	8.3	8.04	7.18	6.62	6.64	7.92	7.36	7.62	7.83	7.9	-
Temperature	°C	27.07	28.99	32.34	31.17	32.65	29.95	29.24	29.32	29.62	31.96	-
Total Dissolved Solids	mg/L	552	558	578	566	580	426	604	550	590	502	504
Total Suspended Solids	mg/L	56.3	-	39.3	43	47.8	52	45	-	-	-	-
Settleable Solids (Sólidos Sedimentables)	mL/L	5	-	1	1.5	1.3	2.5	0.6	-	-	-	-
Turbidity	UNT	100	131	125	140	140	120	120	160	160	140	150
Sediment Density Index	SDI	6.41	5.99	5.17	5.78	5.80	5.85	6.73	6.02	6.18		-
Chlorine (Free)	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-
Alkalinity	mg CaCO3/L	204	207	226	201	218	53.6	214	216	216	206	195
Calcium Hardness	mg CaCO3/L	113	-	122	117	117	107	111	-	-	-	-
Magnesium Hardness	mg CaCO3/L	61	-	68	65	63.6	74.2	62.6	-	-	-	-
Total Hardness	mg CaCO3/L	174	-	190	182	181	181	174	-	-	-	-
Total Organic Carbon	mg/L	27.4	-	23.86	27.69	24.82	33.31	29.51	24.12	24.39	23.88	21.98
Biochemical Oxygen Demand (BOD5)	mg/L	42.6	62.8	47.2	57	53.4	37.8	56.6	42.8	31.5	30.9	38.2
Chemical Oxygen Demand (COD)	mgO2/L	124	-	170	182	168	196	174	-	-	-	-

Parameter	Unit	2 May 2024	3 June 2024	7 July 2024	24 July 2024	28 July 2024	4 August 2024	13 August 2024	18 August 2024	25 August 2024	1 September 2024	8 September 2024
Chemical Demand for Soluble Oxygen (Soluble COD)	mg/L	5.48	-	38.6	178	47	107	50.9	-	-	-	-
Ammoniacal Nitrogen	mg/L	12.6	-	6.08	5.81	4.88	4.41	3.8	-	-	-	-
Nitrates	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.106	<0.1	<0.1	<0.1
Nitrogen Total	mg/L	13	-	18.9	19.4	19.6	17.9	16.6	-	-	-	-
Total Phosphorus	mg/L	1.81	-	3.69	3.19	3.44	3.85	5.28	-	-	-	-
Ortho-Phosphate	mg/L	3.62	1.66	1.4	1.52	1.55	1.51	1.57	1.56	1.03	2.4	1.08
Total Cyanides	mg/L	0.0011	-	0.0052	0.0265	0.0072	0.0104	0.0036	0.0029	0.003	0.0047	-
Fats and Oils	mg/L	<8.56	-	<8.56	<8.56	<8.56	8.59	10.4	-	-	-	-
Arsenic	mg/L	0.0044	-	0.0059	0.0061	0.006	0.0058	0.005	0.0051	-	-	-
Mercury	mg/L	0.0008	-	0.0008	-	-	-	0.0008	0.0009	-	-	-
Boron	mg/L	0.222	-	0.2	0.125	0.125	0.252	0.235	-	-	-	-
Total Chlorides	mg/L	77.3	-	97.3	102	102	102	103	-	-	-	-
Total Fluorides	mg/L	0.343	-	<0.2	0.457	<0.2	0.326	0.317	-	-	-	-
Sulphate	mg/L	125	-	95.2	113	110	116	94.6	-	-	-	-
Alkalinity - Bicarbonate	mg/L	204	209	230	201	<8	53.6	214	216	216	206	195
Alkalinity - Carbonate	mg/L	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Free Carbon Dioxide	mg/L	16.7	9.5	21.1	55.4	20.5	29.5	21.4	25.9	29	15.6	12
Total Carbon Dioxide	mg/L	5.48	-	7.02	7.89	8.09	6.92	8.01	-	-	-	-
Reactive Silica	mg/L	26.24	32.85	34.61	35.49	37.47	1.04	38.57	38.13	36.37	38.13	-
Colloidal Silica	mg/L	0.82	3.66	7.56	2.71	7.29	33.29	11.5	4.27	3.26	6.03	-

Parameter	Unit	2 May 2024	3 June 2024	7 July 2024	24 July 2024	28 July 2024	4 August 2024	13 August 2024	18 August 2024	25 August 2024	1 September 2024	8 September 2024
Silica	mg/L	27.06	36.51	42.17	38.2	44.76	34.33	50.07	42.4	39.63	44.16	-
Barium	mg/L	<0.5	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	<0.1	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	-	-
Selenium	mg/L	<0.005	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-	-
Nickel	mg/L	<0.1	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	-	-
Zinc	mg/L	<0.1	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	-	-
Copper	mg/L	<0.05	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	-	-
Manganese	mg/L	0.088	-	0.073	0.067	0.076	0.09	0.077	0.083	-	-	-
Magnesium	mg/L	13.97	-	16.34	16.06	15.9	15.57	14.3	15.18	-	-	-
Iron	mg/L	0.26	-	0.35	0.38	0.42	0.35	0.28	0.26	-	-	-
Sodium	mg/L	84.88	-	98.89	99.32	99.39	96.62	91.64	93.75	-	-	-
Total Chromium	mg/L	<0.1	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	-	-
Potassium	mg/L	13.04	-	17.09	17.62	17.78	17.62	17.23	17.71	-	-	-
Aluminium	mg/L	0.3481	0.1715	0.4036	0.2501	0.4699	0.2311	0.2021	0.1139	0.1003	0.1996	-
Strontium	mg/L	0.27	-	0.25	0.24	0.23	0.23	0.23	0.23	-	-	-
Cadmium	mg/L	<0.03	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	-	-	-
Total Petroleum Hydrocarbons (GRO)	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocarbons in heavy fraction	µg/L	12.0075	ND	<2	17.092	<2	<2	<2	<2	<2	-	-
Hydrocarbons in light fraction	µg/L	<2	<0.03	<2	<2	<2	<2	<2	<2	<2	-	-
Hydrocarbons in medium fraction	µg/L	125.3383	<0.049	<2	<2	<2	3.7682	7.3967	10.2747	8.7974	-	-
Benzene	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Parameter	Unit	2 May 2024	3 June 2024	7 July 2024	24 July 2024	28 July 2024	4 August 2024	13 August 2024	18 August 2024	25 August 2024	1 September 2024	8 September 2024
Toluene	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Xylene Sum of Immunomers (Ortho, Meta, and Para)	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Acetone	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
Ethanol	ON	NA	-	NA	NA	NA	-	-	-	-	-	-
Ethyl Acetate	ON	NA	-	NA	NA	NA	-	-	-	-	-	-
Isopropylic Alcohol (2-Propanol)	ON	NA	-	NA	NA	NA	-	-	-	-	-	-
Methanol	ON	NA	-	NA	NA	NA	-	-	-	-	-	-
Helminth eggs	HN/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total coliforms	NMP/100mL	43	1,100	2400	11000	11000	11000	23	11000	4600	4600	24000
Faecal coliforms	NMP/100mL	43	1,100	2400	11000	11000	4600	23	4600	2400	4600	11000
Calcium measured as an ion	mg/L	45.65	-	-	-	-	-	-	-	-	-	-

Source: Transition Industries

Note: NA = not applicable; ND = not detectable; (-) no data

5.2.7.6 *Effluent quality*

Using the national standards established under SEMARNAT NOM-002, as outlined in Table 3.6, and comparing them with the monitoring data provided in Table 5.17, the following conclusions can be drawn:

- Most monitored parameters fall within the allowable limits of NOM-002
- COD (196 mg/L), slightly exceed the national (NOM-002) limit (180 mg/L).
- Other parameters like TSS, pH, and temperature are compliant with NOM-002 standards.

In conclusion, the effluent generally meets national Mexican standards except for COD.

5.2.7.7 *Surface water field sampling*

Surface water quality sampling was undertaken in 2024 at the locations listed below in Table 5.18. Samples were collected according to the methodology described in the Terms of Reference for Environmental Baseline data - Surface Water, Groundwater and Soil dated August 2024 (Mexinol, 2024). The results of the testing are in Table 5.19.

Table 5.18 Surface water sample locations

Sample location identifier	X	Y	Location
PM-BL-SW-01	697136	2838944	WTP pipeline irrigation canal crossing
PM-BL-SW-02	696839	2838807	Methanol Pipeline & JAPAMA pipeline canal crossing
PM-BL-SW-03	698177	2837109	Ohuira Bay (In front of Mexinol plant)
PM-BL-SW-04	698911	2838852	Ohuira Bay (vicinity JAPAMA discharge)

Figure 5.14: Methanol and JAPAMA pipeline routes showing surface water crossings

Source: RSK

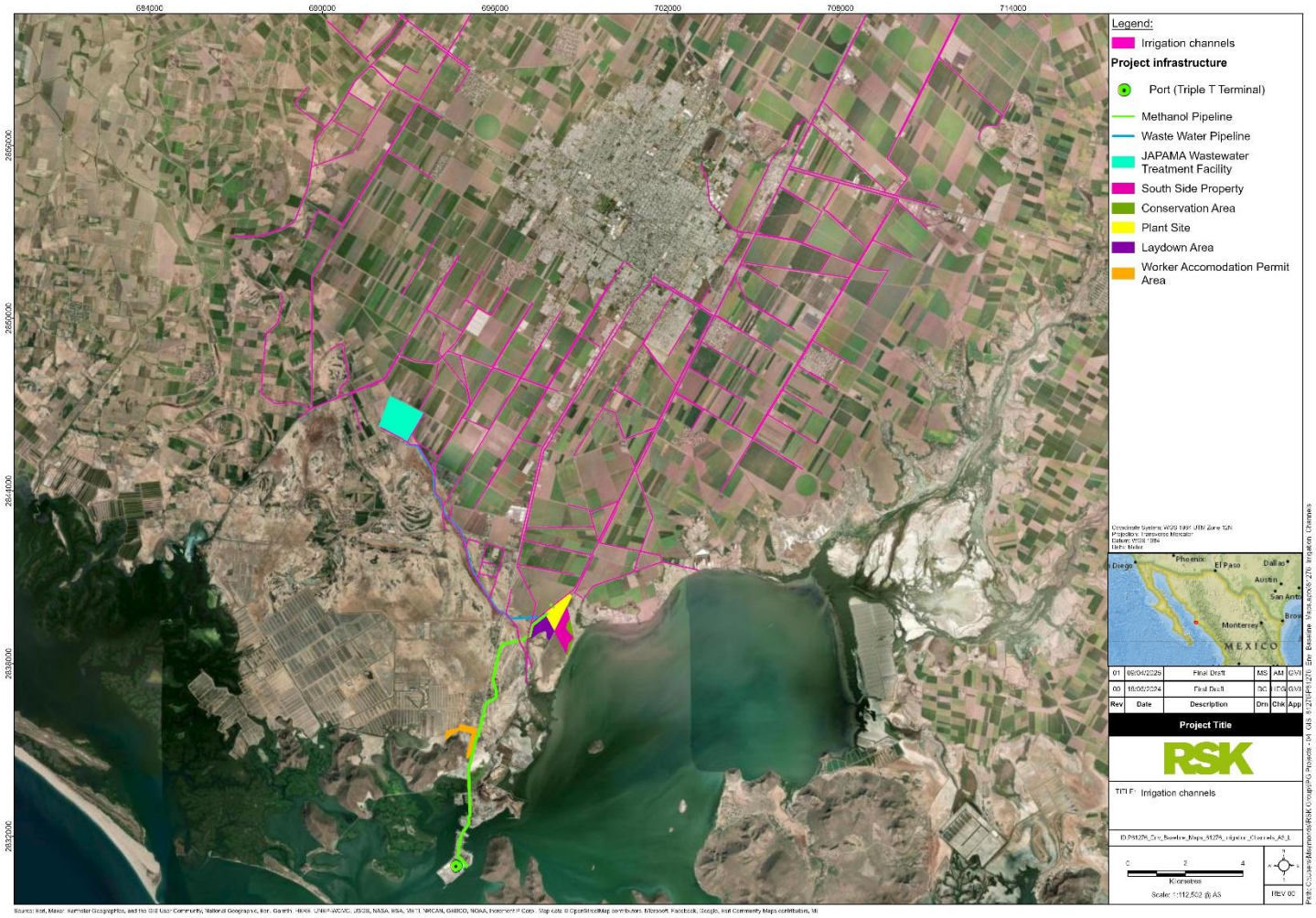


Figure 5.15: Irrigation channels

Source: INEGI (www.inegi.org.mx)

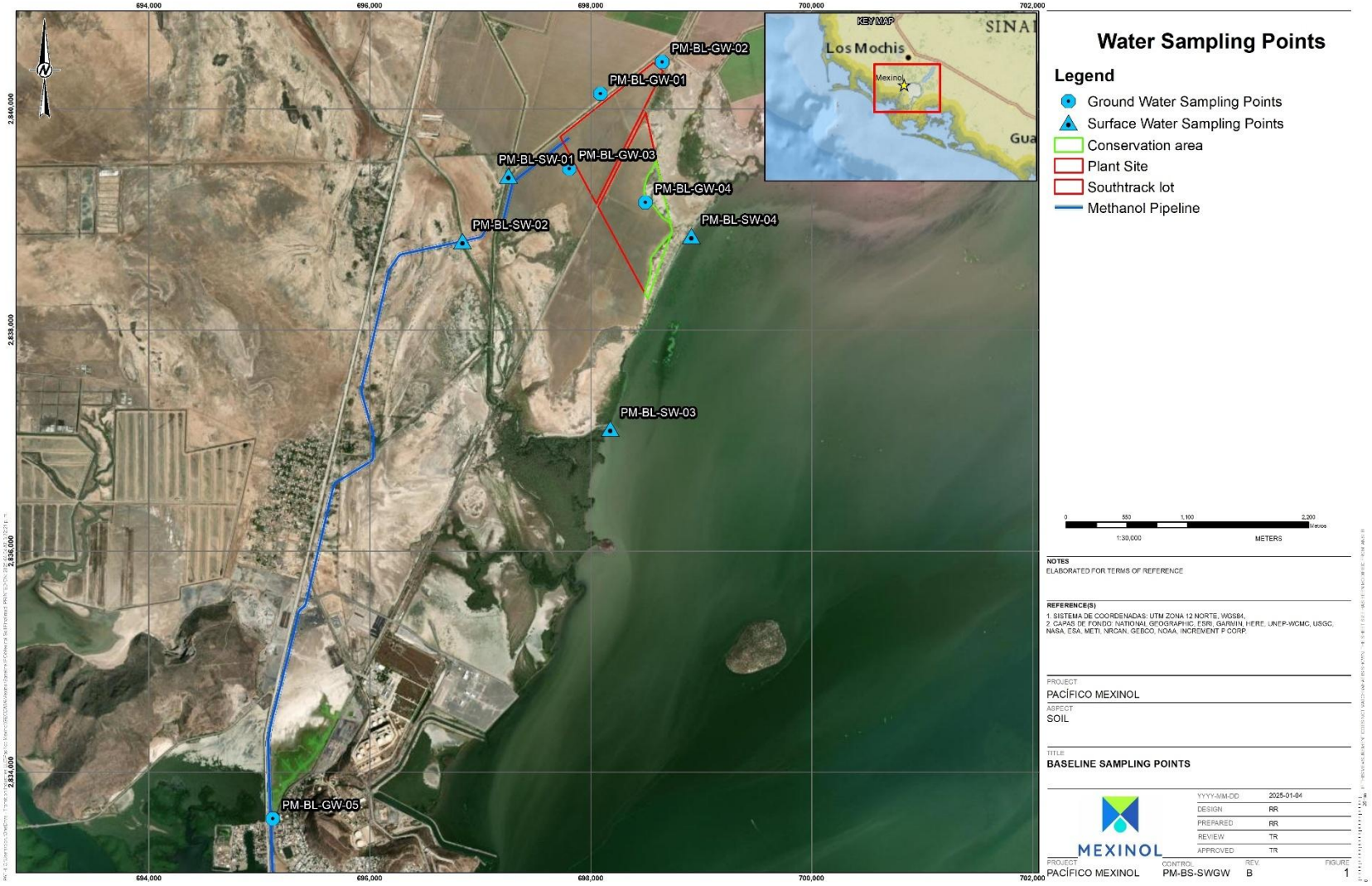


Figure 5.16 Groundwater and surface water sampling locations

Table 5.19: Groundwater sampling results

Parameter	Unit	PM-BL-GW-01	PM-BL-GW-01 Duplicate	PM-BL-GW-02	PM-BL-GW-03	PM-BL-GW-04	PM-BL-GW-05
pH	pH	6.90	6.92	6.45	6.94	6.44	5.66
Temperature	°C	22	22	22	21	19	20
Electrical conductivity	µS/cm	3.88	3.86	6.42	1.58	6.83	14.23
Turbidity	NTU	2.04	2.06	163.00	227.00	228.33	347.33
Floating matter	-	Absent	Absent	Absent	Absent	Absent	Absent
Phosphorus	mg P /L	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Oil and grease	mg/L	8.1	8.1	5.9	4.1	5.5	2.7
Helminth Eggs	Eggs/L	<1	<1	<1	<1	<1	<1
Total Nitrogen	mg/L	2.99	2.99	<1	1	<1.00	<1.00
Total dissolved solids	mg/L	4.012	4.024	13.971	1.347	7.077	86.675
Settleable solids	ml/L	0.20	0.20	0.30	1.00	0.30	45.00
Total suspended solids	mg/L	20	34	165	173	187	255
Total petroleum Hydrocarbons	mg/L	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Phenol	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc Total (Zn)	mg/L	<0.025	<0.025	0.035	<0.025	<0.025	1.419
Cadmium (Cd)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.122
Lead (Pb)	mg/L	<0.100	<0.100	0.180	<0.100	<0.100	1.189

Parameter	Unit	PM-BL-GW-01	PM-BL-GW-01 Duplicate	PM-BL-GW-02	PM-BL-GW-03	PM-BL-GW-04	PM-BL-GW-05
Chromium (Cr)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.41
Mercury (Hg)	mg/L	<0.001	<0.001	<0.003	<0.001	<0.001	<0.001
Nickel (Ni)	mg/L	<0.05	<0.05	0.135	<0.05	<0.05	0.852
Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.984
Cyanides	mg CN-/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate Nitrogen	mg/L	<0.20	<0.20	0.39	<0.23	0.33	0.29
Faecal coliforms	MPN/ml	<30	<30	<30	<30	<30	<30
BOD	mg/L	36.0	39.7	33.1	31.4	30.4	57.3
Nitrite nitrogen	mg/L	<0.010	<0.010	<0.010	<0.010	0.120	<0.010

Note: * PM-BL-SW-04 couldn't be sampled, because the tide was very low and the sample couldn't be retrieved.

Table 5.20: Surface water sampling results

Parameter	Unit	PM-BL-SW-01	PM-BL-SW-02	PM-BL-SW-03	PM-BL-SW-04*	CONAGUA NOM 002-ECOL-1996 (instantaneous maximum	NOM-001-ECOI-1996 (water discharge standards
pH	pH	6.76	7.52	6.34	-	5.5 – 10 units (each sample)	
Temperature	°C	20	19	19	-	≤ 40 °C (unless proven non-damaging)	
Electrical conductivity	µS/cm	7.86	7.32	11.51	-	Not covered	
Turbidity	NTU	49.82	326	299.67	-	Not covered	
Floating matter	-	Absent	Absent	Absent	-	Not covered	

Parameter	Unit	PM-BL-SW-01	PM-BL-SW-02	PM-BL-SW-03	PM-BL-SW-04*	CONAGUA NOM 002-ECOL-1996 (instantaneous maximum	NOM-001-ECOI-1996 (water discharge standards
Phosphorus	mg P /L	0.48	1.30	1.09	-		5-20 mg/l
Oil and grease	mg/L	1.5	7.5	4.3	-	100 mg/L	≤ 15 mg/L (reuse standard)
Helminth Eggs	Eggs/L	<1	<1	<1	-		≤ 1 (direct); ≤ 5 (indirect) (reuse standard)
Total Nitrogen	mg/L	6.98	4.98	9.47	-		25-60 mg/l
Total dissolved solids	mg/L	6.714	5.990	9.775	-	Not covered	
Settleable solids	ml/L	0.20	0.20	0.60	-	10 mL/L	
Total suspended solids	mg/L	10	74	153	-		40-150 mg/l
Total petroleum Hydrocarbons	mg/L	<1.00	<1.00	<1.00	-	Not covered	
Phenol	mg/L	<0.001	<0.001	<0.001	-	Not covered	
Zinc Total (Zn)	mg/L	<0.025	<0.025	<0.025	-	12 mg/l	
Cadmium (Cd)	mg/L	<0.050	<0.050	<0.050	-	1.0 mg/l	
Lead (Pb)	mg/L	<0.100	<0.100	<0.100	-	2.0 mg/l	
Chromium (Cr)	mg/L	<0.05	<0.05	<0.05	-	1.0 mg/l	
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	-	0.02 mg/l	
Nickel (Ni)	mg/L	<0.05	<0.05	0.097	-	8 mg/l	
Arsenic (As)	mg/L	<0.001	<0.001	<0.001	-	1.0 mg/l	
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	-	20 mg/l	
Cyanides	mg CN-/L	<0.02	<0.02	<0.02	-	2.0 mg/l	
Nitrate Nitrogen	mg/L	<0.51	0.78	<0.40	-	Not covered	
Faecal coliforms	MPN/ml	<30	<30	<30	-		1000 MPN/100 mL for all discharge type

Parameter	Unit	PM-BL-SW-01	PM-BL-SW-02	PM-BL-SW-03	PM-BL-SW-04*	CONAGUA NOM 002-ECOL-1996 (instantaneous maximum	NOM-001-ECOI-1996 (water discharge standards
BOD	mg/L	34.6	33.1	28.8	-		≤ 20 mg/L (direct); ≤ 30 mg/L (indirect) (reuse standard)
Nitrite nitrogen	mg/L	<0.010	0.160	<0.010	-	Not covered	

Note: * PM-BL-SW-04 couldn't be sampled, because the tide was very low and the sample couldn't be retrieved.

5.2.7.8 *Groundwater quality*

Based on the data collected (table 5.19), the groundwater quality across the site is variable. Several wells — particularly PM-BL-GW-05 and PM-BL-GW-02 — show evidence of existing potential contamination:

- Elevated turbidity and solids
- High BOD
- Elevated heavy metals (if compared to drinking water threshold e.g. NOM 127) for Lead, Cadmium, Chromium, Nickel.
- Fats and oils were detected in all samples (ranging from 2.7 to 8.1 mg/L), which may indicate contamination from industrial sourcesSurface water quality.

5.2.7.9 *Surface water*

The surface water samples show signs of moderate to significant pollution, particularly at locations PM-BL-SW-02 and PM-BL-SW-03. Key concerns include high turbidity, elevated levels of suspended solids, oil and grease contamination, and excessive nutrients (phosphorus and nitrogen), which indicate potential for eutrophication and organic pollution (supported by high BOD values).

5.3 Terrestrial and aquatic biodiversity baseline

This Chapter presents the terrestrial and aquatic biodiversity baseline in and around the Project's ecological AoI (see Figure 5.17) This is based on the following information:

- a biodiversity baseline assessment for the Project (completed by SLR in 2024).
- an Internationally Recognised Areas Assessment based on the European Union's (EU) Appropriate Assessment methodology (SLR Consulting Limited, 2024a).
- a Critical Habitat and Biodiversity Impact Assessment for the Project which includes data from the three biodiversity surveys (SLR Consulting Limited, 2024b.

5.3.1 Ecological AoI

The ecological AoI encompasses the area affected by the following Project activities (SLR Consulting Limited, 2024b):

- The area physically affected by vegetation clearance, earth moving and trenching activities (e.g., for pipeline installation, access roads and methanol plant) including 13 temporary disturbance zones. This area is assumed to be the infrastructure footprint and construction activities within a 50 m buffer zone either side of the pipeline route and around the methanol plant site.
- The adjacent areas affected by dust, noise, traffic and increased human presence i) during construction and ii) during methanol plant operation (e.g., compressors, turbines, pumps, motors, air coolers and fired heaters). This area is assumed to be a radius of ~500 m from construction sites within which standard operating noise levels are predicted to attenuate to an acceptable noise level for residential areas of 45 dBA. Note: high noise levels could be emitted during release of high-

pressure gases to flare and/or steam release into the atmosphere during non-routine emergency depressurisation events.

5.3.2 Ecological study area

Figure 5.17 illustrates the ecological study area, which includes the AoI and a buffer zone where necessary, where baseline surveys were conducted (SLR Consulting Limited, 2024b).

5.3.3 Biodiversity surveys

Over the last three years a range of ecological surveys have been undertaken within the Project's ecological study area. Surveys of vegetation, herpetofauna, ornithology and mammals were conducted by independent local environmental firms E3 and IGA in May 2021, January 2022, and December 2023. Additionally, the bat cave described in Section 2.1.3.1, which is located several km from the project's ecological study area, was surveyed in May 2021. An SLR international biodiversity specialist verified data during a field visit in February 2024.

During the last three years of ecological surveys, the methodologies used by both E3 and IGA have been similar, so the results are considered to be complementary. The survey reports and detailed methodologies are available on request. The IGA survey methodologies are provided in their report: Protection, Rescue and Relocation Program of Wild Flora and Fauna (Mexinol, 2024), which was produced as a requirement of SEMARNAT in the resolution of permit requirement number SRA/DGIRA/DG-04243-23, on the flora and fauna present in the Project area and in the Regional Environmental System (RES). The SEMARNAT requirement arose as a result of the MIA for the Project. The E3 survey methodologies are also provided in their respective reports.

5.3.4 Ecoregions

The northern portion of the Project area lies within the Sonoran Sinaloan Transition Subtropical Dry Forest. This ecoregion occurs entirely in Mexico and is transitional between the Nearctic Sonoran Desert and the Neotropic Sinaloan Dry Forests, covering an area of 5,109,000 ha across the states of Sinaloa, Sonora and Chihuahua (Noss, n.d.). The ecoregion is characterised by dry steppe and the dominant vegetation within the ecoregion is deciduous thorn forest, in addition to semiarid matorral and thorn scrub (Noss, n.d.).

The southern portion of the Project area (south of the railway line) lies within Northern Mesoamerican Pacific Mangroves ecoregion. This ecoregion comprises mangrove habitats, including four protected (under NOM-ECOL-059-2001[11], CITES[12] and IUCN Species Survival Commission[13]) mangrove species: red mangrove (*Rhizophora mangle*; LC), white mangrove (*Laguncularia racemosa*; LC), black mangrove (*Avicennia germinans*; LC), and button mangrove (*Conocarpus erectus*; LC) (SLR Consulting

[11] Secretaría de Medio Ambiente y Recursos Naturales. (2001). NOM-ECOL-059-2001: Protección ambiental - Especies nativas de México de flora y fauna silvestres - Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio - Lista de especies en riesgo. Diario Oficial de la Federación.

[12] CITES. (1973). Convention on International Trade in Endangered Species of Wild Fauna and Flora.

[13] IUCN Species Survival Commission Mangrove Specialist Group. https://iucn.org/our-union/commissions/group/iucn-ssc-mangrove-specialist-group

Limited, 2024b). This ecoregion occurs entirely in Mexico, covering 821,000 ha across the Pacific Coast and Gulf of California coasts (Schipper, n.d.).

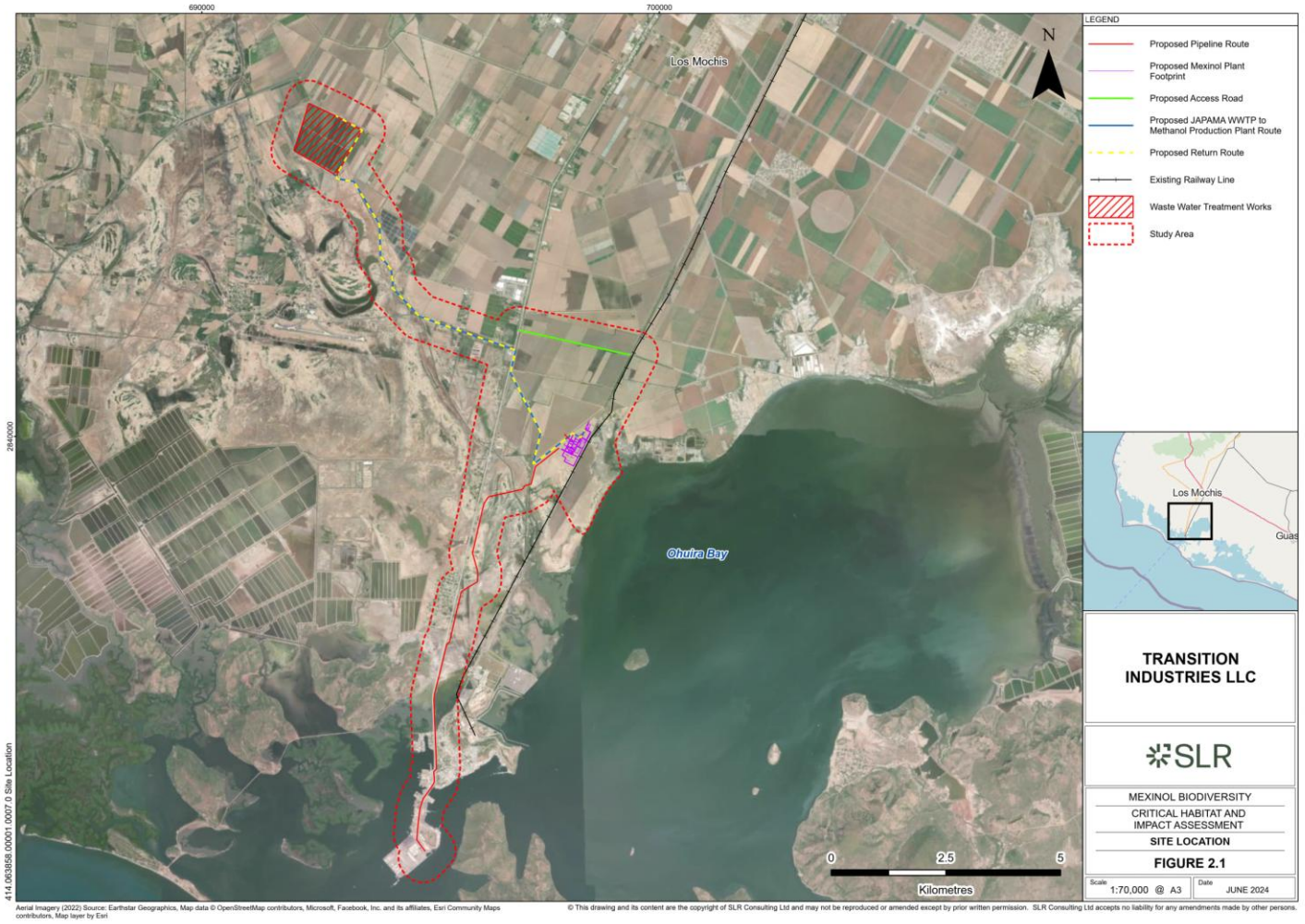


Figure 5.17: Project's ecological study area

Source: SLR Consulting Limited (2024b)

5.3.5 Protected Areas

Two internationally recognized areas of importance for biodiversity will be crossed by the project: the Lagunas de Santa María-Topolobampo-Ohuira Ramsar Site and the Bahia Lechuguilla Important Bird Area (KBA - IBA)e Figure 5.22), and are located partially within the Project's ecological study area.

Additionally, two nationally and one internationally protected, and conservation priority areas are located near the Project's ecological study area:

- The Topolobampo-Caimanero Marshes (RTP-22) – Regional Terrestrial Priority Area (nationally protected, see Figure 5.21).
- Regional Hydrological Area (nationally protected, see Figure 5.21).
- The Islas de Golfo de California Flora and Fauna Protection Area, a World Heritage Natural Site and UNESCO Biosphere Reserve (internationally protected, see Figure 5.22).

Table 5.21 below provides an overview of the protected and conservation priority areas that are located partially within, or near to, the Project's ecological study area, and Figure 5.21 and Figure 5.22 below present the nationally and internationally protected and conservation priority areas within and near the Project's ecological study area.

Often the boundaries of internationally recognised areas are not frequently ground truthed and subject to subsequent amendments. This means that over time, internationally recognised area boundaries, may include both areas of conservation value, but also areas of sub-optimal habitat. This may occur due to an expansion in farmed land, building of a road and disruption of drainage/lagoon systems, urban creep and so on.

Approximately 1.4 km of pipeline will cross the Lagunas de Santa María-Topolobampo-Ohuira Ramsar/IBA (Figure 5.18). The small section of the pipeline which crosses the Ramsar/IBA is aligned next to the Los Mochis-Topolobamporoad. The botanical surveyors described this section of habitat as being highly degraded and significantly modified from its original mangrove habitat by industrial development and due to the alteration of surface hydrology. The water flow across the area has been altered by the construction of a highway, and by the construction of a railway. The photograph below (Figure 5.19) was taken when the lagoon was dry. There is no vegetation and no mangrove. This contrasts with the opposite side of the road, where there is a lagoon that has open access to the sea and has retained a large area of mangrove. The difference in the colour of the water of the two mangroves reflects this. Figure 5.18 shows that on the left-hand side of the road there is the healthy mangrove and lagoon, the right-hand side is devoid of vegetation with highly impeded drainage.

A meeting was held between the Mexinol and the Comisión Nacional de Áreas Naturales Protegidas (CONANP; the official representatives of the Laguna Santa María-Topolobampo-Ohuíra Ramsar) on Thursday 15, February 2024. During the official rulings from the MIA, CONANP determined that the project will not have major alterations to the Ramsar Site No. 2025 Laguna Santa María-Topolobampo-Ohuíra.

Additionally, an Internationally Recognised Areas Assessment, based on the European Union's Appropriate Assessment methodology, was conducted in 2024 (SLR Consulting Limited, 2024a). Internationally recognised areas within 20 km of the Project site were

identified and defined. An Appropriate Assessment was then conducted to identify if there are any likely significant effects generated by the Project that could adversely impact the integrity of the internationally recognised areas. Based on this assessment, the report concluded that the Project would have no likely significant effects on the qualifying features of the internationally recognised sites. Potential impacts on protected areas are assessed further in Sections 8.2.1.1 and 8.2.2.1 of this report.

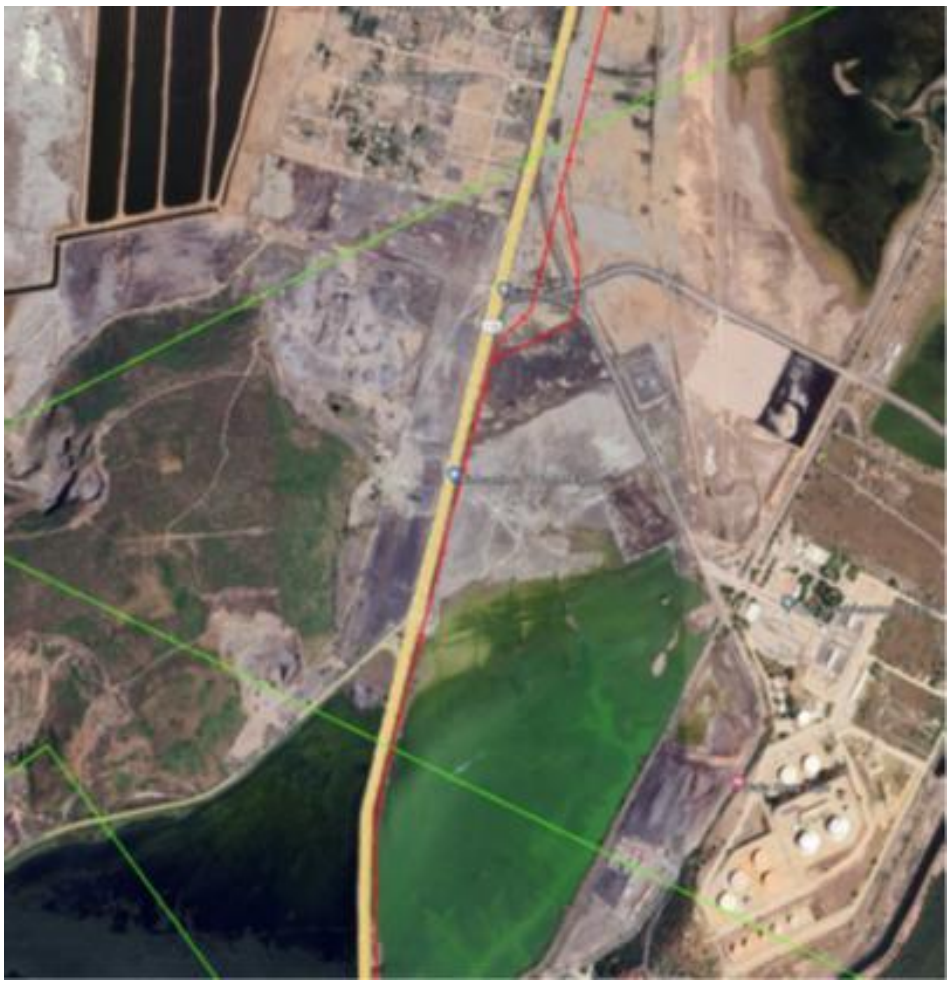


Figure 5.18: Aerial imagery showing the pipeline within the Ramsar site (SLR, 2024)

Figure 5.19: Dry lagoon within the Ramsar site, devoid of vegetation

Figure 5.20: Lagoon within the Ramsar site showing dead mangrove stumps

Table 5.21: Protected / priority conservation areas located partially or fully within, or near to the Project's ecological study area

Protected or conservation priority area	Reason for designation	Relation to Project
Nationally protected / priority conservation areas		
Topolobampo-Caimanero Marshes (RTP-22) Regional Terrestrial Priority Area	Includes highly productive aquatic ecosystems with associated mangroves and saline-adapted halophytic vegetation, and wintering and nesting area for waterbirds.	Main issues in the region include desiccation of swamps and canals for agricultural purposes. Although the Project will be constructed in RTP 22, the northern property (where the Project will be located) is previously converted agricultural land. The Project's polyduct system will be carried out in an isolated area of the lagoon system. Despite its poor environmental quality, this area is still used by some species of fauna, including waterfowl.
Priority Hydrological Region	RHPs are determined based on their terrestrial, marine, and other aquatic ecosystems and ecological complexes of which they are a part.	The Project is located in RHP No. 19 Bay of Ohuira-Ensenada de Palbellón. The area in which the Project will be constructed was previously converted into agricultural land.
Internationally protected / conservation priority areas		
Lagunas de Santa María-Topolobampo-Ohuira Ramsar site and Bahia Lechuguilla Key Biodiversity Area - Important Bird Area	The system is considered an important habitat for nesting and resting birds, in addition to having a significant mangrove population, particularly in the Bay of Santa Maria. In addition, the system is one of the most important fishing areas of the State of Sinaloa, mainly in relation to shrimp farming. Trigger species for the IBA are Ridgway's Rail (*Rallus obsoletus*; NT), Reddish Egret (*Egretta rufescens*; NT), Snowy Egret (*Egretta thula*; LC), Black Skimmer (*Rynchops niger*; LC), Common Gull-billed Tern (*Gelochelidon nilotica*; LC), Forster's Tern (*Sterna forsteri*; LC) and various other non-breeding waterbirds.	The Project will be constructed in areas with already low environmental quality. The methanol production plant will be constructed in an agricultural site and the port facilities will be built within an existing pier in the Port of Topolobampo. However, 1.4 km of the Project's methanol pipeline will overlap the Ramsar site and the KBA. Both areas were historically modified (i.e.: interrupted flows of water following the construction of the Los Mochis-Topolobampo Road and the railway that reaches the Port of Topolobampo and Adolfo López Mateos Avenue). The Project will utilise HDD to minimise impacts to natural vegetation. Once the preparation of the site and construction is finished, herbaceous and shrub vegetation will be restored/rehabilitated. The Project also intends to ensure the conservation area in the southern portion of the Project property remains limited to natural vegetation. The project will affect critical habitat, but since it will not be a significant loss, an **offset will not be required**. This residual impact will be managed through additional conservation programs that will be implemented in the general

Protected or conservation priority area	Reason for designation	Relation to Project
	Forster's Terns (*Sterna forsteri*; LC) nest within marsh; either on tidal islands or evaporation pond islands. Degradation of marsh habitats may be threatening to this species; therefore, preservation of wetlands is essential for their survival. Within Mexico there are little breeding colonies are known; thus this species meets the D1a Criteria, triggering a critical habitat threshold under PS6 approach.	ecological study area and will be designed to benefit the KBA species, following PS6 Paragraph 20.
Lagunas de Santa María-Topolobampo-Ohuira part of the Ilas de Golfo de California complex World Heritage Natural Site and UNESCO Biosphere Reserve	Includes islands important for bird breeding and serves as a corridor for the migratory species. The islands are also habitat to a variety of endemic species particularly reptiles such as piebald chukwall (*Sauromalus varius*; VU), Californian sea lion (*Zalophus calfornianus*; LC), elegant tern (*Sterna elegans*; NT) and several cactus and other succulent species.	This World Heritage Natural Site and UNESCO Biosphere Reserve includes the islands of the Gulf of California, rather than the mainland. Therefore, the site is located outside of the Project's ecological study area. The closest point to the Project is the port area, which lies 1.9 km east of the World Heritage Site and UNESCO Biosphere Reserve.

Source: SLR Consulting Limited (2024b)

Figure 5.21: Nationally protected and conservation priority areas within the ecological study area

Source: SLR Consulting Limited (2024)

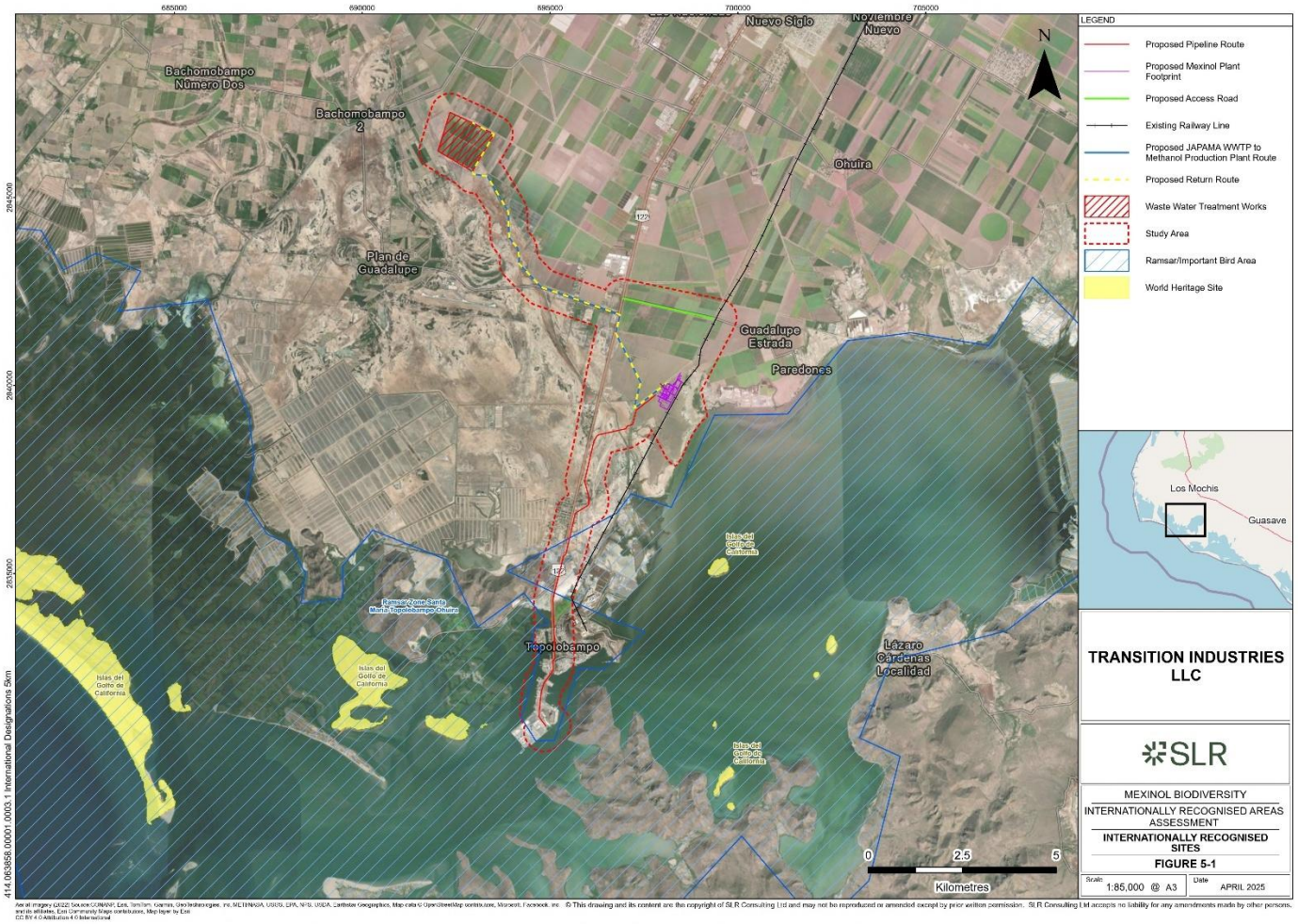


Figure 5.22: Internationally protected and conservation priority areas within the ecological study area

Source: SLR Consulting Limited (2024b)

5.3.6 Terrestrial and aquatic natural and modified habitats

Habitats are categorised into Natural or Modified by the International Finance Corporation (IFC) Performance Standard 6 (PS6) criteria (IFC, 2012) and Guidance Note 6 (IFC, 2019):

- 'Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition'.
- 'Modified habitats are defined by IFC as areas of land that support a large proportion of flora and/or fauna species that are non-native in origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition'.

The majority of the ecological study area comprises modified habitat which has been modified and fragmented for at least 50 years as a result of agriculture activities, with regards to the 'Irrigation District No.75 Red Valle del Fuerte'; and urban development, including the construction of infrastructure such as the Los Mochis-Topolobampo highway and the railroad (Mexinol, 2021).

Approximately 1,058 ha (32%) of the Project's ecological study area comprises natural habitat and 2,246 ha (68%) is modified habitat, much of which is highly transformed for irrigated agriculture and settlement. This excludes the area for the 400 kV transmission line, which is routed through modified habitat, comprising or adjacent to agricultural fields. Additionally, many of the natural habitats are showing signs of fragmentation and degradation as a result of land use changes in the Project area, such as the construction of roads, railways and irrigation canals. These land use changes have also altered the natural hydrology of the Project's ecological study area (SLR Consulting Limited, 2024b).

Table 5.22, and Figure 5.23 and Figure 5.24 below describe the types and extents of natural and modified habitats within the Project's ecological study area.

Table 5.23 below provides a summary of the main natural habitats located within the Project's ecological AoI and photographs are presented in Table 5.25.

Table 5.22: Habitats within the Ecological Study Area

Vegetation and land use	Terrestrial/ aquatic	Ecological study area (ha / %)	Description
Natural Habitat			
Xerophytic vegetation	Terrestrial	706.51 / 21.73	This habitat type is located primarily along the methanol pipeline route, between the existing railway and the main road to Topolobampo, and the JAPAMA pipeline route. Includes species such as *Allenrolfea occidentalis* (not evaluated), *Sesuvium portulacastrum* (LC), *Eragrostis pyramidata* (not evaluated) and *Sporobolus pyramidatus* (not evaluated)
Marine water	Aquatic	182.62 / 5.61	Located outside of the Project development area
Sarcocaule scrub	Terrestrial	29.26 / 0.90	This habitat type is located outside of the Project development area. Includes species such as Boojum Tree (*Fouquieria columnaris*; VU), Copalquín (*Pachycormus discolor*; LC), *Fouquieria sp.* (not evauated)), Pachycereus*spp.* (not evaluated), *Opuntia spp.* (not evaluated) and *Pedilanthus macrocarpus* (not evaluated)
Open water (e.g. canals, aqueducts, stormwater runoff channels, water storage reservoirs and ponds, sedimentation, salt production – see Section 5.2.7)	Aquatic	57.84 / 1.72	Located along the methanol and JAPAMA pipeline routes
Modified Habitat			
Historic area of mangrove swamp – now classed as modified habitat	Aquatic	33.61 / 1.03	Mangrove swamp is not present within the project footprint. Only one isolated juvenile mangrove (see below) was recorded within the Project development area, on the opposite side of the road to the proposed pipeline route and inside the security fence of a small marina (therefore expected to be completely unaffected by the Project). The other mangrove species are located within the Project's ecological AoI but outside of the Project development area, by design, and will not be affected

Vegetation and land use	Terrestrial/ aquatic	Ecological study area (ha / %)	Description
Annual and semi-permanent irrigated agriculture	Terrestrial	1757.01 / 54.01	Comprises much of the Project development area, including the plant site, methanol and JAPAMA pipeline routes and access road
Irrigation channels	Aquatic	N/A*	Irrigation channels in the Project's ecological AoI are part of a much wider irrigation system used for farming
Bare areas/no vegetation	Terrestrial	247.17 / 7.60	Extensively impacted by land use changes, located along the methanol pipeline route
Human settlement / urban areas	Terrestrial	241.54 / 7.43	Located along the methanol pipeline route

Source: (SLR Consulting Limited,2024b)

*These channels traverse both natural and modified habitats across the Project's ecological AoI and have been incorporated into the habitat classifications of the other main habitat types.

Table 5.23: Main natural habitat types found in the Project's ecological AoI

Type of vegetation	Description
Sarcocaule scrub	Predominantly open or moderately dense and floristically rich shrubs with fleshy stems and sometimes papery bark
Sarco-crasicaule scrub	Closely related to the sarcocaule scrub, with many endemic or near-endemic cacti
Mezquital	Shrubby habitat associated with other types of xerophilous scrub, evident in a small part of the Project's ecological AoI to the southwest of the methanol pipeline
Halophytic vegetation	Primarily herbaceous or shrub species in coastal environments
Xerophytic vegetation	Predominantly herbaceous vegetation which is often mixed with species of sarcocaule scrub and frequently contains bushy elements and herbaceous cover

Source: (SLR Consulting Limited,2024b)

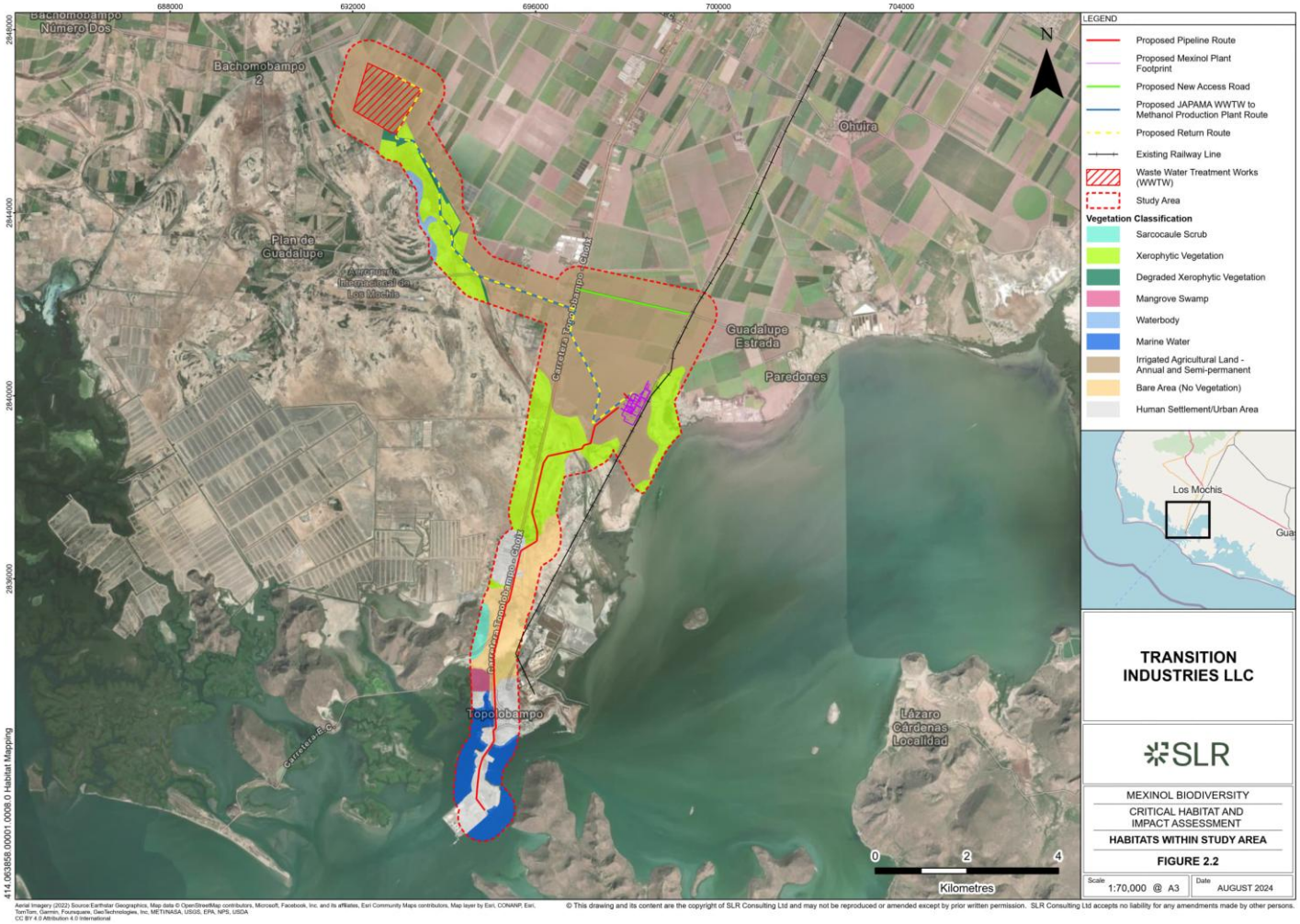


Figure 5.23: Habitat classification

Source: SLR Consulting Limited (2024b)

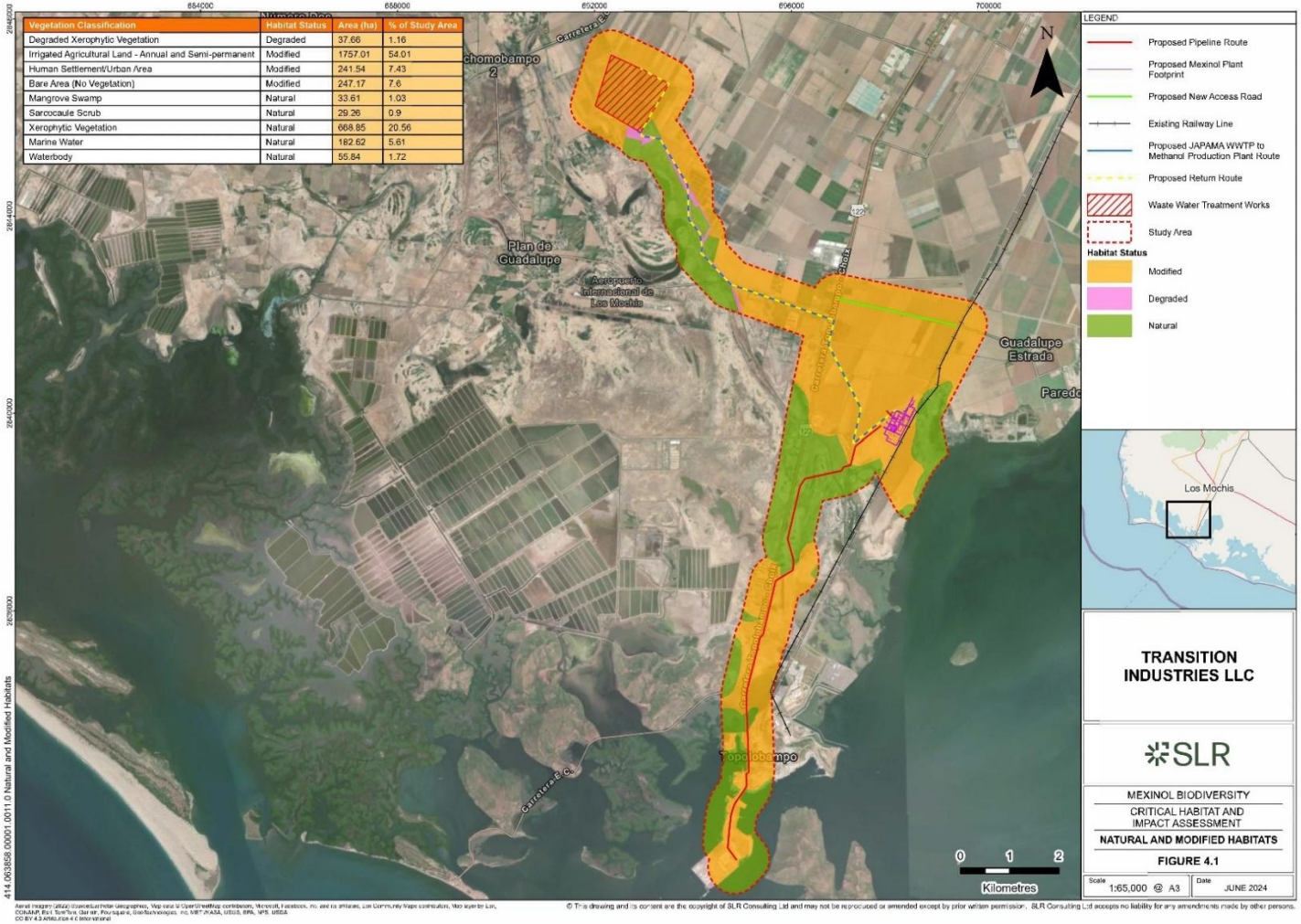


Figure 5.24: Habitat map illustrating the extent of natural and modified habitat types

Source: SLR Consulting Limited (2024b)

5.3.6.1 Fragile areas

During the biodiversity surveys, three ‘fragile areas’ were identified; areas that are particularly susceptible to damage or disturbance due to their delicate ecological balance, low resilience, or the presence of sensitive environmental features.

The classification of fragile areas was primarily influenced by geomorphology, characterised by a low-lying coast susceptible to flooding. While some vegetation areas are moderately well-preserved with good coverage, others have been degraded by human activity. Additionally, the water bodies in these fragile areas (see Figure 5.25) remain constant throughout the year, unlike other seasonal water bodies in the project's ecological study area and are considered highly sensitive to human impacts.

Figure 5.25: Sensitive water bodies in the fragile areas

Source: Transition Industries (April 2025)

The fragile areas have flood zones with good coverage and indications of new plant growth, as shown in Figure 5.26 below.

Figure 5.26: Flood zones in the fragile areas

Source: Transition Industries (April 2025)

Defining the concept of a fragile area is challenging due to the variety of measurement standards and parameters used. In this case, different metrics were employed to quantify

it. Generally, three types of conditions can be synthesised to meet most of the requirements necessary to consider an area sensitive:

- Areas with unstable and/or particularly unfavourable environmental conditions for biological production and recolonisation. These include those affected by pollution of various origins.
- Areas with threatened species.
- Areas that have some particular ecological value (proximity to the Ramsar site of the Project) and are sensitive to natural and anthropic disturbances, areas with keystone species or that host sites or processes that are fundamental from the ecological point of view.

It is important to note that these areas will not be affected during construction and will only be used as recipient areas for the relocation of fauna during pre-construction and construction, if required (SLR Consulting Limited, 2024c). Figure 5.27 below shows where the fragile areas were identified.

5.3.6.2 Irrigation channels

The project site is situated within an extended agricultural area, supported by an extensive and well-maintained network of irrigation canals with a total length of ~587,000 m (refer to Figure 5.28 below). Maintenance work is carried out twice a year along the canal i.e. desilting to remove sediments from the bottom of the channel, weeding to remove any vegetation in the channel, edges and berms; repair works including filling cracks with asphalt mixture and sand. The side channels are also maintained (including weeding, sediment draining or extraction of sediments etc) along with the drains (including the removal of vegetation and sediment). This is likely to result in temporary disturbance and reduced habitat suitability for some bird species.

One segment of this network runs within the project site adjacent to the northern boundary of the project, separated by a road. Development plans include upgrading this road to meet project requirements. If these improvements necessitate additional road width, it may be necessary to cover and channel or pipe the water in this segment to the agricultural properties west of the site. This 1,918 m segment, which may potentially be affected by construction activities, represents only 0.3% of the total irrigation canal network and is therefore not likely to have significant impact on bird species use for habitat.

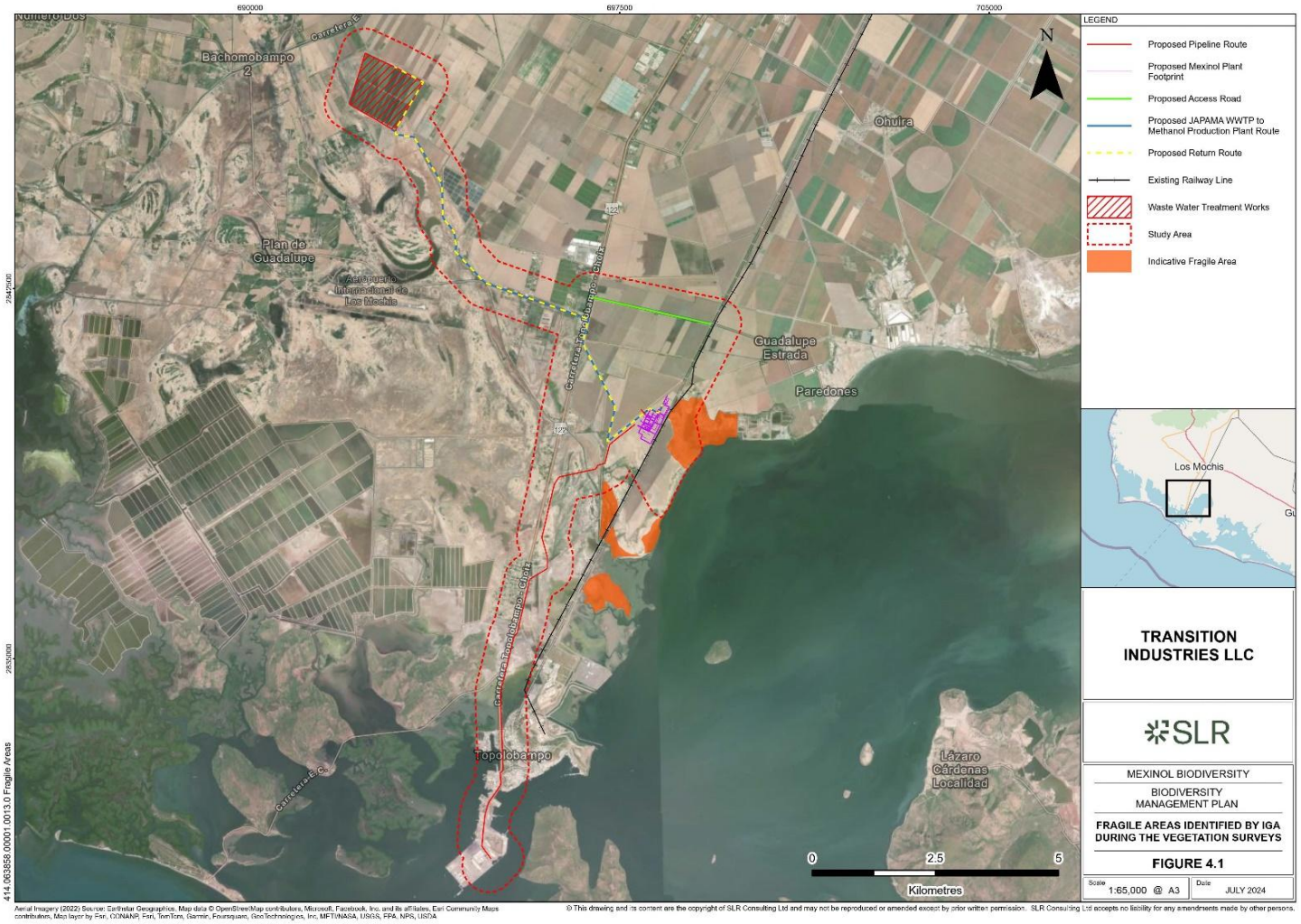


Figure 5.27: Fragile areas identified during vegetation surveys

Source: SLR International Corporation (see Appendix 1: Biodiversity Management Plan)

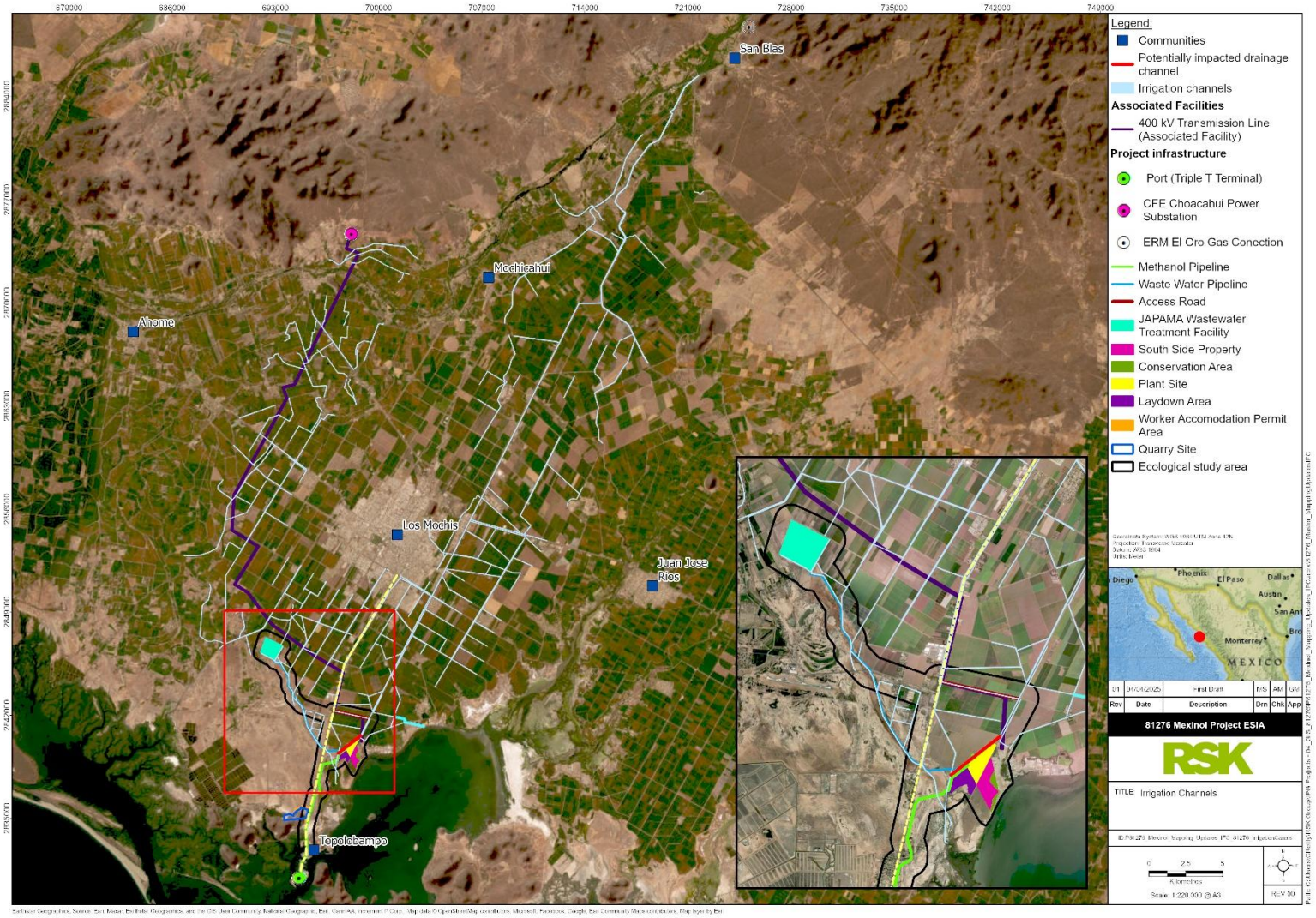


Figure 5.28: Irrigation channels in the Project's ecological study area

5.3.7 Critical Habitat and priority biodiversity values

5.3.7.1 Critical Habitat

A CHA was undertaken by SLR in May 2024 (SLR Consulting Limited, 2024b). The determination of critical habitat triggers was based on the following methods:

1. Identification of an Ecologically Appropriate Area of Analysis (EAAA) at an appropriate scale for biodiversity assessment.
2. Collection and verification of available information on biodiversity using baseline surveys, and secondary data, which draws together information from a number of sources including the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2024).
3. Screening of available information against IFC PS6 (IFC, 2012) criteria.

Two EAAAs were used which were identified and defined based for relevant species groups based on their common ecological requirements or behaviour as follows:

- EAAA for plants and terrestrial fauna: a localised area covering 23.56 km^2, equivalent to the Project's ecological AoI, including a buffer of 50 m for plants and terrestrial fauna.
- EAAA for migratory and congregatory birds and marine species: a larger area covering 225 km^2, based on the Ramsar / IBA site boundary, for migratory and congregatory birds and marine species. A small portion of the Ramsar site overlaps with the pipeline route.

The CHA was based on close examination of the following habitat and species data:

- Data collected during fieldwork (as documented in the MIA, MIA addendums and SLIP) to identify species that were confirmed within the Project's ecological AoI or indicated as potentially likely to occur and which could meet the thresholds for CHA.
- Biodiversity data available for the designated conservation priority areas to confirm if any birds of coastal features may meet CHA thresholds, including Species listed as occurring in the Lagunas de Santa María-Topolobampo-Ohuira Ramsar and Bahia Lechuguilla Key Biodiversity Area (IBA Site), Lagunas de Santa María-Topolobampo-Ohuira Ramsar site and (i.e., the EAAA). This KBA has been designated for *Sterna forsteri* (D1a), that meets Critical Habitat thresholds under criterion 3.

The calculations for determining the percentage of a species global population, within each EAAA was based on the proportion of each species Extent of Occurrence (EOO) that falls within the EAAA for that species group. In other words, spatial distribution of each species was used as a surrogate for population size as population data for all the species (including bird populations in the Ramsar site) that could trigger critical habitat was not available, as per recommendation of IFC GN6 (Clause 65). This approach assumes that species are spatially represented uniformly across their distribution which is typically not the case, especially for congregatory birds which nest or feed in specific localities. However, this approach is believed to be sufficiently robust for the current CHA as the EAAA in all cases represents a very small proportion of all the species EOO.

All biodiversity values with the potential to meet CHA thresholds were screened (Table 5-18) against the Criterions 1 to 4 (Table 5-17) and associated thresholds presented in IFC's performance standard 6 (IFC, 2012) and Guidance Note 6 (IFC, 2019).

Results of the screening exercise are summarised in Table 5-18 and Table 5-19. In summary, the following types of flora and fauna were screened in for further assessment:

- Two cacti plants under Criterion 2: Endemic or Restricted Range Species.
- Two reptiles under Criterion 2: Endemic or Restricted Range Species
- Seven birds under Criterion 3: Congregatory / Migratory; and
- Four mangrove species under Criterion 4: Highly Threatened and Unique Ecosystems.

No species were shortlisted under Criterion 1: Critically Endangered or Endangered Species, although two marine turtles listed as CR and EN may potentially occur in the Ramsar site but were screened out as there is no evidence of any breeding sites or population estimates to show regular occurrence. IFC GN6 guidance states that for critical habitats, consultation with relevant stakeholders is recommended to understand the importance or uniqueness of the site in the regional and global context (GN58). Stakeholder engagement activities were conducted by E3 during the completion of the Project's MIA and by SLR during the completion of the Supplemental Lenders Information Package (SLR 2022). Initial engagement sessions with local communities were also undertaken by E3, prior to the beginning of the Project to present information regarding the Project's environmental impacts and mitigation measures. The Project has sought to consult with the Ramsar and IBA site managers. A short exchange took place in February and 2024, to the outcome being that they didn't think the Project would impact the integrity of the IBA or Ramsar Site.

A separate Internationally Recognised Areas Assessment was undertaken for these sites specifically, based on the European Union's Appropriate Assessment Guidance (European Commission 2021). The conclusion of SLR's was that the Mexinol Project will have no likely significant effects on the qualifying features of the internationally recognised sites.

Nevertheless, the Bahia Lechuguilla KBA - IBA meets Critical Habitat thresholds under criterion 3 for **potentially** having over 1% of the global population of *Sterna forsteri* (Forster's tern - [14]based on the information provided in the IBA/KBA factsheet).[OBJ] In this context, the EAAA is Critical Habitat for this species.

Finally, the habitats within the EAAA are **not** highly threatened or unique (Criterion 4) or important for key evolutionary processes (Criterion 5).

Table 5.24 below provides a summary of the CHA.

Table 5.24: Summary of the Critical Habitat Assessment

[14] SLR's Internationally Recognised Areas Assessment (2024a) assesses the trigger species for the IBA/KBA.

IFC PS6 Criterion	Presence of qualifying biodiversity features	Critical Habitat – EAAA	Critical Habitat – ecological AoI
Criterion 1: CR/EN species	No	No	No
Criterion 2: Restricted range species	No	No	No
Criterion 3: Congregatory / Migratory species	Wetland birds with >1% of global population (green-winged teal and northern shoveler)	Yes	Yes
Criterion 4: Highly Threatened or Unique Ecosystems	No	No	No
Criterion 5: Key Evolutionary Processes	No	No	No

Source: SLR Consulting Limited (2024b)

Table 5-18: Summary Screening Tables

Species	Status	Range Restricted (<50,000km2)	Migratory[5]	Protected*	Habitat in Project Area	Likelihood in EAAA	Presence in Study Area	Year/ season recorded	Rationale for Screening	Further Assessment In/Out
Flora										
Mammillaria mazatlanensis	LC	Possibly	N/A	No	Halophytic vegetation and Sarco-crasicaule shrubland	Confirmed	Yes	May 2021 January 2022	Occurs in Project study area and is likely range restricted.	In (Potential Criterion 2)
Stenocereus alamosensis	VU	Possibly	N/A	No	Halophytic vegetation and Sarco-crasicaule shrubland	Confirmed	Yes	May 2021 January 2022	Occurs in Project study area and is likely range restricted.	In (Potential Criterion 2)
Stenocereus thurberi	LC	No	N/A	No	Sarco-crasicaule shrubland	Confirmed	Yes	May 2021	Occurs in Project study area but is not range restricted	Out
Fouquieria macdougalii	LC	No	N/A	No	Sarco-crasicaule shrubland	Confirmed	Yes	May 2021 January 2022	Occurs in Project study area but is not range restricted	Out
Ferocactus herrerae	VU	Possibly	N/A	No	Sarco-crasicaule shrubland	Confirmed	Yes	May 2021 January 2022	Occurs in Project study area but is not range restricted	Out
Pachycereus pecten-aboriginum	LC	No	N/A	No	Sarco-crasicaule shrubland	Confirmed	Yes	May 2021	Occurs in Project study area but is not range restricted	Out
Guaiacum coulteri	VU	No	N/A	Yes	Sarco-crasicaule shrubland	Confirmed	Yes	May 2021	Occurs in Project study area but is not range restricted	Out
Opuntia gosseliniana	LC	No	N/A	No	Sarco-crasicaule shrubland	Possible	No		Not confirmed in Project study area and is not range restricted	Out
Rhizophora mangle Red mangrove	LC	No	N/A	Yes (Threatened)	Mangrove	Confirmed	No	May 2021	Occurs in Project study area, is protected but is not range	In (Potential Criterion 4)

Species	Status	Range Restricted (<50,000km2)	Migratory[5]	Protected*	Habitat in Project Area	Likelihood in EAAA	Presence in Study Area	Year/ season recorded	Rationale for Screening	Further Assessment In/Out
								January 2022	restricted but is a priority habitat for Ramsar status	
Laguncularia racemosa White mangrove	LC	No	N/A	Yes	Mangrove	Confirmed	No	May 2021 January 2022	Occurs in Project study area, is protected but is not range restricted but is a priority habitat for Ramsar status	In (Potential Criterion 4)
Avicennia germinans Black mangrove	LC	No	N/A	Yes (Threatened)	Mangrove	Confirmed	No	May 2021 January 2022	Occurs in Project study area, is protected but is not range restricted but is a priority habitat for Ramsar status	In (Potential Criterion 4)
Conocarpus erectus Button mangrove	LC	No	N/A	Yes	Mangrove	Likely	No		Not confirmed in Project study area and is not range restricted.	In (Potential Criterion 4)
Birds										
Egretta rufescens Reddish Egret	NT	No	(R)	Yes	Saltpans, coastal lagoons	Confirmed	Yes	May 2021	Trigger for Topolobampo Ramsar Site	In (Potential Criterion 3)
Fregata magnificens Magnificent Frigatebird	LC	No	(R)	Special Protection	Mangroves and sarcocaule scrub	Confirmed	Yes	May 2021	Trigger for Topolobampo Ramsar Site	In (Potential Criterion 3)
Rallus obsoletus Ridgway's rail	NT	No	(R)	Yes	Forests, Wetlands, Marine Intertidal	Confirmed	No	N/A	Trigger species for Bahia Lechuguilla IBA	In (Potential Criterion 3)
Nyctanassa violacea Yellow-crowned night heron	LC	No	(R)	Special Protection	Forests, Wetlands, Marine Intertidal	Confirmed	No	N/A	Not threatened, range restricted or Ramsar site trigger species for congregatory/migratory species	Out
Egretta thula Snowy egret	LC	No	(R)	No	Wetlands, Marine Intertidal	Confirmed	No	N/A	Trigger species for Bahia Lechuguilla IBA	In (Potential Criterion 3)
Rynchops niger Black skimmer	LC	No	(MI)	No	Wetlands, Marine Intertidal	Confirmed	No	N/A	Trigger species for Bahia Lechuguilla IBA	In (Potential Criterion 3)

Species	Status	Range Restricted (<50,000km2)	Migratory[5]	Protected*	Habitat in Project Area	Likelihood in EAAA	Presence in Study Area	Year/ season recorded	Rationale for Screening	Further Assessment In/Out
Gelochidon Nilotica Common gull-billed tern	LC	No	(R)	No	Wetlands, Marine Intertidal	Confirmed	No	N/A	Trigger species for Bahia Lechuguilla IBA	In (Potential Criterion 3)
Sterna forsteri Forster's tern	LC	No	(MI)	No	Wetlands, Marine Intertidal	Confirmed	No	N/A	Trigger species for Bahia Lechuguilla IBA	In (Potential Criterion 3)
Charadrius nivosus Snowy Plover	NT	No	(R)	No	Coastal lagoons, salt flats and seasonal watercourses	Confirmed	Yes	May 2021	Not threatened, range restricted or Ramsar site trigger species for congregatory/migratory species	Out
Sternula antillarum Least Tern	LC	No	(MI)	No	Lakes, rivers estuaries	Confirmed	Yes	May 2021 January 2022	Not threatened, range restricted or Ramsar site trigger species for congregatory/migratory species	Out
Thalasseus elegans Elegant Tern	NT	No	(R)	Yes	Breeds on rocky areas at coast, sometimes in scrub on ground.	Confirmed	Yes	May 2021	Not threatened or range restricted but triggers Ramsar site for large breeding colony	In (Potential Criterion 3)
Mycteria americana Wood Stork	LC	No	(R)	No	Various including wetlands	Confirmed	Yes	May 2021	Not threatened, range restricted or Ramsar site trigger species for congregatory/migratory species	Out
Vireo pallens Mangrove Vireo	LC	No	(MI)	Yes	Subtropical dry forest and mangroves	Confirmed	Yes	May 2021	Not threatened, range restricted or Ramsar site trigger species for congregatory/migratory species	Out
Pelecanus occidentalis Brown Pelican	LC	No	(R)	No)	Inshore waters, estuaries, bays, breeds on islands	Confirmed	Yes	May 2021 January 2022	Not threatened or range restricted but triggers Ramsar site for large breeding colony	In (Potential Criterion 3)
Phalacrocorax auritus	LC	No	(R)	No	Sheltered marine bays, rocky coasts	Confirmed	No	May 2021 January 2022	Not threatened or range restricted but triggers Ramsar	In (Potential Criterion 3)

Species	Status	Range Restricted (<50,000km2)	Migratory[5]	Protected*	Habitat in Project Area	Likelihood in EAAA	Presence in Study Area	Year/ season recorded	Rationale for Screening	Further Assessment In/Out
Double-crested Cormorant					and islands, inland lakes				site for large breeding colony >20,000 birds (Isla Patos)	
Anas carolinensis[15] Green winged Teal	LC	No	(MI)	No	Marine and coastal ponds, lagoons and artificial aquatic habitats	Confirmed	No	N/A	Not threatened or range restricted but triggers Ramsar site for >1% of global population (5.24%)	In (Potential Criterion 3)
Spatula clypeata Northern Shoveler	LC	No	(MI)	No	Freshwater and saltwater lakes and marshes and lagoons	Confirmed	No	N/A	Not threatened or range restricted but triggers Ramsar site for >1% of global population (2.8%)	In (Potential Criterion 3)
Larus livens Yellow-footed gull	LC	No	(MI)	Yes (Special Protection)	Sandy and rocky islands usually with no or little vegetation	Confirmed	No	N/A		Out
Larus heermannii Heerman's Gull	NT	No	(R)	Yes (Special Protection)	Rocky coasts and islets	Confirmed	Yes	May 2021	Not threatened, range restricted or clearly identified Ramsar site trigger species	Out
Amphibians & Reptiles										
Lithobates forreri Forrer's Grass Frog	LC	No	N/A	Yes	Lowland forest and breeds in water bodies	Confirmed	Yes	May 2021 January 2022	Not threatened, range restricted or congregatory	Out
Incilius mazatlanensis Sinaloa Toad	LC	No	N/A	No	Lowland forest and breeds in water bodies	No	No	N/A	Not threatened, range restricted or congregatory	Out
Anaxyrus kelloggi Little Mexican Toad	LC	No	N/A	No	Coastal open lowlands and breeds in water bodies	No	No	N/A	Not threatened, range restricted or congregatory	Out

Species	Status	Range Restricted (<50,000km2)	Migratory[5]	Protected*	Habitat in Project Area	Likelihood in EAAA	Presence in Study Area	Year/ season recorded	Rationale for Screening	Further Assessment In/Out
					including artificial ponds					
Agalychnis dacnicolor Mexican Giant Tree Frog	LC	No	N/A	No	Xeric lowlands and tropical deciduous forest	No	No	N/A	Not threatened, range restricted or congregatory	**Out**
Phyllodactylus homolepidurus Sonoran Leaf-toed Gecko	LC	Po	N/A	Yes	Coastal habitats.	Confirmed	Yes	May 2021	Not threatened or congregatory but is range restricted	**In** (Potential Criterion 2)
Aspidoscelis costatus Western Mexican whiptail	LC	No	N/A	Yes	Coastal forest and savanna	Confirmed	Yes	May 2021 January 2022	Not threatened, range restricted or congregatory	**Out**
Ctenosaura macrolopha Sonoran Spiny-tailed Iguana	LC	No	N/A	No	Desert habitats and seasonally dry tropical lowlands	Confirmed	Yes	May 2021	Not threatened, range restricted or congregatory	**Out**
Ctenosaura pectinata Guerreran Spiny-tailed Iguana	LC	No	N/A	Yes (Special Protection)	Cacti and rocky areas, sandy soils	No (likely)	No	N/A	Not threatened, range restricted or congregatory	**Out**
Lampropeltis polyzona Atlantic Central American Milksnake	LC	No	N/A	No	Rocky semi desert, tropical scrub, mesquite grassland	No	No	N/A	Not threatened, range restricted or congregatory	**Out**
Trimorphodon tau Mexican Lyre Snake	LC	No	N/A	No	Rocky areas and croplands	No	No	N/A	Not threatened, range restricted or congregatory	**Out**
Gopherus evgoodei Sinaloan Thornscrub Tortoise	VU	Po	N/A	No	Rocky areas and croplands	No	No	N/A	Not threatened, range restricted or congregatory	**In** (Potential Criterion 2)
Mammals										

Species	Status	Range Restricted (<50,000km2)	Migratory[5]	Protected*	Habitat in Project Area	Likelihood in EAAA	Presence in Study Area	Year/ season recorded	Rationale for Screening	Further Assessment In/Out
Neotoma phenax Sonoran Woodrat	LC	No	N/A	Yes	Desert scrub and pine oak forest	Confirmed	Yes	May 2021	Not threatened, range restricted or congregatory	**Out**
Chaetodipus goldmani Goldman's Pocket Mouse	NT	No	N/A	No	Agriculture, rocky dry arroyos in thorn scrub, short forest on alluvial soils	Likely	No	N/A	Not threatened, range restricted or congregatory	**Out**
Marine Fauna: Turtles and Cetaceans										
Lepidochelys olivacea Olive Ridley Turtle	VU	No	(Peak turtle breeding season in Mexico is August to November, adults are more likely to be on or close to shore at this time)	Yes	No turtle nesting beaches known but reported to occur in Lagunas Santa Maria-Topolobampo-Ohiura Ramsar site, occasionally seen from boats	Possible	No (unlikely)	N/A	Large distribution and no evidence of breeding sites in Ramsar site	**Out**
Chelonia mydas Green Turtle	EN	No		Yes						
Dermochelys coriacea Leatherback Turtle	VU	No		Yes						
Eretmochelys imbricata Hawksbill Turtle	CR	No		Yes						
Tursiops truncates Common Bottlenose Dolphin	LC	No	(R)	Yes	Marine Pelagic Habitat			N/A		
Berardius bairdii Baird's Beaked Whale	LC	No	(Nearshore more often in summer)	Yes	Marine Pelagic Habitat			N/A		
Mesoplodon peruvianus Pygmy Beaked Whale	LC	No	(unclear)	Yes	Marine Pelagic Habitat			N/A		

Po – possible trigger for CHA

[5] Appears to be referred to as *Anas crecca* in MIA and Ramsar factsheet but on IUCN this bird does not occur. The green winged teal is listed as *Anas carolinensis* on IUCN redlist.
*Appears to be referred to as *Anas crecca* in MIA and Ramsar factsheet but on IUCN this bird does not occur. The green winged teal is listed as *Anas carolinensis* on IUCN redlist.

Table 5-19 Critical Habitat Determination

Species – Latin name	Common Name	Type	IUCN status	Extent of Occurrence (km^2)	Global population (number of individuals)	Presence in Area of Interest		Proportion (%) of global population		Critical Habitat – L qualifying features in EAAA	
						Ramsar (EAAA)	Study Area	EAAA (459 km^2)	Study Area (23.56 km^2)	EAAA	Study Area
Criterion 1: (a) CR/EN Species and (b) VU species											
1a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species)											
1b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a).											
1c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.											
No relevant species											
Criterion 2: Endemic & Restricted Range Species											
Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species											
Mammillaria mazatlanensis		Plant (cacti)	LC	Estimated <50,000	Unknown	Confirmed	Confirmed	<10%	<10%	No	No
Stenocereus alamosensis	Octopus Cactus	Plant (cacti)	VU	Estimated <50,000	Unknown	Confirmed	Confirmed	<10%	<10%	No	No
Gopherus evgoodei	Sinaloan Thornscrub Tortoise	Reptile	VU	Estimated 30,000 km^2	Unknown	Possible	No	<10%	<10%	No	No
Phyllodactylus homolepidurus	Sonoran Leaf-toed Gecko	Reptile	LC	Estimated 30,000 km^2	Unknown	Possible (edge of range)	No	<10%	<10%	No	No
Criterion 3: Congregatory and Migratory Species											
Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.											

Species – Latin name	Common Name	Type	IUCN status	Extent of Occurrence (km^2)	Global population (number of individuals)	Presence in Area of Interest		Proportion (%) of global population		Critical Habitat – L qualifying features in EAAA	
						Ramsar (EAAA)	Study Area	EAAA (459 km^2)	Study Area (23.56 km^2)	EAAA	Study Area
Egretta rufescens	Reddish Egret	Bird	NT	6670000	5000-9999	Confirmed	Confirmed	<1%	<1%	No	No
Fregata magnificens	Magnificent Frigatebird	Bird	LC	32700000	130000	Confirmed	Confirmed	<1%	<1%	No	No
Thalasseus elegans	Elegant Tern	Bird	NT	240000	51000-90000	Confirmed	Confirmed	<1%	<1%	No	No
Pelecanus occidentalis	Brown Pelican	Bird	LC	18600000	300000	Confirmed	Confirmed	<1%	<1%	No	No
Nannopterum auritum	Double-breasted Cormorant	Bird	LC	21500000	Unknown (increasing)	Confirmed	No (likely)	<1%	<1%	No	No
Anas carolinensis	Green winged Teal	Bird	LC	3900000	18800000	Confirmed	No (likely)	<1%	<1%	No	No
Sterna forsteri	Forster's tern	Bird	LC	8980000				>1%	>1%	YES	YES
Spatula clypeata	Northern Shoveler	Bird	LC	39900000	4300000 - 4700000	Confirmed	No (likely)	<1%	<1%	No	No
The IUCN Biodiversity Areas standard uses the following definition for reproductive unit: "the minimum number and combination of mature individuals necessary to trigger a successful reproductive event at a site Examples of five reproductive units include five pairs, five reproducing females in one harem, and five reproductive individuals of a plant species." Eisenberg, 1977. The Evolution of the Reproductive Unit in the Class Mammalia (footnote GN16 under GN72)											

5.3.7.2 *Priority habitats*

The results of the CHA concluded that the Project partially overlaps with a Ramsar site and KBA with the potential to qualify as CH due to the migratory/congregatory wetland birds (Criterion 3): it was defined that the EAAA qualify as CH (see Section 25.3.7.).

5.3.7.3 *Priority flora*

A total of 83 plant species were recorded during the 2021/2022 field surveys in the Project's ecological AoI, of which 34 were recorded in the halophytic vegetation, 44 in sarco-crasicaule scrub, 15 in agricultural areas, and 3 in mangroves. The 2023 surveys by IGA found a similar range of species, 105 species in total, belonging to 39 families. (SLR Consulting Limited, 2024b). Several plant species are endemic or near endemic to the pacific coastal regions from Guatemala, Mexico, and California; some of which are range restricted (i.e., have an extent of occurrence of <50,000 km^2) but do not trigger critical habitat. These include Octopus Cactus (*Stenocereus alamosensis*; VU), Chunari/ Mexican tree ocotillo (*Fouquieria macdougalii*; LC) and Southwestern barrel cactus (*Ferocactus herrerae*; VU) (see Table 5.25 below). No IUCN listed Critically Endangered or Endangered plant species were identified within the Project's ecological AoI, however three species are listed as Vulnerable, namely Octopus Cactus (*Stenocereus alamosensis)*, Southwestern barrel cactus (*Ferocactus herrerae*) and Guayacan (*Guaiacum coulteri*).

Five species recorded in the Project's ecological AoI are listed as protected under the NOM-059-SEMARNAT-2010 list of protected species namely black mangrove (*Avicennia germinans*; LC), red mangrove (*Rhizophora mangle*; LC), white mangrove (*Laguncularia racemose*; LC), and Guayacan (*Guaiacum coulteri*; VU) and button mangrove (*Conocarpus erectus*; LC). It is important to note that no mangroves are found within the Project footprint. Where juvenile mangrove trees are found within 100 m of the Project, horizontal directional drilling (HDD) will be used to avoid negative impacts on these trees.

A summary of these priority flora species recorded in the Project's ecological AoI is presented in Table 5.25 below.

Table 5.25: Priority flora species recorded within the Project's ecological AoI

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Endemic Status	Key threats[16]	Photograph
Mammillaria mazatlanensis	N/A	**Geographic Range:** Endemic to pacific coast of Mexico **Habitat:** Thorn scrub and coastal sand dunes **Population:** Locally very abundant. A density of 330 ind./0.25 ha is reported for the island of Mazocahui	Least Concern	Endemic to pacific coast of Mexico	Coastal tourist development areas	
Stenocereus alamosensis	Octopus cactus	**Geographic Range:** endemic to Mexico, in the states of Sinaloa and Sonora. Occurs from close to sea level to 800 m **Habitat:** common in coastal thorn scrub, but also foothill thorn scrub, low dry forest and desert scrub **Population:** abundant at a very local scale. Third of its range disappeared due to land conversion. This is a highly Very low recruitment rate	Vulnerable	Endemic to pacific coast of Mexico	Land conversion for agriculture and cattle ranching	

[16] According to the IUCN Red List of Threatened Species (2024)

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Endemic Status	Key threats[16]	Photograph
Fouquieria macdougalii	Chunari/ Mexican tree ocotillo	**Geographic Range:** Occurs from the Sonoran Desert of Central Sonora to the south along the Sierra Madre Occidental of southeast Sonora and adjacent Chihuahua, and to the central-south of Sinaloa. The EOO is 163,034.009 km^2. The Area of Observation (AOO) of the taxon is 436 km^2, but likely higher **Population:** Unknown	Least Concern	Endemic to pacific coast of Mexico (not range restricted)	Urban expansion and human settlements, land conversion for agriculture	
Ferocactus herrerae	Southwestern barrel cactus	**Geographic Range:** This species is endemic to Mexico, occurring in the states of Sinaloa and Sonora. It occurs mainly along the coasts from 0 – 400 m asl **Habitat:** The species occurs on the coastal plains from Guaymas, Sonora, to the centre of Sinaloa **Population:** locally abundant	Vulnerable	Endemic to pacific coastal region of Mexico	Land conversion for agriculture and shrimp farming	

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Endemic Status	Key threats[16]	Photograph
Guaiacum coulteri	Guayacan	**Distribution:** Native to Mexico and Guatemala **Ecology:** Dry forest species and can be found on dunes in rocky outcrops along the sand **Population:** Estimated to more than 10,000 mature individuals and the population is scattered and patchy within its local range Population decline is estimated at 41-50% based on habitat loss to agriculture expansion and dry forest loss	Vulnerable	Near-endemic	Habitat loss and over exploitation – logging, land conversion for agriculture	

Source: SLR Consulting Limited (2024b)

5.3.7.4 *Priority fauna*

A total of 150 fauna species of terrestrial vertebrates were recorded during SLR's May 2021 and June 2022 biodiversity surveys. A very similar amount was also identified during the December 2023 surveys (156 species) undertaken by IGA in 2023. The most representative group were birds with 81% of the species recorded, followed by mammals with 10.5%, reptiles with 7% and amphibians with 1.5%. Most birds recorded were associated with the irrigation canals (SLR Consulting Limited, 2024b).

5.3.7.4.1 Priority mammals

None of the mammal species identified by the baseline surveys are categorised as priority mammal species. A total of 16 species of mammals including eight carnivores, four rodents, three rabbits, and one bat (see Table 5.26). A California sea lion (*Zalophus californianus*) was recorded outside of the Project area on a beach adjacent to the Project area, but this was an unusual record, and the site is not typical of the occurrence of this species. No threatened species were recorded. Two species are endemic to Mexico but are not restricted range, one of which is protected (the Sonoran woodrat). As expected, more species were recorded in summer (14 species) than in the winter survey (six species), although this was partly related to lack of sherman and camera trapping in winter. Two additional mammal species were recorded in the January 2022 / winter surveys. No priority bat species were identified as occurring within the Project area. The area is not considered to supporting roosting habitat for bats. One species of cactus recorded within the site in Sarco-crasicaule scrub is pollinated by a nectar-feeding bat namely *Pachycereus pecten-aboriginum* (LC). This species is endemic to Mexico but is wide ranging in the Pacific region from Baja California, Sonora to Chiapas. It is also important to note that Sarcocaule scrub will not be cleared from within the project footprint (see Section 8.2.1.2).

Table 5.26: Mammal species recorded within the Project's ecological AoI

Scientific name	Common name	IUCN Red List rating16	Protection status[18]	Endemic Status
Tadarida brasiliensis	Mouse-tailed bat	LC[17]		
Lepus alleni	Antelope hare	LC		
Sylvilagus audubonii	Desert rabbit	LC		
Sylvilagus floridanus	Castilian rabbit	LC		
Otospermophilus variegatus	Rock squirrel	LC		
Dipodomys merriami	Merriam kangaroo rat	LC		
Chaetodipus pernix	Sinaloan pocket mouse	LC		Endemic to Mexico
Neotoma phenax	Sonoran woodrat	LC	Yes	Endemic to Mexico
Lynx rufus	Lynx	LC		
Canis latrans	Coyote	LC		

[17] LC = Least Concern

Scientific name	Common name	IUCN Red List rating16	Protection status[18]	Endemic Status
Urocyon cinereoargenteus	Grey fox	LC		
Mephitis macroura	Hooded skunk	LC		
Bassariscus astutus	Ringtail	LC		
Nasua narica	Coati	LC		
Procyon lotor	Raccoon	LC		
Zalophus californianus	California sea lion	LC	Yes	

Source: SLR Consulting Limited (2022)

5.3.7.4.2 Priority avifauna

A total of 130 species of birds were confirmed during fieldwork, in which 109 species were recorded in May 2021 33 fauna species were recorded in January 2022 and 130 species were recorded in December 2023 (SLR Consulting Limited, 2024b). Of the 33 species recorded in January 2022, 15 species had not been recorded in May 2021. Of these 15 species, 10 were summer migrants the other five are resident species, only MacGillivray's warbler (*Geothlyphis tolmiei*), is protected (threatened).

Over half of the confirmed species were resident species (58%), followed by winter migratory species (26%); while 10 species are partially resident/migratory, three are summer migratory species Cliff swallow (*Petrochelidon pyrrhonota*; LC), Least Tern (*Sternula antillarum*; LC) and Elegant Tern (*Thalasseus elegans*; NT); and one vagrant species: Stilt sandpiper (*Calidris himantous*; NT). Four species were classified as introduced comprising pigeons, cattle heron, and domestic sparrow. Table 5.27 below lists the 10 priority avifauna species recorded in the Project's ecological AoI during fieldwork, and the additional species as noted below, all of which are either classified in the threatened or special protection categories under NOM-059-SEMARNAT-2010.

An additional species that has been confirmed through data as having been present in the area is the Sterna forsteri (Forster's tern). Information on this species is also included in the table.

Table 5.27: Priority avifauna (bird) species recorded within the Project's ecological AoI (During fieldwork)

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Protection status[18]	Endemic Status	Key threats[16]	Photograph
Tachybaptus dominicus	Least grebe	**Distribution:** Widespread throughout Central and South America **EOO:** 27,000,000 km^2 **Population:** 20,000-500,000 mature individuals, stable **Habitat:** Wetlands (inland) **Migratory / Congregatory:** Congregatory (and dispersive)	Least Concern	Special protection	N/A	N/A	 (Diaz, 2017; photograph not from the Project area)
Charadrius nivosus	Snowy plover	**Distribution:** Widespread. Partial migrant in North America, Central America, western South America and the Caribbean **EOO:** 39,300,000 km^2 **Population:** 24,000-31,000 mature individuals, assumed to be undergoing a moderately rapid population decline **Habitat:** Primarily occurs along sea coasts, but also open flats near brackish or saline lakes, lagoons, seasonal water courses, salt-works and depressions	Near Threatened	Threatened	Near Endemic (West Coast California, Mexico Costa Rica)	Disturbance of coastal habitats, wetland degradation and loss, avian botulism	 (Heaton, 2022; photograph not from the Project area)

[18] Under NOM-059-SEMARNAT-2010

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Protection status[18]	Endemic Status	Key threats[16]	Photograph
		Migratory / Congregatory: Congregatory (and dispersive)					
Larus heermanni	Heerman's gull	**Distribution:** Ranges throughout Canada, USA, Mexico and Guatemala **EOO:** 1,100,000 km^2 **Population:** ~350,000 mature individuals, ~92% of which nest on Isla Rasa, Mexico **Habitat:** Breeds very synchronously and often at high densities (up to 110 nests/100 m^2) on remote rocky coasts and islets **Migratory / Congregatory:** Migratory and congregatory (and dispersive)	Near Threatened	Special protection	N/A	El Niño Southern Oscillation, over-fishing (prey abundance)	 (SLR Consulting Limited, 2024b)
Sternula antillarum	Least tern	**Distribution:** Breeds along almost the entire coast of North America, excluding Alaska and Canada, on the northern coast of Central America and locally on the northern coast of South America. It is migratory, wintering on the southern coast of Central America, and the northern and Atlantic coast of South America as far south as central Brazil	Least Concern	Special protection	N/A	Human disturbance – patagial tagging, recreational activities, habitat loss	 (Eckerson, 2015; photograph not from the Project area)

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Protection status[18]	Endemic Status	Key threats[16]	Photograph
		EOO: 9,890,000 km^2 **Population:** Decreasing, although some populations are increasing or have unknown trends **Habitat:** Lakes, rivers and estuaries, strictly on the coast in some regions but inland in others **Migratory / Congregatory:** Migratory					
Thalasseus elegans	Elegant tern	**Distribution:** Breeds along the Pacific coast from south California, USA., to Baja California and the Gulf of California, Mexico **EOO:** 240,000 km^2 **Population:** 51,000-90,000 individuals with up to 95% breeding on Isla Rasa in the Gulf of California **Habitat:** Breeds on flat rocky areas and is strongly tied to the coast. It forages in inshore waters, estuarine habitats, salt ponds and lagoons. **Migratory / Congregatory:** Migratory and congregatory (and dispersive)	Near Threatened	Special protection	N/A	Declines in fish stocks due to over-fishing and climatic changes	 (Sullivan, 2015; photograph not from the Project area)

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Protection status[18]	Endemic Status	Key threats[16]	Photograph
Mycteria americana	American / wood stork	**Distribution:** USA, Caribbean and Latin America **EOO:** 28,600,000 km^2 **Population:** Decreasing, although some populations have unknown trends **Habitat:** Forest, Grassland, Wetlands (inland), Marine Intertidal, Artificial/Aquatic & Marine **Migratory / Congregatory:** Migratory and congregatory	N/A	Special protection	N/A	N/A	 (SLR Consulting Limited, 2024b)
Egretta rufescens	Reddish egret	**Distribution:** Occurs in Baja California and south along the Pacific coast of Mexico, the southern coast of the USA, through the Caribbean islands, particularly Cuba and Dominican Republic, and down the Central American coast to northern Colombia and Venezuela. **EOO:** 6,670,000 km^2 **Population:** Overall population is best placed in the band 5,000-9,999 mature individuals **Habitat:** Frequents shallow coastal waters, salt-pans, open marine flats and shorelines	Near Threatened	Special protection	N/A	Hunting for food and fishing bait, predation, habitat shifting and alteration	 (Kynd, 2019; photograph not from the Project area)

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Protection status[18]	Endemic Status	Key threats[16]	Photograph
		Migratory / Congregatory: Congregatory (and dispersive)					
Parabuteo unicinctus	Harris' hawk	**Distribution:** USA, Central and South America **EOO:** 34,100,000 km^2 **Population:** Unknown, decreasing in North America **Habitat:** Forest, shrubland, grassland **Migratory / Congregatory:** No	Least Concern	Special protection	N/A	N/A	 (SLR Consulting Limited, 2024b)
Vireo pallens	Mangrove vireo	**Distribution:** Occurs throughout Belize; Costa Rica; El Salvador; Guatemala; Honduras; Mexico; Nicaragua **EOO:** 2,380,000 km^2 **Population:** ~500,000-4,999,999 individuals **Habitat:** Mainly in subtropical dry forest and mangroves **Migratory / Congregatory:** No	Least Concern	Special protection	N/A	N/A	 (Davies, 2014; photograph not from the Project area)

Scientific name	Common name	Ecology	IUCN Red List rating[16]	Protection status[18]	Endemic Status	Key threats[16]	Photograph
Geothlypis tolmiei	MacGillivray's warbler	**Distribution:** Canada, USA, Central America **EOO:** 2,090,000 km^2 **Population:** 11,000,000 mature individuals, undergoing a moderate decline **Habitat:** Forest and shrubland **Migratory / Congregatory:** Migratory	N/A	Threatened	N/A	Climate change	 (Shaw, 2016; photograph not from the Project area)
Sterna forsteri	Fosters Tern	**Distribution:** North and Central America, breeding seasonally in southern Canada, and northern USA and wintering along the eastern and western coast of Mexico and Central America. **EOO:** 8,989,000 km^2 **Population:** 120,000 mature individuals, increasing **Habitat:** Terrestrial, freshwater, marine **Migratory / Congregatory:** Migratory	Least Concern	N/A	N/A	N/A	 (Birdlife, 2025, photograph not from project area)

Source: SLR Consulting Limited (2024b)

5.3.7.4.3 Priority herpetofauna

During the baseline survey undertaken in May 2021 field survey, two species of amphibians and 10 species of reptiles were recorded (see Table 5.28 below). The most dominant species were the desert spiny lizard (*Sceloporus magister*) with 20 individuals, followed by the Sabinal Frog (*Leptodactylus melanonotus*; LC) and the gecko (*Hemidactylus frenatus*; introduced species) with 10 individuals each, and the lizard (*Aspidoscelis costata*; LC) with nine individuals. Two species recorded as Special Protection under NOM-SEMARNAT- 2010 were recorded, Sonoran leaf-toed gecko (*Phyllodactylus homolepidurus*; LC) and the western Mexico whiptail (*Aspidoscelis costata*; LC) (SLR Consulting Limited, 2024b).

During the January 2022 survey, only three herpetofauna species were re-recorded and no additional species were recorded. None of the herpetofauna species were identified as priority species.

Table 5.28: Herpetofauna species recorded within the Project's ecological AoI

Scientific name	Common name	IUCN Red List rating[16]	Protection status[18]	Endemic Status
Amphibians				
Leptodactylus melanonotus	Sabinal Frog	LC		
Lithobates forreri	Forrer's Grass Frog	LC	Yes	
Reptiles				
Hemidactylus frenatus	Common house	Not applicable	Not applicable	
Ctenosaura macrolopha	Sonoran spiny- tailed iguana	Not evaluated	Protected under CITES	Endemic to Mexico
Dipsosaurus dorsalis	Common desert	LC		
Holbrookia elegans	Sonoran earless lizard	LC		Near-endemic (South Arizona and West Mexico)
Sceloporus magister	Desert spiny lizard	LC		
Urosaurus ornatus	Ornate tree lizard	LC		
Phyllodactylus homolepidurus	Sonoran leaf-toed gecko	LC	Yes	Endemic to Mexico
Aspidoscelis costata	Western Mexico whiptail	LC	Yes	Endemic to Mexico
Masticophis bilineatus	Sonoran whipsnake	LC		Near-endemic (South Arizona and West Mexico)
Trachemys nebula	Slider turtle	Not evaluated		Near endemic

5.3.7.4.4 Priority aquatic species

No priority aquatic species were identified during the ecological surveys or as part of the biotic impact assessment and critical habitat assessment.

5.3.8 Terrestrial and aquatic invasive species

During the ecological surveys undertaken in May 2021 and January 2022, the introduced and invasive species, *Tamarix chinensis* (common names: five-stamen tamarisk/Chinese tamarisk/saltcedar; LC see Figure 5.29) was identified along the pipeline corridor, within the Project's ecological AoI. *Tamarix chinensis* is a shrub or tree that is often found along roadsides or adjacent to urban areas. The species is native to China and has been introduced in many parts of the world, including Mexico, the United States of America and South Africa (GBIF, 2024). This species will be monitored and controlled in accordance with the Project's reforestation plan.

Figure 5.29: *Tamarix chinensis*

Source: (Hough, 2017)
Note: This photograph was not taken in the Project area.

5.3.9 Existing threats

One of the main existing threats to biodiversity is land use change for agriculture and aquaculture, which contributes to habitat modification and fragmentation within the Project's ecological AoI (Mexinol, 2021). Agriculture is one of the main economic activities in Ahome, using an estimated 174,468 ha of land within the municipality, of which 151,485 ha is irrigated (Mexinol, 2021). The Río Fuerte Irrigation District No.075, Red Valle del Fuerte, covers 60.12% of the Project area.

Another existing threat to biodiversity in the Project area is urban expansion and development, which also contribute to habitat modification and fragmentation in the Project's ecological AoI. For example, the construction of industrial facilities, quarrying

operations and the building of the Los Mochis-Topolobampo highway to the port have contributed to habitat modification and loss of flora species. In particular, these installations have significantly altered the surface hydrology in the surrounding area and have caused the complete loss of mangrove swamp/lagoon to the east of the Los Mochis-Topolobampo highway (SLR Consulting Limited, 2024a). It is important to note that the pipeline will be routed within this highly modified area to minimise the impact to biodiversity (SLR Consulting Limited, 2024a).

5.4 Socioeconomic baseline

5.4.1 Introduction

This section describes the existing socioeconomic conditions (including human rights, gender and cultural heritage), or baseline, in and around the Project's social AoI. The baseline's purpose is to describe the social receptors that could potentially be affected by the proposed Project and provide a reference case against which potential impacts can be assessed and monitored.

5.4.1.1 Social AoI

A Study Area was defined based on the distance to the Project components. The studies confirmed that the Project's Direct and Indirect social Areas of Influence (AoI) consider the potential socioeconomic risks and impacts for the area affected by:

- Project activities and facilities directly owned, operated and managed by the Project (planned activities)
- unplanned but predicable impacts caused by the Project (unplanned events).

The Project's social AoI is divided into three areas: a Direct AoI, a secondary Indirect AoI and a Regional / National AoI. The Direct and Indirect AoIs are shown in Figure 5.30 below.

The Direct AoI includes the PACs within closest proximity to the Project infrastructure, which have potential to be directly affected by impacts associated with the development of the land. The Direct AoI includes the settlements of Ejido Rosendo G. Castro, Topolobampo and Ejido Topolobampo, and focuses on:

- the Project development site and immediate surroundings (including, methanol pipeline route, Triple T[19] Jetty)
- sections of Los Mochis-Topolobampo highway that may experience an increase in traffic from the transport of goods and people during construction and
- an area affected by the JAPAMA raw and reject water transfer pipeline route.

The Indirect AoI consists of a wider zone (up to 12 km) surrounding the Direct AoI and is defined by settlement areas that may experience indirect negative impacts such as worker influx, housing impacts and changes to baseline contexts for health and social conflict and positive socioeconomic benefits or impacts such as increased employment and multiplier economic effects. The Indirect AoI includes the city of Los Mochis, surrounding ejidos and settlements proximate to the main Project development site. A full list of PACs in the Direct and Indirect AoI is provided in Table 5.29. Note that regardless of indirect or direct, these communities are receiving the same benefits and engagement from the project.

Finally, the social AoI for this ESIA included a Regional / National AoI, since Project activities may exert indirect, unintended or cumulative impacts at the regional or national scale. Regional impacts will extend to the national scale where national stakeholders or

[19] Transoceanic Terminal of Topolobampo (Source: https://www.triplet.com.mx/)

receptors may experience positive impacts such as wider economic effects or benefits to the national economy, education and skills.

It should be noted that the Project's social AoI for associated facilities that would not have been constructed, expanded or viable without the Project will be considered separately within an Associated Facilities Assessment (Chapter 10).

Table 5.29: PACs within the Project's Direct and Indirect AoI

Name of PAC	AoI Type	Indigenous or Non-Indigenous Categorisation	% of total population that belong to an indigenous household
Topolobampo*	Direct	Non-Indigenous	1.5%
Ejido Topolobampo*	Direct	Non-indigenous	3.6%
Ejido Rosendo G. Castro*	Direct	Non-indigenous	1.6%
Los Mochis	Indirect	City	1.2%
Benito Juárez**	Indirect	Non-indigenous	0.4%
Campo Guadalupe Estrada	Indirect	Non-indigenous	2.8%
Ejido 9 de Diciembre	Indirect	Non-indigenous	0.6%
Ejido Benito Juárez	Indirect	Non-indigenous	1%
Ejido Plan de Guadalupe	Indirect	Non-indigenous	0%
Ejido Ricardo Flores Magón	Indirect	Non-indigenous	1.4%
Ejido Tortugas Número 2	Indirect	Non-indigenous	7.6%
Paredones	Indirect	Non-indigenous	10.4%
Plan de Ayala [Campo Cinco]	Indirect	Non-indigenous	0.4%
Ejido Ohuira*	Indirect	Indigenous	24.5%
Ahome	Regional	City	N/A
Mochicahui	Regional	City	N/A
Juan Jose Rios	Regional	City	N/A

*Note: *Direct AoI PAC. *note: Benito Juárez assumed to be located within Ejido Benito Juárez.

The figure below presents the overlapping AoIs to show the rationale behind the definition of the social AoI.

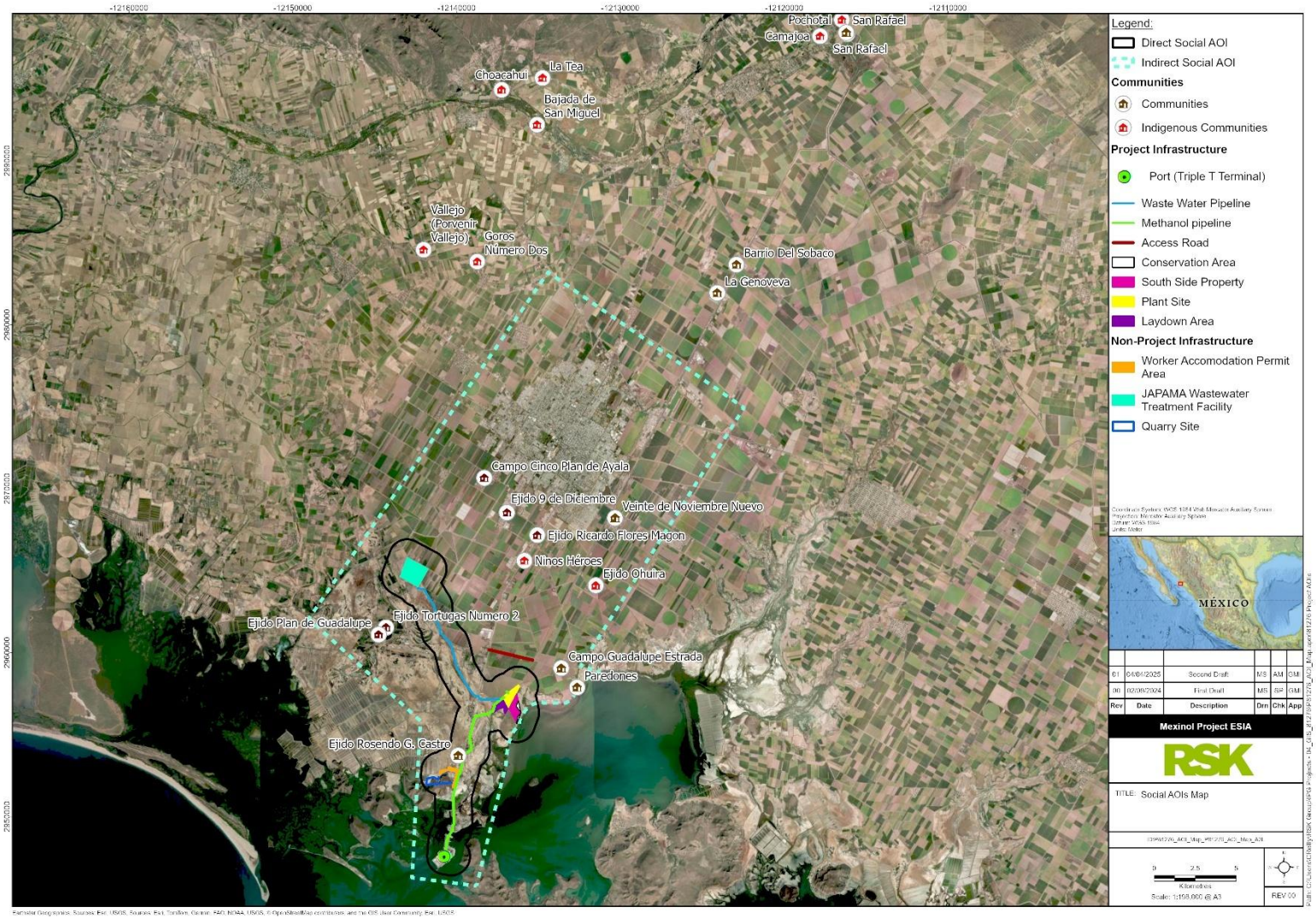


Figure 5.30: Social Area of Influence

5.4.1.2 Community Profiles

As seen in the following tables and figures, community profiles have been created for the Direct AoI communities (Topolobampo, Ejido Topolobampo and Rosendo G. Castro).

Paredones and Campo Guadelupe Estrada, despite not being directly impacted by the Project, are located in near proximity to the Project (3.2 – 3.6 km away, see Figure 5.31) and have 10.8% and 2.4% of their households, respectively, identifying as Indigenous Peoples. Thus, community profiles have also been created for these two additional communities.

As these community profiles summarise data found throughout this chapter, the exact sources of information have not been provided in the tables.

Table 5.34 provides a summary of the main aspirations and challenges faced by these communities. Data was obtained first-hand from various stakeholder engagement and data collection efforts are described in Section 5.4.2.

Campo Guadalupe Estrada	Distancia (km)
Instalaciones (operaciones)	3.2
Ducto de metanol (construcción)	3.6
Ducto de agua (construcción)	3.8

Paredones	Distancia (km)
Instalaciones (operaciones)	3.6
Ducto de metanol (construcción)	4.6
Ducto de agua (construcción)	4.5

Figure 5.31: Project distance from Paredones and Campo Guadelupe Estrada

Table 5.30: Community Profile – Topolobampo

Demographics	Community health, safety and welfare	Education	Economy and livelihoods	Land and social infrastructure	Cultural heritage
• Topolobampo has a population of 6,198. 90% of the population were born within the Municipality of Ahome, Sinaloa. • Religious affiliation: 83% Catholic, 8% Protestant / Evangelical Christian, 9% are not affiliated with a religion • Demographic breakdown: 50% men and 50% women; young (under 15) 21%; working age (15-65) 67% ; elderly (65+) 12% • 4% of the total population belong to an indigenous household • 0.65% of (all ages) speak an indigenous language • 30% are female-headed households.	• Public health clinic, health centre, and private health practice • 80% are affiliated to health service • 9% of people encounter a small degree of difficulty carrying out daily tasks.	• Preschool/kindergarten and a primary school • Secondary or tele-secondary school • Does not have preparatory or tele-preparatory school/ high school • 2% of females and 3% of males aged over 15 years of age did not pass primary education and only attended nursery • 2% of people aged 15 + are illiterate.	• 71% of people aged 12+ are economically active • 56% of total males aged 12+ are economically active • 42% of total females aged 12+ are economically active • Tourism is an increasingly important activity • Markets, including open-air market, and grocery store.	• 0-2% households do not have water access • 1% of private dwellings do not have electricity • 97% of inhabited private dwellings are connected to the public drainage system and have floor made from non-earthen material or dirt • 26% of private dwellings have a fixed telephone line and 53% have internet access • 1% of inhabited private dwellings do not possess a single household good • Marina, 1 (*) • Shipping terminal, 2 (*) • Informal food stalls, 3 (*) • Viewing point, 4 (*) • Souvenir stalls 5 (*) • Waterfront park 6 (*) • Two hotels • One boutique guesthouse.	• No structures of historical or archaeological significance. • Topolobampo Cultural Centre (Centro Cultural de Topolobampo (7).

(*) See image below.

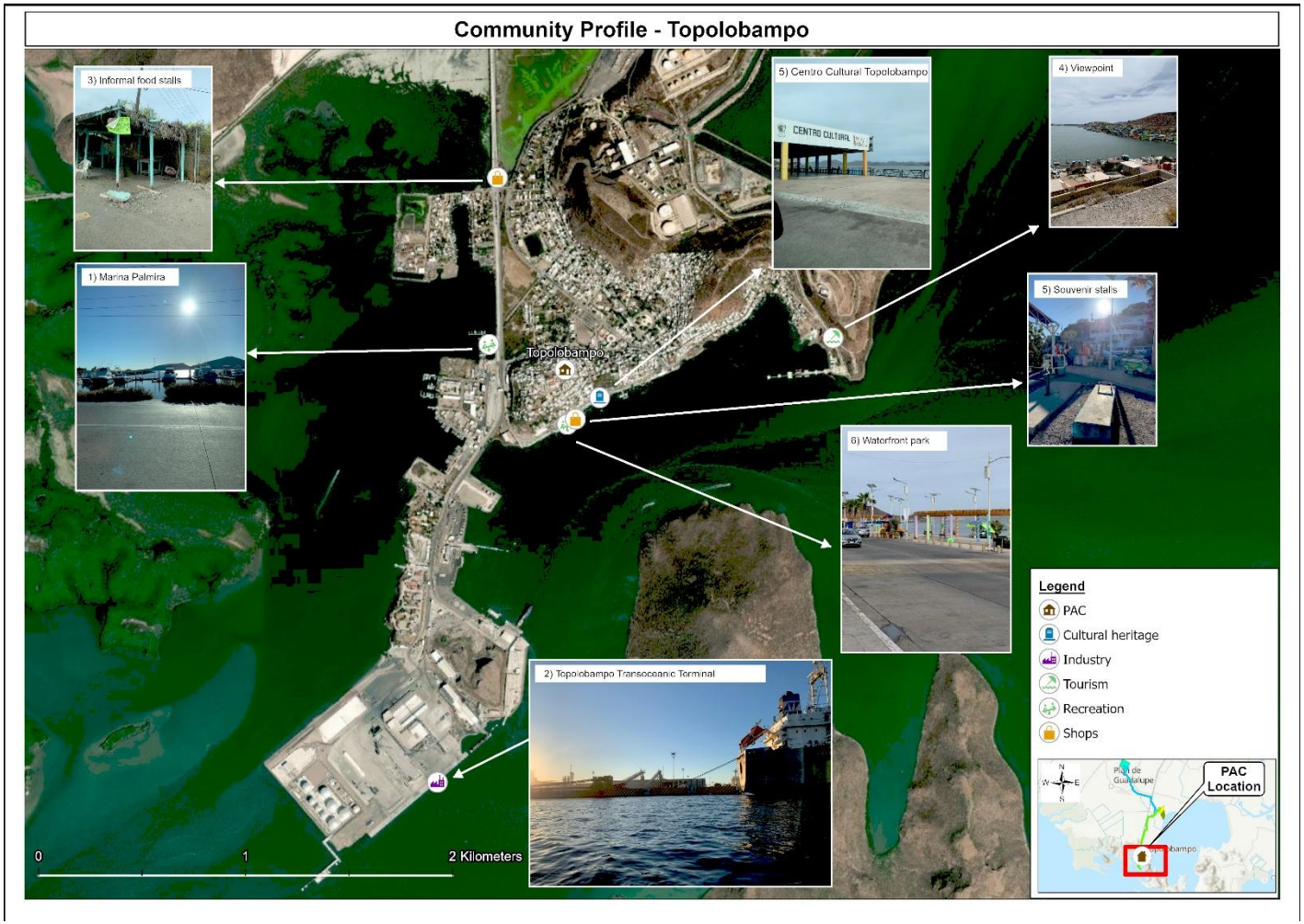


Figure 5.32: Topolobampo

Table 5.31: Community Profile – Ejido Topolobampo

Demographics	Community health, safety and welfare	Education	Economy and livelihoods	Land and social infrastructure	Cultural heritage
• Ejido Topolobampo has a population of 111. 82% of the population were born within the Municipality of Ahome. • • **Religious affiliation: 68**% Catholic, 17% Protestant / Evangelical Christian, 14% are not affiliated with a religion • **Demographic breakdown:** 50% men and 50% women; young (under 15) 25%; working age (15-65) 68% ; elderly (65+) 6% • 2% of the total population belong to an indigenous household • 0.9% of (all ages) speak an indigenous language • 37% are female-headed households.	• No public health clinic, health centre, or private health practice • 69% are affiliated to health service • 13% of people encounter a small degree of difficulty carrying out daily tasks.	• No schools of any level • All females and males aged over 15 years of age passed primary education • All people aged 15 + are literate.	• 80% of people aged 12+ are economically active • 58% of total males aged 12+ are economically active • 33% of total females aged 12+ are economically active • Tourism is an increasingly important activity • Does not have a market or grocery store.	• 0-2% households do not have water access • All private dwellings have electricity • 87% of inhabited private dwellings are connected to the public drainage system • All of occupied private dwellings have floor made from non-earthen material or dirt • No private dwellings have a fixed telephone line • 23% of private dwellings have internet access.	• No structures of historical or archaeological significance.

Figure 5.33: Ejido Topolobampo

Table 5.32: Community Profile – Rosendo G. Castro

Demographics	Community health, safety and welfare	Education	Economy and livelihoods	Land and social infrastructure	Cultural heritage
• Ejido Rosendo G. Castro has a population of 702. 85% of the population were born within the Municipality of Ahome. • **Religious affiliation:** 63% Catholic, 16% Protestant / Evangelical Christian, 21% are not affiliated with a religion • **Demographic breakdown:** 48% men and 52% women; young (under 15) 31%; working age (15-65) 62% ; elderly (65+) 8% • 2% of the total population belong to an indigenous household • 0.43% of (all ages) speak an indigenous language • 37% are female-headed households	• No public health clinic, health centre, or private health practice • 77% are affiliated to health service • Security concerns were not highlighted • 15% of people encounter a small degree of difficulty carrying out daily tasks.	• Has a preschool/kindergarten and a primary school (2) • Does not have a secondary or tele-secondary school and no preparatory or tele-preparatory school/ high school • 6% of females and 5% of males aged over 15 years of age that did not pass primary education and only attended nursery • 6% of people aged 15 + are illiterate.	• 70% of people aged 12+ are economically active • 52% of total males aged 12+ are economically active • 34% of total females aged 12+ are economically active • Shrimp and clams are farmed, 1 (*) • Does not have a market or open air market • Has a grocery store. • Events centre, 5 (*)	• 5% households do not have water access • 2% of private dwellings do not have electricity • 95% of inhabited private dwellings are connected to the public drainage system • 97% of occupied private dwellings have floor made from non-earthen material or dirt • No private dwellings have a fixed telephone line • 30% of private dwellings have internet access • 2% of inhabited private dwellings do not possess a single household good • Shrimp farm • Trailer park, 3 (*)	• Cemetery, 4 (*)

(*) See image below.

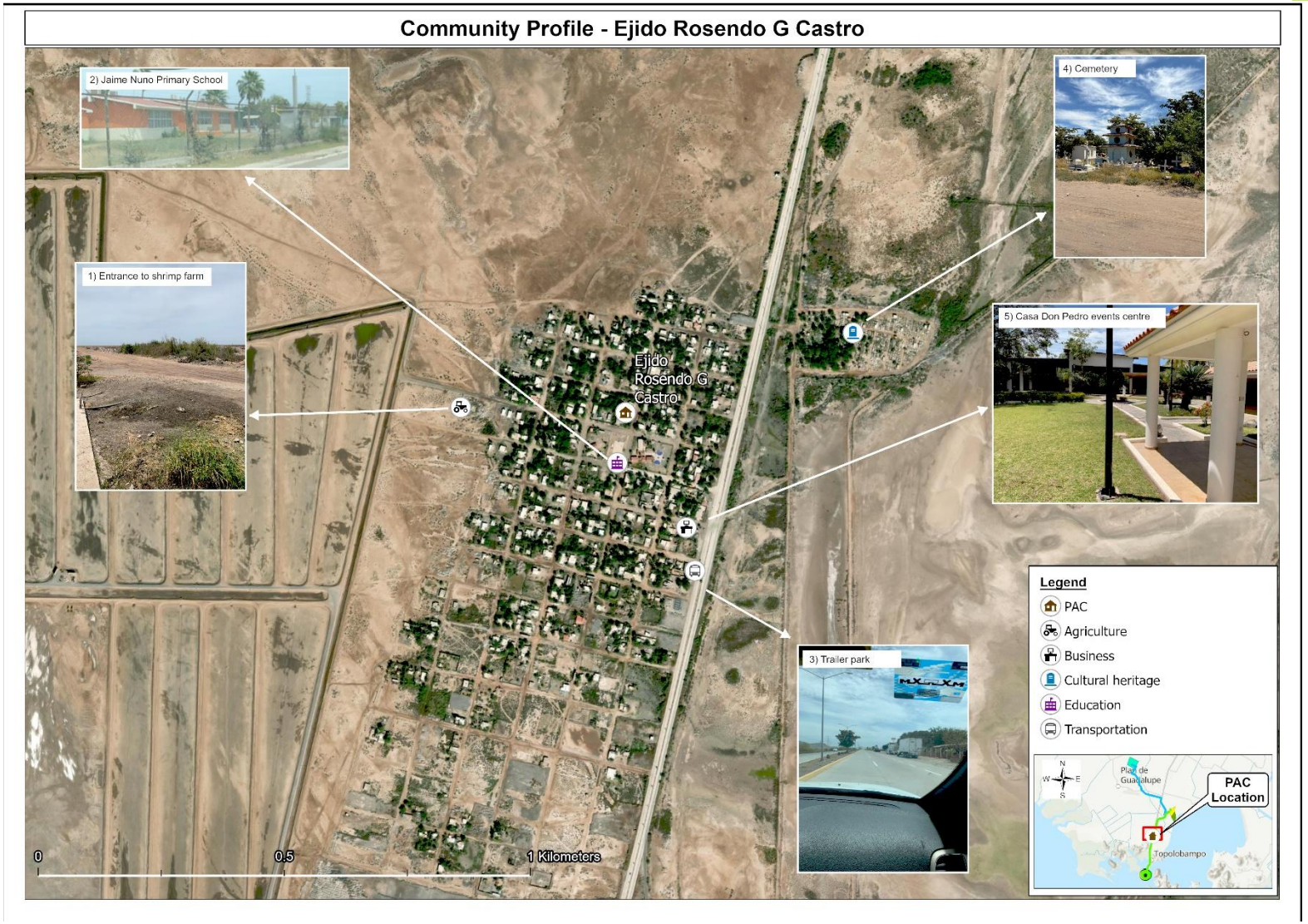


Figure 5.34: Rosendo G. Castro

Table 5.33: Community Profile – Paredones

Demographics	Community health, safety and welfare	Education	Economy and livelihoods	Land and social infrastructure	Cultural heritage
• Paredones has a population of 942. 90% of the population were born within the Municipality of Ahome. • **Religious affiliation:** 84% Catholic, 10% Protestant / Evangelical Christian, 6% are not affiliated with a religion • **Demographic breakdown:** 51% men and 49% women; young (under 15) 26%; working age (15-65) 68% ; elderly (65+) 6% • 10% of the total population belong to an indigenous household • 3.84% of (all ages) speak an indigenous language • 22% are female-headed households	• Has a public health clinic or health centre • Does not have a private health practice • No medical centre or hospital is present • 85% are affiliated to health service • 13% of people encounter a small degree of difficulty carrying out daily tasks • Have traditional medicinal knowledge.	• There is one kindergarten, a regular primary school (2) school and one tele-secondary school that shares premises with the tele-preparatory school • Does not have a high school • Attendance is good • The majority of children who successfully graduate from the tele-secondary school go on to high school • 60% of students are female and 40% are male • School has poor conditions • 3% of all females and 4% of all males aged over 15 years of age did not pass primary education • 4% of people aged 15 + are illiterate • Children prefer to stay in their community rather than pursuing higher education.	• 80% of people aged 12+ are economically active • 61% of total males aged 12+ are economically active • 39% of total females aged 12+ are economically active • Does not have a market or open air market • Does have a grocery store • Young people generally want to stay in the Los Mochis area due to the potential of job opportunities in the area. • Fishing is the most common livelihood activity • Children voluntarily help their families with catching and preparing shrimp without affecting their education • Approximately 8% of children are not interested in pursuing fishing as their main livelihood • People engage in agriculture during the fishing off-season in nearby agricultural fields • Most fishermen receive economic support once a year.	• 0-2% households do not have water access • All private dwellings have electricity • 94% of inhabited private dwellings are connected to the public drainage system • 97% of occupied private dwellings have floor made from non-earthen material or dirt • 2% private dwellings have a fixed telephone line • 21% of private dwellings have internet access • Football pitch, 1 (*) • Fishing pier, 4 (*)	• A ramada • A ceremonial centre, 3 (*) • The sea is important • Festivities combine Yoreme ritual practices and Catholic religion.

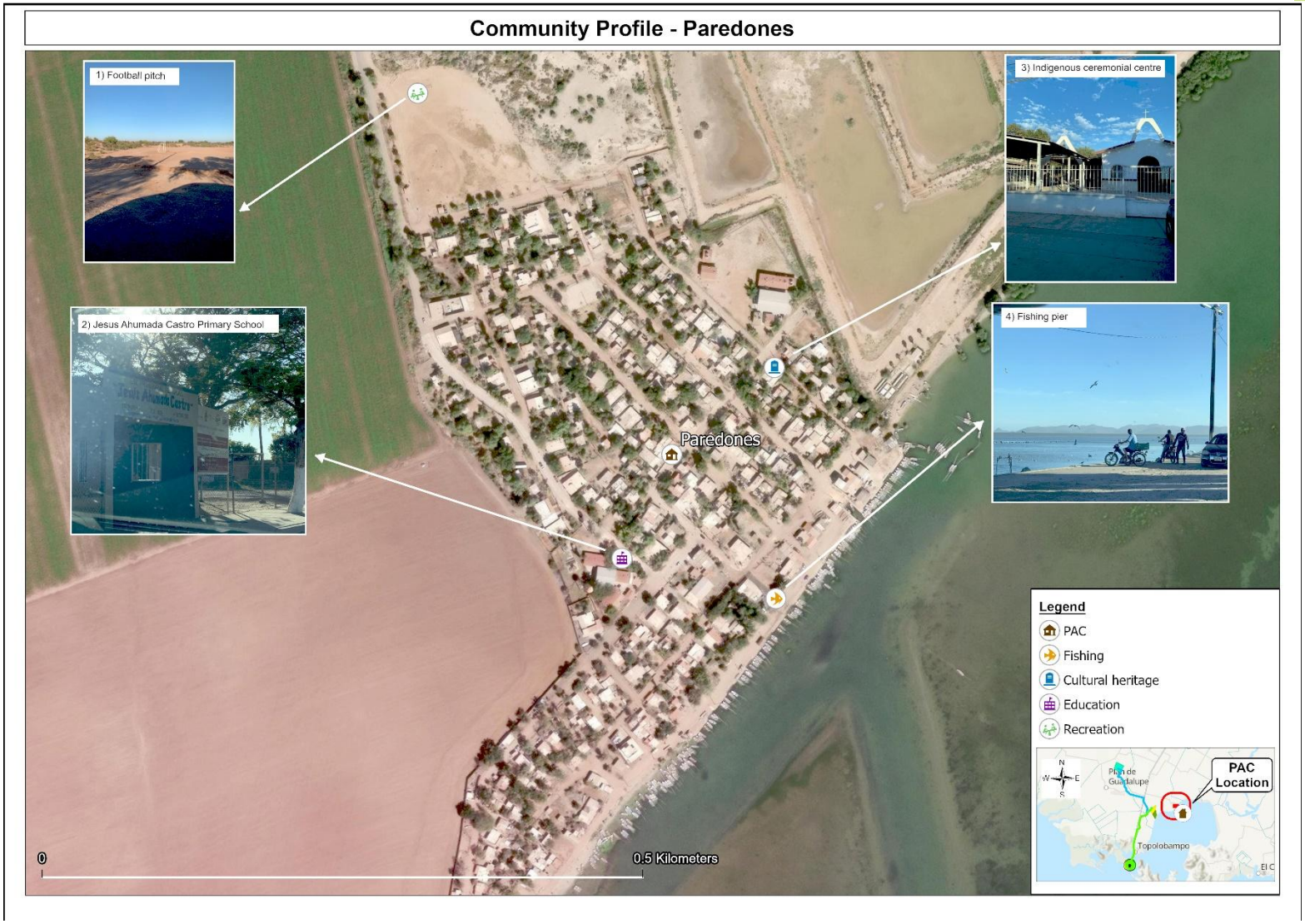


Figure 5.35: Paredones

Table 5.34: Community Profile – Campo Guadalupe Estrada

Demographics	Community health, safety and welfare	Education	Economy and livelihoods	Land and social infrastructure	Cultural heritage
• Campo Guadalupe Estrada has a population of 176. 93% of the population were born within the Municipality of Ahome. • **Religious affiliation:** 84% Catholic, 10% Protestant / Evangelical Christian, 6% are not affiliated with a religion • **Demographic breakdown:** 55% men and 45% women; young (under 15) 19%; working age (15-65) 69% ; elderly (65+) 11% • Almost 3% of the total population belong to an indigenous household • 1.7% of (all ages) speak an indigenous language • 32% are female-headed households	• Does not have a public health clinic, health centre, or a private health practice • 89% are affiliated to health service • 14% of people encounter a small degree of difficulty carrying out daily tasks.	• There is one kindergarten • There is a school in the community, but it is currently not operating due to lack of students • Educational attainment is poor • 6% of all females and 3% of all males aged over 15 years of age did not pass primary education • 4% of people aged 15 + are illiterate.	• 79% of people aged 12+ are economically active • 63% of total males aged 12+ are economically active • 44% of total females aged 12+ are economically active • Does not have a market or open air market • Does have a grocery store.	• 0-2% households do not have water access • 2% of private dwellings do not have electricity • 95% of inhabited private dwellings are connected to the public drainage system • All occupied private dwellings have floor made from non-earthen material or dirt • 2% private dwellings have a fixed telephone line • 9% of private dwellings have internet access • 5 households have a computer, tablet, or laptop • 46 households have cell phones.	• No structures of historical or archaeological significance.

