

Section 4

Alternatives



4. Alternatives

4.1 Introduction

The EIA process and Guidelines (**Appendix A, Volume 1**) require a discussion of project alternatives, demonstrating that environmental performance has been an integral part of the project planning. This section outlines the main alternatives including:

- the ‘no development’ option;
- alternative energy supply options;
- alternative pipeline route selection options (Routes A–D);
- alternative power generation during operations;
- alternative design and construction specifications.

A combination of environmental, economic and technical selection criteria have been used to assist in the review and consideration of each alternative option.

The general locations for above ground facilities (for example, compressor stations, scraper stations etc) have been identified and site selection criteria for these sites are discussed in **Section 5.4**. The location of these sites may well be further refined during the detailed engineering design phase. The selection of suitable sites for construction camps and access tracks are at a similar stage.

Each option has been assessed in terms of its:

- cultural sensitivities;
- logistical advantages and disadvantages;
- positive and negative impacts;
- impacts on matters protected under relevant Commonwealth and Northern Territory legislation.

4.2 ‘No Development’ Option

4.2.1 Implications of the ‘No Development Option’

The implications of the ‘no development’ option would ultimately result in the loss of various economic benefits for the local, regional and national economies. This loss would have negative effects on the following:

- local, regional and national employment and business opportunities in both the short and longer term;
- loss of capital costs to the Northern Territory and Australia, associated with the pipeline and associated infrastructure. The capital costs are expected to be around \$550 million over the life of the project (ACIL Tasman 2004);
- loss of revenue to Territory Government and Commonwealth Government – the TTP is anticipated to add an average of \$29 million per annum to the real GSP of the Northern

Territory and \$27 million per annum to the real GSP of the Australian economy (ACIL Tasman 2004);

- loss of an estimated \$75 million in the net present values of Commonwealth and Northern Territory revenues over the anticipated life of the project (ACIL Tasman 2004);
- loss of local improvements in air quality resulting from the transfer from fuel oil to natural gas.

4.3 Alternative Energy Supply Options

A review of potential alternative energy supply options has been conducted and included:

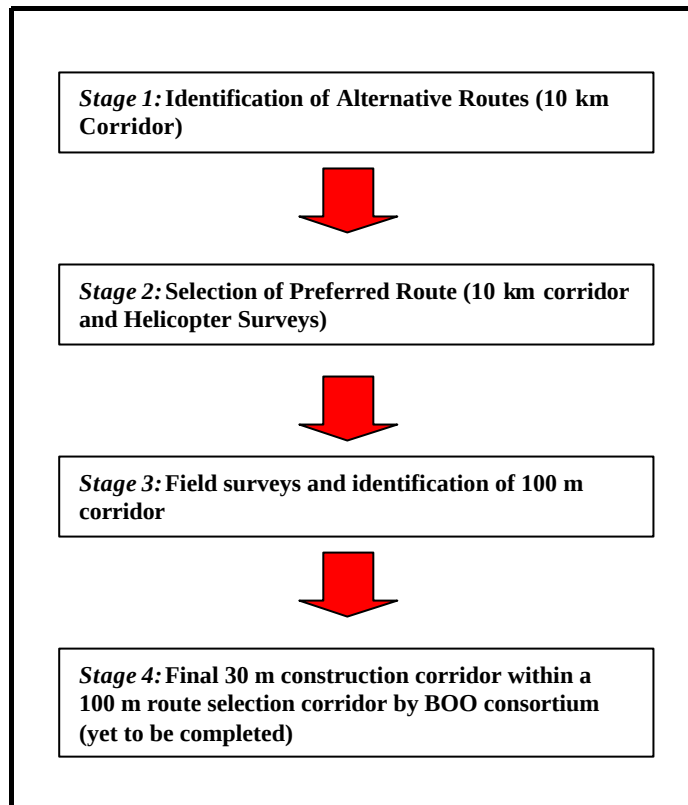
- ***Use of Existing Fuel Oil at the Alcan Gove Refinery:*** The existing Alcan Gove Refinery currently uses fuel oil as a source of energy. Consideration was originally made to continuing to use fuel oil at the Alcan Gove Refinery, thus not necessitating the need for the TTP. As part of Alcan's commitments to improving local air quality, it was concluded that using fuel oil was not the most viable means to achieve this.
- ***Identification of Alternative Fuel Gas Sources:*** A range of gas sources was considered for supplying gas to the Alcan Gove Refinery including Blacktip. Supply of gas from the Blacktip field was considered the only currently feasible option for taking forward into design due to issues of market certainties and security of supply.

