LinkWater Projects

Northern Pipeline Interconnector - Stage 2

ENVIRONMENTAL IMPACT STATEMENT

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This Environmental Impact Statement (EIS) for the Northern Pipeline Interconnector Project Stage 2 has been prepared by Northern Network Alliance on behalf of Southern Regional Water Pipeline Company Pty Ltd trading as LinkWater Projects. In preparing this EIS, Northern Network Alliance has relied upon and presumed accurate certain information provided by specialist subconsultants, certain State and Commonwealth government agencies and others identified herein. Except as otherwise stated in this EIS, Northern Network Alliance has not attempted to verify the accuracy or completeness of any such information. No warranty or guarantee, whether express or implied, is made with respect to the information reported or the findings, observations or conclusions expressed in this EIS. Further, such information, findings, observations and conclusions are based solely on information in existence at the time of the investigation.

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EXECUTIVE SUMMARY

Background to the Project

The south-east Queensland (SEQ) region is one of the fastest growing areas in Australia. However, unprecedented population growth over the last decade has coincided with the worst drought on record. This has placed increasing pressure on the management and use of regional water sources and highlighted the vulnerability of the region's water supplies. In response, the Queensland Government is implementing an integrated water infrastructure network—the SEQ water grid (see Figure 1). The water grid is made up of a group of water supply sources joined by a series of large interconnected water pipelines, which will allow water to be transferred to where it is most needed and ultimately provide water security for the region.

Water Supply and Distribution

The Northern Pipeline Interconnector (NPI) Stage 2 project is a key component of the SEQ grid. Initially, the NPI Stage 2 will transport water under existing utilised entitlement (up to 55% or 3600 ML/a has been used by Noosa Shire in the past) authorised under the *Water Resource (Mary Basin) Plan 2006* (Mary Basin WRP). This existing entitlement comprises 6500 ML/a (18 ML/d) interim water allocation (high priority) held by the SEQ Water Grid Manager within the Upper Mary River Water Supply Scheme. However, the pipe will be sized and designed to accommodate flows from future bulk water sources on the Sunshine Coast, including the Traveston Crossing Dam, should it be approved.

The completed NPI (Stage 1 and Stage 2) will supply a target volume of 65 ML/d of potable fresh water to existing storage facilities at Elimbah and Morayfield for distribution to localities in the greater Brisbane region. Successful completion of Stage 2 will include a number of integration works with NPI Stage 1 in order to operate the project as a whole. Further, the NPI Stage 2 will support the regional growth initiatives on the Sunshine Coast described by the Queensland Water Commission (QWC) (QWC 2008).

Completion of the NPI Stage 1 at the end of 2008 will initially supply the full 65 ML/d drought contingency flows from Baroon Pocket Dam via the Landers Shute water treatment plant (WTP). Completion of Stage 2 will connect the NPI to additional existing water sources (supplying up to 18 ML/d), thereby reducing the reliance on water drawn from the Baroon Pocket Dam to supply drought contingency flows.

Stage 2 Water Supply Strategy

The previous water supply strategy for NPI Stage 2 proposed the abstraction of approximately 40 ML/d of water from the Mary River which would be sought through new entitlements under the Mary Basin WRP. As this proposed entitlement was not included within the establishment of the Mary Basin WRP, any impacts associated with the new allocation would require assessment against relevant state and federal environmental legislation.

Following the review of the previous water supply strategy for Stage 2, a new strategy (now the current water supply strategy) was proposed. The factors influencing the new water supply strategy included:

- improvements in the regional water supply situation following good rainfall over the summer of 2007–08 and in early June 2008, which resulted in spillway overflows at all Sunshine Coast dams;
- recent short-term water balance modelling completed by QWC, which showed that the transfer of 65 ML/d from Baroon Pocket Dam to the SEQ water grid was sustainable until the end of 2011; and
- enhancement of water supply security in SEQ through the completion of a number of key drought contingency projects by the end of 2008.

Under the currently proposed water supply strategy (ie utilisation of existing entitlements) NPI Stage 2 will have the capacity to deliver up to 6500 ML/a (18 ML/d). The obvious advantages of this water supply strategy are:

- the impacts to the environmental values of this entitlement have been assessed and as a result the allocation was authorised under the Mary Basin WRP 2006;
- no new water entitlements are being sought and there are no resulting anticipated impacts on endangered, vulnerable and rare (EVR) species or matters of national environmental significance (MNES) in the Mary River;
- water entitlements have been previously utilised and established under the WRP. This is consistent with the environmental flow objectives (EFOs) of the WRP;
- reduced reliance on Baroon Pocket Dam for drought contingency flows;
- no changes to the existing infrastructure on the Mary River; and
- more easily managed from a risk management perspective, resulting in a more streamlined approvals process.

Figure 1
SEQ WATER GRID

Project Proponent

The proponent for the NPI Stage 2 is the Southern Regional Water Pipeline Company, trading as LinkWater Projects. LinkWater Projects is responsible for a number of major water infrastructure projects in the SEQ region, including the Southern Regional Water Pipeline (SRWP), NPI Stage 1, the Eastern Pipeline Interconnector (EPI) and Toowoomba Pipeline Project (TPP).

LinkWater Projects is a division of LinkWater, which was established as Queensland's Bulk Water Transport Authority with the introduction of the *South East Queensland Water (Restructuring) Act 2007*. LinkWater will retain ultimate ownership of the NPI Stage 2 asset.

LinkWater has a commitment to effective environmental management and lists environment as a key component of its overall vision 'to become an effective partner in delivering water security to SEQ', with an underlying principle of 'Sustainability and positive environmental outcomes'.

For further information regarding LinkWater and LinkWater Projects, please contact:

LinkWater Projects
Level 4, 200 Creek Street
Brisbane QLD 4000
Phone: (07) 3270 4000
www.linkwater.com.au

Project Overview

The completed NPI (Stages 1 and 2) will transport a target volume of 65 ML/d of treated potable water from the Sunshine Coast to Brisbane. Completion of the NPI Stage 1 at the end of 2008 will supply the full 65 ML/d drought contingency flows from Baroon Pocket Dam via the Landers Shute Water Treatment Plant (WTP). Successful completion of the Stage 2 project will connect additional existing and unutilised water sources to the SEQ water grid, thereby reducing the reliance on water drawn from the Baroon Pocket Dam to supply drought contingency flows. The connection of Stage 2 to additional water sources therefore increases the security of water supply for the NPI.

The NPI Stage 2 will have the capacity to deliver up to 6500 ML/a (18 ML/d) from existing utilised entitlements on the Mary River authorised under the Mary Basin WRP. The NPI will be sized and designed to integrate with a future Northern Regional Pipeline (NRP), which would transfer flows from the proposed Traveston Crossing Dam, should it be approved.

The project comprises approximately 48 km of pipeline and associated facilities required to transport water from the existing Noosa WTP near Cooroy and the termination point of the NPI Stage 1 pipeline at Eudlo (see Figure 2). The project footprint is approximately 148 ha, composed mainly of a 30 m wide pipeline corridor.

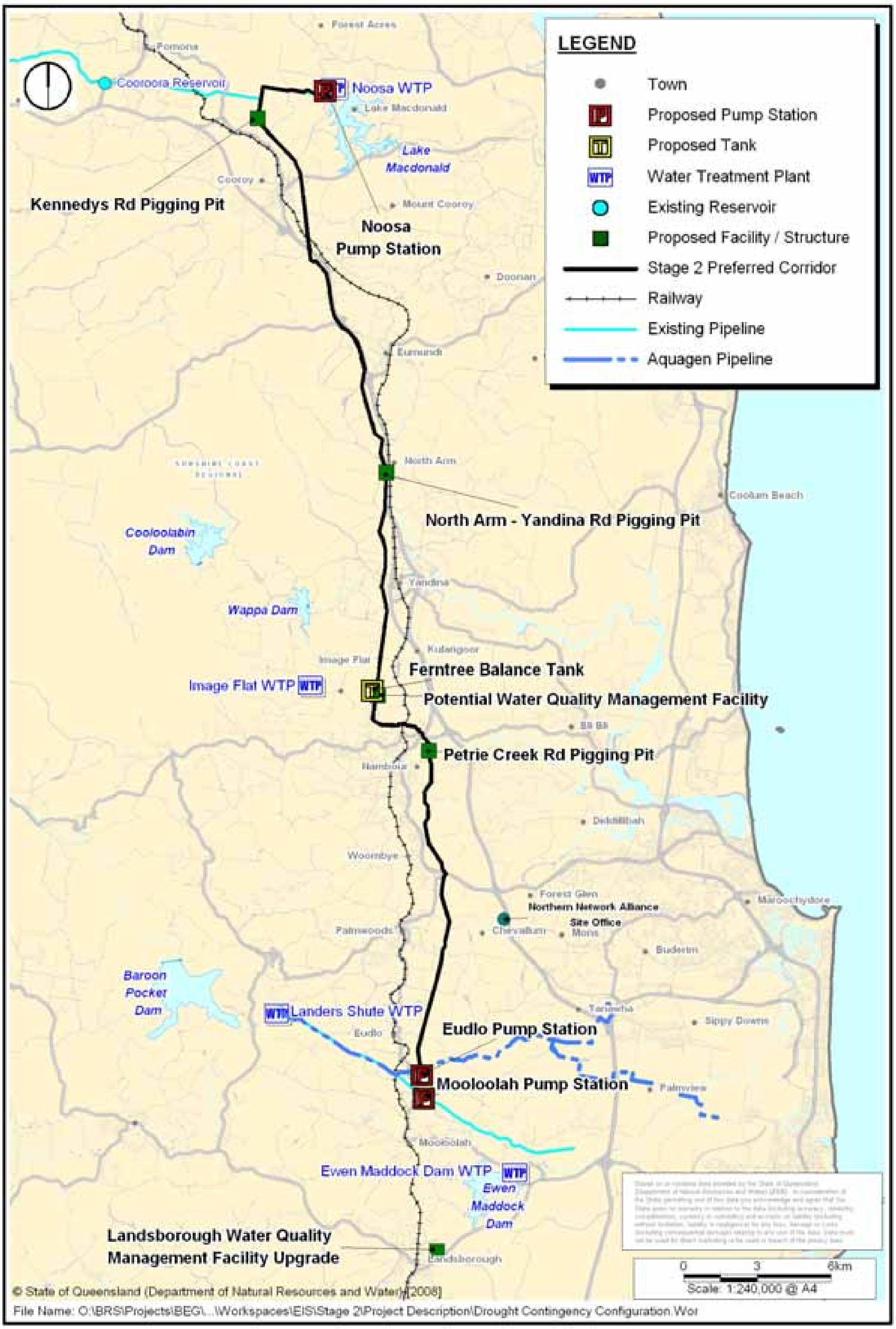

Figure 2
NPI STAGE 2 PREFERRED CORRIDOR

The current proposed NPI Stage 2 system configuration (for the purpose of this EIS) will require:

- the 5 ML Ferntree balance tank at Kulangoor (near Nambour);
- three new pump stations at Lake Macdonald, Eudlo and Mooloolah;
- a new water quality management facility (WQMF) at Kulangoor; and
- upgrades to an existing WQMF at Landsborough.

The majority of the pipeline route is located within existing public utility easements (approximately 68%) or road reserves (approximately 24%) to minimise additional encumbrance to directly affected landholders and disturbance to native vegetation and habitat areas.

In some locations, the use of existing easements or road reserves is not feasible due to engineering or environmental constraints. In these areas, every effort has been made to minimise the number of landholders affected by the project and minimise the potential for environmental harm.

Public Consultation

A comprehensive community consultation program has been undertaken as part of the preparation of this EIS. A Community and Stakeholder Relations team, in conjunction with the Department of Infrastructure and Planning, have consulted with directly affected landholders, nearby residents, community groups and elected representatives. Consultation will continue for the life of the project to identify and manage potential issues. Anyone requiring further information about the NPI Stage 2 project should contact the Northern Network Alliance:

Freecall: 1800 243 998

Reply paid: PO Box 515, Nambour QLD 4560

Environmental Impact Assessment

EIS Process

This EIS is prepared under the bilateral agreement between the Queensland and Commonwealth governments to satisfy the environmental assessment processes under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWOA) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).

The EIS has been prepared to inform directly affected landholders, native title parties, advisory agencies, the Commonwealth Minister for the Environment, Water, Heritage and the Arts and other interested parties about the need for the NPI Stage 2 project, the potential impacts associated with the project and how these impacts will be managed. The Coordinator-General (CG) and the Department of Environment, Water, Heritage and the Arts (DEWHA) are the decision-making authorities for the EIS process.

Submissions

A public notice will be advertised in relevant state and local newspapers. This notice will state:

- where a copy of the EIS is available for inspection;
- where a copy of the EIS may be obtained at a stated cost; and
- the period nominated by the CG during which submissions on the EIS may be made.

Impact Assessment Framework

This EIS has been prepared with input from a wide range of government and private sources, and technical professionals commissioned to undertake specialist studies. Studies and the associated reporting have been undertaken to address the terms of reference prepared by the CG. The outcomes of the various studies have been incorporated into the EIS, either within the main report or as appendices. In many cases, specialist studies undertaken for this EIS have resulted in changes to the project or preferred corridor. As such, these are not included with the EIS document but can be made available to the public by request to LinkWater Projects (see details above).

Construction and Operation

Constructing the Project

Construction of the NPI Stage 2 is proposed to commence in mid-2009 following project approval and is due for completion by 31 December 2011. The primary construction activity will be laying pipe in a trench along the construction right-of-way (ROW). Pipe laying will generally be contained within the 30 m wide permanent easement; however, the ROW may be up to 40 m wide depending on local ground conditions.

There will be three to four pipe-laying work fronts active along the ROW throughout construction, each laying approximately 170 m of pipe per week depending on local ground conditions. Longer duration activities include the construction of waterway crossings and structures. Major tunnel bores may also take up to two years to complete, depending on the tunnel configuration and method chosen.

Major tunnel bores required for the NPI Stage 2 include:

- the Woombye tunnel bore—this crossing of Nambour Connection Road will be achieved by tunnelling under Nambour Connection Road to minimise the impact of construction on the SunCoast Christian College and Christian Outreach Centre; and

- the Pringle Hill tunnel bore—due to hydraulic limitations and construction constraints over this prominent ridge, a corridor within the easement requires the construction of a tunnel through the ridge. Three options are currently being investigated to determine the most appropriate tunnel configuration in this area.

Construction works with the potential to impact on community infrastructure, such as the Woombye tunnel bore and the Yandina Sports Complex, will be timed to minimise the impact on the community. Major waterway crossings will also generally be timed for construction during the drier months of the year to minimise the potential for erosion and impacts on water quality.

Environmental Management Plan (EMP)

The EIS has provided an overall planning environmental management plan (PEMP) framework that provides the basis for minimising the environmental effects of the project development and operation. Construction of the project will be in accordance with a detailed construction environmental management plan (CEMP), prepared in consultation with the Queensland Environmental Protection Agency (EPA). Specific management plans will be incorporated into this overall document and address such factors as soil and water management (including waterway crossings), flora and fauna, weed and pest management, cultural heritage, dust, noise and vibration and waste management.

Commissioning, Operation and Maintenance

Once constructed, the NPI Stage 2 will be hydrostatically tested for strength and integrity. The pipe will also be cleaned or 'pigged' and disinfected prior to commissioning.

As part of the testing, commissioning, operation and ongoing maintenance of the NPI Stage 2, water will be discharged from the pipeline and associated infrastructure into the environment. These discharges would primarily comprise planned discharges, which are the result of scheduled maintenance of the pipeline and associated facilities.

All planned discharges of water to the environment will be managed in accordance with the Operational Guidelines for Water Discharge adopted by LinkWater for projects of this nature.

