The accommodation strategy is further discussed in Section 8.14.

Should construction of any subsequent train not follow on directly from the construction of the previous train, consideration will be given to either mothballing or demobilising the construction workers accommodation facility during the interim period.

3.8.2.8 Sewerage

It is anticipated that package sewage treatment facilities will be installed at the construction workforce accommodation facility and that relevant approvals will be obtained by Santos in conjunction with the facilities' development approvals. Treated effluent will be loaded into tankers and barged to the mainland for disposal at an existing wastewater treatment plant. Santos will discuss this proposal with the Gladstone Regional Council.

3.8.3 Operation

3.8.3.1 LNG Production Technology

The purpose of the LNG facility is to liquefy CSG to facilitate its transport via tanker. The liquefaction technology uses a refrigeration process whereby the refrigerant is expanded and compressed in a closed loop system to achieve the cold temperatures needed for liquefaction. A number of liquefaction processes have been developed around the world, with the differences mainly confined to the types of refrigeration/ liquefaction technology employed.

For the GLNG Project, Santos considered two competing liquefaction processes - the ConocoPhillips (CoP) Optimised Cascade Process (OCP), and the Air Products Chemicals Incorporated (APCI) Propane Pre-cooled Mixed Refrigerant (C3MR) process. Both processes use similar gas treatment unit operations, and LNG storage and ship loading facilities. As described in Section 2.3.3, the key differences between the two processes are in the refrigeration technologies used to liquefy the purified gas. In late 2008, Santos decided to proceed into FEED with only the ConocoPhillips liquefaction process (OCP) and this section relates to that process.

Many of the project's impact assessments that are presented in the appendices were undertaken during 2008 prior to the selection of the OCP and included assessment of both technologies. The EIS sections however have addressed only the OCP technology.

The Phillips Petroleum Company developed the original OCP in the 1960s. The objective was to develop a liquefaction technology that permitted easy start-up and smooth operation for a wide range of feed gas conditions. This process was first used in 1969 at Phillips Petroleum's LNG facility at Kenai, Alaska. The facility was the first to ship LNG to Japan and has achieved uninterrupted supply to its Japanese customers since. This process uses three refrigerants – propane, ethylene and methane circuits - cascaded to provide maximum LNG production. Each circuit uses two 50 % compressors with common process equipment. The OCP can provide designs with high thermal efficiency and achieve designs optimized for project economics. The process utilizes proven technology and equipment, and has a wide range of operational flexibility. The plant provides low utility and reduced flaring requirements. Operating plants (and plants being implemented) using this technology include the Darwin LNG Plant as well as plants in Alaska, Trinidad, Egypt, Equatorial Guinea, Angola and Nigeria. At year end 2008, the LNG production capacity from plants utilising this technology was approximately 31 Mtpa.

Figure 3.8.6 shows a conceptual process flowchart of the OCP process.

Figure 3.8.6 shows the various process stages of gas receiving, treatment, liquefaction, storage and shipping. Note that the process flowchart is generic and not specific to the GLNG Project. During the FEED phase that will take place during 2009, the specific details of the plant technology will be developed.

Figures 3.4.6 and 3.4.7 show the layout of the LNG facility. The facility components forming part of the initial stage (Train 1) are shown together with those proposed for the subsequent stages (Trains 2 and 3).