4.4 Pipeline Route Options

4.4.1 Route Selection Process

An assessment of the different pipeline route options was undertaken early in the project design to determine the most appropriate route based on social, economic, technical and environmental grounds (Section 4.4.2). The route selection process involves four main stages as outlined in Figure 4-1.

■ **Figure 4-1 Route Selection Process**



Stage 1 Desktop Studies: Initial environmental desk-top studies were undertaken to identify key environmental and cultural sensitivities in the region. Based on the findings of these studies, an initial 10 km-wide corridor was selected for a range of alternative routes (**Section 4.4.2**). The project proponent undertook a Preliminary Environmental Constraints Assessment to address environmental considerations for the selection of a pipeline route. This comprised desk-based work and a brief field visit to identify key environmental and cultural sensitivities. As part of the desktop review, all relevant and available public literature was reviewed to:

- identify any significant flora and fauna species occurring in areas traversed by the preferred pipeline route;
- identify aquatic species and habitats that may be particularly sensitive to disturbance from construction and operation of the TTP;
- identify important hydrological systems such as shallow water body ecosystems and sensitive water sources;
- identify flora and fauna species and archaeological sites which have protected status under the Northern Territory and Commonwealth legislation;
- Identify areas of potential cultural and archaeological sensitivity.

Stage 2 Helicopter Surveys, Field Surveys and Route Refinement: A number of field surveys were conducted along a route through Arnhem Land in October 2001 and also a route south of the

preferred route between Wadeye and Katherine. Following consideration of all route options, a preferred route was selected and a preliminary pipeline alignment identified within a 10 km-wide corridor. The following helicopter surveys were conducted as part of this process:

- 1st survey: Initial reconnaissance survey during the dry season June to July 2003 to determine the extent of any residual flooding from the previous wet season. Survey covered routes B, C and D.
- 2nd survey: Additional survey during the wet season (March) 2004 between Katherine and Gove to identify areas subject to inundation.
- 3rd survey: Final survey was conducted in March 2004 to refine the route across the Mitchell Ranges.

Stage 3 Selection of 100 m Pipeline Corridor: The initial 10 km-wide corridor was narrowed down to 100 m based on the field surveys conducted in 2003 and 2004. The field surveys involved a continuous traverse of the pipeline route with a team comprised of a pipeline engineer, geotechnical engineers, environmental scientists, archaeologists, anthropologists, Northern Lands Council (NLC) and Traditional Owners. A number of potential sites for access roads, construction camps, facility sites, cathodic protection sites and main line valve sites were also surveyed during this stage. Refinements to the pipeline corridor and locations for above ground facilities were made while in the field to avoid environmentally and culturally sensitive areas.

Stage 4 Finalise 30 m Construction Corridor: Prior to construction activities the BOO consortium will conduct a land survey to select a 30 m-wide construction corridor within which the pipeline will be located, within the 100 m pipeline corridor.

4.4.2 Alternative Route Options Considered

Initially, four possible pipeline routes were considered by the TTP proponents (Route A, Route B, Route C and Route D) and assessed for potential environmental constraints using topographical maps. These routes are presented in **Figure 4-2** and summarised in **Table 4-1** along with a justification for their selection or rejection.

