HERA FUEL STORAGE AND JETTY DEVELOPMENT-ENVIRONMENTAL MANAGEMENT PLAN (EMP)

This draft Environmental Management Plan (EMP)is prepared by PEC Consulting, Lda on behalf of Esperanca Timor Oan (ETO), Lda. PEC Consulting is a national environmental and engineering consulting company headquartered in Dili. Comments, suggestion and inputs to this draft EIS can be forwarded to pec.dili.consulting@gmail.com

Table of Contents

1. Executive Summary

Proposed fuel storage facilities with the mentioned capacity and associated jetty will be constructed by ETO, Lda. in Suco Hera, District of Dili. The project will take roughly 2 ha of land for storage facility and 600 meter for jetty from the beach toward the sea.

Pre-construction phase activities mainly consist of site survey and assessment followed by site preparation including clearance and grading. These activities have the potential to create temporary environmental impacts such as dust impact to people, solid and liquid waste generated by workers, loss of existing trees and bushes, impact to safety of workers, some degree of traffic disruption to the national road nearby, and noise problem.

After site preparation, enter the construction phase during which the following activities may create impacts that affect people and the environment. This includes dust, solid and liquid waste generated by worker, marine water pollution, loss of coastal seagrass and seaweed beds to make way for the jetty, sedimentation in the coastal area and occupational health and safety. Table 1.1 shows main project activity during Pre-Construction and Operation.

Table 1.1. Main Project Activity in Phases of Project Implementation

Phase	Activities
Pre-Construction and Construction	➢ Excavation and Foundation Works /Earth Work ➢ Construction of Storage tanks ➢ Construction of office spaces ➢ Installation of piping system ➢ Installation of control system
Operation	➢ Loading of Oil from oil Tanker from the jetty ➢ Transportation of fuel from tanker to storage ➢ Filling the tank ➢ Transportation of fuel from tank to the power plant ➢ Transportation from fuel storage to the consumers via truck tanker or direct filling system ➢ Operator//working ➢ Control system
Decommission	No decommissioning plans have been prepared because ETO has plans to further develop the site into depot and office complex in the nearby location therefore ensuring a long term viability of the facility.

The potential social and environmental impacts that may arise from the above list of activities can be be found in the following table.

Table 1.2. Summary of Project Activities and Potential Impacts

Facility	Phase	Potential Impacts	Source Activities	Impact Classification
Jetty	Pre-construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Occuptational health and safety	1. Dredging and worker activities 2. Dredging and worker activities 3. Dredging and worker activities 4. Worker activities	All classified as minor impacts due to the temporary and localized nature of the impacts
	Construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology - negative 4. Marine and coastal ecology – (positive) 5. Coastal hydrology – changes in current pattern, waves and sediment movement 6. Structure inundation 7. Occuptational health and safety 8. Noise and vibration	1. Dredging and worker activities 2. Dredging and worker activities 3. Dredging and worker activities 4. New structure provides attachment place 5. New structure acts as barrier to current, waves and sediment movement 6. Sea level rise 7. From worker activities 8. From equipment operation	All classified as minor impacts due to the temporary and localized nature of the impacts except for impacts from sea level rise
	Operation	1. Water quality problem, bottom contamination and marine/coastal ecology 2. Structural inundation or erosion of structure 3. Noise and vibration 4. Occupational health and safety	1. Oil spill from tanker operation and oil spill from transfer of fuel from tanker to the storage; waste water and solid waste from worker's activities; increased turbidity during jetty maintenance (fixing and part replacement in the water) 2. Sea level rise 3. Ship traffic 4. Worker's activities	1. Potentially major impact depending on the scale of spill (see discussion on different scale of spill in Table 6.6 Scale of Impacts from Oil Spill). 2. Potentially major impact 3. Minor impacts 4. Minor impacts
	Decommissioning	Not taken into consideration		
Storage Facilities	Pre-construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Air quality problem 5. Loss of terrestrial vegetation 6. Noise and vibration impacts 7. Occupational health and safety	1. Increased turbidity as a result of spoil from site grading 2. Same as above 3. Same as above 4. Site grading leads to an increase in level of Particular Matter (PM) in the air 5. Site clearance	All considered minor impacts due to the temporary and localized nature of the impacts

			6. Equipment operation 7. Worker's activities	
	Construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Structure inundation 5. Air quality problem 6. Soil and groundwater quality 7. Noise and vibration 8. Traffic disruption 9. Occupational health and safety	1. Increased turbidity as a result of spoil from construction activities; spill of oil, cement and other chemicals being used for construction; solid and liquid waste generated from worker's activities 2. Same as above 3. Same as above 4. Sea level rise 5. Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air 6. Spill of oil, cement and other chemicals being used 7. Equipment operation 8. Increased vehicle traffic for supply of construction matterial 9. Worker's activities	All considered minor impacts due to the temporary and localized nature of the impacts except for impacts from sea level rise (structural inundation).
	Operation	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Soil and groundwater quality 5. Air quality 6. Noise and vibration 7. Occupational health and safety 8. Structure inundation or structure erosion 9. Visual quality	1. Oil spill from transfer of oil into the storage and oil spill from transfer of oil from storage into tanker trucks for distribution to customer; waste water and solid waste from worker's activities 2. Same as above 3. Same as above 4. Spill of oil, cement and other chemicals being used 5. Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air 6. Equipment operation 7. Increased vehicle traffic for supply of construction matterial	1. Potentially major impact depending on the scale of spill (see discussion on different scale of spill in Table 6.6 Scale of Impacts from Oil Spill). 2. Minor impact 3. Minor impact 4. Potentially major impact depending on the scale of spill 5. Minor impact 6. Minor impact 7. Potentially major impact that can lead to loss of lives 8. Potentially major impact due to loss of part of facility 9. Minor impact

			8. Sea level rise 9. Building on an otherwise unbuilt location	
	Decommision	Not taken into consideration		

The above mentioned impacts in various project phases should be minimized with the proposed mitigation measures which can be found in the following table.

Table 1.3. Summary of Project Activity, Potential Impacts and Recommended Mitigation Measures

Component	Phase	Potential Impacts	Source Activities	Mitigation Measures	Monitoring Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	Dredging	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			Solid and liquid waste from worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Occuptational health and safety	Worker activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eyes protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
	Construction of Jetty	Water quality, bottom contamination,	Dredging	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance)	- Monitor for turbidity that last for more than 12 hours.

		marine and coastal ecology - negative		- Dredging conducted during low tide to minimize dispersement to other locations	
			Worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Marine and coastal ecology – positive	New structure provides attachment place	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	- No specific monitoring measures have been proposed for this, however, special care should be given during fixing or part replacement of the jetty structure as not to displace existing bottom biota that have proliferated on the surface of structure
		Coastal hydrology – changes in current pattern, waves and sediment movement	New structure acts as barrier to current, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	It is actually hard to predict the ultimate impact of alteration to existing coastal hydrology pattern. As such, monitoring should look for evidence of negative impacts of alteration to current, wave and sediment movement. Negative impacts including higher level of sedimentation around the piles and beach erosion on nearby location that threaten the integrity of structure.
			High sediment load going into the bay	- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	- Monitoring for higher than usual sediment loading that leads to more frequent dredging needs. - Changes in sediment loading will also affect mangrove nearby (mangrove ecosystem depends on supply of sediment) therefore, the health of the mangrove community should also be monitored. More discussion on this will be provided under monitoring measures for impacts from fuel storage development.
		Structure inundation	Sea level rise	Several measures are proposed to manage impacts	- Monitoring for sea level movement

				from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	especially in reference to jetty structure.
		Occuptational health and safety	From worker activities	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 1. Ear and eyes protection 2. Helmet 3. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
		Noise and vibration	From equipment operation	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	- Monitoring for complaints from workers and local community.
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	Oil spill from tanker operation and oil spill from transfer of fuel from tanker to the storage	- Use of booms around the connection between tanker ship and jetty - Use of dispersant to minor spill. - For major spill from tanker ship, procedure for response is discussed in the following Section.	- Monitoring for evidence of spill in the marine water (oil film or slick) - Monitor for evidence of spill in the sandy beach and mangrove community - Water testing should be conducted on a regular basis (at least once a year) to understand in more detail level of certain hydrocarbon chemicals as well as toxic heavy metals in the water. Parameters tested should at least be the same as parameters that have been tested for the baseline data collection as reported in Chapter IV, Description of the Environment.
			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste	- Monitoring for signs of eutrophication on the nearby saltmarsh or around mangrove community. - Regular water testing as recommended above.

				water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of litter in the marine environment, sandy beach and mangrove forest.
			Increased turbidity during jetty maintenance (fixing and part replacement in the water)	- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
		Structural inundation or erosion of structure	Sea level rise	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	Monitoring for sea level movement especially in reference to jetty structure.
		Noise and vibration	Ship traffic and operation	Use of proper isolation on the ship's machinery room.	Monitoring for complaint from local community.
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Limited access to the beach especially by fishermen	Development of jetty and storage facility	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	- Monitoring for implementation of the management measure. Monitoring should be conducted with active collaboration from local authority (chefi de aldeia and chefi de suco). - Monitoring for resulting effect from moving the fishermen to a new place. How their level of income are affected and whether there are conflict at the new

					place. - Monitoring should be done for at least one year until the fishermen established their new parking space.
	Pre-construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			Solid and liquid waste from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Bottom contamination	Same as above	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above	Same as above
		Air quality problem	Site grading leads to an increase in level of Particular Matter (PM) in the air	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Loss of terrestrial vegetation	Site clearance	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	Monitoring for at least one year until trees all grow. Every year, as part of ETO's Company Soil Responsibility, continuous tree planting can be done.
		Noise and vibration impacts	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.

	Construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			Solid and waste water from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Bottom contamination	Same as above	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above	Same as above
		Structure inundation	Sea level rise	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of mangrove ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of the mangrove forest. Mangroves provide natural barriers to coastal facilities.

		Air quality problem	Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Traffic disruption	Increased vehicle traffic for supply of construction matterial	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	- Monitoring for large increase of traffic due to construction material transport. - Monitoring for problems due to higher amount of traffic.
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Operation-Storage facility	Water quality	Oil spill from transfer of oil into the storage and oil spill from transfer of oil from storage into tanker trucks	Management measures for slight to minor impacts: - The use of oil separator (constructed as part of the development). - The use of higher grade oil skimming machine when deemed necessary Management measures for major to extensive	For slight to minor impacts: - Monitor for evidence of oil in the environment (soil, saltmarsh, mangrove communities and sandy beach). Monitoring should be conducted on a daily basis. Clean swiftly when there is

			for distribution to customer	impacts: - Routine drill on response plans. There are in general two types of response plans – for spill that makes its way to the water and for spill stranded into the sand or nearby salt marsh.	evidence of spill in the environment. - Monitor for effectiveness of oil separator basin. When not found to be effective, use higher grade skimming machine. - Periodically (at least once a year) conduct testing of effluent from the separator basin to see whether effluent is within allowable standards for effluent from downstream oil facility. Use applicable standards recommended in this EMP or use other standards as recommended by DNMA (recommended standards have to consider the presence of nearby mangrove forest). For major impacts: - Monitoring should focus on ensuring the integrity of the primary, secondary and tertiary containment methods.
			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication on the nearby saltmarsh or around mangrove community. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach and mangrove forest.
		Bottom contamination	Same as above	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above	Same as above
		Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.

				facility in Tibar.	
		Air quality	Tanker trucks delivering fuel out of the facility lead to an increase in traffic that leads to the increase of polluting emission gasses	- Use of newer or well maintained vehicle fleet to curb emission gases	Monitoring for elevated level of air pollution gasses including NO_2, SO_2, CO and CO_2. Air pollution in the area, however, might come from EDTL or vehicle movement in the national road.
		Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	Monitoring for complaint from worker
		Occupational health and safety	Workers activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Structure inundation or structure erosion	Sea level rise	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of mangrove ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of the mangrove forest. Mangroves provide natural barriers to coastal facilities.
		Visual quality	Building on an otherwise unbuilt location	- Landscaping with grass in spaces between the facility and the fence	- Monitoring for complaints from passersby

In order to ensure the implementation of the proposed Environmental Management Plan (EMP), a monitoring plan should be required. During the monitoring activities, important parameters to control are:

- Water quality parameters in term of turbidity, DO, BOD, heavy metal in the sea
- Wastewater quality parameters in term of turbidity, DO, BOD, various heavy metals
- Air quality in term of SO_x, NO_x, and PM
- Mangrove area
- Traffic count
- Fire incident
- Noise control
- Emergency and evacuation plan

Table 1.4 shows monitoring plan during all three phases in project implementation.

Table 1.4. Monitoring Program and Agency Responsible for Activities

Parameters to be monitored	**Method**	**Frequency**	**Agency Responsible for M**
Water quality	Sampling and Insitu measurement	Every 6 month	Project owner, DNMA, MOH
Air quality	Sampling and Insitu measurement	Every 6 month	Project owner, DNMA, MOH
Mangrove	Visual inspection	Every year	Project owner, DNMA, Forestry, Biodiversity Directorate, Fishery
Solid waste and liquid waste	Visual inspection	Every 6 month	Project owner, DNMA, Dili District Administration, local authority
Fire and incident report	Instrument detection and visual inspection	Every 6 month	Project Owner, DNMA, Dili District Administration, Civil Protection, Police
Occupational health and safety	Visual inspection	Every year	Project Owner, DNMA, SEFOPE, MOH
Leak detection	Insitu measurement	Every 6 month	Project Owner, DNMA, ANP, MOH
Loading of fuel from tanker	Visual inspection	During each loading	Project owner

The implementation schedule of the EMP can be seen from the following table.

Table 1.5 Implementation Schedule of the proposed EMP during Pre-Construction, Construction and Operation

Activity of EMP	Year1				Year2				Year 3	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	Pre-Construction		Construction						Operation	
Dust Management	●	●	●	●	●	●	●	●		
Solid and Liquid waste Managem	●	●	●	●	●	●	●	●	●	●
Occupattional heath and Safety	●	●	●	●	●	●	●	●		
Noise Management	●	●	●	●	●	●	●	●		
Inccident management	●	●	●	●	●	●	●	●	●	●
Traffic Management	●				●				●	
Fire Control and Management									●	●
Oil spill detection and management									●	●
Storm runoff and sedimentation	●				●				●	
Solid and Liquid waste Managem	●	●	●	●	●	●	●	●	●	●
Air quality monitoring	●				●				●	
Water quality monitoring			●		●				●	

Q = quater, where each quater is defined as three months

The total cost required by ETO to implement the proposed EMP is about USD 195,000 during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 85,000. A detail breakdown of the costs are provided in the following table.

Table 1.6. Total Cost of the Management Measures

Phase	Group of Activities	Activities	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction	Excavation Material from Grading of Fuel Storage Site	Dumping of excavation material in proper dumping station (Tibar)	2	dumping trip	600	1200
	Air Quality	Spraying of grading site	120	work days	35	4200
	Loss of Terrestrial Vegetation	Replanting program in the upper watershed (to be conducted during O&M phase)	See O&M phase			
	Sanitation	Provision of temporary sanitation facilities	3	temporary toilets for 120 days	200	600
		Routine disposal of liquid waste	24	dumping trip	50	1200
		Garbage bins	10	bins	20	200
		Routine disposal of solid waste	24	dumping trip	25	600
		Worker awareness training	1	event	150	150

	Occupational Health and Safety & Noise and Vibration	Workers protection gears (boots, ear muffle, goggle, bright vest, etc.)	40	protection kit	60	2400
	Total Pre-Construction Cost during the 6 months					**$ 10,550.00**
Construction	Sea Level Rise	Fortification of structure that connects the complex to the jetty	1	structure	150000	150000
		Site elevation	1	time	10000	10000
		Mangrove survey	See Monitoring Measure Costing			
	Air Quality	Spraying of grading site	360	time	35	12600
	Soil and Groundwater Protection	Provision of temporary storage with lining on the ground	1	storage	5000	5000
		Routine dumping of used oil and other chemicals to Tibar	15	dumping trip	35	525
	Traffic Disruption	One personel to direct traffic	1	personel	2700	2700
		Provision of signage	4	signs	10	40
	Occupational Health and Safety & Noise and Vibration	Workers protection gears	40	protection kit	60	2400
	Total Construction Cost during 1.5 years					**$ 183,265.00**
Operation	Oil transfer from jetty to storage	Provision of booms and dispersant	5	units	5000	25000
	Oil filling into EDTL Hera and trucks for distribution to customer	Provision of oil-water separator basin or higher grade separator machine (optional)	1	structure	5000	5000
	Sanitation	Provision of permanent sanitation facilities	4	units	600	2400
		Routine disposal of liquid waste	1	dumping trip	35	35
		Provision of permanent solid waste facilities	10	units	20	200
		Routine disposal of solid waste	26	dumping trip	25	650
		Provision of "No Littering" signs throughout facilities and in the mangrove areas	15	signs	20	300
	Tree Planting in the upper watershed	Tree Planting in the upper watershed	1	event	1000	1000
	Air Quality	Spraying of facility site	180	days	35	6300
	Occupational Health and Safety & Noise and vibration from equipment operation	Workers protection gears	24	kit	60	1440
	Beach Access by Fishermen	Finding new access points				
		Provide assistance to the fishermen	1	event	40000	40000
	Total Operation and Maintenance Cost per Year					**$ 82,325.00**

For monitoring purposes, total cost is estimated at USD 11,000 for pre-construction and construction phases. For the O&M phase, the total monitoring cost is estimated at USD 28,000. A detail breakdown of the monitoring cost is provided in the following table.

Table 1.7. Cost Figure of the EMP Implementation during Operation of the Facility

Phase	Monitoring Measures	Remarks	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction & Construction	Monitoring for turbidity that lasts long	Facility operator, daily basis	720	days		
	Monitoring for leak of waste water and solid waste into the beach, mangrove and marine environment, monitoring for signs of eutrophication	Facility operator,daily basis	720	days		
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	720	days	10	7200
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record	720	days	5	3600
	TOTAL for Pre-Construction and Construction for two years					**$ 10,975.00**
Operation	Monitoring for leak of waste water and solid waste into the beach, mangrove and marine environment, monitoring for signs of eutrophication	Facility operator, daily basis	365	days		
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	365	days		
	Provision of grievance redress procedure to allow for monitoring of complaints from local community and workers	Facility operator	365	days	10	3650
	Monitoring for proper dumping of liquid waste, solid waste and used oil and other chemicals	Facility operator, monthly basis	12	days	5	60
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record				
	Monitoring of sea level movement		720	days	5	3600

	Monitoring of mangrove's health	Engage local environmental NGO, initial and yearly study can be conducted for 1 month as much as possible covering the 15 ha area. Mangrove rehabilitation program can later be initited.	30	days	50	1500
	Outreach to local community, local authority and fishermen group	Facility operator and representative of upper management from ETO, can be conducted once a year during christmas time, anniversary of ETO facility or other proper time	1	per year	5000	5000
	Marine water quality test	Engage a laboratory				
	Marine ecological integrity test (benthic communities stability)	Engage a laboratory	1	per year	6000	6000
	Monitoring for oil spill on a daily basis and monitoring to the effectiveness of oil separator basin	To determine needs for higher grade oil-water separator				
	Monitoring for dust pollution on a daily basis	Facility operator	365	days	5	1825
	Air quality test	Engage a laboratory	1	per year	5000	5000
	Monitoring for tree planting program	Engage local environmental NGO, conduct three planting during rainy season once a year	20	days	25	500
	Monitoring for integrity of primary, secondary and tertiary containment measures	Internal inspection by operator, require data collection and record keeping, conduct at least weekly	52	per yer	10	520
	TOTAL for Operation and Maintenance					**$ 27,830.00**

Note that the project proponent is fully responsible for the implementation of the proposed Environmental Management Plan (EMP) with close consultation with relevant regulatory bodies within the government of Timor Leste. Regular monitoring and testing of the above parameters should be conducted and results must be reported to relevant authorities. Relevant government body should conduct site inspection even its own data collection as necessary to ensure that project proponent implement the EMP effectively.

Project proponent is obligated to take necessary actions if parameters values of the measurable indicators are higher than the ambient environmental quality standards. For instance, wastewater disposal from the facility to the nearest water bodies must not trigger eutrophication or any elevated standard. If ambient water quality does not meet the standards, than assessment of the source of elevated parameters should be conducted. If it is later found out that business as usual will not be effective to keep runoff from the

facility from breaking the ambient water quality standards, then provision of more advanced equipment should be considered. Cost for the provision should be paid by project proponent.

2. Project Proponent

The project is proposed by Esperança Timor Oan (ETO) Lda, a 100% Timorese-own private company devoted mainly to import, distribution and sales of fuels. Company's contact detail is provided as follows:

Sr. Nilton Tilmo G. dos Santos (President)
JL. Rua Cina Rate, Dili, Timor Leste
Telephone: +670 3322336
Mobile: +670 77243585
Email: info@eto.tl

ETO is a local company founded in 2000 and has been involved in fuel distribution business ever since. The company's historical timeline is as follows:

2000 ETO begins a larger scale activity as supplier of fuel for the logistics arm of the United Nations International Peace Keeping Force in Timor Leste. At the start, ETO owned only one single fuel truck, however, it has steadily grown ever since. Over two years, the company gradually increases its client base while improving its service and infrastructure.

2002 ETO in collaboration with three other local companies, obtains its first government contract to supply diesel to power stations throughout the country. Around this time, ETO began to shape its medium and long term vision for a strong national fuel supply and distribution company.

2005 ETO opened its first fuel station in Dili, an important step to further strengthen its distribution services, seize more market share and also started the implementation of its customer loyalty policies.

2006 Groupo Esperanca expanded its portfolio into concrete industry and real-estate.

2010 Expansion of business areas proved to be a positive strategic decision and ETO is ready to start direct imports of fuel (diesel) from Malaysia. ETO was able to secure better prices and conditions, thus overcoming dependency from other importers.

Ever since this time, ETO maintains a policy of progressively pursuing new and complimentary activities following market needs and opportunities. ETO continued to participate actively in Timorese private sector, with the aims of job creations and sustainable capacity building.

2013 ETO and Groupo Esperança now has a joint workforce of over 200 staff and continues to invest in the county through new investments and international partnerships.

Looking ahead, ETO is planning to expand its fuel stations to all the districts. This will allow for ETO's products and quality service to reach throughout the country and consolidate the distribution network. In the long run, ETO would like to participate in the exploration of Timor Sea oil and position itself as one of the buyers of national production of oil and natural gas.

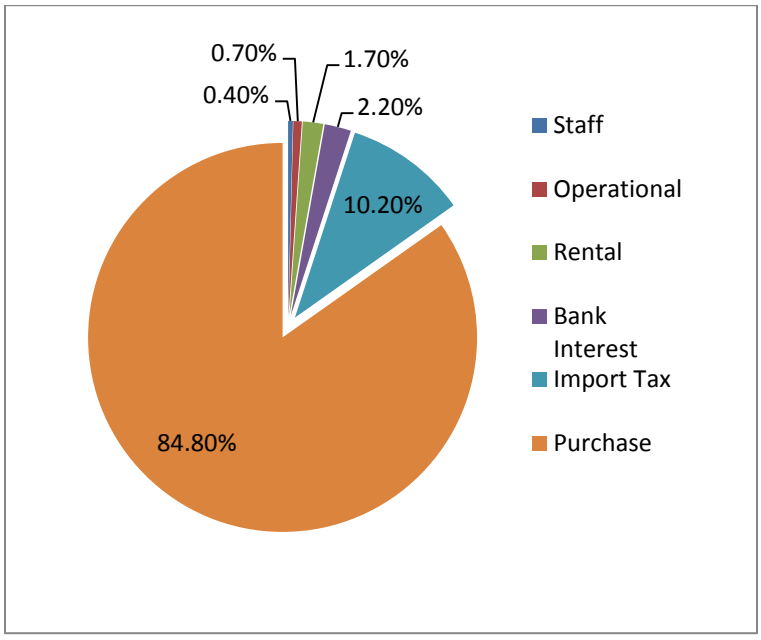
3. Project Description

3.1. Project Overview

The proposed project is part of the vision to improve ETO's capacity, quality and efficiency for fuel distribution. The new facility will allow the company to address the following issues: reduce operational costs; reduce purchase price by increasing volume; reduce costs in rental of storage facilities; increasing operational capacity in distribution; reducing bank interests by reducing business risk.

As shown in Figure 3.1, cost structure of ETO, purchase price remains the largest share of cost for the operation at almost 85%. In addition, bank interest, rental, and operational cost add an additional 4.6% of overall costs which are closely affected by infrastructure and distribution facilities.

Figure 3.1. ETO Cost Structure



3.2. Project Location

The proposed construction is located along the national road connecting Dili to Manatuto. Administratively, the project is located within Aldeia Sukaer Laran, Suco Hera, Sub-district Cristo Rei, District of Dili. Project location can be reached by less than half hour driving from Dili town center. The following figure shows the location of the development in reference to Dili and the national road connecting Dili and Manatuto.

GPS coordinates of the project location are 125.688696°/-8.537717° (longitude/latitude).

Figure 3.2. Location of Development Relative to Dili

Five ha land has been secured by ETO through a long-term lease of 30 years with the government of Timor Leste. Core facilities (fuel storages and associated water cooling storages) will be developed on two ha land within the five ha. This leaves a buffer zone of approximately three ha between the construction and neighboring facilities.

The proposed project site is bounded by a nearby communal cemetery in the West and by mangrove communities in the East. To the south of the site is Hera Power Plant and the northern side is coastal area. The project is located along the national road connecting Dili to Manatuto.

3.3. Project Component

The proposed development consists of two main components – the jetty structure and the fuel storage (tank farm) complex. Figure 3.3 presents a scaled drawing of the two main components superimposed on Google Earth aerial imagery.

Construction of the fuel storage complex will happen on a graded land near the mangrove communities. Main components of the storage complex consist of:

1. Tank farm area – 2 tanks the size of 2000 kL to store diesel fuel; 2 tanks the size of 1000 kL to store gasoline; and 2 tanks the size of 600 kL to store lubricant oil.
2. Bundwall – with a total volume at approximately 3,500 kL (more than 110% the size of the largest tank within the bund).