Description of the Study Area and Potential Impacts

The following provides a summary of the key characteristics of the area likely to be affected by the NPI Stage 2 pipeline, the potential impacts and an overview of mitigation measures.

Geology, Landform and Soils

The majority of the pipeline route traverses low-sloping rural lands. However, the preferred corridor traverses some steep terrain around Nambour and at the southern extent of the route at Eudlo, with other moderately steep areas occurring along the route. These areas are considered risk zones for soil erosion as a result of trenching and earthworks for pipeline construction. There is also some potential for erosion of alluvial soils as a result of flooding around waterways during construction or destabilisation of creek and river banks.

The potential for erosion in high risk areas will be higher during the summer months, when rainfall is generally higher, or during localised flooding. Mitigation strategies will include timing construction to avoid works in steep sections of the route between December and February and implementing site-specific intensive sediment and erosion control measures in risk areas.

Land Tenure and Land Use

The predominant tenure type affected by the project is land held in private freehold. Other affected tenure types include leasehold, reserves, state-owned land, road reserves and unallocated state land present along most watercourses.

Land for above-ground facilities associated with the NPI Stage 2 project will be acquired in freehold. Permanent easements up to 30 m wide may be established for the pipeline project under the SDPWOA in the following ways:

- through the declaration of critical infrastructure easements (CIE) where the corridor coincides with existing public utility easements; and
- by issuing a notice of intention to resume (NIR) where the corridor traverses previously unencumbered freehold land.

The NPI Stage 2 easement establishes the infrastructure owner's right of access to the affected land for continued operation and maintenance of the pipeline. The easement will be a permanent encumbrance on the land title. Once construction works are complete, activities that involve deep excavations or quarrying will be not be allowed over the pipeline. Similarly, no planting of deep-rooted vegetation will be permitted within 5–10 m of the pipe. Other activities will be able to resume with the permission of the easement owner.

Disruptions to existing land uses that will occur as a result of the project will generally be localised and temporary.

Terrestrial Flora

Remnant vegetation in the study area is now largely restricted to hill tops, ridgelines and narrow, discontinuous riparian fringing forests. The route intersects a number of these remnant areas supporting vegetation or fauna associations now uncommon in the region. While clearing of native vegetation will be minimised by locating the route within existing cleared easements, it is estimated that clearing approximately 20 ha of remnant vegetation will be required for the NPI Stage 2 project.

Riparian vegetation communities in particular were identified as having high conservation values. Four listed EVR plant species were located in the study area, three of which occur along waterways within or adjacent to the preferred corridor. These species are listed in Table 1

Table 1 EVR flora species in the study area

Xanthostemon oppositifolius, Southern Penda	*Alyxia magnifolia*, Large-leaved Chain Fruit
Phaius tancarvilleae, Swamp Orchid	*Symplocos harroldii*, Hairy Hazelwood

Damage to riparian vegetation will be minimised by locating waterway crossing points at areas of existing disturbance and minimising the clearing width where intact communities are present. Detailed flora surveys will be carried out in key locations to map the location of individual plants of the species listed in Table 1 prior to finalising the corridor, and translocation plans will be prepared where damage to individual plants cannot be avoided. Where possible, these plants will be propagated for use in revegetating the corridor.

Terrestrial Fauna

The preferred corridor traverses habitats suitable for a wide range of native fauna, including 13 EVR fauna species. A number of migratory bird species also utilise the study area; however, these are highly mobile species that will not be impacted by the project. The species considered most relevant to the NPI Stage 2 are summarised in Table 2.

Table 2 Key EVR fauna species in the study area

Mixophyes iteratus, Giant Barred Frog	*Calyptorhynchus lathami lathami,* Glossy Black-cockatoo
Adelotus brevis, Tusked Frog	*Eroticoscincus graciloides,* Elf Skink

No significant impacts on populations are anticipated to result from the NPI Stage 2 project. Localised impacts on terrestrial fauna will be mitigated by minimising disturbance to habitat areas and particular habitat features, such as stream banks and riparian vegetation or tree hollows. Licensed fauna handlers will be employed during clear and grade activities for the duration of construction to relocate individual animals if required.

Waterway Crossings

The NPI Stage 2 traverses two major catchment areas—the Maroochy River catchment and the southern extent of the Mary River catchment. The project requires the construction of crossings across a number of rivers and creeks in both catchments.

Three waterways in the study area were identified as having high environmental values. The crossing locations of Six Mile Creek, Paynter Creek and Petrie Creek are located outside existing cleared easements, support intact riparian vegetation or contain other environmental features which may be impacted by construction.

A number of streams within existing cleared easements were identified as having moderate environmental value, with the remainder supporting no significant environmental features at the crossing point.

It is proposed to construct trenched crossings of all waterways. To minimise the potential for erosion as a result of heavy rain or flooding events, construction of major waterway crossings will be timed to occur during the drier months of the year or to take advantage of forecast favourable weather conditions. Clearing of riparian vegetation will only be undertaken immediately prior to construction, especially at streams with moderate or high ecological values, with reinstatement occurring as soon as possible after completion.

Native Title and Cultural Heritage

The proposed project corridor falls predominantly within the boundaries of the Gubbi Gubbi People #2. A native title compliance schedule has been prepared for the NPI Stage 2 project to fulfil the procedural rights of native title parties under the *Native Title Act 1993*.

A number of cultural heritage sites have been identified by the traditional owners which will be managed in partnership with the proponent. The primary mechanism for mitigating impact to indigenous cultural heritage will be the implementation of the approved cultural heritage management plan (CHMP) for the project.

Air and Noise

Nuisance impacts with respect to the existing air and noise environment in the study area will be primarily associated with the construction phase. The most likely impacts will result from dust emissions from the ROW and construction traffic, and noise associated with pipe laying and tunnelling activities. These impacts will be minimised by undertaking dust suppression on the ROW and limiting construction hours where feasible.

Pump stations will be the primary source of operational noise emissions for the project. Pump houses will incorporate acoustic design features to ensure that these emissions are minimised.

Transport

Construction traffic will use the ROW wherever feasible to minimise temporary disturbance to road users, local residents and physical impact to roads. However, haulage of pipe, plant and materials will require the use of the Bruce Highway, state and local government-controlled collector roads and local roads. For the majority of the roads affected by the project, noticeable increases in construction traffic will occur over relatively short time frames as the work front progresses. Traffic management plans will be prepared in consultation with relevant authorities where impacts on existing road infrastructure are anticipated.

Social Environment

The overall aim of the SEQ water grid, of which the NPI Stage 2 project is part, is the provision of a secure water supply for the SEQ region. This is a positive outcome for communities currently facing critical water shortages, as well as those communities that may face potential shortages in the future.

However, establishment of the NPI Stage 2 easement will impact on landholders and communities along the route. The primary impact will be on directly affected landholders, who will be compensated for any permanent loss of the use or enjoyment of their land. Impacts on nearby residents and communities, such as temporary access restrictions or nuisance impacts from dust and noise emissions, would occur primarily as a result of the construction phase of the project.

Community consultation will be undertaken to identify and manage potential issues arising from the construction phase of the project.

Economics

Construction of the NPI Stage 2 project is anticipated to cost in the order of $400 million. At the peak of the construction phase, the project is expected to generate employment for 330 workers, comprising 80 staff and 250 skilled and semi-skilled workers. It is estimated that around one-third of the workforce will be sourced from the Sunshine Coast, with the remaining two-thirds employed from the SEQ region. Training opportunities will be made available to all personnel, and it is anticipated that a number of employees will leave with additional qualifications.

Capital expenditure for the project will stimulate economic activity throughout the Sunshine Coast and wider SEQ region, and is anticipated to generate a total employment impact of 1280 full-time equivalents (FTEs).

Ferntree Special Investigation Area

Two potential sites for the Ferntree balance tank are being investigated adjacent to the Ferntree bioreactor site proposed by Sunshine Coast Regional Council at Kulangoor. These sites must be able to accommodate future infrastructure (ultimately, two 35 ML balance tanks) associated with increased flow volumes from the Traveston Crossing Dam, should that project be approved. Both sites were identified through desktop and preliminary surveys as having potentially high environmental values and flagged for further detailed investigation.

The Ferntree special investigation area (SIA) encompasses both proposed balance tank options and potential pipeline routes. The site encompasses a number of different landforms and associated variation in vegetation and habitat types, and forms part of a regional wildlife corridor. The south-eastern extent of the SIA is located within the boundaries of the Ferntree Creek National Park.

Additional engineering and environmental investigations are being undertaken to determine the most appropriate tank site.

Cumulative Impacts

When considered individually many development activities may appear to have relatively minor environmental impact. However, when considered collectively the impacts may be more significant. Cumulative impact assessment focuses on the emergent effects of these individual impacts in combination.

The assessment of cumulative impacts has been undertaken for the key environmental issues associated with the NPI Stage 2. The desktop investigation identified that cumulative impacts of the project could be minimised where appropriate efforts are made to reduce environmental impact for any or all environmental aspects. Cumulative impacts will also be mitigated through the implementation of the CEMP.

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1 INTRODUCTION

LinkWater Projects is developing a drought contingency pipeline to connect existing and future water infrastructure on the Sunshine Coast with the Brisbane network. The Northern Pipeline Interconnector (NPI) will be constructed in two stages and will allow the transfer of up to 65 ML/d of potable water between the Sunshine Coast and Brisbane. Stage 1 of the NPI project—between Landers Shute water treatment plant (WTP) and Morayfield—is due for completion by 31 December 2008.

This environmental impact statement (EIS) has been prepared to address the potential environmental impacts relating to the construction, operation, commissioning and decommissioning of the NPI Stage 2 and associated facilities. This section presents a brief overview of the project and provides information about state and federal assessment processes and other requirements associated with the preparation of an EIS.

The EIS has been prepared to inform directly affected landholders, native title parties, advisory agencies, the Commonwealth Minister for the Environment, Water, Heritage and the Arts and other interested parties about the need for the NPI Stage 2 project, the potential impacts associated with the project and how these impacts will be managed. The Coordinator-General (CG) and the Department of Environment, Water, Heritage and the Arts (DEWHA) are the decision-making authorities for the EIS process.

1.1 Project Proponent

The proponent for the NPI Stage 2 is the Southern Regional Water Pipeline Company Pty Ltd trading as LinkWater Projects. LinkWater Projects is a company incorporated under the *Corporations Act 2001* (Cwlth). On 27 June 2007, 100% of the shareholder base was purchased by the state government. On 16 November 2007 LinkWater was established as a water entity under the *South East Queensland Water (Restructuring) Act 2007* and will retain ultimate ownership of the NPI Stage 2 asset.

Water entities were established as part of state government reforms in accordance with the National Competition Policy and National Water Initiative (NWI) to improve the management, delivery, security and customer service of water supplies in south-east Queensland (SEQ).

LinkWater has a commitment to effective environmental management and lists the environment as a key component of its overall vision ‘to become an effective partner in delivering water security to SEQ’, with an underlying principle of ‘Sustainability and positive environmental outcomes’. As stated on their website, LinkWater Projects and their alliance partners adhere to the following key environmental practices:

- Erosion and sediment controls, water quality protection and continuous improvement in testing methods to reduce water contamination are practised on site.
- Vegetation removed during clearing is stockpiled in rows alongside the edge of easements for mulching and re-spreading during restoration.
- Topsoil is stripped before excavation and preserved for later re-spreading. This topsoil contains soil nutrients and a natural seed bank.
- Environmental impacts are minimised during works through a construction environmental management plan (CEMP) to ensure new projects comply with current legislation and industry best practice.

LinkWater's commitment to sustainability is expressed on its website as follows:

> LinkWater and LinkWater Projects seek to reduce their environmental footprint.
>
> We strive to add value to the management of the natural and built environments by adhering to all appropriate Local, State and Federal environmental guidelines.
>
> Recognising the importance of current trends in climate change policies ie Queensland ClimateSmart 2050 and the South East Queensland Regional Infrastructure Plan and Program 2008-2026, LinkWater are working to minimise and monitor our own carbon footprint whilst delivering water to where it is needed most.
>
> LinkWater is conscious of the legacy we leave and our work life supports this philosophy. We vigorously encourage smart waste management policies including recycling, re-use and reduction both in their offices and at work sites. Reducing energy and water consumption during operations and maintenance work is a priority.

For further information regarding LinkWater and LinkWater Projects, please contact:

LinkWater Projects
Level 4
200 Creek Street
Brisbane QLD 4000
(07) 3270 4000
http://www.linkwater.com.au

LinkWater Projects was initially established to manage and oversee the Southern Regional Water Pipeline (SRWP) project, a 100 km long bulk transport pipeline from Mt Crosby in the western suburbs of Brisbane to Molendinar on the Gold Coast. The projects the proponent is currently managing include:

- Southern Regional Water Pipeline (SRWP); construction due for completion in November 2008;
- Northern Pipeline Interconnector (NPI) Stage 1; construction due for completion in December 2008;
- Eastern Pipeline Interconnector (EPI); construction due for completion in December 2008; and
- Toowoomba Pipeline Project (TPP); construction due for completion in late 2009.

There are no current or former proceedings under a law of the Commonwealth or a state for the protection of the environment or the conservation and sustainable use of natural resources against LinkWater Projects, any board member or its senior management.

LinkWater Projects' alliance partner for the NPI Stage 2 project is the Northern Network Alliance (NNA). The NNA has prepared this EIS on behalf of the proponent.

1.2 Project Description

The NPI is a drought contingency project that will provide a fresh water supply volume target of 65 ML/d between the Sunshine Coast and Brisbane. The project is to be completed in two stages and relies on the collection and transportation of available spare capacity from existing water allocations at supply sources throughout the Sunshine Coast.

The NPI Stage 2 project is defined, for the purposes of the Water Regulation 2002, as that project summarised in the *Report on the Drought Contingency Projects*, prepared by the Department of Infrastructure and Planning (DIP 2008a). The project is part of the south-east Queensland drought emergency strategy and is intended as an interim supply measure until other bulk water sources can be developed. Further, the project is authorised and directed under a regulation made under s.100 of the *State Development and Public Works Organisation Act 1971*.

Once completed, Stage 2 will have the capacity to deliver up to 6500 ML/a (18 ML/d) of potable water to the SEQ water grid from existing utilised entitlements (up to 55% or 3600 ML/a has been used by Noosa Shire in the past) authorised under the *Water Resource (Mary Basin) Plan 2006* (Mary

Basin WRP). Water transported by the NPI Stage 2 will supplement supplies from the Baroon Pocket Dam transported by the NPI Stage 1. Additional yields may be available for transport by the completed NPI provided through the implementation of water use reduction strategies, such as restrictions, for the Sunshine Coast.

The current proposed NPI Stage 2 system configuration (for the purpose of this EIS) will require:

- approximately 48 km of underground pipe between Noosa water treatment plant (WTP) and the termination point of NPI Stage 1 at Eudlo;
- a balance tank with a 5 ML capacity;
- three new pump stations; and
- a new water quality management facility (WQMF) and upgrades to an existing WQMF at Landsborough.

In summary, NPI Stage 2 will involve the construction of new pipelines and infrastructure to provide linkages between existing treatment facilities at the Noosa WTP and the termination of Stage 1 of the NPI near Eudlo.

1.3 Project Rationale

South-east Queensland is one of the fastest growing areas in Australia. However, unprecedented growth over the last decade has coincided with the worst drought on record (see the draft SEQ Water Strategy (QWC 2008) at <http://www.qwc.qld.gov.au/SEQWS)>.

This has placed increasing pressure on the management and use of regional water sources and highlighted the vulnerability of the region's water supplies. If drought conditions were to persist and water restrictions were the sole means of moderation, available water supplies could become severely depleted in many parts of the region.

