5.0 Infrastructure

5.1 Water Supply

5.1.1 Water Source

Supplies of fresh water for the refinery, mine and local communities are obtained from groundwater wells located in the vicinity of the Gove Airport. This groundwater is in an aquifer which is entirely separate from the groundwater aquifers under the refinery and RDA, as described in Section 12.0.

The mine area and airport are located on a bauxite plateau surrounded by a granite outcrop and a submerged coastline. Simplistically, the geology of the Airstrip Plateau can be described as alluvial sands and gravels overlying an undulating granite basement, with a thin cap of bauxite and laterite covering the sequence at the surface. The Airstrip Plateau is eroded on its margins by the sea and a number of creeks/rivers which have formed near vertical cliffs in the bauxite. The following five major creek/river systems intersect and bound the plateau:

- Yirrkala Creek and Lagoon;
- Latram River;
- Shady Gum Creek;
- Rocky Creek; and
- North River.

Groundwater is generally encountered 25 to 35 m below ground level across the Airstrip Plateau, which is 5 to 10 m below the base of the bauxite/laterite sequence. As a result, the aquifer is generally unconfined, and recharge occurs by direct infiltration to the extent that the laterite clays permit.

The sandstone Mullaman Beds which underlie the bauxite/laterite sequence form the primary aquifer beneath the plateau and are the source of water for the current wellfield.

Groundwater discharges occur continuously via sub-surface drainage to the coast as well as stream flow, evaporation and transpiration losses to the Latram River, Yirrkala Creek, North Creek and lower reaches of Shady Gum Creek and Rocky Creek.

5.1.2 Existing Wellfield

The existing wellfield is located within the mine lease area and immediately adjacent to the current airstrip (Figure 5.1.1). The wellfield is made up of two alignments, one along the north-eastern edge of the airstrip and the second along Shady Gum Creek. In total there are 17 production wells and 18 observation bores.

The wellfield was developed progressively between 1970 and 1972 and is currently operating under Permit No. 305 (Amended), issued by the Northern Territory Controller of Waters. The permit conditions include:

- A maximum draw of 12,000 ML over any 12 month period;
- A minimum flow of 50 L/sec to be maintained in Yirrkala Creek; and
- Regular monitoring and reporting of aquifer performance.

A statutory report every three years to provide an evaluation of the performance of the aquifer, the wellfield and Yirrkala Creek over the previous three year period, and predicted performance over the next three years.

5.1.3 Current Water Usage

Water is recovered by a series of wells which connect to a gravity pipeline that feeds an aerator unit to remove carbon dioxide to minimise water acidity. An in-line chlorinator provides disinfection. Chlorine residuals are not detectable in the reticulation system.

A minor pipe with a take-off from the gravity pipeline provides water to the mine. The airport water supply also has its take-off from the wellfield pipeline.

Records for the five years from 1997 to 2001 reveal that water production from the wellfield varied from 820 to 1,210 cubic metres per hour (m^3/h) with the high flows experienced during the dry season. Average annual water extraction is 9,200 megalitres per year (ML/y), which equates to an average hourly rate of approximately 1,000 m^3/h. Demand variations from average are approximately ±20%.

The gravity pipeline from the wellfield has a capacity limit of about 1,020 m^3/h. The water supply during the dry season months is frequently operated at this limit. If limitations were not present, weekly peak capacity would be 1,100 m^3/h. Wellfield production has some spare capacity, however this cannot be utilised due to the capacity limit on the gravity main. This gravity line flows to a pump station from where the water is pumped to both the refinery and to Nhulunbuy.

The water supply to the refinery is marginally influenced by seasonal changes with peaks of 790 m^3/h compared to an average of 670 m^3/h in year 2000. The water supply to Nhulunbuy however can vary from peaks of 300 m^3/h during the dry season to lows of 50 m^3/h in the wet season. The town and refinery both use reservoir tanks to provide a buffer during high consumption periods. The town is the major user of buffer capacity as its evening water consumption in the dry season can reduce the town buffer to very low levels which can result in diversion of water away from the refinery. If conditions of supply cannot be maintained to meet consumption levels, water sprinkler bans are implemented within Nhulunbuy.

5.1.4 Administrative Arrangements

Alcan Gove is responsible for the operation of the water supply system except for within Nhulunbuy. Nhulunbuy Corporation is responsible for the operation of the town rising main within the town lease, the Mt Saunders reservoir, and the reticulation network. It sells water to users within the town. Nhulunbuy Corporation is a private company but fulfils all the functions normally carried out by local government.

5.1.5 Third Stage Expansion Water Demand

The expanded refinery will generate an increased demand for water. Additional water will be required for both the refinery and the steam power station. The demand from Nhulunbuy is also expected to increase. The existing and future average and peak monthly water demand is summarised in Table 5.1.1.