3. Filling station – consists of 6 unit of hand pumps
4. Filling control room by the filling station
5. Fire house complex – consists of a water tank at 330 kL and hydrant pumps
6. Genset house by the fire house complex
7. Office complex (administrative area) and staff boarding facility
8. Security guard and driver room
9. Oil separator at the end of the drainage lines draining the bund area

For detailed scaled drawing of the fuel storage complex, see Annex 2.1.

Figure 3.3. Two Main Components of Project

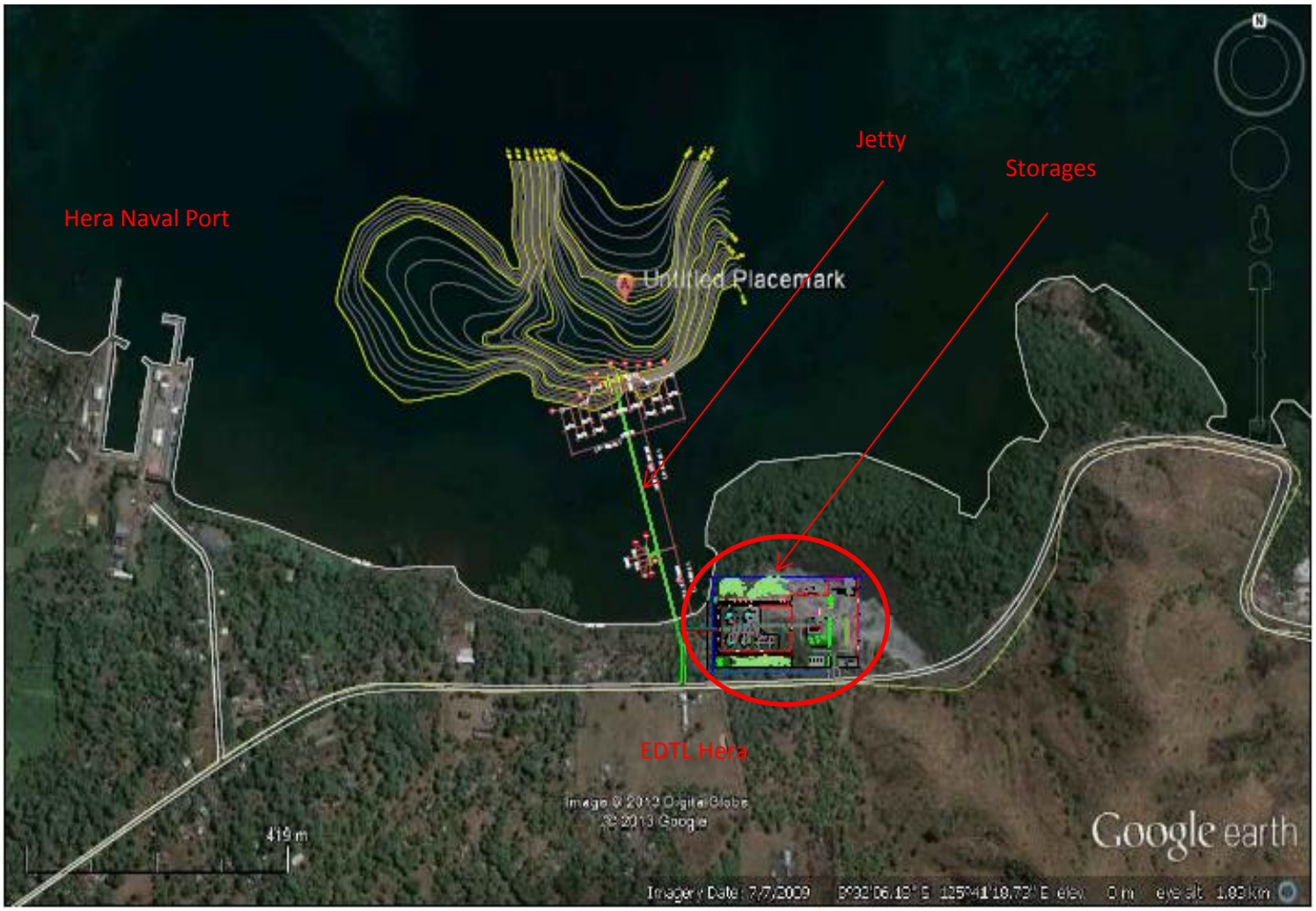
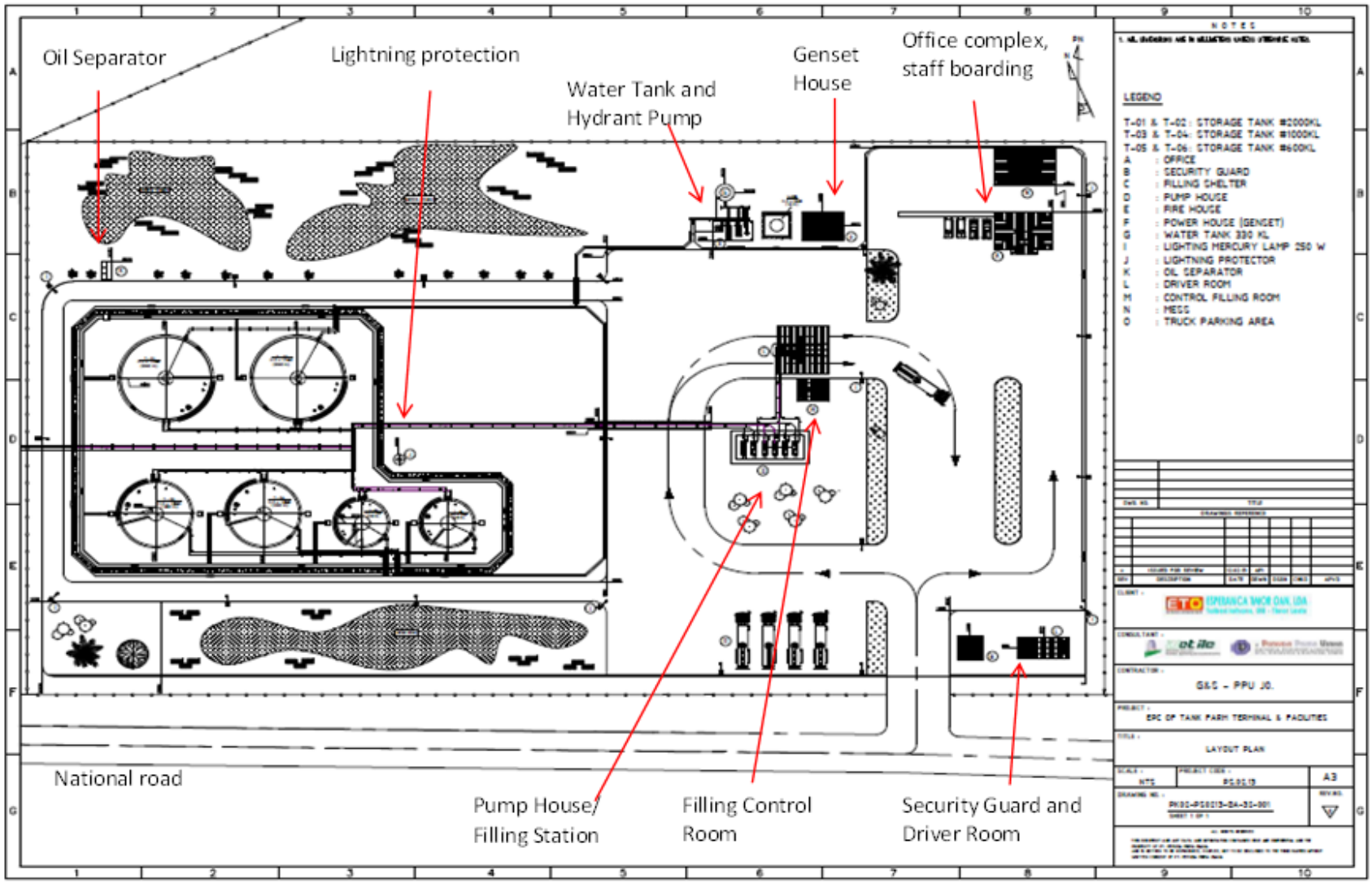


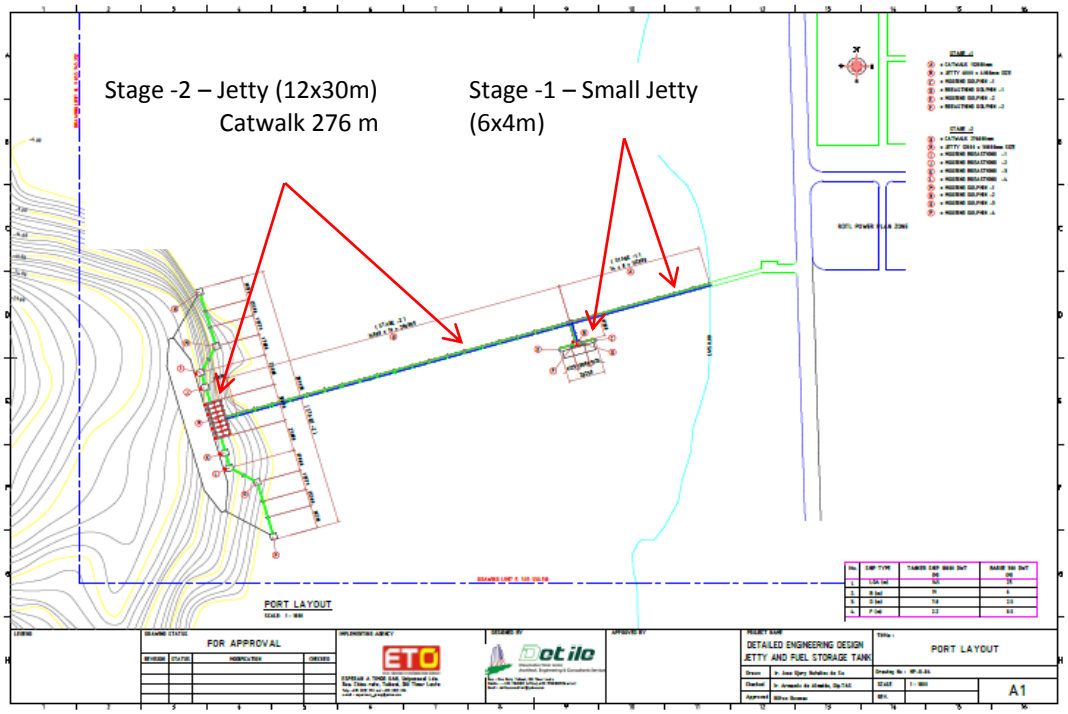
Figure 3.4. Proposed Project Layouts



3.4.1 Jetty

The construction of jetty component itself will be done in two stages, the first one is the small jetty the size of 6x4 m with a 112 m catwalk and then the construction of the large jetty (12x30 m) with a 276 m catwalk. Therefore, in total, the length of the catwalk will be 388 m. A scaled technical drawing of the jetty development is provided in Annex 2.2. The overview of technical drawing of jetty and its component can be seen from the figure (3.5).

Figure 3.5. Jetty Construction Stages



The large jetty will be approximately 2.60 m above the Low Water Spring (+2.60 m LWS). Figures 3.6 and 3.7 present the technical drawings of the long and cross sections of the large jetty.

Figure 3.6. Long Section of Large Jetty

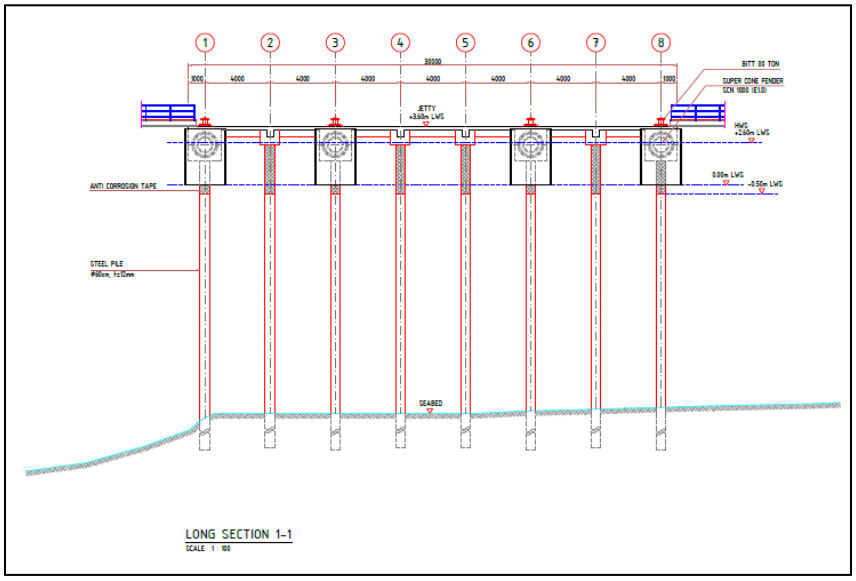
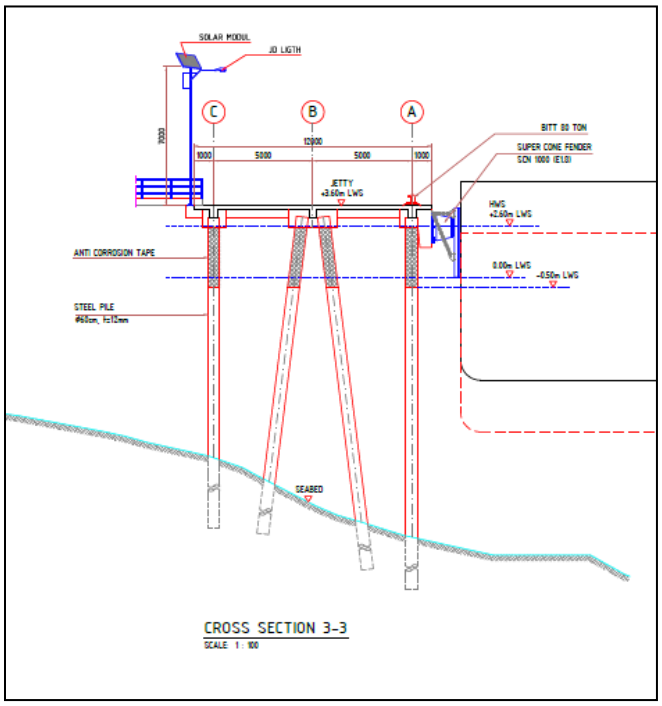


Figure 3.7. Cross Section of Large Jetty



In addition to Jetty, the piping system with the automatic detection control mechanism will also be installed from landing jetty to the storage tanks for the re-fueling activities. The detail of pipeline and technical drawing can be seen from the following figure.

3.4.2 Storage Tanks

A total of six storage tanks in various sizes will be constructed to store and hold the fuel before being distributed to the end-users. Two tanks will be constructed for each fuel with the dimensions calculated based on various factors such as existing market demand, space availability, and assumed future demand and market growth. The following table (Table 3.1) shows the storage tank capacity for each fuel.

Table 3.1 General Specification of Fuel Storage System

Tank	Number	Volume, KL
Gasoline	2	1000
High Speed Diesel Fuel (HSD)	2	2000
Lubricant Oil	2	600

The common shape of storage tank is cylindrical as it is easy to fabricate and has great structural strength. Various engineering design criteria were considered in order to come up with the ratio of height (H) and the diameter of tank (D). As the ratio of height and diameter is a selected design parameter, the height and diameter of storage tank were calculated from the above volume. The following table presents the dimension of each storage tank.

Table 3.2. Summary of Tank Dimension

Tank	Volume, KL	D, m	H, m	Standard
Gasoline	1000	13.58	13.58	1
Diesel Fuel	2000	17.46	17.46	1
Lubricant Oil	600	9.7	9.7	1

The location and space between each tank will be arranged according the standard required by the American Petroleum Institute 2610 (API, 2005). The layout of the fuel storage system can be seen from the following figure.

Figure 3.8. Bundwall Design

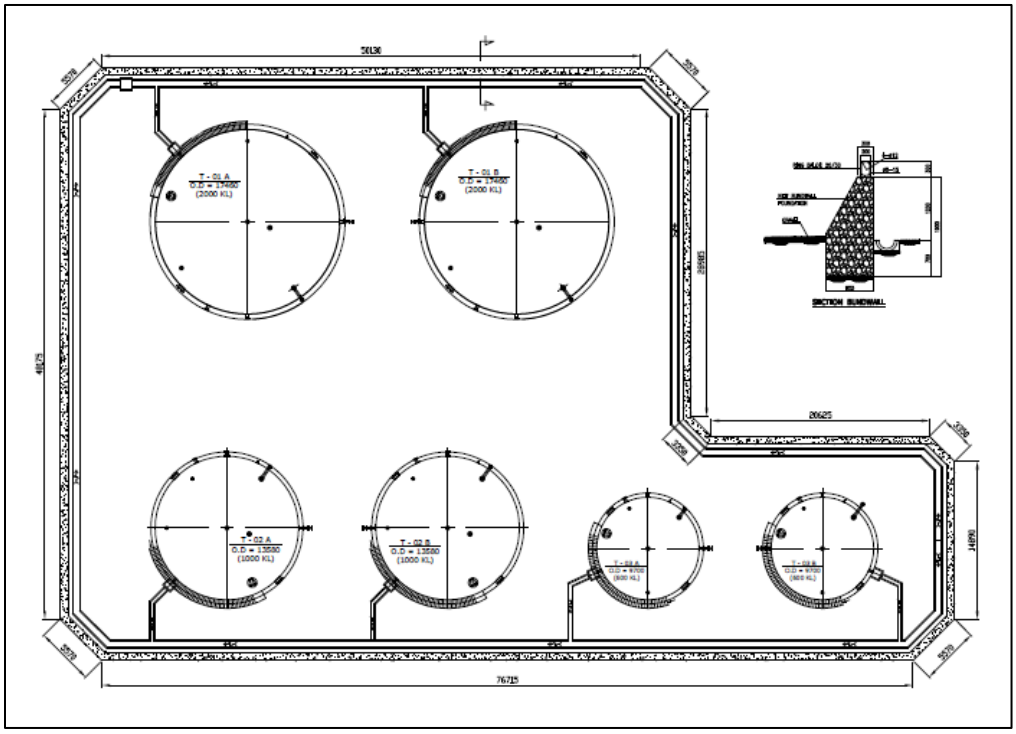


Figure 3.9. A Typical Tank Design

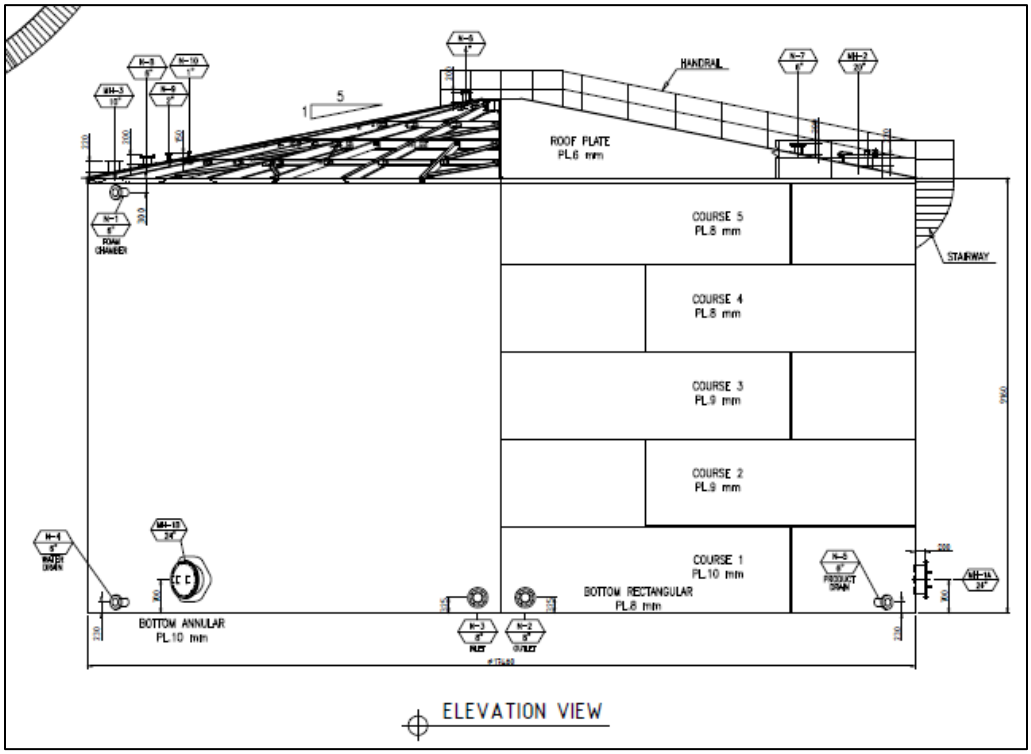
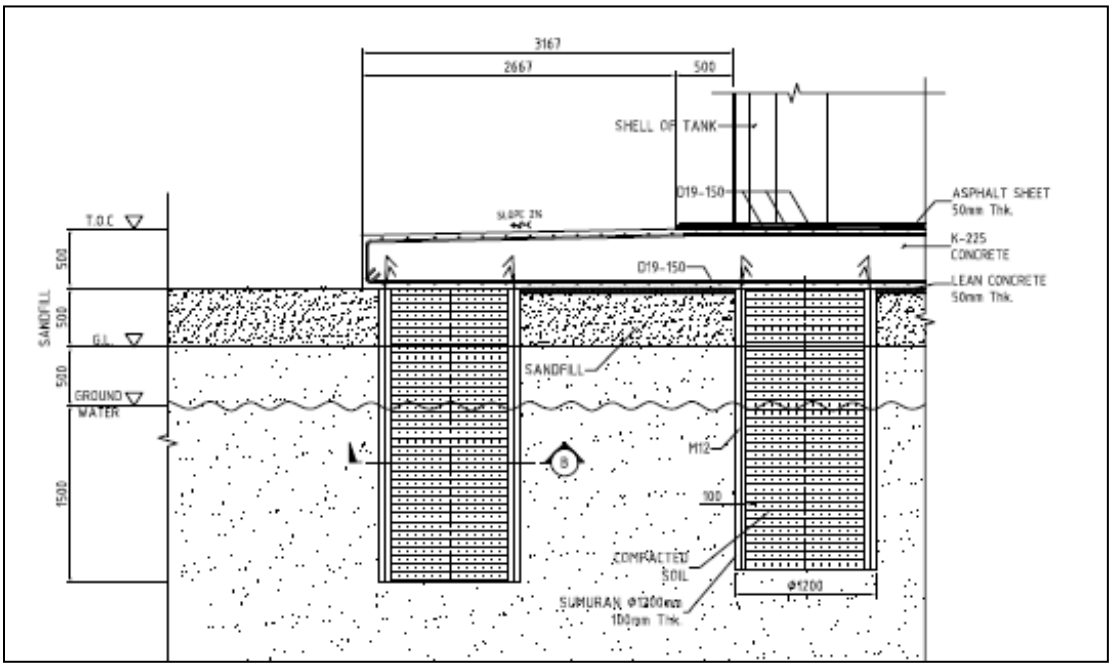


Figure 3.10. Tank Foundation and Bottom Lining Design



Material selection should follow the standard best practice recommended by American Petroleum Institute. Over engineering design should be taken in order to ensure the durability and to reduce the risk of system failure.

3.4.3 Office Complex

The propose program layout as presented in the Figure 3.4 suggested that within the fuel storage complex, office and support building will be constructed. This office building will be used for staff, workers, and guest who visit the project site for various reasons. There are four main buildings that will be constructed to response the current need and future expansion of the storage facility. Additional minor building facility will be constructed near the gateway entrance of the storage facility for the security. The layout of office building complex can be seen from the Figure 3.11.

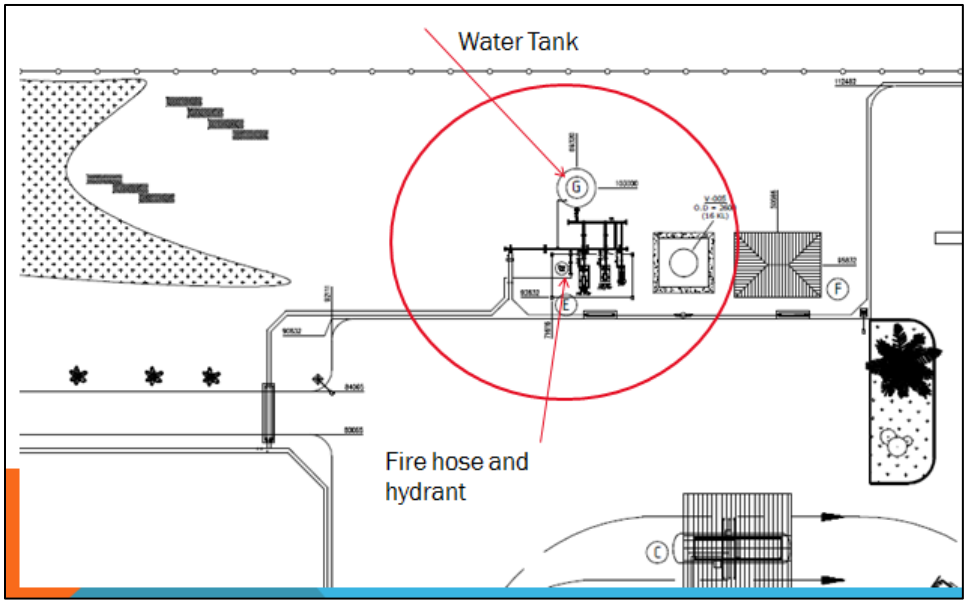
Figure 3.11. Layout of Proposed Office Building

3.4.4 Utilities

The utilities requirement for the proposed fuel storage facility to support the operation and maintenance of the system consist of water, electricity, and fine sand. The power needs to the system will be supplied mainly from the public power line that is available in the site. In addition, the backup power generator is made available to this project in order to supply the power in case of power shutoff, which is always the case in Timor Leste.

