

**ATTACHMENT 1**

**GAS TO ENERGY PROJECT**

**PROJECT SUMMARY**

Esso Exploration and Production Guyana Limited

June 2021

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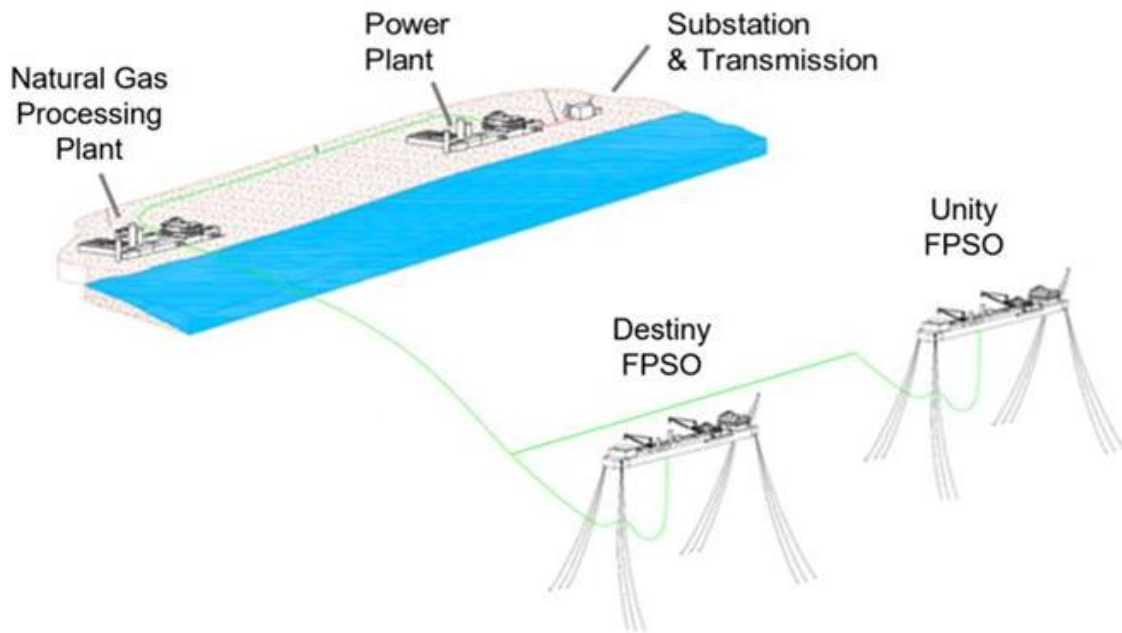
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## 1. INTRODUCTION

The purpose of this Project Summary is to provide technical information for the Guyana Environmental Protection Agency (EPA) to evaluate Esso Exploration and Production Guyana Limited's (EEPGL) Application for Environmental Authorisation for the Gas to Energy Project (Project). EEPGL is the designated Operator for the Stabroek Block and is acting on behalf of itself and on behalf of the other parties comprising the Contractor under the Petroleum Agreement and the Petroleum Prospecting Licence for the Stabroek Block (i.e. Hess Guyana Exploration Limited and CNOOC Petroleum Guyana Limited (formerly known as CNOOC Nexen Petroleum Guyana Limited)). The Project includes the construction and operation of a pipeline from the Liza Phase 1 and Liza Phase 2 Floating, Production, Storage, and Offloading (FPSO) vessels to an onshore natural gas liquids (NGL) and natural gas processing plant (NGL Plant). The pipeline will transport up to approximately 50 million standard cubic feet per day (MSCFD) of dry gas to the NGL Plant. The NGL Plant will drop the pressure of the gas, dehydrate the gas, separate out propane, butane and pentanes+, and treat the gas to the specification to be received by a planned power plant.

The power plant will be owned and operated by Government of Guyana. The Government will also consider alternative options on ownership. Therefore, for the purposes of this summary, the power plant and further distribution is not included in the scope of this application, except for its consideration when addressing cumulative impacts for the Project. Figure 1 provides a schematic of the Project and power plant.

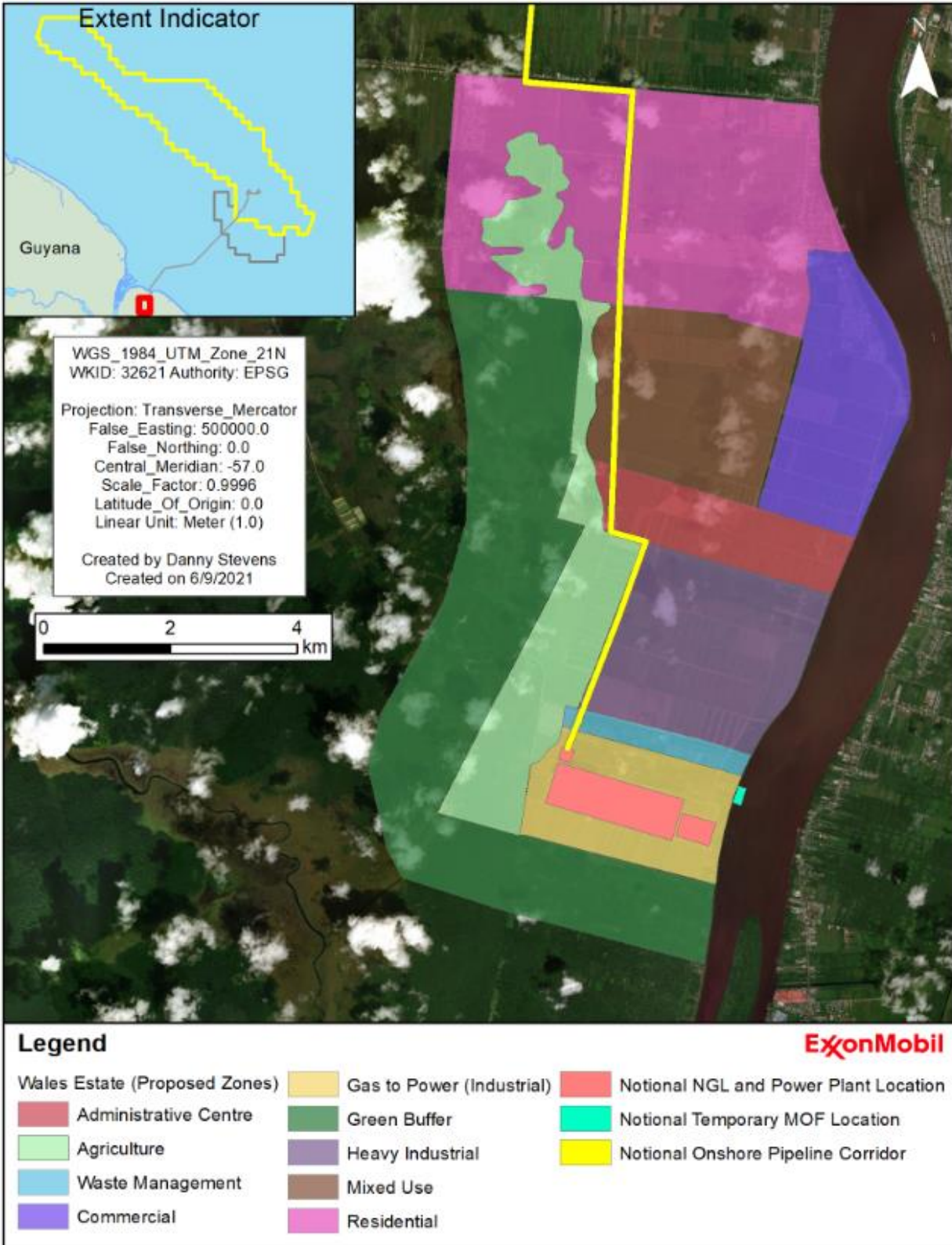


**Figure 1: Notional Project Schematic**

## **2. SCOPE OF THE GAS TO ENERGY PROJECT**

A comprehensive site evaluation process was conducted to determine a location most suitable for the proposed NGL Plant site (“Site”). Twenty (20) sites were evaluated based on a number of criteria, including topography/elevation, soil conditions, biodiversity, socioeconomic factors, site access, and pipeline routing. Of the sites assessed, it was determined that the Wales location is the most favorable candidate for the Site based on constructability, environmental, socioeconomic, and biodiversity perspectives.