Table 5.1.1
Monthly Peak Water Demand

Consumption Areas & Well Production	Existing		Expansion	
	Average (m^3/h)	Peak (m^3/h)	Average (m^3/h)	Peak (m^3/h)
Town Main	180	320	200	340
Refinery	650	690	1025	1080
Refinery Main Off-takes	20	30	20	30
Mine	40	70	40	60
Other	110	110	85	90
Required Well Production	990	1220	1370	1600

5.1.6 Construction Phase Demand

Potable water during the construction phase will be required both at the construction site (refinery) and at the construction workforce accommodation facilities. Anticipated average water needs during construction are summarised in Table 5.1.2 below.

Table 5.1.2
Construction Phase Average Water Demand

Location	Average Demand (m^3/h)			
	2004	2005	2006	2007
Construction Site	20.8	41.7	41.7	10.4
Accommodation Facilities	10.4	31.3	31.3	10.4

An additional allocation of 2.0 ML/d of raw water will be required for construction earthworks during the period late 2004/early 2005.

5.1.7 Wellfield Demand

It is possible that the higher water supply demand required for the expanded refinery could be managed within the existing licence limit of 12,000 ML/year. However, as a contingency, a study of the aquifer has been carried out to determine whether any increased demand could be accommodated without significantly affecting the surrounding environment. In summary, it has been determined that, if required, an additional 2,000 ML/year could be extracted without significant impact. This increase would be sufficient as a contingency for the expanded refinery. A revised licence limit of 14,000 ML/year will therefore be sought through the Northern Territory Controller of Waters.

In order to minimise the extra demand on the aquifer, Alcan Gove will implement a water demand management program which will include the following:

- Design the expansion to minimise the requirement for fresh water in plant maintenance and removal of spillages;
- Design to use waste water rather than fresh water wherever possible; and
- Define fresh water use targets for each operational area and install meters to measure real-time water use on-line.

5.1.8 Wellfield Modelling

5.1.8.1 Objective

A numerical groundwater model has been developed to provide an understanding of the regional hydrogeology of the Airstrip Plateau catchment area and to determine the following:

- The effect of extracting 14,000 ML/year of groundwater from beneath the Airstrip Plateau on surface flow through Yirrkala Creek/Lagoon or any other surface water system in the region; and
- The most efficient configuration of the expanded wellfield to enable extraction of 14,000 ML/year.

In order to achieve these objectives, the model needed to consider the extent of the cone of depression due to groundwater extraction over time and the effect that reduced water levels would have on groundwater discharge volumes to the surrounding creek and river systems. Details of the model are given in Appendix J.

The basic components of the model are as follows:

- Four layers of different geology to represent the bauxite, two layers of cretaceous deposits (aquifer), and basement;
- Regional rainfall recharge;
- Groundwater inflow from neighbouring sub-catchments;
- Evapotransporation;
- Groundwater and surface water outflow from the aquifer system along the creek/river systems; and
- Wellfield extraction.

5.1.8.2 Basis for Assessment

The primary basis for determining if the extraction of additional groundwater from the aquifer is acceptable is its effect on flows at Yirrkala Lagoon. The assessment of impacts on Yirrkala Lagoon is based on the very strong correlation between discharge at Yirrkala Lagoon and the standing water level in a nearby observation bore (OB1) (Figure 5.1.1). This correlation is based on more than 30 years of monitoring data.

In an agreement between Alcan Gove and the NT Controller of Waters, the water levels in OB1 have been accepted as an indicator of discharge to Yirrkala Creek. The critical level in OB1 that indicates that the discharge through Yirrkala Creek is equal to or less than the permitted minimum rate of 50 L/s is 10 m MBHD (Melville Bay Height Datum). If the water level in OB1 is below 10 m MBHD, it is assumed the flow in Yirrkala Creek is less than 50 L/s.

In addition, a “warning level” of 11 m MBHD has been adopted. This signifies at least three years lead time before water levels could drop to the critical level of 10 m MBHD and hence allows time to implement remediation strategies.

Over the 30 year history of wellfield extraction, the water level in OB1 has never dropped below the critical level (10 m MBHD) and has only twice gone below the warning level of 11 m MBHD (September 1992 to January 1995, and March 1998 to February 1999). On both these occasions no observable impact was noted in Yirrkala Lagoon.

5.1.8.3 Model Predictions

The groundwater model was run to predict the effect of increasing the groundwater extraction rate to 14,000 ML/year through an additional seven production wells. To incorporate the redundancy needed (ie. allowing realistically for times when the wells are not operating due to maintenance or repair), the overall capacity of the new wellfield (ie. assuming no down-time for maintenance and repairs) would be approximately 17,000 ML/year.

A number of alternative scenarios were modelled to simulate the expected conditions 30 years from now. The scenarios simulate different expanded wellfield configurations in terms of well positions with respect to future mining operations and groundwater flow direction. The various scenarios and the predicted groundwater levels in OB1 are given in Table 5.1.1.