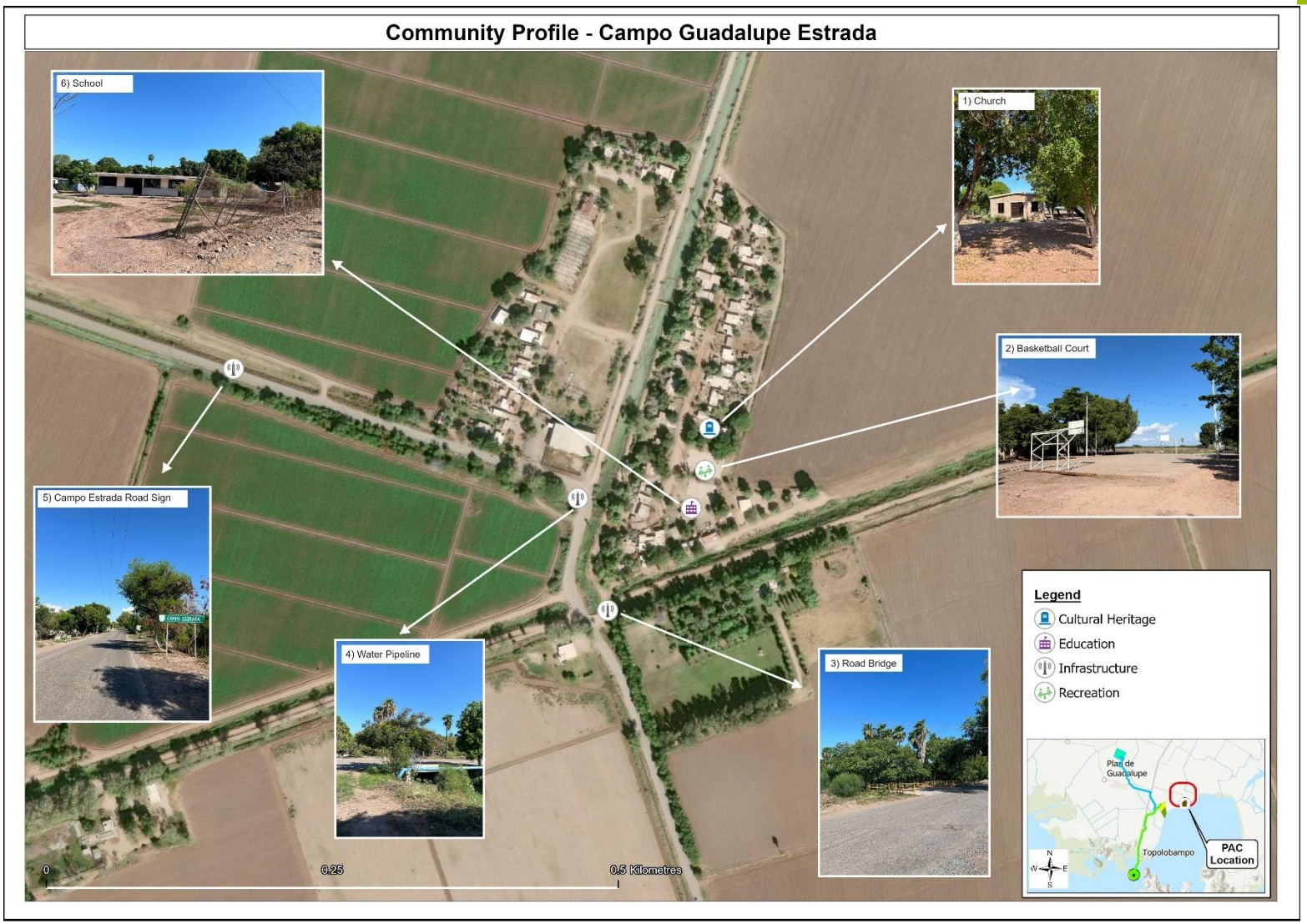


Figure 5.36: Campo Guadalupe Estrada

Table 5.35: Challenges and aspirations

Community	Challenges	Main aspirations for the future	Concerns about the project	Expectations of the project
Topolobampo	• Drug abuse is recognised as a significant health and safety concern. • There are currently no sites where wastewater is discharged. • Ejidal farmers face increasingly high costs, particularly for water permits, seeds, taxation on agricultural produce, planting permits, machinery, rentals, and insecticides.	• Support for local entrepreneurs. • Creation of local jobs.	• Truthfulness about the risks. • Risks associated with vapours at the dock. • Risk differences between specific areas. • Presentation of risks separately rather than collectively. • Reasons for not using water from the bay.	• Local employment opportunities
Ejido Topolobampo	• Dust is the biggest issue • Close to the quarry, including traffic • Blasting, which occurs 2 to 3 times a week • There are currently no sites where wastewater is discharged. • Ejidal farmers face increasingly high costs, particularly for water permits, seeds, taxation on agricultural produce, planting permits, machinery, rentals, and insecticides.	• Employment opportunities for local people	• Doubts about the project's promises and integrity • Potential deforestation of mangroves • Involvement of politicians in the project • Risk of electricity and water services being cut during construction • Whether the community will be treated as separate from Rosendo G.	• Clarification on the project's operational timeline • Payment for municipal wastewater usage • Employment.

Community	Challenges	Main aspirations for the future	Concerns about the project	Expectations of the project
			Castro in terms of policies.	
Rosendo G. Castro	• There is no public drainage, leading to issues with flooding, and waste collection services are unreliable. • There are currently no sites where wastewater is discharged. • The garbage truck does not pass regularly. • Soakaway run-off from widely used septic tanks is believed by the community to have created focal points for disease. • There is currently no public lighting. • Electricity access was interrupted during recent cyclones, resulting in streetlights being turned off. • There are concerns about the number of potholes and the quality of street paving. • There is a lack of recreational facilities. • Ejidal farmers face increasingly high costs, particularly for water permits, seeds, taxation on agricultural produce, planting permits, machinery, rentals, and insecticides • Lack of doctors • Lack of infrastructure, particularly the condition of the streets and the town itself, almost the entire town floods during the rainy season. • Lack of educational services and healthcare.	• To continue studying as adults. • Doctors to address health issues. • Improved infrastructure. • Become an organised community in the future. • Paved streets and public lighting throughout. • Having a functional park with sports fields. • Having drainage throughout the ejido. • Being a well-organised community.	• The real risks to the community posed by the methanol pipeline. • Potential soil contamination in the event of a spill. • The type of contamination that will be present in the air when the plant is operational. • The adequacy of the polyurethane as an insulating material and whether a better alternative exists. • How the boilers that will produce steam will function. • Whether the pipeline will be damaged and how the condition of the pipeline will be monitored. • The reality of the project's design versus its execution. • The distance between the community and	• Employment opportunities.

Community	Challenges	Main aspirations for the future	Concerns about the project	Expectations of the project
			the pipeline carrying methanol. • The presence of containers and storage at the dock. • The timing and manner of the project's introduction to the community.	
Paredones	• They face challenges from overfishing and resource depletion, the species that are used for fishing are becoming scarce due to the considerable increase in the number of fishermen and the premature plundering of the animals that they catch the most. • The bay of Paredones is impacted by previous infrastructure projects that have decreased mangrove areas. In addition, the unloading of cargo ships has reduced the productivity of the species, there is a bad smell in the environment, and in some cases people have suffered throat and eye irritation and have had to go to the hospital for intoxication. • Several people have suffered accidents or have had bad experiences at sea, in some cases their family members have died. • Faces issues related to undocumented land ownership, causing disputes within families. • Garbage collection is slow. • There are frequent conflicts related to drug and alcohol addiction, theft and gender violence within families (women are beaten by their	• Employment • Information sharing and the provision of opportunities.	• The materials used in methanol production (natural gas and water). • The risk of methanol explosion. • Potential environmental pollution (NetZero claims, water use, and management). • Assurance that the pipeline will not cause spills that could contaminate seawater. • Concerns about the discharge of hot water into the bay. • Whether all necessary permits are in place.	• Clear and precise communication about the project's location and construction timelines. • Transparent information about job creation and hiring criteria. • Assurance that construction quality will be monitored even if external companies are involved. • Updates on monitoring activities, such as sample collection in local areas. • Communication with local students and

Community	Challenges	Main aspirations for the future	Concerns about the project	Expectations of the project
	husbands or sons when they are under the influence).		• The reality of the project coming to fruition. • Employment opportunities, including the number of jobs and any potential age limits.	educational institutions about the project's impact and opportunities.
Campo Guadalupe Estrada	• There is no adequate stormwater drainage, and the road is unsealed, leading to mud and causing access difficulties during rains. • The electricity service frequently fails due to very old wiring and transformers, and the service is very expensive. • The drains constantly get clogged. • They lack educational services at all levels, even though they have a building. • The community suffers from a lack of paved streets. • They also perceive an economic problem related to the marketing of shrimp products, claiming that farms are driving them out of the market •	• Better living conditions in the town, including paved streets. • Sufficient and efficient public lighting throughout the community. • A completed church. • A rehabilitated social park. • An operational school. • More and better-paying jobs than they currently have. • Envision their children becoming professionals with jobs close to the community. • Those who have had the opportunity to study wish to work in roles aligned with	• NA	• NA

Community	Challenges	Main aspirations for the future	Concerns about the project	Expectations of the project
		their academic training, with jobs that allow them to contribute to the Mexican Social Security Institute (IMSS) to ensure a pension upon retirement. • Have a dining facility (restaurant) if an employment project comes near the community. • Establish a cooperative to develop a plant for marketing and processing seafood products to gain better earnings for the fishermen's work. • Use the school facilities to offer craft workshops.		

5.4.2 Data collection

The socioeconomic baseline is based on both primary and secondary data. Secondary data sources provided contextual information at the regional level and include:

- Open-source socioeconomic datasets such as those collated by Instituto Municipal de Planeación de Ahome (IMPLAN), including the National Census 2020 (see IMPLAN 2024) and the federal government's DATA México internet portal (Data México 2024)
- Previous socioeconomic assessments completed as part of the Supplementary Lenders Information Package by SLR Consulting Limited (SLR) in 2022 (SLR, 2022) and Mexinol's 2021 Manifestación de Impacto Ambiental (MIA) (Mexinol 2021a)
- Relevant reports published by national agencies, research institutes and international organisations.

Primary data was collected through engagement with all communities during the baseline collection period, including by RSK, Aosenuma and UAIM (as described below).

Social studies were completed in December 2023 and April 2024 by Autonomous Indigenous University of Mexico/Universidad Autónoma Indígena de México (UAIM) in three communities (Ejido Ricardo Flores Magon, Ejido Rosendo G Castro, and Campo Guadalupe Estrada) as part of a community assets and opportunity assessment completed on behalf of Pacifico Mexinol to inform a future community strategic community investment programme and develop methods for entering into community agreements (UAIM 2024a; UAIM 2024b).

The data collection was carried out by visiting private homes in each community and using a household sample survey on specific data collection points:

- Ejido Ricardo Flores Magon: 91 people participated representing 18% of total households
- Ejido Rosendo G Castro: 64 people participated representing 31% of total households
- Campo Guadalupe Estrada: 32 people participated representing 57% of total households

The methodology used was a Development Opportunity Ranking Tool (DOR) which is a participatory research tool based on community collaboration, In the second engagement, the survey team used focus groups (with the same participants) to identify collective community problems and needs, highlighting joint development opportunities. The survey team then returned to each community and presented the results.

Social studies were completed by a local consulting firm, Aosenuma, in March 2024 in six communities (Carrizo Grande, El Cerro Cabezón, Ejido Ohuira, Ejido Topolobampo, Paredones, and Lázaro Cárdenas) as part of an independent community characterisation survey completed on behalf of the project to provide additional community-based information on Indigenous Peoples (Aosenuma 2024).

The methodology included the use of semi-structured interviews with community leader, Indigenous leaders, community members to collect first-hand details related to each communities' origin and history, self-ascription, collective use of language, beliefs and

rituality, social organisation, traditional economic activities, political and administrative organisation and link with the land and territory. Approximately eight to 10 individuals from each community participated in this primary data collection effort.

RSK collected primary data during a field-based socioeconomic study undertaken by two RSK Specialist Social Consultants between 15th and 19th April 2024. The approach mainly utilised qualitative information from key informant interview meetings with local authorities and knowledgeable figures in communities. The purpose of the field visit was to validate socioeconomic baseline information from existing secondary sources (i.e. primarily from the MIA, SLIP SIA) and other supplementary social studies such as those conducted by Aosenuma and UAIM, address any key information gaps and obtain additional baseline data through key informant interviews, field verification and walkover surveys. Details of the meetings and key informant interviews undertaken during this field-based socioeconomic study are provided in Table 5.36.

Table 5.36: Details of the meetings undertaken during the RSK field-based socioeconomic study

Date	Meeting location	Focus of meeting	Attending organisations
Tuesday 16 April	UAIM Los Mochis	Discussion regarding the recent pilot studies that UAIM have undertaken in Ejido Rosendo G. Castro, Ejido Ricardo Flores Magón, Campo Guadalupe Estrada	UAIM
	[redacted] Los Mochis	Discussion regarding the processes related to land valuation, land acquisition and the Mexinol Project	Pacifico Mexinol Transition Industries [redacted]
	Residence of the Ejido commissioner of Ejido Rosendo G. Castro	Meeting with an ejidatorios who sold their land to Pacifico Mexinol to discuss land acquisition process and the Mexinol Project	Ejido Commissioner of Ejido Rosendo G. Castro Owner of land parcels in Ejido Topo Viejo Pacifico Mexinol
	Residence of Mexinol local shareholder Los Mochis	Presentation of previous stakeholder engagement undertaken by the Mexinol Project	Pacifico Mexinol Transition Industries
Wednesday 17 April	IMPLAN offices Los Mochis	Meeting with IMPLAN (Ahome Municipal Planning Institute / Instituto Municipal de Planeación de Ahome -) to discuss the regional statistical database and urban planning developed by IMPLAN and the Mexinol Project	IMPLAN
	Department for the Economy offices Los Mochis	Discussions regarding fishery activities around the Bay of Ohuira and presentation of the Mexinol Project	Fishing division of Department for the Economy of the Municipality of Ahome
	Casa Don Pedro function facility	Meetings with the municipal commissioner of Rosendo G. Castro and the Sindico of Topolobampo to discuss local infrastructure and the Mexinol Project	Ejido Rosendo G. Castro Sindicatura of Topolobampo

Date	Meeting location	Focus of meeting	Attending organisations
	Ejido Rosendo G. Castro		
	Residence of the Ejido commissioner for Ejido 9 de Diciembre Ejido 9 de Diciembre	Meetings with community leaders of the Ejido 9 de Diciembre to discuss local conditions and the Mexinol Project	Ejido 9 de Diciembre
Thursday 18 April	Municipal office of CODESIN Los Mochis	Meeting with CODESIN (Council for Economic Development of Sinaloa / Consejo para el Desarrollo Economico de Sinaloa) and the Secretaria de la Economia (Department for the Economy) to discuss the Mexinol Project and the remit of CODESIN and of the Department for the Economy	CODESIN Municipal Department for the Economy
	Offices of the Secretaria de las Mujeres[20] Los Mochis	Meeting with Department of Female Affairs to discuss GBVH and other issues relevant to local female population and the Mexinol Project	Department of Female Affairs
	Hotel America Los Mochis	Meeting with representatives of the hotel industry to discuss the development of tourism and hotels in the municipality and the Mexinol Project, including capacity and demand forecasts	Hotel America Asociación de Hoteles y Moteles del Norte de Sinaloa[21]
Friday 20 April	Federal Tele-secondary school No 104 Paredones	Meeting with representatives from local schools to discuss education attainment, school infrastructure and the Mexinol Project	Tele-secondary school (No 104) National College of Professional Technical Education, Tele-preparatory (*Colegio Nacional de Educación Profesional Técnica*, CONALEP) (no 045)
	Technological Institute of Los Mochis	Meeting with higher education representatives to discuss current academic offerings and the Mexinol Project	Technological Institute of Los Mochis

[20] Hereafter referred to as the Department of Female Affairs

[21] Referred to as the Association of Hotels and Motels (North Sinaloa)

Date	Meeting location	Focus of meeting	Attending organisations
	Los Mochis		
	Municipal Health Office Los Mochis	Meeting representatives of the Municipal Health Office to discuss health concerns and health services administration in the Ahome municipality and the Mexinol Project	Municipal Health Office

Primary data collected during the field visit have been compiled, interpreted, triangulated and embedded within this socioeconomic baseline alongside secondary data. The data have provided the basis for the identification and assessment of Project impacts on social receptors and will provide a basis for future comparison, to facilitate monitoring for any changes that take place in the socioeconomic environment as a result of the Project.

5.4.2.1 Data assumptions and considerations

The following data assumptions and limitations should be considered when assessing the findings contained within this ESIA:

- Census data that feeds into the IMPLAN dataset and the DATA México portal (see Section 5.4.1.2) is predominantly from the national population and housing census of 2020 conducted by the National Institute of Statistics and Geography (INEGI). It has been reported that the COVID-19 pandemic may have restricted some aspects of data collection.
- During the four-day fieldwork, due primarily to concerns over stakeholder fatigue and time constraints, only a sample of the communities within the AoI were visited, as detailed in Table 5.36. Data from the remainder of the communities was provided by Pacifico Mexinol stakeholder engagement team members and/or secondary information as noted.

5.4.3 Socioeconomic baseline

5.4.3.1 Government and systems for planning and development

Mexico is a democratic, representative, federal, presidential republic, structured across three governmental levels: federal, state, and municipal. The President, serving a non-renewable six-year term, is elected by plurality. The country consists of 31 states and the Federal District of Mexico City, with local elections determining state and municipal leaders. Each state has distinct legislation. The federal legislature is bicameral, consisting of a 500-member Chamber of Deputies elected for three years and a 128-member Senate with six-year terms (SLR, 2022a).

Sinaloa state has 18 municipalities, including Ahome, where the Project is located. Municipalities are governed by the State legislation. From November 2024, two new municipalities, Eldorado and Juan José Ríos, will be created within the borders of the State of Sinaloa (Congreso del Estado de Sinaloa, 2021). State-federal shared responsibilities include primary education, healthcare, poverty relief, social protection, and water. Municipal tasks include urban planning and development, utilities (water distribution, waste), local roads and public transport, street lighting, markets, parks, and public safety. Municipalities also share responsibility for school buildings and social programme implementation and can delegate certain tasks to the state, such as water distribution and urban planning, by agreement (SLR, 2022a).

The National Development Plan (NDP) serves as a framework to identify the nation's challenges and development focus over a six-year period. It was published on July 12, 2019, and focuses on three main themes, specifically politics and governance, social policy, and economy. Regarding social policy, the NDP states that the Mexican government is committed to sustainable development. Sustainable development is

characterised in the Plan as meeting the needs of today's population without hindering future generations' ability to meet their own needs (Mexinol, 2021a).

The Sinaloa State Development Plan 2017-2021 envisions Sinaloa as a region with evenly distributed economic growth and improved employment opportunities. It aims for the state to become a leader in sustainable and competitive agriculture, profitable livestock production, and fisheries and aquaculture sectors. It also recognises that branches of sectors will complement each other to boost economic and social development, with examples including tourism, industries generating production chains and effective knowledge management in science, technology and innovation (Mexinol, 2021a).

Municipalities are the smallest administrative divisions in Mexico. Municipal tasks include urban planning and development, utilities (water distribution, waste), local roads and public transport, street lighting, markets, parks, and public safety. Municipalities also share responsibility for school buildings and social programme implementation, and can delegate certain tasks to the state, like water and urban planning, by agreement (SLR, 2022a). Municipalities have some autonomy but are also subject to regulations and oversight from state governments.

At the municipal level in Mexico, the main authorities include the following:

5.4.3.1.1 Mayor (Presidente Municipal):

- The mayor is the highest-ranking official in the municipality and is elected by the residents
- The mayor's responsibilities include overseeing the administration of municipal government, implementing policies and programmes, managing municipal finances, and representing the municipality in dealings with higher levels of government and other entities.

5.4.3.1.2 Municipal Council (Ayuntamiento):

- The municipal council is the legislative body of the municipality and is composed of elected representatives, known as councillors or "regidores"
- Councillors are elected by the residents of the municipality and serve as representatives of their respective districts or wards
- The municipal council is responsible for passing local ordinances, approving the municipal budget, overseeing municipal policies and programmes, and providing oversight of the mayor's administration.

5.4.3.1.3 Municipal Administration*:*

- The municipal administration consists of various departments and agencies responsible for delivering public services and implementing municipal policies
- Departments may include public works, planning and zoning, finance, public safety, social services, parks and recreation, and others
- The municipal administration is tasked with carrying out the day-to-day operations of the municipality, managing municipal assets and infrastructure, and responding to the needs of residents.

5.4.3.1.4 Municipal auditor (Síndico or sindicatura)

- Within the municipality of Ahome there are seven *Sindicaturas*: Central de Los Mochis, Ahome, San Miguel de Zapotitlan, Heriberto Valdés Romero, Higuera de Zaragoza, Topolobampo and Gustavo Diaz Ordaz. The role of the *síndico* includes:
    - Financial oversight: The síndico is responsible for overseeing the financial affairs of the municipality. This includes monitoring the budget, expenditures, and financial transactions to ensure compliance with laws and regulations
    - Accountability: The síndico plays a key role in ensuring transparency and accountability in municipal government. They may conduct audits and investigations to identify any irregularities or instances of corruption
    - Legal representation: The síndico serves as the legal representative of the municipality in certain matters. They may be involved in legal proceedings on behalf of the municipality or provide legal advice to the mayor and municipal council
    - Checks and balances: The síndico serves as a check on the power of the mayor and the municipal council. By overseeing financial matters and ensuring compliance with laws, the síndico helps maintain balance and prevent abuse of power
    - Citizen representation: In some municipalities, the síndico is elected directly by the citizens, while in others, they may be appointed by the mayor or the municipal council. Regardless of the method of selection, the síndico is expected to represent the interests of the citizens and act as a voice for accountability and transparency in government.

Municipal commissioners act as *community managers* and oversee committees that are specialised in various areas such as road and street lighting maintenance, construction of recreational areas such as parks and sports fields. They are accountable to the city council and are elected by popular vote or plebiscite. Their candidacies are registered by collecting signatures.

At the Ejido (community) level, the supervisory board is made up of six people who are in charge or monitoring the work of the *ejidal commissioner* who is elected by a vote. The *ejidal commissioner,* elected by the *ejidal assembly*, is in charge of agricultural affairs only, whereas the *municipal commissioner* has an administrative role designated by the Mayor. *Ejidatarios* previously paid small administration fees to the *ejidal commissioner,* but this is no longer the case [redacted], L.E. pers. comm. 2024).

Regarding the capacity of local government for service delivery / development planning, there is substantial coordination between the sindico, municipal commissioner and locality level actors. Community WhatsApp groups are a key tool used to help raise awareness of issues amongst the community (for example, when there is electricity cut). According to a CODESIN representative, Ahome is one of best administered municipalities in Sinaloa.[22] There are several active local development plans of relevance to the Project area:

[22] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024.

- Municipal Urban Development Plan 2021-2024 (Plan Municipal de Desarrollo 2021-2024)
- Partial Urban Development Plan for the Los Mochis– Topolobambo Corridor 2018 (Plan Parcial de Desarrollo Urbano Del Corredor Mochis-Topolobampo 2018)
- Los Mochis Updated Urban Development Plan 2019 (Actualización del Plan Director de Desarrollo Urbano de la Ciudad de Los Mochis 2019)
- Urban Development Master Plan for the Port of Topolobampo 2017 (Plan Director de Desarrollo Urbano del Puerto de Topolobampo 2017).

The *Partial Urban Development Plan for the Los Mochis – Topolobampo Corridor 2018* (hereafter Corridor Plan), is a specific urban development plan which identifies land for industrial development corridor between Los Mochis and Topolobampo. As shown in Figure 5.37 the Project is located within the Los Mochis-Topolobambo industrial corridor and is therefore aligned with local government development priorities and land use plans.

The profile of industrial activities for development in this corridor includes manufacturing, storage and distribution of goods, energy and specialised products, collection and processing of agricultural products and operations to support these activities, such as logistics, corporate or similar centres. It also includes generation, storage, regulation, treatment and transmission facilities for water, energy and data. These will be complemented by commercial uses and public and private services in support of industrial activities as well as limited retail trade, such as a mini-supermarket or convenience stores. The development of housing or housing complexes is not encouraged in this area. Housing sites must be aligned with the current Urban Development Plans or planned in the localities indicated as appropriate within the Corridor Plan. Any development activity, building or facility intended for activities regulated by the Federal Government or the Government of the State of Sinaloa will be subject to approval and operation through positive accreditation from higher government authorities.

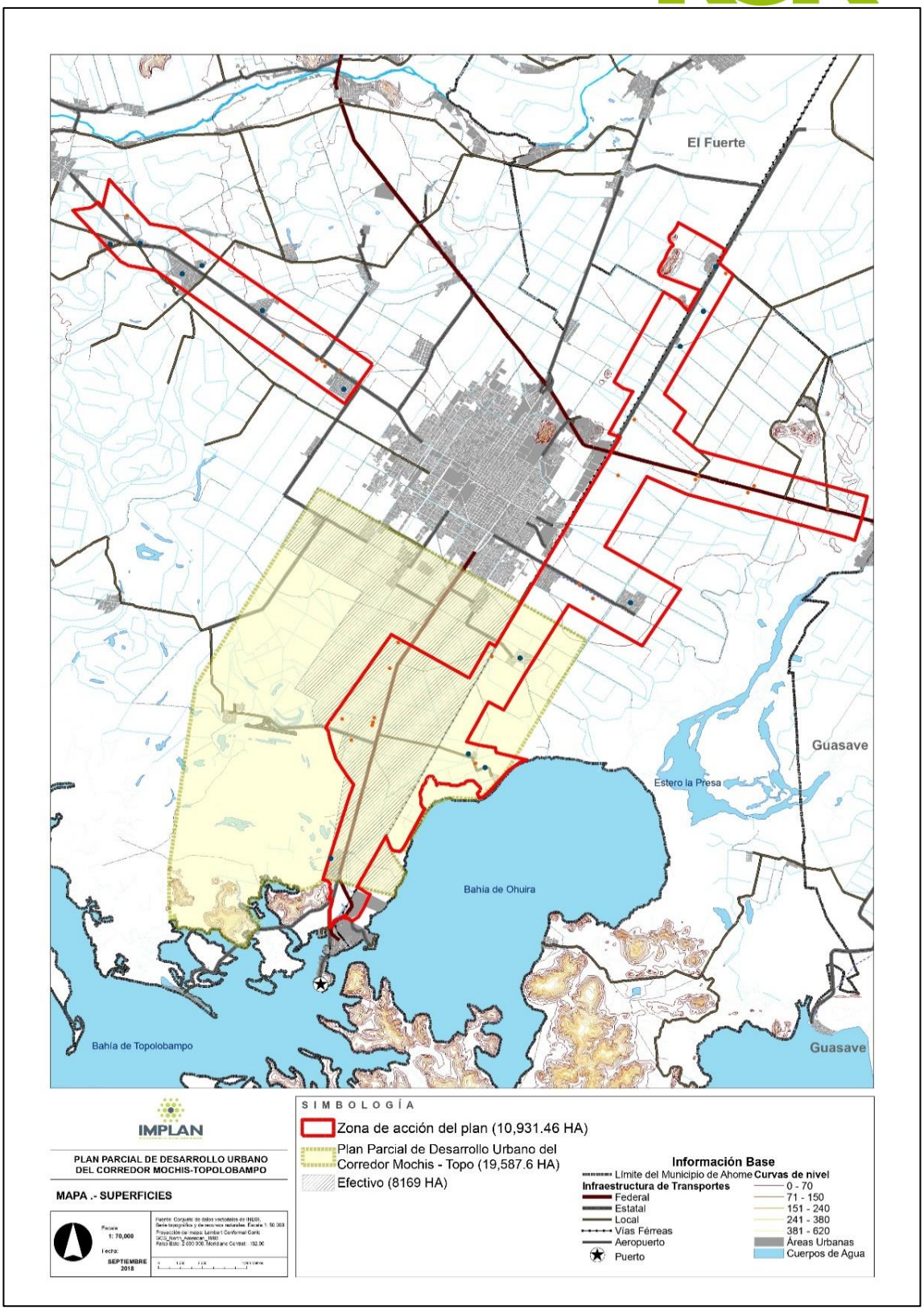


Figure 5.37: Partial Urban Development Plan for the Los Mochis – Topolobambo Corridor

Source: IMPLAN (2018).

IMPLAN is a state planning body with a Municipality of Ahome office in Los Mochis. It is led by a board of directors made up of officials and the population. IMPLAN provides open access for the public to municipality level information on development planning. In 2015 they developed a geographic information system (GIS) platform which holds geographic information relevant to planning (i.e. land use and other social and environmental parameters). Anecdotal evidence suggests that creating a publicly available, open-source database and GIS platform has reduced potential corrupt practices in relation to land acquisition in Los Mochis.

IMPLAN provides guidance to state and private sector organisations interested in land development, as well as advice to interested parties on the land planning data available and procedures that must be followed. IMPLAN also facilitates decision-making for people/companies interested in acquiring land by making publicly available data from various sources more accessible. In 2015, they were part of the NDP process which categorised land suitable for developing an industrial corridor between Los Mochis and Topolobampo.

Depending on the type of land impacted by developments, the main authorities with a responsibility for land regulations and administration include:

Protected Natural Area, RAMSAR Site and Wetlands of International Importance

- The central authority is the Secretariat of Environment and Natural Resources *(Secretaría de Medio Ambiente y Recursos Naturales, SEMARNAT)*
- The sectoral authorities are the Secretary of the Navy *(Secretaría de Marina)* and the National Commission of Protected Natural Areas *(Comisión Nacional de Áreas Naturales Protegidas, CONANP).*

Municipal Territory

- The central authority is the Ahome City Council *(Ayuntamiento de Ahome)*
- The following sectoral authorities may also have a role in land administration:
    - Directorate of Environment and Urban Development *(Dirección de Medio Ambiente y Desarrollo Urbano)*
    - Secretary of Economy of the Municipality of Ahome *(Secretaría de Economía del Municipio de Ahome)*
    - Inspection and Regulation Directorate *(Dirección de Inspección y Normatividad)*
    - Ahome Civil Protection *(Protección Civil de Ahome)*
    - Municipal Drinking Water Board *(Junta Municipal de Agua Potable, JMAS)*

Ejidal Land[23]

- The main authority is the Ejidal Assembly.
- Ejidal land is subject to the determinations of the Municipal Planning Instruments. When it comes to Ejidal land located in Protected Natural Areas, land administration is subject to federal provisions on the matter.

[23] Ejidal land is agrarian land owned by individual ejidatarios but managed under a communal system (for more details, see Chapter 2: Regulatory framework and Land use, land ownership and land impacts).

- Ejidal land property titles are issued by the Agrarian Attorney's Office and registered in the National Agrarian Registry and/or Public Property Registry.

5.4.3.2 Population and demographics

In 2020, Mexico had a population of 128,932,753, with Sinaloa's population at 3,026,943, ranking it as the 17th most populous state in the nation. Sinaloa is divided into 18 municipalities, with Ahome being the third most populated, following Culiacan and Mazatlán. As of 2020, the Municipality of Ahome had a total population of 459,310, with women constituting 50.9% (233,994) and men 49.1% (225,316). The largest population segment is in the 15-19 year age group (39,716), closely followed by the 20-24 year age group (39,554), and the 10-14 year age group (38,263). These age groups, ranging from 10 to 24 years old, make up 25.6% of the total population. Official statistics on Indigenous Peoples indicate that 0.81% of the total population of Ahome self-identify as afro-descendants (SLR, 2022a).

There are two communities within the Project's Direct AoI: Topolobampo (incl. Ejido Topolobampo) and Ejido Rosendo G. Castro. Topolobampo has a population of 6198, Ejido Topolobampo has a total population of 111, while Ejido Rosendo G. Castro has a population of 702.

The Project's Indirect AoI includes 13 further PACs and the City of Los Mochis.

Table 5.37 provides details of the total population and average household size per PAC. The total population across all PACs is 315,500. Household sizes vary per community between 2.7 and 3.9. The average household size among PACs is 3.46.

Figure 5.38 and Figure 5.39 provide the population distribution by gender and age respectively for Direct and Indirect AoI PACs. On average, the ratio of females to males is 1:0.936[24] across all PACs. Age groups of 15-64 years and 65+ constitute 66% and 11% of the population, respectively. Children under 14 years represent 23% of the population.

[24] 52% female and 48% male

Table 5.37: Population within Direct and Indirect AoI PACs

Name of PAC	Total population	Number of census households	Average census households size
Benito Juárez	8	3	2.7
Campo Guadalupe Estrada	176	56	3.1
Ejido 9 de Diciembre	1,974	554	3.6
Ejido Benito Juárez	1,466	409	3.6
Ejido Ohuira*	2,205	567	3.9
Ejido Plan de Guadalupe	338	91	3.7
Ejido Ricardo Flores Magón	1,845	507	3.6
Ejido Rosendo G. Castro**	702	205	3.4
Ejido Topolobampo**	111	30	3.7
Ejido Tortugas Número 2	79	23	3.4
Los Mochis	298,009	90,974	3.3
Paredones	942	245	3.8
Plan de Ayala [Campo Cinco]	1,447	420	3.4
Topolobampo**	6,198	1,871	3.3
Total / Average	**315,500**	**95,955**	**3.46**

*Indigenous Peoples PAC **Direct AoI PAC; Source: National Census 2020

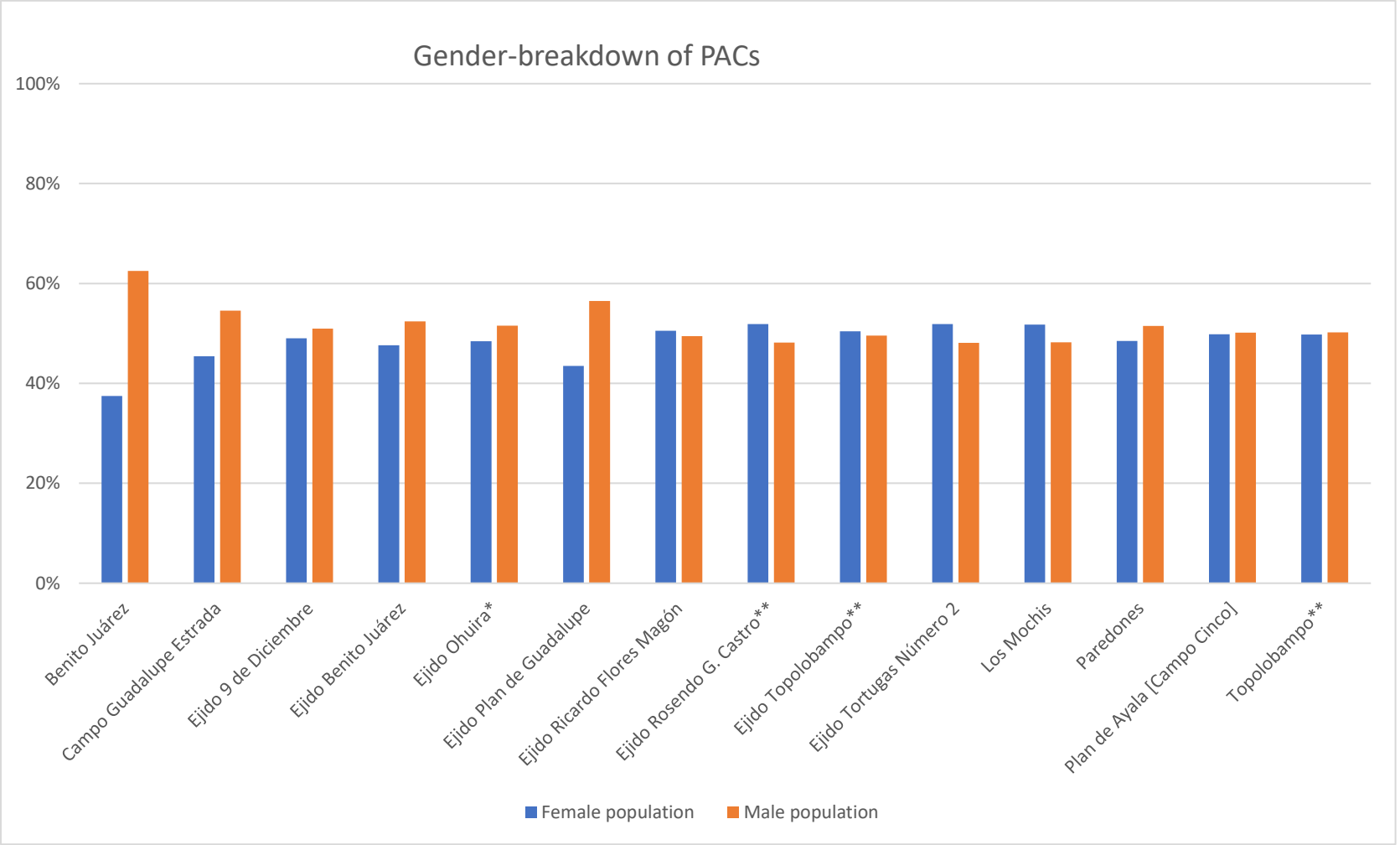


Figure 5.38: Population distribution by gender across PACs

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020

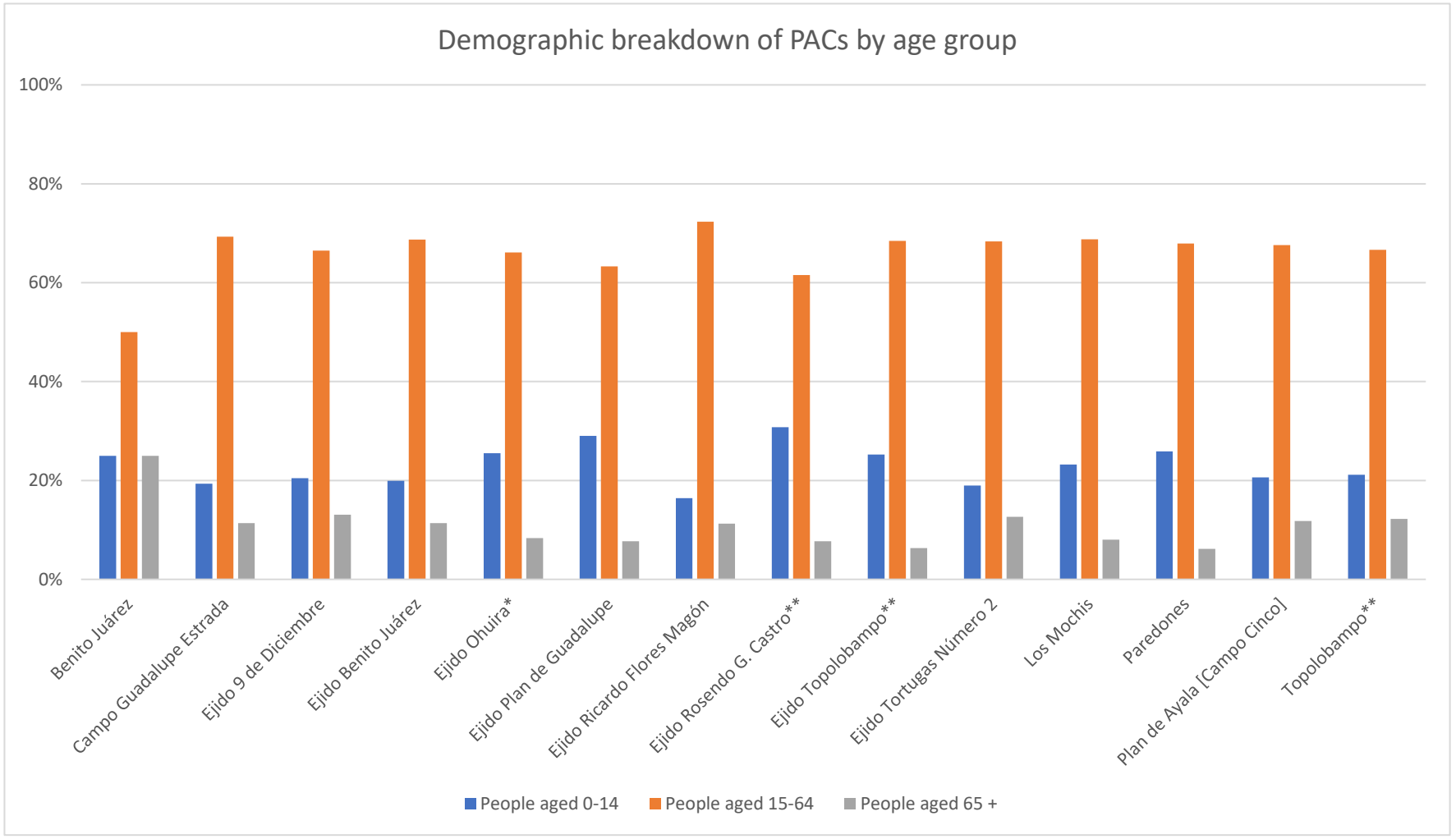


Figure 5.39: Population distribution by age across PACs

*Indigenous Peoples PAC; **Direct AoI PAC Source: National Census 2020.

5.4.3.3 Population change and migration

Mexico received 68,000 new long-term or permanent immigrants in 2021, a 16% increase in the rate of migration from 2020. This group included 15.7% labour migrants, 40.9% family members, and 30.1% humanitarian migrants (OECD Library, 2023)[25]. The leading countries of origin were Honduras, Venezuela, and the United States (OECD Library, 2023). Mexico received nearly 120,000 asylum claims in 2022, putting considerable pressure on the Mexican Commission for Refugee Assistance (OECD Library, 2023). In 2022, 13,000 refugees benefited from relocation and integration assistance through Mexico's and UNHCR's Local Integration Programme (OECD Library, 2023). In May 2023, Mexico also committed to receiving 30,000 individuals monthly from Venezuela, Nicaragua and Cuba on humanitarian grounds (OECD Library, 2023).

Mexican emigration to OECD countries rose by 12% in 2021, reaching 128,000, with the United States being the primary destination for 83% of these emigrants. Mexican emigration to the United States is reported to have increased, with 180,000 Mexican migrants crossing the border between October 2022 and October 2023, four times more than the previous year (Solomon & Gottesdiener, 2023). Increasing insecurity and drug related violence is thought to be a key driver of rising migration to the United States and 88% of Mexicans who passed through Kino during the October 2022 and October 2023 time period cited that they sought to immigrate to the U.S. to escape violence (Solomon & Gottesdiener, 2023). Between 2010 and 2020, the population of Sinaloa State increased by 9.36% (Gobierno de México, 2024). However, this is likely to be predominantly driven by natural population growth rather than in-migration. For example, internal migration data for 2020 illustrates that Sinaloa State's net migration rate was -11,662 (Statista 2023).[26] Overall, at the municipal level of Ahome, current levels of migration are also low.

It was reported that people who work in Los Mochis are mainly from Sinaloa State and that economic migration of workers from other states is currently rare.[27] In-migration to Los Mochis is generally attributed to people who used to live in the area returning after spending time in other cities in north and northwest Mexico such as Chihuahua, Mexicali and Ciudad Obregón. Investment and establishment of large multinational companies from countries such as Peru and Chile is also reported as a driver to increasing population of Los Mochis, and the need for more housing was highlighted as a development priority[28].

Representatives from education providers in Paredones report that young people generally want to stay in the Los Mochis area, motivated by opportunities to obtain employment in the areas' burgeoning industries [redacted]G, 2024 pers. comm.). Conversely, anecdotal evidence also suggests that young people are also generally attracted to travelling to Mexican cities near the US border, such as Mexicali and Tijuana, in search of improved economic opportunities.

[25] The remaining migrants included tertiary-level international students and temporary and seasonal labour migrants (OECD Library 2023)

[26] Data reports recorded population five years or older who migrated in relation to current place of residence five years earlier

[27] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024.

[28] Meeting with IMPLAN team Los Mochis, 17th April 2024.

The city of Los Mochis is going through a process of industrialisation and a transition away from a local economy, with dependence on agriculture and towards the provision of logistics services and other industrial sectors. This is partially attributed to the Port of Topolobampo's growth. However, the rate of urbanisation is controlled and is conducted in accordance with local development plans (see Section 5.4.3.1)[29].

Table 5.38 shows the percentage of population born within each PAC from either Municipality of Ahome or another Mexican municipality. On average 90% of the population from PACs originate from the Municipality of Ahome.

Table 5.38: Place of birth of the population within Direct and Indirect PACs

Name of PAC	Population born within the Municipality of Ahome	Population who originate outside Municipality of Ahome
Benito Juárez	75%	25%
Campo Guadalupe Estrada	93%	7%
Ejido 9 de Diciembre	94%	6%
Ejido Benito Juárez	95%	5%
Ejido Ohuira*	94%	6%
Ejido Plan de Guadalupe	93%	7%
Ejido Ricardo Flores Magón	94%	6%
Ejido Rosendo G. Castro**	85%	15%
Ejido Topolobampo**	82%	18%
Ejido Tortugas Número 2	86%	14%
Los Mochis	90%	10%
Paredones	90%	10%
Plan de Ayala [Campo Cinco]	94%	6%
Topolobampo**	90%	10%
Average	**90%**	**10%**

*Indigenous Peoples PAC **Direct AoI PAC; Source: National Census 2020.

5.4.3.4 Ethnicity, language and religion

There are 68 recognised languages in Mexico, of which 63 are Indigenous Peoples languages (Statista 2024). The most widely spoken language is Spanish which is spoken by 94% of the population (Statista 2024). According to the national census, 6.1% of the population of Mexico aged three or above are registered as speaking an indigenous language, accounting for approximately 7.36 million people (IWGIA 2024).

At the municipality level, while Spanish is the most widely spoken language there are 10 indigenous languages spoken in Ahome by nearly 4,360 people (0.95% of the total Ahome population) (DataMexico 2024). The most common of these is Mayo, with 2,503

[29] Meeting with IMPLAN team Los Mochis, 17th April 2024.

speakers, followed by Tarahumara and Náhuatl, with 841 and 280 speakers respectively (ibid).

Table 5.39 provides data on the population of indigenous language speakers with PACs. An overall average of 1.57% of the population across PACs speak an indigenous language. The Indigenous Peoples PAC of Ejido Ohuira is a significant community for indigenous language speakers within the Indirect AoI. Within Ejido Ohuira a total of 206 people aged over three years old were recorded as speaking an indigenous language during the 2020 national census (see Table 5.39; DataMexico, 2024).

Table 5.39: Number of people within PACs that speak an indigenous language[30]

Name of PAC	Number of people aged 3 years + that speak an indigenous language	% of people (all ages) that speak an indigenous language	Number of people aged 3 years + that speak an indigenous language and do not speak Spanish	% of people of all ages that speak an indigenous language and do not speak Spanish
Benito Juárez	0	0.00%	0	0.00%
Campo Guadalupe Estrada	3	1.70%	0	0.00%
Ejido 9 de Diciembre	2	0.10%	0	0.00%
Ejido Benito Juárez	4	0.27%	0	0.00%
Ejido Ohuira*	206	9.34%	2	0.09%
Ejido Plan de Guadalupe	0	0.00%	0	0.00%
Ejido Ricardo Flores Magón	6	0.33%	0	0.00%
Ejido Rosendo G. Castro**	3	0.43%	0	0.00%
Ejido Topolobampo**	1	0.90%	0	0.00%
Ejido Tortugas Número 2	3	3.80%	0	0.00%
Los Mochis	1459	0.49%	4	0.00%
Plan de Ayala [Campo Cinco]	2	0.14%	0	0.00%
Topolobampo**	40	0.65%	0	0.00%
Total / average	1765	1.57%	6	0.01%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

[30] The percentages (in the third and final columns) in this table have been calculated to two decimal places to ensure that the numbers in column one and two are not calculated as 0%.

The constitution of Mexico declares the country a secular state and provides the right of religious freedom to all, including the right to engage in religious ceremonies and acts of worship. Nationally, approximately 78% of the population identifies as Roman Catholic (DataMexico, 2024). Other religious practices and beliefs include Protestant or evangelical Protestant (10%) as well as 1.5% who reported as 'other religious groups', including Judaism, Jehovah's Witnesses, The Church of Jesus Christ of Latter-day Saints (Church of Jesus Christ) and Islam. It is common for some Indigenous Peoples to practice syncretic religious traditions, often blending Catholicism with indigenous beliefs. This is common within Direct and Indirect AoI PACs and is discussed in further detail in section 5.4.3.21.

Table 5.40 provides details of the religious affiliations of the population from the Project's PACs. The number of PAC members identifying as being affiliated to a religion other than Catholicism, Protestantism or Evangelical Christianity is highest in only two PACs (one in Ejido Ricardo Flores Magón and 299 in Los Mochis). In all other PACS, the figure is 0. Therefore, reflecting the situation nationally, on average 80% of the population identify as Roman Catholic, while 11% identify as Protestant or evangelical Protestant and 9% report having no religious affiliation.

Table 5.40: People affiliated to Catholicism, Protestantism/Evangelical Christianity or without religious affiliation within PACs

Name of PAC	% of people identifying as Catholic	% of people identifying as Protestant / Evangelical Christian	% of people affiliated to a religion other than Catholicism or Protestantism /Evangelical Christianity	% of people without religion or without religious affiliation
Benito Juárez	100%	0%	0%	0%
Campo Guadalupe Estrada	77%	10%	0%	13%
Ejido 9 de Diciembre	72%	18%	0%	10%
Ejido Benito Juárez	85%	12%	0%	4%
Ejido Ohuira*	82%	6%	0%	12%
Ejido Plan de Guadalupe	72%	19%	0%	8%
Ejido Ricardo Flores Magón	86%	5%	0%	8%
Ejido Rosendo G. Castro**	63%	16%	0%	21%
Ejido Topolobampo**	68%	17%	0%	14%
Ejido Tortugas Número 2	92%	5%	0%	3%
Los Mochis	77%	11%	0%	12%
Paredones	84%	10%	0%	6%

Name of PAC	% of people identifying as Catholic	% of people identifying as Protestant / Evangelical Christian	% of people affiliated to a religion other than Catholicism or Protestantism /Evangelical Christianity	% of people without religion or without religious affiliation
Plan de Ayala [Campo Cinco]	82%	13%	0%	4%
Topolobampo**	83%	8%	0%	9%
Average	**80%**	**11%**	**0%**	**9%**

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Mexico's population is composed of many ethnic groups, including those who self-identify as distinct Indigenous Peoples, and a majority who identify as mestizo, or of mixed European – indigenous heritage. At the community level, there are often clear spatial and cultural divisions between indigenous and non-indigenous groups, with anecdotal evidence suggesting that many community members who recognise themselves as indigenous hold a negative general view of mestizo community members[31].

5.4.3.5 Health (including water, sanitation and waste)

The Mexican health system consists of three main components operating in parallel. These components include an employment based social insurance scheme, public assistance services for the uninsured supported by a financial protection scheme, and a private sector comprised of private health service providers, insurers and pharmaceutical and medical suppliers, distributors and manufacturers (WHO, 2020). Approximately 71% of Mexicans are covered by public healthcare (Villareal, V, 2022). Nearly 14% of the population is reported to lack financial protection through enrolment in a health insurance scheme (ibid).

Primary care units within the Mexican health system have different names depending on the state-level government provider concerned, but a basic primary care unit consists of a family or general practitioner, a clinical nurse and a public health nurse (ibid). Each of these primary care units or health centres provide health care to a population in a defined geographical area of up to 500 households or 2500 inhabitants (ibid).

Between 1990 and 2019, Mexico experienced a 1.8% annual growth in personal healthcare access. Between 1990 and 2017 life expectancy at birth rose from 74.3 years to 78.5 years for women and from 68.6 to 72.6 years for men. The primary causes of death in 2017 included heart disease, diabetes, and chronic kidney disease (SLR, 2022).

In Sinaloa, over the same period, life expectancy at birth increased from 76.7 years to 80.8 years for women and from 71 to 72.1 years for men. The most common causes of death and disability in 2019 were heart disease, diabetes, and interpersonal violence

[31] Meeting with UAIM representatives, 16th April 2024.

(SLR, 2022a). In 2020, 62% of people residing in Sinaloa were affiliated to IMSS[32], 10% to the Institute for Social Security and Services for State Workers (ISSSTE)[33] with 26% affiliated to Insituto de Salud para el Bienestar[34] (INEGI, 2020)

As of May 2021, Ahome had 60 public health centres: four run by the Mexican Red Cross, 25 by the Institute of Security and Social Services, 30 by the Municipal Secretary of Health, and one by the Secretary of the Navy. For emergency care, there are seven level two hospitals and 53 hospitals.

There are currently two Level 2 hospitals[35] in Los Mochis and one private hospital (see Figure 5.40)[36]. The establishment of the private MAC Hospital has provided much-needed added capacity and access to health services to Los Mochis. Table 5.41 provides details on the types of primary health facilities (private and public) available within the Indirect and Direct AoI PACs.

Table 5.41: Types of health facilities in each PAC[37]

Name of PAC	Public clinic or health centre[38]	Private health practice[39]
Ejido Benito Juárez	No	No
Campo Guadalupe Estrada	No	No
Ejido 9 de Diciembre	Yes	No
Ejido Ohuira*	No	No
Ejido Plan de Guadalupe	No	No
Ejido Ricardo Flores Magón	No	No
Ejido Rosendo G. Castro**	No	No
Ejido Topolobampo**	No	No

[32] The Mexican Institute of Social Security (Spanish: Instituto Mexicano del Seguro Social, IMSS) is the largest social welfare institution in Latin America and provides medical assistance, social services and pension assistance to the general public and private-sector employees. IMSS is funded through contributions from employees and employers and covers approximately 70,000,000 Mexicans, Approximately 51% of public health coverage in Mexico comes from IMSS (Villareal, V 2022)

[33] ISSTE provides healthcare and social security assistance to government employees and their family members.

[34] Institute of Health for Welfare which provided health care for citizens that were not covered under IMSS or ISSSTE, was disbanded in 2023 and is in the process of being merged with IMSS-Bienestar (Alonso Viña, D (2023)

[35] Hospital General Los Mochis and Centro de Salud Mochis II

[36] MAC Hospital

[37] No data is available for the communities of Ejido Tortugas Número 2 or Benito Juárez.

[38] Clinic or health centre

[39] Consultorio particular

Name of PAC	Public clinic or health centre[38]	Private health practice[39]
Los Mochis	Yes	Yes
Paredones	Yes	No
Plan de Ayala [Campo Cinco]	No	No
Topolobampo**	Yes	Yes

*Indigenous Peoples PAC; **Direct AoI PAC; Source: IMPLAN 2024

Figure 5.40: MAC Hospital (private facility)

Source: RSK field visit, April 2024.

Although traditional medicine and healers (curanderos) were previously prevalent in the communities of Municipality of Ahome, there has been a decline in their usage. Representatives of the Department of Health interviewed during this ESIA report that they are not aware of traditional healers being active at least in the urban areas in, and around, the city of Los Mochis.[40]

It was reported that seven local ambulances are available in the City of Los Mochis to provide emergency support to community members through the SUMMA[41] department. The ambulances are kept in good condition and generally fixed within two days when in need of repair. [42] Community leaders interviewed in the Direct AoI also reported that the SUMMA[43] ambulances are quick to be despatched and provide emergency services to their community members[44].

[40] Meeting with Dept. of Health Los Mochis, 19th April 2024

[41] Servicios de urgencias medicas muncipales de Ahome = Emergency medical services of the Municipality of Ahome.

[42] Meeting with Dept. of Health Los Mochis, 19th April 2024.

[43] Municipal Emergency Medical Services of Ahome

[44] Meeting with Comisariado Municipal of Ejido Rosendo G. Castro and Sindico of Topolobampo, 17th April 2024.

Based on the national census data (2020), 80.1% of the population of Ahome is affiliated to a health service insurance scheme, of which 71.7% are to IMSS, 17.2% are to INSABI, 10.4% are to ISSSTE, and 3.3% are to other health services. Table 5.42 provides the percentage of populations from PACs who are affiliated with a health service. On average, 81% maintain an affiliation to at least one health service insurance scheme.

Table 5.42: Percentage of population of PACs affiliated to a health service

Name of PAC	% of people affiliated to health service	% of people not affiliated to health service
Benito Juárez	75%	25%
Campo Guadalupe Estrada	89%	11%
Ejido 9 de Diciembre	84%	16%
Ejido Benito Juárez	82%	18%
Ejido Ohuira*	79%	21%
Ejido Plan de Guadalupe	92%	8%
Ejido Ricardo Flores Magón	75%	25%
Ejido Rosendo G. Castro**	77%	23%
Ejido Topolobampo**	69%	31%
Ejido Tortugas Número 2	85%	15%
Los Mochis	81%	18%
Paredones	85%	15%
Plan de Ayala [Campo Cinco]	81%	19%
Topolobampo**	80%	20%
Average	**81%**	**19%**

*Indigenous Peoples PAC ; **Direct AoI PAC Source: National Census 2020

According to local health officials, the main health concerns reported to be significant in Los Mochis and the surrounding communities include diarrhoea and respiratory diseases which are typically linked to, and often exacerbated by, periods of warm weather.[45] For example, approximately 1,500 cases of diarrhoea were registered in 2023. It was reported that respiratory diseases are common in children under the age of five and adults over the age of 60.[46] Cervical cancer and breast cancer are also common health issues in women. Tuberculosis is also a common concern and widely prevalent within indigenous communities as is malnutrition, with both concerns attributed to higher levels of poverty within indigenous communities.[47] Teenage pregnancy is widely prevalent in Municipality of Ahome, with the issue described by the health sector representatives as being a concern.[48] GBVH is also stressed as a concern, with cases presented to health

[45] Meeting with Dept. of Health Los Mochis, 19th April 2024.

[46] Ibid.

[47] Ibid.

[48] Ibid.

workers referred through to the Department of Female Affairs which specialises in the providing support to victims, particularly females. [49]

Drug abuse is seen as a key health and safety concern in Topolobampo. Anecdotal evidence suggests that drug consumption is higher during the low season for both fishing and general agricultural activities, when people dedicated to these livelihoods are temporarily unemployed.

Recently there have been widespread public health campaigns focussed on what measures can be taken to prevent health issues, and what support is available to treat diseases and ailments.[50] Community members are generally proactive in requesting support and seeking medical attention when needed, with attendance at health facilities being described as good.

There are four medical dispensaries in the Los Mochis area, which are free at the point of use, and independent of affiliation to a health insurance scheme (IMSS or ISSTE). In the case of Los Mochis, the dispensaries are generally located within settlements that are not serviced by regular clinics and have a population of at least 1,500. The medical dispensaries in the Los Mochis area provide the first level of patient attention to residents and are generally reported to provide good-quality services.[51] However, there can be obstacles to promptly obtaining medical supplies, which are obtained through the Mayor's office, and issues were also reported in relation the maintenance of the dispensaries. [52]

These findings were supported by a socioeconomic characterisation study completed by UAIM specialists. They report that, according to the Ejido Ricardo Flores Magón community, there is no permanent doctor and although there is one dispensary, sometimes beneficiaries of the Ejido are required to donate medicines (UAIM, 2024a). The Department of Health in Los Mochis also reported that medical donations are not generally accepted due to lack of traceability and hygiene considerations.[53]

There are various methods through which community members obtain medical attention in Los Mochis. Pharmacies play a key role in providing initial support to community members when they have mild ailments or health issues and can prescribe generic medicines. Health consultations that cost between 800 MXN (USD 46) and 1,400 MXN (USD 81)[54] are available with discounts provided to affiliates of IMSS and their families. Small medical centres (see Figure 5.41) that offer same-day appointments for as little as 50 MXN, and medical dispensaries (Figure 5.42) play a key role in ensuring that community members can access medical support in a timely manner.

[49] Ibid.

[50] Meeting with Dept. of Health Los Mochis, 19th April 2024.

[51] Ibid.

[52] Ibid.

[53] Ibid.

[54] Rated applicable on 30 April 2024 – USD 1 = MXN 17.10

Figure 5.41: Medical centre offering same-day appointments for 50 MXN (USD 2.92) in Los Mochis

Source: RSK field visit, April 2024.

Figure 5.42: Medical dispensary in Ejido Ohuira

Source: RSK field visit, April 2024.

The Comisión Nacional del Agua (CONAGUA) (National Water Commission) is the government body responsible for managing and preserving Mexico's water in order to guarantee its sustainable usage as a natural resource (Gobierno de México, 2018). The water and sewage board of the Municipality of Ahome (JAPAMA) is responsible for the administration of water, sanitation and wastewater management in Ahome. Drinking water for Los Mochis and the PACs within the Project's Direct and Indirect AoI comes from the Miguel Hidalgo (El Fuerte) and Josefa Ortiz (Choix) storage dams. This water is distributed to the city's three water treatment plants via canals and sub-lateral canals (SLR, 2022a). The Luis Donaldo (Colosio) dam also plays a key role in supplying communities with drinking water.[55] Prior to 2005, the city generated approximately 870 litres per second of untreated wastewater, which was released into the lagoon system of Santa María Bay. To mitigate this, a lagoon system for treating both wastewater and rainwater was established in 2005 (SLR, 2022a).

On average, 94% of occupied dwellings within the Direct and Indirect AoI are connected to the public drainage network (Table 5.43). The number of households without access to water in their houses is low. It is reported that households without water access range from 0-2%, except in Ejido Rosendo G. Castro and Lázaro Cárdenas where it is 5% and 6% respectively (INEGI, 2021). Community leaders from Ejido Rosendo G. Castro and the Sindicatura of Topolobampo report that water quality is good and despite the current dry period, there are no water supply issues. They also report that water is usually abundant, with all households having access to potable water. Even when the water levels are low in the irrigation channels, several wells within these PACs can be used. Although most houses have access to potable water, many households refrain from drinking water directly from the tap. In Ejido 9 de Diciembre, some PAC members have started to drink water from the tap again although this is still not the norm, with bottled water being the preferred choice for most. The Ejido 9 de Diciembre community report that there are ongoing municipal projects aiming to improve drainage and access to potable wate[redacted]pers. comm. 2024).

Table 5.43: Connectivity to the public drainage system in each PAC

Name of PAC	No of inhabited private dwellings that are connected to the public drainage system	% of inhabited private dwellings that are connected to the public drainage system	No of inhabited private dwellings that are not connected to the public drainage system	% of inhabited private dwellings that are not connected to the public drainage system
Benito Juárez	2	67%	0	0%
Campo Guadalupe Estrada	53	95%	3	5%
Ejido 9 de Diciembre	540	97%	12	2%
Ejido Benito Juárez	400	99%	8	2%

[55] Meeting with Comisariado Municipal of Ejido Rosendo G. Castro and the Sindico of Topolobampo, 17th April 2024.

Name of PAC	No of inhabited private dwellings that are connected to the public drainage system	% of inhabited private dwellings that are connected to the public drainage system	No of inhabited private dwellings that are not connected to the public drainage system	% of inhabited private dwellings that are not connected to the public drainage system
Ejido Ohuira*	545	96%	22	4%
Ejido Plan de Guadalupe	89	98%	2	2%
Ejido Ricardo Flores Magón	498	98%	9	2%
Ejido Rosendo G. Castro**	195	95%	10	5%
Ejido Topolobampo**	26	87%	4	13%
Ejido Tortugas Número 2	23	100%	0	0%
Los Mochis	90,616	100%	232	0%
Paredones	230	94%	13	5%
Plan de Ayala [Campo Cinco]	412	99%	2	0%
Topolobampo**	1,821	97%	35	2%
Total / average	95,450	94%	352	3%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

The garbage collection service in the Municipality of Ahome covers 99% of the municipality and is provided by private companies. There is a landfill site called Relleno Sanitario PASA Choacahui serving the city of Los Mochis located near the town of Nuevo San Miguel some 35 km northwest of the Project. Currently, waste collection services pass through most communities at least twice a week, with services passing though larger settlements up to four times a week. However, some PACs have voiced concerns regarding the waste management and collection services. For example, in Ejido Ricardo Flores Magón, the community cite problems with waste accumulation, forcing people in some parts of the settlement to openly burn waste (UAIM 2024a). Two hidden/unregistered 'dumping' areas for waste are located to the north-east of the community of Ejido 9 de Diciembre (IMPLAN, 2024a).

Garbage is reported to accumulate west of the PEMEX dock and along the west side of the Los Mochis-Topolobampo highway leading to the PEMEX Dock. Part of the driver of general littering is a significant lack of waste infrastructure, such as garbage containers and surveillance. Local authorities are reported to be discussing how to improve the waste management programme in the city, including proposals for constructing a new Waste Management facility. Regarding industrial waste, the current policy mandates that each company within the Municipality of Ahome is responsible for managing and disposing of its own waste, including hazardous waste.

Community leaders were not aware of there being any issues with uncontrolled discharge of wastewater or effluent into the sea. They report that wastewater is currently treated at a waste stabilisation or oxidation pond on the site of the JAPAMA wastewater treatment facility, before being discharged into the Bay of Ohuira. However, it was reported that while public services including drainage and water supplies are present in PACs they are often broken or in need of repair. In Campo Guadalupe Estrada, the community report that there is no adequate stormwater drainage and the road is unsealed, leading to mud causing access difficulties during rains (UAIM 2024a). Similarly, in Ejido Ricardo Flores Magón, the community report that the lack of adequate stormwater drainage in some neighbourhoods causes runoff water to stagnate creating focal points for disease (UAIM, 2024a). The community of Ejido Rosendo G. Castro within the Direct AoI report that there is no public drainage, there are issues with flooding and waste collection services are unreliable (UAIM, 2024a). There are currently no sites in the either the Direct or Indirect AoI where wastewater is discharged (IMPLAN, 2024).

In Ejido Rosendo G. Castro, water quality and quantity were described as being good.[56] Water pressure, irrigation infrastructure and treatment of wastewater were aspects that reportedly require improvement. However, conversely it was reported by local business representatives during meetings with CODESIN and the Department for the Economy that water pressure has improved in recent years.[57] Another issue reported locally in Ejido Rosendo G. Castro is that the soakaway run-off from widely used septic tanks is considered by the community to have led to the creation of focal points for disease.[58]

5.4.3.6 Energy access, housing and social infrastructure

The main energy infrastructure supplying Direct and Indirect AoI PACs is the Topolobampo II Juan de Dios Bátiz Thermoelectric Plant, operated by the CFE. This is located at the Port of Topolobampo and includes three units that have a combined capacity of 320.5 GWh (SLR, 2022a). Access to energy at the household level is widespread and on average 99% of dwellings are connected to the electricity grid (see Table 5.44).

Table 5.44: Percentage of dwellings without electricity

Name of PAC	% of private dwellings without electricity
Benito Juárez	0%
Campo Guadalupe Estrada	2%
Ejido 9 de Diciembre	1%
Ejido Benito Juárez	0%
Ejido Ohuira*	1%
Ejido Plan de Guadalupe	3%

[56] Meeting with land owner in Ejido Topo Viejo and ejidal commissioner of Ejido Rosendo G. Castro, 16th April 2024

[57] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024

[58] Meeting with land owner in Ejido Topo Viejo and ejidal commissioner of Ejido Rosendo G. Castro, 16th April 2024

Name of PAC	% of private dwellings without electricity
Ejido Ricardo Flores Magón	0%
Ejido Rosendo G. Castro**	2%
Ejido Topolobampo**	0%
Ejido Tortugas Número 2	0%
Los Mochis	0%
Paredones	0%
Plan de Ayala [Campo Cinco]	0%
Topolobampo**	1%
Average	99%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Although social infrastructure is generally well developed, there are some reported issues with overall quality and reliability. For example, within the community of Guadalupe Estrada the electricity supply network is reported to be unreliable and prone to failure due to the age of the infrastructure (specifically, the wiring and transformers) (UAIM 2024a). Similarly, the Ejido Rosendo G. Castro community report that there is currently no public lighting (UAIM 2024a) and that electricity access was interrupted during recent cyclones which resulted in street lights being turned off[59]. In Ejido Ricardo Flores Magón, the community report that while the public street lighting system is adequate, it is easily damaged and could be better protected (UAIM 2024a).

Overall, the quality of the main road network is excellent as typified by the main Los Mochis-Topolobampo highway (Figure 5.43). However, the lack of paved roads is highlighted as a concern in several PACs, such as in Campo Guadalupe Estrada, where the community report that the roads become difficult to use due to mud after rains (ibid). In Ejido Rosendo G. Castro, there are also concerns over the number of potholes and quality of street paving (ibid).

There are over 96,000 occupied homes within the Direct and Indirect AoI PACs and less than 1% on average have traditional earth floors (Table 5.45). It is reported that out of 108,540 private homes in Los Mochis, there are 3,318 unoccupied available for temporary use (INEGI, 2021).

[59] Meeting with municipal commissioner of Rosendo G. Castro and sindico of Topolobampo 17th April 2024.

Table 5.45: Number of private dwellings with traditional flooring as percentage of private occupied dwellings within Direct and Indirect AoI PACs

Name of PAC	Number of private occupied dwellings	Number of occupied private dwellings with floor made from non-earthen material or dirt	% of occupied private dwellings with floor made from non-earthen material or dirt	Number of occupied private dwellings with dirt/ earthen floor	% of occupied private dwellings with dirt/ earthen floor
Benito Juárez	3	2	67%	0	0%
Campo Guadalupe Estrada	56	56	100%	0	0%
Ejido 9 de Diciembre	554	550	99%	2	0%
Ejido Benito Juárez	406	402	99%	6	1%
Ejido Ohuira*	567	553	98%	14	2%
Ejido Plan de Guadalupe	91	90	99%	1	1%
Ejido Ricardo Flores Magón	507	506	100%	1	0%
Ejido Rosendo G. Castro**	205	199	97%	6	3%
Ejido Topolobampo**	30	30	100%	0	0%
Ejido Tortugas Número 2	23	23	100%	0	0%
Los Mochis	90,192	90,156	100%	687	1%
Paredones	245	238	97%	5	2%
Plan de Ayala [Campo Cinco]	419	414	99%	0	0%
Topolobampo**	1,870	1,812	97%	44	2%
Total / average	95,168	95,031	97%	766	1%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Figure 5.43: Paved road (Los Mochis-Topolobampo highway) between Topolobampo and Los Mochis

Source: RSK field visit, April 2024.

In terms of access to communications at the household level within inhabited homes, while on average only 10% of private dwellings in Direct and Indirect AoI PACs have access to a fixed telephone line (Table 5.46) most people have access to personal cell phones for day-to-day communications. For internet access, phones are typically important for those who own a smartphone, and there is widespread availability of fourth generation (4G) mobile internet network coverage across Direct and Indirect AoI (FELT, 2024). Beyond this, 37% of private dwellings in Direct and Indirect AoI PACs have access to the internet and this rises to 68% in Los Mochis (Table 5.47).

Table 5.46: Access to a fixed telephone lines in the Direct and Indirect AoI PACs

Name of PAC	No of inhabited private dwellings	No of private dwellings with fixed telephone line	% of private dwellings with fixed telephone line
Benito Juárez	3	0	0%
Campo Guadalupe Estrada	56	1	2%
Ejido 9 de Diciembre	554	115	21%
Ejido Benito Juárez	406	71	17%
Ejido Ohuira*	567	16	3%
Ejido Plan de Guadalupe	91	1	1%
Ejido Ricardo Flores Magón	507	101	20%
Ejido Rosendo G. Castro**	205	0	0%
Ejido Topolobampo**	30	0	0%

Name of PAC	No of inhabited private dwellings	No of private dwellings with fixed telephone line	% of private dwellings with fixed telephone line
Ejido Tortugas Número 2	23	0	0%
Los Mochis	90,192	26,304	29%
Paredones	245	4	2%
Plan de Ayala [Campo Cinco]	419	78	19%
Topolobampo**	1,870	485	26%
Total / average	95,168	27,176	10%

*Indigenous Peoples PAC.; **Direct AoI PAC; Source: National Census 2020

Table 5.47: Internet access in Direct and Indirect AoI PACs

Name of PAC	No of inhabited private dwellings	No of private dwellings with internet access	% of private dwellings with internet access
Benito Juárez	3	2	67%
Campo Guadalupe Estrada	56	5	9%
Ejido 9 de Diciembre	554	273	49%
Ejido Benito Juárez	406	216	53%
Ejido Ohuira*	567	127	22%
Ejido Plan de Guadalupe	91	10	11%
Ejido Ricardo Flores Magón	507	234	46%
Ejido Rosendo G. Castro**	205	61	30%
Ejido Topolobampo**	30	7	23%
Ejido Tortugas Número 2	23	2	9%
Los Mochis	90,192	61,100	68%
Paredones	245	51	21%
Plan de Ayala [Campo Cinco]	419	218	52%
Topolobampo**	1,870	989	53%
Total / average	95,168	63,295	37%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National census 2020.

Most PACs within the Direct and Indirect AoI, including Los Mochis, Paredones and Ejido 9 de Diciembre, have recreational facilities such as baseball and football pitches (Figure 5.44). The lack of recreational facilities was reported as an issue in Ejido Rosendo G.

Castro, with the municipal commissioner of the community advising that a multiuse sport court/area would be a welcome addition to the community.[60]

Figure 5.44: Football pitch in Paredones

Source: RSK field visit, April 2024.

5.4.3.7 Education and skills

According to the National census of 2020, Ahome's population has a literacy rate of 97.65% amongst people aged over 15 (DataMexico 2024). Amongst the 2.35% of the population who are illiterate, 53.8% are men and 46.2% are women. About a quarter of the adult population (those over 15 years) has completed high school and/or general baccalaureate, while 17.8% have only reached elementary school education (SLR, 2022a). The majority of the population within the Direct and Indirect AoI communities have completed primary education, with only 3% of females and 6% of males over 15 years old on average not attending primary education (Figure 5.46).

Table 5.48: Percentage of PAC members that did not finalise primary education

Name of PAC	% of females aged over 15 years of age that did not pass primary education and only attended nursery	% of males over 15 years of age that did not pass primary education and only attended nursery
Benito Juárez	0%	27%
Campo Guadalupe Estrada	6%	3%
Ejido 9 de Diciembre	2%	3%

[60] Meeting with municipal commissioner of Ejido Rosendo G. Castro and Sindico of Topolobampo 17th April 2024.

Name of PAC	% of females aged over 15 years of age that did not pass primary education and only attended nursery	% of males over 15 years of age that did not pass primary education and only attended nursery
Ejido Benito Juárez	3%	5%
Ejido Ohuira*	3%	4%
Ejido Plan de Guadalupe	5%	6%
Ejido Ricardo Flores Magón	3%	5%
Ejido Rosendo G. Castro**	6%	5%
Ejido Topolobampo**	0%	0%
Ejido Tortugas Número 2	3%	13%
Los Mochis	2%	2%
Paredones	3%	4%
Plan de Ayala [Campo Cinco]	3%	5%
Topolobampo**	2%	3%
Average	3%	6%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Overall rates of illiteracy within the Direct and Indirect AoI communities reflect trends at the municipality level, with average literacy rates of 96% (Table 5.49). Literacy rates are generally very high across all communities in the Direct and Indirect AoI apart from in Benito Juárez which has a 17% illiteracy rate, well above the municipal average of 3%. Average illiteracy rates across all Direct and Indirect AoI communities are approximately 4%, slightly above the municipal average.

Table 5.49: Illiteracy rates (for peopled aged 15 +) in PACs

Name of PAC	% of people aged 15 + who are illiterate
Benito Juárez	17%
Campo Guadalupe Estrada	4%
Ejido 9 de Diciembre	3%
Ejido Benito Juárez	5%
Ejido Ohuira*	3%
Ejido Plan de Guadalupe	3%
Ejido Ricardo Flores Magón	4%
Ejido Rosendo G. Castro**	6%
Ejido Topolobampo**	0%

Name of PAC	% of people aged 15 + who are illiterate
Ejido Tortugas Número 2	8%
Los Mochis	1%
Paredones	4%
Plan de Ayala [Campo Cinco]	2%
Topolobampo**	2%
Average	4%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Table 5.50 provides data on the illiteracy rates among the population aged over 15 years old within PACs. Average illiteracy rates within the Direct and Indirect AoI PACs are higher in males (6%) than females (3%), with the communities of Benito Juárez and Ejido Tortugas Número 2 notable as having higher populations of illiterate males over the age of 15. Overall, in most PACs, male illiteracy is higher than female illiteracy. On average across all communities, twice as many males are illiterate than females[61]. Amongst the Direct and Indirect AoI PACs, illiteracy rates were recorded above the municipal average for both females and males. Illiteracy rates in Los Mochis, the largest settlement in the AoI, were recorded to be only 1% for both females and males.

Table 5.50: Illiteracy rates of PAC members aged 15 + (disaggregated by gender)

Name of PAC	% of females aged 15 + who are illiterate	% of males aged 15 + who are illiterate
Benito Juárez	0%	27%
Campo Guadalupe Estrada	5%	3%
Ejido 9 de Diciembre	2%	3%
Ejido Benito Juárez	4%	6%
Ejido Ohuira*	4%	3%
Ejido Plan de Guadalupe	3%	4%
Ejido Ricardo Flores Magón	2%	5%
Ejido Rosendo G. Castro**	6%	5%
Ejido Topolobampo**	0%	0%

[61] The male illiteracy rate of 75% in Benito Juárez (a community of only 8 people) increases the average male illiteracy rates across all PACs. If the Benito Juárez is excluded from the calculation, the revised male illiteracy rate would be 4%.

Name of PAC	% of females aged 15 + who are illiterate	% of males aged 15 + who are illiterate
Ejido Tortugas Número 2	3%	13%
Los Mochis	1%	1%
Paredones	4%	3%
Plan de Ayala [Campo Cinco]	2%	3%
Topolobampo**	2%	3%
Average	3%	6%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Access to education is generally good across the Direct and Indirect AoI PACs. Most communities including in Paredones (Table 5.51) have a preschool facility) and primary school (Table 5.51). There are also six secondary schools within the Direct and Indirect AoI, and Los Mochis has 78 pre-schools, 92 elementary schools, 23 high schools, and 27 centres for higher education (technical studies) (SLR, 2022a).

Table 5.51: Types of education establishment in each PAC[62]

Name of PAC	Preschool/ kindergarten	Primary school	Secondary or Tele-secondary	Preparatory or Tele-preparatory school / High school
Ejido Benito Juárez	Yes	Yes	Yes	No
Campo Guadalupe Estrada	Yes	No	No	No
Ejido 9 de Diciembre	Yes	Yes	Yes	No
Ejido Ohuira	Yes	Yes	Yes	No
Ejido Plan de Guadalupe	Yes	Yes	Yes	No
Ejido Ricardo Flores Magón	Yes	Yes	No	No
Ejido Rosendo G. Castro**	Yes	Yes	No	No
Ejido Topolobampo**	No	No	No	No
Los Mochis	Yes	Yes	Yes	Yes

[62] No data was available on types of education establishment in either Ejido Tortugas Número 2 or Benito Juárez

Name of PAC	Preschool/ kindergarten	Primary school	Secondary or Tele-secondary	Preparatory or Tele-preparatory school / High school
Paredones	Yes	Yes	Yes	No
Plan de Ayala [Campo Cinco]	Yes	Yes	No	No
Topolobampo	Yes	Yes	Yes	Yes

*Indigenous Peoples PAC; **Direct AoI PAC; Source: IMPLAN – 'Elementos del sistema de educación' – Programa Municipal de Desarrollo Urbano – Diagnostico.[63]

In Paredones, there is one kindergarten, a regular premier school (see Table 5.51) and one tele-secondary[64] school that shares premises with the tele-preparatory school. The majority of children who successfully graduate from the tele-secondary school are reported to go on to high school [redacted] (2024) pers. comm.). The Director of the federal tele-secondary school no 104 in the community of Paredones reported that attendance is good. The school's pupils are comprised of approximately 60% female students and 40% male (ibid). However, there are only three teachers at the school, with each teacher providing classes in numerous subjects. The school does not currently provide meals to students and instead students either purchase snacks from vendors that gather near the school or go home to eat (ibid).

Conditions in the school were reportedly poor with a reliance on audiovisual educational material, transmitted through the tele-secondary medium and a lack of materials such as labouratory equipment and books (ibid). Although the school has no internet connection[65], the classroom sizes were reported to be adequate given that class sizes are small (generally between three to six children).[66] The school has a covered sports patio area where children play sports and congregate. However, the school director reported that the roof has started to decompose through exposure to salt in the atmosphere (ibid).

State financing for school maintenance is generally provided and the director of the school mentioned that he is hopeful that the upcoming payment of 250,000 MXN (USD 14,000), to be disbursed through the 'La Escuela es Nuestra'[67] programme by the Department of Education, will allow the school to address some of the issues and to build a new perimeter fence.

In the community of Campo Guadalupe Estrada, educational attainment was described as poor in comparison to other surrounding communities such as Ohuira and Paredones.

[63] Available online from: https://www.arcgis.com/apps/View/index.html?appid=9ede8ce3c5d14f3ab37a6ffec7735aab.

[64] Telesecundaria is a teaching model that combines distance education with face-to-face education. It was created in 1968 by the lawyer, journalist and professor Ávaro Gálvez y Fuentes, "El Bachiller", to provide education at the secondary level through television broadcasts, benefit mainly students in rural areas, with difficult access or with low demographic concentration as an alternative to the educational coverage needs of our country. Available online from: https://www.gob.mx/aprendemx/articulos/la-telesecundaria-celebra-su-52-aniversario?idiom=es

[65] During the meeting with the director, it was reported that the monthly cost of providing internet to the school, 600 MXN (USD 35) is currently unaffordable. [redacted] (2024) pers. comm.).

[66] In April 2024, there were 21 students in the 1st grade, 18 in the 2nd and 19 in the 3rd, thus 57 students in total.

[67] In English, "The School is ours".

There is a school in the community, but it is currently not operating due to lack of students.[68]

In Paredones, children are reported to be generally eager to stay in the community before going on to pursue higher education in Los Mochis [redacted] (2024) pers. comm.). Teenage pregnancy is not reported to a be problem with the director only recalling two cases within the last 12 years (ibid).

Figure 5.45: Jesus Ahumada primary school, Paredones

Source: RSK field visit, April 2024.

During meetings with representatives from one of the two CONALEP tele-preparatory schools (No 045) located in Los Mochis, it was reported that over 780 students are enrolled [redacted] 2024) (pers. comm.). Subjects that are taught include:

- administration
- IT
- industrial electronics
- safety, hygiene and civil protection
- operation and maintenance of heavy machinery
- motor transportation.

It was reported during meetings with representatives from the Autonomous Indigenous University of Mexico *(Universidad Autónoma Indígena de México[69], UAIM)* that

[68] Meeting with UAIM representatives, 16th April 2024.

[69] UAIM is a public institution of higher education in Mochicahui, El Fuerte Municipality, Sinaloa. It operates in Mochicahui, Los Mochis and Choix, as well as three extension centres. It was founded on 5 December 2001. Available online from: https://www.uaim.edu.mx/portal/

approximately 90% of the students at UAIM are indigenous.[70] There has also been a generational change affecting the livelihoods and aspirations of the youth. While older generations worked, and continue to work in fishing and agriculture, younger Indigenous People aspire to access higher education opportunities and obtain employment in alternative industries. It was also evident from recent engagement in the predominantly indigenous community of Lázaro Cárdenas undertaken by UAIM representatives that young people are eager to complete their high school education and develop skills that will prepare them for the job market (UAIM, 2024a).

The other main institute of higher education in the Municipality of Ahome is the Los Mochis Campus of the National Technological Institute of Mexico *(Tecnológico Nacional de México, TecNM).*[71] The campus is one of 250 operating under the umbrella of the technological institute across Mexico which has a current nationwide enrolment of approximately 600,000 students. There are three campuses in the municipality of Ahome with 90% of the students studying in the Los Mochis campus. There are currently 198 students studying chemical engineering at the Los Mochis National Technological Institute of Mexico. The Technological Institute hosts students that identify as indigenous including from communities such as Ohuira. Reporting mechanisms and tools are in place to record and monitor the number of Indigenous People attending the three campuses of the National Technological Institute of Mexico in the Municipality of Ahome.

The technological institute's facilities include:

- four product patenting centres
- sports facilities
- clinical laboratories
- lecture auditoriums.

The technological institute currently offers 14 degrees in disciplines such as chemical engineering, public accounting and architecture with additional courses in logistics, IT and administration.[72] Challenges include adapting the academic programmes based on the needs of local organisations and businesses in the chemical industry, agroindustry, fishing and tourism. Additional challenges include accreditation[73] and obtaining job placements for students in companies operating in the area such as GPOI, CFE[74], PEMEX and in the food and petrochemical sectors. Despite these challenges, one of the reported strengths of the technological institute is that it conducts regular engagement with local alumni and companies to understand their needs and can adapt and design academic programmes based on trends.[75]

[70] Meeting with UAIM representatives, 16th April 2024.

[71] Meeting with Tecnológico Nacional de México 19th April 2024.

[72] Ibid.

[73] Accreditation is a status granted to an educational institution or a programme that has been found to meet or exceed stated criteria of educational quality. Accreditation has two fundamental purposes: to assure the quality of the institution or programme, and to assist in the improvement of the institution or programme. Accreditation, which applies to institutions or programmes, is to be distinguished from certification and licensure which apply to individuals. Available online: www.neche.org.

[74] Federal Electricity Commission.

[75] Meeting with Tecnológico Nacional de México 19th April 2024.

The technological institute hosted a workshop for the multinational electric utility company *Iberdrola,* in which approximately 200 candidates were assessed for prospective contracting for a power Project to be implemented in the Municipality of Ahome.

During meetings with representatives from CODESIN, it was reported that the variety of academic disciplines taught in educational establishments is increasing with culinary/gastronomy courses now being taught in the Municipality of Ahome.[76]

The Department of Female Affairs also provides opportunities for women to participate in courses in nail artistry, jewellery making, painting and hairdressing. Participation in these courses has reportedly played a key role in empowering women, particularly those who have been victims of domestic abuse ([redacted] (2024) pers. comm.).

5.4.3.8 Economy and livelihoods

The main economic activity in Sinaloa State is agriculture. The main economic sectors, based on the number of the economic premises/units dedicated to each sector are retail trade (37.7%), services (17.5%), temporary accommodation, and food and beverage (13.1%) and manufacturing (10.3%) (DataMexico 2024).

According to the latest trade data from 2023, the main export for Municipality of Ahome was fresh and chilled vegetables with a value of 112 million US dollars (DataMexico 2024). The main agricultural products for export include figs, pineapples, avocados, guava, mangoes and tomatoes (ibid). The main export destinations for products from Municipality of Ahome are the United States, Japan and Spain.

Sinaloa State attracted foreign direct investment (FDI) to a value of 415 million US dollars in 2023 (ibid). The main origin countries of FDI in Sinaloa State were United States (US$259M), Spain (US$86.9M) and Canada (US$34.7M) (ibid).

According to the Municipal Development Plan (2021-2024) *(Plan Municipal de Desarrollo 2021-2024)*, *"Ahome has an industrial vocation due to its privileged geographical location, which is why the municipality seeks to promote the infrastructure dedicated to the primary sector to become an example of industry without leaving aside agriculture, fishing, commercial and tourist sectors."* The municipal industry development strategy[77] includes the following priorities:

- facilitate the link between academia and industry for the generation of technicians and specialised labour
- promote, together with business chambers, forums, exhibitions and seminars for the benefit of local industrialists
- facilitate access to financing for industrialists to acquire equipment and modernise their facilities
- promote quality certificates to improve industry capabilities.

5.4.3.9 Economically active population

Approximately 60% of the population aged over 15, totalling 218,740 individuals, were reported to be economically active in Municipality of Ahome in 2020 (SLR, 2022a). The

[76] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024.

77 Municipal Development Plan (2021-2024) (Plan Municipal de Desarrollo 2021-2024).

economically active population comprises individuals who are either contributing to the workforce by working or are actively looking for work. The economically inactive population encompasses individuals who, for various reasons, are not currently engaged in paid work or seeking employment. This could be due to retirement, full-time education, caregiving responsibilities, disability, or other factors. Of the 60% economically active population in Ahome, 59.4% are men (DataMexico 2024). Of the 40% of the population who are economically inactive, 37.2% are students, 38.9% are dedicated to household chores, 13.9% are pensioners or retirees, 3.2% are disabled, and 6.9% are involved in other non-economic activities.

At the local level, the economically active population aged 12 or above within the Direct and Indirect AoI PACs ranges from 50% to 77% (Figure 5.46). Ejido Tortugas Número 2 has a notably high level of economically active male population (95%), followed by Ejido Plan de Guadalupe (81%), and Ejido Topolobampo and Paredones, each with 80%. However, there is significant variation among economically active females, ranging from 0% in Benito Juárez to 57% in Ejido Tortugas Número 2 (Figure 5.46) (IMPLAN, 2024).

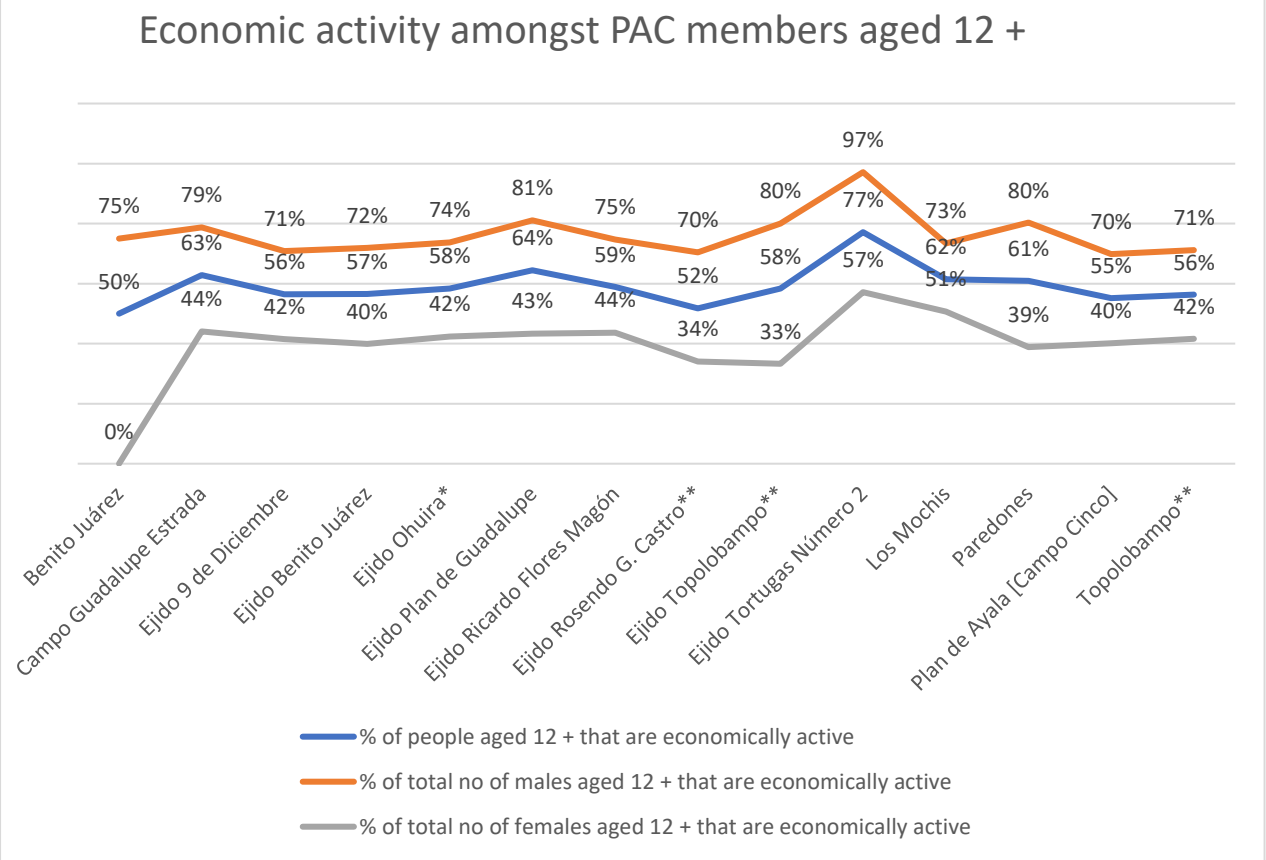


Figure 5.46: Economic activity amongst PAC members aged 12 +[78]

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

[78] Defined as people that 'were working or were not working but looking for work during the reference week (i.e.. the week the census took place).

Similarly, the economically inactive population ranges from 23% to 50% (Figure 5.47). Among males, Ejido Tortugas Número 2 has the lowest rate at 3%, while Ejido Rosendo G. Castro and Plan de Ayala (Campo Cinco) have rates of 30%. For females, the rate varies from 43% to 100% (Figure 5.47).

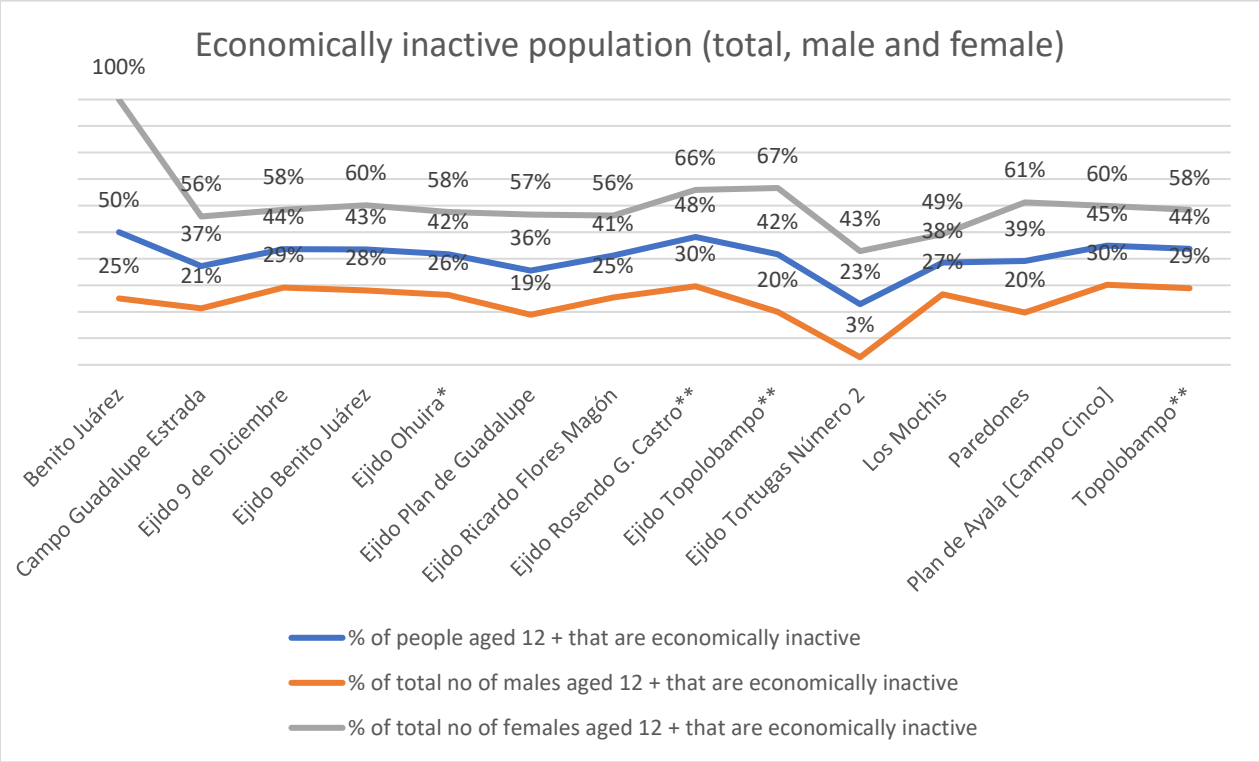


Figure 5.47: Economic inactivity amongst PACs members aged 12 +

*Indigenous Peoples **PAC; **Direct AoI PAC; Source: National Census 2020.**

5.4.3.10 Wealth and poverty

In Municipality of Ahome, 25.3% of the population were living in moderate poverty in 2020, a 4.3% decrease from 2015 (SLR 2022a). The population living in extreme poverty was 2.4% in 2020, a 0.5% increase from 2015 (ibid). Using access to household goods as a wealth proxy, based on the 2020 National census data, 94.8% of the homes in Ahome have a refrigerator, 76.5% have a washing machine, 60.7% reported they have a car, 15.9% a motorcycle and 26.8% a bicycle. Similarly, 93.7% of the homes in Ahome have a cell phone, whereas 23% have a landline, 40% own a computer and 54.7% have access to the internet and 47.8% to a television (DataMexico 2024).

Within the Direct and Indirect AoI, very few private dwellings own no household goods including washing machines, cars, motorbikes, bicycles, phones. The highest number of dwellings without household goods are located in Ejido Rosendo G. Castro and Paredones, where four private dwellings or 2% of total private dwellings lack any household goods.

Table 5.52: Access to general household goods in PACs

Name of PAC	No of inhabited private dwellings	No of inhabited private dwellings with that do not possess a single household good[79]	% of inhabited private dwellings with that do not possess a single household good
Benito Juárez	3	0	0%
Campo Guadalupe Estrada	56	0	0%
Ejido 9 de Diciembre	554	8	1%
Ejido Benito Juárez	406	0	0%
Ejido Ohuira*	567	7	1%
Ejido Plan de Guadalupe	91	1	1%
Ejido Ricardo Flores Magón	507	6	1%
Ejido Rosendo G. Castro**	205	4	2%
Ejido Topolobampo**	30	0	0%
Ejido Tortugas Número 2	23	0	0%
Los Mochis	90192	195	0%
Paredones	245	4	2%
Plan de Ayala [Campo Cinco]	419	1	0%
Topolobampo**	1870	12	1%
Total / average	95168	238	1%

*Indigenous People PAC; **Direct AoI PAC; Source: National census 2020.

5.4.3.11 Farming and agriculture

The agricultural sector in Municipality of Ahome generated 13.7 million Mexican pesos in 2021 with potatoes being the crop with the highest production value, followed by maize and wheat (SLR 2022a). Other common crops include beans, chickpeas, soybeans, sugar cane, cotton, tomatoes, corn, sorghum, rice, tomatillo, and pumpkin (ibid). Commercial agricultural land within the Direct and Indirect AoI is predominantly used for the cultivation of grains like corn, wheat, chickpeas, sesame seeds, beans, and various vegetables. Potato production is another main commercial agricultural activity predominantly managed by agro-industrial companies. Small-scale farmers cultivate crops such as chard, beetroot, radishes, cilantro, safflower and onions.

[79] Refrigerator; washing machine, microwave, car or van, motorbike, scooter, bicycle (used as a form of transport); radio, television, desktop computer, laptop or tablet, internet; fixed telephone line, mobile phone, paid television subscription (i.e. cable or satellite), movie/TV streaming service/subscription, downloaded music or video content or video games.

Figure 5.48: Recently harvested potatoes in a field adjacent to Los Mochis-Topolobampo highway (near Paredones)

Source: RSK field visit, April 2024

The Municipal Development Plan (2021-2024) *(Plan Municipal de Desarrollo 2021-2024)*, details the following agricultural development strategy:

- promote crop diversification
- facilitate producers' access to technology and agricultural innovation
- participate in trade fairs and exhibitions to promote the municipality of Ahome
- assist with the marketing of Ahome products at national and international levels.

Local land use planners emphasise that approximately 60% of the land in the Municipality of Ahome is designated as suitable for farming.[80] Advanced agricultural practices and regular supplies of water from the nearby reservoirs into the region's irrigation channels have helped agriculture remain profitable within the Municipality of Ahome and Sinaloa State. [81]

The main season for crop cultivation is May to September. The main crops cultivated by small-scale Ejido farmers are wheat, beans and corn.[82] Potatoes beans and corn were identified as being the most profitable, although the wholesale price of corn is reported to have reduced in Sinaloa over the last year. During the field visit many fields containing harvested potatoes were seen, including at a site adjacent to Los Mochis-Topolobampo highway near Paredones (see Figure 5.48). [83] Berry production has increased in part due to the introduction of South American agro-industrial companies that have established present in the municipality. [84]

[80] Meeting with IMPLAN Los Mochis, 17th April 2024

[81] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024

[82] Meeting with community leaders of the Ejido 9 de Diciembre 17th April 2024

[83] Ibid.

[84] Ibid.

Livestock farming is limited by the availability of suitable grazing areas around Los Mochis. There are a small number of zero grazing ranches and production facilities specialised in raising cattle and poultry or the production of eggs (see Figure 5.49)

Figure 5.49: Egg farm located along Los Mochis-Topolobampo highway

Source: RSK field visit, April 2024.

The main challenges faced by Ejidal farmers are increasingly high costs, particularly the cost of water permits and of seeds.[85] Taxation for agricultural produce, planting permits, machinery costs, rental costs and the cost of insecticide chemicals are also factors that are increasing the cost of agricultural production. The minimum daily agricultural wage is 220 MXN (USD 13) and agricultural workers receive their salaries every eight days.[86]

During an interview with an affected landowner it was suggested that drought, climate change and high salinity of the land that is adjacent to the Project has made farming more difficult over the recent years.[87] While increased precipitation from storms that impacted the north of Sinaloa in 2023 is reported to have provided conditions that resulted in high cultivation yields and current stockpiles of corn, Los Mochis is currently experiencing a lengthy drought with no substantial rainfall registered since October 2023.[88]

5.4.3.12 Fishing

Fishing is undertaken in Mexico by both industrial and small-scale fisheries in the Atlantic and Pacific Ocean (FAO, 2023).

In 2019, the fishing and aquaculture sector contributed 0.05% to the Mexican economy and over 295,000 people were employed in the sector (ibid). 80% of fisherfolk participated in capture fishing with the remaining 20% involved in aquaculture. Both annual imports and exports of fish and fishery products have increased from approximately 90,000 tonnes per year in 1990 to over 300,000 tonnes per year in 2021 (ibid).

Fishing is an important economic activity in Municipality of Ahome. Fisheries along the coastline support marine species such as shrimp, lobster, giant squid, sardine, Mexican mojarra, snapper, clams, snook, oyster, sawfish, croaker, marlin, and crab (SLR 2022a). The MIA reported that Ahome fishing infrastructure consists of 2,670 vessels, 86 large fishing boats, and 140 cooperative societies (Mexinol 2021). Aquaculture has also

[85] Meeting with community leaders of the Ejido 9 de Diciembre 17th April 2024
[86] Meeting with community leaders of the Ejido 9 de Diciembre 17th April 2024
[87] Meeting with affected landowner and land broker, 16th April 2024
[88] Meeting with community leaders of the Ejido 9 de Diciembre 17th April 2024

experienced recent growth in the region, with 22 fish farms now operating covering 2,700 hectares (SLR, 2022a).

According to the Municipal Development Plan (2021-2024) *(Plan Municipal de Desarrollo 2021-2024)*, the fisheries sector development strategy in Ahome consists of the following:

- manage support from the State and Federal governments for the fishing sector
- promote access to credit for the fishing industry
- promote the rational use of natural resources that promote their conservation and preservation
- participate and promote sport fishing
- diversify the economic activities of fishing fields, such as the processing and packaging of seafood products and
- facilitate investing in more marginalised areas, such as fishing fields.

There are reported to be 12 fishing confederations within communities (Ejido Benito Juarez, Plan de Ayala, 9 de Diciembre, Ricardo Flores Magon, Ohuira, Cerro Cabezon, Guadalupe Estrada, Paredones, Rosendo G. Castro, Lazaro Cardenas, Carrizo Grande, Topolobampo) surrounding the Project, each comprising approximately 40 cooperatives (SLR 2022a). These confederations provide a collective structure to gather the needs of fisherfolk and communicate them to local authorities. They are also responsible for organizing fishing permits and securing funds to improve fisherfolk's working conditions. The type and volume of fish sold must be authorised by the National Aquaculture and Fishing Commission *(Comisión Nacional de Acuacultura y Pesca, CONAPESCA),* the federal government's regulatory institution overseeing fishing activities. In the Bay of Ohuira, fisherfolk harvest lisa (mullet) and crabs, while species such as huachinango (red snapper), sierra (mackerel), corvina (croaker), and sharks are caught in deeper waters (SLR, 2022a). Artisanal fishing activities are conducted both within the Bay of Ohuira and around the town of Topolobampo. Fisherfolk in Paredones mainly target shrimp, lisa, crabs, clams, and various open-sea fish species (SLR, 2022a). In their free time, children in Paredones are reported to voluntarily help their families with catching and preparing shrimp. The involvement of children in fishing, which typically takes place in the nearby Bay of Ohuira once a month at night, is reported to not detrimentally affect their education [redacted](2024) pers. comm.).

Fishing is undertaken all year round although for certain species there are specific seasons/months during which fish catches are higher, for example September to March for shrimp. Fishing methods include Suripera nets (using wind and water currents to capture shrimp), and 1x1 metre traps designed for catching crab (SLR, 2022a). Approximately 40-50 tonnes of shrimp are caught per day during the high season[89]. Approximately, 85% of shrimp that is farmed in Mexico comes from the North of Sinaloa.[90] Temporary closures or limitations on fishing for species, such as shrimp and shark, are often enforced, with the Government monitoring compliance during the closed seasons.

Most people that practice fishing rely on the activity as their main source of livelihood. However, recreational fishing is also conducted and some people practice fishing as a hobby and/or enter fishing competitions. Fishing was reported to be common in In Campo

[89] Meeting with representatives of the Fishing Division of the Department of the Economy 17th April 2024

[90] Meeting with Tecnológico Nacional de México 19th April 2024

Guadalupe Estrada, Ricardo Flores Magón, Ejido Ohuira, Paredones, Lazaro Cardenas, Ejido Carrizo Grande and Cerro Cabezón. As noted in the Community Profile for Paredones, fishing is the most prevalent economic activity in that community (Section 5.4.1.2). The same is also true for Lázaro Cárdenas and Carrizo Grande where fishing provides the main source of income for these PACs.

Most fish caught is sold for commercial sales to buyers in local, state and national markets. Fish is also sold to buyers in California, USA and as far afield as China. In recent years cheaper imports of shrimp from Ecuador have undercut the local shrimp market with the cost of one kilogram of shrimp, previously 70-80 MXN (USD 4-4.71) being reduced to 40 MXN (USD 2.36). [91]

Both indigenous and non-indigenous (i.e. mestizo) fishing cooperatives exist. Fishing cooperatives provide a market for the fish caught, but each cooperative member owns the equipment that they use for fishing. In total, 8,000 fisherfolk are members/affiliated to fishing cooperatives within the municipality.[92]

Currently, there are thought to be at least 7,000 unlicensed fisherfolk in the municipality of Ahome who do not belong to cooperatives, many of whom secretly fish at night. [93]

Fisherfolk pay approximately 2000 MXN (USD 117) for annual fishing permits. Cooperatives themselves pay 80-100,000 per fishing permit. In some cooperatives, a minimum percentage (around 10%) is withheld for product delivery and administrative expenses. [94] This payment from fisherfolk contributes to the running costs of the cooperative. The funds also are used by the cooperative to guarantee sale of fish for fisherfolk, identify new markets and contribute towards the management of fishing equipment. In others, the total product is settled at an agreed price.

Boats that are typically used for small scale fishing in the Bay of Ohuira are 23-25 feet in length, with three fisherfolk per boat. Most engines are 60-75 horsepower. In terms of the equipment used to facilitate fishing, leyeras (small handheld nets) are commonly used, although some fish species such as mullet are difficult to catch due to their tendence to jump out of the nets. Other equipment include traps (for capture of shells).

Challenges reported by fisherfolk include a general lack of fishing equipment, lack of boats, which have reduced in number in recent years, and unreliable fishing motors that are often prone to breaking. [95] Despite challenges fisherfolk generally manage to sustain a living by working together and obtaining the support and equipment that they need. Although it was reported that support from federal and state government is limited, the recent provision of support for 200 fishing boat motors to local fisherfolk helped to address motor-related challenges.

Although fishing is predominantly undertaken by men (approximately 99% of people that fish are male), there is substantial participation in associated tasks by family members. Women often assist with decapitating and packing fish and children are known to help out with fishing tasks outside of school hours. In the commercial fisheries processing and freezing plants, it was reported that approximately 70% of the employees are women.

[91] Meeting with representatives of the Fishing Division of the Department of the Economy 17th April 2024

[92] Ibid.

[93] Ibid.

[94] Ibid.

[95] Ibid.

Other than decapitating and packing fish, other tasks that women undertake are book keeping/administrative tasks and descaling fish. In the community of Paredones, very few children (approximately 8%) are interested in pursuing fishing as their main livelihood. Most children want to study and undertake training instead of fishing [redacted] (2024) (pers. comm.).

There are currently initiatives in place to facilitate and promote commercialisation of the fisheries sector by creating more producers and laying foundations for increased aquaculture in PACs like Ejido Rosendo G. Castro, where shrimp and clams are already farmed. Oysters and clams are recognised as being the most lucrative and profitable species and thus the focus on mariculture is expected to increase in the near future. [96]

5.4.3.13 Tourism

Mexico is the sixth most visited country in the world. The total number of employees in the tourism sector in 2020 was approximately 2 million and contributed 6.7 % of the national GDP (UN Tourism, 2023). The country welcomed 38.3 million international tourists in 2022 an increase of 20.3% on 2021 (Relaciones Exteriores, n.d). Key tourism attractions include beach resorts such as Cancun and Playa del Carmen; pre-Columbian ruins such as those found at Teotihuacan and Chichen Itza and biodiversity hotspots such as the Monarch Butterfly Biosphere Reserve (Kaplan, M, 2024).

Tourism is an increasingly important economic activity in Sinaloa and has seen visible growth around the Topolobampo area and Los Mochis. The number of domestic (accounting for 80% of tourist arrivals in 2023) and international (20% of the arrivals) tourists is increasing within northern Sinaloa State, with international tourists coming mainly from USA, but also from Europe and China.[97] The peak tourist seasons are generally around religious festivals, such as Christmas and Easter, and during the summer period.

The tourism sector around the Port of Topolobampo is reported to have grown in recent years, stimulated by the arrival of cruise ships to the port, visitors seeking to enjoy attractions within the Bay of Ohuira (i.e. diving; whale and dolphin watching) and use the ferry service to La Paz, Sinaloa (SLR 2022a). Tourism enterprises in Topolobampo (water sports providers, restaurants, pleasure boats etc.) serve visitors to the Bay of Ohuira, the Bay of Topolobampo and the Bay of Santa María, with surrounding islands and beaches found in the Sea of Cortez. However, the lodging offer is still limited, with only three hotels and one Airbnb, which restricts the accommodation capacity for a greater numbers of tourists. The Tourism Directorate has made significant efforts to promote Topolobampo at national and international events, primarily as a nature destination.

Various stakeholders that were consulted during the RSK field visit, including members from the business community, land users and hotel industry, emphasised the growth of the tourism sector in Topolobampo in recent years. The growth of tourism in the town is evident in the number of restaurants, souvenir shops and food stalls that are well established along the Topolobampo waterfront. Two hotels are now operating in Topolobampo; the Hotel Aduana (a boutique hotel) and the Marina hotel.[98] One boutique guesthouse and also a cultural centre are now also present in Topolobampo. The number

[96] Meeting with representatives of the Fishing Division of the Department of the Economy 17th April 2024

[97] Meeting with Association for hotels in northern Sinaloa and Hotel America in Los Mochis 19th April 2024

[98] Meeting with CODESIN representatives.

of tourists, shops and the number of companies offering boat trips is reported to have increased during the last seven years.[99] There are currently eight cooperatives and four permit holders operating approximately 42 small eight-seater boats providing whale and dolphin watching trips and operating boat trips to sites including Bay of Ohuira and mangrove areas. Boat trips are priced at between 600 MXN (GBP 28.05) and 8,000 MXN (GBP 373.98) (see Figure 5.53)[100]. However, further tourism growth in Topolobampo is restricted due to the limited supply of lodging, competition among service providers, and the influence of other tourist destinations in the region.

The tourism sector was restricted after the COVID-19 pandemic when cruise ships were suspended from entering the Port of Topolobampo. The arrival of the 'Volendam' liner in December 2023[101] was a key moment in the reactivation of tourism in the area after the COVID pandemic and reiterated the role that cruise passengers play in the local economy by generating jobs and promoting culture (El Sol de Mazatlán, 2023). According to the Directorate of Tourism for Sinaloa, a total of six cruise ships are expected to visit the Port of Topolobampo in 2025. It is important to note that day trips for cruise ships visitors generally involve visits to regional attractions (i.e. visits to the Copper Canyon via the CHEPE train).

Topolobampo is also becoming an important recreational settlement for wealthy Mexicans. It is characterised by its colourful houses and is home to the Palmira Marina and Marina Club where select *mochitenses*[102] maintain their yachts for use in the summer.

The hosting of large festivals has also played a key role in providing Los Mochis with an opportunity to showcase the region's agricultural produce, food and drink to the tourism sector. Los Mochis culinary fest is one of the largest food and drink festivals in Mexico and last took place on 2nd February 2024, bringing together national and international chefs (Municipality of Ahome, 2024)[103]

Another key tourism activity that attracts national and international visitors is the Chihuahua-Pacific train that runs 653 kms from Los Mochis, Sinaloa to Chihuahua City in the neighbouring state of Chihuahua.[104] The train, often referred to as the 'Chepe' train, runs three times a week and provides tourists, generally from Mexico and the USA, with an opportunity to take in the pleasant scenery and travel through sites such as the Copper Canyon and the historical city of El Fuerte.[105]

The Association of Hotels and Motels in Northern Sinaloa is responsible for promoting the north of Sinaloa as a tourist destination.[106] The organisation report that there are currently approximately 1,728 tourist-category hotel rooms in the Municipality of Ahome, with an additional 128 expected to be added to this figure with the opening of the Holiday

[99] Meeting with Association for hotels in northern Sinaloa and Hotel America in Los Mochis 19th April 2024

[100] Calculation based on the rate of 1 GBP to 21.39 MXN on 26 April 2024.

[101] Available online from https://www.elsoldemazatlan.com.mx/finanzas/se-reanuda-la-llegada-de-cruceros-a-topolobampo-11162573.html.

[102] Residents of Los Mochis.

[103] See Municipality of Ahome (2024) "Culinary Fest Los Mochis 2024", reunirá a chefs nacionales e internacionales este viernes 2 de febrero. Available at https://www.ahome.gob.mx/culinary-fest-los-mochis-2024-reunira-a-chefs-nacionales-e-internacionales-este-viernes-2-de-febrero/ (Accessed 09 May 2024).

[104] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024.

[105] See https://www.railsouthamerica.com/blog-posts/the-famed-chihuahua-pacific-train.

[106] Meeting with Association for hotels in northern Sinaloa and Hotel America in Los Mochis 19th April 2024

Inn hotel expected in 2024.[107] Most hotels have approximately 50 to 70 rooms. International-class hotels currently operating in Los Mochos include the ibis, City Express by Mariott and Best Western Plus.[108] The average annual hotel occupancy rate is around 65%, with the highest occupancy rate of around 90% only being achieved during the National Potato Congress[109] that was held in Los Mochis in November 2022.[110]

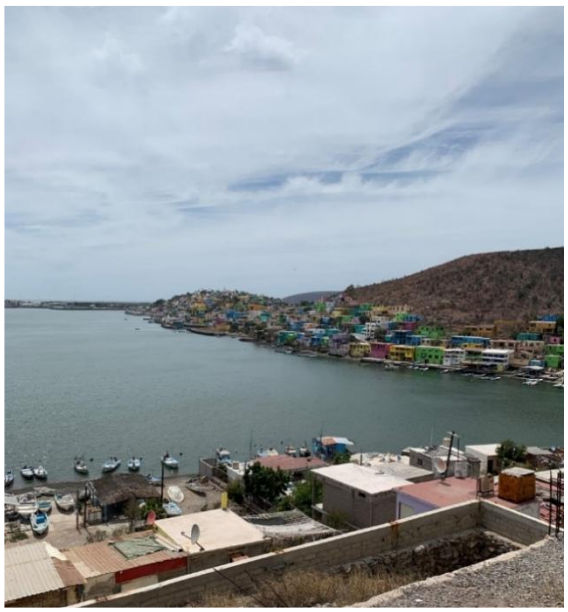


Figure 5.51: View of Topolobampo from the observation deck

Source: RSK field visit, April 2024

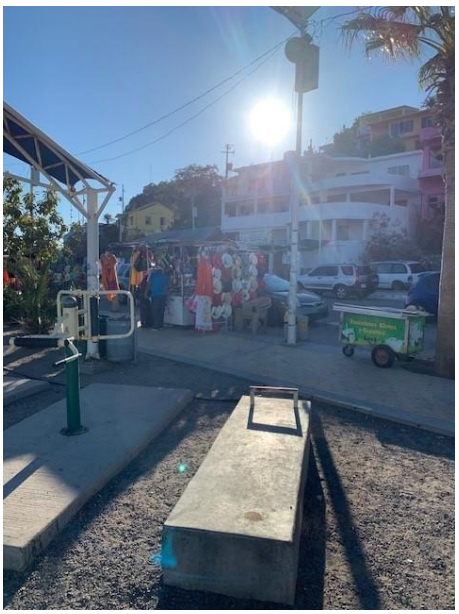


Figure 5.50: Souvenir stalls the waterfront in Topolobampo

Source: RSK field visit, April 2024

[107] Ibid.

[108] Ibid.

[109] *Congreso Nacional de la Papa*

[110] Meeting with Association for hotels in northern Sinaloa and Hotel America in Los Mochis 19th April 2024

Figure 5.52: Small eight seater tourist boats to the east of Topolobampo waterfront

Source: RSK field visit, April 2024

Figure 5.53: Price list for boat trips

Source: RSK field visit, April 2024

5.4.3.14 Local business

There are a total of 4,543 informal and formal commercial establishments in the Municipality of Ahome. This includes a variety of self-service stores, shopping malls, municipal markets, and individual stands (SLR, 2022a). Within the Direct and Indirect AoI there are a variety of types of commerce, including small shops, markets and informal street stalls selling food, tools and clothes. Open air markets are mainly located around Topolobampo and Los Mochis. Most PACs also have a grocery store serving the population (see Table 5.53).

Table 5.53: Types of establishments for provision of households goods

Name of PAC	Market (*Mercado*)	Open-air market (*Tianguis*)	Grocery store (*Abarrote*)
Benito Juárez	No data available		
Campo Guadalupe Estrada	No	No	Yes
Ejido 9 de Diciembre	No	No	Yes
Ejido Benito Juárez	No	No	Yes
Ejido Ohuira*	No	No	Yes

Name of PAC	Market (*Mercado*)	Open-air market (*Tianguis*)	Grocery store (*Abarrote*)
Ejido Plan de Guadalupe	No	No	Yes
Ejido Ricardo Flores Magón	No	No	Yes
Ejido Rosendo G. Castro**	No	No	Yes
Ejido Topolobampo**	No	No	Yes
Ejido Tortugas Número 2	No data available		Yes[111]
Los Mochis	Yes	Yes	Yes
Paredones	No	No	Yes
Plan de Ayala [Campo Cinco]	No	No	Yes
Topolobampo**	Yes	Yes	Yes

*Indigenous Peoples PAC; **Direct AoI PAC. Source: IMPLAN 2024

Informal food stalls have also been established over the past year near the intersection of the Los Mochis-Topolobampo highway and the RoW of the methanol pipeline to the east of Ejido Rosendo G. Castro (see Figure 5.54). Owners of informal street stalls are subject to regulation and are obliged to pay the local council for a permit before establishing operations.

Figure 5.54: Informal food stall near Ejido Rosendo G. Castro

Source: RSK field visit, April 2024.

[111] During the RSK field visit in April 2024, a grocery store was identified in Ejido Tortugas Número 2. However, it was not clear if the store is currently functioning/in operation.

There are approximately 800 industry-related businesses located in and around Los Mochis, including a variety of sectors such as automotive parts, metal mechanics, bodywork, repair shops, textiles, assembly companies and distribution centres. Most of these are family micro-businesses. Various companies involved in food processing, grocery wholesale and utilities have production facilities in the Los Mochis area. These companies, *inter alia*, include,:

- La Costeña (Mexico's number one grocery brand)
- Hortifrut (a berry production company)
- Frito-lay (manufacturer of crisps and other snack foods)
- Iberdrola (Spanish multinational utility company)
- Packet express (food processing plant specialising in potatoes, mango and shrimp) and
- Comisión Federal de Electricidad (CFE) (Mexico's state-owned electric utility company).

A Chilean chemical company called Sociedad Quimica y Minera de Chile[112] (SQM) also has a production plant just outside the Topolobampo industrial park that supplies plant nutrients, iodine, lithium and industrial chemicals (SQM, 2024). Crabway is a processing plant for crab located equidistant between the PACs of Campo Guadalupe Estrada and Paredones and is reported to be a significant source of employment for community members [redacted] 2024) pers. comm.).

Diversification of the commercial sector is supported by CODESIN, which is a government sponsored citizenry body with a base in Los Mochis that develops projects, strategies and public policies to promote commercial development. CODESIN's current area of focus include:

- increasing hotel capacity
- improving health facilities
- improving educational infrastructure and
- ensuring the young talent remains in the north of Sinaloa.

According to CODESIN while increasing participation of youth in higher education has led to an increase in the availability of skilled local people, some businesses still face challenges finding appropriately certified candidates as companies are gradually being required to follow stricter protocols.[113] Although food processing and production of crops such as corn, potatoes and eggs continues to play a key role in the local economy, industrialisation and a shift towards manufacturing has occurred within last 20 years.[114] Competition in the food production sector is growing with some international companies known to employ as many as 5,000 people.[115]

[112] Translated into English as the Chemical and Mining Society of Chile.

[113] Ibid.

[114] Ibid.

[115] Ibid.

5.4.3.15 Land use, land ownership and land impacts

5.4.3.15.1 Methodology

This section covers both permanent and temporary land needs. In relation to land, RSK utilised data review, key informant interviews, and land surveys (through GIS and site walk-overs) to confirm land rights, determine baseline land use, assess potential land access and use impacts and validate that land acquired for the Project was completed through negotiated settlements with property owners, and that all land transactions were voluntary (i.e., market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation).

The baseline data collection included reviewing the Project's inventory of land that will be lost or altered due to the Project, the official land valuation data, and the prices paid for the land against the valuation. Any potential economic impacts at a household level resulting from the loss of land, especially for those households that may be particularly vulnerable, and other potential impacts including loss of access to recreation, ecosystem services or cultural heritage were also assessed at this stage using a combination of data review, key informant interviews and land survey work (i.e. GIS analysis and site walk-overs).

All land plots affected by Project land acquisition are from private and ejido sellers from Ejido Rosendo G. Castro and Ejido Topo Viejo. RSK interviewed three private land sellers, three ejidatarios from Ejido Topo Viejo and the Ejido commissioner responsible for, and knowledgeable about, all sales from Rosendo G. Castro given its communal and socioeconomic status (see Table 5.3.1). It should be noted that Ejido Topo Viejo is not a specific community but rather a collection of people who reside in Topolobampo but own land in the Ejido communal area. To validate and triangulate the commissioner's responses, RSK also utilised the data from the UAIM focus group held on the 20th February 2024, with 64 residents of Rosendo G. Castro, including several ejidatarios who sold their land to the Project (UAIM 2024a; UAIM 2024b). Interviews focused on reviewing the land data provided by the land broker to ensure validity and RSK focused on the following questions:

- Were negotiations legal and voluntary?
- Were the settlements completed at or above market value?
- Were the payments made on time?
- Were there any complaints related to the process?
- Were there any agricultural plots affected?
- Were there any cultural heritage sites affected?
- Did any land acquisition negatively impact communal or individual livelihoods?
- What were the general attitudes and perceptions towards the land acquisition process?

RSK also interviewed the current leaders of both Rosendo G. Castro and Ejido Topo Viejo to inquire as to any potential issues with the selling of the land. The same questions were utilised. No concerns were reported. The land broker responsible for all transactions was also interviewed in detail to present details of each sale and a review of the land database was completed. He provided details (including socioeconomic status,

employment, other land owned etc) as to the private and ejidal landowners not interviewed by RSK.

For land acquired for the Project land use was also mapped using high-resolution satellite imagery, including the Project site, methanol pipeline RoW, and water pipeline RoW (Figure 5.53). Site photos provided by the Project were also reviewed and assessed. During the RSK baseline data collection visit, social and biodiversity specialists from RSK and B+F completed walk-overs and vehicle drives within the Project site and along the entire length of the pipelines to validate GIS findings and identify any anomalies. Land plots with maps, inventory and valuation data, is provided in Appendix 4: Supplemental Land Acquisition Document.

Information related to land acquisition and land use for the Project's Associated Facilities is covered in Section 10.

Table 5.54 Project land per component

Project component	Area required (ha)	Area acquired to date (ha)	Previous landowner	Area in negotiation	Previous use
Project site (plant) and access road	99.99	99.99	Project shareholder	N/A	Commercial Agriculture
Methanol pipeline	53.05	52.15	Government – 15.08 ha Ejidatarios (13)- 22.40 ha Private owners (13) – 14.67 ha	0.278 ha with two landowners (procedural) 0.6224 ha waiting on final HDD design- landowners willing to sell	Sandy soil 0.425 hectares of commercially designated land (not used as commercial)
JAPAMA water pipeline	10.2	0	15 private plots 1 ejidal plot	Valuation and negotiation are underway for the new rerouting of the water pipeline, that only consists of private land.	Sandy soil
Laydown areas (temporary)	40.58	40.58	Project shareholder		Former agriculture (not used in

					recent years due to drought conditions)
Total	**203.82**	192.72			

5.4.3.15.2 Land Ownership – Project site and Methanol Pipeline

Land required for Project components (facility and pipelines) falls under three types of land tenure: public land, private tenure and Ejidal land. *Ejidal l*and is agrarian land owned by individual *ejidatarios* but managed under a communal system. It is important to note that being an *ejidatario* and the communal system does not signify an affiliation with any Indigenous group. All of these land tenure systems are subject to different land acquisition legislation (see Chapter 2).

Land for the Project site (99.99 ha) and the temporary laydown areas (40.58 ha) were purchased from the Project shareholder in 2018.

For the methanol pipeline, according to the Project's Land Acquisition Database reviewed by RSK, since 2018, the Project has acquired a total of 52.15 hectares of land, primarily involving two types of land tenure: Ejidal (22.40 ha) and private land (14.67 ha). There are two exceptions to this, including the acquisition of a total of 15.08 hectares of public land from the government and use of easement mechanisms on some Ejidal land parcels. A majority (35 out of 43 total land transactions with 28 sellers) were completed in 2021 and 2022.

For the methanol pipeline, Mexinol made the offer to each landowner to a) buy the total property of the lot (CV –Enajenación) or b) partial use of the property using a Right of Way (RoW) contract (Servidumbre de Paso). Of the total 43 landowners whose land was needed for the methanol pipeline, 21 preferred to sell their lots outright, and 22 believed that with the industrialization of the area they could rent or sell their property in the future and wanted to retain the land, so ROW contracts were used. For 17 of the 22 contracts, Mexinol also signed Arrendamiento (lease) contracts which allow Mexinol to lease land within the ROW (or in the cases of an owner selling only a partial land plot) for 50 years.

RSK reviewed the official land valuation documents against the amounts paid in the database, which included records of all transactions, notary statements, public registrations, and receipts (see Appendix 4: Supplemental Land Acquisition Document). According to the records, the valuation was a transparent process, and land was sold at well above market replacement price, which contributes to fair compensation and full replacement cost (incl. beyond the equivalence of market value of the assets plus transaction costs).

The National Register holds land certificates and administrative documents (including GPS coordinates) for the sale of the land parcels. Federal notary plays an administrative role in overseeing the sale and purchase of land. The Project did not purchase the land of individuals without documentation. All purchases incorporate an act recognising the land boundaries, a map certified by a notary, registered in the National Agrarian

Register[116]. The payments for each acquired land parcel were done in one instalment (in cheque or bank transfer) and the records were documented.

RSK did not uncover any cases of land conflict or unrecognised landowners. Land acquired for the Project was not identified as owned or under customary use by specific groups of Indigenous Peoples (see Appendix 4: Supplemental Land Acquisition Document). The Project paid above market rate (plus transaction costs) for the land considering replacement value.

5.4.3.15.3 Status

At the time of writing, all private and Ejidal land transactions for lands required for the methanol pipeline had been concluded except for two pending finalised agreements (totalling 0.278 hectares of Ejidal land; 0.52% of the total land required for the methanol pipeline. One is attributed to the fact that the ejidatarios concerned did not update family details when their relative died and therefore the son needs to wait for the administrative process to register him officially as the new owner. The other one refers to an absentee landowner who lives in the U.S. requiring the broker to visit her to finalise the contract. It is expected these contracts will be signed in 2025 – there is no indication that the negotiations would fail, and contracts have already been negotiated and agreed with these affected landowners.

In addition, there are five plots of land at the entrance to the Port authority totalling 0.6224 ha, or 1.2% of the total land required for the methanol pipeline, which the Project has in a pending status with the private landowners (none of whom rely on the land for livelihoods since it is fallow Xerophytic land unsuitable for agriculture). Valuations have been completed, and purchase prices have been negotiated and agreed, awaiting the final methanol pipeline design (e.g. use of HDD). Once the final design is agreed, the Project will purchase either the full lots or partial lots. The land is fallow Xerophytic land unsuitable for agriculture and sits between two roadways (see Appendix 4: Supplemental Land Acquisition Document). There are no assets or land-based investments on the affected lands. It is expected these contracts will be signed in 2025 – there is no indication that the negotiations would fail since prices have already been negotiated and agreed.

Within the Port facilities, where the methanol pipeline will pass and connect at the loading facility, land belongs to the Port Authorities and is not subject to a land acquisition process. Rights of way were granted by the Port Authority in November 2024 and responsibilities and procedures during construction are controlled by the Port Authority under specific laws and regulations (See Appendix 4: Supplemental Land Acquisition Document).

Table 5.54: Land ownership

Project component	Land ownership	Ha
Methanol pipeline	Government	15.08
Methanol pipeline	*Ejidatarios* (13)	22.40
Methanol pipeline	Private owners (13)	14.67

[116] If there were any non-conformances, a 30 day-period is given for those to be presented.

Project component	Land ownership	Ha
Methanol pipeline (remaining contracts)	Private owners (7)	.9004
Project site / pipeline	Project shareholder	99.99
Laydown areas (temporary)	Project shareholder	40.58
Wastewater pipeline	Private owners (15) Ejidatarios (1)	10.2
Total		203.82

Source: Mexinol Land Documents, 2024/2025.

5.4.3.15.4 Private land

The Project acquired a total of 14.67 hectares of private land from 13 private owners for the development of the methanol pipeline. No other formal or informal land users were identified, and the land is free of any third-party dependencies beyond the registered owners. These lands consisted of sandy soil, previously impacted by the JAPAMA drainage and water pipelines. Located adjacent to the highway, the land is not currently used either formally or informally for agriculture, residential, or commercial purposes. Additionally, the landowners **did not have any surface assets** on their plots, as the **soil conditions are unsuitable** for infrastructure development or agricultural cultivation. Only one area classified as agricultural land was identified along the pipeline route, located at the entrance to the Project site. The parcel was purchased from a Project shareholder (see below). Similarly, the lands within the access road ROW were also acquired from the shareholder. Additionally, the Project has also acquired 0.425 hectares of private commercial lot land from three owners in the area where the methanol pipeline extends towards the port.

For the Project site, a total of 99.99 hectares of private land was purchased from one of the Project's shareholders' families, [redacted] This land is the main higher value land unit impacted by the Project. 43.9 hectares out of the 99.99 ha is currently being used for commercial agricultural purposes until the Project initiates construction. No dependencies nor other land users were identified at this land There are no workers on the site that were dependent on this land for their livelihoods.

Ejidal land

RSK also confirmed first through data review that the Project acquired approximately 22.40 hectares of Ejidal land from 13 ejidatarios landowners (non-Indigenous) from Topolobampo and Ejido Rosendo G. Castro for the methanol pipeline. For the methanol pipeline RoW, Mexinol acquired land from 21 ejidatarios, and signed lease contracts with 22 ejidatarios. For 17 of the total contracts, Mexinol also signed Arrendamiento contracts which allows Mexinol to lease land within the RoW (or in the cases of an owner selling only a partial land plot) for 50 years The TransCanada pipeline and CFE electrical towers are present in these areas, and there are no physical assets or land-based investments on this land. Prior to the acquisition, these areas were not being used for agricultural or

housing purposes whether by their owners of any other formal or informal land users, as these consist of sandy and poorly irrigated soils unsuitable for cultivation.

Figure 5.55: Land use and land based impacts for Project components (Overview)

The process for purchasing land in Ejidos is regulated by law. RSK confirmed through document review and subsequent interviews with the Project land broker and notary during the baseline field visit that the law was followed. This process is described below.

There are three types of *ejido* land users: *avencidados*, *posesionarios* and *ejidatarios*. To be an *ejidatario* one needs to first become a formal neighbour (*avecindado*); and being Mexican is a prerequisite for that. *Posesionarios* can own a parcel, but they do not participate in the political decision-making process within the *ejido,* while *ejidatarios* do. Unlike *ejidatario* land users, *avecindado* and *posesionario* land users also do not hold voting rights in the election of the *comisariado ejidal*[117]. Local *ejidatarios* generally own between three and four land parcels. The system works on a communal basis they receive a percentage of each transaction (5-10%), which they distribute according to their decision-making process, either by splitting the benefits among them, or investing in communal ejido land or required infrastructure. The ejido members elect their leaders and participate in the political processes at the local level.

Ejidatarios have a preference right, which means that they have the preference to buy land when another *ejidatario* is willing to sell. According to Article 89 of the Agrarian Law, an *ejidatario* that wants to sell their land must inform the entire *ejido* community and their relatives about the potential purchase by sending them a notification 30 days before the transaction. It should be noted that Ejido land parcels are owned by individuals and ejido permission (from the ejido members as per each ejido decision making process) is only needed if they intend to sell to an *avecindado* or *Posesionarios*.

For the Project's ejidal land acquisitions, the Project's land broker led negotiations, ensuring that all notifications were in order in accordance with law, including those of partners and children outside the marriage. A public notary and two witnesses signed off on the process. It is worth clarifying that none of the ejidal land impacted belonged to indigenous ejidatarios. Hence, it is non-indigenous land. Furthermore, it is important to note that the Project's local Mexican shareholder (who sold the 99.99 hectares) is an *avecindado* and a *posesionario* of both Ejido Rosendo G. Castro and Ejido Topo Viejo as he has purchased land from both Ejidos in the past (prior to the Project). The shareholder was the designated entity who purchased all ejidal land for the Project.

It is important to note that, in accordance with legal provisions, a supplemental percentage typically between 5-10%, depending on the ejido of the price of the sale goes to the ejido as a commission. This commission is paid on top of the price which is considered as a compensation for "communal loss" incurred from the land sale. Per the Law, the funds area received by the Ejidal assembly, which is the formal governing body responsible for deciding how the money is used with the agreement of the members. This may include infrastructure repairs (e.g., roads and buildings), investment in communal benefit projects, or the ejido members may elect to receive each their share of the money. This communal loss fee is not applicable if the land has already been sold to an *avecindado* or *posesionario*. It should also be noted that the term "communal loss" is a legal term and does not infer that there is an actual loss of use, assets, value or other purposes in every case.

[117] The ejido commissioner (or *comisariado/a ejidal*) is elected by the ejido assembly and is charge of agricultural affairs related to ejidatarios. In contrast to the ejidal commissioner, the municipal commissioner has an administrative role within the whole community, not just in relation to ejido /land affairs, as is nominated (without the need for a vote) by the Mayor.

A 5% commission on top of the price was paid by the Project to the associated ejido in each case where required (12 out of the 22 Ejidal land purchases were required, as ten other Ejidal land purchases were with *avecindados* or *posesionarisos,* as described above.).

5.4.3.15.5 Land Ownership – JAPAMA Water Pipeline

In early-2025 and after reviewing the Draft ESIA Land Use Mapping which identified several potential social sensitives along the proposed JAPAMA pipeline RoW, the Project design and engineering team chose an alternate pipeline route to minimise the potential for both temporary and permanent economic displacement. (See Appendix 4: Supplemental Land Acquisition Document for details). This pipeline route follows the existing Japama drainage canals.

At the time of writing, the Project was engaging with landowners (private and Ejidal) along the new water pipeline RoW and conducting the formal valuation process. According to Project's land broker, there are 15 private landowners and one ejidal (non-Indigenous) landowner from Ejido Plan de Ayala Numero 2. This ejido has no official registered population as ejidatarios live nearby in Los Mochis and Tortuga 2. According to Project stakeholder engagement records, those affiliated with Ejido Plan de Ayala Numero 2 do not rely on agriculture for livelihoods as their lands are not productive. A plot of agricultural land is required at the end of the pipeline at the entrance to the Project site; however, this land is owned by the aforementioned Project shareholder and primary affected landowner for the Project site.

Land use mapping and sensitivity analysis was conducted by RSK for the proposed JAPAMA pipeline RoW (see Section 5.4.3.15.6). According to the land use mapping exercise, review of site photographs taken both when RSK conducted their field visit, and subsequently provided by the Project, there appear to be no sensitivities as no landowners rely on the land for their livelihoods, and there are no other formal or informal users or any other individuals or communities whose livelihoods depend on this land. Land use mapping shows the new pipeline RoW is comprised of 0.53 ha of agricultural land (belonging to the project shareholder), 7.8 ha of xerophytic land and less than 0.1 ha of canal and road (which are not adequate for agricultural use).

The Project has committed to following the same willing buyer and willing selling principles as followed for previous ejido land acquisitions, and paying at or above market price (plus transaction costs), when purchasing this land.

5.4.3.15.6 Land use mapping

This subsection presents the results of a land use mapping exercise (using GIS) along with details on land use per Project component (i.e. methanol pipeline, access road, methanol production plant, JAPAMA pipelines). Land use was mapped for each component according to the following buffer areas of interest:

- Mexinol Plant (Exact Footprint)
- Methanol Pipeline (27.4m RoW buffer known)
- Access road (20m RoW known)
- JAPAMA pipeline (10m RoW buffer assumed)

Figure 5.55 below shows the key land uses affected by these Project components. While the land use mapping exercise identified areas of land use sensitivity along the methanol route, it is understood that horizontal drilling procedures (HDD) will be used for some segments of the construction of the pipelines to minimise the impacts to biodiversity and communities (including at the entrance to the Port and within the Port area). The Port Authority will also dictate safety zones, laydown areas, and HDD requirements inside the Port to avoid any temporary impacts to structures or access during construction. As a result, the Project is anticipated to avoid any temporary or permanent impacts within these sensitive land use zones (see table 5.55 which presents the land uses zones considered as sensitive - e.g. agricultural, transport infrastructure, road, canal, barren, community land).

As mentioned in Section 3.2.3 (Land use), the construction will require the clearance of approximately 129 ha of land (out of the 203.82 to be acquired) in total, comprising ~ 27 ha within the 27 m wide methanol pipeline construction footprint (of which 14 m width is permanent and 13 m width is temporary use), ~5 ha within the 2.46 km long (20 m wide) road construction footprint, the ~44 ha methanol production plant of which 44 ha of former agricultural land is estimated to require clearance, ~ 40 for the laydown areas, ~ 4 for the HDD locations and ~8 ha for the JAPAMA pipelines (see Table 3.1). Table 5.55 below summarises the main area measurements per component and the direct land use mapping calculations per Project component as estimated by GIS. The purpose is to understand potential land sensitivities and buffer zones were used and not the entire plots of land that will be/have been acquired (for example not the entire 99.99 ha of project site land was mapped as not all will not be touched).