The NPI Stage 2 will connect with NPI Stage 1 and bulk water supply sources on the Sunshine Coast, with the objective of supplying potable water to existing facilities for distribution to localities in the greater Brisbane region. The NPI Stage 2 will augment the supplies transported by NPI Stage 1 so as to reduce the reliance on a single water source, providing greater security of supply until a bulk water source becomes operational.

The NPI (Stages 1 and 2) will be designed to integrate with the proposed Northern Regional Pipeline (NRP), which will transfer water from existing and future bulk water sources on the Sunshine Coast, including the proposed Traveston Crossing Dam, if approved. Works required to connect the NPI to other bulk water sources, including the dam, are not included in this EIS. However, the infrastructure requirements necessary to support bulk flows have been considered (ie pipeline facilities have been designed to accommodate future bulk flows).

Provision will be made along the NPI Stage 2 for connections to supply future customers in the Sunshine Coast region, such as the localities of Nambour, Yandina and Eumundi. These works are required to support the long-term water planning for the region commencing from 2016. In addition, both stages of the NPI will be designed with a reverse-flow capacity to transport water from Brisbane to the Sunshine Coast under different demand scenarios in the future. However, this design feature is not necessary for delivery of the drought contingency scope detailed in the Water Regulation 2002.

1.3.1 Need for the Project

Recent extended drought conditions in SEQ and the strong growth of the region have highlighted the vulnerability of the region's water supplies. To secure long-term water supply for SEQ over the next 50 years, the Queensland Water Commission (QWC) has developed the draft SEQ Water Strategy 2008. The strategy outlines a range of demand management measures and planning for the building of new water infrastructure.

The SEQ water grid is an initiative under the draft SEQ Water Strategy (see <http://www.qwc.qld.gov.au/Water+Grid> and Figure 1.1) for the connection of new and existing water supply sources via a network of interconnecting pipelines. The NPI (Stages 1 and 2) will form a key component of the grid. The objective of the grid and the NPI project is to provide an interconnected water distribution system that will allow water to be transferred to where it is most needed in the region and ultimately provide water security for SEQ.

The completed NPI Stages 1 and 2 will supply up to 65 ML/d of potable water to existing facilities at Caboolture for distribution to localities in the greater Brisbane region. The Water Regulation 2002 requires the completion of the NPI Stage 2 by 31 December 2011. Initially the NPI will transport drought flows from supply sources on the Sunshine Coast to Brisbane. However, the pipe is designed to accommodate flows from future bulk water sources on the Sunshine Coast, including the Traveston Crossing Dam, should it be approved.

Figure 1.1
SEQ WATER GRID

Construction of the NPI Stage 2 is likely to represent a major economic stimulus to the Sunshine Coast regional economy (see Section 3.11 and Appendix P). The project is expected to stimulate significant economic activity across SEQ, some of which would occur on the Sunshine Coast.

Construction of the NPI Stage 2 has the potential to result in some short-term environmental impacts that will be mitigated through the implementation of the environmental management plan (EMP).

1.3.2 Costs and Benefits of the Project

Economic stimulus associated with the NPI Stage 2 will be generated through inter-industry purchases in both the construction phase and the operation and maintenance phase. Anticipated social impacts include increases in employment, and the use of accommodation and local hospitality services.

Construction of the NPI Stage 2 is anticipated to cost in the order of $400 million. Based on current estimates from the SRWP, it is estimated that maintenance of the overall NPI (Stages 1 and 2) will cost approximately $7.6 million per annum. Detailed estimates of capital expenditure will require approval from LinkWater Projects and the state government. Should the NPI Stage 2 be approved, funding will be provided through a committed budget.

The NPI Stage 2 project will provide the following key economic and social benefits and costs for the Sunshine Coast and the SEQ region:

Benefits

- *Provide long-term security of potable water supply in SEQ:* The project has the ability to provide up to 18 ML/d in the short term and up to 200 ML/d once a bulk water source becomes available for an operational life of approximately 75–100 years.
- *Generate expenditure and stimulate local and regional economies:* Construction of the project is expected to generate approximately $200 million of expenditure in SEQ region.
- *Create direct and indirect sources of employment:* The project is expected to generate up to 1280 full-time equivalent positions.
- *Support regional growth on the Sunshine Coast through provision of a potable water supply:* Population of the Sunshine Coast is expected to increase by an average of 2.5% per annum.
- *Provide flexibility in water supply for Sunshine Coast*: The project provides for future connections to supply Sunshine Coast customers.

- *Provide flexibility in water supply for SEQ:* Opportunity for future implementation of a reverse-flow capacity in the SEQ water grid.

Costs

- *Loss or limitations of residential, commercial and agricultural property uses, eg restrictions on certain activities within an easement*: Approximately 24% of the route has been classified as 'highly productive' agricultural land.
- *Potential indirect impacts on agricultural landholders:* These could result from a decline in surface or groundwater quality.
- *Restricted access to local residents and businesses*: Construction vehicular traffic and possible traffic diversions could restrict access at times.
- *Potential for local traffic congestion*: Congestion could occur around high density areas.
- *Temporary amenity impacts for businesses and residents*: These include potential dust and noise impacts.
- *Associated social impacts:* These include stress or anxiety for affected landholders and community members.

The overall aim of the SEQ water grid, of which the NPI project is part, is the provision of a secure water supply for the SEQ region. This is a positive outcome for communities currently facing critical water shortages, as well as those communities that may face potential shortages in the future.

1.4 Alternatives to the Project

Alternatives to the development of a treated water pipeline include:

- the 'do nothing' or 'no drought contingency pipeline' option;
- development of a water pipeline which would transfer raw water directly to Brisbane for treatment;
- construction of a facility to purify recycled water;
- application of high level water restrictions to the Sunshine Coast Region;
- construction of a dam;
- use of groundwater as a water supply source; and
- construction of a desalination plant with connection to the SEQ water grid via a pipeline, eg Gold Coast Desalination Project.

The primary objective of the NPI Stage 2 as a drought contingency project is to secure additional treated water supplies in the short term in case of ongoing drought conditions in Brisbane's catchment areas prior to water from the proposed Traveston Crossing Dam becoming available in 2011. At this stage, NPI Stage 2 becomes a component of the Northern Regional Pipeline (NRP) which is a key to the long-term water security of SEQ.

Under the short-term drought contingency scenario, the NPI Stage 2 will transport up to 18 ML/d from the Sunshine Coast to Brisbane. However, once a bulk source becomes available, the volume able to be transported is likely to increase to approximately 200 ML/d. The capacity for the NPI Stage 2 to transport short and long-term volumes is critical to the future establishment of the NRP. Any comparison of a viable alternative must therefore accommodate a capacity to support both short and long-term transport options.

Do Nothing

Even with demand reduction measures currently being implemented by the State Government, if no action were to be taken and drought conditions were to return, Brisbane's water supplies could become severely depleted. The 'no pipeline' option is therefore unacceptable and does not support the regional water planning initiatives of the QWC.

Raw Water

A raw (untreated) water pipeline was initially considered as an alternative method of delivering water to Brisbane; however, this option was not pursued because:

- there was no spare treatment capacity in existing water treatment schemes (at Landers Shute WTP and Image Flat WTP);
- transporting raw water is far less energy efficient as treatment would still be required before water could be distributed to local consumers;
- a raw water pipeline would have higher maintenance requirements due to frequent cleaning of biological deposits associated with untreated water; and
- by treating water at the source, it is possible to supply customers with potable water en route to Brisbane, thereby maximising the number of customers receiving water from the NPI and improving supply efficiency.

Overall, a raw water solution would offer less flexibility to accommodate future bulk supply requirements. In addition to the costs associated with construction of a pipeline to transport raw water (this would be comparable to the NPI Stage 2 proposal), there is the additional cost for treatment of the raw water prior to distribution to local consumers. Current estimates of these treatment costs are estimated at $1.3 million per megalitre (ML).

Recycled Water Facility

Similar to the concept underlying the Western Corridor Recycled Water Project, it could be possible to construct a pipeline and associated facilities that could provide similar volumes of water as the NPI Stage 2 (in both the short and long term). The costs of construction of the pipeline would be in excess of NPI Stage 2 as the pipeline would need to be duplicated for the 47 km traverse to Brisbane where the NPI Stage 1 is currently constructed. In addition, the design and construction of an advanced water treatment plant of a size suitable to meet the intended short and long-term requirements for the NPI Stage 2 would make this option cost inhibitive. Based on the published QWC reports for similar projects, these costs could be in excess of $575m.

The location of the pipeline and facilities would need to be in proximity to existing waste water treatment plants on the Sunshine Coast. The treatment plants are currently located close to the coast and therefore any connecting pipeline would traverse ecologically sensitive marine and tidally influenced areas. The combination of economic and environmental costs associated with this alternative make it an unviable option compared to the NPI Stage 2.

Water Restrictions

Under high level water restrictions in the Sunshine Coast Region, it may be possible to augment the supply of water from Brisbane. This could be achieved by localised restrictions in areas that are currently supplied with water north from Brisbane. This would result in the provision of additional capacity within the system, but not a volume equivalent to the NPI Stage 2. Further, this option could only be implemented as a short-term supply strategy due to the significance of social, economic and industry impacts that would result if restrictions were sustained in the long term.

Construction of a Dam

Regardless of the location of an alternative bulk water source (such as the Traveston Crossing Dam proposal), a transport pipeline and associated facilities would be required. The selection of a preferred corridor for construction of the pipeline, water treatment plant, balance tanks, pump stations and other facilities would need to consider the full range of environmental factors such as those discussed in this EIS. The costs associated with a regional water network capable of transporting both short and long-term bulk water supplies would be in the order of $900m (this would include the estimated costs for the NPI Stage 2). In order for a dam option to be a viable alternative to the NPI Stage 2, it must have the capability to supply up to 200 ML/d, based on current and future demand requirements for the Sunshine Coast region.

Groundwater

Previous investigations by the Department of Natural Resources and Water (NRW) into the viability of the Landsborough aquifers identified a low potential for use of local groundwater systems as interim drought supply water sources. The impacts associated with the dewatering and treatment of water sourced from groundwater is incomparable to those for a potable water pipeline. It is likely that these impacts would occur at a greater spatial and temporal scale than those for the NPI Stage 2 pipeline, with increased potential for long-term effects on economic and agricultural resources.

Desalination

Construction and operation of a desalination plant as an alternative method of water supply for Brisbane is not considered a viable alternative to the Stage 2 pipeline for the following reasons:

- The QWC is currently undertaking siting studies into the possible locations for desalination on the Sunshine Coast. Depending on the selection of a preferred site, these locations could be up to 15 km or 20 km away from a connection to the NPI.
- The capital expenditure for a desalination plant capable of producing 18 ML/d yield (similar to the short-term requirements for NPI Stage 2) would be approximately $300 million. In order to produce bulk flows (up to 200 ML/d and the long-term solution for NPI Stage 2) this cost could exceed $1 billion and would be comparable to the Gold Coast desalination plant.
- In addition to the capital cost for construction of a desalination plant, the estimated cost for the connecting pipeline would be approximately $8 million per kilometre. This cost would include major waterway and highway crossings and other associated facilities or construction requirements.
- The location of a desalination plant on the Sunshine Coast is yet to be determined. However, based on the sites being investigated by the QWC, the construction and connection of a desalination plant to the NPI could result in additional costs ranging from $430 million to $470 million.
- The costs involved in providing potable water via desalination are levelised at approximately $3000 per ML/a yield, which includes capital and operational cost (QWC 2008). The desalination plant option is considered to be cost-inhibitive compared with a pipeline only.

- Similar to the recycled water facility option, a connecting pipeline would need to traverse marine and tidally-influenced environments. Further, the selection of a desalination plant would need to consider the impacts associated with production and marine disposal of by-products resulting from the treatment process. The current NPI Stage 2 proposal does not influence or traverse these environmental systems.
- Energy consumption and greenhouse gas (GHG) emissions generated are substantial, eg operation of the Gold Coast Desalination Plant will produce an estimated 235,000 t of CO_2-e per annum, with energy consumption for the NPI Stage 2 (including direct and indirect energy use during construction) estimated to produce a total of approximately 11,600 t of CO_2-e per annum.

Route Options

The NPI Stage 2 project is the preferred option for securing additional treated water supplies under both short-term drought contingency and future bulk flows to Brisbane catchment areas. In addition, construction of the Stage 2 pipeline would benefit the future implementation of a reverse-flow capacity in the system, providing water to the Sunshine Coast if required.

Detailed investigation has been conducted to determine the preferred pipeline route for NPI Stage 2 (see Section 2). Three broad options for the pipeline route were developed on the basis of broad engineering, environmental, geotechnical, topographic and community constraints:

- Eastern corridor option (east of the Bruce Highway through low-lying agricultural land, rejoining the highway near Eerwah Vale);
- Central corridor option (west of the Bruce Highway and North Coast Railway Line); and
- Western corridor option (through the power easement in steep terrain).

These route options are shown on Figure 2.3 in Section 2.3.1. Options were assessed using a multi-criteria analysis which compared the engineering, social, environmental, operational and constructability constraints across all options. Although broad constraints were considered, no detailed consideration of local environmental or social impacts was carried out in developing or assessing these options. However, detailed assessment of local community and environmental issues was undertaken as part of the evaluation of the preferred corridor, which has subsequently resulted in minor route modifications.

A summary of the results of the multi-criteria analysis, including key constraints identified for the corridor options, are outlined in Table 1.1.

Table 1.1 Review of broad pipeline route options

Review criteria	Western corridor	Central corridor	Eastern corridor*	Preferred corridor (variation of central corridor)
Length	46.7 km	44.7 km	49 km	48 km
Number of affected properties	Approximately 275	Approximately 237	Approximately 235	Approximately 233
Land access	Majority critical infrastructure easement	Critical infrastructure easement Some NIRs	Majority NIRs Potentially large landholdings	Majority critical infrastructure easement Some NIRs
Waterway crossings	5 major crossings, including one thrust bore	5 major crossings	1 major crossings (marine)	3 major crossings
Cost	High pipe-laying cost Extensive blasting	High cost crossings Extensive blasting	Expensive waterway crossings	Cost-effective waterway crossings
Construction time constraints	Difficult grade Limited access Few areas for laydowns—20.8 km hard rock Power infrastructure	Difficult grade Difficult crossings High speed traffic corridor Road safety Haulage 10.3 km hard rock Acid sulfate soils	Easy grade No extensive rock Wet trenches Acid sulphate soils All-weather access required	Moderate grade Rock present—not extensive Tunnel bore at Pringle Hill (approximately 12 months)
Construction speed	Slowest	Moderate	Fastest	Moderate
Environmental impacts	Terrestrial	Terrestrial, some marine	Marine Acid sulfate soils	Terrestrial

* *This eastern corridor option was taken to be representative of the various eastern options developed. While there are some variations between the eastern options, they are not considered to be significantly different from one another.*

Based on the key points outlined above, the NPI Stage 2 project provides a relatively cost-effective and timely solution to deliver water to Brisbane and would have less potential to result in significant long-term environmental impacts than the alternatives.

1.5 The Environmental Impact Assessment Process

The following sections outline the state and federal approvals processes.

1.5.1 Methodology of the EIS

When developing a concept and an initial advice statement (IAS) for the project, it was recognised there was potential for impacts on matters of state and federal significance. Initially a referral was made to the Department of the Environment, Water, Heritage and the Arts (DEWHA) seeking a determination of the project under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act). The purpose of the referral was to identify any potential impacts on matters of national environmental significance.

There are two triggers for the preparation of an EIS for the NPI Stage 2:

- the declaration of the NPI Stage 2 project as a ‘significant project’ pursuant to s. 26(1)(a) of the *State Development and Public Works Organisation Act 1971* (SDPWOA) (Qld); and
- the decision by the former Commonwealth Minister for the Environment that the project is a ‘controlled action’ under the EPBC Act.