The Site lies approximately 23 km upriver on the west bank of the Demerara River on abandoned sugarcane fields, as shown in Figure 2.



**Figure 2: Project Site Location**

The Project will include offshore and onshore pipeline segments, and the NGL Plant. The table below provides a tabulation of the major components of project infrastructure:

**Table 2-1: Major Components of Project Infrastructure**

Major Component	Description
Offshore Pipeline	- 12" pipeline that will transport up to 50 million standard cubic feet per day (MSCFD) of gas from Liza Phase 1 and Liza Phase 2 FPSOs to connection with onshore pipeline. Maximum flow of pipeline is approximately 120 MSCFD.
Onshore Pipeline	- 12" pipeline that will transport up to 50 MSCFD of gas from connection with offshore pipeline to the NGL Plant. Maximum flow of pipeline is approximately 120 MSCFD.
NGL Plant	- Onshore plant that will remove propane, butane and pentanes+ liquids with the ability to be sold; and treat remaining gas to specifications required by the power plant, including dehydration and pressure let down of gas.
Temporary Material Offloading Facility (MOF)	- An offloading facility may be established on the west bank of the Demerara River for offloading of heavy modules (use determination to be finalized pending detailed design study) and imported material or equipment.
Associated infrastructure upgrades	- Some degree of construction access road development/improvement will likely be required along the onshore pipeline route. This will likely comprise a combination of soil stabilization and temporary hard-surfacing, with restoration following completion of construction.
Logistics Support	- Marine vessels and helicopters throughout all stages with potential sharing among developments - Onshore infrastructure support, including shorebases, pipe yards, fabrication facilities, fuel supply facilities, and waste management facilities.

The Site occupies an area of approximately 30 acres (12 Ha). An additional area of approximately 100 acres (40 Ha) adjacent to the Site may be used by EEPGL's construction contractor for support of the Project during construction. The additional support area would only be used during the construction phase of the Project and any temporary structures or equipment would be removed from this area upon completion of the construction phase.

The onshore pipeline segment will be between approximately 21 - 27 kilometers in length<sup>1</sup>. As noted in the Government of Guyana letter of June 23, 2021, to allow for optimization, the pipeline right-of-way (ROW) will be within (+/-) 200 m of the proposed route ROW. The final ROW will be determined post-optimization. The nominal temporary workspace area required during construction of the onshore pipeline will be approximately 23 meters wide, resulting in a temporary construction footprint between approximately 123 - 154 acres<sup>1</sup>. Additional temporary workspaces may be required at civil features such as larger canals and roads to facilitate their crossings, and would measure approximately 50 x 100 meters. Following completion of the construction, the permanent right-of-way for the pipeline will be approximately 12 meters wide, resulting in a permanent right way between approximately 64 - 81<sup>1</sup>.

<sup>1</sup> Depending on route selection.

## **2.1. ADJACENT LAND USE**

The Site is currently owned and operated by GUYSUCO and was previously used as a sugarcane plantation. The Site contains abandoned sugarcane fields, which have 5 – 7 years of pioneer species overgrowth, and GUYSUCO office buildings. The Site is densely vegetated with herbaceous and shrub vegetation that is approximately 1 – 4 meters in height. The vegetation is characteristic of reverting agriculture including a mix of sugarcane and pioneer tree, shrub, and grass species such as bloodwood, cecropia, jамoon, moco-moco, black sagebrush, and various grasses. The Site is generally of low value to wildlife. No critical biodiversity (plant or animal) is expected to occur at the Site.

There is no human habitation at the Site since it is controlled by GUYSUCO, but there is some subsistence sugarcane farming and cattle rearing that occurs in portions of the Site. There is no other known significant human use of the Site and there are no known cultural sites or traditional uses within the Site. The Site lies in the vicinity of several communities to the north, east and west.

## **2.2. PROJECT PHASES AND SCHEDULE**

The Project will be implemented in phases and is expected to undergo the following overlapping construction phases, commissioning and a final operational phase:

### Offshore Pipeline

- Surveys – Geophysical and geotechnical surveys to characterize bathymetry and seabed sediment properties. Survey activities will also include a pre-lay survey and a final post-lay survey to record the pipeline as-built configuration.
- Installation – The pipeline will be welded offshore using an installation vessel and then laid on the seabed from the offshore connection point with the FPSOs up to the approximately 20-meter bathymetric contour, where the “nearshore area” begins. In the nearshore area, a trench will be excavated and the pipeline will be laid in the trench, which will then be backfilled. In the last few kilometers near shore (“the shore approach area”), the pipeline may be installed using Horizontal Directional Drilling (HDD). This is subject to further evaluation, as detailed in the next section.
- Pre-commissioning and commissioning – During pre-commissioning, the pipeline will be flooded, cleaned, gauged, hydrostatically tested, dewatered, and inerted (introducing inert gas to produce non-ignitable atmosphere. During commissioning, the natural gas stream will be introduced in the pipeline system in preparation for start-up activities.
- Operation – The pipeline will be operated with the rest of the facilities in accordance with the developed operating procedures (inclusive of maintenance and inspection pigging procedures).

### Onshore Early Works

The following work activities will be undertaken prior to / in parallel with the Onshore Pipeline and NGL Plant construction:

- Surveys along right-of-ways, pipeline corridors, and onshore facility plots to investigate geotechnical and geophysical properties in support of construction activities. Surveys will also be conducted to assess current infrastructure suitability in support of proposed construction activities.
- Site clearing of vegetation and unstable soil (as identified in the above surveys).
- Upgrade / construction of infrastructure (roads, bridges, material offloading facilities, etc.) for use in temporary construction access and/or permanent operational support.
- Site soil stabilization (e.g. pile driving) and foundation construction in support of temporary laydown sites for construction and permanent facility footprints.

### Onshore Pipeline

The different execution phases for the onshore pipeline will be similar to the offshore pipeline with the following differences.

- Construction and installation – This phase will involve excavating a trench along the ROW, stringing and welding the pipeline alongside the trench, lowering the welded segments into the trench, and performing tie-in welding.
- Pre-commissioning and commissioning – Same as for the offshore pipeline.
- Operation – Same as for the offshore pipeline.

### NGL Plant

The following work activities support the construction, commissioning, and operation of the NGL Plant and are typical to an on-shore gas processing facility with no major exceptions.

- Temporary Module offloading will occur at a riverside offloading facility from a transport barge. The modules will subsequently be transported on land to the final site location where they will be installed on the previously constructed foundations.
- Mechanical and electrical hook-up of the modules will take place within the plant boundary (with other interconnected modules) and with the onshore pipeline at the plant boundary.
- Commissioning activities will follow including static and dynamic equipment testing, instrumentation and electrical connection testing, inerting, function tests and finally, introduction of the natural gas stream in preparation for facility start-up.
- Start-up and operation of the facility will follow approved procedures and will commence upon startup of the pipeline and downstream Power Plant.