Table 5.55: Land use mapping calculations per Project component

Land use	Methanol pipeline	Access road	Methanol production plant	JAPAMA pipelines	Laydown areas
	hectares (ha)				
Agricultural	6.4	0.05	56.64	0.73	39.19
Transport Infrastructure	NA	NA	2.44	NA	NA
Road	9	3.18	NA	7.99	NA
Canal	0.66	3.33	NA	0.44	NA
Barren	7.25	NA	NA	0.01	NA
Community Land	0.65	NA	NA	NA	NA
Forest	0.29	NA	NA	NA	NA
Sea	0.13	NA	NA	NA	NA
Commercial	4.76	NA	NA	NA	NA
Xerophytic	6.4	NA	NA	2.66	1.39
Total	35.54	6.56	59.08	11.83	40.58

Source: RSK.

As shown in Figure 5.55 above, no land use sensitivities were found for the methanol production plant and the access road:

- The area affected by the methanol production plant is in an unpopulated agricultural area purchased from one of the Project's shareholders' families in an individual private land purchase agreement as per Mexican law. This is the main higher value land unit impacted by the Project and 43.9 hectares at this site is currently being used for commercial agricultural purposes until the Project initiates construction.
- The proposed primary access road route is located along an existing road through private agricultural land and adjacent to an agricultural drainage creek Although a very small area of agricultural land (0.05 ha) was noted within the 20m RoW assessed for land use mapping, it is understood that this may only require widening and resurfacing within private commercial agricultural land and no significant impact on agriculture is anticipated, especially as this land was also owned by the aforementioned Project shareholder and primary affected landowner for the Project site.

Land within the RoW for the methanol pipeline is predominantly fallow, dryland areas of limited agricultural value, but special attention should be given to the following sensitivities:

- As mentioned in Section 5.4.3.23 Cultural heritage (see Figure 5.58), there is a community cemetery within the lands of Ejido Rosendo Castro. During the RSK field survey it was confirmed that additional land has been purchased to avoid infringement in this area. Documentation of the purchase of this land can be found in the database.

Sensitivities related to commercial and residential areas near the port can be identified in Figure 5.55.

5.4.3.15.7 Physical and economic resettlement scoping

During the RSK field survey visit, RSK reviewed the land acquired for the Project and ensured through visual inspections and stakeholder engagement that it does not contain any physical restructures or resources known to be of importance to the identity of Indigenous Peoples.

To understand the potential for economic resettlement or associated impacts on livelihoods, RSK asked the Project to facilitate interviews with several landowners to assess and validate the acquisition process against the applicable standard (i.e. IFC PS5). As discussed in Section 5.4.3.15.1, interviews conducted with private landowners, ejidal landowners and ejidal commissioners from Ejido Rosendo G. Castro and Ejido Topo Viejo confirmed that no land owners that sold their land to the Project for the methanol pipeline were reliant on the land for their income or nutrition at the time of sale, and there were no any other formal or informal users of the land.[118] Interviews confirmed site walk-over findings that impacted Ejidal land to date is located in a flood zone and of

[118] Meeting with landowner in Ejido Topo Viejo and ejidal commissioner of Ejido Rosendo G. Castro, 16th April 2024.

limited agricultural value due to the costs associated with preventing flood water inundation. [119]

RSK also collected socioeconomic baseline data from Ejido Rosendo G. Castro during the RSK field survey, reviewed data obtained from IMPLAN and UAIM, (see Section 5.4.2) to understand how sale of Ejidal lands by the five ejidatarios who sold their ejidal land may affect livelihoods in the future. Agriculture is not a predominant livelihood within the community, considering the community often floods and adequate drainage is non-existent. The community members who are employed work primarily in the service industry, construction (brick laying) and some partake in fishing for subsistence.

To further rule out any economic displacement from the land acquisition process, RSK conducted interviews with IMPLAN who confirmed from databases (including soil type, characteristics, and historical uses of land) that the land along the Los Mochis-Topolobampo corridor that will be impacted by the methanol pipeline is generally not productive for agriculture.[120]

Site visits to impacted private and Ejidal land areas, and interviews with impacted *ejidatarios,* as described above, confirmed that there are no ongoing grievances and all compensation processes were voluntary and free from coercion, and concluded successfully with fair compensation paid based on above market values. This was further validated by RSK checking the engagement records from 2021 onwards documented by CLOs, the land broker and notaries. During subsequent and extensive visits to communities during the Draft ESIA Public Consultation and Disclosure visit (See Section 6.5), no feedback was received by any stakeholder related to concerns over previous land acquisition.

During the RSK field survey and the site walk of the methanol pipeline route, four informal vacant street vendor businesses were identified and photographed along the RoW at the entrance to Topolobampo. In February 2025, the Project confirmed that these businesses had been moved by the Municipality as they were non-registered businesses and illegally encroaching on the highway which was impacting public safety and the safe installation of a fibre optic cable (See Appendix 4: Supplemental Land Acquisition Document for more details).

In addition to the above street vendors, RSK reviewed whether there were formal or informal users/tenants other than the landowners as per IFC PS5 and asked the following questions:

- Have any users/tenants of land lost their access to agricultural lands that generated income?
- Was there any informal business that lost their primary source of income due to the selling of the land?
- Restrictions on land and natural resource use – Did the selling of land lead to limited or restricted access to natural resources (e.g., water points, fishing areas for instance) of formal or informal land users or tenants?

There were no other formal or informal users or tenants of the land identified by the landowners during the negotiation processes, or by RSK during the verification visits. The

[119] Meeting with landowner in Ejido Topo Viejo and ejidal commissioner of Ejido Rosendo G. Castro, 16th April 2024.

[120] Meeting with IMPLAN Los Mochis, 17th April 2024.

quality of the land does not allow commercial agriculture as it has been described in sections above.

The field validation allowed RSK to confirm there were no cases of physical or economic displacement, which includes no temporary impacts to assets, crops or informal shops. There are also no assets, structures, or investments on private or Ejidal land impacted (other than the agricultural land owned by the aforementioned Project shareholder as described in detail). It is also confirmed that there were no other formal or informal users of the acquired land, therefore the project does not entail any economic displacement nor impact on livelihoods.

Site visits also allowed RSK to complete walk-over surveys on a portion of the current JAPAMA pipeline RoW as it follows the JAPAMA wastewater irrigation canals. There were some structures along the Airport Road which runs parallel to the RoW but not within the RoW boundaries or close enough to be impacted by construction. A RoW survey will be done prior to the start of construction, for a detailed verification of potential impacts on land users and livelihoods. The necessary corrective measures will be developed in alignment with IFC PS5.

5.4.3.16 Transport network and accessibility

The main access route to Topolobampo is via the Los Mochis-Topolobampo highway, a four-lane road that links with the Northern Border in the State of Sonora and extends to the Centre and Bajío regions of the country (see Figure 5.43). The Los Mochis-Topolobampo highway has a maximum speed of 60 km/h, but road traffic speed can be greater than 80 km/h (SLR 2022a). In terms of road safety conditions along the Los Mochis-Topolobampo highway, a higher incidence of accidents is reported during the weekends (SLR, 2022a). Additional paved and dirt roads branch off from this highway to various towns, including a road leading to the Paredones community, which serves as the access route to the northern part of the Project site (SLR, 2022a).

Within the Direct and Indirect AoI PACs, the main means of transportation includes walking, public transport, taxis, private vehicles, motorcycles/scooters and bicycles. Communities predominantly depend on public transportation including buses such as the one highlighted in Figure 5.56 or walking for their daily commutes (SLR 2022a).

The main port serving Sinaloa is the Port of Topolobampo, which has 1,420 linear meters of dock and can accommodate vessels up to 250 meters in length and with a draft depth of 13.3 meters (ibid). It has an annual capacity of 20 million tons, though currently, it handles only about seven million tons across 900-1,000 vessels yearly, operating at roughly 30% capacity. The port maintains a workforce of 50 full-time employees and has approximately 3,000 workers at any given time, which includes those involved in construction activities related to the port's expansion (ibid).

In 2021, SLR interviews with port officials revealed their principal concern is the storage of gasoline and other hazardous chemicals at a new facility currently under construction, which is expected to be completed before the commencement of the Project construction (ibid).

While smaller fishing boats are permitted entry into the Bay via the main channel, fishing within the port area itself is prohibited to ensure safe and efficient port operations. The

Port Operations Manager noted that members of the Paredones fishing community do use the main shipping channel for accessing the Bay and coastal areas (SLR, 2022a).

Some improvements are reported to be needed to the road network in order to promote continued development and economic growth. Specifically improving regional linkages between Los Mochis with the rest of the North of Mexico and Southern United States of America (USA) is emphasised as a priority.[121] Greater international air connectivity at Los Mochis International Airport was also outlined as a key opportunity for improvement and investment in Los Mochis.[122]Expanding the capacity of ferries that connect the north of Sinaloa with Baja California and other important ports in Sinaloa such as Mazatlán was also reported to be one of the goals in relation to infrastructure development in Los Mochis.[123]

Figure 5.56: Public bus transporting passengers between Ejido Ohuira and Los Mochis

Source: RSK field visit, April 2024.

5.4.3.17 Human rights

Mexico has adopted all major international human rights agreements, including the two Covenants in 1981, the Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (CAT) in 1986, the Convention for the Protection of All Persons from Enforced Disappearance in 2008, and the Convention on the Elimination of All Forms of Discrimination Against Women in 1981(SLR, 2022a).

Major human rights issues in Mexico include abuses involving law enforcement and the military, including unlawful killings, torture, and disappearances. Corruption and impunity within the law enforcement and justice systems are also significant challenges. Organised crime has also contributed to human rights issues, with acts of violence, kidnapping, and intimidation against citizens, migrants, journalists, and human rights

[121] Meeting with representatives of CODESIN and Department for the Economy, 18th April 2024.

[122] Ibid.

[123] Ibid.

defenders (SLR, 2022a). Table 5.56 provides a list of the main human rights issues and their current situation in Mexico.

Potential human rights concern relevant the Project include violence and threats against migrants, violence against women, domestic abuse, mistreatment of individuals with disabilities, violence and threats against indigenous peoples and LGBTQ+ individuals, human trafficking, and child labour, including forced labour (SLR, 2022a).

Table 5.56: Human rights issues in Mexico

Human right	Legal status	Current situation
Labour and working conditions	The Mexican Federal Labour Law sets labour and working conditions, defining decent work and basic workers' rights. It regulates employee hiring and work relationships. Mexican labour law allows for flexible start and end times to balance work with personal, and family needs and defines three work shifts – day shift, night shift or a mix between day and night shift. As of January 1, 2024, the minimum wage in Mexico will be 248.93 pesos (USD 13.74) per day, an increase of 20% compared to the previous year. With this increase, the minimum wage has grown 110% in the last six years.[124]	• In 2016, Mexico had the poorest quality of worker income among the 32 OECD countries, with low wages and unequal distribution. • Historically, Mexico has faced high income inequality. • 15% of the workforce (8.5 million) earned below the minimum wage.
Minimum age to work and child labour	Article 123 of the Mexican Constitution prohibits the employment of children and adolescents under the age of 16.	• In 2015, around 2.48 million children were involved in economic activities, with over 1 million (41.1%) under 15 years old and 900,000 (36%) not enrolled in school. • In 2016, 25% of these 2.38 million children worked to support their families financially, with 981,353 (70% girls, 30% boys) not attending school and solely performing household tasks. • In 2014, ILO assessments deemed that Mexico lacked

[124] Available online from: https://www.eleconomista.com.mx/economia/Salario-minimo-en-Mexico-Cuanto-ha-crecido-entre-2018-y-2024-20240109-0047.html

Human right	Legal status	Current situation
		effective policies at federal, state, and municipal levels to prevent and eliminate child labour.
Collective bargaining and freedom of association	Article 356 of the Mexican Federal Labour Law describes a union as an association of workers or employers aimed at studying, improving, and defending their interests. Federal labour law requires a minimum of 20 workers to form a union (USDS, 2021). Unions must register with the Federal Centre for government recognition (USDS, 2021). Anti-union discrimination is prohibited, with laws allowing for worker reinstatement if fired without just cause (USDS, 2021).	• Government continues to strengthen freedom of association protections and improve the right to collective bargain (USDS, 2021). • Still, many labour laws are not enforced adequately (USDS, 2021). • Challenges include violence and intimidation against workers by union leaders with support from employers, vigilantes, and other workers, interference in union activities, and inconsistent enforcement of labour laws (USDS, 2021).
Modern slavery (forced labour/ human trafficking)	The Mexican Constitution forbids forced labour and slavery, with punishments ranging from 10 to 20 years.	• Women and migrants are particularly subject to forced labour in the agricultural, industrial and informal sectors. • According to a survey from 2015, low, semi and unskilled domestic and foreign workers were at risk of forced labour within the agricultural sector in 18 states. • Those most at risk of modern slavery and human trafficking include women, children, indigenous peoples, the disabled, migrants, and the LGBTQ+ community. • Forced prostitution, kidnappings, and labour exploitation are common cartel practices.
Job security/ right to work	Federal Labour Law (FLL) of 1970 is the primary legislation governing employment in Mexico, applying to all employees and employers within the country. This law outlines the minimum benefits for employees, including rights and obligations for both parties, and sets forth procedural requirements for	• The unemployment rate in Mexico has decreased since its peak in June 2020 at 5.5% to 3% in May 2023. This is lower than its December 2019 pre-pandemic level of 3.2% (OECD Library, 2024a).

Human right	Legal status	Current situation
	labour litigation. Amendments in 2019 and 2021 have focused on enhancing union democracy and prohibiting abusive practices in outsourcing. These amendments aimed to promote direct hiring and establish new guidelines for teleworking (Oyster, 2022).	
Non-discrimination	Article 1 of the Constitution and the Federal Labour Law protects against discrimination based on various characteristics including ethnic origin, gender, and sexual preferences. Employers are required to develop protocols to prevent discrimination and promote equality. Remedies for discrimination include legal suits and complaints to authorities like CONAPRED. Employers must also implement D&I policies, which are a legal requirement (CMS, 2024; L&E Global, 2022). The Mexican Standard on Labour Equality and Non-Discrimination and the Mexican Standard on psychosocial risk factors at work, further incorporate gender and non-discrimination perspectives in workplaces, addressing issues from equal pay to prevention of workplace violence (CMS, 2024).	• While anti-discrimination laws exist, they have been critiqued for not being extensively developed regarding labour matters (L&E Global, 2022). • There is a general lack of enforcement of the non-discrimination laws and provisions which hinders concrete sanctions or legal actions if an employer engages in discriminatory acts (L&E Global, 2022).

Occupational safety and health (OSH)	Legislation on OHS is outlined in the Political Constitution, the Federal Labour Law of 1970, the Federal Regulation on Occupational Safety and Health from 2014, and the Official Mexican Standards (NOMs). Article 123 of the Constitution establish employer OHS obligations. The 1997 Federal Regulation on Occupational Safety, Hygiene, and Working Environment, establishes measures for	• Over 500,000 workers per year in Mexico are subject to accidents in the workplace (DOL, 2021).
		• Mexico still faces challenges in implementing OSH regulations, including (DOL, 2021):
		  ○ Harmonizing OSH regulations.
		  ○ Identifying and addressing specific OSH risks relevant for different sectors.
		  ○ Including gender and vulnerable people's

Human right	Legal status	Current situation
	accident and disease prevention to secure safe and healthy working conditions. The 2012 reform of the Federal Labour Law includes OSH provisions. NOMs addressing specific OSH issues, include: • Standard on the Constitution, Composition, Organisation and Operation of Safety and Health Committees. • The General Regulations on the Inspection and Application of Sanctions concerning Labour Legislation Violations of 1998. • The Regulations of the Secretariat of Labour and Social Welfare of 2008.	considerations in OSH policies. ○ Establishing and promoting an OSH prevention culture in the workplace.
Freedom of expression	Freedom of expression in Mexico is constitutionally guaranteed and further upheld by the Law Regarding Freedom of the Press of 1917 (RSF, 2023).	Mexico is one of the deadliest countries for journalists, with ongoing violence and threats severely impacting the ability to freely report and express opinions (RSF, 2023). The President has been criticised by Human Rights Watch for frequently accusing journalists of bias and undermining their work (HRW, 2021).
Right to life and security of person	Federal law in Mexico explicitly prohibits torture and other cruel, inhuman, or degrading treatment. The law also disallows the use of confessions obtained through illicit means in court (USDS, 2022).	Multiple complaints of torture and arbitrary detention involving various branches of the security forces, including the National Guard and the Attorney General's Office (USDS, 2022). Additionally, there were complaints of cruel, inhuman, or degrading treatment (USDS, 2022). Allegations of arbitrary detentions continue to be a concern (USDS, 2022). Expanded role of the military in law enforcement and public security tasks and large number of disappeared people (105,000) (HRW, 2020; HRW, 2021; HRW, 2022).

Human right	Legal status	Current situation
Privacy	The Mexican constitution enshrines the right to privacy is enshrined in article 6 (PI, 2019). Additionally, privacy in Mexico is protected under various laws and regulations that collectively form the Mexican Privacy Laws. These include (DLA Piper, 2024): • The Regulations to the Federal Law on the Protection of Personal Data held by Private Parties. • The Privacy Notice Guidelines. • The Recommendations on Personal Data Security. • The Parameters for Self-Regulation regarding personal data. • The General Law for the Protection of Personal Data in Possession of Obligated Subjects. Additionally, these conventions and protocols were approved in 2018 (DLA Piper, 2024): • Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data • Additional Protocol regarding supervisory authorities and trans-border data flows.	Impacts concerning privacy in Mexico include surveillance abuses, notably the use of NSO Group malware Pegasus for targeting journalists and human rights defenders (PI, 2019). Investigations have not shown significant progress, and the Mexican government has not established an international monitoring mechanism for surveillance activities as of 2018 (PI, 2019). The telecommunications regulator previously imposed obligations on companies to report data about user data requests, but these transparency obligations were removed (PI, 2019).
Right to education	From pre-primary to upper secondary education, school attendance is compulsory for 14 years (OECD Library, 2024), and Mexican law requires children to start pre-primary school at age three (WENR, 2019).	Education faces challenges related to quality, particularly in elementary education, where enrolments have slightly decreased as of 2019, and educational quality is considered below the OECD average (WENR, 2019).
Right to health	The right to health is enshrined in the Mexican Constitution (Gomez-Danted, Frenk and Ibarra, 2013). Efforts to universalise public health insurance through Seguro Popular were made up until	Mexico's health indicators have improved in the past decade, but challenges such as unhealthy lifestyles, chronic diseases, and violence persist (European Observatory on Health Systems and Policies, 2020).

Human right	Legal status	Current situation
	2018, covering a wide but limited package of services. This was replaced in 2019 with a new scheme aiming for universal free access to health services for the uninsured (European Observatory on Health Systems and Policies, 2020).	
Right to participate in the cultural life of the community	Mexico has ratified the Covenant on Economic, Social and Cultural Rights (CESCR), which includes the right of everyone to take part in cultural life (UNHRTB, 2024). The Mexican Constitution, while not explicitly detailing the right to participate in cultural life, indirectly does so through various articles, such as Article 4, which recognises the right to culture (Cámara de Diputados, 2024).	
Right to water	In 2012, the human right to water was added to the Mexican Constitution (TNI, 2016).	Seventy-two million Mexicans lack access to a reliable and safe water supply due to water scarcity and drought, inadequate drinking water quality and wastewater treatment, and inefficient utilities (Water, 2024).
Disability Rights	Mexico ratified the CRPD (Committee on the Rights of Persons with Disabilities) in 2007, which requires governments to set up national agencies ensuring all state offices respect disability rights (Espinosa, 2019). The General Law for the Inclusion of People with Disabilities (LGPID) was enacted in 2011, and calls for government action to promote, protect, and ensure the full societal inclusion of people with disabilities (GDR, n.d.).	Challenges in protecting the rights of individuals with disabilities include (HRW, 2020): • access to legal processes • the ability to engage legally • make informed health decisions • utilise public amenities like buildings and transportation • 54% of people with disabilities in Mexico live in poverty (Espinosa, 2019).

At the local level in areas surrounding Los Mochis, more robust legislation and enhanced regulation of the agricultural supply chains and markets has helped to improve standards

and reduce instances of child labour (Valdez Moreno, L.E. 2024 pers. comm.). However, children are known help their families with fishing and associated activities such as scaling and packaging. That said, this may not be widespread and anecdotal evidence from teachers in the Paradones Tele-secondary school suggests that child involvement in fishing is limited and does not prevent them from attending school (Rodriguez, L. (2024) (pers. comm.)).

5.4.3.18 Community safety, security and welfare

Mexico's homicide rate was 29.07 per 100,000 individuals in 2018 and the country had more intentional homicides than any other country in Latin America in 2018 besides Brazil (SLR, 2022a). Violent criminal activities are also frequent occurrences in Sinaloa State, including those connected to the illegal drug trade, armed robbery, homicide, assault, vehicle theft, economic fraud, minor offenses, and high risk of kidnapping (ibid).

Within the Municipality of Ahome, the rate of domestic violence is high, as outlined in Section 5.4.3.23 of this ESIA. Another common crime is vehicle theft, with 358 reported cases, or 86 per 100,000 residents (ibid). In 2020, women reported feeling less secure than men, with only 27.9% of women feeling safe compared to 37% of men. Confidence in public officials was low, with only 11.3% of Sinaloa's population expressing full confidence in their authorities, and 12% reporting very low confidence (SLR, 2022a). In June 2024 there were 139 domestic violence reports (7.5% growth from previous year), 99 injury reports (1% less compared to previous year), and 58 reports of theft (24.7% less than previous year) in Ahome.

Evidence from PACs within the Direct and Indirect AoI appears to suggest that community safety and security is generally good. For example, according to Focus Group Discussions (FGDs) completed in the community of Guadalupe Estrada within the Indirect AoI by UAIM (2024a), the community feels safe and did not report problems related to drug addiction and violence. Similarly, security concerns were not highlighted by the PACs of Ejido Rosendo G. Castro, Campo Guadalupe Estrada and Ejido Ricardo Flores Magón during the UAIM assessment (UAIM, 2024a). However, anecdotal evidence suggests that PAC members are sometimes less inclined to comment on security perceptions, and the lack of reports of security concerns may not be representative of the security situation in those PACs. In the community of Paredones, representatives from the tele-secondary school reported that they have not been notified of any cases of child abuse amongst the students that attend the school [redacted] (2024) (pers. comm.)).

During the RSK field assessment, insecurity and petty crime were reported as an issue in Ejido 9 de Diciembre but not classed as a huge area of concern for the community in general (Valdez Moreno, L.E. 2024 pers. comm.). Crop thefts were also reported but generally attributed to people who are suffering from drug addiction (ibid). Conflict between PACs can occur and is often motivated by ethnic identity; where conflict or disagreement exists in an Ejido, appeal and contest procedures are in place to deal with such conflicts.[125]

[125] Meeting with UAIM 16th April 2024.

For emergency preparedness and response, it was reported that coordination between the municipal and Sindicatura representatives is efficient.[126]

Road traffic accidents were also not reported as a concern during meetings with stakeholders during the RSK field visit. Although one road traffic accident did occur outside the community of Ejido Rosendo G. Castro near where trailers are known to congregate along the Los Mochis-Topolobampo highway, accidents caused by trailers and passing traffic in general were not reported to be an issue in Rosendo G. Castro.[127]

5.4.3.19 Cultural heritage

Key tangible and intangible cultural values in Sinaloa, include cultural spaces, tangible heritage, education and research centres, fairs and festivities, and indigenous culture (SIC Mexico, 2022). Six key elements of intangible cultural heritage are identified in Sinaloa, including various festivals and the tradition of Tambora Sinaloense Music (IMPLAN, 2024). Key aspects of tangible cultural heritage include Roman Catholic Cathedrals, archaeological areas, railway stations, museums, monuments, theatres, and cultural centres. Three ceremonial centres were identified within the study area: Nuestra Señora del Carmen – Ejido Ohuira, Virgen de Guadalupe – Lazaro Cardenas, and Santa Cruz – Carrizo Grande. Additionally, a death memorial in the Los Mochis-Topolobampo highway which commemorates the fatalities that occurred nearby has been identified by the Project.

No structures of historical or archaeological significance are located within the Direct AoI and therefore there are no impacts to tangible cultural heritage. The Project's ESDD report (WSP, 2023) noted the potential of the proposed RoW of the Mexinol pipeline to infringe upon land occupied by a community cemetery within the Ejido Rosendo Castro (see Figure 5.58). However, during the RSK field survey it was confirmed that additional land has been purchased to avoid infringement in this area. Another cemetery / funeral garden identified during the RSK field visit in April 2024 is located 400 metres to the north of the JAPAMA pipelines and 400 metres to the west of the Los Mochis-Topolobampo highway (see Figure 5.57). The ejido owned the cemeteries, no IP are custodians of the cemeteries. The Project should ensure that during construction activities related to the JAPAMA water pipelines, access to this site is not curtailed. Further details regarding potential impacts from planned activities on cultural heritage are discussed in section 8.3.7.

[126] Meeting with municipal leader of Ejido Rosendo G. Castro and sindico representative of Topolobampo 17th April 2024.

[127] Meeting with land owner in Ejido Topo Viejo and ejidal commissioner of Ejido Rosendo G. Castro, 16th April 2024.

Figure 5.57: Location of the funeral garden (Location: 25°41'5.00"N, 109° 2'31.79"W)[128]

Source: GoogleEarth Pro (imagery date: 22/4/2023)

The presence of death memorials[129] alongside the Los Mochis-Topolobampo highway should be recognised as sensitive tangible cultural heritage for the Project, particularly in reference to potential accidental disturbance during construction.

In the community profiles of five indigenous communities (Carrizo Grande, Cerro Cabezón, Lázaro Cárdenas, Ohuira, Paredones) prepared by Aosenuma (2024), it was found that one community (Lázaro Cárdenas[130]) has sacred sites representative of cultural heritage such as crosses on top of a mountain and a hill associated with the image of the Virgin of Guadalupe, which are important for community rituals and pilgrimages. There is no mention of natural sacred sites for the other four communities included in this study (Ejido Ohuira, Paradones, Ejido Carrizo Grande, and Cerro Cabezón), including the Indigenous Peoples' community of Ejido Ohuira which falls within the Indirect AoI for this ESIA (Aosenuma 2024).

[128] The funeral garden in question is the green plot of land in the centre of the figure. The highway No. 22 Los Mochis-Topolobampo is highlighted in yellow to the right-hand side of the map. The JAPAMA pipeline route (blue line) is shown to the south of the funeral garden.

[129] These death memorials are miniature chapels built along the roadside to remember deceased and celebrate the Day of the Dead on 1st November each year.

[130] Note that Lázaro Cárdenas is located outside the Indirect AoI for this ESIA Socioeconomic Assessment.

In Ejido Ohuira, the ceremonial centre, called the *ramada*, and the Indigenous Church have important cultural value. They are centres for cultural practices and festivities and agreements are made there. In Paredones, there is a *ramada* and a ceremonial centre. Ramada and the indigenous churches are used for cultural practices such as weddings, community and Ejidal assemblies, and consultation processes called the *contis*, which are celebrations during Holy Week and festivities to the Virgin of Guadalupe and the Holy Cross.

Across the Direct and Indirect AoI PACs, fishing plays a culturally significant and symbolic role for community members, whether it be a livelihood, a hobby or a means through competition to win prizes (money). Fishing is a practice that is for everyone, with the quality of seafood produce that comes from fishing being a source of great pride for people [131].

Figure 5.58: Cemetery located along the methanol pipeline route adjacent to the community of Ejido Rosendo G. Castro

Source: RSK field visit, April 2024.

5.4.3.20 Vulnerable groups

CONAPO (2021) reports that the marginalisation rate is very low in the Project area[132]. Key vulnerable groups of relevance to the Project include the elderly, disabled, female-headed households, households living in poverty and indigenous populations within the Direct and Indirect AoI. More detailed information about the vulnerability of Indigenous

[131] Meeting with representatives of the Fishing Division of the Department of the Economy 17th April 2024.

[132] Marginalisation rate is a summary measure that allows for differentiation of locations according to the global impact of the deficiencies suffered by the population (SRL 2022a). This is measured as their spatial intensity as a percentage of the population that does not have access to essential goods and services for the development of their basic capabilities. There are four structural dimensions of marginalization considered in preparing the marginalisation index by municipality: i) lack of access to education, ii) residence in inadequate housing, iii) perception of insufficient monetary income and iv) residing in small towns.

Peoples and women is found in the subsections below (see section 5.4.3.21 and section 5.4.3.22).

As noted in Section 5.4.3.10, in the Municipality of Ahome, 25.3% of the population were living in moderate poverty in 2020, a 4.3% decrease from 2015 (SLR 2022a). This is a lower than the 2020 national average of 35.4 percent (Statista, 2024). The proportion of the population living in extreme poverty was 2.4% in 2020, a 0.5% increase from 2015 (ibid). The population vulnerable due to social deprivation was 30.6%, 0.8% lower than in 2015, while those vulnerable due to low income rose by 4% to 10.4% (ibid). CONEVAL (2021) reports that the primary social deficiencies identified in Ahome in 2020 included lack of access to social security (37.4%), food (23.2%), and health services (20.1%) (ibid). Notable social development challenges in Ahome include overcrowding in homes (18.76%) and incomplete basic education among those aged 15 and above (23.88%) (ibid).

In 2020, 5% of Ahome's population were registered as having disabilities, totalling 23,119 individuals. compared to the national average of 4.8%, totalling 6.1 million people (INEGI, 2021). Disabilities are defined as physical impairments affecting mobility, vision, communication, hearing, and concentration (DataMexico 2024). The primary disabilities identified were physical (11,700 individuals), visual (9,190), and motor (4,840).

Table 5.57 presents the proportion of individuals aged 65 and above within Direct and Indirect AoI PACs (6-25%). In Benito Juárez, the percentage of elderly residents is notably higher (25%) than in other communities, where the percentage ranges between 6% (Ejido Topolobampo) and 13% (Ejido 9 de Diciembre). Several factors render this age group more vulnerable. Many elderly people rely solely on social security benefits or pension, which may not be sufficient to meet their basic needs, leaving them economically vulnerable. Their presence may place additional burdens on their households, particularly if they have care needs. This vulnerability is compounded in settings where access to healthcare services may be limited, or where healthcare infrastructure is inadequate, as is often the case in rural or marginalised communities.

Table 5.57: Percentage of PAC members aged 65 +

Name of PAC	% of people aged 65 +
Benito Juárez	25%
Campo Guadalupe Estrada	11%
Ejido 9 de Diciembre	13%
Ejido Benito Juárez	11%
Ejido Ohuira*	8%
Ejido Plan de Guadalupe	8%
Ejido Ricardo Flores Magón	11%
Ejido Rosendo G. Castro**	8%
Ejido Topolobampo**	6%
Ejido Tortugas Número 2	13%
Los Mochis	8%
Paredones	6%

Name of PAC	% of people aged 65 +
Plan de Ayala [Campo Cinco]	12%
Topolobampo**	12%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Table 5.58 shows the percentage of the population from Direct and Indirect AoI communities with minor difficulties with daily tasks. The data highlights variations in the prevalence of limitations among Direct and Indirect AoI PACs which range from 18% in Plan de Ayala [Campo Cinco], 15% in Ejido 9 de Diciembre, Ejido Benito Juárez and Ejido Rosendo G. Castro, to 0% in Benito Juárez.

Table 5.58: Percentage of PAC members classed as encountering difficulties carrying out daily tasks

Name of PAC	% of people encounter a small degree of difficulty carrying out daily tasks[133]
Benito Juárez	0%
Campo Guadalupe Estrada	14%
Ejido 9 de Diciembre	15%
Ejido Benito Juárez	15%
Ejido Ohuira*	13%
Ejido Plan de Guadalupe	5%
Ejido Ricardo Flores Magón	12%
Ejido Rosendo G. Castro**	15%
Ejido Topolobampo**	13%
Ejido Tortugas Número 2	6%
Los Mochis	10%
Paredones	13%
Plan de Ayala [Campo Cinco]	18%
Topolobampo**	9%
Average	11%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020

Table 5.59 shows the percentage of female headed households within the population of Direct and Indirect AoI PACs. The percentage of female-headed households is notably

[133] Such tasks include: seeing even with the use of glasses, hearing even with the use of hearing aids, walking, going up or downstairs/steps, remembering things or concentrating, washing, getting dressed, eating or communicating.

high and ranges from 37% to 38% in Ejido Benito Juárez, Ejido Rosendo G. Castro and Ejido Topolobampo. It is notable that the percentage of female-headed households is also 32% within the Indigenous Peoples PAC of Ejido Ohuira. There is an intersection of vulnerabilities in this community, where factors such as ethnicity and socioeconomic status can compound the challenges faced by women.

Female-headed households often suffer with economic instability, which can stem from factors like limited access to, and control over resources, lower wages, or lack of employment opportunities, exacerbating the vulnerability of these households.

According to the Director of the Municipal Department of Female Affairs, the population of vulnerable women is higher in rural areas, where issues include sexism, sexual violence and overcrowding in homes.

Table 5.59: Number and percentage of female-headed households in PACs

Name of PAC	Number of census households	Female-headed census households	% of census households that are female-headed
Benito Juárez	3	0	0%
Campo Guadalupe Estrada	56	18	32%
Ejido 9 de Diciembre	554	144	26%
Ejido Benito Juárez	409	155	38%
Ejido Ohuira*	567	179	32%
Ejido Plan de Guadalupe	91	10	11%
Ejido Ricardo Flores Magón	507	158	31%
Ejido Rosendo G. Castro**	205	75	37%
Ejido Topolobampo**	30	11	37%
Ejido Tortugas Número 2	23	8	35%
Los Mochis	90,974	32,697	36%
Paredones	245	54	22%
Plan de Ayala [Campo Cinco]	420	135	32%
Topolobampo**	1,871	567	30%
Average			29%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

5.4.3.21 Indigenous Peoples

Indigenous Peoples are social groups with identities that are distinct from mainstream groups in national societies. They are often among the most marginalised and vulnerable segments of the population. Indigenous Peoples may therefore be more vulnerable to any adverse impacts associated with Project development than non-indigenous communities (IFC, 2012). Indigenous Peoples' cultures and identities are often

“inextricably linked to the land on which they live and the natural resources on which they depend” and their cultures, identities, oral histories and traditional knowledge can often be “connected to, and maintained through the use of, and relationships with, these lands and natural resources” (IFC, 2012).

Mexico has one of the highest Indigenous populations in the world. Out of 68 recognised languages, 63 are indigenous languages spoken by 6.1% of the population (see section 11.4.3.4). Mexico has been a signatory of ILO Convention 169, Indigenous and Tribal Peoples Convention since 1990 (SLR 2022a). The country recognises Indigenous Peoples’ rights to consultation and that this must be free, prior and informed consultation. These rights are protected via legal mechanisms through the Mexican constitution and various laws. As a MIA permit condition, a government-led Indigenous Peoples consultation process will occur in 2024. In order to inform the Project’s ongoing stakeholder engagement process, Pacifico Mexinol commissioned supplementary social studies within several surrounding Indigenous Peoples communities (Aoesenuma 2024).

In Sinaloa, the indigenous communities include Mayo-Yoreme, Tepehuanes del Sur, and Tarahumara. Historically, the Mayo-Yoreme communities are descendants of the major nations that settled along the Fuerte River, also known as the Zuaque or Tegueco River. These include the Sinaloas, Teguecos, Zuaques, and Ahomes, who shared Cahita as their common language. Other groups such as the Yaquis, as well as extinct tribes like the Acaxees, Tahues, Totorames, Guasaves, Achires, Tehuecos, Vacoregues, Ocoronis, Zoeces, and Ahomes, also integrated into the region now comprising Sonora and northern Sinaloa (Noroeste, 2019).

The Mayo-Yoreme people inhabit the regions south of Sonora and north of Sinaloa alongside other populations. The Mayo language is their traditional tongue, but Spanish is the dominant language in the area. Their religious practices are centred around ceremonial centres or traditional villages (SLR, 2022a). Language plays a significant role in identity for these communities. Those within an indigenous community who renounce their heritage and communal responsibilities are labeled as "*Torocoyori,*" which signifies "he who betrays" or "he who denies tradition (Noroeste, 2019[134]).

Most organisational forms and power structures, including ejido commissariats, preventive police, church leadership, progress boards, and municipal authorities, are mainly controlled by Yoris (non-Indigenous people) (SLR, 2022a). The organisational structure of the Mayo-Yoreme people revolves around "*mandas*," or commitments made through promises. Despite the presence and influence of Evangelical and Protestant churches within some Mayo-Yoreme communities, leading to the conversion of some members, the traditional ways of communal commitments, celebrations and promises remains unaltered. Ceremonial life is central to the Mayo-Yoreme Indigenous Peoples, and most festivals are connected to the Catholic Church's liturgical calendar (SLR, 2022a).

For the Mayo-Yoreme Indigenous Peoples, the extended family constitutes the basic social group, including grandparents, parents, children, uncles, nephews, and siblings. Additionally, the town, or ceremonial centre, serves as an important communal space,

[134] Noroeste, “They call to strengthen the Yoreme language”, [online], northwest.com.mx, URL address: https://www.noroeste.com.mx/colabouraciones/llaman-a-fomentar-la-lengua-yoreme -PFOP108986, [accessed March 8, 2024].

uniting various neighbouring communities for active participation in organising traditional and religious festivals (SLR, 2022a).

According to INPI, there are three main health care approaches within Mayo-Yoreme communities: official medical institutions, home-based remedies, and traditional medical practices. Home-based treatments primarily manage common illnesses using simple measures such as infusions, teas and water concoctions made from readily available plants and are typically administered by the mothers. These remedies often include physical methods such as rubbing and topical applications. Commonly treated ailments include stomach-aches, toothaches, ear pain, nausea and fever. For more complex health issues such as bone ailments, fear, mental disturbances, feelings of emptiness, "*corrimiento*" (abnormal flow of fluid from a part of the body), childbirth complications, and even rabies, specialists or healers are consulted. These healers gain their expertise through divine gifts, teachings passed down from family members, or insights revealed in dreams. Their methods include the use of prayers, rosaries, holy water, egg rubs, massage therapies (*sobadas*), poultices, and infusions, utilizing a variety of plants, animals, and minerals in their treatments. Certain healers may also focus on specialised areas such as bone problems, fright, childbirth, or emotional distress (INPI, n.d.).[135]

Houses of the Mayo-Yoreme people were traditionally two-room structures constructed from materials like reeds, concrete, and pitahaya heart, with some featuring wooden or brick roofs. Additionally, they would traditionally include an external room for bathing and another for a toilet. Today, very few houses in the Direct or Indirect AoI PACs are constructed using traditional materials (see section 5.4.3.6). Usually, within Indigenous Peoples communities houses are inherited. The use of gas stoves and electrical installations is now widespread. However, people from Indigenous Peoples communities surrounding the Project are reported to still use firewood, mainly for cooking, sourced from mesquite trees. For example, the people from Ejido Ohuira report that they use firewood collected towards the hills mainly from mesquite trees or dry wood (Aoesenuma 2024). Similarly, in Paradones people report using mesquite trees for firewood (ibid).

Economic production within the Mayo-Yoreme communities is organised on a communal basis, though many engage in rent-seeking and wage-earning jobs, such as day labourers. Others work as packers, cashiers, loaders, bricklayers, and butchers (SLR, 2022a).

In Municipality of Ahome, in 2020, there were 3,761 individuals who identify as Afro-Mexican or Afro-descendant, and roughly 14,600 people belonging to indigenous groups (IMPLAN, 2024). Of these, 4,400 individuals aged three and older speak at least one indigenous language, accounting for 0.96% of Ahome's total population. The primary indigenous languages spoken are Mayo-Yoreme with 2,503 speakers, followed by Tarahumara with 841 speakers, and 300 speakers of unspecified languages. Other languages identified include Nahuatl, Yaqui, Zapotec, Triqui, Chinanteco, Ch'ol, and Cora (Data México, n.d.). [136]

The Mexican consultancy firm Aosenuma conducted social studies in five indigenous communities (Carrizo Grande, Cerro Cabezón, Lázaro Cárdenas, Ohuira, Paredones) as

[135] INPI, "Atlas of the Indigenous Peoples of Mexico", [online], inpi.gob.mx, URL address: http://atlas.inpi.gob.mx/1110-2/, [accessed: March 8, 2024].

[136] Available online from https://www.economia.gob.mx/datamexico/es/profile/geo/ahome#population-and-housing.

part of a community characterisation survey commissioned by the Project in March 2024. It is important to note that none of these five communities fall within the Direct AoI for this ESIA socioeconomic assessment, and only Ejido Ohuira and Paredones fall within the Indirect AoI (see Section 5.4.1.1). Nevertheless, the data across all five provide the most detailed current information available that is illustrative of the issues and challenges for Indigenous Peoples' communities surrounding the Project. While there are no recognised Indigenous People's PACs within the Direct AoI, it is important to note that 2% of the population of Ejido Rosendo G. Castro and Topolobampo self-identify as a member of an indigenous nation (see Table 5.60; Figure 5.59).

Table 5.60: Number of PAC members belonging to an indigenous household[137]

Name of PAC	Total of persons that belong to an indigenous household	% of total population that belong to an indigenous household
Benito Juárez	0	0.4% ~~0%~~
Campo Guadalupe Estrada	5	2.8% ~~3%~~
Ejido 9 de Diciembre	12	0.6% ~~1%~~
Ejido Benito Juárez	8	1%
Ejido Ohuira*	540	24.5% ~~24%~~
Ejido Plan de Guadalupe	0	0%
Ejido Ricardo Flores Magón	26	1.4% ~~1%~~
Ejido Rosendo G. Castro**	11	1.6% ~~2%~~
Ejido Topolobampo**	4	3.6% ~~4%~~
Ejido Tortugas Número 2	6	7.6% ~~8%~~
Los Mochis	3,562	1.2% ~~1%~~
Paredones	98	10.4% ~~10%~~
Plan de Ayala [Campo Cinco]	6	0.4% ~~0%~~
Topolobampo**	95	1.5% ~~2%~~
Average		4%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: Stakeholder engagement in 2024.

[137] Classed as households in which the household head or their partner or once of their ancestors/ascendants declares to be able to speak an indigenous language

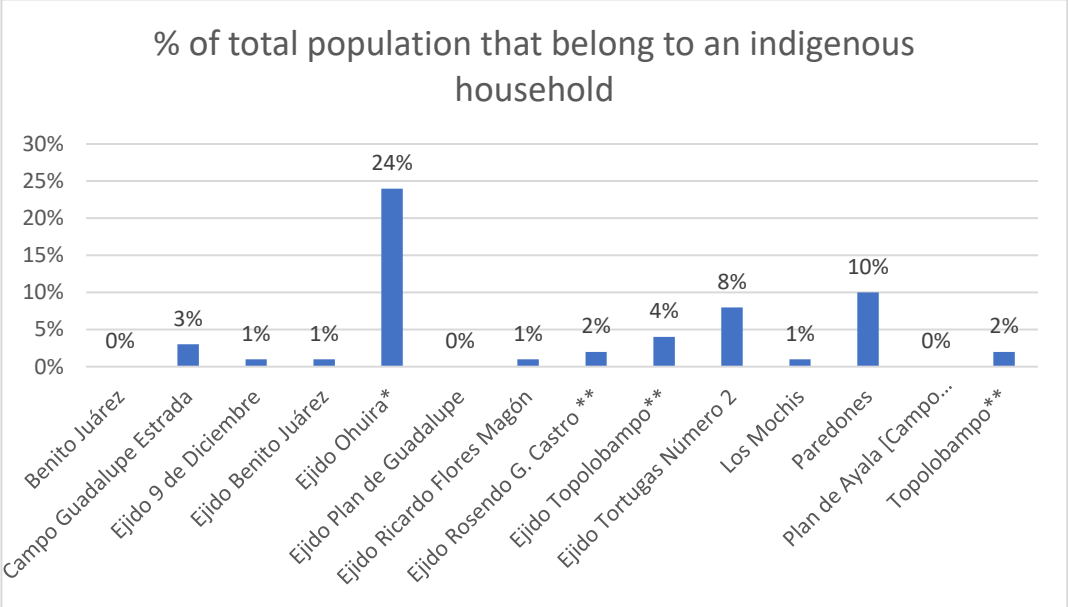


Figure 5.59: Percentage of PAC members belonging to an indigenous household[138]

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

In terms of oral proficiency in indigenous languages, 9.34% of the population (aged 3+) of Ejido Ohuira speak an Indigenous Peoples' language, whereas in Paredones the figure is 3.83% (see Table 5.61).

Table 5.61: Number of PAC members that speak indigenous languages

Name of PAC	Number of people (aged 3 years +) that speak an indigenous language	% of people (all ages) that speak an indigenous language	Number of people (aged 3 years + that speak an indigenous language and do not speak Spanish	% of people (all ages) that speak an indigenous language and do not speak Spanish
Benito Juárez	0	0.00%	0	0.00%
Campo Guadalupe Estrada	3	1.70%	0	0.00%
Ejido 9 de Diciembre	2	0.10%	0	0.00%
Ejido Benito Juárez	4	0.27%	0	0.00%
Ejido Ohuira*	206	9.34%	2	0.09%
Ejido Plan de Guadalupe	0	0.00%	0	0.00%

[138] Classed as households in which the household head or their partner or once of their ancestors/ascendants declares to be able to speak an indigenous language

Name of PAC	Number of people (aged 3 years +) that speak an indigenous language	% of people (all ages) that speak an indigenous language	Number of people (aged 3 years + that speak an indigenous language and do not speak Spanish	% of people (all ages) that speak an indigenous language and do not speak Spanish
Ejido Ricardo Flores Magón	6	0.33%	0	0.00%
Ejido Rosendo G. Castro**	3	0.43%	0	0.00%
Ejido Topolobampo**	1	0.90%	0	0.00%
Ejido Tortugas Número 2	3	3.80%	0	0.00%
Los Mochis	1,459	0.49%	4	0.00%
Paredones	36	3.84%	0	0,00%
Plan de Ayala [Campo Cinco]	2	0.14%	0	0.00%
Topolobampo**	40	0.65%	0	0.00%
Total / average	1,765	1.57%	6	0.01%

*Indigenous Peoples PAC; **Direct AoI PAC; Source: National Census 2020.

Indigenous Peoples communities surrounding the Project are reported to have similar governance structures (Aoesenuma 2024). Ejido Ohuira's governance includes a Municipal Commissioner who is elected every three years and serves as the link between the people and the government; the Ejidal Commissariat; a Traditional Governor; and a Council of Elders with six lifelong members, including one woman, who endorse and review cultural practices (ibid). Paradones has a Municipal Commissioner but compared to the other communities there is currently no traditional authority. The Indigenous Peoples in this community are instead represented by the *cobanaro* of Ejido Ohuira (ibid).

Carrizo Grande has a dual-role leader who serves both as the municipal commissioner and the traditional governor (*cobanaro*). The community primarily adheres to customary law for decision-making and conflict resolution. There is also a Ejidal Commissariat that lives in Los Mochis and who is in charge of convening the ejidal assemblies. Cerro Cabezón has three main authorities: the Municipal Authority handles public service-related matters; the Ejidal Authority oversees issues regarding to the community's ejidatarios; and the Traditional Authority who oversees cultural and religious festivities. Lázaro Cárdenas has a municipal commissioner for community-wide issues and traditional governors (*cobanaros*), who are elected by Yoreme residents and who are in charge of cultural matters and is also the Chief of *Cobanaros* of the state of Sinaloa.

In Ejido Ohuira, knowledge of origins and history is mostly held by older individuals, passed down orally through families. Although not taught in schools, a community member has documented this history in a book available in the library (ibid). The population values the environment highly, and strong cultural value is placed on the sea

and Bay of Ohuria in particular, which has been central to the Yoremes' fishing practices since ancient times. Residents often pray in Yoreme before fishing, seeking blessings from the sea's old woman, the Virgin of Guadalupe, the moon, and the sun for a successful catch (ibid). Cultural practices, including mourning rituals and traditional cooking, remain prevalent among the elderly, as well as a deep connection with nature. Much contemporary ethnic and cultural sense of identity is linked to the festivities. Rituals, including the use of masks, musical instruments, and communal food preparations during significant events like the Semana Mayor, are central to community life. Up to 32 communal kitchens can be active during the festival (ibid).

In Paredones, the sea is also crucial, providing economic benefits and being considered vital for sustaining life (ibid). People pray in Spanish or the Mayo-Yoreme language before going to sea to avoid accidents. Their festivities combine Yoreme ritual practices and Catholic religion in a syncretism that is mainly celebrated during Holy Week every Friday of Lent and for the Virgen del Carmen (ibid). There is a close link with the original Mayo-Yoreme community of Ohuira, as well as with people from various places in the region and beyond. They also celebrate Holy Week festivities together where the traditional Yoreme dish *huacavaqui* is prepared during these celebrations (ibid). Non-indigenous people in the community also participate in these celebrations.

In Paredones, in the centre of the ceremonial centre (Ramada), there is a wooden cross around which the indigenous council of elders[139] congregate around during festivities and when visitors are welcomed.[140] In Lázaro Cárdenas there are two indigenous ceremonial centres. Ejido Carrizo Grande have ceremonial centres, the *ramada* or *enramada* and the indigenous church, used for decision making and celebration of ceremonies and festivities. The *ramada* and the indigenous church are also used for cultural practices such as weddings, community and ejidal assemblies, and consultation processes, the *contis*, which are celebrations during Holy Week, festivities to the Virgin of Guadalupe and mainly to the Holy Cross. Cerro Cabezón has a ceremonial centre consisting of an indigenous church and a *ramada*. However, both places stopped being used about ten years ago.

According to the surveys, the use of the Yoreme language is mainly spoken by the elderly population. Ejido Ohuira reported limited active use of Yoreme, where the majority of people primarily understand rather than speak the language. In Paredones, people use the Yoreme language within specific settings such as family homes, during assemblies by the traditional authority, and in cultural ceremonies. Additionally, in Paredones and Lázaro Cárdenas it was mentioned that the use of the Yoreme language had decreased. In Cerro Cabezón and Lázaro Cárdenas they have primary school education of the Yoreme language and many in the elderly population speak Yoreme.

Most of the communities, including Paredones, engage in fishing activities. In Paredones fishing is the livelihood activity most people engage in, managed by the "Eustaquio Urias Valdez" cooperative, with members engaging in both subsistence and commercial fishing. They face challenges from overfishing and resource depletion (Aoesenuma 2024). People in Ejido Ohuira do not engage in fishing (ibid). Carrizo Grande residents often fish without permits, either in local shrimp farms or in nearby Lázaro Cárdenas, due to a lack of affiliation with a Fishermen's Cooperative. Cerro Cabezón's community

[139] The council of elders is in charge of promoting traditional values within the wider indigenous community.

[140] Meeting with UAIM representatives, 16th April 2024.

members travel to Lázaro Cárdenas to fish in "Bahía de Ohuira". Lázaro Cárdenas has a structured fishing economy with various fishermen's cooperatives and a profitable fishing season, though overexploitation has led to a decline in marine species (ibid).

Land acquired for the Project is not identified as owned or under customary use by specific groups of Indigenous Peoples. Furthermore, the land acquired for the Project does not contain resources known to be of importance to the identity of Indigenous Peoples such as for seasonal or cyclical use as part of livelihoods, culture, ceremonial or spiritual purposes.

People from Indigenous Peoples communities surrounding the Project engage in some form of agriculture. Ejido Ohuira has residents who rent their lands for agricultural purposes, with the produce often sold to regional warehouses (ibid). Paredones engages in agriculture during the fishing off-season, with residents working as day labourers in nearby agricultural fields (ibid). Carrizo Grande faces significant agricultural challenges due to water scarcity and limited resources, making agriculture almost non-existent. Cerro Cabezón utilises an irrigation system to grow corn primarily for self-consumption and also employs residents as day labourers in nearby fields during off seasons. Lázaro Cárdenas has limited agriculture and ejidal lands with high salinity, with a few locals growing corn and cactus for personal use (ibid). Paredones, Cerro Cabezón and Lázaro Cárdenas also have residents working as day labourers.

Day labour jobs primarily entail working within agriculture or agro-industrial fields in their own community or in nearby towns and fields during the fishing off-season (ibid).

Livestock activities are mentioned specifically in Ejido Ohuira and Lázaro Cárdenas but are not a major economic activity (ibid). Livestock raising (cows, sheep and goats) is conducted on a small scale, outside the community by some residents.

Regarding health, both Ejido Ohuira, Paredones and Lázaro Cárdenas have some form of traditional medicinal knowledge. Ejido Ohuira has herbalists who pass down knowledge between generations (ibid). Paredones used to have a healer that helped with pregnancy and minor illnesses, but not anymore. Lázaro Cárdenas has an individual that conduct ritual healing and uses local plants medicinally. No medical centres or hospitals are present in any of the Indigenous Peoples communities surveyed by Aosenuma (2024).

Ejido Ohuira, Carrizo Grande, Cerro Cabezón and Lázaro Cárdenas are organised under the ejidal system, where land is collectively owned and managed. In Ejido Ohuira, land was initially assigned and is now primarily transferred through inheritance. Carrizo Grande manages land distribution through ejidal rights, which are transferred via donation among relatives or through the purchase of rights. In Lázaro Cárdenas most community members are not ejidatarios and while the territory is integrated by two ejidos, no information about transfer of land was provided. For Cerro Cabezón, no information was provided about the transfer of land either. Paredones is the only community, out of the five indigenous communities surveyed, with some lands under private ownership. In addition to this, Paredones faces issues related to undocumented land ownership, causing disputes within families.

Indigenous Peoples communities surrounding the Project primarily have unpaved roads, and the only mention of a paved road is Paredones' main access road (ibid).

In Ejido Ohuira, Paredones, Carrizo Grande and Cerro Cabezón, both local and international migration is common. Migration occurs due to the search for better jobs, higher incomes and limited local employment opportunities (ibid). People are reported to generally migrate to the following locations:

- Ejido Ohuira: migrate towards urban centres in Sinaloa and sometimes to the United States, for some months or years.
- Paredones: migrate to either Los Mochis or the United States.
- Ejido Ohuira and Paredones have schools ranging from kindergarten to secondary education.
- Cerro Cabezón: migrate to either Culiacán within Sinaloa or to the United States.
- Lázaro Cárdenas: migrate primarily to nearby cities like Mochis, Nogales, and Tijuana (ibid).

Figure 5.60: Emiliano Zapata rural primary school, Ejido Ohuira

Source: RSK drive over survey, April 2024.

Ejido Ohuira has a kindergarten, primary (Figure 5.60), and secondary school. Paredones has a kindergarten, a primary/elementary[141] school (see Figure 5.61), and a middle school. Carrizo Grande has a primary school and a kindergarten, while Cerro Cabezón includes a community primary school, a preschool, and a teacher's house.

[141] The terms "Primary School" or "Elementary School" usually corresponds to *primaria*, comprising grades 1–6, when the students are 6 to 12 years old. It starts the basic compulsory education system.

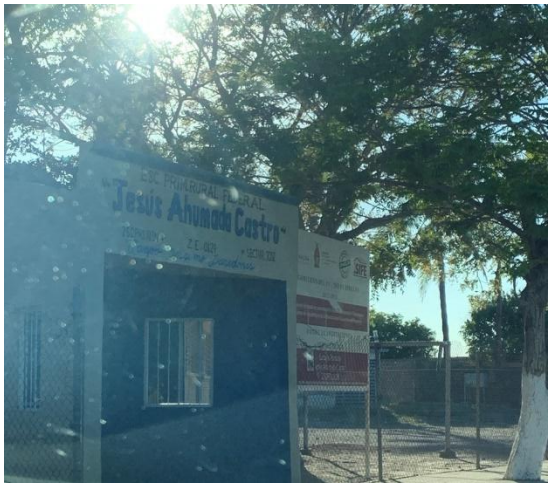


Figure 5.61: Jesus Ahumada rural primary school, Paredones

Source: RSK drive over survey, April 2024

Anecdotal evidence collected during the field visit suggests that younger indigenous community members are gradually opting for a more flexible identity which includes greater participation in the wider urban community through access to higher education and obtaining professional jobs, rather than involvement in traditional events and community affairs.

5.4.3.22 Gender

In Mexico, women's participation in the labour market stood at 49.1% in 2021. Despite a slight increase in female employment rates, the discrepancy in earnings and paid employment is significant, with 79% of men engaged in paid work versus only 45% of women. Additionally, about 60% of employed women are in informal sectors characterised by minimal social security, high instability, and low wages. This limited engagement of Mexican women in the workforce may be because of the substantial amount of unpaid domestic responsibilities they have. In the third quarter of 2021, women constituted merely 3.9% of the national construction workforce (SLR, 2022a).

In Sinaloa, women earn 1,937 pesos less than men. On average, women receive a salary of 7,895 pesos per month, while men receive 9,832 pesos.[142] In politics, women's representation is limited, with only 5.6% of mayors and 34.8% of councilwomen being female, and none holding the position of municipal trustee (*"síndica*"). The most recent elections (June 2, 2024) resulted in the first female president and the largest number of female governors (13 in total) in the history of Mexico. To understand the recent progress, the principle of parity was included in the Constitution in 2014, which forces political parties to nominate the same number of men as women candidates for Congress.[143]

While there has been progress in women's literacy and economic involvement, significant disparities still exist in the labour market and in unpaid domestic work, which is predominantly undertaken by women. The percentage of the female workforce not

[142] Available online from: https://codesin.mx/articulos/mujeres-en-la-economia-sinaloense-reducir-la-brecha-salarial-y-promover-la-participacion-en-actividades-de-mayor-calificacion

[143] Available online from https://elpais.com/mexico/elecciones-mexicanas/2024-06-04/mexico-alcanza-el-mayor-numero-de-gobernadoras-de-su-historia.html

receiving income for their labour stands at 9%, compared to 4.7% for men. Additionally, the COVID-19 pandemic exacerbated these disparities. Women were more likely to lose their jobs, shut down their businesses, or see a reduction in paid work, all while facing increased domestic responsibilities due to childcare needs and school closures (SLR, 2022a).

Prostitution was reported to be well regulated at the local level, and it is not a key concern affecting women involved, according to the Director of the Municipal Department of Female Affairs[144] [redacted] (2024) pers. comm.). The Directorate of Inspection and Regulations of Ahome confirmed that there are around 450 non-regularised sex workers in Ahome. The issuance of cards by the Municipal Health authorities guarantees the adequate health of sex workers on a weekly basis.[145] By the end of February 2023, a total of 280 sex workers began the regularisation process to operate legally and safely within the municipality.[146]

5.4.3.23 Gender-based violence and harassment (GBVH)

Mexico faces high rates of gender-based violence and harassment (GBVH) against women, with 66.1% of Mexican women having experienced some form of violence, and 34% have suffered physical violence from their partners. Domestic violence in relationships is particularly high, at 43.9%. The COVID-19 pandemic further exacerbated the situation, as confinement measures led to an increase in threats to women's safety. There were reports of at least a 30% surge in violence against women in the first three weeks of the pandemic (SLR, 2022a).

In 2020, Sinaloa experienced 26 feminicides, including five in Ahome. Sinaloa also experienced 666 firearm-related violence incidents, 29 in Ahome. Ahome's domestic violence cases stood out in Sinaloa, reaching 1,649 by 2021's end, or 396.1 per 100,000 residents. Additionally, a survey from the State of Sinaloa in 2021 showed that 66.2% of women aged 15 years or older experienced some type of violence (psychological, physical, sexual, economic or patrimonial) throughout their lives and 38.9% in the last 12 months[147]. However, it must be noted that underreporting of domestic violence cases is common, as many women do not disclose their experiences (SLR, 2022a).

GBVH against women was reported by stakeholders during RSK fieldwork to be a serious problem that occurs throughout the entire Direct and Indirect AoI. Based on the ejidal commissioner and councillor of Ejido 9 de Diciembre, the violence against women has decreased, although remains a concerning issue [redacted] L.E. 2024 pers. comm.). Gender-based violence is legitimised by culture and is more prevalent in poorer households, based on the interview held with the Municipal Department of Female Affairs' Directo[redacted]. (2024) pers. comm.). According to her, the vulnerability of women to GBVH is higher in rural areas, where *machismo*, sexual violence and

[144] Secretar*ía* de las Mujeres.

[145] Available online from: https://www.luznoticias.mx/2022-12-27/sinaloa/trabajadoras-sexuales-sin-permiso-en-ahome/153349

[146] Available online from: https://www.luznoticias.mx/2023-02-27/sinaloa/trabajadoras-sexuales-en-ahome-inicia-regularizacion/157560

[147] INEGI National Survey on the Dynamics of Relationships in Households (ENDIREH, 2021). Available online from: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.inegi.org.mx/contenidos/programas/endireh/2021/doc/25_sinaloa.pdf

overcrowding in homes prevail. In indigenous communities, in particular, men traditionally rule the household (ibid).

The Municipal Department of Female Affairs' Director emphasised that violence against women is higher in the summer when local families are under more stress looking after children who are on holiday, the household expenses and chores increase, and men drink alcohol more often (ibid). This causes more conflicts motivated by economic struggles and the unequal distribution of household and caring tasks. Gender-based violence is also linked to alcoholism and drug (crystal meth) consumption, which is high in the area (ibid). Women are often too embarrassed or scared to report issues. Reporting levels are therefore likely to be low and more work at the societal level is required to ensure women feel comfortable reporting GBVH issues (ibid).

To try to address these issues, the Municipal Department of Female Affairs provides psychological and legal advice to victims of violence and encourages women to get out of the vicious cycle of abuse (ibid). It offers a refuge centre and protection schemes for women, restraining orders and court action against male aggressors and summer courses aimed at affected children. Two psychologists are currently available to offer women support through the centre. Increasing the capacity to provide support to women and victims of GBVH is a priority. The Mayor, the Police and the armed forces, and the Department of Female Affairs attend a weekly meeting with various authorities involved in security to summarise findings and outline the nature of the emergency calls that were made regarding gender violence (ibid).

The Department of Female Affairs maintains alliances to train and employ women victims of violence (job pool) (ibid). They help women by building capacity programmes through various workshops (crafts, baking, beauty services) to insert them into the workforce. In addition to providing women with learning opportunities, the Department of Female Affairs have also previously established breastfeeding terminals in Los Mochis to provide a safe space for women to breastfeed when they are away from their homes (ibid).

Aligned with the UN Women's agenda, the Department of Female Affairs implements programmes through POAS (Annual Operational Programmes) and PBR (Results-Based Programmes) (ibid). The department report that 22,000 benefited last year from these programmes at the municipal level (ibid). It advocates for women's economic autonomy and provides services associated with sexual and reproductive health. There have been conferences, schemes and training to raise awareness about diversity issues. The acceptance of sexual diversity has grown in recent years, despite the position of certain teachers against teaching about reproductive health and sexual diversity in schools. Despite progress made in some areas, the lack of integration of gender issues and diversity into public administration remains a challenge (ibid).

5.5 Ecosystem services baseline

5.5.1 Overview

This section establishes the ecosystem services (ES) baseline for the Project. A list was established of ecosystem services that were likely to exist within the direct and indirect social AoI. This was developed using a combination of recent community characterisation studies completed in key communities (Aosenuma, 2024; UAIM 2024), information gathered during RSK's field-based socioeconomic study visit in April 2024, and information reviewed as part of the socioeconomic and biodiversity baseline assessments.

For each potential ES, information on identified ES in the context of the Project area is presented, in addition to ES dependence and alternatives, the main benefits (e.g. income, food security, cultural attachment) generated and the main beneficiaries (e.g. subsistence farmers, fisherfolk). This information is presented in Table 5.62 below, in addition to the following:

- habitat/ecosystem identified
- location/extent of the ES
- description of the ES
- beneficiaries of the ES
- Project activities that could adversely impact on ES
- ES type (1 or 2)
- viable ES alternatives
- importance to beneficiaries
- ES replaceability
- priority ranking (priority or non-priority).

All ecosystem services with potential to be impacted by the Project were initially scoped in, following a precautionary approach. After this, the long list of ecosystem services was refined and classified by priority in line with IFC PS6 (i.e. types I and II).

5.5.2 Summary of ES present in AoI

Table 5.62 below provides a screening table showing the results of the ES prioritisation exercise.

In total, 15 ES were identified: four provisioning, four cultural and seven regulating/supporting. All of the identified ES were classified as type 1, which means that if they were impacted by the Project, they have the potential to generate adverse effects for affected communities and ES beneficiaries. In accordance with the decision trees within WRI's 'Weaving Ecosystem Services into Impact Assessment' methodology (2013), the identified type 1 ES were further assessed into priority and non-priority categories based on potential impacts on ES beneficiaries. This considers whether the Project could impact the ability of others to benefit from the ES, the importance of the ES to beneficiaries and the availability of viable alternatives. For this assessment, ES classed as priority are those services on which Project impacts may affect well-being (i.e. livelihoods and culture) of ecosystem service beneficiaries (WRI 2013). Based on this

analysis, three ES related to cultural services were identified as potential priority ES for the Project and assessed as part of this impact assessment.

In summary, the main local level ES identified of importance for the Project and findings of the ES screening include:

- key provisioning services potentially impacted by the Project include services derived from agricultural land such as crop cultivation for both subsistence and commercial sale purposes and livestock farming, primarily of cattle and goats.
- further key provisioning services include those derived from the Bay of Ohuira and surrounding habitats (i.e. mangroves, Sarcocaule scrub, open water canals and their banks) such as wild plants and other natural resources (i.e. fish / shellfish).
    - while these provisioning services are considered type 1 due to their importance for local beneficiaries, they are screened as non-priority as the Project is unlikely to impact the ability of others to benefit from the service and in the case of agricultural land the loss of ES attributed to the Project will impact one landowner / agribusiness with access to spatial alternatives.
- key regulating and supporting services provided by the coastal marine ecosystem and Bay of Ohuira located close to the Project area include mangrove habitats which provide shoreline protection (i.e., from storm surges), erosion prevention and soil retention for coastal communities.
    - regulating services identified through screening were considered unlikely to be priority, as Project performance is unlikely to be affected by changes to these services and the Project is unlikely to impact the ability of beneficiaries to benefit from these services.
- key cultural services identified include spiritual and aesthetic value provided for local communities by the Bay of Ohuira, cultural connection to the land and aesthetic value of the landscape, traditional knowledge and livelihoods, and rituals and ceremonies.
    - these ES were considered priority services for the assessment as Project-related in-migration of people from outside the region may weaken cultural traditions, languages, practices, knowledge, and skills and visual / landscape impacts associated with the Project could further reduce cultural connections to land and the cultural aesthetic value of the landscape (i.e. for key beneficiaries and sectors such as tourism).

Table 5.62: Ecosystem services impact and dependence prioritisation screening table

Ecosystem / habitat associated with ES	Identified ES	Location and extent of ES associated with the Project	Description of the ES	Beneficiaries of the ES	Activities that could adversely impact on ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES Replaceability	ES priority
Provisioning services										
Annual and semi-permanent irrigated agricultural land	Crop farming	Annual and semi-permanent irrigated agricultural lands within direct and indirect social AoI	The main provisioning service in the Project area is food from cultivated crops, which is used for both subsistence and commercial sale purposes. Some land users irrigate their crops using irrigation canals	All land owners, PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities resulting in decreased crop yields, water quality in irrigation canals, or available agricultural land such as land acquisition and change in land use/access	Type 1	Directly impacted agricultural lands generally of low potential for agriculture and beneficiaries likely to have access to alternative land for crop farming	Essential	High (many spatial alternatives)	Non-priority
Annual and semi-permanent irrigated agricultural land	Livestock farming	Agricultural lands such as xerophytic vegetation within direct and indirect social AoI	Some local communities raise livestock, primarily cattle and goats Some landowners practice feedlot livestock production and agribusiness 'Backyard animals' such as cats, dogs, hens and roosters are also kept in some local communities	Some landowners, PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities resulting in decreased livestock numbers or available agricultural land for feed production such as land acquisition and change in land use/access	Type 1	Directly impacted agricultural lands generally of low potential for livestock farming and alternative higher potential lands widely available.	Moderate	Moderate (some spatial alternatives)	Non-priority
Surface water bodies	Fishing	Bay of Ohuira	Fishing was identified to be a particularly important activity for local communities such as Paredones, for both subsistence and commercial sale purposes. Most frequently fished products include shrimp, crab and mullet. The Bay of Ohuira is used by fishing boats and for recreational fishing, in addition to the transit of commercial vessels and the transportation of passengers	All PACs and IP within and near the Project area are considered to be beneficiaries of this ES. Fishing is the main source of income for many local inhabitants. Strong local fishing culture, e.g. the Paredones is known locally as a "fishing camp"	Activities resulting in decreased water quality in the Bay of Ohuira or disturbance/removal of mangroves	Type 1	Beneficiaries are expected to have access to other areas within the Bay of Ohuira which are suitable for fishing (e.g., accessible, not showing signs of overfishing).	Essential	Moderate (some spatial alternatives in other areas of the Bay of Ohuira)	Non-priority
• Xerophytic vegetation • Marine water	Wild plant and natural resource collection	All natural habitats within the Project area.	Some local communities use wild plants to cure minor ailments such as	All PACs and IP within and near the Project area are	Activities resulting in a decrease in access to, or abundance and diversity of,	Type 1	Beneficiaries are likely to have access to alternative land (e.g., xerophytic vegetation) if	High	High (many spatial alternatives)	Non-priority

Ecosystem / habitat associated with ES	Identified ES	Location and extent of ES associated with the Project	Description of the ES	Beneficiaries of the ES	Activities that could adversely impact on ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES Replaceability	ES priority
• Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)		Particularly the hills around the Ohuira Bay and canal banks	headaches, coughs and intestinal issues. There is also the presence of a couple of artisans who make handicrafts – masks and clothing – for the festivities. Some local communities also gather firewood for festivals (i.e. mesquite deadwood)	considered to be beneficiaries of this ES Lazaro Cardenas, Elido Ohuira, Carrizo Grande Ejido and Cerro Cabezón communities – use of traditional medicine Lazaro Cardenas community – healers, gathering firewood for cooking	wild plants such as the in-migration of newcomers, construction activities near canals and change of land use/access		access to land is restricted, or could potentially purchase wild plants and other natural resources from other sources			
Cultural services										
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)	Cultural connection to the land and aesthetic value of the landscape	All natural habitats within the Project area	The Bay of Ohuira is visited by local communities for spiritual and aesthetic enjoyment Local communities have a special relationship with sea because most of their activities are carried out there e.g., fishing, ritual acts. They are also aware of the importance of the land as the main source of life, because that is where vegetation grows, where the people work and from which they feed and subsist (Aosenuma, 2024)	All PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which disconnect/displace PACs and IP from their land or change the landscape. These may include: • Increased disturbance such as traffic movement • Visual and landscape impacts to the Bay of Ohuira • Reduced land or shore availability	Type 1	There are no viable alternatives for this ES	High	Low/not replaceable (few to no spatial alternatives)	Priority
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)	Traditional knowledge and livelihoods	All natural habitats within the Project area	The general area is used by some local communities who have distinct cultural traditions, languages, practices, knowledge, and skills that are used to sustain their livelihoods and culture	Some PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities that limit or reduce traditional knowledge and that prevent traditional livelihood sustainability	Type 1	There are no viable alternatives for this ES	High	Low/not replaceable (few to no alternatives	Priority

Ecosystem / habitat associated with ES	Identified ES	Location and extent of ES associated with the Project	Description of the ES	Beneficiaries of the ES	Activities that could adversely impact on ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES Replaceability	ES priority
			such as fishing and gathering of natural resources from the land							
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)	Rituals and ceremonies	All natural habitats within the Project area. Particularly the sea, and natural sacred sites in the Lázaro Cárdenas community	Occasional rituals and ceremonies are practiced by local communities in natural spaces in and around the Project area. For example, local communities practice rituals and ceremonies associated with the sea, such as the Feast of the Virgen del Carmen and Virgin of Guadalupe. Additionally, local residents, particularly the Yoremes, pray to the 'old woman of the sea' before entering the sea so that their efforts are fruitful and for protection.	Some PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which alter the landscape or restrict access to sacred sites	Type 1	There are no viable alternatives for this ES	High	Low/not replaceable (few to no alternatives	Priority
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)	Tourism	Port of Topolobampo – natural tourist attractions, water sports Los Mochis – central plaza, fishing, wildlife watching Topolobampo – dolphin-based tourism	Tourism is a growing economic activity in the Project area, with the arrival of cruise ships to the port and ferries to La Paz, Sinaloa. The main tourist attractions and activities include bird and dolphin watching and water sports	Most PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which alter the landscape aesthetic value or degrade the water quality of the Bay of Ohuira	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	Non-priority

Ecosystem / habitat associated with ES	Identified ES	Location and extent of ES associated with the Project	Description of the ES	Beneficiaries of the ES	Activities that could adversely impact on ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES Replaceability	ES priority
Regulating and supporting services[148]										
Mangrove swamp	Shoreline protection and erosion prevention	Bay of Ohuira	Mangroves provide shoreline protection (i.e., from storm surges) and erosion prevention for coastal communities of the Ohuira Bay	Most PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which result in the disturbance, degradation or removal of mangroves	Type 1	Access to viable ES alternatives could i be enhanced elsewhere via improved soil conservation and afforestation of mangroves through biodiversity compensation measures	Moderate	Low/not replaceable (few to no alternatives	Non-priority
	Soil retention	Bay of Ohuira	Mangroves found on the coast of the Bay of Ohuira are known for retaining soil which helps to prevent erosion, maintaining available fish stock and providing a habitat for the birth and development of various fish species	Most PACs and IP within and near the Project area are considered to be beneficiaries of this ES		Type 1	Access to viable ES alternatives could be enhanced elsewhere via improved soil conservation and afforestation of mangroves through biodiversity compensation measures	Moderate	Low/not replaceable (few to no alternatives	Non-priority
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)	Pollination	Lagunas de Santa María-Topolobampo-Ohuira Ramsar Site	Insects, mammals, reptiles and birds present in the Lagunas de Santa María-Topolobampo-Ohuira Ramsar Site provide pollination services for the agricultural areas within the Project area	All PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which decrease the pollination potential of natural habitats and biodiversity, such as vegetation clearance, land cover change and accidental events	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	Non-priority
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub	Air quality regulation	All natural habitats within the Project area	All natural habitats play an important role in regulating air quality by filtering and purifying the air. Vegetation and wetland environments trap and remove airborne pollutants and	All PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities that reduce the air regulating capacity of vegetation	Type 1	Viable ES alternatives could be enhanced through biodiversity compensation measures for natural habitats e.g., xerophytic vegetation, mangroves	Moderate	Moderate (some alternatives)	Non-priority

[148] The stakeholder engagement process mainly focused on provisioning and cultural ES, and did not specifically address regulating and / or supporting ES as gathering quantitative / qualitative data on these services is more difficult given their somewhat subjective nature. The priority ranking of the regulating / supporting ES is therefore based on professional experience, knowledge of the environmental and affected PACs / IP, and a thorough understanding of the Project and potential impacts.

Ecosystem / habitat associated with ES	Identified ES	Location and extent of ES associated with the Project	Description of the ES	Beneficiaries of the ES	Activities that could adversely impact on ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES Replaceability	ES priority
			particulate matter such as dust and smoke. In addition, vegetation is a source of oxygen, as the photosynthesis process of plants produces oxygen as a by-product							
• Marine water • Mangrove swamp • Open water (e.g. canals)	Water purification	Bay of Ohuira – Mangroves, canal banks	Aquatic vegetation, particularly mangroves, filter pollutants, absorb excess nutrients from runoff, and trap sediments, which helps to increase the clarity and quality of water	All PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which decrease the water purifying capacity of the surface and marine water bodies e.g., mangrove degradation	Type 1	Viable ES alternatives could be enhanced through afforestation of mangroves via biodiversity compensation measures	Low (the population in the Project area do not use water in the RAMSAR area as water quality is affected by the JAPAMA wastewater discharges)	Moderate (some alternatives)	Non-priority
• Xerophytic vegetation • Marine water • Mangrove swamp • Sarcocaule scrub • Open water (e.g. canals)	Soil formation and nutrient cycling	All natural habitats within the Project area	Many provisioning ES depend on soil formation. All natural habitats, but particularly the mangroves, play an important role in soil formation and nutrient cycling through providing a habitat for a wide range of plants and animals. As plants and animals die and decompose, they release nutrients that become incorporated into the soil. The dense root systems of mangrove plants also help to stabilise the soil (preventing erosion), and to trap sediment / nutrient which further contributes to soil formation.	All PACs and IP within and near the Project area are considered to be beneficiaries of this ES	Activities which decrease soil formation and reduce nutrient cycling e.g., natural habitat fragmentation or destruction	Type 1	Viable ES alternatives could be enhanced through improved soil conservation and afforestation of mangroves via biodiversity compensation measures	Moderate	Moderate (some alternatives)	Non-priority
• Xerophytic vegetation • Marine water • Mangrove swamp	Carbon sequestration	All natural habitats within the Project area – particularly	All natural habitats, but particularly the mangroves, play an important role in carbon	All PACs and IP within and near the Project area are considered to be	Activities resulting in a decrease in carbon storage and sequestration by	Type 1	Viable ES alternatives could be enhanced through improved soil conservation and	Moderate	Moderate (some alternatives)	Non-priority

Ecosystem / habitat associated with ES	Identified ES	Location and extent of ES associated with the Project	Description of the ES	Beneficiaries of the ES	Activities that could adversely impact on ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES Replaceability	ES priority
• Sarcocaule scrub • Open water (e.g. canals)		the mangrove swamp	storage and sequestration, which is the process of removing carbon dioxide from the atmosphere and storing it in long-term reservoirs. The mangroves act as a natural carbon sink, removing carbon dioxide from the atmosphere and helping to mitigate climate change	beneficiaries of this ES	vegetation including mangroves		afforestation of mangroves via biodiversity compensation measures			

6 STAKEHOLDER ENGAGEMENT

6.1 Introduction

Stakeholder engagement has been (and continues to be) conducted to provide information about the Company and Project to the public and interested stakeholders, and to support the development of the ESIA and associated environmental and social management and monitoring plan (ESMMP). The objectives of the Project's stakeholder engagement activities are:

- Identifying and assessing stakeholders, along with their interests, issues, impacts, and concerns.
- Implementing transparent and accessible communication methods tailored to each stakeholder group, including vulnerable and marginalised groups.
- Building trust and mutual respect between the Project and its stakeholders.
- Communicating information in a culturally appropriate manner.
- Providing a platform for consultation, information sharing, and integrating feedback.
- Establishing effective systems for addressing grievances and resolving disputes, communicated clearly to stakeholders.
- Documenting and analysing stakeholder engagement activities.

This chapter describes the Project's overall engagement strategy and stakeholder engagement activities conducted to date, as well as the engagement that has supported the development of the ESIA and the planned engagement to support disclosure. This chapter also provides a summary of stakeholder comments and how they were addressed in the ESIA.

6.2 Stakeholder Engagement Plan (SEP)

The Project's SEP for the ESIA and pre-construction phase which outlines a strategic approach to facilitate effective communication and collaboration throughout the development and operation of the Project has been appended to the ESIA (see Appendix 2).

The SEP builds upon previous iterations developed the Company's government and community relations teams. The ESIA is occurring alongside other Company activities in Mexico and, as such, the stakeholder engagement process for the Project has benefited from the knowledge and understanding gained through Transition Industries' and the Company's past and ongoing structured engagement activities since 2021.

The primary goal of the SEP is to guarantee that a thorough, consistent, and coordinated approach is maintained in stakeholder engagement, while complying with the IFC PS throughout the lifecycle of the Project. The SEP encapsulates outcomes of stakeholder engagement activities and provides guidance for future consultations during the ESIA disclosure phase. The SEP is designed to ensure stakeholder engagement is based on

relevant, timely, and accessible information and addresses stakeholders' interests, impacts, and concerns related to the Project.

6.3 Stakeholder identification and analysis

Stakeholders are continually identified through various means, including:

- Previous studies such as the SLIP and MIA conducted for the Project.
- ESIA consultants' and subcontractors' knowledge of the area.
- Consultations with other professionals working in the field.
- GIS mapping of the Project's AoI.
- Input from Company and Project Community Liaison Officers (CLOs).
- Consultations conducted during the ESIA baseline data collection phase.

In accordance with the SEP, RSK evaluated a long list of potential Project stakeholders based on their anticipated interest in and influence on the Project. Stakeholders included those with perceived positive, negative, and neutral positions related to the Project. In total, more than 100 stakeholder groups/individuals were identified from the following categories:

- Government authorities/administration at relevant levels (regional, state, municipality) and local community leaders.
- PACs within the AoI, encompassing diverse demographics such as men, women, children, Indigenous Peoples, landowners, land users and vulnerable people.
- Civil society entities, including local non-governmental organisations (NGOs) operating in fields pertinent to the Project's ESIA.
- Local social services and infrastructure providers, such as middle and high schools and healthcare facilities, that may be directly or indirectly affected by the Project.

The understanding of stakeholders and their potential interests and concerns related to the Project have directly informed the engagement programme to date and plans for engagement through the ESIA disclosure period.

6.4 Stakeholder engagement activities undertaken

6.4.1 Previous stakeholder engagement activities undertaken

Since the Project's inception, and more notably upon entry into the design and permitting phase in 2021, Transition Industries has made efforts in engaging various stakeholders, including regulatory entities, government officials, indigenous communities, NGOs, local businesses, and others. These engagements were conducted as part of Project planning, regulatory due diligence, and environmental impact assessments. Noteworthy engagements include discussions with federal regulatory authorities such as SEMANART and the National Institute of Indigenous Peoples (INPI), as well as continued collaboration with Sinaloa State Government entities and municipal authorities in Ahome.

Transition Industries' proactive approach extended to engagement with affected communities, including indigenous and fishing communities, through information sessions, public meetings, and consultations. These interactions aimed to address concerns regarding environmental impacts, transportation strategies, and emergency protocols so that the Project could avoid E&S impacts through design and engineering changes (e.g., Net Zero, location of pipelines, use of wastewater). Notably, positive feedback was received on the wastewater management plan, which utilises residual water from the City of Los Mochis, demonstrating a commitment to sustainable practices and community involvement.

The main stakeholders identified in earlier versions of the SEP (in 2021 when the Project began documenting engagement per IFC PS) include Federal Regulatory Authorities, State Government and regulatory bodies, Municipal Authorities, Public Infrastructure Companies, Communities within the Direct and Indirect AoI), including Indigenous Communities, other communities identified in the MIA, local businesses, local NGOs and CSOs, fishing cooperatives, emergency and security service providers, other social service providers near the Project area, and the media.

6.4.2 Stakeholder engagement activities undertaken as part of the ESIA update

During the ESIA preparation, RSK undertook stakeholder engagement activities as part of the field-based socioeconomic study undertaken between 15th and 19th April 2024. This provided an opportunity to update a limited number of stakeholders across various stakeholder groups about the Project, providing further opportunities for feedback, informing stakeholders about the grievance mechanism, whilst also collecting socioeconomic data.

Beyond this, additional engagement activities were also conducted by social scientists from UAIM during a community needs and opportunity assessment over a two-year period in nine communities to inform the Project's Strategic Community Investment Program (UAIM 2024a). All 13 communities, including the city of Los Mochis and Topolobampo will be included in the SCI Program and ongoing SEP. The Project will integrate specific measures into the broader SCI Plan to take into consideration there are Indigenous Peoples integrated within the larger affected population and Affected Communities. The plan will detail actions to minimise adverse social and economic impacts and identify opportunities and actions to enhance positive impacts of the project on the Indigenous Peoples. The SCI Plan will also ensure all Affected Communities (Direct and Indirect) are engaged with under the Informed Consultation and Participation framework.

Other work has included that of a local Mexican consultancy firm AOSENUMA who completed community engagement within five Indigenous Peoples communities surrounding the Project and Bay of Ohuira as part of a study commissioned to inform the Project's understanding of Indigenous viewpoints. The preliminary results of all these engagement activities have also been incorporated into the SEP.

Stakeholders were divided into various groups, including community leaders, local and state departments, civil society and NGOs, local social services providers, the client, organisations representing the client, business representatives, and land sellers.

A list of stakeholders identified for the purpose of consultations conducted by RSK, UAIM and AOSENUMA are presented in the SEP. RSK's engagement activities included 14 stakeholder meetings conducted with a total of 45 participants. Further details on the engagement methodology used by RSK is provided in the SEP.

It is

6.4.3 Ongoing engagement

Transition Industries is planning to continue to conduct community engagements and disseminate information about the Project to ensure enhanced stakeholder awareness, especially due to confusion with the new industrial development in the area. Transition Industries has since held a public event in Los Mochis to explain the purpose of the Project and innovative wastewater recycling process in partnership with JAPAMA.

The SEP provides a full list of recent and ongoing public engagements for the Project, including news reports and media activities.

6.5 Analysis of stakeholder feedback

Both positive and negative comments towards the Project were received by stakeholders during the ESIA engagement. The updated SEP provides complete details of the topics and comments received during the RSK field-based socioeconomic study engagement.

Government stakeholders, business representatives and a local fishing cooperative expressed support for the Project. Some stakeholders continue to associate the Project within another new industrial development in the area which has faced opposition due to potential impacts on the Bay of Ohuira. This issue was raised ten times in seven different meetings. According to the Project, this is likely due to the fact the Project had extended periods of time (over the past several years) where they could not engage directly with communities. This was as a result of not wanting to interfere with public disclosure and government-led consultation activities for the new industrial development.

Stakeholder engagement by the local Mexican consultancy firm AOSENUMA, as elaborated on Section 5.4.3.22, within five communities surrounding the Project also found that in at least four communities (Lázaro Cárdenas, Carrizo Grande, Ejido Ohuira and Paradones), this other new industrial development has caused a fragmentation of the community into groups for, and against, that development. This has made the Project's engagement with communities more sensitive given the recent legacy issues with the new industrial development.

6.5.1 ESIA public disclosure

A voluntary, non-statutory public disclosure of this ESIA took place in August 2024. This subsection includes the results from the consultation, feedback on the Project's E&S potential impacts and recommended mitigations and controls.

Publicising the public disclosure meetings

Transition Industries and Pacifico Mexinol advertised the two public meetings, Non-technical Summary (NTS) links and contact information on social media and in the major newspapers.

Below are some of the media records (*Debate* newsletter and *Debate Los Mochis* Facebook site) of the advertisement of both events that ensured the participation of the general public.

Figure 6.1: Publicising the public disclosure meetings via newsletters and social media

Materials distributed during the public disclosure meetings

Transition Industries distributed 500 copies of the ESIA information brochure with links and contact details, over 150+ NTS Spanish hard copies and 50+ in Yoreme to IP community members. Additionally, 500 Mexinol feedback/contact cards were also distributed during the public disclosure meetings.

During the six-week disclosure period (which was extended to and ended on 15 September 2024), the number of downloads from their site is:

- ESIA = 144 times
- MIA = 136 times
- NTS Spanish = 629 times
- NTS Yoreme = 139 times.

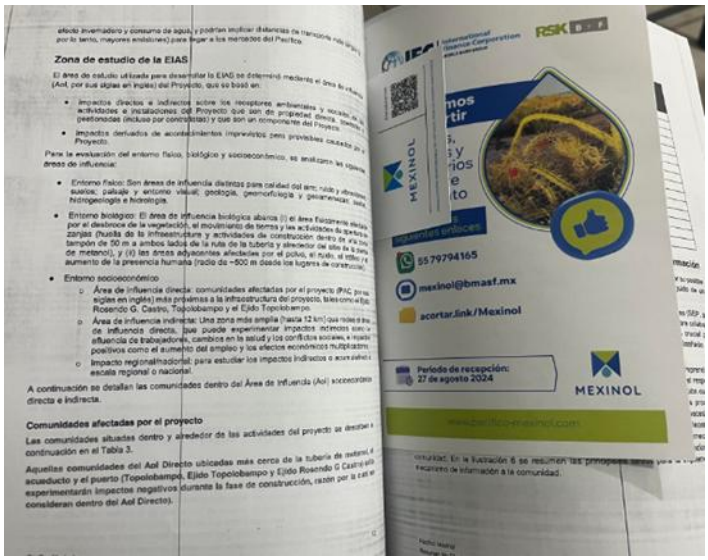


Figure 6.2: Material distribution

Outcomes of the public disclosure meetings

A 30-day public comment period began upon disclosure of the ESIA to the local public and it was extended by 15 days to attract more comments and engagement. As part of the disclosure process, the Project consulted members of the public and interested bodies and organisations to disclose and discuss the results of the ESIA. Public disclosure meetings are detailed below (see Table 6.1).

A total of 562 people attended the public disclosure meetings.

Table 6.1: Public disclosure meetings

Date	Community	Number of questions	Total attendees	Male attendees	Female attendees
27/07/2024	Ejido Tortugas Numero 2	20	20	12	8
28/07/2024	Ejido Plan de Guadalupe	19	23	16	7
28/07/2024	Ejido Plan de Ayala	12	22	12	10
29/07/2024	Ejido Cerro Cabezón (El Chorrito)	6	9	7	2

Date	Community	Number of questions	Total attendees	Male attendees	Female attendees
29/07/2024	Carrizo Grande	5	6	1	5
04/08/2024	Ejido Benito Juárez	14	7	4	3
05/08/2024	Los Mochis Publico	12	180	132	48
05/08/2024	Topolobampo (including members from Campo Guadalupe Estrada)	8	135	70	65
06/08/2024	Ejido Ricardo Flores Magón	5	12	4	8
06/08/2024	Ejido Rosendo G. Castro	15	15	6	9
07/08/2024	Ejido Ohuira	7	32	14	18
08/08/2024	Ejido Topolobampo	10	21	6	15
12/08/2024	Los Mochis Sector	2	55	36	19
14/08/2024	Paredones	18	10	3	7
14/08/2024	Ejido 9 de Diciembre	5	15	2	13

The Los Mochis meeting was attended by the mayor, senior members of the government, business leaders, NGOs, associations, and civil society. Attendance was high and the media coverage was positive.

For Paredones self-appointed community leaders had rejected the invitation to the public disclosure meeting, and therefore other means to get the message out to the wider population were used in addition to a public disclosure meeting. The CLOs went door by door in Paredones and talked to over 70 people and provided the NTS brochure and

contact card. Local inhabitants in Paredones were receptive and interested in hearing that the Project will not impact the Bay. A meeting in Los Mochis for all members of Paredones was arranged through a female community organiser and Transition Industries provided transportation to the event.

During public disclosure, the head of the “Aqui No” movement attended the meeting in Topolobampo and expressed negative views against the industry as a whole. However, consensus expressed by other members of the community during these meetings were of support for the Project and its associated socioeconomic benefits.

The Project received agreement during the meetings in both Ohuira and Ejido Topolobampo to complete UAIM Community Assessments.

In general, all communities understood the public disclosure meetings to be part of an ongoing engagement strategy. They were satisfied with the Project returning to present the results of the ICP period and provide more information.

Analysis of stakeholder comments raised

As Figure 6.3 shows, during the public disclosure meetings, 21% of the questions referred to community benefits (good neighbour policy and job opportunities), followed by 20% who inquired about the project description (methanol process, timeline, ownership, etc.), stakeholder engagement (15%), and risks (14%).

When it comes to the direct Area of Influence communities, their main questions raised included:

Topolobampo; project description (methanol pipeline), risks, community benefits (procurement and job opportunities), the area of influence, and water quantity.

Rosendo G Castro; project description (location, schedule, project site, methanol pipeline, port), risks (malfunction, community health and safety), environmental impact management (soil contamination, air pollution) and community benefits (job opportunities and community development).

Ejido Topolobampo; project description, stakeholder engagement, area of influence, community benefits, wastewater and biodiversity. The community members also talked about their ongoing concerns with the adjacent quarry management. When the project representatives explained that the quarry will be used for the project, they did not express concerns.

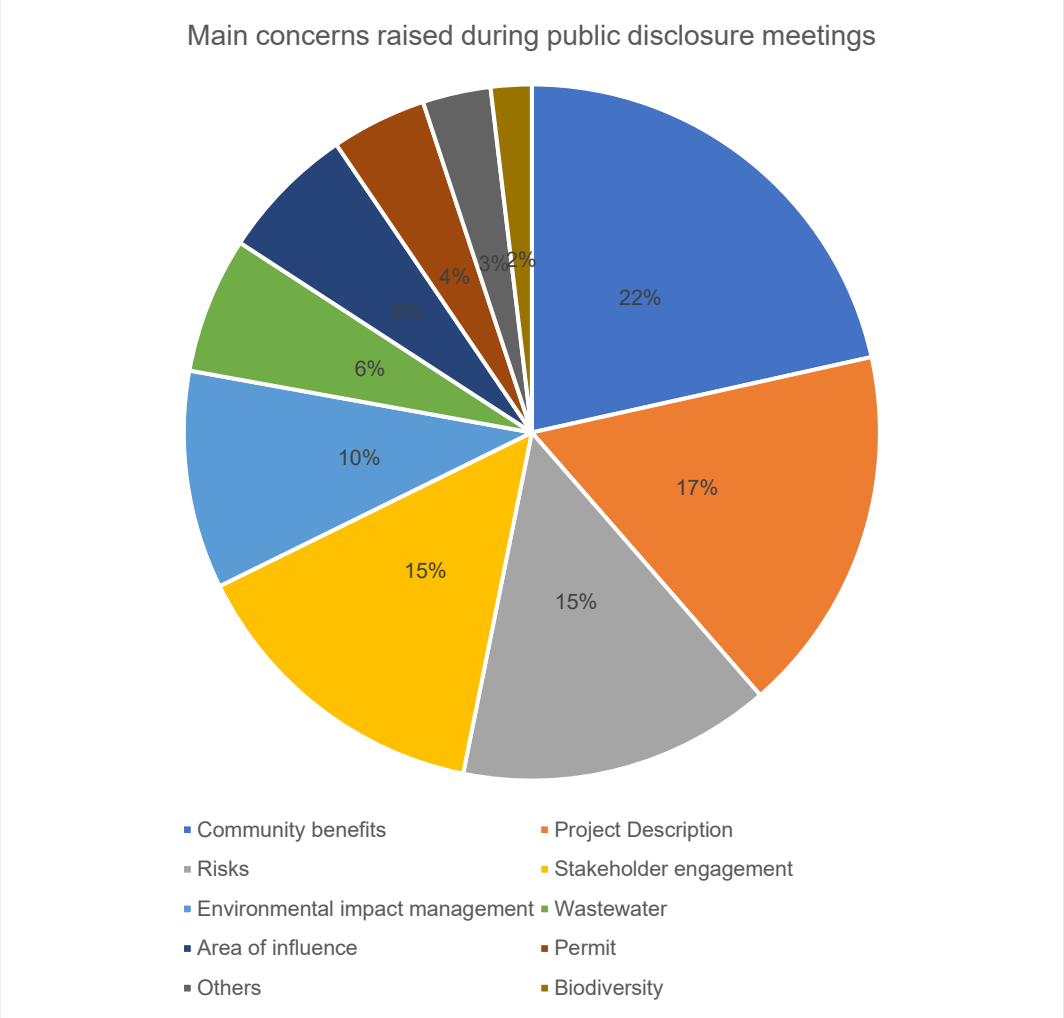


Figure 6.3: Main concerns raised during public disclosure meetings

To date, no questions were asked that require additional text to be added to the ESIA. Below is a crosswalk table addressing all questions and concerns received from the communities during public disclosure, referencing where the answers can be found in the ESIA.

Table 6.2: Questions and issues raised during disclosure of the ESIA

Topic	Questions*	ESIA chapter
Area of influence	Specific questions about why a certain community was considered in the study. (3)	Section 5.4.2 Data collection; Section 5.4.1.1. Social AoI
	How many meters from the community will the pipeline with the methanol pass?	Section 5.4.1.1. Social AoI provides maps with distances
	What is the exact location of the plant and pipelines (6) and why was this location chosen (2)?	Section 3.2.1. Location describes the location of project components and distances to communities

Topic	Questions*	ESIA chapter
Biodiversity	Did you know that a bird called Mexican Austero[149] lives there, which is listed in NOM 059 SEMARNAT 2010?	An avifauna baseline survey was undertaken, and this bird was not identified (see Section 5.3.6.4 Priority fauna). Bird monitoring will be undertaken for the Project area to monitor bird diversity as an indicator of environmental quality. This monitoring will be included in the Flora and Fauna Monitoring Plan (Section 8.2.2 Operations).
	Didn't the IFC require a Biodiversity Net Gains Program for the species (flora and fauna, mainly birds) that exist in the place where they are going to settle?	As stated previously, the KBA is critical habitat but as there will be no significant impacts nor residual impacts, no offsets are required only additional conservation actions focusing on the values of the KBA will be undertaken.
	Are they going to cut down mangroves?	Table 5.19 and Section 5.3.6.3 Priority habitats
Community benefits	Are they going to sign the commitments they make before a Notary Public?	Outside the scope of the ESIA. Addressed separately by the Company.
	Regarding its gender policies, we are fully willing to support it to happen.	Outside the scope of the ESIA. Addressed separately by the Company.
	What benefits are we going to receive from the Project in this community, ejido? (11)	Sections 8.3.2.1 Construction, 8.3.2.2 Operation and 11.5 ESMMP Documents describe benefits
	Will jobs, and how many, go to local communities? (8) Any to young people? Any age limit?	Section 3.9 Workforce describes number of direct and indirect jobs; Section 8.3.3 describes equitable employment policies
	We want you to support us with a Training Centre for the community, where workshops and courses are given for people who want to learn something to become self-employed... how and when can we know if you can support us?	Outside the scope of the ESIA. Addressed separately by the Company.
	Is any specialty required to work with you? What types? (3)	Section 3.9 Workforce describes generally the types of jobs
	Are they already hiring? (2)	Section 3.9 Workforce describes the timing of the expected hiring
	How do they assure us that they will give us employment once the work begins?	Outside the scope of the ESIA. Addressed separately by the Company.
	Will the 160 employees in the operation stage be in 24-hour periods or in shifts?	Section 3.9 Workforce describes the potential for shift work
	What percentage of employees will they consider complying with	Section 3.9 Workforce describes the intent of local content policy

[149] *Calidris minutilla* - Least Sandpiper- NT

Topic	Questions*	ESIA chapter
	inclusion? We can also support you on that topic.	
	When will your Good Neighbour policy and your Strategic Community Investment Plan begin to work?	The Company's Strategic Community Investment activities are generally described in Sections 8.3.2.1 Construction, 8.3.2.2 Operation and 11.5 ESMMP Documents
	Are you going to support entrepreneurs?	Outside the scope of the ESIA. Addressed separately by the Company.
Environmental impact management	What type of air pollutants and toxic substances will be in the air? (2)	Section 8.1.1 Air quality describes potential toxins
	Will there be, and what type of, health effects related to toxic emissions? (2)	Section 8.1.1 Air quality discusses potential impacts
	What will happen to the conservation area after the plant is dismantled?	Outside the scope of the ESIA. Section 8.2.3 indicates that the Decommissioning Plan will be developed closer to the time of decommissioning (30 years).
	What can you tell me about the pollution that is produced to produce green hydrogen?	Sections 3.12.3 Waste describes the waste process
	Is it serious that its serious impacts are minimal?	Section 7.5 Impact assessment methodology describes how impact magnitudes are determined
	How do you prove that they are not going to produce waste, including hazardous waste? (2)	Sections 3.12.3 Waste and 11.5 ESMMP describe the waste management process
	How are they going to manage toxic waste? What happens after it's turned over to 3rd parties?	Sections 3.12.3 Waste and 11.5 ESMMP describe the waste management process
	Why in the water diagram is there a route that says water with contaminants and indicates the discharge into the bay?	Section 8.1.5 Surface water and groundwater section describes the process in detail: no discharge to the Bay
	In this ejido we have many problems with water, what are you going to do about it?	Outside the scope of the ESIA
	Aren't they going to deposit hot water in the bay?	Sections 3.12.3 Waste describes the JAPAMA wastewater treatment process and the design parameters of the discharge
	When they start construction, are they going to cut off our electricity and water?	Section 8.3.8 Social infrastructure and services states that prior to the disabling of the power lines, the existence of sufficient and adequate infrastructure must be guaranteed to carry out the works without affecting the population.
Wastewater	Are you going to pay for the residual water that you are going to use from the municipality? (2)	Outside the scope of the ESIA. Addressed separately by the Company.

Topic	Questions*	ESIA chapter
	If they are going to use wastewater, won't the workers get sick?	Section 3.12.3 Waste describes the JAPAMA wastewater treatment process and the design parameters of the discharge
	What is the transect that they are going to use to transfer the wastewater from JAPAMA to Mexinol?	Figure 3.1 Project location shows the location of the water pipeline between the Project and JAPAMA.
	Are they going to add electricity to the JAPAMA wastewater plant?	Outside the scope of the ESIA. Addressed separately by the Company.
	Does the JAPAMA wastewater treatment plant work?	Outside the scope of the ESIA.
	What are you going to do with the wastewater from the entire facility (including the water from the bathrooms)?	Section 3.5.1.2 Construction (WWTP, WWTP treatment process, WWTP process description, WWTP initial design parameters) includes details of the WWTP and process.
	Why aren't they going to take water from the bay? Is it because the bay doesn't have the capacity to receive more industry?	Section 3.5.1.2 Construction (WWTP, WWTP treatment process, WWTP process description, WWTP initial design parameters) includes details of the WWTP and process.
	Why did they sell the residual water to you if many years ago it was said that this water was for agricultural irrigation?	Outside the scope of the ESIA.
	Where are they going to get water from?	Section 3.5.1.2 Construction (WWTP, WWTP treatment process, WWTP process description, WWTP initial design parameters) includes details of the WWTP and process.
Permit	Doesn't the DGIRA require an external auditor?	Outside the scope of the ESIA. Addressed separately by the Company.
	Do you already have all the necessary permissions and permits? (2)	2.3 Permit and licenses provides a status table
	Have you already covered the SEMARNAT MIA conditions? (2)	2.3 Permit and licenses provides a status table
	I noticed in their presentation that they are not complying with Art. 60 of the Territorial Planning Law.	2.3 Permit and licenses describes all required permits and licenses.
	Why do they indicate the life period of the project at a limit of 30 years? Didn't they give you permission for more time or are you going to operate without permits later?	Outside the scope of the ESIA. Addressed separately by the Company.
Project description	Is the polyurethane you are going to use the best insulating material? Isn't there any other better material?	Outside the scope of the ESIA. Addressed separately by the Company.
	What is the methanol storage capacity (e.g. number of tanks, at the site and port)? (4)	Section 3.3 Process description describes storage capacity

Topic	Questions*	ESIA chapter
	Are they going to handle cooling water?	Section 3.3 Process description describes the cooling process
	Can you describe the methanol production process you are going to use?	Section 3.3 Process description
	What are they going to produce, besides methanol?	Section 3.3 Process description
	How are they going to control the methanol vapours?	Section 3.3 Process description
	What material will the duct be made of?	Outside the scope of the ESIA. Addressed separately by the Company.
	How are the boilers that will produce steam going to work?	Section 3.3 Process description
	What is methanol made of?	Section 3.3 Process description
	What uses does methanol have? (2)	Sections 1.2 Project rationale and 3.3 Process description
	What are they going to use the methanol they are going to produce for?	Outside the scope of the ESIA. Addressed separately by the Company.
	When are they going to achieve zero carbon?	Section 3.3 Process description
	Is the patent to produce NetZero methanol public and free?	Outside the scope of the ESIA. Addressed separately by the Company.
	Where else do you have projects similar to this?	Outside the scope of the ESIA. Addressed separately by the Company.
	Are you going to build the pipelines or an external company?	Section 3.1 Overview (Project Description)
	Is the dock that you are going to use the same one that was granted to GPO?	Section 3.1 Overview (Project Description); not the same as GPO.
	What are the dimensions of your plant?	Section 3.1 Overview (Project Description)
	When will the construction phase begin? (3)	Section 3.4 Schedule
	Will it only operate for 30 years, or do you plan to extend the time?	Outside the scope of the ESIA. Addressed separately by the Company.
Risks	What are the risks (such as methanol or tank explosion, gas leaks, spills) to our communities and health, and what are the risk radii in the event of an accident? (14)	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
	How much risk do we have, that is a reason for you to be here presenting information?	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
	Why do they only show the risks separately and not all of them together?	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
	What risk do the pipelines to the port have, such as vapours? (2)	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)

Topic	Questions*	ESIA chapter
	Is methanol toxic?	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
	What type of contamination would be caused to the soil in the event of a spill?	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
	What damage does methanol cause in the event of a spill? (2)	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
	The design is one and the reality is another, how are they going to check and make sure that the pipeline is not damaged?	Section 8.5 Impact assessment for unplanned events includes results of the QRA (Section 8.5.1)
Stakeholder engagement	Who and how many were interviewed?	Sections 5.4.2 Data collection and 6. Stakeholder engagement
	When are they coming back to bring us more information? (3)	Section 6.5.2 post-ESIA engagement
	Why don't you give this information to the young middle school and high school students in our community?	Section 6.5.2 Stakeholder identification and analysis
	Why do they give us a non-technical summary instead of the original and valid document?	Section 6.5.1 ESIA disclosure describes how full documents were made available
	Why doesn't your study address interculturality? This should talk about the section in SIA where cultures are discussed (workforce from different areas etc.)	Sections 8.3.7 Cultural heritage and 8.3.1.1 Indigenous Peoples.
	When will the indigenous consultation take place and how will it be carried out? (2)	Outside the scope of the ESIA.
	Why are the residents of the indigenous communities and peoples do not present at this meeting?	Section 6.5.1 ESIA disclosure provides details on all communities (including all local IP communities) who were engaged
	What relationship do they have with GPO?	Outside the scope of the ESIA. There is no relationship with other companies.
	Are there politicians among the partners?	Outside the scope of the ESIA.
	Do they need our approval?	Outside the scope of the ESIA.
	Is what we say in this meeting a valid consultation so that you can start operations?	Section 6.1 Introduction (Stakeholder engagement)
	What is the purpose of this meeting, and why now? (4)	Section 6.1 Introduction (Stakeholder engagement)
	Who is going to write down our disagreements and opinions?	Section 6.5.1 ESIA disclosure provides details from the disclosure meetings
	Are you going to fulfil the commitments?	Outside the scope of the ESIA. Addressed separately by the Company.
	We do not trust SEMARNAT, who can assure us that they will do things as well as they say?	Outside the scope of the ESIA.

Topic	Questions*	ESIA chapter
	How can we know that they are different? That's what everyone says. We are already "lamped".	Outside the scope of the ESIA.
Others	Where are they going to sell the methanol, they produce?	Outside the scope of the ESIA. Addressed separately by the Company.
	Are you the ones who went around last week taking samples in the Juan José Ríos estuary and paying 1,500 pesos a day to the people who were guides?	Outside the scope of the ESIA, not related to Project or Company
	Have you already carried out the ESIA study?	Section 1 Introduction describes the process
	Why do they talk as if the plant were a reality?	Section 3.5 Project phases
	At some point in future time, will we have to be relocated?	Section 1.4.1 IFC PS 5 describes how there will be no physical resettlement.

Note: * Numbers in parenthesis next to questions/issues indicates the frequency of each question asked by stakeholders.

Future stakeholder engagement programme

Transition Industries and Pacifico Mexinol have produced short videos to visually answer some of the public questions that we will be shared on social media.

Flyers and other material (a community handout describing all of the questions asked, the answers to the questions, and where they can be found in the Final ESIA) will be given to community members as part of ongoing continuous engagement.

Transition Industries is committed to providing stakeholders with regular access to information about the activities as well as access to a feedback mechanism through which stakeholders may provide input and receive response to feedback.

6.5.2 Post-ESIA engagement

Plans for stakeholder engagement during Project execution are described in the SEP, and engagement activities would be adjusted to reflect evolving Project status and activity level, as well as stakeholder concerns over the life of the Project.

During Project execution, the emphasis of engagement shifts from input gathering to disclosure about planned activities, receiving feedback from members of the public and other stakeholders, and consultation about ongoing and planned activities. The Project would keep the public informed about the general progress of the Project (e.g., completion of Project stages such as construction and installation) and respond to grievances (i.e., specific complaints) filed under the Project's Community Grievance Mechanism which is summarised below and described in the SEP.

6.6 Community grievance management procedure

The Community Grievance Mechanism provides a structured process for receiving and resolving feedback and grievances related to a Project. It emphasises prompt addressing of complaints using transparent and culturally appropriate methods, ensuring accessibility to all affected segments of communities without cost or retribution. The mechanism includes gender-sensitive protocols to cater to the specific needs of women and vulnerable populations, without impeding access to other legal remedies or existing grievance systems.

During the Project, two CLOs (one female and one male) are responsible for managing feedback and grievances, coordinating resolution, and ensuring communication with stakeholders. Methods for sharing contact information (Email: contacto@pacifico-mexinol.com; WhatsApp: +55 52 668 152 9066; Facebook: Pacifico Mexinol; Sitio web: www.pacifico-mexinol.com) through radio can be seen in Table 6.3.

Methods for submitting complaints include face-to-face interactions and electronic means. Standardised information is collected using a Community Feedback Investigation Form, and complaints are categorised into levels to determine appropriate responses. Upon receiving a complaint, the CLOs acknowledge it within three working days and aims to provide a remedy within five days, with verbal and written feedback when feasible. The CLOs investigate grievances as needed, involving relevant parties in the decision-making process. Once a response is approved internally, the CLOs communicate it formally and ensures implementation. If the complainant accepts the proposed resolution, actions are implemented, documented, and closed out formally. If dissatisfaction persists, an appeals process is available, escalating the issue to higher Project authorities. Access to legal recourse is always an option. Overall, the mechanism aims to ensure effective resolution of community feedback and grievances while maintaining transparency and accountability throughout the Project lifecycle.

Table 6.3: Contact information shared through radio

Station	Group	Avg. Spots Per Month (Jun 01 – Jul 7th)	Avg. Spots Per Month Aug 15th – Sep 15th)	Rating	Type of information
LA 65	Chavez	185	185	3	Media packages including interviews
La Maxi	Chavez	178	178	5	Media packages including interviews
La Mexicana	RSN	166	166	1	Media packages including interviews
La Mejor	RSN	166	166	4	Media packages including interviews

Station	Group	Avg. Spots Per Month (Jun 01 – Jul 7th)	Avg. Spots Per Month Aug 15th – Sep 15th)	Rating	Type of information
La Morrita	Luz Network	145	145	8	Media packages including interviews
Stereo 1	Luz Network	175	175	2	Media packages including interviews
La Rancherita	Oir	200	200	6	Media packages including interviews
Vibra	Noticieristas	0	120	9	Media packages including interviews

7 ESIA METHODOLOGY

7.1 Introduction

The purpose of this ESIA is to assess the potential physical, biological, and socioeconomic impacts of the Project. The assessment of impacts for all Project components has been undertaken in a structured and consistent manner. The impact assessment methodology described below has been developed to meet the Mexican legislative requirements (refer to Section 2.1), and good international industry practice (GIIP) as defined in the World Bank Group's Environmental, Health, and Safety Guidelines (IFC, undated[150]), and in accordance with the Consultants' standard practices. The structure is aligned and consistent with the IFC PS on Environmental and Social Sustainability (IFC, 2012) guidelines.

The methodology has been developed to take into consideration the potential impacts on the physical environment (air quality; noise and vibration; landscape and visual amenity; geology, geomorphology and geohazards; soils; hydrogeology and hydrology), the biological environment (protected areas, terrestrial and aquatic habitats, flora and fauna) and the socioeconomic environment (people, livelihoods, ecosystem services, and cultural heritage).

The ESIA was prepared to provide an independent, science-based evaluation of the potential impacts associated with construction, installation, operations, maintenance, and decommissioning of the Project. The ESIA is also the primary mechanism for sharing the findings of this evaluation with stakeholders and decision-makers, so they can make informed decisions regarding the potential benefits and impacts of the Project, as well as the measures proposed to enhance these benefits and mitigate these impacts.

The impact assessment covers:

- Planned activities – those that correspond to routine (normal) activities associated with the construction and commissioning, operation and decommissioning phases of the Project.
- Unplanned events – those events defined as reasonably foreseeable that are not planned to occur as part of the Project works, but which may plausibly occur, even with a low probability.

The assessment of planned activities and unplanned events has been carried out on the assumption that GIIP, presented as management control measures, have been applied to all Project activities.

As per GIIP, Project-specific mitigation measures are required for significant negative impacts only. The main objective of this process is to reduce impact significance to levels that are ALARP through implementation of the mitigation hierarchy; which prioritises impact avoidance, or where avoidance is not possible, impact minimisation, and compensation or offsetting of any residual impacts; in accordance with IFC PS1. Enhancement measures for positive benefits are also documented where relevant.

[150] *Environmental, health, and safety general guidelines* (English). IFC E&S Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/157871484635724258/Environmental-health-and-safety-general-guidelines

7.2 Scope of the ESIA

The scope of the impact assessment includes impacts identified in the Project's AoI (see Section 5.1.1), as well as a screening of potential impacts related to associated facilities.

The overarching objectives of the ESIA are to evaluate the possible impacts of the Project on the natural and social environments in which it is being constructed and to identify the measures that could limit negative impacts and optimise the positive impacts of the Project.

The findings of the ESIA will feed into the Project decision-making process. A further objective of the ESIA is to support the Project in complying with Mexican national legislation, Transition Industries' and Pacifico Mexinol's E&S performance requirements and aligning the Project with GIIP.

7.3 Overall approach

The Project could give rise to several potential impacts on a wide range of E&S receptors. To assess these potential impacts, an ESIA has been undertaken, following the overall process illustrated in Figure 7.1 below. The key steps of the ESIA are described in the subsequent sections:

- Screening: A process to determine the appropriate level of analysis
    - A screening exercise was conducted by Transition Industries, utilising the information provided in the MIA and SLIP, to determine the need for an internationally compliant ESIA
- The IFC reviewed the MIA and SLIP, and supported Transition Industries with preparing ToRs for an IFC-aligned ESIA[151]
- Scoping: The key objectives of scoping are to:
    - Identify the Project's planned activities and unplanned events with the potential to result in significant impacts on physical, biological, and/or social receptors.
    - Gather stakeholder input on potential impacts to these aspects or other concerns regarding the Project; and
    - Help inform the development of a Terms and Scope for the ESIA that outlines the scope and technical approach to be used to conduct the ESIA.
- Project description and interaction with Project design process, including identifying E&S receptors within the AoI
- Environmental and socio-economic baseline studies
- Identify potential environmental and socioeconomic impacts
- Assess impact significance by estimating the magnitude of a potential impact (taking into account management control measures) and the sensitivity of receptors
- Propose mitigation measures to avoid or minimise the potential impacts, and enhancement measures to maximise beneficial impacts

[151] The IFC's ToR was used to guide the structure and content of this ESIA but was not followed in full.

- Determine any residual impacts
- Identify and assess environmental and socioeconomic risks associated with unplanned events and associated facilities
- Development of ESMPs that describe the measures that will be implemented in order to maximise Project benefits and prevent and/or limit the potential negative impacts of the Project.
- Public disclosure according to IFC PS1 and Mexican regulatory requirements
- Implementation of ESMPs.

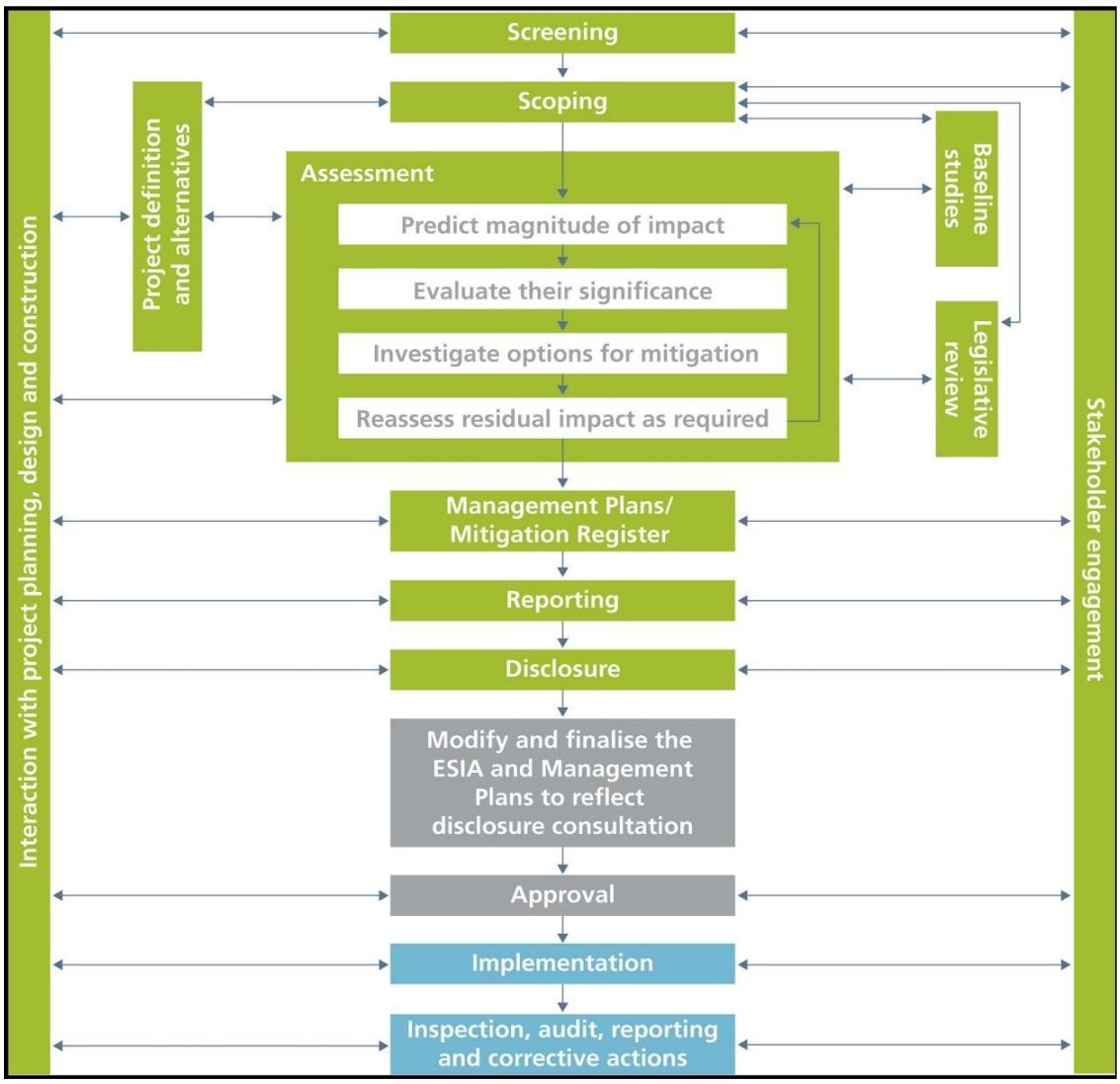


Figure 7.1: ESIA process

Source: RSK

7.3.1 Scoping

In April 2024, RSK produced a Scoping Report for this ESIA with the following objectives

- identify and prioritise issues of importance for the ESIA
- define the approach for the rest of the ESIA process and the terms of reference that:
    - is focused on the key issues (impacts, alternatives, mitigation and management)
    - engages and takes into account the views of relevant stakeholders
    - informs the design of the Project to reduce negative E&S impacts
    - meets national and relevant international requirements
    - is realistic given the timeframe and resources available
- identify any practical challenges for the ESIA in terms of data availability and meeting Mexican and international standards, and to propose solutions for addressing these
- define the approach for stakeholder engagement to ensure stakeholders understand how they may be impacted, have the opportunity to express their opinions and that the ESIA reflects their concerns.

An E&S baseline description was developed based on secondary data sources, primarily the MIA (Mexinol, 2021) and the SLIP (SLR Consulting Limited, 2022), and additional desk-based and primary data collection requirements for the ESIA were identified. A preliminary impact assessment was also completed which included the identification of potentially significant impacts.

7.4 Project definition, baseline and identification of Project aspects and potential impacts

The assessment of existing conditions is aimed at providing sufficient detail to meet the following objectives for the physical, biological, and socioeconomic aspects identified during scoping as having the potential to be significantly impacted by the Project:

- Identify the key conditions and sensitivities in the Project AoI;
- Provide a basis for extrapolation of current conditions, taking into consideration natural variability and changes due to factors external to the Project;
- Further understand stakeholder concerns, perceptions, and expectations regarding the Project;
- Provide data to aid in the prediction and evaluation of potential impacts of the Project;
- Inform development of appropriate mitigation measures; and
- Provide a baseline to inform assessments of future changes and of the effectiveness of mitigation measures.

Potential interactions between Project activities and the physical, biological and social environment were identified based on the information provided in Section 3, and data collected on the baseline conditions provided in Section 5. Potential environmental and

socioeconomic impacts were identified considering aspects of the Project that could change baseline conditions.

The assessment of magnitude with regard to human receptors takes into account their ability to adapt to and manage the effects of an impact.

Impacts can be classified as:

- positive - an impact considered to represent an improvement to the baseline environmental or social conditions, or that introduces a new desirable factor
- negative - an impact considered to represent an adverse change from the baseline conditions, or that introduces a new undesirable factor
- direct - an impact that results from a direct interaction between a Project activity and the receiving environment
- indirect - an impact between a Project activity and the environment because of subsequent interactions, for example, the impact of pollution of a watercourse on users of water abstracted from the watercourse or loss of habitat affecting the viability of a species population
- induced – impacts from non- Project activities that are encouraged to happen because of the Project and that would not occur in the absence of the Project, for example new businesses established to cater for an increased number of construction workers in the area
- cumulative - an impact that acts together with other impacts (including from other third-party Project or projects) to affect the same receptor(s)
- perceived - issues that stakeholders believe would change baseline conditions even when there is no factual basis for the concern. Stakeholder views are obtained via stakeholder consultation.

7.5 Impact assessment methodology

7.5.1 Planned activities

7.5.1.1 Impact magnitude

Impact magnitude is defined according to its **intensity** (degree of the predicted change to the receptor)**,** the **duration** (time) of the impact, and the **frequency** (probability). The criteria for four different grades of impact magnitude were defined, as described in

Table 7.1, from 1 (very low) to 4 (high), based on definitions of negative effects. A rating of 0 is also provided for beneficial (positive) effects.

Table 7.1-: Impact magnitude

Intensity	Frequency	Duration	Overall magnitude rating
Negligible	Episodic	Short-term	Very Low (1)
		Medium-term	
Low	Episodic	Short-term	Very Low (1)
		Medium-term	Low (2)

Intensity	Frequency	Duration	Overall magnitude rating
Medium	Episodic	Short-term	Very Low (1)
		Medium-term	Low (2)
High	Episodic	Short-term	Very Low (1)
		Medium-term	Low (2)
Negligible	Episodic	Long-term	Very Low (1)
Low	Episodic	Long-term	Low (2)
Medium	Episodic	Long-term	Low (2)
High	Episodic	Long-term	Medium (3)
Negligible	Continuous	Short-term	Very Low (1)
		Medium-term	
Low	Continuous	Short-term	Low (2)
		Medium-term	
Medium	Continuous	Short-term	Low (2)
		Medium-term	Medium (3)
High	Continuous	Short-term	Medium (3)
		Medium-term	Medium (3)
Negligible	Continuous	Long-term	Very Low (1)
Low	Continuous	Long-term	Low (2)
Medium	Continuous	Long-term	Medium (3)
High	Continuous	Long-term	High (4)

7.5.1.2 Receptor sensitivity

For the impact assessment, RSK has used professional judgement to assess the quality and sensitivity of the receptor or aspect affected by the impact, taking into account its local, regional, national and international designations, its importance to the local or wider community and its economic value. The assessment of the sensitivity of human receptors, for example, a household, community or wider social group, has taken into account their likely response to change and their ability to adapt to and manage the effects of the impact.

Stakeholder concerns associated with the type of receptor and the potential for cumulative impacts to occur have also been taken into consideration.

The sensitivity of receptors has been determined based on four categories, from 1 (very low) to 4 (high), as described in Table 7.2.

Table 7.2: Receptor sensitivity

Score	Baseline	Definition of receptor sensitivity
1 Very Low	Physical	**Surface water (resources):** surface waters with no community use or only used for low-grade industrial use.
		Groundwater (quality): very low-quality groundwater/ groundwater not used by the community.
		Soil (quality): soils identified as being tolerant of the proposed change without perceptible detriment to its character.
		Landscape: landscape that is dominated by derelict, disused or degraded man-made structures and/ or which is not valued by local communities or others. A natural landscape severely degraded or modified by cultural land uses, such as intensive arable or pastoral agriculture. Visual receptors with no or very limited views.
	Biological	**Biodiversity (habitat):** commonly occurring habitats and species, not subject to significant decline. Habitats that are already disturbed/modified with little biodiversity value.
		Biodiversity (species): fauna and flora present not particularly susceptible to disturbance including noise and vibration.
	Social	**Livelihoods:** highly skilled and experienced labour pool.
		Social cohesion: Project AoI includes a negligible number of inhabitants and/or resources that are not used or protected.
		Cultural heritage: no cultural heritage assets, or artefacts of low archaeological importance.
		Health and safety: no human receptors for health and safety related impacts (e.g., related to changes in air quality, noise, traffic, GBVH, community health) apart from the workforce.
2 Low	Physical	**Surface water (quality):** surface water and sediments with some pre-existing pollution that limits their use or value for wildlife or communities.
		Groundwater (quality): Groundwater with some pre-existing pollution/degradation that limits its use or value for wildlife or communities.
		Soil (quality): soils with no geological, ecological, agricultural or economic value. Soils that respond well to restoration techniques.

Score	Baseline	Definition of receptor sensitivity
		Landscape: a landscape with few intact or distinctive natural or historic features but which is valued at settlement/district/municipal level (e.g., attracts local visitors). Landscape with large / dominant use and/or noisy modern man-made features. A natural landscape is degraded or modified by cultural land uses such as arable or pastoral agriculture. Visual receptors include people at their place of work, industrial facilities.
	Biological	**Biodiversity (value):** low sensitivity or local ecosystem value. Sites of local biodiversity value but not intact, fragile or unique.
		Biodiversity (habitat): habitats that recover quickly following disturbance, e.g., habitats comprising species that rapidly recolonise disturbed areas.
		Biodiversity (species): species present are widespread common species, e.g., International Union for Conservation of Nature (IUCN) listed near threatened or least concern, with low biodiversity value. Fauna and flora present have low susceptibly to emissions and discharges fauna with low susceptibly to noise and vibration emissions.
	Social	**Livelihoods:** skilled labour pool that lacks relevant experience.
		Social cohesion: Project AoI include a low number of inhabitants and/or resources that are used but not protected. Individuals or households in local communities have access to alternative resources, the use of which may cause limited adverse indirect impacts.
		Cultural heritage: designated and undesignated cultural heritage assets of local importance. Areas of negligible or low potential for previously unrecorded buried archaeology.
		Health and safety: human receptors for health and safety related impacts (e.g., related to changes in air quality, noise, traffic, GBVH, community health) are limited to individuals from the local community that may pass through the area, but exposure for extended periods is unlikely.
3 Medium	Physical	**Surface water:** surface water and sediments of moderately high quality, e.g., in its natural state, or supports an area or species valued or designated for its importance at national level. Water is used for drinking or domestic use by a small number of users. Waters that support commercial or subsistence fishery.
		Groundwater: groundwater used for industrial purposes or agriculture. Groundwater that provides baseflow to surface watercourses used for fishing or bathing. Groundwater that supplies springs and wells but is not used for domestic purposes (washing, cooking, bathing).
		Soil (quality): soils that respond moderately well to restoration techniques. Soils with moderate geological, ecological, agricultural or economic value.

Score	Baseline	Definition of receptor sensitivity
		Landscape: Landscape with a number of distinctive natural landforms or historic/traditional features that add character and where modern man-made features may be present but do not significantly degrade the landscape character. Landscape valued or designated for its landscape importance at national level (e.g., attracts tourists within the country). Anthropogenic landscape which has a more traditional, less intensive character and which has a higher sensitivity to change due to the presence of features such as gardens, orchards and traditional or unimproved pastures. A settlement which is valued at provincial /regional level (e.g., attracts tourists from province/region). Visual receptors include people travelling through or past the affected landscape in cars, on trains or other transport routes where higher speeds are involved and views sporadic and short-lived; people engaged in outdoor recreation where enjoyment of the landscape is incidental rather than the main interest,
	Biological	**Biodiversity (value):** medium sensitivity or regional/national ecosystem value.
		Biodiversity (protected areas): sites of regional importance, or designated for protection at a national level, e.g., national parks/marine parks. Internationally recognised areas such as key biodiversity areas and important bird areas.
		Biodiversity (habitat): habitats providing important feeding or breeding grounds. Habitats of protected species or habitat diversity or 'naturalness', or recognised as intact or unique, or areas recognised by non-governmental organisations as having high environmental value. Habitats that are unlikely to return to natural conditions without some intervention, but which are capable of assisted recovery.
		Biodiversity (species): regionally or nationally important population of a species (e.g., protected by NOM-059-SEMARNAT-2010), either because of population size or distributional context. Species listed as vulnerable on the IUCN Red List (global or regional). Keystone species and species with long life histories, reflecting the inability of localised populations to recover from significant disturbance. Fauna and flora with moderate susceptibly to air emissions and discharges, fauna with moderate susceptibly to noise emissions.
	Social	**Livelihoods:** some households and business owners/operators perceive that the change will affect their ability to maintain their livelihood or quality of life for a significant time period (<1 year). Limited skills and experience in the labour pool.
		Social cohesion: Project AoI include a moderate number of inhabitants and/or resources of regional importance. Some individuals/households depend on the affected resource with no nearby alternatives.
		Cultural heritage: cultural heritage sites or artefacts of regional or national importance. Area where archaeological or other cultural heritage resources are present, and/or area where the chance of disturbance of previously unknown or unrecorded buried archaeology is moderate.

Score	Baseline	Definition of receptor sensitivity
		Health and safety: human receptors for health and safety related impacts (e.g., related to changes in air quality, noise, traffic, GBVH, community health) include Project-affected communities where longer periods of exposure may occur.
4 High	Physical	**Surface water:** surface waters and sediments of very high quality, e.g., in natural state or supports an area or species valued or designated for importance at international level. Water is used for drinking or domestic use by many users. Waters that support very productive fisheries.
		Groundwater: aquifer used for drinking or domestic use (e.g., washing, cooking, bathing) by many users. Groundwater that provides essential baseflow to a watercourse.
		Soil (quality): soils with very high agricultural or economic value. Land supporting critically endangered species whose presence is dependent on soil quality, structure or properties.
		Landscape: landscape valued or designated for its landscape importance at international level (e.g., attracts foreign tourists). Landscape with a high degree of naturalness or dominated by traditional/historic landscape features and an absence of modern man-made features or wilderness landscape. Visual receptors include occupiers of homes, users of outdoor recreational facilities where landscape value is important or integral to that activity, communities who have views of the landscape that they value highly, and homes and hotels purposely positioned/placed to take advantage of a view.
	Biological	**Biodiversity (value):** high sensitivity or international ecosystem value.
		Biodiversity (protected areas): sites of international importance/designated for protection at international level, e.g., World Heritage Area, Ramsar wetlands. Areas internationally recognised as Alliance for Zero Extinction sites.
		Biodiversity (habitat): highly threatened and/or unique ecosystems and areas illustrative of key evolutionary processes, as defined in IFC PS6[152]. Critical habitats as defined by IFC PS6. Habitats that are very difficult to restore to natural conditions.
		Biodiversity (species): species listed as critically endangered or endangered on the IUCN Red List (global or regional). Endemic and/or range-restricted species, migratory and/or congregatory species triggering critical habitat as per IFC PS6. Fauna and flora with high susceptibly to air emissions and discharges, fauna with very low tolerance for noise and vibrations.

[152] Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to critically endangered and/or endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (IFC, 2012).

Score	Baseline	Definition of receptor sensitivity
	Social	**Livelihoods:** many households and business owners/operators perceive that the change will affect their ability to maintain their livelihood or quality of life to an unacceptable extent and may have to leave the area/community. Lack of skilled and experienced labour pool.
		Social cohesion: Project AoI include a significant number of inhabitants and/or resources of national or global importance. Communities depend on the affected resource(s) with no nearby alternatives.
		Cultural heritage: cultural heritage sites or artefacts of international importance such as United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Sites. Area where significant or important archaeological or other cultural heritage resources are present, and/or where the chance of disturbance of previously unknown or unrecorded archaeology is high.
		Health and safety: human receptors for health and safety related impacts (e.g., related to changes in air quality, noise, traffic, GBVH, community health) include Project-affected communities, schools, hospitals where near-constant presence of people is possible and long-term exposure is likely.

7.5.1.3 Impact significance

The impacts are assessed by examining both the magnitude of the impact and the sensitivity of the receptor that is affected. Together, the magnitude of the impact (1 – 4) and the sensitivity of the receptor(s) (1 – 4) allows the forecast of the impact significance. This interaction between magnitude and sensitivity can be expressed as a matrix, shown in Figure 7.2, thereby bringing a transparent structure to complex interactions.

Significance			Sensitivity rating			
			Very low	Low	Medium	High
		0 Positive	1	2	3	4
Magnitude rating	Very low	1	1 Negligible	2 Negligible	3 Minor	4 Minor
	Low	2	2 Negligible	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

Figure 7.2: Significance matrix

The significance of the overall assessment for each E&S aspect was defined as follows, based on best international practice:

- Major impact: impacts that have the potential to cause irreversible or widespread harm to an environmental or social receptor that is unique or has a limited capacity to adapt to change. Avoidance through appropriate design responses is the only effective mitigation.
- Moderate impact: impacts that have the potential to degrade or upset an environmental or social receptor due to their scale or its susceptibility to change. The receptor's abundance or resilience to change ensures that replacement and recovery is achievable.
- Minor impact: when an environmental or social receptor with low sensitivity is exposed to minor alterations that will not affect its viability, provided standard controls are adopted.
- Negligible impact: when an environmental or social receptor with low sensitivity is exposed to minor alterations which will not result in any noticeable change.
- Positive impact: impacts that have the potential to create beneficial or uplifting effects on an environmental or social receptor.

Major and moderate impacts are considered 'significant' and thus warrant identification of possible mitigation measures.

Impacts of minor or negligible impact are considered not to warrant additional mitigation measures, although in some cases low-cost actions are proposed that would be expected to further reduce corresponding impact significance. Within the social impact assessment (see Section 8.3) mitigation measures have been provided in most cases even where the impact has been assessed as not significant (e.g., minor or negligible). This is largely because the measures set out are part and parcel of GIIP for socioeconomic management.

Positive impacts, particularly within the socioeconomic sphere (e.g., an increase in local employment opportunities due to the Project), can result from Project activities. In this circumstance, such impacts have not been ranked but were assigned a 'positive impact' for simplicity and discussed as appropriate, based on the assumption that any measures that would optimise benefits will be effectively implemented.

7.5.1.4 Presentation of impact assessment

Summary tables of impact assessment magnitude, sensitivity and significance, and residual impact where relevant, are provided for each environmental and socioeconomic aspect assessed in Sections 8.1, 8.2 and 8.3. Refer to section 7.6 for information regarding mitigation measures and residual impacts.

Full summary tables of the environmental, biodiversity and social impact assessments are provided in Table 8.39, Table 8.70 and Table 8.98 respectively.

7.5.2 Unplanned events

An unplanned event is defined as 'a reasonably foreseeable event that is not planned to occur as part of a Project, but which may conceivably occur as a result of Project activities (e.g., accidents), even with a low probability'. Unplanned events may occur during any phase of a Project. The risk assessment is based on the application of experience of events or incidents to predict risk in the future. Consequences of potential impacts were first determined using severity levels and definitions. The impact of unplanned events on the environment and public health and safety, and the likelihood of their occurrence, were taken into consideration.

Unplanned events have been assessed using a risk assessment matrix (RAM), which enables qualitative assessments of 'reputation', 'health and safety', 'environment', 'social' and 'commercial' risk (Figure 7.3). The likelihood was rated from highly unlikely to very likely (highly unlikely, unlikely, possible, probable and very likely), whilst the severity was rated from insignificant to very high (insignificant, low, medium, high and very high). The risk ranking was subsequently rated from small to critical (small, material, severe and critical).

			CONSEQUENCES TO PROJECT OBJECTIVES					LIKELIHOOD				
			Reputation	**H&S**	**Environmental**	**Social (eg accidental damage or interruption to infrastructure/cultural site etc, damage to or loss of a livelihoods asset (including livestock))** *(NB restitution/compensation for any damage is not considered within this column, only the extent of the impact)*	**Commercial**	Incident hardly ever occurs in industry	Occurs in <1 in 100 projects	Occurs in <1 in 10 projects	Occurs in many projects	Expected to occur in every project
								Highly unlikely	**Unlikely**	**Possible**	**Probable**	**Very likely**
								1	**2**	**3**	**4**	**5**
IMPACT	5	Very high	International Level	Multiple fatalities	Long term impact within or outside of company site. Restitution time >3 years. Tier 3 response.	>Severe damage or disruption of access to infrastructure or assets for multiple communities/ households. >Severe follow-on impacts on multiple households' livelihoods/ businesses. >Time is required to re-instate access, provide alternative access or repair damage to infrastructure or asset. >Permanent destruction or complete loss to a cultural heritage site	>$50mln loss					
	4	High	Regional Level	PTD/ Single fatality	Large effect within or outside of company site. Restitution time 1-3 years. Tier 2 response.	>Substantial damage or disruption of access to infrastructure or assets for multiple communities/ households. >Severe damage or disruption of access to infrastructure or assets for 1-2 households with follow on severe damage to those households' livelihoods. >Substantial follow- on impacts on multiple households' livelihoods/ businesses. >Time required to re-instate access, provide alternative access or repair damage to infrastructure or asset. >Substantial destruction takes place to a cultural heritage site which is at least partially repairable.	$30-50mln					
	3	Medium	Country Level	Major injury/ LTI	Any effect outside of company site. Short term effect on environment but contained within company site. Restitution time <3 months. Tier 1 response.	>Moderate damage or disruption of access to infrastructure or assets for one or two communities/ several households. >Moderate follow- on impacts on at least one households' livelihoods/ businesses. >Reinstatement of access, repair or provision of alternative infrastructure/asset can occur quickly >Some destruction takes place to a cultural heritage site, but this is repairable.	$10-30mln					
	2	Low	Industry Level	Minor injury/ RTW	Minor effect on environment & contained within company site. Restitution timer <3 months. Tier 1 response only.	>Minor damage or disruption of access to infrastructure or assets for one or two communities/ one or more households. >Minor follow-on impacts on one or more households' livelihoods/ businesses. >Reinstatement of access, repair or provision of alternative infrastructure/asset can occur quickly >No impacts at all on vulnerable individuals.	$1-10mln					
	1	Insignificant	Internal Knowledge only	Slight Injury/ First Aid	Limited or no effect on environment. Contained within site/system. Restitution time <1 month. Tier 1 response	>No livelihoods impact for any community or household as a result of damage to or interruption of access to community infrastructure or livelihood assets. >Reinstatement of access, repair of damage is immediate.	<$1mln					

Small	Material	Severe	Critical

Figure 7.3: RAM for unplanned events

7.5.3 Ecosystem services assessment

Ecosystem services (ES) are defined as the direct and indirect benefits that people (including PACs) derive from ecosystems, which are a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit (World Resources Institute (WRI), 2013). For example, a stand of trees can reduce air pollution, purify the water supply, reduce the likelihood of floods, and help regulate the climate by capturing and storing carbon. It might also provide timber for buildings, a space for recreation and improve the aesthetic qualities of the landscape. ES valued by humans are often underpinned by biodiversity, hence adverse impacts on biodiversity can often adversely affect the delivery of ecosystem services. ES are categorised as follows:

- provisioning services – the products people obtain from ecosystems
- regulating services – the benefits people obtain from the regulation of ecosystem processes
- cultural services – which are the nonmaterial benefits people obtain from ecosystems
- supporting services – which are the natural processes that maintain the other services.