The water utility requirement to support the operational of the storage facility consists of domestic need (drinking, bathing, washing, and irrigation) and for the fire fighter purpose. The water consumption for domestic utilization is relatively small, which can be fulfilling by water tanker delivery to the small reservoir unit within the system. The water needs for firefighting on the other could be huge if the fire does occur. The water need for this purpose is from both fresh water and salt water. 330 kilo liter of storage will be constructed to store fresh water for the firefighting purpose. Additional need for firefighting need is to utilize the sea water in case the fresh water reserve is not sufficient. For this purpose the piping and installation should be considered. The water from the reservoir or seawater should be properly connected to the fire hose and hydrant so that in the fire event, the fire hose and pump shall be operated to supply the water to where the requirement is.

Figure 3.12. Water Tank and Fire Hydrant



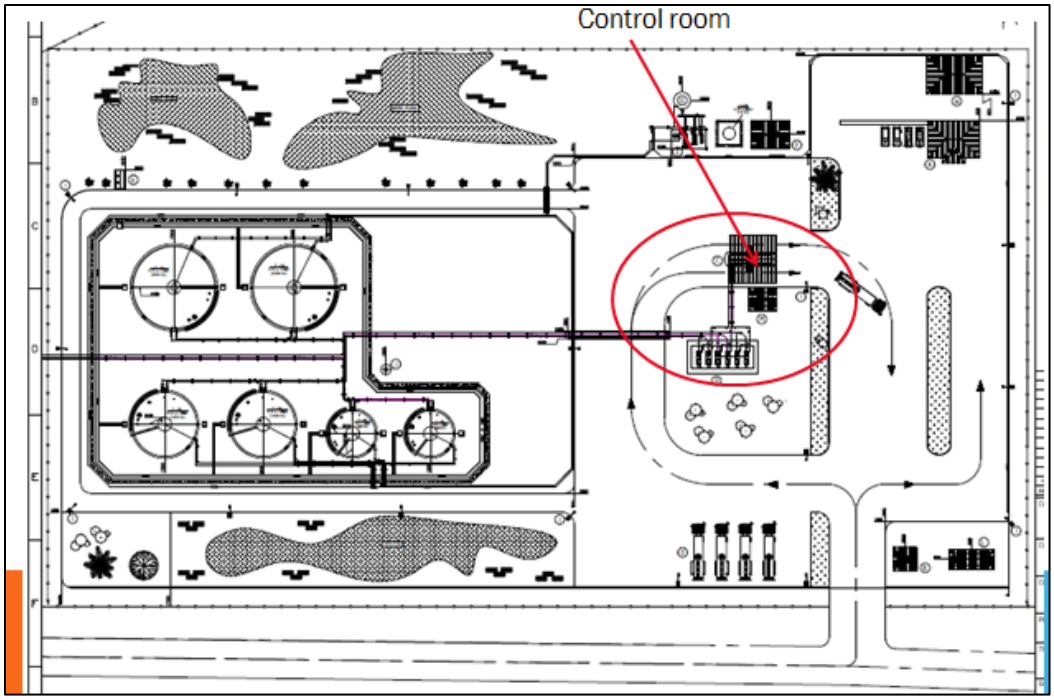
The fire extinguisher will be also made available to the site so that they may be utilized to kill the fire.

3.4.5 Instrumentation and Control Room

Automatic instrumentation controls are very important in any system operation, particularly in the oil industry such as refinery and storage system where manual inspection and control mechanism is not possible due to large scale of operation. The instrument is installed in the key component of the operating system in order to detect variable overtime to ensure that the system will always in the operating condition. Through the automatic control system, the unexpected event/condition will be detected as early as possible so that proper preventive action would be taken in order to minimize the occurrence of the negative impact.

For the fuel storage system, variable to control may vary from flow rate, level indicator in the tank, leakage, smoke/fire, temperature, pressure and others. The control room is constructed as part of this proposed program so that all the control instrumentation will be placed to control the system to operate as desire.

Figure 3.13. Control Room of System Operation

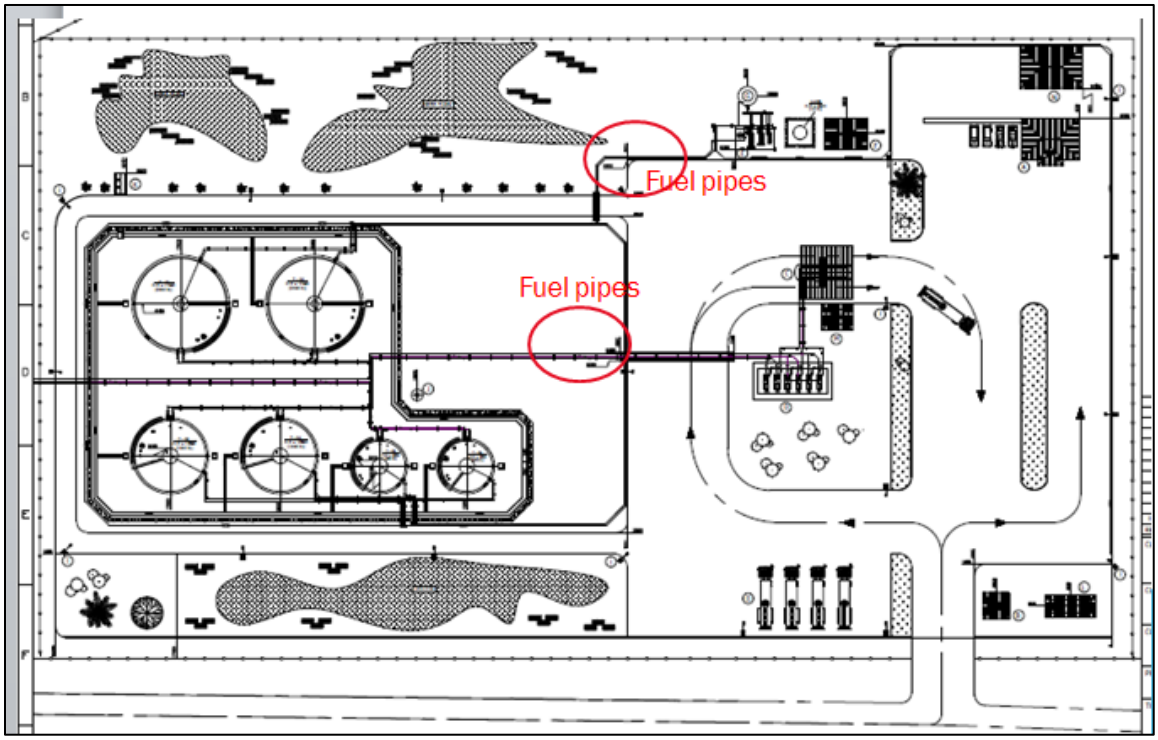


The detail system instrumentation and control parameters should be defined later as the controller and instruments are not available at the stage of planning and design of the system.

3.4.6 Piping System

Piping system is one of the important components of the program to move the fluid material from one location to the other. For the current proposed fuel storage system, the piping system consists of water and fuel pipe. The piping installation will be one of the major works to be completed as the piping system will start from Jetty and will be end at EDTL Power plant fuel tanks reservoir. The following layout of propose program shows the fuel piping from Jetty to the storage system.

Figure 3.14. Piping System Layout



There are three different pipes that will convey three different products (Gasoline, diesel fuel, and lube oil). The proposed technical drawing in the appendix suggested that various pipes sizes range from 4 to 1.5 inches of galvanize pipe will be used in the installation. The choice of using the galvanize pipe is good as this type of pipe is resilience to various climate and weather condition and also the human vandalism. The proper maintenance of the piping system such as regularly painting may be required to prong the life time of the pipe as the corrosion may occur due to natural exposure to the sea water.

3.4. Area Affected by Development

Areas affected by the proposed development consist of:

1. Marine/coastal water
2. Sensitive environmental receptors nearby includes a mangrove communities about 10 ha in size, seagrass, seaweed and coral beds immediate by the project site, marine water quality and other marine flora and fauna such as bottom fauna, fish, phytoplankton and zooplankton.
3. Surface and groundwater
4. Local communities in Hera
5. National government properties
6. Existing and future expansion of infrastructure

Impacts of the development will be discussed in more detailed in Impact Assessment Chapter.

Figure 3.15. Affected Area of Project

3.5. Construction Activities

Table 3.3 contains a list of project activities during Construction Stage for both jetty and storage facility.

Table 3.3 List of Project Activities during the Construction stage

Jetty Construction Activities (Stage 1 & 2)		Fuel Storage Construction Activities	
1	Construction of steel pile, pile cap	1	Construction of site drainage
2	Construction of concrete beam	2	Construction of fencing
3	Construction of floor	3	Construction of tank farm
4	Construction of fender, bollard	4	Construction of tank farm bundwall
5	Construction of catwalk	5	Construction of offices, fire house & water tank, power house, pump station, driver shelter, security post, officer's housing.

6	Construction of jetty	6	Construction of offices, fire house & water tank, power house, pump station, driver shelter, security post, officer's housing.
7	Construction of PV system	7	Construction of pavement
8	Material: pre-fabricated plates, steel piles, concrete and stones	8	Construction of fire hydrant network, lightning protection and earthing,
		9	Construction of piping network, valve and joints.
		10	Construction of electrical system

Material: pre-fabricated plates, steel piles, concrete and stones

3.6. System Operation and Management

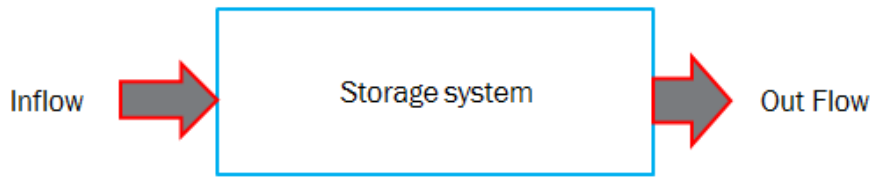
ETO has proposed to out-source system operation to be handled by a foreign company that has experience in operating and maintaining similar facilities with support from local employees. In the future, this operator will train local Timorese managers to take over leadership and managing responsibility for the operation and maintenance of the entire facilities.

In general, system operation of the fuel storage can be described into three main components:

1. Unloading of fuel from tanker
2. Fuel tanker feed the system through Jetty
3. Fuel loading into the tanks
4. Fuel dispensing through the pumping facility to be loaded into tanker trucks

The first two components can be considered as input into the system, storage tanks as "a system", and fuel distribution as the "outflow" system (Figure 3.16).

Figure 3.16. System Inflow and Outflow of the storage Facility



During system design, the rate of inflow and outflow are estimated or assumed, and then the capacity of the system is calculated. Normally the demand forecasting figure would be used to determine the outflow

rate and that is the main objective of the entire program, to fulfill the demand of the fuel all the time. By knowing the volume rate of the outflow, the design capacity of the storages should be calculated. Based on the storages volume and the outflow rate, the frequency of loading at the jetty can be estimated.

The system will operate semi-continuously, where the inflow is intermittent but the distribution system will operate continuously. As the demand may fluctuate over time, the outflow rate will not be constant overtime, subsequently; the inflow rate is not constant. For this reason, the storage tanks are designed to stabilize this fluctuation and guarantee the supply.

For each product (diesel fuel, gasoline and lubricants) two tank storages are proposed and dispensing or distribution of each product will be arranged such that one storage tank will be unloaded and the other one act as a backup. So, when one is empty, operator will reorder for refill. This arrangement will allow a constant and reliable supply of products for EDTL client and the rest of Timor Leste market.

System Inflow

System inflow started at jetty, where the fuel tanker periodically feed the system, through the piping system. As the petroleum product to be stored and distributed are three types (Gasoline, Lubricant, and HSD), three different fuel tanker would be expect to deliver each of these products. The frequency of inflow loading for each product will be roughly estimated as follows:

- *Gasoline*

  Volume of storage tank =1000 KL
  Demand Rate (roughly) =50KL/day

Based on the demand assumption, at least twice a month the fuel tanker should refuel the storage system in order to ensure the continuity of supplying the gasoline to the costumers in Timor Leste

- *Diesel Fuel*

Volume of storage tank = 2000 KL

The demand rate was based on EDTL consumption, which was about 200 KL/day for both Hera and Betano Power Plant. Additional 10% for other users should be added in the calculation of the current demand factor.

Demand Rate (roughly) = 220 KL/day

Based on the rate of demand and volume of the storage, the average time require to empty one tank is equal to 10 days. Therefore, ideally every 10 days, the fuel tanker carrying diesel fuel should refuel the system.

- *Lubricant*

  Volume of storage tank =600 KL

The demand of lube oil also estimated based on Hera and Betano power plant consumption, which is about:

Demand Rate (roughly) =1000 L/day

The above calculation suggested that within the month, the traffic of ship tanker would load the system 6 times in month, which is relatively low traffic. If the demand growth to be proportional the current economic growth, which is assumed 10% (Based GDP growth), in the next 10 years the traffic

Table 3.4. Estimated Traffic at Jetty in next 20-year from the Initial Operation

Timeline	Traffic, number tanker/month
Initial operation	6
5-years	9
10-years	14

The above traffic projection suggests that, the system is designed and operated dynamically based on the demand. If the demand increases, the traffic will increase. The tanker boat land at the jetty, the tanker would start refueling the storage tank by connecting the hose from tanker to the piping system.

Distribution System and Product Specification

The distribution system to deliver the products to the end user will be achieved through several mechanisms:

- Vehicle Tanker
- Direct Piping System
- Direct Supply

All the infrastructures to the above methodologies need to be built. For the direct piping system for time being is mainly designed to supply the fuel to fulfill the large demand. EDTL power plant in Hera is operating continuously 24/7 and the daily demand for the fuel is equal to 200 KL. The direct piping system meant that there will be direct line from ETO fuel storage facility and supply directly to EDTL. ETO also plan to construct a gas station that will directly distributed to the fuel to the end users such as vehicular or smaller scale of users.

4. Legal Requirement

Timor Leste legislation framework related to environmental and social aspect of the proposed project area presented and discussed. The best practice of environment and social impact and mitigation measures in Timor Leste and other international best practice are elaborated.

4.1 Environmental Legislation in Timor Leste

Timor Leste Constitution provides a strong foundation for the protection of the environment. Article 6(f) states that one of the objectives of the State is to protect the environment and preserve the natural resources. Moreover, two other articles, i.e. Articles 61 and 139 stipulated conditions for the use and preservation of the environment and natural resources respectively with the purpose of ensuring an ecologically balanced and sustainable development approaches.

Decree law 5/2011- Environmental Licensing contains procedures and other requirements related to securing environmental permit to start development activities. As of lately, guidelines for the formulation of required documents to prepare for environmental license have been developed through the Expert101 system that contains checklist and other necessary documents for the preparation of Project Document, Environmental Impact Statement (EIS) for category A projects and Simplified EIS for category B projects.

Other relevant environmental laws and their objectives are listed in Table 4.1.

Table 4.1. Relevant Laws and Regulations

Agency	Relevant Laws
State Secretary of the Environment	Decree Law No.5/2011
	Decree Law No. 26/2012 on Environmental Base Law
	(Draft) Law on Biodiversity (March 2012)
	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Forestry and Protection of the Nature	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Fisheries and	Law No. 12/2004 on Crimes Related to Fisheries

Aquaculture	Law No.6/2004 on Legal Basis for Management and Regulation of Fisheries and Aquaculture
National Petroleum Authority	(Draft) Regulation on Installation and Operation of Fuel Depot
International	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Protocol)

4.2 Standard and Best Practices in Environmental and Social Assessment

Standard and best practice of environmental and social quality in Timor Leste is still limited. However, in the absence of local regulation, the government of Timor Leste always refers to the best international practices. The following are standard best practice that Timor Leste has derived from various international best practices (Table 4.2).

Table 4.2. Standard Best Practise in Timor Leste in Absence of Timor Leste Standard

Environmental Standard	**TL National Standard**	**International Standard**
Drinking Water Quality Standard	Non-exist	WHO
Waste water effluent	Non-exist	WHO/USEPA
Ambient Air Quality Standard	Non-exist	IFC/WHO
Heavy Metal Standard	Non-exist	WHO

4.3 Guidelines in Measurement and Monitoring

Several guidelines are applicable for measurement and monitoring of the environmental and social parameters. These guidelines included those guidelines published by DNMA such as the Expert101 Guidelines as well as applicable international guidelines such as the Head of BAPEDAL Diploma No. 113/2000 on General and Technical Guidelines for Environmental Laboratory tests.

5. Contractual and Corporate Obligations

The proposed development is 100% private sector-funded, therefore, there is limited contractual and corporate obligations in relation to the natural environment and social impacts related to the development. Decree Law No.5/2011 in Articles 15 and 16 established the Impacts and Benefit Agreement procedure to allow for project proponent and affected communities around Category A projects to enter into a legal agreement for the community's benefit (Table 5.1.). While there have been no clear guidelines on how to enter into these types of agreement, it is prudent to say that most project proponents are willing to enter into this type of agreement as far as the agreements are reasonable and within the scale of the potential impacts identified in the EIS.

For this particular project, during the final stakeholder consultation and the presentation of the draft EIS, it was clear that some fishermen in the vicinity of project location will be affected by the development. They will have to move their fishing apparatus (boat, fishnet and others) from the area they traditionally use. ETO as the project proponent has stated openly during the stakeholder consultation that they are willing to provide compensation for losses experienced by the fishermen. This statement will have to be followed up upon approval of the EIS according to timing for negotiation as determined in Article 16 Decree Law No. 5/2011.

Table 5.1. Impacts and Benefits Agreement in Decree Law No. 5/2011

Chapter	Article	Article Title	Main Point
V	15	Impacts and Benefits Agreement (IBA)	Establishment of the IBA as the legal instrument for communities around or near the proposed Category A projects to enter into an agreement that defines rights and obligations between the community and project proponent in relation to traditional land use, customs and community rights to the scale of potential impacts identified in the EIS.
	16	Negotiation of the IBA	Timing of the IBA negotiation, process, facilitation, conflict resolution and status of the IBA as a "statute."

6. Summary of Impacts

Likely environmental impacts are associated with activities conducted for the construction of two components of the project that will alter or put negative influence to the existing biophysical environment. Impacts from the activities are assessed within the context of existing environmental, climate change and socio-economic characteristics of the site and surrounding areas.

6.1 Impacts from Jetty Structure

The following table presents all potential impacts from the development of the jetty structure grouped based on the activities that generate the impacts – i.e. site preparation (Pre-Construction), Construction and Operation and Management (After Construction).

Table 6.1. Type, Nature, Indicator and Methodology to Assess Impacts

Type of Impact	Nature of Impact	Scope of Impact	Impact Indicator	Design and Methodology to Assess Impacts
	Impacts during Site Preparation			
Water quality From increased turbidity due to dredging	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Near coast water especially in the embayment area	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test designed to measure important water quality parameters
Bottom contamination From resettlement of sediment due to dredging	Localized, direct, could be medium term, negative but not significant, unavoidable	Areas immediate along the footprint of the jetty, some impacts to the embayment	Areas covered by sediment settlement, areas cleared out	Visual assessment
Marine and coastal ecology	Direct and indirect, cumulative, Could be medium term, Not significant, unavoidable	The embayment area, close-by mangrove communities and the extended mangrove forests	Benthic macrofauna	Especially for mangrove communities, at a minimum, the study should be designed to track long-term changes in mangrove areas. Laboratory test designed to measure stability of benthic macrofauna community.
	Impacts during Construction			

Water quality, Bottom contamination, Marine and Coastal Ecology	Same as during Site Preparation, related to increased turbidity			
Marine and Coastal ecology New structure as "attachment place"	Localized esp. on structures in the water, long term, **positive**, not significant, unavoidable	Submerged structure only	Colonization of submerged structure	Visual
Coastal Hydrology from enactment of large structure in marine environment**:**				
Changes in current pattern, wave and sediment movement that could lead to higher sedimentation rate or erosion	Localized, indirect, Long term, negative and could be significant, unavoidable	Areas immediate to the jetty structure, mangrove forests, impact could extend to the embayment	Beach erosion (loss of sandy area along the beach) or coastal erosion (loss of sediment from the bottom of the coastal area).	Actually impacts will directly be felt by the facility in terms of the frequent need to dredge from the high rate of sedimentation. What should be closely assessed are impacts of changes in sediment movement pattern to the health of the nearby mangroves. Methodology will at least be routine assessment of the area of the mangrove communities.
Stagnant pool of water may be formed behind structures	Localized especially around Jetty structure, long term, negative but not significant, unavoidable	Areas immediate to the jetty structure	Formation of stagnant water	Visual
Noise and vibration From equipment operation	Localized, short term, negative, not significant, unavoidable	Only up to areas 100 meters away from the source of the noise. See detailed explanation on noise impacts in Section 6.1.3	Community complain	On site test
Water quality, bottom contamination and marine ecology from waste generation From worker activities	Localized, short term, negative, not significant, avoidable	Affecting area immediate to the jetty structure and the embayment. Solid waste could travel a long distance	Concentration of solid waste along the beach, solid waste floating in the mangrove area and around the project area, evidence of eutrophication in	Visual

		in the marine environment.	the water	
Impacts during Operation and Maintenance				
From Ship Traffic				
Water quality, Bottom contamination, Marine and Coastal Ecology:				
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Area immediate to the jetty structure, the embayment including sensitive receptor nearby. Large scale oil spill could travel to larger marine environment	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing designed to measure oil spill impacts including level of toxicology. At the very least, laboratory testing of marine water should cover parameters tested in the baseline information data collection.
Waste water	Localized, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure up to the embayment	Eutrophication, bacterial count	Visual, laboratory testing
Garbage (solid waste)	Could be dispersed to larger marine environment, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure, the embayment and potentially dispersed to the larger marine water	Concentration of solid waste along the beach, solid waste floating in the mangrove area and around the project area	Visual
Noise and Vibration from ship traffic	Localized, not significant, happened several times in a month during the time ship is coming	Most likely affecting workers on the ship and jetty structure only	Noise level, complain from surrounding resident	Site testing or nuisance level
From Maintenance of Jetty				

Water quality, Bottom contamination, Marine and Coastal Ecology From increased turbidity related to fixing and parts replacement	Same as during Site Preparation above

6.2 Impacts from Fuel Storage

Major impacts from fuel storage development are related especially to oil spill and fire hazard. Magnitude of impacts will depend on the scale of the spill and fire with impacts range from slight to extensive impacts (Table 6.2) that can lead to long term alteration to ecosystem function and permanent species or asset loss. The following table contains potential environmental impacts from fuel storage development.

Table 6.2. Type, Nature, Indicator and Methodology to Assess Impacts

Type of Impact	Nature of Impact	Impact Indicator	Methodology to Assess Impacts
Impacts during Site Preparation			
Surface and Marine Water quality, bottom contamination and marine/coastal ecology From increased turbidity due to spoil from site preparation	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test
Terrestrial Ecology	Direct, long term, not significant, unavoidable	Loss of habitat	Site survey
Impacts during Construction			
Surface and marine water quality, Bottom contamination, Marine and Coastal Ecology from increased turbidity due to spoil from site preparation	Same as during Site Preparation, related to increased turbidity due to spoil from construction activities		
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be medium term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test

Air Quality from traffic during construction	Direct, short term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, short term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Impacts during Operation and Maintenance			
Surface water quality, marine water quality, bottom contamination, marine and coastal ecology from:			
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing
Liquid and solid waste	Localized, could be significant to sensitive flora and fauna, avoidable	Solid waste floating in the mangrove area and around the project area, bacterial contamination, level of nutrients in the water	Visual, laboratory testing
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be long term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test
Air Quality from traffic during construction	Direct, long term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, long term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Visual quality	Direct, long term, not significant, unavoidable	Visual stimulation	Visual

6.3 Potential Climate Change Impacts

Generally speaking, there are two types of potential climate change impacts relevant to the development. The first are Adaptation types of impacts which are impacts that will influence the ability to adapt to changes in physical characteristics of the environment such as sea level rise, change in rainfall pattern, raising temperature, and others. The second types of impacts are the Mitigation impacts which are the impacts that will influence the ability to mitigate the increase in Greenhouse Gas (GHG) emission and to

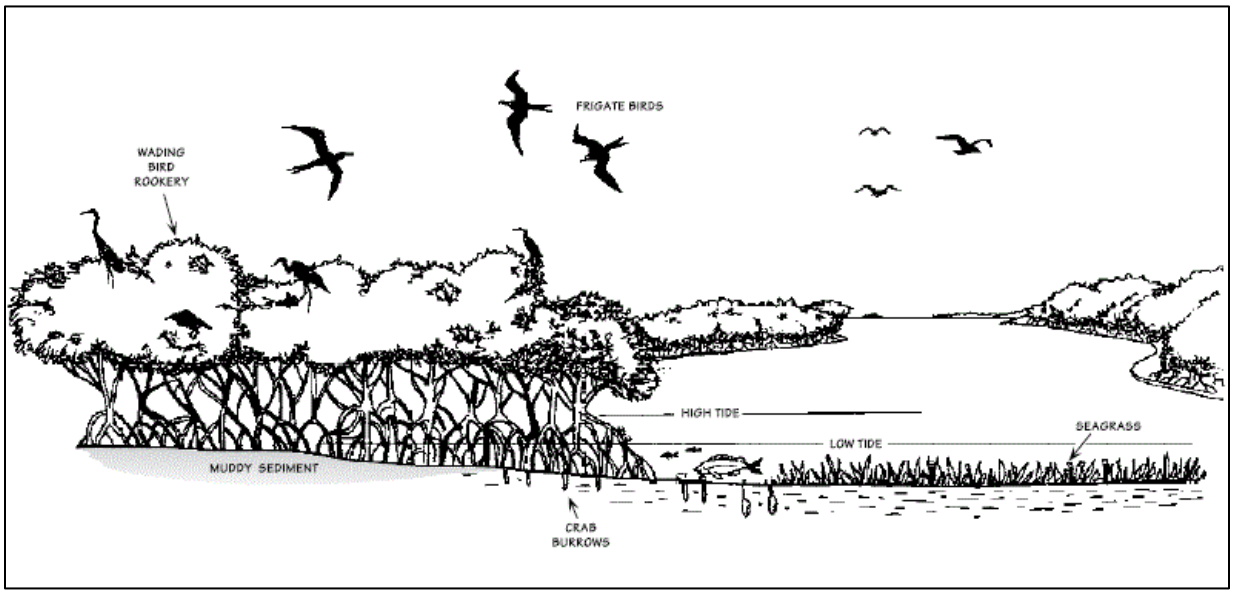
stop the loss of carbon pool (loss of trees and other vegetation) and to increase the potential for carbon sequestration. Of these impacts, several are considered relevant for the project and are explained below.