Table 5.1.1
Predicted Groundwater Levels in OB1

Scenario No.	Description	Modelled Extraction Rate (ML/year)	Minimum OB1 Level (m MBHD)
1	Current wellfield.	12,000	11.6
2	Current wellfield, plus the seven new bores extending on the same alignment to the south-east of the airstrip into an unmined area.	14,000	10.4
3	Current wellfield, plus the seven new bores extending south of the airstrip into a previously mined area.	14,000	10.3
4	Scenario 3, plus relocation of three of the existing bores to the north of the exiting wellfield.	14,000	10.1
5	Scenario 3, plus five of the existing bores moved 5 km west of the airstrip.	14,000	11.1
6	Current wellfield, plus the seven new bores located south of the existing eastern arm across Shady Gum Creek in a previously mined area.	14,000	10.4

Based on the above modelling results, the following conclusions can be drawn.

- For all scenarios run, the stabilised level in OB1 is above the “critical” level of 10 m MBHD. Therefore, predicted flow to Yirrkala Lagoon remains above 50 L/sec no matter the configuration of the wellfield for a 14,000 ML/year extraction rate. Scenarios 2 and 6 show marginally less drawdown in OB1 as compared to Scenario 3, with Scenario 4 the lowest OB1 level and only 0.1 metres above the “critical” level of 10 m MBHD.
- Creating a second wellfield to the west of the airstrip to capture groundwater discharging to the Latram River (Scenario 5) would necessitate additional piping and pumping requirements without any significant benefit in terms of the water level in OB1.

Scenarios 3, 4 and 6 incorporate an expanded wellfield configuration that is located in previously mined areas and/or along existing access roads. These would pose less of a constraint to future mining operations. Of Scenarios 3, 4 and 6, Scenario 6 produces the least impact to OB1 water levels and is therefore the preferred option in terms of wellfield configuration.

5.1.8.4 Wellfield Modifications

To achieve the increased production of water, if required, an extra seven production wells will be installed as described in Scenario 6 above. The proposed well locations have been determined by groundwater modelling to have minimal impact on flows out of the aquifer.

In addition, the current mine plan involves mining the bauxite at the eastern end of the airport. This will require closure of the south-eastern end of the runway and extending it further to the north-west. None of these actions are associated with the refinery expansion. This action will disturb part of the current wellfield. Eight of the existing production wells will need to be temporarily removed to allow for mining and then replaced once the mining is finished.

The complete wellfield redevelopment for current mine planning and the expansion therefore incorporates the following items:

- Increasing the wellfield capacity to 14,000 ML/year through an additional seven production wells; and
- Temporarily removing and then replacing eight of the existing production wells.

5.1.8.5 Wellfield Expansion Impacts

Yirrkala Lagoon

In all of the predicted scenarios run (Table 5.1.1), the predicted water level in OB1 never falls below 10 m MBHD, and in the preferred option (Scenario 6) the predicted level in OB1 stabilises at 10.4 m MBHD. This is a conservative estimate given 30 years of average rainfall, and the predicted level is only 1.2 m below that for the current wellfield configuration extracting 12,000 ML/year.

In the unlikely event that the water level in OB1 nears the 10 m MBHD “critical” level, it is possible to supplement the flow in Yirrkala Lagoon through a 50 L/s well point system. Previous investigations (AGC, 1988) have shown that this could be achieved utilising up to 25 well points spaced at 12 m intervals parallel to the lagoon margin. The system would be pumped by one or two pumps directly into the lagoon for a period of 2 to 4 months.

Shady Gum Creek

The preferred option for expanding the wellfield is towards Shady Gum Creek. The groundwater extracted from the expanded wellfield will be taking a portion of the groundwater that has been discharging along the lower reaches of Shady Gum Creek and beneath Rocky Bay. The model predicts that the portion of this overall discharge to be removed by the additional wells will be small. As Rocky Bay is a marine environment, the small reduction in fresh groundwater inflow through the near-shore seabed will have no significant effect.

The consequence of locating the new wellfield, as proposed, is to spread the groundwater drawdown effects across a wider front away from Yirrkala Lagoon.

Latram and North Rivers

Modelling has shown that the groundwater levels in the vicinity of both the Latram and North Rivers show no measurable difference between the current wellfield configuration and the preferred expanded wellfield scenario. Therefore, no change is predicted in base flows in either the Latram or the North Rivers from expanding the wellfield as proposed.

Other Groundwater Users

Yirrkala bore in the only groundwater user in the vicinity of the wellfield that may potentially be affected by the expanded wellfield.

The modelling results indicate a potential reduction in the available drawdown of the Yirrkala bore of less than 1 m. A reduction in available drawdown of less than 1 m is not considered significant and should not affect the ability of the well to produce and maintain the design duty of 30 L/sec.