■ **Table 4-1 Pipeline Route Alternative Options**

Route Option	Pipeline Length (km)	Geographical Description of Route	Justification for Selection or Non Selection
Route A (Direct Route)	892	Most direct route from the proposed Blacktip gas plant to Alcan Gove Refinery.	The route passes directly through Kakadu National Park and was immediately rejected on environmental grounds.
Route B (Northern Route)	923	Passes approx 2.5 km south of Kakadu National Park and directly through Nitmiluk (ie Katherine Gorge) National Park. Route passes approx 49 km north west of Katherine.	Major deviations were required along the route to avoid undesirable geological conditions. Deviations added significantly to the overall length of the pipeline. Route considered unfeasible and rejected on environmental, engineering and economic grounds.
Route C (Preferred Route)	940	Passes approx 14 km south of Katherine.	This route offered the best balance between pipeline length and engineering feasibility and was selected as the preferred route.
Route D (Southern Route)	953	Passes approx 46 km south of the Katherine township.	The route follows a direct line from Wadeye to Mataranka, and then follows a previously surveyed pipeline corridor from Mataranka to the Gove Peninsula. This route was considered feasible for construction, however, it was considered the longest pipeline option due to deviation requirements around surface rocks and was consequently ruled out.

Routes B, C and D were short-listed and assessed in more detail during the helicopter survey of July 2003. Route C was then selected as the preferred alignment option based on the information gained during the survey. Specific factors, which determined the alignment of Route C, included:

- In the western area the pipeline route passes close to Dorisvale Station, which has reasonable road access. The Dorisvale Road would give access to the eastern end of the Wingate Plateau, which has very limited road access.
- The route up the escarpment near Tom Turners Crossing on the Moyle River was chosen as it was assessed that construction traffic including pipe trucks would be able to ascend the escarpment at this point, albeit with some degree of difficulty. This route was refined during the 2003/2004 ground surveys.

4.4.3 Pipeline Deviations

Following the selection of Route C as the preferred pipeline route, detailed site surveys were carried out to further identify any minor deviations required around environmentally or culturally sensitive areas and sites. Based on the findings of these surveys and on technical grounds, refinements or deviations to the preferred pipeline route were made. **Figure 4-3** and **Table 4-2** presents the deviations or bypasses considered for defining the Route C alignment.

■ **Table 4-2 Pipeline Deviations or Bypass Options Considered**

Deviation/ Bypass Option	Geographical Description of Route	Justification for Selection or Non Selection
Bypass N	Located along the far western section of the preferred route. Passes north of the preferred Route C close to Wadeye and through a black soil plain with areas of swamp.	This bypass provided a saving of 11 km, but passes through a swamp area 2.3 km in width. It was considered that the cost and possible environmental damage of this bypass made it unfeasible.
Bypass D1	Passes to the east of Wadeye up a steep rocky escarpment where the land rises from the coastal plain up to the Wingate Mountains. Route then passes inaccessible land.	This bypass considerably shortens the overall length of the preferred route. This route was not selected based on engineering difficulties and economic implications.
Bypass D2	Passes through Maiwok, Flying Fox and Derim Creeks and the steep High Black Range escarpment.	This bypass would also shorten the overall pipeline length, but was considered uneconomic from a construction point of view.
Bypass D3	Crosses the Mitchell Ranges	Several routes across the Mitchell Ranges were considered. This route was rejected due to the difficult terrain encountered including large amounts of rocks. Following a helicopter survey from Katherine to Gove in March 2004 it was considered that a northern crossing following the Central Arnhem road would be the best option. This bypass was therefore rejected.

To reach the final route alignment seven separate major revisions have been made to the preferred route in order to avoid areas of environmental or cultural sensitivities and to provide the best engineering option.

4.5 Alternative Power Generation During Operation

Electricity will be required along the pipeline route to supply power to above ground facilities and the pipeline cathodic protection system during operational activities. Two main options were examined for power generation including:

- diesel generation
- Remote Area Power Supplies (RAPS)

Diesel generators can be used to charge batteries and supply power. The generators can be designed to be self-starting and therefore not run continuously. The generators require frequent delivery of fuel along the pipeline corridor during operation. Regular maintenance will also be required for the generators, and hydrocarbon spills pose a potential environmental hazard. Noise and air pollution may also present a potential impact from the use of diesel generators.

An alternative to diesel generators, RAPS systems were explored. RAPS systems range from small petrol generators, able to power appliances directly, to more complex installations using only renewable energy, with a combination of both also being possible. RAPS systems offer the following benefits:

- reduction of fuel consumption and transport costs;
- reduction of the risks associated with fuel storage and transport (for example spillage);
- reduction of local impacts of fossil fuel generation (noise and air pollution).