6.3.1 Mangrove and Protection from Coastal Erosion/Inundation (Adaptation Impacts)

Mangrove protection has been advocated as one of the strategies to increase resilience of coastal countries to the effect of sea level rise. Mangrove communities provide a lot of environmental and economically important services including:

1. Provide habitat for mollusks, crustaceans, fish, birds and monkeys
2. Nursery for shrimp and other economically important fish
3. Harvested for firewood, charcoal and timber
4. Pollutant trapping and filtering
5. Stabilization (protection from erosion) of coastal land by trapping of sediment and protecting from storm damage

Figure 6.1. Intertidal Mangrove Community and its Linkages to other Ecosystems



Mangrove communities are very sensitive ecosystem that depends on a number of factors for survival, including sediment and freshwater supply, salinity level, effects from storm and others[1]. Impacts from the proposed development to the nearby mangrove communities could come from oil spill, solid and liquid waste loading into the mangrove areas. Within the context of changing climate/sea level rise and rapid development of coastal areas, mangrove communities are also under pressure from lack of space to move inland as sea level rises.

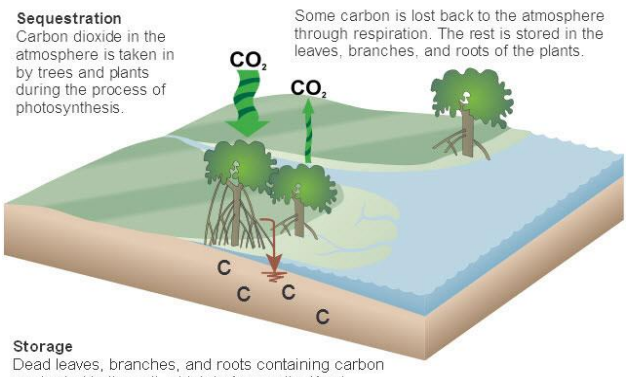
[1]McLeod, Elizabeth and Salm, Rodney V. (2006). Managing Mangroves for Resilience to Climate Change. IUCN, Gland, Switzerland. 64pp.

In addition to protection of mangrove communities, another equally important climate change consideration involves the protection of facility itself from sea level rise. As previously elaborated in Section 4.1 Climate, a study from the Australian Bureau of Meteorology (BOM) and Commmonwealth Science and Industrial Research Organization (CSIRO), sea level rise has been predicted to increase between 6-15 cm by 2030, 12-30 cm by 2055 and between 21 – 59 cm by 2090 (mid-level scenario). These increases have been based on the 1990 sea level, therefore when compared to the year 2014's level, the maximum level of increase will likely be less than 59 cm by 2090[2] or less than 30 cm by 2055. Based on this estimate, it is recommended that the ground floor level be elevated by at least 50 cm in order to respond to the climate change in the future. This recommendation is also consistent with recommendation put forward by Geotech consultant hired to make assessment on ground stability for the structure (see Annex 4.1 for results of Geotech analysis).

6.3.2 Declining Carbon Stock

Direct carbon stock loss from loss of seagrass bed, coral and existing tree due to site preparation will be limited because of the limited footprint of the underwater support structure (piles rather than massive walls). Vegetation cleared out on the terrestrial environment is also limited. No mangrove will be cleared out from surrounding the site. The largest impact to the seagrass bed, coral and mangrove will come from the O&M activities in the form of pollution that affect these biota.

Moreover, from climate change point of view, certain coastal ecosystems such as mangrove, seagrass and salt marsh ecosystem has the potential to store large quantities of carbon for a long period of time, a process also known as carbon sequestration (Figure 6.4). High carbon sequestration potential of these types of ecosystem is due to – (1) these plants usually grow a lot each year, and in the process, capture (or sequester) large amounts of carbon dioxide (CO2); (2) Soils under the plants are largely anaerobic (without oxygen) so carbon that gets incorporated into the soils decomposes very slowly and can persist for hundreds or even thousands of years (carbon storage)[3].



Given the importance of mangrove and sea grass ecosystem to adaptation and mitigation potential from climate change, it is therefore important to incorporate active protection of the ecosystem in the Environmental Management and Monitoring Plans.

[2] This rough assumption is based on a mid-level scenario of GHG emission. As noted in the above table, there are two other scenarios of GHG emission that might produce a lower level of sea level rise (in blue) and a higher level of sea level rise (in purple).

[3] National Oceanic and Atmospheric Administration (NOAA) Habitat Conservation – National Marine Fisheries Service. http://www.habitat.noaa.gov/coastalcarbonsequestration.html

Table 6.9 contains criteria, indicators and methodology to assess impacts of development to mangrove communities.

Table 6.3. Relevant Parameters, Criteria and Indicators for Adaptation and Mitigation to Climate Change Impacts

Type of Impact	Nature of Impact	Impact Indicator	Methodology to Assess Impact
Mangrove protection and coastal erosion	Localized to mangrove communities, long term, could be significant and irreversible (mangrove communities nearby is lost forever), avoidable	Decrease in size of mangrove communities	Field survey, aerial mapping
Emission from vehicle and equipment, ship traffic	Localized, not significant and unavoidable	Level of emission, type of emitted GHG gases	Rough emission calculation (Tier 1).
Loss of seagrass bed, coral, mangrove, existing vegetation	Localized to mangrove communities, long term, could be significant and irreversible (mangrove communities nearby is lost forever), avoidable	Decrease in size of mangrove communities and seagrass beds	Field survey, aerial mapping

6.4 Potential Social Impacts

This social impact assessment has the objective of analyzing potential social consequences of the development to Hera community and being able to come up with recommendations to prevent or mitigate negative social consequences from the development. The scope of the social assessment is the community in which the development is taking place, that is, Aldeia Sucaer Laran and Suco Hera. Workers in the facility whether they come from Hera or other places are also included in the analysis because the social consequences of the development will also be felt by them.

Desk review and field interview conducted for the project found several key social issues in the affected community that are relevant to the development. The key social issues are:

1. Relatively high unemployment level in Suco Hera: based on Census 2010 data, it was found that the unemployment rate in Suco Hera is 13.7% or about one in seven persons that are available for work do not find job.

2. The community health status is still a reflection of rural Timor Leste's health status where there is a need for improvement on the number of children receiving immunization, nutrition status of children and the prevalence of malaria. Health facility remains basic in the community.
3. In terms of educational attainment, Suco Hera has about 66% of population 5 years old and over with some schooling (Census 2010). This relatively higher number, however, is not reflected in the educational attainment at the secondary level, where there is only 38.6% of the population actually finished Junior and High School level (Census 2010).
4. Educational facility only covers primary to junior high school level. High school students have to commute to Dili for continued education. Tertiary educational institution (UNTL Hera) is present in the community but only the engineering school.
5. Gender equality in general is improving, however, there are more work to be done as indicated by the presence of less girls in the university level education (83 girls for every 100 boys enrolled). In the employment sector, data from the United Nations Development Programme (UNDP) also pointed to the traditional male dominance in the non-agricultural emplyment sector.
6. Fishermen group has been found to be the most potentially affected group in the community in relation to the development. This is because a section of the coastline that are well used by the fishermen in the community will have to be cleared from all fishing activities for the proposed development. Some fishermen will have to move their boats and fishing aparatus to other location. The impact could be significant to affected fishermen as field interview found that the fishermen mainly dependent on fishing as their main economic activities and has been able to generate satisfying level of income.

Per the above findings, several recommendations have been put forward for the development to help contribute to the improvement of social condition as well as to ease the impacts on the fishermen group. The recommendations are:

1. Absorption of local labor into the facility: this should start right from the beginning phase of the development/site preparation to construction and operation and management.
2. Preference to women labor: it is believed that certain percentage of labor in the facility should be made open for women, preferably for permanent position. Permanent position carries with it more benefits in the form of opportunities for education and training that not only increase the skill level but provide with positive learning and working experience.
3. Education and training for facility's employees: this should be pursued in a continuous basis with tangible results. For example, upper level management that will be filled with foreign employees at the start of the employment should be filled with Timor Leste citizens within several years.
4. Social contribution: routine social contribution should be made to local community and should contribute to meeting long term social needs of the community. For example, contribution into local schools and health care center, scholarship for students in need and others. This routine social contribution can be coordinated with the church and local authority as the prominent social institutions in the community.

6.5 Potential Economic Impacts

The potential economic impacts section focus on several points: the cost and benefits of several important mitigation measures and potential cost incurred due to environmental damage.

The total cost required by ETO to implement the proposed EMP is amounted to USD 780,000 with annual operating cost of $ 104,700.

The above cost of the mitigation measures can be further classified into capital cost or one-time cost at the beginning of the development and recurring cost that require routine expenditure every six months, every one year or so. The capital cost is estimated at a total of USD 780,000 while the expenditure is estimated at a total of USD 100,000 per year.

Several important benefits will be able to be realized by investment in the mitigation measures. The benefits are as follows:

1. Protection of the mangrove ecosystem nearby. As previously discussed, this alone will generate between USD 20,960/year and USD 101,100/year in fishery and coastal protection from mangrove.
2. Rehabilitation of the environment. In addition to protection benefits, other benefits that should be taken into consideration is the benefits in terms of the avoidance of conducting rehabilitation.
3. Protection of nearby infrastructure. Should any major accident happen, most likely, not all of the infrastructure will be damaged, however, at least a part of it will be affected. In the case of EDTL Hera, it will be more realistic to say that the facility might not be totally damaged but some disruption to the service might happen and economically, the cost could be significant due to the importance of electricity in the economy.
4. Protection of workers. It is hard to put a price on the protection of human being from injury or loss of life. It should also be noted that not only workers in the ETO facility will be affected. Should a major accident happen, there is a high possibility that workers at EDTL Hera might be affected.

7. Proposed Mitigation Measures

In the section 6 of this report has discussed extensively on the potential environmental, climate change and socio-economic impacts resulted from the development. Several types of potential impacts can lead to significant damage to the environment and existing infrastructure near the development site, not to mention the potential for loss of lives should any large accident happen on the site. Additionally, several potential socio-economic impacts are also significant to Hera community and the national economy. These potentially significant impacts are listed in Table 7.1.

Table 7.1. Potentially Significant Environmental and Socio-Economic Impacts

No	Significant Impacts	Source Activity	Phase in the Development
Environmental			
1	Marine Water Quality	Especially from oil spill and associated toxic substances present in the product	Risks from significant impacts are especially during O&M phase.
2	Bottom Contamination		
3	Coastal and Marine Ecology		
4	Surface Water Quality		
5	Soil and Ground Water Quality		
Socio Economic			
1	Loss of lives and potentially significant economic loss from explosion and fire	Spill, overfill or other loss of containment that leads to explosion or fire	Especially during O&M phase

Due to the potential scale of damage from the above impacts, it is deemed important to discuss management and monitoring measures that are relevant to these impacts in more detail.

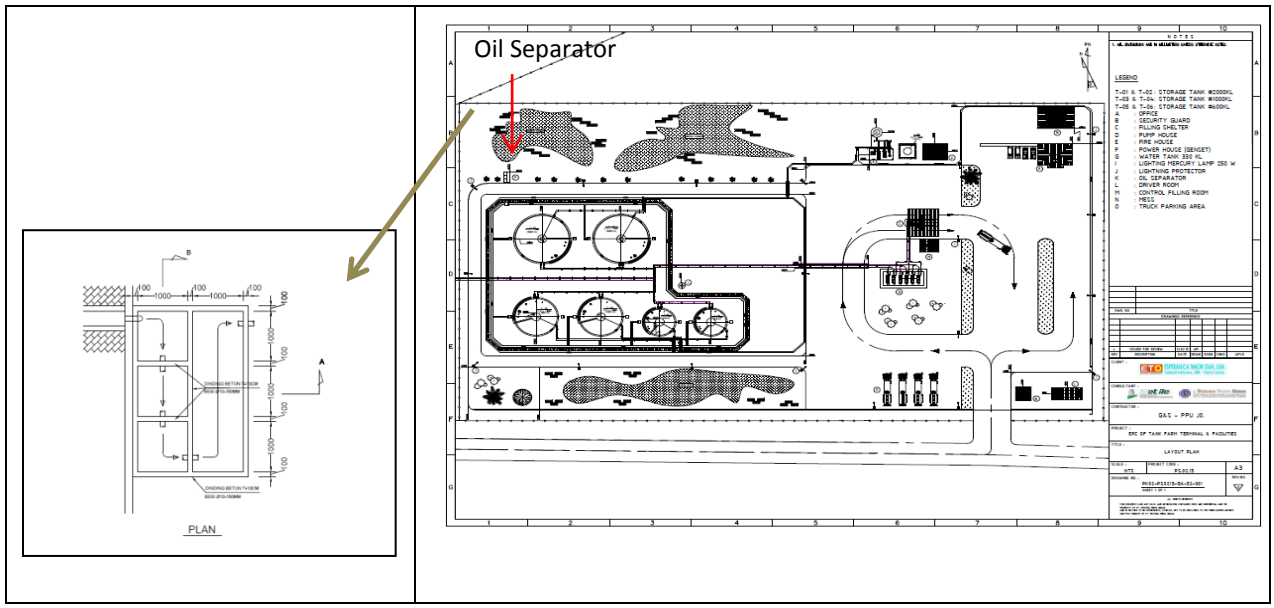
7.1 Management Plans for Major Impacts

As noted in Table 8.1 Scale of Impacts from Oil Spill (under Section VI.1.5 Water Quality, Bottom Contamination and Marine/Coastal Ecology from Oil Spill), there are five scale of impacts from oil spill. The first three scales of impacts – slight to local impacts – are impacts from relatively small spill that can cause severe damage when happen repeatedly while the later impacts – major to extensive impacts – are impacts from large enough spills that only need to happen once to cause severe impacts. Management measures for both groups of impacts are discussed as follows.

7.1.1 Management Measures for Slight to Local Impacts

To prevent small spills from reaching nearby environment, a physical measure in the form of oil separator will be put in place (Figure 7.1). This oil separator will intercept drainage lines coming out of the bundwall, catching the runoff. When operators observe oil in the water, the oil will be skimmed and disposed-off properly.

Figure 7.1. Water-Oil Separator



When deemed necessary (determination will be done by professional operator and relevant authority), further clean-up of drainage water can be done using a skimming machinery similar to the one depicted in the illustrative figure below.

Figure7.2. Higher-Grade Skimming Machine (Cost US$ 15,000 – US$ 35,000)

As for potential for small spills from tanker ship during the transfer of products from ship to EDTL and storage tank, several steps should be taken:

1. The use of boom around tanker ship to prevent spill from spreading to the surrounding location.
2. Application of dispersant (detergent) into spill that will reduce the oil/water interfacial tension, making it easier for waves to break up oil into larger numbers of smaller particles. Dispersant also prevents dispersed particles from recoalescing and forming bigger, more buoyant droplets that float to the surface.

7.1.2 Management Measures for Major to Extensive Impacts

Large Scale Oil Spill from Tanker Ship

No large scale oil handling facility plan to have an accident. This statement was echoed during the first stakeholder consultation meeting with relevant agencies in March 2014. Yet, accidents happen whether it is a result of human error, mechanical failure or catastrophic natural events beyond human control. Therefore it is important to establish a Response Plan that would become handy in the event of a large scale accidental oil spill.

Overall Goal

Goals of the Response Plans should be (in order of significance):

1. Ensure safety of workers, nearby community and other people around the site
2. Contain and stabilize the situation so it does not progressively worsen
3. Minimize adverse environmental and socio-economic impact

Objectives

Objectives are different than overall goals. Objectives are specific response outcomes that are based on the unique characteristics of the spill. Head of the response team has to be able to define proper objectives in every situation based on the overall goals as state above.

Several possible objectives in different spill scenarios are presented in the following table.

Table 7.2. Example of Specific Objectives

No	Spill Scenario	Example of Specific Objectives
1	Tanker has an accident, spill started to occur on water.	- Prevent fire from happening - Prevent fishermen nearby from spill or fire effect - Stop the spill from tanker - Prevent spill from reaching the shoreline, mangrove communities on the eastern side of facility.
2	There is a failure in tank filling control system. Spill started at one of the tanks.	- Prevent fire from happening - Stop the spill from tanks - Evacuate nearby community - Prevent spill from reaching the drainage system

Windows of Opportunity

It is important for the response manager to define available window of opportunity or the period during which rapid response actions are viable. Changes in weather, for example, will limit the viability of certain types of action. Therefore, the action has to be carried out as soon as possible and those carrying out the response actions has to watch for certain changes in weather or other physical parameters (current, wave, etc.)

Cleaning Methodology

Various techniques and technologies are available for cleaning large scale oil spill. These methods have their advantages and disadvantages and should be employed with caution because some methods could actually exacerbate the situation and lead to unnecessary impacts to the surrounding communities and the environment. Lessons learned from study of previous emergency response have even suggested that in some situation, leaving the environment as it is and allowing for natural recovery from weathering, wave and biological actions are actually best.

General Principles for Oil Spill Cleaning

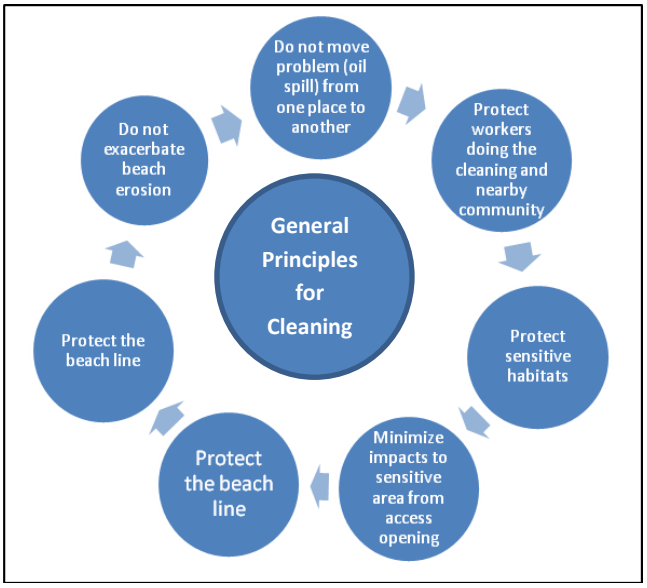


Table 7.3 contains a list of clean up methodologies, its affectivity and potential impacts to the environment.

However, General Principles on Implementing Certain Cleaning Method is summarized in the following figure.

Deciding on Which Methodologies to Use (Strategies)

Being clear on the window of opportunity and having specific objectives help tremendously in Being

clear on the window of opportunity and having specific objectives help tremendously in developing appropriate strategies from a variety of response actions available. Information on the different types of response methodologies, their advantages and potential biological constraints are also helpful in deciding how to proceed with the spill response. Developing best strategies to employ, however, should be based on accurate information on the nature of the spill, human environment and other physical factor. The following are some basic information that needs to be collected before developing the strategies categorized based on location of affected area, i.e. on water or along the shoreline.

Table 7.3. Different Cleaning Methodology

No	Method	Description	Objective	Suitable Habitat	When to Use	Biological Constraints	Environmental Effect	Waste Generation
1	Natural Recovery	No action is taken, except monitoring of contaminated areas	Oil is left in place to degrade naturally.	All	When natural removal rate is fast (e.g. for gasoline spill); when degree of oiling is light; when cleanup actions will do more harm than natural recovery	May be inappropriate for areas used by high numbers of people, mobile animals (birds, marine mammals) or endangered species	Same as from the oil alone.	None
2	Booming	A boom is a floating physical barrier, placed on the water to contain or exclude oil. Booms must be properly deployed and kept clean from debris and re-adjusted to changing water flow directions, water levels, and wave conditions. Proper deployment involves use of mooring systems (e.g., anchors, land lines) and skilled teams. Tidal-seal boom is a special type of boom designed to be deployed in the intertidal zone.	To prevent oil from contacting resources at risk, and to facilitate oil removal	Can be used on all water environments (weather permitting). Booms begin to fail by entrainment when the effective current or towing speed exceeds 0.7 knots perpendicular to the boom	Most responses to spills on water involve deploying boom. Containment booming of gasoline spills is usually not attempted, because of fire, explosion, and inhalation hazards. However, when public health is at risk, gasoline can be boomed if foam is applied and extreme safety procedures are used.	Placing and maintaining boom and anchoring points should not cause excessive physical disruption to the environment and booms in very shallow water should be monitored so they do not trap wildlife (such as fish coming in at high tide).	Minimal	Cleaning booms will generate contaminated wastewater that must be collected, treated, and disposed of appropriately. Discarded booms will need to be disposed of according to appropriate waste disposal regulations.
3	Skimming	There are numerous types of skimming devices, described in the annually published World Catalog of Oil Spill Response Products (SL Ross 2008): brush, disc, drum, paddle, belt, rope mop, sorbent belt, submersion plan, suction, and weir. They are placed at the oil/water interface to recover, or skim, oil from the water's surface and may be operated independently from shore, be mounted on vessels, or be completely self-propelled.	To recover floating oil from the water surface using mechanized equipment.	Can be used on all water environments (weather and visibility permitting).	When sufficient amounts of floating oil can be accessed. Skimming spilled gasoline is usually not feasible however, when public health is at risk, gasoline can be skimmed if foam is applied and extreme safety procedures used.	Vehicle and foot traffic to and from skimming sites should not disturb wildlife unreasonably	Minimal	Free-floating oil can be recycled. Emulsions formed during the process must be treated (broken) before recycling. Oil-contaminated waste from the treatment phase should be treated as wastewater.
4	Barriers/Berms	A physical barrier (other than a boom) is placed across an area to prevent oil from passing. Barriers can consist of earthen berms, trenching, or filter fences. When it is necessary for water to pass because of water volume, underflow or overflow dams are used.	To prevent entry of oil into a sensitive area or to divert oil to a collection area	At the mouths of creeks or streams to prevent oil from entering, or to prevent oil in the creek from being released into offshore waters	When the oil threatens sensitive habitats and other barrier options are not feasible	Responders must minimize disturbance to bird nesting areas, beaver dams, or other sensitive areas. Placement of dams and filter fences could cause excessive physical disruptions, particularly in wetlands.	May disrupt or contaminate sediments and adjacent vegetation.	Sediment barriers will become contaminated on the oil side and filter fence materials will have to be disposed of as oily wastes
5	Physical Herding	Plunging water jets, water or air hoses, and propeller wash can be used to dislodge trapped oil and divert or herd it to containment and recovery areas. May emulsify the oil.	To free any oil trapped in debris or vegetation on water; to direct floating oil towards containment and recovery devices; or to divert oil from sensitive areas	In near shore areas where there are little or no currents, and in and around man-made structures such as wharves and piers.	In low-current or stagnant water bodies, to herd oil toward recovery devices. In high-current situations to divert floating oil away from sensitive areas.	When used near shore and in shallow water, must be careful not to disrupt bottom sediments or submerged aquatic vegetation.	May generate high levels of suspended sediments and mix them with the oil, resulting in deposition of contaminated sediments in benthic habitats.	None
6	Manual Oil Removal	Removal of surface oil using hands, rakes, shovels, buckets, scrapers, sorbents, pitchforks, etc., and placing in containers. No mechanized equipment is used except for transport of collected oil and debris.	To remove oil with hand tools and manual labor	Can be used on all habitat types	Light to moderate oiling conditions for stranded oil, or heavy oils on water or submerged on the bottom that have formed semi-solid or solid masses and that can be picked up manually	Foot traffic over sensitive areas (marshes, tidal pools, etc.) should be restricted or prevented. There may be periods when shoreline access should be avoided, such as during bird nesting	Minimal	May generate significant quantities of oil mixed with sediment and debris that must be properly disposed of or treated.