5.1.9 Wellfield Management and Monitoring

An application will be made to the Northern Territory government for a permit for the proposed wellfield expansion.

Maintaining the efficiency of the wellfield and reducing the risk of bore and/or equipment failure is a process of continuous monitoring and review. Monitoring to be undertaken to allow effective management is as follows:

- Monitor groundwater extraction volumes and water levels in all production bores on a monthly basis.
- Monitor the water level in all observation wells on a monthly basis.
- Record rainfall totals on a monthly basis.
- Record stream flow volumes in the following surface water systems:
  - Yirrkala Lagoon
  - Latram River
  - Shady Gum Creek
- Conduct a detailed review of the monitoring data every three years. The objective of the review is to:
  - Evaluate the performance of the aquifer, the wellfield and associated surface water systems; and
  - Recalibrate the model developed against observed measurements from the previous three years, and predict performance for the next three years with respect to the aquifer, wellfield and surrounding creeks.

A strategic environmental management plan for the water supply wellfield is given in Section 25.

5.1.10 Water Supply Reticulation

5.1.10.1 Pipeline from Wellfield to Pump Station

Discharge from the aerator at the wellfield flows via a gravity pipeline over a distance of 10 km to the pump station. This pipeline will be duplicated to increase the total capacity by 430 m^3/h to about 1,450 m^3/h.

The new pipeline will be located beside the existing pipeline in the existing easement which has sufficient width to allow for a construction road, pipe layout area, trench, and an area to stockpile trench spoil and topsoil. The pipeline will be laid at approximately the same depth as the existing pipeline. Minimal vegetation will need to be cleared as the existing pipeline easement will be used. Any clearing that is required will be restricted to within the proposed easement. Once the pipe has been laid, the disturbed ground will be stabilised and stormwater runoff controls installed to minimise erosion. The management strategies outlined in Section 16.4.5.1 will be implemented as necessary.

5.1.10.2 Pipeline from Pump Station to Refinery

The pipeline to the refinery will require a flow capacity upgrade for the average flow of 1,200 m^3/h. This pipeline will be duplicated to achieve the required flow capacity without exceeding the overall pressure limit. The pumps supplying this main will also be assessed to identify their suitability at the increased flow capacity and upgraded as appropriate.

As discussed above for the pipeline from the wellfield to the pump station, the new pipeline will be located beside the existing line in the existing easement. The same clearing, drainage and erosion controls as described above for the wellfield pipeline will be implemented for the refinery pipeline.

5.1.10.3 Pipeline from Pump Station to Nhulunbuy

The pipeline supplying Nhulunbuy from the pump station has sufficient capacity to achieve the minor proposed consumption increase without requiring any upgrading.

5.1.10.4 Refinery Reticulation

Three pumps supply the present refinery requirements through a system of 250, 375 and 450 mm diameter mains with two pumps in operation and one on standby. Tests suggest that the Dundas Point main would exceed 9-bar pressure if flow exceeds about 1,000 m^3/h. Future peak conditions will exceed this flow. Accordingly the mains will require upgrading and pumps will require engineering design to assess suitability.

5.1.10.5 Nhulunbuy Reticulation

Three pumps supply the town requirements through a 300 mm diameter main. Typically two pumps will be in operation with a third in standby mode on rotating duty. No changes in pumps or discharge piping to the town will be required.

Part of the town supply feeds directly to the town reticulation system and part to the Mount Saunders reservoir.

5.1.10.6 Mine Reticulation

The mine water supply takeoff is located in the aerator area. This has its own pumping system that will continue to be operated as at present.

5.2 Energy

5.2.1 Existing Energy Production

Alcan Gove generates all steam and power requirements within the refinery at the steam power station which uses fuel oil as its primary energy source. The station has three high pressure boilers and two low pressure package boilers. Steam is used primarily for heating in the refinery but also drives turbines that generate power for the refinery, mine, Nhulunbuy, and other local communities. This is an extremely efficient means of energy conversion. A fourth high pressure boiler is currently under construction as part of ongoing refinery improvements.

Electricity is generated at 11,000 volts (V) AC by the turbines and increased to 22,000 V AC for distribution to the town and mine. Transformers at load centres reduce the voltage to normal levels for further distribution and use. At the refinery, different voltages are used for different purposes.

Boilers produce steam at 95 atmospheres (atm) (9,653 kPa). This steam drives the turbines to produce electricity. Steam is extracted from the turbines at 12 atm for use mostly in digestion. The remaining steam leaves the turbines at 5 atm for distribution throughout the refinery. Most areas in the refinery condense the steam to form pure condensate. The condensate is returned to the power station for re-use in the boilers. This reduces water demand and heat loss from the system. It is important that pure condensate is returned for several reasons:

- The treated water make-up system has a limited capacity and hence a high level of condensate return reduces the demand on the make-up system;
- Dumping of condensate wastes both heat and treated water; and
- Adding condensate to the liquor circuit increases the volume of water requiring disposal.

