2.4 Description of Facilities

The facility will be designed for LNG transfers, storage and reloading onto LNG carriers (LNGC), for transshipment to market destinations. The Project will consist of a tank farm of eight LNG storage tanks, interconnecting flow lines, re-liquefaction equipment, vaporization and power generation, support facilities, a waste water handling system, a fire protection system, three LNGC berths and a tug basin. The facility will also be designed to allow ship-to-ship transfer of LNG. The facilities will include onshore and pier fire fighting capability and onsite spill containment and clean-up equipment.

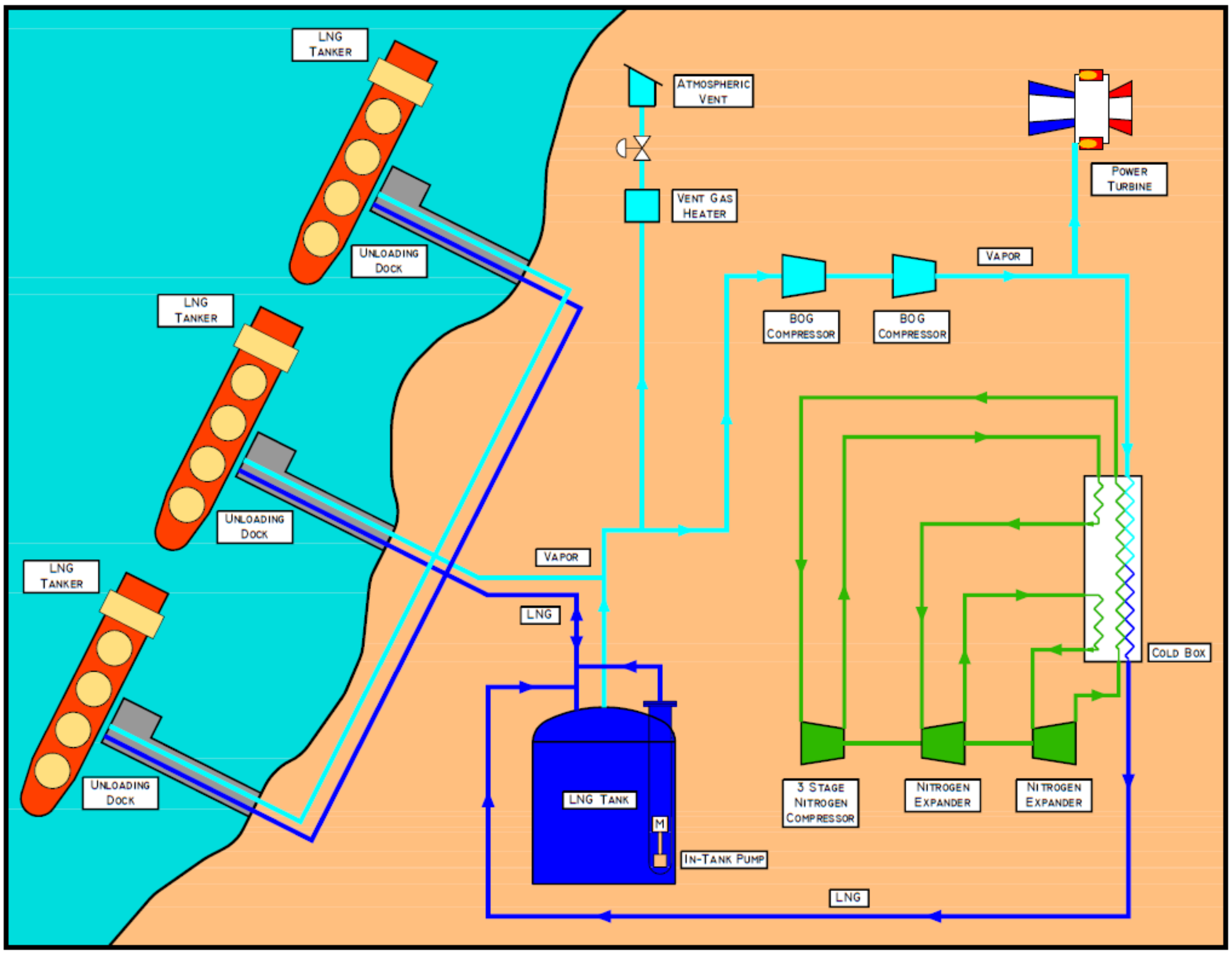

Figure 2.1 Liquefied Natural Gas Transshipment and Storage Terminal Schematic

The proposed Project facilities are as follows:

- Three piers each with service platforms and transfer arms
- Tug basin
- LNG pipeline from each pier to the LNG storage tanks
- Eight 160,000m3 to 200,000m3 LNG storage tanks
- In tank LNG pumps
- Cryogenic compressors

- Cryogenic blowers
- Boil-off gas (BOG) compressors
- Fuel gas system which includes LNG pumps and vaporizers
- Nitrogen re-liquefaction system for LNG BOG
- Seawater pumps
- Cooling water pumps
- Fire suppression system
- Gas turbine power plant
- Various plant support auxiliary systems, including waste water handling system
- Various safety systems including fire, gas and low temperature detection

The main processes of the facility are as follows:

- LNG transfer systems to and from LNGC's and LNG storage tanks
- LNG storage
- BOG re-liquefaction systems
- Ship-to-ship transfer of LNG
- Power generation

2.4.1 Facilities Overview, Layout and Footprint

The Project will consist of eight LNG storage tanks with impoundments, a re-liquefaction process area, three piers for the LNGCs, a power generation area to serve the facility and various ancillary buildings as required to support the facility. The facility is designed to provide LNG transshipment from one LNGC to another as well as provide on-site storage and re-liquefaction capacity for the BOG. The facility will accommodate LNGC's up to 265 000 m^3 in capacity. All pier's will be able to support side-by-side docking of two LNGCs.

Access to the site will be via a secondary road off the main highway. The developed area of LNG facility will encompass approximately 115 hectares.

A plan view of the LNG facility layout is presented in Figure 2.12 (below). (Need to provide drawing of Grassy Point LNG Facility)

Figure 2.12 General Arrangement LNGas Marine Terminal and Facility

2.4.2 LNG and Natural Gas Characteristics

2.4.2 LNG and Natural Gas Characteristics

LNG and natural gas are clear and odorless compounds. Both are a gas at room temperature, but, of course, LNG is processed as a cryogenic liquid. While natural gas supplied by utilities is normally odorized by adding mercaptan, LNG and natural gas associated with an LNG ship and an LNG terminal is not odorized except in some cases fuel gas may be odorized. Therefore, sense of smell cannot be depended upon to detect leaks. Operations personnel will have portable leak detectors and fixed-point leak detectors to use for monitoring the process.

Natural gas contains mostly methane (CH_4), but also contains many impurities when it is first received from its source. These impurities (impurities from an LNG standpoint) include ethane, propane, butane, pentane, hexane plus, nitrogen, water, sulfur compounds, nitrogen, carbon dioxide, and trace amounts of others. At ambient temperature and low pressure, these impurities do not significantly affect natural gas handling. However, at elevated pressure some impurities such as water will begin to condense and will form hydrate that may plug equipment. Further, as natural gas is cooled to cryogenic temperature, water and carbon dioxide will freeze and plug equipment. Therefore, one of the most important steps in the LNG product chain is the purification step before liquefaction. To be processable LNG must be primarily methane (C_1). Small amounts of hydrocarbons (C_2 - C_6) and nitrogen are acceptable, but water, carbon dioxide, and sulfur compounds must be near or completely absent. Natural gas composition varies around the world. Therefore, LNG from different areas tends to have differing compositions. The following table lists representative LNG compositions.