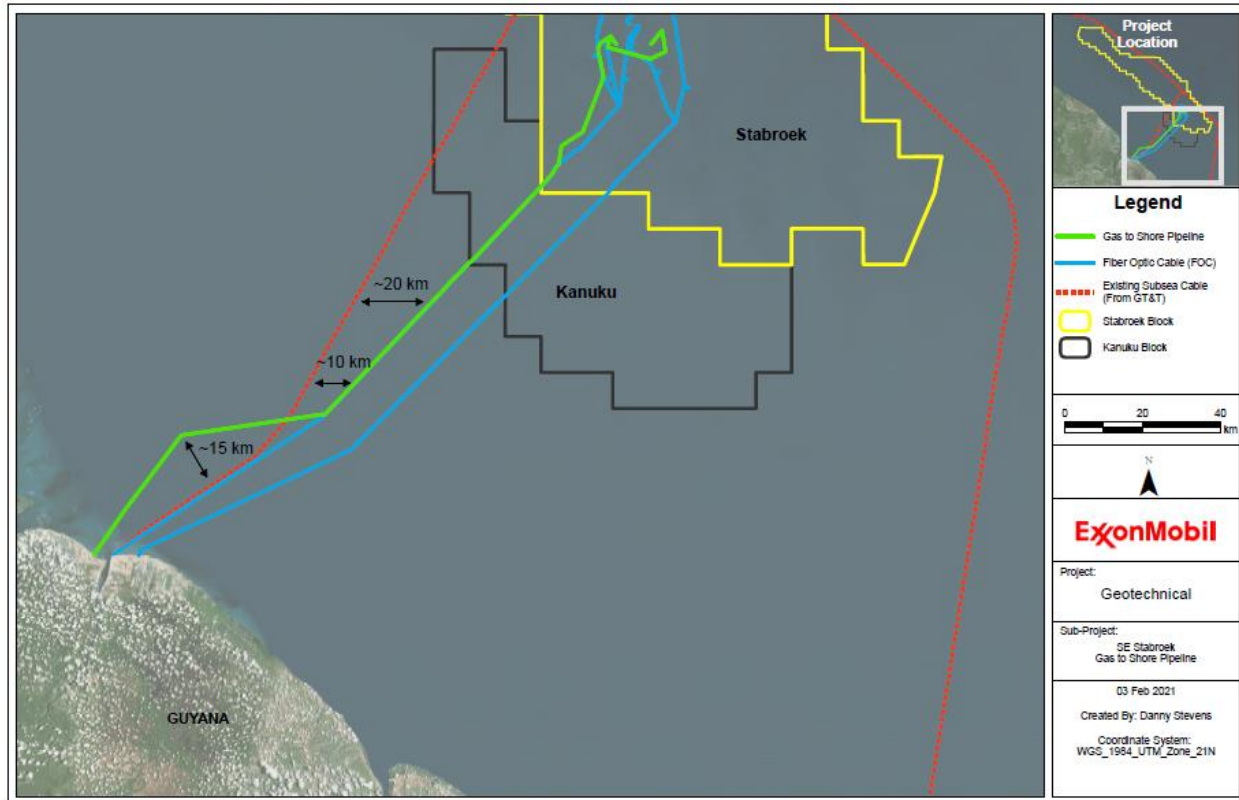
## **2.3. OFFSHORE PIPELINE**

The Project infrastructure will initiate at shutdown valves on both the Liza Destiny and Unity FPSO topsides. From this point, a new riser will be installed, leading to a pipeline end termination (PLET) situated on the seabed near the Liza Destiny FPSO (the Destiny PLET). A subsea pipeline will be installed from the Destiny PLET to a shore landing point with an intra-field pipeline from



the Liza Unity FPSO tying-in to the main export pipeline to shore in the vicinity of the Destiny FPSO at location to be further assessed and finalized in future Project phases.

As detailed below, subsea pipeline design and installation specifications will vary depending on the water depth along the pipeline route. The total offshore pipeline length will be approximately 220 kilometer (km) (~200 km from Destiny and an additional ~20 km from Unity). Figure 3 shows the approximate route for the offshore pipeline.



**Figure 3: Offshore Pipeline Notional Route**

Installation methods for the offshore pipeline will vary depending on the water depth. In deep water (greater than ~500 m water depth), installation is likely to utilize a dynamically-positioned (DP) J-lay installation vessel. At shallower depths, the S-lay installation method is likely to be employed, with a transition from DP to anchor-moored pipeline lay vessel in the nearshore area (~20 – 30 m water depth). At a minimum, the pipeline will be laid in a trench and buried in the shallow water nearshore area starting from the 20-meter bathymetric contour for protection purposes. Additional burial requirements beyond the 20-meter bathymetric contour will be further assessed and finalized in future Project phases. Multiple trenching techniques will be evaluated including both suction dredging and jet plowing methods. The trench will be generally backfilled using the excavated material as much as practicable. Bedding and rock protection layers may be required for the bottom and top portions of the trench, respectively. In the shore approach area, the pipeline may be installed using either HDD or open cut trenching techniques. EEPGL is currently evaluating both options.

Prior to commencing operations, the pipeline will be pre-commissioned including hydrotesting to confirm its integrity. Due to lack of equipment and space available on the FPSO, hydrotesting equipment required to flood the pipeline is likely to be placed on another vessel alongside the FPSO. Hoses would run from the FPSO to the vessel and then the vessel would tie into the pipeline. Seawater used for hydrotesting would likely be treated with oxygen scavengers, corrosion inhibitors, and biocides. After hydrotesting, the treated seawater would be discharged in accordance to best management practices and applicable regulatory requirements. Additional drying of the pipeline may be needed after the hydrotest water is discharged. This process would involve running pigs with batch treatment to absorb the remaining water in the pipeline. The final pre-commissioning step then follows, and includes inerting the pipeline with nitrogen gas.

## **2.4. ONSHORE PIPELINE**

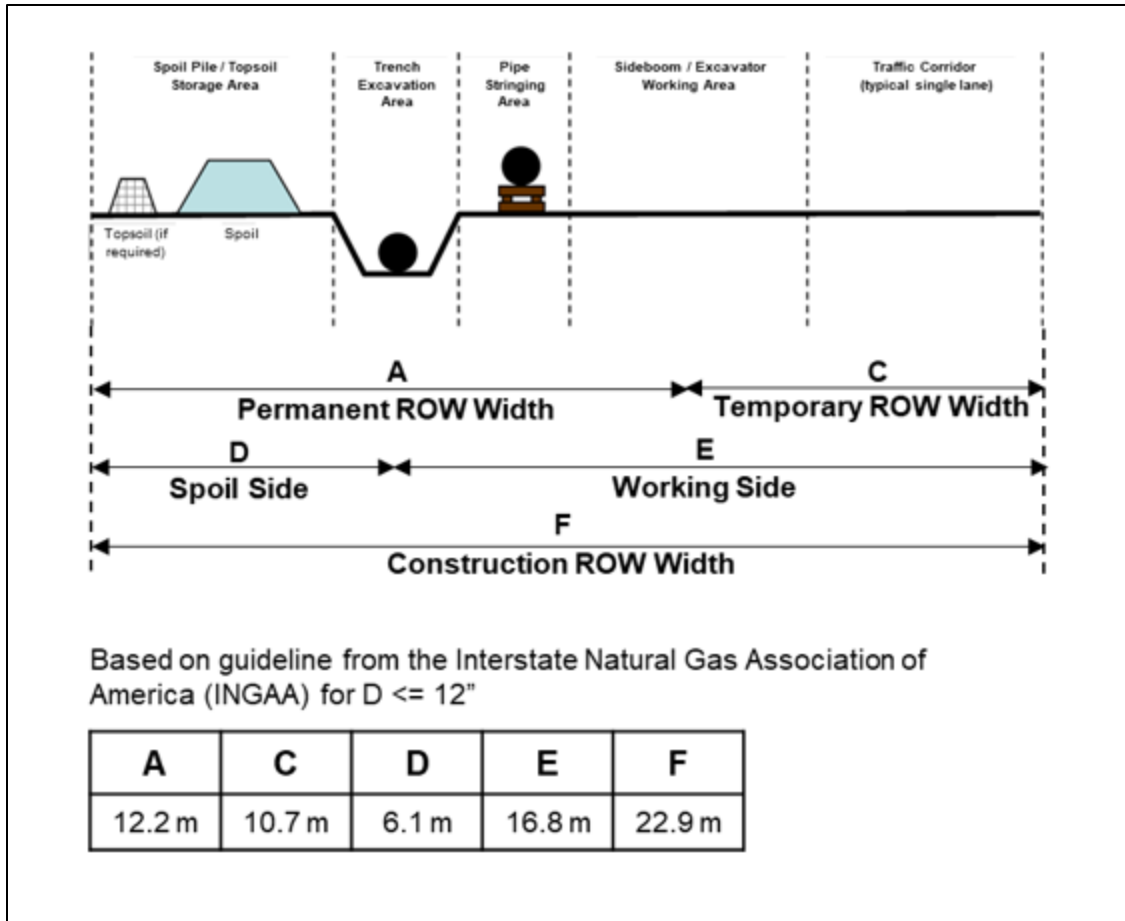
The shore landing point will be located west of the Demerara River. The preliminary location of this point is shown in Figure 4, approximately 4 km northwest of the mouth of the Demerara River. From the shore landing, the pipeline will be installed below ground up to the Site using a combination of conventional open cut construction techniques and HDD (the latter method likely to be used especially for road and water crossings in particular). Figure 4 below shows the proposed routing options that the Government of Guyana selected June 23, 2021. The figure reflects two 200m corridors that will allow for future pipeline micro-optimizations during detailed design. The route is approximately 27 km long and allows predominant use of open cut construction by leveraging available easements under the State's control along canals and associated access roads.