As back-up in times of high electrical power demand, the refinery has five fixed emergency generators together with an additional mobile diesel generator. These diesel-fired generators have a combined capacity of 12 megawatts (MW).

5.2.2 Third Stage Energy Demand

The Third Stage Expansion will require, on average, 36 MW of additional energy for the refinery and associated infrastructure including Nhulunbuy. The average energy requirement for the total operations following expansion will be 99 MW with load peaks up to 108 MW.

Equipment specified for the Third Stage Expansion will be required to maximise energy efficiency. Due to the use of more energy efficient equipment and more efficient processes, energy consumption for the expanded refinery will reduce by 4% per tonne of alumina.

One additional high pressure steam boiler and two back-pressure steam turbines will be constructed as part of the expansion to provide the additional energy demand. They will be installed at the southern end of the existing power station. They will operate in the same manner as the existing facilities.

Fresh make-up water for the new boiler will be provided from a new package water treatment plant utilising ion exchangers to treat the incoming water. The plant will have a capacity of 100 m^3/h.

Diesel-powered emergency generators will be retained with sufficient capacity to re-start and maintain essential electrical supplies.

5.2.3 Power Distribution

The power distribution system design and layout for the Third Stage Expansion will be compatible with the existing power distribution systems at the refinery. The primary distribution voltage of 22 kV will be retained.

New substations will be required throughout the various process areas within the refinery.

5.2.4 Nhulunbuy

The increase in power demand from Nhulunbuy will be small and will be met by the upgraded steam power station. Power prices will not be influenced by the fuel type used in the power station.

Power for the temporary construction accommodation village will be drawn from the existing power grid. Sufficient power for the village will be available from the upgraded steam power station and on-site generators will not be required except in emergency or peak demand situations.

5.3 Fuel

5.3.1 Fuel Oil

Fuel oil is currently used as the fuel for the refinery. It is used for the power station, the calciners and the lime kiln. Existing fuel oil consumption is 480,000 t/y. Low sulphur fuel oil is used for periods when odours from the stack emissions create a nuisance (principally in the wet season).

Fuel oil is transported to the site by ship and unloaded at the bulk cargo wharf. From there it is pumped to the harbour tank farm which consists of large fuel oil storage tanks as well as caustic soda storage tanks. Each fuel oil tank has a heat exchanger installed on the fuel oil suction line. This is required to ensure fluid viscosity is maintained at an adequate level to enable the required transfer-pumping rates to be achieved.

Fuel oil will continue to be used for the expanded refinery until a gas supply is secured. In this situation, the fuel oil consumption rate will be 850,000 t/y. As discussed in Section 8.5.2, a fuel switching strategy will be used to reduce the impact of air emissions.

5.3.2 Natural Gas

Once a gas supply is secured, there could be times when supply is interrupted for pipeline maintenance purposes. This could occur intermittently for up to eight days spread throughout the year. During these times, fuel oil will be used. Fuel oil will continue to be used for the lime kiln and for the rotary calciner which will be used as backup to the stationary calciners. The average annual fuel oil consumption for an expanded gas-fired refinery will be approximately 34,000 t/y.

Because of the reduced consumption rate of fuel oil with a gas-fired expanded refinery and hence longer storage times, it is proposed to use a fuel oil which is lighter than that which is currently used. This will reduce any problems associated with high viscosity and heating requirements incurred during pumping. This lighter fuel oil will also have a reduced sulfur content.

5.3.3 Other Fuels

Diesel is consumed on site in the diesel-fired emergency generators and in vehicle usage at the refinery, the residue disposal area and at the mine. Diesel is imported via the general cargo wharf and stored above-ground in the light fuel tank farm. Existing diesel consumption is 7,200 t/y.

Petrol and aviation fuel are also imported via the general cargo wharf and stored in the light fuel tank farm.

After the expansion, diesel consumption for vehicle and emergency generator use will increase to 10,200 t/y. The existing storage tanks at the light fuel tank farm will be adequate for this increased consumption and no additional storage facilities will be required.

5.4 Sewerage

5.4.1 Refinery

Except for some isolated septic tanks, sewage is collected in pump stations throughout the refinery and treated in a central oxygestor (primary treatment system). Treated effluent from this plant is discharged to the refinery outfall to Melville Bay. Sludge from the septic tanks and sewage treatment plant is removed by suction truck and disposed at the Wallaby Beach digestion lagoons located adjacent to existing residue disposal area.

Current and forecast sewage loads are depicted in Table 5.4.1.