Table 2.4.2-1 Typical LNG Composition

Component	Typical LNG Import (%)
C_1	86-95
C_2	4-14
C_3-C_5	3-7
C_6+	0.5-1
N_2 + CO_2	0.1-1
Gross (Higher) Heating Value	1050-1200 (Btu/ft^3)

GTI World LNG Source Book (2001) and Zeus Development Corp. (June 2003)

Natural gas is purified and converted to LNG so that this energy source can be shipped economically. LNG occupies 1/600th the volume of its source gas. Unlike heavier hydrocarbons, methane cannot simply be liquefied by increasing its storage pressure. Methane first must be cooled below its critical temperature before it can be liquefied at any pressure. Generally, LNG is handled at approximately atmospheric pressure. This low pressure dictates that the LNG temperature is about -259°F (-161°C). LNG weighs 42-47% (42-47 kg/m^3) of an equal volume of water (1000 kg/m^3). Cold LNG vapor, or natural gas, is heavier than air (specific gravity 1.52) and therefore, will sink. However, once LNG vapor has heated to about -100°C it becomes lighter than air and will rise. LNG vapor's flammability range in air is 5-15%. Outside this range, ignition will not occur. LNG liquid itself is non-flammable.

The properties of LNG and the fact that it is stored at low pressure make a pressure-related tank rupture/explosion very improbable. Instead, an LNG leak from a low-pressure source, such as a large LNG storage tank, may form a boiling pool on the ground (usually inside a spill containment area). LNG vapor liberated from the pool will dissipate into the atmosphere as it warms. There will be a flammable zone in the vapor cloud where the vapor composition is 5-15%. If ignition occurs, the vapor above the pool will burn, but not the liquid. This can make for a significant localized fire, but, because LNG liquid will not burn, the fire will not enter a liquid-filled tank space nor will fire propagate into an oxygen-deficient vapor space. Thermal radiation exclusion zones and impoundment areas are sized to minimize or eliminate the impact of a fire on adjacent property.

If ignited, LNG vapor burns slowly relative to some other fuels. Therefore, the flame front associated with an LNG vapor cloud ignition travels relatively slowly and, if in an open space, results in a deflagration-type (low overpressure and slow flame front) flash fire. LNG vapor must be confined when ignited to cause significant overpressure and damage.

There is no standard temperature where the cryogenic realm is considered to start. Some consider -100°C as entry into the cryogenic temperature range while others consider -150°C or -180°C the entry point into the cryogenic temperature range. When speaking on an industrial scale, LNG is considered a cryogenic liquid. Cryogenic fluids can cause cold burns to skin and special materials of construction are required for process equipment in contact with cryogens such as LNG. Generally, certain metal alloys that contain face-centered-cubic (fcc) ingredients such as aluminum, copper, nickel, and austenitic stainless steels are used for cryogenic applications because they are ductile at very low temperatures. 9% Ni steel is often used for LNG storage tank inner vessels. Carbon steel, for example, is an unacceptable primary LNG containment metal because it is very brittle at cold temperatures.

Heat always migrates from higher temperature to lower temperature. In an LNG process, therefore, heat in-leak to the process from the surrounding environment is always occurring. Insulation and, in some cases, vacuum application to an annulus between two pipe or tank walls are used to reduce heat in-leak. Heat in-leak's effect is an important consideration because heat that leaks into the system must be removed from the system. Outside of sub-cooling a portion of the LNG and reinserting it into the tank to take up heat, heat removal from LNG storage is done through generation of boil-off gas (BOG). Boil-off gas is inherent to the processing and storage of cryogenic liquids and results from heat in-leak providing latent heat of vaporization energy to the liquid. Boil-off gas is valuable and it is a greenhouse gas. Therefore, in this project, boil-off gas will be collected and reliquefied or used for power production. Boil-off gas will not normally be vented to atmosphere.

2.4.3 Design Standards and Activities

2.4.3.1 Standards

Where applicable, the design and construction of the LNG facility shall be in compliance with the following standards, codes and design guides.

1.0 AASHTO American Association of State Highway and Transportation Officials
2.0 AISI American Iron and Steel Institute
3.0 ANSI American National Standards Institute
4.0 API American Petroleum Institute
5.0 API RP 2A-LRFD Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Load and Resistance Factor Design
6.0 API SPEC 2B Specification for Fabricated Structural Steel Pipe
7.0 API 5L Specification for Line Pipe
8.0 API PUB 5L Guide for Application of Water Spray Systems for Fire Protection in the Petroleum Industry

9.0 ASTM A307 Carbon Steel bolts and Studs
10.0 ASTM A325 Structural bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
11.0 BS 6349: Part 1 : British Standard Code of Practice for Maritime Structures – Part 1 General Criteria
12.0 BS 6349 : Part 2 : British Standard Code of Practice for Maritime Structures – Part 2 Design of Quay Walls, Jetties & Dolphins
13.0 BS 6349 : Part 4 : British Standard Code of Practice for Maritime Structures – Part 4 Design of Fendering and Mooring Systems
14.0 Canadian Foundation Engineering Manual
15.0 Canadian Electrical Code C22.1 & C22.2
16.0 CAN/CSA-S6 : Canadian Highway Bridge Design Code (CHBDC)
17.0 CSA A23.1 : Concrete Materials & Methods of Concrete Construction
18.0 CSA A23.2 : Methods of Test for Concrete
19.0 CSA A23.3 : Design of Concrete Structures
20.0 CSA A23.4 : Precast Concrete – Materials and Construction
21.0 CAN/CSA-S16.01 : Limits States Design of Steel Structures
22.0 CAN/CSA G40.20 General Requirements for Rolled or Welded Structural Quality Steel
23.0 CAN/CSA G40.21 Structural Quality Steels
24.0 CSA S37 : Antennas, Towers and Antenna Supporting Structures
25.0 CSA Z276-01 : Liquefied Natural Gas (LNG) – Production, Storage & Handling
26.0 CISC Handbook of Steel Construction
27.0 CISC Design Guide for Hollow Structural Section Connections and Trusses
28.0 CPCA Concrete Design Handbook
29.0 CSA Z299.3 : Quality Verification Program Requirements
30.0 NBCC National Building Code of Canada
31.0 NFCC National Fire Code of Canada
32.0 NFPA National Fire Protection Association
33.0 Fire Commissioner of Canada FC No. 373 Standard for Piers and Wharves
34.0 OCIMF : Oil companies International Marine Forum
35.0 SSPC Steel Structures Painting Council
36.0 Transport Canada TP 743 : Code of Recommended Standards for the Safety and Prevention of Pollution for Marine Transportation Systems and Related Assessment Procedures (TERMPOL CODE)
37.0 Workplace Hazards Materials Information System (WHMIS)