**Figure 4: Onshore Pipeline Notional Routing**

As noted previously, to allow for optimization, the temporary construction right-of-way (ROW) and permanent operational ROW will be within the 200 m proposed route ROW. The final ROW will be determined post-optimization. The construction ROW width is approximately 23 meters. The permanent ROW is assumed to be approximately 12 meters in width, see Figure 5. These preliminary estimates will be further assessed and finalized in future Project phases. The minimum cover depth is planned to be 1.22 m. For sections that will be constructed with open cut methods, a trench will be excavated in segments along the ROW. Depending on the height of the water table, construction activities in the trench may require dewatering using pumps. Pipeline segments will be stringed and welded along the excavated trench. These welded segments will then be lowered in the trench for final tie-in welding. HDD sections will be constructed by first drilling a directional bore from an entry to a target exit point. The pipeline will then be welded from one side of the bore and pulled from the other using a pulling head and a winch.

Pre-commissioning will include activities similar to the description in Section 2.3 for the offshore pipeline. Pre-commissioning of the offshore and onshore sections may be done concurrently or in separate stages depending on design and execution considerations to be further assessed. After hydrotesting is successfully completed, the trench will be backfilled using the excavated material to the extent practicable.



**Figure 5: Notional Construction Right of Way Layout**

## 2.5. NATURAL GAS PROCESSING PLANT

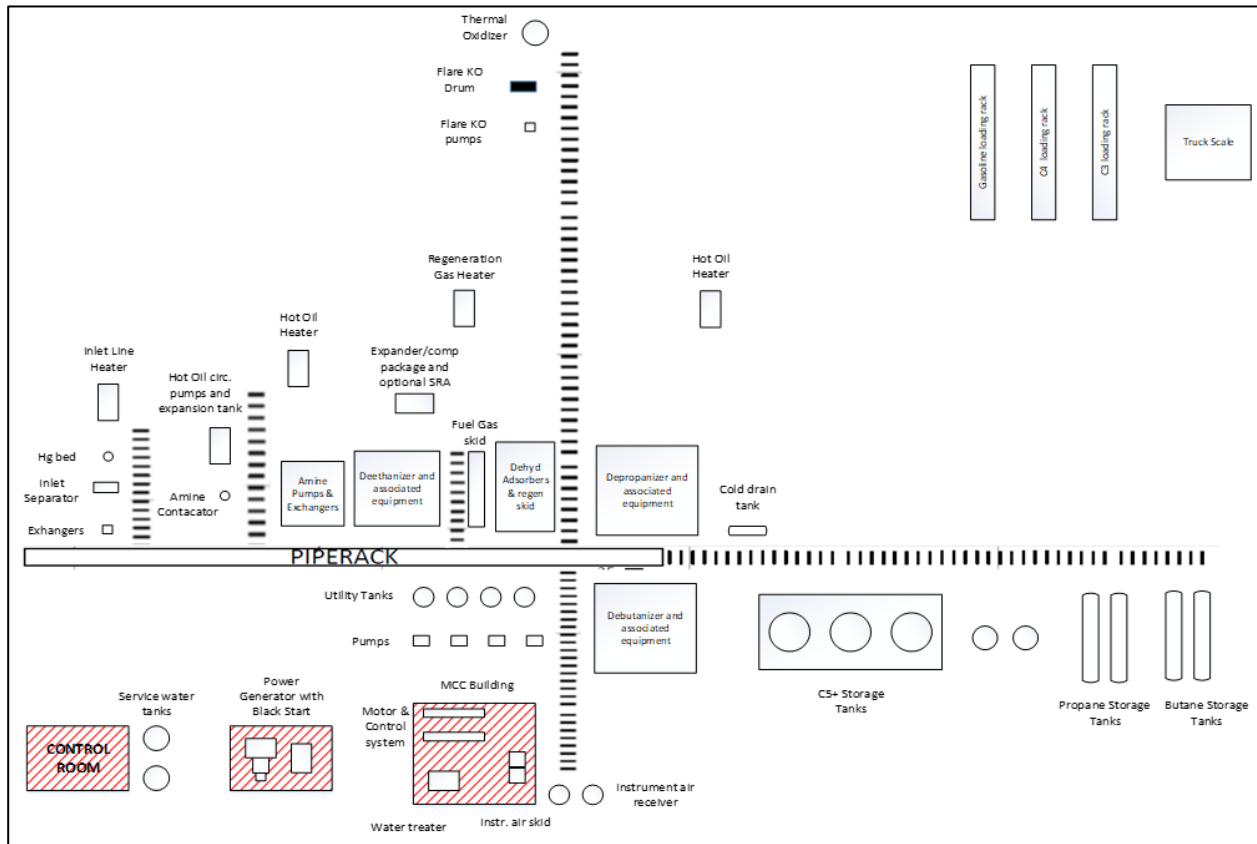
The onshore pipeline will terminate at the Site. The principal infrastructure at the Site will include the following, see Figure 6 as well:

- Metering skids will be part of the design to measure the volume of gas delivered to the Site;
- A pressure let-down station, which will reduce the incoming pressure of the gas stream to the design pressure for gas processing;
- A NGL Plant, which will extract NGL and dehydrate the gas to the specifications required for use as fuel for a planned downstream power plant;
- Back-up generators;
- Ground flare infrastructure<sup>2</sup>; and

<sup>2</sup> Extent and design of this infrastructure remains under consideration subject to design parameters and technical configuration of the Site.



- A metering skid, the outlet of which will serve as the point of custody transfer for the natural gas.