On 21 September 2007, the NPI Stage 2 was gazetted as a ‘significant project’ for which an EIS is required under the Queensland SDPWOA. The EIS process for significant projects is overseen by the Coordinator-General (CG) and provides for a coordinated assessment of the potential environmental effects of the project by various government agencies.

On 24 October 2007, the then Commonwealth Minister for the Environment and Water Resources determined that the project was a ‘controlled action’ under the EPBC Act due to the likely impact on matters of national environmental significance (MNES).

As a result of being both a ‘significant’ project and a ‘controlled action’, the project EIS is the appropriate method of assessment and approval for the project.

A bilateral agreement between the Queensland and Commonwealth governments accredits environmental assessments under state legislation as meeting the standards required to assess the impacts of the project required under the EPBC Act. As an EIS prepared under the SDPWOA, this document will be assessed at both the state and federal levels.

The environmental impact assessment process for this project is summarised in Figure 1.2.

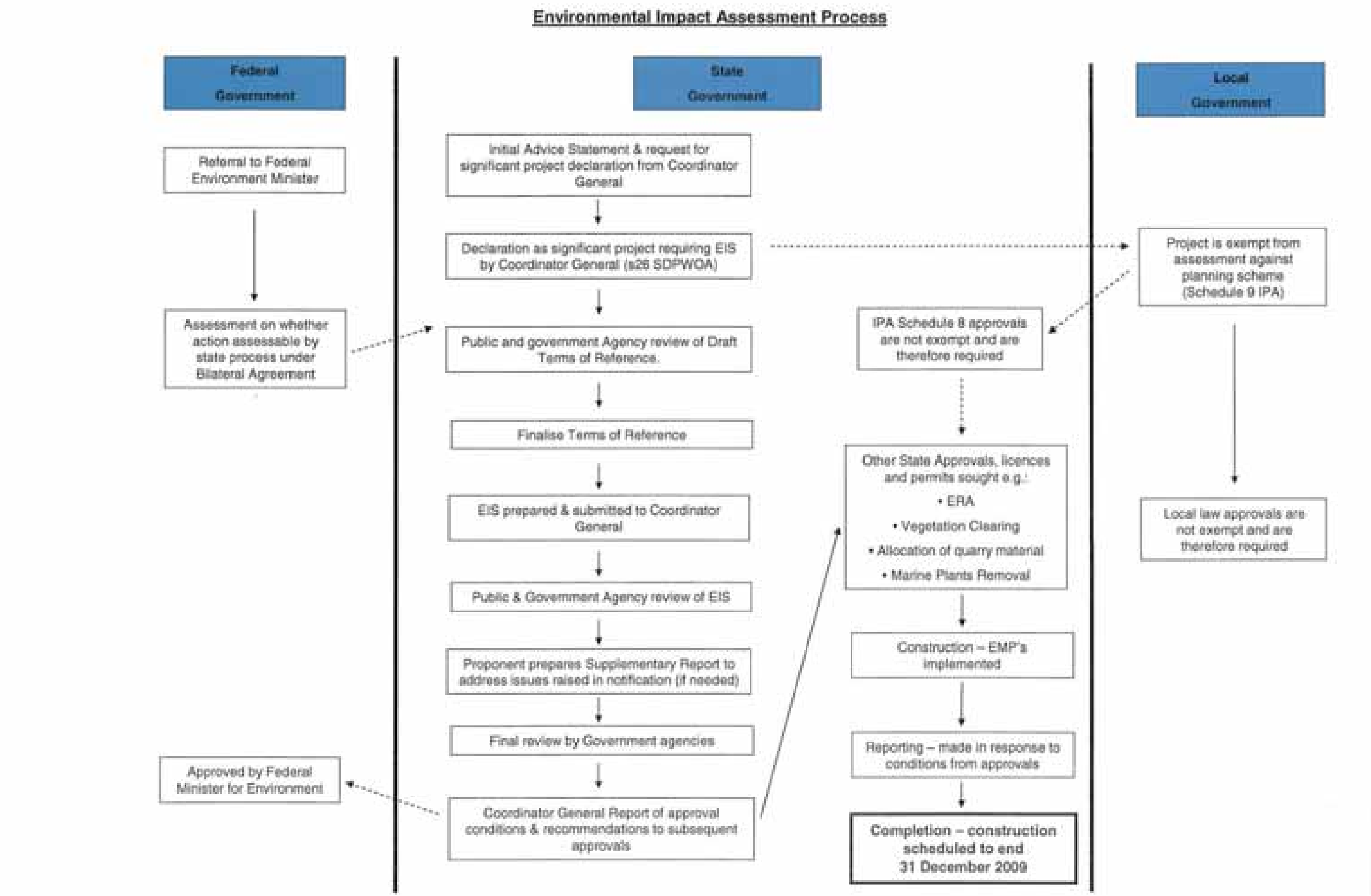

Figure 1.2
ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

It is important to note in this figure that there are three opportunities for formal public comment within the EIS process. The period for public comment in each of these instances is in accordance with a statutory requirement.

Initially DEWHA published the referral for the project, seeking public comment. Preparation of the draft terms of reference (ToR) included a one-month period where comment was sought formally from the public and other government agencies. Following receipt of these comments, the ToR were finalised. Once the CG is satisfied that the EIS addresses the ToR, the public and other government agencies will again be invited to provide formal submissions on the project.

A comprehensive description of other statutory approvals required for the project can be found in Section 1.7.

1.5.2 Objectives of the EIS

The content of the EIS is determined by the requirements of the EPBC Act, the SDPWOA and the project TOR prepared by the Department of Infrastructure and Planning (DIP) (refer to Appendix A). The ToR include the results of submissions received from the public and other government agencies.

The primary objective of this EIS is to ensure all potential environmental values, social and economic impacts of the NPI Stage 2 project are identified, and appropriate mitigation measures are recommended. The EIS will be structured to provide the following elements:

- a description of the project proponent, a description and rationale for the project, need for the project, costs and benefits, alternatives to the project, the environmental impact assessment, and the public consultation process and project approvals (Section 1);
- an overview of the project, describing the location, construction commissioning, operation, rehabilitation, associated infrastructure requirements, workforce and accommodation, transport, water supply and distribution, electricity and telecommunications (Section 2);
- a description of the existing values and an assessment of the potential impacts and mitigation measures on all elements of the environment, including its natural, social, cultural and economic aspects (Section 3); and
- conclusions and recommendations (Section 5).

The information contained within this EIS will form the basis of the project's construction environmental management plan (CEMP) and subsequent environmental management plans (EMPs), which are the standards to be used for the construction and operation of the project. The EMPs will address the levels of impact on environmental values.

This EIS has been prepared to inform directly affected landholders, advisory agencies, the Commonwealth Minister for the Environment, Heritage and the Arts and other interested parties about the need for the NPI Stage 2, the potential environmental impacts associated with the project and how these impacts will be managed.

1.5.3 Submissions

Comment on the EIS document is invited from all interested parties. Submissions should be in writing and received on or before the last date of the advertised public notification period. They must be signed by each person making the submission and state the name and address of each person making a submission, the grounds of the submission and the facts and circumstances relied on in support of these grounds.

Submissions made to the DIP will be provided to the proponent for consideration. The CG may request that the proponent prepare a supplement to the EIS to address the issues raised.

Submissions should be in hard copy or electronic format, signed by each person making the submission and sent to:

EIS Project Manager—Northern Pipeline Interconnector, Stage 2
Major Projects Division
Department of Infrastructure and Planning
PO Box 15009
CITY EAST QLD 4000

1.6 Public Consultation Process

As part of the project development and preparation of this EIS, a Communications and Stakeholder Relations team has been established to engage and inform key stakeholders with an interest in the project. The key stakeholder groups are identified below and quantified by tenure type in Table 1.2:

- directly affected landholders;
- other individuals potentially affected by the project;
- community, environmental and business/development groups;
- elected representatives from federal, state and local government; and
- federal, state and local government authorities.

Table 1.2 Summary of tenure types of stakeholders

Tenure type	Number of properties
Leasehold	1
Freehold	223
Reserve	6
State land	3
Total	**233**

Consultation with directly affected landholders is being achieved in collaboration with the DIP. Landholders whose properties will be traversed by the pipeline are issued with notices under s. 136 of the SDPWOA, which allows access to affected land for investigation purposes. Contact will be made by DIP representatives prior to accessing the land.

Table 1.3 summarises stakeholder facilitation activities undertaken by the Northern Network Alliance (NNA) as part of the community consultation process for NPI Stage 2 between January and October 2008. These activities are discussed in further detail in Appendix F. Consultation has also been undertaken with indigenous groups with respect to cultural heritage, which is addressed at Section 3.9 of this EIS.

Table 1.3 Summary of community consultation activities

Activity	Description
Letters to potential directly affected landholders	These letters introduced the project and advised landholders that their property was within the preferred corridor for investigation for the NPI Stage 2.
Regular email updates	Regular email updates are compiled and distributed to subscribers with an interest in the project.
Stakeholder correspondence	Stakeholders have been encouraged to provide information to the project team that would assist investigations into the project. Information provided helped to inform the team of particular sensitivities along the preferred corridor for investigations
Fact sheets	Fact sheets were developed to cover topic areas where key stakeholders had shown a particular interest in finding out further information.
Community newsletter	A community newsletter providing information about the project will be mailed to key stakeholders. The newsletter will be directly mailed to residents living in the area for the preferred corridor and adjacent communities.

Table 1.3 (continued)

Activity	Description
Media statements and releases	In a statement to local media on 21 August 2008, the Deputy Premier and Minister for Infrastructure and Planning, the Hon. Paul Lucas MP, announced the government's preference to co-locate the pipeline within existing easements wherever possible.
Freecall line—1800 243 998	The Freecall number is staffed during business hours (8.30 am to 5.30 pm, Monday to Friday) and diverted to a message bank after hours, at weekends and on public holidays. All calls are returned within 24 hours by an NNA staff member with specific knowledge about any issue identified by the caller.
Project email address	A project email address, info@nnalliance.com, was set up to provide another channel for stakeholders to contact the project team with information to assist with investigations or to ask questions of the team.
Consultation management database (CMS)	A consultation database was initiated to log and track all contact and correspondence with stakeholders during the EIS process.
Community meetings	Meetings were arranged in communities within and adjacent to the preferred corridor. These meetings provided an open forum for community members and the project team to discuss concerns and issues. Information gathered from the meetings helped to inform the EIS investigations.
Meetings with elected representatives	Meetings were held with elected representatives of local, state and federal governments to provide details on the project and the NNA.
Meetings with government agencies	Meetings were held with government agencies to provide details on the project and the NNA and facilitate a cooperative working relationship to ensure the project meets all federal, state and local government requirements.

An overview of the issues of concern that key stakeholders raised during the course of the EIS investigations is presented below.

Issues raised by the general community were:

- potential linkage with Traveston Dam;
- water take from Mary River catchment;
- potential impact on endangered flora and fauna within the area;
- public safety during construction, particularly increase in traffic;

- potential impact of the project on lifestyle and health;
- potential impact on local infrastructure such as roads;
- timing of construction, including length of time taken for construction to be completed;
- how areas will be reinstated once construction is finished; and
- the exact location of the preferred corridor and pipeline.

A more comprehensive explanation of the issues raised by the community is presented in Appendix F.

Issues raised by potential directly affected landowners were:

- potential impact of alignment of corridor on future development plans;
- impact of construction on existing infrastructure such as houses, sheds, fencing;
- potential impact of ongoing operation of pipeline and associated infrastructure (vents, valves, etc);
- impact of construction on business operations, particularly farming operations;
- compensation for disruption and taking an easement through the property; and
- potential impact the project will have on lifestyle and health.

A community consultation plan has been developed (Appendix F) which outlines the following:

- the types of activities to be undertaken and the timing of these activities;
- targeting of stakeholder/community representatives;
- integration with other EIS activities;
- consultation responsibilities;
- communication protocols; and
- reporting and feedback arrangements.

1.7 Project Approvals

1.7.1 Relevant Legislation

The NPI Stage 2 project is assessable under a range of local and state government approval and permitting requirements, including the *State*

Development and *Public Works Organisation Act 1971* (SDPWOA), *Integrated Planning Act 1997* (IPA), *Water Act 2000*, Environmental Protection Act 1994 (EP Act) and associated regulations and policies.

The types of approvals, including a list of environmentally relevant activities (ERAs) required for NPI Stage 2, are detailed in Appendix G. This appendix outlines the approvals necessary under federal, state and local government authorities. The specific implications of key legislation, policy and strategies affecting the pipeline are discussed below.

State Development and Public Works Organisation Act (Qld)

The SDPWOA provides for the declaration of 'significant projects' and 'prescribed projects' to enable specific assessment processes for projects that hold particular significance to the state.

The NPI Stage 2 was declared a 'significant project' for which an EIS is required on 13 September 2007. Under s. 26 of the SDPWOA, the CG may declare by gazette notice that a project is a 'significant project'. This process allows for the appropriate level of environmental and public scrutiny. The EIS that is required under this designation may also be used to satisfy the project assessment requirements of other Acts or approval processes.

In addition to providing a mechanism for consolidating community, social, biological and environmental issues related to the project, 'significant project' declaration provides:

- the necessary justification for making an application to clear vegetation for an ongoing purpose under the *Vegetation Management Act 1999* (VMA); and
- a link with the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) under a bilateral agreement for delineation of powers regarding the assessment process for actions under the EPBC Act.

Under s. 76E(1) of the SDPWOA, the Minister may declare the NPI a 'prescribed project' and a 'critical infrastructure project.' The declaration can be made in respect of a 'significant project' (under s. 26), and is effective once a gazette notice is published.

The main benefit of a prescribed project declaration is to allow the CG to have a closer involvement in the timing of approvals processes under the assessment system set up by the IPA. Specifically, the CG is able to issue progression notices, notices to decide and step-in notices.

Under s. 153B of the SDPWOA, a critical infrastructure project declaration would enable the DIP to register a critical infrastructure easement over land within an existing public utility easement. A declared critical infrastructure project may be constructed within a critical infrastructure easement made in favour of the CG.

A works regulation has also been made under s. 100 of the SDPWOA authorising and directing the proponent to undertake works for the NPI. The purpose of this regulation is to allow the CG to manage and facilitate critical items (such as land acquisition) for delivery of the project.

Works conducted under these designations may seek use of the CG's broad powers under ss. 136, 138 and 140 of the SDPWOA for temporary activities. This would include the ability to conduct works including watercourse crossings, and to allow site access for investigations.

Integrated Planning Act (Qld)

Schedule 9 of the IPA lists development that is exempt from assessment against a planning scheme. The NPI Stage 2 has been determined to fall within the exemptions of Schedule 9 where Table 5 Item 4 states that 'all aspects of a development a person is directed to carry out under a notice, order or direction made under State law' constitute exempt development.

The designation under the SDPWOA means that the NPI Stage 2 will not be subject to the normal integrated development assessment system (IDAS) process. There are no formal information request and notification stages. The report of the CG on the EIS is taken to replace the role of referral agencies. Further, as the NPI Stage 2 would normally be considered as 'impact assessable', any submissions received would be considered in the EIS decision stage.

While the NPI Stage 2 project is not assessable under local planning scheme provisions, local laws and Schedule 8 of the IPA continue to apply. Under Schedule 8, a listed assessable or self-assessable development remains assessable regardless of the exemptions under Schedule 9. Relevant state planning policies prepared under the IPA have been considered in preparing this EIS and are summarised in Table 1.4. A detailed description of the desired environmental outcomes (DEOs) from the Noosa and Maroochy planning schemes can be found in Section 3.2.3.