2.4.3.2 Hazard and Operability Analysis

CSA Z276-01, the Canadian Labour Code(s), Provincial Labour Code(s), and good engineering/operating practice require procedures to be established and measures to be taken to help ensure an LNG facility is designed, constructed, and operated in a way that keeps the public, the environment, and the on-site workers safe. One element of a safe design is the team-based process hazards analysis (PHA). The HAZOP (hazards and operability) analysis is a generally accepted design analysis technique in industry that is applicable to large LNG projects. During the FEED stage, as sufficient design information is completed, a HAZOP will be performed. The following information and resources will be included in the HAZOP:

- Process Flow Diagram (PFD) that will show flow rates, temperatures, pressures, inventories, and key process equipment and piping
- Process and Instrumentation Diagrams (P&ID's)
- Plant Layout that indicates locations of buildings, roads, process equipment, property lines, marine facilities, major piping, sensitive environmental areas (if any), and thermal radiation and vapour exclusion zones that were determined per CSA Z276-01 guidelines
- LNG properties and potential hazards (as well as information about any other relevant compounds)
- Relevant guidance documents, such as CSA Z276-01 and API 752, that relate to facility siting and layout as well as a checklist(s) to facilitate an analysis of the facility's layout
- Written process, facility, and safety systems description
- Brief training in the PHA methodology for most team members (the facilitator will be formally/thoroughly trained)
- Team members that include engineering, operating, maintenance, instrumentation, and control personnel with experience in the process
- A trained, independent facilitator
- A means to document the team's review and findings
- A list of previous incidents related to the type of facility/process being constructed
- Guidance on risk ranking methodology

HAZOP is a structured design analysis method that involves dividing the process into small units called "nodes", describing the intended operation of each node, and determining the possibility and severity of consequences for deviations in each node's operation. For example, for a pumping/piping system, a common possible deviation is "no flow". When considering this deviation, the team will evaluate the causes, consequences, and safeguards associated with an unintended interruption in the normal flow through the node. If the team deems the present design and procedures adequate to safely accommodate the deviation, they will simply document their discussion/finding and move to the next deviation or node. However, if the team thinks an improvement in the design is warranted or possible, they may make recommendations for design changes or request further investigation into possible design changes. The HAZOP team's objective is to identify possible design deficiencies or oversights, but not necessarily to solve design problems that may be outside their expertise or time allotment. Therefore, management, after due study and consideration of each team recommendation, may implement the recommendation, implement an alternative, or choose not to implement any changes regarding a particular recommendation. Management will document their response to each team recommendation as part of the HAZOP follow-up process.

2.4.3.2 Seismicity

The LNG Transshipment Facility will be designed in accordance with the seismicity requirements of the NBCC and CSA Z276-01 codes.

2.4.6 Pier and Transfer Facilities

The LNG facility will be constructed with three piers that will be outfitted with applicable LNG transfer equipment. The transfer platforms for each pier will be interconnected to shore via an elevated access trestle. The exact configuration of the piers is currently under design review.

Only LNG product will be transferred between vessels or to and from the land based LNG storage tanks.

2.4.6.1 Pier

Each pier will be capable of berthing a 140,000 m^3 and 265,000 m^3 LNG vessel. The construction of the three berths will be phased in over the duration of the Project.

Each pier will be similar in construction and will consist of a service platform, mooring dolphins, berthing dolphins, access trestle connecting the loading platform to shore and walkways connecting the mooring and berthing dolphins.

The three piers will include facilities for the receiving, unloading and loading of LNG product from LNG carriers. The piers will have safety design features including quick disconnect transfer arms and quick release mooring hooks.

Each pier will be constructed with the following structures and features:

- service platform approximately 30 m x 30 m;
- two berthing dolphins approximately 9 m x 12 m;
- four mooring dolphins approximately 6m x 8 m;
- steel truss catwalks connecting the dolphin structures;
- access trestle capable of carrying vehicle traffic and LNG pipe racks;
- quick release mooring hooks;
- spill containment equipment;
- fire fighting equipment and fire monitors; and
- electrical supply and lighting.

Each pier will have four mooring dolphins; two on either side of the service platform. The mooring dolphins will be designed to withstand forces created by wind, waves and currents on the LNG carriers. Each mooring dolphin will be equipped with:

- triple quick release hook assemblies with powered capstans; and
- handrail and bull rails.

Each pier will have two berthing dolphins, which are designed to absorb the berthing forces of the LNG carriers. The berthing dolphins will be equipped with energy absorbing fenders.

Sub-Structure

The sub-structure support for the service platform, dolphins and access trestle will be steel-pipe-piles which are driven into the bedrock and grouted to the pile caps. An optional structural configuration would utilize pre-fabricated steel jackets. The final selection of the structural system will be determined upon completion of the geotechnical surveys, engineering design and costing exercises.

All piling will consist of steel pipes which are driven/drilled into the bedrock. Piles under tension loads will have to be fixed to the seabed by grouting anchors into the pile annulus and drilling and grouting the anchors into the bedrock. All drill cuttings will be returned to the drilling barge and discharged onshore in accordance with regulatory requirements.

Superstructure

The superstructure of each of the marine structures will consist of a combination of pre-cast concrete elements combined with in-situ concrete. Concrete bases will be provided for mechanical equipment. Handrails and bull rails will provide protection along the perimeter of the service platform, mooring dolphins and berthing dolphins.

Service Platform

Each service platform will be equipped with four loading arms. Three arms will be dedicated for LNG flow and one for vapour return. The service platform will be accessible for vehicle traffic and will be equipped with:

- a control station
- pipe racks
- mooring hooks to handle the vessel spring lines
- cranes
- lighting and electrical distribution systems
- navigational aids
- cathodic protection
- communications equipment
- fire detection and fire fighting equipment
- gas detection systems

Access trestle

An access trestle will serve to provide a support system for the pipe racks, mechanical systems, electrical trays and vehicle traffic. The trestle lengths will vary with each pier. The overall width will be sufficient to provide one way vehicle traffic, pedestrian right of way, pipeline and other utilities.

Trestles will be constructed of steel plate girders with pre-cast deck elements. Piping and utilities will be supported by a steel truss structure. The trestle will be supported on a concrete pile cap supported on steel pipe piles. Elastomeric bearing pads will be provided under each of the trestle bearing points.

Access Walkways

Steel truss walkways will link the service platform, berthing dolphins and mooring dolphins. The walkways will also carry the cable trays for electrical conduits for power, navigation aids and piping for LNG product.

Tugboat Berth

A dedicated tug berth will be provided for the mooring of four tugs. Typical services such as fuel and water will be provided at this berth.

2.4.6.2 LNG Transfer Arms

LNG transfer arms, used for both loading and unloading LNG carriers, will be installed at each of the three piers associated with this project. LNG carriers ranging in capacity from 140,000 m^3 to 265,000 m^3 are included in the design basis for the pier and loading arms. Each berth will have four 500 mm (20”) LNG transfer arms (one vapour, three liquid). The piping system and pumps will be designed for a maximum transfer rate of 15,000 m^3 per hour and such that LNG can be transferred from onshore tanks to ships, from ships to onshore tanks, or from ship to ship. Typical transfer arms are displayed as connected in Figure 2.4.6.2-1.