**Figure 6: Natural Gas Processing Plant Infrastructure <sup>3</sup>**

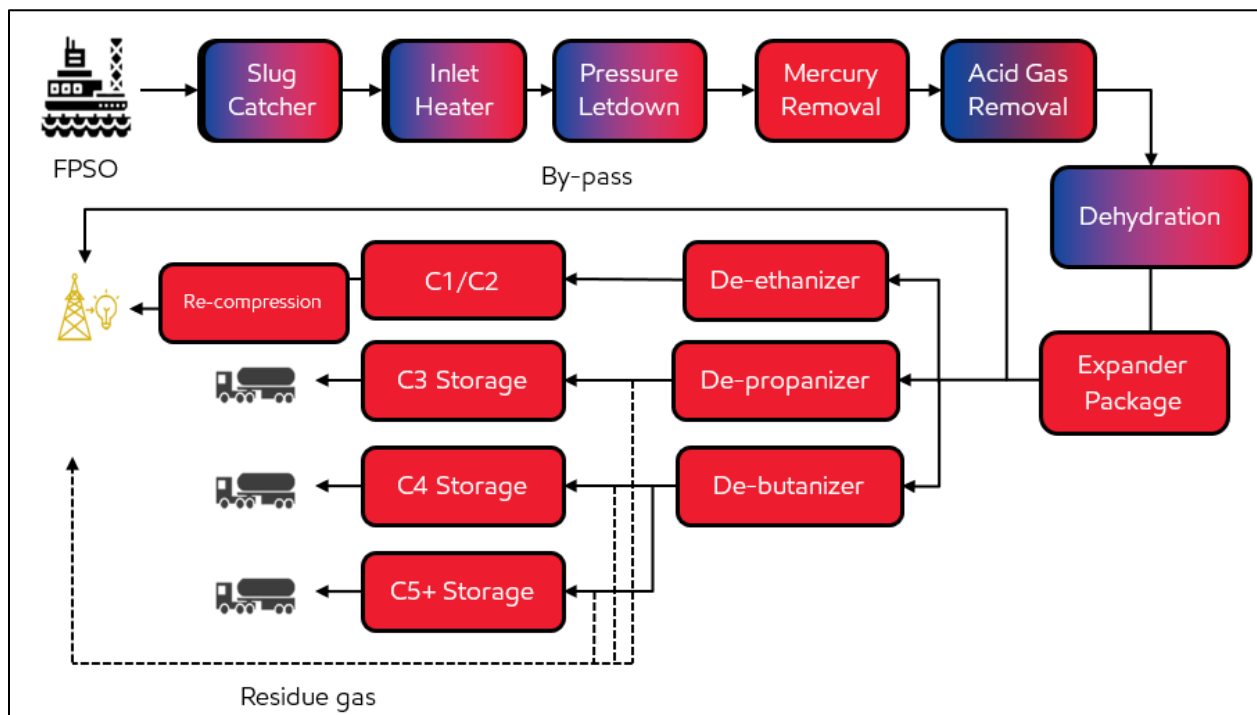
The Site will require earthworks such as clearing, cutting, filling, and soil improvement and site preparation, such as piling. Infrastructure will either consist of skid-mounted equipment packages that will be fabricated outside of Guyana (modular construction) and installed on the Site or “stick build”, meaning that it will be fabricated on the Site. Temporary construction facilities, such as temporary office spaces, eating areas, bathrooms, and rest areas, will also be constructed. A laydown area of approximately 100 acres will accommodate materials storage and construction tools and equipment access and / or storage.

Gas from the Liza reservoir will be separated from the production stream (gas and liquid) at the offshore FPSOs and then sent via pipeline to an onshore NGL Plant in the gaseous phase. The NGL Plant will receive a rich gas feed from the pipeline, sweeten the gas (remove hydrogen sulfide from the stream), separate condensate and NGLs, send methane / ethane gas to the power plant, and fractionate the gas stream into saleable propane, butane, and pentane for the local market. The NGL Plant will consist of an acid gas removal train, dehydration unit, mercury removal train,

<sup>3</sup> Conceptual design, configuration may change through Detailed Design Phase.

cryogenic process, and a series of fractionators whose purpose is to separate a mixture of light hydrocarbons into various pure productions. A schematic of the NGL Plant is provided in Figure 7.

The Site will include utility systems as well, such as chemical and methanol injection systems, instrument / utility air systems, portable / utility water system, a drain system, and a sanitary sewage treatment plant. A water supply will be required for sanitary systems, cooling system makeup, fire protection, etc. Subject to further study, the water may require a water treatment system to treat the water for use within the NGL Plant. Storm water may be directed to detention basins to allow for water to percolate through the soil media before returning to the environment. Oil water separators will be used to treat any oily water. Clean water from the separators may be directed to the detention ponds and oily waste may be trucked off-site for disposal. Sanitary wastewater may be directed to an onsite septic system. EEPGL will work with the local municipality to discuss options for sourcing water supply and the selected alternative for wastewater management for the plant. Once operational, the power plant will be the main source of power for the NGL Plant and emergency generators will be used as back-up. A flare and blowdown system will be included to safely accommodate non-routine flaring.



**Figure 7: Overview of a Natural Gas Processing Plant Process**

A communication and controls network will be established between the NGL Plant and the Integrated Operations Center (IOC) at the Ogle Office Complex to enable high bandwidth, low

latency connectivity between the NGL Plant and offshore FPSOs, and provide remote real time surveillance.

## 2.6. SUPPORT SERVICES

The Project will utilize onshore infrastructure which may include shorebases, warehouses, storage and pipe yards, fabrication facilities, fuel supply facilities, and waste management facilities in Guyana. Such infrastructure will be used to support the construction, installation, production operations, and decommissioning stages. Additional logistical support may be provided by others outside of Guyana, as determined by the Project contractors. Helicopters required for crew changes are planned to be operated out of the Eugene F. Correia International Airport as is currently being done for EEPGL drilling and offshore operation activities. In some cases, crew transfers may occur by marine vessel.

A temporary materials offloading facility (MOF) may be utilized on the west bank of the Demerara River for offloading of heavy modules as well as other imported site construction materials (piles, rebar, etc.). The offloading facility potentially could include a vessel based crane, an offloading barge with riverside mooring points, and a ramp connection to a riverside laydown areas. Dredging and other in-water activities may be required as part of the temporary MOF construction, the extent of which will be identified in future studies and the impacts of which will be addressed in the EIA for the Project. Some degree of construction road development/improvement will likely be required along the onshore pipeline route. The ROW will likely comprise a combination of soil stabilization and temporary hard-surfacing, followed by restoration as directed by the government or private landowner. No major transportation infrastructure improvements are anticipated to be required. The preliminary Project planning basis includes ~10 km of new road construction and ~10 km of minor road improvements for pipeline ROW and Site access.

## 2.7. PROJECT CONSTRUCTION PERSONNEL AND WORKFORCE ESTIMATE

The Project is in the initial stages of planning and design, and detailed estimates of workforce requirements have not yet been developed. Preliminary workforce estimates are provided below. These estimates will be refined following selection and contracting for the offshore and onshore scopes of work. The estimated peak construction workforce will be on the order of 600 persons or less, with accommodation needs served by existing lodging in the greater Georgetown area.

**Table 2-2: Preliminary Workforce Levels**

Project Component/Stage	Preliminary Workforce Level
1) Offshore Pipeline Installation	Approximately 300 workers at peak. Estimate is preliminary and dependent on construction / installation and support vessels selected.
2) Onshore Pipeline Installation	Approximately 100 workers at peak.
3) NGL Plant Construction	~ 300 workforce at peak.
4) Operations	Approximately # 25 at peak.
5) Decommissioning	Approximately # 50 at peak



In addition to the above, there will be a comparatively smaller number of personnel providing shorebase and logistical support onshore. The onshore staff will be expected to ramp up gradually through the mobilization and installation stage until reaching a maximum level during the construction and installation activities, and then diminishing during operations. The onshore staff is expected to increase again briefly during decommissioning. Logistical support is expected to be shared among all of EEPGL's activities.