Table 1.4 State planning policies

State planning policy	Planning intent
SPP 1/92 Development and conservation of agricultural land	Sets out broad principles for the protection of good quality agricultural land from inappropriate developments.
SPP 2/02 Planning and managing development involving acid sulfate soils (ASS)	Aims to ensure that development involving ASS is managed to avoid the release of potentially harmful contaminants into the environment.
SPP 1/03 Mitigating the adverse impacts of flood, bushfire and landslide	To minimise the potential adverse impacts of flood, bushfire and landslide on people, property, economic activity and the environment.
SPP 2/07 Protection of extractive resources	Identifies extractive resources of state or regional significance not covered under the *Mineral Resources Act 1989*. Aims to protect resources from developments that might prevent or constrain future extraction.

In preparing the assessment report of the EIS, the CG will include comments and recommendations from relevant government agencies, including the Sunshine Coast Regional Council. Further, the NPI Stage 2 is working closely with the council to ensure that local policies and standards are being implemented wherever possible, eg Maroochy Manual for Erosion and Sediment Control 2007.

Water Act and Regulation (Qld)—Water Resource (Mary Basin) Plan 2006

Amendments to the *Water Act 2000* and the Water Regulation 2002 direct that works be carried out under state law to complete the NPI Stage 2 by 31 December 2011. These works are described in the Report on Drought Contingency Projects (2008) produced by the CG.

Pursuant to s. 4(2) of this Act, the requirement to seek a Riverine Protection Permit does not apply to the NPI Stage 2 project. Approval to clear riparian vegetation will be sought under the *Vegetation Management Act 1999*.

The *Water Resource (Mary Basin) Plan 2006* (Mary Basin WRP) provides a framework for the allocation and sustainable management of water as required by the *Water Act 2000*. The NPI Stage 2 water supply strategy proposes to transport water under existing utilised entitlements (up to 55% or 3600 ML/a has been used by Noosa Shire in the past) authorised under the Mary Basin WRP. The proposed supply strategy is consistent with the outcomes and strategies identified in the Mary Basin WRP.

Environmental Protection Act (Qld)

Under the EP Act, LinkWater and its contractors have a 'duty of care' not to carry out any activities that cause, or are likely to cause, environmental harm unless all reasonable and practical steps are taken to minimise that harm. Table 1.5 summarises the policies and requirements under this Act that are relevant to the NPI Stage 2 project.

Table 1.5 Application of the EP Act to the NPI Stage 2

Element	Comment
Environmental management plans (EMPs)	In accordance with LinkWater's 'duty of care' requirements, EMPs are being developed to address specific environmental issues relevant to the project.
Environmentally relevant activities (ERAs)	ERAs will also be required for chemical storage at water quality management facilities as chemicals will be stored and operated in volumes greater than the threshold amount specified in the Regulation. It is anticipated that ERAs will also be required for fuel storage and a motor vehicle workshop associated with construction site office/s.
Contaminated lands	Sites listed on the Contaminated Lands Register (CLR) and Environmental Management Register (EMR) (includes unexploded ordinances—UXO) are addressed at Section 3.2.4.
Environmental Protection (Water) Policy 1997	Sets a framework for managing environmental impacts on water and identifying environmental values and guidelines to protect the water environment.
Environmental Protection (Air) Policy 1997	Sets a framework for the assessment of air quality issues and air quality criteria.
Environmental Protection (Noise) Policy 1997	Sets a framework for the assessment of noise issues and defines relevant criteria.
Environmental Protection (Waste) Policy 1997	Provides requirements for handling specific waste streams and outlines the preferred waste management hierarchy and principles for achieving good waste management.

1.7.2 Planning Processes and Standards

SEQ Regional Plan 2005-2026

This plan allocates land within SEQ into five regional land use categories. The NPI Stage 2 alignment falls predominantly within the Regional Landscape and Rural Production Area category and the Urban Footprint category (SEQ Regional Plan 2005–2026 (DIP 2008b)).

The pipeline route will generally be contained within an existing 30 m wide permanent easement; however, the ROW may be up to 40 m wide depending on local ground conditions. It is anticipated that disruptions to existing land uses will generally be localised and temporary.

SEQ Regional Infrastructure Plan and Program 2008–2026

This plan describes the government's infrastructure priorities for the SEQ region to support the SEQ Regional Plan (DIP 2008c).

The Desired Regional Outcome 11 (Water Management) describes the need for additional water sources within the SEQ region by 2020. NPI Stage 2 has been listed as one of the regional water infrastructure projects to deliver this outcome.

Climate Change

In the spirit of the Kyoto agreement, the Australian Government has committed to reaching the 60% reduction threshold by 2050. Key mechanisms for delivering this goal are carbon pricing and the emissions trading scheme. In preparation for emission trading, the government has passed the *National Greenhouse and Energy Reporting Act 2007*. The Act came into force on 1 July 2008 and establishes a single, national system for reporting greenhouse gas emissions, abatement actions, and energy consumption and production by corporations.

The Queensland Government is committing to achieving a national target of 60% reduction in 2000 level GHG emissions by 2050. The ClimateSmart 2050 strategy is driving the actions to tackle the challenges of climate change and provide a platform for the government, community and industry to move towards a low carbon future.

Within the planning and design phases of the NPI Stage 2, options were considered for reducing GHG emissions (eg minimising energy inputs by selection of a shorter pipeline route).

National Strategy for Ecologically Sustainable Development

The National Strategy for Ecologically Sustainable Development (NSESD) adopts five key principles with respect to ESD in Australia. These include:

- integrating economic and environmental goals in policies and activities;
- ensuring that environmental assets are properly valued;
- providing for equity within and between generations;
- dealing cautiously with risk and irreversibility; and
- recognising the global dimension.

Section 18 of the NSESD addresses the water resource management sector. This section recognises that the major challenge in relation to the sector is to 'develop and manage in an integrated way, the quality and quantity of surface and groundwater resources, and to develop mechanisms for water resource management which aim to maintain ecological systems while meeting economic, social and community needs.'

The Mary Basin WRP stipulates outcomes to achieve the sustainable management of water, performance indicators and objectives and a range of strategies for achieving outcomes. The NPI Stage 2 project is consistent with the outcomes and strategies identified in the WRP and, consequently, with the implementation of the NSESD.

Native Title

The *Native Title Act 1993* allows for native title parties to be notified of 'future acts' that may affect native title rights. The construction of the NPI would be a future act for the purpose of the Act. Notification under s. 24KA of the Act allows for the provision of a water pipeline on land the subject of works. Comment has been invited from interested parties on the potential impact of the project on any rights conferred (current or potential), by the existence of native title.

Australian Heritage Council

The *Australian Heritage Council Act 2003* establishes the Australian Heritage Council, which will compile and maintain the Register of the National Estate (RNE). The RNE lists important natural, indigenous and historic places throughout Australia. Searches of the register were undertaken and the project will not affect any place listed on the RNE.

Vegetation Management

The NPI Stage 2 project will require clearing of regional ecosystems classified as 'endangered', 'of concern' and 'not of concern' under the *Vegetation Management Act 1999* (VMA). As the project has been declared a 'significant project' under s. 26 of the SDPWOA, an application to clear is deemed to be for a relevant purpose under s. 22A(2). An application to clear for an ongoing purpose can be assessed under 'Part S' of the South East Queensland Bioregion Regional Vegetation Management Code ('the Code'). Section 81 of the Act (a transitional provision) provides that any clearing done under s. 269 of the *Water Act 2000* is valid under the VMA. The need to seek a riverine protection permit is no longer required (see Water Act above), and a permit under the VMA to clear vegetation is now sufficient.

Water Reform Framework, COAG Agreement 1994

The Council of Australian Governments (COAG) Agreement covers water pricing, allocations and trading, environmental and water quality issues, and public education. The agreement implements the National Competition Policy and related reforms, in which governments are committed to:

- price water and wastewater services so businesses can achieve full cost recovery, with prices set on a consumption basis where cost-effective;
- create clearly specified water entitlements separate from land;
- recognise the environment as a user of water by allocating water specifically for use by the environment;
- encourage intrastate and interstate trading in water entitlements;
- implement market based and regulatory measures aimed at improving water quality;
- integrate natural resource management and catchment management processes;
- implement a range of institutional reforms, including separating the roles of service provision and standards setting and regulation, and ensuring better commercial performance by water businesses;
- employ rigorous economic and environmental appraisal processes before new investment in rural water schemes; and
- conduct public education and consultation programs and ensure stakeholder involvement in significant change issues.

The reforms aim to promote good water management practices and ensure the development of strategies to promote water uses that make good business sense, are good for the environment and ultimately ensure the long-term sustainability of the resource.

National Water Initiative

The National Water Initiative (NWI) was established in 2004, and adopted by all state and territory governments by 2006. The NWI builds on the 1994 Water Reform Framework, and aims to achieve a nationally compatible market, regulatory and planning based system of managing surface and groundwater resources that optimises economic, social and environmental outcomes.

The NWI includes objectives, outcomes and agreed actions to be undertaken by governments across eight interrelated elements of water management. Those objectives relevant to the NPI project include:

- integrated management of water for environmental and other public benefit outcomes—to identify within water resource planning frameworks the environmental and other public benefit outcomes sought for water systems and to develop and implement management practices and institutional arrangements that will achieve those outcomes; and
- urban water reform—to ensure healthy, safe and reliable water supplies; increase water use efficiency in domestic and commercial settings; encourage the reuse and recycling of wastewater; facilitate water trading between and within the urban and rural sectors; encourage innovation in water supply sourcing, treatment, storage and discharge; and achieve improved pricing for metropolitan water.

In relation to urban water reform, the NWI requires that proposals for investment in new or refurbished water infrastructure continue to be assessed as economically viable and ecologically sustainable prior to the investment occurring. The EIS addresses the principles of the NWI by providing an assessment of the environmental, social and economic impacts of the project in accordance with the terms of reference prepared by the CG.

Nature Conservation

Previously, clearing permits under the *Nature Conservation Act 1992* and Regulation were normally required for interfering/taking protected plants. As of early 2008, the Environmental Protection agency (EPA) ordinarily requires a clearing permit made under the Nature Conservation Act. Further investigations into the proponent's obligations under this amendment are currently being undertaken.

Development in koala habitat areas is assessed by the EPA against koala conservation criteria. This process occurs at the referral stage under the IDAS, with the EPA acting as a concurrence agency to an application to clear for an ongoing purpose under the VMA. Approval will be required for the NPI Stage 2 where the preferred corridor intersects mapped koala habitat near Cooroy.

Fisheries

Permits may be required under the *Fisheries Act 1994* for the construction of waterway barriers (which may impede fish movement) that may be required during the construction program. Permits for waterway barriers will be sought if required. No marine plants that would require permits to remove have been located during field survey.

Coastal Protection and Management

No works are to be undertaken within a declared coastal management district (CMD) for the NPI Stage 2.

Land Protection (Pest and Stock Route Management)

The Act and Regulation provide for the declaration of weed or pest species as being Class 1, 2 or 3 species, with penalties for persons dealing with, releasing, feeding and supplying these species. The NPI Stage 2 will meet its obligations with regard to pest management by implementing a suitable management plan and will seek the relevant approvals if required.

Acquisition of Land

Notices of intention to resume (NIRs) will be issued under the *Acquisition of Land Act 1967,* which allows for the Crown or a person authorised under an Act to take land (except freehold leases granted under the *Land Act 1994*), or be granted an easement in their favour. Land may be taken by an entity as the ‘constructing authority’ for purposes stated in the Schedule, which include ‘works for the conservation or reticulation of water.’ A similar head of power exists under s. 125 of the SDPWOA to create a critical infrastructure easement (CIE) which allows the CG to take land. While land may be taken through the use of either Act, the process for paying compensation under the *Acquisition of Land Act 1967* will be followed.

Land

Resource entitlement or a permit to occupy under the *Land Act 1994* will be sought where the NPI Stage 2 requires construction works on unallocated state land, a reserve or a road.

Mineral Resources

The *Mineral Resources Act 1989* aims, among other things, to encourage the mining of minerals and reduce conflicts with incompatible land uses. Resources such as clay and shale are considered as minerals under the Act and are governed by mineral leases issued by NRW. Mining approval (including extractive resources such as sand and gravel), are licensed as environmentally relevant activities by the EPA under the *Environmental Protection Act 1994*. The NPI crosses land associated with mineral leases near the Cooroy region of the Sunshine Coast Regional Council. Wherever possible, the NPI route would be situated to avoid clashes with mining activities.

Transport Infrastructure Act

The *Transport Infrastructure Act 1994* aims to provide a regime that allows for and encourages effective integrated planning and efficient management of a system of transport infrastructure. This infrastructure includes (state-controlled) roads, rail, ports and busways. However, applications for works near roads and rail are dealt with differently.

Works within state-controlled road reserves can be identified within Schedule 8 of the IPA, and require an 'ancillary works and encroachments permit' under the Act. Applications for such works are made under s. 12 of the Regulation. The NPI Stage 2 corridor crosses, and aligns within, several state-controlled roads throughout its entirety. All applicable permits will be sought from Department of Main Roads as required.

Works within rail corridors can be identified within Schedule 8 of the IPA, and therefore require a 'Wayleave Approval' and 'Licence to Enter and Construct'. At present, the NPI Stage 2 corridor intersects the North Coast Rail Line in two locations. These crossings will be constructed via a tunnelling method. The applicable approvals and resource entitlement will be sought from Queensland Rail and Queensland Transport respectively.

Electricity

Energex is the region's major electricity provider. Its easements are extensive, and the NPI Stage 2 route has attempted to maximise the use of these easements where practical in order to reduce potential social and environmental impacts caused by the clearing of a corridor. The CG has authority under s. 153B of the SDPWOA to use public utility easements and has entered into a co-use agreement with Energex to this effect. As such, no formal permits are required under the *Electricity Act 1994* and the IPA for works within or adjacent to electricity easements.

Fire and Rescue Service

Depending on the nature and volume of material stored as part of the NPI Stage 2, information may be required to be provided to Queensland Fire and Rescue Service (QFRS) in addition to the approval for an ERA required under the Environmental Protection Act (see above).

Dangerous Goods Safety Management

The *Dangerous Goods Safety Management Act 2001* establishes requirements for the safe storage and handling of dangerous goods and flammable liquids, and the safe operation of major hazard facilities. The NPI Stage 2 project will require the storage of flammable and combustible liquids and the storage of chemicals defined as dangerous goods under the Act at the major facilities. All relevant permits and approvals will be obtained from the applicable authorities under the Act. Additionally, management plans will be implemented to ensure safety to persons and prevent harm to property and the environment.

1.7.3 Accredited Process under Australian Government Legislation

The former Commonwealth Minister for the Department of Environment and Water Resources considered a referral for the project under the EPBC Act. On 24 October 2007, the Minister determined that the project was a controlled action under the following controlling provisions:

- listed threatened species and communities—ss. 18 and 18A; and
- listed migratory species—ss. 20 and 20A.

The following reasons were given as to why the project was determined likely to have a significant impact on matters of national environmental significance (MNES) protected under the EPBC Act:

- a number of listed threatened and migratory species are expected to use habitat within and immediately adjacent to the proposed corridor for nesting, breeding and foraging; and
- the harvesting of water from the Mary River catchment (ie in the case that new water entitlements are sought) may directly or indirectly impact upon listed threatened or migratory species that live in or rely on the riparian and aquatic environment.

This EIS considers the potential impacts on listed threatened species and communities and migratory species associated with construction of the pipeline and facilities for the NPI Stage 2. The NPI Stage 2 will connect with the Noosa WTP, which is supplied with water under existing utilised entitlements (up to 55% or 3600 ML/a has been used by Noosa Shire in the past). The NPI Stage 2 will transport water volumes in excess of the current daily demands but within these existing approved entitlements. No additional water entitlements, allocations or new water licences are required for water to be transported by the NPI Stage 2. The potential impacts on matters relevant to the EPBC Act from the use of existing water entitlements are considered in this EIS to the extent they are applicable.