Based on these benefits RAPS systems were identified as the preferred power supply option for the TTP. The alternative RAPS systems explored include the following:

Solar Powered (Photovoltaic module): The basic component of a photovoltaic module is the solar cell, which converts sunlight directly into electricity. Photovoltaic (PV) modules consist of many solar cells connected together and encapsulated under glass. Usually several modules are connected together to form an array, which has a Direct Current (DC) output.

Thermal-Electric Generators: This system consists of a bank of thermo-electrical generator units which work on the principle of thermo-coupling. Heat to the hot thermo-couple junction is provided by burning gas in a flameless catalytic heater. A gas pressure reduction station is required to supply gas to the catalytic heater.

Closed Cycle Vapour Turbogenerator: This system consists of a gas burner which boils a liquid, the high pressure vapour produced drives a turbine, then the low pressure vapour is condensed in an air cooler and returned to the boiler. A gas pressure reduction station is required to supply low-pressure gas to the burner.

Wind Turbines: Although they vary greatly in size and design, nearly all wind turbines feature several blades that rotate about a horizontal or vertical axis. The turbine is connected to a generator that converts the wind energy directly into DC (Direct Current) or AC (Alternating Current) electricity.

Microhydro Generators: When a steady and reliable source of flowing water is available, microhydro generators can be used to produce electricity. As with a wind turbine, the device is used to drive a generator.

Diesel, LPG and Petrol Generators (gensets): These use an internal combustion engine to drive a generator, usually with an AC output. Gensets are often used as a backup source of electricity for when the renewable sources are insufficient (ie hybrid systems).

The RAPS system which has been selected is solar powered and is discussed further in **Section 5.10.6** of the Draft EIS.

4.6 Design and Construction Alternatives

There is limited scope for making changes to the design of high pressure gas pipelines. Pipelines are typically constructed using a universal, standard ‘spread’ technique (**Section 5**). There are however, opportunities for considering alternative construction techniques for pipelines crossing roads, rail and river crossings. The selection of the crossing technique could result in different

levels of potential environmental impact. Potential crossing techniques considered as part of the design considerations include:

- Horizontal Directional Drilling (HDD)
- open cut methods
- horizontal boring

HDD has been selected for a number of watercourse crossings, which represent sensitive habitats containing important species or have cultural significance.

The process for identifying the most appropriate method to construct each of the watercourse crossings involved consideration of each of the aspects (summarised in **Table 4-3**) by technical experts, and negotiation between the various stakeholder groups, to ultimately come up with a crossing method with which all groups agreed. The outcome of the crossing assessment was that HDD techniques were proposed for 12 waterway crossings. Detail on the location of these crossings and a detailed description of the various crossing techniques, is provided in **Section 5.8.10**.

■ **Table 4-3 Selection Criteria for Watercourse Crossings**

Issue	Aspect
Impact on environmental values	Type and integrity of riparian vegetation Susceptibility to erosion and potential to cause downstream sedimentation impacts Ability to stabilise and rehabilitate in short time frame between construction and the following wet season (dependent on various factors including soil type, vegetation, stream flow) Type and integrity of in-stream habitat Declared Beneficial Uses of water Threatened fauna and flora
Impact on archaeological and heritage sites	Significant archaeological sites or objects Significant historic heritage sites
Impacts on social values	Declared Beneficial Uses of water Landowner wishes Recreational and tourism use of waterways
Impact on cultural values	Aboriginal Sacred Sites Aboriginal cultural values
Engineering feasibility	Soil and rock type Bank profile Cost and logistics of construction Ability to stabilise and rehabilitate Water flow Feasibility of trenching

Alternative Pipeline Routes

- Route A (Blue line)
- Route B (Black line)
- Route C (Red line)
- Route D (Green line)
- Route B Interlink (Dashed black line)
- National Park / Natue Reserve / Conservation Area (Green hatched area)

Scale: 0 to 100 Kilometres

Inset Map: AREA OF DETAIL showing the location of the study area within Australia, highlighting the Northern Territory (NT) and surrounding states (WA, SA, QLD, NSW, VIC, TAS).

Figure 4-3: Alternative Pipeline Deviations to Preferred Routes