Figure 2.4.6.2-1 Typical Transfer Arms

Figure 2.4.6.2-2 PERC Installations

Safety and operability of the transfer arm connection process and pier facilities will be enhanced by quick connect/disconnect couplers, powered emergency release couplings (PERC’s), hazard detection instruments, emergency and automatic shutdown systems, remote monitoring devices, increased personnel attendance during LNG transfers, and fire extinguishing equipment. Figure 2.4.6.2-2 and 2.4.6.2-3 show a PERC design and quick connect/disconnect coupler. The PERC's are used for emergency quick disconnect of the ship-to-shore piping connections. The quick connect/disconnect couplers are used to align and connect the unloading arm flange and the ship's flange during hook-up. The quick connect/disconnect couplers will enhance efficiency and worker safety during the ship-to-shore connection process.

Figure2.4.6.2-3 Quick Connect/Disconnect Coupling

A containment area consisting of concrete curbs and a sump will be constructed around the transfer arms to contain any spilled LNG. A sump pump will pump the LNG ashore.

2.4.7 LNG Storage Facilities

2.4.7 LNG Storage Facilities

Storage facilities include LNG storage tanks and their associated containment systems, which are explained in the following sections.

2.4.7.1 LNG Storage Tanks

There will be eight LNG storage tanks. The nominal capacity of each tank will be between 160,000-200,000 m^3. The proposed LNG storage tanks are single-containment, double-wall, metal tanks. However, the containment type will be determined after further review of the available space and layout availability. The inner tanks will be made of 9% nickel steel with either a carbon steel or concrete outer shell. The tank design pressure will be 2 psig.

The tanks will be insulated with perlite in the annular space between the walls, cellular foam glass blocks on the bottom and fiberglass blanket on the suspended deck. The tank and insulation systems will be designed to limit the heat leak such that the maximum boil-off gas generated from the tank will be 0.05% of the tank's volume. The inner tank will contain LNG and will operate at cryogenic temperature. The outer wall will contain the vapor and will fully enclose the insulation and inner tank. This is the most common LNG tank type in North America. The tanks will be designed, constructed, and tested per CSA Z276 and API 620.

The LNG tanks will be equipped with level devices, pressure/vacuum relieving devices, pressure make-up system, remote monitoring capability, overfill prevention interlocks, pressure and temperature indication, and LNG density profiling capability to detect stratification. The piping systems will be designed so that LNG can be re-circulated or loaded from both the top and bottom to help prevent stratification. Fire/leak detection and fire extinguishing equipment will be sited throughout the tank area to detect and mitigate leaks and fires. There will be no below-liquid-level tank penetrations. This is possible due to the incorporation of submersible LNG "in-tank" LNG pumps that will be installed inside the inner tanks and discharge through the top of the tanks. Eliminating below-liquid-level penetrations reduces the likelihood of LNG leaks.

As with any LNG storage or handling operation, boil-off gas will be generated by heat input to the LNG from the environment and from processing operations. The boil-off gas will be controlled by the use of boil-off compressors that will pull the vapors from the LNG storage tanks and send the vapors to the fuel gas system, back to the tanker, or to the re-liquefaction units. For upset conditions, there will be a heated vent gas system which will be tied to all LNG storage tanks and will vent to atmosphere at a safe location.

2.4.7.2 Storage Tank Containment

Secondary containment for each LNG storage tank will be provided by an independent bund wall impoundment system designed as per CSA Z276-01, section 4.2.2. The impoundments will be designed to hold the full contents of each LNG tank plus a 10% allowance for precipitation accumulation. Some equipment may be sited inside an LNG tank's impoundment area. The holding volume of the impoundment will be designed to account for any volume lost to equipment foundations.

The impoundments will be designed per the seismic criteria contained in CSA Z276-01 and will, therefore, maintain their structural integrity and spill containment capability for the safe shutdown earthquake (SSE).

Water accumulation is inevitable due to precipitation from weather conditions. Therefore, a means to pump water from the impoundments will be installed at a low point or sump in each containment area. These pumps will contain low temperature sensors and gas detection equipment to detect any spilled LNG and prevent the accidental pumping of LNG out of the impoundment area.

2.4.8 Re-liquefaction Facilities

The re-liquefaction facilities will include the refrigerant and liquefaction system and boil-off gas/vapor handling system.

2.4.8.1 Re-liquefaction

Most LNG terminals conventionally have offloading and re-gasification of LNG flowing into a natural gas pipeline to a local market. Grassy Point is a transshipment and storage terminal and, as such, does not have an outlet for the boil-off gas/vapors (BOG). BOG can be partially used for fuel gas for local power generation needs but will require facilities to re-liquefy much of the BOG and return it as LNG to the storage tanks.

Since the Grassy Point location does not have a natural gas pipeline to provide an outlet for the boil-off gas/vapors, a re-liquefaction system will be installed to re-liquefy the boil-off and return the LNG to the storage tanks. There will be four re-liquefaction trains installed for this process.

Each re-liquefaction train will consist of a nitrogen refrigerant system, which will include compression and expanders. Each train will have a cold box where heat is exchanged between the boil-off gas and refrigerant, cooling the boil-off gas to a point it condenses into a liquid (LNG). The refrigerant system will also include one to two nitrogen generation units.

Each cold box will have containment underneath and any LNG spill would be contained. There will be a containment trench sloped from each cold box to a process impoundment area.

Prior to entering the cold box, boil-off gas/vapors will be compressed to approximately 750 psig through the boil-off gas compressors. The pressure of the LNG flowing from the cold box will then be reduced and sent to the LNG transfer headers to the LNG tankers and storage tanks. See schematic of re-liquefaction system in Figure 2.4.8.1-1 below.