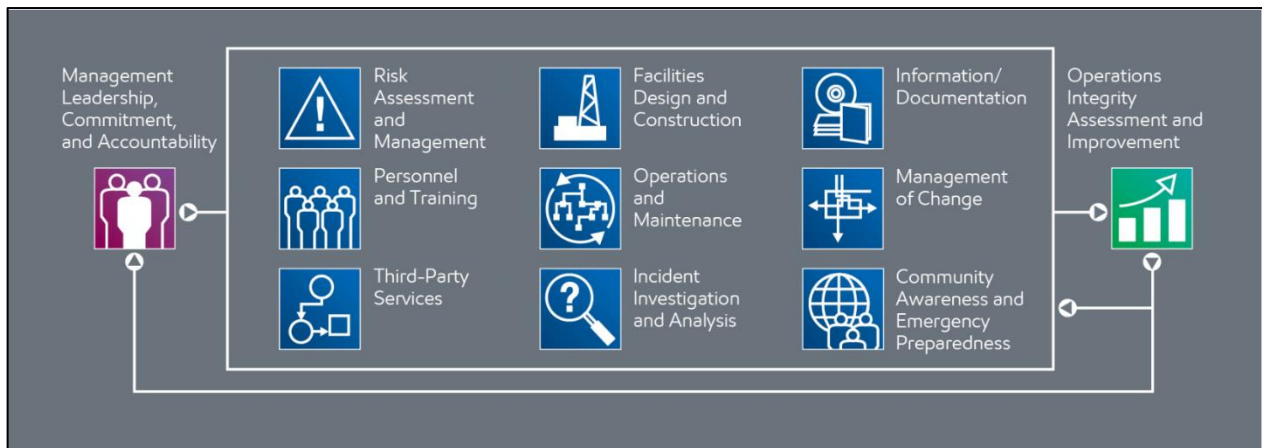
Prior to the end of the Project life, a decommissioning program will be submitted for approval by the government. EEPGL will select, in consultation with the appropriate Guyanese agencies, the final decommissioning strategy based on a comparative assessment, which is designed to evaluate the potential safety, environmental, technical, and economic impacts and associated mitigation measures in order to finalize the decommissioning program.

### 3. ADMINISTRATIVE FRAMEWORK

EEPGL is committed to conducting business in a manner that is compatible with the environmental and economic needs of the communities in which it operates, and that protects the safety, security, and health of its employees, those involved with its operations, its customers, and the public. These commitments are documented in its Safety, Security, Health, Environmental, and Product Safety policies.

These policies are put into practice through a disciplined management framework called the ExxonMobil Operations Integrity Management System (OIMS). The OIMS Framework establishes common expectations used by EEPGL and its affiliates worldwide for addressing risks inherent in their respective businesses. The term “Operations Integrity” is used to address aspects of EEPGL’s business that can impact personnel and process safety, security, health, and environmental performance.

Application of the OIMS Framework is required across all of EEPGL’s affiliates, with particular emphasis on design, construction, and operations. Management is responsible for ensuring that management systems satisfying the Framework are in place. Management system implementation will be consistent with the risks associated with the business activities being planned and performed. A graphical model of OIMS is shown in Figure 8.



**Figure 8: Operations Integrity Management System (OIMS)**

## 4. POSSIBLE EFFECTS ON ENVIRONMENT

EEPGL has identified possible effects from the Project which are related to physical, biological, socioeconomic and, community health, and human environment values. A preliminary list of resources and receptors that could potentially experience effects related to the Project include the following:

- Air quality and climate
- Sound
- Marine geology and sediments
- Marine water quality
- Groundwater quality/quantity
- Terrestrial wildlife and habitat
- Riverine water quality/quantity
- Protected areas and special status species
- Seabirds
- Marine mammals
- Marine turtles
- Marine fish
- Marine benthos
- Riverine wildlife and habitat
- Ecological balance and ecosystems
- Cultural heritage
- Community health and wellbeing
- Employment and livelihoods
- Marine use and transportation
- Social infrastructure and services
- Visual and landscape aesthetics
- Land use
- Ecosystem services
- Indigenous people
- Economy/economic conditions
- Waste management infrastructure and capacity
- Soils
- Coastal habitats

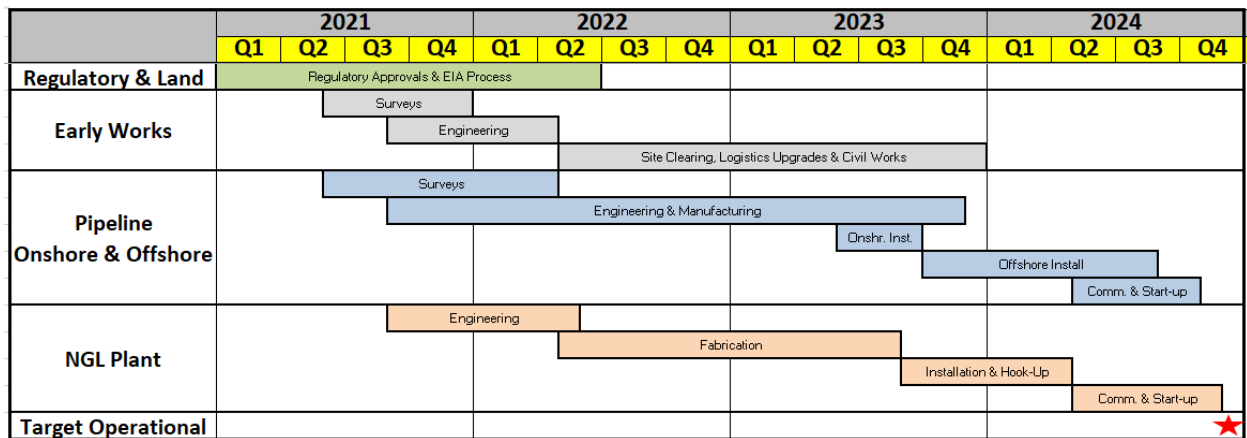
The potential effects could be directly and/or indirectly generated by the Project during construction, operations, and/or decommissioning, and such effects could be adverse or positive in nature. The potential for cumulative impacts exists where impacts from the Project overlap with impacts from other activities affecting the same resources/receptors, including EEPGL's other ongoing or reasonably foreseeable activities and other reasonably foreseeable third-party activities, including the power plant that will be supplied gas by the Project. As such, a cumulative impact assessment will be performed as part of the Project EIA. Additional information on potential effects is included in Attachment A.

As part of any EIA required by the EPA, EEPGL will scope, study, and assess possible effects in its EIA covering the Project per the laws of Guyana, in particular the Environmental Protection Act 1996. Through an EIA, EEPGL and those qualified independent environmental consultants chosen and approved to conduct the EIA would study and assess the significance of possible effects generated by the Project, and would identify mitigation measures and monitoring programs to address any identified adverse impacts of significance.

## 5. DURATION OF PROJECT

The Project lifecycle will include engineering, construction, commissioning, operations and decommissioning. The engineering phase will include design, Front-End Engineering and Design (FEED), and detailed engineering. The construction phase will include procurement, fabrication and construction, installation, commissioning and start-up. Operations will follow commissioning and start-up, and will be the longest phase of the Project with a duration of at least 25 years. Startup of the facilities is expected to occur in 2024.

Figure 9 provides a preliminary sequence of major scheduling milestones for the construction, installation, and commissioning of the pipelines and NGL Plant, however, it is still being refined and is subject to change.