7	Mechanical Oil Removal	Oil and oiled sediments are collected and removed using mechanical equipment not specifically designed for pollution response, such as backhoes, graders, bulldozers, dredges, draglines, etc. Requires systems for temporary storage, transportation, and final treatment and disposal of collected material.	To remove oil from shorelines, and bottom sediments using mechanical equipment	On land, possible wherever surface sediments are both amenable to, and accessible by, heavy equipment. For submerged oil, used in sheltered areas where oil accumulates. On water, used on viscous or solid contained oil.	When large amounts of oiled materials must be removed. Care should be taken to remove sediments only to the depth of oil penetration, which can be difficult with heavy equipment. Should be used carefully where excessive sediment removal may cause erosion of the beach or shore.	Heavy equipment use may be restricted in sensitive habitats (e.g., marshes, soft substrates) or areas used by protected species.	The equipment is heavy, with many support personnel required. May be detrimental if excessive sediments are removed without replacement (beach erosion risk).	Can generate significant quantities of contaminated sediment and debris that must be treated or landfilled.
8	Sorbents	Organic, inorganic, and synthetic materials that remove oil through absorption (uptake into the sorbent material, like a sponge) or through adsorption (coating of the sorbent's surface). Sorbents are placed on the floating oil or water surface, allowing them to sorb oil, or are used to wipe or dab stranded oil.	To remove surface oil by using oleophilic (oil-attracting) material placed in water or at the waterline.	Can be used on any habitat or environment type.	When oil is free-floating close to shore, or stranded on shore; the oil must be able to be released from the substrate and sorbed by the sorbent. Sorbents can be used as a secondary treatment method after gross oil removal in sensitive areas where access is restricted. Selection of sorbent varies by oil type: heavy oils only coat surfaces, requiring use of sorbents with high surface areas to be effective; lighter oils can penetrate sorbent material.	Access for deploying and retrieving sorbents should not 1) adversely affect wildlife; 2) be through soft or sensitive habitats	Physical disturbance of habitat during deployment and retrieval.	In most cases, sorbents must eventually be collected for proper disposal so care should be taken to select and use sorbents properly, and prevent overuse and generation of large amounts of lightly oiled sorbents. Because large amounts of waste may be generated, recycling should be emphasized over disposal.
9	Vacuum	A vacuum unit is attached via a flexible hose to a suction head that recovers free oil. The equipment can range from small, portable units that fill individual 55-gallon drums to large super suckers that are truck- or vessel-mounted and can generate enough suction to lift large rocks.	To remove oil pooled on a shoreline substrate or sub-tidal sediments	Any accessible habitat type.	When oil is stranded on the substrate, pooled against a shoreline, concentrated in trenches, or trapped in vegetation.	Special restrictions should be established for areas where foot traffic and equipment operation may be damaging, such as soft substrates. Operations in vegetated areas must be very closely monitored, and a site-specific list of procedures and restrictions developed to prevent damage to vegetation.	Minimal, if access is controlled.	Collected oil and/or oil/water mix will need to be stored temporarily before recycling or disposal.
10	Debris Removal	Manual or mechanical removal of debris (driftwood, seaweed, trash, wreckage) from the shore or water surface.	To remove debris in the path of a spill before oiling, and to remove contaminated debris from the shoreline and water surface.	Can be used on any habitat or environment type where access is safe	When debris is heavily contaminated and provides a potential source of secondary oil release;	Foot traffic over sensitive areas (wetlands, spawning grounds) must be restricted	Physical disruption of substrate, especially when mechanized equipment must be deployed to recover a large quantity of debris	Will generate contaminated debris
11	Sediment Reworking /Tilling	The oiled sediments are roto-tilled, disked, or otherwise mixed using mechanical equipment or manual tools. Along beaches, oiled sediments may also be pushed to the water's edge to enhance natural cleanup by wave activity (surf washing).	To break up oily sediments and surface oil deposits, increasing their surface area, and mixing deeper subsurface oil layers, thus enhancing the rate of degradation through aeration	On any sedimentary substrate (sand, mud, etc.) that can support mechanical equipment or foot traffic and hand tilling.	On sand to gravel beaches with subsurface oil, where sediment removal is not feasible (due to erosion or disposal problems).	Avoid use on shores near sensitive wildlife habitats, such as fish-spawning areas or bird-nesting or concentration areas because of the potential for release of oil and oiled sediments into adjacent bodies of water. Should not be used in shellfish beds or vegetated habitats.	Mixing of oil into sediments could further expose organisms that live below the original layer of oil.	None

12	Vegetation Cutting/Removal	Oiled vegetation is cut with weed trimmers, blades, etc.	To remove portions of oiled vegetation or to access oil trapped in vegetation to prevent oiling of wildlife or secondary oil releases.	Habitats composed of vegetation, such as salt marsh, sea grass beds, etc.	When the risk of oiled vegetation contaminating wildlife is greater than the value of the vegetation that is to be cut,	Operations must be strictly monitored to minimize the degree of root destruction and mixing of oil deeper into the sediments. Access in bird-nesting areas should be restricted during nesting seasons. Cutting only the oiled portions of the plants and leaving roots and as much of the stem as possible minimizes impacts to plants.	Vegetation removal will destroy habitat for many animals. Cut areas will have reduced plant growth and, in some instances, plants may be killed.	Cut portions of oiled plants must be collected and disposed
13	Flooding	A perforated header pipe or hose is placed above the oiled shore or bank. Ambient-temperature water is pumped through the header pipe at low pressure and flows downslope to the water where any oil released is trapped by booms and recovered by skimmers or other suitable equipment.	To wash oil stranded on land to the water's edge for collection.	All shoreline types where the equipment can be effectively deployed.	In heavily oiled areas when the oil is still fluid and adheres loosely to the substrate, and where oil has penetrated into gravel sediments. This method is frequently used with other washing techniques (low- or high-pressure, cold- to hot-water flushing).	May need to restrict use so that the oil/water effluent does not drain across sensitive intertidal habitats. Not appropriate for muddy substrates.	Habitat may be physically disturbed by foot traffic during operations and smothered by sediments washed down the slope. Flooding may cause sediment loss and erosion of the shoreline and shallow rooted vegetation.	Depends on the effectiveness of the collection method
14	Low-pressure, Ambient-Water Flushing	Ambient-temperature water is sprayed at low pressures (<10 psi), usually from hand-held hoses, to lift oil from the substrate and float it to the water's edge for recovery by skimmers, vacuum, or sorbents. Usually used with a flooding system to prevent released oil from re-adhering to the substrate downstream of the treatment area.	To remove fluid oil that has adhered to the substrate or man-made structures, pooled on the surface, or become trapped in vegetation.	On substrates, riprap, and solid, man-made structures, where the oil is still fluid. In wetlands and along vegetated banks where oil is trapped in vegetation.	Where fluid oil is stranded onshore or floating in shallow intertidal areas	May need to restrict use so that the oil/water effluent does not drain across sensitive intertidal habitats, and so that mobilized sediments do not affect rich subtidal communities	If containment methods are not sufficient, oil and oiled sediments may be flushed into adjacent areas.	Depends on the effectiveness of the collection method
15	High-pressure, Ambient-Water Flushing	Similar to low-pressure flushing, except that water pressure is 100–1,000 psi (720–7,200 kpa). High-pressure spray will more effectively remove sticky or viscous oils. If low water volumes are used, sorbents are placed directly below the treatment area to recover oil.	To remove oil that has adhered to hard substrates or man-made structures (e.g. jetty)	On bedrock, man-made structures, and gravel substrates.	When low-pressure flushing is not effective at removing adhered oil, which must be removed to prevent continued oil release or for aesthetic reasons.	May need to restrict flushing so that the oil does not drain across sensitive habitats. Flushed oil must be recovered to prevent further oiling of adjacent areas. Should not be used directly on attached algae nor rich, intertidal areas.	All attached animals and plants in the direct spray zone will be removed, even when used properly. May drive oil deeper into the substrate or erode fine sediments from shorelines if water jet is improperly applied. If containment methods are not sufficient, oil and oiled sediments may be flushed into adjacent areas. Some trampling of substrate and attached biota will occur.	Depends on the effectiveness of the collection method
16	Low-pressure, Hot-Water Flushing	Hot water (90°F [32°C] up to 171°F [77°C]) is sprayed with hoses at low pressures (<10 psi [<72 kpa]) to liquefy and lift oil from the substrate and float it to the water's edge for recovery by skimmers, vacuums, or sorbents. Used with flooding to prevent released oil from re-adhering to the substrate.	To remove non-liquid/non-fluid oil that has adhered to the substrate or man-made structures, or pooled on the surface.	On bedrock, sand to gravel substrates, and man-made structures	Where heavy, but relatively fresh, oil is stranded onshore.	Avoid vegetated areas or rich intertidal communities so that the hot oil/water effluent does not contact sensitive habitats	Hot water contact can kill attached animals and plants. If containment methods are not sufficient, oil may be flushed into adjacent areas.	Depends on the effectiveness of the collection method
17	High-pressure, Hot Water Flushing	Hot water (90°F [32°C] up to 171°F [77°C]) is sprayed with hand-held wands at pressures greater than 100 psi (720 kpa). If used without water flooding, this procedure requires immediate use of vacuum or sorbents to	To mobilize weathered and viscous oil strongly adhered to	Gravel substrates, bedrock, and man-made structures.	When oil has weathered to the point that warm water at low pressure no longer effectively removes oil.	Use should be restricted so that the oil/water effluent does not drain across sensitive habitats (damage can result from exposure to oil, oiled sediments, and hot water). Should not be used directly on	All attached animals and plants in the direct spray zone will be removed or killed, even when used properly.	Depends on the effectiveness of the collection method

		recover the oil/water runoff. When used with a flooding system, the oil is flushed to the water surface for collection by skimmers, vacuum, or sorbents.	surfaces.			attached algae nor rich, intertidal areas.		
18	Steam Cleaning	Steam or very hot water (171°F [77°C] to 212°F [100°C]) is sprayed with hand-held wands at high pressure (2,000+ psi [14,400 kpa]). Water volumes are very low compared to flushing methods.	To remove heavy residual oil from solid substrates or man-made structures	Man-made structures such as seawalls and riprap	When heavy oil residue must be removed for aesthetic reasons, when hot water flushing is not effective, and no living resources are present	Not to be used in areas of soft substrates, vegetation, nor high biological abundance directly on, nor below, the structure	Complete destruction of all organisms in the spray zone	Depends on the effectiveness of the collection method. Usually sorbents are used, generating significant waste volumes
19	Sand Blasting	Use of sandblasting equipment to remove oil from the substrate.	To remove heavy residual oil from solid substrates or man-made structures.	On heavily oiled bedrock, artificial structures	When heavy oil residue must be cleaned for aesthetic reasons, and even steam-cleaning is not effective.	Not to be used in areas of soft substrates, vegetation, nor high biological abundance directly below, nor adjacent to, the structures.	Complete destruction of all organisms in the blast zone.	Will need to recover and dispose of oiled sand used in blasting
20	Dispersants	Dispersants reduce the oil/water interfacial tension, making it easier for waves to break up oil into larger numbers of smaller particles. Also prevents dispersed particles from recoalescing and forming bigger, more buoyant droplets that float to the surface	To reduce impact to sensitive shoreline habitats and animals that use the water surface by chemically dispersing oil into the water column.	Water bodies with sufficient depth and volume for mixing and dilution	When the impact of the floating oil has been determined to be greater than the impact of dispersed oil on the water-column and benthic community	Use in shallow water could affect benthic resources. Consideration should be made to avoid directly spraying any wildlife, especially birds or fur-bearing marine mammals.	Until sufficiently diluted, the dispersed oil can adversely impact organisms in the upper water column. Because dispersion may be only partially effective, some water-surface and shoreline impacts could occur	None
21	Emulsion-treating Agents	Emulsion-treating agents are surfactants that are applied to emulsified oil at low concentrations (0.1–2 percent). They can be injected into skimmer reservoirs to break the emulsion as it is skimmed from the water. They can be sprayed (similar to dispersants) directly onto slicks to break or prevent emulsions, although this type of application has been used only in field trials.	To break or destabilize emulsified oil into separate oil and water phases. Also can be used to prevent emulsion formation, increasing oil recovery rates, extending the window for dispersant application, or making burning possible.	On all water environments	To break emulsions in skimming systems, where storage capacities are very limited. To separate the recovered, emulsified oil and water so that the water can be treated and discharged.	Use in shallow water could affect benthic resources. Responders should avoid directly spraying any wildlife, especially birds or fur-bearing marine mammals.	Environmental concerns include the potential for increased oil content of separated water; whether the oil will be more readily dispersed; and how the treated oil will behave upon contact with skimming equipment, birds, mammals, and shorelines.	May enable recycling of oil/water mixtures by breaking down emulsions
22	Elasticity Modifiers	The liquid product is applied at a rate of 1:13 to 1:150 product:oil, depending on the oil type. Some mixing is required and is usually provided by the water spray during application. Treated oil is gelatinous, or semi-solid, but still fluid; there is no chemical change in the oil. The primary purpose is to increase skimmer efficiency removal rates while minimizing water recovery amounts.	To impart visco-elastic properties to floating oil, thereby increasing skimming rates.	On all water environments where oil can be accessed for skimming. Not suitable for use near wetlands nor debris because of increased adhesive properties of the treated oil.	When skimmer efficiency is low. Must be used with booming or other physical containment. Ideal for thin slicks of No. 2 fuel oil or diesel that are very difficult to recover with mechanical equipment or sorbents.	Not suitable for vegetated shores nor where extensive debris is mixed in the oil. Should be avoided when birds or other wildlife cannot be kept away from the treated oil.	May increase the smothering effect of oil on organisms; therefore, use should be considered only where recovery of the treated oil is likely.	If skimming efficiency is increased, will reduce the volume of water in oil/water collections.
23	Surface Collecting Agents	These agents, which are insoluble surfactants and have a high spreading pressure, are applied in small quantities (1–2 gallons per	To collect or herd oil into a smaller area	On all still-water environments	Potential use for collection and protection. For collection, used to push slicks out from under docks and piers	Not suitable for use in very shallow water nor fish-spawning areas	Direct acute toxicity to surface-layer organisms possible, though available	Same as for manual oil recovery.

		lineal mile) to the clean water surrounding the edge of a fresh oil slick. They contain the oil, prevent spreading, but do not hold the spill in place. Hand-held or vessel-mounted systems can be used. Must be applied early in spill, when oil is still fluid.	and thicker slick in order to increase recovery.		where it has become trapped, or in harbors where the equipment is readily accessible for use early in the spill. For protection in low-current areas, used to push slicks away from sensitive resources such as wetlands. Not effective in fast currents, breaking waves, nor rainfall.		products vary greatly in their aquatic toxicity.	
24	Solidifiers	Chemical agents (polymers) are applied to oil at rates of 10–50 percent or more, solidifying the oil in minutes to hours. Various broadcast systems, such as leaf blowers, water cannons, or fire suppression systems, can be modified to apply the loose granular product over large areas. Can be applied to both floating and stranded oil. Mixing is usually needed, and can be done with a strong water spray. Can be placed in booms, pads, pillows, and socks and used like sorbents.	To change the physical state of spilled oil from a liquid to a solid.	All water environments, bedrock, sediments, and artificial structures.	To immobilize the oil or prevent refloating from a shoreline, penetration into the substrate, or further spreading. However, the oil may not fully solidify unless the product is well mixed with the oil, and may result in a mix of solid and untreated oil. Generally not used on heavy oil spills that are already viscous.	Must be able to recover all treated material	Products are insoluble and have very low aquatic toxicity. Unrecovered solidified oil may have longer impact because of slow weathering rates. Physical disturbance of habitat is likely during application and recovery on land.	If skimming efficiency is increased, solidifiers may reduce the volume of water collected during oil recovery. Oil treated with solidifiers is typically disposed of in landfills.
25	Surface Washing Agents	Special formulations are applied to the substrate, as a presoak and/or flushing solution, to soften or lift weathered or heavy oils from the substrate to enhance flushing methods. The intent is to lower the water temperature and pressure required to mobilize the oil from the substrate during flushing.	To increase the efficiency of oil removal from contaminated substrates.	On any habitat where water flooding and flushing procedures are applicable. Has been used to increase the removal of oil adhered to vegetation.	When the oil has weathered to the point where it cannot be removed using ambient water temperatures and low pressures. This approach may be most applicable where flushing effectiveness decreases as the oil weathers.	When the product does not disperse the oil into the water column, the released oil must be recovered from the water surface. Use should be restricted so that the oil/water effluent does not drain across sensitive habitats	The toxicity and effects on dispersability of treated oil vary widely among products. Selection of a product should consider its toxicity.	Because treated oil must be recovered, waste generation is a function of recovery method, which often includes sorbents.
26	Nutrient Enrichment (Biostimulation)	Liquid products are diluted in water and applied with spray or injection systems. Dry products may be applied by hand or powder spray systems. Oleophilic fertilizers are sprayed neat directly on the oiled surface. The frequency of nutrient addition is determined by monitoring porewater so that nitrate-N concentrations are in the range of ~2–10 mg/L. Regular tilling or other means of aeration may be needed to maintain minimum oxygen levels, break up the oil residues, and provide mixing of the nutrients with the oiled sediments.	To accelerate the rate of hydrocarbon degradation due to natural microbial processes by exploiting ability of microorganisms to convert hydrocarbons to carbon dioxide, water, and innocuous by-products.	Could be used on any shoreline habitat type where access is allowed and nutrients are deficient.	Only when nutrients are limiting the rates of natural biodegradation. On moderate- to heavily-oiled substrates, after other techniques have been used to remove free product; on lightly-oiled shorelines, where other techniques are destructive or ineffective; and where nutrients limit natural attenuation. Most effective on light to medium crude oils and fuel oils. Less effective where oil residues are thick. Not considered for gasoline spills, which evaporate rapidly.	Avoid using ammonium-based fertilizers adjacent to waterbodies because un-ionized ammonia is toxic to aquatic life at very low levels. Nitrate is just as good a nitrogen source without the ecotoxicity. If nutrients are applied properly with adequate monitoring, eutrophication should not be a problem. Only nutrient additives proven to be nontoxic and effective in either the laboratory or the field should be used in the environment. Check fertilizers for their metal content since some common fertilizers contain relatively high levels of metals.	Detrimental effects to shoreline from foot or vehicle traffic caused by workers applying nutrients (unless nutrients are sprayed from a vessel or aircraft).	None
27	In-situ Burning	Oil floating on the water surface is collected into slicks at least 1–2 mm thick and ignited. The oil can be contained in fire-resistant booms, or by natural barriers such as ice or the shore. On land, oil can be burned when it is on a combustible substrate such as vegetation, logs, and other debris. Oil can be burned from non-flammable substrates using a burn promoter. On sedimentary substrates, it may be necessary to dig trenches for oil to accumulate in pools to a thickness that will sustain burning.	To remove oil from the water surface or habitat by burning the oil in place	On most habitats, except dry, muddy substrates where heat may impact the biological productivity of the habitat. May increase oil penetration in permeable substrates. Not suitable for woody vegetation such as mangroves.	On floating slicks, early in the spill event when the oil can be kept thick enough to sustain the burn. On land, where there is heavy oil in sites neither amenable nor accessible to physical removal and the oil must be removed quickly. Removal rates of 50,000 gal/hour can be achieved for a burn area of 10,000 ft2; under prime conditions, removal efficiencies can exceed 90%. In vegetated and mud habitats, a water layer will minimize impacts to sediments and roots. There are many operational and public health limitations.	All biota in the burn area will be impacted. The possible effects of large volumes of smoke on nesting birds and populated areas should be evaluated.	Temperature and air quality effects are likely to be localized and short-lived. Toxicological impacts from burn residues have not been evaluated. On water, burn residues may sink. Recent studies have predicted that about half of international crude oils would tend to sink in seawater, but only after cooling. On land, removal of burn residues is often necessary for crude and heavy oils.	Any residues remaining after burning will need to be collected and landfilled but, with an efficient burn, will be a small fraction of the original oil volume

Table 7.4. Information Needs in the Event of Spill

Category	Location: Spill On Water Information Needed	Location: Spill Along the Shoreline Information Needed
Safety	Worker oil exposure Fire hazard	Worker oil exposure Fire hazard
Nature and Amount of Oil	Oil type spilled Oil volume and area and shape of slick(s) and stranded oil Variations in oil thickness and distribution Emulsification	Oil type spilled Stranded oil amount in terms of percent cover, thickness, width Stranded oil distribution
Proximity	Source considerations Water depths Shoreline and resources at risk Air and vessel traffic Equipment staging and support locations Special consideration areas	Access from water and/or roads Worker support services Staging/deployment sites
Timing	Personnel and equipment availability Logistics support for sustained operations Time until impact Weathering	Timely strategy development Rapid cleanup to prevent oil remobilization
Environment	Weather (wind/rain, other precipitation) Water depth Wind and waves Tides and currents Visibility Temperature Ice and floating debris Vulnerable species and habitats Human use	Waves Tides Currents Weather (wind/rain, other precipitation) Shoreline type Water depth and sea bottom character Vulnerable and threatened/endangered species and habitats Human use constraints Cultural constraints
Authorization	Approval to burn and/or apply chemical countermeasures* Approval to access restricted areas Transport and disposal of recovered oil or waste Necessary permits	Approval to burn and/or apply chemical countermeasures* Required consultations for protection species and cultural resources Approval to access restricted areas Transport and disposal of recovered oil or waste Necessary permits

As is clear from information on the different methodologies for spill response, implementing a combination of several spill response actions is better than implementing only one or two actions. The

actions complement each other and some planned actions have to have a back-up due to the ever changing weather and other environment condition.

Generally speaking, the sequence of actions that make up the strategy for on water spill is as follows:

1. Spill happen
2. Monitor and collect information immediately. Hold any active response.
3. Assess safety of workers and nearby communities.
4. Implement physical containment and mechanical recovery actions which will remove oil with the least environmental impacts but with limitations due to changing weather, visibility, logistics and others. See Table 7.3 for different physical and mechanical recovery options.
5. Apply dispersant, emulsion treating agent, surface collecting agent or solidifiers depending on the situation.
6. Apply in-situ burning in favorable weather condition, watch for trajectory of black smoke to the surrounding area.
7. Direct the rest of the oil (those unable to be contained treated and/or burned) to the shore. As much as possible protect oil from reaching the intertidal habitat (mangrove) because it will be easier to clean the shore line rather than the muddy intertidal habitat.
8. Apply shore cleaning

On shore cleaning are a little bit different than the on water spill because – (1) oil typically stay in place, (2) land-based operation is less weather dependent, (3) different worker and environmental safety factor to consider.

The main treatment objective for shoreline area is to restore the environment to "clean" condition. Clean condition, however, is not the same as original pre-spill condition and the level of "clean" will be different for each spill. A combination of natural recovery, physical washing, sand removal, in-situ burning, chemical and biological treatment may be used as appropriate. As noted for each cleaning methodology, waste disposal should be incorporated in the action plan.

Large Scale Spill from Fuel Storage

Bulk storage facilities have the potential to cause severe pollution and damage to the nearby receptors through the release of hazardous liquids, explosion and fire. To manage the risks, they are required to have three layers of pollution prevention measures or also known as containment measures. The three layers are – (1) primary containment measures; (2) secondary containment measures; (3) tertiary containment measures. What constitute and the objectives of the containment layers are explained as follows:

1. Primary containment measures

Objective	Prevent release from tank overfilling, rapture and leakage through tank walls, bottom and the pipework
Consists of	Tanks, pipework, valves, gauging and alarm system, corrosion protection

2. Secondary containment measures

Objective	Prevent release to the environment should primary containment fail
Consists of	Bund walls, ground lining and bund /wall seals

3. Tertiary containment measures

Objective	Additional barrier to prevent uncontrolled spread from failure of secondary containment. Tertiary containment should be controlled separately from the secondary containment
Consists of	Drainage ditches and separate basins to contain spill

The proposed development has all the above containment measures with varying degree of completeness and standards. Additionally, the proposed development is also equipped with fire protection capability and an Emergency Response Plan in the event of fire.

1. Primary Containment

Primary containment measures for the proposed development consists of six tanks – 2 with 2,000 kL capacity to store gasoline, 2 with 1,000 kL capacity to store diesel fuel and 2 with 600 kL capacity to store lubricant. The following are technical specifications of the tanks.

Maximum design capacity	2,000 kL or 2,000 m3
Design code	Shall be equivalent to API Standard, 610
Tank bottom design	Single skin bottom
Tank corrosion protection	Yes
Storage fill/empty mode	Ship

To effectively manage risks from failures of the primary containment, several management and monitoring measures has to be put in place. These management and monitoring measures are categorized into five types and range from tank overfill protection and tank maintenance, measures for spill accounting and oil-water separation as well as emergency plans.

Table 7.5. Primary Containment Management and Monitoring Measures

No	Type	Management Measures	Maintenance/Monitoring Measures
1	Tank Overfill Protection	Tank level measurement	Regular (monthly) maintenance

		High Level Alarm (HLA) capable of annunciation and automatic shut down	Regular (monthly) testing
		High High Level Alarm (HHLA) capable of annunciation and automatic shut down	Regular (monthly) testing
2	Tank Maintenance and Inspection	Visual observation of leaks, crack, etc along the wall	Should be conducted at least of a weekly basis. Best if conducted on a daily basis.
		Undertank leak inspection	Should be conducted on a regular basis at least once a week. Best using visual and
3	Pipework and fuel transfer safety	Fire safe shut-off inlet/outlet valves that can be remotely shut off	Testing should be conducted on a weekly basis.
		Clear procedure for transfer control (written procedure)	Training at the beginning of operation and regularly at least once a year. Loading are always supervised.
4	Spill Accounting, Oil & Water Separator	Storage inventory reconciliation meaning input minus output of fuel equals what is left in the storage tanks. If fuel in the storage is less than input minus output, check for spill.	Conducted at least weekly and best if conducted on a daily basis.
		Oil/water separation dike to separate spill from tanks and off-tanks (from valves, joint, etc along the pipeworks). See Technical Drawing in Annex _2.1	Monitor the dike on a daily basis, skim oil leaks
5	Emergency Plan and Equipment	Fire Emergency Response Plan (to be prepared by Operator).	Regular (annual) training and drill
		Spill Response Plan	Regular (annual) training and drill
		Emergency equipment ready for rapid deployment for both spill and fire or spill only emergencies.	Regular (monthly) testing of equipment

2. Secondary Containment Measures

Secondary containment measures for the proposed development consist of bund wall and the size of 3500 kL (more than 110% the volume of largest tank). The primary function of the bund wall is to prevent the spread of tank contents if the tank overflows or fails structurally (breakdown). If more than one tank is enclosed within a dike, the standard practice was for the dike to contain at least the volume of the largest tank.

Other factors that need to be taken into account in secondary containment are potential for leaks from pipework penetration on the walls. These pipework penetrations have to be sealed properly using fire resistance sealant.

Recommended management and monitoring measures for secondary containment involvesa minimum of weekly inspection of bund floor and wall to check for cracks and failures to the pipework sealant.

3. Tertiary Containment Measures

Tertiary containment consists of impervious lining of the facility and drainage ditch that drain rainwater as well as spill from inside the bund wall. Impervious lining protect oil spill from contaminating soil and reaching ground water while drainage ditches provide means to drain the bund area. Drainage ditches have to be able to be shut off to prevent spill from reaching sensitive receptors around the site.

Management and monitoring measures for tertiary containment include regular inspection to check for cracks and other irregularities to the impervious lining and drainage ditches.

4. Fire Protection Capability and Fire Response Plan

There are several types of fire hazards common to large tanks storing petroleum product. The hazards have different level of severity from simple fire vent fire to full liquid surface tank fire. Several types of fire incidents are more common than others, for example, an overfill ground fire, a vent fire and rim seal fire are more common than other types of fire. Common types of fire hazard are explained below.