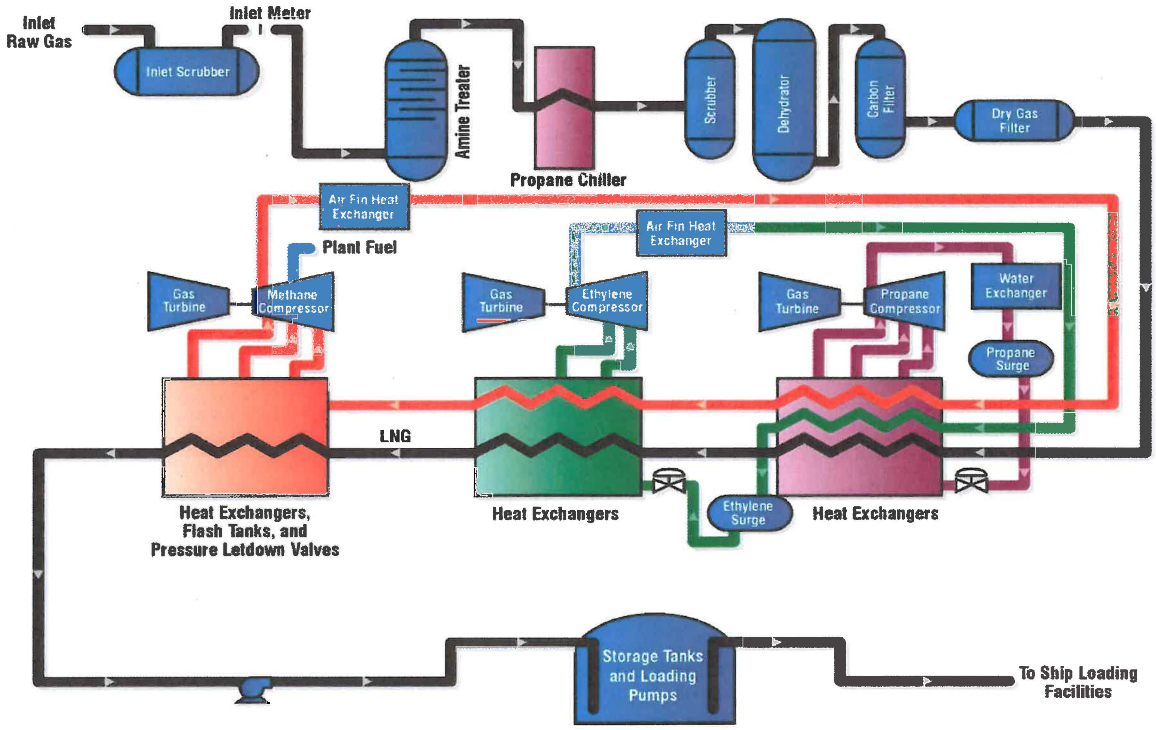

Figure 3.8.6 Conceptual Process Flowchart

Figure 3.8.7 shows the LNG facility that was recently constructed at Darwin. This facility uses the OCP process and is similar to what the GLNG LNG facility will look like. The figure clearly shows the liquefaction facility, the LNG storage tank and the product loading facility.

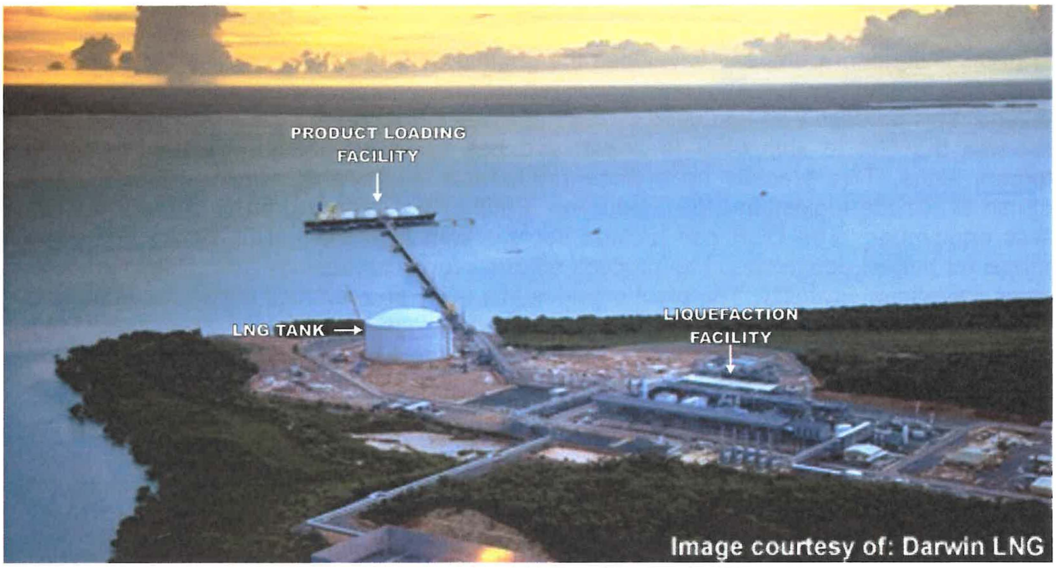

Figure 3.8.7 Darwin LNG Facility

3.8.3.2 Inlet Facilities

CSG will be transported to the LNG facility via the gas transmission pipeline. The gas has a high methane concentration with very few impurities, no heavy hydrocarbons or water. The typical composition of CSG is summarised in Table 3.8.4.