Methodology – ES analysis

This section describes the approach used to conduct the ES impact assessment for the Project. The ES impact assessment will provide information on impacts to each ecosystem directly or indirectly affected by the Project. After the analysis of impacts for identified priority ES, specific mitigation and management measures may be identified for incorporation into the ESIA and ESMPs. The methodology used to perform this ES assessment is based on the Guide for the Integration of Ecosystem Services in the Impact Assessment of the World Resources Institute (WRI) (World Resources Institute, 2013) and has two objectives:

- to identify and mitigate the impacts of the Project on the benefits provided by ES, and
- to provide measures to manage operations that rely on those services to achieve planned performance (if required).

This ES assessment also followed the IFC PS (2012), which requires that the assessment considers both potential impacts on ES and dependency of the Project on ES for its operation. Particularly, IFC PS 6 requirements include conducting a systematic review to identify priority ES and where adverse impacts are unavoidable, the client will minimise them and implement mitigation measures that aim to maintain the value and functionality of priority ES. For any identified Project dependencies on ES the Project should minimise impacts and implement measures that increase resource efficiency of operations, as described in PS 3. Additional provisions for ES are also included in PS 1, 4, 5, 7, and 8.

IFC also specify that, “priority ecosystem services are two-fold:

- those services on which Project operations are most likely to have an impact and, therefore, which result in adverse impacts to Affected Communities, and/or,

- those services on which the Project is directly dependent for its operations (e.g., water).

It should also be noted that when Affected Communities are likely to be impacted, they should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in Performance Standard 1" (International Finance Corporation, 2012).

In accordance with the World Resources Institute (WRI) guidance 'Weaving Ecosystem Services into Impact Assessment' (WRI, 2013) the ES analysis involved the following components:

- A comprehensive summary and characterisation of all ES associated with ecosystems within and surrounding the Direct and Indirect Social AoI
- The identification of beneficiaries of the services provided by ecosystems that could be positively or negatively affected as a result of Project-related impacts
- Assigning of a priority ranking (low, medium, high or critical) for each ES in alignment with GIIP WRI (2013) and based on IFC PS6 'Biodiversity Conservation and Sustainable Management of Living Natural Resources' (IFC, 2012) Guidance Note (IFC, 2019).

The results of the ES analysis are presented in Section 5.5. All ecosystems included in the analysis are considered to be present within and surrounding the direct or indirect social AoI as defined by the socioeconomic impact assessment and are believed to provide beneficial ES to beneficiaries (PACs and/or IP) at a local level. The ES analysis consisted of three main steps:

Identification of ecosystems, associated ES and activities that could potentially be adversely impacted

The first step in the analysis was to identify and map the extent of the ecosystems within the AoI that are believed to provide ES to beneficiaries and that could potentially be adversely impacted by Project-related activities. A list was prepared of ES likely present in the Project's social Direct and Indirect AoI meeting two criteria:

- Habitats or ecosystems present in the AoI that are believed to provide this service or similar habitats elsewhere that provide this service
- People are believed to benefit from this service, whether locally, nationally or globally and/or the Project is expected to benefit from this service.

During the scoping phase, by using a combination of literature review (incl. reviews of previous assessments provided by SLR and in the MIA), satellite imagery and mapping data analysis, and data from ongoing stakeholder engagement (i.e. 2024 community characterisation reports by UIAM and Aosenuma), a list was established of ecosystem services that were likely to exist within the direct and indirect social AoI established for the socioeconomic assessment. At this stage, all ecosystem services that were identified and had potential to be impacted by the Project were scoped in, following a precautionary approach. Following the completion of the RSK field-based socioeconomic study in April 2024, the long list of ecosystem services was refined and classified by priority in line with IFC PS6.

ES were included in the scope of the assessment if;

- One or more potentially significant source of direct or indirect impact has been identified that would affect the value and functionality of the ES; and/or
- The Project will be potentially dependent on the service (e.g. erosion control provided by coastal mangroves that protect and maintain access to Project facilities).

Activities that have the potential to adversely impact ES were identified based on an understanding of the Project activities, the nature of each ES and previous experience.

Classification of ES

The identified ES were classed as Type 1 or Type 2 based on IFC PS6 and Guidance Note 166 (IFC, 2019) which categorises ES as:

- Type I: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and where impacts on such services may adversely affect communities.
- Type II: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and on which the Project directly depends for its operations (e.g., water).

All identified ES were categorised as Type 1.

Prioritisation of ES

"Priority" ES are those on which the Project may affect the ability of others to benefit and affected communities depend strongly, and with limited viable alternatives. The prioritisation of ES focused on identifying services that are important to local stakeholders (PACs and IP) and that are difficult to replace, where loss or degradation of the service could adversely affect local communities. The prioritisation process considered the following criteria:

- **Identification of the importance of ES to beneficiaries:** The importance of ES to beneficiaries was assessed according to the below criteria and assigned a rating. The weight given to each of these components (low to essential) varied slightly depending upon the service, but the importance to stakeholders and beneficiaries took precedence over other criteria (i.e. replaceability) with respect to the ultimate rating.
    - Intensity of use e.g. daily, weekly or seasonal use.
    - Scope of use e.g. household versus community level, commercial use only, subsistence only or both.
    - Degree of dependence e.g. contribution of fish to total protein in the diet; contribution of fishing to employment in the community.
    - The importance expressed by stakeholders and beneficiaries, including cultural and historical importance. The weight given to each of these components (low to essential) varied slightly depending upon the service, but the importance to stakeholders and beneficiaries took precedence over other criteria (i.e. replaceability) with respect to the ultimate rating.
- **Assessing the availability of ES alternatives (i.e. replaceability):** Project-related impacts on an ES will be felt more acutely by beneficiaries if there are no viable alternatives to that service, leaving them unable to cope with changes in

that service. Understanding the availability of spatial alternatives was critical to assessing the extent to which a community will be adversely impacted if that service declines due to Project-related activities. Affected stakeholders were considered to have viable alternatives to an ES benefit if they can, without unacceptable physical, economic, or psychological burden, get the same benefit from:

  - A non-ecosystem-based solution (e.g. beneficiaries can receive income from employment or compensation can be provided for impacts on land use that affect livelihoods).
  - An ecosystem service supplied by another ecosystem (e.g. freshwater from another river in the area).

The 'replaceability' of a service was assessed according to the following criteria and assigned a rating from high (many alternatives) to low (few or no alternatives):

  - The existence of spatial alternatives, including both natural replacements (e.g. the replacement of one type of wild food with another) and man-made substitutes (e.g. the availability of man-made items as an alternative to handicrafts).
  - The accessibility, cost and sustainability of potential alternatives, including the consideration of other users and the existing status and threats to the resource(s) providing natural alternatives to the service.
  - Preference / appetite for and cultural appropriateness of alternative services.

- **Determining priority ES:** After assessing the importance and replaceability of each ES, the WRI guidance 'Weaving Ecosystem Services into Impact Assessment' (WRI, 2013) was used to determine priority ES (see Figure 7.4 below). ES were prioritised based on the potential for the Project to affect the ability of others to benefit from the ES, whether the ES is important to beneficiaries, and whether viable alternatives are available. Only priority ES were taken forward to the impact assessment.

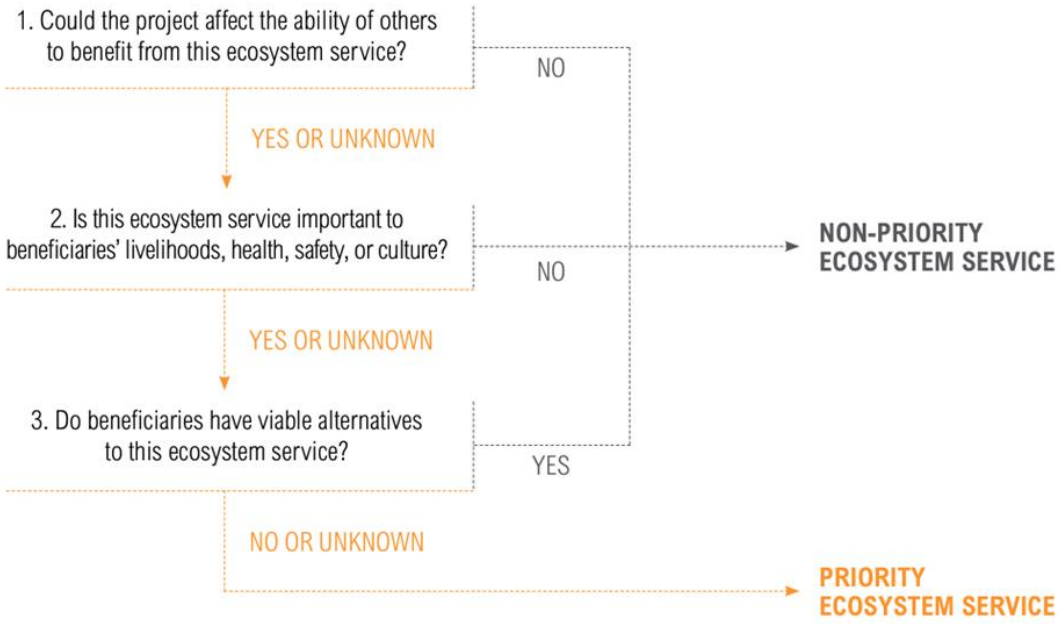


Figure 7.4: Decision tree to prioritise relevant ES according to potential Project impacts on beneficiaries

Source: (WRI, 2013)

Methodology - ES impact assessment

The ES impact assessment involved an assessment of Project impacts, significance of impacts and dependencies on priority ecosystem services. This step involved both an assessment of Project impacts on ecosystem services supply and a prediction of impact significance on people's livelihoods, health, safety and culture based on the sensitivity of stakeholders to these Project impacts to ecosystem services supply and their ability to adapt.

A review of Project impacts identified throughout this ESIA was completed to determine and predict likely impacts on the type and condition of affected ecosystems and ecosystem service supply. At the end of the review, it is possible to infer from these impacts whether stakeholders may experience a gain, loss or no change in ES benefits as a result of the Project.

The ES impact assessment was undertaken for priority ES identified during the ES baseline study and followed the same methodology described for E&S impacts in the ESIA (see Sections 7.5.1 and 7.5.2). The ES impact assessment provided a significance rating for potential Project-related impacts on priority ES pre and post mitigation (i.e., residual impacts). The ES impact assessment also identified which services may require mitigation or management measures to ensure their continued supply during the Project duration as required by IFC (PS 6).

Significance of ES impacts was established by evaluating the magnitude of impact in terms of size, frequency, duration, reversibility and intensity. Levels of dependency, ability to adapt through diversified livelihood portfolios and the availability of alternatives was also considered when assessing significance.

Where socioeconomic and/or environmental mitigation measures are required (for moderate, high and/or major impacts), applicable mitigation measures from Sections 8.1, 8.2 and 8.3 are referenced (note for this assessment no additional ES specific mitigation measures are proposed).

7.6 Identification of mitigation measures and assessment of residual impacts

7.6.1 Mitigation measures

Mitigation measures are proposed to reduce potential negative impacts ranked moderate or major, and enhancement measures recommended to maximise potential positive impacts where possible. The mitigation hierarchy is followed for identifying appropriate mitigation measures:

- avoid at source - remove the source of the impact by employing alternative designs or operations to avoid potential adverse interactions with E&S receptors
- reduce at source – reduce the source of the impact by lessening the consequence of adverse interactions that cannot be avoided (e.g., reduce the size of the Project footprint)
- reduce off-site/at receptor – reduce the impact by lessening the chance of adverse interaction between the Project and receptors
- repair or remedy - if adverse interactions between the Project and receptors cannot be avoided or their consequences reduced, then “repair” the consequences of the impact after it has occurred through rehabilitation, reclamation, restoration, compensation, and/or other measures
- compensate in kind –if there are any remaining significant biodiversity impacts, these should be offset / compensated for.

The above hierarchy is aimed at ensuring that, wherever possible, potential negative impacts are mitigated at the source rather than mitigated through restoration after the impact has occurred.

Where original assessments made in the SLIP (SLR Consulting Limited, 2022) have been verified by RSK experts, these references have not been directly quoted. Original mitigations made in both the SLIP and the MIA are cited (2022 and 2021, respectively) since the front-end engineering and design of the Project has advanced considering these mitigations and many have become embedded controls. The health and safety, security, environment and social performance (HSSE&SP) management plans have also taken into consideration earlier mitigations. However, for consistency’s sake, all previously agreed mitigations and new mitigations assigned by RSK have been assessed to derive residual impact magnitude.

7.6.2 Residual Impacts

The assessment of residual impacts is based on the effective implementation of:

- avoidance, mitigation and management measures for adverse impacts
- measures to optimise benefits.

Residual impacts with initial significance ratings of moderate or major are discussed in more detail and required additional mitigation measures specific to that impact to reduce the impact significance down to an acceptable level. In some cases, 'additional' measures have been proposed even though significance is rated at 'minor' or less.

8 IMPACT ASSESSMENT

8.1 Physical environment impact assessment for planned events

8.1.1 Air quality

8.1.1.1 Air quality assessment methodology

This section discusses the methodology followed to identify the potential impacts on ambient air quality during construction, commissioning, operation and decommissioning of the Mexinol Project. Based on the magnitude of impact assessed for various activities and aspects, and the receptor sensitivity identified through baseline survey, impact significance is determined. The existing controls have been considered, and additional mitigation measures have been recommended where the impact significance is medium or above. Residual effects, after the implementation of mitigation, are reported in Section 8.1.1.14

8.1.1.1.1 Activities and aspects of the Project that could affect the ambient air quality of the AoI

The following planned Project activities and aspects could affect ambient air quality in the AoI during construction, commissioning and decommissioning, releasing fugitive dust, air pollutants and greenhouse gases:

- Early works
- Logistics (materials, equipment and people)
- Construction and decommissioning activities related to the methanol plant, methanol pipeline, and connections of the methanol plant to the cables and other pipelines.

The key activities during operation of the Project are follows:

- Commissioning and operation of the methanol plant, leading to the release of the volatile organic compounds through equipment leaks.
- Commissioning and operation of the pipeline and above ground installations (AGIs), releasing air pollutants and greenhouse gases
- Maintenance activities (at the methanol plant, pipeline and AGIs), releasing air pollutants and greenhouse gases

Unplanned and accidental activities, although rare and limited, will also lead to the release of air pollutants and greenhouse gases. These are covered in Section 8.5.

8.1.1.1.2 Key sensitivities and considerations

Baseline Section 5.2.1 identifies the local air quality conditions within the AoI. The receptor sensitivity is determined based on the criteria identified in

Table 8.1 Receptor Sensitivity

Receptor Sensitivity	Description
5	The Project affects areas where the baseline air quality is already poor (air pollutant concentrations >100% of the Assessment Criteria) and people are likely to be exposed (e.g. residential buildings, schools, offices, shops, markets, hospitals).
4	The Project affects areas where the baseline air quality is already poor (air pollutant concentrations >90% but less than 100% of the Assessment Criteria) and people are likely to be exposed (e.g. residential buildings, schools, offices, shops, markets, hospitals).
3	The Project affects areas where the baseline air quality is already poor (air pollutant concentrations above 70% but less than 90% of the Assessment Criteria) and people are unlikely to be exposed for long periods (e.g. people working in fields).
2	The Project affects areas where the baseline air quality is already poor (air pollutant concentrations above 50% but less than 70% of the Assessment Criteria) and people are unlikely to be exposed for long periods (e.g. people working in fields).
1	The Project affects areas where the baseline air quality is already poor (air pollutant concentrations less than 50% of the Assessment Criteria) and people are unlikely to be exposed for long periods (e.g. people working in fields).

8.1.1.1.3 Magnitude of impact

The magnitude of impact of the construction and decommissioning activities have been assessed as per the internally recognised guidance developed by the IAQM – 'Guidance on the Assessment of Dust from Demolition and Construction 2024'. The magnitude of impact of the commissioning and operational activities are assessed as per the IAQM guidance – 'Land-Use Planning & Development Control: Planning for Air Quality 2017'.

Air Quality Legislation and Guidance

USEPA National Ambient Air Quality Standards (NAAQS) 2021

Ambient air quality guidelines are specific concentration of pollutant levels in air that are established to protect human health in locations where exposure can potentially occur. These generally include a margin of safety to protect individuals with a higher sensitivity to air pollutants. The guidelines used for reference in this assessment are those established by the WHO and the USEPA. WHO guidelines can be found in the WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide—Global Update 2005 (WHO 2005) and the more recent WHO Global Air Quality Guidelines (WHO 2021), except for carbon monoxide (CO), hydrogen sulphide (H_2S), and toluene, for which WHO guidelines were published in the WHO Air Quality Guidelines for Europe, 2nd edition (WHO 2000). The USEPA National Ambient Air Quality Standards (NAAQS) are summarised in USEPA 2021.

The ambient air quality guidelines considered for assessment of existing conditions and the impact assessment are summarised in Table 8.4.

WHO Air Quality Guidelines, 2000 & 2005

The WHO air quality Guidelines have been widely used as a reference tool to assist decisionmakers around the world in setting air quality standards and goals. The WHO Air Quality Guidelines Global Update, 2005 provides global recommendations on important air contaminants that pose health concerns, including thresholds and restrictions.

The Guidelines apply worldwide to both outdoor and indoor environments and are based on expert evaluation of current scientific evidence.

The IFC EHS General Guidelines reproduce the 2005 WHO Guidelines as recommended criteria for air quality, in the absence of national standards.

WHO Air Quality Guidelines, 2021

WHO published revised air quality guidelines for pollutants in ambient air in September 2021. The new AQGs for particulate matter (PM) and nitrogen dioxide (NO_2) are substantially lower than the previous (2005) guidelines and are widely exceeded in many urban and other locations around the world. Interim targets are provided as achievable 'milestones' on the journey to meeting the guidelines.

Secretary of Health, 1994

The current Air Quality Mexican Official Standards defined by the Secretary of Health, regulate 7 criteria pollutants by setting maximum allowable concentrations. They were implemented in 1994 but some of them have been updated in recent years. Mexico's Ecology and Climate Change Institute (INECC) also monitors nationwide air quality to allow for more effective enforcement.

Guidance on the Assessment of Dust from Demolition and Construction

The IAQM published a guidance document (2024) v2.2 on the assessment of construction phase impacts (herein the 'IAQM construction dust guidance'). The guidance was produced to provide advice to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measure appropriate to the level of risk identified.

Land-Use Planning & Development Control: Planning for Air Quality

Environmental Protection UK's (EPUK) and the IAQM jointly published a revised version of the guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' in 2017 (herein the 'EPUK-IAQM guidance') to facilitate consideration of air quality within local development control processes. It provides a framework for air quality considerations, promoting a consistent approach to the treatment of air quality issues within development control decisions.

The guidance includes methods for undertaken an air quality assessment and an approach for assessing the significance of effects. The guidance note is widely accepted as an appropriate reference method for this purpose.

8.1.1.1.4 Air quality assessment criteria

World Health Organisation (WHO) Air Quality Guidelines, 2000 & 2005

The WHO air quality Guidelines have been widely used as a reference tool to assist decisionmakers around the world in setting air quality standards and goals. The WHO Air Quality Guidelines Global Update, 2005 provides global recommendations on important air contaminants that pose health concerns, including thresholds and restrictions.

The Guidelines apply worldwide to both outdoor and indoor environments and are based on expert evaluation of current scientific evidence.

The IFC EHS General Guidelines reproduce the 2005 WHO Guidelines as recommended criteria for air quality, in the absence of national standards. The relevant 2005 WHO Guidelines levels and interim targets are shown in Table 8.2 below.

Table 8.2 Relevant WHO Air Quality Guidelines 2005 & interim targets

Pollutant	Averaging time	Interim target			Air Quality Guideline
Particulate matter, $PM_{2.5}$, µg/m^3	Annual	35	25	15	10
	24-hour[a]	75	50	37.5	25
Particulate matter, PM_{10}, µg/m^3	Annual	70	50	30	20
	24-hour[a]	150	100	75	50
Ozone, O_3, µg/m^3	8-hour[a]	160	-	-	100
Nitrogen Dioxide, µg/m^3	Annual	-	-	-	40
	1-hour	-	-	-	200
Sulphur Dioxide, µg/m^3	24-hour[a]	125	50	-	20
	10-minute	-	-	-	500

[a] 99th percentile (i.e. 3–4 exceedance days per year)

World Health Organisation (WHO) Air Quality Guidelines, 2021

WHO published revised air quality guidelines for pollutants in ambient air in September 2021. The new AQGs for particulate matter (PM) and nitrogen dioxide (NO_2) are substantially lower than the previous (2005) guidelines and are widely exceeded in many urban and other locations around the world. Interim targets are provided as achievable 'milestones' on the journey to meeting the guidelines.

The relevant 2021 WHO Guidelines levels and interim targets are shown in Table 8.3.

Table 8.3 Relevant WHO Air Quality Guidelines 2021 & interim targets

Pollutant	Averaging time	Interim target				Air Quality Guideline
		1	2	3	4	
Particulate matter, $PM_{2.5}$, µg/m^3	Annual	35	25	15	10	5
	24-hour[a]	75	50	37.5	25	15
	Annual	70	50	30	20	15

Pollutant	Averaging time	Interim target				Air Quality Guideline
		1	2	3	4	
Particulate matter, PM_{10}, µg/m^3	24-hour[a]	150	100	75	50	45
Ozone, O_3, µg/m^3	8-hour	160	120	-	-	100
	Peak season[b]	100	70	-	-	60
Nitrogen Dioxide, µg/m^3	Annual	40	30	20	-	10
	24-hour[a]	120	50			25
	1-hour	-	50	-	-	200
Sulphur Dioxide, µg/m^3	24-hour[a]	125	50	-	-	40
	10 min	-	-	--	-	500
Carbon Monoxide, CO, mg/m^3	24-hour[a]	7	-	-	-	4
	8 hour	-	-	-	-	10
	1 hour	-	-	-	-	35
	15 min	-	-	-	-	100

[a] 99th percentile (i.e. 3–4 exceedance days per year).

[b] Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running-average O_3 concentration.

Mexico: Air Quality Standard

Air quality legislation has been in place in Mexico since the 1970s, and current ambient air quality at the federal level is regulated by Mexico's Secretary of Health. In 1994, the *Secretaria de Salud* issued a series of Mexican official standards, or *normas oficiales* (NOMs), that regulate maximum concentrations of environmental contaminants. These include 7 criteria pollutants: carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), sulphur dioxide (SO_2) and lead (Pb). Standards for ozone and particulate matter were updated in 2014. Mexico's Ecology and Climate Change Institute, *Instituto Nacional de Ecologia y Cambio Climatico (INECC),* which functions as the research arm of The Secretary of Environment, *Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT),* monitors air quality and manages the Air Quality National Information System *(SINAICA).*

USEPA, National Ambient Air Quality Standard

The United States Environmental Protection Agency (USEPA) sets the National Ambient Air Quality Standards (NAAQS) to protect public health and the environment from the harmful effects of air pollution. These standards are established under the Clean Air Act and cover six major air pollutants: ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and lead (Pb). To ensure that the NAAQS provide adequate protection, the USEPA evaluates them on a regular basis, taking into account the most recent scientific evidence. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The implementation and enforcement of NAAQS involve

collaboration between federal, state, and local agencies to monitor air quality, develop state implementation plans, and take corrective actions to address non-compliance.

Standards comparison and selection

A comparison of the Mexico Air Quality Standards, USEPA NAAQS and WHO Guidelines is presented in below. The Mexico standard and WHO standards are used primarily for this assessment; however, where relevant, other standards (from the USEPA etc.) have been used if Mexico/WHO standards are unavailable.

Although, it should be noted that because of the significant contribution of natural sources of PM_{10} and $PM_{2.5}$, the WHO AQGs maybe not be suitable and the WHO interims targets (see Table 8.3) may be more appropriate.

Table 8.4 Comparison of Ambient Air Quality Standards

Pollutant	Averaging Period	Air Quality Standard - Ambient Air Concentration, µg/m³				Air Standards used in Assessment
		WHO	WHO	Mexico	United States	
		2000/ 2005(Global)	2021 interim target level 1	Air Quality Standard, Secretaría de Salud, Secretary of Health	USEPA (NAAQS)	
Nitrogen dioxide, NO_2	Annual	40 µg/m³	40 µg/m³	-	99.64 µg/m³	40 µg/m³
	1 month	-	-	-	-	-
	24 hr	-	120 µg/m³[a]	-	-	120 µg/m³
	8 hr	-		-	-	
	1 or 2-hr	200 µg/m³	-	394.8 µg/m³	188 µg/m³	394.8 µg/m³
	10 mins	-	-	-	-	-
Oxides of nitrogen, NOx (as NO_2)	Annual	-	-	-	-	-
	1 month	-	-	-	-	-
	24 hr	-	-	-	-	-
	1 hr	-	-	-	-	-
	10 mins	-	-	-	-	-
Carbon monoxide, CO (mg/m³)	8 hr	10,000 µg/m³	-	12595 µg/m³	10305 µg/m³	12595 µg/m³
	1 hr	30,000 µg/m³	-	-	40075 µg/m³	40075 µg/m³
	24 hr	-	7 µg/m³[a]	-	-	7 µg/m³
	15 min	100,000 µg/m³		-	-	100,000 µg/m³
Particulate matter, PM_{10}	Annual	20 µg/m³	70 µg/m³	40 µg/m³ [d]	-	40 µg/m³
	24 hr	50 µg/m³	150 µg/m³[a]	75 µg/m³ [c]	150 µg/m³	75 µg/m³
Fine particulate matter, $PM_{2.5}$	Annual	10 µg/m³	35 µg/m³	12 µg/m³ [d]	9 µg/m³	12 µg/m³
	24 hr	25 µg/m³	75 µg/m³[a]	45 µg/m³ [c]	35 µg/m³	45 µg/m³

Pollutant	Averaging Period	Air Quality Standard - Ambient Air Concentration, µg/m^3				Air Standards used in Assessment
		WHO	WHO	Mexico	United States	
		2000/ 2005(Global)	2021 interim target level 1	Air Quality Standard, Secretaría de Salud, Secretary of Health	USEPA (NAAQS)	
Ozone, O_3	Peak season	60 µg/m^3	-	-	-	60 µg/m^3
	8 hr	100 µg/m^3	100 µg/m^{3,a}	137.41 µg/m^{3,b}	137.41 µg/m^3	137.41 µg/m^3
	1 hr	-	-	186.489 µg/m^3	-	186.489 µg/m^3
Sulphur oxides, SO_2	Annual	-	-	65.5 µg/m^3	-	65.5 µg/m^3
	24 hr	20 µg/m^3	125 µg/m^{3,a}	215.93 µg/m^3	-	215.93 µg/m^3
	Hourly (10 min)	500 µg/m^3	-	-	-	500 µg/m^3
	1 hour				196.5 µg/m^3	196.5 µg/m^3
Hydrogen Sulphide	24-hr	150 µg/m^3	-	-	-	150 µg/m^3
Benzene	24 hr	-	-	-	-	-
Toluene	24 hr	-	-	-	-	-
	1 week	260 µg/m^3	-	-	-	260 µg/m^3
Ethyl Benzene	24 hr	-	-	-	-	-
Xylenes	8 hr	-	-	-	-	-

[a] 99th percentile (i.e. 3–4 exceedance days per year).

[b] 75th percentile, over a period of one year.

[c] 75th percentile of each hour concentration per day, averaged over a period of one year

[d] 75th percentile of each 24-hour concentration per trimester, averaged over one year (at least 3 trimesters)

Table 8.5 Comparison of Volatile Organic Compound Standards and Guidelines

Pollutant	Averaging Period	Derivation method	Air Quality Standard used in Assessment (Assessment Criteria)
Benzene	Annual mean	UK, Air Quality Standard Regulation 2010	5 µg/m^3
Toluene	1 week	WHO 2000	260 µg/m^3
Ethylbenzene	Annual mean	Environment Agency, England, EAL	4410 µg/m^3
Xylene, m-	Annual mean	Environment Agency, England, EAL	4410 µg/m^3
Xylene, o-	Annual mean	Environment Agency, England, EAL	4410 µg/m^3

8.1.1.2 Assessment scope and methods

8.1.1.2.1 Overall approach

The approach taken for assessing the potential air quality impacts of the proposed demolition and refurbishment site may be summarised as follows:

- Baseline characterisation of local air quality;
- Qualitative impact assessment of the construction phase of the development;
- Qualitative assessment of air quality impacts during the operational phase of the Project using the 2017 EPUK-IAQM guidance;
- Recommendation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised; and
- Identification of residual impacts from the Project.

8.1.1.2.2 Baseline characterisation

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources.

A desk-based study has been undertaken including a review of any monitoring data in Section 5.2.1 .

8.1.1.3 Construction Phase Assessment

Construction Dust and Particulate Matter

Demolition has the potential to lead to the release of fugitive dust and particulate matter. An assessment of the likely significant effects of demolition phase dust and particulate matter at sensitive receptors has therefore been undertaken following the IAQM's 2024 guidance on the assessment of dust from demolition and construction. Three aspects to dust impacts were considered:

- disamenity or annoyance due to dust soiling;
- The risk of health effects due to an increase in PM_{10} concentrations; and
- Harm to ecological receptors.

In order to assess the potential impacts of construction, activities are divided into four types:

- Demolition;
- Earthworks;
- Construction; and
- Trackout[153].

The risk of dust and PM_{10} arising to cause disamenity and/or health or ecological impacts was based on an assessment of likely emissions magnitude and the sensitivity of the

[153] Trackout is defined as the transport of dust and dirt from the construction / demolition sites onto public road network, where it may be deposited and then re-suspended by vehicles using the network.

surrounding environment. The risk category may be different for each of the four activities.

Once the level of risk has been determined, then site specific mitigation proportionate to the level of risk can be identified (as detailed in Section 8.1.1.14).

Statutory ecological receptors near the Project site area have been provided from Transition Industries LLC.

8.1.1.4 Operational phase impact assessment

8.1.1.4.1 Emissions to Air from Operational Phase Traffic

The EPUK-IAQM 2017 guidance provides indicative criteria for when an air quality assessment is required, if none of the criteria are exceeded, it is considered unlikely that there will be any significant impacts, and further assessment should not be required. A simple screening level assessment against these criteria has been undertaken in of this report.

8.1.1.4.2 Exposure of Future Occupants to Air Pollution

The potential exposure of future occupants of the Project has been considered by reviewing the baseline conditions (Section 5.2.2) and the locations of sensitive receptors within the Project, as well as considering the EPUK-IAQM guidance.

Electricity required for the Mexinol plant operation will be obtained from the national grid to meet the energy demand. It is understood that no significant fossil fuel combustion sources and this report has therefore not considered emissions related to energy generation any further. However, the potential impacts of any fugitive emissions have been considered qualitatively.

8.1.1.5 Baseline air quality characterisation

Existing or baseline air quality, Section 5.2.2, refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources. Baseline air quality data employed in this study have been obtained from the monitoring study by RSK on 07th May 2024.

8.1.1.5.1 Emission sources and key air pollutants

The application site is located adjacent to the Los Mochis - Topolobampo road I-22 road in the northwest. As a result, transport related air emissions from local traffic are expected to be the primary contributor to ambient air quality impacts within the AOI.

The principal pollutants relevant to this assessment are considered to be PM_{10} and $PM_{2.5}$, generally regarded as the most significant air pollutants released by vehicular combustion processes, or subsequently generated by vehicle emissions in the atmosphere through chemical reactions.

8.1.1.5.2 Baseline monitoring data

A review of the monitoring data available from the air quality monitoring carried out at twelve monitoring locations within the proposed Mexinol plant and dedicated pipeline to

an existing jetty in the Port of Topolobampo suggests that PM_{10} and $PM_{2.5}$ levels monitored at 12 automatic monitors don't exceed the 24-hour Mexico Air Quality standards

The maximum PM_{10} and $PM_{2.5}$ was identified as 28.6µg/m^3 and 28.2 µg/m^3 in the monitoring location 7 which is closer to the Los Mochis-Topolobampo highway and it's surrounded by the residential properties.

With respect to road transportation, the road transportation network in the vicinity of the Project, specifically the Topolobampo to Los Mochis Highway (I-22) already exhibits high frequency of vehicle traffic, especially during peak daylight hours as it is the primary road leading to the Port. However, it is considered that the Project's committed embedded controls and mitigation measures (e.g., Traffic Management Plan) has taken into account for this possibility and are designed to minimise the Project's contribution to transport related air emissions.

It is noted that most of the monitoring locations were dusty as the site is located outside of Topolobampo but is in the close proximity to the Los Mochis-Topolobampo highway and surface roads, the Port of Topolobampo and the PEMEX export facility. The monitoring location 8 was located near to the existing quarrying site and this causes the potential to exceed the dust level. Also, all other monitoring location were realistically dusty as it is closer to the Los Mochis-Topolobampo highway, the terrain was dry and it was windy during sampling. The monitoring results were shown in Section 5.2.1.

8.1.1.6 Construction and demolition phase

Atmospheric emissions from construction activities will depend on a combination of the potential for emissions (the type of activity and prevailing conditions) and the effectiveness of control measures. In general terms, there are two sources of emissions that will need to be controlled to minimise the potential for adverse environmental effects:

- Exhaust emissions from site plant, equipment and vehicles; and,
- Fugitive dust emissions from site activities.

8.1.1.7 Fugitive dust emissions

Fugitive dust emissions arising from construction activities are likely to be variable in nature and will depend upon the type and extent of the activity, soil type and moisture, road surface conditions and weather conditions. Periods of dry weather combined with higher than average wind speeds have the potential to generate more dust.

Construction activities that are considered likely to be the most significant potential sources of fugitive dust emissions at the Project site are:

- Earth moving, due to the handling, storage and deliveries of soil and subsoil materials;
- Construction aggregate usage, due to the transport, unloading, storage and use of dry and dusty materials (such as cement and sand);
- Movement of heavy site vehicles on dry or untreated haul routes; and,
- Movement of vehicles over surfaces where muddy materials have been transferred off-site (for example, on to public highways).

Fugitive dust and emissions arising from construction activities is mainly of a particle size greater than the PM_{10} fraction (that which can potentially impact upon human health); however it is noted that construction activities may contribute to local PM_{10} concentrations. Appropriate dust control measures can be highly effective for controlling emissions from potentially dust generating activities identified above, and adverse effects can be greatly reduced or eliminated. For a conservative assessment, the potential impacts considered below are based on a pre-mitigation scenario.

8.1.1.8 Potential Dust Emission Magnitude

With reference to the IAQM 2014 criteria, the estimation of dust emission magnitudes for demolition, earthworks, construction and trackout activities are presented in Table 8.6 .

Details given in the sections below have been provided by the client and where details are unknown professional judgement has been used where appropriate.

Table 8.6 Summary of Dust Emission Magnitudes (Before Mitigation)

Activity	IAQM Criteria	Dust Emission Magnitude
Demolition	• No onsite crushing and screening proposed • Height of demolition activities 0 m • Minimal demolition works will be undertaken (relocation of transmission towers only)	Small
Earthworks	• Total area of the sites is between >110,000 m^2 • The number of earths moving vehicles active at any one time will be 20-50. • Height of stockpile material <4 m • The work will span approximately 8 months from start to finish, encompassing both dry and wet months due to Mexico's climatic conditions during this period.	Large
Construction	• Total building volume will be 12000 to 75000 m^3. • No construction materials are likely to be typical building materials (e.g. bricks, mortar, tiles, timber etc.) which are considered to be potentially dusty. • On-site concrete batching will occur. • No on-site sandblasting will occur.	Medium
Trackout	• The maximum number of HDV outward movements in any one day will be 20-50. • It is estimated that the length of unpaved road on site would be <100 m. • Haul roads will be 'CH' classified which refers to clay with high plasticity. This type of soil typically has a high capacity to retain water and can undergo significant volume changes with changes in moisture content	Medium

8.1.1.9 Sensitivity of the Area

As per the IAQM Guidance, the sensitivity of the area takes into account a number of factors, including:

- The sensitivity of individual receptors in the area;
- The proximity and number of those receptors;
- For the human health assessment, the monitored PM_{10} and $PM_{2.5}$ concentrations (taken from Section 5.2.2); and,
- Site specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Consideration is given to human and ecological receptors, where present, from the impact of the construction site boundary and routes along which Heavy Duty Vehicles (HDVs) may facilitate trackout.

Table 8.7 presents the determined sensitivity of the area with the factors itemised which have helped to define this.

Earthworks and construction activities are relevant up to 350 m from the Project site boundary whereas the trackout and pipeline construction activities are only considered relevant up to 50 m from the edge of the road for trackout and the centre of the pipeline trench (based on small dust emission magnitude), as per the guidance. Therefore, 20 m, 50 m buffers are considered for the trackout and pipeline construction activities. The site access for construction traffic will be from the local road network to Port of Topolobampo. The construction and trackout buffers were shown in Figure 8.1, Figure 8.2 and Figure 8.3.

No ecological receptors were identified within 50 m of the site boundary or trackout route, based on information submitted by Transition Industries LLC. Human receptors were identified by making reference to online publicly available satellite imagery.

Table 8.7 Sensitivity of the Area

Potential Impact		Sensitivity of the surrounding area				
		Demolition	Earthworks	Construction	Trackout	Pipeline Construction
Dust soiling	Receptor sensitivity	Low	Low	Low	Low	Low
	Number of receptors	>1	>1	>1	>1	10-100
	Distance from the source	<350 m	<350 m	<350 m	<350 m	<50 m
	Sensitivity of the area	**Low**	**Low**	**Low**	**Low**	**Low**
Human health	Receptor sensitivity	Low	Low	Low	Low	Medium
	Annual mean PM_{10}	<40 mg/m^3	<40 mg/m^3	<40 mg/m^3	<40 mg/m^3	<40 mg/m^3

Potential Impact		Sensitivity of the surrounding area				
		Demolition	Earthworks	Construction	Trackout	Pipeline Construction
	concentration					
	Number of receptors	>1	>1	>1	>1	10-100
	Distance from the source	<350 m	<350 m	<350 m	<350 m	<50 m
	Sensitivity of the area	**Low**	**Low**	**Low**	**Low**	**Medium**
Ecological	N/A					

Figure 8.1 Construction Buffers at the development site

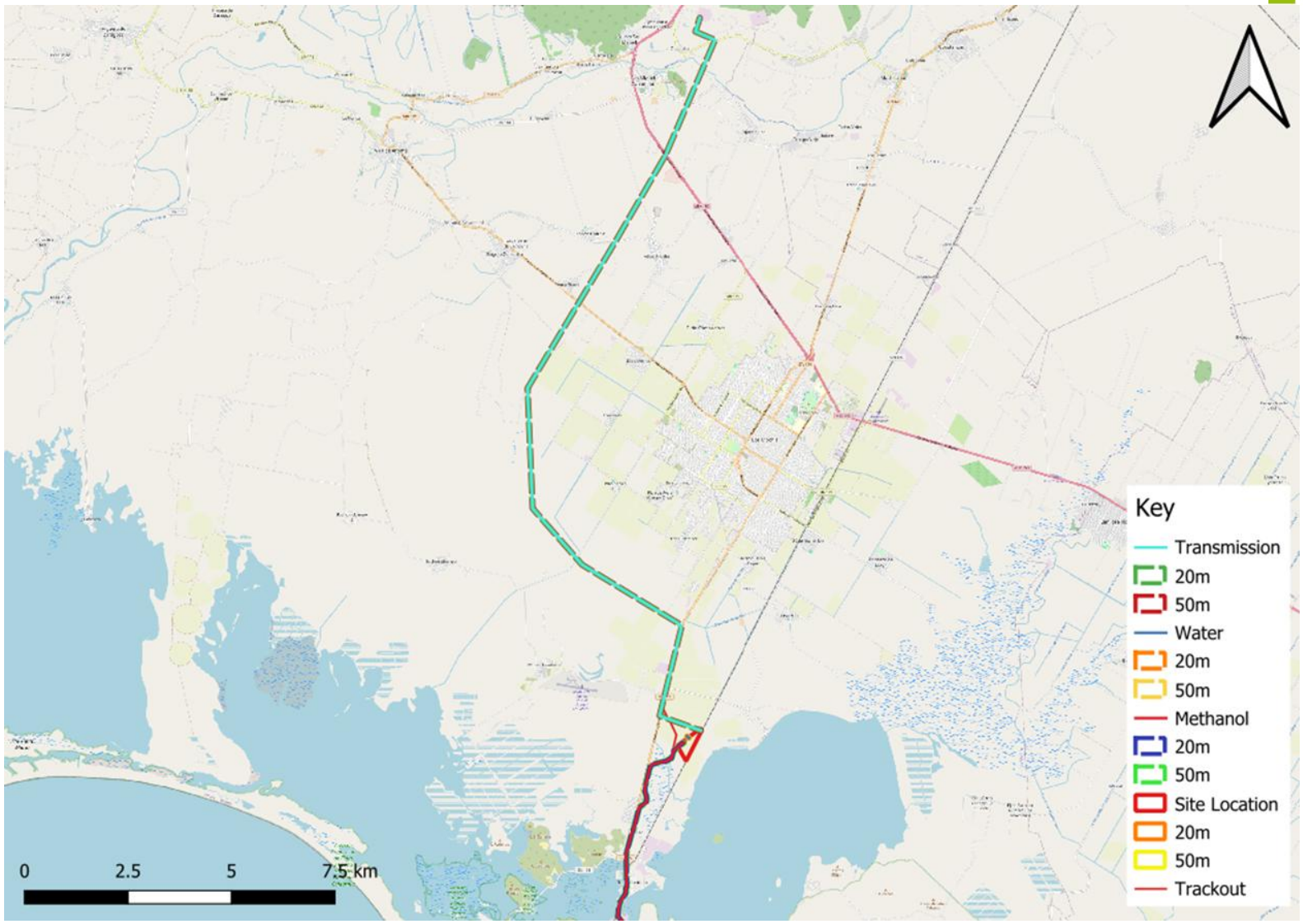


Figure 8.2 Construction Buffers of Pipelines

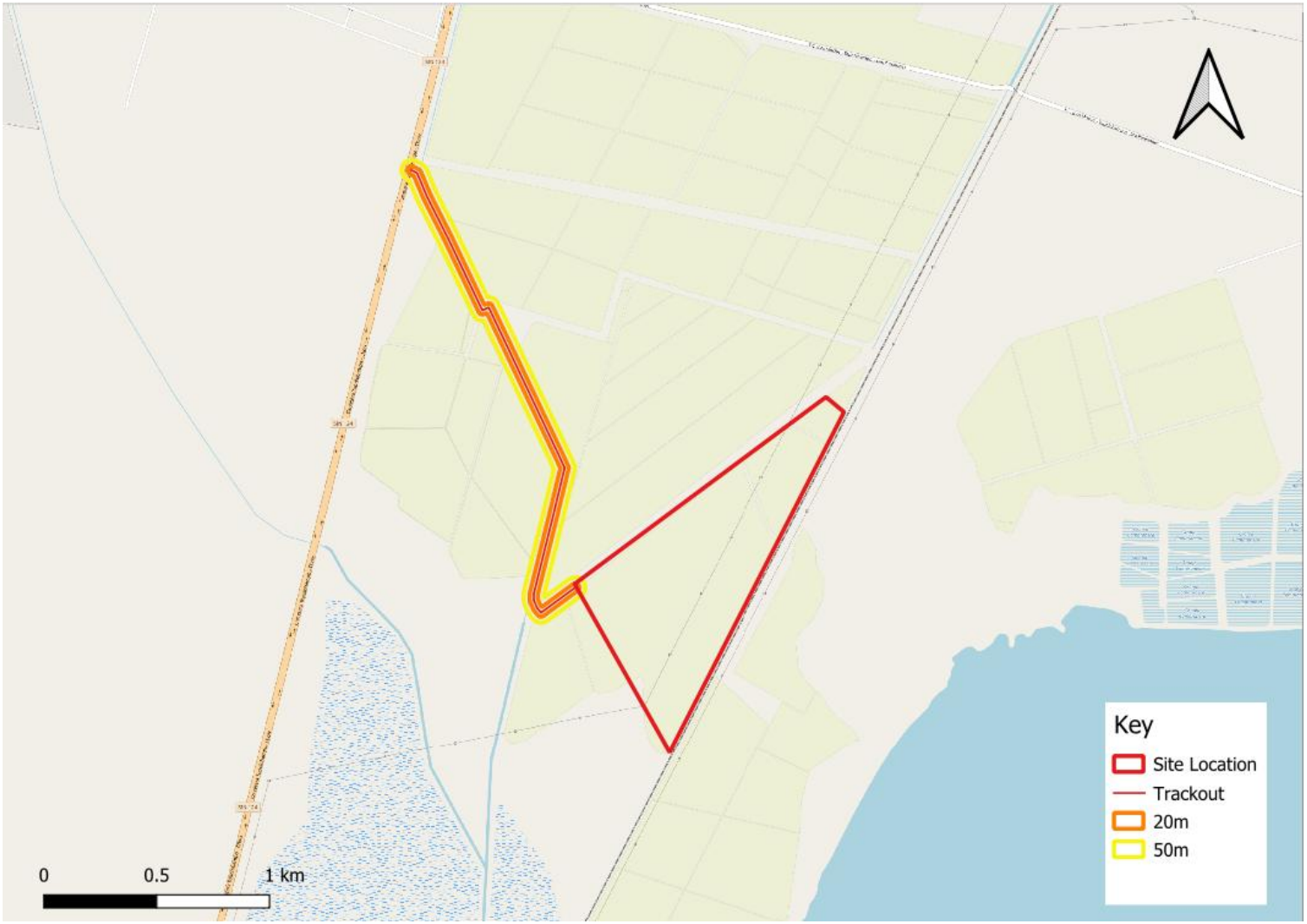


Figure 8.3 Trackout Buffers at the development site

8.1.1.10 Risk of impacts

The dust emission magnitude summarised in Table 8.6 has been combined with the sensitivity of the area in Table 8.7 to determine the risk of impacts of construction activities before mitigation; these have been evaluated based on risk categories of each activity. The dust emissions magnitude is also considered small for the pipeline works.

The risk of dust impacts from construction activities, including those for the pipeline works, is identified as low risk, as shown in Table 8.8. Site specific mitigation measures to reduce construction phase impacts are defined based on this assessment in Section 8.1.1.2.

Table 8.8 Summary of the Dust Risk from Construction Activities

Potential Impact	Demolition	Earthworks	Construction	Trackout
Dust soiling	Negligible	Low	Low	Low
Human health	Negligible	Low	Low	Low
Ecological	N/A			

8.1.1.11 Exhaust emissions from construction vehicles

The operation of vehicles and equipment powered by internal combustion engines results in the emission of exhaust gases containing pollutants including NOx, PM_{10}, $PM_{2.5}$, volatile organic compounds, and carbon monoxide. The quantities emitted depend on factors such as engine type, service history, pattern of usage and fuel composition.

Construction traffic will likely comprise of haulage vehicles and vehicles used for workers' trips to and from the application site. The greatest impact on air quality due to emission from construction phase vehicles will be in areas adjacent to the application site access and nearby road network.

It has been estimated by the client that the number of daily heavy goods vehicles (HGVs) entering and leaving the site will be a maximum of 350 HGVs a day during the early works phase (which will last for approximately 8 to 13 months). The majority of these trips will route along the Los Mochis – Topolobampo Highway to a quarry south of Ejido Rosendo G. Castro, which is located in a rural, sparsely populated area. This construction route is only 5 km long; however, it would pass along the highway by the settlement of Ejido Rosendo G. Castro (approximately 600 inhabitants).

The EPUK-IAQM 2017 guidance provides indicative criteria to determine when vehicle emissions are likely to be significant. For HGVs outside of an Air Quality Management Area with poor air quality, an increase of 100 trips per day as an annual average daily traffic (AADT) is the indicative criterion. The predicted construction HGV traffic generation is above this criterion; therefore, the guidance suggests the impacts have the potential to be significant and further assessment is needed.

The EPUK-IAQM 2017 guidance highlights the criteria are precautionary and should be treated as indicative, with professional judgement being applied, bearing in mind that the ultimate aim is to determine the significance of any emissions or impacts.

In this case, the impacts of the construction vehicle traffic are judged to be not significant, despite the exceedance of the indicative screening threshold and further assessment, such as detailed modelling, is not judged to be required. This judgement is based on the following:

- The majority of receptors are set at a distance from the road of greater than 25 m, with only a few receptors being closer (the nearest being 10 m in a non-canyon environment);
- Baseline monitoring of NO_2 being 17% of the WHO Interim Target 1 Standard and 68% of the WHO Air Quality Guideline Value (see monitoring location MP7 in Table 5.5). Making exceedances of any objectives due to the scheme improbable.
- Baseline monitoring[154] of PM_{10} and $PM_{2.5}$ being 22% and 48% of the WHO Interim Target 1 Standards[155] for PM_{10} and $PM_{2.5,}$ respectively. Making exceedances of any objectives due to the scheme improbable.
- The assumption that the road is well trafficked and the increase in 350 HGVs per day will only be a small proportion of the total trips.
- While the specific impact cannot be determined without modelling, the EPUK-IAQM 2017 impact criteria considers the baseline. As the baseline is less than 75% of the referenced objectives, the increases in concentrations would need to exceed 10% of the Air Quality Standards for moderate adverse (or significant) impacts to occur. Only for the NO_2 Air Quality Guideline Value (which is 10 µg/m^3) is this probable.

8.1.1.12 Operational phase

Electricity required for the Mexinol plant operation will be obtained from the national grid to meet the energy demand. It is understood that no significant fossil fuel combustion sources will be present, and this report has, therefore, only considered them qualitatively below.

Plant/Fugitive emissions

The operations are estimated to have a negligible impact on air quality because of the technical design of the Project (eliminating combustion sources like fire heaters or fuel gas). Emissions will occur from the flaring of methanol using natural gas. In order to reduce process air emissions, the flare will be operated using best practices, therefore reducing emissions associated with incomplete combustion (particulate matter and methanol etc). Residual NOx, CO, methanol and PM emissions are likely to be present; however, if operated using best practices, and when considering the source being a single flare and the distance to sensitive receptors (approximately 2 km), impacts are likely to be negligible. Therefore, there are no major relevant air emission point source that require dispersion modelling.

With the elimination of the fire heaters, the primary sources of air emissions are now fugitive emissions of Volatile Organic Compounds (VOCs) from methanol storage tanks

[154] An average of the two hour-long baseline monitoring surveys has been used.

[155] As previously discussed, because of the significant contribution of natural sources of PM_{10} and $PM_{2.5}$, the WHO AQGs maybe not be suitable and the WHO interims targets (see Table 8.3) may be more appropriate

and the vapours generated during methanol ship loading. The use of a vapour recovery system during ship loading and tank emissions routed to scrubbers, along with an approved start-up/shut-down malfunction plan that conforms to 40 CFR 65.6, will prevent the escape of VOCs. Furthermore, methanol (the main anticipated VOC) has a lower toxicity[156] when compared to other VOCs; this, combined with the likely dispersion between the facility and the nearest off site social sensitive receptors (approximately 2 km), best available techniques for a methanol facility management are considered sufficient to control the risks associated with escaping fugitive emissions.

Odour emissions

The main odour emissions will be associated with the site's WWTP. Mitigation will involve designing the WWTP facility to meet WB EHS Guidelines for Water and Sanitation (2007). These include ensuring the reduction of any potential hazards during the design phase (i.e. the appropriate design of the WWTP to reduce odour generation) and the design of buffer strips or other methods of physical separation around the site.

In terms of likely odour impacts, due to the remote location of the facility and the prevailing wind direction being away from the nearest sensitive receptors[157], there is a low likelihood of any sensitive receptors being impacted by the WWTP or any odour emissions from the facility.

Transport emissions

The EPUK-IAQM 2017 guidance provides indicative criteria to determine when an air quality assessment is likely to be required. Table 8.9 presents a comparison of the relevant EPUK-IAQM screening criteria with traffic and other information on the Project. Traffic data has not been provided by the client at this point meaning the daily number of vehicle movements and HGVs numbers are unknown, therefore, it is unclear whether the Project is expected to cause an increase of more than 100 AADT for Light Duty Vehicles (LDVs) and/or an increase of more than 25 AADT for Heavy Duty Vehicles (HDVs) (based on EPUK-IAQM screening criteria for developments inside an AQMA).

The road transportation network in the vicinity of the Project, specifically the Topolobampo to Los Mochis Highway already exhibits high frequency of vehicle traffic, especially during peak daylight hours as it is the primary road leading to the Port. Accordingly, the potential cumulative impacts of multiple construction projects (e.g., the Project, Proman, the Port Expansion, Jetty upgrades, road improvements) could combine to lead to a network that is near or beyond capacity in terms of roadway level of service. However, Transition Industries LLC has considered this and the Project's committed embedded controls and mitigation measures (e.g., Traffic Management Plan) already take account for this possibility and are designed to minimise the Project's contribution to a cumulative impact.

[156] The U.K. Environment Agency's annual mean Environmental Assessment Level (EAL) for methanol is 532 times higher than the U.K. Air Quality Standard for benzene.

[157] The nearest sensitive receptors are approximately 2 km to the southwest of the facility. The nearest receptors downwind of the prevailing wind direction (which is from the northwest) are over 7 km away.

Table 8.9 Screening Criteria from EPUK-IAQM Guidance and Comparison with the Project Operational Phase

EPUK-IAQM Screening Criteria	Comparison of Project to screening criteria
A change of Light Duty Vehicles (LDVs) of: • More than 500 AADT not within an AQMA • More than 100 AADT within an Air Quality Management Area	**Criterion not exceeded:** It is assumed that the Project's Traffic Management Plan is designed to minimise the Project's traffic contribution and therefore not expected to increase AADT beyond the screening criteria
A change of Heavy-Duty Vehicles (HDVs) of: • More than 100 AADT not within an Air Quality Management Area • More than 25 AADT within an Air Quality Management Area	**Criterion not exceeded:** It is assumed that the Project does not exceed the Heavy-Duty Vehicle (HDV) per day criteria.
Road realignment, where the change is 5 m or more and the road is within an Air Quality Management Area.	**Criterion not exceeded:** No existing roads are within an Air Quality Management Area.
Introduction of a new junction or the removal of an existing junction near to relevant receptors. This applies to junctions that cause traffic to significantly change vehicle accelerate/ decelerate, e.g. traffic lights, or roundabouts.	**Criterion not exceeded:** It is understood that Project's Traffic Management Plan is designed to minimise the Project's traffic contribution, and no new junctions will be proposed.
Introduction or change of a bus station, where bus flows will change by: • more than 25 AADT within or adjacent to an Air Quality Management Area • more than 100 AADT elsewhere.	**Criterion not exceeded:** the development is not expected to introduce any additional bus routes.
Have an underground car park with extraction system, where the ventilation extract for the car park will be within 20 m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).	**Criterion not exceeded:** No underground car parking is proposed.

While the traffic data has not been provided for the operation of the development, none of the EPUK-IAQM traffic criteria have been exceeded (as in Table 8.9), either due to their inapplicability to the scheme or traffic management commitments by the scheme. As such, the impacts of the operational traffic are judged to be not significant.

8.1.1.13 Exposure of future development users to air pollution

The potential exposure of future users of the Project to poor air quality has been considered by undertaking a qualitative review of the baseline conditions (Section 5) and the locations of sensitive receptors near the Project.

Based on the local monitoring data, the annual and hourly mean PM_{10} and $PM_{2.5}$ air quality objectives are considered unlikely to be exceeded at the site.

The EPUK-IAQM 2017 guidance indicates that the annual mean PM_{10} concentrations tend to be greater than ~75µg/m^3 for an exceedance of the daily mean PM_{10} Mexico AQS to be likely. Based on the monitoring data available of PM_{10}, it is considered unlikely that annual mean or short-term PM_{10} AQSs would be exceeded at or in close proximity to the Project site.

Overall, exceedances of any of the relevant AQSs are not anticipated at the site; therefore, the existing air quality conditions are good.

8.1.1.14 Mitigation measures and residual impacts

8.1.1.14.1 Construction phase mitigation

The dust emitting activities outlined in Section 8.1 can be effectively controlled by appropriate dust control measures and any adverse effects can be greatly reduced or eliminated.

A Dust Management Plan (DMP) (which will be part of a site -specific Construction Environmental Management Plan (CEMP), should be prepared and agreed with the local authority and implemented to ensure that the potential for adverse environmental effects on local receptors is minimised. The recommended mitigation measures from the IAQM 2014 guidance, based on the dust risk assessment impact of 'Low risk', are presented below[158]. Measures related to demolition have been excluded, as while the assessment of demolition impacts has been undertaken for completeness, demolition activities will be minimal (the relocation of transmission towers only) and far below activities referenced within the guidance.

Communications

- Display the name and contact details of people accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.

Dust Management

- *Develop and implement a DMP, which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.*

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.

[158] There are two categories of mitigation measures – 'highly recommended' and 'desirable'. Desirable measures are presented in italics.

- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site or the action taken to resolve the situation in the logbook.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority if asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with any dust management plan, record inspection results, and inspect log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- *Fully enclose site specific operations where there is a high potential for dust production and the site is active for an extensive period.*
- Avoid site runoff of water or mud.
- *Keep site fencing, barriers and scaffolding clean using wet methods.*
- *Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.*
- *Cover, seed or fence stockpiles to prevent wind whipping.*

Operating Vehicles/Machinery

- Ensure all NRMM meet the required emission standards.
- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
- *Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas.*

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- *Ensure equipment is readily available on site to clean any dry spillages and clean up as soon as reasonably practicable after the event using wet clean methods.*

Waste Management

- No burning of waste materials.

Measures Specific to Construction

- *Avoid scabbling (roughening of concrete surfaces) if possible.*
- *Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.*

Measures Specific to Trackout

- *Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.*
- *Avoid dry sweeping of large areas.*
- *Ensure vehicles entering and leaving sites are covered to prevent the escape of materials during transport.*
- *Record all inspections of haul routes and subsequent action in site logbook.*
- *Implement wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).*

Operational phase mitigation

As identified in Section 8.1.1.6, no significant operational phase impacts on local air quality are anticipated. Ambient air quality is not expected to have significant adverse effects on future site users. Therefore, the impact of the operational phase of the Project on local air quality is negligible.

As mentioned in section 8.1.1.6, Transition Industries has committed, embedded controls and mitigation measures designed to minimise the Project's traffic contribution.

Residual impacts

With the implementation of the proposed construction phase mitigation measures (detailed above), the residual impacts are low.

It is recommended that **no further** assessment is required for operational phase impacts.

8.1.2 Noise

This section provides a summary of the noise impact assessment that has been undertaken for the Project. Vibration has been scoped out of the assessment due to the nature of the operations, the substantial separation distances between the proposed plant installations and the surrounding sensitive receptors, and the construction methods to be adopted.

8.1.2.1 Receptor sensitivity

The sensitivity of receptors is presented in Table 8.10. It should be noted that the sensitivity of a receptor remains the same regardless of the location.

Table 8.10: Receptor sensitivity

Sensitivity	Receptor
High (4)	Residential properties, educational establishments, hospitals, places of worship, hotels, children's nurseries, nursing homes
Medium (3)	Commercial premises including offices, halls, public municipal areas, bars and restaurants
Low (2)	Industrial premises
Very Low (1)	All other areas such as those used primarily for agricultural purposes

The magnitude of impact within this assessment has been described using the following scale:

- high
- medium
- low
- very Low.

Although the lowest measure of magnitude of effect is defined as 'very low', it should be noted that noise levels may still be audible during the construction and operational phases. Table 8.11 presents the noise sensitive receptors, their sensitivity and position (see Figure 5.7).

Table 8.11: Noise sensitive receptors and sensitivity

Noise Sensitive Receptor (NSR)	Receptor Description	Receptor Sensitivity	Position (UTM)	
			E	N
NSR1	Isolated dwelling – 3.8 km east of Ampliacion Nuevo Bachomobampo Nuero Dos	High (4)	691004	2847748

Noise Sensitive Receptor (NSR)	Receptor Description	Receptor Sensitivity	Position (UTM)	
			E	N
NSR2	Isolated dwelling – 900 m north-east of Ejido Tortugas Numero 2	High (4)	691875	2844118
NSR3	Semi residential area off Carrera Aeropuerto – 4.8 km east of Ejido Plan de Guadalupe	High (4)	695731	2842413
NSR4	Isolated dwelling – 600 m south-west of Campo Guadalupe Estrada	High (4)	700351	2840997
NSR5	Semi-residential area - Paredones	High (4)	701628	2840399
NSR6	Semi-residential area - Ejido Rosendo G. Castro	High (4)	695599	2836958
NSR7	La Curva – north-west region of Topolobampo	High (4)	695052	2833376
NSR8	Pesquera - south-west region of Topolobampo	High (4)	695174	2832431
NSR9	Octava Zona Naval – south-west region of Topolobampo	Medium (3)	694688	2831455

8.1.2.2 Impact magnitude and significance

The criteria in Table 8.12 have been adopted for the assessment of impact magnitude. These have been derived from relevant guidance and standards detailed below, relevant to both construction and decommissioning phases, and operational phases of the Project. Where not stated, it has been assumed that the criteria should apply at the external façade of the receptors.

- Construction and decommissioning phase - British Standard BS 5228-1:2009+A1:2014; and
- Operational phase - WBG/ IFC EHS Guidelines.

Unless otherwise stated, daytime refers to the hours between 07:00 and 22:00, with night-time between 22:00 and 07:00, as per the WBG/IFC EHS guidelines. The British Standard adopted for the assessment of construction/decommissioning related noise impacts has been implemented due to the lack of equivalent Mexican standard for short term related impacts. The Mexican standards relate to boundary noise from long term, continuous sources of noise, in this case this has been assumed to apply for the operational phase of the Project.

Table 8.12: Adopted impact magnitude rating

Source	Period	Magnitude rating			
		Very Low	Low	Medium	High
Construction /decommissioning noise	Day	< 55 dB $L_{Aeq,T}$	55 – 65 dB $L_{Aeq,T}$	66 – 75 dB $L_{Aeq,T}$	75 > dB $L_{Aeq,T}$
	Night	< 40 dB $L_{Aeq,T}$	40 – 45 dB $L_{Aeq,T}$	46 – 55 dB $L_{Aeq,T}$	55 > dB $L_{Aeq,T}$
Operational noise	Day	< 50 dB $L_{Aeq,T}$	50 – 55 dB $L_{Aeq,T}$	56 – 60 dB $L_{Aeq,T}$	60 > dB $L_{Aeq,T}$

Source	Period	Magnitude rating			
		Very Low	Low	Medium	High
	Night	< 40 dB $L_{Aeq,T}$	40 – 45 dB $L_{Aeq,T}$	46 – 50 dB $L_{Aeq,T}$	50 > dB $L_{Aeq,T}$
Note - where baseline noise levels exceed the low magnitude range, a significant impact would occur where noise from site operations increases the existing ambient level by 3 dB					

It is acknowledged that the Mexican Standard NOM-081-SEMARNAT-1994 regulates noise from industrial and commercial fixed sources as measured at the perimeter of the facility (fence line) however, at this stage exact details of plant emissions are not available. For the purposes of the operational assessment, it has been assumed that the Project would comply with NOM-081-SEMARNAT-1994 at the facility fence line.

8.1.2.3 Construction phase

Construction activities, and associated plant lists have been developed through discussions with the Project's design and engineering team. The primary construction activities that have the potential to be significant are presented in Table 8.13.

Table 8.13: Likely construction activities

Component	Construction activity
Enabling Works – Mexinol Facility, including WWTP	Task 1 - Installation of security fencing and facilities
	Task 2 - Site Clearance and grubbing
	Task 3 - Site welfare establishment
Construction Works – Mexinol Facility, including WWTP	Task 4 - Site preparation and earthworks
	Task 5 - Internal access route construction
	Task 6 - Installation of foundations (piling)
	Task 7 - Installation of foundations (concreting)
	Task 8 - Fixed plant installation
	Task 9 - Commissioning
Pipeline Construction	Task 10 – Cut and fill
Port Upgrade Works	Task 11 - Site preparation and earthworks
	Task 12 - Installation of foundations (concreting)
	Task 13 - Fixed plant installation

Typical noise levels generated by the construction phase activities have been predicted to determine potential impacts at sensitive receptors. This has been calculated in accordance with BS 5228-1:2009+A1:2014 (as noted above).

For the purposes of this assessment, it has been assumed that the surrounding land is flat and acoustically reflective i.e. no acoustic screening from the intervening topography, or attenuation due to ground absorption. This has the potential to overestimate the predicted noise levels and therefore offers a robust and more cautious assessment.

The anticipated plant items and cumulative sound pressure levels for the various construction tasks are presented in Table 8.14 to Table 8.17.

Table 8.14: Construction phase plant list: Enabling works

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
Task 1 - Installation of security fencing and facilities	Lorry	C4.53	77	1	10	**83**
	Telehandler	C2.35	71	1	30	
	Tracked excavator	C2.14	79	2	40	
	Wheeled loader	C2.28	76	1	20	
	Tracked mobile crane	C3.28	67	1	40	
	Petrol hand-held circular saw	C4.70	91	1	10	
	Hand tools	--	--	--	--	
Task 2 - Site clearance and grubbing	Tracked excavator	C2.14	79	2	70	**85**
	Dozer	C2.10	80	2	40	
	Wheeled loader	C2.28	76	3	50	
	Dump truck (tipping fill)	C2.30	79	2	50	
	Hand tools	--	--	--	--	
Task 3 - Site welfare establishment	Lorry with lifting boom	C4.53	77	1	30	**81**
	Tractor (towing equipment)	C4.74	79	1	30	
	Telehandler	C2.35	71	2	50	
	Tracked excavator	C2.14	79	1	60	
	Dump truck (tipping fill)	C2.30	79	1	40	
	Diesel generator	C.4.82	56	2	100	
	Hand tools	--	--	--	--	

Table 8.15: Construction phase plant list: Mexinol and WWTP facilities

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
	Tracked excavator	C2.14	79	3	70	**87**

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
Task 4 - Site preparation and earthworks	Dozer	C2.10	80	2	40	
	Dump truck (tipping fill)	C2.30	79	2	50	
	Grader	C6.31	86	2	20	
	Vibratory compactor plate	C2.41	70	2	40	
	Tractor (towing equipment)	C4.74	79	1	20	
	Wheeled loader	C2.28	76	2	30	
	Water pump	C2.45	65	1	40	
	Water bowser (discharging)	C6.37	81	1	20	
Task 5 - Internal access route construction/ upgrade	Grader	C6.31	86	1	20	**86**
	Vibratory roller	C5.21	80	1	15	
	Asphalt paver (+ tipper lorry)	C5.30	75	1	60	
	Tracked excavator	C2.14	79	2	30	
	Petrol hand-held circular saw	C4.70	91	1	20	
	Dump truck (tipping fill)	C2.30	79	2	20	
	Hand tools	--	--	--	--	
Task 6 - Piling (foundations)	Tracked excavator	C2.14	79	1	20	**86**
	Dump truck (tipping fill)	C2.30	79	1	10	
	CFA piling rig	C3.14	83	1	50	
	Tracked mobile crane	C3.28	67	1	15	
	Concrete pump	C3.26	75	1	50	
	Petrol hand-held circular saw	C4.70	91	1	20	
Task 7 - Concreting	Dump truck (tipping fill)	C2.30	79	1	20	**82**
	Concrete mixer truck	C4.20	80	1	70	
	Concrete pump	C3.26	75	1	70	
	Diesel generator	C4.78	66	1	80	
	Tracked excavator	C2.14	79	1	20	
	Vibratory Poker	D6.20	81	1	30	
Task 8 - Fixed plant installation	Wheeled mobile telescopic crane	C4.38	78	1	40	**79**
	Telehandler	C2.35	71	2	70	
	Lorry with lifting boom	C4.53	77	1	30	

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
	Tracked excavator	C2.14	79	1	20	
	Hand-held welder	C3.31	73	1	30	
	Generator for welding	C3.32	73	1	30	
	Hand Tools	--	--	--	--	
Task 9 - Commissioning	Diesel generator	C4.78	66	1	80	**77**
	Centrifugal Pump	C2.45	65	1	80	
	Wheeled mobile telescopic crane	C4.38	78	1	40	
	Lorry with lifting boom	C4.53	77	1	30	

Table 8.16: Construction phase plant list: Pipeline works

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
Task 10 - Cut and fill	Tracked excavator	C2.16	75	2	20	**75**
	Dozer	C2.1	75	1	20	
	Dump truck (tipping fill)	C4.7	78	1	10	
	Wheeled mobile crane	C4.43	70	1	10	
	Vibratory roller	C5.20	75	1	10	

Table 8.17: Construction phase plant list: Port upgrade and expansion

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
Task 11 - Site preparation and earthworks	Tracked excavator	C2.14	79	2	40	**83**
	Dozer	C2.10	80	1	20	
	Dump truck (tipping fill)	C2.30	79	1	20	
	Vibratory compactor plate	C2.41	70	1	50	
	Tractor (towing equipment)	C4.74	79	1	20	
	Wheeled loader	C2.28	76	1	30	
	Vibratory roller	C5.21	80	1	20	

Activity	Plant	BS 5228 Plant Ref.	Noise at 10 m, dB(A)	No. of items in use	% time	Total noise at 10 m, dB(A)
	Water pump	C2.45	65	1	40	
	Water bowser (discharging)	C6.37	81	1	20	
Task 12 - Port upgrade and expansion works	Tracked excavator	C2.14	79	2	70	**83**
	Dump truck (tipping fill)	C2.30	79	1	30	
	Wheeled loader	C2.28	76	1	30	
	Vibratory roller	C5.21	80	1	20	
	Wheeled mobile telescopic crane	C4.38	78	1	40	
Task 13 - Concreting	Dump truck (tipping fill)	C2.30	79	1	20	**82**
	Concrete mixer truck	C4.20	80	1	70	
	Concrete pump	C3.26	75	1	70	
	Diesel generator	C4.78	66	1	100	
	Tracked excavator	C2.14	79	1	30	
	Vibratory Poker	D6.20	81	1	30	

In order to assess the magnitude impact relating to noise from construction activity, noise levels have been calculated using the computational noise modelling software SoundPlan v9.0. The software calculates construction noise from mobile and static sources in accordance with BS 5228-2:2009+A1: 2014 and adopts the different construction tasks and associated noise levels to predict likely noise levels at the sensitive receptors considered.

Though it is anticipated that the total number of plant items used during the construction tasks may exceed those specified in the plant lists above, it would be expected that the plant be spread across the entire work extents and not localised at the closest point to the receptor location. Similarly, many of the plant items would be mobile and operate on a transient basis across the worksite, with many of those tasks, particularly those associated with pipeline constriction (Task 10), only likely to occur for a short period of time. As such, the plant lists above would represent a worst-case scenario.

Noise relating to construction traffic has been scoped out of the assessment owing to the location and existing traffic along the construction routes.

Table 8.18 and Table 8.20 detail the predicted noise levels during both daytime and night-time periods. Predicted noise levels remain the same for both periods, with colour coding applied to highlight the magnitude of impact in line with the criteria applied in Table 8.12

Table 8.18: Predicted construction phase noise levels at noise sensitive receptors - daytime

Task No.	Predicted noise level, dB $L_{Aeq,T}$								
	NSR1	NSR2	NSR3	NSR4	NSR5	NSR6	NSR7	NSR8	NSR9
Task 1	40	37	33	38	34	33	27	26	25
Task 2	42	39	35	40	36	35	29	28	27
Task 3	38	35	31	36	32	31	25	24	23
Task 4	44	41	37	42	38	37	31	30	29
Task 5	43	40	36	41	37	36	30	29	28
Task 6	43	40	36	41	37	36	30	29	28
Task 7	39	36	32	37	33	32	26	25	24
Task 8	36	33	29	34	30	29	23	22	21
Task 9	34	31	29	34	30	29	23	22	21
Task 10	29	36	43	26	23	46	65	62	60
Task 11	19	21	22	22	22	28	38	43	65
Task 12	19	21	22	22	22	28	38	43	65
Task 13	21	27	42	37	21	20	21	64	18

During daytime construction activities, the predicted noise levels associated with the construction would be below 55 dB $L_{Aeq,T}$ for tasks 1 to 9 at all facilities and therefore represent a **very low (1)** magnitude of impact. These works are associated with the construction of the Mexinol and WWTP facilities. Based on a **very low (1)** magnitude affecting **high (4)** sensitivity receptors, this constitutes a **minor (4)** short term negative impact significance.

For those daytime construction tasks associated with pipeline construction and extension of the port (tasks 10 to 13), predicted noise levels would represent a **low (2)** magnitude of impact at receptors 7 to 9, given the reduction in distance between source and receivers. On the basis of a **low (2)** magnitude of impact, affecting both **high (4) and medium (3)** receptors, this constitutes a **moderate (8; 6)** short term negative impact significance. It is recommended that mitigation measures be applied, particularly during construction tasks 10 to 13, in order to reduce noise levels as much as practically possible. It should be noted that in the case of pipeline construction, the works associated would be transient, with predicted noise levels only likely to occur for a short period of time. Naturally, as the works progress along the pipeline route, this would increase the

distance between source and receiver and would inevitably result in noise levels lower than those predicted.

Table 8.19: Predicted construction phase noise levels at noise sensitive receptors – night

Task No.	Predicted noise level, dB $L_{Aeq,T}$								
	NSR1	NSR2	NSR3	NSR4	NSR5	NSR6	NSR7	NSR8	NSR9
Task 1	40	37	33	38	34	33	27	26	25
Task 2	42	39	35	40	36	35	29	28	27
Task 3	38	35	31	36	32	31	25	24	23
Task 4	44	41	37	42	38	37	31	30	29
Task 5	43	40	36	41	37	36	30	29	28
Task 6	43	40	36	41	37	36	30	29	28
Task 7	39	36	32	37	33	32	26	25	24
Task 8	36	33	29	34	30	29	23	22	21
Task 9	34	31	29	34	30	29	23	22	21
Task 10	29	36	43	26	23	46	65	62	60
Task 11	19	21	22	22	22	28	38	43	65
Task 12	19	21	22	22	22	28	38	43	65
Task 13	21	27	42	37	21	20	21	64	18

Should there be a requirement to undertake construction activities at night, the predicted noise levels would represent a **very low (1)** magnitude of impact at all receptors considered for tasks 3 and 7 to 9. Given the more restrictive criteria applied at night, predicted noise levels would result in a **low (2)** magnitude of impact for tasks 1, 2 and 4 to 6. Based on a **low (2)** magnitude affecting **high (4)** sensitivity receptors, this constitutes a **moderate (8)** short term negative impact significance.

Predicted noise levels indicate that should tasks 10 to 13 occur during the night, there would likely be a **low (2)** to **high (4)** impact at a number of those noise sensitive receptors considered. Based on a worse case **high (4)** impact affecting **high (4)** sensitivity receptors, this constitutes a **major (16)** short term negative impact significance.

The impacts of noise from construction activities are presented in Table 8.20.

Table 8.20: Impacts of noise from construction activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Daytime					
Enabling Works – Mexinol Facility and WWTP	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N
Construction Works – Mexinol Facility and WWTP	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N
Pipeline Construction	Noise disturbance	Low (2)	High (4)	**Moderate (8)**	Y
Port Upgrade Works	Noise disturbance	Low (2)	Medium (3)	**Moderate (6)**	Y
Night					
Enabling Works – Mexinol Facility and WWTP	Noise disturbance	Low (2)	High (4)	**Moderate (8)**	Y
Construction Works – Mexinol Facility and WWTP	Noise disturbance	Low (2)	High (4)	**Moderate (8)**	Y
Pipeline Construction	Noise disturbance	High (4)	High (4)	**Major (16)**	Y
Port Upgrade Works	Noise disturbance	High (4)	High (4)	**Major (16)**	Y

8.1.2.3.1 Mitigation measures

The Project will ensure that management control measures shall be implemented as part of construction activities to reduce noise levels at source. Proposed mitigation is in line with the previous SLIP document:

- The machinery and equipment will comply with the Official Mexican Standard NOM-080-SEMARNAT-1994, which establishes the maximum permissible noise emission limits from motor vehicles, motorcycles and motorised tricycles in circulation, and their measurement method (2022; 2021).
- All vehicles, equipment and noise control measures to be maintained and in good and efficient working order and operated to minimise noise emissions as prescribed by the manufacturer (2022; 2021).
- When the exact construction methods are known, a detailed noise modelling and design review exercise should be undertaken to determine the noise levels of construction operations at the nearest noise-sensitive receptors (NSR's) (2022; 2021). Particular attention would be paid for NSR 7 to NRS 9 which according to the predictive model exceeds regulatory threshold night noise. New modelling will

be done once construction methods are confirmed. If appropriate, mitigation measures will be implemented for example: Restriction of high-noise operations (e.g., heavy machinery, loading/unloading, blasting) to daytime hours whenever possible; Fitting of equipment (e.g., generators, compressors) with enclosures, silencers, or mufflers to reduce emissions).

8.1.2.3.2 Residual impacts

The implementation of effective noise control will help to manage the potential impacts related to construction noise. Through adoption of the mitigation and management measures, this will reduce the magnitude to **very low (1)**, resulting in a **minor (4)** negative impact significance. There will be **no significant** residual impacts associated with noise from the construction activities.

8.1.2.4 Operational phase

During the operational phase, numerous elements of the Project have the potential to generate noise emissions that may be perceptible at sensitive receptors in the surrounding area. The key operational facilities are noted below:

- operation of the Mexinol Plant – including compressors, turbines, air coolers, fans, primary reformer, pumps and steam generation
- ASU
- hydrogen generation unit
- WWTP.

The noise levels generated by the operation of the proposed facilities have been calculated using the computational noise modelling software SoundPlan v9.0. The software calculates industrial noise from mobile and static sources in accordance with International Standard ISO 9613-2:2024[159].

The ISO 9613-2:2024 method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation. The methodology takes account of numerous physical effects, such as geometrical divergence, atmospheric absorption, reflection and screening by obstacles.

The total number of each identified element of noise emitting plant has not been defined at this stage. Vendor datasheets are not available for the proposed plant installations. In the absence of this information, noise emissions from plant operations are assumed to comply with NOM-081-SEMARNAT-1994, which regulates perimeter noise from industrial and commercial fixed sources as measured at the perimeter of the Mexinol facility and WWTP (fence line). In this case, it has been assumed that the following criteria would be secured through design:

- 06:00 to 22:00 - 68 dB(A)
- 22:00 to 06:00 - 65 dB(A)

[159] International Organization for Standardization (2024) 9613-2:2024 Acoustics, attenuation of sound during propagation outdoors. Part 2 – Engineering method for the prediction of sound pressure levels outdoors. International Organization for Standardization

The adoption of the above noise levels at the fence line has been used to calculate the noise impact at each of the identified noise sensitive receptors. It is recommended that vendor plant data is obtained for all installations, sufficient to validate the predicted receptor noise levels.

Other assumptions made in respect of the proposed plant installations include dimensional data, height of the source emissions above ground level and the source directivity. The modelling parameters are presented in Table 8.21.

Table 8.21: Operational phase modelling parameters

Parameter	Setting
Algorithm	International Standard ISO 9613-2:2024 *'Acoustics, attenuation of sound during propagation outdoors. 'General method of calculation'*
Ground Absorption	Acoustically hard surfaces - coefficient of 0.0 i.e. roads, hard standing areas etc.
Façade Corrections	Not applied i.e., results represent free-field noise levels
Receptor Height	A receptor height of 1.5 m above ground level has been assumed
Source Modelling/ Data	It is assumed that the proposed plant installations will operate continuously during both daytime and night-time periods, with compliance achieved at the perimeter fence line through design. The noise emissions have been modelled at 4 metres height using spectral data obtained from RSK's database of similar developments. No allowance has been made for directivity of the plant noise emissions i.e., model assumes omni-directional propagation.
Barriers / structures	The model does not incorporate features on site which may provide partial screening (e.g., buildings and equipment items). Consequently, the contribution of certain sources may be overestimated.

The predicted noise levels for the operation of the Mexinol facility and WWTP at the closest surrounding sensitive receptors are presented in Table 8.22 and Figure 8.4. Colour coding has been applied to highlight the magnitude of impact in line with the criteria applied in Table 8.12.

Table 8.22: Predicted operational phase noise levels

Noise Sensitive Receptor (NSR)	Receptor Description	Predicted noise level, dB $L_{Aeq,T}$[1]	
		Day	Night
NSR1	Isolated dwelling – 3.8 km east of Ampliacion Nuevo Bachomobampo Nuero Dos	23	20
NSR2	Isolated dwelling – 900 m north-east of Ejido Tortugas Numero 2	19	16

Noise Sensitive Receptor (NSR)	Receptor Description	Predicted noise level, dB $L_{Aeq,T}$[1]	
		Day	Night
NSR3	Semi residential area off Carrera Aeropuerto – 4.8 km east of Ejido Plan de Guadalupe	14	11
NSR4	Isolated dwelling – 600 m south-west of Campo Guadalupe Estrada	21	18
NSR5	Semi-residential area - Paredones	14	11
NSR6	Semi-residential area - Ejido Rosendo G. Castro	13	10
NSR7	La Curva – north-west region of Topolobampo	10	10
NSR8	Pesquera - south-west region of Topolobampo	10	10
NSR9	Octava Zona Naval – south-west region of Topolobampo	10	10

[1] A minimum noise level of 10 dB $L_{Aeq,T}$ has been presented. Noise levels below 10 dB(A) cannot be reliably measured or verified.

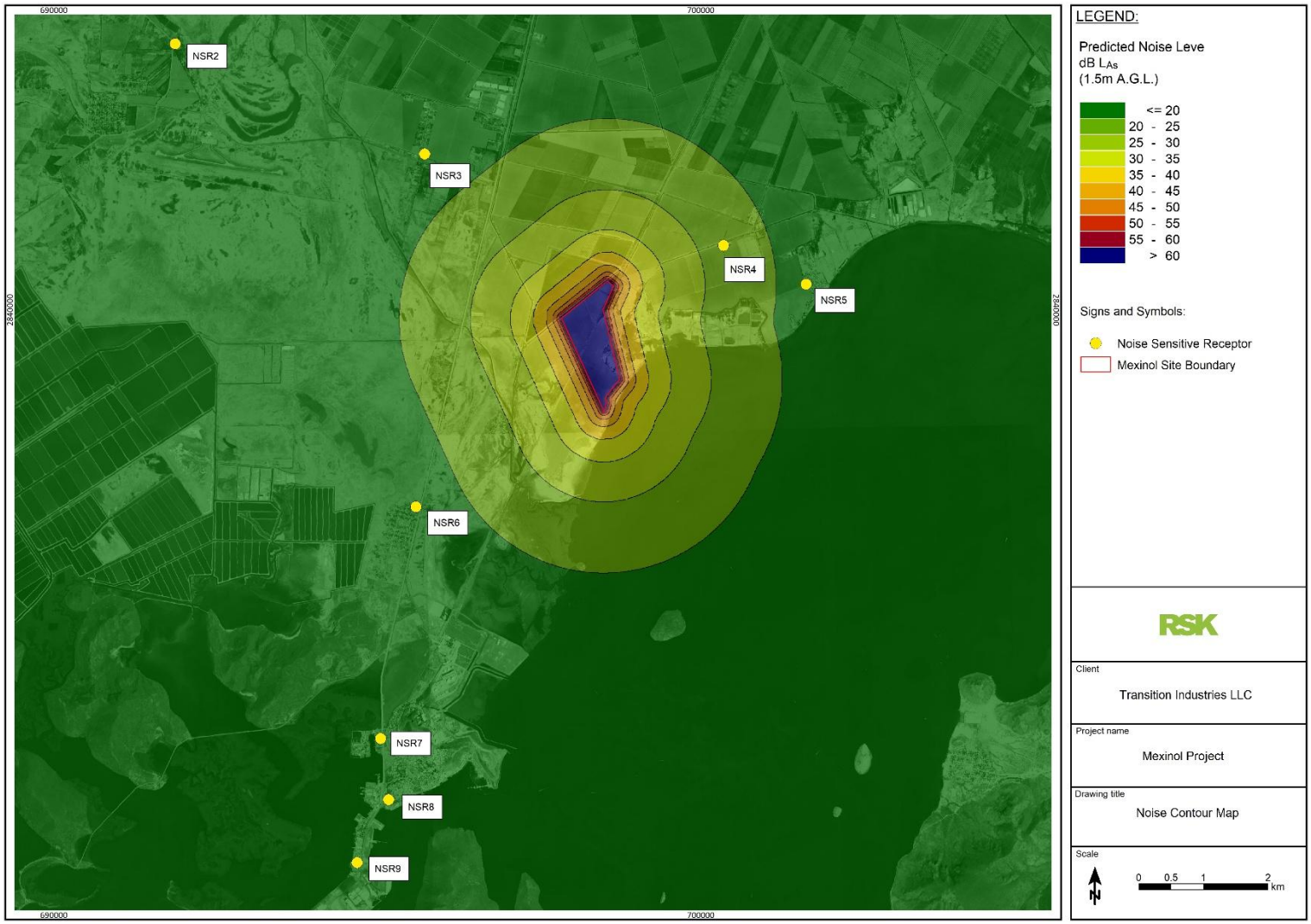


Figure 8.4: Noise contour map for operational phase

The operational phase noise levels associated with the Mexinol Plant and WWTP will be below 40 dB $L_{Aeq,1hr}$ and therefore represent a **very low (1)** impact magnitude. On the basis of a **very low (1)** magnitude, affecting **high (4)** sensitivity receptors, this constitutes a **minor (4)** long term negative impact significance.

Operation of the port facilities will consist primarily of methanol loading into the tankers and vapour management, in addition to vessel movements in/out of the port. Given the likely low noise emissions from these operations, and relatively few numbers of vessel movements, noise from the port facilities is expected to present a **very low (1)** impact magnitude, affecting **medium (3)** sensitive receptors (those closest considered); this constitutes a **minor (3)** long term negative impact significance.

Similarly, with regards to road transport, existing vehicle numbers along the primary route to the port (Topolobampo to Los Mochis Highway) are likely to be high, with expected vehicle increases from the Project in combination with Topolobampo III and Topolobampo Port, likely to contribute a relatively small increase to existing flows. As a result, operational road traffic is expected to present a **very low (1)** impact magnitude, affecting **high (4)** sensitivity receptors; this constitutes a **minor (4)** long term impact significance.

The impacts of noise from the during operation are presented in Table 8.23.

Table 8.23: Impacts of operational noise

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Operation of the Mexinol Facility	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N
Operation of the Port	Noise disturbance	Very Low (1)	Medium (3)	**Minor (3)**	N
Operational road traffic	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N

8.1.2.4.1 Mitigation measures

Impacts of noise during operation are considered to be **minor**, therefore, no further mitigation measures included in the project design are deemed necessary.

8.1.2.4.2 Residual impacts

There will be **no significant** residual impacts associated with noise during operation.

8.1.2.5 Decommissioning

Decommissioning of the Plant is expected to result in many of those tasks associated with construction being replicated but in reverse order. It can therefore be reasonable to assume that predicted noise levels and those residual impacts are to remain consistent. Decommissioning is conservatively considered to have a **minor (4)** negative impact similar

to that of the construction phase; there will be **no significant** residual impacts associated with noise from the decommissioning activities.

8.1.2.6 Residual impacts - operation

There will be **no significant** residual impacts associated with noise during operation.

8.1.3 Landscape and visual amenity

This section discusses the potential impacts to landscape and visual receptors during construction and operations of the Project.

8.1.3.1 Methodology

In accordance with Guidelines for Landscape and Visual Impact Assessment Third Edition (Landscape Institute and IEMA, 2013, GLVIA3) the significance of landscape and visual effects is determined by considering, in tandem, the sensitivity of landscape and visual receptors (landscape elements, landscape character areas, landscape designations and groups of people who may be affected by changes in visual amenity) and the magnitude of effect arising from the Project.

8.1.3.1.1 Sensitivity

Sensitivity (described as high, medium or low) is judged by combining component judgements about the value and susceptibility of the receptor, as illustrated in Table 8.24 and Table 8.25.

- Landscape Value: This is the relative value or importance attached to different landscapes by society on account of their landscape qualities. These include factors related to natural and cultural heritage (for example ecological, geological or heritage matters), landscape condition, cultural associations (in terms of connections with people, arts or events), distinctiveness (i.e. a sense of unique identity in the landscape), recreational opportunities, perceptual aspects (including scenic quality, wildness and tranquillity) and landscapes with a clearly identifiable role or function. In this assessment, the value attributed to the landscape is described as: **National**, **Regional** or **Community**.
- Value of Views: The value of public views, which is the focus of GLVIA3, will vary depending on the nature, location and context of the view and the recognised importance of the view. Considerations include cultural associations; designation or policy protection; views of or from landmarks; and/or the scenic quality of the view. It should be noted that the value attributed relates to the value of the view only (e.g. a National Trail is nationally valued for access, but not always for the available views from every section). In this assessment, the value attributed to visual amenity is described as: **National**, **Regional** or **Community**.
- Landscape Susceptibility: Landscape Susceptibility according to GLVIA3 means "*the ability of the landscape receptor to accommodate the proposed Development without undue consequences for maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*" (paragraph 5.40). The susceptibility of the landscape varies depending on the type of development proposed and the particular site location. Judgements on landscape susceptibility include references to both the physical and aesthetic characteristics

and the potential scope for mitigation. In this assessment, the susceptibility of the landscape is described as **High**, **Medium** or **Low**.

- Susceptibility of Visual Receptors: Those living within view of the Proposed Development are usually regarded as the highest susceptibility group as well as those engaged in outdoor pursuits for whom landscape experience is the primary objective. The susceptibility of potential visual receptors will also vary depending on the activity of the receptor. For visual receptors, susceptibility and value are closely linked - the most valued views are also likely to be those where viewer's expectations will be highest. In this assessment, visual receptor susceptibility is defined in accordance with the criteria below.
    - High - Local residents; tourists; people engaged in outdoor recreation focused on an appreciation of views including users of footpaths and quiet country lanes, beauty spots and picnic areas and people experiencing views to or from important features of physical, visual, cultural or historic interest.
- Medium-Local Road users and travellers on trains. People engaged in outdoor recreation with some appreciation of the landscape e.g. road cycling, nature conservation, golf and water-based recreation.
    - Low - Workers, users of facilities and commercial buildings (indoors) experiencing views from buildings. Road and rail users on fast moving commuting or trunk routes. Visual receptors where views are incidental to the activity and/or location.

It should be noted that intermediate assessments of value or susceptibility may be applied (e.g. High/Medium, Medium/Low or National/Regional, Regional/Community). Likewise, when combining susceptibility and value to determine sensitivity, an intermediate assessment is adopted where overall sensitivity is judged to lie between levels. In all instances, professional judgement is employed, and the tables below should not be interpreted rigidly to give a specific answer. A slightly greater weight is given to susceptibility in judging the sensitivity of visual receptors.

Table 8.24: Landscape sensitivity

Landscape Receptors		Susceptibility		
		High	Medium	Low
Value	National	High	High/Medium	Medium
	Regional	High/Medium	Medium	Medium/Low
	Community	Medium	Medium/Low	Low

Table 8.25: Visual sensitivity

Visual Receptors		Susceptibility		
		High	Medium	Low
Value	National	High	High/Medium	Medium
	Regional	High/Medium	High/Medium	Medium/Low
	Community	High/Medium	Medium	Low

8.1.3.1.2 Magnitude

The magnitude of effect arising from the Project (described as high, medium, low or very low) is assessed in terms of its scale, geographic extent of the area or receptor that is influenced and its duration.

Scale of change (expressed as large, medium, small, negligible) is the first and primary factor in determining magnitude.

- Landscape: Judgements concerning the Scale of the change take account of degree of loss or alteration to key landscape features/elements; characteristics; and for designated areas – special qualities and/or purposes of designation; distance from the development; and landscape context to the development. The approach to assessing effects on landscape character is to consider the key characteristics for the Landscape Character Area (LCA) within which the proposed development is located (the host LCA) and if relevant the adjacent LCA's (non-host) and identify which of these the proposed development would affect. A large-scale change in landscape character is likely to occur where key characteristics would be lost or substantially changed. A small-scale change is likely to occur where key characteristics are altered to a lesser degree and this can be influenced by distance and surrounding context. Where particular views are a key characteristic of a landscape type, large or medium scale landscape character effects may occur where the proposed development becomes a key feature of those views. A similar approach applies to designated landscapes, for which the effects on the defined purposes of designation and special qualities are considered. In this assessment, the scale of landscape change is described as: **large**, **medium**, **small** or **negligible**.
- Visual: The Scale of change arising from the Project as experienced by a visual receptor group reflects the degree to which the nature of the views from that location would be changed taking into account: the distance of the viewpoint from the development; the degree to which the development is visible or screened; the angle of view in relation to main receptor activity or main focus of the view; the horizontal and vertical field of view occupied by the development; and, the extent and nature of other built development visible. In this assessment, the scale of change in view is described as: **large**, **medium**, **small** or **negligible**

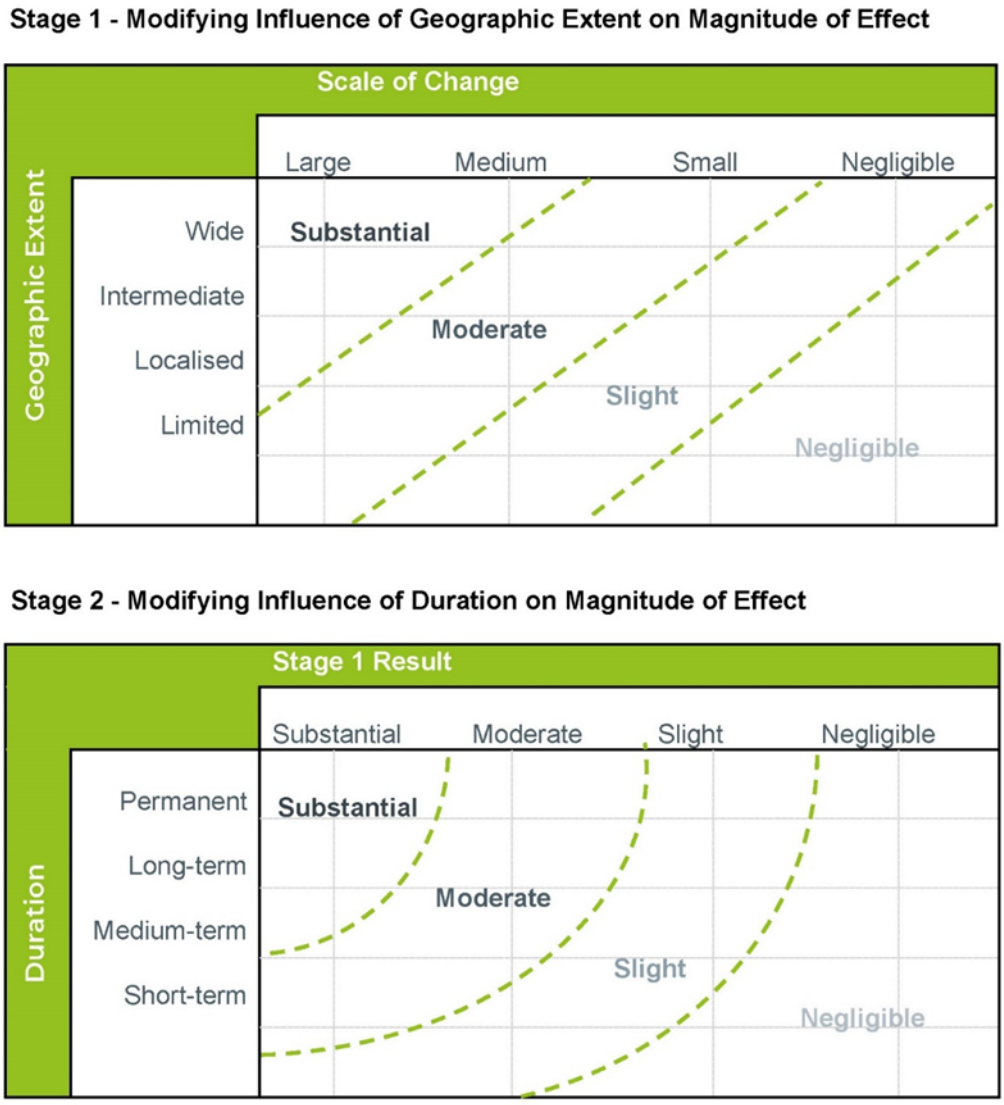
Geographical extent and duration of the effect are modifying factors to the overall magnitude judgement which may be higher if the effect is particularly widespread and/or long lasting, or lower if it is constrained in geographic extent and/or timescale.

- In this assessment, the geographical extent of landscape and visual change is described as: **Wide**, **Intermediate**, **Localised** or **Limited**.
- Duration and Reversibility can be linked depending on the nature of the development. Reversibility is a judgement about the practicality of reversing the landscape and visual effects of the Project (for example, solar farms are ultimately largely reversible whilst housing is permanent). Duration reflects how long the change will last and can include frequency the effect would be experienced. In this assessment, the duration of the change would be considered: **short term** when lasting less than 0-5 years; **medium term** when lasting between 5 and 10 years; **long term** when lasting between 10 and 25 years, and **permanent** for more than 25 years.

The diagrams presented below in Figure 8.5 below illustrate and outline how these two modifying factors are considered in a two-stage process. A judgement is first formed about the scale of the change to the landscape or visual receptor. The geographic extent of the effect is then considered as a modifying influence in the first part of Plate 1 (Stage 1). The result or outcome of Stage 1 is then considered again in relation to the duration of the effect as illustrated in the second part of Plate 1 (Stage 2). The outcome of Stage 2 is the overall magnitude of effect judgement reported in the assessment. Plate 1 is not intended to be interpreted rigidly as a chart to provide definitive answers; professional judgement is employed as appropriate to arrive at an overall judgement on the magnitude of effect.

Where magnitude of effect (or other judgements) is judged to lie between levels, an intermediate assessment is adopted and is expressed as e.g. moderate/slight.

Figure 8.5: Illustration of how magnitude of effect is established



8.1.3.1.3 Significance of effects

The significance of a landscape or visual effect (described as major, moderate, minor or negligible) is assessed using professional judgement, combining the sensitivity of the receptor with the predicted magnitude of effect, as summarised in Table 8.26. Table 8.26 is not used as a prescriptive tool and illustrates the typical outcomes, allowing for the exercise of professional judgement. In some instances, a particular parameter may be considered as having a determining effect on the analysis. Where significance is judged to lie between levels, an intermediate assessment will be adopted for example 'moderate/minor'. Such a judgement indicates that the significance of effect is less than moderate but more than minor.

Table 8.26: Significance matrix

		Magnitude of Change			
		Major	Moderate	Slight	Negligible
Receptor Sensitivity	High	Major	Major-Moderate	Moderate	Minor
	Medium	Major-Moderate	Moderate	Moderate-Minor	Minor-Negligible
	Low	Moderate	Moderate-Minor	Minor	Negligible

Where the effect has been classified as major or major/moderate, this is equivalent to a likely significant effect. Where 'moderate' effects are predicted, professional judgement is applied to determine whether the effect is significant or not ensuring that the potential for significant effects to arise has been thoroughly considered and justification is provided for the judgement reached as appropriate. Effects of moderate/ minor, minor, minor/ negligible or negligible significance are considered to be not significant.

8.1.3.1.4 Beneficial/adverse

Landscape and visual effects can be beneficial or adverse and, in some instances, may be considered neutral. Neutral effects are those which overall are neither adverse nor positive but may incorporate a combination of both. Whether an effect is beneficial, neutral or adverse is identified based on professional judgement.

8.1.3.2 Effects on site fabric

Early works at the plant site are expected to include the following effects on site fabric:

- vegetation clearance
- clearing, levelling and compacting of the Project site
- water course filling and de-watering of any standing water areas
- levelling of site for construction platform
- soil excavation and relocation
- relocation of seven overhead power lines

Site clearance would also occur along the methanol and vapour recovery pipeline between the plant site and port, and water transfer/return pipeline routes between the plant site and JAPAMA treatment facility.

The facilities at the existing dock would be modified to load methanol into tankers through a pipeline that will transport methanol from the plant site.

8.1.3.3 Landscape Sensitivity Assessment

The sensitivity of the landscape character areas which may receive significant landscape effects are assessed below. Landscape sensitivity is not absolute and can only be defined in relation to each development and its location. To assess the sensitivity of a

particular landscape it is good practice to consider the value attached to the landscape and its susceptibility to the form of change likely to result from the proposed development. Assessment text relates to sensitivity of the landscape receptor as a whole, to the proposed development, with additional comments regarding the Site where relevant. In the main this has been taken from the findings of the desktop baseline assessment. Table 8.27 below is based on guidance provided within LI TGN 02/21 - specifically Table 1 within that document.[160]

Table 8.27: Factors affecting sensitivity

Factors affecting sensitivity	Lower sensitivity to industrial development	Higher sensitivity to industrial development
Value attached to Landscapes		
Designated scenic quality	No specific designation	National or regional designation
Natural Heritage	Low presence of ecological or geological / geomorphological interest.	High presence of ecological or geological / geomorphological interest.
Cultural Heritage	Low presence of archaeology or historical interests	High presence of archaeology or historical interests
Landscape condition/ quality	Landscape in a poor state of repair with incongruous elements	Landscape fully intact in good condition with limited incongruous elements
Cultural associations	No strong associations with notable people, events or the arts.	Strong cultural associations with notable people, events or the arts, which contribute to perceptions of natural beauty.
Distinctiveness	Commonplace elements and features, or the landscape itself. Lacking distinctive and strongly expressed character and with no important relationship to a settlement.	Presence of rare elements or features or rarity of the landscape itself. Landscape with a distinctive and clearly expressed character and/or with an important relationship to a settlement.
Amenity and recreation	Limited amenity/recreational function where experience of the landscape is important	Well used for recreation where experience of the landscape is important; or forms part of a view that is important to a recreational experience. May contain National Trails or other long-distance routes.
Perceptual (Scenic)	Landscape with no particular scenic / visual appeal.	Landscape with strong appeal to the senses, particular visual.
Perceptual (Wildness and Tranquillity)	Busy with evidence of human activity, well-lit.	Remote, peaceful or with a sense of wildness. Dark skies.

[160] Landscape Institute (2021), 'Assessing landscape value outside national designations'. Available online: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2021/05/tgn-02-21-assessing-landscape-value-outside-national-designations.pdf (accessed 24 June 2024)

Factors affecting sensitivity	Lower sensitivity to industrial development	Higher sensitivity to industrial development
Function	No important blue/green infrastructure function or important relationship with national landscape designation.	Landscape with important blue/green infrastructure function or strong relationship that is important to a national landscape designation.
Susceptibility		
Scale	Landscapes where scale of development is similar to or smaller than scale of receiving landscape	Landscapes where scale of development is larger than scale of receiving landscape
Openness/enclosure	Enclosed and sheltered landscapes	Open and exposed landscapes
Land cover, landform, complexity and patterns	Complex, intimate or mosaic cover or complex or irregular patterns	Extensive areas of simple or regular landcover or simple and sweeping lines, linear feature and patterns
Built Environment	Within an area of industry or industrial fringe	Established, traditional or historic built character, or open countryside
Key Views and intervisibility	Visually contained and have limited inward or outward views	Extensive views within or of the area from key views
Landscapes that form settings, skylines, backdrops, focal points	Generally low-lying landscapes without a strong visual relationship or association with adjacent areas.	Areas with strong features, focal points that define the skyline; or that form the landscape setting to historic towns or other valued townscapes or landscapes.

Table 8.28: Host Landscape: Arid Scrub LCA

Factors affecting sensitivity	Explanation	Judgement
Designated scenic quality	No national or local landscape designations.	Community
Natural Heritage	Predominantly degraded scrub vegetation interspersed with bare ground and drainage ditches; some annual and semi-permanent irrigated agriculture.	Community
Cultural Heritage	Local cemetery associated with Ejido Rosendo G Castro; roadside memorials on highway 22; indigenous settlements at Paredones	Regional
Landscape condition/ quality	Degraded, vacant landscape with frequent infrastructure and remnant landscape features in the form of irrigation ditches.	Community

Factors affecting sensitivity	Explanation	Judgement
Cultural associations	No known associations with notable people, events or the arts.	Community
Distinctiveness	Elements and features appear commonplace with no important relationship to nearby settlements.	Community
Amenity and recreation	No apparent amenity/recreational function where experience of the landscape is important	Community
Perceptual (Scenic)	Scenic quality is low, with the existing PEMEX and PROMAN industrial works being a major detractor along with frequent overhead lines and towers. There are no attractive views in or out of the aspect area.	Community
Perceptual (Wildness and Tranquillity)	Whilst there is an overall perception of vacancy, human activity along the transport corridors and at existing industrial sites is also prominent.	Community
Function	There is no blue/green infrastructure function other than remnant irrigation ditches.	Community
Overall Judgement of Value		**Community**
Scale	Large scale landscape	Low
Openness/enclosure	This is a topographically flat location, providing an exposed, open landscape.	High
Land cover, landform, complexity and patterns	Extensive areas of simple landcover with simple linear feature and patterns	Low
Built Environment	Within an area of industry or industrial fringe	Low
Key Views and intervisibility	The site lies on the flat coastal plain and has substantial visibility in and out	High
Landscapes that form settings, skylines, backdrops, focal points	This is a low-lying landscape without a strong visual relationship or association with adjacent areas.	Low
Overall Judgement of Susceptibility		**Medium/Low**

Table 8.29: Landscape: Arable Plain LCA

Factors affecting sensitivity	Explanation	Judgement
Designated scenic quality	No national or local landscape designations.	Community
Natural Heritage	Predominantly annual and semi-permanent irrigated agriculture.	Community

Factors affecting sensitivity	Explanation	Judgement
Cultural Heritage	Funeral garden on Carrera Aeropuerto; roadside memorials on highway 22; indigenous settlements at Ninos Heroes and Ohuira	Regional
Landscape condition/ quality	Highly modified annual and semi-permanent irrigated agriculture.	Community
Cultural associations	No known associations with notable people, events or the arts.	Community
Distinctiveness	Typical, commonplace farmed landscape with limited variety or distinctiveness.	Community
Amenity and recreation	No apparent amenity/recreational function where experience of the landscape is important	Community
Perceptual (Scenic)	Primarily a working landscape, with frequent overhead lines and towers. Wide, open vistas but no specific attractive views in or out of the aspect area.	Community
Perceptual (Wildness and Tranquillity)	Dominated by agricultural activity, with further human activity along the transport corridors and associated commercial development and isolated settlement.	Community
Function	There is no significant blue/green infrastructure function other than irrigation ditches associated with agricultural fields.	Community
Overall Judgement of Value		**Community**
Scale	Large scale landscape	Low
Openness/enclosure	This is a topographically flat location, providing an exposed, open landscape.	High
Land cover, landform, complexity and patterns	Extensive areas of simple landcover with simple linear feature and patterns	Low
Built Environment	Established agricultural countryside, with linear infrastructure evident	Medium
Key Views and intervisibility	The site lies on the flat agricultural plain and has substantial visibility in and out	High
Landscapes that form settings, skylines, backdrops, focal points	This is a low-lying landscape without a strong visual relationship or association with adjacent areas.	Low
Overall Judgement of Susceptibility		**Medium/Low**

Table 8.30: Landscape: Ohuira Bay Lagoon LCA

Factors affecting sensitivity	Explanation	Judgement
Designated scenic quality	No national or local landscape designations.	Community
Natural Heritage	Part of an Area of Protection of Flora and Fauna "Islas del Golfo de California", a World Heritage natural site and UNESCO Biosphere Reserve. Ramsar Site no. 2025.	National
Cultural Heritage	Lázaro Cárdenas community has sacred sites representative of cultural heritage, which are important for community rituals and pilgrimages.	Regional
Landscape condition/ quality	Largely undeveloped, natural landscape with unmodified areas of habitat.	Regional
Cultural associations	No known associations with notable people, events or the arts.	Community
Distinctiveness	Distinctive mountainous coastal fringe encloses the lagoon in the south, which is highly visible from a large proportion of the study area forming a recognisable southern horizon.	Regional
Amenity and recreation	Popular area for wildlife tourism, boat tours and fishing	Regional
Perceptual (Scenic)	Distinctive and dramatic landforms resulting from a harmonious combination of water, islands and hilly coastal edge.	Regional
Perceptual (Wildness and Tranquillity)	High levels of tranquillity due to links to nature, presence of wildlife/ birdsong and relative peace and quiet	Regional
Function	Clear relationship between landscape components, wildlife value and associated tourism/fishing activities.	Regional
Overall Judgement of Value		**Regional**
Scale	Large scale landscape	Low
Openness/enclosure	Open and exposed landscapes	High
Land cover, landform, complexity and patterns	Contrasting combination of simple expansive lagoon with dramatic, complex coastal edge landforms	Medium
Built Environment	Open, undeveloped coastal landscape, albeit influenced by existing industry and linear infrastructure (pylons and overhead lines) within the adjacent character area	Medium
Key Views and intervisibility	This coastal lagoon and has substantial visibility in and out, contained only at its southern edge by hilly coastal edge	High

Factors affecting sensitivity	Explanation	Judgement
Landscapes that form settings, skylines, backdrops, focal points	This internationally designated area for wildlife forms the backdrop and skyline for an extensive part of the wider study area.	High
Overall Judgement of Susceptibility		**High/Medium**

Table 8.31: Landscape: Aquaculture LCA

Factors affecting sensitivity	Explanation	Judgement
Designated scenic quality	No national or local landscape designations.	Community
Natural Heritage	Little/no natural heritage value; highly modified.	Community
Cultural Heritage	Low presence of archaeology or historical interests	Community
Landscape condition/ quality	Highly modified to facilitate aquaculture farming, with little no natural landscape features remaining	Community
Cultural associations	No known associations with notable people, events or the arts.	Community
Distinctiveness	Elements and features are generic to this land-use and commonplace across the industry.	Community
Amenity and recreation	No amenity/recreational function.	Community
Perceptual (Scenic)	Scenic quality is low, an intensive farming functional outlook. There are no attractive views in or out of the aspect area.	Community
Perceptual (Wildness and Tranquillity)	A low intensity but highly artificial landscape.	Community
Function	There is no blue/green infrastructure function other than irrigation channels as a functional element of the aquaculture.	Community
Overall Judgement of Value		**Community**
Scale	Medium scale landscape	Low
Openness/enclosure	This is a topographically flat location, providing an exposed, open landscape albeit enclosed by mangrove swamp to the south.	Medium
Land cover, landform, complexity and patterns	Extensive area of simple landcover with simple linear feature and patterns	Low
Built Environment	An area of intensive farming	Low

Factors affecting sensitivity	Explanation	Judgement
Key Views and intervisibility	The site lies at the edge of a flat coastal plain with visibility to the north and east, but contained to the south and west by high coastal fringe landform and mangrove swamp	Medium
Landscapes that form settings, skylines, backdrops, focal points	This is a low-lying landscape without a strong visual relationship or association with adjacent areas.	Low
Overall Judgement of Susceptibility		**Low**

8.1.3.4 Viewpoint analysis

Viewpoint analysis has been undertaken from a total of 6 viewpoints to inform the assessment of the likely magnitude and significance of landscape and visual effects arising because of the Project. The viewpoint locations are illustrated on Figure 5.8 with photographs of each existing view illustrated below as Viewpoints 1 to 6. This viewpoint assessment considers the nature of the predicted view and the scale of change. The wider extent of the effect (beyond the individual viewpoint considered), and its duration, are not captured in the viewpoint analysis (as a single viewpoint cannot capture extent or duration) and are considered in the main body of the assessment. Extent and duration are factors in the overall judgement on magnitude of change, therefore judgements on magnitude of change and overall level of effect and significance are also provided in the main assessment. Observations are made of the baseline landscape and visual characteristics at each of the representative viewpoints. Professional judgements are applied to determine the scale of change attributable to the proposed development (Large, Medium, Small and Negligible) upon landscape character and visual amenity at each individual viewpoint in order to determine the scale of effect.

It should be noted that Table 8.32 considers the nature and scale of changes to character and views at each viewpoint location only. The sensitivity of receptors and wider extent of the effect (beyond the individual viewpoint location) and its duration are considered in the main body of the assessment text below as part of the consideration of the magnitude and significance of effects.

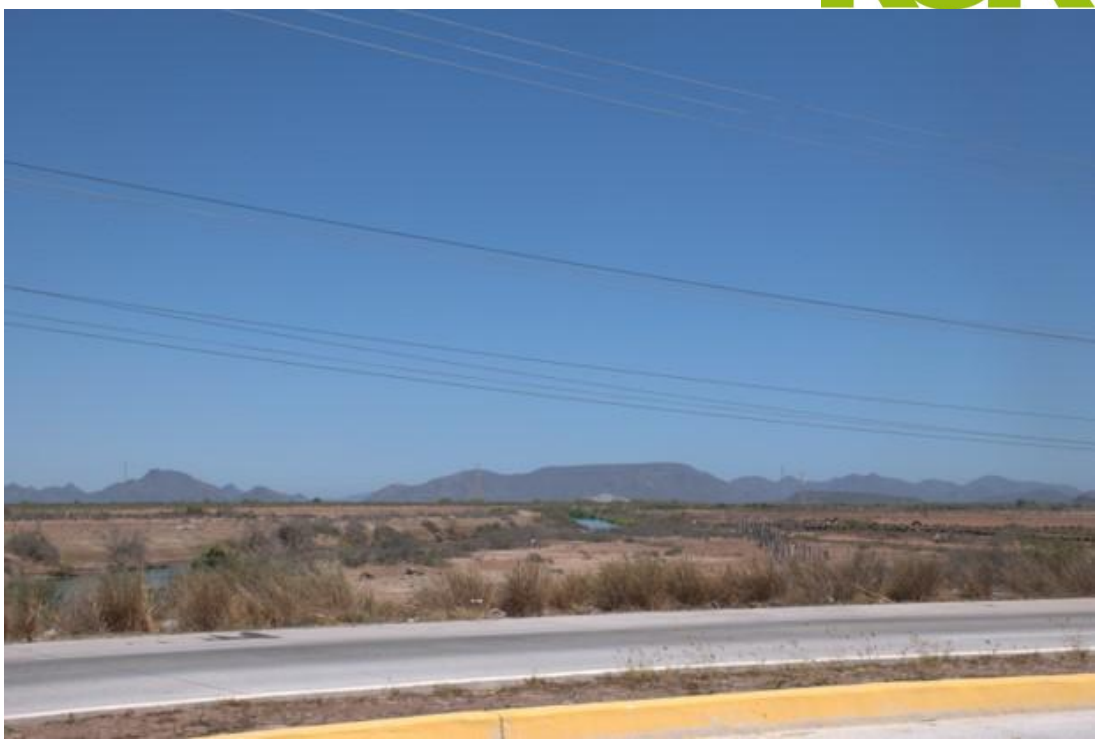


Figure 8.6: Viewpoint 01 – Poultry Farm

Figure 8.7: Viewpoint 02 - Ejido G Rosendo

Figure 8.8: Viewpoint 03 - PEMEX-PROMAN industrial area

Figure 8.9: Viewpoint 04 – Isla de Patos

Figure 8.10: Viewpoint 05 – Lazaro Cardenas

Figure 8.11: Viewpoint 06 - Parque Industrial Topolobampo

Table 8.32: Viewpoint analysis summary

VP	Location	Key features of existing view	Predicted visual change	Predicted change to landscape character
1	Poultry Farm 1.4 km, W Arid plain LCA	Broad, flat, and open arid plain, interrupted by streetlights associated with the road and frequent telegraph poles and overhead wires. This generally 'vacant' landscape, with isolated, low-rise farm sheds, has little vegetation, which is limited to roadside verges and incongruous palm trees along the central reserve of the highway. Focus is drawn to the horizon in the south, where the mountainous coastal edge forms a contrasting shallow enclosure to the view.	Construction: There would be views of the site clearance in the middle distance and of the stripping of vegetation and soils. Construction of the plant site would be clearly evident, along with stockpiles of materials and construction paraphernalia on the laydown areas. Operation: The full vertical and horizontal extent of plant site would be clearly viewed in the middle distance. The development would not screen some longer distance views of the mountainous horizon but would form a highly visible new industrial feature and would slightly reduce the sense of 'big skies. The development would be viewed as an isolated element within this otherwise degraded agricultural landscape.	Construction: There would be an increase in activity associated with earthworks, site clearance and construction within the area of degraded agricultural land which would be uncharacteristic in this view. The topography of the site would be little effected, requiring only a suitable platform for the proposed development. The establishment of the lay down area would require existing vegetation and soils to be stripped, and a suitable hard pad developed. Given the current disturbed nature of this area, this would not be a considerable change to the character of the fields during the construction period. Operation: The proposed development would be perceived as an isolated industrial complex set within this otherwise open and vacant landscape. The reinstated fields and ditches would recreate the existing field and drainage pattern.
2	Ejido G Rosendo 3.5 km, SW Arid plain LCA	Broad, flat, and open arid plain, interrupted by streetlights associated with the road and frequent telegraph poles and overhead wires. Electricity transmission towers draw the focus of the foreground view, running alongside the highway. Scrubby	Construction: Views of construction activity at the plant site would be visible to the NE, albeit as a localised feature in a broad horizon. More immediate views of site clearance and earthworks associated with the trench for the methanol pipeline	Construction: There would be an increase in foreground activity associated with the construction of the methanol pipeline which would be uncharacteristic in this view. The topography of the site would not be noticeably affected. The

VP	Location	Key features of existing view	Predicted visual change	Predicted change to landscape character
		vegetation provides enclosure around the adjacent settlement and cemetery. Existing industrial development is visible to the south, although this does not interrupt the mountainous coastal edge skyline, which forms a contrasting shallow enclosure to the view.	would be evident in the foreground, albeit to the rear of the cemetery and beyond the highway. Construction of the methanol pipeline would be clearly evident, along with stockpiles of materials and construction paraphernalia on the laydown areas. Increased traffic on the highway may be evident with workers travelling to and from temporary worker accommodation nearby. Operation: Limited views of the upper levels of the tallest chimneys to the NE, seen above roadside vegetation. The development would be viewed as an isolated element on the horizon, and at a smaller scale than the transmission towers in the foreground. Reinstatement of the buried methanol pipeline would return the pipeline route to a comparable condition to the existing view.	establishment of the RoW for the pipeline would require existing vegetation and soils to be stripped. Given the current disturbed nature of this area and sporadic vegetation distribution this would not be a considerable change to the character of the fields during the construction period. Operation: The proposed development would be perceived as a distant, isolated industrial complex, comparable to the existing industrial sites to the south but more visible as it is viewed against the horizon. The reinstated fields and ditches along the methanol pipeline would recreate the existing field and drainage pattern.
3	PEMEX-PROMAN industrial area, 5.4 km S Arid plain LCA	Flat, open industrial land, enclosed to the immediate east by the hill landform which separates the industrial area and open landscape to north from Topolobampo further south. The foreground is dominated by a surfaced haulage / HGV area. Topolobampo Bay is visible to the west, below a headland of higher ground where open cast mining is evident. Highway 22, which runs on a causeway across the bay to the west is not prominent in the view.	Construction: Views would be largely screened by existing vegetation along the northeast horizon. Construction activity associated with the methanol pipeline may be discernible to the west, but not prominent in the view. Operation: Distant, limited views of the upper levels of the tallest chimneys of the plant site may be visible over intervening vegetation. The scale of the plant site would	Construction: There would be some short-term increased activity within the landscape that would be just perceptible but with no change in the overall character. Operation: The proposed development would be perceived in the context of the existing industrial complex with no change in landscape/ townscape character.

VP	Location	Key features of existing view	Predicted visual change	Predicted change to landscape character
		Electricity transmission towers form the focus of the view to the north, crossing from left to right and towards the viewer. Industrial development / construction is visible to the northwest horizon, with vegetation associated with the western edge of the PEMEX facility obscuring the northeast horizon and the lower portion of pylons receding in the distance.	appear as a minor element compared to pylons in the view.	
4	Isle de Patos, 4.1 km SE Ohuira Bay Lagoon LCA	'Big sky' view across the lagoon, with the mainland forming a narrow ribbon on the horizon to the north and east. The focus of the view is drawn to the complex peaks associated with the hilly coastal edge to the south and west, with existing industry at PEMEX / PROMAN evident in front. The entirety of the flat horizon is punctuated by electricity pylons, which form a repeating vertical element against the skyline from left to right.	Construction: Distant views of the tallest plant site components will be discernible on the horizon to the north as construction proceeds, albeit occupying a relatively small extent of the overall view. Operation: Distant, views of the plant site will be visible, occupying a relatively small extent of the overall view. The scale of the plant site would appear comparable in scale to the existing pylons, but as a discrete component in the view.	Construction: There would be some short-term increased activity on the distant horizon that would be just perceptible but with no change in the overall character. Operation: The proposed development would be perceived in the context of the existing industrial complex and overhead line pylons, with no change in landscape character.
5	Lazaro Cardenas, 8.4 km SE Ohuira Bay Lagoon LCA	'Big sky' view across the lagoon, with the mainland barely visible to the northwest. The focus of the view is drawn to the lagoon islands in the middle distance to the west (Isla Bledos, Isla Bleditos), and complex peaks beyond associated with the hilly coastal edge enclosing the lagoon to the south and west.	Construction: Views of construction are likely to be barely perceptible at this distance. Operation: Distant, views of the plant site are likely to be barely perceptible at this distance and would in any case occupying a minor extent of the overall view. The focus of the view will remain the 'big sky', lagoon	Construction: Views of construction are likely to be barely perceptible at this distance, with no change in the overall character. Operation: Views of plant site are likely to be barely perceptible at this distance, with no change in the overall character.

VP	Location	Key features of existing view	Predicted visual change	Predicted change to landscape character
			islands and hilly coastal edge to the south and west.	
6	Parque Industrial Topolobampo, 2.5 km NW Agricultural Plain LCA	Broad, flat, and open arable fields, lying beyond Highway 22. Streetlights associated with the road and frequent telegraph poles, overhead wires and communication masts clutter the skyline, exacerbated by roadside advertising billboards which appear incongruous with this otherwise agricultural landscape. Field boundaries are generally open, often surrounded by irrigation ditches. Scrubby vegetation provides enclosure around frequent low scale commercial properties along the roadside, screening most views from individual properties. Focus is drawn to the horizon in the south, where the mountainous coastal edge forms a contrasting shallow enclosure to the view.	Construction: There would be views of the site clearance in the distance and of the stripping of vegetation and soils. Construction of the plant site would be clearly evident, along with stockpiles of materials and construction paraphernalia on the laydown areas. Operation: The plant site would be visible in the middle distance, albeit partially screened by roadside vegetation and built form. The plant site would interrupt some longer distance views of the mountainous horizon to the south and would form visible new industrial feature in the view, slightly reducing the sense of 'big skies. The development would be viewed as an isolated element within this arable agricultural landscape.	Construction: There would be an increase in activity associated with earthworks, site clearance and construction within this farmland, which would be uncharacteristic in this view. The topography of the site would be little effected, requiring only a suitable platform for the proposed development. Given the current disturbed nature of this area, this would not be a considerable change to the character during the construction period. Operation: The proposed development would be perceived as an isolated industrial complex set within this otherwise open agricultural landscape.

Each of the viewpoints is a 'sample' of the potential effects, representing a wide range of receptors – including not only those at the viewpoint, but also those nearby, at a similar distance and/or direction. From these viewpoints it can be seen that the distribution of effects would be as follows:

Effects on character:

- Large and medium scale effects would be unlikely throughout much of the study area and would be limited to the site and its immediate environs; such large-scale effects are inevitable given the proposed change from a degraded agricultural landscape to an industrial development. How rapidly effects diminish beyond the plant site is dictated by the scale of the Project, the context and visibility of the proposal.
- Effects would rapidly reduce to small scale in the large-scale open landscape to the northwest and west, from where the influence of existing infrastructure and development becomes less differentiated.
- Effects on landscape character are judged to reduce to negligible beyond these areas, primarily to the south and east, from where the proposals would be viewed in the context of the existing visible edge of the PEMEX and GPO industrial areas which are already an influence at a similar distance.

Effects on views:

- The extent of large-scale visual effects, where the Project would form a major alteration to key elements, features, qualities and characteristics of the view such that the baseline would be fundamentally changed, would generally be limited to locations within or immediately adjacent to the site.
- Beyond this area, medium scale visual effects would arise within an area up to 3.5 km, decreasing to small scale beyond as the Project is increasingly seen in the context of other tall structures (electricity pylons) and industrial areas.
- Beyond approximately 5 km from the plant site boundary, the scale of visual effects would reduce to Negligible due to the distance over which views would be experienced.

8.1.3.5 Effects on landscape character

Descriptions for each of the assessed character areas are briefly summarised below, along with further observations from site-based work.

Based on the assessments of the scale of effects at viewpoints as set out above, some of the character areas identified in Section 5.2.3 would experience negligible effects and do not require detailed assessment:

- Ohuira Bay Lagoon LCA (1.2 km, E) – whilst the Project would be a noticeable and disconnected addition to the western horizon, this would be perceived as a very minor element viewed in the context of existing industrial sites further south as well as the frequent electricity pylons apparent from the closest parts of this character area. Mitigation for the Project will conserve a coastal area immediately south of the plant site, providing a buffer between the Project and this LCA and thereby mitigating potential effects upon it. The key characteristic of this area, the contrasting wide, open bay and craggy dramatic peaks of the coastline to the south would be unaffected.
- Aquaculture LCA (3.8 km, SW) – due to intervening distance and vegetation, visibility is likely to be very limited from within this character area and would tend to be mostly negligible scale where views are available.

8.1.3.5.1 Arid scrub LCA

As shown on Figure 5.8, this character area includes the site and extends to the south to Topolobampo, along the lagoon coastal fringe to the NE, and beyond the study area to the west.

Key characteristics are identified as:

- Large scale, open, textured, predominantly vacant and fragmented landscape
- Flat, unenclosed arid plain, with sporadic vegetation
- Areas of annual and semi-permanent irrigated agriculture
- Los Mochis-Topolobampo highway, billboards, road lighting, railway, and frequent telegraph poles, electricity pylons and associated overhead lines
- Prominent industry in the south, and Los Mochis airport to the northwest
- Isolated, scattered settlements
- Fragmented coastal lagoon edge
- Distant views to rugged dramatic coastline peaks.

As identified within above, the susceptibility of this character area is judged to be Medium/Low. This large-scale landscape of simple linear features and existing industrial influences has a weak transitional structure with evidence of degradation and several detracting features. This would suggest a low susceptibility to the Project, increased only by the openness and extensive views in and out of this landscape. As described at Section 5.2.3 above, the value of the landscape within this character area/type is judged to be Community. The natural heritage is already degraded and heavily modified, with linear infrastructure dominant (particularly to the east of the LCA). Whilst there are infrequent and isolated cultural heritage features, there are no significant cultural associations or amenity/recreational functions, and scenic quality is low. Considering susceptibility and value together the sensitivity is judged to be medium/low.

As described in Section 8.1.3.2 above, large scale effects would occur across the plant site itself due to the change from agricultural to industrial character. The scale of change would rapidly reduce to Medium in the immediate environs of the plant site. Beyond these distances, and in all other directions, effects on landscape character would be no greater than small.

The primary change in landscape character would arise from a limited change in landcover from remnant agricultural fields to an industrial facility.

The plant site would introduce a prominent vertical development into a landscape of wide, open horizons. However, this would be of limited extent and would be comparable with the scale of other elements of this character area (e.g. PEMEX/GPO industrial facilities and electricity pylons).

The operation of the Project would introduce regular movement of vehicles and plant within the site, although much of this would be screened by walls / fencing surrounding the site and not uncharacteristic of the existing transport routes that cross this area.

Construction of the buried water and methanol pipelines would require vegetation clearance and excavations along extensive tracts of land through this LCA. However, these generally follow existing linear features in the landscape (road verges, field boundaries), and ground levels would be reinstated on completion. Whilst it is likely that any vegetation removed would not be replaced within the immediate pipeline corridors,

this would not alter the sense of openness or enclosure in the landscape due to the scattered nature of existing vegetation cover.

Overall, the Project would occupy a very small proportion of the overall LCA. The construction works and operation of the Project would therefore result in direct short-term and long-term effects on the landscape character of this part of the LCA, and perceptual/experiential effects on part of the wider LCA, as described above. Effects on the majority of the LCA, particularly the western/southern part of the character area more distant from the site, would be very limited.

During construction, the magnitude of effect is therefore assessed as **medium/low** within the plant site (which covers only a very limited geographic extent of the whole LCA), reducing to **low (2)** within the immediate environs of the site, and **very low (1)** for the more distant western/southern part of the LCA. During operation, the magnitude would be **medium (3)**, **low (2)** and **very low (1)** respectively. With medium-low sensitivity, this would result in a short-term **minor** and permanent **moderate-minor** Adverse effect, reducing to **negligible** with increasing distance from the site. This is considered to be **not significant** at the scale of the site and for the LCA as a whole.

8.1.3.5.2 Agricultural plain LCA

As shown on Figure 5.8, this character area extends north from the plant site and beyond the study area to Los Mochis.

Key characteristics are identified as:

- Flat, open and large-scale arable landscape, defined by uniform structure of rectilinear fields
- Scrub and isolated trees associated with field margins and highway / property boundaries
- The Los Mochis-Topolobampo highway, billboards, road lighting, railway, and frequent telegraph poles, electricity pylons and associated overhead lines
- Minor settlements and frequent isolated farms, businesses and residential properties, focussed along main transport routes
- Distant views to the south of the rugged, elevated coastline peaks

As identified above the susceptibility of this character area is judged to be medium/low. This large-scale landscape is simple, modified arable farmland with common/ indistinct features and minimal variation in landscape pattern. As with the Arid Scrub LCA, this would suggest a low susceptibility to the Project, but it also shares similar openness and extensive intervisibility. As described in Section 5.2.3 above the value of the landscape within this character area/type is judged to be Community. This is an undesignated landscape with few, if any distinct features and various degrading elements. Considering susceptibility and value together the sensitivity is judged to be medium/low.

As described in Section 8.1.3.2 above, there would be no direct impacts in this area resulting in any existing landscape elements being lost because of the Project. Effects on the LCA would therefore be experiential/perceptual only. An increase in activity associated with the Project would be evident during construction and operation when the plant site would interrupt a small part of the southern horizon. The scale of change would be greatest in the southern margin of the LCA, within 2.5 km of the plant site. In this area the plant site would be perceived as an isolated, industrial facility, breaking and extending

above the distant skyline of the rugged, elevated coastline peaks to the south. This would result in a small scale of change in a localised part of the LCA. Beyond these distances, the plant site would be either generally viewed against the elevated coastline or screened by intervening vegetation, landform or built form, and effects on landscape character would be negligible.

Short and long-term effects on this character area during both construction and operation would be of **low (2)** magnitude in the southern extent of this LCA, reducing to **low-very low** with increasing distance north. At most the significance would be **minor** (**not significant**) and adverse, reducing with distance to be **minor-negligible** for the majority of the LCA.

8.1.3.6 Visual effects

Based on the assessments of the scale of effects at viewpoints as set out in Section 8.1.3.2 above, some of the visual receptors identified in Section 5.2.3.7 would experience negligible effects and do not require detailed assessment. These are additional to those already discounted from further assessment as part of the baseline review:

- PEMEX / GPO industrial area (4.2 km, south) – This receptor group is located at the southern tip of the Arid Plain LCA, immediately north of the distinct hill landform which separates the industrial area and open landscape to north from the Topolobampo settlement further south. This receptor group is of Low sensitivity to change. A panoramic view opens to the north towards the plant site location, across an isolated area of mangrove. During construction and operation, the scale of change would be negligible, with the Project being a Limited part of the overall view. Effects on this area would be of negligible magnitude, negligible significance and would be neutral in nature (not significant).

8.1.3.6.1 Visual receptor groups

This assessment focuses on effects on groups of visual receptors, incorporating effects on views from public spaces and streets within neighbourhoods. The assessment of effects focuses on the visual amenity of public spaces, though views from groups of dwellings would also be noted in the descriptions.

Poultry farm (1.4 km, west)

This receptor group comprises low-rise agricultural sheds and associated commercial buildings located immediately east of the Los Mochis-Topolobampo highway. Users include people at work. This receptor group is of **low (2)** sensitivity to change.

The Project would appear as a visually prominent feature, occupying an Intermediate extent of the view to the east, above the flat horizon. It would have a medium-scale effect because of a noticeable change in the view, albeit it would not obscure characteristic views to the mountainous coastal edge to the south. The Project would be viewed in the context of other infrastructure in this broad corridor, including the overhead electricity line towers that run perpendicular across the view.

Short-term effects on this area during construction would be **medium/low** magnitude, **minor** significance (**not significant**) and **adverse**. Permanent effects during operation would be **medium (3)** magnitude, **moderate/minor** significance (**not significant**) and **adverse**.

Campo Guadalupe Estrada (2.4 km, north east)

This receptor group comprises a small settlement of approximately 50 residential dwellings, located within farmland between the railway line and lagoon coastline. This receptor group is of High/Medium sensitivity to change.

The south-eastern edge of the settlement is formed by the primary access road from the Los Mochis-Topolobampo highway. On the approach to the settlement, the road verges and field boundaries are increasingly vegetated. This, in tandem with similar boundary vegetation to individual properties and the density of built form within the settlement itself would result in mainly glimpsed views of the Project, appearing as a Localised component in the view where these are available.

Short-term effects on this area during construction would be **very low (1)** magnitude, **minor/negligible** significance (**not significant**) and **adverse**. Permanent effects during operation would be **low (2)** magnitude, **moderate/minor** significance (**not significant**) and **adverse**.

Paradones (3 km, northeast)

This fishing community is located on the lagoon coast, southeast of Campo Guadalupe Estrada. This receptor group is of high/medium sensitivity to change.

No access to the area was available for site surveys, but a review of desk-top mapping and aerial imagery suggests a similar settlement form to Campo Guadalupe Estrada. Therefore, a combination of vegetation to individual property boundaries and the density of built form within the settlement itself is assumed, with properties generally focussed on the coastal outlook across the lagoon immediately east. This would result in mainly glimpsed views of the Project, appearing as a limited component in the view where these are available.

Short-term effects on this area during construction would be **very low (1)** magnitude, **minor/negligible** significance (**not significant**) and **adverse**. Permanent effects during operation would be **low/very low** magnitude, **minor** significance (**not significant**) and **adverse**.

Ejido Rosendo G. Castro (3.5 km, southwest)

This receptor group comprises a small settlement of approximately 200 residential dwellings, located immediately west of the Los Mochis-Topolobampo highway. It includes Ejido Topolobampo (an extension of the same settlement form immediately to the south), and a community cemetery at the northeast corner of the settlement, on the other side of the Los Mochis-Topolobampo highway. This receptor group is of High/Medium sensitivity to change.

The settlement is situated on flat ground and is laid out on a grid of unmade roads that run perpendicular to the Los Mochis-Topolobampo highway. The orientation of this grid would limit any views along the settlement streets towards the plant site, and views from perimeter properties would be generally screened by existing vegetation already present along the boundaries with the Los Mochis-Topolobampo highway. The Project would be Localised in any views from the settlement and viewed in the context of the Los Mochis-Topolobampo highway in the foreground and its scale would appear comparable with existing electricity overhead line towers.

The western part of the cemetery is heavily vegetated, which is likely to screen views of the Project. Desk-top information suggests that the eastern part of the cemetery is less vegetated, affording more open views towards the plant site and construction of the methanol pipeline. Whilst construction of the pipeline would represent a medium scale of change in the view from this area, this would reduce following reinstatement of the pipeline route during operation. The plant site would form a Localised component of an extensive panoramic view, and like the adjacent settlement it would be seen in the context of overhead electricity line towers.

Short-term effects on this area during construction would be **medium/low** magnitude, **moderate** significance (**not significant**) and **adverse**. Permanent effects during operation would be **low (2)** magnitude, **moderate/minor** significance (**not significant**) and **adverse**.

Isla de Patos (4.1 km, southeast)

This uninhabited island forms part of the RAMSAR designation, the "*Islas del Golfo de California*" Area of Protection of Flora and Fauna and the World Heritage natural site and UNESCO Biosphere Reserve. Users include frequent small boats associated with fishing and wildlife tourism. This receptor group is of High sensitivity to change.

During construction and operation distant views of the tallest plant site components would be discernible on the horizon to the northwest, albeit occupying a Limited extent of the overall view. The scale of the plant site would appear comparable in scale to the existing pylons, but as a discrete component in the view and would not detract from the principal focus of the view towards the rugged, elevated coastline enclosing the lagoon to the southeast.

Short-term effects on this area during construction would be **low (2)** magnitude, **moderate/minor** significance (**not significant**) and **adverse**. Permanent effects during operation would be **low (2)** magnitude, **moderate/minor** significance (**not significant**) and **adverse**.

Parque Industrial Topolobampo (2.5 km northwest)

This receptor group comprises various mainly commercial properties located in a 2 km strip primarily on the western verge of the Los Mochis-Topolobampo highway, north of Carrera Aeropuerto. Users include people at work, and the receptor group considered to be of **low (2)** sensitivity to change.

Many properties have enclosed boundaries with the Los Mochis-Topolobampo highway, either in the form of walls, fences or vegetation. Views southeast to the plant site are therefore generally restricted. Similarly, those properties on the eastern side of the road tend to be heavily vegetated to the rear, where an irrigation channel runs parallel with the highway. Where views are available, construction of the plant site would be clearly evident, along with stockpiles of materials and construction paraphernalia on the laydown areas. Similarly, during operation the plant site would be visible in the middle distance, albeit partially screened by roadside vegetation and built form. The plant site would interrupt some longer distance views of the mountainous horizon to the south, representing a medium scale of change and a localised new component in the view.