**Figure 9: Preliminary Project Schedule**

## Attachment A - Possible Effects of the Project

Resource or Receptor	Possible Effect	Primary Sources of Possible Effects	How Possible Effects Could Impact Human Life and Environment
<b>Physical Resources</b>			
Air Quality and Climate	Air emissions resulting from the Project have the potential to affect ambient air quality in the Project area on a localized basis and to contribute to greenhouse gas (GHG) emissions.	<ul style="list-style-type: none"> <li>• Emissions from construction equipment and back-up diesel-fired power generation</li> <li>• Emissions from operational point sources</li> <li>• Non-routine, temporary flaring</li> <li>• Pilot flare</li> <li>• Plant emissions</li> <li>• Fugitive emissions from construction or operations</li> <li>• Non-routine, unplanned event</li> </ul>	Localized, increased concentrations of criteria pollutants in ambient air could contribute to health concerns in exposed humans and wildlife. Combustion of hydrocarbons from Project activities would contribute to GHG emissions.
Sound	Subsea sound has the potential to affect sensitive marine fauna (e.g., marine mammals, turtles, and fish) in and along the offshore pipeline route. Onshore sound could cause impacts on nearby communities in the Project area.	<ul style="list-style-type: none"> <li>• Installation of offshore and onshore pipeline</li> <li>• Pressure letdown of gas</li> <li>• Plant construction and operations</li> <li>• Non-routine, unplanned event</li> </ul>	Exposure of humans and wildlife to increased sound has the potential to affect potential auditory injury/behavioral changes or nuisance.
Marine Geology and Sediments	The development has the potential to affect marine geology and sediments along the offshore pipeline route.	<ul style="list-style-type: none"> <li>• Installation of offshore pipeline</li> <li>• Non-routine, unplanned event</li> </ul>	Disturbance of the seabed during offshore pipeline installation activities has the potential to affect benthic habitat and cause death/injury of benthic fauna.
Marine Water Quality	The Project has the potential to affect marine water quality along the offshore pipeline route from construction and hydrotesting discharges.	<ul style="list-style-type: none"> <li>• Installation of offshore pipeline</li> <li>• Marine vessel wastewater discharges</li> <li>• Hydrotesting discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Temporary increased total suspended solids or potential release of chemicals during construction has the potential to affect marine water quality and marine habitat quality and affect wildlife.
Soils	The Project will cause localized disturbance of soils within the Project area.	<ul style="list-style-type: none"> <li>• Installation of onshore pipeline</li> <li>• Construction of shore landing for the temporary Materials Handling Facility (MOF)</li> <li>• Construction of the NGL Plant</li> <li>• Non-routine, unplanned event</li> </ul>	Earthworks to install Project infrastructure will disturb soils, which could have associated effects to receptors utilizing those soils.

<b>Resource or Receptor</b>	<b>Possible Effect</b>	<b>Primary Sources of Possible Effects</b>	<b>How Possible Effects Could Impact Human Life and Environment</b>
Groundwater Quality and Quantity	The Project has the potential to affect localized effects on groundwater quality and recharge of shallow aquifers.	<ul style="list-style-type: none"> <li>• Dewatering of construction sites</li> <li>• Management/infiltration of stormwater</li> <li>• Non-routine, unplanned event</li> </ul>	Dewatering of pipeline trenches or NGL Plant foundation/piling excavations has the potential to affect groundwater flow on a temporary localized basis. Stormwater retention areas will be designed to promote onsite infiltration, which may promote shallow groundwater recharge and cause minor elevation of the water table near the retention ponds.
Riverine Water Quality and Quantity	The Project has the potential to affect the quality of freshwater in the canals along the pipeline corridor from construction- and hydrotesting-related discharges. Construction of the temporary MOF may temporarily impact water quality in the Demerara River.	<ul style="list-style-type: none"> <li>• Installation of onshore pipeline</li> <li>• Construction of the temporary MOF</li> <li>• Hydrotesting discharges</li> <li>• NGL Plant operational discharges</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Earthworks related to construction of the pipeline have the potential for discharge of sediment to canals or drainage features that discharge to the Demerara River. Construction of the temporary MOF will temporarily disturb the riverbed in the Demerara River, causing a temporary increase in turbidity and potentially releasing other materials into the water column. The hydrotesting water discharged from the pipeline at the end of construction could also have temporary impacts on surface water features depending on how the water is managed prior to release. NGL Plant operational discharges could affect water quality in canals and/or the Demerara River.
Terrestrial Wildlife and Habitat	The Project has the potential to affect temporarily terrestrial habitats and wildlife along the onshore pipeline right of way, within the NGL Plant site, and in the riparian habitat in the vicinity of the temporary MOF.	<ul style="list-style-type: none"> <li>• Installation of onshore pipeline</li> <li>• Construction and operation of the NGL Plant</li> <li>• Construction of the temporary MOF</li> <li>• Hydrotesting discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Discharge of hydrotest water to surface water bodies may temporarily displace sensitive species from riparian zones in the vicinity of the discharges. Construction related traffic along ROWs or within the footprint of the NGL Plant may injure or kill terrestrial wildlife. Temporary auditory or water quality impacts in the vicinity of the temporary MOF or NGL Plant may likewise cause displacement of riparian or terrestrial wildlife, respectively, from the vicinity of these activities.

Resource or Receptor	Possible Effect	Primary Sources of Possible Effects	How Possible Effects Could Impact Human Life and Environment
<b>Biological Resources</b>			
Protected Areas and Special Status Species	The Project is not expected to impact Protected Areas. The development could potentially impact some special status species (e.g., endangered or listed species) within the Project area.	<ul style="list-style-type: none"> <li>• Underwater sound generated by marine component operations and activities</li> <li>• Lighting on offshore vessels during pipeline installation</li> <li>• Wastewater discharges</li> <li>• Hydrotesting discharges</li> <li>• Vessel movements</li> <li>• Offshore and onshore pipeline installation</li> <li>• NGL Plant construction</li> <li>• Temporary MOF construction</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Reduction in wildlife habitat quality and disturbance, injury, or mortality of wildlife. Potential declines in local abundance of some species within the Project area caused by decreased water quality and entrainment of early life stages of special status fish species, auditory impacts on noise-sensitive species, injury/death from vessel collisions, and habitat degradation and loss.
Seabirds	The Project has the potential to affect seabirds within the Project area.	<ul style="list-style-type: none"> <li>• Lighting on offshore pipeline installation vessels</li> <li>• Offshore pipeline installation</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Possible direct mortality and injury related to pipeline installation vessel strikes may occur.
Marine Mammals	The Project has the potential to affect marine mammals within the Project area.	<ul style="list-style-type: none"> <li>• Underwater sound generated by marine component operations and activities (mammals, turtles, and fish only)</li> </ul>	Potential acoustic injury to marine biota from Project-related underwater noise, and auditory disturbance of marine mammals.
Marine Turtles	The Project has the potential to affect some marine turtles within the Project area.	<ul style="list-style-type: none"> <li>• Ship strikes</li> <li>• Lighting on offshore pipeline installation vessels</li> <li>• Wastewater discharges</li> </ul>	Potential injury/mortality of marine turtles or marine mammals from collisions with Project-related vessel traffic. Minor potential impacts from decreased water quality on all taxa related to altered water quality in the Project area.
Marine Fish	The Project has the potential to affect some marine fish in the Project area.	<ul style="list-style-type: none"> <li>• Offshore pipeline construction</li> <li>• Hydrotesting discharges</li> <li>• Vessel movements</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Potential injury/mortality of marine turtles or marine mammals from collisions with Project-related vessel traffic. Minor potential impacts from decreased water quality on all taxa related to altered water quality in the Project area.
Marine Benthos	The Project has the potential to affect some benthic habitat and organisms within the Project area.	<ul style="list-style-type: none"> <li>• Installation of offshore pipeline</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Disturbance of benthic habitat in the Project area and potential smothering of benthos within footprint of the pipeline and sediment deposition zones.
Riverine Fish and Wildlife Species and Habitat	The Project has the potential to affect fish and wildlife in the canals and along the Demerara River.	<ul style="list-style-type: none"> <li>• Installation of onshore pipeline</li> <li>• Construction of the temporary MOF, inclusive of dredging</li> </ul>	Earthworks related to construction of the pipeline may cause discharge of sediment to canals or drainage features that discharge to