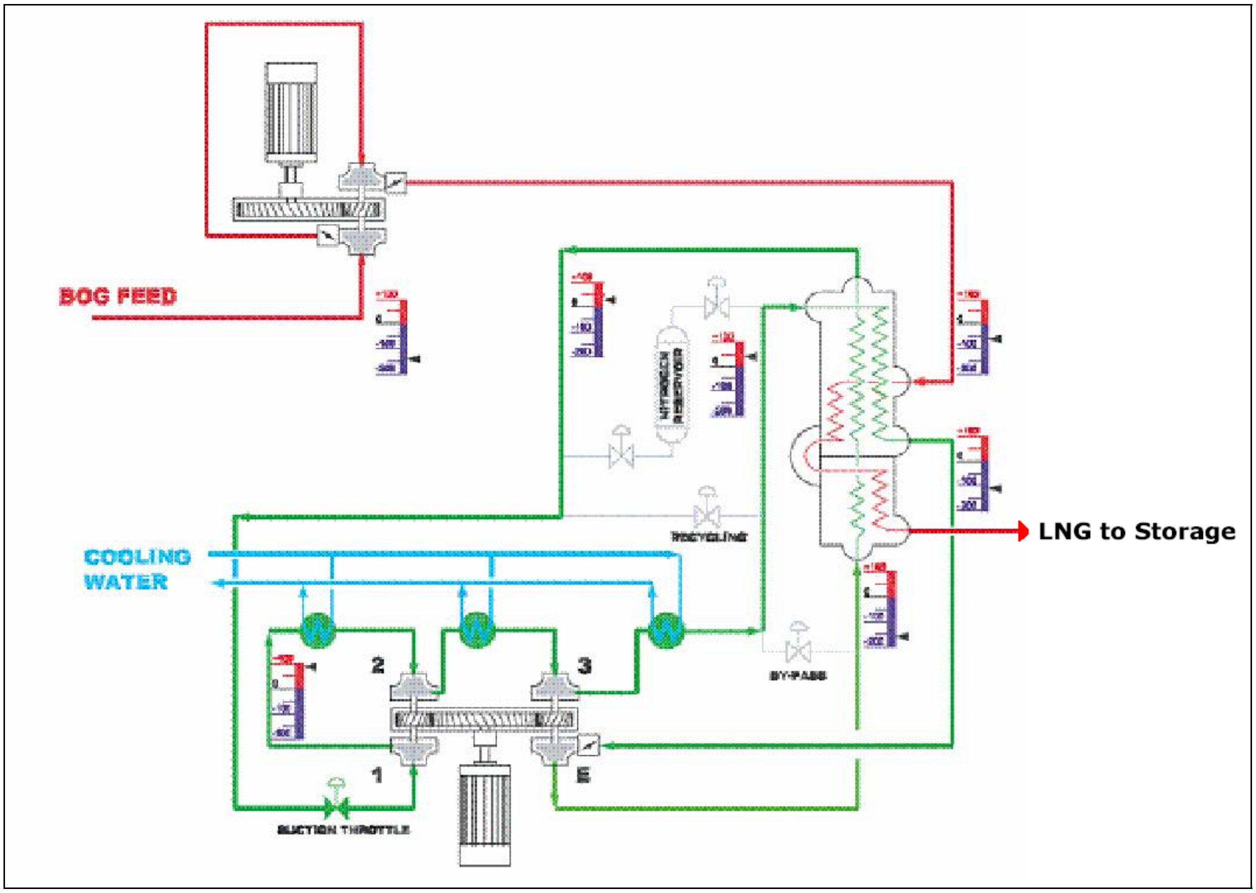

Figure 2.4.8.1-1 Schematic of Re-liquefaction System

The re-liquefaction system and boil-off gas compressors will require cooling. A closed loop water/glycol system utilizing propylene glycol will be used to provide cooling to inter-stage and after-stage heat exchangers. This system will comprise of pumps, interstage and after-stage heat exchangers, expansion/surge tank and seawater heat exchanger(s). A seawater once-through cooling system will be utilized to remove heat from the closed loop water/glycol system. The seawater cooling system will include seawater intake, pumps, heat exchanger(s) and discharge piping.

Boil-off Gas and Vapor Handling Systems

During tanker transfer, boil-off gas is created in greater quantities. These vapors are generated by heat in-leak from the environment, heat from mechanical input, and displacement when filling a ship or storage tank. The storage tanks or ship being emptied requires vapor to be returned to fill the void from the liquid being transferred.

Cryogenic Blowers

Cryogenic blowers will be installed to move displacement vapors back to the ship when unloading LNG. The ships will have blowers onboard to move vapors back to the storage tanks. These blowers will increase the pressure to approximately 10 to 18 psig.

Boil-off Gas Compressors

Both cryogenic and non-cryogenic compressors will be installed to increase the boil-off gas/vapor pressure to approximately 750 psig. The boil-off gas discharge from these compressors will then flow into the fuel gas system or to the re-liquefaction system.

Vent Gas System

A vent gas system will be provided which will include an atmospheric vent stack and a heated water/glycol loop to heat the vapors before they enter the vent stack. This system is intended to operate during unusual circumstances such as power outage. During a power outage, the boil-off gas generated in the storage tanks will not be re-liquefied due to lack of power to the refrigerant compressor. A back-up generator will provide power to supply boil-off gas compressor (for fuel gas), water/glycol heater, pumps and control system.

During these periods, the boil-of gas will enter the vent gas system and go through a heat exchanger which will transfer heat from the heated water/glycol to the boil-off gas. The boil-off gas will then be vented through the vent stack to the atmosphere. This heating process is intended to warm the vapors to a temperature such that the vapors will be lighter than air which will rise into the atmosphere.

The water/glycol system will include two hot water heaters, pumps, expansion/surge tank and plate-fin heat exchanger. The system will utilize propylene glycol and will be common with the water/glycol system required for the fuel gas systems as well. A third hot water heater will be installed for the fuel gas system as well as additional pumps.

Fuel Gas System

The fuel gas system will provide fuel for the hot water/glycol heaters and the power generation equipment. During idle periods and periods when LNG is being transferred, boil-off gas vapors will supply all of the fuel gas requirements. However, prior to LNG transfer operations, the re-liquefaction process will be started for cool down. During this period, the amount of boil-off gas vapors will not be enough for power generation. Therefore two shell and tube LNG vaporizers and pumps will be installed to supplement the fuel gas system during these periods. Once LNG transfer begins, the boil-off gas generated will be more than enough to supply the fuel for power generation and the LNG vaporizers and associated pumps will shut down. A heated water/glycol loop will provide the heat for LNG vaporization.

2.4.9 Fire Prevention, Control and Prevention

Fuel, oxygen, heat and an ignition source must be present for a fire hazard to exist. Eliminating any one of these four factors can control fire hazards. Correcting leaks, controlling venting and preventing spills of LNG can reduce or eliminate the fuel. Purging vessels and piping with an inert gas prior to the introduction of LNG or natural gas vapour will reduce the oxygen concentration to below the explosive range. Proper location and control of equipment and traffic can control ignition sources. It should be noted that although methane or natural gas has a relatively high ignition temperature (above 538°C), it requires very little energy to ignite a combustible natural gas mixture.

A potential cause of fire in a LNG facility can be due to escaping gas. This may be due to leaks, upset conditions resulting in a pressure safety valve (PSV) discharge, spills or improper storage of flammable materials. Leaks and spills will be predominantly in areas where flammable equipment handling flammable material is located. The source starting the fire could be due to static electricity, lightning, or sparks.

2.4.9.1 Dry Chemical Fire Extinguishing System at each LNG Storage Tank

- The dry chemical extinguishing systems shall be designed, constructed and installed in accordance with NFPA-17.
- It is assumed at this time that each LNG storage tank shall have two pressure relief vents, each approximately 300 mm by 400 mm.
- Nominal 909 kg dry chemical skid mounted system with 818 kg of Purple K dry chemical agent mounted on top of each LNG storage tank to protect the tank vents.
- Four (4) nitrogen cylinders mounted on the skid shall provide the system pressure.
- The skid shall be pre-piped prior to arriving on site.
- The skid shall include a corrosion control package to enable it to be mounted outdoors in a marine environment without fear of corrosion.
- The preliminary anticipated tank relief vent flow rate to be 5.89 cubic meters per second. This is the total for both vents.
- Discharge nozzles shall be aimed at a point 300 mm above the top of each vent.
- Discharge nozzles shall be located a maximum of 300 mm below the top of each vent stack.
- Nozzles and piping shall be routed exposed on top of each LNG storage tank.
- The system shall be capable of both automatic and manual activation. A fire alarm panel shall be provided complete with the skid to enable interfacing with fire detection devices mounted in the field to enable the system to be activated automatically.

2.4.9.2 Dry Chemical Fire Extinguishing Systems for Each Pier

- The dry chemical extinguishing systems shall be designed, constructed and installed in accordance with NFPA-17.
- Nominal 909 kg dry chemical skid mounted system with 818 kg of Purple K dry chemical agent.
- Four (4) nitrogen cylinders mounted on the skid shall provide the system pressure.
- The skid shall be pre-piped prior to arriving on site.
- The skid shall include a corrosion control package to enable it to be mounted outdoors in a marine environment without fear of corrosion.
- The skid shall include a 30 meter hand held hose and nozzle and hard piped monitor nozzle on a turret assembly.
- The system shall be capable of both automatic and manual activation. A fire alarm panel shall be provided complete with the skid to enable interfacing with fire detection devices at the pier to enable the system to be activated automatically.