Short-term effects on this area during construction would be **medium/low** magnitude, **minor** significance (**not significant**) and **adverse**. Permanent effects during operation

would be **medium (3)** magnitude, **moderate/minor** significance (**not significant**) and **adverse**.

8.1.3.6.2 Key routes

Los Mochis-Topolobampo highway – this route originates south of Los Mochis. This flat, straight highway extends in a broadly southerly direction across the farmland and arid scrub to Topolobampo. The highway provides access to the minor road network, unmade farmland access tracks, settlements and farmsteads. At its closest point, it lies approximately 1.4 km west of the plant site. Users of this road are of **low (2)** sensitivity.

Due to the openness of the landscape, the Project is likely to be visible over an intermediate extent of the route, albeit views will be frequently filtered by roadside vegetation. Where visible, the plant site would be oblique to the direction of travel and be experienced by road users travelling in both directions.

Overall, the scale of visual change for the section of the road with predicted visibility is small, resulting in short-term effects of **low (2)** magnitude and **minor** significance (**not significant**) during construction, and permanent effects of **moderate/slight** magnitude and **minor** significance (**not significant**) during operation.

8.1.3.7 Summary of landscape and visual effects

Effects on the receptors assessed are summarised in the Table 8.33 below.

The effects upon the Arid Scrub LCA would be at most **minor** significance (**not significant**) during construction and **moderate/minor** significance (**not significant**) during operation. The Project would result in a slight deterioration of the quality and integrity of the landscape because of the introduction of a further industrial component into this arid landscape. There would be limited loss of valued features within an area where significant industrial facilities and infrastructure are an existing characteristic of the wider landscape. There would be no direct impacts on the agricultural plain landscape character area, but extensive intervisibility with the Arid Scrub LCA would result in at most **minor-negligible** effects (**not significant**) upon this area at most.

Given its scale, views of the Project from receptor groups in such an open landscape are inevitable. However, short-term effects would be at most **moderate** significance (**not significant**) during construction and permanent effects would be at most **moderate/minor** significance (**not significant**) during operation. These effects are the result of a combination of the distance between the plant site and higher sensitivity receptors and localised intervening vegetation/built form in the vicinity of the receptors themselves.

For road users on the Los Mochis-Topolobampo highway, short-term and permanent visual effects would be **minor** significance (**not significant**). From other routes effects would be **negligible** significance (**not significant**).

In summary, the permanent landscape and visual effects would be at most **moderate/minor** significance (**not significant**) and **adverse** and the landscape would have the capacity to accommodate this Project.

Only effects of greater than negligible magnitude and/or negligible significance are included in the summary table, significant effects are underlined.

Table 8.33: Summary of landscape and visual effects

Receptor	Description	Sensitivity	Magnitude	Significance	Beneficial /Neutral /Adverse
Landscape Character					
Arid Scrub LCA	Short-term effects on the plant site and pipeline routes, rapidly diminishing with distance from these areas, during construction	Medium-Low	Medium-Low	**Minor (4)**	Adverse
	Permanent effects on the plant site, rapidly diminishing with distance from the plant site, once completed		Medium (3)	**Moderate-Minor (6)**	
Agricultural Plain LCA	Short-term experiential/perceptual effects, rapidly diminishing with distance from the southern edge of the LCA, during construction	Medium-Low	Low (2)	**Minor (4)**	Adverse
	Permanent experiential/perceptual effects, rapidly diminishing with distance from the southern edge of the LCA, once completed		Low (2)	**Minor (4)**	
Visual Receptor Groups					
Poultry Farm	Short-term effects arising from views of the construction work at the plant site on people working in or visiting this receptor group.	Low	Moderate-Slight	**Minor (4)**	Adverse
	Permanent effects arising from views of the completed development on people working in or visiting this receptor group.		Moderate	**Moderate-Minor (6)**	
Campo Estrada	Short-term effects arising from views of the construction work at the plant site on people living in, working in or visiting this receptor group.	High-Medium	Negligible	**Minor-Negligible (3)**	Adverse

Receptor	Description	Sensitivity	Magnitude	Significance	Beneficial /Neutral /Adverse
	Permanent effects arising from views of the completed development on people living in, working in or visiting this receptor group.		Slight	**Moderate-Minor (6)**	
Paradones	Short-term effects arising from views of the construction work at the plant site on people living in, working in or visiting this receptor group.	High-Medium	Negligible	**Minor-Negligible (3)**	Adverse
	Permanent effects arising from views of the completed development on people living in, working in or visiting this receptor group.		Slight-Negligible	**Minor (4)**	
Ejido G Rosendo	Short-term effects arising from views of the construction work at the plant site and methanol pipeline on people living in, working in or visiting this receptor group.	High-Medium	Moderate-Slight	**Moderate (8)**	Adverse
	Permanent effects arising from views of the completed development on people living in, working in or visiting this receptor group.		Slight	**Moderate-Minor (6)**	
Isla de Patos	Short-term effects arising from views of the construction work at the plant site and methanol pipeline on people working in or visiting (recreation/tourism) this receptor group.	High-Medium	Slight	**Moderate-Minor (6)**	Adverse
	Permanent effects arising from views of the completed development on people working in or visiting (recreation/tourism) this receptor group.		Slight	**Moderate-Minor (6)**	
Parque Industrial Topolobampo	Short-term effects arising from views of the construction work at the plant site and JAPAMA	Low	Moderate-Slight	**Minor (4)**	Adverse

Receptor	Description	Sensitivity	Magnitude	Significance	Beneficial /Neutral /Adverse
	pipeline on people working in or visiting this receptor group.				
	Permanent effects arising from views of the completed development on people working in or visiting this receptor group.		Moderate	**Moderate-Minor (6)**	
Key Routes					
Los Mochis-Topolobampo highway	Short-term effects arising from views of the construction work at the plant site, water and methanol pipelines on people travelling in either direction on this route.	Low	Low	**Minor (4)**	Adverse
	Permanent effects arising from views of the completed development on people on people travelling in either direction on this route.		Moderate-Slight	**Minor (4)**	

8.1.4 Soils

This section discusses the potential impacts to soil receptors during construction and operations of the Project.

8.1.4.1 Construction phase

All of the land that will be used for construction of the Project components is of negligible impact significance for agricultural use and importance for livelihoods (see social impact assessment section). The access road route is located along an existing road though fields and along an agricultural drainage creek. Any clearance of topsoil during site preparations will be deposited on degraded agricultural lands (SLR Consulting Limited, 2022) in accordance with a Topsoil Management Plan or procedure.

8.1.4.1.1 Methanol production plant

Activity: Land clearance

Impact: Loss of topsoil

The land that will be used for construction of the plant is of negligible impact significance for agricultural use and importance for livelihoods. The magnitude of the impact to the existing soil for the methanol plant land clearance is therefore considered to be **very low**, the sensitivity is **low**, and therefore the impact significance is **negligible (2).**

The land that will be used for construction of the plant is of negligible impact significance for agricultural use and importance for livelihoods. The magnitude of the impact to the existing soil for the methanol plant land clearance is therefore considered to be **very low**, the sensitivity is **low**, and therefore the impact significance is **negligible (2).**

Activity: Preparation of site

Impact: Depletion of natural resources, for example, aggregate

Aggregate will be needed as fill material for raising the elevation of the land at the plant site. Approximately 731,691 m^3 of material will be taken from the local quarry located immediately to the west of the Los Mochis-Topolobampo highway, north of the town of Topolobampo (coordinates 695003.42 m E 2835434.01 m N (UTM12N)). The extraction and use of aggregate constitutes the use of non-renewable natural resources. The extraction and use of the material from the quarry will be undertaken in accordance with an existing permit.

The magnitude of the impact is therefore considered to be **very low**, the sensitivity is **low**, and therefore the impact significance is **negligible (2).**

Methanol pipeline, JAPAMA pipelines and access road

Activity: Excavation of trench for pipeline

Impact: Loss of topsoil causing reduced fertility and impaired reinstatement

Preparation of the pipelines' RoW and construction of the access road, including removing vegetation, topsoil stripping and benching, will affect soil structure and stability. This may increase the risk of erosion, particularly where the soil has poor cohesion or there are steep slopes. The erosion risk is expected to be highest during wet weather, when runnels may develop, and it will be exacerbated by vehicle movements.

Topsoil removed from the RoW will be stored at the edge of the working area pending replacement during reinstatement. Topsoil stockpiles can be poorly consolidated, so prone to erosion and soil loss via wind erosion or washout by rainfall.

Soil stability at areas that exhibit active erosion could be made worse by pipeline construction activities, or erosion could be triggered in areas with erosion potential.

The land that will be used for construction of the Project components is of negligible impact significance for agricultural use and importance for livelihoods. The magnitude of the impact to the existing soil for the methanol plant land clearance is therefore considered to be **very low**, the sensitivity is **low**, and therefore the impact significance is **negligible (2)** (see Table 8.34)**.**

Activity: Management of waste and accidental release of fuel and chemicals

Impact: Soil contamination

Construction activities have the potential to produce soil contamination. The principal potential contaminants associated with the construction activities are:

- fuels and lubricating oils
- hazardous wastes
- welding wastes
- field coating materials

- paints and solvents.

Potential indirect impacts from contamination of soil include:

- impacts on the viability of terrestrial flora and fauna
- damage to the viability of aquatic vegetation and fish through contaminants leaching into watercourses
- impacts to groundwater quality through leaching and mobilisation of contaminants from the shallow soil.

The pre-mitigation impact for solid and liquid waste disposal and accidental release of oil or chemicals during construction is considered **negligible (2)** because of the **very low (1)** magnitude, **low (2)** sensitivity, short duration, and site-specific extent of the potential impact (see Table 8.34).

Table 8.34: Impacts to soils during the construction phase

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Methanol Plant					
Land clearance	Loss of topsoil	Very Low (1)	Low (2)	**Negligible (2)**	N
Preparation of site	Depletion of natural resources, for example, aggregate	Very Low (1)	Low (2)	**Negligible (2)**	N
Methanol pipeline and JAPAMA pipelines and access road					
Excavation of trench for pipelines	Loss of topsoil causing reduced fertility and impaired reinstatement	Very Low (1)	Low (2)	**Negligible (2)**	N
Management of waste and accidental release of fuel and chemicals	Soil contamination	Very Low (1)	Low (2)	**Negligible (2)**	N

8.1.4.2 Operations phase

No sources of impacts to soil during the planned operations phase have been identified.

8.1.5 Surface water and groundwater

This section discusses the potential impacts to water receptors during construction and operations of the Project. No water abstraction is planned during either construction or

operation of the Project. The methanol pipeline route crosses drainage channels at locations that are presented in the baseline section. The JAPAMA pipeline route crosses drainage channels at several locations (see baseline section for details).

8.1.5.1 Construction phase

8.1.5.1.1 Surface water

There are no surface water bodies within the AoI of the Methanol Plant and therefore no further assessment of impacts from construction of the plant is required.

Methanol pipeline and JAPAMA pipelines

Activity: Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

There is the potential for direct impacts on surface water quality in receiving watercourses from the following sources:

- the management of solid and liquid waste generated during the construction process
- the management of surplus water (trench water) from working areas
- the accidental release of oil or chemicals during construction.

The principal potential contaminants associated with the construction activities are:

- fuel and lubricating oils
- hazardous waste
- paints and solvents.

Surface water contamination may increase downstream substance concentrations with indirect impacts on water supplies for aquatic biodiversity.

The irrigation channels have good water quality and therefore have moderate sensitivity to contamination.

The pre-mitigation impact for the management of liquid waste and surplus water, and the accidental release of oil or chemicals in watercourses during construction is considered **minor (3)** because of the **very low** magnitude (1), **medium** sensitivity (3) transient duration and local extent of the potential impact.

Activity: Excavation of pipeline trenches and horizontal directional drilling (HDD)

Impact: Sediment contamination of surface waters

Direct impacts from erosion-causing and sediment-generating activities may occur during construction, including from vegetation removal and topsoil stripping.

Sediment suspended in runoff from construction areas may be transported to downstream receptors. It may also be released to watercourses during soil handling, using vehicles in watercourses and during the excavation of trenches. Sediment reduces light levels within the water column and can therefore have an indirect impact on aquatic biodiversity.

Horizontal directional drilling methods will be used at surface water crossings may affect the stability of the bed and banks of watercourses formed in uncohesive alluvial material. Natural processes of channel erosion and deposition may be exacerbated, resulting in an indirect impact on agricultural land.

The pre-mitigation impact for erosion and increased suspended sediment in watercourses during construction is considered **moderate (6)** because of the low magnitude (2), medium sensitivity (3), short duration and local extent of the potential impact.

Groundwater

Methanol production plant and both pipelines

No water abstraction is planned during either construction or operation of the Project. Groundwater is relatively shallow, and water quality is generally good in the AoI; potential impacts may occur to groundwater quality (see baseline section). No wells were identified in the AoI as stated in the baseline section. The comprehensive safety measures implemented in both the pipeline system and the methanol storage area will significantly limit the potential for groundwater contamination from methanol leaks. The advanced leak detection technology, combined with a robust pipeline design, automatic blocking system, and enhanced storage safeguards, ensures that the risk of contamination is minimised. These precautions, along with adherence to the highest safety standards, will protect groundwater sources from any potential harmful impacts from methanol leakage. In addition, no impacts to the quality of the water will result due to the soluble and biodegradable nature of methanol.

Activity: Excavation of pipeline trenches

Impact: Reduced flow of groundwater due to dewatering or other trenching activities below the water table

No wells were identified in the AoI as stated in the baseline section. The pre-mitigation impact of excavation during construction is considered **minor** because the magnitude is very low (1), sensitivity is likely to be medium (3), the duration is transient, and the extent is site-specific.

Activity: Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of groundwater

Potential direct impacts on groundwater quality may occur due to the storage, transportation, treatment and disposal of solid and liquid waste, chemicals and fuel.

The pre-mitigation impact of waste management and accidental release of oil or chemicals during construction is considered **minor** because the magnitude is very low (1), sensitivity is likely to be medium (3), the duration is transient, and the extent is site-specific.

Table 8.35: Impacts to surface water and groundwater during Project construction

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Surface Water					
Methanol pipeline and JAPAMA pipelines					
Management of Waste and Accidental Release of Oil or Chemicals	Contamination of surface water	Very Low (1)	Medium (3)	**Minor (3)**	N
Excavation of pipeline trenches	Erosion of channel banks, sediment contamination of surface waters	Low (2)	Medium (3)	**Moderate (6)**	Y
Groundwater					
Methanol Plant and both pipelines					
Excavation of pipeline trenches	Reduced flow of groundwater due to dewatering or other trenching activities below the water table	Very Low (1)	Medium (3)	**Minor (3)**	N
Management of waste and accidental release of fuel and chemicals	Contamination of groundwater	Very Low (1)	Medium (3)	**Minor (3)**	N

8.1.5.1.2 Mitigation measures

During the construction of the pipelines and the trench excavation works, measures will be required to reduce the significance of the potential impact to the irrigation channels and other surface water receptors. Although the significance of contamination of surface water is minor, the below measures also include good practice to reduce potential impacts. These comprise:

- At crossings under irrigation channels and other surface water bodies, exercise extra vigilance to avoid soil and other material from entering the channel/surface water body.
- Location specific method statements for HDD at watercourse crossings will be prepared where necessary to address construction activities at irrigation channels crossed by the methanol pipeline and the JAPAMA pipelines.

- Survey, maintain integrity of, and reinstate where necessary existing irrigation and drainage infrastructure
- Appropriate transportation, storage, handling and disposal of hazardous materials
- Refuelling away from sensitive areas and according to defined procedure
- Spill response preparedness (procedure, spill kits, training)
- HDD muds to be water based
- The discharge of any waste into intermittent runoff, irrigation canals, or to the Bay of Ohuira will be prohibited. Mexinol will not discharge wastewater to the Bay of Ohuira, all water will be retreated and recycled in the Mexinol WWTP (Mexinol, 2021).
- Discharge of any dewatering water during HDD will be monitored to prevent impacts to surface water and groundwater quality and will be in accordance with the Mexican regulations (e.g. permits).

8.1.5.2 Operations phase

8.1.5.2.1 Surface Water

No potential impacts to surface water have been identified during the normal operation of the methanol plant and the pipelines. Potential accidental leaks of methanol to the irrigation channel may occur; no impacts to the quality of the water will result from that due to the soluble and biodegradable nature of methanol.

Wastewater from the treatment plant at the Mexinol plant that is returned to the JAPAMA treatment plant as reject water for treatment.

8.1.5.2.2 Groundwater

No potential impacts to groundwater have been identified during the normal operation of the methanol plant and the pipelines. Should methanol accidentally leak to the groundwater; no impacts to the quality of the water will result from that due to the soluble and biodegradable nature of methanol.

8.1.6 Wastewater

The water that will be returned to JAPAMA will be a combination of cooling tower blowdown water and reverse osmosis treatment reject water. These streams will be combined and neutralised before returning to Japama. The return stream will be fully compliant with WBG EHS Guidelines for Water and Sanitation (2007), as well as those of the official Mexican standards (NOM-001-SEMARNAT-2021 and NOM-002-SEMARNAT-1996). NOM-001-SEMARNAT-2021 would be applicable if Mexinol discharged directly to the Bay of Ohuira (and is provided for comparison purposes only). NOM-002-SEMARNAT-1996 is applicable for discharges to municipal treatment facilities. This data is presented in Table 3.8.

The relationship between Mexinol and JAPAMA is expected to generate significant benefits for JAPAMA, particularly in terms of environmental impact reduction, water management, and operational support. The return effluent quality stream will be fully compliant with WBG General EHS Guidelines -Wastewater and ambient water quality

(Table 1.3.1 – Indicative values for treated sanitary sewage discharges) as well as those of the official Mexican standards (NOM-002-SEMARNAT-1996). Contrary to any concerns, there will be no negative impact on JAPAMA's Water Treatment Plant (WTP) from Mexinol's operations. Specifically, the facility will source wastewater from JAPAMA open lagoons, the municipal wastewater treatment provider in Los Mochis, for its industrial processes—including cooling and steam generation—and will return to treated effluent compliant with national effluent standards and WBG EHS guidelines effluent levels to the same facility for further treatment and discharge.

This approach demonstrates a resource-efficient and circular water strategy, whereby the Project avoids abstraction from freshwater ecosystems. The initiative represents a first-of-its-kind industrial water reuse model in the region, helping to minimize water-related impacts and safeguard local water availability for other users and ecosystems.

The Project will reduce the volume of wastewater that JAPAMA discharges into the Bay, after pretreatment in oxidation ponds (open lagoons). In fact, Mexinol's efforts to optimise water use will indirectly enhance JAPAMA's operations and the overall quality of water management in the region.

One of the key environmental benefits is that Mexinol's water usage processes will reduce the overall burden on the Ohuira Lagoon, which currently receives a large percentage of drainage water. A significant amount of wastewater that would otherwise flow into the JAPAMA lagoons will be redirected by Mexinol's processes, thereby helping alleviate some of the stress on the lagoon's ecosystem. By reducing the volume of water entering the lagoon, Mexinol helps to mitigate potential negative environmental impacts associated with over drainage and surface water further quality degradation, thus contributing to the improvement of the ecological lagoon and surrounding ecosystems.

Furthermore, a critical advantage lies in the quality of the treated wastewater discharged back to JAPAMA's oxidation ponds which is 3,840 m³/day. This treated effluent, after passing through Mexinol's internal treatment processes, will comply with national effluent standards and WBG EHS guidelines effluent levels and as a result, it can positively contribute JAPAMA's treatment system, by reducing the overall pollutant load, enhancing the efficiency of oxidation ponds biological treatment, and potentially lowering the JAPAMA's operational burden.

8.1.6.1 Waste management infrastructure capacity

Waste impacts have been assessed throughout the impact assessment sections, including impacts to soil – potential soil contamination from waste management (Section 8.1.4.1 of the ESIA); impacts to surface water and groundwater – potential contamination from waste management (Section 8.1.4.1 of the ESIA); and impact of waste accumulation on biodiversity (throughout Section 8.2 of the ESIA).

However, the planned activities of the Project will generate various hazardous and non-hazardous wastes during construction, operation and decommissioning stages. Many of these wastes will be recycled, treated and/or disposed using waste management infrastructure in Mexico, specifically in Sinaloa (see Section 3.12.3). This assessment addresses the potential impacts on the capacity of Mexico's waste management infrastructure to accommodate the needs of the Project as well as other non-project needs. While it is anticipated that the Project will first identify options for reuse or recycling

of decommissioned equipment from the Project, the assessment of waste capacity at that time (30 years) will be assessed closer to the time of decommissioning. This assessment therefore focuses on construction and operations stages.

8.1.6.2 Construction

The Project has confirmed with the local Ahome municipal waste disposal and special handling waste facility (Promotora Ambiental La Laguna S. A. de C. V.) which is closest to the site, that they operate at approximately 60% average capacity. The Project's anticipated 711 tons per year of mixed construction and domestic solid waste equates to approximately seven days of waste handling capacity at the facility (minimum of 100 tons per day handled) or 1.9% of the total capacity of the facility. Depending upon the type of construction waste (to be determined), it is also likely it will be disposed of at this facility.

The predicted volumes of hazardous waste are approximately 52 tons annually for the construction phase, which is 3.7% of the capacity of the two facilities in Sinaloa which can manage up to 1,377 tons of oils and contaminated waste. Other hazardous waste facilities within a day's transport range operate with similar capacity.

The Project has also confirmed that the JAPAMA wastewater treatment facility can handle the estimated 65 m^3 of wastewater generated each day from the sanitary services (i.e., portable bathrooms) provided for the workforce.

The frequency is continuous, the duration is medium-term, and the intensity is low. The magnitude is therefore **low (2)**. The sensitivity of the receptor is estimated to be **low (2)**. The significance is therefore scored as **minor (4)**.

Table 8.36: Waste-related impacts during Project construction phase

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Disposal of construction phase waste	Impact on the capacity of the existing waste facilities	Low (2)	Low (2)	**Minor (4)**	N

8.1.6.2.1 Mitigation measures

The Project's Waste Management Plan (PWMP) requires each EPC to develop their activity specific WMP. As documented in Section 3.12.3, the Project has identified and mapped the various waste management facilities in the general area, as well as further afield from the Project site, which will likely be used by the Project.

The PWMP provides details as to how different types of waste will be handled, stored and transported to avoid any potential environmental, health or safety issues. Specifically, it describes how different types of waste will be segregated, the types of containers that will be used, and the labelling requirements for waste containers. All

transfers of waste will be covered by use of waste transfer documentation to the point of final disposal.

The hazardous waste management plan and special handling waste management plan (RME, RSU, RP) produced by IGA as submitted to SEMARNAT as part of the MIA permitting process describes how hazardous waste will be managed, including compliance with environmental legislation; record keeping; waste identification, handling, segregation, transportation, storage, treatment and recovery; training; innovation; reduction in hazardous waste generation; and requirements for suppliers and contractors.

A Toxicity Characteristic Leaching Procedure (TCLP) test will be used to classify hazardous and non-hazardous wastes and define the appropriate disposal methods.

The Project is committed to conducting regular audits on the facilities used to ensure they are of sufficient quality to manage Project wastes, as well as having sufficient capacity.

8.1.6.3 Operations

As described in Section 3.12.3, approximately 5-6 tons/day of dry matter from sludge (which is characterised as any waste would be and managed accordingly) and 60 tons of solid waste will be generated each year because of the operations workforce being on site. This equates to approximately 2,250 tons per year of non-hazardous waste or 6% capacity of the local Ahome municipal waste disposal and special handling waste facility (Promotora Ambiental La Laguna S. A. de C. V.).

Hazardous waste generated during the operations phase is expected to comprise oil filters, rags, absorbent materials and waste contaminated with greases and oils. Although volumes are unknown, as with the construction phase, it is estimated that enough facilities exist for the handling of this waste. Every four years, major plant maintenance will be carried out, which is expected to generate 250,000 litres of lubricating oil waste. This is well within the capacity of the Sinaloa hazardous waste facilities.

Wastewater will be handled on site.

The frequency is continuous, the duration is medium-term, and the intensity is low. The magnitude is therefore **low (2)**. The sensitivity of the receptor is estimated to be **low (2)**. The significance is therefore scored as **minor (4)**.

Table 8.37: Waste-related impacts during Project operations phase

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Disposal of operations phase waste	Impact on the capacity of the existing waste facilities	Low (2)	Low (2)	**Minor (4)**	N

8.1.6.3.1 Mitigation measures

The Project will prepare a WMP to address the operations phase. The Project is committed to conducting regular audits throughout the operations phase period on the facilities used to ensure they are of sufficient quality to manage Project wastes, as well as having sufficient capacity.

The mitigation measures stated above for the construction phase will also be implemented.

8.1.7 Environmental impact assessment summary

Table 8.38 and Table 8.39 provide a summary of the physical environmental impact assessment[161].

[161] Landscape and visual amenity impacts are not included because a different methodology was used (as described in Section 8.1.3.1).

Table 8.38: Impact magnitude scoring for physical environment impacts

No.	Project activity	Description of impact	Intensity	Frequency	Duration	Magnitude of impact
Construction phase						
1	Land clearance	Formation of dust due to excavation and transport	Low	Episodic	Short-term	Low (2)
2	Excavation of trench for pipeline	Formation of dust due to excavation and transport	Low	Episodic	Short-term	Medium (3)
3	Construction Works – methanol production plant	Formation of dust due to construction and transport	Low	Episodic	Short-term	Low (2)
4	Enabling Works – methanol production plant including WWTP	Noise disturbance	Very Low (1)	Episodic	Short-term	Very Low (1)
5	Construction Works – methanol production plant including WWTP	Noise disturbance	Very Low (1)	Episodic	Short-term	Very Low (1)
6	Pipeline construction	Noise disturbance	Low (2)	Episodic	Short-term	Very Low (1)
7	Port of Topolobampo upgrade works	Noise disturbance	Low (2)	Episodic	Short-term	Very Low (1)
8	Land clearance	Loss of topsoil	Very Low (1)	Episodic	Short-term	Very Low (1)
9	Preparation of site	Depletion of natural resources, for example, aggregate	Very Low (1)	Episodic	Short-term	Very Low (1)
10	Excavation of trenches for pipelines	Loss of topsoil causing reduced fertility and impaired reinstatement	Very Low (1)	Episodic	Short-term	Very Low (1)
11	Management of waste and accidental release of fuel and chemicals	Soil contamination	Very Low (1)	Episodic	Short-term	Very Low (1)
12	Management of waste and accidental release of oil or chemicals	Contamination of surface water	Very Low (1)	Episodic	Short-term	Very Low (1)
13	Excavation of pipeline trenches	Sediment contamination of surface waters	Low (2)	Episodic	Short-term	Low (2)
14	Excavation of pipeline trenches	Reduced flow of groundwater due to dewatering or other trenching activities below the water table	Very Low (1)	Episodic	Short-term	Very Low (1)
15	Management of waste and accidental release of fuel and chemicals	Contamination of groundwater	Very Low (1)	Episodic	Short-term	Very Low (1)
16	Disposal of construction phase waste	Impact on the capacity of the existing waste facilities	Low (2)	Continuous	Medium-term	Low (2)
Operation phase						
17	Operational road traffic	Emissions due to increased road transport	Very Low (1)	Continuous	Long-term	Very Low (1)
18	Operation of the Mexinol Facility	Noise disturbance	Very Low (1)	Continuous	Long-term	Very Low (1)
19	Operation of the Port	Noise disturbance	Very Low (1)	Continuous	Long-term	Very Low (1)
20	Operational road traffic	Noise disturbance	Very Low (1)	Continuous	Long-term	Very Low (1)
21	Disposal of operations phase waste	Impact on the capacity of the existing waste facilities	Low (2)	Continuous	Long-term	Low (2)

Table 8.39: Pre-mitigation impact scoring and post mitigation residual impact significance for physical environment impacts

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[162]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
Construction phase									
1	Land clearance	Formation of dust due to excavation and transport	Low (2)	Medium (3)	**Minor (3)**	Y	Very Low (1)	Low (2)	**Minor (3)**
2	Excavation of trenches for pipelines	Formation of dust due to excavation and transport	Medium (3)	Medium (3)	**Moderate (9)**	Y	Very Low (1)	Medium (3)	**Minor (3)**
3	Construction Works – methanol production plant	Formation of dust due to construction and transport	Low (2)	Medium (3)	**Minor (3)**	Y	Very Low (1)	Low (2)	**Minor (3)**
4	Enabling Works – methanol production plant including WWTP	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N	Very Low (1)	High (4)	**Minor (4)**
5	Construction Works – methanol production plant including WWTP	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N	Very Low (1)	High (4)	**Minor (4)**
6	Pipeline construction	Noise disturbance	Low (2)	High (4)	**Moderate (8)**	Y	Very Low (1)	High (4)	**Minor (4)**
7	Port of Topolobampo upgrade works	Noise disturbance	Low (2)	Medium (3)	**Moderate (6)**	Y	Very Low (1)	Medium (3)	**Minor (3)**
8	Land clearance	Loss of topsoil	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
9	Excavation of trenches for pipelines	Depletion of natural resources, for example, aggregate	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
10	Excavation of trenches for pipelines	Loss of topsoil causing reduced fertility and impaired reinstatement	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
11	Management of waste and accidental release of fuel and chemicals	Soil contamination	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
12	Management of waste and accidental release of oil or chemicals	Contamination of surface water	Very Low (1)	Medium (3)	**Minor (3)**	N	Very Low (1)	Medium (3)	**Minor (3)**
13	Excavation of pipeline trenches	Erosion of channel banks, sediment contamination of surface waters	Low (2)	Medium (3)	**Moderate (6)**	Y	Very Low (1)	Medium (3)	**Minor (3)**
14	Excavation of pipeline trenches	Reduced flow of groundwater due to dewatering or other trenching activities below the water table	Very Low (1)	Medium (3)	**Minor (3)**	N	Very Low (1)	Medium (3)	**Minor (3)**
15	Management of waste and accidental release of fuel and chemicals	Contamination of groundwater	Very Low (1)	Medium (3)	**Minor (3)**	N	Very Low (1)	Medium (3)	**Minor (3)**
16	Disposal of construction phase waste	Impact on the capacity of the existing waste facilities	Low (2)	Low (2)	**Minor (4)**	N	Low (2)	Low (2)	**Minor (4)**
Operation phase									
17	Operational road traffic	Emissions due to increased road transport	Very Low (1)	Medium (3)	**Minor (3)**	Y	Very Low (1)	Medium (3)	**Minor (3)**
18	Operation of the methanol production plant	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N	Very Low (1)	High (4)	**Minor (4)**
19	Operational activities at the Port of Topolobampo	Noise disturbance	Very Low (1)	Medium (3)	**Minor (3)**	N	Very Low (1)	Medium (3)	**Minor (3)**
20	Operational road traffic	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N	Very Low (1)	High (4)	**Minor (4)**
21	Disposal of operations phase waste	Impact on the capacity of the existing waste facilities	Low (2)	Low (2)	**Minor (4)**	N	Low (2)	Low (2)	**Minor (4)**

[162] Refer to Sections 8.1.1-8.1.5 for details of proposed mitigation measures

8.2 Biodiversity impact assessment for planned events

This section discusses potential impacts to biodiversity receptors during construction and operation of the Project. Associated mitigation measures to be adopted are also discussed and residual impacts are assessed in addition to mitigations from the MIA and SLIP, mitigations from the Internationally Recognised Areas Assessment (SLR Consulting Limited, 2024a) and the CHA Impact Assessment (SLR Consulting Limited 2024b) have been considered.

8.2.1 Construction

8.2.1.1 Protected areas

8.2.1.1.1 Methanol pipeline construction

The methanol pipeline crosses a 1.4 km section of the Lagunas de Lagunas de Santa María-Topolobampo-Ohuira Ramsar site and Bahia Lechuguilla Key Biodiversity Area - Important Bird Area, however the habitats are devoid of vegetation, having been previously impacted by the construction of industrial facilities, quarrying operations and the building of a highway to the port. These developments have significantly altered the surface hydrology of the surrounding area, leading to the complete loss of mangrove swamp/lagoon to the east of the highway. It is through this area that the pipeline will be routed, to cause minimal impact to an area devoid of vegetation (SLR Consulting Limited, 2024a). Based on the findings of the Internationally Recognised Areas Assessment (SLR Consulting Limited, 2024a), the methanol pipeline (and wider Project) will have no likely significant effects on the qualifying features of the internationally recognised sites. This conclusion was reached, due to the poor condition of this particular section of the Ramsar site and the lack of Project-related impacts on the integrity of the internationally recognised area(s), following the diligent application of the management control (e.g., HDD) and mitigation measures presented in this ESIA (SLR Consulting Limited, 2024a).

Considering the above, the impact magnitude is assessed as **very low (1)**. The receptor sensitivity is **high (4)** because although the overlapping section of the Ramsar site is degraded, it is internationally recognised. The impact significance is therefore **minor (4)** (see Table 8.40).

Methanol production plant, access road and JAPAMA pipeline construction

The methanol production plant, access road and JAPAMA pipelines are not within any internationally recognised site and are predominantly within agricultural land (SLR Consulting Limited, 2024a). Therefore, there is no expected impact to protected areas from construction activities associated with these components.

Table 8.40: Impacts to protected areas from construction activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction activities	Disturbance or degradation of protected areas	Very Low (1)	High (4)	**Minor (4)**	N

Mitigation measures

No specific mitigation measures are required however the measures listed in the remainder of this section will be implemented as a course of GIIP.

8.2.1.2 Habitat and flora

Natural habitat loss, fragmentation and edge effects

Overview

The most significant impact on habitats associated with the Project will occur during construction when areas of the Project footprint will be cleared. The Project will result in the loss of natural and modified habitats; however most of the Project area has been impacted by some degree of anthropogenic disturbance such as agriculture and urban expansion (see Section 5.3.9). The areas of modified and natural habitat to be cleared of vegetation are shown in Table 8.41.

It is expected that construction will require the clearance of ~130 ha of land in total, comprising 27.81 ha within the 27.4 m wide pipeline construction footprint (of which 14.4 m is permanent and 13 m temporary use), 4.95 ha within the 2.46 km long (20 m wide) access road construction footprint, 43.90 ha methanol production plant, 40.58 ha laydown areas and the 8.48 ha JAPAMA pipeline construction footprint (see Table 8.41 below), of which at least 92.18 ha of agricultural land is estimated to require clearance. In addition, there are 13 discrete temporary use areas occupying 3.54 ha that are required for construction, mostly in degraded habitats (SLR Consulting Limited, 2024b). Additionally, a total of 93,000 m^3 of soil is estimated to require removal and storage from the construction areas.

A total of 1,918 m of the irrigation channels may be infilled for the construction of the project. These channels are categorised as modified habitats. The loss of these channels represents 0.3% of the available network. Whilst birds do use these channels, their carrying capacity is small compared to the wider network of irrigation channels and other key natural habitats in the regions including wetlands. Birds also do not congregate in significant numbers in these channels.

Impacts of pipeline (methanol and JAPAMA) construction and construction of the methanol production plant and access road on habitats are assessed separately as different habitat types will be affected.

Table 8.41: Extent of habitat types within the direct Project footprint

Habitat status	Vegetation and land use	Methanol pipeline (27 m RoW)	Access road (20 m RoW)	Plant site	Laydown areas	HDD locations	JAPAMA pipelines (10 m RoW)	Total
		hectares (ha)						
Natural (degraded)	Sarcocaule scrub	-	-	-	-	-	-	-
	Xerophytic vegetation	7.58	-	0.04**	1.39	1.39	7.92	18.32
	Water body	0.14	-	-	-	-	-	0.14
	Marine water	-	-	-	-	-	-	-
Modified	Annual and semi-permanent irrigated agriculture	2.81	4.95**	43.86**	39.19	0.84	0.53	92.18
	Disturbed habitat historically mangrove swamp	0.98*	-	-	-	-	-	0.98
	Bare areas (no vegetation)	7.32	-	-	-	1.55	-	8.87
	Human settlement / urban areas	8.98	-	-	-	0.4	0.03	9.41
Totals		27.81	4.95	43.90	40.58	4.18	8.48	129.90

Source: Updated data from SLR Consulting Limited (2024a)

Note: *No mangroves or water body will be affected by construction. Small areas indicated as falling within the Project footprint are artefacts of mapping and the definition of the full 27 m wide construction corridor of the methanol pipeline.

**These values indicate permanent habitat loss.

Methanol and JAPAMA pipelines

The area required for the construction of the methanol and JAPAMA pipelines comprise mainly modified habitat. However, 7.58 ha of the methanol pipeline route (located between the existing railway line and main road to Topolobampo), and 7.93 ha of the JAPAMA pipeline route, comprise mainly degraded and fragmented xerophytic vegetation. There are some more intact patches of xerophytic vegetation, including three small patches along the methanol pipeline route, occupying a total area of ~200 m, which may include individuals of range restricted species (see sub-section, Clearance of priority flora, below) and could be affected by construction. However, these patches will either be avoided by routing around them or will be drilled under using HDD. A total of 1.41 km of HDD is anticipated to avoid these patches of xerophytic vegetation and some mangroves located in drainage channels (SLR Consulting Limited, 2024b).

HDD will be used in three areas where individual mangrove shrubs are within 55 m of the pipeline route. One of the temporary areas is close to two species of white mangrove but are separated by a fence and their location will be marked during construction to avoid disturbance (SLR Consulting Limited, 2024b).

Habitat clearance during construction is likely to result in the loss and fragmentation of natural habitats, which would add to the relatively high existing levels of fragmentation. Residual fragments may be vulnerable to edge effects[163] leading to their degradation. Given that there may be a limited, but permanent loss of natural habitat on a localised scale, the magnitude of the impact of natural habitat loss, fragmentation and edge effects along the pipeline route is **medium (3)**. Receptor sensitivity is **low (2)** considering the existing degree of fragmentation, disturbance and modification, meaning the overall impact significance is **moderate (6)** (see Table 8.42).

Methanol production plant and access road

All the land that will be used for the methanol production plant and access road is classified as modified habitat – annual and semi-permanent irrigated agricultural land – which is of minimal biodiversity value and therefore has a **low (2)** sensitivity. Filling of an agricultural drainage channel (which comprises 0.3% of the total regional irrigation network) within the Project site may be required to level the site for construction. The access road route is located along an existing road through fields and along an agricultural drainage creek. Any clearance of topsoil during site preparations will be deposited on the southern part of the site and subsequently reused for agriculture (SLR Consulting Limited, 2024b). Considering the localised (site) extent, low intensity and permanent loss of modified agricultural habitat, the impact magnitude is **low (2)**, and the overall impact significance is therefore **minor (4)** (see Table 8.42).

[163] Edge effects are diverse physical and biotic alterations associated with the artificial boundaries of fragments of land, which can have serious impacts on species diversity and composition, community dynamics, and ecosystem functioning (Laurance et al., 2007).

Table 8.42: Impacts to natural habitat from clearance activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Land clearance for construction of the methanol and JAPAMA pipelines	Natural habitat loss, fragmentation and edge effects	Medium (3)	Low (2)	**Moderate (6)**	Y
Land clearance for construction of the methanol production plant and access road	Natural habitat loss, fragmentation and edge effects	Low (2)	Low (2)	**Minor (4)**	N

Mitigation measures

As an embedded control, the Project plans to implement HDD during construction to minimise impacts on sensitive vegetation (i.e. natural habitats) where possible.

The following mitigation measures will be used to avoid the impacts to natural habitat from clearance activities:

- Demarcate patches of sensitive sarcocaule vegetation and nearby mangrove trees with marking pegs or tape as 'no-go zones' to prevent damage by vehicles or workforce during land clearance (2022).
- Demarcate vehicle access routes, turning circles and parking areas to existing tracks or degraded routes or sites where possible and instruct staff not to traverse areas outside of these areas (2022).

The following mitigation measures will be used to reduce (minimisation step in the mitigation hierarchy) the impacts of clearance of natural habitat:

- Minimise construction footprints by clearly designating work areas on site development plans and no-go zones. Routine checks will be undertaken to ensure vegetation clearance is confined to defined areas of disturbance (2022; 2021).
- Minimise clearance of natural vegetation and habitats where possible.
- Herbicide and fire will not be permitted to clear vegetation during construction.

The following mitigation measures will be used to restore/rehabilitate natural habitats:

- Develop and implement a Natural Habitat Restoration Plan to re-establish natural habitats, native species and support natural ecological processes in the construction areas and conservation area. This program should include monitoring and maintenance for at least two years or until such time as natural restoration is secured (2022).

- Progressive rehabilitation of natural habitat will be undertaken where possible through seeding (using seeds of local provenance that are devoid of AIS and pathogens) and natural revegetation.
- Implement topsoil management in accordance with a Topsoil Management Plan or procedure. Remove topsoil from the cleared area and place in designated stockpile areas and protect from wind and water erosion (e.g., with geotextile covering). Scarify / loosen compacted soils in temporary work areas and replace the topsoil across these areas to facilitate revegetation (2022; 2021).

The following mitigation measures will be used to compensate/offset the impacts to natural habitat from clearance activities:

- Although the KBA crossed by the Project is a Critical Habitat, it is not expected to cause negative impacts on the triggering biodiversity value (*Sterna forsteri*), therefore an offset is not a necessary requirement.
- The natural habitat loss will be 18.32 ha of Xerophytic vegetation, the project will develop a strategy to meet NNL of this habitat, considering habitat quality metrics.
- In addition, the Project plans to provide compensation equating to an area that is at least 10% of the Project footprint, even if the impacted/lost habitat type is less than this. This will enable the project to achieve no net loss of natural habitat. These measures are expected to include approximately 6 ha of reforestation (i.e., scrubbing) and cactus planting, plus 6 ha of mangrove restoration. As no mangrove habitat is expected to be impacted by the Project, the mangrove restoration is therefore considered to be an additionality (SLR Consulting Limited, 2024a). The reforestation/restoration locations, and details of land ownership and access, are yet to be determined.
- As part of the implementation of the Mitigation Hierarchy, and specifically as a measure to avoid impacts, the project will implement a *set aside.* A 15 ha 'conservation area' on the south tract of the methanol production plant (between the railroad and the Ohuira Bay) will be delimited. This area has natural vegetation and will not be developed or subject to land use change. It can also be used to translocate native flora outside of the Project footprint, if determined appropriate by the ecologist (2022; 2021). The areas of the south tract that have been developed for agricultural use will be used to deposit topsoil removed during early works from the north tract and will remain in agricultural use.
- The BMP outlines a more detailed approach to ensure no net loss of natural habitat.

Residual impacts

The project will achieve a no net loss of natural habitat through the implementation of the key mitigation measures listed above. With the implementation of mitigation, the impact magnitude related to construction of the methanol and JAPAMA pipelines, where there is some natural habitat, is expected to fall to **very low (1)**. The receptor sensitivity remains **low (2).** The residual impact significance is therefore reduced to **negligible (2).**

The impact significance for the methanol production plant and access road will also be reduced to **negligible (2)**.

Clearance of priority flora

Methanol and JAPAMA pipelines

Five priority species of flora were identified during the biodiversity baseline study (see Section 5.3.7.3). As previously noted, there are three small patches of xerophytic vegetation that may include individuals of range restricted, priority flora species such as Octopus Cactus (*Stenocereus alamosensis*) (also listed as Vulnerable by the IUCN), Chunari/ Mexican tree ocotillo (*Fouquieria macdougalii*; LC) and Southwestern barrel cactus (*Ferocactus herrerae*; VU), which could be affected by construction of the methanol pipeline. However, these patches will either be routed around or horizontally drilled, meaning that clearance will not be required. The species that will be cleared along the methanol pipeline route, including those within the 13 temporary construction areas, are all common and widespread species. No threatened or protected species (including mangroves) require clearance from any of the temporary work's areas (2022).

The receptor sensitivity is **medium (3)** because there is a potential for known, range restricted and endemic (priority) species along the methanol pipeline route to be affected by construction. The impact magnitude is **low (2)** due to the existing management control measures, which means that the impact significance is **moderate (6)** (see Table 8.43).

Methanol production plant and access road

There is no planned clearance of priority flora for the construction of the methanol production plant and access road, so the impact magnitude for these areas is **very low (1)**. Additionally, the methanol production plant and access road are located in modified habitat, which means that the receptor sensitivity is also **medium (3)** and the overall impact significance is **minor (3)** (see Table 8.43).

Table 8.43: Impacts priority flora from the clearance activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Land clearance for construction of the methanol and JAPAMA pipelines	Clearance of priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y
Land clearance for construction of the methanol production plant and access road	Clearance of priority flora	Very Low (1)	Medium (3)	**Minor (3)**	Y taking a precautionary approach

Mitigation measures

In addition to the measures implemented to address natural habitat loss, fragmentation and edge effects, the following mitigation measures will be applied to avoid impacts to priority flora from clearance activities:

- Undertake pre-construction surveys of selected portions of the pipeline routes to identify fauna and flora search and rescue needs, specifically protected species listed in NOM-059-SEMARNAT 2020. This should be done by qualified ecologists (e.g., University accredited or similar experience level) (2022; 2021).
- Areas for translocation of species will be identified, potentially the conservation area (to the south of the methanol production plant). Some native plants can potentially be retained for landscaping of the plant area / reconditioning activities. As required by SEMARNAT, all search and rescue efforts to be documented (2022; 2021).
- A qualified ecologist (e.g. University accredited or similar experience) will be present on-site during site clearance (and trenching) to translocate any fauna that does not disperse from the construction activities. Areas for translocation of species will be identified, potentially the conservation area (to the south of the methanol production plant). Some native plants can potentially be retained for landscaping of the plant area/ reconditioning activities. As required by SEMARNAT, all search and rescue efforts will be documented (2022).
- Search, rescue and translocation requirements will be documented in a Flora and Fauna Management Plan or protocol. Which may include contracting with a local botanist prior to early works to specify requirements and to mark individuals that should be avoided where possible or which are feasible to move. This should potentially include harvesting of seed if feasible for replanting elsewhere and identification of suitable relocations (2022).

Residual impacts

With the implementation of mitigation, the impact magnitude related to construction of the methanol pipeline is expected to fall to **very low (1)**. The receptor sensitivity remains **medium (3).** The residual impact is therefore reduced to **minor (3).**

The impact significance for the methanol production plant and access road remains **minor (3)**.

Changes to air quality

Construction activities for the methanol production plant, access road and pipelines are likely to result in indirect localised impacts from fugitive dust emissions arising from construction vehicle and heavy machinery movements as well as clearing, levelling, grading, backfilling, and other earth moving activities and construction processes. These impacts are expected to occur over a relatively short period of time in any given location, as construction activities will progress throughout the site.

In cases where continuous dust emissions may settle in a given area, this may result in localised damage to priority flora and degrading of natural habitats due to smothering of stomata on the surface of leaves which will adversely impact the biological fitness and survival of plants which in turn may result in habitat degradation over time. Hence prior to the application of mitigation measures, smothering could lead to a localised decline in priority flora and natural habitat degradation. However, given the expectedly highly

localised extent of this impact as well as its generally short-term nature, the impact magnitude for both natural habitats and flora has been assessed as **low (2)**. The receptor sensitivity for natural habitats is **low (2)**. Therefore, the impact significance for natural habitat is **minor (4)** (see Table 8.44).

The receptor sensitivity for priority flora is **medium (3),** as five species of priority flora (including endemic, range-restricted and protected species) were identified in the ecological AoI, which results in a **moderate (6)** impact significance to priority plants (see Table 8.44).

Table 8.44: Impacts to habitats and flora from fugitive dust emissions

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction vehicle and heavy machinery movements	Fugitive dust emissions and adverse impacts to natural habitats	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach
	Fugitive dust emissions and adverse impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

To avoid dust impacts to habitats and flora, earthworks and dust-generating activities will be avoided during windy conditions.

The following mitigation measures will be used to reduce the impacts to habitats and flora from fugitive dust emissions:

- Implement industry standard dust suppression along access roads during hot, dry, and windy conditions to minimise dust impacts on vegetation (and local communities) e.g. the use of water (2022).
- The stabilisation of landforms and implementation of erosion prevention measures.
- Limit vehicle speeds to 30 km/hour on construction roads (2022; 2021).
- Adherence to the Traffic Management Plan always.
- [Repeated] Demarcate vehicle access routes, turning circles and parking areas to existing tracks or degraded routes or sites where possible and instruct staff not to traverse areas outside of these areas (2022).

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and priority flora is expected to fall to **very low (1)**.

The receptor sensitivity for natural habitats remains **low (2),** therefore reducing the impact significance to **negligible (2).**

The receptor sensitivity for priority flora remains **medium (3),** which reduces the impact significance to **minor (3)**.

Changes in hydrology and water quality

There are no large surface water bodies within the ecological AoI, however there are some small surface water bodies such as agricultural drainage ditches that lead to the Ohuira Bay. Groundwater is relatively shallow, and water quality is generally good in the ecological AoI. Groundwater quality could be impacted by arise from the excavation of pipeline trenches resulting in reduced flow of groundwater due to dewatering or other trenching activities below the water table.

An estimated 50,000 m^3 of water is required for hydrotesting the pipelines following construction. The water that will be used in the Project's processes will be obtained from the JAPAMA treatment plant (Potable Water and Sewage Board of the Municipality of Ahome where the pre-treatment of municipal wastewater from the city of Los Mochis is carried out). Wastewater that cannot be reused in the methanol production plant will be returned to JAPAMA (SLR Consulting Limited, 2024b). No water abstraction is planned during either construction or operation of the Project.

During the construction of the methanol and JAPAMA pipelines there is minor risk of the direct contamination of surface water quality in receiving watercourses, particularly of fuel and lubricating oils, hazardous waste, paints and solvents. The irrigation channels have good water quality and therefore have moderate sensitivity to contamination. There is also a minor risk of ground water contamination from the storage, transportation, treatment and disposal of solid and liquid waste, chemicals and fuel. These impacts are discussed in more detail in Section 8.1.5.

In addition to impacting water quality, trenching for the methanol and JAPAMA pipelines could pose a barrier to subsurface flow within the ecological AoI. Removal of material from the trenches, if not all replaced and left in mounds along the pipeline route could cause some alteration in natural runoff. However, the JAPAMA pipelines are routed through mainly modified or degraded natural habitat; and the methanol pipeline will be trenched through an area historically likely to have been dominated by mangroves and inundated by tidal flows, where natural surface hydrology is modified as a result of road and rail construction, and agricultural development. These developments have altered the natural dispersed flow pathways across the site, resulting in most natural flow being rerouted along narrow creeks to drain into the margins of the Ohuira Bay. The existing road and rail embankments located on either side of the proposed methanol pipeline route as well as industrial development to the east of the railway line present a barrier to natural tidal movement which has caused a drying out and loss of mangroves and tidal salt marsh vegetation across most of the pipeline route between km4 and km7.4 (SLR Consulting Limited, 2024b). Therefore, pipeline construction is not expected to create a significant additional barrier to subsurface flow and no or minimal additional adverse impacts on water bodies and aquatic biota is expected.

The magnitude of the impact to natural habitats from changes in hydrology and water quality is assessed as **low (2)**, given the localised and short-term extent of anticipated impacts. Natural habitat within the ecological AoI has a **low (2)** sensitivity, given that it is

already highly degraded and natural flows are modified, and the majority of natural habitat along the methanol pipeline route comprises xerophytic vegetation, which is generally adapted to living in water-limited conditions. The resulting impact significance is **minor (4)** (see Table 8.45).

The receptor sensitivity of priority flora is **medium (3)** given that excavation along the methanol pipeline route could impact species that are endemic/near-endemic, range-restricted and vulnerable species, the impact significance is **moderate (6)** (see Table 8.45).

Table 8.45: Impacts to habitats and flora from changes in surface hydrology

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction activities including trenching for construction of the methanol and JAPAMA pipelines, and the use of fuel, oil, solvents etc.	Changes in hydrology and water and impacts to natural habitat	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach
	Changes in hydrology and water and impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The mitigation measures presented in Section 8.1.5 will be implemented to reduce the impacts to habitats and flora from changes in hydrology and surface and ground water quality. This includes monitoring the construction area for any spills of hazardous and non-hazardous compounds and to ensure any spills detected are cleaned up immediately. Any contaminated material shall be disposed of appropriately as hazardous waste (2022).

In addition, the following mitigation measures will be used to minimise the impacts to habitats and flora from changes in surface hydrology and water quality:

- Remove excavated material that is not needed as fill material for the pipelines either for use in construction site founding material, as berms around the plant or landscaping within the plant area, or disposed of in other degraded areas where it may need to be contoured to a natural profile to allow natural revegetation if possible. Reseeding with indigenous species may be required if natural revegetation does not occur within two years or to suppress dust (2022).
- Evaluate the requirement for installing subsurface drainage measures where the pipelines cross wet areas to reduce the risk of ponding / water collection upslope of the pipelines (2022).

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and priority flora is expected to fall to **very low (1)**. The receptor sensitivity for natural habitats remains **low (2)**, therefore reducing the impact significance to **negligible (2)**. The receptor sensitivity for priority flora remains **medium (3)**, which reduces the impact significance to **minor (3)**.

8.2.1.2.1 Introduction of invasive species

Mobilisation and construction work involve the collection, transportation, handling, storage, and disposal of various types of materials, some of which may cause introduction of invasive or non-native species, more commonly termed as Alien Invasive Species (AIS). These invaders may out-compete the native species, resulting in a shift of ecological structure in the area. Such an introduction would be considered an unintended impact but may occur because of planned activities and have far-reaching consequences if left unmitigated.

The Project area is largely located within modified habitats and one AIS; five-stamen tamarisk/Chinese tamarisk/saltcedar (*Tamarix chinensis*; LC) has been identified along the methanol pipeline route. There is a potential for the spread of *Tamarix chinensis* within the Project area, or the introduction and spread of a new AIS. This would be considered potentially significant, as the spread of any AIS into the natural habitats within the Project area may have detrimental impacts.

The magnitude of impacts to natural habitats is **medium (3)**, as the introduction and/or spread of AIS could degrade the quality of natural habitats within the ecological AoI. Receptor sensitivity for natural habitats is considered to be **low (2)**, given that the habitats are already degraded and AIS are present in the area. Therefore, the resulting impact significance is **moderate (6)** (see Table 8.46).

The magnitude of impacts to priority flora is also **medium (3)**, as the AIS may out-compete native species and alter floral compositions within the ecological AoI. Receptor sensitivity for priority flora is **medium (3)**, considering that five species of priority flora (including endemic, range-restricted and protected species) were identified in the ecological AoI. Therefore, the resulting impact significance is **moderate (9)** (see Table 8.46).

Table 8.46: Impacts to habitats and flora from the introduction of AIS

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Collection, transportation, handling and storage of construction materials	Introduction and/or spread of AIS and adverse impacts to natural habitats	Medium (3)	Low (2)	**Moderate (6)**	Y

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Collection, transportation, handling and storage of construction materials	Introduction and/or spread of AIS and adverse impacts to priority flora	Medium (3)	Medium (3)	**Moderate (9)**	Y

Mitigation measures

The following mitigation measures will be used to avoid the impacts to habitats and priority flora from the introduction of AIS:

- An AIS prevention protocol will be implemented to prevent the introduction and transfer of invasive species (i.e., *Tamarix chinensis*). This will include the avoidance of affected areas by staff and vehicles where possible. Non-invasive local species will only be used for revegetation.

The following mitigation measures will be used to reduce the impacts to habitats and priority flora from the introduction of AIS:

- The AIS prevention protocol will minimise the risk of transfer of invasive species (i.e., *Tamarix chinensis*) from affected areas along the methanol pipeline route into the other Project areas and surrounds. This will include washdown procedures of Project vehicles moving from areas known to be affected by AIS.

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and flora is expected to fall to **very low (1)**. The receptor sensitivity for natural habitats remains **low (2),** therefore reducing the impact significance to **negligible (2).** The receptor sensitivity for priority flora remains **medium (3),** which reduces the impact significance to **minor (3).**

Induced access and Project-related in-migration

Construction workers could adversely affect natural habitats and priority flora by using habitats as a latrine, littering, making fires and trampling and disturbance of indigenous vegetation from uncontrolled access e.g. to the designated conservation area). These impacts could continue through the operational phase. However, the impacts can be managed through effective contractor management (SLR Consulting Limited, 2024b).

The proposed conservation area to the southeast of the methanol production plant and adjacent tidal drainage area, as well as portions along the first 4 km of the methanol pipeline are of relatively high sensitivity. However, much of the ecological AoI is in modified, or degraded natural habitat, and access to the conservation area will be

restricted and it is not expected to be impacted, which means the overall receptor sensitivity is **low (2)** (SLR Consulting Limited, 2024b). The impact magnitude is assessed as **low (2)** due to the localised and relatively short-term extent but likely occurrence of the impact. Therefore, the resulting impact significance is **minor (4)** (see Table 8.47).

Priority flora could be impacted by increased trampling of vegetation and collection/harvesting of plants by construction workers. Priority flora in the ecological AoI has a **medium (3)** sensitivity, and the impact magnitude is, again, considered to be **low (2)**. Therefore, the resulting impact significance is **moderate (6)** (see Table 8.47).

Table 8.47: Impacts to habitats and flora from induced access and Project-related in-migration

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Presence of construction workforce on site	Induced access and Project-related in-migration and adverse impacts to natural habitat	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach
	Induced access and Project-related in-migration and adverse impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be used to reduce the impacts to habitats and flora from induced access and Project-related in-migration:

- Staff will be restricted from walking outside of designated areas (e.g., for rest breaks) including walking through the designated 'conservation area' or down to the edge of the Bay of Ohuira to minimise risk of scaring off waterbirds from foraging areas. A designated shaded area will be provided for staff to take breaks equipped with litter bins (protected from wind) that shall be routinely cleared to prevent wind blow litter and pollution of the adjacent areas (2022).
- Staff induction and toolbox talks shall explain the importance of conservation, and prohibitions on trampling vegetation or harvesting plants (or wildlife), and prevention of littering, fires or use of the environment as a latrine (2022; 2021).

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and priority flora is expected to fall to **very low (1)**. The receptor sensitivity for natural habitats remains **low (2)**, therefore reducing the impact significance to **negligible (2)**. The

receptor sensitivity for priority flora remains **medium (3)**, which reduces the impact significance to **minor (3)**.

Waste accumulation in nearby habitats

Generation of waste on site during the construction phase would expectedly be limited to construction wastes and waste streams associated with preparation of food for workers. Packaging and food waste will typically be generated in a single location at the kitchens or mess facilities. If not properly managed, such wastes will likely enter the environment and surrounding habitats where such accumulation may result in the degradation of habitats. This impact is easily prevented and managed through application of simple housekeeping procedures and good waste management processes (SLR Consulting Limited, 2024b).

There is also a potential for spills of oils, fuel or lubricants from the use of plant, equipment and construction vehicles. These spills would expectedly be small and contained within the ecological AoI but could cause damage to priority flora through localised smothering impacts and degrade natural habitats.

The rate of waste generation is expectedly relatively small for a construction Project of this type and the magnitude of this impact is conservatively assessed as **medium (3)** for both natural habitats and priority flora, as it is expected that such an impact would be limited to the local area immediately adjacent to the Project site. The receptor sensitivity for natural habitats has been assessed as **low (2)**, as it is expected that such an impact would be limited to the local area immediately adjacent to the Project site, which is predominantly modified. The resulting impact significance is therefore considered to be **minor (4)**. The receptor sensitivity for priority flora is **medium (3)** which results in a **moderate (6)** impact significance (see Table 8.48).

Table 8.48: Impacts to habitats and flora from waste accumulation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Generation of construction waste, use of plant, equipment and construction vehicles	Waste accumulation in nearby habitats and impacts to natural habitats	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach
	Waste accumulation in nearby habitats and impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

Appropriate waste management procedures will be developed and implemented, in addition to the following mitigation measures.

The following mitigation measures will be used to reduce the impacts to natural habitats and priority flora from waste accumulation:

- A Project ban on open burning of waste will be implemented.
- The risk of adverse impacts to habitats and flora from accidental spills of diesel fuel and non-hazardous waste will be minimised through the effective implementation of emergency preparedness and response management measures for pollution events.

The following mitigation measures will be used to remediate the impacts to natural habitats and priority flora from waste accumulation:

- Monitor the construction area for any spills of oils, fuel or lubricants, and ensure any spills detected are cleaned up immediately, and the spill site is monitored for remaining contaminates. Any contaminated material shall be disposed of appropriately as hazardous waste (2022).

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and priority flora is expected to fall to **very low (1)**. The receptor sensitivity for natural habitats remains **low (2)**, therefore reducing the impact significance to **negligible (2)**. The receptor sensitivity for priority flora remains **medium (3)**, which reduces the impact significance to **minor (3)**.

8.2.1.3 Fauna and their habitats

Habitat loss and fragmentation

It is expected that a total 111.44 ha of modified habitat and 18.46 ha of natural habitats will be cleared for the construction of the methanol production plant, laydown areas, access road and pipelines, resulting in both temporary and permanent loss of natural and modified habitats (see the relevant section above). Habitat loss is likely to result in the displacement of fauna (i.e. commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value) from the within the Project development area. Habitat clearance is not expected to adversely impact these the populations of these species at a local, national or international level. Given the highly localised extent of the habitat clearance works and the conservation status of these species, the magnitude has been assessed as **low (2)**. Similarly, the receptor sensitivity has been assessed as **very low (1)**. The resulting impact significance is therefore considered to be **negligible (2)** (see Table 8.49).

The ecological AoI is known to support 10 priority bird species (see Section 5.3.7.4, Table 5.27). Some of these birds use the modified irrigation channels that are present within the Project's ecological AoI and wider environs. Collectively, habitat clearance for the construction of the methanol production plant, access road and pipelines may potentially result in the minor loss and fragmentation of foraging habitat for these priority bird

species, a 0.3% loss of habitat provided by the irrigation channels, and potentially a very minor loss of breeding habitat for the MacGillivray's warbler (*Geothlypis tolmiei*; LC).

Given the highly localised extent of this habitat loss and fragmentation for these priority bird species, the magnitude has been assessed as **low (2)**. Similarly, the receptor sensitivity has been assessed as **low (2)**, as the priority bird species present are widespread, common species (i.e. IUCN (2025) listed near threatened or least concern), and although in some cases are locally or regionally vulnerable, do not trigger CH. The resulting impact significance is therefore considered to be **minor (4)** (see Table 8.49).

Table 8.49: Impacts to fauna and their habitats from habitat loss and fragmentation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Land clearance and modification during construction	Habitat loss and fragmentation and the displacement of commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach
	Habitat loss and fragmentation and the displacement of priority birds from 0.3% / 1,918 m of the irrigation channels	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation and monitoring measures

The following mitigation measures will be used to reduce the impacts to fauna and their habitats from habitat loss and fragmentation:

- A minimal-impact footprint will be ensured during habitat clearance to minimise the loss of natural habitats in the Project development area by demarcating the boundaries of the area to be cleared for Project components. Sensitive areas of natural habitat that are not scheduled to be cleared will be demarcated and clearly marked as 'no go areas.
- A qualified ecologist (e.g. University accredited or similar experience) will be present on-site during site clearance (and trenching) to rescue any fauna that does not run away from the construction activities. Areas for translocation of species will be identified, potentially the conservation area (to the south of the methanol production plant). Some native plants can potentially be retained for

landscaping of the plant area/ reconditioning activities. As required by SEMARNAT, all search and rescue efforts will be documented (2022).

- Routine checks will be undertaken to ensure vegetation clearance is confined to defined areas of disturbance.
- [Repeated] Herbicide and fire will not be permitted to clear vegetation during construction.
- [Repeated] Progressive rehabilitation of natural habitat will be undertaken where possible through seeding (using seeds of local provenance that are devoid of AIS and pathogens) and natural revegetation.

The following mitigation measures will be used to compensate/offset the impacts to habitats that support fauna from natural habitat loss, fragmentation and edge effects:

- [Repeated] the project will cross critical habitat, but since it will not be a significant loss, an offset will not be required. This residual impact will be managed through additional conservation programs that will be implemented in the affected important biodiversity area (Bahia Lechuguilla KBA-IBA). However, there is a requirement from SEMARNAT to provide compensation equating to an area that is at least 10% of the Project footprint, even if the impacted/lost habitat type is less than this. These measures are expected to include approximately 6 ha of reforestation (i.e., scrubbing) and cactus planting, plus 6 ha of mangrove restoration which is likely to have some benefits to fauna in general. As no mangrove habitat is expected to be impacted by the Project, the mangrove restoration is therefore considered to be an additionality (SLR Consulting Limited, 2024a). The reforestation/restoration locations, and details of land ownership and access, are yet to be determined.
- [Repeated] A 15 ha ‘conservation area’ south of the methanol production plant and adjacent to the Ohuira Bay will be delimited. This area can also be used to translocate native flora outside of the Project footprint, if determined appropriate by the ecologist (2022; 2021).

Residual impacts

With the application of the mitigation measures listed above, the impact significance of habitat loss and fragmentation is unlikely to change and will remain as **negligible (2)** for commonly occurring fauna species and **minor (4)** for priority birds.

Accidental vehicle and machinery collisions with fauna

Preparatory works (i.e. habitat clearance and earth work) and the construction of the methanol production plant, access road and pipelines will present a risk of accidental mortality and injury to fauna and birds because of accidental collision with the Project’s vehicles and machinery. The areas where fauna and birds will be most at risk are areas of natural habitat within the Project footprint where machinery and vehicles are operating. The risk of accidental collision with fauna is greater when vehicles and machinery are being operated at night at which time fauna are less likely to be seen by drivers and may be startled by vehicle headlights. Ground dwelling, low-flying bird species and nesting birds are also at a greater risk of accidental collide with vehicles and machinery, particularly at dusk or dawn when birds are generally more active.

The likelihood of mortality or injury may be partly reduced as fauna are expected to avoid areas of activity due to disturbances (i.e. noise, vibration, artificial lighting and presence of humans etc.). Most vehicles and machinery will be travelling at reduced speeds in and around the Project sites. Nevertheless, some fauna, particularly small slow-moving mammals and slow-moving herpetofauna may be killed or injured, especially during vegetation clearance works.

The impact magnitude from the accidental vehicles and machinery collision with non-priority fauna is assessed as **low (2).** The receptor sensitivity for fauna is **very low (1)** as fauna species identified within the Project development area commonly occurring species that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value and their population will not be adversely impacted at the regional or global levels. This means that the resulting impact significance is **negligible (2)** (see Table 8.50)**.**

The impact magnitude from the accidental collisions of Project vehicles and machinery with priority birds is assessed as **low (2).** The receptor sensitivity for priority birds is assessed as **low (2)** resulting in the impact rating of **minor (4)** prior to the application of mitigation measures (see Table 8.50).

Table 8.50: Impacts to fauna and their habitats from accidental vehicle collision with fauna and priority birds

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Vehicle and machinery operation during construction Vehicle and machinery operation during construction	Accidental vehicle and machinery collisions with commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach
	Accidental vehicle and machinery collisions with priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The following mitigation measures will be used to reduce the impacts to fauna and priority birds from the accidental collisions with the Project's vehicles and machinery:

- The employment of qualified and experienced staff to operate machinery and vehicles.
- [Repeated] Limit vehicle speeds to 30 km/hour on construction roads (2022).

- [Repeated] Adherence to the Traffic Management Plan always.
- The implementation of a 'sensitive vegetation clearance methodology' to minimise the risks during the vegetation clearance works. This entails the following:
    - Pre-clearance checks for nesting birds and the appropriate management of active nests.
    - The progressive vegetation clearance method to avoid fauna from becoming isolated in fragmented areas of vegetation and promote their natural dispersal into the adjacent environs. This may also include passive dispersal techniques such as increased noise disturbance from vehicles and machinery (2021).
    - The approach for staff and contractors to follow regarding pre-clearance site checks and the translocation of slow-moving fauna, as well as species protected under NOM-059-SEMARNAT, to receptor sites during vegetation clearance (2021). Translocation works will be carried out by a suitably qualified professional (e.g. an ecologist) (2021).
- The provision of a toolbox talks to staff and contractors to promote the application of the sensitive vegetation clearance methodology, including the approach for the translocation of fauna including potentially venomous species.
- In the event of an incident, an Injured Wildlife Protocol will be followed by staff and contractors which includes a mandatory reporting system. This will enable an assessment of the incident to be undertaken and the requirements for any further actions or mitigation measures to be determined.

Residual impacts

With the listed mitigation measures in place, the impact magnitude regarding fauna is reduced to **very low (1)** while the receptor sensitivity remains **very low (1)**. Therefore, the residual impact significance is **negligible (1)**.

Furthermore, with application of these mitigation measures, the impact magnitude regarding priority birds is reduced to **very low (1)** while the receptor sensitivity remains **low (2),** hence, the residual impact significance is categorised as **negligible (2)**.

Accidental injury or mortality to fauna from falls and entrapment in pipeline trenches

Trenching of the 10.4 km methanol pipeline and 9 km JAPAMA pipelines (between the existing water treatment plant and the new water treatment plant) will involve use of an excavator to excavate the trench in which to lay the pipelines and optic fibre cable. Open trenches and pits created for pipeline construction can pose a risk to reptiles (lizards and snakes) and small mammals. It is also considered in this assessment that although no small mammals or herpetofauna of conservation importance were identified as occurring within the Project development area, a number of endemics, near endemic, and protected reptile and rodent species associated with halophytic vegetation may occur in the ecological AoI. Most rodents and reptiles are unlikely to suffer injury or death if they fall into the excavations, however if they become trapped, over a period they may suffer injury or death through dehydration (SLR Consulting Limited, 2024b).

No priority small mammals or herpetofauna of conservation importance were identified as occurring within the Project development area. Impacts to these commonly occurring species are not expected to adversely impact their populations at local, national or international levels. Considering this, the impact magnitude is assessed as **low (2)** given the localised extent, short timeframe and low intensity. The receptor sensitivity is **very low (1)** and the resulting impact significance is **negligible (4)** prior to the application of mitigation measures (see Table 8.51).

Table 8.51: Impacts to fauna and their habitats from falls and entrapment in pipeline trenches

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Pipeline trenching	Fauna falling into trenches and becoming trapped resulting in injury or mortality	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach

Mitigation measures

The following reduction mitigation measures will be applied:

- Minimise the duration that trenches, or pits are left open where possible (2022).
- Fence trenches and pits with construction fencing/barricades in sensitive areas (i.e., sections that overlap protected areas and natural habitats) (2022).
- Place a log or rough escape measure every 100 m inside trenches to enable fauna to climb out of trenches (2022).
- Conduct daily checks of trenches to remove fauna where possible to an adjacent natural area with ground cover like where they were extracted (to minimise predation) at least 250 m away from the construction area or preferably released into a 'No-go area' such as the conservation area. The removal of fauna should be undertaken in accordance with a procedure that has been prepared by an ecologist (2022; 2021).

Monitoring

It is recommended that the following monitoring measures are undertaken:

- Implement fauna management and monitoring Programme for rescue and translocation of any snakes, lizards, or other fauna. Fauna monitoring shall be conducted for at least two years to verify the presence and distribution in the Project area where species were originally observed and shall be documented in a Flora and Fauna Monitoring Plan. Staff to inform a designated and qualified person of any animals that need to be rescued and released (2022).

Residual impacts

With the listed mitigation measures in place, the impact magnitude is reduced to **very low (1)** while the receptor sensitivity remains **low (2)**. Therefore, the residual impact significance is **negligible (2)**.

Changes to air quality

Fugitive dust emissions and combustion emissions during activities (see Section 3.12.1). These emissions are likely to be short-term, localised and staged over a moderately short period (approximately 12 months). Localised air quality impacts are expected to occur within approximately 1 km of the Project footprint and 200 m from unsealed roads (depending on weather conditions). Impacts are also likely to be greater during the dry season than the wet season, when there is a lack of rainfall to supress ambient dust levels.

The magnitude of impacts to fauna arising from the inhalation of these emissions (dust and air pollutants) will be dependent on the quantity, composition, respiratory rates and health of fauna. Emissions are known to can cause irritation and impairment of respiratory functions, skin irritation and vision impairment of fauna (Brüning et al., 2014; Sanderfoot & Holloway, 2017). Potential impacts may be cumulative in nature. Pollutants can also be ingested (for example when deposited on plants or fruit which is then consumed by fauna) and then adversely affect the health of fauna (Swarup & Patra, 2005). In this instance, fugitive dust emissions (e.g. PM_{10} and $PM_{2.5}$) and combustion emissions air pollutants are unlikely to cause significant adverse impacts to the biological fitness of priority birds and commonly occurring fauna species as many species are expected to disperse or be removed from the Project development area during habitat clearance.

Dust emissions may potentially result in temporary, localised sediment loading in the irrigation channels prior to the diligent application of best practice mitigation measures to minimise fallout and sediment loading.

The impact magnitude from air quality impacts to non-priority fauna is assessed as **low (2)**.The receptor sensitivity for fauna is **very low (1)** as fauna species identified within the ecological AoI are commonly occurring species that do not trigger CH and as such are not categorised as priority fauna of high conservation value and their population will not be adversely impacted at the regional or global levels. This means that the resulting impact significance is **negligible (2)** (see Table 8.52).

The impact magnitude from air quality impacts to priority birds is assessed as **medium (3).** The receptor sensitivity for priority birds is assessed as **low (2)** resulting in the impact rating of **moderate (6)** prior to the application of mitigation measures (see Table 8.52).

Table 8.52: Impacts to fauna and their habitats from fugitive dust emissions and sediment loading

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Habitat clearance and topsoil, grading and vehicle movement on exposed surfaces and general construction activities	Adverse impacts from fugitive dust emissions (e.g. PM_{10} and $PM_{2.5}$) and combustion emissions air pollutants (i.e. CO, SO_2, NOx, particulate matter and VOCs) to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach
	Adverse air quality impacts on priority bird species, including those resulting from changes to irrigation channels that serve as modified habitats	Medium (3)	Low (2)	**Moderate (6)**	Y taking a precautionary approach

Mitigation measures

The following mitigation measures will be used to reduce the impacts to fauna from fugitive dust emissions:

- [Repeated] Implement industry standard dust suppression along access roads during hot, dry, and windy conditions to minimise dust impacts on vegetation (and local communities) e.g. the use of water (2022).
- [Repeated] the stabilisation of landforms and implementation of erosion prevention measures.
- [Repeated] Limit vehicle speeds to 30 km/hour on construction roads (2022; 2021).
- [Repeated] Adherence to the Traffic Management Plan always.
- [Repeated] Confine vehicle movement to designated access routes and roads.

Residual impacts

With the listed mitigation measures in place, the impact magnitude to non-priority fauna is reduced to **very low (1)** while the receptor sensitivity remains **very low (1)**. Therefore, the residual impact significance is **negligible (1)**.

Furthermore, with application of these mitigation measures, the impact magnitude to priority birds is reduced to **very low (1)** while the receptor sensitivity remains **low (2),** hence, the residual impact significance is assessed as **negligible (2)**.

Increased noise and vibration

The predominant noise and vibration sources during construction of the methanol production plant, access road and pipelines that may result in disturbance to fauna and avifauna will be generated by sources such as earthmoving equipment, tippers and backhoe, vehicles, pile drivers, concrete trucks, and hydraulic excavators. Construction phase noise emissions from the Project development area will be temporary, localised in nature, and short term.

Generally large mammals and birds are wary of unfamiliar and/or loud noise and vibration, particularly if it is associated with anthropogenic disturbance, and are expected to respond with a flight reaction. Mammals and birds can also experience stress, reduced biological fitness and decreased breeding success (Francis & Barber, 2013; Meillère et al., 2015; Collins et al., 2022). Chronic stress can make species more susceptible to diseases, pathogens and parasites via allostatic overload, where the body's adaptive mechanisms become dysregulated and fail to return to baseline, resulting in long-term physiological consequences (Sapolsky et al., 2000; Guidi et al., 2021). Some species may be able to habituate to consistent noise and vibration levels. The behaviour of birds and social mammals (e.g. primates) could be adversely affected if vocalisations are masked or the perception of sound is inhibited by high noise and vibration levels, as a large proportion of these species rely on acoustic signals for courtship and mating and predator detection and avoidance (Gómez-Espinosa et al., 2022). Some birds and mammals are known to develop short term adaptations to noise, such as vocal adjustments (i.e. changing song frequencies, amplitude or timing; Barber et al., 2010). Species that are quickly able to adapt to changes in ambient noise and vibration levels are less affected than species that are unable adapt predator behaviour (Francis & Barber, 2013).

It is likely that increased noise and vibration levels generated from clearing and construction activities will result in the localised disturbance to fauna (i.e., commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger CH and as such are not categorised as priority fauna of high conservation value) and priority birds within the Project development area and the immediate environs. This may potentially result in the displacement of some species from within the Project footprint (i.e. small mammals) and priority birds. This is not expected to adversely impact these the populations of these species at local, national or international levels.

Given the localised extent of the predicted increased in ambient noise and vibration levels and the conservation status of the non-priority fauna species, the magnitude has been assessed as **low (2)**. Similarly, the receptor sensitivity has been assessed as **very low (1)**. The resulting impact significance is therefore considered to be **negligible (2)** (see Table 8.53).

For the priority bird species, the magnitude has been assessed as **low (2)**. Similarly, the receptor sensitivity has been assessed as **low (2)**, given that none of the fauna species on the site itself are expected to trigger CH, but in some cases are locally or regionally vulnerable. The resulting impact significance is therefore considered to be **minor (4)** (see Table 8.53).

Table 8.53: Impacts to fauna and their habitats from noise and vibration

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
The use of noisy machinery and vehicles and general construction activities	Disturbance and displacement of commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach
	Disturbance and displacement of priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The following avoidance measures will be used to reduce the impacts to fauna from increased noise and vibration emissions:

- Where possible, the use of noisy machinery and vehicles and general contraction activities will be avoided at dusk, dawn and at night to prevent disturbance to fauna and avifauna from increased noise and vibration levels.

The following minimisation measures will be used to minimise the impacts to fauna from increased noise and vibration emissions:

- The maintenance of equipment and machinery.
- Adherence to the additional minimisation mitigation measures presented in Section 5.2.2.

Residual impacts

With the listed mitigation measures in place, the impact magnitude to non-priority fauna is reduced to **very low (1)** while the receptor sensitivity remains **very low (1)**. Therefore, the residual impact significance is **negligible (1)**.

Furthermore, with application of these mitigation measures, the impact magnitude to priority birds is reduced to **very low (1)** while the receptor sensitivity remains **low (2),** hence the residual impact significance is assessed as **negligible (2)**.

Introduction of invasive species

Mobilisation and construction work involve collection, transportation, handling, storage, and wate disposal increases the risk of AIS and pest fauna species introductions and spread in the Project development area and surrounding environs. These may out-compete or predate upon the native fauna species, resulting in a shift of ecological structure in the area (Pyšek et al., 2020; Gupta, 2021; Kacheche & Mzuza, 2021). AIS can also disrupt ecosystem services such as nutrient cycling, pollination and pest control, affecting of the overall functioning of ecosystems (Shah et al., 2020; Kacheche & Mzuza, 2021). Such an introduction would be considered an unintended impact but may occur as a result of planned activities and have far-reaching consequences if left unmitigated.

Given that the impacts from AIS and pests can have far-reaching consequences and the conservation status of the non-priority fauna species, the magnitude has been assessed as **medium (3)** and the receptor sensitivity has been assessed as **very low (1)**. The resulting impact significance is therefore considered to be **minor (3)** (see Table 8.54).

For the priority bird species, the magnitude has been assessed as **medium (3)** and the receptor sensitivity for priority birds has been assessed as **low (2)**, given that none of the bird species on the site itself are expected to trigger CH, but in some cases are locally or regionally vulnerable. The resulting impact significance is therefore considered to be **moderate (6)** (see Table 8.54).

Table 8.54: Impacts to fauna and their habitats from the introduction of AIS

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Mobilisation and construction work involve collection, transportation, handling, storage, and wate disposal	Disturbance and displacement of non-priority fauna and avifauna from AIS and pests	Medium (3)	Very Low (1)	**Minor (3)**	Y
	Disturbance and displacement of priority birds from AIS and pests	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be used to avoid the impacts to fauna and their habitats and from the introduction of AIS:

- The AIS prevention protocol will minimise the risk of transfer of invasive species from affected areas along the methanol pipeline route into the other Project areas and surrounds. This will include washdown procedures of Project vehicles moving from areas known to be affected by AIS.
- Effective waste management practices will be maintained during construction to minimise the risk of attracting pest's species to area.
- A pest control programme will also be put in place to minimise the risk of pest outbreaks.

Residual impacts

With the listed mitigation measures in place, the impact magnitude to non-priority fauna and avifauna is reduced to **low (2)** while the receptor sensitivity remains **very low (1)**. Therefore, the residual impact significance is **negligible (2).**

Furthermore, with application of these mitigation measures, the impact magnitude to priority birds is reduced to **low (2)** while the receptor sensitivity remains **low (2**), hence, the residual impact significance is assessed as **minor (4).**

Induced access and Project-related in-migration

Fauna, including priority birds, could be directly impacted by disturbance relating to increased human presence, noise and uncontrolled staff access to their habitats (e.g., if allowed to walk down to the edge of the Ohuira Bay or through the designated conservation area). Additionally, fauna could be indirectly impacted by induced access and Project-related in-migration through habitat degradation (as discussed in the previous sub-section, Habitats and flora). However, these impacts could continue through the operational phase. However, the impacts can be managed through effective contractor management (SLR Consulting Limited, 2024b). The impact magnitude is therefore assessed as **low (2),** given the localised and relatively short-term extent but likely occurrence of the impact.

The receptor sensitivity for commonly occurring species of fauna is **very low (1)**, which results in a **negligible (2)** impact significance (see Table 8.55).

The receptor sensitivity for priority birds is also **low (2)** which means that the resulting impact significance is **minor (4)** (see Table 8.55).

Table 8.55: Impacts to fauna and their habitats from induced access and Project-related in-migration

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Induced access and Project-related in-migration of construction workers	Disturbance to non-priority fauna and avifauna	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach
	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The following mitigation measures will be used to reduce the impacts to fauna and their habitats from induced access and Project-related in-migration:

- [Repeated] Staff induction and toolbox talks shall explain the importance of conservation, and prohibitions on trampling vegetation or harvesting plants (or wildlife); killing of fauna, and prevention of littering, fires or use of the environment as a latrine (2022; 2021).
- Bins and skips will be covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.

Residual impacts

With the listed mitigation measures in place, the impact magnitude is reduced to **very low (1)**. The receptor sensitivity for non-priority fauna and avifauna remains **very low (1)**, which reduces the residual impact significance to **negligible (1)**. The receptor sensitivity for priority fauna and avifauna remains **low (2)**, which reduces the residual impact significance to **negligible (2)**.

Waste accumulation in nearby habitats

Generation of waste on site during the construction phase would expectedly be limited to construction wastes and waste streams associated with preparation of food for workers. If not properly managed, these wastes will likely enter the environment and surrounding habitats, where such accumulation may cause accidental injury or mortality to fauna if ingested and potentially when in contact with hazardous compounds. This impact is easily prevented and managed through application of simple housekeeping procedures and good waste management processes (SLR Consulting Limited, 2024b).

There is also a potential for spills of oils, fuel or lubricants from the use of plant, equipment and construction vehicles, which could result in the contamination of habitats including

irrigation channels (modified habitats in the Project's ecological AoI). These spills would expectedly be small and contained within the ecological AoI but could also cause accidental injury or mortality to fauna.

The rate of waste generation is expectedly relatively small for a construction Project of this type and the magnitude of this impact is conservatively assessed as **low (2)**, as it is expected that such an impact would be limited to the local area immediately adjacent to the Project site. The receptor sensitivity for commonly occurring fauna and avifauna has been assessed as **very low (1)**, which means the resulting impact significance is **negligible (2)**. The receptor sensitivity for priority birds is **low (2),** given the potential contamination of irrigation channels within the Project area, which results in a **minor (4)** impact significance (see Table 8.56).

Table 8.56: Impacts to fauna and their habitats from waste accumulation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Generation of construction waste, use of plant, equipment and construction vehicles	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach
	Adverse impacts on priority birds, including those resulting from changes to irrigation channels that serve as modified habitats	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The mitigation measures described for the impact of waste accumulation to natural habitats and flora will also be implemented for fauna and their habitats.

Residual impacts

With the implementation of mitigation, the impact magnitude is expected to fall to **very low (1)**. The receptor sensitivity for commonly occurring fauna and avifauna remains **very low (1)**, therefore the residual impact significance remains **negligible (1)**. The receptor sensitivity for priority birds remains **low (2)**, which means the residual impact significance is **negligible (2)**.

8.2.1.3.1 Changes in hydrology and water quality

There are no large surface water bodies within the ecological AoI, however there are some small surface water bodies such as agricultural drainage ditches that lead to the Ohuira Bay. During the construction of the methanol and JAPAMA pipelines there is minor risk of the direct contamination of surface water quality in receiving watercourses. The principal potential contaminants associated with the construction activities are fuel and lubricating oils, hazardous waste, paints and solvents.

The irrigation channels have good water quality and therefore have moderate sensitivity to contamination. Although birds have been noted to use the irrigation channels in the Project area, it is important to note that irrigation channels do not provide a high-quality habitat for birds compared to the ecological richness and diversity that natural habitats provide. Additionally, a study conducted in Mexico concluded that the opening of new agricultural areas has led to the loss of bird species due to homogenisation of the landscape and a decrease in key microhabitats that these birds need for survival (Figueroa-Sandoval et al., 2019). Only one study could be identified for the region which documents the use of agricultural areas near wetlands and floodplains by birds but no large or significant congregations, or frequent usage by species of conservation concern were noted (Lopez et al., 2016). Given that only 0.3% of the irrigational system could potentially be affected by the Project, the subsequent impact on birds is expected to be insignificant.

Excavation of trenches for the pipelines also poses a risk of erosion and sediment loading of surface waters. Groundwater is relatively shallow, and water quality is generally good in the ecological AoI. There are potential minor impacts may occur to groundwater quality by arise from the excavation of pipeline trenches resulting in reduced flow of groundwater due to dewatering or other trenching activities below the water table. No water abstraction is planned during either construction or operation of the Project. There is also a minor risk of ground water contamination due to the storage, transportation, treatment and disposal of solid and liquid waste, chemicals and fuel. These impacts are discussed in Section 8.1.5.

Generally, the consistent ingestion of water with a high sediment content may adversely affect the health fauna and avifauna. Some species of fauna are expected to avoid using water sources with a high turbidity. The ingestion of contaminated water with non-hazardous and hazardous compounds is known to be detrimental to the health of fauna resulting in a decline in biological fitness or mortality (Beyer et al., 2000). However, given the minor risks of sediment loading and pollution to ground and surface water, and the conservation status of the non-priority fauna species, the magnitude has been assessed as **low (2)**. Similarly, the receptor sensitivity has been assessed as **very low (1)**. The resulting impact significance is therefore considered to be **negligible (2)** (see Table 8.57).

For the priority bird species, the magnitude has been assessed as **low (2)**. Similarly, the receptor sensitivity has been assessed as **low (2)**, given that none of the fauna species on the site itself are expected to trigger CH, but in some cases are locally or regionally vulnerable. The resulting impact significance from changes in water quality is therefore considered to be **minor (4)** (see Table 8.57).

Table 8.57: Impacts to fauna and their habitats from induced access and Project-related in-migration

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction of the methanol and JAPAMA pipelines	Changes in hydrology and water quality resulting in adverse impacts to non-priority fauna and avifauna through injection and contact	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach
	Changes in hydrology and water quality resulting in adverse impacts to priority birds through injection and contact	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The mitigation measures presented in Section 8.1.5 will be implemented to minimise the impacts to fauna and their habitats from changes in hydrology and surface and ground water quality. This includes monitoring the construction area for any spills of hazardous and non-hazardous compounds and to ensure any spills detected are cleaned up immediately. Any contaminated material shall be disposed of appropriately as hazardous waste (2022).

Residual impacts

With the listed mitigation measures in place, the impact magnitude to non-priority fauna is reduced to **very low (1)** while the receptor sensitivity remains **very low (1)**. Therefore, the residual impact significance is **negligible (1)**.

Furthermore, with application of these mitigation measures, the impact magnitude to priority birds is reduced to **very low (1)** while the receptor sensitivity remains **low (2),** hence the residual impact significance is assessed as **negligible (2)**.

Artificial light spill

Although construction activities are currently planned during daylight hours, there is a potential for some night-time work during the construction phase. Artificial night-time lighting used within the Project's ecological AoI could potentially impact and modify fauna behaviour and physiology, such as altering circadian rhythms and disrupting seasonal acclimatisation, as well as also potentially increasing prey intake (Gaston et al., 2013). Artificial night-time lighting can increase activity in diurnal or crepuscular species or reduce it in others. This can affect physiological systems such as breeding success. For example, lighting can artificially initiate dawn bird singing considerably earlier than daybreak.

Many species use natural light sources (e.g., moonlight) as cues for movement around their environment. Any significant changes to these sources by light pollution may disrupt these movements by disorienting the animal (Gaston et al., 2013). For example, moths noticeably modify their movement in the presence of artificial light, while predators of moths may use this to their advantage. It appears that artificial night lighting often disrupts predator-prey relationships (Minnaar et al., 2014).

It is difficult to predict the overall reaction of the species present in and around the planned development to artificial night-time lighting because animals can experience changes in orientation, disorientation, attraction or repulsion in the presence of light pollution. Substantial behavioural or physiological changes may result in altered foraging, reproduction, migration, sociality and communication (Longcore and Rich, 2004). Nocturnal species that remain in proximity to active areas will be the most significantly impacted by extensive light pollution.

With regards to non-priority fauna and birds, the impacts are predicted to be **negligible (2),** as the magnitude of the disturbance levels from artificial light on non-priority fauna and birds is assessed as being **low (2)**, and the sensitivity for these species is **very low (1)** prior to the application of mitigation measures (see Table 8.58).

The predicted impacts to priority birds from artificial light spill is assessed as **minor (4)** as the sensitivity for these species is **low (2)** and the magnitude of impacts is also **low (2)** (see Table 8.58).

Table 8.58: Impacts to fauna and their habitats from artificial light spill

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Use of artificial lighting during the construction of the methanol production plant, access roads and pipelines	Disturbance to non-priority fauna and birds	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach
	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The following mitigation measures will be used to reduce the impact to fauna and their habitats from artificial light spill:

- The use of blinds on windows in the methanol production plant to reduce light spill.

- The installation of capped or directional lighting on outdoor lights with the Project area and access road to minimise disturbance to fauna and birds within natural habitats where possible.

Residual impacts

With the listed mitigation measures in place, the impact magnitude to non-priority fauna is reduced to **very low (1)** while the receptor sensitivity remains **very low (1)**. Therefore, the residual impact significance is **negligible (1)**.

Furthermore, with application of these mitigation measures, the impact magnitude to priority birds is reduced to **very low (2)** while the receptor sensitivity remains **low (2)**, hence the residual impact significance is assessed as **negligible (2)**.

8.2.2 Operations

8.2.2.1 Protected areas

Disturbance to waterbirds and Ramsar Site from Project operations

The methanol production plant operation is located 750 m from the edge of Ohuira Bay and 3.4 km northwest from the nearest bird island (Isla de los Patos) with its numerous and diverse bird life. Noise from the 24-hour processing activities is expected to have minimal impact on waterbirds on the Isla de los Patos, considering the distance from the methanol production plant, and that waterbirds tend to be fairly resilient and tolerant of coastal development noise and activity as long as their foraging areas are not affected (SLR Consulting Limited, 2024b).

Increased shipping activities for methanol export (roughly one ship per week) entering the Port of Topolobampo will have negligible impact on waterbirds or other marine fauna in the context of the existing port operations and vessel movements. The export vessels will not pass near any of the bird islands in Ohuira Bay. Furthermore, any qualifying species of the internationally recognised sites are already habituated to the shipping which uses the port area (SLR Consulting Limited, 2024b).

There is a potential for the Ohuira Bay to be impacted by changes in hydrology and water quality. The Ohuira Bay is internationally recognised as a Ramsar Site of importance for waterbirds and other marine life. The bay is particularly sensitive to adverse water quality impacts because it is already threatened by multiple developments around the margins, including shrimp farming, irrigation and industrial development, which have a cumulative impact on biodiversity. This impact is amplified by the bay's relatively narrow outlet for drainage to the sea. However, Section 8.1.5.2 indicates that no potential impacts to surface water and groundwater have been identified during the normal operation of the methanol plant and the pipelines (SLR Consulting Limited, 2024b).

The impact magnitude is assessed as **very low (1)** given the distance between Project operations and the nearest bird island, and that there are no expected impacts to water during planned Project operations. The receptor sensitivity is **high (4)** which means that the resulting impact significance is **minor (4)** (see Table 8.59).

Table 8.59: Impacts to protected areas from Project operations

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project operations	Disturbance to waterbirds and Ramsar Site from Project operations	Very Low (1)	High (4)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

No mitigation for potential noise impacts on birds from plant processing operations are specifically required. Any noise mitigation that is required for human receptors will also serve to benefit marine fauna and waterbirds. Additionally, no mitigation for the movement of vessels for methanol export is warranted.

The following mitigation measures will be implemented as a course of GIIP:

- Bird deflectors will be mounted on overhead cables to reduce the risk of bird collisions (2022).

Monitoring

It is recommended that the following monitoring is undertaken:

- Bird monitoring will be undertaken for the Project area to monitor bird diversity as an indicator of environmental quality. This monitoring will be included in the Flora and Fauna Monitoring Plan (2022; 2021).
- A Surface Water Monitoring Plan will be implemented around the plant including downslope and downstream around the perimeter of the southern conservation area before runoff enters the Ohuira Bay to detect non-compliances with standards and to allow corrective measures to be applied. Monitoring results should be shared with regulatory authorities (2022).

Residual impacts

With the implementation of mitigation measures, the impact significance remains **minor (4)**.

8.2.2.2 Habitat and flora

8.2.2.2.1 Natural habitat loss, fragmentation and edge effects

During the operations phase, there are no expected impact to natural habitat because of planned activities causing habitat loss, fragmentation or edge effects.

8.2.2.2.2 Clearance of priority flora

During the operations phase, there are no expected impact to priority flora because of clearance, as no clearance activities are planned.

8.2.2.2.3 Changes to air quality

Materials, personnel and equipment will be transported within, to and from the Project sites during the operations phase. There is a potential for indirect impacts from fugitive dust emissions, however, as identified in Section 8.1.1, no significant operational phase impacts on local air quality are anticipated. Additionally, like during the construction phase, the impact would be highly localised and there are no earth moving activities planned. The impact magnitude is therefore considered to be **very low (1)**. The receptor sensitivity for natural habitats is **low (2)** and the resulting impact significance is **negligible (2)**. The receptor sensitivity for priority flora is **medium (3)** and the resulting impact significance is **minor (3)** (see Table 8.60).

Table 8.60: Impacts to habitats and flora from fugitive dust emissions

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Transportation of materials, personnel and equipment	Fugitive dust emissions and adverse impacts to natural habitats	Very Low (1)	Low (2)	**Negligible (2)**	N
	Fugitive dust emissions and adverse impacts to priority flora	Very Low (1)	Medium (3)	**Minor (3)**	N

Mitigation measures

Additional mitigation measures will not be required during the operational phase given the **negligible/minor** impact.

8.2.2.2.4 Changes in hydrology and water quality

Stormwater will be drained to an underground storage tank and recycled in the Project's WWTP for reuse. Through reuse of wastewater by the methanol production plant, it has been estimated that the plant will marginally reduce the volume of existing wastewater discharged to the Ohuira Bay but will have a negligible effect on the salinity and water balance of the system and therefore will have no impact on salt-tolerant mangrove species (SLR Consulting Limited, 2024b).

No water will be abstracted, and no effluent or stormwater will be discharged to nearby waterbodies, including agricultural drainage channels and the Bay of Ohuira. Additionally,

there will be no impacts to surface water and groundwater from planned Project activities (see Section 8.1.5.2).

The magnitude of the impact to natural habitats and flora is **very low (1)**, given that no water abstraction is planned, and there is no anticipated to surface water and groundwater quality during planned Project activities. Natural habitat within the ecological AoI has a **low (2)** sensitivity, given that it is already highly degraded and natural flows are modified, and the majority of natural habitat along the methanol pipeline route comprises xerophytic vegetation, which is generally adapted to living in water-limited conditions. The resulting impact significance is **negligible (2)**. The receptor sensitivity of priority flora is **medium (3)** given that species have been identified in the ecological AoI that are endemic/near-endemic, range-restricted and vulnerable species. Therefore, the impact significance is **minor (3)** (see Table 8.61).

Table 8.61: Impacts to habitats and flora from changes in surface hydrology

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project operations	Changes in hydrology and water and impacts to natural habitat	Very Low (1)	Low (2)	**Negligible (2)**	Y taking a precautionary approach
	Changes in hydrology and water and impacts to priority flora	Very Low (1)	Medium (3)	**Minor (3)**	Y taking a precautionary approach

Mitigation measures

No further mitigation is required for impacts to habitats and flora from changes in surface hydrology.

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and priority flora is expected to fall to **very low (1)**. The receptor sensitivity for natural habitats remains **low (2)**, therefore reducing the impact significance to **negligible (2)**. The receptor sensitivity for priority flora remains **medium (3)**, which reduces the impact significance to **minor (3)**.

8.2.2.2.5 Introduction of invasive species

During the operations phase, with the AIS prevention protocol in place, there is no expected impact to habitats and flora from the introduction of AIS.

8.2.2.2.6 Induced access and Project-related in-migration

The potential adverse impacts to habitats and flora described for the construction phase, may continue into the operations phase although the number of workers is much reduced, see Section 3.9 (SLR Consulting Limited, 2024b).

The impact magnitude has been assessed as **low (2)** because although the impact could occur over a long period of time, the extent will be localised, and the workforce is significantly reduced compared to the construction phase. Additionally, it is anticipated that the management control and mitigation measures will remain in place from the construction phase. Receptor sensitivity of natural habitats is **low (2)** which means that the resulting impact significance is **minor (4)**. Receptor sensitivity for priority flora is **medium (3)**; therefore, the resulting impact significance is **moderate (6)** (see Table 8.62).

Table 8.62: Impacts to habitats and flora from induced access and Project-related in-migration

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Presence of operational workforce on site	Induced access and Project-related in-migration and adverse impacts to natural habitat	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach
	Induced access and Project-related in-migration and adverse impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be used to reduce the impacts to habitats and flora from induced access and Project-related in-migration:

- All plant staff shall be provided with designated eating areas and shall be restricted from free access to the Bay of Ohuira edge where they could cause disturbance to wildlife including waterbirds. Staff shall be restricted from walking outside of designated areas (e.g., for rest breaks) including walking through the designated 'conservation area' or down to the edge of Bay of Ohuira to minimise risk of scaring off waterbirds from foraging areas. A designated shaded area shall be provided for staff to take breaks equipped with litter bins (protected from wind) that shall be routinely cleared to prevent wind blow litter and pollution of the adjacent areas (2022).
- The conservation area in the southern portion of the site will need to be monitored and protected from human encroachment and development as it serves as a

buffer of ~750 m between the Project and the bay. A Conservation Management Plan (CMP) will be developed for this area (2022).

Residual impacts

With the implementation of mitigation, the impact magnitude for natural habitats and priority flora is expected to fall to **very low (1)**. The receptor sensitivity for natural habitats remains **low (2)**, therefore reducing the impact significance to **negligible (2)**. The receptor sensitivity for priority flora remains **medium (3)**, which reduces the impact significance to **minor (3)**.

8.2.2.2.7 Waste accumulation in nearby habitats

During the operations phase, the potential remains for small quantities of packaging and food waste to be generated, and if not properly managed, to enter the environment and surrounding habitats. There is also a potential for minor spills of oils, fuel or lubricants from the use of plant, equipment and construction vehicles to cause damage to natural habitats and priority flora through localised smothering impacts.

Given that the workforce will be much reduced in the operations phase, the rate of waste generation is expected to be lower than during the construction phase. Furthermore, the probability of spills is also reduced, and any spills would be highly localised. The magnitude of this impact is therefore assessed as **very low (1)**. The receptor sensitivity for natural habitat is **low (2)** which results in a **negligible (2)** impact significance. The receptor sensitivity for priority flora is **medium (3)** which results in a **minor (3)** impact significance (see Table 8.63).

Table 8.63: Impacts to habitats and flora from waste and litter accumulation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Generation of operational waste, use of plant, equipment and vehicles	Waste accumulation in nearby habitats and impacts to natural habitats	Very Low (1)	Low (2)	**Negligible (2)**	N
	Waste accumulation in nearby habitats and impacts to priority flora	Very Low (1)	Medium (3)	**Minor (3)**	N

Mitigation measures

Additional mitigation measures will not be required during the operational phase given the **negligible/minor** impact.

8.2.2.3 Fauna and their habitats

8.2.2.3.1 Fauna habitat loss and fragmentation

No further loss or degradation is predicted during the operations phase.

8.2.2.3.2 Accidental vehicle and machinery collisions with fauna

The risk of vehicle collision within the Project footprint will be lower during the operation phase compared to construction due to a reduction in the volume of vehicles and their duration of operation. The residual impact significance is therefore assessed as **negligible (1)** for non-priority fauna and birds, and **negligible (2)** for priority avifauna.

8.2.2.3.3 Accidental injury or mortality to fauna from falls and entrapment in pipeline trenches

Impacts are highly unlikely, particularly for priority birds, as there will be no open trenches.

8.2.2.3.4 Changes to air quality

Materials, personnel and equipment will be transported within, to and from the Project sites during the operations phase. There is a potential for indirect impacts from fugitive dust emissions, however, as identified in Section 8.1.1.6, no significant operational phase impacts on local air quality are anticipated. Additionally, like during the construction phase, the impact would be highly localised and there are no earth moving activities planned. The residual impact significance is therefore assessed as **negligible (1)** for non-priority fauna and birds, and **negligible (2)** for priority avifauna.

8.2.2.3.5 Noise and vibration

Disturbance to non-priority fauna and avifauna and priority fauna from noise and vibration emissions will be lower during the operation phase compared to construction due to a reduction in the operation of vehicles and machines, the workforce and general construction activities. Hence the residual impact significance is assessed as **negligible (1)** for non-priority fauna and birds, and **negligible (2)** for priority avifauna.

8.2.2.3.6 Introduction of invasive species

During the operations phase, with the AIS prevention protocol in place, there is no expected impact to non-priority fauna, priority birds and their habitats from the introduction of AIS.

8.2.2.3.7 Induced access and Project-related in-migration

Any impact on the priority birds and other commonly occurring fauna from plant workers is expected to be minimal, because they will have limited access to areas outside of the plant and will be able to take lunch breaks at the cafeteria on the plant.

The impact magnitude has been assessed as **low (2)** because although the impact could occur over a long period of time, the extent will be localised, and the workforce is significantly reduced compared to the construction phase. Additionally, it is anticipated that the management control and mitigation measures will remain in place from the construction phase.

The receptor sensitivity for commonly occurring species of fauna is **very low (1)**, which results in a **negligible (2)** impact significance. The receptor sensitivity for priority birds is **low (2)**, which results in a **minor (4)** impact significance (see Table 8.64).

Table 8.64: Impacts to fauna and their habitats from induced access and Project-related in-migration

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Induced access and Project-related in-migration of operational workers	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach
	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach

Mitigation measures

The following mitigation measures will be used to reduce the impact to fauna and their habitats from induced access and Project-related in-migration:

- All plant staff will be provided with designated eating areas and shall be restricted from free access to the Bay of Ohuira edge where they could cause disturbance to wildlife including waterbirds. Staff shall be restricted from walking outside of designated areas (e.g., for rest breaks) including walking through the designated 'conservation area' or down to the edge of Bay of Ohuira to minimise risk of scaring off waterbirds from foraging areas. A designated shaded area will be provided for staff to take breaks equipped with litter bins (protected from wind) that shall be routinely cleared to prevent wind blow litter and pollution of the adjacent areas (2022).
- The conservation area in the southern portion of the site will need to be monitored and protected from human encroachment and development as it serves as a buffer of 1 km between the Project and the bay. A CMP will be developed for this area (2022).

Residual impacts

With the listed mitigation measures in place, the impact magnitude is reduced to **very low (1)**. The receptor sensitivity for non-priority fauna and avifauna remains **very low (1)**,

which reduces the residual impact significance to **negligible (1)**. The receptor sensitivity for non-priority fauna and avifauna remains **low (2)**, which reduces the residual impact significance to **negligible (2)**.

8.2.2.3.8 Waste accumulation in nearby habitats

During the operations phase, the potential remains for small quantities of packaging and food waste to be generated, and if not properly managed, to enter the environment and surrounding habitats. There is also a potential for minor spills of oils, fuel or lubricants from the use of plant, equipment and construction vehicles to cause accidental injury or mortality to fauna if ingested (SLR Consulting Limited, 2024b).

Given that the workforce will be much reduced, the rate of waste generation is expected to be lower than during the construction phase. Furthermore, the probability of spills is also reduced, and any spills would be highly localised. The magnitude of this impact is therefore assessed as **very low (1)**. The receptor sensitivity for commonly occurring fauna and avifauna is **very low (1)** which results in a **negligible (1)** impact significance. The receptor sensitivity for priority birds is **low (2)** which results in a **negligible (2)** impact significance (see Table 8.65).

Table 8.65: Impacts to fauna and their habitats from waste and litter accumulation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Generation of operational waste, use of plant, equipment and vehicles	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Very Low (1)	Very Low (1)	**Negligible (1)**	N
	Disturbance to priority birds	Very Low (1)	Low (2)	**Negligible (2)**	N

Mitigation measures

Additional mitigation measures will not be required during the operational phase given the **negligible** impact.

8.2.2.3.9 Changes in hydrology and water quality

During the operations phase, no water will be abstracted, and no effluent or stormwater will be discharged to nearby waterbodies, including agricultural drainage channels and the Bay of Ohuira. Additionally, there will be no impacts to surface water and groundwater from planned Project activities. The impact magnitude is therefore **very low (1)**. receptor

sensitivity of common fauna has been assessed as **very low (1)**. The resulting impact significance is therefore considered to be **negligible (1).** For the priority bird species, the receptor sensitivity has been assessed as **low (2)**, given that none of the fauna species on the site itself are expected to trigger CH, but in some cases are locally or regionally vulnerable. The resulting impact significance from changes in hydrology and water quality is therefore considered to be **negligible (2)** (see Table 8.66).

Table 8.66: Impacts to fauna and their habitats from changes in hydrology and water quality

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project operations	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Very Low (1)	Very Low (1)	**Negligible (1)**	N
	Disturbance to priority birds	Very Low (1)	Low (2)	**Negligible (2)**	N

Mitigation measures

Additional mitigation measures will not be required during the operational phase given the **negligible** impact.

8.2.2.3.10 Artificial light spill

The methanol production plant will be operational 24 hours a day. Artificial night-time lighting used at the plant and along the access road could potentially impact and modify fauna behaviour and physiology in the same ways as described for the construction phase (see Section 8.2.1.3).

With regards to non-priority fauna and birds, the impacts are predicted to be **minor (3),** as the magnitude of the disturbance levels from artificial light on non-priority fauna and birds is assessed as being **medium (3)**, and the sensitivity for these species is **very low (1)** prior to the application of mitigation measures (see Table 8.67).

The predicted impacts to priority birds from artificial light spill is assessed as **moderate (6)** as the sensitivity for these species is **low (2)** and the magnitude of impacts is **medium (3)** (see Table 8.67).

Table 8.67: Impacts to fauna and their habitats from artificial light spill

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Use of artificial lighting during the operation of the methanol production plant and along the road	Disturbance to non-priority fauna and birds	Medium (3)	Very Low (1)	**Minor (3)**	Y taking a precautionary approach
	Disturbance to priority birds	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be used to minimise the impact to fauna and their habitats from artificial light spill:

- The use of blinds on windows in the methanol production plant to reduce light spill.
- The installation of capped or directional lighting on outdoor lights with the Project area and access road to minimise disturbance to fauna and birds within natural habitats where possible.

Residual impacts

With the listed mitigation measures in place, the impact magnitude to non-priority fauna is reduced to **low (2)** while the receptor sensitivity remains very **low (1)**. Therefore, the residual impact significance is **negligible (2)**.

Furthermore, with application of these mitigation measures, the impact magnitude to priority birds is reduced to **low (2)** while the receptor sensitivity remains **low (2)**, hence the residual impact significance is assessed as **minor (4)**.

Flaring from the gas stack

During the operational phase, the methanol production plan will have a 75 m stack that will incorporate a flare system. A pilot light, burning natural gas will be permanently lit, then during flaring events, the flare will burn a mix of argon, hydrogen and nitrogen (SLR Consulting Limited, 2024b).

During the first few weeks of operation, quite a bit of flaring will occur during the testing phase. After that it will be limited to when required. During the daytime, the flame will be invisible, but it will be visible throughout the night. This represents a potential hazard to birds, if flying during the day, when they cannot see the flame, and fly through it. Or during the night if the flame attracts birds, due to the light it emits (SLR Consulting Limited, 2024b).

The methanol production plant has been built in an area of arable land, rather than adjacent to the bays and lagoons of the coast. The location of the plant, ~1 km inland from the Bay of Ohuria, should limit the number of migratory birds passing over the flare stack. During the ornithological surveys, no flocks of birds (on migration or remaining local) were noted passing over the methanol production plant site (SLR Consulting Limited, 2024b).

The impact on birds remains unknown but is anticipated to be of only local extent and of low intensity, resulting in a **low (2)** impact magnitude. The sensitivity of non-priority fauna and birds is **very low (1)** which results in a **negligible (2)** impact significance. The sensitivity of priority birds is assessed as **low (2)** which results in a **minor (4)** impact significance (see Table 8.68).

Table 8.68: Impacts to fauna and their habitats from flaring from the gas stack

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Flaring from the gas stack	Disturbance to non-priority fauna and birds	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach
	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y

Monitoring

As the potential for impacts on birds is not known, but anticipated to be low, ongoing monitoring will take place. Monitoring will be implemented as part of the Programme for Avifauna Monitoring (2021).

The environmental team will also record any bird deaths noted (if they occur) on a daily basis. After six months, the results will be analysed (as this period will include for one migration event). If more than two deaths per month on average are occurring, then adaptive management will be implemented. This may include the use of a siren prior to flaring or adding bird deterrents to the tower. The exact methods will be decided based on the evidence gathered (2021).

Residual impact

The potential full impact of flaring from the gas stack is unknown. With the recommended monitoring in place, the predicted impact magnitude remains **low (2)** because the full impact is unknown. Therefore, the impact significance for non-priority fauna and birds, and for priority birds remains **negligible (2)** and **minor (4)** respectively.

8.2.3 Decommissioning

Decommissioning of the methanol production plant is conservatively considered to have similar impacts to those of the construction stage. A Decommissioning Plan will be developed closer to the time of decommissioning (30 years).

8.2.4 Biodiversity impact assessment summary

With the diligent application of the mitigation measures described above, the Project will have no moderate or major residual impacts on natural and modified habitats, flora and fauna. These mitigation measures are presented in the ESMMP (see Section 0) and the Biodiversity Management Plan (BMP) (Appendix 1). In addition to the BMP, there are a number of regulatory-driven plans and programs which inform the BMP. These are listed as follows:

- Protection Program of Flora and Fauna
- Wetlands Benefit Compensation Program
- Reforestation of Native Species
- Environmental Monitoring Plan
- Program of Environmental Education
- Preventive and Corrective Maintenance Program for Machinery
- Environmental Program
- Emissions Monitoring Program
- Groundwater Monitoring Program
- Waste Management Program (RME, RSU, RP)
- Soil Monitoring Program
- Program for Avifauna Monitoring
- Program for Monitoring, Capture and Conservation
- Reforestation Program for Temporary Areas
- Relocation of Temporary Area 12.

Table 8.69 and Table 8.70 provide a summary of the biodiversity impact assessment. Please note that this does not specify the mitigation measures.

The project is committed to achieving no net loss of natural habitats as presented above and in the BMP. This will be achieved though developing and implementing the following:

- Natural Habitat Restoration Plan: to re-establish natural habitats, native species and support natural ecological processes in the construction areas and conservation area. This will include the progressive restoration of natural habitats and should include monitoring and maintenance for at least two years or until such time as natural restoration is secured (2022).
- Topsoil Management Plan or procedure: to facilitate natural habitat restoration (2022; 2021).
- Natural habitat compensation:
- The natural habitat loss will be 18.32 ha of Xerophytic vegetation, the project will develop a strategy to meet NNL of this habitat, considering habitat quality metrics.

- By national requirements, the Project plans to provide compensation equating to an area that is at least 10% of the Project footprint. These measures are expected to include approximately 6 ha of reforestation (i.e., scrubbing) and cactus planting, plus 6 ha of mangrove restoration. As no mangrove habitat is expected to be impacted by the Project, the mangrove restoration is therefore considered to be an additionality (SLR Consulting Limited, 2024a). The reforestation/restoration locations, and details of land ownership and access, are yet to be determined.
- A set aside (avoidance): The development of a 15 ha ‘conservation area’ (2022; 2021).

Due the overlapping of the Project with Internationally Recognized Areas, previsions of GN Par 20 applies. In this context three of the four requirements have already been met by Mexinol e.g.: Demonstration that the proposed development in such areas is legally permitted; Acting in a manner consistent with any government recognized management plans for such areas; and undertaking of consultation with protected area sponsors and managers). The fourth requirement consists of the Project implementing additional programs, as appropriate, to promote and enhance the conservation aims and effective management of biodiversity in the region and to benefit to the values of the KBA.

The scope of these actions will be defined following consultation with the site managers and detailed in the BMP.

Table 8.69: Impact magnitude scoring for biodiversity impacts

No.	Project activity	Description of impact	Intensity	Frequency	Duration	Magnitude of impact
Construction phase						
1	Construction activities	Disturbance or degradation of protected areas	Negligible	Continuous	Medium-term	Very Low (1)
2	Land clearance for construction of the methanol and JAPAMA pipelines	Natural habitat loss, fragmentation and edge effects	Medium	Continuous	Long-term	Medium (3)
3	Land clearance for construction of the methanol production plant and access road	Natural habitat loss, fragmentation and edge effects	Low	Continuous	Long-term	Low (2)
4	Land clearance for construction of the methanol and JAPAMA pipelines	Clearance of priority flora	Low	Continuous	Long-term	Low (2)
5	Land clearance for construction of the methanol production plant and access road	Clearance of priority flora	Negligible	Continuous	Long-term	Very Low (1)
6	Construction vehicle and heavy machinery movements	Fugitive dust emissions and adverse impacts to natural habitats	Medium	Episodic	Medium-term	Low (2)
7	Construction vehicle and heavy machinery movements	Fugitive dust emissions and adverse impacts to priority flora	Medium	Episodic	Medium-term	Low (2)
8	Construction activities including trenching for construction of the methanol pipeline, and the use of fuel, oil, solvents etc.	Changes in hydrology and water and impacts to natural habitat	Medium	Episodic	Medium-term	Low (2)
9	Construction activities including trenching for construction of the methanol and JAPAMA pipelines, and the use of fuel, oil, solvents etc	Changes in hydrology and water and impacts to priority flora	Medium	Episodic	Medium-term	Low (2)
10	Collection, transportation, handling and storage of construction materials	Introduction and/or spread of AIS and adverse impacts to natural habitats	Medium	Continuous	Medium-term	Medium (3)
11	Collection, transportation, handling and storage of construction materials	Introduction and/or spread of AIS and adverse impacts to priority flora	Medium	Continuous	Medium-term	Medium (3)
12	Presence of construction workforce on site	Induced access and Project-related in-migration and adverse impacts to natural habitat	Medium	Continuous	Short-term	Low (2)
13	Presence of construction workforce on site	Induced access and Project-related in-migration and adverse impacts to priority flora	Medium	Continuous	Short-term	Low (2)
14	Generation of construction waste, use of plant, equipment and construction vehicles	Waste accumulation in nearby habitats and impacts to natural habitats	Medium	Episodic	Medium-term	Low (2)
15	Generation of construction waste, use of plant, equipment and construction vehicles	Waste accumulation in nearby habitats and impacts to priority flora	Medium	Episodic	Medium term	Low (2)
16	Land clearance and modification during construction	Habitat loss and fragmentation and the displacement of commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low	Continuous	Long-term	Low (2)
17	Land clearance and modification during construction	Habitat loss and fragmentation and the displacement of priority birds	Low	Continuous	Long-term	Low (2)
18	Vehicle and machinery operation during construction	Accidental vehicle and machinery collisions with commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Medium	Episodic	Medium-term	Low (2)

No.	Project activity	Description of impact	Intensity	Frequency	Duration	Magnitude of impact
19	Vehicle and machinery operation during construction	Accidental vehicle and machinery collisions with priority birds	Medium	Episodic	Medium-term	Low (2)
20	Pipeline trenching	Fauna falling into trenches and becoming trapped resulting in injury or mortality	Medium	Episodic	Medium-term	Low (2)
21	Habitat clearance and topsoil, grading and vehicle movement on exposed surfaces and general construction activities	Adverse impacts from fugitive dust emissions (e.g. PM_{10} and $PM_{2.5}$) and combustion emissions air pollutants (i.e. CO, SO_2, NOx, particulate matter and VOCs) to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Medium	Episodic	Medium-term	Low (2)
22	Habitat clearance and topsoil, grading and vehicle movement on exposed surfaces and general construction activities	Adverse air quality impacts on priority bird species, including those resulting from changes to irrigation channels that serve as modified habitats	High	Episodic	Long-term	Medium (3)
23	The use of noisy machinery and vehicles and general contraction activities	Disturbance and displacement of commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Medium	Episodic	Medium-term	Low (2)
24	The use of noisy machinery and vehicles and general contraction activities	Disturbance and displacement of priority birds	Medium	Episodic	Medium-term	Low (2)
25	Mobilisation and construction work involve collection, transportation, handling, storage, and wate disposal	Disturbance and displacement of non-priority fauna and avifauna from AIS and pests	Medium	Continuous	Medium-term	Medium (3)
26	Mobilisation and construction work involve collection, transportation, handling, storage, and wate disposal	Disturbance and displacement of priority birds from AIS and pests	Medium	Continuous	Medium-term	Medium (3)
27	Induced access and Project-related in-migration of construction workers	Non-priority fauna and avifauna	Medium	Continuous	Short-term	Low (2)
28	Induced access and Project-related in-migration of construction workers	Priority birds	Medium	Continuous	Short-term	Low (2)
29	Generation of construction waste, use of plant, equipment and construction vehicles	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Medium	Episodic	Medium-term	Low (2)
30	Generation of construction waste, use of plant, equipment and construction vehicles	Disturbance to priority birds	Medium	Episodic	Medium term	Low (2)
31	Construction of the methanol and JAPAMA pipelines	Changes in hydrology and water quality resulting in adverse impacts to non-priority fauna and avifauna through injection and contact.	Medium	Episodic	Medium-term	Low (2)
32	Construction of the methanol and JAPAMA pipelines	Changes in hydrology and water quality resulting in adverse impacts to priority birds through injection and contact.	Medium	Episodic	Medium-term	Low (2)
33	Use of artificial lighting during the construction of the methanol production plant, access roads and pipelines	Disturbance to non-priority fauna and birds	Medium	Episodic	Medium-term	Low (2)
34	Use of artificial lighting during the construction of the methanol production plant, access roads and pipelines	Disturbance to priority birds	Medium	Episodic	Medium-term	Low (2)
Operation phase						
35	Project operations	Disturbance to waterbirds and Ramsar Site from Project operations	Negligible	Continuous	Long-term	Very Low (1)
36	Transportation of materials, personnel and equipment	Fugitive dust emissions and adverse impacts to natural habitats	Negligible	Episodic	Long-term	Very Low (1)
37	Transportation of materials, personnel and equipment	Fugitive dust emissions and adverse impacts to priority flora	Negligible	Episodic	Long-term	Very Low (1)

No.	Project activity	Description of impact	Intensity	Frequency	Duration	Magnitude of impact
38	Project operations	Changes in hydrology and water and impacts to natural habitat	Negligible	Episodic	Long-term	Very Low (1)
39	Project operations	Changes in hydrology and water and impacts to priority flora	Negligible	Episodic	Long-term	Very Low (1)
40	Presence of operational workforce on site	Induced access and Project-related in-migration and adverse impacts to natural habitat	Low	Continuous	Long-term	Low (2)
41	Presence of operational workforce on site	Induced access and Project-related in-migration and adverse impacts to priority flora	Low	Continuous	Long-term	Low (2)
42	Generation of operational waste, use of plant, equipment and vehicles	Waste accumulation in nearby habitats and impacts to natural habitats	Negligible	Episodic	Medium-term	Very Low (1)
43	Generation of operational waste, use of plant, equipment and vehicles	Waste accumulation in nearby habitats and impacts to priority flora	Negligible	Episodic	Medium-term	Very Low (1)
44	Induced access and Project-related in-migration of operational workers	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low	Continuous	Long-term	Low (2)
45	Induced access and Project-related in-migration of operational workers	Disturbance to priority birds	Low	Continuous	Long-term	Low (2)
46	Generation of operational waste, use of plant, equipment and vehicles	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Negligible	Episodic	Long-term	Very Low (1)
47	Generation of operational waste, use of plant, equipment and vehicles	Disturbance to priority birds	Negligible	Episodic	Long-term	Very Low (1)
48	Project operations	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Negligible	Episodic	Long-term	Very Low (1)
49	Project operations	Disturbance to priority birds	Negligible	Episodic	Long-term	Very Low (1)
50	Use of artificial lighting during the operation of the methanol production plant and along the road.	Disturbance to non-priority fauna and birds	Medium	Continuous	Long-term	Medium (3)
51	Use of artificial lighting during the operation of the methanol production plant and the access road.	Disturbance to priority birds	Medium	Continuous	Long-term	Medium (3)
52	Flaring from the gas stack	Disturbance to non-priority fauna and birds	Low	Episodic	Long-term	Low (2)
53	Flaring from the gas stack	Disturbance to priority birds	Low	Episodic	Long-term	Low (2)

Table 8.70: Pre-mitigation impact scoring and post mitigation residual impact significance for biodiversity impacts

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[164]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
Construction phase									
1	Construction activities	Disturbance or degradation of protected areas	Very Low (1)	High (4)	**Minor (4)**	N	Very Low (1)	High (4)	**Minor (4)**
2	Land clearance for construction of the methanol and JAPAMA pipelines	Natural habitat loss, fragmentation and edge effects	Medium (3)	Low (2)	**Moderate (6)**	Y	Very low (1)	Low (2)	**Negligible (2)**
3	Land clearance for construction of the methanol production plant and access road	Natural habitat loss, fragmentation and edge effects	Low (2)	Low (2)	**Minor (4)**	N	Very low (1)	Low (2)	**Negligible (2)**

[164] Refer to Sections 8.2.1-8.2.3 for details of proposed mitigation measures

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[164]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
4	Land clearance for construction of the methanol and JAPAMA pipelines	Clearance of priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y	Very low (1)	Medium (3)	**Minor (3)**
5	Land clearance for construction of the methanol production plant and access road	Clearance of priority flora	Very Low (1)	Medium (3)	**Minor (3)**	Y taking a precautionary approach	Very low (1)	Medium (3)	**Minor (3)**
6	Construction vehicle and heavy machinery movements	Fugitive dust emissions and adverse impacts to natural habitats	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
7	Construction vehicle and heavy machinery movements	Fugitive dust emissions and adverse impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y	Very low (1)	Medium (3)	**Minor (3)**
8	Construction activities including trenching for construction of the methanol and JAPAMA pipelines, and the use of fuel, oil, solvents etc.	Changes in hydrology and water and impacts to natural habitat	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
9	Construction activities including trenching for construction of the methanol and JAPAMA pipelines, and the use of fuel, oil, solvents etc	Changes in hydrology and water and impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y	Very low (1)	Medium (3)	**Minor (3)**
10	Collection, transportation, handling and storage of construction materials	Introduction and/or spread of AIS and adverse impacts to natural habitats	Medium (3)	Low (2)	**Moderate (6)**	Y	Very low (1)	Low (2)	**Negligible (2)**
11	Collection, transportation, handling and storage of construction materials	Introduction and/or spread of AIS and adverse impacts to priority flora	Medium (3)	Medium (3)	**Moderate (9)**	Y	Very low (1)	Medium (3)	**Minor (3)**
12	Presence of construction workforce on site	Induced access and Project-related in-migration and adverse impacts to natural habitat	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
13	Presence of construction workforce on site	Induced access and Project-related in-migration and adverse impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y	Very low (1)	Medium (3)	**Minor (3)**
14	Generation of construction waste, use of plant, equipment and construction vehicles	Waste accumulation in nearby habitats and impacts to natural habitats	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
15	Generation of construction waste, use of plant, equipment and construction vehicles	Waste accumulation in nearby habitats and impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y	Very low (1)	Medium (3)	**Minor (3)**
16	Land clearance and modification during construction	Habitat loss and fragmentation and the displacement of commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach	Low (2)	Very Low (1)	**Negligible (2)**
17	Land clearance and modification during construction	Habitat loss and fragmentation and the displacement of priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Low (2)	Low (2)	**Minor (4)**
18	Vehicle and machinery operation during construction	Accidental vehicle and machinery collisions with commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical	Low (2)	Very Low (1)	**Negligible (2)**	Y	Very low (1)	Very low (1)	**Negligible (1)**

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[164]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
		habitat and as such are not categorised as priority fauna of high conservation value				taking a precautionary approach			
19	Vehicle and machinery operation during construction	Accidental vehicle and machinery collisions with priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
20	Pipeline trenching	Fauna falling into trenches and becoming trapped resulting in injury or mortality	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
21	Habitat clearance and topsoil, grading and vehicle movement on exposed surfaces and general construction activities	Adverse impacts from fugitive dust emissions (e.g. PM_{10} and $PM_{2.5}$) and combustion emissions air pollutants (i.e. CO, SO_2, NOx, particulate matter and VOCs) to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach	Very low (1)	Very low (1)	**Negligible (1)**
22	Habitat clearance and topsoil, grading and vehicle movement on exposed surfaces and general construction activities	Adverse air quality impacts on priority bird species, including those resulting from changes to irrigation channels that serve as modified habitats	Medium (3)	Low (2)	**Moderate (6)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
23	The use of noisy machinery and vehicles and general contraction activities	Disturbance and displacement of commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach	Very low (1)	Very low (1)	**Negligible (1)**
24	The use of noisy machinery and vehicles and general contraction activities	Disturbance and displacement of priority birds	Low (2)	Low (2)	**Minor (4)**	Y	Very low (1)	Low (2)	**Negligible (2)**
25	Mobilisation and construction work involve collection, transportation, handling, storage, and wate disposal	Disturbance and displacement of non-priority fauna and avifauna from IAS and pests	Medium (3)	Very Low (1)	**Minor (3)**	Y	Low (2)	Very Low (1)	**Negligible (2)**
26	Mobilisation and construction work involve collection, transportation, handling, storage, and wate disposal	Disturbance and displacement of priority birds from AIS and pests	Medium (3)	Low (2)	**Moderate (6)**.	Y	Low (2)	Low (2)	**Minor (4)**
27	Induced access and Project-related in-migration of construction workers	Non-priority fauna and avifauna	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach	Very low (1)	Very low (1)	**Negligible (1)**
28	Induced access and Project-related in-migration of construction workers	Priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
29	Generation of construction waste, use of plant, equipment and construction vehicles	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach	Very low (1)	Very low (1)	**Negligible (1)**
30	Generation of construction waste, use of plant, equipment and construction vehicles	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[164]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
31	Construction of the methanol and JAPAMA pipelines	Changes in hydrology and water quality resulting in adverse impacts to Non-priority fauna and avifauna through injection and contact.	Low (2)	Very Low (1)	**(Negligible 2)**	Y taking a precautionary approach	Very low (1)	Very low (1)	**Negligible (1)**
32	Construction of the methanol and JAPAMA pipelines	Changes in hydrology and water quality resulting in adverse impacts to priority birds through injection and contact.	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very low (1)	Low (2)	**Negligible (2)**
33	Use of artificial lighting during the construction of the methanol production plant, access roads and pipelines	Disturbance to non-priority fauna and birds	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach	Very Low (1)	Very Low (1)	**Negligible (1)**
34	Use of artificial lighting during the construction of the methanol production plant, access roads and pipelines	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very Low (1)	Low (2)	**Negligible (2)**
Operation phase									
35	Project operations	Disturbance to waterbirds and Ramsar Site from Project operations	Very Low (1)	High (4)	**Minor (4)**	Y taking a precautionary approach	Very Low (1)	High (4)	**Minor (4)**
36	Transportation of materials, personnel and equipment	Fugitive dust emissions and adverse impacts to natural habitats	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
37	Transportation of materials, personnel and equipment	Fugitive dust emissions and adverse impacts to priority flora	Very Low (1)	Medium (3)	**Minor (3)**	N	Very Low (1)	Medium (3)	**Minor (3)**
38	Project operations	Changes in hydrology and water and impacts to natural habitat	Very Low (1)	Low (2)	**Negligible (2)**	Y taking a precautionary approach	Very Low (1)	Low (2)	**Negligible (2)**
39	Project operations	Changes in hydrology and water and impacts to priority flora	Very Low (1)	Medium (3)	**Minor (3)**	Y taking a precautionary approach	Very Low (1)	Medium (3)	**Minor (3)**
40	Presence of operational workforce on site	Induced access and Project-related in-migration and adverse impacts to natural habitat	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very Low (1)	Low (2)	**Negligible (2)**
41	Presence of operational workforce on site	Induced access and Project-related in-migration and adverse impacts to priority flora	Low (2)	Medium (3)	**Moderate (6)**	Y	Very Low (1)	Medium (3)	**Minor (3)**
42	Generation of operational waste, use of plant, equipment and vehicles	Waste accumulation in nearby habitats and impacts to natural habitats	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
43	Generation of operational waste, use of plant, equipment and vehicles	Waste accumulation in nearby habitats and impacts to priority flora	Very Low (1)	Medium (3)	**Minor (3)**	N	Very Low (1)	Medium (3)	**Minor (3)**
44	Induced access and Project-related in-migration of operational workers	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Low (2)	Very Low (1)	**Negligible (2)**	Y	Very Low (1)	Very Low (1)	**Negligible (1)**

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[164]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
						taking a precautionary approach			
45	Induced access and Project-related in-migration of operational workers	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Very Low (1)	Low (2)	**Negligible (2)**
46	Generation of operational waste, use of plant, equipment and vehicles	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Very Low (1)	Very Low (1)	**Negligible (1)**	N	Very Low (1)	Very Low (1)	**Negligible (1)**
47	Generation of operational waste, use of plant, equipment and vehicles	Disturbance to priority birds	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
48	Project operations	Disturbance to commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value	Very Low (1)	Very Low (1)	**Negligible (1)**	N	Very Low (1)	Very Low (1)	**Negligible (1)**
49	Project operations	Disturbance to priority birds	Very Low (1)	Low (2)	**Negligible (2)**	N	Very Low (1)	Low (2)	**Negligible (2)**
50	Use of artificial lighting during the operation of the methanol production plant and along the road.	Disturbance to non-priority fauna and birds	Medium (3)	Very Low (1)	**Minor (3)**	Y taking a precautionary approach	Low (2)	Very Low (1)	**Negligible (2)**
51	Use of artificial lighting during the operation of the methanol production plant and the access road.	Disturbance to priority birds	Medium (3)	Low (2)	**Moderate (6)**	Y	Low (2)	Low (2)	**Minor (4)**
52	Flaring from the gas stack	Disturbance to non-priority fauna and birds	Low (2)	Very Low (1)	**Negligible (2)**	Y taking a precautionary approach	Low (2)	Very Low (1)	**Negligible (2)**
53	Flaring from the gas stack	Disturbance to priority birds	Low (2)	Low (2)	**Minor (4)**	Y taking a precautionary approach	Low (2)	Low (2)	**Minor (4)**

8.3 Social impact assessment for planned events

This section outlines potential impacts of planned events on the following socio-economic receptors: economy; employment and skills development; labour and working conditions; land ownership and livelihoods; community health, safety, security and welfare; cultural heritage; and social infrastructure and services; gender and vulnerable groups. Specific issues concerning human rights and Indigenous People are also addressed. Relevant planned Project activities and associated potential impacts on these social receptors are identified, and the significance of each potential impact is assessed in accordance with the methodology described in Section 7. A pre-mitigation impact significance rating is provided for each identified socioeconomic impact that considers existing embedded controls and mitigation measures. Any additional mitigation measures required to supplement these existing controls are described, and a residual impact rating is specified.

8.3.1 Crosscutting issues

8.3.1.1 Indigenous Peoples

Details regarding the indigenous Mayo-Yoreme peoples from the social AoI, including their distinct cultures, resources and traditions, and social marginalisation and vulnerability are provided in Section 5.4.3.21. Ejido Ohuira is the nearest officially acknowledged Indigenous Peoples community from the Project, located approximately 9.5 kilometres north of the Project by road with 540 recorded indigenous households. However, it is important to recognise that Indigenous Peoples populations are represented in most communities, as seen in Section 5.4.3.21, including within the direct AoI communities such as Topolobampo (95 indigenous households) and Ejido Rosendo G. Castro (11 indigenous households).

Although Indigenous Peoples (Lázaro Cárdenas, Carrizo Grande, Ejido Ohuira, Cerro Cabezón and Paradones) surrounding the Project are reported to use firewood for cooking sourced from mesquite trees, no evidence of potential uses were identified within the lands affected by the Project (including lands affected by the Japama pipelines, methanol transfer pipeline and Port of Topolobampo upgrades) during the RSK 2024 field-based socioeconomic study which included triangulating results from UAIM and Aosenuma studies (as described in Section 5.4.2). Furthermore, there will be no impacts to the lands, habitats, ancestral territories or ecosystem services specific to the natural resource-based livelihoods of Indigenous Peoples because of the Project (Section 5.5).

While there are no recognised Indigenous People's PACs within the Direct AoI, it is important to note that 2% of the population of Ejido Rosendo G. Castro and Topolobampo self-identify as a member of an indigenous nation. Indigenous Peoples are considered as vulnerable group by the Project. Some of these groups have already expressed opposition to another proposed petrochemical development *(Gas y Petroquímica de Occidente)* within the social AoI (as recent as 2024). At the community level there are already pre-existing tensions and divisions over opposition to, or support for, this planned third-party petrochemical development which may result in higher risks of mistrust about the Project's impacts, even though there is no connection between the two and the Project is implementing different design and engineering factors (e.g. use of wastewater,

NetZero) to prevent impacts. Although there are no formally recognised Indigenous Peoples communities or cultural resources in the direct AoI and therefore there is no requirement to undertake FPIC under IFC PS7. The Project is committed to implement "Informed Consultation and Participation" (ICP) and to include the relevant IPs communities in it, as there may be indirect impacts on their culture and lifestyles, to ensure potential impacts are managed in a culturally appropriate manner.

The Project will have the potential to impact the intangible cultural heritage of Indigenous People as a result of Project-related in-migration. The Project's workforce, which will peak at 3,500 new temporary workers during construction, includes a proportion of workforce from outside the municipality. At the community level, there are often clear spatial and cultural divisions between indigenous and non-indigenous groups, with anecdotal evidence suggesting that many community members who recognise themselves as indigenous hold a negative general view of mestizo community members. The influx of workers with different values and beliefs, may weaken local cultural practices, particularly the Mayo-Yoreme people's rituals, ceremonies and intangible heritage (such as weddings, community and Ejidal assemblies, consultation processes (called contis) celebrations during Holy Week, festivities to the Virgin of Guadalupe and the Holy Cross taking place in ramadas and indigenous churches). Similarly, across the Direct and Indirect AoI PACs, fishing plays a culturally significant and symbolic role for community members, but the job opportunities to be generated by the Project and other industries might deepen an ongoing generational change affecting those cultural practices. However, these impacts are not considered to be significant considering the implementation of planned management controls (Chapter 12).

The main impacts of significance for Indigenous Peoples include increased social tensions and conflict related to access to Project economic benefits. These impacts are discussed in further detail in Section 8.3.2.

An updated Stakeholder Engagement Plan has been prepared as part of this ESIA which includes a summary of the outcomes of stakeholder consultation completed to date, along with details regarding the Community Grievance Mechanism that will be established by the Project. It is also important to note the Project is supporting a government-led consultation exercise with Mayo-Yoreme peoples from Ahome Municipality and must submit a report of these consultations to the relevant authorities (i.e. SEMARNAT - Dirección General de Impacto y Riesgo Ambiental) as a key environmental permit authorisation requirement. Transition Industries has also commissioned independent specialists to complete supplementary social studies within several surrounding Indigenous Peoples communities to help inform the process (Aoesenuma 2024).

8.3.1.2 Human rights

Good international industry practice requires that where a Project has a potential to cause adverse Human Rights impacts, the ESIA should include an assessment of those impacts. Therefore, the scope of this assessment on human rights is to identify and address any significant human rights risks that relate to the Project, either directly though Project activities or indirectly through contractors, or potential supply chains within the social AoI. It should be noted that the identification of human rights risks within the Project's global supply chain is beyond the scope of this assessment, although it is worth noting that global materials and supplies will be predominately from Mexico, USA, S.

Korea and Germany (all typical countries with low risk for human rights in commercial supply chains).

The assessment was completed against several relevant applicable international standards including the United Nations Guiding Principles on Business and Human Rights ("UNGPs") 2011, the Universal Declaration of Human Rights (UDHR), 1948, and relevant aspects of the Equator Principles (EP4), 2020, IFC Performance Standards, 2012 and International Labour Organisation (ILO) practices. Potential human rights risks for the Project were identified using a rights-based approach focused on potential human rights related impacts and risks through direct Project activities or the indirect activities of contractors, suppliers or other relevant agencies (including public security or governmental organisations). A review of the main human rights potential impacts for the Project based on a contextual review of human rights risks in Mexico and at the local level is provided in Section 8.3.9.

8.3.1.3 *Gender*

Good international industry practice requires that a Project applies gender inclusive interventions, such as closing gaps between men and women in how they access and benefit from Project opportunities, increasing diversity and inclusion, and ensuring safe and fair working and living conditions.