Table 5.4.1
Current and Predicted Sewage Volumes at Refinery

Stage	People	Worker Type	Usage per person per day (L/p/d)	Daily Hydraulic Load (m^3/d)	Total Daily Hydraulic Load (m^3/d)
Current	470	Shift	180	85	127
	470	Office	90	42	
Third Stage Construction	470	Shift	180	85	253
	470	Office	90	42	
	1,200	Construction	105	126	
Third Stage Operations	532	Shift	180	96	144
	532	Office	90	48	

The existing sewage treatment plant at the refinery will be upgraded to meet the increased demand from the construction workforce.

5.4.2 Nhulunbuy

Sewage from Nhulunbuy is treated at a sewage treatment facility located to the north of the town near the golf club. Treatment is by a series of primary and secondary treatment ponds that are designed and operated to have zero release. However, some of the effluent is re-used as irrigation water on the adjacent golf club. The effluent is chlorinated prior to re-use and the bacteriological quality is suitable for restricted spraying applications. The treatment facility is currently operating at 50% of design capacity.

The town sewage treatment system has sufficient capacity to treat the increased load from both the construction workforce accommodation village as well as the increased permanent population following the expansion. As the town previously had a population of 5,000 (compared to its current population of 3,800) there will be adequate capacity to accommodate the additional peak load from the construction workers. However, the pump station servicing the area of the construction workforce accommodation village will be upgraded to provide sufficient capacity to pump sewage to the treatment plant.

5.5 Transport

5.5.1 Air

5.5.1.1 Current Facilities

The Gove airport consists of a single sealed runway, an (unused) control tower, navigation and landing aids, lighting, fuel facilities and passenger terminal. The Bureau of Meteorology maintains a weather observation station on the south-western side of the runway.

Qantas operates a daily service between Darwin and Cairns via Gove using BAe-146(300) aircraft with high passenger load factors. Other operations consist mainly of charters and operators servicing Aboriginal communities in Arnhem Land.

5.5.1.2 Third Stage Expansion Demand

Projected peak daily passenger numbers during the Third Stage Expansion construction are shown in Table 5.5.1. These figures have been used as the basis of design for the proposed airport works.

Table 5.5.1
Forecast Daily Peak Passengers

Flight	Originating Passengers	Transfers	Terminating Passengers
Morning Peak			
Qantas (Darwin-Gove-Cairns)			
Construction passengers	80		20
Standard Gove commuters	35*		35
AirNorth (Groote Eylandt-Gove-Darwin)			
Standard Gove commuters	0	6	3
Evening Peak			
Qantas (Cairns-Gove-Darwin)			
Construction passengers	20		80
Standard Gove commuters	35		35*
AirNorth (Darwin -Gove- Groote Eylandt)			
Standard Gove commuters	3	6	0

** includes transfers*

Based on the above forecast passenger numbers, Qantas has indicated that Boeing 737-400 aircraft will be introduced prior to the beginning of the construction of the Third Stage Expansion.

5.5.1.3 Airport Works in Progress

The following work is currently being undertaken at the airport to address community and business needs (including mining of an area currently taken up by part of the airport runway):

- Runway works to increase the effective runway length from 2,058 m to 2,208 m by:

  - extending the runway by 1,050 m to the north-west; and
  - shortening the south-east end of the runway by 900 m.
- Decommissioning two of the four existing taxiways and constructing one new taxiway to service the modified runway;
- Construction of a new apron;
- Upgrading of navigation and landing aids;
- Installation of new runway, taxiway and apron lighting in accordance with Civil Aviation Safety Authority Australia (CASA) regulations;
- A new package sewage treatment system utilising grey water re-use and effluent irrigation;
- Installation of rainwater tanks for irrigation and non-potable use; and
- Construction of a new passenger terminal designed in accordance with the requirements of the Building Code of Australia (BCA), based on Australian best practice and the recommendations of the International Air Transport Association (IATA) and the International Civil Aviation Organisation (ICAO).

This work will be completed in the latter half of 2004.

5.5.2 Roads

5.5.2.1 Vehicles

The approximate number of vehicles that are used at the refinery and are owned by Alcan Gove include 85 light vehicles (mainly 4WD), 8 trucks, 23 motor bikes (used only on the refinery site and not on public roads) and 7 buses used to transport workers to site each day.

Alcan Gove owns almost all of the vehicles used at the mine and the refinery. This includes light passenger vehicles (except for local hire cars), buses, trucks (except for those owned by contractors), haul trucks, loaders, dump trucks, forklifts etc. There are some small trucks, cranes and high pressure water blasters that are owned by contractors.

Diesel fuel used by the above vehicles is currently 7,200 t/y and this will increase to 10,200 t/y following the expansion.

There is a large workshop at the mine where all large hauls trucks and other mining equipment is maintained. This workshop is roofed with a fully bunded diesel storage facility. The refinery also has maintenance workshops, electrical workshops and vehicle workshops. Panel beating and other specialist work on vehicles and equipment is undertaken either by contractors at Gove or they are sent off-site to Darwin.