- Dry chemical skid packages shall be located on each 30 meter by 30-meter pier service platform.

2.4.9.3 High Expansion Foam System for each LNG Storage Tank Secondary Impoundment Area

- The high expansion foam systems shall be designed and installed in accordance with NFPA-11.
- Each dyke shall be drained to a secondary impoundment area within the main impoundment dyke. The secondary impoundment shall be of concrete construction to match the main impoundment.
- The anticipated initial size of the secondary impoundment area shall be 14 meters by 7 meters by 7 meters deep.
- The concrete trench between the main impoundment and the secondary impoundment shall be insulated with Perlite insulation to minimize the heat gain to the LNG as it makes its way to the secondary impoundment.
- Each secondary impoundment area will be protected with a high expansion foam system.
- The high expansion foam system for the secondary impoundment trench shall be capable of supplying foam at a rate of 1.83 meters of foam per minute.
- The foam concentrate tank shall be capable of storing enough foam concentrate to enable 60 minutes of foam generator operation.
- The high expansion foam system design shall utilize a 1.15 foam shrinkage factor and a 1.2 foam leakage factor in the sizing of the high expansion foam generator.
- The preliminary required high expansion foam generator capacity shall be 4.12 cubic meters per second.
- The preliminary initial high expansion foam generator selection for this particular application shall have a foam capacity of 5.96 cubic meters per second at a residual water pressure of 344 kPa and a seawater flow of 11.37 liters per second.
- Each system will use a balanced pressure bladder tank to store high expansion foam concentrate.
- Water pressure supplied by the sea water fire pumps will pressurize the bladder tanks to provide the motive force to inject the high expansion foam concentrate into a foam proportioner.
- A pipe mounted foam proportioner shall be supplied for each high expansion foam system. The seawater shall flow through the proportioner and in doing so shall create a point of low pressure. The difference between the seawater pressure applied to the bladder and the lower pressure in the proportioner shall cause the high expansion foam concentrate to be drawn into the proportioner and mixed with the seawater.
- Foam proportioning shall be 2.75% (2.75 units of high expansion foam concentrate to 97.5 units of sea water). The preliminary foam concentrate required capacity based upon the preliminary generator selection shall be 1296 liters of concentrate.
- The design foam expansion rate shall be 500:1, which shall make it less susceptible to wind conditions then higher expansion foam rates.
- The high expansion foam system shall be total flooding as opposed to on/off control.

- A deluge valve shall be used to control the seawater applied to both the high expansion foam concentrate tank and the foam generators.
- The piping between the deluge valve, bladder tank, proportioner and the foam generator shall be dry until the deluge valve is activated.
- The high expansion foam generator shall be mounted on top of the secondary impoundment area walls.
- The foam generator shall have 316 stainless steel housing and motor bracket suitable for seawater applications.
- The foam generator shall be UL listed for heat exposure to LNG fires.
- There shall be eight (8) such systems.

2.4.9.4 High Expansion Foam System for the Process Impoundment Area

- An impoundment area shall be provided at the process area to collect and contain an inadvertent LNG spill.
- The process impoundment shall be of concrete construction to match the impoundments at the LNG storage tanks.
- The anticipated initial size of the process impoundment area shall be 10 meters by 10 meters by 6 meters deep.
- The process impoundment area shall be protected with a high expansion foam system.
- The preliminary required high expansion foam generator capacity shall be 3.04 cubic meters per second.
- The preliminary initial high expansion foam generator selection for this particular application shall have a foam capacity of 5.96 cubic meters per second at a residual water pressure of 344 kPa and a seawater flow of 11.37 liters per second.
- The design and layout of the high expansion foam system for the process impoundment area shall be identical to that described above for the LNG storage tank secondary impoundment areas.

2.4.9.5 High Expansion Foam System for the Pier Impoundment Area

- An impoundment area shall be provided at the pier to collect and contain an inadvertent LNG spill.
- The pier impoundment shall be of concrete construction to match the impoundments at the LNG storage tanks.
- The anticipated initial size of the pier impoundment area shall be 9 meters by 7 meters by 5 meters deep.
- The pier impoundment area shall be protected with a high expansion foam system.
- The preliminary required high expansion foam generator capacity shall be 2.6 cubic meters per second.
- The preliminary initial high expansion foam generator selection for this particular application shall have a foam capacity of 1.51 cubic meters per second at a residual water pressure of 516 kPa and a seawater flow of 2.6 liters per second. There shall be two (2) such generators required to service the pier impoundment area.

- The design and layout of the high expansion foam system for the pier impoundment area shall be identical to that described above for the LNG storage tank secondary impoundment areas.

2.4.9.6 Water Based Pier Fire Protection

- All areas on each pier are to be capable of being covered with at least two water streams.
- Two hydrants shall be provided on each pier service platform, one at either end of the 30-meter by 30-meter platform.
- Hydrants shall be complete with NPS 1-1/2 and 2-1/2 hose connections.
- Hydrants shall be located within hose houses.
- Hydrants shall be provided with NPS 2-1/2 by NPS 1-1/2 reducer connections and 30 meters of NPS 1-1/2 hose, rack mounted and physically connected to the hydrant.
- The hose houses shall also be outfitted with 30 meters of NPS 2-1/2 hoses and an assortment of nozzles, spanners, etc.
- Tower mounted monitors shall be provided at either end of each 30 meter by 30 meter service platform. Tower mounting shall enable the monitors to remain effective in fighting fires on the deck of each vessel as the vessel rises in the water during product off loading. The monitors shall be electrically actuated and remotely operated using a control unit and joystick arrangement. Each monitor shall have a 165-degree sweep (rotation) side to side and a vertical movement of +90 degrees and –60 degrees. Each monitor shall be provided complete with an integral nozzle. Each monitor shall be sized to provide a range of jet of 76.2 meters with an incoming water pressure of 902 kPa and a water flow of 5700 liters per minute.
- Water supply to the each pier must have the capability of supplying all hydrants and monitors, which service the pier simultaneously in addition to an allowance of 3790 liter per minute. This will mean a pier preliminary design seawater fire flow of 18,950 liters per minute.
- A residual pressure of 516 kPa is required at the hydraulically most remote hydrant on each respective pier from the seawater fire pump with at least two devices (both monitors) in simultaneous operation at that particular pier.
- A hydrant with NPS 2-1/2 hose connections shall be provided at each pier to shore connection. This hydrant shall have an international connection size so that hoses from the ship can connect to this hydrant and draft from the yard main.