As a controlled action, the project requires assessment and approval by the present Commonwealth Minister for the Environment, Water, Heritage and the Arts. Information relevant to MNES is provided at Appendix D of this EIS.

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2 DESCRIPTION OF THE PROJECT

The following sections describe the project through its lifetime of construction, operation and decommissioning.

2.1 Overview of the Project

The completed NPI (Stage 1 and Stage 2) will supply a target volume of 65 ML/d of potable fresh water to existing facilities at Caboolture for distribution to localities in the greater Brisbane region. NPI Stage 2 will have the capacity to deliver up to 18 ML/d (under existing utilised entitlements for the Noosa Shire), thereby reducing the reliance on water drawn from Baroon Pocket Dam to supply drought contingency flows. NRW data shows that up to 55% or 3600 ML/a of this existing entitlement has been used by Noosa Shire in the past. Successful completion of Stage 2 will include a number of integration works with Stage 1 (including an upgrade to the existing Landsborough water quality management facility) in order to operate the project as a whole. Further, a number of water use reduction strategies, such as restrictions, may also be implemented on the Sunshine Coast to provide additional yield.

The current proposed NPI Stage 2 system configuration (for the purpose of this EIS) will require:

- approximately 48 km of underground pipe (1200 mm diameter) between Noosa water treatment plant (WTP) and the termination point of NPI Stage 1 at Eudlo;
- a balance tank with a 5 ML capacity (bulk flows will require a larger capacity balance tank);
- three new pump stations; and
- a new water quality management facility (WQMF) (at Kulangoor) and upgrades to an existing WQMF at Landsborough.

In the event of a bulk water source (eg Stage 1 of the Traveston Crossing Dam project or a desalination plant on the Sunshine Coast) being approved, the 5 ML balance tank at the Ferntree site (at Kulangoor), would need to be replaced with a 35 ML balance tank and a pump station. The Ferntree site would remain the optimal location for the facilities required for both bulk water and drought flows. Regardless of the flow requirements, the new WQMF will be collocated at the Ferntree site.

This EIS has assessed the potential impacts associated with the construction footprint (including vegetation clearing) of a 35 ML balance tank. This assessment was completed to include impacts regardless of the water source as it was the optimal site for the facility. The EIS is not assessing or seeking approval for any other facilities other than those required for drought flows.

Construction of the NPI Stage 2 project is proposed to commence in mid-2009 following project approval and is due for completion by 31 December 2011. The construction of the project is anticipated to cost in the order of $400 million.

Environmental Design Features

The following is a list of key environmental design features included on the NPI Stage 2:

- co-location of the pipeline within existing public utility easements and linear infrastructure (such as Energex infrastructure) to reduce the overall vegetation clearing footprint and impacts on unencumbered landowners;
- underground pipeline to minimise visual amenity impact and allow general recommencement of activities above the pipe;
- maximisation of opportunities for gravitational flows to reduce the energy required to pump and distribute water;
- location of drain down valves commensurate with the surrounding environment (refer Appendix I);
- balance tank and facilities siting assessments to reduce the overall environmental impacts;
- preparation of erosion prediction models to assist in the proactive mitigation of risk areas (including the establishment of permanent sediment detention facilities);
- rationalisation of haulage routes and pipeline storage areas to minimise localised traffic impacts and fuel usage;
- design of construction program to reduce the time between activities and to avoid high rainfall periods;
- impact assessment of all waterway crossings undertaken to consider the most appropriate construction method;
- number and layout of air valves and pigging (cleaning) pit facilities designed to reduce encumbrance on landowners and visual amenity; and
- acoustic design features for pump stations to reduce noise emissions.

2.2 Location

Land Tenure and Acquisition Process

The location and boundaries of land tenures and easement widths in relation to the NPI Stage 2 pipeline, facilities and proposed site offices are shown in Figures 3.12 to 3.14 in Section 3.2.3.

The majority of the route is located within existing road reserves (approximately 24%) or public utility easements (approximately 68%). Other affected tenure types include leasehold, reserves, state owned land (includes railways) and unallocated state land present along most watercourses. Where the pipeline corridor crosses freehold land, a permanent easement up to 30 m wide will be established for pipeline construction and maintenance. Drainage easements will also be required in certain locations to enable discharge of water from the pipeline for maintenance purposes at infrequent intervals.

Easements may be established for declared critical infrastructure projects of state importance and prescribed projects under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWOA) in the following ways:

- through the declaration of a critical infrastructure easement (CIE) where the corridor coincides with existing public utility easements; and
- by issuing a notice of intention to resume (NIR) where the corridor traverses previously unencumbered freehold land.

In summary, a CIE is available to projects that are declared critical projects under the SDPWOA, where an easement only is required and it falls within an existing public utility easement. This allows the Deputy Premier (or delegate) to 'overlay' an existing state easement and grant licences to the various operators within the corridor for specific purposes (such as LinkWater or Energex).

An NIR is a notice issued under the *Acquisition of Land Act 1967* (ALA) to 'take' a form of tenure across a parcel of land. This may be a freehold parcel, an easement across a property or a volumetric right above or below the surface of the property.

Land for permanent above-ground structures, such as pigging (cleaning) stations, pump stations or balance tanks, will be purchased as a freehold title. Landholders are typically entitled to compensation where properties are directly affected by the project. Compensation arrangements will be negotiated through the Department of Infrastructure and Planning (DIP).

Given that the pipeline will be underground in most instances, private landowners will generally be able to resume previous land use activities within the pipeline corridor, provided that the use does not include excavation or deep ripping activities. While deep-rooted vegetation will not be allowed to be re-established directly above the pipeline (due to potential damage to the corrosion protection systems and pipeline integrity), shallow-rooted crops and grassland re-establishment will be encouraged with permission from the easement owner/s. Where the pipeline will co-locate with existing utilities, the conditions of use will be consistent for both utilities.

Framework for Corridor Selection

A range of information sources, including aerial photography, Commonwealth and state government databases and preliminary ground-truthing of the corridor were used to determine features of interest in the study area. These included:

- areas of native vegetation;
- habitat for rare and threatened flora and fauna species;
- waterway crossings;
- groundwater resources;
- sensitive land uses within or adjacent to the corridor which may be impacted by construction activities resulting in dust emissions, noise and vibration or traffic and access disruptions; and
- sites of cultural heritage significance.

An overview of the key characteristics within the preferred corridor is provided in Table 2.1 and shown on Figure 2.1. Where the corridor coincides with existing power easements or road reserves, and no significant issues were identified through this preliminary review, no further detailed assessment has been undertaken for the EIS. Where the corridor is likely to have some impact on one or more of the features described above, these have been identified and assessed in the relevant sections of this document.

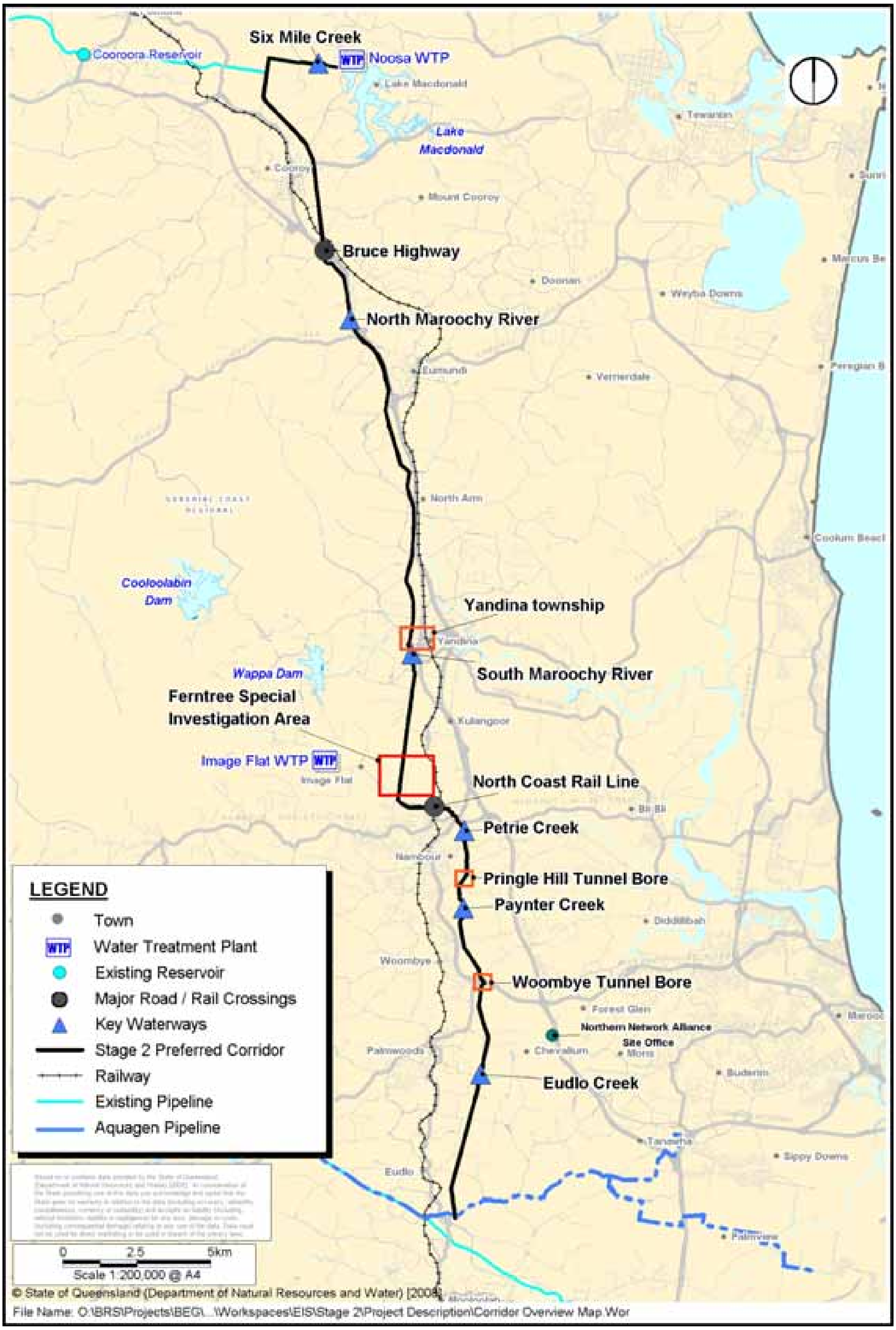

Figure 2.1
CORRIDOR OVERVIEW

In some parts of the corridor, the constraints imposed by engineering, topography, environment and geotechnical conditions have resulted in diversions from public utility easements or road reserves. These locations are identified in Table 2.1 and discussion of these sites is included in the EIS as indicated.

Table 2.1 Corridor overview

Site	Chainage	Summary of issues	Addressed at
1	0–0.4 km	**Steep terrain south of Nobels Road** Wildlife corridor of state significance. Potential need for clearing outside the easement to create safe access for plant and machinery.	Section 3.3
2	0.4–5.6 km	**Existing cleared power easement** Construction of waterway crossings on Acrobat and Eudlo Creeks. Residents within 100 m of the corridor.	Section 3.4
3	8.3–9 km	**Woombye tunnel bore** A number of options were investigated for this section of the corridor. Tunnel bore under intersection of Nambour Connection Road and Kiel Mountain Road.	
4	9–l0 km	**Existing cleared power easement** Residents within 100 m of the corridor.	
5	10–11.4 km	**Paynter Creek** Diversion outside easement to avoid additional crossings of Paynter Creek. *Phaius tankervilleae* (EPBC-Endangered) recorded in the area—final alignment to be determined following detailed survey.	Sections 3.3 and 3.4
6	11.4–12.5 km	**Existing cleared power easement** Residents within 100 m of the corridor.	
7	12.5–13.6 km	**Pringle Hill tunnel bore** Tunnel bore under existing ridge below 133 mAHD.	Section 3.4
8		**Maroochy Showgrounds** Diversion from the easement to minimise construction impact on community infrastructure	
9	13.8–17 km	**North Coast rail line** Diversion from the easement into south-western corner of Ferntree Creek National Park to comply with Queensland Rail requirement to cross rail line at 90 deg.	Sections 3.3 and 3.4
10	17–19 km	**Ferntree special investigation area** Two potential locations for a balance tank, with provision for future bulk flow balance tanks.	Section 3.3

Table 2.1 (continued)

Site	Chainage	Summary of issues	Addressed at
11	19–22.5 km	**Existing cleared power easement** Construction of waterway crossings at South Maroochy River and Mount Combe Creek. Residents within 100 m of the corridor.	Section 3.4
12	22.5–23.4 km	**Yandina township** A number of route options were investigated in this area to minimise impacts on the local community.	
13	23.4–36 km	**Existing cleared power easement/road reserve/agricultural land** Construction of a waterway crossing at North Maroochy River.	
14	36–37 km	**North Maroochy tributary** Diversion to rejoin power easement south-west of Holts Road. Construction of waterway crossings at a tributary of the North Maroochy River.	Section 3.4
15	37–37.4 km	**Bushland to the south-west of Holts Road** Potential need for clearing outside the easement to create safe access by plant and machinery.	
16	37.4–42 km	**Existing cleared power easement** *Alyxia magnifolia* (NCA-Rare) recorded on the east side of the easement to the south of Tewantin Road. *Symplocos harroldii* (NCA-Rare) recorded to east of easement.	Section 3.3
17	42–45.6 km	**Existing cleared power easement/road reserve** Construction of waterway crossings at Six Mile Creek.	Section 3.4
18	45.6–46.5 km	**Kennedys Road, Cooroy** Narrow drainage easement along alignment of Mary River main to Noosa pump station. Clearing required at edges of vegetation to accommodate construction.	
19	46.5–46.9 km	**Six Mile Creek** Clearing of vegetation outside the existing narrow drainage easement. *Xanthostemon oppositifolius* (EPBC-Endangered) recorded within the corridor—final crossing point to be determined.	Sections 3.3 and 3.4
20	46.9 km–end	**Existing cleared road reserve** Residents within 100 m of the corridor.	

Preferred Corridor

The preferred corridor was determined based on the framework described in the above section and is detailed further in Section 2.3.2. Reports summarising the preferred corridor were published in July and August 2008 to better inform the public about progress on selecting a corridor for the project.

The corridor presented in this EIS has incorporated design standards required for the hydraulic operation of a treated water pipeline, taking account of the need to:

- maximise the operational efficiency of the pipeline;
- accommodate a balance tank at 145 m reduced level (RL);
- not exceed 133 m RL across the Pringle Hill ridge; and
- co-locate facilities where feasible.

The overall objective in selecting the corridor was to identify the shortest feasible route that would limit the environmental and social impacts of the project. To achieve this, the route follows existing disturbed easements and road reserves where possible to:

- minimise additional encumbrance to affected landholders; and
- minimise further disturbance to native vegetation and habitat areas.

In some locations, the use of existing easements is not feasible due to engineering or environmental constraints. In these locations, the following criteria have been adopted when selecting the preferred route:

- minimise the number of affected landholders where possible;
- avoid or minimise the impact on areas of environmental significance such as intact remnant vegetation or habitat for rare and threatened species;
- minimise the visual impact of the project;
- minimise the potential for disruption to residents and the community during construction (such as air, noise and vibration impacts and access restrictions);
- minimise the earthworks required for construction; and
- minimise construction/operational costs.

In some areas a number of potential options were identified within the broad corridor. These locations and the rationale for the present location of the corridor are summarised below and shown on Figure 2.2.

Woombye Tunnel Bore

This location is highly constrained by existing roads and community infrastructure. A number of route options and construction methodologies were investigated to achieve this crossing of Nambour Connection Road.