The ESIA utilised gendered analysis focused on four key themes: access to assets; practices and participation; beliefs and perception; and laws and policies to scope specific areas where Project activities can cause specific gendered impacts and benefits. This includes but is not limited to such themes as traditional gender roles; women's access to employment and services; gender-based discrimination in access to employment and services; prevalence of GBVH; and key obstacles to strengthening gender equality. These thematic areas identified the priorities that were considered when collecting and reviewing data, assessing specific gender risks and impacts and developing gender-specific impact avoidance, minimisation, mediation and corrective action planning for the Project. Public disclosure concerns were tracked per gender. There is a female CLO who is trained and responsible for receiving GBVH related grievances.

The evaluation of risks and impacts took into consideration the four study-specific criteria defined above with the overarching aim of exploring the potential differential effects (including those that are unintended) that the Project may have on women, men, and vulnerable people and how they may positively or negatively impact benefits and opportunities for these groups.

The main impacts of significance as it pertains to gender and requiring gender-specific mitigations include: Greater gender disparity caused by higher male employment uptake (See Section 8.3.3); Failure of contractors and sub-contractors to provide adequate accommodation (See Section 8.3.4); and, increased GBVH as a result of non-local workforce arrival (See Section 8.3.6).

Furthermore, recommendations have been made in the ESMS to incorporate gender specific actions, such as:

- Ensure that gender concerns and women's needs, and perspectives are explicitly considered in the Project, and that women and men participate equally in any

relevant decision-making process, particularly when making decisions on Projects that would benefit the local communities. (SEP)

- Assign responsibilities to a female Stakeholder Engagement Officer for day-to-day engagement with local communities, monitoring and reporting, management of grievance mechanism (including acting as liaison for any female or vulnerable grievances), SEP implementation, and oversight of the EPC CLOs, to ensure that women's views are considered and that engagement with woman and vulnerable populations is taken into consideration. (SEP)
- Develop gender responsive training to ensure all staff (including EPC and contractors) responsible for engagement efforts to understand and acknowledge the requirement for gender specific protocols. (SEP)
- Prior to resumption of early works, ensure that the Grievance Redress Mechanism (GRM) is promoted in the community through dedicated awareness campaigns led by Stakeholder Engagement Officer and CLOs, making specific efforts for female staff to target women and vulnerable people in the community. (SEP)
- GBVH training programs included alongside Human Rights training for all security personnel; and include explicit mention of recruitment of female security guards. (Security Management Plan)
- Develop a gender-inclusive procurement policy to improve identification of and contracting with women-owned businesses, including with catering. (Local Content Plan)
- Women should be fitted for special gender-specific Personal Protective Equipment (PPE) and clothing that is designed to fit women workers. (OHS Plan)

8.3.1.4 Uncontrolled Project-induced in-migration or influx

An evaluation of the risks of Project-induced in-migration (or influx) has been completed as part of this ESIA. The likelihood of a Project experiencing Project induced in-migration is often predicted based on three factors:

- Existence of a mobile population;
- Characteristics of the Project; and
- Capacity of the area to meet Project needs.

Current levels of in-migration at the local level are low and generally related to former residents returning from periods of residence in other areas of the country. There is no typical mobile population within Mexico which moves from site to site in anticipation of potential construction related job opportunities. In addition, industrial development within Sinaloa state is a new phenomenon and is unlikely to attract job seekers from other states where job opportunities are more prevalent. According to the Project's EPC recruitment data, the closest industrial hubs with large construction project opportunities are in Chihuahua, Coahuila, and Jalisco, each over 850 km away from Los Mochis.

At the same time systems and capacity for planning economic development and social infrastructure within Los Mochis and Sinaloa State are strong, while relevant socio-cultural factors are positive such as the acceptance of newcomers within communities, particularly within urban areas around Los Mochis and Topolobampo. It is important to note that the smaller communities within the Social AoI have strong social ties, and it is unlikely that if in-migration of job seekers were to occur, they would choose to reside in

the smaller communities unless they had familial ties. The likelihood is therefore, that any job seekers would attempt to assimilate in Los Mochis and Topolobampo, where the potential impacts on existing social infrastructure and services could accommodate job seekers.

According to the Project's engagement with construction companies and EPCs in the Los Mochis area, influx of job seekers coming to the area in anticipation of receiving a job is very low. The likelihood of additional people ("followers") who may follow the incoming hired workforce with the aim of selling them goods and services, or in pursuit of indirect job or business opportunities, is also very low.

As a result, this ESIA considers the risks associated with uncontrolled Project-induced in-migration (or influx) as scoped out due to the assimilative capacity of the Project Social AoI. However, where relevant potential adverse impacts associated with planned employment and associated Project-induced in-migration, particularly during the construction phase, have been identified and integrated into the assessment (i.e. increased pressure on social infrastructure and services, potential impacts on cultural heritage, potential impacts on gender including increasing disparity and GBVH). However, the Project will work with the EPCs and Ahome Municipality authorities, including the urban development office to monitor for signs of uncontrolled in-migration (e.g. job seekers at the gate and project offices). If necessary, the Project will develop an in-migration management plan.

8.3.2 Economy

8.3.2.1 Construction

Economic benefits to local businesses and economy

The main economic activity in Sinaloa State is commercial agriculture. The main economic sectors, based on the number of the economic premises/units dedicated to each sector are retail trade (37.7%), services (17.5%), temporary accommodation, and food and beverage (13.1%) and manufacturing (10.3%) (DataMexico 2024). More detail on the regional economy is provided in Section 5.4.3. According to the latest trade data from 2023, the main export for Municipality of Ahome was fresh and chilled vegetables with a value of 112 million US dollars (ibid). By comparison, in 2023 the mineral and chemical sector resulted in 1.58 million US dollars of export sales predominantly to the US (67.9%) (ibid).

The Project is predominantly located within an area designated for industrial development, between the commercial Port of Topolobampo and surrounding commercial agricultural lands. The City of Los Mochis is located 14 km to the north of the methanol production facility and contains a variety of enterprises and markets including supermarkets, food and household goods shops, hardware stores supplying electrical and construction related supplies and tools. Local chambers of commerce in Los Mochis are anticipating local economic benefits and are eager to engage with the Project.

Opportunities will be created for local and national companies to provide the goods and services required for the construction of the Project. Likely materials and services include fuel, aggregates, paint, steel, cement, fencing, food and catering services, office supplies, cleaning supplies and services. Additionally, the MIA (Mexinol, 2021) commits to ensuring

that supplies such as drinking water, food, fuel, and other necessary materials are available to local businesses within the community and provide a supply, as necessary, to the local community.

Project procurement of goods and services from small, medium, and large enterprises will benefit not only the business itself but also generate an economic multiplier effect across the economy within the municipality and beyond. Sinaloa State attracted foreign direct investment (FDI) to a value of 415 million US dollars in 2023. The main origin countries of FDI in Sinaloa State were United States (US$259M), Spain (US$86.9M) and Canada (US$34.7M) (DataMexico 2024). As noted in the MIA (Mexinol, 2021), it is expected that the Project would (at the least) generate an investment of 9,331 million pesos during the site preparation and construction, and approximately 152 million pesos per year for the operation and maintenance of the plant. This is anticipated to have a significant positive effect on the local and regional economies.

The Project is developing a Local Content Plan which will demonstrate the proponent's commitment to local procurement and outline strategies, systems, plans and programmes to address gaps between local supplier capacity and the Project's corporate procurement standards. The objectives of the Local Content Plan are to 1) maximise the hiring of local workers using a tiered approach (residents of Los Mochis and surrounding communities, Ahome, Sinaloa, and other Mexican citizens); 2) maximise procurement from local suppliers and economic benefits for local businesses, and 3) improve capacity and skills of local workers and local businesses to capture business opportunities associated with the Project, both locally and nationally. The preference of hiring staff from nearby towns is also a commitment stressed in the existing MIA. To avoid an overdemand for supplied and materials the MIA commits to ensuring that there will be no shortage of supplies of drinking water, food, fuel and other materials through the preliminary identification of supply centres.

The Project will work with the EPC contractors to develop EPC specific Local Content Plans as a key contractual requirement focused on promoting local employment and procurement during construction. The Local Content Strategy will ensure that the Project's E&S standards and commitments are adequately communicated by the contractor to its subcontractors and suppliers and included in their contractual arrangements.

This is a **positive impact**, the magnitude of which will be dependent on the value of the local procurement activity (see Table 8.71).

Table 8.71: Economic benefits to local businesses due to the purchase of goods and services

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project procurement providing opportunities for regional and local businesses.	Economic benefits to local businesses and local and regional economies	**Positive (0)**			N/A for positive impacts

Enhancement measures

To enhance the positive impacts of construction phase procurement, the Local Content Plan and EPC contractors Procurement and Local Content Plans will include a commitment to work with appropriate local business networks, such as the Sinaloa Economic Development Council (CODESIN, Consejo para el Desarrollo Económico de Sinaloa) and other relevant local business chambers, as well as municipal procurement bodies to ensure continued alignment with complementary programmes and local development plans that are also promoting local supplier capability and workforce training. The Project will also make sure that mechanisms are specified in these plans to ensure that information about business and employment opportunities is regularly shared with these stakeholders.

To enhance the positive impacts of construction phase procurement, a targeted industrial baseline survey (or similar study) assessing the local workforce availability and supply chain will be completed by each EPC Contractor. It will include analysis and mapping of current local supplier capability, and analysis of the supply and demand for relevant labour categories, goods and services during the Project lifecycle.

The Project's Local Content Plan will also include the following:

- a commitment to build partnerships with higher education institutions to support research, training and development programmes
- a commitment to prioritise procurement from local suppliers of goods and services where they are of sufficient quality and availability and are price competitive
- provision of business development support including training and development programmes to build capacity of local companies, including initial training on procurement information processes and support in meeting the Project's HSSE&SP and Supplier Code of Conduct requirements
- structuring of major contracts to provide opportunities for national and local suppliers to prequalify
- an outline of specific local content reporting requirements (procurement, recruitment and capacity building) for contractors that should be embedded in

contracts, covering both workforce and procurement, and including requirements for regular monitoring, reporting and auditing on local content procurement.

- a link to SEP to keep PACs informed on local content efforts and monitoring outcomes to manage expectations, demonstrate project efforts, as well as to receive feedback on better ways to involve PACs.

It should be noted that even with commitments to prioritise local procurement wherever possible, it is expected that some purchasing will inevitably be conducted internationally, for example for high specification products and engineered components not available locally, or where quality and quantity cannot be assured with a locally available product.

Reduction of tourism visitors and loss of associated economic benefits

While the Project is predominantly located within an area designated for industrial development, the tourism sector around Topolobampo has seen economic growth in recent years with various enterprises serving tourist visitors to the Bay of Ohuira, the Bay of Topolobampo and the Bay of Santa María, with surrounding islands and beaches found in the Sea of Cortez. This includes a small number of eight-seater boat operators offering daily whale / dolphin tours, water sports providers, restaurants, souvenir shops, food stalls along the Topolobampo waterfront, and two hotels operating in Topolobampo. These enterprises provide economic benefits in the form of direct employment and economic multiplier effects across the local economy.

It should be noted, however, that many of the newer restaurants and food vendors in Topolobampo within the popular pier area cater to workers of new businesses at the port and industrial areas, and not only recreational tourists. The Project workforce management will likely also frequent these establishments which will contribute positively to the economy.

During the construction phase, the Project will cause increased demand for accommodation for workers and recruitment projections indicate that the use of accommodation on the open market such as hotels may be required, prior to and after the construction of a dedicated worker accommodation facility. The EPC Consortium Techint/Samsung has completed a worker accommodation study to assess the availability and suitability of accommodation on the open market (see 8.3.4.1 for further details). If hotels within the Topolobampo area are utilised this may result in a decline in the availability of rooms for an emerging tourism industry which may cause a corresponding decline in visitor numbers with knock on economic effects for associated tourism enterprises and local people economically engaged in the sector.

Project construction activities, especially in and around Topolobampo, such as an increase in construction related traffic, movement of heavy plant machinery and temporary road closures may result in temporary reduced access or appeal for tourist visitors. However, this is unlikely considering such activity would occur away from the popular pier area. Therefore, this is not likely to cause a corresponding reduction in direct and indirect economic benefits for local people involved in the sector.

Prior to the application of mitigation measures, the receptor sensitivity is assessed as **low** (2) due to the current scale of the affected tourism sector, and the impact magnitude is assessed as **low** (2) due to likely continuous duration of impact and high receptor reliance on income from tourism. The impact significance is assessed to be **minor** (4) (see Table 8.71).

Table 8.72: Reduction of tourism visitors and loss of associated economic benefits

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project procurement of accommodation services and increased construction traffic and road closures during construction	Reduced tourism visitors to Topolobampo and associated economic benefits	Low (2)	Low (2)	**Minor (4)**	N

Additional measures

During the construction phase, as part of the socioeconomic monitoring included in the Social Management Plan, the Project should monitor the occupancy rates and tourism usage of hotels and guest houses in Topolobampo to ensure available headroom exists for tourism sector. Where monitoring determines an external accommodation supplier in Topolobampo is reaching capacity within the tourism season, the Project and EPC contractor should prioritise the use of an alternative hotel.

8.3.2.2 Operations

National economic benefits, payment of taxes and levies to government

Sinaloa State attracted foreign direct investment (FDI) to a value of 415 million US dollars in 2023. The main origin countries of FDI in Sinaloa State were United States (US$259M), Spain (US$86.9M) and Canada (US$34.7M) (DataMexico 2024). A total investment of 2.2 billion USD is expected to be required to construct the Project. This capital investment, combined with taxes on profit, will lead to payment of corporate taxes and income taxes on wages to the state. Increased state revenue will be a direct benefit of the Project, as will the diversification of the economy of Sinaloa state, and the Municipality of Ahome, from a largely agrarian economy.

As part of a commitment to significantly reduce carbon emissions, the Project will purchase green power through clean energy certificates from energy suppliers, in addition to direct renewable energy generation. This procurement of clean energy will benefit renewable energy producers in Mexico by reducing market risks, enhancing the attractiveness for investment and contributing nationally towards the development of renewable energy production. The Project itself also contributes to the country's commitments under the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement and 2022 Nationally Determined Contributions by developing and operating a green methanol export facility (see Table 8.73).

Table 8.73: National economic benefits during operations

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project payment of taxes	Increased state revenue	**Positive (0)**			N/A
Purchase of clean energy certificates	National investment in energy transition and renewables sector	**Positive (0)**			N/A

Enhancement measures

To enhance the positive economic development benefits from taxes and revenue accrued at the national level, the Project should liaise with local and national government agencies to promote the use of revenue from the Project in the Project's AoI for local development.

Increased cost of living, inflationary pressure from Project procurement

The increased procurement of goods and services by the Project from local and national suppliers will be in competition with other companies seeking to purchase similar goods and services. Local businesses may be more price sensitive and have less leveraging ability and thus may suffer more from any induced inflation. This impact may extend beyond construction related industries and include food and supplies, which in turn may place some inflationary or supply pressures on local households as well as businesses who also rely on these local providers. Vulnerable groups (mainly deprived households) are the most sensitive to any inflationary pressures on essential goods.

The Project's workforce and increased employment is limited relative to the overall size of the workforce at the municipal level, and therefore the impact of these Project-induced costs of living and inflationary pressures will be more limited when viewed across the entire Project duration and region. That said, Project-induced cost of living increases and inflationary pressure will be highest during construction when a significantly higher number of workers are likely to be required (3,500 at peak[165]) and limited to particular categories of workers or segments of society (i.e. communities with higher percentages of skilled construction workers, machine operators and their families).

It is likely that the Project will compete with other companies involved in the infrastructure sector at the municipality level for the employment of skilled, semi-skilled and support services labour; this cumulative impact will be covered in more detail in Chapter 10. As a result, there may be upward pressure on wages for some categories of workers at the sector level. These competitors may not be able to pay salaries comparable to the Project. This impact may also be more acute for the commercial agriculture sector, where

[165] It is important to note the MIA (Mexinol, 2021) considered only 2,900 workers at peak and 1,500 workers average; however, with the advanced stages of design and further information provided by EPCs, this number has increased.

employees with transferrable skills (such as tractor drivers or other agricultural machine operators) may be drawn to work opportunities created by Project-related construction.

Receptor sensitivity of local businesses, competitors, and local households has been assigned as **low (2)** due to the predominantly commercial agrarian economy and low number of employment opportunities in relation to likely workforce at the municipality level, whereas affected vulnerable groups are classed as **medium (3)** as they are most sensitive to inflationary pressures on essential goods. The impact magnitude has been assessed as **low (2)** for non-vulnerable groups**,** due to the short duration of the construction activities and the likely limited impact of Project procurement within an already industrialising region. For vulnerable groups impact magnitude is assessed as **medium (3),** as the intensity of impacts are likely to be higher. The resulting impact significance is **minor (4)** for non-vulnerable groups and **moderate (9)** for vulnerable groups (see Table **8.74**).

Table 8.74: Inflationary pressures due to Project procurement

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Procurement of goods and services	Increased cost of living, inflationary pressure from Project procurement	Low (2)	Low (2) – non-vulnerable groups	**Minor (4)**	N
		Medium (3)	Medium (3) – vulnerable groups	**Moderate (9)**	Y

Mitigation measures

The Project will develop a Social Management Plan which will include:

- Monitoring of socio-economic changes in the Social AoI, including population size of communities and vulnerable groups.
- Price survey/market monitoring of businesses that reflect the markets/businesses that communities (including vulnerable groups) within the AoI purchase from.

Project's Local Content Plan aims at enhancing opportunities for local communities to benefit from the economic growth driven by the project, whilst monitoring their situation against baseline conditions. It will include measures to support mitigation of inflationary pressures. The Project needs to take a balanced approach to support local content while monitoring any associated cost of living increases for vulnerable households. As part of the Local Content Plan and based on monitoring data, suppliers might be asked to identify alternative sources for certain household items (such as food) that are highly demanded by vulnerable groups.

Residual impacts

With the above mitigation measures, the impact magnitude is expected to reduce to **very low (1)** for both groups. Residual impact significance is anticipated to be **minor (3)** for vulnerable groups and **negligible (2)** for non-vulnerable groups.

Increased social tensions and conflict over Project benefits

There are high expectations for business opportunities and employment benefits within local communities. If recruitment and procurement processes are not managed appropriately (i.e. highly transparent) and if benefits are not made (and perceived to be made) broadly accessible, there is potential for an increase in social tensions and conflicts both between local people and the Project, and between key receptors within communities and socially differentiated groups. Tensions may also arise between the local population and persons recruited or suppliers sourced from other parts of the country, particularly during construction when employment and business opportunities will peak.

There are pre-existing tensions and divisions in some communities over opposition to or support for another proposed petrochemical development in the Los Mochis / Topolobampo area. Connected to this, there may also be a risk enhanced public anxiety surrounding the increasing industrialisation of the area and perceived safety of industrial developments. These issues should be carefully monitored and managed, particularly to ensure inherently marginalised or disadvantaged segments of society such as Indigenous Peoples or vulnerable households are able to equitably access any available employment or local procurement benefits for which they are qualified.

The Project has already recruited two experienced Community Liaison Officers (one male and one female) and is developing a Local Content Plan as part of its commitment to enhancing local economic benefits. A Strategic Community Investment Plan to enhance community social development is also under development and will be informed by a recent community needs and opportunity assessment (UAIM 2024a) which is being extended to all communities who wish to participate within the Social AoI. The resulting Community Agreements between the Project and each participating community will ensure equitable provisions of benefits to further reduce social tensions.

Receptor sensitivity has been assigned as **medium (3)** because of ongoing tensions caused by the opposition to another petrochemical development in the area, whereas the impact magnitude has been assessed as **very low (1)** as although existing levels of inter and intra community cohesion can be poor in some communities, there may also be local employment benefits due to the availability of skilled and unskilled workers in those communities. The resulting impact significance is **minor (3)** (see Table 8.75).

Table 8.75: Increased social tensions and conflict over Project benefits

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Creation of Project-related employment	Increased social tension and conflict over Project benefits	Very Low (1)	Medium (3)	**Minor (3)**	N

Additional measures

The Project will develop pro-active engagement strategies to identify emerging conflicts early and reduce the risks of community conflicts. Where conflicts emerge, strategic engagement plans can be developed alongside the Project's SEP to tailor communications and ensure forums are created for discussion and conflict-resolution.

The Project will also ensure that Local Content Plan and Company Code of Conduct and Supplier Code of Conduct incorporate measures to promote non-discrimination and equal opportunities across communities for selection, remuneration, and promotion of economic benefits including employment opportunities.

8.3.2.3 Decommissioning

Economic benefits to local businesses and economy

During the 24-month decommissioning phase the Project is likely to create further economic benefits to local and national companies to provide the goods and services required to safely shut down and decommission the plant. Specialist teams will clean and decontaminating the plant, before dismantling of the plant commences.

Opportunities are likely to be created for specialist service providers and private sector waste handlers or remediation companies during this process. These economic opportunities may lead to the creation of employment, creating a minor economic multiplier effect within the regional economy. These benefits will be enhanced by the Project's Local Content Plan which includes strategies, systems, plans and programmes to maximise any local job creation opportunities and procurement via local businesses wherever possible.

This is a **positive impact**, the magnitude of which will be dependent on the value of the local procurement activity (see Table 8.71).

Table 8.76: Economic benefits to local businesses due to the purchase of goods and services during decommissioning

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project procurement during decommissioning providing opportunities for regional and local businesses.	Economic benefits to local businesses and local and regional economies	**Positive (0)**			N/A for positive impacts

Enhancement measures

No further enhancement measures are required for this positive impact during decommissioning.

8.3.3 Employment and skills development

Construction

Generation of employment opportunities

Approximately 60% of the population aged over 15, totalling 218,740 individuals, were reported to be economically active in Municipality of Ahome in 2020. At the local level, the economically active population aged 12 or above within the Direct and Indirect AoI PACs ranges from 50% to 77%. Similarly, the economically inactive population ranges from 23% to 50% (see Section 5.4.3.9 for more detail).

At its peak, the Project is expected to employ a workforce of 3,500 during construction, predominantly through the EPC and associated subcontractors and suppliers. Up to approximately 70 additional workers will be contracted through the construction contractor for the pipeline construction and approximately 100 for other aspects, including the WWTP. Employment benefits related to construction are expected to last approximately 36 months, with an additional 12 months for early works.

During the construction phase, the Project will seek to optimise the use of local content, with a target of over 50% of the workforce to comprise Mexican labour, wherever possible and where experience and skills are compatible with Project needs. The Project will develop a Local Content Plan with a focus on workforce development, including hiring local personnel and equipping them with the professional skills needed to support the Project. The Project's Local Content Plan will also include training for local providers on the use and development of local suppliers and will require EPC contractors to develop their own Local Content Plans and optimise the use of local content. Additionally, the MIA commits the Project to implement training and development aimed at promoting training

of young people in the field of energy generation, and creation of internships where applicable. The MIA also stresses that the Project should give preference to hiring staff from nearby towns which is a key component to the Local Content Plan.

The construction of the Project will have a **positive** short-term impact by providing additional employment opportunities for Mexican nationals, and to some extent for people from within the AoI. These are more likely to be in the unskilled and lower skill sectors. Employment may lead to a short-term improvement in living standards and well-being at household level of those employed, with some spill-over effect into the surrounding communities.

Women and Indigenous Peoples are sensitive receptors likely to represent marginalised and vulnerable groups within PACs. The Project will create opportunities to overcome any inherent barriers preventing women and Indigenous Peoples from benefiting from Project-related activities and opportunities for social development (detailed within the Strategic Community Investment Plan). Specific measures to ensure effective communication and engagement with women and Indigenous Peoples are outlined in the SEP (see Table 8.77).

Table 8.77: Generation of employment opportunities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Employment opportunities	Generation of local employment opportunities	**Positive (0)**			N/A

Enhancement measures

To enhance the positive impacts of local employment, the Project will develop and implement local recruitment and training measures as part of the scope of the Local Content Plan currently under preparation. To help ensure the positive aspects of training are captured, local recruitment and training scope and targets will also be included within the EPCs Procurement and Local Content Plans. This should outline the job specific skills and competency training requirements that contractors must provide to support an overall upskilling of both individual workers and local industry.

To further enhance positive impacts of the Project's provision of employment and training opportunities, the following enhancement measures will be adopted by the Project:

- ensure that the Company Code of Conduct and Supplier Code of Conduct incorporate measures to promote non-discrimination and equal opportunities for selection, remuneration, and promotion (particularly for marginalised and vulnerable groups, such as women, disabled people and Indigenous Peoples) and ensure clear, transparent, accessible and fair recruitment procedures that

prioritise local workers and their employment, especially for unskilled labour within the AoI.

- skills and competency mapping will be completed across surrounding communities.
- report employment figures on regular basis disaggregated by community, Indigenous Peoples, gender, skill level and disabilities, if applicable.
- consult IP leaders and vulnerable group representatives (such as women, disabled population, poor households) about their preferred way to inform the wider community (including vulnerable groups) about job opportunities generated by the Project. This will ensure culturally appropriate engagement methods that would reach the most disadvantaged subgroups within society.
- continue creating alliances with local universities and educational institutions to support the development and availability of pre-employment skills training.
- set specific targets for contractor worker training programmes to be agreed between Project and contractors.
- require all contractors training records to be passed onto Project Proponent.
- to support skills development and skills/experience recognition, the Local Content Plan (and associated recruitment and training scopes) of both Project and contractors should require that all workers receive end of labour certificates and/or references, as appropriate.

The Project will also develop a culturally appropriate worker grievance mechanism for direct and contracted workers, for reporting workplace grievances or any concerns related to the recruitment process. The worker grievance mechanism will aim to address concerns promptly, using an understandable and transparent process that provides timely feedback without any retribution. It will also allow for anonymous complaints to be raised and addressed and will not impede access to other judicial or administrative remedies.

Greater gender disparity caused by higher male employment uptake

In Mexico, women's participation in the labour market stood at 49.1% in 2021. Despite a slight increase in female employment rates, the discrepancy in earnings and paid employment is significant, with 79% of men engaged in paid work versus only 45% of women. Additionally, about 60% of employed women work in informal sectors characterised by minimal social security, high instability, and low wages. This limited engagement of Mexican women in the workforce may be because of the substantial amount of unpaid domestic responsibilities they have.

In the third quarter of 2021, women constituted merely 3.9% of the national construction workforce. According to the National Institute of Statistics and Geography (INEGI), nearly 150,000 women work in the construction industry in Mexico, which has been increasing in recent years. Concerning activities related to masonry, the National Occupation and Employment Survey (ENOE) corresponding to the fourth quarter of 2013 revealed that Mexicans employed in this sector were just over 2.4 million, of which 99.6% were men and only 0.4% were women.[166] However, the ENOE for the fourth quarter of 2022

[166] Available online from: https://www.economia.gob.mx/datamexico/en/profile/occupation/albaniles-y-otros-trabajadores-en-la-edificacion-de-construcciones

highlights that, of the 3.1 million people employed in masonry, 99.2% are men and 0.8% women. That is, there has been an increase of 0.4 percentage points between those periods in the number of women bricklayers, which today is close to 30,000 Mexicans.[167]

In Sinaloa, women earn 1,937 pesos less than men. On average, women receive a salary of 7,895 pesos per month, while men receive 9,832 pesos. While there has been progress in women's literacy and economic involvement, significant disparities still exist in the labour market and in unpaid domestic work, which is predominantly undertaken by women. The percentage of the female workforce not receiving income for their labour stands at 9%, compared to 4.7% for men.

At the local level, the economically active population aged 12 or above within the Direct and Indirect AoI PACs ranges from 50% to 77%. Ejido Tortugas Número 2 has a notably high level of economically active male population (95%), followed by Ejido Plan de Guadalupe (81%), and Ejido Topolobampo and Paredones, each with 80%. However, there is significant variation among economically active females, ranging from 0% in Benito Juárez to 57% in Ejido Tortugas Número 2. Similarly, the economically inactive population ranges from 23% to 50%. Among males, Ejido Tortugas Número 2 has the lowest rate at 3%, while Ejido Rosendo G. Castro and Plan de Ayala (Campo Cinco) have rates of 30%. For females, the rate varies from 43% to 100% (see Section 5.4.3.9 for more detail).

The Project workforce is expected to reach up to 3,500 peaks during construction. The majority of these workers are anticipated to be male, and this will further exacerbate gender disparity at the local level. Employment in construction is commonly regarded by both men and women as “men’s work” and these gendered perceptions can be hard to overcome. Women typically have low levels of relevant skills and are not provided with or made aware of skill enhancement opportunities which further disadvantages them when jobs are created in the construction sector. Greater gender disparity can exacerbate the existing vulnerability of women, forcing increased reliance on vulnerable employment within the informal economy. The Project has developed a Gender Equality and Inclusion Policy which will outline key corporate commitments to overcoming gender disparity and inequality. A Gender Based Violence and Harassment Risk Management Plan has also been prepared and is undergoing review by local municipality gender specialists which will outline measures that will further facilitate the creation of a gender-inclusive workplace.

Receptor sensitivity has been assigned as **medium (3)**, given the widespread inequalities regarding access to paid jobs for women at the local level. The impact magnitude has been assessed as **low (2)**, because local women are not traditionally inclined to apply for construction worker positions. The impact significance is therefore **moderate (9)** (see Table 8.78).

[167] Available online from: https://centrourbano.com/revista/construccion/participacion-mujeres-construccion/

Table 8.78: Greater gender disparity caused by higher male employment uptake

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Employment opportunities, training and skills development	Greater gender disparity caused by higher male employment uptake	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The Project should contract an independent local gender specialist to assist in the development of a gender equality strategy. The strategy should examine internal systems for talent management and Project construction and operations employment from a gender perspective. The strategy should identify key actions to facilitate greater diversity of employment and access for women and include goals for gender equity. The strategy should also include a plan for how to achieve and monitor these goals, along with appropriate budget and accountability structures. The Project should include specific programmes of support targeted at enhancing women's access to pre-employment skills and training for the construction sector within the Strategic Community Investment Plan. These should be developed prior to construction in partnership with relevant local authorities, such as the Department of Female Affairs and alliances with local universities and educational institutions.

Residual impacts

With the implementation of the above mitigation measures, the residual impact magnitude is assessed as being **very low (1)**. The receptor sensitivity remains as **medium (3).** The residual impact significance is therefore **minor (3).**

8.3.3.1 Operations

Operations employment, training and skills development

The Project will employ approximately up to 161 full-time workers during the operational phase, which is anticipated to last 30 years. Additionally, it is likely that up to 300 jobs will be contracted to deliver services such as security, food preparation, routine maintenance, and cleaning. During the operations phase, the proportion of local content used is expected to increase over time, as local capabilities are built.

As discussed previously, the Project will develop a Local Content Plan with a focus on workforce development, including hiring local personnel and development of the professional skills needed to support the operation. Once recruited, various levels of training and skills development opportunities will be provided to the workforce throughout the Project lifecycle to ensure they are able to fulfil their roles and promote ongoing

learning and capacity building. This includes basic training on HSSE&SP, labour management and, where required for specific job profiles, vocational training.

This employment creation, training and skills development will result in a **positive** long-term impact by providing additional employment opportunities for Mexican nationals, and to some extent for people from within the AoI where professional skills are available. This employment and skills development will lead to a longer-term improvement in living standards, employability and well-being at household level of those employed, with some spill-over effect into the surrounding communities (see Table 8.79).

Table 8.79: Operations employment, training and skills development

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Employment opportunities, training and skills development	Household income, skills and employability	**Positive (0)**			N/A

Enhancement measures

During operations, the Project will continue to provide skills training and professional development as part of the Local Content Plan. The Project will also continue alliances with local universities and educational institutions to support the development and availability of pre-employment skills training.

To further enhance positive impacts of the provision of training opportunities, the following enhancement measures will be adopted:

- establish regular coordination with regional and state employment services to promote opportunities for employment, training and skills development,
- require all contractors training records to be passed onto Project Proponent,
- provide a culturally appropriate worker grievance mechanism for direct, contracted and supply chain workers. The worker grievance mechanism aims at addressing concerns promptly, using an understandable and transparent process that provides timely feedback without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed and should not impede access to other judicial or administrative remedies.

8.3.3.2 *Decommissioning*

Termination of employment: demobilisation after construction and decommissioning

During the construction phase, the Project is expected to employ a workforce of 3,500 at its peak (with target of over 50% of the workforce to comprise Mexican labour) and up to

approximately 70 additional workers will be contracted through the construction contractor for the pipeline construction and 100 workers for other Project components. Employment benefits related to construction are expected to last approximately 36 months, with an additional 12 months for early works. The Project is expected to remain in operation for at least 30 years, after which decommissioning will begin. Decommissioning of the methanol production unit is expected to require 24 months to complete.

Termination of employment for the workforce will result in a loss of household income with knock-on negative impacts on the affected households as key receptors. Sudden loss of employment benefits through demobilisation of construction crews and full-time employees can lead to an increase in grievances and potentially a loss of support for the Project, leading to protests, roadblocks, or demonstrations, though this is unlikely considering the nature and location of the Project in an industrialising region with a diversifying economy.

Receptor sensitivity has been assigned as **low (2)**, as the economic boom and industrial development of the area provide workers with alternative job opportunities.

The impact magnitude has been assessed as **medium (3)**, given the number of workers who will be demobilised in a short time frame during construction, whereas the impact magnitude has been assessed as **very low (1)** for the workers who will be let go during decommissioning as the end of employment will likely be known months to years in advance providing the small workforce ample time to seek alternative employment.

The impact significance is therefore **moderate (6)** for construction and **negligible (2)** for decommissioning (see Table 8.80).

Table 8.80: Demobilisation and the termination of employment contracts

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Completion of demobilisation after construction	Termination of employment contracts	Medium (3)	Low (2)	**Moderate (6)**	Y
Completion of decommissioning activities	Termination of employment contracts	Very low (1)	Low (2)	**Negligible (2)**	N

Mitigation measures

The Project and contractors will implement measures as part of their Local Content Plans to reduce the adverse impacts of dismissals. For example, the EPC Consortium of Techint/Samsung have internal procedures in place that involve moving or rotating Mexican workers from various projects around the country to keep them employed. The Project will ensure that all workers receive notice of dismissal (unless clearly stated in

their fixed short-term contracts) and severance payments mandated by law and collective agreements in a timely manner.

Contractors should also be required to provide end of contract documentation to workers that reflects the skills used and training provided during their employment period to assist them with future job opportunities.

Under the Project's SEP there will be provisions for on-going communication around employment needs and the short-term nature of the work to ensure workers have realistic expectations.

The Project will also require the implementation of a Worker Grievance Management Procedure which will allow workers hired by the Project, contractors and sub-contractors to raise issues that cause problems during the demobilisation process.

Residual impacts

With the implementation of the above mitigation measures, the residual impact magnitude for demobilisation after construction is assessed as being **low (2)**. The receptor sensitivity remains as **low (2).** The residual impact significance is therefore **minor (4).**

8.3.4 Working conditions

8.3.4.1 *Construction*

8.3.4.1.1 Violation of labour rights by contractors and subcontractors

During construction, the bulk of the workforce will be employed through the primary EPC contractor and their sub-contractors. As stated, the Project is expected to employ a peak workforce of 3,500 during construction, predominantly through the primary EPC, pipeline EPC, and associated subcontractors and suppliers.

There are some risks to the basic human right to 'just and favourable conditions at work' associated with child labour practices. In 2020, in Sinaloa, 95% of girls and boys between 6 and 14 years of age attend school (INEGI, 2024).According to the National census of 2020, the majority of the population within the Direct and Indirect AoI communities have completed primary education, with only 3% of females and 6% of males over 15 years old on average not attending primary education. At the local level in areas surrounding Los Mochis, more robust legislation and enhanced regulation of the agricultural supply chains and markets has helped to improve standards and reduce instances of child labour [redacted] 2024 pers. comm.). However, children are known help their families with fishing and associated activities such as scaling and packaging. That said, this may not be widespread and anecdotal evidence from teachers in the Paradones Telesecondary school suggests that child involvement in fishing is limited and does not prevent them from attending school [redacted](2024) (pers. comm.).

Without controls, the potential exists for the violation of both national labour legislation and international labour standards, with particular risk associated with sub-contractors used by Project or EPC contractor. This may include aspects such as working hours, pay and conditions, freedom from forced labour, freedom of association, child labour, equal treatment in the workplace and health and safety.

The majority of local and/or smaller enterprises have limited human resource management capacity and present a greater risk of labour rights violations. The risks are also higher within sub-contractors employing unskilled workers, or supply chains linked to the commercial agricultural sector (i.e. food procured by Project), where child labour risks are still prevalent.

The Project has existing management control measures in place. The Project's HSSE&SP policies include prohibitions on use of forced or child labour as well as monitoring and auditing practices. There is a contractor and vender pre-qualification approval process, which includes contractual requirements for ensuring supply chains and sub-contractors comply with the Project's HSSE&SP policies. The MIA also includes several commitments that will improve worker's safety. These include weekly inductive talks to workers in the first three months and each time a new group of workers is incorporated. The MIA also stresses that safety awareness talks should be held throughout the Project and safety signalling at strategic points within active work areas. The commitment that all personnel will receive PPE equipment and the Project will provide training on how to use safety equipment is also stressed. Furthermore, the MIA states that proper labelling of equipment, safety procedures, and security measures will also be communicated to all personnel (including subcontractors). Additionally, procedures will be established in preparation for and response to extreme weather events.

Receptor sensitivity has been assigned as **low (2)** due to the seasonality of local child labour practices and the high school attendance levels. The impact magnitude has been assessed as **low (2),** due to the existing management control measures. The resulting impact significance is **minor (4)** (see Table 8.81).

Table 8.81: Violation of labour rights

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Violation of labour rights by contractors and sub-contractors	Low (2)	Low (2)	**Minor (4)**	N

8.3.4.1.2 Failure of contractors and sub-contractors to provide adequate accommodation

The EPC Consortium Techint/Samsung completed a worker accommodation study to assess the availability and suitability of accommodation on the open market. The study found that although there are enough accommodations on the local market (including hotels and rental housing), there was not enough to house 1,220 workers during the average construction period and therefore a worker accommodation facility / camp would be constructed. Further details on worker accommodation can be found in Section 3.10.1.

It is worth highlighting that the Association of Hotels and Motels in Northern Sinaloa reported that there are currently approximately 1,728 tourist-category hotel rooms in the Municipality of Ahome, with an additional 128 expected to be added to this figure with the opening of the Holiday Inn hotel expected in 2024. Most hotels have approximately 50 to 70 rooms. International-class hotels currently operating in Los Mochis include the ibis, City Express by Mariott and Best Western Plus. The average annual hotel occupancy rate is around 65%, with the highest occupancy rate of around 90% only being achieved during the National Potato Congress that was held in Los Mochis in November 2022. As of December 2020, Los Mochis had 48,556 available rooms, of which 21,657 were occupied, leaving a remaining of 26,899 rooms for rent (IMPLAN 2024).

As noted above, the worker accommodation facility for 1,220 construction staff. While the Project's workforce is expected to peak at 3,500 during construction, the average size of the workforce employed during the construction phase is expected to be 1,500 (See Chapter 3). Recruitment Projections developed by the Project suggest that the total workforce may exceed 1,400 for 20 months during the construction phase, requiring housing between 100 and 300 management and Project administration in up to 70 rental houses and on average 100 temporary management and administration in available hotels (when visiting over the shorter-term).

A failure to provide safe and healthy accommodation, especially in worker accommodation facility / camp, that also allows for the recreation and/or relaxation of workers after work, could cause both high levels of tension and reduced worker well-being and serious health issues (for example if cramped conditions facilitate the spread of contagious disease). Social issues that may impact worker health and safety such as potential drug abuse or excessive alcohol consumption within the worker accommodation facility should also be appropriately managed.

The Project is committed to ensure accommodation services for workers (particularly for female workers) as a key receptor are provided in a non-discriminatory manner that complies with national and international standards for quality, security, safety and professional competency (IFC PS2). This potential impact is also a human rights impact, the right to health, and the right to just and favourable conditions at work. The Project has established Accommodation Rules and Code of Conduct and require all personnel residing in the EPC camp to review, sign and abide by these. This Code of Conduct includes specific regulations prohibiting drug or alcohol use within the worker accommodation facility.

Prior to the application of mitigation measures, the receptor sensitivity is assessed as **low (2)** due to the likely suitability of accommodation on the open market based on conducted interviews, and the impact magnitude of potential failure of contractors and sub-contractors to provide adequate accommodation is assessed as **medium (3).** The impact significance is assessed to be **moderate (6)** (see Table 8.82).

Table 8.82: Failure to provide adequate workers accommodation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Failure of contractors and sub-contractors to provide adequate accommodation	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

The Project contractor will adhere to EBRD/IFC Accommodation Standards for the provision of accommodation and services. The standards will establish how accommodation services will be provided in a manner consistent with the principles of IFC PS2 such as ensuring non-discrimination and equal opportunity, non-infringement on workers' freedom of movement or of association, and meeting basic social and environmental requirements (i.e. minimum space, supply of water, adequate sewage and garbage disposal system, appropriate protection against heat, cold, damp, noise, fire and disease-carrying animals, adequate sanitary and washing facilities, ventilation, cooking and storage facilities and natural and artificial lighting, and access to basic medical services).

For both accommodation provided within the worker accommodation facility and additional rooms sourced on the open rental market, the EPC contractor(s) will also be required to:

- inspect and monitor conditions with respect to accommodation and services provided to ensure these adhere to EBRD/IFC Accommodation Standards
- ensure recreational facilities are provided adequate to the size of the accommodation facilities provided and provide alternatives (e.g., TV room, gym, sports facilities such as football pitch, general recreation room) if possible.
- ensure leisure areas provided are designed to be attractive to all workers (male or female).
- provide training for all contractor and sub-contractor workers during the induction process on basic worker rights and the Worker Grievance Management Procedure, with emphasis on no disciplinary action for reporting credible grievances, including those specific to gender-based violence and harassment.

Require the EPC contractor to include in its detailed Occupational Health and Safety Management Plan gender and GBVH aspects, such as: separate gender accommodation for workers in the various camps; separate, lockable latrines; WASH facilities that are well-lit and conveniently located and easily accessible; Provision of hygienic and safe sanitation disposal facilities; separate sleeping areas for men and women with lockable doors and window; Leisure areas designed to be attractive to all workers; measures in place to avoid overcrowding and lack of privacy.

To ensure workers' safety committee addresses women complaints and needs, require the EPC contractor to have a trained female worker representative sitting in this committee to represent the concerns of women.

Residual impacts

With the implementation of mitigation, the impact magnitude is expected to fall to **very low (1)**. The receptor sensitivity remains **medium (3).** The residual impact is reduced to **minor (3).**

8.3.4.1.3 Inadequate management of occupational health and safety

It is anticipated that the health and safety hazards for the construction phase will be similar to those for the construction of most large industrial facilities. The construction will be undertaken by primary EPC contractors and their sub-contractors.

If construction related health and safety hazards are not identified and adequately managed, workers health may be adversely impacted, and accidents may injure workers.

Methanol is a toxic chemical and can cause serious health issues through inhalation, ingestion, or skin contact. The Project will implement a comprehensive approach to manage methanol exposure risks, ensuring worker safety and regulatory compliance. This includes engineering and administrative controls, mandatory PPE (e.g. flame-resistant clothing, chemical-resistant gloves, chemical splash suits, respiratory protection, self-contained breathing apparatus, personal gas detectors and flame-retardant hoods and gloves), emergency showers and eyewash stations, thorough training, and emergency preparedness. The Project will adhere to established exposure limits, ensure adequate ventilation, employ leak detection systems, enforce safe work practices, and conduct routine exposure monitoring. Emergency preparedness will involve training, spill kits, and clear procedures for emergencies, including evacuation plans.

One particular concern for the Project is the proximity of the workers camp to the quarry site as during early-works there may be up to 350 heavy goods vehicle trips per day moving between the quarry and project site on a rotational basis. This heavy traffic may create adverse health and safety risks and impacts that should be appropriately managed by the Project (i.e. risk of pedestrian collision, noise, dust emissions). The Project has developed a Health, Safety, Environment, and Social Performance Policy and associated Project Health and Safety Plan (H&S Plan) which includes the health and safety protection arrangements for the construction phase. The H&S Plan includes requirements for both the Mexinol Project team and contractors, subcontractors and service providers. The H&S Plan includes health and safety protection arrangements, roles and responsibilities for health and safety management, competence and training requirements and compliance and assurances processes. It specifies requirements from contractors, including the need for contractors to develop their own detailed plans to implement the requirements of the H&S plan, where relevant. There is also a contractor and vender pre-qualification approval process, which includes contractual requirements for ensuring supply chains and sub-contractors comply with the Project's H&S policies and the H&S plan. Further details of the Project's occupational H&S arrangements can be found in Chapter 12.

During the construction stage, the following hazardous activities are identified in the H&S Plan, which includes details of mitigation measures for each hazard:

- Working with chemicals
- Adverse weather conditions
- Excavating and trenching
- Slips, trips and falls
- Use of hand, air and electrical tools
- Use of electrical equipment
- Use of welding and burning equipment
- Liquefied Petroleum Gas and Acetylene
- Compressed gas cylinders
- Radiography
- Construction plant
- Working at height
- Rigging and suspended platforms
- Working in confined spaces
- Operation of forklift and other powered industrial trucks
- Site vehicle operation

Overall safety procedures identified to mitigate the risks presented by these hazards include:

- **Roles and Responsibilities**: The H&S Plan identifies all key H&S related roles as well as related responsibilities. Contractor and sub-contractor roles and responsibilities are also identified, and these will be passed on through contractually
- **Risk assessment/hazard identification (HAZID)**: Site Risk Assessment will be performed for each area based on activities to be performed on site
- **Job Safety Analysis (JSA)**: This tool will be used and developed by supervisors with the participation of all personnel involved in the task. The JSA Form will be prepared daily
- **Different Organisations Operating in the Same Area (SIMOPS)**: The coordination in the field of construction will be carried out through the implementation of the construction program, periodic specific coordination meetings and the flow of information through the Safety Committee
- **Activity with Chemicals, Hazard Communication (HAZCOM)**: each organisation taking chemical products to the site shall compile and review MSDS and develop a Chemical List, filed for review upon request. The hazard communication procedure will include instructions for implementation of “Labelling System” and a training / information program
- **Hot weather, strong winds, sun**: PPE protection for head and eyes, potable water provision, wind speed measurement with agreed level over which lifting and other activities must be suspended, dust suppression and dust filter masks availability
- **Toolbox meetings**: will be conducted daily before work begins by the Construction Supervisor on each shift
- **Daily Dialogue on Prevention (DDP) meeting**: to discuss risks identified in the JSA, including environmental aspects e.g. spill prevention and control, waste management, protection of flora and fauna, water sources, cultural heritage

- **Behaviour Based Safety (BBS)**: to identify and reinforce safe behaviour while reducing unsafe behaviour
- **Training**: all contractors will be required to ensure adequate and continuous training/awareness to prevent the more common occupational injuries, including hand, manual handling, working at height injuries
- **Observation and Data Collection**: all contractors will be required to implement an Observation Reporting Program and maintain a register for hazard reporting, positive interventions and suggested improvements in H&S management
- **Data Analysis and Intervention**: will be implemented to analyse trends and implement continuous improvement
- Competent/Qualified Peron Designation: a list of competent persons for all identified higher risk activities will be compiled and held by the Project H&S Manager
- **Personal Protective Equipment (PPE)**: adequate PPE will be made available to all site workers by contractors and sub-contractors and will meet national and international standards
- **Housekeeping**: all work areas will be kept free of debris, equipment and materials and adequate waste management and storage will be provided
- **Signs and Tags**: The H&S Site Officer and the construction supervisors will be responsible for ensuring that signs relating to warnings, precautions, notices, and other information pertinent to personnel, road access ways and closures are provided and fully understood by all personnel
- **Permit to Work (PTW) System**: A PTW System will be implemented during the construction phase in compliance with the Mexinol and the Laws and regulations. During the construction stage, this will be implemented by the Contractor. During commissioning, responsibility will be with Mexinol
- **Fall Protection**: Fall protection systems will be used in accordance with applicable regulations and manufacturers guidelines
- **Dropped Object Protection Plan (DOPP)**: dropped objects present a significant safety risk in the project. A comprehensive DOPP will be implemented by each contractor
- **Use of Barriers:** ladders, floor, roof and platform openings will be systematically guarded by adequate barriers and handrails appropriate for the use
- **Use of tools and Equipment:** appropriate procedures will be applied covering the use of all tools, including Do Not Operate signs on defective tools, the need for appropriate PPE and the installations and maintenance of protective guards and disabling controls
- **Welding and Burning:** appropriate procedures will be applied, as with the operation of tools, with the provision of appropriate fire extinguisher and protection of others working nearby
- **Compressed Gas Cylinders:** procedures will be implemented by each contractor for the safe use and storage of pressurised cylinders in accordance with national regulations and international best practice
- **Radiography:** will be managed through the PTW system. Practitioners will have the correct certification and adhere to applicable legislation
- **Construction Plant and Crane Operation:** strict procedures will be implemented to meet statutory safety requirements. The H&S Manager for the site will maintain all procedures and undertake regular checks, as required

- **Noise and Vibration:** noise levels experienced by site workers and the local community will be monitored and control measures put in place, in line with industry best practice and Contractor contractual requirements

Receptor sensitivity has been assigned as **low (2)** due to the understanding that the experienced and competent workers will be selected through the contractor selection process. The impact magnitude has been assessed as **low (2)**, due to the existing management control measures. The resulting impact significance is **minor (4)** (see Table 8.83).

Table 8.83: Inadequate management of occupational health and safety

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Inadequate management of occupational health and safety	Low (2)	Low (2)	**Minor (4)**	N

8.3.4.2 *Operations*

8.3.4.2.1 Inadequate management of occupational health and safety

During operations employees will operate and maintain the Project components. The operational phase health and safety hazards will be different from those encountered during the construction phase. It is important that the health and safety hazards for the operations phase are identified, risks assessed, and appropriate control measures implemented. Without controls, employees' health may be adversely impacted and their safety compromised. This may result in ill health and injuries amongst the employees.

As outlined in Section 8.3.4.1 above, the Project has developed a H&S Plan, the scope of which includes health and safety protection arrangements, roles and responsibilities for health and safety management, competence and training requirements and compliance and assurances processes. As the document is a dynamic document, it will be updated as the Project progresses to reflect the outcomes of the risk assessment of health and safety hazards related to the phase of the Project being delivered.

An OHS Monitoring Plan will be developed for application during the plant operations stage. This OHS Management Plan will cover the following requirements:

- **Roles and responsibilities/competency**: occupational health professionals will be responsible for determining health surveillance requirements and implementing a health surveillance system
- **Assessment of risks**: determining the risk and appropriate health assessment based on the specific hazards present on the operational site

- **Legal and other requirements**: identify and adhering to statutory and project requirements for health surveillance
- **Regular monitoring**: implementing an ongoing process of health checks, designed to be relevant to workers potentially exposed to harmful substances or activities on a methanol production plant
- **Records**: identify requirements for record keeping, including privacy and document retention requirements.

A Health Surveillance Procedure will be implemented, to be followed during plant operations.

Receptor sensitivity has been assigned as **low (2)** as the workers will be employees during the operations and will be subject to competency management. The impact magnitude has been assessed as **low (2)**, based on the understanding that the H&S Plan will be updated for the operations phase and implemented. The resulting impact significance is **minor (4)** (see Table 8.84).

Table 8.84: Inadequate management of occupational health and safety

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Inadequate management of occupational health and safety	Low (2)	Low (2)	**Minor (4)**	N

8.3.4.2.2 Inadequate assessment of occupational exposure to methanol

Employee exposure to methanol during routine and non-routine operations (e.g. cleaning and maintenance) is a possibility. Exposure to small amounts can be damaging to health. Primary routes of entry into the body include inhalation, absorption through the skin/eye because of direct contact and ingestion (Methanol Institute 2020). Initial signs of exposure may include irritation to skin, eyes and respiratory tract followed by dizziness headache, vomiting and pain in the abdomen and or back. Significant exposure may lead to blindness, organ failure and death (ibid).

The existing H&S plan describes the need for risk assessments and chemical work permits. It does not specifically mention the need for occupational exposure assessments.

Prior to the application of mitigation measures, the receptor sensitivity is assessed as **low (2)**, as the workers will be employees during the operations and will be subject to competency management and the impact magnitude of potential exposure to methanol is assessed as **medium (3)**. The impact significance is assessed to be **moderate (6)** (see Table 8.85).

Table 8.85: Inadequate assessment of occupational exposure to methanol

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Inadequate assessment of occupational exposure to methanol	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

Prior to the commencement of the operations phase, the Project will complete a detailed methanol occupational exposure assessment and update the H&S Plan with relevant findings. The assessment should include all relevant Project sites, for all planned events (including routine and non-routine events), outline suitable control measures and identify the occupational exposure limits applicable and where relevant health surveillance requirements for the Project. The findings of the assessment should be reflected in the H&S Plan.

The Project will also confirm the need for methanol occupational exposure monitoring and implement if required. This assessment may form part of the methanol occupational exposure assessment described above or may need to be a separate assessment.

Residual impacts

With the implementation of mitigation, the impact magnitude is expected to fall to very **low (1)**. The receptor sensitivity remains **low (2)**. The residual impact is reduced to **minor (3)**.

8.3.4.3 Decommissioning

8.3.4.3.1 Inadequate occupational health and safety management

Decommissioning phase health and safety hazards will be different from those encountered during the previous phases. It is important to assess these hazards before decommissioning activities commence to avoid impact to employees and contractors' health and safety.

The Project H&S Plan will be updated in the future to reflect the health and safety hazards related to the decommissioning phase of the Project.

Receptor sensitivity has been assigned as **low (2)** due to the understanding that the experienced and competent workers will be selected through contractor selection process. The impact magnitude has been assessed as **low (2)**, based on the understanding that the H&S Plan will be appropriately updated and implemented. The resulting impact significance is considered to be **minor (4)** (see Table 8.86).

Table 8.86: Inadequate management of occupational health and safety

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Inadequate management of occupational health and safety	Low (2)	Low (2)	**Minor (4)**	N

8.3.5 Land ownership and livelihoods

8.3.5.1 *Construction*

8.3.5.1.1 Reduced access to land for agriculture, livelihoods, recreation and other activities

As described in Section 5.4.3.15 and in Appendix 4: Supplement Land Acquisition Document, the process for land acquisition is confirmed as following the willing buyer willing seller method. The transactions are confirmed as all voluntary and at or above market value or replacement value (plus transaction costs), whichever is higher and to the satisfaction of landowners. In regards to the Project site and methanol pipeline, he outcome of the key informant interviews undertaken by RSK between 15th and 19th April 2024 for this ESIA confirmed that the Project land transactions for Ejidal land have no impact on agriculture, livelihoods or recreation as the plots concerned are fallow areas covered with xerophytic vegetation. There are also reported to be no land-based investments or assets within the impacted Ejidal land. The main high value land impacted is private land (99.99 ha) which was owned by one landowner who is currently a local agribusiness owner and shareholder of the Project. Of this 99.99 hectares (which comprises the Project site, part of the methanol pipeline and the access road), 43.9 hectares is currently being used predominantly for commercial agricultural production. When this land is no longer available for use, it will not have a negative economic impact on the Project shareholder (who owns significant amounts of agriculture land in Mexico.)

To reiterate, this ESIA confirmed through interviews with affected landowners, a key receptor, that no livelihood activities or land-based assets will be impacted for the Project components (Project site, Port of Topolobampo upgrades, methanol transfer pipeline), and therefore the land-related transactions of the Project for these components will not result in any physical or economic displacement in accordance with IFC PS 5. Furthermore, interviews with affected landowners confirmed that none of the affected lands represent the traditional or customary lands of Indigenous Peoples. Regarding impacts regarding land and conformance with IFC PS 5 for the Project site and methanol pipeline this ESIA finds the following:

- all compensation processes have concluded successfully with no ongoing grievances documented by CLOs, notaries or land agents,
- all transactions were voluntary and paid at or above market rates (considering replacement value) and conducted under the “willing seller” and “willing buyer” premise,
- there are no cases of land conflict or unrecognised landowners,
- there are no cases of physical or economic displacement, as no impacts on agriculture affecting livelihoods, and Ejidal or private land (other than that of the Project shareholder) is used for productive use,
- land acquired for the Project is not identified as owned or under customary use by specific groups of Indigenous Peoples, nor does the land contain resources known to be of importance to the identity of Indigenous Peoples,
- no assets or structures, or investments on Ejidal land were impacted.

Regarding the JAPAMA water pipeline, results from the site visit, and land sensitivity mapping confirm there is no physical resettlement, and economic displacement is highly unlikely considering there is no economic activity on the affected land. This analysis confirmed the affected lands are predominantly dryland areas with xerophytic vegetation and of limited agricultural value given soil conditions. The Project has engaged Ejido Plan de Ayala as part of continuous community engagement activities and according to the Project’s stakeholder teams, the primary livelihoods in the community are related to employment opportunities at the airport and other service sectors. There is no reliance on the land to be acquired for any economic activity. However, the absence of any permanent economic displacement should be confirmed during monitoring activities through engagement with affected landowners once the land acquisition process has been completed.

A land use mapping exercise along with more specific details on land impacts per project component (i.e. methanol pipeline, access road, methanol production plant, JAPAMA pipelines) can be found in Section 5.4.3.15. The assessment identified no land use sensitivities associated with the JAPAMA pipelines. For the methanol pipeline two potential sensitivities were identified including community lands (graveyard 0.65ha) and a forested area (0.29ha) within the methanol pipeline RoW.

However, it is understood that temporary or permanent land use impacts are unlikely to be caused by the Project as horizontal drilling procedures (HDD) are likely to be used to avoid impacts to sensitive sites such as high value biodiversity land and community land.

It should be noted that the increase in demand for development land by Project procurement may push general land prices higher, causing localised inflation and speculation within the land market. This impact may be particularly relevant to the local land market surrounding the Project within the industrial corridor. This impact may further restrict the availability of land for the general population within the Direct and Indirect AoI.

The Project has a Community Grievance Mechanism which allows any concerns about land compensation or access to be raised by community members and establishes a recourse mechanism, so that any future land-related grievances may be raised by community members and resolved in an impartial manner if required. Thus, if there were

issues related to impacting landowners and agriculture during construction, that would be handled through the grievance mechanism.

Receptor sensitivity is assessed as **low (2)** as the Ejidal lands (which tend to have more vulnerable socioeconomic populations) impacted by the Project are not subject to agricultural or recreational use or important for livelihoods. Following the methodology in Chapter 7, the impact magnitude is assessed as **very low (1)** because of the willing seller/willing buyer approach, and therefore of **negligible (2)** impact significance requiring no specific mitigation measures (see Table 8.87).

Table 8.87: Reduced access to land for agriculture, livelihoods, recreation and other activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Land acquisition for Project, land easements	Reduced access to land for agriculture, livelihoods, recreation and other activities	Very Low (1)	Low (2)	**Negligible (2)**	N

There is no mitigation measures required for this impact. Nevertheless, social monitoring conducted as part of the Project's ESMMP will include specific metrics to monitor for knock-on adverse impacts within the local land market, particularly concerning the price and availability of land for small scale Ejido farming.

It is worth noting that an IFC-aligned ESIA will be conducted for the Associated Facilities and a separate assessment against IFC PS5 will be provided in that ESIA. While the Project is committed to no physical relocation, the possibility exists for economic displacement (temporary and/or permanent) depending upon the land to be purchased and the linear extent of the transmission line (see Chapter 10 for recommended mitigation measures).

Construction for the Project site will occur within the project footprint and will not impact other land not already acquired for the Project. Construction along the methanol pipeline will occur within the rights of way already acquired by the Project. Should construction traffic be required to work parallel to the RoW, these activities will not affect access to, or use of adjacent lands (incl. for livelihoods or access to any associated economic structures or assets).

Increased traffic and reduced road safety along the access roads, particularly during construction, is assessed in Section 8.3.6.1. As noted, it is assessed that there will be no restrictions to access to land or use for communal property and natural resources, as these were not identified within the Project site and along the rights of way (for both the methanol pipeline and the JAPAMA pipeline). To avoid restrictions along the methanol

pipeline to the cemetery identified at Ejido Rosendo G. Castro, the Project purchased additional land adjacent to the cemetery to avoid infringing on or restricting access.

There are no anticipated permanent impacts for any project components as it relates to land use and land acquisition.

8.3.6 Community health, safety, security and welfare

8.3.6.1 *Construction*

8.3.6.1.1 Adverse public health impacts due to increased noise and vibration or declines to air quality

There is potential that an increase in ambient noise levels during the construction period (e.g. due to increased traffic volumes, piling, the operation of construction equipment) may lead to anxiety, irritation and a reduction in the overall well-being of PAC members. Individuals living with underlying mental health conditions will be particularly sensitive to this impact.

There is also potential for a decline in local air quality due to combustion emissions generated by construction activities or increased fugitive dust emissions from construction site activities. This could lead to an increase in respiratory conditions or an exacerbation of existing respiratory conditions in the PACs. The elderly and children will be particularly sensitive to this impact.

An assessment of the likely impacts related to declining air quality and increased noise levels for sensitive receptors has been completed as part of this ESIA (see Section 8.1.1 and Section 8.1.2).

Table 8.88: Summary of potential impacts on public health (pre-mitigation)

Potential Impact	Magnitude	Sensitivity	Significance	Mitigation needed
Anxiety, irritation and reduced well-being amongst PACs resulting from an increase in ambient noise levels.	See Section 8.1.1			
Increase in respiratory conditions or exacerbation of existing respiratory conditions resulting from a decline in local air quality.	See Section 8.1.2.			

8.3.6.1.2 Delays, increased journey times, and reduced road safety due to increased construction-related traffic

During construction, sections of the Los Mochis-Topolobampo highway (Los Mochis – Topolobampo) will experience an increase in traffic from the transport of goods and workers. Traffic impacts may be more acutely felt at the entrance/exit of the Worker Accommodation Facility / Camp to be constructed located off the Los Mochis-Topolobampo highway by the Topolobampo bypass, and to be constructed between the quarry and the community of Ejido Topolobampo. This heightened traffic is because of the worker bus transport to/from the site 8 km away, and will occur more frequently during

morning, lunch and evening commute times and shift changes. Traffic in the general area of the bus arrival and departure road could also be exacerbated by the general activity at the quarry. For example, as a worst-case scenario for several months during early-works there may be up to 350 heavy goods vehicle trips per day moving between the quarry and site on a rotational basis, affecting Ejido Topolobampo in particular.

The Project has developed an access road strategy which includes working with local authorities to gain authorisation to upgrade existing infrastructure, assessing road conditions and upgrade requirements on key access routes, evaluating the development of alternative routes where communities will not be impacted and the potential temporary use of roads to support the transportation of heavy equipment and modules. Through these measures, Transition Industries have identified a primary access road option south of the Project which is currently under consideration as offering potential for use by construction-related heavy traffic thereby avoiding any likely significant impacts on existing community roads. No new land will be acquired for this purpose. Transition Industries have also completed a survey and study of the affected portions of the main "Los Mochis-Topolobampo highway" which includes assessments of current road condition, traffic patterns and identification of logistical challenges to ensure smooth and safe transportation for the Project.

Local agricultural service roads linking the site with the Los Mochis-Topolobampo highway will also be upgraded to facilitate site access during construction and operations. Public road use will increase daily at peak hours (i.e. via worker arrival and departure) as discussed above. Other increases in traffic will have short term peaks, such as the delivery of equipment, materials or engineered plant infrastructure. Some of these vehicle movements will require heavy goods vehicles that may have limited operator visibility and limited manoeuvrability. It is also anticipated that there may be some road closures during delivery of major equipment (electrolysers) which will be short-term (hours) and pre-approved and require traffic rerouting where possible. As a result of the Project, road safety for users of surrounding public roads may decrease.

The Project will ensure that trucks, vehicles, and machinery required for the Project will not be parked on the Los Mochis-Topolobampo highway at any time of day as a specified commitment established in the MIA.

The Project will make improvements to the existing feeder road network as part of planned upgrade works which will enhance safety and may include improved surfaces, signage and lighting. Besides the planned road upgrades, to address impacts to road safety and congestion, the Project will also develop a Traffic Management Plan, as committed in the MIA, as part of the ESMMP for both the construction and operation phases. This plan will aim to minimise any impacts on key receptors such as community road users.

The MIA has committed to establish information mechanisms on road crossings and other infrastructure that could affect the user population and the preparation of a communication mechanism to address, identify and track problems raised by community members. The MIA also commits to developing and implementing a plan of vehicular traffic, schedules, routes and guidelines to prevent vehicular traffic congestion on crossings or areas where trucks are loading materials or equipment. The MIA also stresses that speed signs should be posted to allow community members to safely use the roads.

Additionally, the MIA has committed to consult the communities in the Project's AoI regarding Project activities and implement a communication mechanism to address any problems that may arise. Such information campaigns, including regular engagement visits and provision of information on road safety and traffic, will be essential for the Ejido Topolobampo because of the proximity to the worker accommodation facility / camp to this community.

Receptor sensitivity is assessed as **medium (3)** as while the affected roads are part of a wider road network with good capacity and existing safety infrastructure, there are few alternative routes for PACs. Following the methodology in Chapter 7, the impact magnitude is assessed as **medium (3**) because, although there will be short-term peaks during construction, overall, the impact will extend over the medium term (1-5 years). Therefore, the impact is assessed to be a **moderate (9)** impact, requiring specific mitigation measures (see Table 8.89).

Table 8.89: Construction traffic related impacts (Delays, increased journey times and reduced road safety)

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Increased construction traffic	Delays, increased journey times and reduced road safety due to increased construction-related traffic	Medium (3)	Medium (3)	**Moderate (9)**	Y

Mitigation measures

The Project will ensure the Traffic Management Plans provide guidance on road safety during transportation activities, define transport routes, vehicles and drivers, outline journey management planning and road safety concerns. Where transport-related activities are performed by subcontractors, the Project will use commercially reasonable efforts to influence the safety of these service providers, contractually requiring traffic safety risk analysis and adoption and implementation of driver safety programmes.

Any road closures will obtain necessary permits and approvals and be advertised to the public in advance to decrease associated impacts on public travel needs.

Management programmes will include traffic emergency preparedness and response plans that address contingencies for emergency assistance to the driver and to third parties alike.

Consistent engagement with the Ejido Topolobampo is needed, as truck traffic schedules will be transparently shared. There is also the potential need for traffic flag persons at the entrance to the quarry.

The Project will implement a Community Road Safety Programme to build awareness of road safety risks in vulnerable receptors such as local school children, the elderly and the disabled.

The Project's SEP should include measures to ensure regular engagement with community members in Ejido Topolobampo, including those most vulnerable, to discuss traffic and other potential community health and safety issues because of the worker accommodation facility / camp.

Residual impacts

The implementation of effective Traffic Management Plans and Community Road Safety Programmes will help to manage the potential impacts related to road safety and traffic. This will reduce the magnitude to **very low**. The impact significance will reduce to **minor**.

8.3.6.1.3 Increased gender-based violence and harassment (GBVH)

A survey from the State of Sinaloa in 2021 showed that 66.2% of women aged 15 years or older experienced some type of violence (psychological, physical, sexual, economic or patrimonial) throughout their lives and 38.9% in the last 12 months (ENDIREH, 2021). In 2020, Sinaloa experienced 26 feminicides, including five in Ahome. Ahome's domestic violence cases stood out in Sinaloa, reaching 1,649 by 2021's end, or 396.1 per 100,000 residents. There are inherently high risks of GBVH within the Municipality of Ahome and incidents of domestic violence are higher that other parts of Sinaloa State.

GBVH against women was reported by stakeholders during RSK fieldwork to be a serious problem that occurs throughout the entire Direct and Indirect AoI. Gender-based violence is legitimised by culture and is more prevalent in poorer households, based on the interview held with the Municipal Department of Female Affairs' Director [redacted] (2024) pers. comm.). According to their data, the vulnerability of women to GBVH is higher in rural areas, where machismo, sexual violence and overcrowding in homes prevail. In indigenous communities, in particular, men traditionally rule the household. Women are often too embarrassed or scared to report issues (ibid).

The Project workforce is expected to reach up to 3,500 at peak during construction. Most of these workers are anticipated to be male, as reflected within the current workforce statistics at the municipal level. Accommodation services for these workers will be provided within a worker accommodation facility / camp and within available housing on the open market within communities/cities in and around the Project. Women employed by the Project may face higher risks of GBVH within the workplace or home because of income disparities and knock on tensions at the household level (i.e. if women earning an income is not seen favourably by male spouses). Additionally, women in local communities may be exposed to harassment and violence against them by the non-local male workforce. This could be most prevalent if workers are allowed to drink and fraternise off hours. While other issues like crime and violence (in general) could also rise, stakeholders have expressed most concern about GBVH related topics.

Although prostitution is regulated in Ahome, poverty and lack of access to basic resources among some local communities and lower-paid workers can mean they are forced into prostitution. Workers with relatively high levels of disposable income can take advantage of these circumstances. Young women in local communities can be particularly vulnerable to exploitative sexual relationships. Workers' use of prostitutes in

local communities can also be accompanied by increased physical violence, sexually transmitted diseases and unwanted pregnancies (EBRD, 2020).

GBVH and related gender impacts tend to be higher when gender stereotypes are strong, in particular, the widespread belief that men are naturally aggressive and justified in perpetrating GBVH, which allows it to be perpetrated without challenge; where intimate partner violence is widespread; and/or where a large new male workforce and/or an influx of workers is required, whose relatively high income may create opportunities for sexual exploitation of people in the local community (EBRD, 2020). Other exacerbating factors, such as lack of specific legislation and corruption also make combating GBVH challenging.

The Project is currently developing a Gender-Based Violence and Harassment Risk Management Plan with input from local gender experts as a key management control focused on addressing GBVH risks and management within the workplace. The requirements within the GBVH Risk Management Plan will be cascaded to all contractors. While GBVH can occur within workers' families and intimate relationships, this was not assessed further as the Project has little ability to control or influence workers outside of their employment; however, these types of issues will be part of the GBVH awareness raising campaign.

Receptor sensitivity is considered **high (4)** given the widespread prevalence of GBVH within the baseline context. The magnitude of impact of GBVH occurring to women and other gendered groups (e.g. LQBTQ) in the workplace is assessed as **low (2)** as while the potential for the impact to occur will exist over the Project duration, the likelihood of impact occurring frequently is considered to be lower due existing controls within the workplace. As a result, the impact significance within the workforce setting is assessed as **moderate (8).** The magnitude of the impact of GBVH perpetrated on community members from the workforce, either during off hours when away from the worker accommodation facility / camp or by those living on the economy in rented houses and hotels is assessed as **medium (3)** as the number of prevailing factors which lead to GBVH are high and this could prevail over the entire time of construction. As a result, the impact significance is assessed as **major (12)** (see Table 8.90).

Table 8.90: Increased GBVH as a result of non-local workforce arrival

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Increased workforce recruitment	Increased GBVH as a result of non-local workforce arrival in communities	Medium (3)	High (4)	**Major (12)**	Y

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Increased workforce recruitment	Increased GBVH within the workforce	Low (2)	High (4)	**Moderate (8)**	Y

Mitigation measures

To address impacts to GBVH it is advised that the Project includes specific programmes of support targeted at mitigating and raising awareness about GBVH within the Strategic Community Investment Plan. These awareness raising campaigns should be developed in partnership with relevant local authorities, such as the Department of Female Affairs, and relevant civil society groups, NGOs, and local social services providers. The Project will also ensure any specific awareness raising, mitigation and prevention measures within the Gender-Based Violence and Harassment Risk Management Plan are extended to any contractors and suppliers. For the EPC contractor, this may be through the EPC Worker Code of Conduct.

The Project will ensure that the EPC is aligned with the Gender-Based Violence and Harassment Risk Management Plan and Gender Equality and Inclusion Policy, and includes measures to prevent and address harassment, intimidation, and/or exploitation, especially regarding women and migrant workers.

The Project will ensure that the worksites and Worker Accommodation Facility / Camp are designed and built with safe and inclusive spaces, including provision of adequate gender-sensitive facilities and infrastructure, such as female changing rooms and toilets.

The Project will ensure EPC's assign responsibilities to a female camp administrator or assistant trained in gender mainstreaming to ensure that female worker needs are considered and that female workers can more easily speak up for their labour and working conditions needs.

Any prostitution involving those under the age of 18 is a form of sexual exploitation, as minors are unable to give consent, and will result in employment termination. This should be clearly stated in the workers Code of Conduct (CoC). Communities should be aware of the CoC and have access to report incidents through the GRM.

The Project will also develop a culturally appropriate community grievance mechanism and a worker grievance mechanism for direct and contracted workers, for reporting GBVH grievances and concerns from local women and female workers respectively. The grievance mechanisms will aim to address this type of concerns promptly, using an

understandable and transparent process that provides timely feedback without any retribution. It will also allow for anonymous complaints to be raised and addressed and will not impede access to other judicial or administrative remedies. Special efforts will continue to be made to disclose GRM to communities surrounding workers accommodation.

The Project will appoint a female contact person and special measures on confidentiality who will oversee GBVH.

Implement annual perception surveys with communities to gather feedback about effectiveness of GBVH prevention and to build internal knowledge of what works to prevent, mitigate and respond to GBVH. Use indicators such as “Percentage of community members who feel less safe since Project construction began”.

Conduct annual employee engagement surveys (disaggregate by type of worker and whether from local community) with specific section dedicate to GBVH to measure effectiveness of GBVH prevention, including indicators/questions like “percentage of workers who feel safe at work”, “Do you think GBVH risks in the workplace have increased, decreased or stayed the same over the past year?”

The Project will use the data obtained through the worker and community grievance mechanism to assess issues pertaining to GBVH and as necessary, may develop remediation plans, such as requiring the worker accommodation facility / camp to be “closed” and/or develop more worker awareness campaigns.

The Project will develop and implement training and awareness-raising activities on GBVH policies and procedures with all Contractor Human Resources and related functions. This includes:

- addressing the risks of GBVH during the recruitment process, including checking that appropriate processes are followed in terms of job applications, interviews, vetting and background checks, contracting and inductions
- zero-tolerance for GBVH and associated consequences for those who violate this rule
- how to support workers who experience GBVH by directing them to relevant services and ensuring they are not unfairly disciplined if the violence is affecting their performance at work (survivor-centred approach).

Residual impacts

Implementation of specific programmatic activities for GBVH within the wider community will help to manage the potential impacts related to Project workforce recruitment and economic benefits. This will reduce the magnitude to **very low (1)**. The impact significance will reduce to **minor (4)**; however, it should be noted that each circumstance related to GBVH is different and therefore the possibility exists that residual impacts could be higher.

8.3.6.2 *Operations*

Increased marine traffic and reduced marine safety

The Project design anticipates loading and departure of ships from the Triple T Jetty facility at a frequency of three to four vessels per month. It is also anticipated that some

plant equipment and building materials will be delivered through the port resulting in a further Project-related increase in marine vessel movements. These movements will build upon baseline levels of marine traffic at the port and within the bay. The bay entrance around the Triple T Port is relatively narrow and important for other marine users and local industries (fishing and tourism).

The SLIP SIA (SLR 2022) reports that baseline levels of marine traffic at the port based on 2020 annual data averaged 72 vessels per month. The Project's increase in marine vessel traffic (up to four vessels per month) will therefore be low in relation to baseline volumes of marine traffic and the existing users have experience of such traffic. Therefore, receptor sensitivity is considered **low (2).** Following the methodology in Chapter 7 the impact magnitude is also assessed as **low (2)** as the extent of impacts are likely to be localised, short term and within current acceptable limits given the port safety systems in place. Therefore, the significance is **minor (4)**. No additional mitigation measures are therefore required (see Table 8.91).

Table 8.91: Increased marine traffic and marine safety

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Increased marine traffic (during construction and operations)	Increased marine traffic and reduced marine safety	Low (2)	Low (2)	**Minor (4)**	N

8.3.6.1 *Decommissioning*

Increased construction traffic and reduced road safety

The decommissioning process will involve a 24-month phase in which specialist teams will safely shut down, decontaminate, and remove hazardous waste before remediating the site. Community safety will be a top priority during this phase and close communications will be maintained with surrounding stakeholders, along with strict protocols restricting access to sites containing hazards.

The decommissioning phase the Project is likely to create an increase in heavy machinery and construction-related traffic which may reduce road safety within the surrounding road network. However, receptor sensitivity is assessed as low **(2)** as by this stage the Project will have implemented a Community Road Safety Programme to build awareness of road safety risks and the impact magnitude is assessed as **low (2**) because, although there is likely to be short-term peaks during decommissioning, the duration of potential impact is likely to be relatively short-term. Therefore, the impact is

assessed to be a **minor (4)** impact, requiring no specific mitigation measures (see Table 8.89).

Table 8.92: Construction traffic related impacts (Delays, increased journey times and reduced road safety)

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Increased construction traffic during decommissioning	Delays, increased journey times and reduced road safety due to increased construction-related traffic during decommissioning	Low (2)	Low (2)	**Minor (4)**	N

8.3.7 Cultural heritage

8.3.7.1 *Construction*

Potential impacts on cultural heritage because of large non-local workforce

No direct impacts to tangible cultural heritage are anticipated because of the Project and no structures or properties with known historical or archaeological significance are located within the Project footprint. Nevertheless, a cemetery / funeral garden is located within the Direct AoI near the route of the raw and wastewater reject pipeline adjacent to the Los Mochis-Topolobampo highway and the Project should ensure that access to this site is not curtailed during construction activities related to the JAPAMA pipelines.

There are death memorials alongside the Los Mochis-Topolobampo highway which are important for communities remembering the dead and typically visited during celebrations for the Day of the Dead. These elements of tangible cultural heritage are also within the Direct AoI and the Project should also ensure that access is maintained and that these are not disturbed or impacted, particularly during construction. Project construction activities, such as an increase in construction related traffic, movement of heavy plant machinery and temporary road closures, have the potential to impact death memorials and the funeral garden within the Direct AoI.

Receptor sensitivity is considered **medium (3)** due to cultural relevance of the cemetery and death memorials found within the Direct AoI. The magnitude is **low (2)** due to the short-term nature of potential impacts during the peak for workforce recruitment during construction. Overall, a **moderate (6)** impact is predicted (see Table 8.93).

Table 8.93: Potential impacts on cultural heritage because of large non-local workforce

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction related workforce influx	Potential impacts on cultural heritage as a result of large non-local workforce	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The Project will ensure measures to maintain community access to identified tangible cultural heritage (i.e. death memorials and funeral garden) are included in the Cultural Heritage Management Plan (CHMP).

The CHMP will also include details of a monitoring plan for tangible and intangible cultural heritage and a chance find procedure[168] during construction. The Project will ensure that the chance find procedure is approved by the INAH as good international industry practice.

The Project will highlight the presence of culturally significant tangible and intangible cultural heritage to contractors and sub-contractors during site induction processes as Project cultural awareness training, to promote the workforce's respect for local cultural heritage, traditions and taboos.

Residual impacts

Implementation of specific mitigation measures to raise workforce awareness and respect for local cultural heritage, coupled with specific measures to ensure continued access to identified tangible cultural heritage will help to manage the potential impacts on cultural heritage. This will reduce the magnitude to **very low (1)**. As a result, the impact significance will reduce to **minor (3)**.

8.3.8 Social Infrastructure and services

8.3.8.1 *Construction*

Increased pressure on local infrastructure and services

The Project may employ a workforce of up to 3,500 during construction and up to approximately 70 workers will also be contracted for the pipeline construction (see more detail in section 0). Not all these workers are likely to be found within the existing

[168] A chance find procedure is a Project-specific procedure that outlines the actions to be taken if previously unknown cultural heritage is encountered. IFC Performance Standards 8 Cultural Heritage. Available online from: https://www.ifc.org/en/insights-reports/2012/ifc-performance-standard-8

municipality workforce, and it is likely that a significant number will require accommodation. The EPC contractor is planning to develop an accommodation facility for 1,220 construction staff and have conducted a worker housing study to understand housing needs and assess the standard and availability of accommodation on the local market (see more detail in section 0). It is likely that the Project will utilise local guesthouses, hotels and rentals currently catering the tourism and business traveller market. This may cause shortages in availability and increase prices, with knock-on effects for the tourism sector.

The arrival and housing of significant numbers of workers at peak construction will also place an additional burden on local social infrastructure and services. An area of particular sensitivity is domestic waste, where there are existing issues with the capacity and quality of service delivery. Poor waste collection services and infrastructure are already contributing to pollution and sanitary issues within some communities, where open burning or disposal of domestic wastes occur. As part of existing controls, a Project Waste Management Plan will be prepared as part of the ESMMP to ensure appropriate reduction in the generation of waste and appropriate handling and disposal of waste in accordance with IFC PS3 (see Chapter0). The MIA also includes a commitment that the rights of way of all existing infrastructure will be respected and in the case of any damage to existing infrastructure it will be repaired immediately.

According to the MIA, during the removal of the power lines (early works), the population could be affected by temporary power outages. However, the MIA stresses that prior to the disabling of the power lines, the existence of sufficient and adequate infrastructure must be guaranteed to carry out the works without affecting the population.

Additionally, as identified in the MIA, the demand for resources such as drinking water, fuel, materials, and other inputs might create an excess demand, potentially impacting the residents of the communities within the Project's AoI.

Receptor sensitivity is considered **medium (3)** due to the significance of the pre-existing issues with waste collection services and affected infrastructure (including competition with tourism sector for accommodation). The magnitude is **low (2)** due to the short-term nature of potential impacts during peaks for workforce recruitment during construction. Overall, a **moderate (6)** impact is predicted (see Table 8.94).

Table 8.94: Increased pressure on social services and infrastructure (i.e. waste management)

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction related workforce recruitment	Increased pressure on local services and social infrastructure (i.e. waste management)	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The Project will monitor knock-on effects of the workforce housing within the community upon the housing, hospitality and tourism sectors on a regular basis. If significant knock-on price increases are identified, the Project will ensure alternative measures are in place to satisfy worker accommodation requirements, such as increased the available space in the temporary workforce accommodation facility or another dedicated housing solution.

As accommodation services might be provided by subcontractor companies, the disposal of waste should be monitored accordingly.

Residual impacts

Through implementation of proposed mitigation measures, the Project will ensure potential impacts are managed. This will reduce the magnitude to **very low (1)**. As a result, the impact significance will reduce to **minor (3)**.

8.3.8.2 *Operations*

Improved water quality within the Bay of Ohuria

During the operations phase, the Project's water requirements are expected to be entirely satisfied by water obtained from the effluent of the JAPAMA municipal wastewater treatment plant (open lagoons). This will be transferred to and from the Project's onsite water treatment plant via the JAPAMA wastewater transfer and rejected water return pipelines. Any wastewater generated by the Project will be treated on-site and returned to be reintroduced as treated reject water to the JAPAMA municipal wastewater treatment plant. Operation of this system is expected to have a positive impact on overall water quality within the Bay of Ohuria. The closed loop system will contribute to reducing the volume wastewater currently discharged from the JAPAMA municipal wastewater treatment plant to the Bay of Ohuria. The corresponding improvements in water quality will benefit people who depend on the Bay of Ohuria for their livelihood activities such as aquaculture, fishing, and tourism. This is a **positive impact**, the magnitude of which will be dependent on the final volume of JAPAMA untreated wastewater used by the Project. (see Table 8.95).

Table 8.95: Improved water quality within the Bay of Ohuria

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Development of Project raw and reject water treatment system	Improved water quality within the Bay of Ohuria	**Positive (0)**			N/A

Enhancement measures

The Project will monitor reject wastewater (treated Project wastewater on-site) quality against applicable Mexican effluent standards, WBG EHS guidelines effluent levels (see Section 8.1.5). No further enhancement measures are anticipated to be required.

8.3.9 Human rights

The human rights assessment identified that violence and threats against migrants, violence against women, domestic abuse, mistreatment of individuals with disabilities, violence and threats against Indigenous Peoples and LGBTQ+ individuals, threats to freedom of expression, potential human trafficking, and child labour, including forced labour and labour rights are key risks to human rights present in Mexico and to varying extent (depending upon the risk) at the local level.

The table below presents an overview of the potential adverse human rights impacts and risks which were identified as salient for the Project. These potential Project-related impacts or risks are identified before considering the application of existing management measures. In the context of the Project, the most likely human rights risks and issues are expected to revolve around:

- Right to equal opportunity and non-discrimination
- Right to just and favourable working conditions
- Right to work
- Freedom from child labour
- Freedom from forced labour
- Right to freedom of association and collective bargaining
- Right to safe and healthy working conditions
- Right to freedom of opinion and expression
- Right to freedom of assembly
- Right to health and right to safety
- Right to liberty and security
- Rights of minorities
- Right to self- determination and natural resources
- Right to a clean environment (including water)
- Right to access remedy.

With adequate application of the existing management measures outlined in Table 8.96 prior to construction, most human rights risks and impacts are likely to be mitigated. However, two potential human rights impacts were evaluated in further detail within the social impact assessment: violation of labour rights by contractors and sub-contractors, and failure of contractors and sub-contractors to provide adequate accommodation (see Section 8.3.4).

Table 8.96: Potential human rights related impacts and risks

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
Labour and working conditions			
Right to equal opportunity and non-discrimination	• UDHR (Art 1,2 & 23(2)) • International Covenant on Civil and Political Rights (ICCPR; Art 2, 3 and 7) • International Covenant on Economic, Social and Cultural Rights (ICESCR; Art 2 and 3) • CAT (Art 2(1), 4 and 10) • Convention on the Elimination of All Forms of Discrimination against Women (CEDAW; Art 2, 3 and 11) • ILO's Discrimination (Employment and Occupation) Convention, 1958 (No. 111) • ILO's Equal Remuneration Convention, 1951 (No. 100) • ILO's Maternity Protection Convention, 2000 (No. 183), and its accompanying Recommendation No. 191 (2000)	• National anti-discrimination laws have been critiqued for not being extensively developed regarding labour matters (see Section 5.4.3.17 on human rights). • Possible lack of enforcement of the non-discrimination laws and provisions nationally (see Section 5.4.3.17 on human rights). • Potential for biased hiring practices within Project, contractors or suppliers. • Risk of wage disparity among workers based on gender, ethnicity, or social status. • Women might face unequal opportunities and treatment in recruitment, promotion, and working conditions. • Individuals with disabilities might face barriers to access, leading to exclusion from job opportunities. • Potential exclusion of minority-owned businesses from procurement and supply chain opportunities.	Corporate policies: • Suppliers Code of Conduct • Company Code of Conduct • Harassment Prevention Policy • Human Rights Policy • Gender Equality and Inclusion Policy Company / Project Management Plans: • Gender Based Violence and Harassment Risk Management Plan • Local Content Plan EPC Specific Management Plans: • EPC Contractor Management Plan • EPC Supplier Code of Conduct • EPC Worker Code of Conduct • Procurement and Local Content Plan
Right to just and favourable working conditions	• UDHR (Art 7, 23, 24, and 25) • ICESCR (Art 7, 10, and 11) • ICCPR (Art 23) • CEDAW (Art 11) • Convention on the Rights of the Child (CRC; Art 5),	• Many labour laws are not enforced adequately (see Section 5.4.3.11 on human rights). • Potential lack of proper rest breaks and reasonable working hours.	Corporate policies: • Human Rights Policy EPC Specific Management Plans: • EPC Worker Accommodation Plan • EPC Worker Accommodation and Transportation Plan

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
	• ICESCR General Comment No. 23 (2016) • ILO Minimum Wage Fixing Convention C131 (Art 3) • ILO Social Policy Convention C117 (Art 5) • ILO Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy (Art 34) • ILO Holidays with Pay (Revised) Convention C132 (Art 4(2)) • ILO Maternity Protection Convention C183 (Art 4) • ILO Hours of Work (Industry) Conventions C1 and C14 • ILO Hours of Work (Commerce and Offices) Convention C30 (Art 3 and 4) • ILO Weekly Rest (Commerce and Industry) Convention C106 • ILO Forty-Hour Week Convention C47	• Possibility of limited job security such as adequate contracts for workers. • Potential lack of adequate accommodations for workers. • There may be insufficient provisions recreational facilities, impacting workers' well-being.	
Right to work	• UDHR (Art 23) • ICESCR (Art 6)	• Possible discrimination against local communities in accessing job opportunities. • The Project may not generate as many job opportunities for local communities as desired, leading to unmet employment expectations.	Corporate policies: • Human Rights Policy

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
		• Employment opportunities might be short-term or unstable, leading to potential insecurity and lack of long-term livelihood prospects. • Local workers may lack the necessary skills for available positions, leading to possible limited local hiring and reliance on external labour. • Marginalised groups, including women and indigenous people, may face barriers to accessing job opportunities within the Project.	
Freedom from child labour	• ICESCR (Art 10) • CRC (Art 32) • ILO Minimum Age Convention No. 138, • ILO Worst Forms of Child Labour Convention No. 182, • ILO Minimum Age for Admission to Employment Recommendation R146 (Art 3) • ILO Worst Forms of Child Labour Recommendation R190 all work to combat child labour.	• ILO assessments deemed that Mexico lacked effective policies at federal, state, and municipal levels to prevent and eliminate child labour (see Section 5.4.3.11 on human rights). • Children have been reported to help their families with fishing and associated activities such as scaling and packaging in or around the Project Aoi. • Risks that Project, contractors or Project workers procure goods which have been produced using child labour.	Corporate policies: • Human Rights Policy • Suppliers Code of Conduct
Freedom from forced labour	• UDHR (Art 4 and 13(1)) • ICESCR (Art 6 and 7) • ICCPR (Art 8) • International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (ICMW; Art 11)	• Forced labour exist in Mexico (see Section 5.4.3.11 on human rights). • There have been reports that forced labour occur on commercial plantations and smallholder farms in Sinaloa (US DOL, 2024).	Corporate policies: • Human Rights Policy • Suppliers Code of Conduct

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
	• CEDAW (Art 6)	• If the Project, contractors or Project workers procure goods which have been produced by forced labour, the Project may be indirectly linked to forced labour. • The Project might inadvertently engage in or benefit from coercive labour practices, particularly through third-party contractors.	
Right to freedom of association and collective bargaining	• UDHR (Art 20(1) and 23(4)) • ICCPR (Art 21 and 22) • ICESCR (Art 8) • ILO Freedom of Association and Protection of the Right to Organise Convention C87 (Art 2-5) • ILO Right to Organise and Collective Bargaining Convention C98 (Art 1, 3, and 4) • ILO Collective Bargaining Convention C154 (Art 5 and 8) • ILO Workers Representatives Convention C135 (Art 1 and 2)	• Intimidation against workers by union leaders have been reported in Mexico (see Section 5.4.3.11 on human rights). • Interference with union operations and collective bargaining processes have been reported in Mexico (see Section 5.4.3.11 on human rights). • Potential restriction on workers' ability to form or join unions. • Potential inadequate support for workers to organise and negotiate collectively. • Lack of workforce (including contractor) access to appropriate feedback or grievance mechanisms. • Potential government retaliation against those who seek to collectively bargain.	Corporate policies: • Employee Confidentiality Agreement Company / Project Management Plans: • Stakeholder Engagement Plan • Community Grievance Mechanism EPC Specific Management Plans: • Stakeholder Engagement Plan + Community Grievance Mechanism
Right to safe and healthy working conditions	• UDHR (Art 7) • ICESCR (Art 6 and 7) • CEDAW (Art 11) • ILO Convention 155 Concerning Occupational Health and Safety and the Working Environment (1981) (Art 4, 5, and 13)	• Over 500,000 workers per year in Mexico are subject to accidents at work (see Section 5.4.3.11 on human rights). • OHS concerns from potentially hazardous working conditions and unforeseen incidents.	Corporate policies: • Alcohol and Substance Abuse Prevention Policy¨ • Health, Safety, Environment, and Social Performance Policy • Human Rights Policy

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
	• ILO Convention 161 on Occupational Health Services (1985)	• Possibility of workers not using protective equipment adequately, increasing health hazards for workers. • The Project is expected to increase traffic in the area, potentially posing a safety risk to workers and community members.	• PROJECT Safe Driving and Transportation Policy • PROJECT Stop Work Authority Policy • Security Management Policy Company / Project Management Plans: • Project Health and Safety Plan • Project Security Management Plan EPC Specific Management Plans: • EPC Occupational Health and Safety Plan • EPC Transportation Management Plan • EPC Emergency Response Plan, including Medevac Plan • EPC Worker Accommodation and Transportation Plan
Community-level human rights			
Right to freedom of opinion and expression	• UDHR (Art 19) • ICCPR (Art 19)	• Mexico has face challenges in terms of freedom of expression, especially for journalists (see Section 5.4.3.11 on human rights). • Potential lack of adequate community access to appropriate feedback or grievance mechanisms. • Potential lack of effective access to stakeholder engagement process and opportunity to comment on activities that may have an impact. • Local community members may face restrictions or reprisals when voicing	Company / Project Management Plans: • Stakeholder Engagement Plan • Community Grievance Mechanism EPC Specific Management Plans: • Stakeholder Engagement Plan + Community Grievance Mechanism

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
		concerns or opposition to the Project by the government or security forces. • Employees might be discouraged or penalised for expressing grievances or opinions about working conditions and practices. • Journalists and activists reporting on the Project's impacts could potentially feel hesitant to do so.	
Right to freedom of assembly	• UDHR (Art 20) • ICCPR (Art 21 & 22) • ICESCR (Art 8)	• Potential government and/or private security force retaliation against those that raise issues related to the Project. • Potential government and/or private security force retaliation against those that peacefully protest or demonstrate against the Project.	Corporate policies: • Human Rights Policy • Company Code of Conduct
Right to health and right to safety	• UDHR (Art 25) • ICESCR (Art 12) • Committee on Economic, Social and Cultural Rights General Comment 14 on the Right to Health	• The Project may contribute to straining the access to healthcare further due to an influx of workers. • The Project may be linked to increases in sexually transmitted infections (STIs) and/or diseases, due to interactions between workers and the local populations. • The Project may contribute to increased prevalence of traffic accidents. • Potential leaks or spills may contaminate local water sources, potentially posing health risks to communities relying on them.	Corporate policies: • PROJECT Safe Driving and Transportation Policy • Community Relations and Indigenous Rights Policy Company / Project Management Plans: • Community Health, Safety and Security Plan • Gender Based Violence and Harassment Risk Management Plan • Project ESMMP EPC Specific Management Plans: • EPC Community Health, Safety and Security Plan

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
Right to liberty and security	• UDHR (Art 3) • ICCPR (Art 6) • ICESCR (Art 12)	• The Project may be linked to increased instances of crime due to Project-related in-migration or influx. • The Project may lack the ability to control Government Security approach or procedures. • Tensions and/or conflicts might arise between local communities and Project workers.	Corporate policies: • Community Relations and Indigenous Rights Policy • Security Management Policy Company / Project Management Plans: • Community Health, Safety and Security Plan • Gender Based Violence and Harassment Risk Management Plan • Project Security Management Plan EPC Specific Management Plans: • EPC Community Health, Safety and Security Plan • EPC Security Management Plan • Facility Lighting Management Plan
Rights of minorities	• ICCPR (Art 27)	• Potential perceived or actual discrimination against minorities, including Indigenous Peoples from the in-migration of workers for Project or contractors.	Corporate policies: • Community Relations and Indigenous Rights Policy • Human Rights Policy Company / Project Management Plans: • Indigenous Peoples Plan • Strategic Community Investment Plan EPC Specific Management Plans: • EPC Social Performance Management Plan
Right to self-determination and natural resources	• UDHR (Art 21) • ICCPR (Art 1) • ICESCR (Art 1)	• Unplanned events impacts, noise pollution and land access impacts might impact the access to natural resources.	Corporate policies: • Community Relations and Indigenous Rights Policy

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
			Company / Project Management Plans: • Indigenous Peoples Plan • Strategic Community Investment Plan
Right to a clean environment (including water)	• UDHR (Art 25) • ICESCR (Art 12) • The Committee on Economic, Social and Cultural Rights' General Comment 15 (2002) • UN General Assembly's Resolution 64/292 (28 July 2010)	• The Project may impact the environment through accidental spillage or through unplanned events. • The construction and operation of the Project might disrupt local ecosystems.	Company / Project Management Plans: • ESMMP • Air Quality Management Plan • Noise Management Plan • Waste Management Plan • Water Management Plan • Biodiversity Management Plan • Soil Management Plan EPC Specific Management Plans: • EPC Environmental Management and Monitoring Plan • EPC Air Quality Management Plan • EPC Construction Fugitive Dust Control • EPC Noise Management Plan • EPC Waste Management Plan, including Chemicals, Hazardous Materials, Spill Prevention, Controls and Countermeasures • EPC Water Management Plan, including Wastewater and Stormwater Pollution and Prevention • EPC Biodiversity Management Plan • EPC Soils Management Plan, including Erosion Control, Revegetation, and Maintenance;

Salient human rights	International guidelines	Potential Project-related impacts or risks	Existing management controls and mitigation measures
			Unanticipated Sediment and Soils Discovery; and Fill Management • EPC Horizontal Direction Drills (HDD) Contingency Plan
Right to access remedy	• UDHR (Art 7 and 8) • ICCPR (Art 2)	• Community unrest due to potential livelihood loss, incorrect stakeholder identification, and conflicts over the sharing of Project benefits (i.e. employment or business opportunities). • Increased uncertainty and concern about the Project due to insufficient information and communication. • Inadequate feedback and grievance mechanisms for the workforce, including contractors. • Limited access for the community to appropriate feedback and grievance mechanisms.	Company / Project Management Plans: • Stakeholder Engagement Plan • Community Grievance Mechanism EPC Specific Management Plans: • Stakeholder Engagement Plan + Community Grievance Mechanism

Transition Industries has an established Human Rights Policy which will apply to the Project. This policy, alongside wider corporate social performance policies and management plans as part of the Project's social management system will serve to protect individual rights holders directly impacted by the Project's operations or indirectly through contractors or national suppliers (see Table 8.96). The Project is committed to compliance with all applicable rights established by federal and state laws. The Project has established requirements confirming respect for human rights through various company policies, including:

- Human Rights Policy
- Community Relations and Indigenous Rights (Good Neighbour Policy)
- Suppliers Code of Conduct
- Company Code of Conduct
- Health, Safety, Environment, and Social Performance Policy
- Harassment Prevention Policy, Community Relations and Indigenous Rights Policy
- Gender Equality and Inclusion Policy, and
- Security Management Policy

These policies will be complemented by similar policies established for the primary EPC contractor and through any contractual relationships with other third parties and suppliers. An updated Stakeholder Engagement Plan has been prepared as part of this ESIA, and the Project has also developed a Community Grievance Mechanism which will provide an early warning of any potential repeated rights violations and process for remediation. Although not required, the Project has committed to preparing an Indigenous Peoples Plan prior to construction.

The Project has developed a Security Management Plan to ensure standards of private security provision align with industry regulations and GIIP such as those specified by the Voluntary Principles on Security and Human Rights (VPSHR). This includes screening measures for human rights violations for prospective security personnel during the recruitment processes of the Project or contractors.

The Project will provide opportunities to enhance or improve human rights, particularly in the areas of right to work and right to fair working conditions. Benefits are expected to include improvement of employee knowledge on basic human rights through the provision of employee induction training on the Company Code of Conduct and Human Right Policy.

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- Human Rights Policy
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- Suppliers Code of Conduct
- Company Code of Conduct
- Health, Safety, Environment, and Social Performance Policy
- Harassment Prevention Policy, Community Relations and Indigenous Rights Policy
- Gender Equality and Inclusion Policy
- Security Management Policy.

These policies will be complemented by similar policies established for the primary EPC contractor and through any contractual relationships with other third parties and suppliers. An updated Stakeholder Engagement Plan has been prepared as part of this ESIA, and the Project has also developed a Community Grievance Mechanism which will provide an early warning of any potential repeated rights violations and process for remediation. Although not required, the Project has committed to preparing an Indigenous Peoples Plan prior to construction.

The Project has developed a Security Management Plan to ensure standards of private security provision align with industry regulations and GIIP such as those specified by the Voluntary Principles on Security and Human Rights (VPSHR). This includes the requirement to complete a security risk assessment and screening measures for human rights violations for prospective security personnel during the recruitment processes of the Project or contractors.

The Project will provide opportunities to enhance or improve human rights, particularly in the areas of right to work and right to fair working conditions. Benefits are expected to include improvement of employee knowledge on basic human rights through the provision of employee induction training on the Company Code of Conduct and Human Right Policy.

8.3.10 Social impact assessment summary

Table 8.97 and Table 8.98 provide a summary of the social impact assessment.

Table 8.97: Impact magnitude scoring for social impacts

No.	Project activity	Description of impact	Intensity	Frequency	Duration	Magnitude of impact
Construction phase						
1	Project procurement providing opportunities for regional and local businesses.	Economic benefits to local businesses and economy	N/A			Positive
2	Employment opportunities	Generation of local employment opportunities	N/A			Positive
3	Employment opportunities, training and skills development	Greater gender disparity caused by higher male employment uptake	Low	Continuous	Short-term	Low (2)
4	Project employment	Violation of labour rights by contractors and sub-contractors	Medium	Continuous	Short-term	Low (2)
5	Project employment	Failure of contractors and sub-contractors to provide adequate accommodation	High	Continuous	Short-term	Medium (3)
6	Project employment	Inadequate management of occupational health and safety	High	Episodic	Medium-term	Low (2)
7	Increased construction traffic	Delays, increased journey times and reduced road safety due to increased construction-related traffic	High	Continuous	Short-term	Medium (3)
8	Increased workforce recruitment	Increased GBVH as a result of non-local workforce arrival in community	High	Continuous	Short-term	Medium (3)
9	Increased workforce recruitment	Increased GBVH within the workforce	Medium	Continuous	Short-term	Low (2)
10	Construction related workforce influx	Potential impacts on cultural heritage as a result of large non-local workforce	Medium	Continuous	Short-term	Low (2)
11	Construction related workforce recruitment	Increased pressure on local services and social infrastructure (i.e. waste management)	Medium	Continuous	Short-term	Low (2)
Operation phase						
12	Project payment of taxes	Increased state revenue	N/A			Positive
13	Purchase of clean energy certificates	National investment in energy transition and renewables sector	N/A			Positive
14	Procurement of goods and services	Increased cost of living, inflationary pressure from Project procurement	Low	Continuous	Medium-term	Low (2)
15			Medium	Continuous	Medium-term	Medium (3)
16	Creation of Project-related employment	Increased social tension and conflict over Project benefits	High	Episodic	Short-term	Very Low (1)
16	Employment opportunities, training and skills development	Household income, skills and employability	N/A			Positive
17	Project employment	Inadequate management of occupational health and safety	Medium	Episodic	Medium-term	Low (2)
18	Project employment	Inadequate assessment of occupational exposure to methanol	High	Continuous	Medium-term	Medium (3)
19	Land acquisition for Project, land easements and temporary restrictions on land access	Reduced access to land for agriculture, livelihoods, recreation and other activities	Negligible	Continuous	Short-term	Very Low (1)
20	Increased marine traffic (during construction and operations)	Increased marine traffic and reduced marine safety	Low	Continuous	Short-term	Low (2)
21	Development of Project raw and reject water treatment system	Improved water quality within the Bay of Ohuria	N/A			Positive
Decommissioning phase						
22	Completion of demobilisation after construction	Termination of employment contracts	High	Continuous	Medium-term	Medium (3)
23	Completion of decommissioning activities	Termination of employment contracts	Negligible	Continuous	Short-term	Very Low (1)

No.	Project activity	Description of impact	Intensity	Frequency	Duration	Magnitude of impact
24	Project employment	Inadequate management of occupational health and safety	Medium	Episodic	Medium-term	Low (2)

Table 8.98: Pre-mitigation impact scoring and post mitigation residual impact significance for social impacts

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[169]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
Construction phase									
Economy									
1	Project procurement providing opportunities for regional and local businesses.	Economic benefits to local businesses and economy	**Positive**			N/A	**Positive**		
Employment and skills									
2	Employment opportunities	Generation of local employment opportunities	**Positive**			N/A	**Positive**		
3	Employment opportunities, training and skills development	Greater gender disparity caused by higher male employment uptake	Low (2)	Medium (3)	**Moderate (6)**	Yes	Very Low (1)	Medium (3)	**Minor (3)**
Working conditions									
4	Project employment	Violation of labour rights by contractors and sub-contractors	Low (2)	Low (2)	**Minor (4)**	No	**N/A**		
5	Project employment	Failure of contractors and sub-contractors to provide adequate accommodation	Medium (3)	Low (2)	**Moderate (6)**	Yes	Very Low (1)	Medium (3)	**Minor (3)**
6	Project employment	Inadequate management of occupational health and safety	Low (2)	Low (2)	**Minor (4)**	No	Very Low (1)	Medium (3)	**Minor (3)**
Land ownership and livelihoods									
7	Land acquisition for Project, land easements and temporary restrictions on land access during construction	Reduced access to land for agriculture, livelihoods, recreation and other activities	Very Low (1)	Low (2)	**Negligible (2)**	No	**N/A**		
Community health, safety, security and welfare									
8	Increased construction traffic	Delays, increased journey times and reduced road safety due to increased construction-related traffic	Medium (3)	Medium (3)	**Moderate (9)**	Yes	Very Low (1)	Medium (3)	**Minor (3)**

[169] Refer to Sections 8.3.1-8.3.9 for details of proposed mitigation measures.

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[169]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
9	Increased workforce recruitment	Increased GBVH as a result of non-local workforce arrival in community	Medium (3)	High (4)	**Major (12)**	Yes	Very Low (1)	High (4)	**Minor (4)**
10	Increased workforce recruitment	Increased GBVH within the workforce	Low (2)	High (4)	**Moderate (6)**	Yes	Very Low (1)	High (4)	**Minor (4)**
Cultural heritage									
11	Construction related workforce influx	Potential impacts on cultural heritage as a result of large non-local workforce	Low (2)	Medium (3)	**Moderate (6)**	Yes	Very Low (1)	Medium (3)	**Minor (3)**
Social infrastructure and services									
12	Construction related workforce recruitment	Increased pressure on local services and social infrastructure (i.e. waste management)	Low (2)	Medium (3)	**Moderate (6)**	Yes	Very Low (1)	Medium (3)	**Minor (3)**
Operation phase									
Economy									
13	Project payment of taxes	Increased state revenue	**Positive**			N/A	**Positive**		
14	Purchase of clean energy certificates	National investment in energy transition and renewables sector	**Positive**			N/A	**Positive**		
15	Procurement of goods and services	Increased cost of living, inflationary pressure from Project procurement	Low (2)	Low (2) – non-vulnerable groups	**Minor (4)**	Yes	Very Low (1)	Low (2)	**Negligible (2)**
			Medium (3)	Medium (3) – vulnerable groups	**Moderate (9)**	Yes	Very Low (1)	Medium (3)	**Minor (3)**
16	Creation of Project-related employment	Increased social tension and conflict over Project benefits	Very Low (1)	Medium (3)	**Minor (3)**	No	**N/A**		
Employment and skills									
17	Employment opportunities, training and skills development	Household income, skills and employability	**Positive**			N/A	**Positive**		
Working conditions									
18	Project employment	Inadequate management of occupational health and safety	Low (2)	Low (2)	**Minor (4)**	No	**N/A**		
19	Project employment	Inadequate assessment of occupational exposure to methanol	Medium (3)	Low (2)	**Moderate (6)**	Yes	**Low (2)**	**Low (2)**	**Minor (3)**
Community health, safety, security and welfare									
20	Increased marine traffic (during construction and operations)	Increased marine traffic and reduced marine safety	Low (2)	Low (2)	**Minor (4)**	No	**N/A**		
Social infrastructure and services									

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[169]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
21	Development of Project raw and reject water treatment system	Improved water quality within the Bay of Ohuria	**Positive**			N/A	**Positive**		
Decommissioning phase									
Employment and skills									
22	Completion of demobilisation after construction	Termination of employment contracts	Medium (3)	Low (2)	**Moderate (6)**	Yes	Low (2)	Low (2)	**Minor (4)**
23	Completion of decommissioning activities	Termination of employment contracts	Very Low (1)	Low (2)	**Negligible (2)**	No	**N/A**		
Working conditions									
24	Project employment	Inadequate management of occupational health and safety	Low (2)	Low (2)	**Minor (4)**	No	**N/A**		

8.4 Ecosystem services impact assessment

The World Resources Institute (WRI) guidelines and IFC PS6 requires that priority ecosystem services are identified, and impacts to those services are assessed (IFC, 2012). Impacts to the three priority ES have been assessed and the results are presented in Table 8.99 below.

Three moderate impacts were identified for the priority cultural ES, which require mitigation. However, the mitigation measures required will already be implemented because of the cultural heritage and visual impact assessment. These impacts relate to Project-related in-migration of people from outside the region which may weaken cultural traditions, languages, practices, knowledge, and skills and visual / landscape impacts associated with the Project which could further reduce cultural connections to land and the cultural aesthetic value of the landscape (i.e. for key beneficiaries and sectors such as tourism). Inversely, Project-related in-migration could positively impact traditional knowledge and livelihoods by increasing the diversity of cultural practices in the Project area.

Table 8.99: Ecosystem services impact assessment

ES name, type and priority	Project related activities with the potential to impact ES	Summary of the potential adverse impacts on ES	Project phase	Impact significance			Mitigation needed	Residual impact significance
				Magnitude	Sensitivity	Significance		
Cultural services								
Cultural connection to the land and aesthetic value of the landscape (Priority: Type 1)	Long-term uptake of natural land for the Project	*Temporary/permanent loss of land and natural habitats:* The long-term uptake of natural land for the Project could disconnect PACs/IPs from cultural heritage and reduce the visual amenity of the land (refer to Section 8.1.3), which could adversely impact on this ES.	All phases	Very low (1)	Medium (3)	**Minor (3)**	No (no significant impact on ES anticipated)	**Minor (3)**
	Induced access and Project-related in-migration	*Cultural heritage impact:* Increased access to the Project area could result in damage to known cultural heritage features (e.g., cemeteries, memorials) which could adversely impact on this ES.	All phases	Low (2)	Medium (3)	**Moderate (6)**	Yes, refer to Section 8.3.7	**Minor (3)**
Traditional knowledge and livelihoods (Priority: Type 1)	Induced access and Project-related in-migration	*Weakening of local cultural practices:* The in-migration of non-local people in the Project area could result in generational changes related to cultural significance and the symbolic role of fishing which could adversely impact this ES.	All phases	Low (2)	Medium (3)	**Moderate (6)**	Yes, refer to Section 8.3.7	**Minor (3)**
		Increased diversity of cultures: The in-migration of non-local people in the Project area could increase the diversity of cultural practices, thus positively impacting this ES.	All phases	**Positive**			No (positive impact on ES anticipated)	**Positive**
Rituals and ceremonies (Priority: Type 1)	Induced access and Project-related in-migration	*Weakening of local cultural practices:* The in-migration of non-local people in the Project area could weaken local cultural practices such as rituals, ceremonies and intangible cultural heritage (e.g., weddings, community assemblies, Holy Week celebrations, festivities to the Virgin of Guadalupe and the Holy Cross) which could adversely impact this ES.	All phases	Low (2)	Medium (3)	**Moderate (6)**	Yes, refer to Section 8.3.7	**Minor (3)**

8.5 Impact assessment for unplanned events

‘Credible’ unplanned events during the construction phase and operation phase activities leading to environmental or social impacts were identified during the impact assessment process.

A summary of unplanned events associated with the Project is presented in Table 8.100. This includes an overview of the Project activity, receptor, potential impact, Project phase event could occur, severity of impact, likelihood of impact, overall risk ranking and a summary of primary mitigation measures. Each management plan referenced has more detailed information on each specific action to be taken.

Table 8.100: Potential impacts during unplanned events

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
Potential environmental impacts from unplanned events							
Management of hazardous materials	• Soil quality • Surface water quality • Groundwater quality • Air Quality • Biodiversity	Accidental loss of containment or spillage of hazardous materials during storage, handling or use results in contamination of soil and/or water resources. The accidental release of fugitive dust and particulate matter during construction, handling or use of materials. The accidental release of pollutants generated during operations phase.	• Construction • Operation • Decommissioning	Low (2) Minor effect on the environment, contained within the site and likely to be quickly remediated	Unlikely (2)	**Small**	• Regularly inspect and maintain plant, equipment, and vehicles for leaks of diesel or chemicals. • Hazardous materials storage areas shall have secondary containment within a berm perimeter able to contain 110% of the largest tank volume. • Regularly inspect storage areas for any leakage or spillage of diesel or chemicals. • Locate drip collection trays at refuelling areas. • Locate spill clean-up kits at strategic locations and replace/replenish as required. • Develop and implement a Hazardous Materials Management Plan

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
							within the ESMP which includes measures such as having waste manifests and contractual clauses on failure to dispose of waste property. • Develop and implement a Spill Response Plan within the ESMP. • The implementation of the committed Traffic Management plan and effective contractor management will reduce the risk of dust and particulate matter being generated and re-suspended. • The Implementation of committed Air Quality Management Plan. • The Implementation of committed Air Biodiversity Management Plan.
Storage of hazardous materials and equipment	• Soil quality • Surface water quality	Flooding events could result in the accidental release of hazardous	• Construction • Operation • Decommissioning	Medium (3) Potential impacts beyond	Unlikely (2)	**Material**	• Design project site layouts taking into consideration any flood risk assessments

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
containing hazardous materials (i.e., vehicles and machinery) and hazardous waste	• Groundwater quality • Biodiversity	materials from storage areas, vehicles and machinery and hazardous waste areas should these areas be damaged or submerged by floodwaters resulting in contamination of soil, surface water or groundwater.		company site but likely to be short-term and quickly remediated			conducted for the project and location storage areas for hazardous materials, hazardous waste and vehicle and machinery outside of flood risk zones. • Regularly review weather forecasts and move vehicles, machinery and any hazardous materials to safe areas should heavy rainfall or storm events be forecast. • Do not store hazardous materials, hazardous wastes, vehicles or machinery on bridges, at culvert crossings or where pipelines cross surface water bodies. • Develop and implement a Hazardous Materials Management Plan within the ESMP. • Develop and implement a Spill Response Plan within the ESMP.

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
Potential social impacts from unplanned events							
Use of vehicles and machinery for project activities	• Other road users • Pedestrians	Traffic accidents resulting in material damage, injury or fatality of another road user or pedestrian.	• Construction • Operation • Decommissioning	High (4) Key receptors include Project-affected communities where near-constant presence of people is possible or long-term risk exposure likely	Possible (3)	**Severe**	• Develop and implement a Traffic Management Plan within the ESMP. • Transition Industries and contractor(s) will develop and implement public safety communications protocols (including awareness building and emergency response) to mitigate risks to communities from accidents such as those related to traffic and unauthorised access. • Contractor(s) will undertake a pre-construction survey of the roads to be used by project traffic and identify community hazards. Actions will then be taken to minimise community safety risks at these locations (i.e., post signs and notices, reduced speed limits

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
							close to highly sensitive location such as schools, identification of alternative routes etc.). • Transition Industries and the contractor will monitor Community Grievance Management Procedure for issues and concerns related to traffic management. • Postage of culturally appropriate safety signage and information in communities near project roads. This includes information for communities on incident investigations processes and lessons learned where appropriate.
Use of vehicles and machinery for project activities	• Land users, especially those using land for livelihoods and	Unexpected damage to crops, animals or other land-based livelihood activity caused by Project infringement	• Construction	Low (2) Small amount of land resource area at risk and	Unlikely (2)	**Small**	• Develop and implement a Traffic Management Plan within the ESMP restricting Project vehicles, especially during pipeline

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
	agricultural purposes			affected persons likely to have access to alternative resources			construction, from operating outside of rights-of-way and access roads • Postage of culturally appropriate safety signage and information in communities near project roads. • Transition Industries and the contractor will ensure any damage to livestock or agriculture land is addressed through the Community Grievance Management Procedure and include provisions for restoration according to IFC PS5.
Mobilisation, construction phase site activities	Community health	Unexpected outbreak of communicable disease caused by worker influx and related in-migration	• Construction	High (4) Social receptors include Project-affected communities, schools and hospitals were long term exposure likely	Unlikely (2)	**Material**	• The project Health, Safety, Environment, and Social Performance Policy, and Project Health and Safety Plan are key internal measures to mitigate health risks among the workforces. • These are complemented EPC

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
							Community Health, Safety and Security Plan • The project should monitor community health as part of the project ESMP
Use of marine vessels for project activities	• Other marine users • Fisherfolk	Marine accidents resulting in material damage, injury or fatality of another marine user	• Construction • Operation	High (4) Human receptors include Project-affected fishing communities where near-constant presence of people is likely	Unlikely (2)	**Material**	• Develop and implement a Marine Traffic Safety and Management Plan within the ESMP. • Transition Industries and Port Authority will develop and implement public marine safety communications protocols (including awareness building and emergency response) to mitigate risks to communities from accidents such as those related to marine traffic. • Transition Industries and the contractor will monitor Community Grievance Management Procedure for issues and concerns related

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
							to marine traffic management. • Postage of culturally appropriate safety signage and information in communities near port facility. This includes information for communities on incident investigations processes and lessons learned where appropriate.
Project activities	Workforce health and safety	The potential failure of the contractor(s) and sub-contractors working on the project facility to meet requisite occupational health and safety standards increases the risk of unsafe workplaces and conditions that could lead to workplace injuries and/or fatalities.	• Construction • Operation • Decommissioning	Medium (3) Human receptors where health and safety related impacts are expected over longer periods of exposure	Possible (3)	**Material**	• Robust contractor pre-qualification and due diligence process that includes a review of contractor's health and safety policies to ascertain whether prospective contractors meet required standards. • Occupational health and safety training will be provided to the entire workforce as part of the induction process. • Transition Industries and contractor(s) will develop and

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
							implement comprehensive Health and Safety Plans.
Mobilisation, construction phase site activities, operations and decommissioning	Workforce and community health and safety	While part of the methanol plant site will be fenced and a Community Health, Safety, and Security Management Plan will be prepared for construction and operational phases as part of the project's ESMP active civil works areas on the site, port facility, access road or pipeline will increase risks for incidents of accidental injury or death to a worker or community third party.	• Construction • Operations • Decommissioning	High (4) Human receptors where health and safety related impacts are expected to include Project-related communities and long-term periods of exposure	Unlikely (2)	**Material**	• Transition Industries will create robust contractor pre-qualification and due diligence process that includes a review of contractor's health and safety policies to ascertain whether prospective contractors meet required standards. • Occupational and community health and safety training will be provided to the entire workforce as part of the induction process. • Transition Industries and contractor(s) will develop and implement a Health, Safety and Security and Environment (HSSE) Management Plan as part of the ESMP.

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
Operation of the methanol production plant, pipeline and ship offloading (see Section 8.5.1)	Workforce and community health and safety	Risk of accidental injury or death to a worker or community third party (i.e. member of or visitor to Rosendo G Castro or Topolobampo communities) because of the following events: • Fire ball • Jet fire • Early and late pool fire • Vapour cloud explosion • Flash fire • Unignited flammable release Refer to Sections 8.5.1-8.5.3 below.	• Operations	High (4) Human receptors where health and safety related impacts could occur include Project-related communities and long-term periods of exposure	Almost zero	**Negligible**	• Public safety education and joint emergency drills for few structures within 1xE^{-4} and 1xE^{-6}

8.5.1 Quantitative Risk Assessment

8.5.1.1 Introduction

As part of the unplanned events assessment process a quantitative risk assessment (QRA) has been carried out to identify and evaluate credible risk event scenarios related to the operation of the new plant and associated infrastructure. The objective of the QRA was to assess the risks to both personnel and public associated with the operations of the methanol production plant, pipeline and ship offloading.

The QRA has been carried out to:

- Assess the risks to both personnel and public associated with the operations of the Mexinol production plant, pipeline and ship offloading facility.
- Provide comments/recommendations on the need for further risk mitigation.
- Present Location Specific Individual Risk (LSIR) contours for on and off-site populations.
- LSIR contours showing risk contributions from individual hazard effects i.e. flammable gas.
- F-N curve for offsite risk.

8.5.1.2 Methodology

The major hazards from the project were identified as part of the separate HAZID study and were used as a basis for the desktop QRA hazard identification exercise.

The quantitative risk assessment aims to address key inquiries such as:

- Identifying potential risks;
- Evaluating the potential consequences of these risks;
- Assessing the likelihood of these risks materializing; and
- Determining the necessity for proactive risk reduction measures.

The QRA was carried out on the following areas:

- Methanol plant
    - Unit4011–Feedgas preparation
    - Unit4031–Catalytic POX and waste heat recovery
    - Unit4041–CO Conversion
    - Unit4051–CO_2 Removal
    - Unit4061–Methanol Synthesis
    - Unit4071–Methanol Distillation
    - Unit4111–Hydrogen Recovery
    - Unit4131–POX Syngas Generation
    - Unit8101–Methanol Intermediate Storage
    - Unit9531–Methanol Storage
- Pipeline to port
    - 28”,10.4 km pipeline from methanol plant to port loading

- Methanol loading at port
    - Unit9631 loading arms with integrated gas return (3000m3/hr rated transfer and loading rate) operating in parallel.

A number of agreed risk event scenarios were modelled based upon the following criteria:

- Process conditions within the pipe (e.g., temperature, pressure);
- Composition of the methanol;
- Possible sizes of the potential leak;
- Locations where the leak might occur;
- Volume of methanol available for the leak; and
- Anticipated duration of the leak, considering the available volume of Methanol and any potential actions to isolate the leak.

The list of hazards was transformed into modelling scenario. Identify the potential leak sources and failure events, based on:

- Location
- Duration
- Isolation

Total of 168 individual nodes, each of these had 4 representative hole sizes (except for tanks and loading arm). Total of 76 compositions modelled with approximately 670 cases modelled in total.

8.5.1.2.1 Consequence modelling and frequency assessment

Consequence modelling determines the potential characteristics of the material upon release, such as phase, quantity, and velocity and assess the flammable and toxic dispersion effects that may arise from the failure. The model evaluates the probability of fatality associated with the material's properties, using the human probit function specifically for methanol

The QRA study assessed the consequences of the following types of events, where applicable:

- Fire Ball: the size of the fireball following the immediately ignited catastrophic ruptures was assessed using the Martinsen Time Varying model;
- Jet Fire: including mass rate, flame length, distance downwind to intensity levels of 4.7, 12.5, 37.5 (kW/m^2);
- Early and Late Pool Fire: including pool diameter, distance downwind to intensity levels of 4.7, 12.5, 37.5 (kW/m^2);
- Vapour cloud explosion: including peak over-pressure 1.0, 0.5 and 0.2 Bar;
- Flash fire: including maximum distance to LFL, height at max flash fire distance;
- Unignited Flammable release at 50% LFL, LFL.

Consequences were modelled for two representative wind speeds and Pasquil stabilities, distributed proportionately with typical local weather conditions for both the main plant, pipeline and jetty offloading.

Frequency Assessment is preformed to calculate the likelihood of the hazards by combining frequency of release with probabilistic conditions. Release frequencies were

derived using a standard QRA package count tool, based on IOGP release frequencies (IOGP. Risk Assessment Data Directory: Ignition Probabilities Report 434-06, September 2019). This tool calculates an overall frequency for each major equipment type, by assigning several parts and pipework and thus derives a frequency for each equipment item.

The pipeline to port has been modelled using the IOGP underground release model in SAFETI. The release direction and extent of dispersion, wind direction and speed probabilities have been incorporated into the Safeti model.

8.5.1.2.2 Risk calculations

The Safeti software has been used to calculate the risks across the facility using the event trees embedded within the software.

Risk = Probability of Fatality x Frequency

The manning data was provided for the following worker groups: Methanol Plant & Port. Offsite data was provided and incorporated to establish the extent of the release.

For this study, societal risk was evaluated against a common risk criterion from the United Kingdom (UK) Health and Safety Executive (HSE). The IFC also considers the US NFPA Codes, in addition to the UK HSE risk criteria, and these include:

- No residential or public buildings are allowed inside 10-4 risk contours;
- Public safety education and joint emergency response drills if residential properties or public buildings are between 10^{-4} year and 10^{-6} years risk contours, plus special community engagement; and
- Special community engagement if residential properties or public buildings are between 10^{-6} to $3x10^{-7}$ risk contours.

8.5.2 Risk assessment results

This QRA has been carried out for the analysis of potential fire, explosion and gas scenarios that could occur on site following a Loss of Containment (LOC) event. The focus will be on the scale and extent of the hazards on the site; the key focus of the assessment will be on offsite risks. The results of the QRA study are summarised below:

8.5.2.1 LSIR

The LSIR is defined as the hypothetical risk of fatality for an individual at a specific location if present for 24 hours a day, 365 days a year (i.e. 100% of the time). LSIR contour plots shown below are generated for outdoor populations.

The total outdoor LSIR contour reveals a localised peak, risk contour of 10^{-3} per year (1 in 1,000 years), this contour is located around the CO_2 removal system and is driven by the large number of equipment items located in that area.

The methanol plant is surrounded by a broader 10^{-6} per year (1 in 1,000,000 years) risk contour, it is important to note that there are no offsite populated areas close to the methanol plant.

Along the pipeline route the total LSIR is less than 10^{-5} per year (1 in 100,000 years) and at this frequency there is no off-site risk to any residential areas. This level of risk is negligible and is considered acceptable according to the HSE risk acceptance criteria.

The primary individual contributor to the overall risk comes from a single release dominating the overall risk, the release from Raw Methanol to Pre-Run Column Overheads Condenser.

The following results detail the contributions and breakdown of toxic and thermal effects which contribute to the combined LSIR risk result presented above. The analysis predicts that fireballs at an effect level of 6.3 kW/m^2 are not anticipated to occur. The outdoor toxic risk contour results are presented below in Figure 8.15.

The highest risk contour of 10^{-3} per year (1 in 1,000 years) is centred around the methanol plant with the contours extending out to 10^{-6} per year (1 in 1,000,000 years). Toxic effects are the primary drivers of risk due to the inventories present, and downwind dispersion influenced by the wind.

Figure 8.13 below illustrates the outdoor jet fire contours for thermal radiation effect of 6.3 kW/m2. This covers most of the site, with the 10^{-6} per year contour extending slightly beyond the site boundary.

The jet fire contours are centred around the methanol plant, with the highest risk contour at 10^{-4} per year (1 in 10,000 years) and the lowest at 10^{-6} per year (1 in 1,000,000 years). The outdoor pool fire results for thermal radiation effect of 6.3 kW/m^2 are presented in Figure 8.16.

Figure 8.16 below illustrates the highest risk contour of 10^{-3} per year (1 in 1,000 years) which is centred around the methanol tanks. Other high pressure liquid release from various units also contribute to the pool's spread. Additionally, the 10^{-6} per year (1 in 1,000,000 years) risk contour extends around the methanol plant, pipeline, and port.

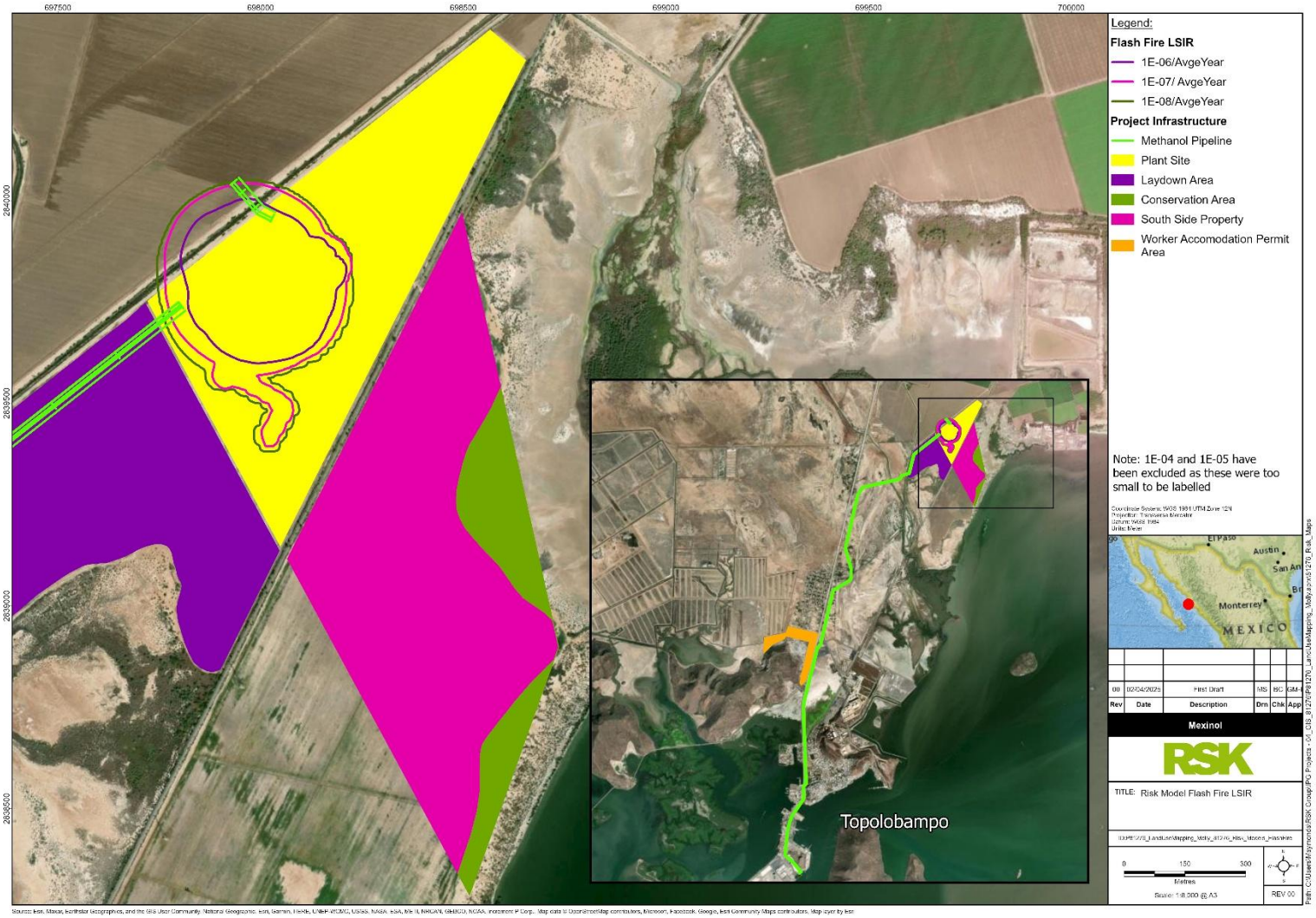

Figure 8.12: Risk model flash fire LSIR

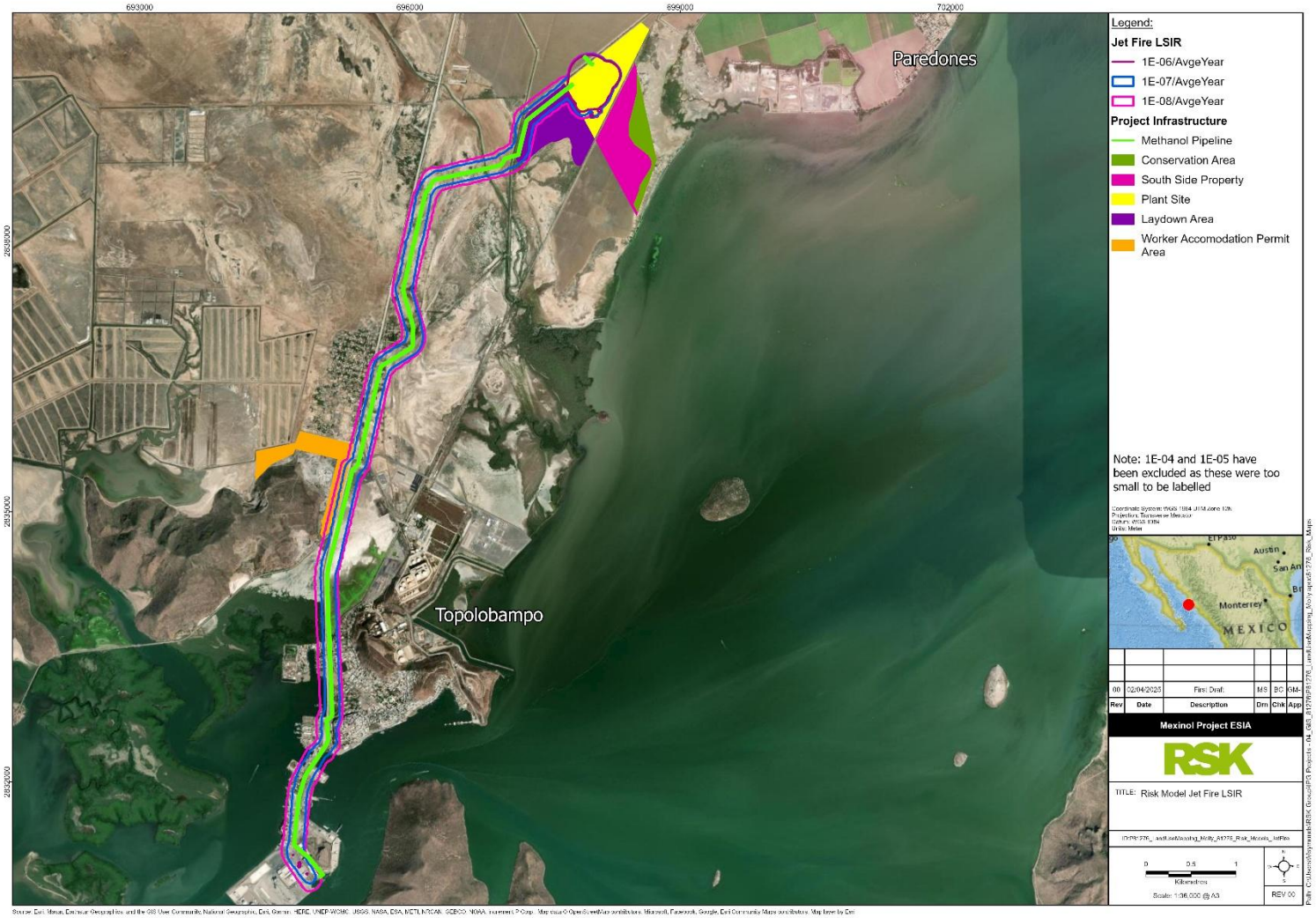

Figure 8.13: Risk model jet fire LSIR

Figure 8.14: Risk model outdoor LSIR

Figure 8.15: Risk model toxic LSIR

Figure 8.16: Risk model pool fire LSIR

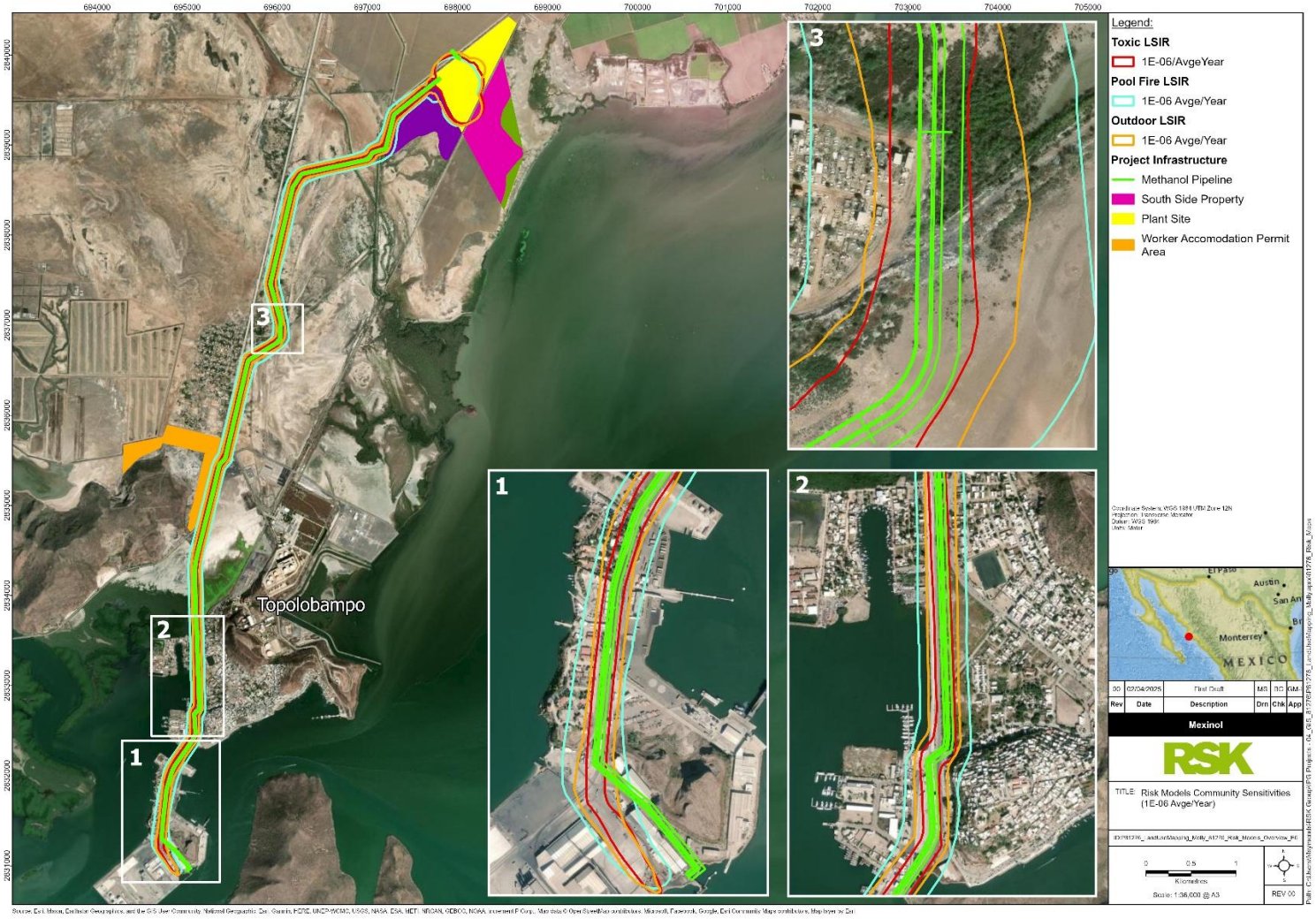

Figure 8.17: QRA Community Sensitivities (1E-06 Avge/Year)

8.5.2.2 Societal risk (FN curves)

The societal risk was calculated in Safeti and an F-N curve was produced, as presented in Figure 8.18. The FN curve presented below predicts a single fatality to offsite populations at a frequency of approximately $2.0E^{-04}$ per year. The peak number of fatalities of ~150 people occur at a frequency of approximately $1E^{-06}$ per year, this represents negligible risk to a relatively small number of the total population assessed. The HSE risk acceptance criteria are presented on the FN curve. The risk to offsite populations lies in the middle of the "ALARP" region, i.e. within the area between the two criterion lines and is tolerable.