2.4.9.7 Yard Main System

- A yard main shall be provided in accordance with NFPA-24.
- The yard main shall serve dry barrel hydrants with NPS 6 connections.
- The design fire flow for each hydrant shall be 31.6 liters per second which will ensure compliance with the maximum outside hose allowance for any type of sprinkler system which may be installed in any of the various buildings around the site.
- To overcome friction loss in the hydrant branch, hydrant and suction hose, a minimum residual pressure of 150 kPa is normally required in the underground main at the branch connection to each hydrant to ensure sufficient pressure for a

pumper to draft from the hydrant. In this particular application the hydrants are to be supplied without NPS 3-1/2 pumper connections since it is a private fire service main. Therefore to allow short hose lines to be operated directly from the hydrants without pumping, a minimum residual pressure of 500 kPa is to be maintained at each hydrant in the system. Higher pressures will be required in the private yard main to ensure adequate pressure to service sprinkler systems, standpipe and hose systems, water monitors, and high expansion foam generators. A computer model of the yard main system will be generated and the flow and residual pressure required at each of the various take-offs from the yard main will be established by analyzing the requirements of the various fire protection systems serving the site. Numerous scenarios shall be modeled for the yard main assuming flow and pressure criteria outlined above to properly size the yard main piping system and fire pump to ensure adequate flow and pressure is available in the yard main at all times.

- The underground yard main piping shall be sized for a maximum water flow velocity of 4.87 meters per second.
- Each NPS 6 fire hydrant connection to the private yard main shall have an isolation valve key operated from the surface.
- The hydrants shall be spaced such that no hydrant is within 13.7 meters of a building.
- Hydrants shall be spaced at 91.5 meters center-to-center distances around the site to comply with the Insurers Advisory Organization (IAO) hydrant spacing for private yard mains. In addition hydrants shall be spaced such that every building on the site is within 30 meters of a hydrant.
- Every building equipped with either a sprinkler and/or standpipe and hose system shall have a fire department connection equipped with two (2) NPS 2-1/2 threaded connections. These fire department connections shall be located such that they are within 45 meters of a hydrant.
- The underground yard main shall be constructed of cement lined ductile iron to AWWA standards. The fittings shall be mechanical joint and shall be restrained with EBBA Iron megalugs. Concrete thrust blocks shall be provided at changes in direction such as at hydrant connections.
- The yard main shall be dry under normal circumstances and shall only be flooded during a fire event.
- Hydrants shall be provided with both NPS 1-1/2 and 2-1/2 threaded connections. The NPS 1-1/2 connection shall be accomplished through the installation of a reducer on one of the hydrant NPS 2-1/2 connections.
- Hydrants shall not be provided with NPS 3-1/2 pumper connections since it is a private fire service main and not a public water supply.
- Hydrants around the site shall be installed in hose houses.
- Each hose house shall have a hose rack with 30 meters of NPS 1-1/2 hose physically connected to the hydrant at all times. In addition each hose house shall be outfitted with 30 meters of NPS 2-1/2 hose and a supply of various nozzles, spanners, etc.
- Two vertical turbine fire pumps installed in accordance with NFPA-20 shall supply the yard main. These fire pumps shall be installed in a pump room located directly adjacent to the ocean. The pumps shall be installed in a wet well located directly below the pump room. One pump shall be electric operated off the main grid while the other shall be diesel driven as an emergency back up. The fire

pumps shall supply salt water to the dry private service main for fire fighting throughout the site.

2.4.9.8 Sprinkler Systems

- Sprinkler systems shall be designed in accordance with NFPA-13 for the various buildings throughout the site.
- Sprinkler systems shall be either dry, single interlock pre-action, double interlock pre-action or deluge depending upon the application.
- All above ground sprinkler piping shall be steel, ASTM A53, Grade B, schedule 40.
- Threaded piping shall be schedule 30 over NPS 8.
- Threaded piping NPS 8 and below shall be schedule 40.
- Roll-grooved piping shall be schedule 10 up to NPS 5, 3.4 mm wall thickness for NPS 6, 4.78 mm wall thickness for NPS 8 and NPS 10, and 8.38 mm wall thickness for NPS 12 piping.
- All sprinkler systems shall be hydraulically calculated.
- Total combined iside/outside hose allowance shall be added to the sprinkler water demand for each building in order to determine the required water flow required to service the sprinkler system in each respective building.
- Design areas for the sprinkler systems shall be adjusted upward by 30% to account for the fact that the sprinkler systems are to be dry.
- The design water flow density shall depend upon the hazard classification for each particular application.
- Rack storage higher then 3.65 meters shall require in-rack sprinklers or adjustment of the design density of the ceiling mounted sprinklers to account for the rack storage.
- An assessment of the rack storage shall have to be made on a building-by-building basis in order to properly determine the design criteria for the sprinkler system for each particular application.
- Minimum design pressure at each sprinkler head shall be 48.2 kPa.

2.4.9.9 Standpipe and Hose Systems

- Standpipe and hose systems shall be installed in accordance with NFPA-14.
- Standpipe and hose systems shall be automatic dry type.
- Standpipe and Hose systems shall be installed where required by the National Building Code of Canada (NBC), National Fire Code of Canada (NFC) and any applicable NFPA standards.
- The standpipe and hose systems shall utilize dry alarm valves for initiation.
- The design air pressure shall be 137.8 kPa higher then the design trip pressure of the dry pipe valve.
- The residual pressure at the top of the hydraulically most remote standpipe NPS 2-1/2 hose connection shall be 689 kPa.
- The residual pressure at the top of the hydraulically most remote standpipe NPS 1-1/2 hose station shall be 447 kPa.
- The class of standpipe and hose system installed in any one building shall be as required by the relevant codes and standards outlined above. The systems shall

be either Class 1 (NPS 2-1/2 hose connections only); class 2 (NPS 1-1/2 hose connections only); or Class 3 (NPS 1-1/2 and NPS 2-1/2 hose connections).

- Each NPS 1-1/2 hose connection shall be provided with a rack and 30 meters of NPS 1-1/2 hose.
- NPS 2-1/2 connections shall be provided with a threaded end cap only.
- NPS 2-1/2 hose connections shall be installed in exit stairwells at intermediate landings where applicable.
- NPS 1-1/2 hose stations, when required, shall be spaced throughout the protected building at a maximum spacing of 39.6 meters.
- Buildings protected throughout with sprinkler systems shall be permitted to have the NPS 1-1/2 hose station installation requirement wavered in accordance with NFPA-13 and NFPA-14 unless required by another code or standard.
- Hose connections shall be mounted between 1 and 1.5 meters above the finished floor.
- The minimum size of any standpipe shall be NPS 4.
- Separate standpipes shall be provided for each exit stair in buildings requiring NPS 2-1/2 hose connections for fire fighter usage.
- Fire department connections for standpipe and hose systems shall be installed within 45 meters of a hydrant.
- Standpipe and hose systems shall be hydraulically calculated.
- Class 1 and Class 3 standpipe and hose systems shall be hydraulically calculated to provide each of the two top most hose connections on the hydraulically most remote standpipe with a water flow of 15.79 liters per second. In addition a flow of 15.79 liters per second shall be added for each successive standpipe back to the entrance to the building to a total flow of 78.95 liters per second or 63.2 liters per second for a building, which is sprinklered throughout.
- For horizontal Class 1 and Class 3 standpipe systems the hydraulic calculation outlined above shall be extended to three (3) hose connections and a total of 47.4 liters per second per horizontal standpipe.
- Class 2 standpipe and hose systems shall be hydraulically calculated to provide 6.3 liters per second at the top most hose station on the hydraulically most remote standpipe. No additional flow is required to be added neither for additional hose stations on the most remote standpipe nor for additional standpipes.