When vehicles and equipment owned by Alcan Gove are no longer required, they are generally sold to second hand purchasers either at Gove or elsewhere. Used vehicles or equipment that are not suitable for resale are sent to Darwin for recycling. The disposal of waste tyres, oils, batteries and engine coolants is described in Section 7.3.1.

5.5.2.2 Katherine to Gove

Road access to Gove is via a 650 km unsealed road from Katherine that is normally open only during the dry season. Use of this road for heavy loads is difficult and limited. Due to the unreliable nature of deliveries via this road, it is proposed that virtually all of the construction materials for the expansion will be brought to the site by sea.

Furthermore, construction workers will be flown to and from the site. On this basis the expansion project will have little impact on the existing Katherine-Gove road.

5.5.2.3 Nhulunbuy to Refinery

A company bus is provided to transport employees between the refinery and town. Some employees use private vehicles and motorcycles. A number of employees ride bicycles. Traffic between the refinery and town will increase during the Third Stage Expansion construction, particularly at shift changeover. The majority of construction workers will be transported to and from the construction village by bus. Table 5.5.2 indicates the typical traffic movements before, during, and after the construction phase along Melville Bay Road.

Table 5.5.2
Existing and Projected Typical Traffic Movements between Nhulunbuy and Refinery

Vehicle Type	Number of Traffic Movements per Day		
	Existing Operations	Third Stage Expansion Construction (including Existing Operations)	Expanded Operations
Motorcycles	20	20	22
Employee vehicles	480	580	530
Company vehicles	170	170	190
Consultants	20	20	22
Major contractors (light)	15	65	15
Minor contractors (light)	10	10	11
Light Vehicles Total	**715**	**865**	**790**
Company bus	18	60	20
Major contractors (heavy)	7	20	7
Minor contractors (heavy)	30	55	33
Heavy Vehicles Total	**55**	**135**	**60**
TOTAL	**770**	**1,000**	**850**

The estimates in Table 5.5.2 show that traffic on Melville Bay Road will increase during the construction phase. The most significant increases will be from the additional buses and contractors' heavy vehicles. While there will be a significant increase in traffic at the beginning and end of each working day, the total increase in average daily traffic movements is only 30% and this will occur only during the peak of the construction phase (approximately six months). The capacity of the existing road is adequate to cater for the expected construction phase traffic.

5.5.2.4 Nhulunbuy to Mine

Due to the limited Third Stage Expansion work at the mine, there will be minimal increases in traffic between the town and mine site. The existing road system will adequately accommodate this traffic.

5.5.2.5 Nhulunbuy to Airport

There will be an increase in passenger traffic through the airport and therefore on the road to and from the airport as a result of the Third Stage Expansion (Table 5.5.1). However, this increase is small compared to the capacity of the existing road. Furthermore, a bus service will operate to connect with scheduled flights, so the amount of additional traffic generated will be less than the number of additional passengers.

5.5.2.6 Port Area

Most of the construction loads will be transported to the site by barge and will be unloaded at Perkins Wharf. Alcan Gove has reached an agreement with Perkins Shipping to unload construction materials on a wharf within the existing Perkins lease area. Perkins Shipping will expand their existing wharf to provide sufficient area for these operations. From there, they will be transported by truck to the laydown areas east and west of the refinery. This will generate approximately 2,000 truck trips over the construction period split 35/65 to the east and west respectively.

New construction haul roads will be constructed from the wharf to each of the laydown areas as shown on Figure 4.9.1. The roads will be built to accommodate heavy construction loads.

Truck movements between the wharf and the site will generally occur only when the barge is in port. On average, there will be four barges per month for the peak 12-month period of the construction phase and two barges per month for the remainder. There will be approximately 40 truckloads per barge unloading over a 12-hour period, or an average of seven truck movements per hour.

As discussed in Section 4.9.2.1, some of the new plant will be delivered to the site in the form of pre-assembly modules (PAMs). The modules will be loaded onto a large multiple-wheel (minimum 24 axles) low-loader called a self-propelled modular transporter (SPMT). The SPMT will transport the PAMs to a staging area to allow prompt turnaround of the barge. When the barge departs for its next load, the PAMs will be transported from the staging area to the job site for placement in their final positions.

SPMTs using the haul road to the eastern side of the refinery will first need to travel along the main refinery access road (Melville Bay Road). As the road will need to be temporarily closed for these operations, these movements will only be undertaken at night and with appropriate police clearances. The closure times will be no more than one hour for each movement.

Smaller construction loads are also expected to be unloaded at Perkins Wharf. These loads will be trucked to the construction laydown areas along the construction haul roads.