Table 7.6 Types of Tank Fire

Type of Tank Fire	Description	Severity
Overfill ground fire	Also known as dike fires, resulting from tanks or pipe leaks. Leakage can be attributed to operator error or equipment malfunction.	Least severe
Vent fire	Usually caused by lightning strike that ignites fugitive vapor present at the vent.	Less severe
Rim seal fire	Usually caused by lightning strike although in certain types of tanks, an induced electrical charge without a direct lightning hit may occur. May lead to explosion.	Less severe
Full liquid surface fire	Very unlikely to occur although have previously occur due to a variety of reason including an overfill accident.	Severe

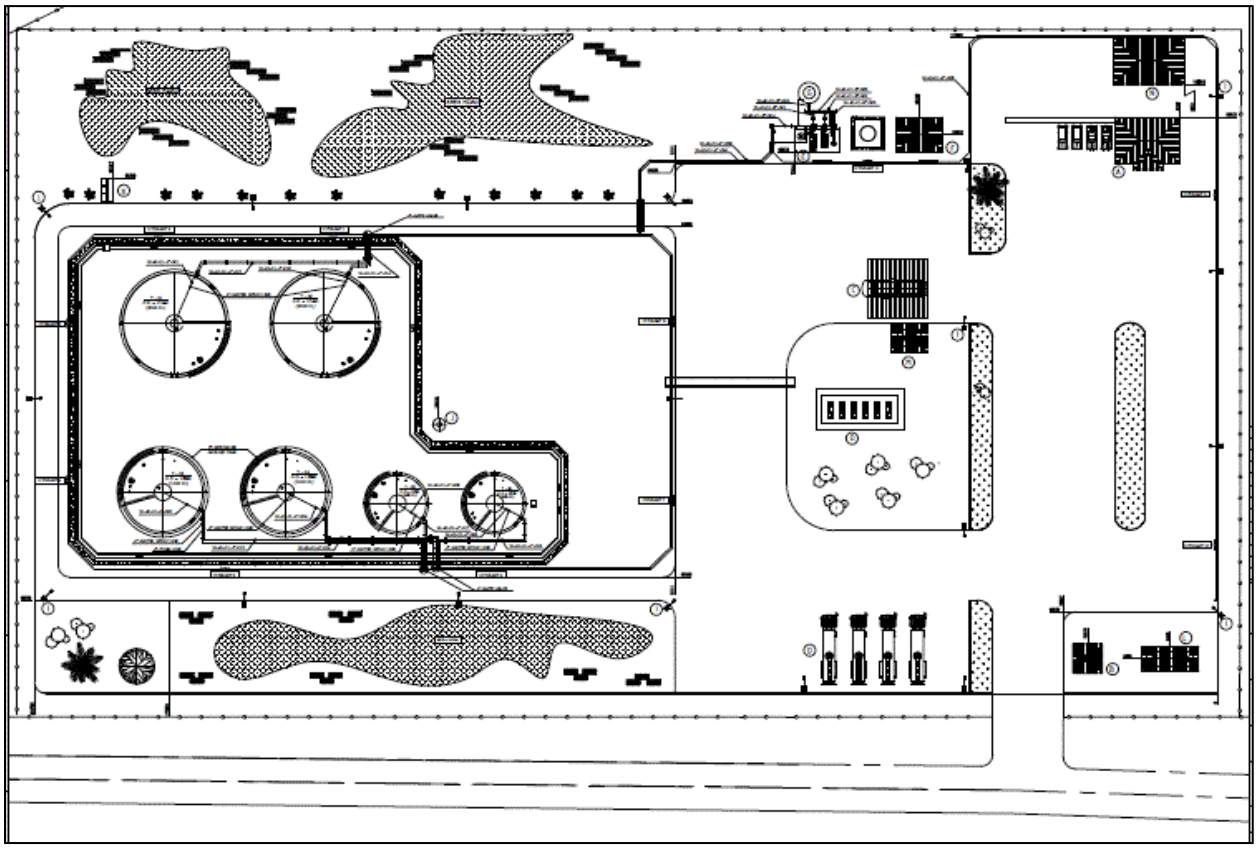
A complete Fire Response and Evacuation Plans will be prepared by professional operator that will run the facility for the first few months and provide training to the local employees. As a general rule, however, minimum fire-fighting apparatus that need to be provided at the facility include:

- Design and size have to adhere to an international standard (NFPA, OSHAS)
- Fire extinguishers have to be made available in areas with highest risk from fire (around tanks containing gasoline and diesel fuel), two 9 kg tanks have to be available/100 m2 area.

- Fire extinguishers have to be made available in areas with least risk from fire (around lubricant tanks), one 9 kg tank/100m2
- Fire extinguishers in non-risky areas according to guidelines from civil protection
- Sand with volume 1m3/2500 m2 area
- Hydrant system, has to be a separate system from other use of water. Hydrants have to be placed in strategic locations that cover all facility (Figure 8.3).
- Sprinkling water device within tanks
- Foam, has to be high expansion type. Design of the foam system, foam tank and location of tanks has to adhere to guidelines from civil protection.

As part of the design, the facility has incorporated several fire-fighting response apparatus including water tank and hydrant, foam and sand as part of ETO's Safety Policy.

Figure 7.3. Hydrant Pipeline Lay Out System



As for evacuation plan, minimum requirements are:

- Has to be available for different cluster of buildings in the facility.
- Has to be prepared by professional operator and has to be approved by ANP

- Certified evacuation training for manager.
- Training for evacuation and emergency situation has to be provided for all employees
- Training also has to be provided for first aid and personal safety

In addition to the above, there is a need to establish alternative routes in the case of closure of the national road during emergency. The establishment of alternative route can be coordinated by MSS with relevant agencies involved in disaster risk management.

7.2 Management Plans for Other Impacts

Other impacts related to the development can be categorized into environmental, climate change and socio economic impacts (Table 7.7).

Table 7.7. Other Potential Impacts from Proposed Development

No	Less Significant Impacts	Source Activities	Phase in the Development		
			Site Prep.	Construction	O&M
	Environmental				
1	Water Quality	Waste water and solid waste from worker's activities, dust and other sediment generated during dredging and construction	v	v	v
2	Bottom Contamination		v	v	v
3	Coastal and Marine Ecology		v	v	v
4	Terrestrial Ecology	Clearance of existing terrestrial vegetation	v		
5	Air Pollution	Emission from vehicles coming in and out of the site, ship emission, flying dust	v	v	V
6	Noise and Vibration	From equipment operation	v	v	v
7	Visual Quality	From enactment of tanks and jetty.			v
	Climate Change				
1	Beach Erosion	From enactment of jetty		v	v
2	Loss of mangrove forests	From pollution and direct clearance			v
	Socio-Economic				
1	Livelihood of Fishermen	Enactment of jetty, limitation to access	v	v	v
2	Worker's Health and Safety	Exposure to fuel fumes, accidents			
3	Job creation and Tax Contribution	Operation activities	v	v	v

Proposed management and monitoring measures to mitigate impacts to the environment are provided as follows.

Table 7.7. Management Measures for Minor Impacts

Component	Phase	Potential Impacts	Source Activities	Mitigation Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	Dredging	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations
			Solid and liquid waste from worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Occuptational health and safety	Worker activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eyes protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	Dredging	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations
			Worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Marine and coastal ecology – positive	New structure provides attachment place	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area
		Coastal hydrology – changes in current pattern, waves and sediment movement	New structure acts as barrier to current, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement
			High sediment load going into the bay	- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes.

				- Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.
		Structure inundation	Sea level rise	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.
		Occuptational health and safety	From worker activities	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 4. Ear and eyes protection 5. Helmet 6. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Noise and vibration	From equipment operation	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	Oil spill from tanker operation and oil spill from transfer of fuel from tanker to the storage	- See discussion on Management Measures for Major Impacts above.
			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.

			Increased turbidity during jetty maintenance (fixing and part replacement in the water)	- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations
		Structural inundation or erosion of structure	Sea level rise	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.
		Noise and vibration	Ship traffic and operation	Use of proper isolation on the ship's machinery room.
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Limited access to the beach especially by fishermen	Development of jetty and storage facility	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another
	Pre-construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water
			Solid and liquid waste from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Air quality problem	Site grading leads to	- Spraying broken soil every few hours

			an increase in level of Particular Matter (PM) in the air	- Workers and visitors wearing mask to protect from dust - Temporarily pave access road
		Loss of terrestrial vegetation	Site clearance	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility
		Noise and vibration impacts	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water
			Solid and waste water from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Structure inundation	Sea level rise	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.

		Air quality problem	Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road
		Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.
		Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Traffic disruption	Increased vehicle traffic for supply of construction matterial	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Operation-Storage facility	Water quality	Oil spill from transfer of oil into the storage and oil spill from transfer of oil from storage into tanker trucks for distribution to customer	Management measures for slight to minor impacts: - See discussion in Section 7.1 above Management measures for major to extensive impacts: - See discussion in Section 7.1 above

			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.
		Air quality	Tanker trucks delivering fuel out of the facility lead to an increase in traffic that leads to the increase of polluting emission gasses	- Use of newer or well maintained vehicle fleet to curb emission gases
		Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Occupational health and safety	Workers activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Structure inundation or structure erosion	Sea level rise	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.
		Visual quality	Building on an otherwise unbuilt location	- Landscaping with grass in spaces between the facility and the fence

8. Governing Parameters

The proposed governing parameters are used to quantify measurable environmental quality such that changes in environmental conditions can be compared to the baseline and ambient quality threshold. The following standards could be used as threshold value for environmental evaluation.

(1) Emission

In discussing emission standards, it should be noted that there are no national standards for emission currently in effect in Timor Leste. Therefore, international emission standards from other countries have to be adopted. Several types of emission standards are recommended for the facility as listed in the following table.

Table 8.1. Emission Standards Recommended

No	Element	Source	Recommended Standards
1	Air	Vehicular emission	Indonesian Government's Regulation No. 35/MENLH/10/1993 on Upper Limit for Vehicle Emission
2	Water	Drainage water loading from the facility as a whole	Indonesian Environmental Ministerial Diploma No. 42/MENLH/10/1996 on Wastewater Standards for Oil, Gas, and Geothermal Activities
3	Noise	Pre-construction, construction and operation	Indonesian Environmental Ministerial Diploma No. 48/MENLH/11/1996 on Noise Level Standards
4	Vibration	Pre-construction, construction and operation	Indoensian Environmental Ministerial Diploma No. 49/MENLH/11/1996 on Vibration Level Standards

(2) Ambient Environmental quality

Ambient environmental quality consists of standards relevant to maintain good quality of air, water and soil. In relation to ambient air quality, project owner and regulatory agencies should measure the ambient air quality at least once a year and compare the results to the baseline survey in absence of the project. Recommended standards for ambient air quality are the Indonesian Government Regulation No. 41/1999. Water body found in the area is coastal water body and the recommended standards for the water quality is Indonesian Ministry of Environment Ministerial Decision (KepMen LH) Kep.51/MENLH/2004.

(3) Occupational Health and Safety Standard

Recommended Occupational Health and Safety Standards for every project activity during the construction and during the operation should be followed. This includes:

- General construction health and safety standard
- Safey and health standard of of vessel construction

- Occupational health and safety standard in marine environment
- Occupational health and safety standard related to operation of oil piping system
- Occupational health and safety standard related to operation fuel storage
- Occupational health and safety standard related operation machine
- Occupational health and safety standard related to operation fuel transportation

9. Monitoring Programs

Monitoring program is very important to ensure that the mitigation measures are implemented effectively by project proponent. The objectives of the monitoring programs are:

- To measure the impacts that occur during pre-construction, construction, operation and maintenance
- To ensure compliance with legal requirements and corporate commitments
- To determine effectiveness of mitigation measures and other environmental and social protection measures
- To determine accuracy of impact predictions
- To facilitate impact management by warning of previously unanticipated impact

Recommended monitoring program for the facility are spelled out in the following table.

Table 9.1. Monitoring for the Mitigation Measures

Component	Phase	Potential Impacts	Mitigation Measures	Monitoring Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Occuptational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eyes protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

		Marine and coastal ecology – positive	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	- No specific monitoring measures have been proposed for this, however, special care should be given during fixing or part replacement of the jetty structure as not to displace existing bottom biota that have proliferated on the surface of structure
		Coastal hydrology – changes in current pattern, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	It is actually hard to predict the ultimate impact of alteration to existing coastal hydrology pattern. As such, monitoring should look for evidence of negative impacts of alteration to current, wave and sediment movement. Negative impacts including higher level of sedimentation around the piles and beach erosion on nearby location that threaten the integrity of structure.
			- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	- Monitoring for higher than usual sediment loading that leads to more frequent dredging needs. - Changes in sediment loading will also affect mangrove nearby (mangrove ecosystem depends on supply of sediment) therefore, the health of the mangrove community should also be monitored. More discussion on this will be provided under monitoring measures for impacts from fuel storage development.
		Structure inundation	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	- Monitoring for sea level movement especially in reference to jetty structure.
		Occupational health and safety	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 1. Ear and eyes protection 2. Helmet 3. Foot protection (safety boot) and wet suit as	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and

			necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	SEPFOPE
		Noise and vibration	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	- Monitoring for complaints from workers and local community.
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	- Use of booms around the connection between tanker ship and jetty - Use of dispersant to minor spill. - For major spill from tanker ship, procedure for response is discussed in the following Section.	- Monitoring for evidence of spill in the marine water (oil film or slick) - Monitor for evidence of spill in the sandy beach and mangrove community - Water testing should be conducted on a regular basis (at least once a year) to understand in more detail level of certain hydrocarbon chemicals as well as toxic heavy metals in the water. Parameters tested should at least be the same as parameters that have been tested for the baseline data collection as reported in Chapter IV, Description of the Environment.
			- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several “rooms” where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication on the nearby saltmarsh or around mangrove community. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach and mangrove forest.

			- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
		Structural inundation or erosion of structure	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	Monitoring for sea level movement especially in reference to jetty structure.
		Noise and vibration	Use of proper isolation on the ship's machinery room.	Monitoring for complaint from local community.
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Limited access to the beach especially by fishermen	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	- Monitoring for implementation of the management measure. Monitoring should be conducted with active collaboration from local authority (chefi de aldeia and chefi de suco). - Monitoring for resulting effect from moving the fishermen to a new place. How their level of income are affected and whether there are conflict at the new place. - Monitoring should be done for at least one year until the fishermen established their new parking space.
	Pre-construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

			mangrove community and its function in fishery production.	
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Air quality problem	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Loss of terrestrial vegetation	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	Monitoring for at least one year until trees all grow. Every year, as part of ETO's Company Soil Responsibility, continuous tree planting can be done.
		Noise and vibration impacts	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Structure inundation	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of mangrove ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of the mangrove forest. Mangroves provide natural barriers to coastal facilities.
		Air quality problem	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Soil and groundwater quality	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker

		Traffic disruption	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	- Monitoring for large increase of traffic due to construction material transport. - Monitoring for problems due to higher amount of traffic.
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Operation-Storage facility	Water quality	Management measures for slight to minor impacts: - The use of oil separator (constructed as part of the development). - The use of higher grade oil skimming machine when deemed necessary Management measures for major to extensive impacts: - Routine drill on response plans. There are in general two types of response plans – for spill that makes its way to the water and for spill stranded into the sand or nearby salt marsh.	For slight to minor impacts: - Monitor for evidence of oil in the environment (soil, saltmarsh, mangrove communities and sandy beach). Monitoring should be conducted on a daily basis. Clean swiftly when there is evidence of spill in the environment. - Monitor for effectiveness of oil separator basin. When not found to be effective, use higher grade skimming machine. - Periodically (at least once a year) conduct testing of effluent from the separator basin to see whether effluent is within allowable standards for effluent from downstream oil facility. Use applicable standards recommended in this EMP or use other standards as recommended by DNMA (recommended standards have to consider the presence of nearby mangrove forest). For major impacts: - Monitoring should focus on ensuring the integrity of the primary, secondary and tertiary containment methods.
			- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility.	- Monitoring for signs of eutrophication on the nearby saltmarsh or around mangrove community. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach and mangrove forest.

			- Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Soil and groundwater quality	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Air quality	- Use of newer or well maintained vehicle fleet to curb emission gases	Monitoring for elevated level of air pollution gasses including NO_2, SO_2, CO and CO_2. Air pollution in the area, however, might come from EDTL or vehicle movement in the national road.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	Monitoring for complaint from worker
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Structure inundation or structure erosion	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of mangrove ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of the mangrove forest. Mangroves provide natural barriers to coastal facilities.

			mangrove to move inland.	
		Visual quality	- Landscaping with grass in spaces between the facility and the fence	- Monitoring for complaints from passersby

Table 9.2. Recommended Monitoring Parameters for Air Quality, Marine Water Quality, Marine Ecological Quality and Social Impacts.

No	Parameters	Methodology	Sampling Location	Frequency	Responsibilities
Air Quality					
1	SO_2	In situ measurement	Within the perimeter of storage complex	Once a year	Project proponent in coordination with DNMA
2	NO_x				
3	PM_{10}				
4	$PM_{2.5}$				
Marine Water Quality - Physical Parameters					
1	Turbidity	In situ measurement	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
2	Smell				
3	Suspended solid				
4	Solid waste				
5	Temperature				
6	Oil layer				
Marine Water Quality – Chemical Parameters					
1	pH	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
2	Salinity				
3	Total ammonia				
4	Sulfide				
5	Total hydrocarbon				
6	Total fenol				
7	PCB				
8	Surfactant				
9	Oil and fat				
10	TBT				
Marine Water Quality – Soluble Heavy Metal					
1	Mercury	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
2	Copper				
3	Cadmium				
4	Zinc				
5	Lead				
Marine Water Quality - Bacteriology					
1	Total coliform	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
Marine Ecological Quality					
1	Shanon-Wienner Diversity Index	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
Social Impact					
1	Worker's Health and Safety	Record of health complaint, record of work-related accidents	Workers	Monthly	Project proponent in coordination with SEPFOPE
2	Social contribution	Record of contribution to local community, contribution to fishermen group	Local community, local fishermen group	Once a year	Project proponent in coordination with local authority and Ministry of Social Solidarity (MSS)
3	Social Order	Complaint from local community	Local community	Monthly review	Project proponent in coordination with local authority

In addition to the above monitoring program, a routine internal inspection and testing should be conducted to ensure the integrity of the primary, secondary and tertiary containment measures. This internal inspection should be conducted on a routine basis as noted in the following table. The responsibility for the inspection and testing rested at the hand of the project proponent (operator) in coordination with ANP.

Table 9.3. Monitoring Program for Primary, Secondary and Tertiary Containment Measures

No	Type	Management Measures	Maintenance/Monitoring Measures
1	Tank Overfill Protection	Tank level measurement	Regular (monthly) maintenance
		High Level Alarm (HLA) capable of annunciation and automatic shut down	Regular (monthly) testing
		High High Level Alarm (HHLA) capable of annunciation and automatic shut down	Regular (monthly) testing
2	Tank Maintenance and Inspection	Visual observation of leaks, crack, etc along the wall	Should be conducted at least of a weekly basis. Best if conducted on a daily basis.
		Undertank leak inspection	Should be conducted on a regular basis at least once a week. Best using visual and
3	Pipework and fuel transfer safety	Fire safe shut-off inlet/outlet valves that can be remotely shut off	Testing should be conducted on a weekly basis.
		Clear procedure for transfer control (written procedure)	Training at the beginning of operation and regularly at least once a year. Loading are always supervised.
4	Spill Accounting, Oil & Water Separator	Storage inventory reconciliation meaning input minus output of fuel equals what is left in the storage tanks. If fuel in the storage is less than input minus output, check for spill.	Conducted at least weekly and best if conducted on a daily basis.
		Oil/water separation dike to separate spill from tanks and off-tanks (from valves, joint, etc along the pipeworks). See Technical Drawing in Annex _2.1	Monitor the dike on a daily basis, skim oil leaks
5	Emergency Plan and Equipment	Fire Emergency Response Plan (to be prepared by Operator).	Regular (annual) training and drill
		Spill Response Plan	Regular (annual) training and drill
		Emergency equipment ready for rapid deployment for both spill and fire or spill only emergencies.	Regular (monthly) testing of equipment

To ensure proper protection from fire accident, project proponent or in this case the project operator should also test and inspect the fire protection measures in place at the facility. The procedure for inspection and testing for fire protection should be coordinated with Civil Protection.

10. Reporting Requirement

All the monitoring activities should be coordinated with relevant government agency to ensure that the parameters being collected meet regulatory requirement in place for that particular set of parameters. After data have been collected, they should be submitted to relevant authority as previously noted in the above tables.

At a minimum, the reporting should cover:

- Internal monitoring and inspection
- Incident, accident and emergency reporting
- Performance indicators and any follow up actions needed
- Training programs

The types of report, including formatting and reporting frequency should be coordinated with relevant authority. Per DNMA's rules, however, the environmental license of the project is only valid for one year and should be renewed every year by reporting on an updated EMP. Therefore, at a minimum, a once a year reporting should be required.

11. Responsibilities for Mitigation and Monitoring

As previously noted in Section 3.2 Relevant Institutional Aspects, the following agencies within the government (Table 11.1) is responsible for environmental, social and economic safeguarding from impacts generated by the project.

Table 11.1. Relevant Institutions and Their Responsibilities

No	Responsibility	Relevant Institutes
1	Environment and Nature Protection (Terrestrial)	State Secretary of the Environment
		State Secretary of Forestry and Natural Protection
2	Marine and Coastal Environment	State Secretary for Fisheries and Aquaculture
3	Downstream Petroleum Industry	National Petroleum Authority (ANP)
4	Public and Worker's Health and Safety	Ministry of Health
		National Directorate for Civil Protection
		State Secretary for Labor Protection and Training (SEPFOPE)

Coordination between project proponent and these institutions should happen right from the preparation of the project, site preparation, construction and operation and maintenance phase.

1. Project Preparation

During project preparation, design for the facility is being drawn. Project proponent should coordinate with several institutions for several purposes related to their competency. The institutions and coordination purpose are:

- ANP: to adjust facility lay out and design to requirements for large fuel storage depot. After environmental license has been secured, the process for securing approval from ANP can commence.
- DNMA: for classification of environmental licensing requirements, preparation of environmental licensing.
- Civil Protection (Fire Fighter): to adjust fire protection lay out and design to requirements set out by Civil Protection.

2. Site Preparation
   - DNMA: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Site Preparation. To report on the results of mitigation and monitoring measures. Coordinate for inspection.

3. Construction
   - DNMA: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Construction. To report on the results of mitigation and monitoring measures. Coordinate for inspection during construction.
   - ANP: to report on the construction of requirements relevant to protection and safeguarding of the facility, the operation and workers in the facility. Report on the training arrangement for future staff of the facility because ANP regulation require that training be provided to all workers 6 months prior to the start of operation.
   - Civil Protection: to report on the construction of fire protection aparatus as required by previous consultation.

4. Operation and Maintenance
   - DNMA: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Operation and Maintenance. To coordinate on evaluating the effectiveness of previous mitigation measures implemented during Site Preparation and Construction phases. Effective mitigation measures should be continued while those that are not effective should be adjusted. To coordinate for inspection during Operation and Maintenance.
   - ANP: further coordinate on several operational aspects of the facility, including training and skill transfer between foreign operators and local staff, emergency preparedness plans, evacuation plans, and other.
   - Civil Protection: in coordination with ANP, conduct initial testing of fire fighting equipment, implement fire drill and coordinate on evaluation of emergency preparedness and evacuation plans.
   - SEPFOPE: coordinate on workers' health and safety issue including the need to wear workplace protection and the kind of workplace protection needs to be provided for this type of work. Also coordinate on contract preparation and other labor-related issues.
   - MSS, ANP, Civil Protection, SEPFOPE, EDTL Hera: as a large industrial complex storing higly volatile compound, there is a risk of significant industrial accident to occur in the complex. Therefore, an large scale emergency preparedness plan should be prepared.

12. Emergency Plans

In general, two types of emergency preparedness plans should be prepared for the facility – (i) emergency plans related to fire accident, (ii) emergency plans related to oil spill accident. In addition, for each type of accident, at least two types of emergency plans should be in place, the first one is for small to medium types of emergency and the second one is related to large and extensive types of accidents affecting nearby resources and facilities. Figure 12.1 provides an illustration of agencies responsible for the emergency plans.

Figure 12.1. Agencies Responsible for the Emergency Plans

	Small to medium scale	Large to extensive scale
Fire accidents	Project Proponent (Operator) and evaluated by Civil Protection and ANP	A joint effort by ANP, Civil Protection, MSS, EDTL Hera, DNMA, Fishery
Oil spill accidents	Project Proponent (Operator) and evaluated by ANP, Fishery, DNMA	A joint effort by ANP, MSS, Hera Naval Force, DNMA, Fishery

The small to medium scale emergency preparedness plan will be provided by operator of the facility and evaluated by ANP and Civil Protection in the case of fire accident while for oil spil accident, the emergency preparedness plan should be prepared by project proponent and evaluated by ANP, Fishery and DNMA because oil spill can happen on the water and most likely affecting mangrove and other coastal resources nearby.

The large to extensive emergency preparedness plan should be prepared through a joint effort by relevant agencies including ANP, Civil Protection, MSS, EDTL Hera, DNMA and Fishery in the case of fire accident and ANP, MSS, Hera Naval Force, DNMA and Fishery in the case of oil spill accidents. The involvement of MSS in both large scale emergency preparedness is based on the current arrangement for natural disaster response and management. It was not very clear, however, whether this arrangement is also relevant for industrial disaster response and management. It should be noted though that MSS has gotten support from United Nations Development Programme (UNDP) for natural disaster management including having the ability to map out evacuation routes and providing basic necessities for affected people. As for downstream oil and gas industry, ANP remains to be the agency with the capacity to inspect and make sure that proper protection from large oil and gas industrial accidents are in place. The Civil Protection agency, on the other hand, has firefighting equipment but may lack the training and

capacity to fight large scale fire. As for large oil spill accidents, Hera Naval Force is very relevant due to their nearby location and the boat fleet that they own. Nevertheless, it should be noted that there is a lack of clear coordination arrangement among relevant agencies for large to extensive scale accidents and the existence of two large fuel storing facilities such as the fuel depot and EDTL Hera should prompt the authorities to start thinking about large scale industrial accident preparedness.