The preferred corridor is located within the existing Energex easement and will be achieved by tunnelling under Nambour Connection Road. This is preferred because it:

- minimises the impact of construction on the Nambour Christian College and Christian Outreach Centre; and
- is consistent with the requirements of the Department of Main Roads with respect to traffic management.

Pringle Hill Tunnel Bore

A number of options (three listed below) have been investigated through this section, with the preferred corridor now located within the existing Energex easement. Due to hydraulic limitations and construction constraints over this peak, a corridor within the easement requires the construction of a tunnel through the ridge. Engineering investigations are continuing to determine the most appropriate construction configuration through this area, with the following tunnelling options being considered:

- *Option 1 (three tunnels within Energex easement):* This option would involve construction of three separate micro-tunnels 100–700 m in length, sized to match the pipe diameter. Four shafts would be required to connect the tunnels and to launch/retrieve the tunnel boring machine. Shaft depths would be 7–40 m.
- *Option 2 (single large diameter tunnel within Energex easement):* This option would involve construction of a large diameter (approximately 4 m) tunnel within the volumetric boundaries of the existing Energex easement. The tunnel would be constructed using road header machines, with tunnel lining to seal and support the structure. Two shafts would be required to launch and retrieve the road header machines.
- Option 3 (single tunnel outside of Energex easement): This option would involve construction of a single micro-tunnel, sized to match the pipe diameter and with shallow entry/exit shafts.

Yandina Township

Three options were considered in the area around Yandina township, which included assessing both the entry and exit points for the town. The preferred corridor follows the existing power easement north from the South Maroochy River, along Buckle Street and through the Yandina Sports Complex because it:

- is located entirely within existing road reserves and easement;

- minimises the number of affected private properties;
- minimises the impact on endangered remnant vegetation communities and associated threatened species; and
- minimises the potential for acid sulfate soils.

Paynter Creek and Six Mile Creek

Additional investigations will be undertaken at Paynter Creek and Six Mile Creek with a view to determining the most appropriate alignment and construction method in the corridor. These are also summarised at Section 3.3 and Section 3.4 of this EIS.

Preferred Facilities Locations

Using the preferred corridor as a basis, the selection of sites suitable for the location of facilities was based on the following criteria:

- land tenure—access requirements, safety considerations, security of site considered and typically easement or freehold land are preferred for facilities;
- system configuration requirements;
- specific design requirements—balance tank to be located at an elevation above 145 RL, maximising the hydraulic grade line to increase overall efficiency and reduce ongoing pumping requirements, co-location of facilities to reduce the overall construction footprint; and
- potential for impact on the surrounding environment—including residences, existing infrastructure and environmental values.

Once suitable facility sites are identified (using the above criteria), various configurations and layouts for these potential facility sites are assessed with respect to:

- construction footprint and earthworks required;
- vegetation clearing footprint;
- potential impacts on flora and fauna communities;
- potential impacts on watercourses;
- land tenure and access; and
- impacts on nearby residents and local community (eg visual amenity, noise, air quality).

The preferred facility sites were selected on the basis that they minimised potential environmental and social impacts and met the design and construction requirements. The proposed locations for the mainline facilities required for the operation and maintenance of the NPI Stage 2 are shown in Figure 2.2.

Construction impacts are detailed in Section 2.3 of this EIS for each of the facility types. Further, route options for the Ferntree balance tank are assessed in this EIS and are discussed as a 'special investigation area' in Section 3.3.5.

Figure 2.2 shows the location of the infrastructure required for the NPI Stage 2 project. The NPI Stage 2 project area takes in the hinterland areas of the Sunshine Coast region to the north of Brisbane. The preferred corridor is located in the Sunshine Coast Regional Council boundaries, and passes through the localities of Eudlo, Palmwoods, Woombye, Nambour, Kulangoor, Yandina, Bridges, North Arm, Eerwah Vale, Cooroy and Lake Macdonald.

Project Footprint

The project footprint encompasses approximately 144 ha (excluding laydown areas and temporary facilities), comprised mainly of a 30–40 m construction corridor. Information about the footprint of the corridor and associated facilities are summarised in Table 2.2. While dimensions are given for air valves and pigging/cleaning pits, these will be located within the permanent NPI Stage 2 easement.

Table 2.2 Approximate dimensions of pipeline corridor and facilities

Project element	Approximate dimensions		Approximate area
Pipeline corridor	48 km long	30 m wide (avg)	144 ha
Balance tank	26 m diameter	10 m wall height	8 ha*
Pump stations (3)	26.5 m long	22.5 m wide	597 m^2
Water quality management facility	56 m long	34 m wide	1904 m^2
Air valves (approx 150)	2 m long	1 m wide	1 m^2
Pigging/cleaning pits (3)	8.3 m long	6.5 m wide	54 m^2

* *This area provided for the Ferntree balance tank site represents an approximate footprint for all facilities (access roads, etc) required under the ultimate scheme.*

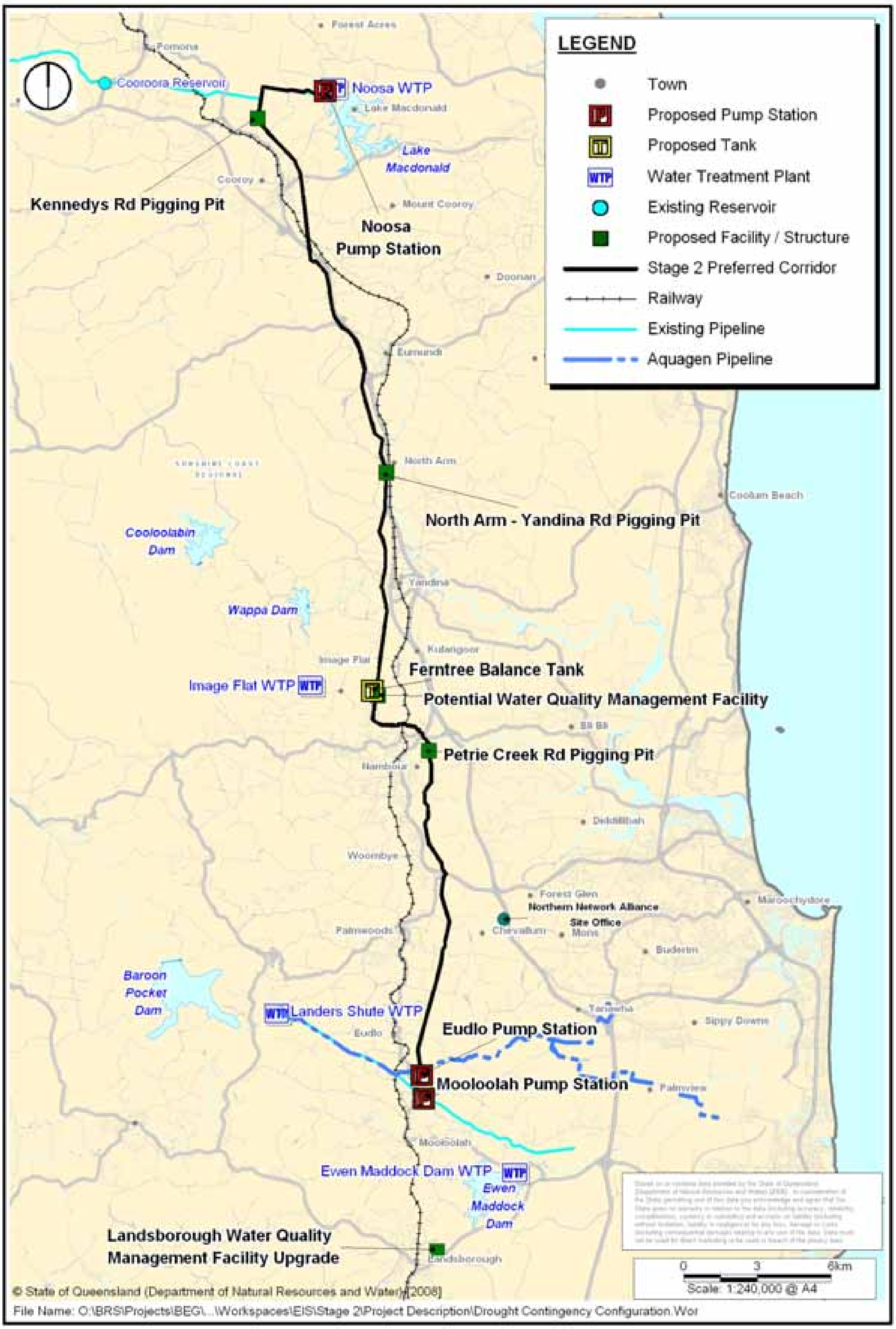

Figure 2.2
NPI STAGE 2 PREFERRED CORRIDOR

2.3 Construction and Operation

2.3.1 Pre-construction Activities

Initial Corridor Investigations

Three broad options for the pipeline route were developed on the basis of broad engineering, environmental, geotechnical, topographic and community constraints:

- the eastern corridor option (east of Bruce Highway through low-lying agricultural land, rejoining the highway near Eerwah Vale);
- the central corridor option (west of the Bruce Highway and North Coast Railway Line); and
- the western corridor option (through power easement in steep terrain).

These route options are shown on Figure 2.3. Options were assessed using a multi-criteria analysis which compared the engineering, social, environmental, operational and constructability constraints across all options. Although broad constraints were considered, no detailed consideration of local environmental or social impacts was carried out in developing or assessing these options. However, detailed assessment of local community and environmental issues was undertaken as part of the evaluation of the preferred corridor, which has subsequently resulted in minor route modifications.

The results of the multi-criteria analysis, including key constraints identified for the corridor options, are summarised below.

Key constraints identified for the western corridor precluded this option from further detailed investigation and are listed below:

- large areas of steep terrain with limited access points;
- significant areas of hard rock; and
- pockets of high quality remnant vegetation.

Detailed investigation was undertaken for the eastern corridor on the basis of its largely flat terrain and ease of construction. During this investigation, two variations of the eastern corridor were also developed (see Figure 2.3). Field investigation of the eastern corridor (including the corridor variations) identified a number of constraints, including:

- waterlogged in swampy areas;
- associated potential or actual acid sulfate soils;

- residential areas around Bli Bli likely to be impacted by the corridor;
- significant conservation areas (Maroochy Wetland Sanctuary); and
- significant mosquito populations in flooded areas.

Due to the constraints identified for both the western and eastern corridor options, the central option was flagged for further investigation. A variation of the central corridor was developed, which maximised the use of existing cleared public utility easements (now the 'preferred corridor'). In comparison with the western and eastern corridor options, the preferred corridor:

- is significantly shorter;
- makes greater use of existing public utility easements;
- minimises impacts on landholders;
- minimises construction through hard rock areas;
- minimises the potential for interaction with acid sulfate soils (ASS) (eastern option);
- minimises the potential for interaction with significant groundwater resources (eastern option);
- reduces the number of major waterway crossings (eastern option); and
- minimises the impact on sensitive wetland vegetation (eastern option).

Table 2.3 provides a summary of the key constraints for each of the discussed options.

Table 2.3 Review of broad pipeline route options

Review criteria	Western corridor	Central corridor	Eastern corridor*	Preferred corridor (variation of central corridor)
Length	46.7 km	44.7 km	49 km	48 km
Number of affected properties	Approximately 275	Approximately 237	Approximately 235	Approximately 233
Land access	Majority critical infrastructure easement	Critical infrastructure easement Some NIRs	Majority NIRs Potentially large landholdings	Majority critical infrastructure easement Some NIRs
Waterway crossings	5 major crossings, including one thrust bore	5 major crossings	1 major crossing (marine)	3 major crossings

Table 2.3 (continued)

Review criteria	Western corridor	Central corridor	Eastern corridor*	Preferred corridor (variation of central corridor)
Cost	High pipe-laying cost Extensive blasting	High cost crossings Extensive blasting	Expensive waterway crossings	Cost-effective waterway crossings
Construction time constraints	Difficult grade Limited access Few areas for laydowns 20.8 km hard rock Power infrastructure	Difficult grade Difficult crossings High speed traffic corridor Road safety Haulage 10.3 km hard rock Acid sulfate soils	Easy grade No extensive rock Wet trenches Acid sulfate soils All-weather access required	Moderate grade Rock present—not extensive Tunnel bore at Pringle Hill (approximately 12 months)
Construction speed	Slowest	Moderate	Fastest	Moderate
Environmental impacts	Terrestrial	Terrestrial, some marine	Marine Acid sulfate soils	Terrestrial

* *This eastern corridor option was taken to be representative of the various eastern options developed. While there are some variations between the eastern options, they are not considered to be significantly different from one another.*

The preferred corridor is the corridor assessed for the purposes of this EIS. While minor refinements may be made through future detailed design and approvals processes, significant changes to the main pipeline corridor are unlikely. In locations where the route is not yet finalised, all options are included in the assessment (eg eastern and western Ferntree balance tank site options).

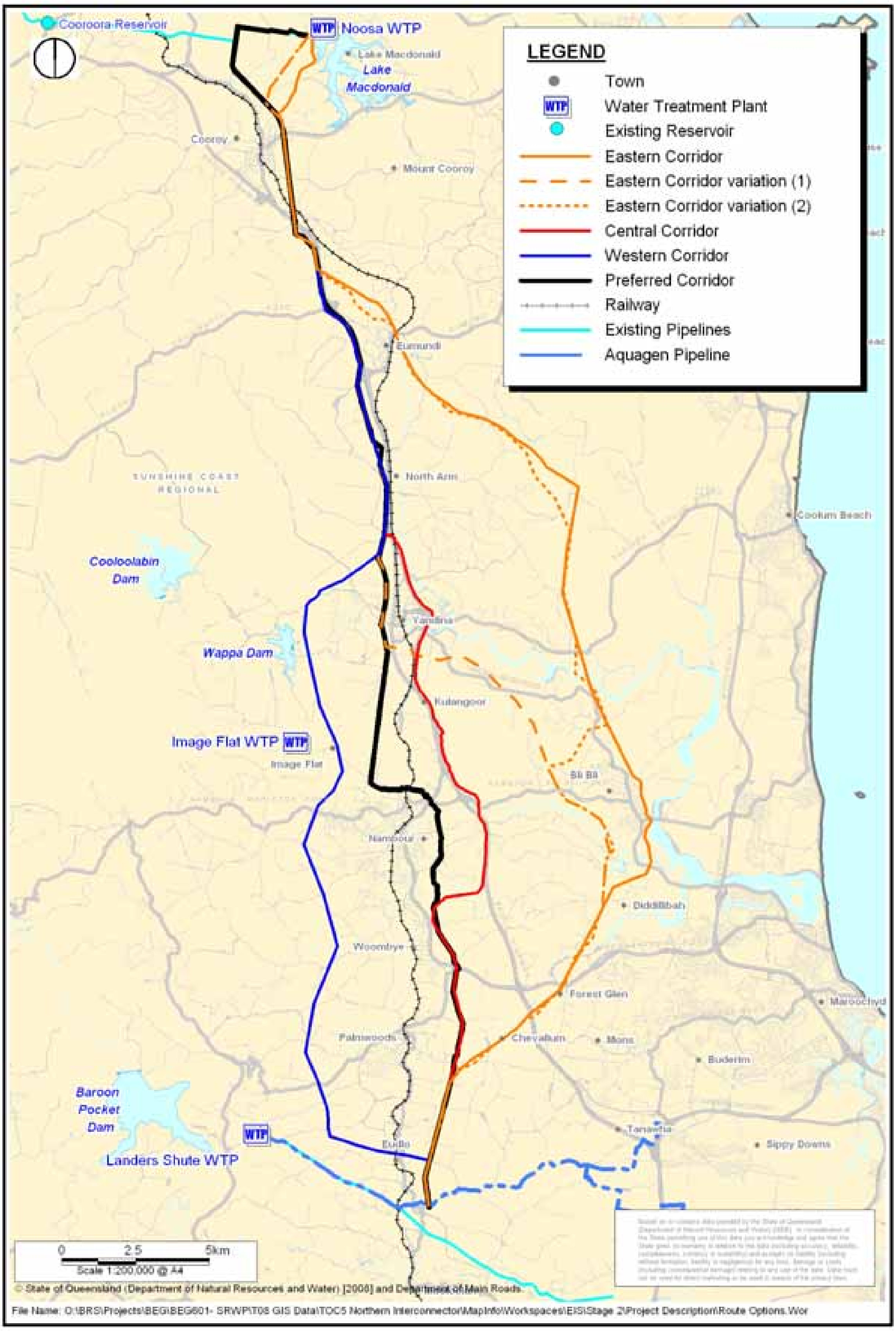

Figure 2.3
NPI STAGE 2—ROUTE OPTIONS

Pre-construction Activities

No roads or other facilities will be required to be relocated as a result of NPI Stage 2. Further, no clearing of mapped vegetation will occur prior to the assessment of the EIS. However, a range of other activities will need to be completed prior to construction and these include:

- establishment of a site office, pipe storage areas and other temporary work sites;
- a range of exploratory geotechnical studies for testing substrate for the extent of rock, acid soils and acid sulfate soils;
- design and site selection for mainline facilities (eg balance tank, pump stations, water quality management facility and pigging (cleaning) stations);
- cadastral and engineering survey and utility service locator surveys such as Dial Before You Dig; and
- extensive landholder consultation and broader community engagement.