2.4.9.10 Clean Agent Fire Suppression Systems

- Clean agent fire suppression systems shall be installed in accordance with NFPA-2001.
- Clean agent fire suppression systems shall be installed in critical areas such as control rooms where the release of water or dry chemical would cause considerable damage to electronic equipment.
- Fire suppression agent to have an ozone depletion potential of zero, a global warming potential of 1 and a five-day atmospheric lifetime.
- System to be suitable for Class A, B and C fires.
- System shall be total flooding.
- The design concentration of fire suppression agent upon discharge shall be between 4 to 6%.
- Preliminary system selection shall be Ansul Sapphire clean agent fire suppression system utilizing Novec 1230 as the fire suppression agent.

- The fire suppression agent is a clear, odorless, colorless liquid that is super-pressurized with nitrogen and stored in high-pressure cylinders.
- The high-pressure liquid vaporizes into a gas upon discharge.
- The system shall be capable of both automatic and manual activation. Automatic activation shall be electric.
- The system shall include a fire alarm panel, which shall be interfaced with field-mounted devices to enable automatic activation of the system.
- Preliminary system sizing for the various systems that will be required at the site is not possible given that the areas to be protected have not been clearly identified nor has the sizes of these spaces.

2.4.9.11 Fire Extinguishers

- Portable fire extinguishers shall be selected and located in accordance with NFPA-10.
- Fire extinguisher type shall be selected based upon the type of fire they are intended to extinguish.
- Large, 70 kg wheeled dry chemical extinguisher units with a 15 meter hose will be provided at the pier service platforms, mooring dolphins, and throughout the process area. These extinguishers shall use potassium-bicarbonate (Purple-K).

2.4.9.12 Fireproofing and Cryogenic Spill Protection

Critical vertical structural members (if applicable) that support cryogenic piping, or equipment in areas of more likely potential for LNG spills, will be supported with concrete columns. If the columns are of strictly concrete design (no steel member), the column will be designed such that its integrity would not be compromised in a LNG spill.

Generally, structural supports will have concrete foundations above grade elevation, which provide sufficient protection from exposure to LNG. Spill pans will be provided under the tank platform to protect the tank roof from possible LNG leaks in the platform piping.

2.4.14 Water Supply

To be added after modelling is complete.

2.4.15 Ancillary Facilities

The following buildings will be erected at the facility:

- Administrative Office
- Warehouse and Maintenance Building
- Guard House
- Control Room and Electrical Building
- Compressor Buildings
- Nitrogen Compressor Buildings
- Nitrogen Generation Buildings
- Water/glycol heater and air compressor building

- Power Generation Building
- Fire Pump Building
- Gas Chromatograph Building

2.4.15.1 Main Control Room and Electrical Building

This building will house the main electrical controls for the facility as well as the emergency generator controls. The final dimensions of this building will be determined during the detailed design. Approximate dimensions are 50 m x 15 m x 6m (L x W x H).

The building will be constructed of concrete foundations in combination with a steel frame structural system. Cladding will consist of concrete block, metal siding and roofing supported on a secondary structural system of girts and purlins.

2.4.15.2 Warehouse and Maintenance Building

The warehouse and maintenance building will be constructed of concrete foundations in combination with a steel frame structural system. Cladding will consist of metal siding and roofing supported on a secondary structural system of girts and purlins.

The building will be sized to meet the needs of the facility including the storage of spare parts and consumables. A workshop complete with a small tool inventory will be provided.

The final dimensions of the building will be based on the project requirements determined during the design phase of the project. Approximate building dimensions are 40 m x 20 m x 8 m (L x W x H).

2.4.15.3 Compressor Buildings

The two compressor buildings will be pre-engineered metal style buildings designed and erected in accordance with codes specific to commercial unmanned (machinery) buildings. Each building will have a “drop out” area at one end for placement of equipment for maintenance purposes, with large overhead doors for equipment removal. The approximate dimensions of the buildings are 82m x 35m x 8m and 52m x 35m x 8m. Each building will contain an overhead gantry crane with no more than a 10 ton rating.

2.4.15.4 Guard House

A small building will be constructed at the entrance of the site to house site security and provide controlled access to the site.

This building will be constructed of concrete foundations in combination with a timber framing structural system. Cladding will consist of metal siding.

The final dimensions of the building will be based on the project requirements determined during the design phase of the project. Approximate building dimensions are 5 m x 4 m x 3 m.

2.4.15.5 Administrative Office

An administrative building will be constructed on site to house workers and administrative staff. The building will be equipment with general offices, washrooms, common areas, document control, lunchroom facilities and file storage.

The building will be constructed of concrete foundations in combination with a steel frame structural system. Cladding will consist of metal siding and roofing supported on a secondary structural system of joists, girts and purlins.

The final dimensions of the building will be based on the project requirements determined during the design phase of the project. Approximate building dimensions are 40 m x 30 m x 4 m.

2.4.15.6 Power Generation Building

A power generation building will be constructed on site to house the equipment required for the control of on site power generation.

The building will be designed to meet all building codes requirements for such building types. The building will be constructed of concrete foundations and a structural steel frame. Exterior cladding will consist of metal siding.

The final dimensions of the building will be determined during detailed design phase of the project.

2.4.15.7 Fire Pump Building

A fire pump building will be constructed on site to house the main pumps used for site wide fire protection. The building will be constructed of concrete foundations will concrete block exterior walls and structural steel roof. A 5t overhead crane will be installed in the building for pump maintenance.
The final dimensions of the building will be determined during detailed design of the fire fighting capacity requirements of the facility.

2.4.15.8 Gas Chromatograph Building

The gas chromatograph building will be situated on site adjacent to the LNG process facility. The building will house equipment specific to the sampling and analyzing of the LNG product. The building will be constructed of concrete foundations with concrete block exterior walls, structural steel roof and metal wall and roof cladding.

2.4.15.10 Nitrogen Compressor Buildings

The two nitrogen compressor buildings will house the compressors and heat exchangers required for the nitrogen liquefaction process. The buildings will be pre-engineered metal style buildings designed and erected in accordance with codes specific to commercial unmanned (machinery) buildings. Each building will have a “drop out” area for placement of equipment for maintenance purposes, with large overhead doors for equipment removal. The approximate dimensions of the buildings are 34m x 28m x 8m. Each building will contain an overhead gantry crane with no more than a 5 ton rating.

2.4.15.11 Nitrogen Generation Buildings

The two nitrogen generation buildings will house the nitrogen generators, buffer tanks, and reservoirs required for the nitrogen liquefaction process. The buildings will be pre-engineered metal style buildings designed and erected in accordance with codes specific to commercial unmanned (machinery) buildings. Each building will have a “drop out” area for placement of equipment for maintenance purposes, with large overhead doors for equipment removal. The approximate dimensions of the buildings are 25m x 19m x 5m. Each building will contain an overhead gantry crane with no more than a 5 ton rating.

2.4.15.12 Water/Glycol Heater and Air Compressor Building

The water/glycol heater and air compressor building will be pre-engineered metal style buildings designed and erected in accordance with codes specific to commercial unmanned (machinery) buildings. Each building will have a “drop out” area for placement of equipment for maintenance purposes, with large overhead doors for equipment removal. The approximate dimensions of the building are 32m x 22m x 8m. The building will contain an overhead gantry crane with no more than a 10 ton rating.