13. Decommissioning Plans

No decommissioning plan has been specifically developed for the facility, as the project is being planned for long term use and further expansion in the form of ETO's headquarter building is already developed for the facility. Therefore, decommissioning is only possible in the face of a force majeure for example, a natural disaster event take place leading to a significant damage to the facility. A large and extensive accident may also change the perception on the viability of a large facility like that in the location. Should this is happening, a decommissioning plan should be developed by the operator/project proponent taking into consideration the demolition of the jetty as well. Such demolition plan should also incorporate measures to bring back the condition of the area to the original state.

14. Capacity Development and Training

Capacity development and training is required for staff in the facility consisting of:

- For facility manager: training courses from accredited training providers, covering storage facility management course and Health, Safety and Environment (HSE) and quality standards.
- For staff: at a minimum, all staff in the facility should be provided with certified training on first aid and safety.

The responsibility for EMP implementation as well as monitoring of the environmental parameters rests with project operator or in this case management of the facility. It is therefore very critical for the manager to have proper training on HSE and to understand the EMP well.

In addition to the above, as part of skill transfer, several mid-level employees should be prepared to eventually take over management from foreign operator. These mid-level employees or management trainee should be provided all trainings required for facility manager.

15. Public Consultation and Information Disclosure

Public and community consultation were conducted with two kinds of meeting arrangement: (1) Large meeting by inviting many and (2) meeting one on one in the project location. (3). Intensive discussion with relevant government bodies. The purpose of the consultation was to gauge the stakeholder opinion and concern regarding the project activity and impacts that may arise during each cycle of project implementation. The consultation also aims to communicate the scope of the EIS and receive and opinion from various stakeholders in order to improve the results of the impact assessment.

Public meetings as part of the EIS process were conducted two times to consult on the project scoping of the EIA and the draft EIS. The results of these large consultation meetings were very useful in terms of providing additional information for improvement of the EIA scoping document and improvement of the draft EIS. Representatives from various agencies raised mostly technical opinions related to project. The representatives consist of Fisheries, ANP, Civil Protection, DNMA, NGOs, and community representatives. Main input received during public consultation of the EIA scoping can be found in the following table.

Table 15.1. Summary of Main Comment During the Scoping Consultation

No	Agency	Input and Suggestion
1	National Directorate for the Environment	Add applicable scale to all maps
		Drainage should not be directed to the sea due to pollutant content
		EIS should take into consideration plans for urbanization of Hera
		Clear data on affected fishery community (income level, etc)
		Clear measures to impact from water spill – cleaning, etc. what to do if spill happens, how to manage tailing
		More testing to compare results (second opinion on results)
		Emergency preparedness and response plan (include emergency route in the event of fire)
		Add National Directorate of Biodiversity and Directorates from Ministry of Public Works to the stakeholder consulted
2	National Directorate of Forestry	Emergency response plan for underwater accidents
		Adaptation and mitigation plans are important due to existence of coastal and marine biota. Long term protection to mangrove communities need to be spelled out. Idea – mangrove rehabilitation type of activities can be implemented working together with relevant organizations such as the government or the civic society sector.
		Clearly explain current status of fuel distribution to EDTL Hera.
		Status of future to EDTL power plant should be considered
		Socio-economic impact to Hera community should be clearer
3	Department of Environmental Health, Ministry of Health	Impacts of project activities to public health

		Clear procedures to attend to work-related accidents. Note that facility is relatively far from large clinics.
		Clearer impact from development activities
		Workers health and safety protection from exposure to potentially hazardous substances
4	National Directorate for Civil Protection	Development need active involvement from Civil Protection due to the potential for fire hazard
		Different measures should be available for fire protection not only water.

The second public consultation was conducted in Hotel Vila Verde on May 6, 2014, with the summary of main points as followed.

Table 15.2. Summary of Main comment during the second public consultation

No	Agency	Input and Suggestion
1	National Petroleum Authority	- Concern mainly to oil spill and potential fire hazard condition and proposed plan on how to mitigate the problem - ANP also suggested to include the API design standard in the EIA and also the draft regulation so that project owner will have sufficient information on the standard and requirement - The design of the system (storage tanks, instrumentation, etc.) must be consulted with the relevant expertise and ANP has some experience on this issue - The dimension and capacity of the storages tanks which is available in the design document
2.	DNMA; Directorate National do Meiu Ambient	- Data on the hydro-geology in the site regarding the groundwater table and the current utilizing of groundwater. Note the groundwater in the area is shallow and the quality is brackish - Emergency Training for the staff and mitigation plan for fire and oil spill both in the jetty and in the storage tank - The project owner is suggested to implement what is written in the plan and this is for the goodness of ETO in order to protect the business and their own people - Soil texture which is dominated by clay type should not be used as foundation material
3	National Directorate of Forestry	- Buffer zone/green zone between jetty and mangrove should be kept - The effect of fuel supply to EDTL power plant should not disturb the traffic flow in the national road, which will be the case by arrangement of the schedule or direct pipe line from fuel storage tanks to the Power plant - Traffic management boat tanker within the jetty and naval port, which currently is not an issue but in the future it may be an issue - Mitigation of the sea level rise by various management strategic such as wall protection and proper arrangement of floor level of the compound

4.	ETO-Project Owner	- Staff training program has been arranged with the experience company from Indonesia - Equipment to reduce or handle the oil spill will be provided by ETO both within the jetty and in the storage facility - ETO will reclaimed the mangrove and replanted in elsewhere is there is any damaged but as the plan indicated that the construction activity will causes significant problem in the mangrove area - ETO is willing to participate in the program of reforestation in the upland catchment that will reduce the sedimentation problem in the Bay, which will causes the low cost of degrading at the Port and jetty - PEC consulting to provide detail guideline on the oil spill management - Clarification on the medium used to kill the fire in case of fire hazard such as sea water, fresh water, and dust/fine sand that is commonly used in fire extinguisher

The above comment and feedback have been addressed in both Scoping Document as well as (draft and final) EIS.

Based on the above two public consultation meetings as well as based on one on one interview with local fishermen, it can be concluded that public outreach has been conducted sufficiently and that local community is informed on the coming project and their concerns be heard. In the future, during project construction and operation and maintenance, this good relation with local community should be maintained through the implementation of several measures as follows:

1. Public participation in the project: throughout project life cycle, public participation in the project should be continuously encouraged through provision of temporary jobs such as grass cleaning or minor repair to local labor pool. As noted in the Social Impact Assessment Section, as much as possible, this temporary jobs should incorporate women labor.
2. Contribution to local community: this has also been discussed under the Social Impact Assessment Section. A routine contribution should be made to local community. The contribution should be designed to be a sustainable, long term contribution for the betterment of the community. For example, a contribution to local schools and health facility or programs that are targeting children.
3. Complaint and grievance redress mechanism: in addition to the above measures, the management of the facility should be open to receiving complaints from local community and has a procedure in place to address grievances. Several simple mechanisms can be pursued for example, adding a box outside of the facility for any complaint from the community, being open to direct complaint from the community during office hours or complaints can also be sent to local leaders, police and others.

16. Workplan and Implementation Schedule of EMP

The workplan and implementation schedule of the EMP is given as follows:

Activity of EMP	Year1				Year2				Year 3	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	Pre-Construction		Construction						Operation	
Dust Management	●	●	●	●	●	●	●	●		
Solid and Liquid waste Managem	●	●	●	●	●	●	●	●	●	●
Occupattional heath and Safety	●	●	●	●	●	●	●	●		
Noise Management	●	●	●	●	●	●	●	●		
Inccident management	●	●	●	●	●	●	●	●	●	●
Traffic Management	●				●				●	
Fire Control and Management									●	●
Oil spill detection and management									●	●
Storm runoff and sedimentation	●				●				●	
Solid and Liquid waste Managem	●	●	●	●	●	●	●	●	●	●
Air quality monitoring	●				●				●	
Water quality monitoring			●		●				●	

The work plan of the proposed EMP program must apply in every step of the project from pre-construction, construction phase, and during the operation of the facility.

- Implementation of EMP during the pre-construction activity
- Implementation of EMP during the construction phase
- Implementation of EMP during the operational phase
- Implementation of EMP during the decommission phase

17. Cost Estimate

Total cost needed to implement the EMP can be estimate from activity, instruments required, and personnel required implementing the plan. Cost figure consist of the following:

- Instrument for sampling and monitoring (Fire alarm system, water quality lab, air quality instrument, leak detection instrument,
- Officer for environmental and instrument specialist
- Administration
- Upland catchment protection
- Community support system (community development)
- Out sourcing expert for review
- Construction safety
- Solid waste management
- Wastewater treatment
- Detention treatment
- Reporting cost

The total cost required by ETO to implement the proposed EMP is about USD 195,000 during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 85,000. A detail breakdown of the costs are provided in the following table.

Table 17.1. Total Cost of the Management Measures

Phase	Group of Activities	Activities	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction	Excavation Material from Grading of Fuel Storage Site	Dumping of excavation material in proper dumping station (Tibar)	2	dumping trip	600	1200
	Air Quality	Spraying of grading site	120	work days	35	4200
	Loss of Terrestrial Vegetation	Replanting program in the upper watershed (to be conducted during O&M phase)	See O&M phase			
	Sanitation	Provision of temporary sanitation facilities	3	temporary toilets for 120 days	200	600
		Routine disposal of liquid waste	24	dumping trip	50	1200
		Garbage bins	10	bins	20	200
		Routine disposal of solid waste	24	dumping trip	25	600
		Worker awareness training	1	event	150	150
	Occupational Health and Safety & Noise and Vibration	Workers protection gears (boots, ear muffle, goggle, bright vest, etc.)	40	protection kit	60	2400
	Total Pre-Construction Cost during the 6 months					**$ 10,550.00**
Construction	Sea Level Rise	Fortification of structure that connects the complex to the jetty	1	structure	150000	150000

		Site elevation	1	time	10000	10000
		Mangrove survey	See Monitoring Measure Costing			
	Air Quality	Spraying of grading site	360	time	35	12600
	Soil and Groundwater Protection	Provision of temporary storage with lining on the ground	1	storage	5000	5000
		Routine dumping of used oil and other chemicals to Tibar	15	dumping trip	35	525
	Traffic Disruption	One personel to direct traffic	1	personel	2700	2700
		Provision of signage	4	signs	10	40
	Occupational Health and Safety & Noise and Vibration	Workers protection gears	40	protection kit	60	2400
	Total Construction Cost during 1.5 years					**$ 183,265.00**
Operation	Oil transfer from jetty to storage	Provision of booms and dispersant	5	units	5000	25000
	Oil filling into EDTL Hera and trucks for distribution to customer	Provision of oil-water separator basin or higher grade separator machine (optional)	1	structure	5000	5000
	Sanitation	Provision of permanent sanitation facilities	4	units	600	2400
		Routine disposal of liquid waste	1	dumping trip	35	35
		Provision of permanent solid waste facilities	10	units	20	200
		Routine disposal of solid waste	26	dumping trip	25	650
		Provision of "No Littering" signs throughout facilities and in the mangrove areas	15	signs	20	300
	Tree Planting in the upper watershed	Tree Planting in the upper watershed	1	event	1000	1000
	Air Quality	Spraying of facility site	180	days	35	6300
	Occupational Health and Safety & Noise and vibration from equipment operation	Workers protection gears	24	kit	60	1440
	Beach Access by Fishermen	Finding new access points				
		Provide assistance to the fishermen	1	event	40000	40000
	Total Operation and Maintenance Cost per Year					**$ 82,325.00**

For monitoring purposes, total cost is estimated at USD 11,000 for pre-construction and construction phases. For the O&M phase, the total monitoring cost is estimated at USD 28,000. A detail breakdown of the monitoring cost is provided in the following table.

Table 17.2. Cost Figure of the EMP Implementation during Operation of the Facility

Phase	Monitoring Measures	Remarks	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction & Construction	Monitoring for turbidity that lasts long	Facility operator, daily basis	720	days		
	Monitoring for leak of waste water and solid waste into the beach, mangrove and marine environment, monitoring for signs of eutrophication	Facility operator,daily basis	720	days		
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	720	days	10	7200
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record	720	days	5	3600
	TOTAL for Pre-Construction and Construction for two years					**$ 10,975.00**
Operation	Monitoring for leak of waste water and solid waste into the beach, mangrove and marine environment, monitoring for signs of eutrophication	Facility operator, daily basis	365	days		
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	365	days		
	Provision of grievance redress procedure to allow for monitoring of complaints from local community and workers	Facility operator	365	days	10	3650
	Monitoring for proper dumping of liquid waste, solid waste and used oil and other chemicals	Facility operator, monthly basis	12	days	5	60
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record				
	Monitoring of sea level movement		720	days	5	3600

	Monitoring of mangrove's health	Engage local environmental NGO, initial and yearly study can be conducted for 1 month as much as possible covering the 15 ha area. Mangrove rehabilitation program can later be initited.	30	days	50	1500
	Outreach to local community, local authority and fishermen group	Facility operator and representative of upper management from ETO, can be conducted once a year during christmas time, anniversary of ETO facility or other proper time	1	per year	5000	5000
	Marine water quality test	Engage a laboratory				
	Marine ecological integrity test (benthic communities stability)	Engage a laboratory	1	per year	6000	6000
	Monitoring for oil spill on a daily basis and monitoring to the effectiveness of oil separator basin	To determine needs for higher grade oil-water separator				
	Monitoring for dust pollution on a daily basis	Facility operator	365	days	5	1825
	Air quality test	Engage a laboratory	1	per year	5000	5000
	Monitoring for tree planting program	Engage local environmental NGO, conduct three planting during rainy season once a year	20	days	25	500
	Monitoring for integrity of primary, secondary and tertiary containment measures	Internal inspection by operator, require data collection and record keeping, conduct at least weekly	52	per yer	10	520
	TOTAL for Operation and Maintenance					**$ 27,830.00**

18. Review of the EMP

The EMP should be reviewed by project owner, updated and submitted to DNMA for re-approval every year. Project proponent can engage local consultants for update of the EMP. Data collection should take place as part of the EMP update focusing on near coast water quality assessment and air quality data.

DNMA can review results from monitoring activities and compare them with baseline results collected during EIS preparation. Monitoring or data collection can also be taken on need basis when certain parameters have visually been observed to be elevated. Complains from community should also be taken into consideration and appropriate assessment and data collection take place to formulate proper ways to address the complaints.

19. Non-Technical Summary

Suco Hera, Sub-District Cristo Rei, Dili District. The project will be implemented by Esperança Timor Oan (ETO), a national private company. The project will incorporate two main elements – (1) the development of 600 m jetty structure and (2) the development of fuel storage facility on a 2 ha land.

The main objectives of the development is to provide a fast and reliable supply of fuel for use in the Hera Power Plant, for transportation purpose and other industrial supplies. Fuels to be delivered including gasoline, diesel fuel and lubricant. Fuel transport to the facility will happen through a tanker ship that will come and deliver the fuel once or several times a month depending on demands.

Jetty Development

The jetty will be constructed about 600 meter of coastline that connect the landing jetty to the storage facility. It is an integrated part of the proposed fuel storage development, where the oil tanker will supply the oil to the storage system. The jetty construction, as it will take a place near the mangrove community and within the marine coastal area, proper environmental impacts assessment must be carried out in order to asses the impacts and proposed the mitigation plan that will be implemented in order to reduce the negative impacts.

As can be seen from the detail EIS that small disturbance on the marine water may occurs during the construction and operation. The major impacts mainly on the operation when the oil tanker loading the oil into the storage system, where there may potential fire and oil spill within the marine ecosystem. The minor issue can be mitigated with the proposed mitigation plan, while the major issue such as disaster should be responded by involving national and international aid, as the scale will be beyond the ability of the project owner to handle. Nonetheless, the catastrophic event or major disaster event usually occurs but with very low probability.

Fuel Storage Complex

The fuel storage facility consists mainly of six storages, office buildings, utilities, piping system, and the necessary control system. This facility will take roughly 2 ha land, which has been secured through long-term lease arrangement between project proponent and the government of Timor Leste.

This Environmental Impact Statement (EIS) has been prepared as part of the process to secure an environmental licensing. Before the EIS is being developed, a project document has been submitted to the National Directorate for the Environment (DNE or DNMA in Portuguese acronym). The project document was submitted to allow authority to determine whether the project proponent should develop a full EIS or a simplified EIS. DNMA required that project proponent develop a full EIS because the proposed development is located near sensitive ecosystem, in this case the mangrove ecosystem.

As a fuel storage and sea transport development located near sensitive area and large national infrastructure, the development potentially has devastating impacts from day to day operation (cumulative impacts) as well as from large scale oil spill or fire accidents. It is therefore very important to develop a thorough program for impact management and monitoring measures. It is also vital to develop emergency preparedness and response procedures to accidents in any scale it might happen. A thorough management

and monitoring program will result in an excellent record in Health, Safety and Environment (HSE) and can serve as a model of responsible development for Timor Leste.

Institution and Legal Frameworks

As part of the EIS development, analysis of relevant institution and legal framework in effect in Timor Leste should be conducted. It was found that protection of the environment is protected by the country's Constitution. For example, article 6(f) of the Constitution clearly mention that one of the objectives of the State is to protect the environment and preserve the natural resources.

Additionally, other relevant laws and regulations are also in effect for the protection of the environment and for the protection of affected community. These laws and regulations include local and international laws and regulations. Some of the important laws and regulations are listed as follows:

Table 19.1. Relevant Regulatory Framework of Timor Leste Environmental Protection

Agency	**Relevant Laws**
State Secretary of the Environment	Decree Law No.5/2011
	Decree Law No. 26/2012 on Environmental Base Law
	(Draft) Law on Biodiversity (March 2012)
	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Forestry and Protection of the Nature	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Fisheries and Aquaculture	Law No. 12/2004 on Crimes Related to Fisheries
	Law No.6/2004 on Legal Basis for Management and Regulation of Fisheries and Aquaculture
National Petroleum Authority	(Draft) Regulation No. xx/2014 on Installation and Operation of Fuel Storage
International	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Protocol)

Contractual and Corporate Obligations

The proposed development is 100% private sector-funded, therefore, there are not much contractual and corporate obligations in relation to the natural environment and social impacts resulted from the development. Decree Law No.5/2011 in Articles 15 and 16 established the Impacts and Benefit Agreement procedure to allow for project proponent and affected communities around Category A projects to enter into a legal agreement for the community's benefit. For this particular project, during the final stakeholder consultation and the presentation of the draft EIS, it was clear that some fishermen in the vicinity of project location will be affected by the development. They will have to move their fishing equipment such as boats and fishnets from the area they traditionally use.

ETO as the project proponent has stated openly during the stakeholder consultation that they are willing to provide compensation for losses experienced by the fishermen. This statement will have to be followed up upon approval of the EIS according to timing for negotiation as determined in Article 16 Decree Law No. 5/2011 on Environmental Licensing.

Brief Description of Impacts

Impacts from Jetty Structure

The following table presents all potential impacts from the development of the jetty structure grouped based on the activities that generate the impacts – i.e. site preparation (Pre-Construction), Construction and Operation and Management (After Construction).

Table 19.2. Type, Nature, Indicator and Methodology to Assess Impacts from Jetty Development

Type of Impact	Nature of Impact	Scope of Impact	Impact Indicator	Design and Methodology to Assess Impacts
	Impacts during Site Preparation			
Water quality From increased turbidity due to dredging	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Near coast water especially in the embayment area	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test designed to measure important water quality parameters
Bottom contamination From resettlement of sediment due to dredging	Localized, direct, could be medium term, negative but not significant, unavoidable	Areas immediate along the footprint of the jetty, some impacts to the embayment	Areas covered by sediment settlement, areas cleared out	Visual assessment

Marine and coastal ecology	Direct and indirect, cumulative, Could be medium term, Not significant, unavoidable	The embayment area, close-by mangrove communities and the extended mangrove forests	Benthic macrofauna	Especially for mangrove communities, at a minimum, the study should be designed to track long-term changes in mangrove areas. Laboratory test designed to measure stability of benthic macrofauna community.
	Impacts during Construction			
Water quality, Bottom contamination, Marine and Coastal Ecology	Same as during Site Preparation, related to increased turbidity			
Marine and Coastal ecology New structure as "attachment place"	Localized esp. on structures in the water, long term, **positive**, not significant, unavoidable	Submerged structure only	Colonization of submerged structure	Visual
Coastal Hydrology from enactment of large structure in marine environment**:**				
Changes in current pattern, wave and sediment movement that could lead to higher sedimentation rate or erosion	Localized, indirect, Long term, negative and could be significant, unavoidable	Areas immediate to the jetty structure, mangrove forests, impact could extend to the embayment	Beach erosion (loss of sandy area along the beach) or coastal erosion (loss of sediment from the bottom of the coastal area).	Actually impacts will directly be felt by the facility in terms of the frequent need to dredge from the high rate of sedimentation. What should be closely assessed are impacts of changes in sediment movement pattern to the health of the nearby mangroves. Methodology will at least be routine assessment of the area of the mangrove communities.
Stagnant pool of water may be formed behind structures	Localized especially around Jetty structure, long term, negative but not significant, unavoidable	Areas immediate to the jetty structure	Formation of stagnant water	Visual
Noise and vibration From equipment operation	Localized, short term, negative, not significant, unavoidable	Only up to areas 100 meters away from the source of the noise. See detailed explanation on noise impacts	Community complain	On site test

		in Section 6.1.3		
Water quality, bottom contamination and marine ecology from waste generation From worker activities	Localized, short term, negative, not significant, avoidable	Affecting area immediate to the jetty structure and the embayment. Solid waste could travel a long distance in the marine environment.	Concentration of solid waste along the beach, solid waste floating in the mangrove area and around the project area, evidence of eutrophication in the water	Visual
Impacts during Operation and Maintenance				
From Ship Traffic				
Water quality, Bottom contamination, Marine and Coastal Ecology:				
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Area immediate to the jetty structure, the embayment including sensitive receptor nearby. Large scale oil spill could travel to larger marine environment	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing designed to measure oil spill impacts including level of toxicology. At the very least, laboratory testing of marine water should cover parameters tested in the baseline information data collection.
Waste water	Localized, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure up to the embayment	Eutrophication, bacterial count	Visual, laboratory testing
Garbage (solid waste)	Could be dispersed to larger marine environment, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure, the embayment and potentially dispersed to the larger marine water	Concentration of solid waste along the beach, solid waste floating in the mangrove area and around the project area	Visual

Noise and Vibration from ship traffic	Localized, not significant, happened several times in a month during the time ship is coming	Most likely affecting workers on the ship and jetty structure only	Noise level, complain from surrounding resident	Site testing or nuisance level
From Maintenance of Jetty				
Water quality, Bottom contamination, Marine and Coastal Ecology From increased turbidity related to fixing and parts replacement	Same as during Site Preparation above			

Impacts from Fuel Storage Development

Major impacts from fuel storage development are related especially to oil spill and fire hazard. Magnitude of impacts will depend on the scale of the spill and fire with impacts range from slight to extensive impacts (Table 6.2) that can lead to long term alteration to ecosystem function and permanent species or asset loss. The following table contains potential environmental impacts from fuel storage development.

Table 19.3. Type, Nature, Indicator and Methodology to Assess Impacts from Fuel Storage Development

Type of Impact	Nature of Impact	Impact Indicator	Methodology to Assess Impacts
Impacts during Site Preparation			
Surface and Marine Water quality, bottom contamination and marine/coastal ecology From increased turbidity due to spoil from site preparation	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test
Terrestrial Ecology	Direct, long term, not significant, unavoidable	Loss of habitat	Site survey
Impacts during Construction			

Surface and marine water quality, Bottom contamination, Marine and Coastal Ecology from increased turbidity due to spoil from site preparation	Same as during Site Preparation, related to increased turbidity due to spoil from construction activities		
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be medium term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test
Air Qualityfrom traffic during construction	Direct, short term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, short term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Impacts during Operation and Maintenance			
Surface water quality, marine water quality, bottom contamination, marine and coastal ecology from:			
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing
Liquid and solid waste	Localized, could be significant to sensitive flora and fauna, avoidable	Solid waste floatingin the mangrove area and around the project area, bacterial contamination, level of nutrients in the water	Visual, laboratory testing
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be long term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test
Air Quality from traffic during construction	Direct, long term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, long term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community

Visual quality	Direct, long term, not significant, unavoidable	Visual stimulation	Visual

Potential Climate Change Impacts

Generally speaking, there are two types of potential climate change impacts relevant to the development. The first are Adaptation types of impacts which are impacts that will influence the ability to adapt to changes in physical characteristics of the environment such as sea level rise, change in rainfall pattern, raising temperature, and others. The second types of impacts are the Mitigation impacts which are the impacts that will influence the ability to mitigate the increase in Greenhouse Gas (GHG) emission and to stop the loss of carbon pool (loss of trees and other vegetation) and to increase the potential for carbon sequestration. Of these impacts, several are considered relevant for the project and are explained below.

a. Mangrove and Protection from Coastal Erosion/Inundation (Adaptation Impacts)

Mangrove protection has been advocated as one of the strategies to increase capabilities of coastal countries to protect themselves from the effect of sea level rise. This is because one of the services that a mangrove ecosystem provide is the stabilization or protection from erosion of coastal lands by trapping of sediment and protecting the lands from storm damage.

Moreover, another equally important climate change consideration is the protection of the developed facility (i.e. the jetty and the fuel storage) from the effect of sea level rise. For Timor Leste, it was estimated that the sea level rise will increase between 6-15 cm by 2030, 12-30 cm by 2055 and between 21 – 59 cm by 2090 (based on mid-level greenhouse gas emission scenario). These increases have been based on the 1990 sea level, therefore when compared to the year 2014's level, the maximum level of increase will likely be less than 59 cm by 2090 or less than 30 cm by 2055. Based on this estimate, it is recommended that the ground floor level be elevated by at least 50 cm in order to respond to the climate change in the future. This recommendation is also consistent with recommendation put forward by Geotech consultant hired to make assessment on ground stability for the structure

b. Declining Carbon Stock

Declining carbon stock is related to the loss of carbon from the loss of seagrass bed, coral and existing tree due to site preparation. These losses, however, is predicted to be limited because of the limited footprint of the underwater support structure (piles rather than massive walls) and vegetation cleared out on the terrestrial environment is also limited. No mangrove will be cleared out from surrounding the site. The largest impact to the seagrass bed, coral and mangrove will come from the O&M activities in the form of pollution that affect these biota.