5.5.3 Shipping

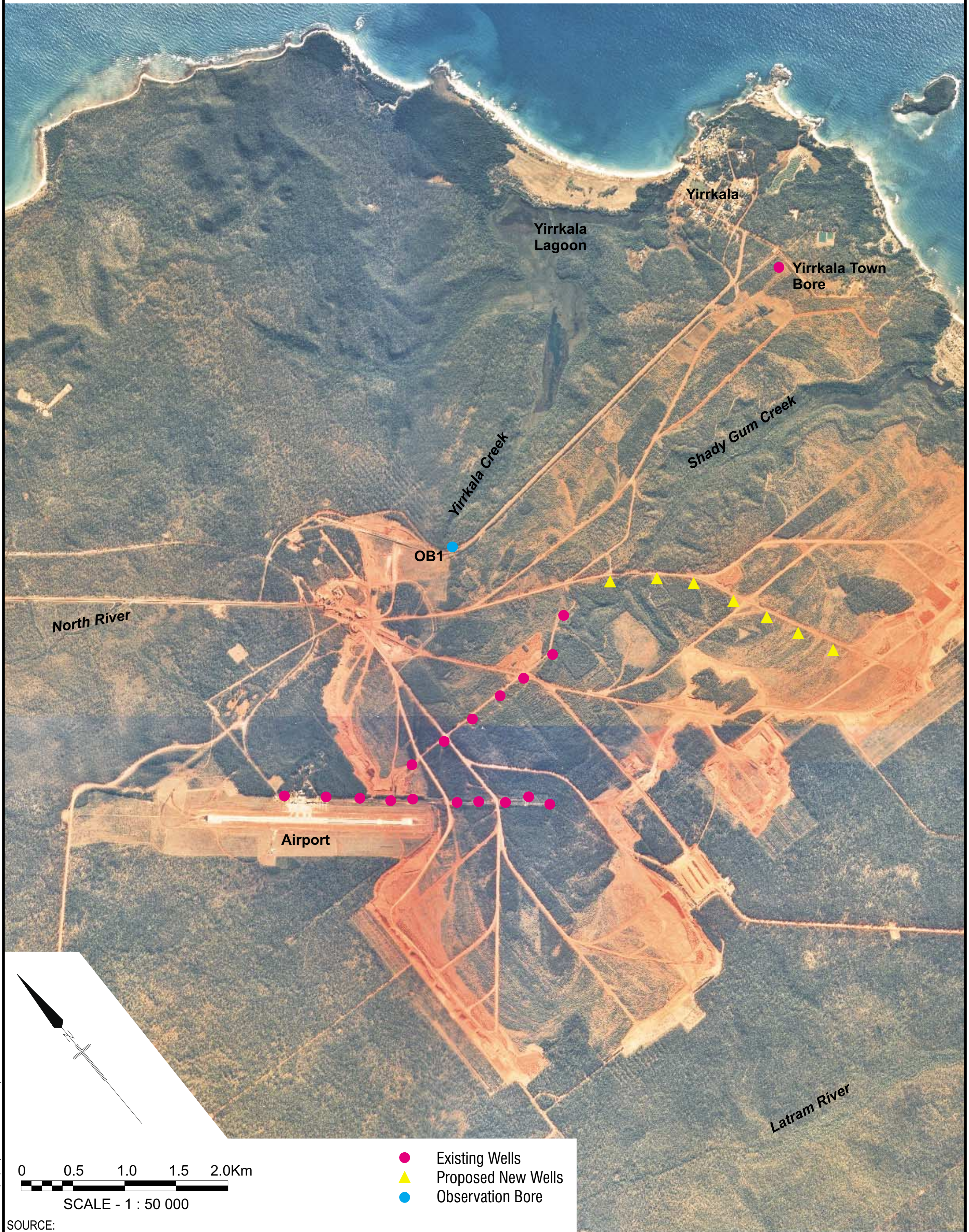
The primary mode of cargo transport to Gove is shipping. Raw materials and products for the refinery are imported and exported via either the Bulk Cargo Wharf or the General Cargo Wharf. Associated shipping movements are described in detail in Table 4.7.1.

General cargo for Nhulunbuy is shipped generally from Darwin and unloaded at Perkins Wharf and transported into town by truck. This facility is operated by Perkins Shipping, currently the only shipping transport company servicing Gove. The schedule for shipping of general cargo into Nhulunbuy is shown in Table 5.5.3.

Table 5.5.3
General Cargo Shipping into Nhulunbuy

Day	Size (t)	Last port of call
Monday	2 000	Darwin
Thursday	400	Darwin
Saturday	1 200	Karumba

Due to existing spare cargo capacity, the number of shipping movements is expected to remain generally unchanged during construction and after the Third Stage Expansion.



SOURCE:

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ALCAN GOVE REFINERY EXPANSION
ENVIRONMENTAL IMPACT STUDY

WATER SUPPLY WELLFIELD

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Figure **5.1.1**