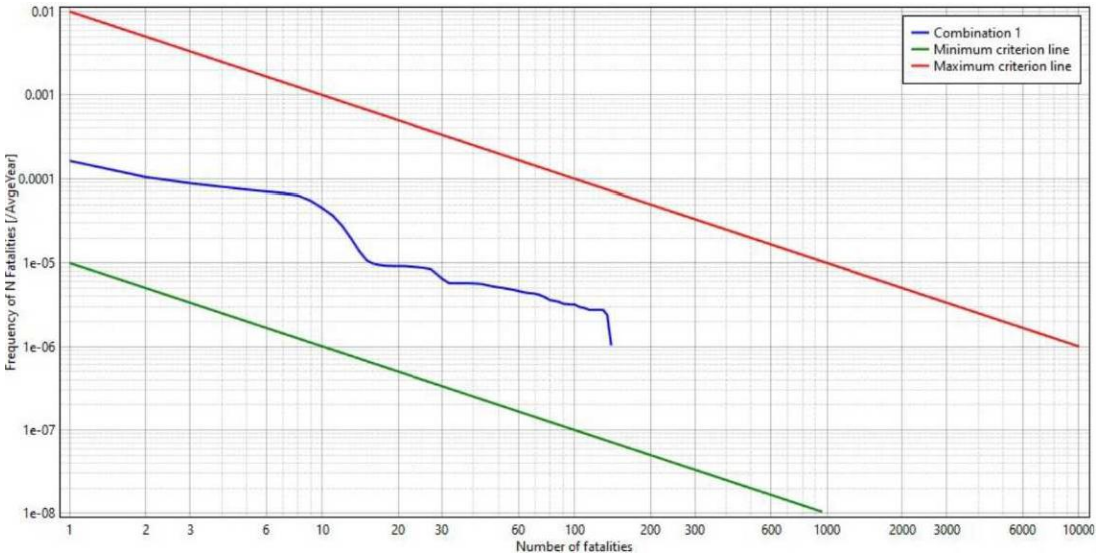

Figure 8.18: Societal risk curve

8.5.3 Recommended Mitigations Specific to the QRA

As discussed above, there are no residential or public buildings inside any of the scenarios 10^{-4} risk contours;

- Public safety education and joint emergency response drills if residential properties or public buildings are between 10^{-4} year and 10^{-6} years risk contours, plus special community engagement; and
- Special community engagement if residential properties or public buildings are between 10^{-6} and $3x10^{-7}$ risk contours.

Figure 8.17 above shows the community sensitivities within the 10^{-6} contour. These include many residential properties, commercial buildings, restaurants, gas stations, yachts, recreational and commercial fishing piers in Topolobampo, and many buildings, houses, facilities, piers, ports, restaurants and a hospital in the Port Authority (see call-out boxes 1 and 2). There is also a cemetery near the Rosendo G Castro community (see call-out box 3) that lies within the 10^{-6} contour. RSK recommends that Transition Industries conducts public safety education, joint emergency drills and special community engagement for these communities, as appropriate and in line with the US NFPA Code mentioned above.

8.5.4 Summary and Conclusion

This QRA has been carried out to determine the potential impact of toxic, flammable dispersion, fire and explosion scenarios following a LOC event on the site. The key focus of the assessment being offsite risks to nearby populations i.e. people outside of the site fence line.

The results of the QRA show that methanol plant is surrounded by a broader 10^{-6} per year (1 in 1,000,000 years) risk contour, it is important to note that there are no offsite populated areas close to the methanol plant. Along the pipeline route the total LSIR is less than 10^{-5} per year (1 in 100,000 years) and at this frequency there is no off-site risk to any residential or commercial (non-Project) area.

The results of the QRA confirm that there are no significant off-site impacts from the risk scenarios identified. All the potential impacts from the risk events are confined to within the operational boundary of the plant and associated infrastructure.

However, the QRA results for the pipeline may trigger the IFC's requirements for “public safety education and joint emergency response drills" prior to operations for the few structures in Topolobampo and/or the Port that sit between the 1xE-^{4} and 1xE^{-6} contours for the pool fire scenario (Figure 8.16).

The QRA results for the pipeline may also trigger IFC’s requirement for “special community engagement if residential or public buildings are between 1xE^{-6} and 3xE^{-7} contours" prior to operations for various structures in Rosendo G. Castro and Topolobampo. It should be noted that establishing the outer boundary of the area that requires special community engagement will be identified by extrapolating between the 1xE^{-7} and 1xE^{-8} as shown on Figures 8.12 to 8.17 (with Figure 8.17 establishing the outer boundary for all scenarios).

As such, an associated mitigation for special community engagement has been carried in the commitments register and in Table 8.100.

9 CLIMATE CHANGE RISK AND GREENHOUSE GAS ASSESSMENTS

9.1 2024 Update to Physical Climate Change Risk Assessment

As stated in EP4, a Climate Change Risk Assessment (CCRA) is required for "Category A and, as appropriate, Category B projects. For these projects, the CCRA is to include consideration of relevant climate-related 'physical risks' as defined by the Task Force on Climate-Related Financial Disclosure (TCFD)".

A Project physical CCRA was drafted by SLR in 2021 as part of the SLIP. The 2021 CCRA followed the 2020 EP4 guidance note on CCRA. Since publication of the SLR (2021) CCRA an updated EP4 Guidance Note on Climate Change Risk Assessment (Ramboll, May 2023) has been released. The new guidance differs from the old guidance in two key ways: (1) there is a requirement for all projects to demonstrate their alignment with national climate commitments (NCCs) for climate adaptation; (2) projects must take a double materiality approach and consider not only financial materiality, but also impact materiality (i.e. the combined impact of climate change and the Project on environment and society) Consequently, this CCRA provides updates to the Project's original CCRA in accordance with the latest EP4 guidance.

The Project GHG assessment (Section 9.2) shows that scope 1 and 2 emissions are not expected to be more than 100,000 tCO_2e annually. Therefore, no transition risk assessment is required under EP4.

9.1.1 CCRA update approach

This CCRA includes the following steps:

- Alignment with Mexico's adaptation NCCs (Section 9.1.2)
- Overview of climate change in the Project area as presented in the 2021 CCRA This section also includes updates to climate Projections for Sinaloa. Projection data is taken from the sixth phase of the Coupled Model Inter-comparison projects (CMIP6), overseen by the World Climate Research Program. This data is updated annually. (Section 9.1.3)
- Overview of climate risks, financial materiality and mitigation measures as identified in the 2021 CCRA (Section 9.1.4)
- Impact materiality assessment (Section 9.1.4)
- Identification of additional potential management measures (adaptations) that the Project could use to support a Project Adaptation Management Plan or embed in the ESMP.

9.1.2 Alignment with Mexico's NCCs

This section provides an initial consideration of the Project's compatibility with adaptation and resilience requirements defined in Mexico's Nationally Determined Contributions (NDC) (2022) submission to the UNFCCC. The NDC submission contains commitments to adaptation and climate resilience. If a Project includes investment contradictory to the

declared adaptation strategy, it is determined to be “Not Aligned”. In all other cases it requires further evaluation to determine alignment. Table 9.1 details each adaption priority area defined in the NDC. A brief assessment of the extent to which the Project is aligned with each adaptation area is also provided.

Table 9.1: Compatibility with national climate commitments for adaptation

Adaptation priority area	Description	Project alignment with adaptation
A. Society	Implement actions in 50% of vulnerable municipalities according to the National Atlas of Vulnerability to Climate Change and the Special Climate Change Program 2020-2024	No risks or opportunities identified
	Strengthen resilience in human settlements	No risks or opportunities identified
	Strengthen early warning systems	No risks or opportunities identified
	Incorporate adaptation at the government level	No risks or opportunities identified
	Strengthen financial instruments for disaster risk management	No risks or opportunities identified
	Reduce climate related health impacts	No risks or opportunities identified
	Identify and manage climate related migration	No risks or opportunities identified
B. Agriculture and food security	Promote sustainable production and consumption practices	Potential for Project to contribute to food insecurity where food goods increase in price as a result of Project related procurement and where food prices rise as a result of other socio-environmental factors (e.g. weather and climate related shocks and stresses)
	Incorporate climate planning into productive sectors	No risks or opportunities identified
	Prevent climate related pests and diseases	No risks or opportunities identified
	Strengthen environmental policy instruments relevant to agriculture and food security.	No risks or opportunities identified
	Promote financing mechanisms	No risks or opportunities identified
C. Biodiversity and ecosystem services	Achieve zero net deforestation by 2030	The Project itself will not have a significant impact on deforestation. However, to align with national environmental policy, the Project will result in approximately 6 ha of reforestation (i.e., scrubbing) and cactus planting, plus 6 ha of mangrove restoration. (see Section 2.1.3.3)
	Strengthen environmental policy instruments to conserve and restore ecosystems	Presence of operational workforce on site may lead to induced access and Project-related in-migration and adverse impacts to priority flora. Impacts may be exacerbated by climate change (see Section 8.2)

Adaptation priority area	Description	Project alignment with adaptation
	Strengthen instruments for the conservation of biodiversity in marine, coastal and freshwater ecosystems, and increase carbon reservoirs, emphasizing blue carbon	No risks or opportunities identified
	Prevent invasive species, diseases and pests,	No risks or opportunities identified
	Combating desertification and soil conservation	No risks or opportunities identified
	Policy instruments to increase island resilience	No risks or opportunities identified
	Promote resilience to climate change for seas	No risks or opportunities identified
D. Water resources	Sustainable use of water resources	The Project will make use of alternative water supplies so as not to affect the total demand for water resources from the regional supply. The plant will use treated wastewater from JAPAMA, the municipal wastewater treatment company of Los Mochis.
	Promote hydrological environmental services with special attention to nature-based solutions	
	Increase the treatment of industrial and urban wastewater	
	Guarantee access to water for human populations	
E. Buildings, infrastructure and cultural heritage	Ensure resilience of strategic infrastructure	Potential for Project to serve as example of resilience of strategic infrastructure where organisational and structural risk mitigation measures are followed as identified in Section 9.1.4.1
	Incorporate criteria for adaptation to climate change and comprehensive disaster risk management in strategic infrastructure investment projects	
	Generate and strengthen public financing instruments, and promote private investment, for infrastructure and cultural heritage	No risks or opportunities identified

Adaptation priority area	Description	Project alignment with adaptation
	Protect, restore and conserve tangible cultural heritage against the impacts of climate change	No direct impacts to tangible cultural heritage are anticipated because of the Project and no structures or properties with known historical or archaeological significance are located within the Project footprint.

9.1.3 Overview of climate change in the Project area

9.1.3.1 Climate scenarios and timelines

Climate Projection data for Sinaloa was taken from World Bank's Climate Change Knowledge Portal (CCKP). The Portal provides an online platform to access comprehensive data related to climate change. The CCKP uses data from the Coupled Intercomparison Project Phase 6 (CMIP6). This is the same dataset used by the Intergovernmental Panel on Climate Change (IPCC) for its Sixth Assessment Report (AR6). The AR6 report is based on five illustrative scenarios that cover the range of possible future development of anthropogenic drivers of climate change found in peer reviewed literature. These are described in Table 9.2.

Table 9.2: IPCC'S SSP-RCP Scenarios (Source: IPCC,2021)

SSP-RCP[170]	Description of scenario	Estimated warming *Very likely range (°C)*		
		Short term (2021-2040)	Mid-term (2041-2060)	Long-term (2061-2100)
SSP1-1.9	Most optimistic: emissions reach net zero by 2050.	1.2 to 1.7	1.2 to 2.0	1.0 to 1.8
SSP1-2.6	Next best/low emissions: emissions reach net-zero after 2050.	1.2 to 1.8	1.3 to 2.2	1.3 to 2.4
SSP2-4.5	Middle of the road: emissions only reach net-zero by 2100.	1.2 to 1.8	1.6 to 2.5	2.1 to 3.5
SSP3-7.0	Medium/ high emissions: emissions roughly double from current levels by 2100.	1.2 to 1.8	1.7 to 2.6	2.8 to 4.6
SSP5-8.5	High emissions: Current CO_2 emissions levels roughly double by 2050.	1.3 to 1.9	1.9 to 3.0	3.3 to 5.7

This CCRA builds on the original SLR (2021) CCRA and uses the same two climate scenarios: SSP2-4.5 and SSP5-8.5. The SSP2-4.5 represents an intermediate future and the SSP5-8.5 represents a high-risk future. The Mexinol Project is expected to begin operations in 2028 and continue operations for at least 30 years (until 2058) before decommissioning. Consequently, Projections are considered across two time periods which are equivalent to the IPCC's near-, and medium-term. These are: 2020-2039, and 2040-2059, The uncertainties associated with each Projection are also presented in the form of percentiles (10^{th}, 50^{th}, and 90^{th} percentiles). Climate data in this CCRA has been updated to reflect annual updates in the CCKP.

[170] Representative Concentration Pathway

9.1.3.2 Climate hazards

The EU Taxonomy (as referenced in the EP4 CCRA guidance) suggests a standard set of variables that provide a broad indication of the climate hazards to be included in a physical risk assessment screening. Not all climate conditions will be relevant to all projects as climate change will manifest differently at geographical locations. Climate variables are divided into chronic (those that that manifest over a long period of time) and acute (those that are short lived). Hazards are further divided into temperature- related, wind-related, water-related and solid mass-related.

Table 9.3 presents the acute and chronic climate-related hazards, as described by the EU Taxonomy, that have been deemed relevant to the Project. Those highlighted in green were identified during the 2021 CCRA. Those highlighted in red were identified as part of this update.

Table 9.3: Potential Project climate hazards as defined the EU Taxonomy

	Temperature-related	Wind-related	Water-related	Solid mass-related
Chronic	Changing temperature (air, freshwater, marine water)	Changing wind patterns	Changing precipitation patterns and types (rain, hail, snow/ice)	Coastal erosion
	Heat stress		Precipitation or hydrological variability	Soil degradation
	Temperature variability		Ocean acidification	Soil erosion
	Permafrost thawing		Saline intrusion	Solifluction
			Sea-level rise	
			Water stress	
Acute	Heat wave	Cyclone, hurricane, typhoon	Drought	Avalanche
	Cold wave/frost	Storm	Heavy precipitation (rain, hail, snow/ice)	Subsidence

	Temperature-related	Wind-related	Water-related	Solid mass-related
	Wildfire	Tornado	Flood (coastal, fluvial, pluvial, ground water)	
			Glacial lake outburst	

9.1.3.2.1 Temperature related

Mean temperature in Sinaloa is expected to increase under all emissions scenarios. In the near team, under SSP2-4.5, this could be between 0.56 °C (10th percentile) and 1.12°C (90th percentile). In the medium term, under a high emissions scenario, this could be between 1.4°C (10th percentile) and 2.39°C (90th percentile). The number of days with temperatures exceeding 35°C or 40°C is also expected to increase through time and under different climate scenarios. In the near-term, under SSP2-4.5, there may be 19.69 extra very hot days (>35 °C) compared to the 2014 baseline (50th percentile). In the medium-term, under SSP5-8.5, there may be 48.11 extra very hot days compared to the same baseline (50th percentile). Table 9.4 provides more details of these changes.

It is generally accepted that climate change is likely to play a greater role in determining wildfire regimes alongside human activity (medium confidence) (IPCC, AR6, 2022). It is likely that the frequency of fire weather (i.e. high temperature and greater variance in rainfall) will increase. Where there are a greater number of days with weather that could support fire spread it is likely the fire season will increase in duration and severity (Engelbrecht et al., 2015). Sinaloa is already in an area of high risk for wildfire hazard (Global Facility for Disaster Reduction and Recovery (GFDRR), 2024). This means that each year, at the state level, there is more than a 50% chance of weather that could support a significant wildfire. However, the specific distribution of wildfire is difficult to predict because anthropogenic factors are a key driver of fire risk.

9.1.3.2.2 Water-related

Precipitation

Precipitation trends are highly variable and are affected by seasonal El Niño patterns and/or the presence and severity of hurricanes and tropical cyclones.

Under both the intermediate and high-risk climate scenarios precipitation is expected to decrease within Sinaloa (see Table 9.5).

For the near term (2020-2039), under an intermediate scenario (SSP2-4.5, 50th percentile) precipitation in Sinaloa is expected to decrease by up to 3.5 mm/yr. For the medium term (2040-2059), under a high emissions scenario (SSP5-8.5, 50th percentile) precipitation is expected to decrease by up to 15.92 mm/yr. However, there is significant uncertainty in these trends.

Maximum 1-day and 5-day precipitation show an increasing trend, however, again, there is high uncertainty. For example, under a high emissions scenario in the medium term, a slight increase of 0.52 mm rainfall is expected at the 50th percentile. However, the expected maximum precipitation in one day anomaly ranges from -72.4 mm (10th percentile) to 72.90 (90th percentile).

There is an indication that the maximum number of consecutive dry days may increase (50th percentile), and that the maximum number of consecutive days wet days may decrease over time (50th percentile). Despite the uncertainty present in the precipitation Projections, there is generally good agreement in the CMIP6 model outputs. The mean trends indicate a relative drying of the Northern Central America coastline. If heavy precipitation occurs, it is unlikely to change the mean number of consecutive wet and dry days, suggesting that precipitation may be intense but short-lived when it occurs.

Sea-level rise

No projections for sea level rise (SLR) at the local level were available. It is expected that sea-level rise will increase the return period of extreme water level events, so that low occurring events (e.g., 1 in 100 year) will become far more likely with just a small rise in local sea level. As detailed in the 2021 CCRA, coastal flood modelling is beyond the scope of a CCRA and will require specialist modelling capabilities combined with local sea-level rise projections.

The geographically closest SLR report found during the 2021 CCRA was from Mazatlán, Sinaloa, around 430 km away from the Project site. SLR Projections for Mazatlán show the site is Projected to be submerged by 0.63 m (SSP2-4.5) and 0.82 m (SSP5-8.5) by 2100, relative to a 1995-2014 baseline (NASA, 2022). Based on this information, the 2021 CCRA concludes that SLR in the Project area does not pose an immediate risk to the Project.

9.1.3.2.3 Wind related

The hazard level for hurricanes in Ahome is high, which means that there is more than a 20% chance of potentially damaging wind speeds in the Project area in the next 10 years (GFDRR, 2025). The 2021 SLIP further details hurricane risk for the region, although an assessment of risk in relation to climate change is not made. There is significant uncertainly and a lack of consensus on how climate change will affect the tropical cyclone frequency, although most climate models show a decreased frequency in future Projections. The literature on tropical cyclones suggests a that an increase of intensification rates (where a cyclone dramatically strengthens in a short period of time) in the Atlantic are aligned with climate change. It is possible that hurricanes may become less frequent but more intense in the future but there is an absence of evidence to show how this may materialise over the lifespan of the Project.

Table 9.4: Expected changes to temperature for Sinaloa across two emissions scenarios and two time periods

Temperature variables		2020-2039						2040-2059					
		SSP2-4.5			SSP5-8.5			SSP2-4.5			SSP5-8.5		
		10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th
Mean Temp.	Change in near surface air temperature (degrees Celsius) relative to 1995-2014	0.56	0.85	1.12	0.62	0.97	1.28	1.11	1.48	1.90	1.40	1.89	2.39
Max. Temp.	Change in the mean of maximum daily temperatures (degrees Celsius) relative to 1995-2014	0.59	0.87	1.28	0.62	1.00	1.31	1.20	1.50	1.95	1.50	1.94	2.45
Very Hot Days (>35)	Number of additional days of maximum temperatures above 35 degrees Celsius relative to 1995-2014	11.86	19.69	28.57	12.97	22.44	31.67	26.14	35.42	47.06	34.27	48.11	63.15
Extreme Hot Days (>40)	Number of additional days of maximum temperatures above 40 degrees Celsius relative to 1995-2014	0.87	2.03	3.70	1.05	2.33	4.24	2.29	4.48	6.80	3.63	7.25	11.40

Table 9.5: Expected changes to precipitation for Sinaloa across two emissions scenarios and two time periods

Precipitation Variables		2020-2039						2040-2059					
		SSP2-4.5			SSP5-8.5			SSP2-4.5			SSP5-8.5		
		10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th
Precip.	Change (%) in annual precipitation relative to 1995-2014	-15.75	-3.50	9.85	-14.04	-3.62	10.34	-17.40	-6.51	9.39	-18.94	-5.92	6.09
Max. Precip 1 day	Change (mm) in maximum precipitation in 1 day relative to 1995-2014	-65.11	0.20	67.45	-90.46	-4.98	47.02	-73.26	1.98	69.25	-72.49	0.52	72.90
Max. Precip. 5 days	Change (mm) in maximum precipitation in 5 days relative to 1995-2014	-89.11	1.09	96.94	-109.32	-2.59	82.33	-86.93	14.41	105.83	-86.93	14.41	105.83
Consec. Wet Days	Maximum number of additional consecutive wet days relative to 1995-2014	-8	-1	5	-7	0	6	-8	-1	5	-10	-3	4
Consec. Dry Days	Maximum number of additional consecutive dry days relative to 1995-2014	-8	2	11	-8	3	13	-7	6	17	-6	6	16

9.1.4 Risks, materiality and mitigation measures

The EP4 (2023) guidance states that the Project should take a double materiality approach by identifying the risks that climate change may have on the financial performance of the Project (i.e. financial materiality) and the potential for the Project to exacerbate direct climate change impacts within the direct AoI (i.e. impact materiality).

9.1.4.1 Impact materiality

Using the impacts identified in Chapter 8 of this ESIA, impact materiality has been determined across relevant categories as detailed in Table 9.6). Impact materiality is determined by detailing the existing risk (as described in section 8.5 of the ESIA) and outlining how climate may exacerbate this impact. Only impacts from the ESIA that occur during operations and that have been categorised as moderate or major before mitigation have been included. This is presented in Table 9.7.

Table 9.6: Rationale for inclusion in impact materiality assessment

Categories	Inclusion in impact materiality assessment
Air Quality	Not included – no significant operational phase impacts on local air quality are anticipated. The impact of the on local air quality is considered to be negligible
Noise	Not-included – no interaction between noise and climate change in Project area
Soils	Not included – no sources of impacts to soil during the planned operations phase have been identified.
Biodiversity	Included – moderate impacts have been identified and there is a potential for interaction between climate change and Project impacts
Water	Not included – no potential impacts to groundwater have been identified during the normal operation of the Project
Social	Included – moderate impacts have been identified and there is a potential for interaction between climate change and Project impacts

Table 9.7: Project and climate change contribution to impact materiality for environmental, biodiversity and social impacts

VEC	Risk	Pre-mitigation risk rating	Description of climate impact on risk	Mitigation measure
Biodiversity	Operational workforce/in-migration may create adverse impacts for priority flora	Moderate	Presence of operational workforce on site may lead to induced access and adverse impacts to priority flora through could be impacted by increased trampling of vegetation and collection/harvesting of plants by construction workers (see Section 8.2). Climate variables, such as precipitation and temperature, influence the presence, absence, distribution, reproductive success, and survival all species. Where climate changes create conditions that are favourable to non-native species, invasives may become established at the expense of native species. Effectiveness of control strategies may also be affected by climate change.	Mitigation measures already identified in the ESIA include: • All plant staff restricted from free access to the Bay of Ohuira edge • Staff litter bins to be protected from wind and routinely cleared to prevent wind blow litter and pollution of the adjacent areas • Conservation area in the southern portion of the site to be monitored and protected from human encroachment and development For full details see Section 8.2. Post-mitigation, the risk is reduced to minor No further measures are required in the context of climate change
Social	Procurement of goods and services leading to increased cost of living, inflationary pressure from Project procurement	Moderate	The increased procurement of goods and services by the Project may lead to inflation. This impact may extend beyond construction related industries and include food and supplies, leading to inflationary pressure on local households and businesses. Vulnerable groups (mainly deprived households) are the most sensitive to inflationary pressures on essential goods.	Mitigation measures already identified in the ESIA include development of a Social Management Plan which will include: • Monitoring of socio-economic changes in the Social AoI, • Price survey/market monitoring of businesses within the AoI • Local Content Plan will include measures to support mitigation of inflationary pressures.

VEC	Risk	Pre-mitigation risk rating	Description of climate impact on risk	Mitigation measure
			Climate change is a significant threat to agriculture across the country. Dry spells and extreme weather events (e.g. floods, heavy rainfall) can lead to damaged crops and failed harvests. Rainfed crops are dependent on predicable rainfall - yields of maize are often reduced following poor rainfall. Where a growing season results in lower yields and reduced market availability of goods, increases in food prices can be expected.	Post-mitigation, the risk is reduced to minor In addition to the existing measures, client could: incorporate climate risk into monitoring of changes in the AoI.

9.1.4.2 Financial materiality

This section presents a high-level financial materiality assessment for the Project. The section also contains an updated list of risk mitigation measures as documented. These measures should form part of the Project's ESMMP.

SLR (2021) identified the following climate related hazards as "material" to Project site:

- Increase in frequency and severity of extreme events (including flood and sea level rise)
- Increase in maximum temperatures and increases in the number of hot days (i.e., heatwaves)
- Changes in annual precipitation leading to drier days.

These climate hazards were subsequently analysed by SLR based on their potential impact on core Project components, i.e., facilities operated and maintained by the Project, and activities directly associated with their operation and maintenance. The following potential Project risks were identified:

- R1: Water shortages
- R2: Risk of site flooding
- R3: Higher energy cost for cooling and air conditioning
- R4: Reduction in productivity and risk of injury to Project workforce
- R5: Wildfire

Details of the financial materiality of each risk are given in Table 9.8.

The magnitude, probability, and duration of the potential risk was used to determine risk significance. The criteria for assessing each company of risk are detailed in Table 9.9. Risk significance was assessed according to the 'pre-mitigation' state and the 'post-mitigation' state, following the implementation of the recommended mitigation measures.

Prior to any mitigation being implemented, risks R1, R2, R3, R4, and R5, were deemed major by SLR (2021). SLR presented a suite of risk mitigation measures for each potential Project risk, with the aim of lowering the risk significance. The analysis of the risks is summarised in Table 9.10

Table 9.8: Financial materiality of Project risks

Risk	Financial materiality
R1: Water shortages	Where local competition for water resources increases and the Project is seen to use large amounts of water, reputational risk may occur. In addition, local water shortages may compromise operations. Material impacts include: • Reduced client and employee loyalty • Loss of social license to operate • Divestment • Halt to operations during water shortages
R2: Flooding around the port	Coastal flooding at the port area may damage assets and create delays to operations: Material impacts include: • Potential for need to halt operations and evacuate the site during flooding • Potential for protracted delays to production following flooding if damage is significant and workers cannot access the site • Delays in received essential supplies • Increased down time following disruptions to utilities (energy, communications, water and waste treatment), and disrupted transportation links
R3: Increased temperatures leading to demand for air conditioning and cooling	Cooling represents around 10% of global electricity demand. During summer in hotter countries electricity demand can rise by more than 50% and the national grid must respond to increased electricity demand by increasing capacity. Material impacts include: • Increased energy consumption and associated costs • Production delays and decreased output where adequate cooling is not achieved • Increased down time following disruptions to off-site utilities (energy, communications, water and waste treatment) where grid cannot meet energy demand
R4: Reduction in productivity and	Raising temperatures, coupled with heat waves, are expected to result in heat-related illness (HRI) and a loss of working hours. HRI includes work-related injuries such as heat stroke Hot temperatures, along with heat energy from construction equipment, and the use of PPE such as long-sleeved cotton jumpsuits, rubber or leather boots, hard hats and safety

Risk	Financial materiality
risk of injury of Project workforce	glasses increases the susceptibility of construction workers to HRI. Temperature extremes affect health by compromising the body's ability to regulate temperature. This can lead to heat cramps, heat exhaustion, heatstroke, and hyperthermia. It may also worsen chronic conditions such as cardiovascular disease, respiratory disease, cerebrovascular disease, and diabetes-related conditions (WHO, 2018). For the industry sector in Mexico, extreme heat resulted in an estimated 0.71% reduction in total working hours in 1995. By 2030, the share of total working hours lost in the sector is Projected to rise to 1.27% • Costs associated with delay to construction during down time • Reduced productivity leading to increased costs from efficiency reduction • Litigation costs associated with long-term worker health impacts
R5: Wildfire affects assets and creates health and access risks	Acute events such as wildfire affect the ability of employees to commute and access the Project site resulting in a potential delay to operations. Fires adjacent to the asset can cause extensive damage to equipment and buildings. Material impacts include: • Costs associated with delay to construction during down time • Reduced productivity leading to increased costs from efficiency reduction • Litigation costs associated with long-term worker health impacts • Costs associated with remedial action (repairs and replacement of assets) • More frequent/intense asset maintenance programmes with associated capital cost • Changes to depreciation rates and premature asset write-off • Additional unplanned capital investment, including increased expenditure to replace damaged assets. • Increased insurance premiums and potential for reduced availability of insurance on assets in "high-risk" locations • Write-offs and early retirement of asset

Table 9.9: Risk significance scoring method for financial materiality (SLR, 2021)

Magnitude	
Rating	Definition
Very High (5)	Very high severity of consequences, whereby Project activities may cease functioning. Project components have high sensitivity and are not able to respond to or adapt to climate hazards. Characteristics include: • Need to cease operations completely. • Loss of life. • Financial losses that could result in bankruptcy, i.e., liabilities that exceed ability to pay them. • Litigation against company Directors that could result in prison sentences. • Irreversible environmental damage.
High (4)	High severity of consequences, whereby Project activities may cease functioning. Project components have high sensitivity and are not able to respond to or adapt to climate hazards. Characteristics include: • Financial losses or liabilities that could have a significant impact on the business, e.g., resulting in needing to downscale, liabilities that require the company to significantly change its plans. • Litigation against company or Directors that could result in significant fines. • Major environmental damage. • Negative publicity and damage to reputation which may result in the loss of very significant portion of customer base
Moderate (3)	Moderate severity of consequences, whereby Project activities may cease functioning in part. Project components have moderate sensitivity and limited ability to respond to or adapt to climate hazards. Characteristics include: • Financial losses or liabilities that could result in a material impact on the business, e.g., major impact on profitability. • Minor environmental damage. • Negative publicity and damage to reputation which results in the loss of some of customer base
Low (2)	Low severity of consequences, whereby there is minimal impact on Project components. Project components have low sensitivity and are readily able to respond to or adapt to climate hazards. Characteristics include: • Small losses or liabilities that do not have a material impact on the business. • No environmental damage. • Short lived or minor reputational damage and no customers lost as a result.
Negligible (1)	No consequences and therefore no impacts on Project components. Project components are able to fully respond and adapt to climate hazards. Characteristics include: • Negligible financial loses or liabilities. • No environmental damage.

Magnitude	
Rating	Definition
	• No negative publicly
Probability	
Rating	Definition
Highly likely (5)	The risk is highly likely to occur (approximate percentage likelihood of >85%).
Likely (4)	The risk is likely to occur (approximate percentage likelihood of 65%-85%)
Possible (3)	It is possible that the risk will occur (approximate percentage likelihood of 35%- 65%)
Unlikely (2)	The risk is unlikely to occur (approximate percentage likelihood of 15%-35%).
Rare (1)	The risk is expected to occur rarely (approximate percentage likelihood of 0%- 15%)
Duration	
Rating	Definition
Very long term (5)	The risk will have permanent or long-lasting effects on Project components (approximate duration >30 days
Long term (4)	The risk will have medium-term effects on Project components (approximate duration 10-30 days).
Medium term (3)	The risk will have short-term effects on Project components (approximate duration 3-10 days).

Magnitude	
Rating	Definition
Short term (2)	The risk will have short-term effects on Project components (approximate duration 1-3 days).
Temporary (1)	The risk will have temporary or very short-term effects on Project components (<1 day)
Risk significance	
Rating	Definition
Significant (13-15)	The risk poses a significant threat to Project components.
Major (10-12)	The risk poses a major threat to Project components
Moderate (7-9)	The risk poses a moderate threat to Project components.
Minor (5-6)	The risk poses a minor threat to Project components
Insignificant (3-4)	The risk poses an insignificant threat to Project components.

Table 9.10: Risk mitigation measures with risk significance pre and post mitigation for financial materiality (adapted from SLR, 2021)

Risk	Pre-mitigation				Mitigation Measures	Post-mitigation			
	Magnitude	Probability	Duration	Risk		Magnitude	Probability	Duration	Risk
R1: Water shortages	Moderate	Possible	Medium-term	Moderate	[CCRA 1] Engage with local authorities to monitor water supply. For water supply, Mexinol will rely on Los Mochis municipal wastewater and not compete with regional agriculture, industry and communities for access to fresh water.	Low	Possible	Short-term	Minor
R2: Flooding at the site	Low	Likely	Medium-term	Major	[CCRA 2] Use weather and climate services (e.g. weather forecasts) to anticipate potential extreme events and plan accordingly. [CCRA 3] Development and implementation of response procedures	Low	Possible	Short term	Moderate

Risk	Pre-mitigation				Mitigation Measures	Post-mitigation			
	Magnitude	Probability	Duration	Risk		Magnitude	Probability	Duration	Risk
					and instructions in case of extreme weather events (including flood, heat and fire) should be incorporated into the emergency response and health and safety plans. [CCRA 4] Develop plans to ensure only key personnel are onsite in advance of flood, and non-critical personnel are off-site. [CCRA 5] Facility design solutions that adequately take into consideration Projected changes in precipitation/ flooding for determining the elevation of road surface, and flood control structures.				

Risk	Pre-mitigation				Mitigation Measures	Post-mitigation			
	Magnitude	Probability	Duration	Risk		Magnitude	Probability	Duration	Risk
					[CCRA 6] Business continuity plan should take into account extreme events (including flood, heat and fire). [CCRA 7] Explore the potential for additional investments to protect port assets if required.				
R3: Increased temperatures leading to greater demand for energy	Low	Highly likely	Medium-term	Minor	[CCRA 2] Use weather and climate services (e.g. weather forecasts) to anticipate potential extreme events and plan accordingly. [CCRA 6] Business continuity plan should take into account extreme events (including flood, heat and fire.	Negligible	Unlikely	Short-term	Insignificant

Risk	Pre-mitigation				Mitigation Measures	Post-mitigation			
	Magnitude	Probability	Duration	Risk		Magnitude	Probability	Duration	Risk
R4: Increased temperatures creates risk for workers	Low	Hugh likely	Medium-term	Major	[CCRA 8] Review health and safety plans, including development of heat-health action plans, and health and safety regulations such as: • Provision of cool potable water • Provision of shaded areas during rest periods • First Aid equipment to include treatment for dehydration e.g., electrolytes • Compulsory labour rest times on hot days • Appropriate dress codes • Changes to working hours • Information campaigns.	Negligible	Highly-likely	Temporary	Moderate
R6: Wildfire	High	Likely	Medium	Major	[CCRA 9] Development of fire management plan				Moderate

Risk	Pre-mitigation				Mitigation Measures	Post-mitigation			
	Magnitude	Probability	Duration	Risk		Magnitude	Probability	Duration	Risk
					with measures for preventing fire (e.g. fire will not be permitted as a means to clear vegetation, staff induction and toolbox talks shall explain prohibitions around fires). CCRA 10] Develop relationships with local fire and emergency response teams as part of the EPRP. [CCRA 2] Use weather and climate services (e.g. weather forecasts) to anticipate potential extreme events and plan accordingly. [CCRA 3] Development and implementation of response procedures				

Risk	Pre-mitigation				Mitigation Measures	Post-mitigation			
	Magnitude	Probability	Duration	Risk		Magnitude	Probability	Duration	Risk
					and instructions in case of extreme weather events (including flood, heat and fire) should be incorporated into the emergency response and health and safety plans.				

9.1.4.3 Risks to project infrastructure, workers and community safety

As noted throughout this section, there are several climate hazard scenarios that pose risks to infrastructure, workers safety and communities. In terms of potential infrastructure impacts, flooding at the site and port could cause the need for the Project to halt construction or operations. Depending upon the severity of the flooding, there could be significant damage to related project infrastructure. However, detailed design engineering considered climate hazards, including sea level rise exacerbating flood return periods, and the site was specifically chosen away from the Bay of Ohuira to avoid such flooding impacting on Project infrastructure. In terms of port flooding from a major storm event (hurricane, tropical cyclone or depression), the Project is using the existing Port of Topolobampo which was built to withstand the most likely of events. Should significant coastal flooding occur because of a climate related event, loading/unloading operations would be halted and infrastructure repaired. Section 8.5 took into consideration the most likely potential impact occurrence - localised flooding events from excessive rain/storms in/around the site. Such event could result in the accidental release of hazardous materials from storage areas, vehicles and machinery and hazardous waste areas should these areas be damaged or submerged by floodwaters resulting in contamination of soil, surface water or groundwater. This was assessed as a potential material risk.

In terms of workers safety, high maximum temperatures and increases in the number of hot days (i.e., heatwaves) is the most likely climate related event that could result in impacts to worker health. Raising temperatures, coupled with heat waves, can result in heat-related illness (HRI) and work-related injuries such as heat stroke and dehydration. Hot temperatures, along with heat energy from construction equipment, and the use of PPE such as long-sleeved cotton jumpsuits, rubber or leather boots, hard hats and safety glasses increases the susceptibility of construction workers to HRI. Temperature extremes affect health by compromising the body's ability to regulate temperature. The Project's Health and Safety plan takes into consideration local weather conditions and mandates work clothing and PPE and appropriate outdoor work schedules. Section 8.5 Assessment for Unplanned Events took into consideration workforce health and safety. The potential failure of the contractor(s) and sub-contractors working on the project facility to meet requisite OHS standards increases the risk of unsafe workplaces and conditions that could lead to workplace injuries and/or fatalities. This includes in the context of a climate related event. This was assessed as a potential material risk. Any extreme weather event like flooding, storms or wildfires could also pose a risk to workers by creating unsafe conditions. The Project's Emergency Response and Preparedness Plan takes these factors into consideration.

In terms of community risk because of climate hazards brought on through Project activities, water shortages and increased temperatures leading to greater demand for energy. Climate change is a significant threat to agriculture across the country. Dry spells and extreme weather events (e.g. floods, heavy rainfall) can lead to damaged crops and failed harvests. Rainfed crops are dependent on predicable rainfall - yields of maize are often reduced following poor rainfall. Where a growing season results in lower yields and reduced market availability of goods, increases in food prices can be expected. However, the Project's use of recycled and treated municipal wastewaters for all industrial water used for operations, means that water shortages which are already prevalent in Mexico, will not be exacerbated by the Project. As described in Section 3.6.2, drinking water will be provided by local sources. As described in Section 8.3.8, the Project has committed

to ensuring that such supplies of drinking water (and other necessary materials) required for the Project workforce do not impact availability or cost of resources for neighbouring communities. The residual impact significance was rated as Minor. Greater demand for energy by communities as a result of rising temperatures will not be further impacted by the Project as the PPAs and associated power contracts ensure that there is sufficient capacity within the national grid to absorb Project demand.

9.1.4.4 Summary

By the end of the life of the Project, climate hazards are unlikely to have manifested in a way that presents a high-risk to operations. Nevertheless, special attention should be paid to the evolving science especially on climate Projections. It will be important for Transition Industries to continue to assess climate risk throughout the lifetime of the Project. It is recommended that Transition Industries assign climate change monitoring to a member of personnel. Responsibilities may include monitoring changes to policy especially around national climate commitments, updates to national and state level climate Projections, and publication of specialist studies using climate data e.g. flood risk assessments. It should be noted that as a signatory to the UNFCCC, Mexico has committed to publish an updated set of NDCs every five years. The next round of NDC submission for all signatories is expected in 2025. Mexico may also pursue domestic adaptation measures before the NDC deadline. These should be monitored.

As with all companies operating in extreme environments, the physical impacts of climate change should be included on the corporate risk register. Companies should disclose the assessment results to existing and potential investors and to wider stakeholder groups.

9.2 Greenhouse Gas Assessment

9.2.1 Introduction

A high-level assessment of Greenhouse Gas (GHG) emissions related to the construction and operation of the Project has been undertaken, in part based upon previous studies undertaken by the applicant. Decommissioning has been scoped out of this assessment, due to both the uncertainty of decommissioning processes so far in the future, and the likely immaterial magnitude of emissions relative to construction and operation. The results of the GHG assessment have been used to evaluate the significance of emissions from the Project.

9.2.2 Methodology

9.2.2.1 Scope

IFC Performance Standard (PS) 1 Guidance Note states that the Clients' "risks and impacts identification process will consider the emissions of greenhouse gases, the relevant risks associated with a changing climate and the adaptation opportunities, and potential transboundary effects." IFC PS 3 requires projects to promote more sustainable use of resources and reduce Project-related GHG emissions. It requires projects that are expected to produce more than 25,000 tonnes of CO_2 equivalent (tCO_2e) each year to quantify scope 1 and 2 emissions annually, aligned with internationally recognised methodologies and good practise.

Alongside IFC requirements, the fourth iteration of the Equator Principles (EP4) requires quantification of Projected scope 1, 2 and, as appropriate, 3 GHG emissions aligned with the methodologies of the Greenhouse Gas Protocol to determine whether a transition climate change risk assessment is required. If scope 1 and 2 emissions are greater than 100,000 tCO_2e annually then a transition climate change risk assessment should be undertaken.

This GHG assessment focuses on scope 1 and 2 emissions from the Project, with reference to appropriate, material sources of scope 3 emissions.

9.2.2.2 Methodology

The assessment has quantified applicable Kyoto Protocol GHGs as measured in tonnes of carbon dioxide equivalence (tCO_2e), where equivalence means having the same warming effect as CO_2 over 100 years. The seven Kyoto Protocol gas groups are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and perfluorocarbons (PFCs). The global warming potential (GWP) of each is presented in Table 9.11.

Table 9.11: Kyoto Protocol GHGs and their global warming potential (GWP)

Greenhouse gas/group	Chemical formula	GWP (CO_2e)
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
Hydrofluorocarbons	HFCs	Depends on specific gas
Sulphur hexafluoride	SF_6	23,500
Perfluorocarbons	PFCs	Depends on specific gas
Nitrogen Trifluoride	NF_3	16,100

Emissions have then been quantified by applying the most relevant and up-to date emission factors to the activity data (described in more detail in Section 3).

An emission factor is a representative value that relates the quantity of a pollutant released into the atmosphere with an activity associated with the release of that pollutant. Emission factors are typically available from government publications, independent agencies, and scientific research journals; however, the quality and accuracy of such factors can vary significantly. Factors can differ depending on the research body and/or underlying methodologies applied. It is, therefore, good practice to apply emission factors only from reputable sources.

9.2.3 Assessment of significance

Using the reporting thresholds from several organisations, such as the EP4, and IFC PS, an assessment of emissions magnitude can be made as illustrated in Table 9.12.

Table 9.12: Magnitude level for Project GHG emissions

Magnitude level	Annual Project GHG emissions (tCO_2e)
Very large	> 1,000,000
Large	100,000 – 1,000,000
Moderate	25,000 – 100,000
Small	5,000 – 25,000
Negligible	< 5,000

Impact assessments normally assess to what degree the Project will affect the baseline environment of the study area. In the case of GHG emissions, any emissions will have a long-term, irreversible negative effect on the global climate, which is considered to be highly receptive to any emissions of GHGs. A specific source of GHG emissions cannot be linked to impacts at a specific location but will have impacts globally.

This GHG assessment will therefore evaluate the significance of emissions from the Project with relation to Mexico's national carbon budget. This is aligned with the methodology from the Institute of Environmental Management and Assessment's (IEMA) Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance.

This GHG assessment will therefore evaluate the significance of emissions from the Project with relation to the goals of the Paris Agreement (i.e. a science-based 1.5°C trajectory), as displayed in Table 9.13.

Table 9.13: IEMA's guidance to assessing GHG significance (2022) framework for assessment of significant effects

Significance	Level	Criteria
Significant	Major adverse	Project adopts a business-as-usual approach, not compatible with the national Net Zero trajectory, or aligned with the goals of the Paris Agreement (i.e. a science-based 1.5°C trajectory). GHG impacts are not mitigated or reduced in line with local or national policy for projects of this type.
	Moderate adverse	Project's GHG impacts are partially mitigated and may partially meet up-to-date policy; however, emissions are still not compatible with the national Net Zero trajectory or aligned with the goals of the Paris Agreement.
Not significant	Minor adverse	Project may have residual emissions, but the Project is compatible with the goals of the Paris Agreement, complying with up-to-date policy and good practice.
	Negligible	Project has minimal residual emissions and goes substantially beyond the goals of the Paris Agreement, complying with up-to-date policy and GIIP.
Significant	Beneficial	Project causes GHG emissions to be avoided or removed from the atmosphere, substantially exceeding the goals of the Paris Agreement with a positive climate impact.

Given the international urgency of climate change, the sensitivity of the receptor (i.e. global climate) to fluctuations in GHG emissions is considered 'Very High'. Thus, the level of the significance of effects is determined by the magnitude, and timing, of GHG emissions and the likelihood of avoiding severe climate change.

9.2.4 Impact assessment

9.2.4.1 Construction

Based upon industry research and RSK's experience with previous projects, the largest emissions source during the construction phase is likely to be the embodied emissions associated with the manufacture and processing of construction materials (product stage). Other construction-related emissions comprise the consumption of fuel on site for construction activities, water consumption and waste (construction stage). Concrete and steel data were provided from the client from the Bill of Quantities (BoQ) for the areas of Outside & Utilities (O&U), ASU, H2, and the Methanol Process Plant to estimate the product stage emissions. These are summarised in Table 9.14.

Table 9.14: Product stage emissions

Construction material	Unit	Quantity	Emissions (tCO_2e)
Concrete (piles, foundations, floor slabs, and buildings)	m^3	197,205	53,419
Metals (reinforcement bars, steel structures, equipment, pipes, cables, pipe racks and supports)	ton	124,724	284,001
Total concrete and steel emissions			337,420
Total product stage emissions (+15% uplift to account for other materials and design uncertainty)			**388,033**

It was not possible to attain any estimates of other construction emissions sources; however a high-level uplift exercise has been undertaken, and results summarised in Table 9.15. It has been assumed that the embodied emissions from the product stage comprise 90% of total construction emissions, and construction activities (transport to site and installation) comprise 10% of emissions. This is based upon industry research (including the RMI[171] and the LETI climate emergency design guide[172]) and RSK experience of previous construction projects. Whilst construction stage emissions will include some scope 3 emissions sources, including water consumption, waste and construction worker commuting, to adopt a conservative approach it has been assumed

[171] https://rmi.org/embodied-carbon-101/

[172] https://www.leti.uk/cedg

that all emissions in this category comprise scope 1 emissions (direct fuel consumption on site).

Table 9.15: Construction phase emissions

Emissions scope	Emissions source	Emissions (tCO_2e)	Source
Scope 1	Construction stage emissions (transport to site and installation)	46,828	Estimated as 10% of all construction emissions
Scope 3	Product stage emissions ('embodied carbon')	388,033	Table 9.14: Steel and concrete data from BoQ
Total		**431,147**	

9.2.4.2 Operation

The following information on the operation of the Project has been taken from MMSA 'Mexinol Methanol Project Carbon Intensity Analysis' (May 2024). The raw data and detailed methodology have not been available to review.

The Project will employ natural gas autothermal reforming technology (ATR). Renewable electricity (instead of fired heaters) will be used in the ATR. Renewable electricity will also be used to power electrolisers to supply additional hydrogen to the plant. This reduces scope 1 emissions to near zero by avoiding the need to burn natural gas or fuel gas for reformer fuel.

In Mexinol's process, the unconverted hydrocarbons from the methanol synthesis process, burned as fuel gas in a typical methanol process, are converted to CO_2 and hydrogen. This captured CO_2 and hydrogen, supplemented with renewable hydrogen from the electrolysers, is recycled to the syngas feed stream to the methanol synthesis section to produce additional methanol.

The scope 1 and 2 emissions from all methanol production are 0.0114 tCO_2e / tonne methanol. The MMSA report also estimated scope 3 emissions associated with the upstream and downstream processes associated with the methanol manufacture and use. Based upon the MMSA report, and assuming production of 6,130 metric tonnes per day (MTPD), annual scope 1, 2 and 3 emissions are displayed in Table 9.16.

Table 9.16: Annual operational scope 1, 2 and 3 emissions

Scope	Emissions source	Emissions factor (tCO_2e/ tonne methanol)	Emissions (tCO_2e)	Source
1 & 2	Process emissions, onsite combustion, purchased electricity	0.0114	24,109	MMSA 'Mexinol Methanol Project Carbon Intensity Analysis' (May 2024)
3	Delivered raw materials	0.100	211,485	
3	Product transport and end use	1.405	2,971,364	
Total			**3,206,959**	

Note: assumes daily methanol production of 6,130 MTPD and annual production of 2,114,850 tonnes (at 345 days operation per year, equivalent to 94% availability).

9.2.5 Assessment of magnitude and significance

9.2.5.1 Lifecycle emissions

Total construction emissions are taken from Table 9.15. The annual operational figures from Table 9.16 have been uplifted to account for the expected Project lifespan of 30 years.

Table 9.17: Lifecycle emissions for the Project across 30 years

Scope	Emissions source	Source of data	Emissions (tCO_2e) over 30 year life	Proportion of lifecycle emissions
Construction				
1	Fuel consumption for construction	High level extrapolation	43,115	0.04%
3	Embodied emissions from concrete and metals	Raw data on concrete and metals from BoQ	388,033	0.4%
Operation				
1&2	Operational scope 1 and 2 emissions	MMSA 'Mexinol Methanol Project Carbon Intensity Analysis' (May 2024)	723,279	0.7%
3	Delivered raw materials		6,344,550	6.6%
3	Product transport and end use		89,140,928	92.2%

Scope	Emissions source	Source of data	Emissions (tCO_2e) over 30 year life	Proportion of lifecycle emissions
Total scopes 1,2 and 3 emissions			**96,639,904**	**100%**
Total scopes 1 and 2 emissions			**766,393**	

9.2.5.2 Annual emissions

The construction phase is expected to begin by mid-2025 and will last approximately 36 months. Annual construction emissions provided in Table 9.18 were derived from the total construction emissions occurring over 3 years as detailed in Table 9.15. Annual operational emissions (Table 9.17) are also included in Table 9.18.

Table 9.18: Annual emissions during construction and operation phases

Phase	Scopes 1, 2 and 3 emissions (tCO_2e)	Scopes 1 and 2 emissions (tCO_2e)
Construction (3 years)	143,716	14,372
Operation (30 years)	3,206,959	24,109

Note: annual estimated construction emissions will occur for 3 years, annual estimated operational emissions will occur over 30-year timespan.

Annual operational scope 1 and 2 emissions total 24,109 tCO_2e per year. These can be categorised as small based upon the assessment metrics in Table 9.12. The annual emissions magnitude does not trigger the need for the quantification of scope 1 and 2 emissions annually, aligned with the requirements of IFC PS 3 (emissions greater than 25,000 tCO_2e annually), or the need for a transition climate risk assessment, aligned with the requirements of EP4 (emissions greater than 100,000 tCO_2e annually).

9.2.5.3 Significance

According to the MMSA report, the scope 1 and 2 emissions from all methanol production are less than 0.0114 tCO_2e / tonne methanol. This compares to 0.678 tCO_2e / tonne methanol for a conventional methanol plant. The Mexinol facility is expected to save 1.41 million tons of annual process CO_2 emissions compared to a conventional grey methanol plant with steam-methane and autothermal reforming technology.

Aligned with the IEMA framework of significance (Table 9.13), this can be considered as compatible with the goals of the Paris Agreement, complying with up-to-date policy and good practice, demonstrating a minor adverse, not significant, impact on climate.

10 ASSOCIATED FACILITY PRELIMINARY SCREENING

10.1 Introduction

This chapter presents a summary of the assessment results for key environmental and social (E&S) impacts associated with the Project's associated facility e.g. the transmission line, as identified through the ESIA process. In line with IFC PS 1, particularly paragraph 8, the evaluation considers the Project's area of influence, which includes facilities that are not funded as part of the Project but are essential to its viability and would not have been developed otherwise. This associated facility—while outside the Project's direct control—may still present E&S risks and impacts that could interact with or compound those of the core Project. RIC Energy will be the entity responsible for developing, building, operating and maintaining the transmission line. Given their commercial relationship, the Project had already obtained commitment from RIC Energy to design, construct and operate a 43 km long transmission line per requirements of national law and building standards, IFC's PSs, and WBG EHS Guidelines for Power Transmission requirements.

As discussed in Chapter 3, the development of a circa 43 km 400 kVA power transmission line to connect the Project with the national transmission grid is an infrastructure development considered to be an 'associated facility (AF)' to the Project. This facility would not have been constructed if the Project did not exist, and without which the Project would not be viable. This development is being implemented by a different promoter, RIC Energy, is subject to different funding arrangements and has its own development timeframe (see Chapter 3).

Given the shorter design, permitting and construction period for the transmission line and as compared to other components of the project (e.g., onsite and offsite Project components), the associated facility is on a separate timeline with the preparation of the regulatory and IFC-aligned E&S studies (e.g. ESIA, EvIS) commencing only once financial investment decision (FID) has been reached with the exception of the the birds migratory studies that will start in September/October 2025. Construction is tentatively planned to start in late 2026. Therefore, the PS-compliant ESIAs and associated disclosure for the transmission line will be handled in a separate phase, outside of the project ESIA timeline.

This preliminary E&S impact screening is provided to highlight the most salient potential impacts expected because of the transmission line design, construction and operation based on available desktop information provided to the ESIA team by RIC Energy.

10.2 Project Description

The Project will be connected to the Mexican national electricity grid through the construction of a new 400 kVA, 43 km power transmission. The development of this associated facility will include:

- a 500 MVA substation situated within the Mexinol Project's development land

- approximately 43 km of high-voltage 400 kVA overhead transmission line connected to the grid at the Choacahui Substation (a total land area of approximately 154.8 ha considering a 36 m RoW on either side depending upon the design of the towers).
- construction of towers built approximately every 400 m.

Figure 3.3 shows the location of the transmission line and substation.

All connection and reinforcement work will be carried out as required by the national energy control centre or El Centro Nacional de Control de Energía (CENACE). Any upgrades at Choacahui Substation are yet to be fully determined but typically include expanding the substation bay and replacing interrupters and electrical breakers. No expansion of the Choacahui Substation overall developed area is anticipated, only minor works. The entire scope of this development will be handled by RIC Energy and its contractors.

RIC Energy will be overall responsible for developing, building, operating and maintaining the transmission line. A final RoW alignment for the transmission line is currently under consideration and this will largely involve communities who have an existing RoW for another national transmission line within their lands.

According to Mexican regulations, the width of the RoW for transmission lines vary depending on the specifications of the line, the type of structure that supports the line and other variables of the power lines and, it is regulated by two documents the NOM-001-SEDE (in general) and specifically a document of the CFE that is called "CFE L1000-10 Specification".

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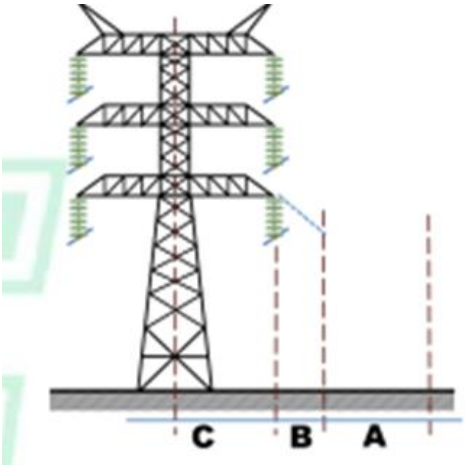

Figure 10.1: Mandatory minimum RoW distance of 36m for Mexico in accordance with the selected transmission line design and applicable regulations (including NOM-001-SEDE and CFE L1000-10 Specification)

Where:

A = Minimum horizontal safety separation.

B = Horizontal projection of the arrow plus chain of insulators.

C = Distance from the axis of the structure to the external conductor at rest.

A = Oscillating length of the insulator chain in meters.

f16 °C = flecha final 16 °C.

RoW width = 2 (A + (La + f16 °C) sin α + C).

The RoW width for the transmission line has been determined to be 36 meters based on these parameters. Regarding the height of the lines and permitted land use within the RoW, regulations permit all agricultural activities, roads, rivers, and other liner manmade and natural features can be located below the line provided a height of 20m between the conductor cables and any trees or structures is maintained.

The original design and route alternative analysis began in mid-April 2024), and this predevelopment phase is scheduled to be complete in December 2025. . Construction of the 400kV High Voltage Line is scheduled to take 546 days, and testing is planned for 60 days. The development is expected to be completed and operational in late-2027 so that power can be provided to the main facility well in advance of commissioning.

RIC Energy plans to begin securing rights-of-way for the high-voltage transmission line with Private and Ejido Landowners once the Mexinol project's Final Investment Decision (FID) has been determined. This milestone will allow RIC Energy to finalise land scouting, ensuring that the selected route is fully viable from an environmental, social, technical, and regulatory standpoint. The ESIA work will start also once FID has been achieved to the exception of the birds' baseline study that will be conducted September-October 2025 to document the migration period. Once feasibility is confirmed, RIC will then obtain land appraisals and initiate negotiations for obtaining the final rights-of-way for the high-voltage transmission line.

10.3 Transition Industries influence over associated facility

The power transmission line and associated substations will be owned, constructed and operated by RIC Energy, a financing partner of the Project. As the exclusive qualified user, Transition Industries, and its subsidiary Pacifico Mexinol (the Company), will have leverage over, and influence on, RIC Energy through contractual agreements. While the Company will not have direct control over RIC Energy, the qualified seller and qualified user agreement stipulates that RIC Energy must design, construct and operate the power transmission line and substations to international standards, specifically the IFC Performance Standards, World Bank Group (WBG) General EHS Guidelines and WBG EHS Guidelines for Electric Power Transmission and Distribution.

The Company will utilise available contractual leverage with RIC Energy to ensure E&S impacts, risks and sensitivities identified through the desktop assessment completed as part of this ESIA are shared with RIC Energy and acted upon. This will enable the identification and consideration of impact avoidance measures. Additionally, the Company (Transition Industries) will require RIC Energy to engage qualified experts to carry out a full ESIA for the associated facility, in line with IFC Performance Standards. This ESIA should include field studies and primary data collection and will serve to comprehensively assess potential impacts, propose effective mitigation measures, and ensure there are no significant adverse effects on sensitive environmental or social receptors, nor any non-compliance with applicable standards, including the IFC Performance Standards. The findings presented in this chapter will provide a foundation for that assessment.

Although RIC Energy has direct responsibility for managing E&S specific risks and impacts and associated mitigation measures, RIC Energy will collaborate with the Company to establish and monitor such mitigation measures. Any corrective and preventive actions will be established collectively, and the Company will ensure periodic monitoring for effectiveness and to achieve E&S outcomes that are consistent with the IFC Performance Standards. The Company will support and/or supplement the E&S actions of RIC Energy through regular meetings, monitoring and establishment of required management plans, where necessary.

10.4 Methodology

This desktop E&S screening included a review of key documentation provided by RIC Energy (note, at the time of writing no ESIA studies had commenced), information gained from a series of online working sessions with RIC Energy, and an independent GIS-based spatial sensitivity analysis completed by RSK completed along the proposed route (focused on completing an analysis of key sensitivities for social and biodiversity receptors along the proposed routes).

The E&S information gathered was then screened against specified lender requirements (i.e. International Finance Corporation (IFC) Performance Standards (2012) and Equator Principles (EP4) (2020) similar to the assessment of other Project components. The purpose of this screening was to identify key E&S risks and impacts for the Project's associated facility against applicable international standards using the same methodology as described in Section 7 of this report. As mentioned, the screening exercise was desk-based however the biodiversity expert did travel the route in 2024 to

perform initial screening potential impacts on birds and fauna. Furthermore, RIC Energy and Company stakeholder engagement staff provided documentation such as meeting minutes, and photos which RSK specialists used to validate desktop findings.

Using professional judgment, knowledge of the project area, and experience in assessing transmission lines of similar scale, RSK conducted a preliminary screening exercise to identify key environmental, social, health, safety, and security impacts that could result in significant adverse effects on human health, communities, or the environment. Impacts that were considered but determined not to warrant further assessment (i.e., scoped out) are listed in Section 10.8. For those impacts carried forward for further analysis, proposed mitigation measures—including any requirements for additional studies or assessments—are detailed in the relevant impact sections.

10.5 Screening results

10.5.1 Summary of analysis

RIC Energy has been working on the preliminary design of the transmission line from 2023 and since that time has conducted an initial land scouting process, stakeholder engagement (see Section 10.7) and a full topographical survey involving data from the national land database (Registro Agrario Nacional or RAN). Various rights-of-way options for the transmission line falling broadly within a corridor containing an existing CFE transmission line, starting at CFE Choacahui Substation and finishing at the Mexinol site, have been evaluated, and the best route was selected for more detailed analysis based on criteria and constraints as described in Table 10.1. In addition to the final route currently under evaluation, RIC Energy explored an alternative route option which would have run parallel to an existing natural gas line. However, it was determined that the efficiencies this new route may have provided in terms of accessibility were less critical than the fact that the route would potentially run through sensitive biodiversity areas (mangroves) and therefore it was not chosen for further evaluation.

Table 10.1: Alternatives analysis selection criteria

Criteria / Constraints	Description	Justification
Technical Elements		
Distance not running perpendicular to existing infrastructure	CFE and regulations prohibit private TLs from crossing CFE TLs. If they must cross, the CFE TL must be the higher of the TLs.	To not create any conflict with CFE existing lines and regulations, the route screening process mapped all CFE and private TLs in the areas from the substation to the site and developed potential routes that run parallel to CFE lines and do not cross any TLs.
Presence of infrastructure	Regulations allow natural features and manmade linear features (roads, railroads) to exist below TLs; however, no buildings can exist under the TL in the established RoW.	The existing potential routes were reviewed to choose the route with the least number of obstacles. Once chosen, the route would then undertake a micro-routing option to ensure no obstacles are within the RoW.
Accessibility	Using existing routes allows for proximity to	The route is reviewed based on the ability to conduct construction and

Criteria / Constraints	Description	Justification
	roads and pathways to reduce disturbance and maintenance costs.	allow for maintenance. (See note below)
Erosion Risk	Geotechnical hazards can considerably impact the stability of, and costs for structures.	The route is reviewed based against the areas where the pylons and structures will need to be placed (every 400 m) to ensure there is no risk of erosion (on riverbeds etc.)
Corridor length and location of towers	Length in km is assessed as is the number of towers.	The route distance is then reviewed to determine the number of towers required (every 400 meters). However, final layout could have additional towers at shorter distances if deflection points are required to avoid sensitive receptors (IP communities, buildings, landowners not willing to sell rights of way).
Natural or Physical Environment		
Critical Habitat / Important Bird Areas	IBAs are globally important for the conservation of bird species. The presence of TLs could result in habitat loss, habitat fragmentation, and risk of bird collisions or electrocution.	The Bahia Lechuguilla IBA (i.e. the EAAA used for this CHA) was defined as critical habitat. Use of existing TL corridors reduces the risk of impacts because of distance from CH and IBA; however, bird strikes are still possible regardless of the routing.
Wetlands	Wetlands are areas with considerable biodiversity and are often used for agricultural purposes. In addition, they can have unstable soil areas with low bearing capacity.	No wetlands are within the TL RoW.
Watercourse crossings	Crossing watercourses may require removal of riparian vegetation resulting in habitat disturbance and increased risk of erosion and sedimentation.	No significant water crossings are within the TL RoW.
High value agricultural area	Although TLs can be placed above agricultural areas without restrictions, no high value agricultural areas are used for the placement of towers.	No high-value agricultural areas (including orchards etc) are used for the placement of towers. The initial E&S risk assessment prepared by RSK for RIC energy identified 11 hectares of specific higher value lands (orchards) – see Section 10.9.3. RIC Energy is in the process of micro-routing to ensure no towers are placed in these areas. RIC Energy will ensure the height of the line in these areas meets the regulatory standard of 20 m between conductor wire and nearest vegetation on the ground.
Human Environment		
Project Affected People (PAPs)	The number of PAPs directly correlates with a	Initial stakeholder engagement has found that only 11 communities will be

Criteria / Constraints	Description	Justification
	project's social impacts and is often an important consideration in Project cost and social acceptability.	impacted by the TL RoW. See stakeholder engagement Section 10.7 for additional information. Where PAPs do not want to sell their land, micro-routing is conducted to avoid that plot of land. No expropriation is ever considered.
Urban areas	Urban areas can increase the potential for physical resettlement and economic replacement, either for a temporary or permanent length of time. Physical resettlement is to be avoided through micro-routing.	Following an existing TL RoW limits the number of urban areas that may need to be disturbed. There are no heavily populated areas along the chosen TL RoW.
Commercial or residential buildings	The TL 25-meter RoW cannot include any commercial or residential structures.	The initial E&S screening prepared by RSK identified 27 residential structures and 6 commercial structures within a 70meter buffer zone of the RoW centre line. RIC Energy is in the process of micro-routing to avoid any structures within the 36-meter RoW. Should noise modelling conducted during the ESIA identify sensitive noise receptors who may be impacted by noise or electromagnetic fields at distances greater than the 36-meter RoW, RIC energy will micro-route to avoid these sensitive social receptors.
Indigenous Peoples / Indigenous Communities	Any direct impacts to Indigenous peoples, including land and economic impacts, are to be avoided through micro-routing.	There are no IP lands (plots owned by IP or IP Ejidos) that are directly impacted by the TL RoW. The initial E&S screening prepared by RSK identified an IP community called Juricahui which has a population of 133 people (50% of which identify as IP) and had lands under one portion of the TL RoW. RIC Energy is in the process of micro-routing to avoid the TL RoW traversing over lands or resources owned by this community. See Section 10.8.1 (Indigenous Peoples Screening) for more details.
Cultural Heritage sites	Cultural heritage sites are to be avoided through micro-routing.	The initial E&S screening prepared by RSK identified only one cultural heritage site (a ceremonial centre in Ejido Porvenir Vallejo) which was located 350 meters from the TL RoW. No impacts are expected on this CH site or any other CH area. However, a chance find procedure will be implemented as described in Section 10.9.3 Impacts to Cultural Heritage.

10.6 Micro-Routing / Re-Routing

As described in Section 10.5, micro-routing (or re-routing) is a common approach taken during the final engineering and design process. This is important for avoidance of E&S impacts. The current proposed rights-of-way is chosen based on the initially proposed route, yet this will be subject to modification until commitments with landowners are signed and there are assurances through the ESIA process that no significant residual (after mitigation measures) environmental, social or community health and safety impacts are identified. During the verification process, if any indigenous communities, settlements, buildings, or other constraints are identified, necessary deviations will be made to the re-route under all such circumstances. Importantly, no physical displacement of existing properties or settlements will occur through avoidance of these within the RoW, even if an extended route is required to accommodate these changes.

When such obstacles have been identified, RIC Energy follows the procedure established below to modify the transmission line route to avoid such obstacles. The steps include, but are not limited to:

- Identifying obstacles – Assess any impediments along the proposed route, including settlements, infrastructure, IP land or resources or environmental constraints. This is done through continuous engagement with landowners and communities, as well as through the ESIA process.
- Evaluating alternative paths – Conduct a thorough review of the lands surrounding the area with obstacles to determine feasible re-routing options.
- Engaging local stakeholders – Contact landowners, including private parcels and Ejidos, along the proposed alternative route to assess the feasibility of building the high-voltage transmission lines through such lands.
- Compliance assessment – Verify the environmental and regulatory feasibility and potential impact of route modifications in coordination with Project, with the objective to avoid and minimize the scale of E&S impacts.
- Topographic survey and tower relocation – Perform a detailed topographical survey of the lands along the new route.
- Revising route design – Update the transmission line route based on new lands and the corresponding feasibility studies.

As an example, during initial route topographical surveys and engagements with affected landowners, one landowner expressed that they would deny granting rights of way in his land for the construction of the transmission line due to an existing CFE line already impacting his property. RIC Energy used micro-routing to bypass this plot of land. Figure 10.2 below (courtesy of RIC Energy) shows the initial proposed deviation.

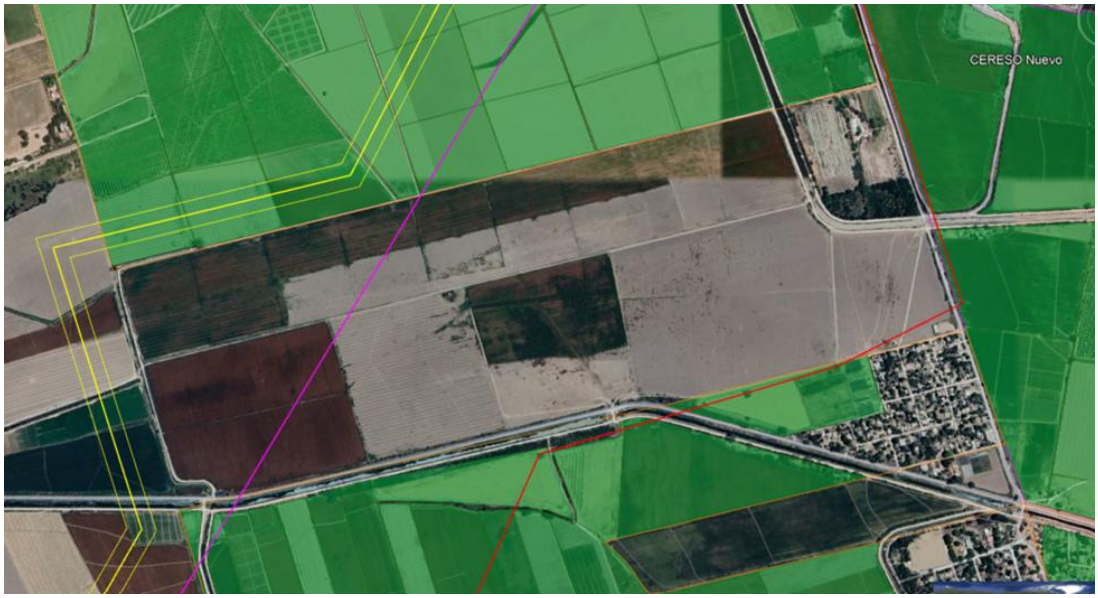

Figure 10.2: Alternative micro-routing used to avoid affected land

Source: RIC Energy

As the process to determine the final route of the transmission line continues, RIC might encounter future obstacles that may require a change in route. Therefore, RIC Energy shall follow the procedure established previously to correct such situations.

10.7 Stakeholder Engagement

As described in Section 10.6, evaluation of landowners and adjacent communities was part of the initial route selection process. RIC Energy's land management team began identifying landowners using the RAN database and development of topographical maps (See Figure 10.3 for an example). Meetings were then arranged at the corresponding communities and potentially affected landowners, including ejidos and non-ejido communities.

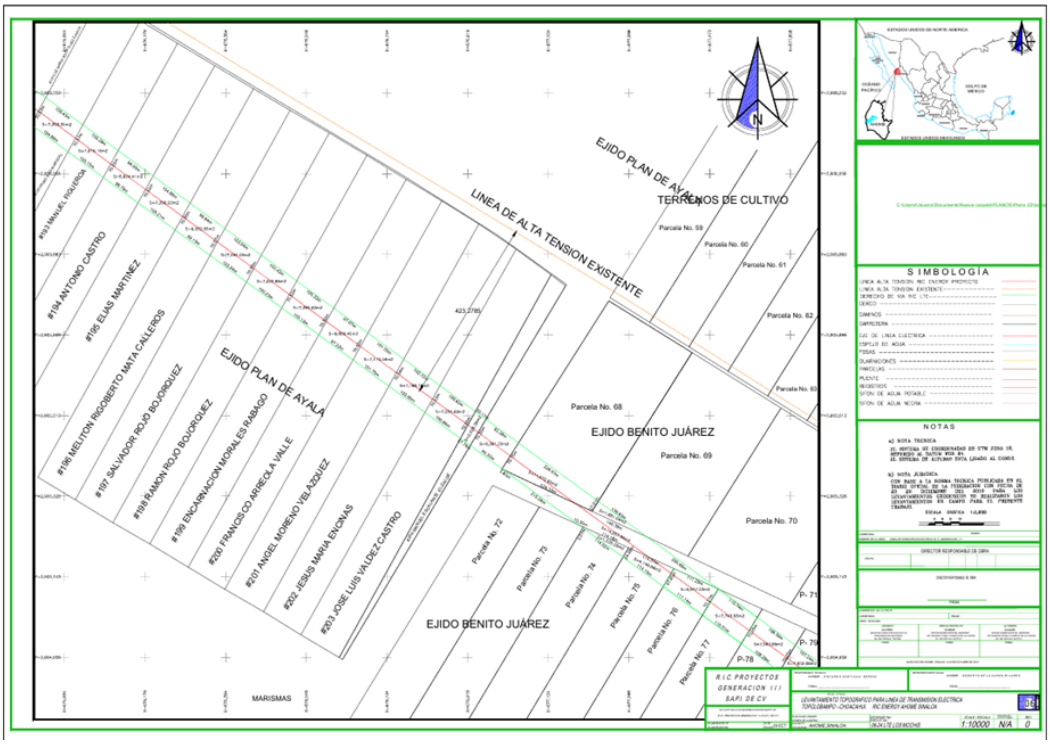

Figure 10.3: Topographical map along the RoW showing parcels and land ownership

Although Choacahui (an IP community) is not directly impacted by the transmission line or substation (the town centre is approximately 1,000 meters and 2,000 meters from the transmission line and substation, respectively), RIC Energy's typical stakeholder engagement plans include all adjacent Indigenous communities, including Choacahui. While there is a current amparo (local lawsuit) against a municipal waste facility issued by this community, RIC Energy did not encounter any negative feedback from the community.

The land management team first visited the communal land commissary of each community to introduce the project and ask for assistance in arranging a meeting with the communal land assembly. Once a date was determined, the land management team returned to the community and presented the development (see Table 10.2), including details on the construction phase, routing, and RAN database. Most comments received by stakeholders during the presentation involved questions about land ownership and timing of when negotiations and payments would commence. All comments received were classed as positive.

In December 2023 and January 2024, the land management team returned to each of the communal land commissaries to discuss the findings of the RAN database search and share the topographical maps. This allowed the associated facility development to further define the number of landowners and the willingness of landowners to participate in the "willing seller, willing buyer" programme.

Figure 10.4: Photographs from community presentations

Table 10.2: Dates of community presentations

Community	Date of Presentation(s)
San Miguel Zapotitlan	May 22-27, 2023, January 8-12, 2024
Choacahui	May 29-June 4, 2023, January 8-12, 2024
18 De Marzo	January 8-12, 2024
Ejido Emiliano Zapata (Olas Altas)	May 22-27, 2023
Ejido Rosendo G. Castro / Ejido Topolobampo	May 22-27, 2023
Ejido Ricardo Flores Magón	January 8-12, 2024
Plan de San Luis	December 4-15, 2023
Los Mochis No.1 Individualista (Ejido Mochis)	January 8-12, 2024
Los Goros	May 1-5, 2023
Ejido Louisiana	January 8-12, 2024
Plan de Ayala (Campo Cinco) / Numero Dos	July 17- 23, January 8- 12, 2024
Ejido Benito Juárez	May 22-27, 2023
Ejido 9 de Diciembre	June 14-23, 2023

Feedback from the communities was positive. As there are various existing CFE rights-of-way in the area, community members were generally aware of the construction process for transmission lines.

10.8 Scoped Out Impacts

The following potential impacts have been scoped out because of the E&S screening process. Further justification can be found in the relevant sections.

10.8.1 Impacts on Indigenous People

There are several recognised Indigenous People's (IP) communities (including San Miguel Zapotitlán, Choacahui, Goros Número Dos and Ejido Vallejo) located within the Project area (defined for this assessment as within 2 km of the proposed transmission line RoW) but none are directly affected by land acquisition or land use for the RoW. The largest of these, San Miguel Zapotitlán, serves as the indigenous ceremonial centre and holds the most extensive traditional jurisdiction, which also includes the communities of Choacahui and Goros Número Dos. It is important to note that San Miguel Zapotitlán is unique in its governance structure, featuring two individuals who share the role of Traditional Governor. The traditional / indigenous governor represents the Yoremes of the State of Sinaloa on the National Advisory Council of the National Institute of Indigenous Peoples (INPI). The communal land commissary is another key participant in the traditional activities of the indigenous community.

As shown in Figure 10.5, there is no Indigenous territory identified by the government in the Project area (in Mexico an indigenous territory refers to a geographical area that includes not only the land but also natural resources, water, forests, and other environmental elements. It has deep cultural, spiritual, and social significance for indigenous peoples).

Figure 10.5: Indigenous lands acknowledged by the Government

Source: LandMark (2022). Global Platform of Indigenous Lands.

Table 10.4 provides population data on the 13 communities within the Project area that have been engaged. Of these, Choacahui is the only registered IP community, with the community of Juricahui having been identified during the E&S desktop screening but not yet engaged (because of re-routing, no land impacts will occur in Juricahui). There are no direct Indigenous land impacts as all land required for the rights-of-way, including in the areas adjacent to Choacahui and Juricahui, are under private ownership or ejido (non-IP) ownership. Furthermore, the purchase, sale or transfer of Indigenous land is regulated by the Agrarian Law, as documented in the RAN which is further evidence that no Indigenous land is being impacted through land acquisition or land use.

A screening checklist based on IFC PS7 – Indigenous Peoples guidance has been used to scope potential impacts to IP and enable avoidance measures to be explored by RIC Energy.

Table 10.3: Screening checklist based on IFC PS7 – Indigenous Peoples

Key Concerns	Yes / No / Unknown	Remarks
IP Identification		
Are there socio-cultural groups present in or use the project area who may be considered as "indigenous communities" in the project area?	Yes, in Project Area (within 2 km)	At least two registered IP communities (Choacahui and Juricahui) and are present in the general project area (located within 2 km) but will not be directly impacted.
Are there national or local laws or policies that consider these groups present in or using the	Yes	Table 10.4 provides details based on the national indigenous census

Key Concerns	Yes / No / Unknown	Remarks
project area as belonging to IP groups?		
Do such groups self-identify as being part of a distinct social and cultural group?	Yes	See above
Do such groups maintain collective attachments to distinct habitats or ancestral territories and/or to the natural resources in these habitats and territories?	Not in the Direct AoI	No such practices have been observed in the direct area of influence (within the rights-of-way) and no ancestral territories or natural resources are being collectively used by a certain group of people. In addition, all the land acquired by the project is privately owned land and has only been attributed to individual or ejidal (non-IP) use.
Do such groups maintain cultural, economic, social, and political institutions distinct from the dominant society and culture?	Not in the Direct AoI	As has been observed, the communities living around the project area do not have any distinctive way of conducting their cultural, economic, social, and political practices from the broader community of which they are apart.
Do such groups speak a distinct language or dialect?	Yes	Table 10.4 provides details based on the national indigenous census
Have such groups been historically, socially and economically marginalised, disempowered, excluded, and/or discriminated against?	Yes	There is no evidence found during the engagement efforts that the development of transmission line projects has taken discriminative actions in the community in the project area.
Are such groups represented as "Indigenous Peoples" in any formal decision-making bodies at the national or local levels?	Yes	Individuals who represent IP groups are represented in local government.
Identification of Potential Impacts		
Will the project directly or indirectly benefit or target Indigenous Peoples?	No	There are no IP communities within the Direct AoI and any indirect impacts are not targeted at IP communities
Will the project directly or indirectly affect Indigenous Peoples' traditional socio-cultural and belief practices? (e.g. childrearing, health, education, arts, and governance)	No	There are no IP communities within the Direct AoI and indirect impacts (e.g. dust during construction) will not impact cultural or belief practices.
Will the project affect the livelihood systems of Indigenous Peoples? (e.g., food production system, natural resource management, crafts and trade, employment status)	No	There are no IP communities within the Direct AoI and no specific livelihood systems impacted
Will the project be in an area (land or territory) occupied, owned, or used	No	There are no IP communities within the Direct AoI. All land is privately or ejidal (non-IP) owned.

Key Concerns	Yes / No / Unknown	Remarks
by Indigenous Peoples, and/or claimed as ancestral domain?		
Commercial development of the cultural or natural resources and knowledge of Indigenous Peoples?	No	Not applicable for this project
Physical displacement from traditional or customary lands?	No	The project has no physical displacement. All land is privately or ejidal (non-IP) owned.
Acquisition of lands that are traditionally owned or customarily used, occupied or claimed by indigenous peoples?	No	All land is privately or ejidal (non-IP) owned.

While there are no impacts to IP groups identified, there are IP individuals within the broader TL route area. Therefore, once the final routing is determined (and all micro-routing complete to avoid sensitive receptors, such as IP), RIC Energy must document there is no IP land through the formal RAN and topographic land ownership process. It's important to note that all land required for the RoW is private or privately held plots within non-IP ejido land. However, if any of the plots are owned by an Indigenous person, this does not constitute impacts to Indigenous land as it privately held and not under "common or collective use" category per Mexican law.

It should be noted that during the RSK E&S screening process, an IP community called Juricahui (with a population of 133 people, 50 percent of whom identify themselves as IP) was identified as having land impacted by the transmission line RoW. RIC Energy engineering teams informed RSK that the route initially had been farther to the east, avoiding this community altogether. However, a private landowner who indicated he did not wish to sell the RoW meant the proposed alignment had been micro-routed to the west (and therefore within the IP community area). RIC Energy is in the process of revising the proposed RoW alignment to the east to avoid these IP lands and the private landowner's land.

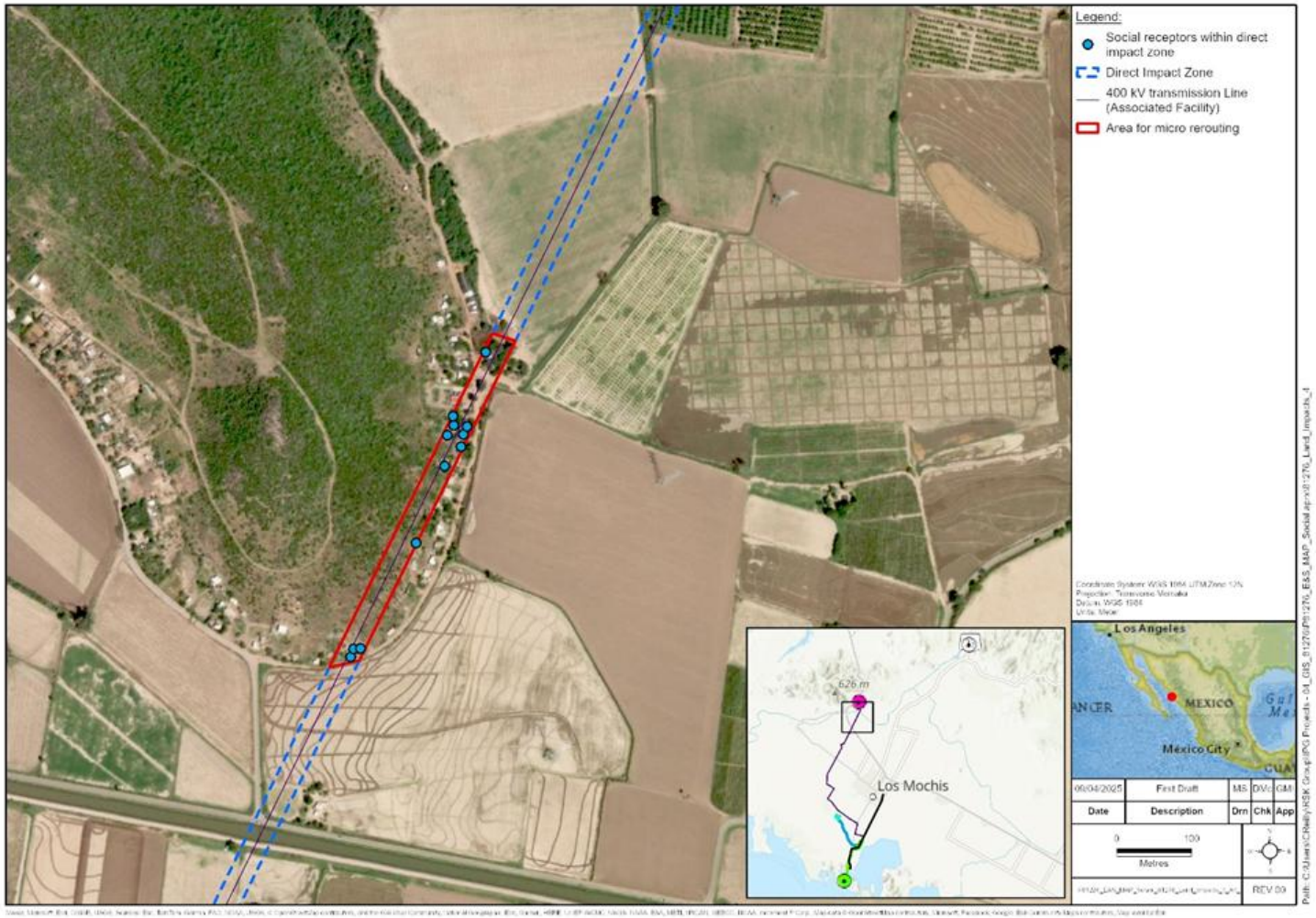

Figure 10.6: Land and resettlement impacts identified for the Juricahui IP community during RSK E&S screening (micro-rerouting will be applied by RIC Energy to avoid these lands)

To ensure full respect for Indigenous communities and their territories, the final proposed route will be planned to completely avoid impacts to any IP land or recognised resources within the RoW. In cases where unidentified lands within the initial route of the transmission line are later confirmed to belong to IP communities, RIC Energy will initiate a micro-routing process to re-route and avoid these impacts, as described in Section 10.6, ensuring that alternative paths are evaluated while maintaining compliance with legal, environmental, and social considerations. The approach prioritises responsible planning, cultural sensitivity, and proactive engagement to uphold IP rights and minimise any potential impact and comply with IFC PSs.

If it is determined that IP land or natural resources will be impacted (if avoidance is not achieved) or the results of the ESIA/EviS determines a specific IP consultation process is required, RIC Energy will develop an Indigenous Peoples Plan (IPP). Regardless, as part of good practice and Informed Consultation and Participation (ICP), dedicated consultation and participation measures for IP groups will continue to be outlined in the RIC Energy Stakeholder Engagement Plan and Table 10.4 provides further details on the potential affected population of IPs within the broad area of influence. In addition to this, an Indigenous Peoples Planning Framework (IPPF) has been prepared as part of this ESIA (Appendix 3) to guide dedicated activities to minimise and/or compensate for adverse social and economic impacts and identify opportunities and actions to enhance positive impacts of the project on the Indigenous Peoples. Communications materials related to construction activities (e.g., safety zones, road impacts) will also be printed and shared in the appropriate Indigenous language.

Table 10.4: Communities within the Project area of the transmission line

ID	Name of Community	Population Total	Average size of household	Population of indigenous households	Percentage of indigenous households	Population over 3 years old who speak an indigenous language	Percentage over 3 years old who speak an indigenous language	Population over 3 years old who speak an indigenous language and do NOT speak Spanish	Percentage over 3 years old who speak an indigenous language and do NOT speak Spanish	Population over 15 years old who are illiterate
250010189	Ejido 9 de Diciembre	1974	3.6	12	0.6%	2	0%	0	0%	45
250010215	Ejido Ricardo Flores Magón	1845	3.6	26	1.4%	6	0%	0	0%	58
250010088	Ejido Benito Juárez	1466	3.6	8	0.5%	4	0%	0	0%	56
250010197	Plan de Ayala [Campo Cinco]	1447	3.4	6	0.4%	2	0%	0	0%	28
250010370	Ejido Rosendo G. Castro	702	3.4	11	1.6%	3	0%	0	0%	28
250010626	Ejido Topolobampo	111	3.7	4	3.6%	1	1%	0	0%	0
250010992	Plan de Ayala Número Dos	10	*	*	*	*	*	*	*	*
250010227	San Miguel Zapotitlán	6253	3.8	352	5.6%	116	2%	0	0%	122
250010146	Goros Número Dos	1758	4.1	623	35.4%	207	12%	3	0%	32
250010129	Dieciocho de Marzo	897	3.6	24	2.7%	8	1%	0	0%	35
250010174	Ejido Louisiana	867	3.3	5	0.6%	1	0%	0	0%	24
250010199	Plan de San Luis	664	3.6	0	0.0%	0	0%	0	0%	13
250010530	Choacahui	587	4.4	392	66.8%	198	34%	2	0%	19
250011381	Ejido Emiliano Zapata (Olas Altas)	1	*	*		*		*	*	*
250010183	Mochis (Ejido Mochis)	2984	3.53	29	0.01	10	0.00	0	0	51

Source: Censo de Poblacion y Vivienda 2020 INEGI

10.8.2 Physical Resettlement

As discussed in Section 10.6, there will be no physical resettlement as all impacts related to commercial and/or residential buildings and properties will be avoided.

10.9 Preliminary screening results and identified impacts

This section presents the results of a preliminary desktop screening of E&S impacts completed as part of this ESIA. These preliminary results are intended to provide guidance as to the most significant potential impacts that could prevail. As previously noted, thePS-aligned ESIA to be commissioned by RIC Energy in mid-2025 will provide a comprehensive assessment.

Unless otherwise stated, the impacts screened in this chapter focused on those that can manifest during the construction phase as this is where the most impacts typically occur for Transmission Line projects. It is based on RSK's knowledge of the general area, desk top research, and professional judgement. Where baseline data has been found through secondary sources, it is summarised at the introduction to each potential impact. In some cases, it was not possible to assess the level of impact significance without primary baseline data or survey results. Recommendations for the collection of such data through the IFC-aligned ESIA is therefore recommended in relevant sections.

As in other sections of this ESIA, it provides residual impact significance ratings assuming the recommended mitigations are applied.

Table 10.6 provides a full summary of the identified potential E&S impacts associated with the transmission line associated facility.

10.9.1 Physical environment

10.9.1.1 Soil erosion during construction

10.9.1.1.1 Description of impact

The transmission line passes through two types of soil, Solonchak which have a high concentration of soluble salts and Vertisol which are usually inflatable clays which undergo changes in volume depending upon humidity levels but tend to be very hard when dry but sticky when wet.

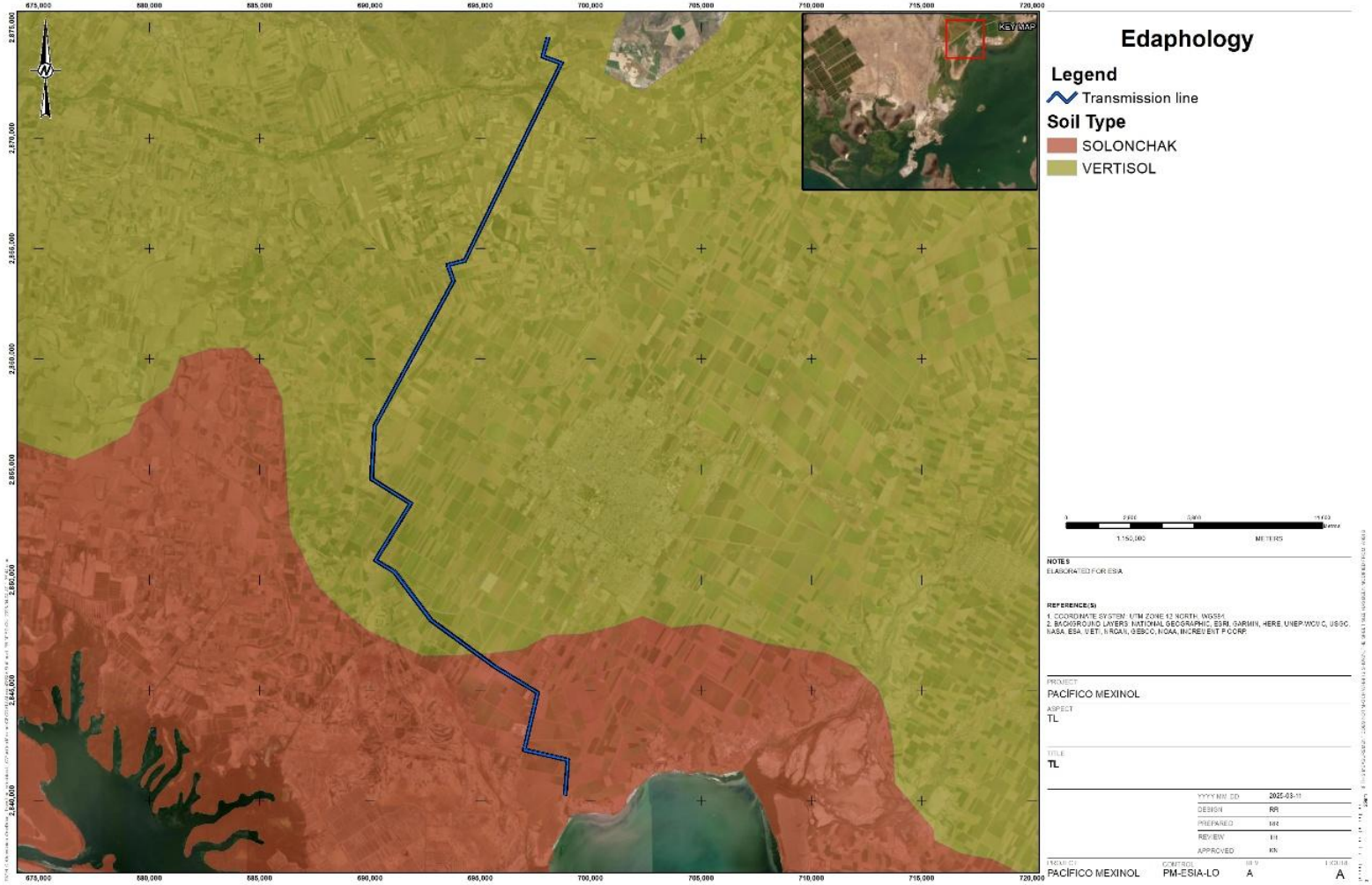

Figure 10.7: Dominant soil types along the proposed transmission line RoW

Vegetation clearance in the RoW related to construction activities for permanent infrastructure (i.e. towers) and removal of vegetation (i.e. trees over required safety height) will expose soils and increase the volume of stormwater runoff from cleared areas leading to potential soil erosion, which may be more significant for the Vertisol soils which have less tolerance for runoff.

Movement of construction vehicles over farmland and natural vegetation areas to the RoW may also cause further vegetation loss and exposure of soils to erosion. The risk of erosion and sedimentation at watercourse crossings water crossings situated along the route may cause wider impacts to local water quality. Extraction of material required for tower or access road construction from quarries and failure to reinstate quarries properly could lead to further soil erosion beyond the immediate areas of impact.

However, the construction of foundations for towers requires minimal surface area and the overall footprint is limited to only essential engineered parameters. Siting of permanent structures (i.e. towers) will be adjusted (within maximum 400m spacing requirement) according to the natural terrain, with forested areas and sloped terrain avoided.

10.9.1.1.2 Pre-mitigation significance

The intensity of these impacts will be **moderate**. The frequency will be temporary during construction and impacts primarily restricted to the RoW. The magnitude and the overall the significance of this impact is likely to be **minor** considering the properties of the soils concerned.

10.9.1.1.3 Proposed mitigation

A Soil Management Plan should be prepared as part of the IFC-aligned ESIA which specifies limits for the clearance of vegetation in the RoW as far as possible and only as necessary to allow for stringing of cables. The plan should specify measures to restrict vegetation clearance at tower positions (e.g. utilise pruning as an option) as far as possible. This Soil Management Plan should also:

- specify that unnecessary soil excavations are avoided and opt for manual tasks when feasible and safe.
- develop measures to strengthen the steep slopes with vegetation, grass and plants, or gabions.
- control soil excavations to ensure they are necessary for required activities.
- specify measures to restore landscapes to their near original conditions after the completion of works and after use of quarries or borrow pits as well as restoring the vegetation cover in accordance with the design constraints of transmission lines.

10.9.1.2 Soil compaction during construction

10.9.1.2.1 Description of impact

During construction, development of the RIC Energy transmission line will result in compaction of soil by heavy machinery and vehicles. This will occur within a wider zone of influence as these vehicles access the transmission line RoW and within the RoW itself at tower locations.

10.9.1.2.2 Pre-mitigation significance

The intensity of these impacts will be **moderate**. The frequency will be temporary during construction and as the development is linear in nature impacts will be primarily restricted to the RoW. The magnitude and the overall the significance of this impact could be **minor** considering the properties of the soils concerned.

10.9.1.2.3 Proposed mitigation

A Soil Management Plan should be prepared to address soil compaction during construction and operations.

A Traffic Management Plan should also be developed as part of the IFC-aligned ESIA that specifies that the development should use existing access roads/tracks where possible. The Traffic Management Plan should specify:

- No roads accessing or within the RoW to be hard surfaced.
- Decompaction of soil within the RoW following construction to match soils outside of RoW.
- Clean and level only the necessary terrain, optimising earth movement.
- Minimise soil compaction by reducing machinery transit and material storage areas.
- Avoid levelling and compacting unused soil portions to minimise impacts on soil quality and worker safety.

10.9.1.3 Soil and surface water contamination

10.9.1.3.1 Description of impact

During construction, development of the RIC Energy transmission line could result in unplanned spillages from vehicles and machinery leading to contamination of soils and pollution of surface water. The intensity of these impacts will be higher at surface water crossings along the TL alignment, particularly where the RoW crosses drainage canals carrying water for domestic or agricultural usage.

10.9.1.3.2 Pre-mitigation significance

The intensity of these impacts will be **low to high** depending on the status of the soil or water course concerned. The frequency will be episodic during construction. The magnitude and the overall the significance of this impact could be **minor to moderate** depending on the spill event.

10.9.1.3.3 Proposed mitigation

All hazardous materials should be stored in such a way to prevent contamination on site. Refuelling of plant should be undertaken at construction camps to limit the potential for spillages and in no circumstances near watercourses. A Waste Management Plan should be developed as part of the IFC-aligned ESIA.

10.9.1.4 Surface and groundwater impacts during piling

10.9.1.4.1 Description of impact

The Project area is located entirely within the "Rio Fuerte" aquifer, which is in the northwestern end of the state of Sinaloa, on the border with the states of Sonora and Chihuahua. According to open-source information, this area corresponds to a heterogeneous and anisotropic free aquifer, consisting in its upper portion of alluvial, fluvial, eolian, foothill and lacustrine sediments, as well as polymictic conglomerates, whose thickness can reach a few hundred metres in the centre of the plain. The lower portion is housed in a sequence of volcanic rocks, including acid tuffs, rhyolites, ignimbrites and andesites, and intrusives, which present secondary permeability due to fracturing and alteration.

The National Network for Water Quality Measurement (RENAMECA) carries out systematic and permanent monitoring of the water quality of the main water bodies in the country, and four groundwater monitoring points are located near the Project area as shown in Figure 10.8. The results of the most recent data points available in Table 10.5 show higher concentrations of contaminants in the areas closer to major population centres as would be expected. Additional baseline data to decide on the significance of the potential impact was not found in secondary sources.

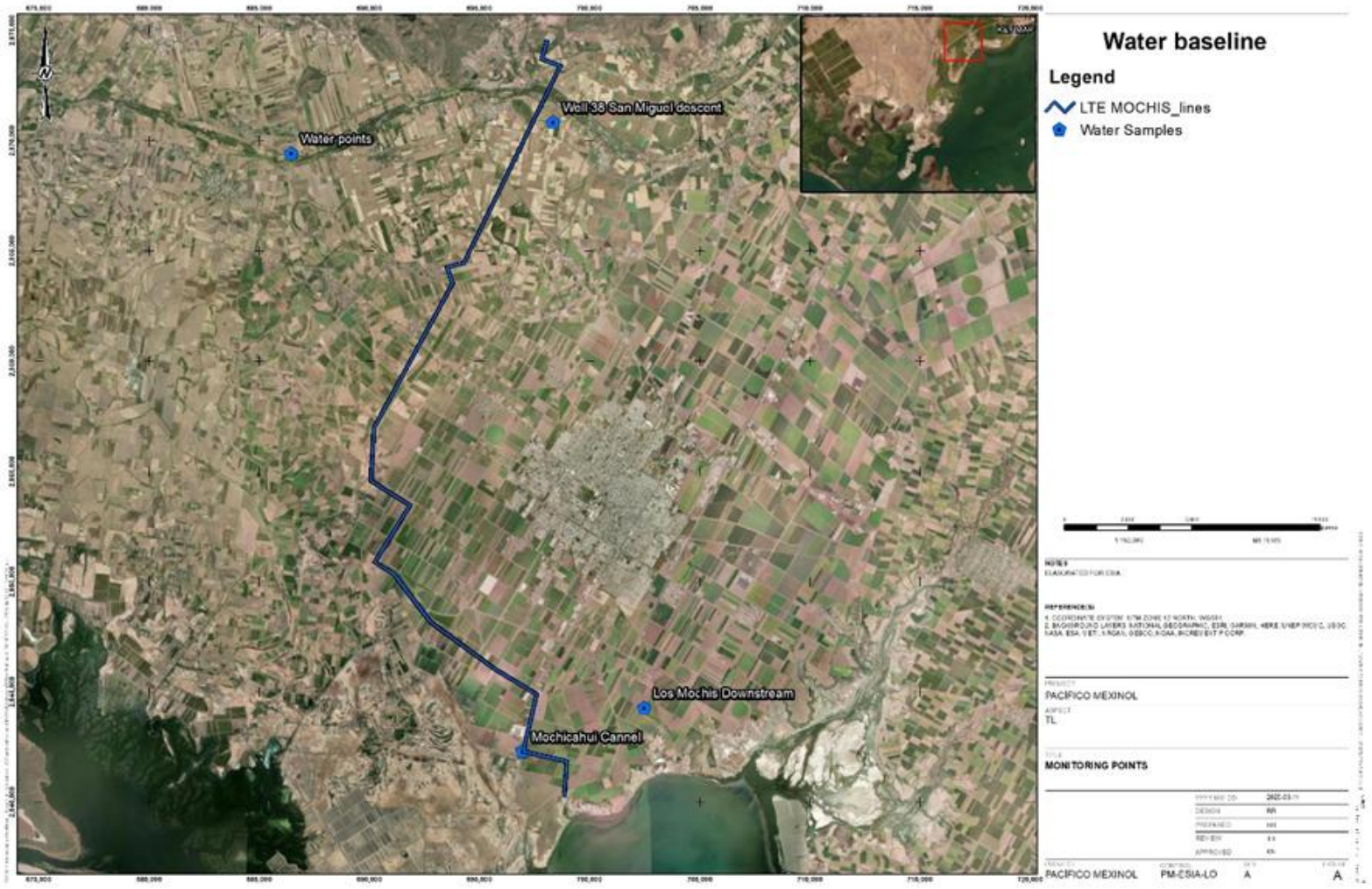

Figure 10.8: RENAMECA groundwater sampling locations

Table 10.5: Groundwater water quality results

Point Name	Sampling Date	Total coliform bacteria	DBO	DQO	Total nitrogen	Total phosphorus	pH	Total suspended solids
Mochicahui Canal	06/12/2018	>241960	8	20.26	6.781388	0.85175	7.8	174
	11/02/2019	>241960	8.8	68.29	6.734946	0.8393	7.7	109.41
	18/09/2020		5.98	73.93	13.070357	1.87783	7.8	215.2
Los Mochis Canal	11/02/2019	>241960	30.7	212.86	14.311539	2.51798	8.3	152
	18/09/2020		21.6	113.25	17.806649	3.59188	7.9	77
	05/09/2022		86.5	118.18			8.3	84.7
Well 38, San Miguel descent	12/07/2018				10.583136	0.2103	7.87	
	22/12/2018				7.384731	0.2743	7.8	
Fuerte River	27/11/2018	2987	<2	11.82	1.285664	0.19672	7.9	<10
	29/01/2019	2613	<2	14.21	1.026555	0.16623	7.9	<10
	20/09/2020		<2	<10	0.768804	0.26419	8	<10
	09/09/2022		4.1	11.82			8	<10

Source: REMECA (2022)

It is likely that RIC Energy will use piling techniques during construction at tower positions. Potential impacts to water quality and flow could arise during piling. Impacts could exceed acceptable standards for water quality and could impact local groundwater users.

10.9.1.4.2 Pre-mitigation significance

The significance of this potential impact has not been assessed as detailed technical specifications; alongside additional baseline determination and risk assessment is required.

10.9.1.4.3 Proposed mitigation

A Piling Risk Assessment is recommended to evaluate potential impacts to groundwater and developed as part of the IFC-aligned ESIA. This should include the collection of baseline data on the area of the aquifer that will be penetrated during piling and the potential receptors. It should address impacts due to potential contamination of groundwater by concrete; cement paste or grout as well as potential impacts to groundwater flow. The contractor should be informed on the risks to implement the necessary measures to protect groundwater.

10.9.1.5 Temporary air quality deterioration

10.9.1.5.1 Description of impact

There is only one type of climate characteristic in the transmission line development area. It is mainly defined as warm with average annual temperatures of 22 and the coldest month 18 degrees Celsius within a summer rainfall regime (García, 2004). There are three Climatological stations within the transmission line development area, which report that the average maximum annual temperature is 32.8°C, the minimum is 17.8°C and the annual average is 25.3°C.

A meteoblue monitoring platform (Meteoblue, 2025) for air quality within the transmission line development area provides the following data for:

- Ozone (O_3) daily concentration range of 100-120 µg/m^3
- Sulphur Dioxide (SO_2) daily concentration range of 0-1 µg/m^3
- Nitrogen Dioxide (NO_2) daily concentration range of 0-1 µg/m^3
- Carbon Monoxide (CO) daily concentration range of 110-150 µg/m^3
- Particulate matter smaller than 10 microns (PM_{10}) daily concentration range of 5-15 µg/m^3
- Particulate matter smaller than 2.5 microns ($PM_{2.5}$) daily concentration range of 2-10 µg/m^3

Development of the RIC Energy transmission line will result in dust generation and vehicle emissions during construction activities on site and the transportation of people and materials. Such temporary impacts may exceed acceptable limits for sensitive receptors leading to a deterioration in air quality, especially in more remote areas where air quality is affecting the health of surrounding communities during construction.

10.9.1.5.2 Pre-mitigation significance

Emissions will be short-term and localised to the site therefore the intensity will be **low**, the frequency over the construction phase and episodic during operations (RoW maintenance activities) and therefore be long-term leading to a **medium** magnitude. The overall the significance of this impact could be **moderate or minor** depending on proximity to social receptors.

10.9.1.5.3 Proposed mitigation

An air quality impact assessment and Air Quality Management Plan should be developed as part of the IFC-aligned ESIA. This should include a plan for Construction Fugitive Dust Control and the implementation of dust suppression on gravel roads to and on site. A Biodiversity Management Plan should also be developed which restrict clearing of access tracks or roads to the RoW. RIC Energy should ensure that its own vehicles and contractor plant machinery are serviced in accordance with manufacturers specifications to minimise emissions.

10.9.1.6 Increased noise levels due to construction activities

10.9.1.6.1 Description of impact

Background noise levels in the area are likely to be predominately low due to the rural setting. During construction it is likely that excavation and land clearance activities will create noise emissions. An increase in noise pollution is also expected from the operation of heavy machinery during construction and due to increased movement of construction-related traffic.

10.9.1.6.2 Pre-mitigation significance

The severity of this impact is likely to be reduced due to the rural setting and low numbers of social receptors near the RoW. The overall significance of this impact could be **moderate or minor** depending on proximity to social receptors.

10.9.1.6.3 Proposed mitigation

A detailed noise assessment to international standards should be performed to inform micro-re-routing as part of the IFC-aligned ESIA process. A Noise Management Plan should also be developed as part of the IFC-aligned ESIA. This should ensure all powered mechanical equipment and machinery are fitted with noise abating gear, such as mufflers for effective sound reduction, in full compliance with the applicable regulations. Where possible, the operation of heavy equipment should be limited to daylight hours. The Noise Management Plan may require reasonable mitigation measures to be used, such as installing acoustic screens to minimise noise near noise-sensitive areas.

10.9.1.7 Increased noise levels due to corona discharge or health impacts from electromagnetic fields (EMF) during operations

10.9.1.7.1 Description of impact

Prevailing background noise levels are predominately low and there are some sensitive social receptors within 200 m of the RoW, leading to potential noise nuisance for these specific receptors. The ESIA for the transmission line will provide a justification for the

selected route, with a focus on avoiding and minimizing impacts on these sensitive receptors within the 200 m buffer. The scale and magnitude of potential noise impacts on these receptors will be assessed and clearly presented in the ESIA.

The operation of the transmission line could result in increased noise levels from the corona effect from the ionization of air around the conductors. Although the potential health impacts of EMF from power lines are not scientifically proven, potential exposure for sensitive receptors should also be assessed and mitigation measures explored.

10.9.1.7.2 Pre-mitigation significance

Prevailing low background noise conditions and rural context suggest that the intensity of this potential impact could be **high** if there is not adequate capacity in the line to mitigate the corona effect. The frequency will be continuous over the long-term during operations and the life of the project. The significance of this impact is subject to further assessment.

10.9.1.7.3 Proposed mitigation

A detailed noise modelling and assessment to international standards should be performed to inform micro-re-routing as part of the IFC-aligned ESIA process. This should include an assessment of the potential exposure to the public to EMF against the reference levels, which are developed by the International Commission on Non-Ionizing Radiation Protection. Avoidance measures could then be explored, such as siting the power transmission line to avoid or minimise exposure to the public (i.e. avoiding installation of transmission line above or adjacent to residential properties or other locations intended for frequent human occupancy, such as schools, clinics, or offices). If EMF levels are still confirmed or expected to be above the recommended exposure limits, application of engineering techniques should also be considered to reduce the EMF produced by development. Examples of these techniques include shielding with specific metal alloys, increasing height of transmission towers and modifications to size, spacing, and configuration of conductors.

Should noise modelling conducted during the IFC-aligned ESIA identify sensitive receptors who may be impacted by noise or electromagnetic fields at distances greater than the 36 m RoW, RIC Energy will micro-route to avoid these sensitive social receptors. A Noise Management Plan for operation should also be developed as part of the IFC-aligned ESIA. Conductor design options should be explored to minimise impacts for identified sensitive receptors and should have adequate capacity to mitigate corona discharges leading to reduced noise impacts during operations.

10.9.2 Biophysical environment / biodiversity

10.9.2.1 Permanent loss of vegetation in the RoW (operations) and modification of natural and wildlife habitats

10.9.2.1.1 Description of impact

The Sinaloa state has six forest ecosystems comprising 10 tree formations and 27 vegetation types. Jungles are the most extensive (41.0%), followed by lowland forests (39.9%). These tree formations are found across all 18 municipalities, with Rosario and San Ignacio having the most (8) and El Fuerte and Salvador Alvarado the fewest (3). The

Project area lies within the Northwest Coastal Province, a floristic region that is part of Mexico's xerophytic zone. It has a hot, arid to semi-arid climate, with vegetation dominated by xerophilous shrubs and thorny forests. In its southern part, the flora increasingly resembles that of the Caribbean Region.

A high-level habitat/land use mapping exercise completed as part of the desktop E&S assessment showed that the majority of land (92%) within 200m of the current proposed RoW is categorised as modified (agricultural, orchards, residential, commercial/industrial) and only 8% is likely natural habitat (dominated by forest and naturally occurring sparsely vegetated land).

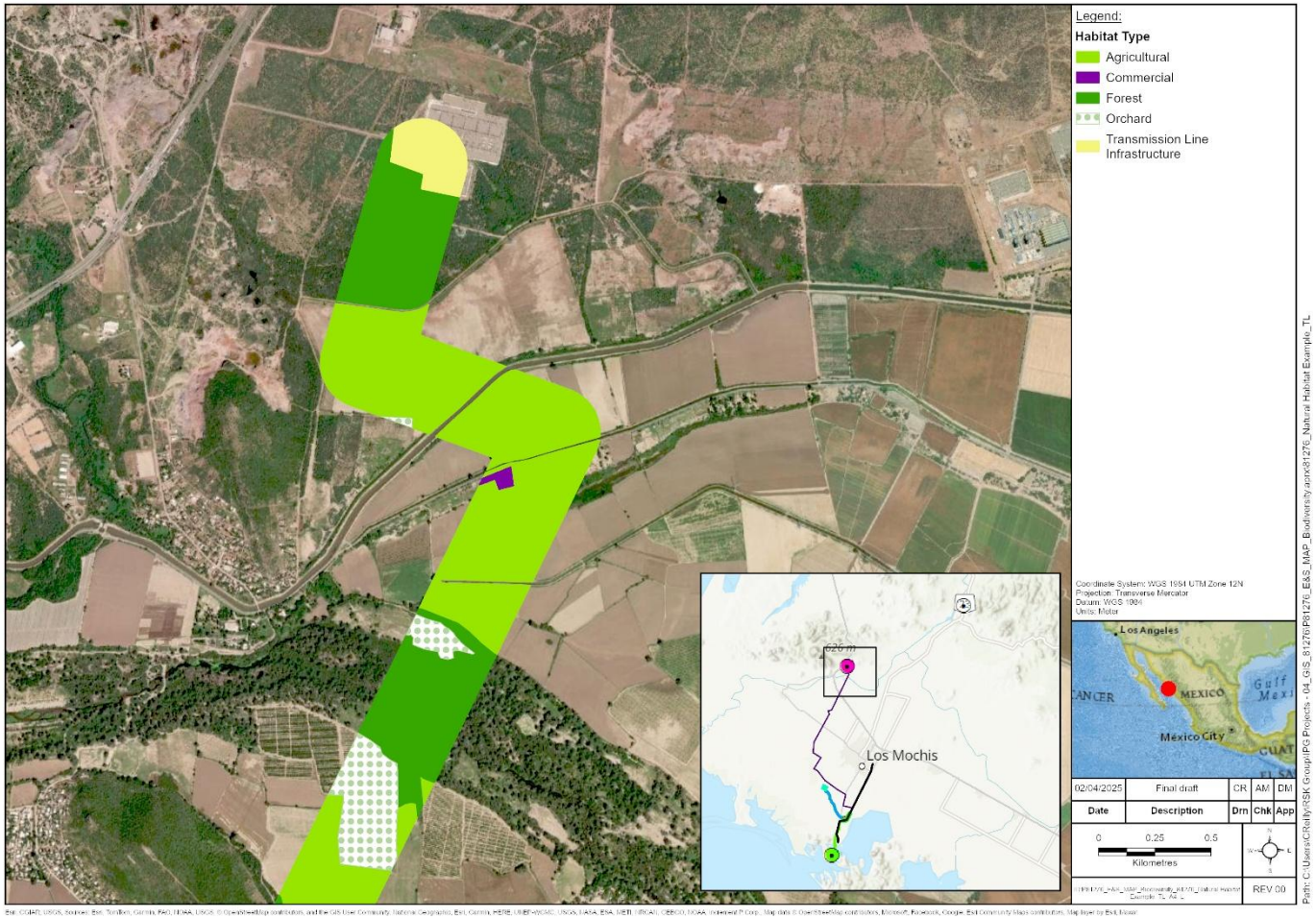

Figure 10.9: Example of natural habitats along the transmission line route

Source: ArcGISPro (WorldView03(2022)

Development of the RIC Energy transmission line will result in some permanent loss of vegetation and modification of wildlife habitats within the RoW, specifically where the transmission towers are placed. This will occur during construction and extend through the operation phase and life of the project. The transmission lines also typically require clearance of vegetation over specific heights (20m from the lowest conductor line to the highest point of vegetation) and active management of vegetation within the RoW to reduce arcing and fire risks which could cause further disruption to habitats on a permanent basis.

Furthermore, development of transmission line will require construction activities that may result in modification of natural habitats on a temporary basis. This may be either through the direct effects of construction machinery (i.e. degradation during site access) or via the introduction of invasive species.

RIC Energy will ensure compliance with relevant national standards such as NOM-059-SEMARNAT-2010 which provides lists of species at risk, risk categories and their specifications for inclusion, exclusion, or change. It should be noted that the transmission line will not directly impact protected areas, either within or in proximity to the development. The closest protected area to the footprint of the transmission line is the Lagunas de Santa María-Topolobampo-Ohuira Ramsar Site which is located approximately 1.2 km from the start of the transmission line at the proposed Mexinol Plant. The Navachiste Ecological Conservation Area is located approximately 10 km from transmission line at the Mexinol Plant, and the Sistema Lagunar Agiabampo - Bacorehuis - Río Fuerte Antiguo Ramsar Site is approximately 13 km from the CFE Choacahui Power Substation.

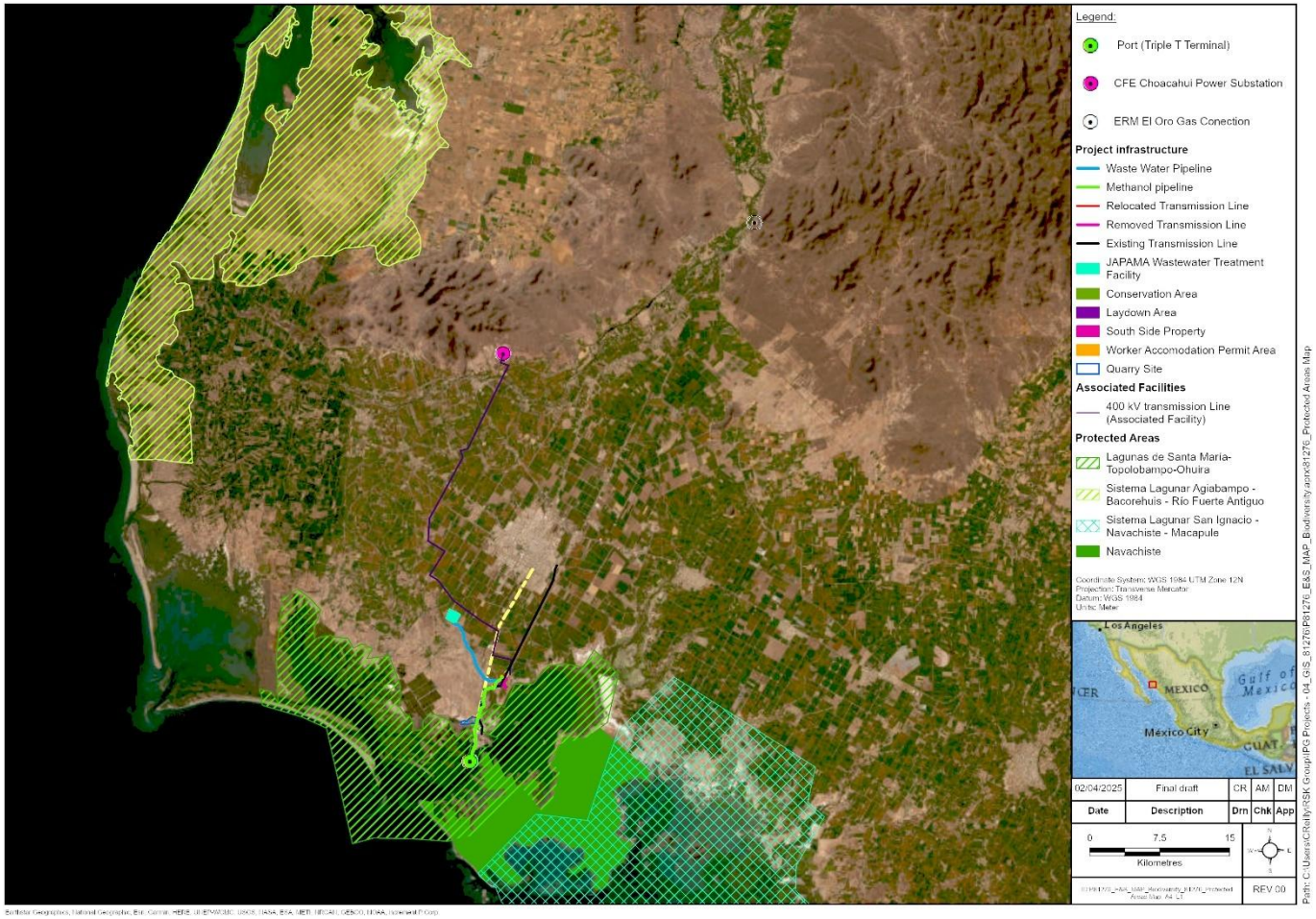

Figure 10.10: Protected Areas in proximity to the transmission line route

Source: (WorldView03(2022)

10.9.2.1.2 Pre-mitigation significance

The intensity of these impacts will be **high** depending upon the required amount of land and/or construction activities concerned. The frequency for permanent loss of habitat will be continuous over the long-term as the RoW will require vegetation management leading to a **medium** magnitude (considering the lower percentage of quantity of potential habitat loss) and the overall the significance of this impact could be **minor to moderate** depending on the sensitivity of habitats concerned. The frequency for modified habitat in the construction phase may be episodic but the duration will be short-term leading to a **low** magnitude and the overall the significance of this impact could also be **minor or moderate** depending on the sensitivity of habitats concerned.

10.9.2.1.3 Proposed mitigation

RIC Energy will ensure that adequate biodiversity assessment studies are undertaken as part of the IFC-aligned ESIA and a Biodiversity Management and Monitoring Plan (BMMP) should also be developed.

The studies and mitigation measures will focus on natural habitats and areas where bird species are particularly vulnerable to collision risks. This will be based on the identification of ecological features, considering both landscape-level factors and species susceptible to electrocution or collision.

10.9.2.2 Increased bird and bat fatalities through collisions and electrocution

10.9.2.2.1 Description of impact

An independent avifauna collision risk study for the RIC Energy transmission line was developed by SLR Consulting (2024b). The study assessed the significance of the risks of bird collision and electrocution along the overhead transmission line and proposed mitigation measures. The study identified that most of the species located within the area of influence are characterised as being at medium risk of negative impact from the transmission line. Additionally, the study identified nine species of avifauna that are at medium-high or high risk. Of these nine species, two were identified as priority birds; Harris' hawk (*Parabuteo unicinctus*) and reddish egret (*Egretta rufescens*). These two priority bird species were also assessed as being susceptible to electrocution. The remaining priority birds were assessed as medium or low risk or were not included in the assessment.

The development of a new 400 KVA electrical transmission line will likely increase bird and bat fatalities through collisions and electrocution.

10.9.2.2.2 Pre-mitigation significance

The intensity of these impacts may be **high** depending on the species concerned. The frequency may be episodic, but the duration will be long-term leading to a **medium** magnitude and the overall the significance of this impact could be **moderate or major** depending on the species concerned.

10.9.2.2.3 Proposed mitigation

The IFC-aligned ESIA baseline will include a detailed avifauna electrocution and/or collision risk study to collect adequate field and desk-based data (to supplement the desk study completed by SLR in 2024) along the transmission line corridor, including:

- bird species inventory (species list, abundance, location, flight behaviour),
- photographs of representative habitats,
- spatial mapping of micro habitats (rivers, wetlands, crop lands, estuaries etc.)
- identification of any sensitive receptors (roosts, nests etc.)

The baseline will focus on assessing presence of birds prone to collision to determine optimal location of bird deterrents on the line so that design and engineering parameters can ensure use of deflectors and line markings with Bird Flight Diverters within areas most likely to support bird species susceptible to collisions. The targeted survey will also include terrestrial habitats to identify any stopover points along the routes.

The use of pylons which carry all cables on a single horizontal plane and ensuring a safe distance between the energised conductors or a wire and any grounded element of a pylon are also recommended measures to reduce bird and bat fatalities through collisions and electrocution.

A BMMP should also be developed as part of IFC-aligned ESIA.

10.9.2.3 Risk of injury or death to fauna during construction

10.9.2.3.1 Description of impact

According to the National Institute of Statistics and Geography (INEGI), of Land Use and Vegetation database, the richness of fauna species potentially present in the transmission line development area that influence the presence or absence of the different types of fauna, is related to their location in the interaction between the Neotropical and Nearctic Biogeographic Regions, particularly in the biotic province of Sinaloa. It also has altitudes ranging from zero meters above sea level to above 400 meters above sea level and therefore has various types of habitats.

The Mexinol Project area comprises natural habitats: xerophytic vegetation, marine water, sarcocaule scrub, open water; and modified habitats: historic areas of mangrove swamp, annual and semi-permanent irrigated agriculture, irrigation channels, bare areas, and human settlements/urban areas. A total of 156 fauna species of terrestrial vertebrates were recorded during site surveys in December 2023. The most representative group were birds with 81% of the species recorded (10 being priority species), followed by mammals with 10.5%, reptiles with 7% and amphibians with 1.5%.

The act of clearing vegetation during the construction phase will kill or injure some sessile animals that are unable to move away from land clearing and construction activities. Herptiles and invertebrates are particularly susceptible to direct and indirect mortality during vegetation clearance because they typically have small home ranges and a sedentary lifestyle and are behaviourally prone to rely on camouflage to avoid predation rather than actively evading a threat. Nevertheless, because of the sequenced, linear vegetation clearing typical of transmission line developments, most wildlife will have the ability to detect and move away from vegetation-clearing activities and equipment.

Operation of vehicles and heavy equipment during all Project phases, but particularly during the construction stage, can result in interactions between vehicles/equipment and wildlife, possibly leading to direct mortality or injury of animals. However, this impact is expected to be infrequent because most animals in the Project area may be accustomed to vehicular traffic and habituated to avoiding it. Furthermore, work activities will be limited

to daytime hours and most vehicular mortality on wildlife occurs at night when wildlife are most active.

10.9.2.3.2 Pre-mitigation significance

The intensity of these impacts may be **medium** depending on the types of species within the Project area. The frequency may be episodic, but the duration will be short-term during the construction phase leading to a **low** magnitude and the overall the significance of this impact could be **minor** depending on the species concerned.

10.9.2.3.3 Proposed mitigation

Ensure the IFC-aligned ESIA includes mapping of habitats in accordance with PS6 habitat definitions and identifies any sensitive priority habitats or biodiversity values. The Traffic Management Plan should also include mitigations such as speed restrictions that limit the potential for vehicle-wildlife interactions.

10.9.3 Human environment

10.9.3.1 Delays and road restrictions for local road users

10.9.3.1.1 Description of impact

According to the 2016 Statistical and Geographic Yearbook by State, in 2015 the State of Sinaloa had a road length of 16,707 km (of 40% are dirt roads). A total of 1,137,857 vehicles were on the road network of which 58% were cars, 35% trucks and cargo vans, 7% motorcycles, and 1% passenger trucks. Of these vehicles, 15% were registered in Ahome and Mazatlan (INEGI, 2015).

The proposed RoW for the transmission line development will traverse two major highways (including the Navojoa – Los Mochis highway 15 and Los Mochis – Higuera de Zaragoza highway) and several minor feeder roads, as well as traverse many smaller dirt roads. During construction there may be some disruption to traffic and transport as the transmission line is developed. Construction-related traffic could potentially have impacts on road function and condition (wear and deterioration) of public and local roads used by the community. The surfaced roads in the transmission line development area are not expected to be impacted from the planned increase in vehicle movements. Movement along the unsurfaced roads is more likely to have an impact as the potential for wear and tear is much greater.

Project traffic to and from the construction areas along the RoW will consist of personnel commuting trips, chemical/waste/water/material transport, construction equipment (including cranes) and product transport. Based on a typical assumption that there would be up to three teams of ten working sequentially along the transmission line and their associated vehicles for delivery of equipment, the transmission line development could add between 20 and 30 vehicle movements (predominantly trucks and vans) per day during the early stages of equipment delivery and cement works. This would taper off during the steel erection and conductor stringing works and taper off even further during commissioning works.

Traffic and transport disruption caused by poorly managed road closures or construction works traversing roads or important access routes to agricultural land or markets could lead to secondary impacts on livelihoods and/or economic activities.

10.9.3.1.2 Pre-mitigation significance

Overall, the intensity may be **high**, but it will occur episodically and in the short-term (under one year) as construction will occur in a linear fashion and be located at any one place for only weeks/months. This result is a **very low** magnitude and overall, the significance of this impact is **minor**.

10.9.3.1.3 Proposed mitigation

The IFC-aligned ESIA should include targeted baseline traffic count data at all major intersections and crossings and the identification of routes used by farmers and agricultural production within the transmission line development area.

A Traffic Management Plan should be developed as part of the IFC-aligned ESIA process. This should outline specific procedures to minimise the impact of road closures on local road users and outline the type of community related engagement required to minimise road restrictions. The Traffic Management Plan should include specific measures to avoid road closures within key parts of the farming seasonal calendar (i.e. key market days or within harvest / planting seasons).

10.9.3.2 Risk of accidents/incidents with road users and pedestrians

10.9.3.2.1 Description of impact

The presence of Project traffic on public roads has the potential to impact community health and wellbeing. For example, increased road traffic and the movement of heavy vehicles and large loads may result in increased risks of accidents and injury to pedestrians or other road users. During the Construction stage, a typical transmission line project could have on average up to 30 daily one-way trips for construction activities in each area of the linear transmission line RoW over a course of days to weeks in each area. During the Operations stage, the Project anticipates significantly less traffic with minimal vehicles conducting one-way trips. This increased traffic activity has implications for local drivers on the roads, including a potential increase in the risk of vehicular accidents. A higher number of vulnerable people in each community, especially densely populated areas with significant number of children and elderly, elevate the potential risks.

10.9.3.2.2 Pre-mitigation significance

Due to the short-term movement of oversized vehicles and potential for traffic disruptions impacts to occur episodically and only during the construction phase this results in a **very low magnitude** and overall, the significance of this impact is **minor**.

10.9.3.2.3 Proposed mitigation

A Traffic Management Plan should be developed as part of the IFC-aligned ESIA process. This should outline specific procedures to improve road safety in and around active construction sites and planned road closures. It should ensure construction activities are limited to daylight hours to the extent practicable.

10.9.3.3 Economic displacement because of land acquisition and/or land use

10.9.3.3.1 Description of impact

Failure to identify impacts on land, land-based assets or livelihoods and failures within the land compensation process could result in unintentional economic displacement of livelihood activities or inadequate compensation measures for affected landowners leading to community grievance and community action against the Project.

The topographical surveys completed of the final transmission line route, including National Agrarian Registry (Registro Agrario Nacional, RAN) mapping of affected land boundaries to identify affected ejidatarios, identified a total of 11 Ejido communities as having land directly impacted by this proposed RoW and these have been consulted by RIC Energy (see Section 10.7) to gauge initial support for the development. All impacted landowners showed initial support for the development and were willing for the company to acquire usage rights along the proposed RoW, except for only one ejidatario who would not like additional permanent infrastructure within his land (due to the presence of the existing CFE tower on his property). RIC Energy re-aligned the route to avoid his parcel of land.

Once the tower locations and the RoW are finalised, the development will be formally discussed with affected community assemblies, and negotiations will start based on private land valuations. Land prices will be evaluated through a private appraisal, timed to coincide with contract finalisation to ensure accuracy. The RIC Energy team will ensure that property owners have up-to-date documents, RAN participation will be enforced and registered, and payments will be traceable and registered in the form of checks and/or bank deposits.

At present, indications suggest that RIC Energy will be able to buy land rights over the RoW under the “willing seller” and “willing buyer” premise at market rates or equivalent for the land considering replacement value. This will be independently verified during the preparation of the IFC-aligned ESIA in accordance with IFC PS5 prior to commencement of construction. This is especially important since initial GIS analysis conducted as part of E&S screening for this ESIA found a total of 11 hectares of specific higher value lands such as orchards within the RoW. As transmission line easements typically place some restrictions on land use for safety reasons (i.e. restricted tree height due to higher risks of arcing / fire), these land uses may become restricted. In these instances, RIC Energy will explore design avoidance options (higher conductor line, or micro-re-routing) to ensure no land-based livelihoods or economic activities are impacted.

10.9.3.3.2 Pre-mitigation significance

Should these impacts occur the intensity of these impacts would be **high,** and the frequency will be continuous over the long-term leading to a **high** magnitude rating. While these impacts are unlikely given RIC Energy’s intention to use avoidance, the overall the significance of this impact could be **minor to major** depending on the sensitivity of land units or livelihoods concerned.

10.9.3.3.3 Proposed mitigation

The IFC-aligned ESIA shall include socioeconomic data of the 11 identified communities within the Project area (RoW and substation). This includes such data as (i) population; (ii) demographic characteristics; (iii) physical locations; (iv) income level and sources; (v)

health conditions; (vi) educational attainment levels; (vii) access to health and education services and facilities; (viii) governance and decision-making structure at the community and local government levels ; (ix) use and access of local natural resources; (x) community land use patterns and ; (xi) key livelihood activities; and (xii) current perception on the project and key concerns..

Although assessed as unlikely given the final Transmission Line routing and the Project's avoidance hierarchy, should the IFC-aligned ESIA determine that the project may result in temporary or permanent economic displacement due to construction activities or RoW land acquisition, a Livelihood Restoration Plan (LRP) should be developed in advance of construction. Economic displacement could be the result of individuals losing business, income or suffering temporary effects, such as disturbance to land or crops, during construction.

The LRP must follow guidance as provided for IFC PS5 which stipulates that displaced communities and people must be offered compensation for the loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods. The LRP must include the following:

- Define national and international requirements for physical and economic resettlement, as applicable, identify any gaps between national requirements and those of the IFC PS 5, and determine how to bridge those effectively.
- Document a process for cut-off date for compensation planning purposes; census of affected people and households; detailed inventory of affected assets; eligibility for compensation entitlements; specific types and amounts of compensation to be provided, including cash compensation rates and conceptual plans or designs for any replacement assets; and implementation.
- Prepare and implement an engagement plan with those affected and other stakeholders.
- Include a feedback mechanism to receive and resolve concerns related to economic resettlement.
- Design supportive measures, including those relating to livelihood restoration, vulnerable persons support, and any other appropriate assistance that are not included in regulation.
- Implement monitoring and evaluation of the implementation process.

Throughout the LRP implementation, specific objectives should be defined as follows:

- Continue to engage with those affected.
- Undertake individual negotiations and sign individual agreements which detail eligibility, entitlements, and supportive measures as defined by Mexican law and in the LRP.
- Finalise entitlement arrangements, including processes for compensation, plans/designs/construction of any replacement assets, purchase of any replacement lands, etc.
- Finalise supportive measures, including implementation arrangements.
- Deliver entitlements to those affected and secure/access land for Project use.

10.9.3.4 Damage to crops during RoW management

10.9.3.4.1 Description of impact

During operations the RoW will require intermittent vegetation management which will involve site access across a largely agrarian landscape. There is a risk that such maintenance activities may result in damage to crops, resulting in potential grievances for affected landowners.

10.9.3.4.2 Pre-mitigation significance

The intensity of these impacts could be **high**. The frequency will be episodic over the long-term leading to a **medium** magnitude and the overall the significance of this impact could be **moderate** for affected landowners.

10.9.3.4.3 Proposed mitigation

As part of the IFC-aligned ESIA, Grievance Mechanism and Stakeholder Engagement Plan will be prepared that aligns with best-international practice in order to handle such potential grievances.

10.9.3.5 Disturbance to known or unknown archaeological and cultural heritage resources

10.9.3.5.1 Description of impact

The proposed RoW avoids all impacts to the known scared sites or natural resources of indigenous peoples within surrounding lands. While the transmission line does span the Fuerte River (a collective natural resource with spiritual significance for the Yoremes), the transmission line spanning will be done to avoid any impacts to the riverbanks or river. However. construction activities could result in disturbance to archaeological and cultural heritage resources if they are hitherto unknown or not clearly demarcated.

10.9.3.5.2 Pre-mitigation significance

The intensity of these impacts could be **high** depending on the nature of the construction activities concerned. Due to the short-term nature of the construction period a **medium** magnitude of impact is predicted. Sensitivity ratings for impacted cultural heritage or archaeological sites may range from **very low to high** depending on the inherent value of the resources present. As a result, overall impacts may also range from **minor to major**.

10.9.3.5.3 Proposed mitigation

The IFC-aligned ESIA should include a Cultural Heritage Management Plan, and a Chance Find Procedure (CFP) as required by IFC PS8 which identifies all tangible and intangible cultural heritage sites.