Potential Social Impacts

Social impacts are assessed within the context of the local community where development is taking place, that is, Aldeia Sucaer Laran and Suco Hera. Workers in the facility whether they come from Hera or other places are also included in the analysis because the social consequences of the development will also be felt by them. Desk review and field interview conducted for the project found several key social issues in the affected community that are relevant to the development. The key social issues are:

1. Relatively high unemployment level in Suco Hera: based on Census 2010 data, it was found that about one in seven persons that are available for work do not find job.
2. In terms of health status, there is a need for improvement on the number of children receiving immunization, nutrition status of children and the prevalence of malaria. Health facility remains basic in the community.
3. In terms of educational attainment, Suco Hera has about 66% of population 5 years old and over with some schooling (Census 2010). This relatively higher number, however, is not reflected in the educational attainment at the secondary level, where there is only 38.6% of the population actually finished Junior and High School level according to Census 2010.
4. Educational facility only covers primary to junior high school level. High school students have to commute to Dili for continued education. Tertiary educational institution (UNTL Hera) is present in the community but only the engineering school.
5. Gender equality in general is improving, however, there are more work to be done as indicated by the presence of less girls in the university level education (83 girls for every 100 boys enrolled). In the employment sector, data from the United Nations Development Programme (UNDP) also pointed to the traditional male dominance in the non-agricultural emplyment sector.
6. Fishermen group has been found to be the most potentially affected group in the community in relation to the development. This is because a section of the coastline that are well used by the fishermen in the community will have to be cleared from all fishing activities for the proposed development. Some fishermen will have to move their boats and fishing aparatus to other location. The impact could be significant to affected fishermen as field interview found that the fishermen mainly dependent on fishing as their main economic activities and has been able to generate satisfying level of income.

Per the above findings, several recommendations have been put forward for the development to help contribute to the improvement of social condition as well as to ease the impacts on the fishermen group. The recommendations are:

1. Absorption of local labor into the facility: this should start right from the beginning phase of the development/site preparation to construction and operation and management.
2. Preference to women labor: it is believed that certain percentage of labor in the facility should be made open for women, preferably for permanent position. Permanent position carries with it more benefits in the form of opportunities for education and training that not only increase the skill level but provide with positive learning and working experience.

3. Education and training for facility's employees: this should be pursued in a continuous basis with tangible results. For example, upper level management that will be filled with foreign employees at the start of the employment should be filled with Timor Leste citizens within several years.
4. Social contribution: routine social contribution should be made to local community and should contribute to meeting long term social needs of the community. For example, contribution into local schools and health care center, scholarship for students in need and others. This routine social contribution can be coordinated with the church and local authority as the prominent social institutions in the community.

Potential Economic Impacts

The potential economic impacts focused on several points: the cost and benefits of several important mitigation measures and potential cost incurred due to environmental damage.

The total cost required by ETO to implement the proposed EMP is estimate to amount to USD 780,000 with annual operating cost of $ 104,700.

The above cost of the mitigation measures can be further classified into capital cost or one-time cost at the beginning of the development and recurring cost that require routine expenditure every six months, every one year or so. The capital cost is estimated at a total of USD 780,000 while the expenditure is estimated at a total of USD 100,000 per year.

Several important benefits will be able to be realized by investment in the mitigation measures. The benefits are as follows:

1. Protection of the mangrove ecosystem nearby. As previously discussed, this alone will generate between USD 20,960/year and USD 101,100/year in fishery and coastal protection from mangrove.
2. Rehabilitation of the environment. In addition to protection benefits, other benefits that should be taken into consideration is the benefits in terms of the avoidance of conducting rehabilitation.
3. Protection of nearby infrastructure. Should any major accident happen, most likely, not all of the infrastructure will be damaged, however, at least a part of it will be affected. In the case of EDTL Hera, it will be more realistic to say that most likely, not the entire facility will be damaged but some disruption to the service might happen and economically, the cost will be significant due to the importance of electricity to the entire economy.
4. Protection of workers. It is hard to put a price on the protection of human being from injury or loss of life, it should also be noted that not only workers in the ETO facility will be affected. Should a major accident happen, there is a high possibility that workers at EDTL Hera might be affected.

Proposed Mitigation Measures

Potentially significant environmental, social and economic impacts are related to oil spill and the fire/explosion potential of that comes out of wrong handling of the fuel. To avoid these risks, several mitigation measures have been proposed to be incorporated into the development. The mitigation measures are divided into two types of mitigation measures – (1) mitigation measures for major impacts (related to oil spill and fire/explosion) and (2) mitigation measures for smaller or minor impacts (related to day to day operation and workers activities on the facility.

a. Management Plans for Major Impacts

Major impacts are related to oil spill and the associated fire/explosion risks of a fuel storage facility therefore management plans for this should be with the purpose of minimizing risks from spill as well as fire/explosion. Recommended management measures for these risks are provided in the following table.

Table 19.3. Summary of Management Measures for Oil Spill and Fire/Explosion Risks

No	Mitigation Measures	Purpose
Measures for Slight to Local Spills		
1.	Water-Oil Separator	Separating minor spills originating from the bundwall area
2.	High Grade Skimming Machine	Optional equipment for separating water-oil from the water oil separator if the gravity system failed
3.	Use of Booms around Tanker Ship	Containment of oil spill during transfer of oil from the tanker ship to the fuel storage.
4.	Application of Detergent (Dispersant)	Breaking the oil droplets to allow for faster natural assimilation in the case of slight to local spill into the marine environment
Measures for Large to Extensive Spills		
5.	Well-designed tanks, pipework, valves, gauging and alarm system, corrosion protection (also called primary containment)	Prevent release from tank overfilling, rapture and leakage through tank walls, bottom and the pipework
6.	Well-designed bund walls, ground lining and bund /wall seals	Prevent release to the environment should primary containment fail
7.	Well-designed drainage ditches and separate basins to contain spill	Additional barrier to prevent uncontrolled spread from failure of secondary containment. Tertiary containment should be controlled separately from the secondary containment
8.	Application of response plans that incorporate proper overall goals and objectives	Responding to large or extensive spill. Have to be a coordinated attempt by several relevant agencies.
9.	Application of proper mechanical, chemical and biological cleaning methodologies	Part of the response plans was the cleaning of spill. A combination of mechanical, chemical and biological cleaning methodologies should be employed to ensure better results.
10.	Provision of industrial-scale fire-fighting apparatus consisting of water, sand and foam	Fast response to major fire
11.	Provision of portable fire-extinguishers at strategic areas	Fast response to minor fire

b. Management Plans for Minor Impacts

Minor impacts are typically impacts related to day to day operation of the facility such as impacts related to solid and liquid waste produced by workers on the site, noise and vibration from equipment operation. To help mitigated these types of impacts, the following measures are proposed(Table19.4).

Table 19.4. Summary of Management Measures for Minor Impacts

Component	Phase	Potential Impacts	Mitigation Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Occuptational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eyes protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Marine and coastal ecology – positive	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area
		Coastal hydrology – changes in current pattern, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement
			- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.
		Structure inundation	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex

			and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.
		Occuptational health and safety	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 1. Ear and eyes protection 2. Helmet 3. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Noise and vibration	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.
			- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations
		Structural inundation or erosion of structure	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.
		Noise and vibration	Use of proper isolation on the ship's machinery room.
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Limited access to the beach especially by fishermen	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another

	Pre-construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Bottom contamination	Same as above
		Marine and coastal ecology	Same as above
		Air quality problem	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road
		Loss of terrestrial vegetation	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility
		Noise and vibration impacts	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water
			- Provision of temporary sanitation facilities with waste disposed off at Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.
		Bottom contamination	Same as above
		Marine and coastal ecology	Same as above
		Structure inundation	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise.

			- Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.
		Air quality problem	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road
		Soil and groundwater quality	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Traffic disruption	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Operation-Storage facility	Water quality	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.
		Bottom contamination	Same as above
		Marine and coastal ecology	Same as above
		Soil and groundwater quality	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.

		Air quality	- Use of newer or well maintained vehicle fleet to curb emission gases
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Structure inundation or structure erosion	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.
		Visual quality	- Landscaping with grass in spaces between the facility and the fence

Governing Parameters

The proposed governing parameters are used to quantify measurable environmental quality such that changes in environmental conditions can be compared to the baseline and ambient quality threshold. The following standards could be used as threshold values for environmental evaluation.

(1) Emission

There are no national standards for emission currently in effect in Timor Leste. Therefore, international emission standards from other countries have to be adopted. Several types of emission standards are recommended for the facility as listed in the following table.

Table 19.5. Emission Standards Recommended

No	Element	Source	Recommended Standards
1	Air	Vehicular emission	Indonesian Government's Regulation No. 35/MENLH/10/1993 on Upper Limit for Vehicle Emission
2	Water	Drainage water loading from the facility as a whole	Indonesian Environmental Ministerial Diploma No. 42/MENLH/10/1996 on Wastewater Standards for Oil, Gas, and Geothermal Activities
3	Noise	Pre-construction, construction and operation	Indonesian Environmental Ministerial Diploma No. 48/MENLH/11/1996 on Noise Level Standards
4	Vibration	Pre-construction, construction and operation	Indoensian Environmental Ministerial Diploma No. 49/MENLH/11/1996 on Vibration Level Standards

(2) Ambient Environmental quality

Ambient environmental quality consists of standards relevant to maintain good quality of air, water and soil. In relation to ambient air quality, project owner and regulatory agencies should measure the ambient air quality at least once every year and compare the results to the baseline survey conducted as part of the EIS development. Recommended standards for ambient air quality are the Indonesian Government Regulation No. 41/1999. Water body found in the area is coastal water body and the recommended standards for the water quality is Indonesian Ministry of Environment Ministerial Decision (KepMen LH) Kep.51/MENLH/2004.

(3) Occupational Health and Safety Standard

Recommended Occupational Health and Safety Standards for every project activity during the pre-construction, construction and during the operation should be followed. This includes general construction health and safety requirements, occupational health and safety standard in marine environment and occupational, safety standard in operation of fuel storage as well as others.

Monitoring Programs

Monitoring program is very important to ensure that the mitigation measures are implemented effectively by project proponent. Another objectives of the monitoring programs including to determine effectiveness of mitigation measures and to facilitate impact management by warning of previously unanticipated impacts.

Recommended monitoring program for the facility are spelled out in the following table.

Table 19.6. Monitoring for the Mitigation Measures

Component	Phase	Potential Impacts	Mitigation Measures	Monitoring Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Occuptational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eyes protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	- Limit dredging to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

		Marine and coastal ecology – positive	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	- No specific monitoring measures have been proposed for this, however, special care should be given during fixing or part replacement of the jetty structure as not to displace existing bottom biota that have proliferated on the surface of structure
		Coastal hydrology – changes in current pattern, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	It is actually hard to predict the ultimate impact of alteration to existing coastal hydrology pattern. As such, monitoring should look for evidence of negative impacts of alteration to current, wave and sediment movement. Negative impacts including higher level of sedimentation around the piles and beach erosion on nearby location that threaten the integrity of structure.
			- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	- Monitoring for higher than usual sediment loading that leads to more frequent dredging needs. - Changes in sediment loading will also affect mangrove nearby (mangrove ecosystem depends on supply of sediment) therefore, the health of the mangrove community should also be monitored. More discussion on this will be provided under monitoring measures for impacts from fuel storage development.
		Structure inundation	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	- Monitoring for sea level movement especially in reference to jetty structure.
		Occupational health and safety	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 4. Ear and eyes protection 5. Helmet 6. Foot protection (safety boot) and wet suit as	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and

			necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	SEPFOPE
		Noise and vibration	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	- Monitoring for complaints from workers and local community.
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	- Use of booms around the connection between tanker ship and jetty - Use of dispersant to minor spill. - For major spill from tanker ship, procedure for response is discussed in the following Section.	- Monitoring for evidence of spill in the marine water (oil film or slick) - Monitor for evidence of spill in the sandy beach and mangrove community - Water testing should be conducted on a regular basis (at least once a year) to understand in more detail level of certain hydrocarbon chemicals as well as toxic heavy metals in the water. Parameters tested should at least be the same as parameters that have been tested for the baseline data collection as reported in Chapter IV, Description of the Environment.
			- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several “rooms” where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication on the nearby saltmarsh or around mangrove community. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach and mangrove forest.

			- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
		Structural inundation or erosion of structure	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	Monitoring for sea level movement especially in reference to jetty structure.
		Noise and vibration	Use of proper isolation on the ship's machinery room.	Monitoring for complaint from local community.
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Limited access to the beach especially by fishermen	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	- Monitoring for implementation of the management measure. Monitoring should be conducted with active collaboration from local authority (chefi de aldeia and chefi de suco). - Monitoring for resulting effect from moving the fishermen to a new place. How their level of income are affected and whether there are conflict at the new place. - Monitoring should be done for at least one year until the fishermen established their new parking space.
	Pre-construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

			mangrove community and its function in fishery production.	
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Air quality problem	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Loss of terrestrial vegetation	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	Monitoring for at least one year until trees all grow. Every year, as part of ETO's Company Soil Responsibility, continuous tree planting can be done.
		Noise and vibration impacts	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of mangrove community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Structure inundation	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for mangrove to move inland.	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of mangrove ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of the mangrove forest. Mangroves provide natural barriers to coastal facilities.
		Air quality problem	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Soil and groundwater quality	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker

		Traffic disruption	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	- Monitoring for large increase of traffic due to construction material transport. - Monitoring for problems due to higher amount of traffic.
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Operation-Storage facility	Water quality	Management measures for slight to minor impacts: - The use of oil separator (constructed as part of the development). - The use of higher grade oil skimming machine when deemed necessary Management measures for major to extensive impacts: - Routine drill on response plans. There are in general two types of response plans – for spill that makes its way to the water and for spill stranded into the sand or nearby salt marsh.	For slight to minor impacts: - Monitor for evidence of oil in the environment (soil, saltmarsh, mangrove communities and sandy beach). Monitoring should be conducted on a daily basis. Clean swiftly when there is evidence of spill in the environment. - Monitor for effectiveness of oil separator basin. When not found to be effective, use higher grade skimming machine. - Periodically (at least once a year) conduct testing of effluent from the separator basin to see whether effluent is within allowable standards for effluent from downstream oil facility. Use applicable standards recommended in this EMP or use other standards as recommended by DNMA (recommended standards have to consider the presence of nearby mangrove forest). For major impacts: - Monitoring should focus on ensuring the integrity of the primary, secondary and tertiary containment methods.
			- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility.	- Monitoring for signs of eutrophication on the nearby saltmarsh or around mangrove community. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach and mangrove forest.

			- Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Soil and groundwater quality	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Air quality	- Use of newer or well maintained vehicle fleet to curb emission gases	Monitoring for elevated level of air pollution gasses including NO_2, SO_2, CO and CO_2. Air pollution in the area, however, might come from EDTL or vehicle movement in the national road.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	Monitoring for complaint from worker
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Structure inundation or structure erosion	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise. - Protection of the health of mangrove communities including providing buffer for mangrove moving inland due to sea level rise. - It is highly recommended that the salt marsh between mangrove and the facility not to be developed. The saltmarsh is the buffer area for	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of mangrove ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of the mangrove forest. Mangroves provide natural barriers to coastal facilities.

			mangrove to move inland.	
		Visual quality	- Landscaping with grass in spaces between the facility and the fence	- Monitoring for complaints from passersby

Table 19.7. Recommended Monitoring Parameters for Air Quality, Marine Water Quality, Marine Ecological Quality and Social Impacts.

No	Parameters	Methodology	Sampling Location	Frequency	Responsibilities
Air Quality					
1	SO_2	In situ measurement	Within the perimeter of storage complex	Once a year	Project proponent in coordination with DNMA
2	NO_x				
3	PM_{10}				
4	$PM_{2.5}$				
Marine Water Quality - Physical Parameters					
1	Turbidity	In situ measurement	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
2	Smell				
3	Suspended solid				
4	Solid waste				
5	Temperature				
6	Oil layer				
Marine Water Quality – Chemical Parameters					
1	pH	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
2	Salinity				
3	Total ammonia				
4	Sulfide				
5	Total hydrocarbon				
6	Total fenol				
7	PCB				
8	Surfactant				
9	Oil and fat				
10	TBT				
Marine Water Quality – Soluble Heavy Metal					
1	Mercury	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
2	Copper				
3	Cadmium				
4	Zinc				
5	Lead				
Marine Water Quality - Bacteriology					
1	Total coliform	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
Marine Ecological Quality					
1	Shanon-Wienner Diversity Index	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and DNMA
Social Impact					
1	Worker's Health and Safety	Record of health complaint, record of work-related accidents	Workers	Monthly	Project proponent in coordination with SEPFOPE
2	Social contribution	Record of contribution to local community, contribution to fishermen group	Local community, local fishermen group	Once a year	Project proponent in coordination with local authority and Ministry of Social Solidarity (MSS)
3	Social Order	Complaint from local community	Local community	Monthly review	Project proponent in coordination with local authority

In addition to the above monitoring program, a routine internal inspection and testing should be conducted to ensure the integrity of the primary, secondary and tertiary containment measures. This internal inspection should be conducted on a routine basis. The responsibility for the inspection and testing rested at the hand of the project proponent (operator) in coordination with ANP.

To ensure proper protection from fire accident, project proponent or in this case the project operator should also test and inspect the fire protection measures in place at the facility. The procedure for inspection and testing for fire protection should be coordinated with Civil Protection.

Reporting Requirement

All the monitoring activities should be coordinated with relevant government agency to ensure that the parameters being collected meet regulatory requirement in place for that particular set of parameters. After data have been collected, they should be submitted to relevant authority as previously noted in the above tables.

At a minimum, the reporting should cover:

- Internal monitoring and inspection
- Incident, accident and emergency reporting
- Performance indicators and any follow up actions needed
- Training programs

The types of report, including formatting and reporting frequency should be coordinated with relevant authority. Per DNMA's rules, however, the environmental license of the project is only valid for one year and should be renewed every year by reporting on an updated EMP. Therefore, at a minimum, a once a year reporting should be required.

Responsibility for Mitigation and Monitoring

The following agencies within the government (Table 19.8) is responsible for environmental, social and economic safeguarding from impacts generated by the project.

Table 19.8. Relevant Institutions and Their Responsibilities

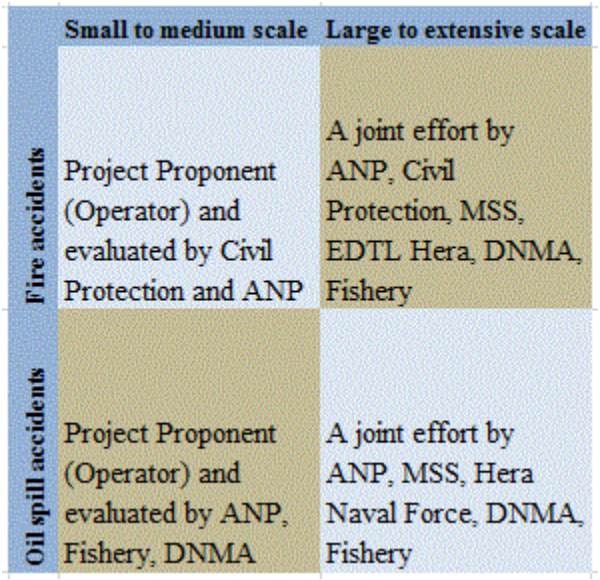
No	Responsibility	Relevant Institutes
1	Environment and Nature Protection (Terrestrial)	State Secretary of the Environment
		State Secretary of Forestry and Natural Protection
2	Marine and Coastal Environment	State Secretary for Fisheries and Aquaculture

3	Downstream Petroleum Industry	National Petroleum Authority (ANP)
4	Public and Worker's Health and Safety	Ministry of Health
		National Directorate for Civil Protection
		State Secretary for Labor Protection and Training (SEPFOPE)

Emergency Plans

In general, two types of emergency preparedness plans should be prepared for the facility – (i) emergency plans related to fire accident, (ii) emergency plans related to oil spill accident. In addition, for each type of accident, at least two types of emergency plans should be in place, the first one is for small to medium types of emergency and the second one is related to large and extensive types of accidents affecting nearby resources and facilities. Figure 19.1 provides an illustration of agencies responsible for the emergency plans.

Figure 19.1. Agencies Responsible for the Emergency Plans



The small to medium scale emergency preparedness plan will be provided by operator of the facility and evaluated by relevant agencies which are ANP and Civil Protection in the case of fire accident. For oil spill accident, the emergency preparedness plan should be prepared by project proponent and evaluated by ANP, Fishery and DNMA because oil spill can happen on the water and most likely affecting mangrove and other coastal resources nearby.

Large to extensive emergency preparedness plans should be prepared through a joint effort by relevant agencies including ANP, Civil Protection, MSS, EDTL Hera, DNMA and Fishery in the case of fire accident and ANP, MSS, Hera Naval Force, DNMA and Fishery in the case of oil spill accidents.

Decommissioning Plans

No decommissioning plan has been specifically developed for the facility, as the project is being planned for long term use and further expansion in the form of ETO's headquarter building is already developed for the facility. Therefore, decommissioning is only possible in the face of a force majeure for example, a natural disaster event take place leading to a significant damage to the facility. A large and extensive accident may also change the perception on the viability of a large facility like that in the location. Should this is happening, a decommissioning plan should be developed by the operator/project proponent taking into consideration the demolition of the jetty as well. Such demolition plan should also incorporate measures to bring back the condition of the area to the original state.

Capacity Development and Training

Capacity development and training is required for staff in the facility consisting of:

- For facility manager: training courses from accredited training providers, covering storage facility management course and Health, Safety and Environment (HSE) and quality standards.
- For staff: at a minimum, all staff in the facility should be provided with certified training on first aid and safety.

The responsibility for EMP implementation as well as monitoring of the environmental parameters rests with project operator or in this case management of the facility. It is therefore very critical for the manager to have proper training on HSE and to understand the EMP well.

In addition to the above, as part of skill transfer, several mid-level employees should be prepared to eventually take over management from foreign operator. These mid-level employees or management trainee should be provided all trainings required for facility manager.

Public Consultation and Information Disclosure

Public and community consultation were conducted with two kinds of meeting arrangement: (1) Large meeting by inviting many and (2) meeting one on one in the project location. (3). Intensive discussion with relevant government bodies. The purpose of the consultation was to gauge the stakeholder opinion and concern regarding the project activity and impacts that may arise during each cycle of project implementation. The consultation also aims to communicate the scope of the EIS and receive and opinion from various stakeholders in order to improve the results of the impact assessment.

Public meetings as part of the EIS process were conducted two times to consult on the project scoping of the EIA and the draft EIS. The results of these large consultation meetings were very useful in terms of providing additional information for improvement of the EIA scoping document and improvement of the draft EIS. Representatives from various agencies raised mostly technical opinions related to project. The representatives consist of Fisheries, ANP, Civil Protection, DNMA, NGOs, and community representatives. Main inputs received during public consultation are:

1. Clear data on affected fishery community (income level, etc)
2. Clear measures to impact from water spill – cleaning, etc. what to do if spill happens, how to manage tailing
3. Emergency preparedness and response plan (include emergency route in the event of fire)
4. Adaptation and mitigation plans are important due to existence of coastal and marine biota. Long term protection to mangrove communities need to be spelled out. Idea – mangrove rehabilitation type of activities can be implemented working together with relevant organizations such as the government or the civic society sector.
5. Impacts of project activities to public health
6. Clear procedures to attend to work-related accidents. Note that facility is relatively far from large clinics.
7. Workers health and safety protection from exposure to potentially hazardous substances
8. Different measures should be available for fire protection not only water
9. ANP suggested to include the API design standard in the EIA and also the draft regulation so that project owner will have sufficient information on the standard and requirement
10. The design of the system (storage tanks, instrumentation, etc.) must be consulted with the relevant expertise and ANP has some experience on this issue
11. Buffer zone/green zone between jetty and mangrove should be kept to allow mangroves moving inland when sea level rise.

Workplan and Implementation Schedule of the EMP

The workplan and implementation schedule of the EMP is given as follows:

Activity of EMP	Year1				Year2				Year 3	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	Pre-Construction		Construction						Operation	
Dust Management	●	●	●	●	●	●	●	●		
Solid and Liquid waste Managem	●	●	●	●	●	●	●	●	●	●
Occupattional heath and Safety	●	●	●	●	●	●	●	●		
Noise Management	●	●	●	●	●	●	●	●		
Inccident management	●	●	●	●	●	●	●	●	●	●
Traffic Management	●				●				●	
Fire Control and Management									●	●
Oil spill detection and management									●	●
Storm runoff and sedimentation	●				●				●	
Solid and Liquid waste Managem	●	●	●	●	●	●	●	●	●	●
Air quality monitoring	●				●				●	
Water quality monitoring			●		●				●	

Cost Estimate

The total cost required by ETO to implement the proposed EMP is about USD 195,000 during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 85,000. For monitoring purposes, total cost is estimated at USD 11,000 for pre-construction and construction phases. For the O&M phase, the total monitoring cost is estimated at USD 28,000.

Review of the EMP

The EMP should be reviewed by project owner and then updated and re-submitted to DNMA for re-approval every year. Project proponent can engage local consultants for update of the EMP. Data collection should take place as part of the EMP update focusing on near coast water quality assessment and air quality data.

DNMA can review results from monitoring activities and compare them with baseline results collected during EIS preparation. Monitoring or data collection can also be taken on need basis when certain parameters have visually been observed to be elevated. Complains from community should also be taken into consideration and appropriate assessment and data collection take place to formulate proper ways to address the complaints.