Resource or Receptor	Possible Effect	Primary Sources of Possible Effects	How Possible Effects Could Impact Human Life and Environment
	Construction of the temporary MOF may temporarily impact water quality in the Demerara River.	<ul style="list-style-type: none"> <li>• Hydrotesting discharges</li> <li>• Operational effluent discharges</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	the Demerara River. Construction of the temporary MOF will temporarily disturb the riverbed in the Demerara River, causing a temporary increase in turbidity and potentially releasing other materials into the water column. Hydrotesting water discharged from the pipeline may have impacts on surface water features depending on how the water is managed prior to release.
Ecological Balance and Ecosystems	The Project has the potential to affect localized changes in marine and riverine nutrient cycles, gene flow, and biodiversity.	<ul style="list-style-type: none"> <li>• Offshore pipeline construction</li> <li>• Onshore pipeline construction</li> <li>• NGL Plant construction</li> <li>• Temporary MOF construction</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	Ecological impacts to marine resources could potentially have ramifications for commercial and/or subsistence fisheries.
<b>Social, Cultural, and Economic Resources</b>			
Cultural Heritage	The Project has the potential to impact cultural heritage through localized disturbance of archaeological or historical sites related to Project development.	<ul style="list-style-type: none"> <li>• Installation of offshore and onshore pipeline</li> <li>• Construction of NGL Plant</li> <li>• Construction of temporary MOF</li> </ul>	Disturbance of the seabed could potentially affect submerged archaeological resources (e.g., shipwrecks). Disturbance of land onshore could potentially affect archaeological resources.
Community Health, Safety, and Security	Introduction of limited levels of foreign specialized labor could potentially have indirect health and socioeconomic impacts from worker presence. The Project could potentially impact community health, safety, and security in the Project area due to onshore traffic or interactions between Project workers and communities.	<ul style="list-style-type: none"> <li>• Increased traffic as a result of development and construction activities</li> <li>• Social interaction between Project workers and residents</li> <li>• Noise and light near shore and onshore by Project operations</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned events</li> </ul>	Increased vehicular traffic, increased demand for limited emergency and health services in Guyana, and a potential increased risk of communicable disease transmission could potentially result from Project activities.
Employment and Livelihoods	The Project is expected to build capacity in the local labor force, increase demand for skilled labor, and increase demand for service industries (beneficial impact). There is the	<ul style="list-style-type: none"> <li>• Local employment for:                             <ul style="list-style-type: none"> <li>– Installation vessels</li> <li>– Site clearance and preparation</li> <li>– Marine support and supply vessels</li> <li>– Onshore construction activities</li> </ul> </li> </ul>	Direct and indirect employment for the Project would enhance livelihoods and family incomes, but could result in some competition with other businesses for skilled workers. Marine/riverine safety exclusion



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	potential for limited adverse impacts on fishing and farming activities.	<ul style="list-style-type: none"> <li>– Other related service industries</li> <li>• Marine/riverine safety exclusion zones</li> <li>• Project-related marine and riverine traffic</li> <li>• Installation vessel and support vessel operations (aspects relating to occupational health and safety for Project workforce)</li> <li>• Non-routine, unplanned event</li> </ul>	zones for the major installation vessels, Project-related vessel traffic, and seabed and onshore land disturbance due to pipeline installation could potentially interfere with fishing and farming activities in certain areas.
Marine and Riverine Use and Transportation	The Project has the potential to affect marine and riverine shipping and general marine/riverine-related traffic, which could potentially contribute to vessel congestion nearshore or in port areas.	<ul style="list-style-type: none"> <li>• Project-related marine/riverine vessel operations</li> <li>• Non-routine, unplanned event</li> </ul>	Increased vessel traffic could result in localized potential congestion nearshore and in the Demerara River during construction, in particular near the temporary MOF; safety exclusion zones around major installation vessels would restrict access by unauthorized vessels.
Social Infrastructure and Services	The Project will use public infrastructure and services and thus could potentially compete with other existing businesses and consumers across a range of services (e.g., roads, medical and emergency response, accommodation, and utilities). The development may result in increased vehicular traffic in Georgetown and communities near the Project site, which could potentially contribute to vehicular congestion in certain areas.	<ul style="list-style-type: none"> <li>• Project demand requirements for selected infrastructure and services, which could overburden existing capacity and supply</li> <li>• Shorebase and temporary MOF operations</li> <li>• Ground transportation operations</li> </ul>	Increased demand for public infrastructure, services, and housing by the Project workforce could influence the availability of these services; increased Project-related traffic could result in localized traffic congestion.
Land Use	The Project has the potential to affect land along the proposed pipeline routes and at the NGL Plant site.	<ul style="list-style-type: none"> <li>• Construction of Project facilities and associated temporary changes to land use</li> <li>• Permanent land use changes within operational Project footprint</li> </ul>	Humans or other receptors utilizing land within the Project construction or operational footprint could experience changes to or loss of benefits deriving from that land use.
Visual and Landscape Aesthetics	The Project will introduce a new feature into viewsheds near the NGL Plant and temporary MOF.	<ul style="list-style-type: none"> <li>• Construction of the NGL Plant</li> <li>• Construction of the temporary MOF</li> </ul>	The industrial nature of the Project’s visual character will be different from the communities and agricultural-dominated landscape adjacent to the Project facilities.

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Ecosystem Services	The development could potentially affect ecosystem services in the Project area as a result of direct impacts to or prevention of access to the resources from which these ecosystem services are derived.	<ul style="list-style-type: none"> <li>• Direct effects to resources from which ecosystem services are derived (e.g., disturbance of resources during construction activities)</li> <li>• Prevention of access to resources from which ecosystem services are derived (e.g., permanent removal of access to Project operational areas that were formally a source of ecosystem services)</li> <li>• Operational effluent discharges</li> <li>• Non-routine, unplanned event</li> </ul>	If resources affected by the Project provide ecosystem services, this could result in indirect effects to these services. As an example, such effects to resources could potentially affect provisioning services particularly for communities that rely on fishing, hunting, and harvesting activities for subsistence and livelihoods. In addition, coastal flood protection services offered by mangrove forests could be affected as a result of removal/disturbance of mangroves during construction. Cultural services could also be affected for some communities that make use of the seashore or river in traditional and/or religious ceremonies.
Indigenous People	The Project is not expected to directly cause any changes to population and demographics in indigenous communities. The development could potentially affect indigenous peoples in the Project area through effects to other resources.	<ul style="list-style-type: none"> <li>• Effects to other resources used by indigenous people in the Project area</li> </ul>	If resources affected by the Project are used by indigenous peoples, this could result in indirect effects to these individuals or populations.
Economy/Economic Conditions	The Project is generally anticipated to have a positive effect on the economy of Guyana as a result of more affordable and reliable electricity, as well as increased local employment and procurement opportunities. Potential adverse effects may include potential shorter-term increases in the cost of living as a result of increased demand for certain goods and services. Potential adverse effects on income from agriculture and fisheries could also occur as a result of presence of Project working spreads during installation and construction, or as a	<ul style="list-style-type: none"> <li>• Provision of gas to a third-party power plant that will supply more affordable and reliable electricity</li> <li>• Local purchases of select materials, goods, and services</li> <li>• Limited local employment (direct and indirect)</li> <li>• Increased spending on select materials, goods and services (indirect multiplier effects for local/regional population)</li> <li>• Installation and construction activities in areas where other economic livelihood activities occur</li> <li>• Removal of access to lands used for other economic livelihood activities</li> <li>• Non-routine, unplanned event</li> </ul>	Positive economic effects could extend throughout the portions of the country that would ultimately have access to electricity generated from the third-party power plant. Positive effects related to local purchasing and employment could potentially affect all segments of the population. Potential adverse effects related to temporary interference with other livelihood activities or removal of access to lands used for such would be limited to the construction and operational footprints of the Project, respectively.

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	result of permanent land use/access changes.		
Waste Management Infrastructure Capacity	The Project could potentially stress the capacity to manage wastes in Guyana.	<ul style="list-style-type: none"> <li>• Project-generated wastes requiring off-site treatment, storage, or disposal</li> </ul>	If the capacity in Guyana to properly treat, store, or dispose of waste is overburdened by Project demands, this could affect the ability to properly accommodate treatment, storage, or disposal needs by other parties.