Table 10.6: Key environmental and social impact summary

Potential impact	Phase (Construction / Operations)		Type of impact	Intensity	Frequency	Duration	Anticipated Significance			Mitigation measures (at a minimum, as the IFC-aligned ESIA will likely provide more detailed mitigations based on the full assessment)	Anticipated Residual Significance (post-mitigations)
	Construction	Operations					Magnitude	Sensitivity	Significance		
Physical environment											
Soil erosion during construction	✓		Negative, direct	The intensity of these impacts will be moderate. The frequency will be temporary during construction and linear in nature with impacts primarily restricted to the RoW. The magnitude and the overall the significance of this impact could be minor to moderate depending on the properties of the soils concerned.			Moderate	Moderate	**Moderate to minor**	• A soil management plan should be prepared as part of the IFC-aligned ESIA • Limit clearance of vegetation in the RoW as far as possible and only as necessary to allow for stringing of cables. This soil management plan should also: • specify that unnecessary soil excavations are avoided and opt for manual tasks when feasible and safe. • develop measures to strengthen the steep slopes with vegetation, grass and plants, or gabions. • control soil excavations to ensure they are necessary for required activities. • specify measures to restore landscapes to their near original conditions after the completion of works and after use of quarries or borrow pits as well as restoring the vegetation cover in accordance with the design constraints of transmission lines.	Negligible to Minor
Soil compaction as a result of construction vehicles during construction and RoW maintenance during operations	✓	✓	Negative, direct	The intensity of these impacts will be moderate. The frequency will be temporary during construction and linear in nature with impacts primarily restricted to the RoW. The magnitude and the overall the significance of this impact could be minor to moderate depending on the sensitivity of soils.			Moderate	Moderate	**Moderate**	• A soil management plan should be prepared to address soil compaction during construction and operations. • A Traffic Management Plan should be developed as part of the IFC-aligned ESIA that specifies that the development should use existing access roads/tracks where possible. The Traffic Management Plan should specify: • No roads accessing or within the RoW to be hard surfaced. • Decompaction of soil within the RoW following construction to match soils outside of RoW. • Clean and level only the necessary terrain, optimizing earth movement. • Minimise soil compaction by reducing machinery transit and material storage areas.	Minor

Potential impact	Phase (Construction / Operations)						Anticipated Significance			Mitigation measures (at a minimum, as the IFC-aligned ESIA will likely provide more detailed mitigations based on the full assessment)	Anticipated Residual Significance (post-mitigations)
	Construction	Operations	Type of impact	Intensity	Frequency	Duration	Magnitude	Sensitivity	Significance		
										• Avoid levelling and compacting unused soil portions to minimise impacts on soil quality and worker safety. •	
Soil and surface water contamination because of construction of access roads, tower positions and borrow pits or quarries	✓		Negative, direct	The intensity of these impacts will be low to high depending on the status of the soil or water course concerned. The frequency will be episodic during construction. The magnitude and the overall the significance of this impact could be minor to moderate depending on the spill event.			Moderate to minor	Moderate	**Moderate to minor**	• A Waste Management Plan should be developed as part of the IFC-aligned ESIA. • All hazardous materials should be stored in such a way to prevent contamination on site. • Refuelling of plant should be undertaken at construction camps to limit the potential for spillages and in no circumstances near watercourses.	Minor
Degradation of groundwater quality or alteration of flow during piling activities, affecting local water users and ecosystems	✓		Negative, direct	The significance of this potential impact has not been assessed and technical specifications alongside additional baseline determination and risk assessment is required to provide adequate mitigation.			tbd	To be determined once final design parameters are known	Minor to Major	• A piling risk assessment is recommended to evaluate potential impacts to groundwater. • This should include the collection of baseline data on the aquifer that will be penetrated during piling and the potential receptors. It should address impacts due to potential contamination of groundwater by concrete, cement paste or grout as well as potential impacts to groundwater flow. The contractor should be informed on the risks to implement the necessary measures to protect groundwater.	Minor to Moderate
Temporary air quality deterioration during construction	✓		Negative, direct	Emissions will be short-term and localised to the site therefore the intensity will be low, the frequency over the construction phase and episodic during RoW maintenance and therefore be long-term leading to a medium magnitude. The overall the significance of this impact could be moderate or minor depending on proximity to social receptors.			Moderate	Moderate	**Moderate to minor**	• An Air Quality Management Plan should be developed as part of the IFC-aligned ESIA. • This should include a plan for Construction Fugitive Dust Control and the implementation of dust suppression on gravel roads to and on site. • A Biodiversity Management Plan should also be developed which restrict clearing of access tracks or roads to the RoW. • RIC Energy should ensure that its own vehicles and contractor plant machinery are serviced in accordance with manufacturers specifications to minimise emissions.	Minor
Increased noise levels due to construction activities	✓		Negative, direct	The severity of this impact is likely to be reduced due to the rural setting and low numbers of social receptors near the RoW. The overall the significance of this impact could be moderate or minor			Moderate	Moderate	Moderate to minor	• A detailed noise assessment to international standards should be performed to inform micro-re-routing as part of the IFC-aligned ESIA process.	Minor

Potential impact	Phase (Construction / Operations)		Type of impact	Intensity	Frequency	Duration	Anticipated Significance			Mitigation measures (at a minimum, as the IFC-aligned ESIA will likely provide more detailed mitigations based on the full assessment)	Anticipated Residual Significance (post-mitigations)
	Construction	Operations					Magnitude	Sensitivity	Significance		
				depending on proximity to social receptors.						• A Noise Management Plan should also be developed as part of the IFC-aligned ESIA which: • ensures all powered mechanical equipment and machinery are fitted with noise abating gear, such as mufflers for effective sound reduction, in full compliance with the applicable regulations. • where possible, the operation of heavy equipment should be limited to daylight hours. • reasonable mitigation measures may be required, such as installing acoustic screens to minimise noise near noise-sensitive areas.	
Biodiversity											
Permanent loss of vegetation in the RoW and modification of wildlife habitats	✓	✓	Negative, direct	The intensity of these impacts will be high. The frequency will be continuous over the long-term as the RoW will require vegetation management leading to a high magnitude and the overall the significance of this impact could be minor to major depending on the sensitivity of habitats concerned.			High	Very low to High	**Minor to Moderate**	• Further biodiversity assessment studies should be undertaken as part of the pre-development phase within the MIA. • These should be supplemented via the Performance Standards aligned ESIA and a BMMP should also be developed.	Minor
Increased bird and bat fatalities through collisions and electrocution		✓	Negative, direct	The intensity of these impacts may be high depending on the species concerned. The frequency may be episodic, but the duration will be long-term leading to a medium magnitude and the overall the significance of this impact could be moderate or major depending on the species concerned.			Medium	Very low to High depending on species concerned	**Minor to Major**	• Targeted survey as part of the IFC-aligned ESIA to assess presence of birds prone to collision to determine optimal location of bird deterrents on the line • Terrestrial survey to determine stopover locations • BMMP should also be developed.	Minor to Moderate
Construction activities may also modify natural habitats through degradation and introduction of alien species (i.e. via heavy plant machinery access and movement)	✓		Negative, direct	The intensity of these impacts may be high depending on the construction activities concerned. The frequency may be episodic, but the duration will be short-term leading to a Low magnitude and the overall the significance of this impact could be minor or moderate depending on the sensitivity of habitats concerned.			Low	Low to high	**Minor to moderate**	• Further biodiversity assessment studies should be undertaken as part of the pre-development phase within the MIA. • These should be supplemented via the Performance Standards aligned ESIA and a BMMP should also be developed.	Minor

Potential impact	Phase (Construction / Operations)		Type of impact	Intensity	Frequency	Duration	Anticipated Significance			Mitigation measures (at a minimum, as the IFC-aligned ESIA will likely provide more detailed mitigations based on the full assessment)	Anticipated Residual Significance (post-mitigations)
	Construction	Operations					Magnitude	Sensitivity	Significance		
Socio-economic											
Delays and road restrictions for the local road users due to increased construction traffic	✓		Negative, Direct	Overall, the intensity may be **high**, but it will occur **episodically** and in the **short-term** (under one year) as construction will occur in a linear fashion and be located at any one place for only weeks/months. This result is a very low magnitude.			Very Low (1)	Medium (3) as longer periods of exposure for human receptors may exist if a construction site yard/laydown area is established	**Minor (3)**	• A Traffic Management Plan should be developed as part of the IFC-aligned ESIA process. • This should outline specific procedures to minimise the impact of road closures on local road users.	Negligible to Minor
Risk of accidents/incidents with road users and pedestrians due to increased construction traffic	✓		Negative, Direct	Overall, the intensity may be medium. but due to the short-term movement of oversized vehicles and potential for traffic disruptions impacts will occur episodically and only during the short-term construction phase resulting in very low magnitude.			Very Low	Medium since major highways and feeder roads are used by local communities and serve agricultural areas	**Minor**	• A Traffic Management Plan should be developed as part of the IFC-aligned ESIA process. This should outline specific procedures to minimise the impact of road closures on local road users.	Negligible to Minor
Economic displacement of individuals or households due to loss of access to land-based assets or livelihoods without adequate compensation	✓	✓	Negative, Direct	If compensation is inadequate or not aligned with IFC PS5, the effect on affected livelihoods could be long-term. Overall, intensity of these impacts would be high, and the frequency will be continuous over the long-term leading to a high magnitude rating.			High	High since the route intersects productive agricultural land, commercial agribusinesses, and orchard areas and people would experience significant impacts if compensation were delayed or inadequate.	**Moderate to Major**	• Should the Transmission Line ESIA determine that the project may result in temporary or permanent economic displacement due to construction activities or RoW land acquisition, a Livelihood Restoration Plan (LRP) should be developed in advance of construction. • The LRP must follow guidance as provided for IFC PS5 which stipulates that displaced communities and people must be offered compensation for the loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods.	Minor to Moderate
Health impacts (e.g. dust, air emissions, noise) on nearby communities due to exposure to construction activities (e.g., piling, traffic)	✓	✓	Negative, Direct	Emissions will be short-term and localised to active construction sites therefore the intensity will be low**,** the frequency over the construction phase and episodic during operations (i.e. RoW maintenance). Therefore, impacts have potential to be long-term leading to a **medium** magnitude.			Medium	Currently high since some social receptors, including residential properties, schools, and an indigenous community, lie near the direct impact zones until avoidance options are fully explored.	**Minor to Moderate**	• Conduct an air quality impact assessment to international standards and ensure micro-realignment options are fully explored • An Air Quality Management Plan should be developed as part of the IFC-aligned ESIA • Develop and implement a Community Health and Safety Management Plan. • Integrate air quality, noise and vibration control measures into the IFC-aligned ESIA ESMP. • Ensure the SEP includes communication about potential health risks and mitigation measures with affected stakeholders.	Minor

Potential impact	Phase (Construction / Operations)		Type of impact	Intensity	Frequency	Duration	Anticipated Significance			Mitigation measures (at a minimum, as the IFC-aligned ESIA will likely provide more detailed mitigations based on the full assessment)	Anticipated Residual Significance (post-mitigations)
	Construction	Operations					Magnitude	Sensitivity	Significance		
										• Monitor ambient noise and air quality during construction near identified sensitive locations.	
Potential health effects (e.g., noise) from corona discharge and EMF associated with high-voltage transmission lines		✓	Negative, Direct	Intensity of impact could be **high** if there is not adequate capacity in the line to mitigate the corona effect. Frequency will be continuous over the long term.			tbd	To be determined once final design parameters are known	**Minor to Major**	• A detailed noise assessment to international standards should be performed to inform micro-re-routing as part of the IFC-aligned ESIA process. • Assessment of the potential exposure to the public to EMF should be completed against the reference levels, which are developed by the International Commission on Non-Ionizing Radiation Protection. • A Community Health and Safety Management Plan should be developed and implemented • Ensure the SEP includes communication about potential health risks and mitigation measures with affected stakeholders. • Monitor ambient noise and air quality during construction and operation near identified sensitive locations.	Minor to Moderate

10.10 Recommendations

The desktop screening of key E&S impacts from the Project's associated facility completed as part of this ESIA identified several main priority E&S issues. The primary concerns identified during the E&S screening process were related to potential for noise at sensitive receptors, bird or bat species prone to collision, impacts to surrounding communities related to traffic, impacts to landowners and land-based economic activities, location of commercial and residential buildings within the current proposed RoW. To address key identified E&S impacts and risks and support overall conformance with applicable IFI standards, the Company/Transition Industries should utilise available contractual influence with RIC Energy to ensure the following key recommendations are taken for further action:

- Micro-routing to avoid impacts to identified sensitive receptors (see Section 10.6).
- Conduct an IFC-aligned ESIA which includes a detailed assessment of E&S risks and impacts per requirements of IFC PSs and WBG EHS General Guidelines and WBG EHS for Electric Power Transmission and Distribution.
- As part of the ESIA focus among other aspects focus should be on noise assessment of background noise levels, sensitive social receptors and potential construction and operation phase noise impacts (incl. corona noise discharge and EMF) (See Section 10.9.1).
- Based on ToRs agreed with IFC, conduct an electrocution and/ or collisions risk assessment, as part of an IFC-aligned ESIA to determine potential mitigation measures (i.e. optimal location of bird's deterrents on the line) for inclusion in a BMMP for the project. (See Section 10.9.2).
- Assess the presence of sensitive terrestrial habitats within the proposed RoW, identify potential direct and indirect impacts, and determine potential mitigation measures for inclusion in a BMMP for the project (See Section 10.9.2).
- Complete a detailed cultural heritage and archaeology assessment as part of IFC-aligned ESIA to evaluate potential impacts and risks to known or hitherto unknown archaeology and cultural heritage values and include a chance finds procedure in the ESMP (See Section 10.9.3).
- Conduct targeted socioeconomic baseline and impact assessment to determine any temporary or permanent impacts to economic activities (e.g., agricultural land) and if necessary, develop a Livelihood Restoration Plan within the ESMP which conforms to IFC PS5 (See Section 10.9.3).

11 CUMULATIVE IMPACT ASSESSMENT

11.1 Introduction

This section assesses cumulative impacts. Cumulative impacts result from the successive, incremental and/or combined effects of a project or activity, when added to other past, existing, planned and/or reasonably anticipated future ones (IFC, 2013). As discussed in Section 10, the Transmission Line scope of work will include a CIA and once detailed routing and the ESIA for the TL becomes available, this chapter will be updated if the new information materially alters the conclusions of the current assessment; otherwise, the existing CIA will remain valid.

11.2 Approach

Cumulative impacts have been identified and assessed in accordance with the 'IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets' (2013). The IFC Good Practice Handbook (GPH) uses a six-step approach to cumulative impact assessment (CIA), as presented in Figure 11.1. This approach is described in more detail in the sections below.

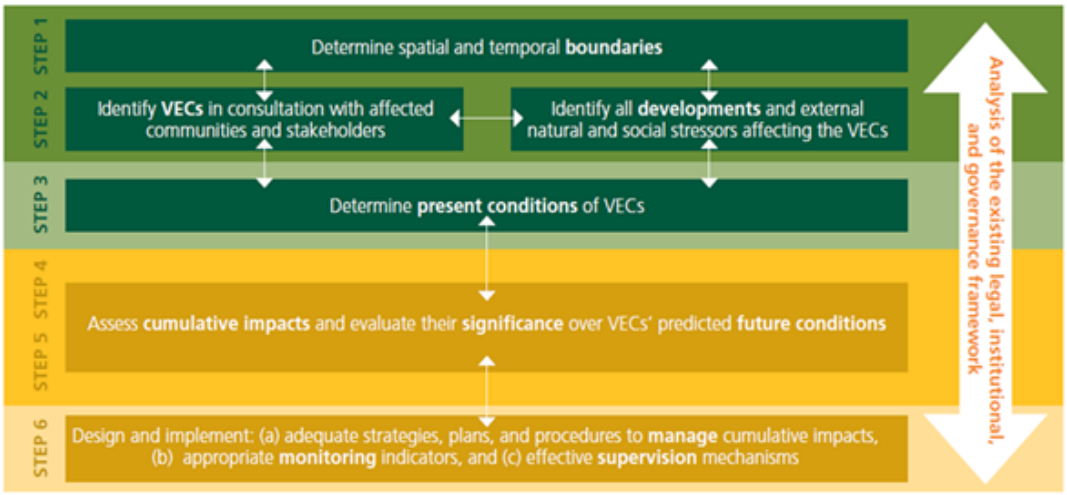

Figure 11.1: IFC cumulative impact assessment process

Source: IFC (2013)

It should be noted that the GPH suggests that government and regional planners have ultimate responsibility for CIA. However, it is recognised that there can be challenges to managing the CIA process through government-led avenues, such as limited government capacity or the absence of strategic regional, sectoral or integrated resource planning schemes. It can therefore be in the best interest of the developer, i.e. Transition Industries, to lead the CIA process and recommend management measures to address cumulative impacts.

11.2.1 Defining the AoI (Step 1)

For the CIA, the same AoI is used as the Project impact assessment described in the previous sections (see Section 5.1.1). The temporal boundary of the CIA is the lifetime of the Project as this is the duration of potential impacts on receptors.

In addition, a precautionary study area around the Project footprint in the municipality of Ahome has been used to identify third-party projects that have the potential to lead to cumulative impacts. The CIA study area, shown in Figure 11.2 is a radius of approximately 15 km around the Project footprint and including the transmission line, which is an associated facility, see section 11.2.4.1. This area encompasses the Project AoIs mentioned above.

It should be noted that unplanned/accidental events are not considered in this CIA as the likelihood of simultaneous large-scale events is considered too remote.

Figure 11.2: CIA study area around the Project site for identifying third-party projects

11.2.2 Stakeholder engagement (Step 2)

Stakeholder engagement has been carried out with national, regional, district and community level stakeholders (see Section 6) throughout the ESIA process. During stakeholder engagement, questions were posed to community members regarding their use of natural resources and their perception of the Project, including their thoughts on potential positive and negative impacts. The output from this engagement has been used to identify E&S concerns and potential sources of cumulative impact in the AoI and study area.

11.2.3 Valued environmental and social components (Step 3)

The IFC GPH defines valued environmental and social components (VECs) as "environmental and social attributes that are considered important in assessing risks" (IFC, 2013). These attributes may be:

- physical features, habitats, wildlife populations (e.g., biodiversity)
- ecosystem services (e.g., provisioning, regulating, cultural, and supporting services)
- natural processes (e.g., water and nutrient cycles, microclimate)
- social conditions (e.g., health, economics)
- cultural aspects (e.g., traditional spiritual ceremonies).

In accordance with the IFC GPH, the following criteria for the identification of VECs (or receptors) has been defined:

- identified as important and/or sensitive in this ESIA (see Section 5 and 8)
- identified as important by the national/international scientific community, i.e., meeting the GPH criterion that a VEC should be recognised as important based on scientific concern
- identified as important or sensitive by stakeholders, see Section 6.5 and the Stakeholder Engagement Plan.

A list of the identified VECs used for the CIA is presented in Table 11.1. The baseline condition of each VEC is included in the previous sections above. Note, not all the receptors included in Section 5 have been included in the CIA, only those that meet the criteria outlined above.

The thresholds, limits of acceptable change, or preferred condition required by the GPH are defined in Table 11.1 on a case-by-case basis depending on the receptor and the nature of the cumulative impact being assessed. Where objective threshold values are identified by legislation, or by the IFC guidelines, these have been adopted (if relevant to the cumulative impact). For most receptors, however, threshold values are not defined, and limits of acceptable change or preferred condition have been used instead.

Table 11.1: VECs considered in the CIA

VEC	Reason for inclusion	Threshold / limit of acceptable change / preferred condition
Physical environment		
Climate	This VEC is the global climate, including greenhouse gas emissions.	Mexico's ability to meet its emission reduction target published as part of the UNFCCC's Paris Agreement is not impacted.
Surface water, including Bay, quality	Surface water bodies, including the Bay of Ohuira, are located within the Project AoI. The Bay of Ohuira is important for fishing and other livelihood activities. Questions and feedback related to perceived abstraction and discharge of a treated effluent via JAPAMA lagoons to the bay, creeks or canals have been raised during Project-led stakeholder engagement.	No impact to pre-construction channel morphology and stability, bay water quality and drainage patterns.
Biodiversity		
Legally protected, internationally or nationally recognised areas	Areas that are internationally or nationally recognised or legally protected within the Project AoI, such as the Lagunas de Santa María-Topolobampo-Ohuira and Bahia Lechuiguilla Ramsar/IBA Site; Lagunas de Santa María-Topolobampo-Ohuira, part of the Ilas de Golfo de California complex; Topolobampo-Caimanero Marshes (RTP-22); and the Priority Hydrological Region.	The limit of acceptable change is there will be no impacts to the integrity or ecological function of a protected area from the combined effects of the Project and other developments.
Natural habitats, priority flora, priority birds and non-priority fauna and birds	Natural habitats and priority flora and birds are recorded in the Project AoI, including species that are protected at national level and those that are classified by the IUCN as Vulnerable or Near Threatened. Concerns regarding potential deforestation of mangroves were raised during Project-led stakeholder engagement.	The preferred condition is that the number of priority species and individuals remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.

VEC	Reason for inclusion	Threshold / limit of acceptable change / preferred condition
Socioeconomic		
Economy and social cohesion	Potential for Project-induced cost of living increases and inflationary pressure due to procurement and workforce employment. The significance of impacts from inflationary pressure is greater for vulnerable groups.	The preferred condition is for the standards of living of communities in the AoI to be equal to, or better than, before construction.
	High expectations for business opportunities and employment benefits exist within AoI communities. The possibility of infrastructure developments leading to increased employment opportunities and better wages was raised during Project-led stakeholder engagement. Potential for increased competition within local labour market and pressure for local skilled labour.	Trends of availability of labour for vulnerable competing sectors (e.g. agriculture/fishing) maintained at pre-construction rates.
	Intra-community cohesion can be poor, resulting in potential for increased conflict if benefits are not equitably shared. Specifically, potential impacts on Indigenous People include social tensions and conflict related to access to Project economic benefits (see Section 8.3.1.1). Concerns were raised during Project-led stakeholder engagement by community groups regarding the development of third-party infrastructure projects, and related division in social unity among community members.	Pre-construction trends in community conflict, opposition and protest related to proposed petrochemical projects should not be increased.
	Increased gender disparity caused by higher male employment uptake, considered a crosscutting issue (see Section 8.3.1.3).	Current trends of women's participation within the labour force to be at least maintained at pre-construction rates.
Infrastructure and services	Worker influx and related in-migration placing additional burden on social infrastructure and services, in particular waste management, accommodation, sanitation, healthcare, education etc.	The limit of acceptable change is defined as no significant deviation from current trends related to the original condition of social infrastructure and level or quality of service provision before construction.

VEC	Reason for inclusion	Threshold / limit of acceptable change / preferred condition
Community health, safety and security	Increased traffic and reduced road safety a potential concern for community health and safety, particularly during construction.	The preferred condition is for current roadway level of service to be maintained and there to be no discernible reduction in road safety compared to pre-construction.
	Inherently high risks associated with gender-based violence and harassment (GBVH) within the AoI at societal level.	The preferred condition is there should be no discernible increased rates of GBVH, compared to pre-construction levels.
Cultural heritage and Indigenous People	Tangible and intangible cultural heritage elements present within the AoI, including sites linked to religious values (i.e. funeral gardens, churches and death memorials) and distinct Mayo-Yoreme peoples (Indigenous People), cultures and traditions. Influx of workers from outside the municipality may weaken local customs and cultural practices or traditions.	The preferred condition is for all tangible cultural heritage elements to be preserved in situ and current trends of participation in cultures, traditions and practices of Indigenous Peoples are not exacerbated.
Ecosystem services	Ecosystem services are a valued environmental component for stakeholders (see Table 5.35 in Section 5.4). There are ecosystems found within the AoI that provide important ecosystem services to affected communities and the Project (i.e. mangroves providing fish breeding grounds and shoreline protection from storm surges). There may be impacts upon cultural services related to worker in-migration and Project-related influx.	The preferred condition is there should be no discernible impacts to ecosystems, compared to pre-construction levels. For cultural ecosystem services, refer to the row above which details the preferred condition for intangible cultural heritage.

11.2.4 Defining the sources of cumulative impacts (Step 4)

A source of potential cumulative impact is something that affects the condition of the identified VECs.

Cumulative impacts in the study area, as defined in Section 11.2.1, potentially occur from the combined impacts of Project activities with other activities. These include:

- the transmission line (associated facility)
- past and existing third-party projects that continue to affect the current and predicted future of the receptor
- reasonably defined/foreseeable third-party projects
- developments or activities induced by the Project
- other sources of human and natural stressors on the receptors.

11.2.4.1 Associated facilities

IFC PS 1 (IFC 2012a) defines associated facilities as:

"Facilities that are not funded as part of the project, would not have been constructed or expanded if the project did not exist and without which the project would not be viable".

IFC Guidance Note 1 (IFC 2012b), clause 52 states that:

". . . the client should normally have some commercial leverage on the operators of such [associated] facilities. Where such leverage allows, undertakings can be secured from these operators to operate their facilities consistent with the applicable Performance Standards. In addition, the client should identify its own actions, if any, that could support or supplement the actions of the operators of the associated facilities."

One associated facility, **a 400 kV transmission line**, has been identified in consultation with Transition Industries, and is shown in Figure 11.3. The proponent is RIC Energy.

The transmission line will connect the new 500 megavolt-amperes (MVA) Methanol Production Plant substation to the existing *Comisión Federal de Electricidad (CFE)* Choacahui Power Substation. Connection and reinforcement works are required by the Centro Nacional de Control de Energía (CENACE). Upgrades to the Choacahui Power Substation may include an expansion of the substation bay and replacement of interrupters and electrical breaks. The transmission line will have an approximate length of 43 km. The RoW for the transmission line will be 25 m wide. Two power switches and associated primary equipment will also be installed and commissioned within the Choacahui Substation. The typical workforce for the requirements of this type of project is around 200 technically qualified individuals. The transmission line project will abide by CFE guidelines, procedures and frameworks *(NORMA Oficial Mexicana, NOM)* with regards to safety and security for high voltage transmission lines and step-down substations, and the IFC PS, whichever is more stringent.

See Section 3.13 for further details.

As part of the contract between Transition Industries and RIC Energy, Transition Industries may stipulate that all Project phases of the transmission line are conducted in line with international standards, specifically IFC PS, to align with the Mexinol Project.

This includes undertaking a CIA as part of the ESIA for the transmission line (see Section 11.4.1). Gaps between the NOM and IFC PS should be identified during screening, and the more stringent regulations or standards applied. This should be monitored during all phases of the projects, for example, through auditing.

11.2.4.2 Past and present activities

The CIA study area is in the Ahome region in the State of Sinaloa; there are several different past and present activities in the area that are relevant to the CIA. The main economic activity in the Sinaloa State is agriculture and there is commercial agricultural land within the study area. Fishing is also an important economic activity in the Municipality of Ahome, with fisheries located along the coastline. The Municipal Development Plan (2021-2024) *(Plan Municipal de Desarrollo 2021-2024)* details development strategies for both agriculture and the fisheries sector. See Sections 5.4.3.11 and 5.4.3.12.

Tourism is an increasingly important economic activity in Sinaloa and has seen visible growth around the Topolobampo area and Los Mochis. For example, the Chihuahua-Pacific train (often referred to as the 'Chepe' train) runs 653 km from Los Mochis, Sinaloa to Chihuahua City in the neighbouring state of Chihuahua. The train provides tourists with an opportunity to travel through sites such as the Copper Canyon and historical city of El Fuerte. Additionally, there are initiatives reported to encourage cruise ships to the Port of Topolobampo (Debate, 2023; Noroeste, 2023). See Section 5.4.3.13 for further information on the tourism sector.

In and around Los Mochis, there is ongoing urban development including residential buildings, commercial developments such as hotels, shopping plazas and offices, as well as hospitals. The study area also includes the Los Mochis – Topolobampo Corridor, which is specified in an urban development plan (Corridor Plan, 2018) as land intended for industrial development and limited retail trade, and the development of housing is not encouraged in this area.

Existing third-party facilities and activities are assumed to be covered by the ESIA baseline (see Section 5). However, past and existing third-party projects that continue to affect the current and predicted future of VECs are discussed where appropriate.

Past and present activities considered in this CIA include:

- **the upgrade and expansion of the bulk dock** position number 3 to a length of 300 m at the Port of Topolobampo, including expansion of railway spurs and access roads to the port
- **operational activities at the Topolobampo III Combined Cycle Power Plant**, which has two gas turbines, one steam turbine, two to three heat recovery units and one open cooling system with sea water, with a net capacity of 779 megawatts (MW)
- **all operational activities at the Topolobampo port**, such as the PEMEX oil and liquefied petroleum gas (LPG) facility and docks; the Sempra refined fuels terminal operated by IEnova; facilities for handling of bulk products operated by Triple T; the ISAOSA fertilisers terminal; and the existing Amacendora fertilisers warehouse.

Screened in activities are shown in Figure 11.3.

11.2.4.3 *Planned third-party developments*

Planned third-party developments have been identified (within the study area defined in Section 11.2.1) based on the IFC definitions that projects are reasonably defined, reasonably predictable or foreseeable[173].

Third-party developments were identified by:

- request for information to the Ahome Municipality Economic Development Officer
- review of district development plans and national development plans, for example the *Plan Nacional de Infraestructura*, 2019-2024
- review of international finance institutions' (IFI) websites for projects receiving or applying for funding
- review of other publicly available information on key developments in the region, such as websites of known developers and the press
- consultation with stakeholders and with Transition Industries.

Figure 11.3 presents the projects that have been screened into the CIA (i.e., they are reasonably defined, reasonably predictable or foreseeable). A brief description of the projects that have been screened in is provided below:

- **Gas y Petroquimica de Occidente Topolobampo Complex (GPO) (Gas y Petroquimica de Occidente SA de CV, a subsidiary of Proman AG)** – a gas and petrochemical complex to be constructed in Topolobampo on an area of 40 hectares (ha), to include a 2,200 metric tons/day anhydrous ammonia plant.

  The complex will use natural gas as its key feedstock and is expected to commence commercial operations in 2026. A methanol plant and urea plant have also been announced as future plans for the GPO complex, although details of these plants are limited at the time of writing.

- **Vista Pacifico Liquefied Natural Gas (LNG) (Sempra Infrastructure)** – the LNG terminal is likely to be comprised of a 4 million tonnes per annum (mtpa) liquefaction unit, a 180,000-cubic-metre tank, an LNG jetty and other related facilities. Additional LNG liquefaction trains are also under consideration. The facility would concentrate on sending LNG cargoes from Topolobampo to markets in Asia; it is estimated that Vista Pacifico LNG would export about 4 million metric tons of LNG per year. It expects to begin exports in 2027.

The *Plan Nacional de Infraestructura*, 2019-2024 was reviewed, which included a vision for planned infrastructure and programs nationwide, such as the installation of wireless internet coverage across the country. However, at the time of writing they have not been taken into consideration in the CIA due to lack of project detail available at the time of writing.

11.2.4.4 *Induced development of facilities and services*

The CIA considers Project-induced development. Induced development comprises impacts from non-project activities that are encouraged to happen because of the Project

[173] Definition of projects that are "reasonably defined", taken from IFC Performance Standard 1 (IFC, 2012a). Definition of projects that are "reasonably predictable" or that are "foreseeable future developments", taken from the IFC GPH.

and that would not occur in the absence of the Project. For example, new/opportunistic businesses (not directly supported by the Project) established to cater for an increased number of construction workers in the area.

11.2.4.5 Other sources of human and natural stressors

Receptors are exposed to stresses, threats and pressures that are not directly connected with formal development. Consequently, they have not been considered as a source of cumulative impact and are assumed to be described in the baseline sections in Section 5.

Figure 11.3: Location of third-party projects and associated facility screened into the CIA

11.2.5 Impact assessment (Step 5)

For an impact to be assessed as cumulative, the Project AoI and the source of cumulative (SCI) impact AoI must overlap, and the impacts must occur in the same timescale. See Figure 11.4.

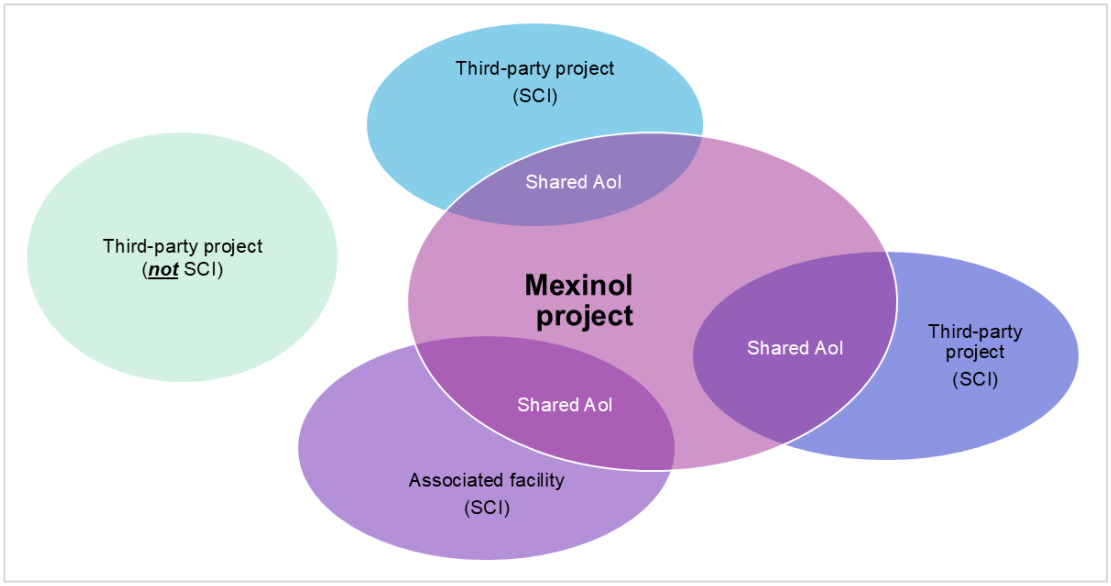

Figure 11.4: Schematic of shared AoIs

Where available information on SCIs is limited, professional judgement has been used to predict the impacts from these developments.

The significance of cumulative impacts has been determined qualitatively based on a predicted exceedance of VEC thresholds, limit of acceptable change or preferred condition as recommended by the GPH. The cumulative impact assessment is presented in Section 11.3.

11.2.6 Management and monitoring (Step 6)

The final step of the IFC GPH CIA process is concerned with designing and implementing the management and monitoring measures required to prevent significant cumulative impacts (i.e., above the threshold, or outside the limits of acceptable change) from occurring. If they are not avoidable, any adverse impact should be reduced as far as reasonably practicable. A distinction has been drawn, as discussed in the GPH, between management of significant cumulative impacts associated with the Project (where it can be expected that Transition Industries has a high degree of control or influence over mitigation/management) and management of impacts outside of Transition Industries' control (because other third-party projects are the main cause of the cumulative impact). Figure 11.5, taken from the GPH, illustrates this difference and suggests how management/mitigation should proceed ideally, depending on whether the Project has control or can exercise leverage, to achieve optimal cumulative impact management.

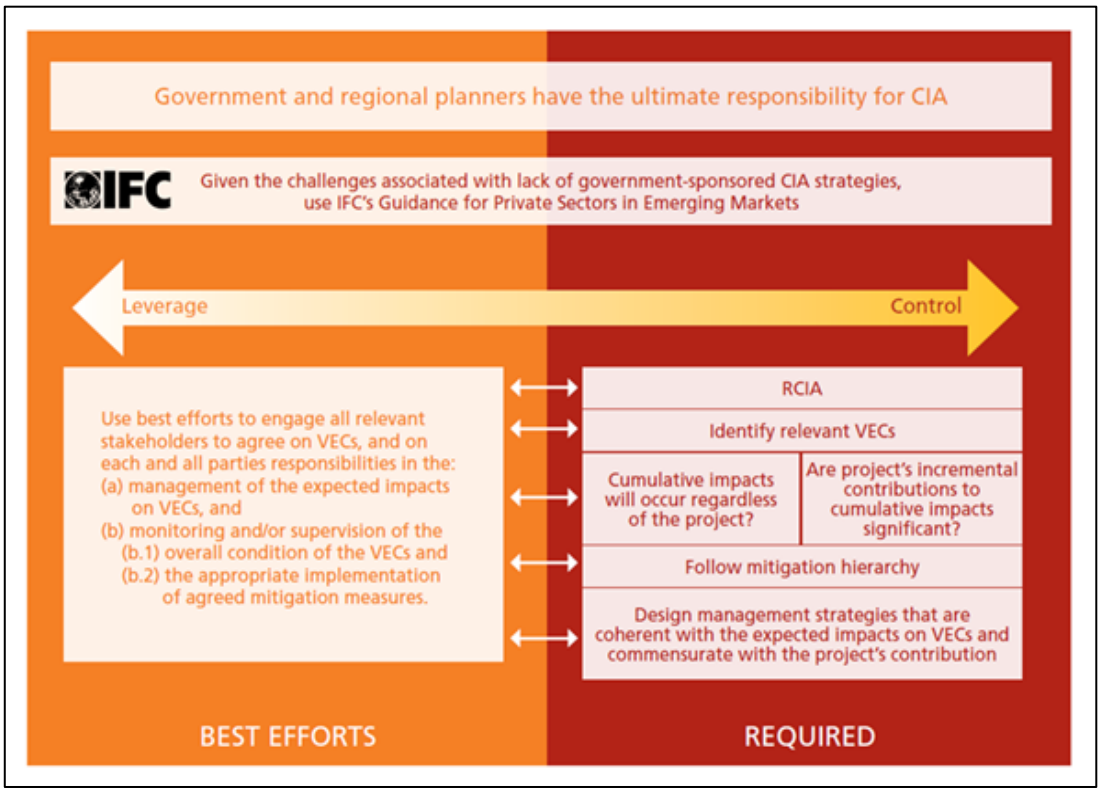

Figure 11.5: IFC guidance on responsibility for management and mitigation of cumulative impacts

Source: IFC (2013)

It is acknowledged in the GPH that the total cumulative impacts due to multiple projects typically should be identified in government-sponsored assessments and regional planning efforts. According to IFC PS 1, IFC clients are expected to ensure that their own assessment determines the degree to which each project under review is contributing to the cumulative effects. Figure 11.5 shows the importance of differentiating between those actions over which a private sector sponsor has direct control and those for which it may have leverage to influence others to achieve optimal cumulative impact management as part of a multi-stakeholder effort; an effort that ideally should be led by government agencies, but at a minimum must involve government agencies.

11.2.6.1 *Management of impacts where Transition Industries has control*

As recommended in this ESIA, Transition Industries has committed to undertake an extensive range of management and monitoring activities; see Section 12. Management and monitoring measures have been developed that will be sufficient to ensure cumulative impacts can be managed in accordance with the mitigation hierarchy:

- avoid at source: remove the source of the impact
- abate at source: reduce the source of the impact
- attenuate: reduce the impact between the source and the receptor
- abate at the receptor: reduce the impact at the receptor
- remedy: repair the damage after it has occurred
- compensate/offset replace in kind or with a different resource of equal value.

Where existing mitigation measures from Section 12 that are within Transition Industries' control are sufficient to manage the cumulative impact, no further action is recommended.

11.2.6.2 *Management of impacts outside of direct Transition Industries control*

Where significant potential cumulative impacts are identified but action from other parties is required to manage the cumulative impact, Transition Industries will make best endeavours to engage with the appropriate parties and use the leverage it may have to:

- inform others of the potential cumulative impact
- exchange information to assist in the further definition of the cumulative impact as needed
- agree responsibilities for the management of cumulative impacts
- agree monitoring measures as appropriate.

These parties may include the proponents of other project developers, government agencies and affected communities. The actions taken and the effort expended will be proportionate to the likely scale of the cumulative impacts.

Proposed management and monitoring are presented in Section 11.4.

11.2.6.3 *Limitations*

The CIA involved review of available information, including existing national documents, baseline data, output from stakeholder engagement, and online publicly available information. The assessment considers the typical limitations that a project developer may face in this type of evaluation, including:

- uncertainty regarding the execution of future projects
- incomplete information about other projects and activities (for example, if the information is not available in the public domain).

11.3 Cumulative impact assessment

11.3.1 Introduction

Cumulative impacts result from numerous activities that may have impacts on a receptor when the impacts arising from different sources are combined. Individually, the Mexinol Project's impacts may not be significant, but when combined with impacts from different sources that have overlapping AoIs, the cumulative impact may be significant. Such effects may arise due to their proximity in space or time, or because a certain receptor is particularly sensitive.

To determine the cumulative impacts that could occur because of the proposed Project it is necessary to identify interactions between Project aspects and VECs, see Table 11.2. Once interactions have been identified, literature sources and professional judgement have been used to understand the potential impacts on VECs and how these impacts may change with the inclusion of future projects. The current condition of each VEC is account considered, as well as any potential natural stresses and events.

Analysis of cumulative impacts on VECs focusses on estimating the future state of the VECs that may result from the impacts they experience from predictable third-party future developments. Past and existing third-party projects that continue to affect the current and predicted future of the receptor are also discussed in certain cases where it is important that trends are considered. The objective is to estimate the state of VECs from the aggregated stresses that affect them.

Cumulative impacts are measured not in terms of the intensity of the stress added by a given development but in terms of the VEC's response and, ultimately, any significant changes to its condition.

Table 11.2: Cumulative impacts interaction table

VEC	Associated facility and third-party developments/activities					
	Transmission line	GPO	Vista Pacifico LNG	Upgrade and expansion of Port of Topolobampo bulk dock position number 3	Topolobampo III Combined Cycle Power Plant	Operational activities at Topolobampo port
Climate	X	X	X	X	X	X
Surface water	X					
Legally protected, internationally or nationally recognised areas				X		X
Habitats, flora and fauna species of conservation importance		X	X		X	X
Economy and social cohesion	X	X	X			
Infrastructure and services	X	X	X			
Community health, safety and security	X	X	X			

VEC	Associated facility and third-party developments/activities					
	Transmission line	GPO	Vista Pacifico LNG	Upgrade and expansion of Port of Topolobampo bulk dock position number 3	Topolobampo III Combined Cycle Power Plant	Operational activities at Topolobampo port
Cultural heritage and Indigenous Peoples	X	X	X			
Ecosystem services	X	X	X			

Note: X = interaction between Mexinol Project and other project.

Indigenous people are covered in the socio-economic subsections below as appropriate.

11.3.2 Physical environment

11.3.2.1 Climate and greenhouse gas (GHG) emissions

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects/activities (see Table 11.2):

- transmission line
- GPO
- Vista Pacifico LNG
- upgrade and expansion of Port of Topolobampo bulk dock position number 3
- Topolobampo III Combined Cycle Power Plant
- operational activities at Topolobampo port.

Climate change risk and GHG assessments for the Mexinol Project are provided in Section 9.

The limit of acceptable change is Mexico's ability to meet its emission reduction target published as part of the UNFCCC's Paris Agreement is not impacted. Based on the latest update to Mexico's nationally determined contributions (NDC) in 2022, this equates to a 35% reduction in emissions by 2030, compared to the previous target of 22%. This update includes specific goals such as reducing methane emissions by 30% and greenhouse gas emissions from the oil and gas sector by 14% (IEA, 2024).

GHG emissions are a unique type of impact that demands consideration in a different manner to the other types of impact. GHG emissions are inherently cumulative; no specific impact location or magnitude can be attributed to a particular emission and all emissions have the same impact on the same ultimate receptor. The impact is climate change, or global warming, caused by the radiative forcing effects of GHGs in the atmosphere. The affected receptor is the global climate and all the ecosystems and biomes that depend on it.

Emissions from nearby and associated developments will have a cumulative effect with those from any GHG-emitting activity both nationally, and indeed globally. The transmission line and planned third-party developments will cause emissions during all phases of development (construction, operation and decommissioning). Operation and decommissioning of existing third-party developments will also cause emissions. **As the overall effect of GHG emissions is cumulative in nature (in that all emissions act on the same receptor – the global climate), these developments will have an additional negative effect on the global climate and are therefore considered to be significant.**

At the time of writing, it is not possible to know the volume of GHG emissions or consider the effects of GHG emissions from the associated facility and other third-party projects and activities in the CIA study area, and therefore each project or activity's contribution to cumulative effects on the climate cannot be determined. However, it should be noted that during the operations phase, the Mexinol Project will utilise AdWinMethanolZero© Technology, which allows for net zero GHG emissions in the methanol production

process. Therefore, **the Project's contribution to the cumulative impact will be negligible.**

Transition Industries should use their influence over the transmission line associated facility to ensure its design minimises the release of GHGs as far as reasonably practicable.

11.3.2.2 Surface water

Potential cumulative impacts are predicted between the construction of the Mexinol Project and construction of the transmission line (see Table 11.2).

The baseline for surface water (hydrology) is provided in Section 5.2.7. Within the Project area, there are channels that are used for irrigation purposes and are generally characterised as of good quality.

The limit of acceptable change is no impact to pre-construction channel morphology and stability, water quality and drainage patterns.

The transmission line crosses various irrigation channels that also fall within the AoI of the Mexinol Project JAPAMA water pipelines. Cumulative impacts may arise from contamination of the water in the channels.

Direct impacts from erosion-causing and sediment-generating activities may occur during construction, including from vegetation removal, topsoil stripping and benching. Sediment suspended in runoff from construction areas may be transported to downstream VECs. It may also be released to watercourses during soil handling, using vehicles in watercourses and during the excavation of trenches. Sediment reduces light levels within the water column and can therefore have an indirect impact on aquatic biodiversity. Open-cut crossings may affect the stability of the bed and banks of watercourses formed in un-cohesive alluvial material. Natural processes of channel erosion and deposition may be exacerbated, resulting in an indirect impact on agricultural land.

During the construction of the transmission line and the trench excavation works, measures will be required to reduce the significance of the potential impact to the irrigation channels and other surface water receptors. Although the significance of contamination of surface water is minor, the below measures will be implemented by the Project and as good practice are assumed to be implemented by the transmission line contractors to reduce potential impacts:

- at crossings over irrigation channels and other surface water bodies, exercise extra vigilance to avoid soil and other material from entering the channel/surface water body
- location-specific method statements for open-cut watercourse crossings will be prepared where necessary to address construction activities at irrigation channels
- survey, maintain integrity of, and reinstate where necessary existing irrigation and drainage infrastructure
- appropriate transportation, storage, handling and disposal of hazardous materials
- refuelling away from sensitive areas and according to defined procedure

- spill response preparedness (procedure, spill kits, training)
- HDD and other drilling muds to be water based.

With the implementation of these mitigation measures, cumulative impacts during construction are predicted to be not significant.

During operations no further cumulative impacts on surface water are predicted.

11.3.3 Biological environment

11.3.3.1 Legally protected, internationally or nationally recognised areas

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects/activities (see Table 11.2):

- upgrade and expansion of the Port of Topolobampo
- Port of Topolobampo operations.

The baseline of the terrestrial and aquatic biodiversity in the AoI is provided in Section 5.2.7.8 of this ESIA. The methanol pipeline crosses a 1.4 km section of the Lagunas de Santa María-Topolobampo-Ohuira Ramsar site and Bahia Lechuguilla Key Biodiversity Area - Important Bird Area. This section of the Ramsar site and IBA are devoid of vegetation, having been previously impacted by the construction of industrial facilities, quarrying operations and the building of a highway to the port. The hydrology that sustains mangrove habitat has been artificially modified by drainage channels, a railway line and road crossing. The current ecological value of this portion of Ramsar/IBA Site is considered low (SLR Consulting Limited, 2024).

The limit of acceptable change for legally protected, internationally or nationally recognised areas is there will be no impacts to the integrity or ecological function of a protected area from the combined effects of the Project and other developments.

From an analysis of the protected area boundaries in Figure 5.21 and Figure 5.22 and the location of the IEnova terminal in Figure 11.3, the IEnova terminal appears to overlap with the Lagunas de Santa María-Topolobampo-Ohuira Ramsar site and Bahia Lechuguilla KBA - IBA. The operational Port of Topolobampo is also located immediately adjacent to the Ramsar/IBA Site. Without a baseline assessment for these developments, it is not possible to determine the extent of their impacts to legally protected, internationally or nationally recognised areas. However, based on analysis of Google Earth imagery, there could have been a loss of ~25 ha of natural, marine habitat associated with the extension of the port.

Considering that the Mexinol Project is not expected to have any significant impacts on legally protected, internationally or nationally recognised areas (and is, therefore, a minor contributor to any cumulative impacts); that mitigation measures will be implemented to minimise any impacts; and the existing degradation of the overlapping portion of the Ramsar/IBA, it is unlikely that there will be a significant cumulative impact.

Cumulative impacts from the Mexinol Project and construction of the 400 kV transmission line are not anticipated, as it will not be constructed within a legally protected, internationally or nationally recognised area. According to the findings of the Internationally Recognised Areas Assessment (SLR Consulting Limited, 2024), there are

no likely significant effects on the qualifying features of the Ramsar site due to the existing poor condition of this area and the effective implementation of mitigation measures. The localised and non-significant nature of the impacts, combined with the degraded condition of the relevant sections of protected sites, supports this conclusion.

Cumulative impacts of proposed third-party projects are expected to be negligible. The GPO project is situated outside any natural area protected by municipal, state, or federal decrees, thus posing no threat to such regions according to the Project MIA (Capsa, 2013). Although the GPO project is reported to involve dredging in the bay (Bahía de Ohuira-Ensenada del Pabellón) for the construction of a terminal at the Port of Topolobampo (Mazatlan Post, 2019), the Mexinol Project and its associated facility do not involve dredging activities, and so cumulative impacts in this protected area are not expected. Additionally, the Vista Pacifico project documentation does not mention any interaction with protected areas, suggesting a lack of impact (Office of Resource Sustainability/Office of Fossil Energy and Carbon Management, 2022).

Consequently, when considering the Mexinol Project alongside the GPO and Vista Pacifico projects, there will be no cumulative impacts on legally protected, internationally or nationally recognised areas.

11.3.3.2 Habitats, flora and fauna species of conservation importance

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects/activities (see Table 11.2):

- transmission line
- Vista Pacifico LNG
- GPO
- upgrade and expansion of the Port of Topolobampo
- Topolobampo III Combined Cycle Power Plant
- Port of Topolobampo operations.

The baseline of the terrestrial and aquatic biodiversity in the AoI is provided in Section 5.2.7.8. The Mexinol Project is primarily located within modified habitat, much of which is highly modified by agricultural activities.

The results of the CHA concluded that the Project partially overlaps with a KBA – IBA due to the migratory/congregatory wetland birds (Criterion 3), the Project's EAAA qualify as CH.

The Project area supports five priority flora species, of which three plant species are listed by IUCN (2024) as Vulnerable. In total, ten priority avifauna species were recorded in the Project's AoI during baseline surveys. The remaining fauna identified within the AoI was listed as non-priority.

The preferred condition for natural habitats, priority flora, priority birds and non-priority fauna and birds is that the number of priority species and individuals remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.

11.3.3.2.1 Natural habitat

It is expected that construction of the Project will require the clearance of approximately 130 ha of land in total, comprising ~111.5 ha of modified habitat and ~18.5 ha of natural habitats. None of the habitats within the Project's AoI are rare or threatened and are commonly occurring at the regional and national scales. That said, loss of mangrove swamp and xerophytic vegetation will be compensated by the Project in accordance with national legislation (SLR Consulting Limited, 2024).

Where a project will cause natural habitat loss, there is a requirement from SEMARNAT to provide compensation equating to an area that is at least 10% of the project footprint, even if the impacted/lost habitat type is less than this. For the Mexinol Project, these measures are expected to include approximately 6 ha of reforestation (i.e., scrubbing) and cactus planting, plus 6 ha of mangrove restoration. As no mangrove habitat is expected to be impacted by the Project, the mangrove restoration is therefore considered to be an additionality (SLR Consulting Limited, 2024).

It is uncertain whether past and present activities were required to provide compensation for natural habitat loss, however, it is likely that appropriate mitigation measures were implemented. Therefore, considering the residual impact of natural habitat loss during both the construction and operational phases of the Mexinol Project is expected to be insignificant, there is no cumulative impact anticipated between the Mexinol Project and past and present activities.

The transmission line is routed primarily through modified, agricultural habitat. Any natural habitat loss from the construction of the transmission line is expected to be short-term and adequately mitigated by progressive restoration. If the transmission line does result in the permanent net loss of natural habitat, it will also be required to compensate under SEMARNAT regulations. As such, there will not be any cumulative impacts on natural habitats from the Project and the transmission line.

The GPO project will establish a buffer zone around the plant to mitigate pollutant emissions and uncontrolled fires, as well as a conservation area near mangrove vegetation. The distance to protected natural areas is significantly greater than the dispersal area of potential plumes, ensuring no alterations in water quality at the project's water intake point (Capsa, 2013). This preventive approach minimises any adverse impacts on nearby natural habitats. The Vista Pacifico project has undergone a Technical Justification Study, demonstrating that the removal of natural vegetation will not jeopardise the ecosystem's biodiversity (Office of Resource Sustainability/Office of Fossil Energy and Carbon Management, 2022). Given these considerations, **there is no cumulative impact on natural habitats anticipated from the combined effects of the Mexinol, GPO, and Vista Pacifico LNG projects.**

11.3.3.2.2 Priority flora

Three relatively intact patches of xerophytic vegetation were identified along the methanol pipeline route, which will be constructed between the methanol production facility and the Port of Topolobampo. These patches may contain priority, range-restricted floral species which could be affected by pipeline construction. There is a potential for the priority floral species identified in the baseline assessment for this Project (see Section 5.3.7.3) to be present elsewhere in the region. There could be cumulative impacts, for example, from air emissions, increased trampling or waste accumulation,

between the Mexinol Project construction and operations, and the Topolobampo III Combined Cycle Power Plant and operational activities at Topolobampo port. Such impacts are unlikely to affect priority flora at national or global levels, though some regional effects may be observed. However, no significant cumulative impact anticipated between the Mexinol Project and these projects/activities.

The transmission line is routed primarily through modified, agricultural habitat. The construction and operation of the transmission line is unlikely to impact priority flora. However, if it does, it is not anticipated to affect the viability and longevity of the local, regional and national populations. As there are no significant residual impacts to priority flora expected from the Mexinol Project, there is no significant cumulative impact anticipated between the Mexinol Project and the transmission line.

Neither the GPO project nor Vista Pacifico LNG project reports priority species of flora. The GPO project refers to vegetation, which could potentially be species that overlap with the Mexinol Project's identified priority flora. As mentioned, the GPO project will establish a buffer zone to minimise impacts. The project mitigations plus the buffer zone are likely to minimise cumulative impacts on priority flora in the immediate vicinity, although potential impacts on priority flora in the surrounding environs could occur. Despite this, such impacts are unlikely to affect priority flora at national or global levels, though regional effects may be observed.

As described, the Vista Pacifico project has determined that the removal of natural vegetation will not jeopardise the ecosystem's biodiversity. This finding indicates that the cumulative impacts with the Mexinol Project on priority flora from the removal of natural vegetation are minimal.

Overall, the cumulative impacts of the Mexinol Project and the third-party projects on priority flora are assessed to be not significant and localised, and therefore no additional management control mitigation measures beyond those proposed in Section 8.2.1.2 are proposed.

11.3.3.2.3 Priority birds

There is a potential for past and present activities around the port to disturb priority birds, for example by air and noise emissions, or to a lesser extent, from the loss of their habitats. The regional impacts are considered minor and unlikely to have significant effects at national or global levels, particularly as the priority species are listed as Least Concern (LC) or Near Threatened (NT) by the IUCN (2024) and are commonly occurring, with the exception of the snowy plover (*Charadrius nivosus*; NT) which is near endemic. Therefore, the cumulative impacts from the Mexinol Project, along with the past and present Project activities, on priority bird species are expected to be not significant and localised.

There is a potential for the construction of the transmission line to disturb priority birds, for example from increased light, noise or dust emissions. However, these impacts would be short-term. Therefore, there could be a cumulative impact if the construction timelines overlapped. However, with the application of good industrial international mitigation measures, this impact is not anticipated to be significant.

There is also a potential for impacts to priority birds from the operation of the transmission line, which could result in direct bird mortality from collision with cables and electrocution

on pylons. The Avifauna Collision/Electrocution Risk Study (SLR Consulting Limited, 2024b) conducted for the Project identified nine species of avifauna that are at medium-high or high risk. Of these nine species, two were identified as priority birds for the Mexinol Project; Harris' hawk (*Parabuteo unicinctus*; LC) and reddish egret (*Egretta rufescens*; NT). The remaining priority birds were assessed as medium or low risk or were not included in the assessment. With the appropriate mitigation measures (e.g., bird flight diverters) in place, there should be no significant residual impacts to priority birds from the transmission line. Therefore, given that there are no significant residual impacts to priority birds expected from the operation of the Mexinol Project, no significant cumulative impact is anticipated between the Mexinol Project and the transmission line.

Neither the GPO project nor Vista Pacifico LNG project reports priority species of birds. The GPO project indicates a minor loss of foraging and breeding habitats for birds and some disturbance due to construction activities (Capsa, 2013). The regional impacts are considered minor and unlikely to have significant effects at national or global levels, particularly as the affected species are listed as Least Concern (LC). While there is potential for light pollution from the projects, no specific priority bird species have been identified as being affected within the ESIA for the GPO project. Therefore, given that there are no significant residual impacts to priority birds expected from the construction and operation of the Mexinol Project, no significant cumulative impact is anticipated between the Mexinol Project and third-party projects.

Overall, the cumulative impacts from the Mexinol Project, the GPO and Vista Pacifico projects, on priority bird species are expected to be not significant and localised, and no additional management control mitigation measures beyond those proposed in Section 8.2.1.3 are proposed.

11.3.3.2.4 Non-priority fauna and birds

Non-priority fauna and birds have been identified for the Mexinol Project as commonly occurring species of small mammals, birds, reptiles, amphibians that do not trigger critical habitat and as such are not categorised as priority fauna of high conservation value. Although these species are non-priority, some are near-endemic or protected under NOM-059-SEMARNAT-2010 so are still considered in this CIA.

The potential cumulative impacts on non-priority birds from the operation of the transmission line (collision/electrocution) is the same as for priority birds, which means there is no significant cumulative impact expected. Similarly, the construction of the transmission line could cause short-term disturbance to non-priority fauna and birds. However, with the application of GIIP mitigation measures for both the Mexinol Project and the transmission line, this cumulative impact is not expected to be significant.

The assessment of cumulative impacts on non-priority fauna and birds from the proposed third-party projects, namely the GPO and Vista Pacifico LNG projects, shows no significant cumulative impact. The GPO project has found minimal wildlife populations within the area, with specific local and temporary impacts on black iguanas (*Ctenosaura similis*; LC) during construction. To mitigate this, a capture and relocation program was implemented, along with a prohibition on hunting these iguanas (Capsa, 2013). The Vista Pacifico project has conducted a Technical Justification Study that confirms the ecosystem's biodiversity will not be compromised despite the removal of natural

vegetation (Office of Resource Sustainability/Office of Fossil Energy and Carbon Management, 2022).

The Mexinol Project will similarly not affect the longevity and viability of non-priority fauna and bird populations at regional, national, and international levels. These species, including small mammals, birds, reptiles, and amphibians within the Project's AoI, are commonly occurring and do not trigger critical habitat designation or high conservation value categorisation. Therefore, **the combined impacts of the Mexinol Project and third-party projects/activities are considered not significant, localised, and short-term.**

11.3.4 Socio-economic environment

11.3.4.1 Economy and social cohesion

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects/activities (see Table 11.2):

- transmission line
- GPO
- Vista Pacifico LNG.

There are several potential beneficial cumulative impacts from the development of the Mexinol Project and the other projects in the study area. For example, the generation of employment opportunities across all the projects and subsequent upskilling of people, economic benefits associated with increased payment of taxes, increased foreign direct investment and contribution to diversification of the state economy, and economic multiplier impacts across the economy through procurement opportunities associated with the provision of goods and services to the new businesses. The remainder of this section will consider the potential adverse cumulative impacts arising.

11.3.4.1.1 Project-induced cost of living and inflationary pressure due to procurement, increased workforce employment and Project-induced in-migration

Further details regarding the workforce employment and predicted Project-induced in-migration are provided in Section 8.3.3. The Project's workforce is expected to peak during construction at 3,500.

The preferred condition is for the standards of living of communities in the AoI that may be impacted by living cost-of-living increases or inflationary pressure to be equal to, or better than, before construction.

Project procurement of goods and services from local markets is predicted to potentially impact local communities and businesses via increased inflationary pressure, particularly for households and business sectors that are price sensitive, and vulnerable people. Inflationary pressures may be further exacerbated by the arrival of migrant skilled workers and their families.

The cumulative impact of similar effects from other planned third-party developments and workforce recruitment or procurement by the transmission line developer and contactors (i.e., RIC Energy) may increase the combined inflationary pressure on local markets.

Inflationary pressure and price increases for basic foodstuffs and household necessities will impact the poorest segments of society within the AoI. This cumulative impact may be particularly acute during construction phases of these developments when procurement, economic opportunities and the recruitment of workers will peak.

Existing Project strategies and management controls that will be adopted include:

- inclusion of measures to support the mitigation of inflationary pressures within the Local Content Plan
- monitoring of cost of living and socioeconomic conditions within vulnerable groups
- price surveys and monitoring of markets for key goods and services.

The Project will have some influence over the implementation of similar controls within the development of the transmission line. However, **cumulative effects from the planned third-party developments may be of a similar magnitude to the Project. Without further management, cost of living increases and inflationary pressure may still exceed the limit of acceptable change**. It is therefore recommended that:

- the Project utilises available influence with RIC Energy (and therefore its associated contractors) to ensure alignment with measures to mitigate inflationary pressure as established within the Project's Local Content Plan
- the Project should regularly share the findings of monitoring (i.e. cost of living reviews, socioeconomic monitoring) with the other third-party projects and considering establishing a forum for collective action. This should agree required thresholds for vulnerable markets, sectors or goods are at risk, protocols for sharing key monitoring data, and key actions (i.e., shifting suppliers for food or household goods, and ensuring procurement from alternative regions etc.).

11.3.4.1.2 Increased competition within local labour market and pressure for local skilled labour

Further details on the status of employment rates within the economically active population are provided in Section 8.3.3.

For increased competition within the local labour market and pressure for local skilled labour, the limit of acceptable change is for current trends of availability of labour for vulnerable competing sectors (e.g., agriculture/fishing) to be maintained at pre-construction rates.

The creation of employment opportunities by the Project will increase competition within the labour market for the employment of skilled, semi-skilled, low-skilled and support services labour. The combined pressure for local skilled labour is likely to result in scarcity of workers within key vulnerable sectors (i.e. agriculture and fishing) as workers leave lower paying jobs and are attracted to temporary work opportunities during construction. Cumulative effects of increased employment during construction within the industrial sector associated with the Project, the transmission line and other planned third-party developments will also create enhanced upward pressure on wages for some categories of workers. This will further disadvantage sectors that compete for low-skilled workers, such as agriculture and fishing.

The Project will implement local recruitment and training measures as part of the scope of the Local Content Plan currently under preparation. Local recruitment and training scopes and targets will also be included within the EPC contractor's Procurement and Local Content Plan. The Project will also continue to create alliances with local universities and educational institutions via the Local Content Plan to support the development and availability of pre-employment skills training for the general population. These measures may serve to facilitate an increase in workforce recruitment among the economically inactive population thus limiting any workforce competition between the industrial and farming/fishing sectors. Any relevant grievances related to labour market competition will also be monitored by the Project at the community level through the grievance mechanism.

With these existing strategies and management controls, the limit of acceptable change should not be exceeded, provided the availability of pre-employment training is enhanced prior to construction, and **the cumulative impact is considered to be not significant**.

11.3.4.1.3 Increased gender disparity caused by higher male employment uptake

Further details on key gender issues and the status of gender disparity within the economically active population are provided in Section 8.3.1.3.

For increased gender disparity caused by higher male employment uptake, the limit of acceptable change is for current trends of women's participation within the labour force to be at least maintained at pre-construction rates.

The creation of employment opportunities by the Project, particularly during construction will likely involve jobs taken up predominantly by males mainly due to inherent gender skills gaps and gendered stereotypes around employment. Without effective mitigation this will result in exacerbation of gender disparity at the local level. Cumulative effects of increased employment during construction within the industrial sector associated with the Project, the transmission line and other identified planned third-party developments will further exacerbate this issue.

The Project will contract an independent local gender specialist to assist in the development of a gender equality strategy, which will examine internal systems for talent management and Project construction and operations employment from a gender perspective. The strategy will also identify key actions within the Project's control to facilitate greater diversity of employment and access for women and include goals for gender equity within the workforce. The Project will include specific programmes of support targeted at enhancing women's access to pre-employment skills and training for the construction sector within the Strategic Community Investment Plan.

In addition, the Project should

- utilise available influence with RIC Energy (and their contractors) to ensure similar measures to those implemented by TI for gender equality are considered where possible.

With these existing strategies and management controls, the limit of acceptable change should not be exceeded, and **the cumulative impact is not significant**.

11.3.4.1.4 Increased social tensions and conflict over Project benefits

Further details on current levels of community cohesion and conflict are provided in Section 8.3.2.

The preferred condition is for the pre-construction trends in community conflict, opposition, and protest related to proposed petrochemical projects should not be increased.

There are currently high expectations for business opportunities and employment benefits within local communities and if recruitment and procurement processes are not highly transparent and if benefits are not made (and perceived to be made) broadly accessible, there is potential for increased social tensions and conflicts. Levels of community cohesion are currently poor within certain communities, with clear divisions over other planned petrochemical developments. These are the main Project impacts for Indigenous People, see Section 8.3.1.1.

Given this situation, the cumulative creation of economic benefits from the transmission line and other planned third-party developments may risk increasing social tensions and conflicts against the industrial development sector more broadly.

The Project will carefully monitor and manage the issue through effective stakeholder engagement and transparent benefit sharing to ensure inherently marginalised or disadvantaged segments of society, such as Indigenous Peoples or vulnerable households, can equitably access any available employment or local procurement benefits. The Project has recruited an experienced Community Liaison Officer and plans to continue conducting community engagements and disseminating information about the Project to ensure enhanced stakeholder awareness.

Existing Project strategies and management controls that will be adopted include:

- continue building stakeholder relations and awareness about the Project within all Project-affected communities
- equitable sharing of benefits through the Local Content Plan and Strategic Community Investment Plan.

Without management, increased social tensions and conflict over Project benefits may still exceed the limit of acceptable change, because of pre-existing high tensions caused by the opposition to another petrochemical development in the area and existing low levels of community cohesion. It is recommended that:

- the Project utilises available influence with RIC Energy (and their contractors) to ensure alignment with its own measures to mitigate social tensions and conflict.
- the Project should collaborate with other planned third-party developments by sharing data on escalating grievances and tensions, and effective stakeholder engagement, conflict resolution and communications strategies.
- The Project should prepare strategic engagement plans alongside the Project's SEP, when necessary, to tailor communications and ensure forums are created for discussion and conflict-resolution.

11.3.4.2 *Infrastructure and services*

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects/activities (see Table 11.2):

- transmission line
- GPO
- Vista Pacifico LNG.

11.3.4.2.1 Overburden on social services and infrastructure including waste management due to worker presence

Details on the status of domestic waste services, housing, utilities services and infrastructure, education, health and emergency services are provided in Section 5.4.3.

For overburden on social services and infrastructure the limit of acceptable change is defined as no significant deviation from current trends related to the original condition of social infrastructure and level or quality of service provision before construction.

The presence of workers associated with the Project's creation of employment and that of other planned third-party developments and the transmission line, are predicted to result in cumulative impacts related to additional burden on domestic waste infrastructure, and increased demand for housing, utilities and social services (i.e. education, health and other available services). This could be exacerbated by uncontrolled in-migration if it were to occur at a larger scale than predicted (see Section 8.3.1.4).

The quality of waste management services is a key concern in the AoI amongst stakeholders in smaller communities (e.g., Rosendo G. Castro) outside of the more populated urban centres of Los Mochis and Topolobampo. Although the garbage collection service covers 99% of the Municipality of Ahom, there are reports of dumped waste accumulating west of the Pemex dock (in the Port area), with littering attributed to a lack of waste infrastructure, including waste containers and enforcement in the Port area. Poor waste collection services and infrastructure are already contributing to pollution and sanitary issues within some smaller communities, where open burning or disposal of domestic wastes occur. Therefore, the Project will establish controls to manage Project-related waste (i.e. Waste Management Plan and monitoring of waste management by accommodation service providers). However, it is likely that the cumulative effects of similar additional non-hazardous waste generated by workforce and influx may create a significant burden on waste management services and infrastructure.

Additionally, the Project workforce will require housing; the use of the local accommodation market to house the temporary workforce during construction may cause scarcity in the market and price inflation, with knock on effects for key sectors such as tourism. The cumulative effects of similar demand from other planned third-party developments and the transmission line (although to a lesser extent given the linear, shorter-term nature of construction) will further exacerbate these impacts. The Project workforce and related influx will also increase demand for access to healthcare and education services within the Aoi, primarily within the larger urban centres such as Los Mochis and Topolobampo where workers who are not housed in project accommodations are anticipated to reside. The cumulative effects of concurrent demand created by the in-migration of workforce and influx associated with other planned third-party developments

and the transmission line could impact levels of service delivery for the general population.

Existing strategies and management controls that will be adopted by the Project include:

- development of a Waste Management Plan
- ensuring that investment in municipal waste services (as necessary) is a priority for the planned Strategic Community Investment Programme
- monitoring of local accommodation market for knock-on price inflation.

The Project will have some influence over the implementation of similar controls within the development of the transmission line. However, **cumulative effects from the other planned third-party developments (e.g. GPO and Vista Pacifico Liquefied Natural Gas) may be of a similar magnitude to the Project, and without further management overburden of local social services and infrastructure may still exceed the limit of acceptable change.**

It is therefore recommended that:

- the Project and EPC contractor work with the municipal authorities on waste management solutions for domestic waste, and identify and qualify private hazardous waste contractors prior to the start of construction
- to address potential cumulative impacts related to increased demand on lodging and housing and utilities, monitor the surplus private sector accommodation needs of all contractors working on the Project and the transmission line to assess how the companies anticipate managing those accommodation needs, during the Project construction stage
- the Project includes a dedicated medical facility for the use of staff and families
- the Project and RIC Energy should coordinate with the relevant municipal authorities and other planned third-party developments to monitor cumulative effects on health services, education and waste management and develop suitable solutions where required.

11.3.4.3 Community health, safety and security

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects/activities (see Table 11.2):

- transmission line
- GPO
- Vista Pacifico LNG.

11.3.4.3.1 Reduced road safety due to traffic increase

The road transport network surrounding the Project, specifically the Los Mochis-Topolobampo highway, already has high volumes of vehicle traffic during peak hours. Further details regarding the traffic and road safety baseline for the Project are provided in Section 5.4.3.16.

The preferred condition or limit for acceptable change is for current roadway level of service to be maintained and there to be no discernible reduction in road safety compared to pre-construction.

During the construction phase, increased road traffic deriving from increased movement of goods and people daily is expected between the Port of Topolobampo and Los Mochis along sections of the Los Mochis-Topolobampo highway and surrounding feeder roads. Increased delays, journey times and reduced road safety are anticipated due to increased road traffic related to the Project. Heavy goods vehicles with limited operator visibility and/or manoeuvrability will be used to transport and delivery equipment, construction materials or engineered plant infrastructure to the Project. The transportation of workers will further increase the number of large vehicles that would use daily as a result of the Project. The cumulative impact of combined increased traffic deriving from multiple construction projects (i.e. the Project, the transmission line, and other planned third-party developments) is likely to result in a combined reduction in road safety and reduction in roadway level of service.

Existing strategies and management controls that will be adopted by the Project include:

- improvements to the existing feeder road network including improved surfaces, signage and lighting
- development of a Traffic Management Plan
- implementation of a Community Road Safety Programme

The Project will use available influence with the developer of the transmission line (i.e. RIC Energy) and its contractors to ensure similar controls are implemented should the construction phase of these projects coincide or overlap. It is considered that these embedded controls and mitigation measures will ensure the Project's contribution to these cumulative impacts are minimised and not significant. The preferred condition is therefore likely to be maintained, and limit of acceptable change is unlikely to be reached.

While other planned third-party developments may combine in space and time with the Project to create cumulative effects, such as increased marine traffic, the Project's impacts on marine traffic and existing controls are considered sufficient to address any potential contributions to cumulative impacts. Therefore, marine traffic impacts are screened out of this assessment.

11.3.4.3.2 Increased incidence of gender-based violence and harassment

Gender-based violence and harassment (GBVH) is widely legitimised and more prevalent in rural areas and during the summer holidays and worsened by alcohol/drug consumption. Reporting levels are likely to be low. Further details regarding the GBVH baseline for the Project can be found in Section 5.4.3.23.

The preferred condition is there should be no discernible increased rates of GBVH compared to pre-construction levels.

The cumulative impact of similar effects from other planned third-party developments and the transmission line developer and contractors (i.e. RIC Energy) may increase the combined risk associated with GBVH within the Aoi at a societal level due to the multiple Project-related employment and economic benefits changing household/societal dynamics. There are inherently high risks of GBVH, which may be exacerbated by an

influx of a predominantly male workforce or tensions created in households that contain women who are employed by the projects in the study area.

Existing strategies and management controls that will be adopted by the Project include:

- development of a GBVH Risk Management Plan with a focus on the management and mitigation of GBVH risks within the company's control.
- development of a culturally appropriate community grievance mechanism and a worker grievance mechanism for direct and contracted workers for reporting GBVH concerns.

The Project will also ensure that the EPC Local Content Plan is aligned with the Gender-Based Violence and Harassment Risk Management Plan and Gender Equality and Inclusion Policy, and includes measures to prevent and address harassment, intimidation, and/or exploitation, especially regarding women and migrant workers.

While the Project will have some influence over the implementation of similar controls with the developer of the transmission line (i.e. RIC Energy), **cumulative effects from the other planned third-party developments may be of a similar magnitude to the Project. Without further management, these risks of increased GBVH may still exceed the limit of acceptable change.** Given the high sensitivity of the social receptors that could be impacted by GBVH, additional measures should be implemented by the Project to further mitigate the impacts.

It is recommended that:

- the Project utilises available influence with RIC Energy (and contractors) to ensure alignment with measures to mitigate GBVH within the GBVH Risk Management Plan. The Project should work with RIC Energy (and contractors) and other identified third-party developments (e.g. GPO and Vista Pacifico Liquefied Natural Gas), to ensure that anonymous data from the grievance mechanism is shared with the view to facilitating wider GBVH monitoring and identification of trends in reported cases of GBVH. Should any trends be identified, the Project could adapt controls and measures accordingly to address GBVH issues.
- the Project should collaborate with other planned third-party developments and develop partnerships with relevant local authorities, such as the Department of Female Affairs, and relevant civil society groups, NGOs, and local social services providers to enhance service provision for the victims of GBVH or programmatic interventions to reduce GBVH risks.

11.3.5 Cultural heritage and Indigenous People

Potential cumulative impacts are predicted between the construction and operation of the Mexinol Project and the following projects (see Table 11.2):

- transmission line
- GPO
- Vista Pacifico LNG.

Details of the Project's cultural heritage baseline is provided in Section 5.4.3.19. The Project's social direct and indirect Aoi is characterised by unique tangible and intangible cultural heritage elements such as cultural spaces, tangible heritage (i.e. roadside memorials, cemeteries), education and research centres, fairs and festivities, and indigenous culture associated with the Mayo-Yoeme Indigenous People.

The preferred condition is for all tangible cultural heritage elements to be preserved in situ and current trends of participation in cultures, traditions and practices of Indigenous People are not exacerbated.

The influx of workers with different values and beliefs, may weaken local cultural practices, particularly the Mayo-Yoeme people's rituals, ceremonies and intangible heritage. These impacts may peak during construction when the Project's workforce, which will peak at 3,500 new temporary workers. The potential cumulative impacts of multiple construction projects (i.e. the Project, transmission line, and other planned third-party projects) overlapping, should this occur, may amplify any effects on the weakening of local cultural practices and traditions.

Existing Project strategies and management controls that will be adopted by the Project include:

- development of a CHMP
- ensuring that measures to maintain community access to identified tangible cultural heritage sites are included in the CHMP
- development of a monitoring plan for tangible cultural and intangible cultural heritage
- Project cultural awareness training, as part of contractors and sub-contractors site induction processes to promote the workforce's respect for local cultural heritage, traditions and taboos.

It is considered that **with these embedded controls and mitigation measures, the Project's contribution to a weakening of local cultural heritage may not be considered significant, and cumulative impacts will not exceed the limit of acceptable change**. However, it is recommended that

- the Project considers forming collaborations for the design and delivery of cultural awareness training with local education providers such as the UAIM who have expert knowledge in this field.

11.3.6 Ecosystem services

The Project will be constructed within modified habitat resulting from agricultural activities, and the Project-related land use change will not impact the overall ecological functions of the landscape or wider ecosystem. Furthermore, due to the Project's JAPAMA water transfer and rejected water system, there will be no negative impacts concerning effluent discharge to freshwater systems or extraction. **The Project's contribution to ecological degradation is not expected to exceed the preferred condition and proposed management measures are considered sufficient to address the Project's potential contribution to cumulative impacts on surrounding ecosystems.**

However, the Mexinol Project and transmission line (associated facility), as well as other planned third-party developments (e.g. GPO and Vista Pacifico LNG), are predicted to result in cumulative impacts related to changing local customs and intangible cultural practices or traditions caused by an in-migration of workers and Project-related influx. These cumulative effects are considered in more detail in Section 11.3.5.

11.4 Management and monitoring

The effective management of cumulative impacts requires collaboration of all parties that contribute to these cumulative impacts. Ideally, cumulative impact management should be led by government entities that have direct influence on proponents, in order to identify the contributions of each actor and establish the mechanism to handle the cumulative effects. GIIP establishes that individual proponents should mitigate the effects generated by their Project and, at a minimum, support and influence cumulative effects management strategies (IFC 2013).

Transition Industries will comply with IFC Guidance Note 42, which specifies that commercially reasonable attempts should be made to engage relevant stakeholders (e.g., government authorities, affected communities, other developers) in the assessment, design and implementation of coordinated mitigation measures to manage the potential cumulative impacts resulting from multiple developments in the Project's Aoi.

11.4.1 Management of cumulative impacts

The cumulative impacts identified in this assessment are summarised in Table 11.3, which also lists actions for Transition Industries to mitigate cumulative impacts either by management and/or monitoring, and collaborative mitigations where Transition Industries will engage and liaise with other proponents (or the district authorities) to further understand, assess or manage potential cumulative impacts or improve overall management of cumulative impacts to the general benefit of both or all parties.

In some cases, the proposed measures are beyond Transition Industries' control and remit and should be driven and implemented by district authorities. However, the potential for this could be explored with the relevant stakeholders as part of ongoing stakeholder engagement.

Transition Industries will use commercially practicable efforts to engage relevant government authorities, other developers and other relevant stakeholders, in the implementation of coordinated mitigation measures to manage the potential cumulative impacts. This includes Transition Industries' influence over RIC Energy, to ensure it undertakes a CIA as part of the ESIA process for the transmission line (associated facility) project. All stakeholder engagement will be undertaken in accordance with the Project Stakeholder Engagement Plan.

Overall, Transition Industries will consider participation, to the extent feasible and practicable, in working groups and/or industry organisations aimed at addressing management of potential cumulative impacts on regional resources to which the Project could incrementally contribute.

Table 11.3 summarises the additional mitigation measures required to manage the identified significant cumulative impacts in this section. As described in Section 11.2.5, impacts are considered significant when it is predicted that the impact may push a VEC beyond the defined threshold, preferred condition, or limit of acceptable change.

Table 11.3: Summary of CIA findings and management/mitigation measures

VEC	Cumulative impact	Management / mitigation measures
All significant cumulative impacts		Transition Industries will consider participation, to the extent feasible and practicable, in working groups and/or industry organisations aimed at addressing management of potential cumulative impacts on regional resources to which the Project could incrementally contribute.
		With regards to its influence over the associated facility, Transition Industries should stipulate that all Project phases of the associated facility are conducted in line with international standards, specifically IFC PS, to align with the Mexinol Project. The Project should undertake a gap analysis between NOM and IFC PS during the associated facility screening, to ensure that they align with the Mexinol Project and meet international standards; the most stringent regulations or standards will be applied. This should be monitored during all phases of the projects, for example, through auditing.
		Once the transmission line ESIA is complete, including the completion of a CIA in accordance with IFC PS 1, the Mexinol Project CIA should be reviewed and updated as required.
Economy and social cohesion	Project-induced cost of living and inflationary pressure due to procurement, increased workforce employment and Project-induced in-migration	The Project will utilise available influence with RIC Energy (and contractors) to ensure alignment with measures to mitigate inflationary pressure as established within the Project's Local Content Plan
		The Project should regularly share the findings of monitoring (i.e. cost of living reviews, socioeconomic monitoring) with the other third-party projects and establish a forum for collective action. The forum should establish required thresholds for vulnerable markets, sectors or goods that are at risk, and protocols for sharing key monitoring data and key actions (i.e. shifting suppliers for food or household goods, ensuring procurement from alternative regions etc.).
	Increased gender disparity caused by higher male employment uptake	The Project should utilise available influence with RIC Energy (and their contractors) to ensure similar measures for gender equality are considered where possible, such as specific programmes of support targeted at enhancing women's access to pre-employment skills and training for the construction sector.

VEC	Cumulative impact	Management / mitigation measures
	Increased social tensions and conflict over the benefits from concurrent projects	The Project should utilise available influence with RIC Energy (and their contractors) to ensure alignment with its own measures to mitigate social tensions and conflict.
		The Project should collaborate with other planned third-party developments by sharing data on escalating grievances and tensions, and effective stakeholder engagement, conflict resolution and communications strategies.
		The Project should prepare strategic engagement plans alongside the Project's SEP, when necessary, to tailor communications and ensure forums are created for discussion and conflict-resolution.
Infrastructure and services	Overburden on social services and infrastructure due to worker influx and in-migration	The Project and EPC will work with the municipal authorities on waste management solutions for domestic waste and identify and qualify private hazardous waste contractors prior to the start of construction.
		The Project will monitor the surplus private sector accommodation needs of all contractors working on the Project and the transmission line to assess how the companies anticipate managing those accommodation needs, during the Project construction stage.
		The Project will provide a dedicated medical facility for the use of staff and families.
		The Project and RIC Energy should coordinate with the relevant municipal authorities and other planned third-party developments to monitor cumulative effects on health services, education and waste management and develop suitable solutions where required.

VEC	Cumulative impact	Management / mitigation measures
Community health, safety and security	Increased incidence of gender-based violence and harassment	The Project will utilise available influence with RIC Energy (and contractors) to ensure alignment with measures to mitigate GBVH within the GBVH Risk Management Plan. The Project should work with RIC Energy (and contractors) and other identified third-party developments (e.g. GPO and Vista Pacifico Liquefied Natural Gas), to ensure that anonymous data from the grievance mechanism is shared with the view to facilitating wider GBVH monitoring and identification of trends in reported cases of GBVH. Should any trends be identified, the Project could adapt controls and measures accordingly to address GBVH issues.
		The Project should collaborate with other planned third-party developments and develop partnerships with relevant local authorities, such as the Department of Female Affairs, and relevant civil society groups, NGOs, and local social services providers to enhance service provision for the victims of GBVH or programmatic interventions to reduce GBVH risks.
Cultural heritage	Influx of workers with different values and beliefs weakening local cultural practices	The Project will consider forming collaborations for the design and delivery of cultural awareness training with local education providers such as the UAIM who have expert knowledge in this field.

12 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING FRAMEWORK

12.1 Introduction

This environmental and social management and monitoring framework (ESMMF) describes how the management and mitigation measures identified in this ESIA will be implemented and monitored through development of an ESMS that includes a suite of ESMMPs. The Project ESMS is being developed in line with Transition Industries' HSSE&SP management system, referred to as the "Good Neighbour" Framework, and other policies and applicable standards detailed in Section 12.2.

The Project has taken every effort, informed by technical experience and industry knowledge, to evaluate potential impacts and identify appropriate mitigation measures, which will be incorporated into relevant management plans. Should unforeseen impacts arise during the implementation of the Project, the Project will undertake the necessary assessments, develop adequate mitigation measures and inform SEMARNAT and other partners (e.g., IFC) as required.

12.1.1 Elements of an ESMS

A fully robust and operating ESMS is composed of nine key interrelated parts. Each of these nine elements are important, as they help to assess, control, and continually improve E&S performance. Figure 12.1 below presents the nine key elements included in the ESMS. The Project ESMS is under development, according to the different stages of the Project, and will incorporate the commitments described in Table 12.1 below.

The ESMS will apply over the entire Project life cycle, including early works, construction, operations, and site decommissioning and restoration. It also applies to the oversight of:

- The consortium joint venture between Techint and Samsung, who will serve as the Project's engineering, procurement and construction (EPC) Contractor for the main methanol production plant, including tanks (EPC1)
- Bonatti as the EPC contractor for the part of the Project related to the port facilities and two underground pipelines to be routed between the main methanol production plant and the port area (EPC2)
- The contractor for the Water Treatment Plant and tie into the JAPAMA facility (EPC3)
- The contractor for the hydrogen production plant (EPC4)
- RIC Energy, responsible for the electrical part of the Project for connection to the national distribution power grid, as well as the transmission line to substation (associated facility).

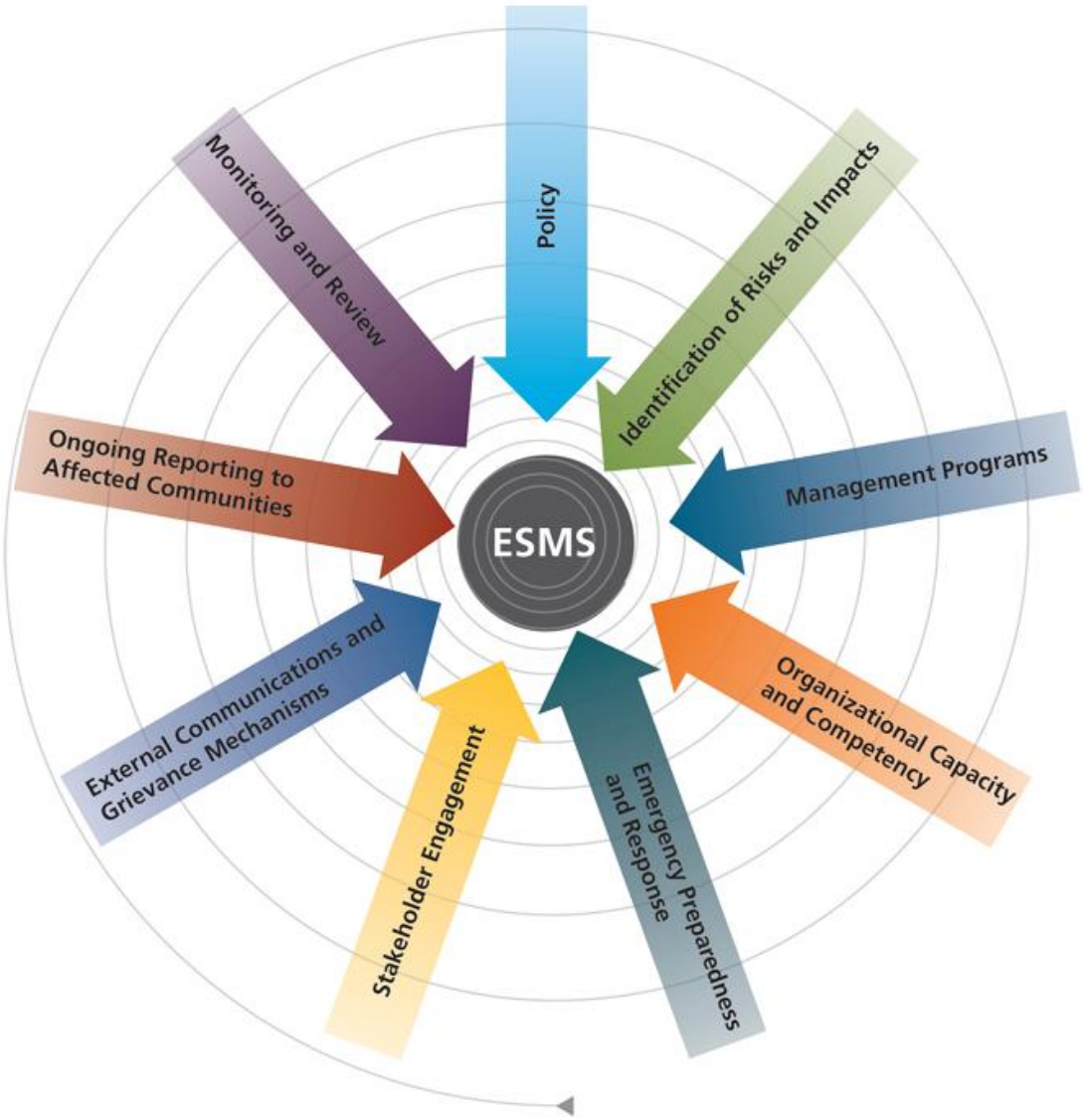

Figure 12.1: Elements of the ESMS

Source: IFC (2015)

Table 12.1: Commitments for each ESMS element

Elements of an ESMS	Commitments
Policy	• HSSE&SP and related policies, signed by managers, employees, contractors and subcontractors, reflecting acknowledgement and commitment with the implementation.
Identification of risks and impact	• Periodically identify, assess and update list of environmental, biodiversity, social, labour, and health and safety risks associated with the Project in all of its stages. • Periodically update the stakeholder engagement plan (SEP) to identify social risks of the Project within the Project's Aoi

Elements of an ESMS	Commitments
Management programs	• Supplement the Project's existing plans, policies, and procedures with tailored management plans, as detailed in Section 12.5. The purpose of the management plans is to address the risks and impacts identified. • Each Plan has measurable events to the extent possible, with elements such as key performance indicators (KPI) targets, or acceptable criteria that can be tracked over defined time periods and with estimates of the resources and responsibilities for implementation.
Organisational capacity and competency	• E&S roles, responsibilities and authorities will be defined within an organisational structure to implement the ESMS. • Experienced staff assigned: at least one senior person will be responsible for the implementation of the ESMS. This person will be a HSSE&SP specialist, familiar with IFC PS, assisted by a team of other professionals with experience in security, social management, community health and community engagement. • E&S responsibilities will be assigned and communicated to key relevant personnel and the rest of the organisation. • Relevant training programs will be given to all HSSE&SP personnel, including social and biodiversity related topics. • Security related matters, including community and personnel, will be managed by a Site Security Manager reporting directly to the Project Director in close coordination with the HSSE&SP Manager. • Community liaison and public relations management role will be filled with a specialist with excellent communication skills to manage communication with third parties in close coordination with the HSSE&SP Manager.
Emergency preparedness and response plan (EPRP)	• Development of an emergency action plan (EAP), which includes assistance and collaboration with local stakeholders for risk analysis. • Disclosure of EAP with the local stakeholders. • Coordination with local authorities for the alignment of the EPRP with the guidelines of the Civil Protection Authority at the local level to respond to emergencies due to natural hazards.

Stakeholder engagement plan (SEP)	• Stakeholder's identification and mapping.
	• Development and implementation of a SEP with the following specifications:
	  ○ Periodic revisions and updates, as required according to results of any updated stakeholder mapping.
	  ○ The SEP will be an active tool tailored to the Project's risks and impacts.

Communications and grievance mechanism	• Development and implementation of community and worker grievance mechanisms that comply with the following:

Elements of an ESMS	Commitments
	○ Available and communicated to all relevant internal and external stakeholders as early as possible in the Project development phase. ○ Performance and maintenance of a grievance registration system, to systematise results and use the information to update Project-related social programs.
Ongoing reporting to stakeholders within the Project's Aoi	• Submission of monitoring results to the local authorities as requested in the Environmental License. • Proactive addressing of local stakeholder issues and concerns. • Ongoing communication to facilitate stakeholder understanding of risks and impacts of the Project. • Update of ESMS if new environmental or social risks emerge. • Reporting of progress on implementation of E&S commitments with identified stakeholders. • Reporting of monitoring results on issues of interest to local stakeholders. • Information disclosure that uses local language and easily understandable formats. According to IFC's guidelines, the frequency of this communication will be proportional to the scale of stakeholders' concerns, but it will be at least annual.
Monitoring and review	• Biodiversity, physical, and social monitoring programs as detailed in the related ESMMPs. • Documentation of monitoring results to track performance and compare these against the previously established points of reference or requirements in the management program, and to identify and reflect the necessary corrective and preventive actions. • Development of internal inspections and audits, to verify compliance and progress towards the desired outcomes of the management program. • Development of a Contractor Management Plan.

12.1.2 Management and monitoring approach

The Project's approach to E&S management applies the 'plan, do, check, act' continuous improvement principles of ISO 14001: Environmental Management Systems (2015), and ISO 45001: Occupational Health and Safety Management Systems (2018) international environmental management system standards (see Section 12.2). Further details of how the plan-do-act-check process will apply to the Project are provided in Table 12.2.

E&S impacts are managed throughout the full Project life cycle through to decommissioning and restoration, and the entire value chain through the implementation of an ESMS, which includes the Project ESMMP documents and other supporting documents.

A suite of ESMMP documents is currently in various stages of development and approvals, including many that already exist but will be revised prior to construction, and will include management and monitoring requirements for the construction of the Project. These will be updated as the Project progresses, with key updates taking place prior to the operational phase and decommissioning phase.

Key requirements for ESMMP documents are included in Section 12.5 and comprise a set of topic-specific plans (e.g., waste management, soil management, community health and safety, cultural heritage management) that address the E&S commitments made in the ESIA. The E&S commitments are presented in the Project E&S commitments register ('commitments register'). The ESMMP documents will be the definitive compilation of relevant commitments agreed for the Manifestation de Impacto Ambiental (MIA) permitting, and those made in this ESIA, and will be used to coordinate and review the E&S performance of the Project.

Commitments detailed in the commitments register will be finalised following the ESIA disclosure process, considering any issues raised, and during contractual arrangements between Transition Industries and the EPC and operation and maintenance (O&M) contractors.

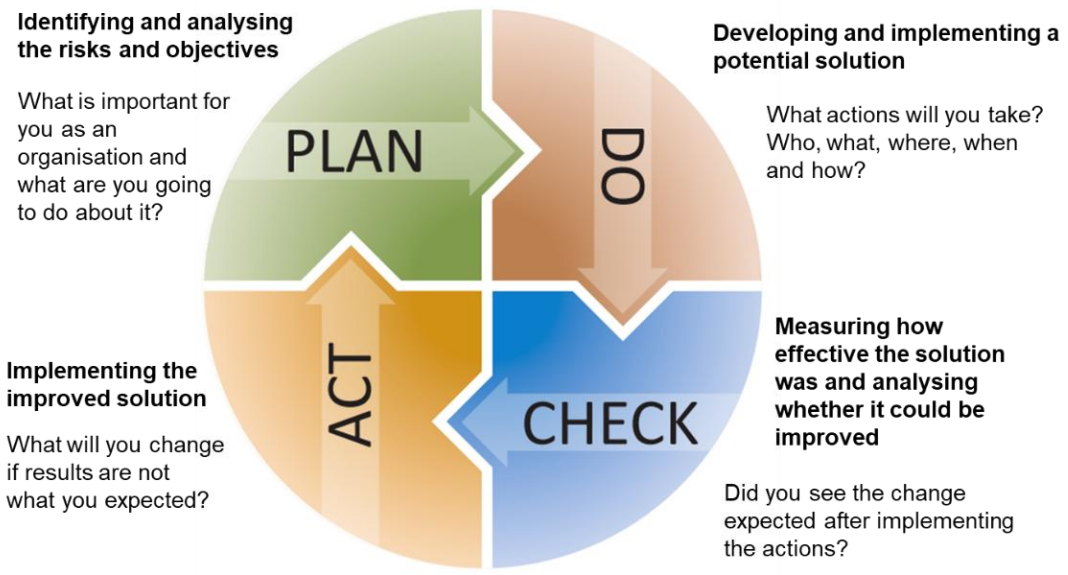

Figure 12.2: Plan-do-check-act continuous improvement principles

Source: IFC (2015)

Table 12.2: Plan-do-check-act description

Stage	Description
Plan	• Identify hazards and risks to the Project, for example, through the ESIA process. 'Plan' also involves identifying legal and other requirements and setting goals and targets. • The ESMMP documents list relevant commitments that have been generated in the ESIA process and assigns the responsibility for each commitment that will be implemented in the 'do' stage of the cycle. The ESMMP documents are 'live' documents and will be updated during the Project, as required.
Do	• The ESMS will include the ESMMP documents containing several management plans to be developed by Transition Industries and/or the EPC and O&M contractors. • Figure 12.3 illustrates the anticipated key documents within the construction phase ESMS. • Training and skills development plans will be implemented either directly by Transition Industries or via its contractors to ensure that required competencies are available and appropriate to the defined risks. The training programme (including daily toolbox meetings) will be updated in accordance with changes to the scope of work, incident statistics and/or regulatory requirements. • Priorities for capacity development of the Project workforce in relation to E&S will be identified. Capacity development activities will be tailored to the needs of the workforce and be accessible in the appropriate language. • Transition Industries will proactively identify vulnerable groups and develop specific engagement activities/methods where necessary to ensure vulnerable groups are aware of employment and training opportunities. Targets and hiring criteria will be included where possible and appropriate to ensure active inclusion of women and for the training of women.
Check	• Transition Industries and the EPC/O&M contractors will implement E&S audit and assurance processes aimed to confirm that the commitments made during the ESIA are fulfilled. • The ESMMP documents will specify key indicators for E&S performance. • The EPC/O&M contractor will develop an E&S monitoring and reporting plan that reflects the specific monitoring requirements contained within the ESMMP documents and will produce a combined E&S monitoring report monthly for Transition Industries to review.
Act	• Where performance monitoring identifies non-conformance (i.e., deviations from Transition Industries requirements) or non-compliance (i.e., failure to comply with a legal requirement), these will be investigated to identify likely causes and appropriate corrective/preventive actions. • All non-conformances/non-compliances will be assigned a corrective action, and preventative action where appropriate.

Stage	Description
	• Procedures will be developed for non-conformance/non-compliance management, action tracking and the management review process.

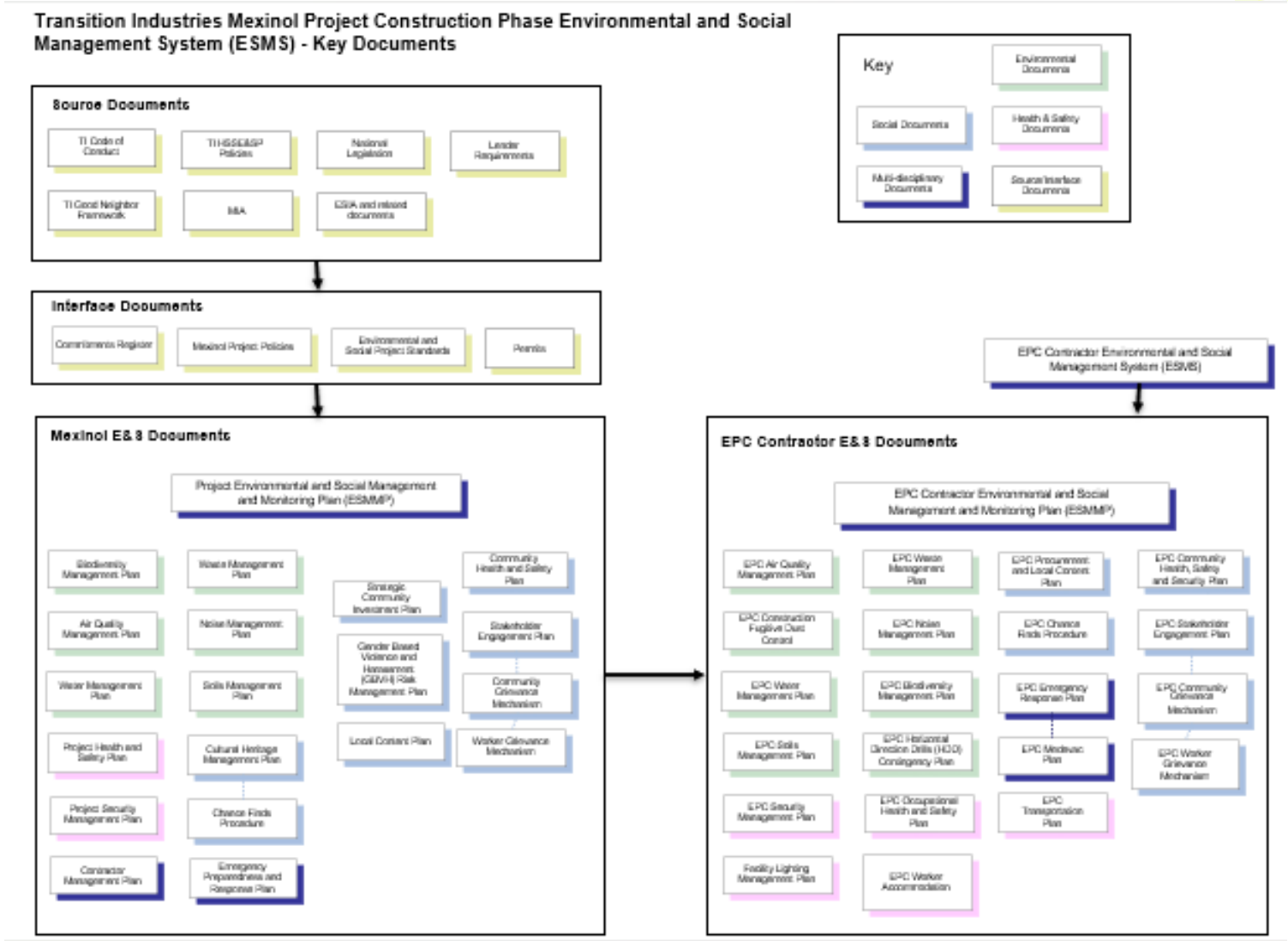

Figure 12.3: Mexinol Construction ESMS - Key documents

12.2 Policies and applicable standards

Understanding and properly implementing applicable E&S requirements and standards are critical to business planning. Applicable requirements include Mexican regulatory requirements, MIA requirements, Lender requirements, Equator Principles, IFC PS, and other requirements affecting the natural gas processing sector (as described in Chapter 2). Transition Industries identifies and follows applicable national, international, and local legislation on E&S resources, including labour and health and safety. Further details are provided in Section 2 ("Regulatory Framework"). Responsibilities for identifying and tracking changes to legislation and other applicable standards are detailed in Section 12.6.3, and implications for E&S management and monitoring will be handled in accordance with the management of change procedure, as described in Section 12.12.

This section outlines Transition Industries and Mexinol Project policies, relevant to the Project ESMMF. See Chapter 2 for national and international regulations and standards.

12.2.1 Good Neighbour Framework

The Good Neighbour Framework establishes common expectations used by Transition Industries and its affiliates (including Pacifico Mexinol) for addressing risks. It is guided by the concepts of integrity and transparency, and is used to systematically manage workforce safety and health, process safety, reliability and integrity, environment, efficiency, security, and stakeholders to meet the following core objectives:

- Leading, managing and driving HSSE&SP performance so that it is a part of Company culture and is embedded across all teams and disciplines
- Using a risk-based systematic approach to identify, assess, prioritise and manage risk to prevent occupational health and safety (fatalities, serious injuries and illnesses), environmental and socioeconomic impacts
- Designing, constructing and preparing for start-up by eliminating high-consequence process safety incidents, environmental and socioeconomic risk and operating with industry-leading reliability
- Selecting, training, engaging and enabling people, including within the Company and with all third parties
- Leading the industry on energy and resources efficiency
- Proactively engaging with stakeholders and communities and conducting issues management to address business risks
- Managing changes and learning from experience.

Figure 12.4 presents a high-level description of the Good Neighbour Framework and its essential elements. Implementation of the Good Neighbour Framework will be consistent with the risks associated with Project activities being planned and performed.

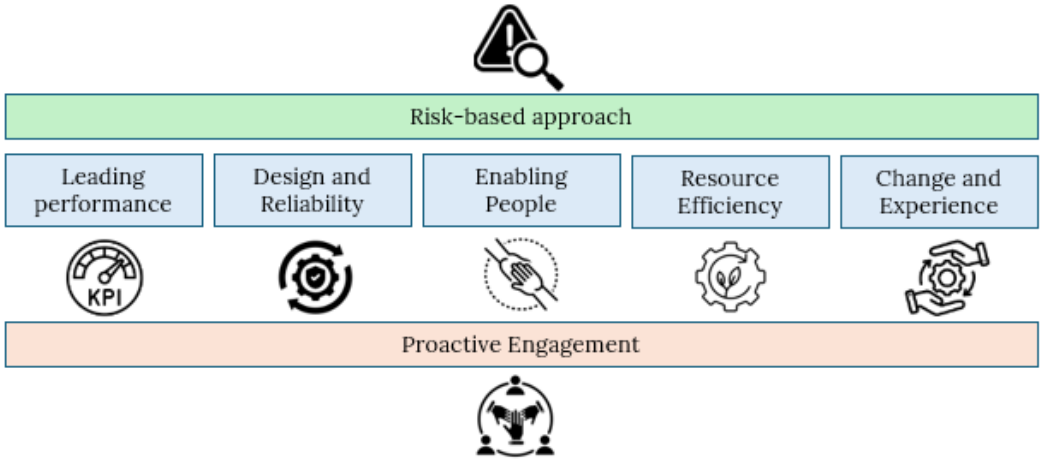

Figure 12.4: Good Neighbour Framework elements

12.2.2 Mexinol Project policies

The following Transition Industries policies are applicable to the Mexinol Project:

- Health, Safety, Environment and Social Performance Policy
- Sustainability Policy
- Anti-bribery and Corruption Policy
- Human Rights Policy, which includes commitments to adhere to the UN Voluntary Principles on Security and Human Rights, as well as Modern Slavery
- Human Resources Policy, which includes Code of Conduct, tenets related to diversity, equity, and inclusion (DE&I), working conditions, management of relationships, and terms of employment
- Security Management Policy.

Transition Industries' policies are published on the following website: www.transitionind.com. Transition Industries provides a copy of the policies to all employees and contractors upon induction, and to potential clients during the development stage.

12.3 Identification and assessment of risks and impacts

Transition Industries, through the Mexinol Project subsidiary, will take the full responsibility of the E&S management of the construction and operations of the Project. The ESMS will address the Project description as detailed in the Section 3 ("Project Description"). As described in Section 12.1.2, the identification of E&S risks and impacts is a continuous process and is reassessed following abnormal operating conditions, emergencies, or unforeseen circumstances experienced by Project activities and facilities. The identification process addresses direct, indirect, and cumulative impacts. Furthermore, the risk and impact identification process encompass all of Transition Industries' activities, including those carried out on behalf of Transition Industries by a contractor or supplier.

The identification and assessment process initiated during the Project planning phase through the MIA process, is continued in this ESIA (see Section 8 ("Impact assessment")). As a result, E&S management and monitoring will be guided through the Project ESMS, and specifically by the tailored, topic-specific ESMMP documents that are currently in various stages of development; more details are provided in Section 12.5.

In order to ensure that all E&S hazards are appropriately identified and the impacts and risks are assessed, Transition Industries conducts a periodic review of the identification of hazards and risk assessments initiated as part of the MIA and subsequent applicable studies, including this ESIA.

The Project's HSSE&SP Manager is responsible for leading this process in collaboration with the contractors' (or supplier) HSSE&SP representative(s). In this role, the Project's HSSE&SP Manager will periodically review the planned Project activities, identify hazards or risks, keep commitments register with risk management action plans, and assess their potential impacts. The Project's HSSE&SP Manager will form a Risk Assessment Team, which will include members of the contractor's and Project's HSSE&SP teams responsible for compliance, community relations, security, engineering, construction and other related teams.

Based on the information reviewed, the team will use the commitments register as a guideline to identify E&S impacts and risks. The assessment will consider the activities and equipment used under all phases of the Project's lifecycle and will include normal operating conditions, transients, or unstable operating conditions (e.g., tests, commissioning, start-up, shutdown, recycling, or maintenance), and potential emergencies. The periodic assessment examines direct, indirect, and cumulative E&S risks and impacts. The goal of this assessment process is to ensure that no new or developing risks and impacts go unnoticed or unmitigated.

Once the risks and impacts have been identified, the Project will assess the risks. The highest impacts (with greatest significance) and risks (with the greatest severity rating and the greatest probability of occurring) are managed first. The lowest impacts (with lower significance) and risks (with a lower severity rating and the lowest probability of occurring) are managed in descending order of importance. Mitigation measures following the risk mitigation hierarchy are applied. Once the team has established the mitigation and control measures, the impacts and risk(s) will be reassessed. The Project HSSE&SP Manager is then responsible for recording the resulting reduced impact and risk (i.e., residual) in the commitments register.

The identification and assessment of E&S risks and impacts, the corresponding registers and relevant documentation, is reviewed at least annually and whenever there is a change that may affect the existing risks, such as changes to facilities, activities, installations, the communities, or the environment; a significant change in compliance obligations; or when emergency incidents happen. See Section 12.10.5 ("Management Review") for further details of the management review process.

The Project's E&S commitments register will serve as a tool, linking sources of internal and external requirements. The register details Project activities, as well the relevant HSSE&SP aspects that are relevant to each activity, so that relevant procedures, job descriptions, and trainings can be targeted to the right member and/or division of Mexinol and/or contractors. The register also includes a description of what measures, plans,

and/or procedures will be implemented to address the identified risks during different Project phases and assigned responsible parties.

12.4 Environmental and social management

Mexinol's ESMS provides an overview of how E&S management and monitoring will be implemented for the construction and operations phases of the Project, including the tailored management plans described in Section 12.5.

The purpose of the ESMS is to enable users to consistently foresee and address issues, while also helping to prevent potential E&S risks and impacts during construction and operations. The goal is to ensure that all appropriate policies, plans, and procedures are in place, and that staff are adequately trained to implement the ESMS through continued and improved learning.

The Project ESMS is intended for several parties:

- **Administrative authorities** (responsible for monitoring the E&S impact of the Project and the effectiveness of the mitigation measures): The ESMS is a reference document that local and central authorities can use to check that Mexinol honour commitments in the construction, operations and decommissioning phases.
- **Lenders**: The ESMS provides evidence that the commitments made through the ESIA documentation and the financing closure process, which reflects the Lender's E&S policies requirements, are implementable, budgeted, can be monitored and audited.
- **Local communities and organisations**: The ESMS describes the measures to manage and mitigate negative impacts and corrective actions to adapt to unforeseen changes during its implementation. The ESMS forms a basis for exchanges and negotiations in the consultation phases and the validation of the mitigation and compensation strategy proposed by Transition Industries and Mexinol
- **Mexinol's and contractor's HSSE&SP and the Technical Team**: The ESMS acts as the E&S roadmap for construction and operations. It sets out the commitments made by Transition Industries and Mexinol before the authorisation to start the main construction and established the logic behind E&S actions.
- **Owners and operators of other projects in the region**: The ESMS informs such parties of the objectives of each E&S action. In this way, it helps to facilitate possible synergies or avoid incompatible interfaces with other Project ESMMPs and to develop collective solutions where appropriate.

Various organisations (e.g., contractors, suppliers) are involved to support a smooth and successful development of the Project. Therefore, the ESMS will have a particular focus on managing contractors and suppliers, so that they are both aware and fully compliant with Transition Industries' commitment to E&S regulations and Lender requirements. A firm understanding of these requirements will also allow contractors and suppliers to commit to the same standards in all their operations within the Project's premises.

12.4.1 Contractors' ESMSs

For construction, the EPC contractors' ESMS, bridged with the Project's ESMS, will form the framework for managing E&S issues throughout construction.

The EPC contractors' management system will provide details of how the commitments for which the contractor has responsibility will be implemented. A comparative arrangement will be made during the operation phase between Transition Industries and the O&M contractor.

The management system(s) will be consistent with the principles of, but not necessarily certified to, ISO 14001/45001 or other similar standards.

The management system(s) will focus on the main mechanisms by which commitments are translated into practice, giving special consideration to:

- practical training and raising the E&S awareness of personnel
- supervision and monitoring of E&S issues in the field and tracking the implementation of corrective actions
- continuous improvement of E&S performance throughout the Project.

The Project's ESMS and the EPC/O&M contractors' management system(s) will each be commensurate with the scale of the Project and focus on the issues that are most important for managing E&S performance, without burdening the Project with excessively complex systems.

12.5 ESMMP documents

As part of the E&S approval process for the Project, tailored ESMMP are needed to address the risks and impacts identified in the 2021 MIA and this ESIA. The ESMMP will be used to minimise and/or reduce negative impacts, where these cannot be avoided, and optimise positive impacts.

This section describes the ESMMP documents that will be drafted to support the implementation of the ESMS. Table 12.3 summarises the documents relevant to the construction phase of the Project and Figure 12.3 depicts how the categories and management plans are included under the ESMS. The list is preliminary and only contains key ESMMP documents, which may be subject to change as the Project progresses to reflect management and contracting strategy decisions.

The management plans will typically include details of the following (or reference to associated Project documentation), as relevant to the topic of the plan:

- objectives
- roles and responsibilities
- summary of identified key issues impacts and risks
- legislative and institutional framework
- mitigation and management measures
- monitoring requirements and activities
- audit and inspection requirements
- implementation schedules
- reporting and record keeping

- performance targets/indicators
- training.

ESMMP documents will be reviewed annually as a minimum or more frequently as required in response to Project evolution, lessons learnt or adaptive management. During construction the Project, either Transition Industries or relevant EPC contractor, will be responsible for the content, drafting, implementation and revisions of the management plans described in this section. Requirements for the O&M contractors and decommissioning contractors will be determined prior to the start of the operational and decommissioning phases respectively.

Table 12.3: Preliminary key ESMMP documents and minimum content

Developer document	Key topics included	Expected EPC document
Project ESMMP	Defines the approach for E&S management, monitoring and reporting; including E&S management and mitigation measures (in line with ESIA commitments), training, monitoring and inspections programmes, management and investigation of non-compliance/non-conformance, corrective and preventative action management and tracking, and internal and external reporting.	EPC Environmental Management and Monitoring Plan
Contractor Management Plan	Describes the approach for communication with, and oversight of, contractors including arrangements for performance monitoring, HSSE training, cooperation for emergency preparedness and response, expectations for workers' and third-party grievance management, HSSE performance reporting, demobilisation of contractors and documentation management.	EPC Environmental Management and Monitoring Plan EPC Social Performance Management Plan
Project Health and Safety Plan	Outlines the health, safety and environmental requirements throughout the Project.	EPC Occupational Health and Safety Plan EPC Worker Accommodation and Transportation Plan
Project Emergency Preparedness and Response Plan	Emergency response will be covered, including the approach to emergency risk analysis, emergency preparedness, response planning and incident management, and will include measures for spill response. Also includes measures related to extreme	EPC Emergency Response Plan, including Medevac Plan

Developer document	Key topics included	Expected EPC document
	climate events, such as flooding, hurricanes, and heatwaves.	
Community Health and Safety Plan	Covers community health and safety, including management of community notification, worker-community interaction, sexual and communicable disease and community awareness programmes. Also outlines traffic management, such as requirements relating to pre-construction surveys, defined transport routes, vehicles and drivers, journey management planning and culturally appropriate information, signage and safety awareness education for communities.	EPC Community Health, Safety and Security Plan EPC Transportation Management Plan
Air Quality Management Plan	Outlines control measures for air quality in line with regulatory and good international industry practice.	EPC Air Quality Management Plan EPC Construction Fugitive Dust Control
Noise Management Plan	Outlines control measures for noise and vibration in line with regulatory and good international industry practice.	EPC Noise Management Plan
Waste Management Plan	Outlines the waste storage, handling and disposal requirements in line with the waste hierarchy, and regulatory and good international industry practice. Including measures relating to hazardous waste.	EPC Waste Management Plan, including chemicals, hazardous materials, spill prevention, controls and countermeasures
Water Management Plan	Details water consumption, groundwater and surface water management and sustainable management activities.	EPC Water Management Plan, including wastewater and stormwater pollution and prevention
Biodiversity Management Plan	Defines the approach to reduce impacts on biodiversity prior to, during and post construction. This will include footprint management, pre-construction surveys (PCS), restrictions on the timings of works and plans for habitat management and reinstatement. The plan also includes provisions to achieve No Net Loss of natural habitat, through implementation of the mitigation hierarchy and proposed compensation measures.	EPC Biodiversity Management Plan

Developer document	Key topics included	Expected EPC document
Soil Management Plan	Defines the approach to soil management and temporary erosion control reinstatement, including requirements relating to construction planning surveys and assessments, erosion and sedimentation control techniques, contaminated land and reinstatement.	EPC Soils Management Plan, including erosion control, revegetation, and maintenance; unanticipated sediment and soils discovery; and fill management EPC Horizontal Direction Drills (HDD) Contingency Plan
Strategic Community Investment Plan	Outlines approach to and requirements for voluntary contributions or actions by Transition Industries and Mexinol to help communities in the vicinity of the Project address their development priorities, and take advantage of opportunities created by private investment, in ways that are sustainable and support business objectives.	EPC Social Performance Management Plan
Gender Based Violence and Harassment (GBVH) Risk Management Plan	Outlines approach to the management and mitigation of GBVH risks within Transition Industries' control.	EPC Social Performance Management Plan
Local Content Plan	Outlines requirements for the recruitment, employment, training and demobilisation of local Project workers. Includes requirements for recruitment plans; inclusion, training and additional assistance for women; culturally appropriate training programmes and the communication of these programmes. Includes specific targets for the local workforce during construction and operations. Includes activities aimed at identifying opportunities for enhancing local content (both workforce and businesses); demobilisation support and end of contract documentation.	EPC Procurement and Local Content Plan
Cultural Heritage Management Plan, including Project Chance Find Procedure	Defines the approach to the management and mitigation of impacts on tangible and intangible cultural heritage. Includes a Chance Finds Procedure.	EPC Chance Finds Procedure
Stakeholder Engagement Plan and Community Grievance Mechanism	Provides an overview of the planned stakeholder engagement process including stakeholder identification and analysis, the stakeholder engagement programme, grievance management and data management.	EPC Stakeholder Engagement Plan and Community Grievance Mechanism

Developer document	Key topics included	Expected EPC document
Project Security Management Plan	Outlines management and mitigation measures necessary to ensure that security is adequately managed, including security risk assessments, security contractor management, physical security (such as fencing, signage, lighting etc.), protocols for security issues, and incident reporting, investigating and resolving. It needs to be in line with IFC PS 4 (community and occupational security aspects).	EPC Security Management Plan Facility Lighting Management Plan

The ESMMP documents outlined above constitute the foundation of Mexinol's ESMS and are communicated to employees throughout the entire organisation at all levels, including subcontracted employees and Mexinol and Transition Industries' employees, as well as other stakeholders where required (e.g., shareholders, local stakeholders and communities). They describe E&S mitigation and performance improvement measures that address the identified E&S risks of the Project and apply throughout Mexinol's organisation.

As with other aspects of the ESMS, the ESMMP documents will be responsive to changes in circumstance, unforeseen events, and the results of monitoring, audits, and continued review, as per the management of change procedure (Section 12.12).

12.6 Roles and responsibilities

A key success factor for the effective implementation of the ESMS and the associated ESMMP is the definition of roles and responsibilities, both within Transition Industries, Mexinol and between Transition Industries/Mexinol and EPC contractors. This section describes the organisation structure, including roles and responsibilities for the Project.

12.6.1 Transition Industries organisational structure

As part of design and implementation for the Project, Transition Industries has established an organisational structure within the affiliate, Pacifico Mexinol (the Project), that is responsible for managing Project activities over the life cycle of the Project (at least 30 years). A dedicated in-country organisation will be in place throughout each Project stage. The organisational size and makeup will evolve over time to accommodate the business needs associated with construction, operations, and ultimately decommissioning.

The in-country organisation will be led by a Project Director and supported by various discipline managers such as Operations, Project Engineering, Human Resources, Business Services (e.g., Procurement, Controllers, Information Technology) and HSSE&SP (including community and government relations). The in-country organisation will also be supported by several technical, business, and administrative specialists located inside and outside of Mexico. The in-country organisation is responsible for all in-

country Project activities and will be the organisation that interfaces with government and stakeholders.

The Mexinol management team will be supported by an HSSE&SP team that provides technical expertise, training, and administrative support for HSSE&SP implementation, which addresses disciplines such as safety, environment, occupational health and safety, regulatory, permitting and socioeconomics.

The in-country organisation will also be supported by several teams that are responsible for managing certain types of Project activities. Examples of such teams include a Logistics Team that manages logistical support, and a Project Team that manages the engineering, procurement, construction, and installation of the Project components. Each of these teams has a suite of discipline managers to support the planning and execution of the Project activities for which they are responsible, including HSSE&SP.

The Mexinol management team is accountable for managing Project activities in alignment with the HSSE&SP established policies, in compliance with the laws and regulations of Mexico, and in line with the commitments and obligations associated with environmental authorisations and the Project ESMMP.

Functional direction is provided primarily through the processes and procedures established in the management plans.

12.6.2 Contractor management

Transition Industries manages the compliance of the EPC and O&M contractors with the ESMMP through clauses within the EPC and O&M contractors' contracts. These clauses ensure that the contractors develop and comply with the E&S commitments specified in the ESMMP and stipulate that the contractor(s) allocate sufficient qualified staff and equipment to carry out the Project. These processes, including pre-qualification, procurement, award and monitoring, are detailed in the Contractor Management Plan.

12.6.2.1 Organisational capacity and competency

An organisation chart presenting Mexinol Project management and HSSE&SP-related staff is provided in Figure 12.5.

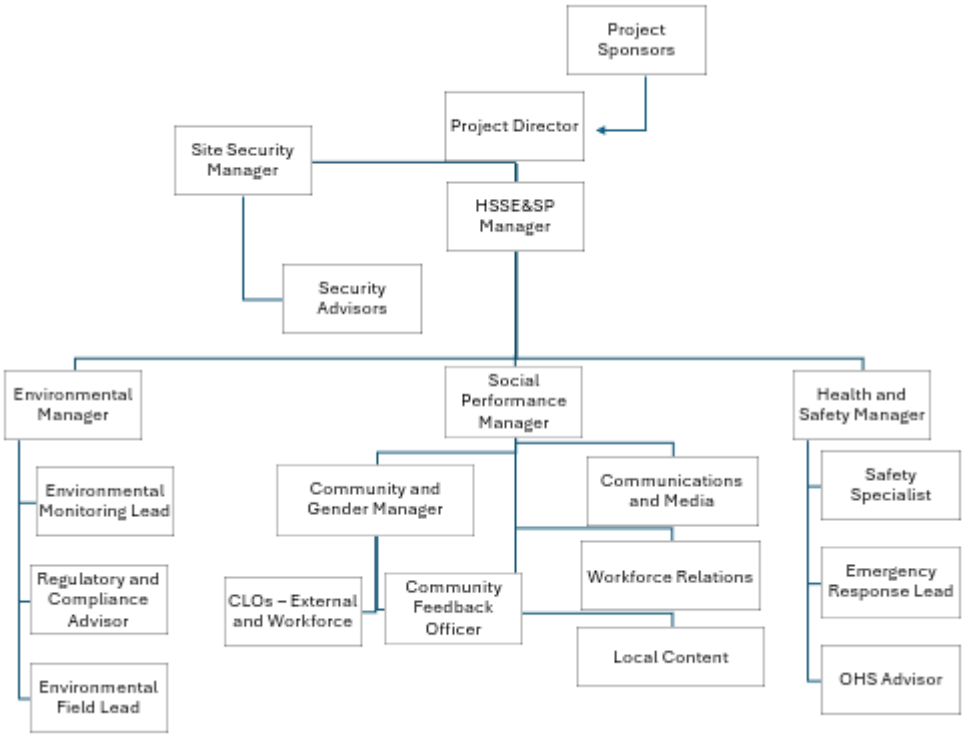

Figure 12.5: Mexinol organisation chart

At the Project construction site, the Project Director and Construction Management Team are responsible for ensuring the proper allocation of human, technical, and financial resources needed to implement and maintain the ESMS. Furthermore, Transition Industries' senior corporate management, including the Director of Environmental, Social and Governance (ESG) and the Director of Corporate Affairs, have responsibilities to ensure that all Mexinol Project HSSE&SP commitments are honoured and managed to good international industry practice (GIIP), as described throughout this ESIA.

12.6.3 Summary of key roles and responsibilities

Table 12.4 outlines the key roles and responsibilities of parties implementing the ESMS.

Table 12.4: Key roles and responsibilities

Role	Responsibilities
Project Developer: Transition Industries and its subsidiary Pacifico Mexinol	• Implement and operate the Project and ensure that all Project-related activities are carried out in compliance with the Lenders E&S requirements and Mexican regulations • Maintain permit conditions. • Approval and implementation of the Project E&S policies, principles, and objectives. • Ensure that an ESMS is established and maintained and providing overall direction, support, and resources for the implementation during construction and commissioning. • Establish objectives for E&S performance and ensure contractors have appropriate environmental controls and systems in place.

Role	Responsibilities
	• Provide access to land to the EPC contractors prior to main construction. • Implement ESMS and perform E&S activities required to mitigate impacts other than those caused by construction methods and operation and maintenance activities. • Monitor the state of the receiving environment that could be affected by the Project activities. • Undertake E&S management actions as directed by regulatory agencies. • Inform regularly the community and other external stakeholders of Project activities and impacts and address issues raised by the community. • Ensure that employees are aware of and understand their E&S responsibilities and encourage proactive involvement in implementing the ESMS.
EPC Contractors O&M Contractors	• Prepare detailed ESMMPs and schedule works in a way that avoids and minimises adverse E&S effects. • Work with Mexinol Project to improve and adapt the design to minimise adverse impacts. • Respond to any complaints received in accordance with the Project Grievance Mechanism. • Comply with the relevant E&S requirements detailed in the Project ESMS and ESMMP, including the submission of plans and procedures under EPC/O&M responsibility that meet, as a minimum, Project E&S standards. • Provide site personnel induction training, including communication of Project E&S requirements prior to commencing on-site activities, and specific E&S training to personnel who have jobs with significant E&S risks. • Communicate relevant E&S requirements to subcontractors and specialist contractors and oversee their scope of work. • Implement self-verification processes and cooperate with and participate in Project E&S site audits and inspections led by the Project Management Team. All non-conformities, non-compliances and hazards identified during these audits and inspections must be addressed with appropriate preventive/corrective actions and reported as required. • Report all Project E&S issues, including incidents, and performance data to the Mexinol Project management team relevant HSSE&SP Manager.
Project workforce	• Be aware of and demonstrate E&S commitment through their actions by knowing and respecting the E&S rules and practices in their work areas and actively participating in E&S meetings, safety talks, toolbox talks, training sessions and drills. • Perform their job and behave in a manner which prevents accidents, eliminates harm to people and does not damage the environment; this includes stopping work that is unsafe. • Use personal protective equipment (PPE), tools, equipment, and their safeguards correctly.

Role	Responsibilities
	• Report any hazards, near misses or incidents to their supervisor.

12.7 Awareness, training and capacity building

To ensure its technical capacity, Transition Industries implements an annual training program in E&S management for the personnel responsible for the implementation of the ESMS. The annual training will be developed so that all employees have knowledge of Transition Industries' and Project E&S policies (awareness) and so that employees who have a role in E&S issues know their roles and responsibilities and are tooled to properly implement them (training). This training is mandatory for all employees with relevant ESMS roles and responsibilities.

In addition, the HSSE&SP Manager, the Safety Officer and Security Managers will determine the need for specific and complementary technical training on risks, impacts, management, or GIIP of E&S aspects for their personnel. Each individual unit/manager is responsible for determining the frequency of complementary and required training, based on their abilities and needs (subject to human resources (HR) Department approval).

New hires also receive orientation that includes E&S awareness training. During the construction phase, EPC contractors are responsible for training the on-site contracted workers. Mexinol tailors training for contracted workers based on site-specific E&S policies and procedures. The EPC contractors and Contractor Management Team are also responsible for ensuring that all contracted employees are competent, perform their job duties safely and in a legally/environmentally compliant manner, and are clearly aware of all potential E&S hazards, impacts, and proper response measures. E&S awareness amongst contracted employees will include, at minimum:

- Relevant risks and exposures from the identified significant impact/hazards
- The importance of observing all ESMS policy, procedure, and plan requirements, including the consequences should an employee fail to observe these requirements
- Personal roles and responsibilities required by the ESMS.

Mexinol promote ESMS awareness through repeated and clear communication using the following methods of communications:

- Contractor and/or vendor orientation
- Awareness training for contractors, visitors, new employees
- Safety and/or environmental and individual team trainings during the construction phase of the Project (e.g., Toolbox Talks, mandatory safety meetings prior to starting your shift)
- Online trainings (e.g. via Webex)
- Posted e-mails
- Incident-related trainings, as decided by the Project Director

- Posters and banners
- Spot checks.

The HSSE&SP Manager handles the performance and documentation of the above-mentioned E&S awareness trainings. The manager is also responsible for ensuring the Contractor Management Team (and future Plant Operations Manager) is fully apprised of:

- Relevant existing, new, or modified legal and other requirements related to any mandatory environmental trainings
- E&S awareness training(s) warranted by the nature of the operations and the requirements of the ESMS
- Suitable training materials and qualified training vendors.

The HSSE&SP Manager is also responsible for developing and maintaining a current "Training Needs" matrix, which lists all the significant E&S training programs conducted, how they pertain to various job classifications, and frequency of trainings. Team Leaders and/or Lead Specialists are responsible for ensuring that all employees receive all their required trainings in a timely manner, per the "Training Needs" matrix.

12.8 Emergency preparedness and response

The objective of the EPRP is to provide comprehensive guidance regarding response to accidental and emergency situations identified during the hazard identification and risk assessment process. The EPRP includes protocols to ensure close coordination with local, state, and federal agencies and emergency response officials. These collaborative efforts will continue throughout the development, construction, operation, and future decommissioning stages of the Project. The EPRP will comply with Mexican regulations and international standards (IFC Performance Standards, WBG EHS General Guidelines, WBG EHS Guidelines for Natural Gas Processing, and WBG EHS Guidelines for Ports, Harbors, and Terminals).

The purpose of the EPRP is to define and provide measures to effectively respond to emergency situations, thereby reducing risk of injury, illness, and fatalities to all personnel and the public, as well as to limit the damage done to the environment, infrastructure, and surrounding areas. The Project's EPRP:

- assesses and identifies foreseeable, credible emergency scenarios that may occur during execution of Project operations
- establishes organisational, operational, and preventive measures to guarantee the safety of individuals and property within the Project sites and network
- identifies areas where accidents and emergency situations may occur and how communities/individuals may be impacted
- provides guidelines for immediate responsive actions to face emergency situations and contain and control environmental emergencies caused by accidents (e.g., spills, fires, and accidents involving wildlife)
- ensures provisions and resources are adequately identified and supplied
- ensures compliance with national legislation and international applicable standards

- minimises negative effects on the environment
- supports communication with stakeholders (IFC Performance Standard 4)
- supports effective mechanisms established for protecting the health, safety, and security of nearby communities from direct and indirect Project-related health impacts and hazards.

Mexinol provides the Project EPRP to all employees and designated contractors. The contractors' EHS Compliance Manager, in collaboration with Mexinol's HSSE&SP Manager, will ensure the implementation of fully robust Project EPRP, which covers major emergency scenarios. EPC contractors will be required to develop and implement an EPC Emergency Response Plan, reflecting the requirements of the Project EPRP. Mexinol will also make the appropriate plans available to relevant first response agencies, regulatory authorities, community officials and affected community members, as appropriate.

The EPRP defines the specific activities, responsibilities, equipment, and resources necessary to respond to an emergency and to prevent and minimise harm to employees, contractors, and local communities. The EPRP will be communicated, reviewed, and periodically updated. Contractors will ensure that emergency procedures relevant to the Project are practiced on a periodic basis recognising that construction and operations phases will have different frameworks. For example, the Terminal, water, and wastewater treatment facilities will have separate service providers and coordination with EHS matters will be required (e.g. access, inspections, maintenance, security, etc.).

The HSSE&SP Manager, Safety Officer, and Security Managers are also responsible for revising and updating the EPRP as needed, to reflect major changes that may occur within the facility, as well as any lessons learned from actual emergency events or from the result of periodic simulations and/or drills. Contractors will report the results of the exercises, simulations, and drills to the Project HSSE&SP Manager. The results will include any nonconformities and corrective actions that are identified.

Mexinol will provide comprehensive training to ensure that all facility personnel are familiar with the safety procedures, operating procedures, and maintenance procedures utilised at the Project. Professional instructors with expertise in their area of responsibility will be responsible for conducting the training. During emergency response training, coordination with and involvement of appropriate local emergency responders will be undertaken to ensure effective integration with local communication and emergency response systems.

12.9 Stakeholder engagement

Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a Project's E&S impacts (IFC Performance Standard 1). Stakeholder engagement is an ongoing process and generally involves the following elements:

- Stakeholder analysis and planning
- Disclosure and dissemination of information
- Consultation and participation
- Community grievance mechanism

- Ongoing reporting to stakeholders.

As part of its ESMS, Transition Industries has developed a SEP that is in line with relevant applicable standards and the nature, frequency, and level of effort of stakeholder engagement activities is commensurate with the Project's E&S risks and adverse impacts.

12.10 Performance monitoring and review

Mexinol tracks its E&S performance through several formal documented procedures, mechanisms, and tools (e.g., internal inspections, KPIs, and audits) to monitor significant Project-related impacts and risks. Mexinol's extent of monitoring is commensurate with the Project's E&S risks and impacts, as well as Lender and regulatory requirements.

Team Leaders within each division or department will be responsible for measuring and tracking progress against the E&S targets/objectives. The Mexinol programs and parameters to be used for measuring and tracking progress are detailed in Section 12.10.1. Team Leaders/Specialists report progress to the HSSE&SP Manager, who is then responsible for consolidating the information into a concise presentation for the Project Director and the Contractor Management Team during the construction phase. During the operation phase, the Plant Team Leaders/Specialists will be responsible for preparing a presentation for the relevant regulatory agencies and the Plant Operations Manager.

On a periodic[174] (e.g., annual) basis, Transition Industries' corporate management is also responsible for reviewing the effectiveness of the implementation of the ESMS, based on systematic data collection (e.g., KPIs) and analysis (this review will include data obtained throughout the course of the year). Based on the results of this review, Transition Industries' corporate management will take the appropriate steps to ensure that company's E&S policies, procedures, programs, plans, and instructions are being implemented effectively, deviations are corrected as necessary, and the path of continual improvement is defined.

Transition Industries may also consider involving representatives from local communities to participate in monitoring activities.

12.10.1 Monitoring parameters

Mexinol monitoring programs and parameters to be used for measuring and tracking progress shall include, as a minimum, those detailed in Table 12.5 below.

Table 12.5: Mexinol monitoring programs and parameters

Monitoring aspect	Mexinol program	Parameters
Air/atmospheric monitoring	Emission monitoring program	Quantitative: • CO, CO2, NOX, SO2 (through the state vehicular verification program) • PM10, PM2.5

[174] Significant incident will trigger immediate emergency review by management.

Monitoring aspect	Mexinol program	Parameters
		Qualitative: • Air quality condition
Water monitoring	Groundwater monitoring program	Quantitative: • pH, temperature, electrical conductivity, total dissolved solids, salinity, REDOX potential and percentage of oxygen, hydrocarbons, etc.
Soil monitoring	Soil monitoring program	Qualitative: • Organoleptic tests (weekly/monthly) Quantitative (only in case of a suspected incident or incident) • Lab test for hydrocarbons or the analyte of concern
Waste monitoring	Waste management program • Municipal solid waste • Especial management waste • Hazardous waste	Qualitative: • Correct waste management Quantitative: • Weight generated
Biodiversity monitoring	• Monitoring, capture, conservation and maintenance program for fauna species** • Avifauna monitoring program • Wild fauna and flora protection, rescue and relocation program** • Wetlands benefit compensation program • Reforestation of native species program • Reforestation for provisional areas program	Quantitative: • Species richness* • Abundance of species* • Dominance* • Number of surviving specimens* • Number of specimens rescued* • Reforested area* Qualitative: • General condition of the specimens
Other aspects monitoring	• Environmental education program • Machinery maintenance program	Quantitative: • Number of people having completed required training as specified in the education program • Number of equipment maintained
Compliance monitoring	• Environmental monitoring plan • Environmental monitoring program	Quantitative: • % KPIs achieved
Note:		

Monitoring aspect	Mexinol program	Parameters
** The programs are going to be fed with the same inputs (activities/results). Both are repeated in the Project authorisation, as the “Monitoring, capture, conservation and maintenance program for fauna species” was proposed in the MIA, and the “Wild fauna and flora protection, rescue and relocation program” was established as a specific condition from SEMARNAT. These programs will therefore be implemented to meet regulatory requirements. * As applicable to the relevant Mexinol program.		

12.10.2 Internal audits

A programme of internal audits will be implemented to confirm that the Project and contractors are adequately implementing the arrangements in the ESMS, and that those arrangements are sufficiently managing the E&S impacts related to the Project. Where these audits identify non-conformances with Project requirements, corrective/preventative actions will be identified and tracked until closure.

12.10.3 External audits

Transition Industries will utilise external audits (e.g., regulatory, third-party, Lenders) and inspections, where relevant, to verify compliance and progress towards desired E&S objectives and targets. External monitoring will be adjusted, according to the relevant regulatory authorities and will be managed by Transition Industries corporate.

12.10.4 HSSE&SP monitoring reports

The overall objectives and targets, will be tracked and recorded in the monthly HSSE&SP monitoring report, prepared by HSSE&SP team. The monthly HSSE&SP monitoring report will identify non-conformance[175] events and document progress with steps taken to mitigate reoccurrence (i.e., corrective action). Progress and results regarding internal audits and inspections will be contained in the HSSE&SP monitoring report. Once operation begins, HSSE&SP monitoring reports will likely become bi-annual.

12.10.5 Management review

During construction and operation, Transition Industries will begin annual management reviews of its ESMS and related policies and procedures. The Construction Project Director and Operations Plant Manager will be responsible for leading this annual review, along with the support from the HSSE&SP Manager and teams. Both parties will ensure continuing suitability, adequacy, and effectiveness of all elements of the ESMS.

The management review will take into account information from various sources, including:

- The status of recommended actions from previous management reviews
- Results from internal audits and the status of any resulting corrective/preventive actions taken

[175] A non-conformance results from an implementation audit (i.e., evaluating the appropriate implementation and effectiveness of the ESMS system via audits, emergency events, unplanned reviews, and number of safety occurrences).

- E&S performance, including the extent to which the Project has achieved the established E&S objectives and targets
- Changes in business strategy, assets, operations, technologies, and associated E&S impacts
- New and emerging issues affecting the Project and interested E&S stakeholders
- Communications from external stakeholders, including grievances.

Each annual management review (as well as any associated meeting minutes) will be documented electronically according to Transition Industries' document control standards (see Section 12.11). The HSSE&SP Manager is responsible for ensuring that all relevant changes are incorporated into the ESMS.

12.11 HSSE&SP Records

Transition Industries has established a records retention policy, which governs the identification (i.e., naming convention), maintenance, timely retrieval, retention, and disposition of E&S records to demonstrate conformance to the requirements of the ESMS and document E&S performance. Transition Industries considers the following materials to be ESMS-related records:

- Training records
- Any records generated internally or externally, which detailed measured environmental, health, and safety performance
- Internal or external audit reports
- Corrective and/or preventive action plans to address identified significant non-conformances.

The HSSE&SP Manager is responsible for implementing and controlling ESMS-related records. This responsibility also includes ensuring records remain legible, identifiable, and traceable. Additionally, the HSSE&SP Manager will prevent the unintended use of outdate or obsolete versions of records.

12.12 Management of change

Changes to the Project may occur after the preparation and submission of this ESIA. Applicable regulatory requirements identified and followed by Mexinol and Transition Industries (see Section 2 and Section 12.1.2) may also change throughout the different Project phases, such as new or modified legislation at international, national and local levels. Transition Industries will develop and implement a management of change procedure so that any changes occurring during the final design stages, construction, operation or decommissioning are subject to scrutiny and any implications for E&S issues are identified, approved and addressed through the management of change procedure.

The management of change procedure will include:

- Guidelines for the E&S appraisal of the change including the identification of new or revised mitigation measures
- A health and safety evaluation
- Consultation with engineering and health, safety and environment disciplines

- Consultation with SEMARNAT (or other authority) on the need for amendments to the MIA permit if required
- Management of change approval process.

Following management of change approval, changes to the ESMS and supporting management plans will be communicated to relevant parties and implemented.

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APPENDIX 1
BIODIVERSITY MANAGEMENT PLAN

Appended in Volume 2

APPENDIX 2
STAKEHOLDER ENGAGEMENT PLAN

Appended in Volume 2

APPENDIX 3
INDIGENOUS PEOPLES PLANNING FRAMEWORK (IPPF) FOR TL

Appended in Volume 2

APPENDIX 4
SUPPLEMENTAL LAND DOCUMENT

Appended in Volume 2