Table 3.8.4 Gas Composition

Constituents	Composition (%)		
	Start of Life	Average	End of Life
Methane	95.45	94.95	95.0
Ethane	0.03	0.03	0.03
Propane	0.02	0.02	0.02
Nitrogen	4.0	4.0	2.95
Carbon Dioxide	0.5	1.0	2.0

On entering the facility, gas from the transmission pipeline will first be routed through the inlet facility where it will pass through a pipeline gas heater and a pressure letdown station prior to entering an inlet separator. The pipeline gas heater will be necessary to avoid freezing and hydrate formation when the gas is depressurised (which results in a cooling of the gas due to the Joule Thompson effect).

Downstream of the inlet separator the gas will flow through a metering package. Metering facilities will be used to measure the amount of gas received for use in pipeline monitoring and possibly gas transfer accounting. The last step in the inlet facilities will be inlet filters which remove any contaminant particles entrained in the gas.

The inlet facility will also be equipped with a scraper receiving station which will be used to collect scrapers (internal pipeline cleaning equipment which is typically spherical in shape with an outside diameter equal to the pipeline's inside diameter) sent down pipelines for cleaning / monitoring purposes.

3.8.3.3 Gas Treatment

After the inlet facilities the gas will enter the gas treatment section to remove any impurities within the gas stream that are detrimental to the natural gas liquefaction process. These components are primarily carbon dioxide (CO_2) and water.

The first step in the gas treatment process will be the removal of CO_2 and trace sulfur-containing compounds (collectively called acid gas). If CO_2 is not removed, it will solidify (freeze) during the LNG liquefaction process plugging equipment and causing maintenance outages.

The feed gas which contains CO_2 and possibly trace sulfur containing compounds will enter the bottom of a CO_2 absorber where it will counter-currently contact an amine solution. This interaction will cause the acid gas from the feed gas to be absorbed into the amine solution via a physical and chemical process. The feed gas will then exit the top of the CO_2 absorber free from acid gas. The amine solution is then stripped of acid gas in a regenerator and directed to the acid gas vent stack for final disposal within regulatory limits.

After the gas leaves the amine treatment section it will be routed to a dehydration unit. As with CO_2, if water is not removed from the gas stream prior to liquefaction, it will freeze once temperatures are reduced and will plug equipment. The first stage of dehydration will be to chill the gas in order to condense and drop out a large percentage of the water.

After being chilled, the gas will then be routed through a three-bed molecular sieve system to remove the final traces of water to a dew point of approximately -70 °C. Three beds will be used, two in operation and one in regeneration/cool down or standby mode. Water collected will be sent to the wastewater treatment system.

The final gas treating step will use two sulfur impregnated carbon beds to remove trace amounts of mercury (if present) in the gas. While the CSG contains no measurable level of mercury, if a small amount is present and left entrained in the CSG, it could cause corrosion of the brazed aluminum heat exchangers located downstream in the process. The mercury removal beds will serve as a safeguard to help ensure the integrity of the downstream equipment. The beds will be designed to be in use for the design life of the plant.

3.8.3.4 Gas Liquefaction and Nitrogen Removal

The dry, mercury free gas will flow into the refrigeration and then liquefaction system where it will be liquefied to become the LNG product. In order to meet sales quality specification for LNG, nitrogen in the gas must be removed.

The nitrogen will be removed by letting down the pressure of the condensed feed gas. The vapour produced from this pressure letdown (fuel gas rich in nitrogen) will be compressed in a fuel gas compressor and used as plant fuel gas. The LNG, will then be within sales LNG specifications, and will be pumped to the LNG product storage tanks.

3.8.3.5 Gas Storage

LNG will be stored in double walled, full-containment storage tanks. For the eventual 10 Mpta development on the site, it is anticipated that three tanks, each with a storage capacity of between 125,000 and 200,000 m^3 will required. Each tank will be approximately 80 m diameter and 60 m high to the top of the dome. The individual tank and total LNG storage capacity will only be finalised following negotiation of the LNG sales and purchase agreements with LNG buyers. However for initial planning purposes, Santos has assumed this may total 420,000 m^3 for the 10 Mpta development.

Each tank will consist of an inner container of 9 % nickel-steel surrounded by insulation, contained within an outer wall. The inner container will hold the LNG product at its boiling point of -161 °C at a pressure slightly above atmospheric. In the unlikely case of inner tank failure, both the liquid and vapour will be contained within the outer tank.

The cross section of a typical full-containment LNG storage tank is provided in Figure 3.8.8.

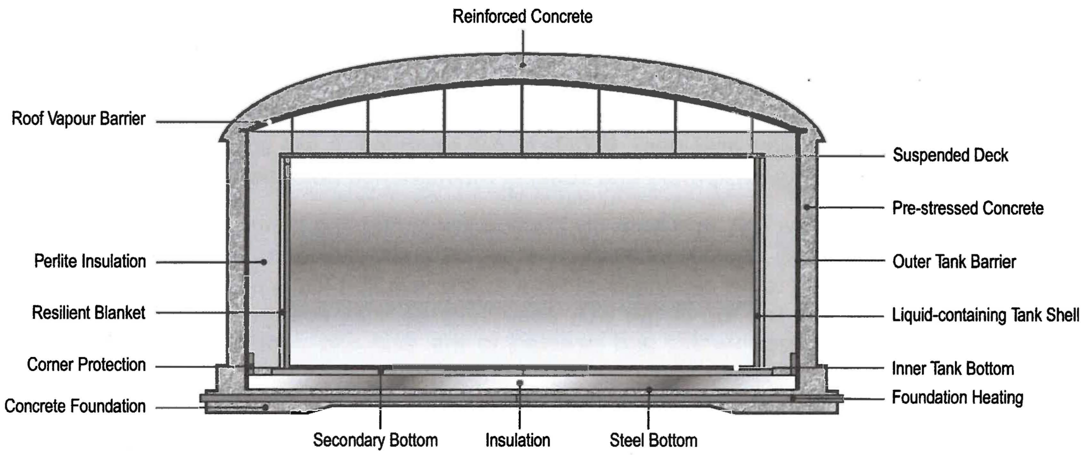

Figure 3.8.8 LNG Storage Tank Configuration

While no refrigeration is used to maintain the -161 °C temperature, the storage system will include a boil-off compressor for handling the vaporising LNG and product pumped for ship loading. This latter system will recover vapour produced in the storage tanks due to heat gain or displaced by liquid as the tanks are filled, and return it to the facility for fuel or re-liquefaction.

LNG will be held in the storage tanks until it is transferred to the PLF for loading into ships for export. The LNG will be pumped from the tanks via pipework connections through the tank roofs using in-tank pumps to avoid the need for any sidewall penetrations.

3.8.3.6 Product Loading Facility

The product loading facility (PLF) will include:

- Access trestle – approximately 300 m long piled structure over the water. The pipes on this trestle will connect the onshore plant to the offshore loading platforms;
- Loading platform with four loading arms for loading of LNG onto ships;
- Marine operations platform - for housing the marine terminal, which may be moved to onshore at a later stage in design;
- Building, electrical room, firewater pumps and stand-by generators, which may be moved to onshore at a later stage in design and the firewater supplied from an onshore tank; and
- Six mooring and four breasting dolphins.

The access trestle, loading platform and berthing dolphins will load LNG to specially designed LNG tankers for shipment to markets.The proposed layout of the trestle and berth structures is shown on Figure 3.8.9.

The current trestle design is for a tubular steel-piped structure which will carry a roadway and pipe rack out to the loading platform. Pipeline expansion loops will be provided at regular intervals and pipeline anchor points will be provided between expansion loops.

The final location, length and orientation of the loading trestle and platform will be determined during FEED and will:

- Provide safe and reliable access for marine vessels to service the site;
- Minimise the extent of dredging, to reduce level of environmental impact and dredging costs;
- Allow for adequate draft for the size of LNG tankers expected;
- Preserve the mangroves to the best extent possible;
- Account for the prevailing waves and currents; and
- Avoid disruption of other marine traffic.

LNG will be pumped from the storage tanks to the ships via a pipeline and PLF-mounted retractable loading arms that connect the pipeline to the ships' storage tanks. During ship loading, gas vapours will be produced as a result of heat gain throughout the process and the venting of the displaced vapour space within the ship as it is filled. Some of these vapours will be used to displace the LNG being removed from the storage tanks during loading and the remaining vapours will be routed to boil-off gas compressors and sent back to the LNG liquefaction section for use as fuel or re-liquefaction. In this way the release of fugitive gas emissions to the atmosphere will be minimised.

In the event that the vapour is produced at a higher rate than the boil off compressors can handle, the surplus vapours will be routed to a marine flare which will be located onshore at the end of the PLF.