Although the design and site selection for mainline facilities is undertaken as a pre-construction activity, no vegetation will be cleared until the construction phase of the project (ie pending approval of this EIS). The framework for Stage 2 facilities site selection is detailed in Section 2.3.2.

2.3.2 Construction

Construction Program

Construction of the NPI Stage 2 will commence in mid-2009 and is due for completion by 31 December 2011. Construction will comprise three main components carried out between mid 2009 and December 2011:

- standard pipe-laying activities;
- major tunnelling activities;
- crossings (waterways, major road and rail infrastructure); and
- structures such as pump stations, balance tanks and WQMFs.

It is anticipated that pipe-laying crews will each lay an average of 170–200 m of pipe per week. Longer duration construction activities include the construction of structures and the Woombye and Pringle Hill tunnel bores. Depending on the tunnelling method chosen, these activities may take up to two years to complete.

Construction works associated with the Woombye tunnel bore will be timed to minimise the potential for impact on the Sunshine Coast Christian College and Outreach Centre. Similarly, pipe laying through the Yandina Sports Ground will be scheduled in consultation with relevant stakeholders to avoid major events and minimise disruption to community activities.

Construction of some facilities associated with NPI Stage 2 may take up to eight months to complete. The construction program for these facilities will be developed to minimise potential impacts on local communities and landholders, including consideration of haulage routes and traffic volumes. Construction impacts associated with these facilities are detailed further on in this section.

Waterway crossings will typically be timed for construction during the drier months of the year (May–September) to minimise the potential for sediment and erosion problems and impacts on stream water quality. However, this may alter to take advantage of favourable weather forecasts during other times of the year. The construction of the NPI Stage 2 will not cross any areas within the Coast Management District and is unlikely to intercept acid sulfate soils during construction based on the proposed trenching method (see Section 3.2.2).

The majority of construction activities will take place within the permanent easement established for the NPI Stage 2, or on freehold properties acquired for associated facilities. However, some facilities are required to be constructed outside the easement. These include:

- a construction site office (located at Chevallum);
- 3–4 temporary laydown areas for storage of pipe and materials (locations to be confirmed);
- access roads (locations to be confirmed);
- temporary construction areas where a wider right of way (ROW) is required (by negotiated agreement with individual landholders); and
- temporary construction areas for commissioning.

Table 2.4 provides a summary of the proposed construction program to be used for the NPI Stage 2.

Table 2.4 Summary of construction program

Construction element	Details
Width of construction corridor	30–40 m
Depth of cover	900–1200 mm
Maximum depth of trench	4–5 m
Construction workforce	250 personnel (peak)
Number of pipe-laying fronts	3–4
Length of open trench	Maximum 100 m continual open trench per work front in open areas; significantly reduced in difficult construction areas
Normal time between clear and grade and initial restoration	4 weeks where feasible; longer where restricted by access and local site conditions
Construction duration (approximate)	Mid 2009 – December 2011

Pipeline Design

The design of the NPI Stage 2 takes into consideration a range of elements, including:

- project requirements—capacity of the system to provide secure supply of potable water as directed by and authorised under the Water Act 2000 and Water Regulation 2002, accommodation of flows from future bulk water sources, flexibility in water supply (eg provision for future connections to other supply customers);
- design criteria—design of the pipeline, facilities and structures required for system operation, pipeline materials, system configuration;
- construction standards—safety in design reducing risks to project personnel, public and the surrounding environment, construction methods, pipeline integrity and minimum structural requirements for operation and maintenance (including accessibility);
- constructability—consideration of detailed technical information collected during field investigations (undertaken by a dedicated constructability team) and desktop assessments; and
- operational requirements—provision for isolation of sections of the pipeline for maintenance or repair access, required facilities/amenities for system control and management during operation (eg water quality laboratory and appropriate chemical storage facilities for WQMF).

The following sections provide descriptions of some of the key design considerations for the NPI Stage 2.

The pipeline has been designed to a typical burial depth of 1–1.5 m below ground, and to be consistent with local and state government requirements (ie road and rail crossing requirements, future infrastructure planning). The pipeline has also been designed to minimise impacts on current land use. For example, the typical burial depth may allow the re-establishment of shallow-rooted crops such as ginger and pineapples across the entire easement.

The design criteria which apply to the construction of the pipeline relate to pipe material, pipe jointing, pipe isolating valve assemblies, drain valve assemblies, and pipeline marking. Australian Standards which apply to the design of the NPI Stage 2 include, but are not limited to:

- AS 1281–2001: *Cement mortar lining of steel pipes and fittings*;
- AS 1579–2001: *Arc welded steel pipes and fittings for water and wastewater*;
- AS 2280–2004: *Ductile iron pipes and fitting*;
- AS 2566–1998: *Buried flexible pipelines*;
- AS 2832–2004: *Cathodic protection of metals—pipes and cables*; and
- AS 4795–2006: *Double flanged butterfly valves for waterworks purposes*.

Consideration of Q2 and Q100 flood levels and determination of the inundation risk has been incorporated into the design of the Stage 2 pipeline. For waterway crossings, the pipeline will be protected from damage up to the Q100 flood level.

Roads

The pipeline will be buried below ground in accordance with local council and Main Roads requirements. The pipeline traverses the Department of Main Roads North Coast Hinterland District area. Where major roads exist, the general requirement will be that the pipeline will be drilled below the road. Discussions will be held with the relevant authority (Department of Main Roads or Sunshine Coast Regional Council) in order to determine the most appropriate method for crossing minor roads. The crossing methodology will take into account local traffic volumes (particularly truck volumes) and the integrity of the pipeline.

Rail

There are two crossings of Queensland Rail (QR) railway lines. These pipeline crossings have been designed in accordance with AS 4799:2000: *Installation of underground utility services and pipelines within railway boundaries*. Negotiations have been held with QR to discuss crossing requirements. The outcome of these negotiations will be included in the design and construction of the pipeline.

Pipe Laying

The primary construction activity for the NPI Stage 2 will be laying pipe in a trench along the construction ROW. Pipe purchased from manufacturers is first delivered to temporary laydown areas for storage, and transported to work fronts as required.

Pipe laying will generally be contained within the 30 m wide permanent easement established for the project. However, in some locations, the ROW may be up to 40 m wide depending on local ground conditions. Figure 2.4 shows the typical arrangement of the construction ROW in unconstrained conditions.

It is anticipated that there will be three to four pipe-laying fronts along the ROW throughout construction, and that each crew will lay approximately 170 m of pipe per week depending on local ground conditions. Each of these fronts will consist of:

- survey and fencing crews;
- clear and grade crews;
- material deliveries;
- trenching crews;
- pipe laying and backfilling crews ;
- valve installation crews;
- reinstatement crews; and
- hydro-testing crew.

There will be a lag between clear and grade and the commencement of pipe-laying activities. The typical progression for each work front is discussed below.

Survey and Fencing

At the commencement of the construction phase, survey teams mark the pipe centreline and width of the ROW. Existing fencing is removed where required, and temporary fences installed as appropriate. Temporary gates may also be installed to allow vehicle access along the ROW.

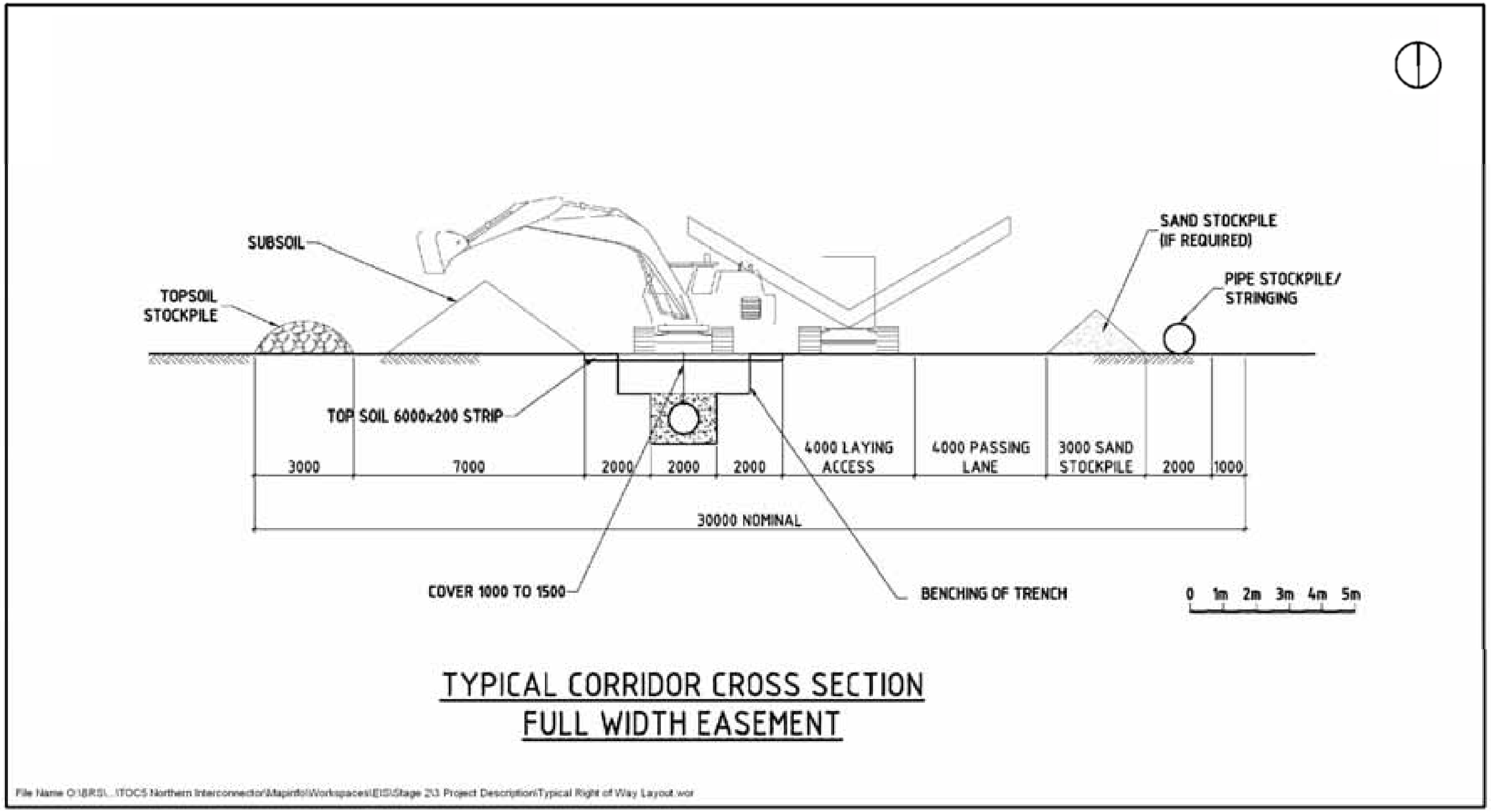

Figure 2.4
TYPICAL RIGHT OF WAY LAYOUT

Clear and Grade

Following survey, the ROW is cleared of all vegetation using chainsaws to fell larger trees and/or stick rakes fitted to bulldozers to clear the remaining lower density vegetation. Timber felled is typically stockpiled adjacent to the ROW for use in reinstatement or in accordance with landholder agreements. In some locations the timber may be shredded using specialised grinding equipment. Graders are then used to strip topsoil. Topsoil is typically stockpiled separately from subsoil at the edges of the cleared ROW for respreading during reinstatement. In areas of restricted working width, the topsoil is required to be relocated and stockpiled.

Bulk Earthworks

Where required, clear and grade is followed by bulk earthworks to create access for heavy vehicles to travel along the ROW. Material is cut from along the ROW using excavators and bulldozers with excavated material being stockpiled adjacent to the ROW where possible or transported by truck and stored off site until reinstatement is carried out. These works are generally required where there is a side slope or uneven terrain.

Material Delivery

Pipe and imported bedding and backfill material are then delivered and stockpiled along the ROW. Pipe is transported by truck from temporary laydown areas and laid end to end along the ROW ('stringing') where possible. In limited access areas, pipe is carried in from a temporary stockpile located as close as possible to the work area.

Pipe is required to be laid on bedding material (typically sand or aggregate) for support, which maintains its quality and integrity. Bedding and imported backfill material will be sourced locally from quarries on the Sunshine Coast. This material is then transported by truck and stockpiled along the ROW.

Dig, Lay and Bury

An excavator is used to excavate a trench approximately 1.8 m wide and between 2.5 m and 5 m deep in which the pipe is laid. Topsoil is stripped generally to a depth of approximately 150 mm and stockpiled separately to subsoil material. The trench is benched or battered in accordance with safety requirements under the *Queensland Workplace Health and Safety Act 1995* and Queensland Workplace Health and Safety Regulation 2008. In restricted areas, trench boxes are used to ensure the safety of workers entering the trench. Excavated material is generally stockpiled along the ROW for later use when backfilling the trench.

A 150 mm layer of bedding material is then placed along the bottom of the trench using front end loaders and a bedding box. Pipe is then lifted into the trench using side-boom tractors or excavators. Pipes are connected inside the trench using rubber ring joints or welding, depending on the type of pipe used.

The trench is then backfilled and compacted in layers. Imported fill material is used to cover the pipe to a depth of 150 mm over the top of the pipe. The remainder of the trench is backfilled using excavated fill and compacted by track rolling with a bulldozer in layers or by using a large roller. Topsoil is then reinstated and contoured to a standard suitable for vegetative rehabilitation.

It is anticipated that pipe-laying crews will lay 35 m/d on average; however, this will vary depending on local conditions. In particular, the following conditions require specific treatment and may result in longer construction durations:

- low-lying wet or swampy terrain—a ROW of up to 30 m will be required to ensure adequate separation of stockpiled material;
- steep terrain or cross-slopes—these may require establishment of a wider ROW and/or bulk earthworks to create a safe working platforms for construction;
- rock—trenches will be excavated using rock hammers, rock picks, rock saws and/or drilling and blasting;
- low powerlines—for safety reasons, plant and machinery will not operate directly under low powerlines; in some steep areas, construction may require clearing of vegetation adjacent to the existing easement; and
- street works—in some urban areas, trench boxes will be used rather than benching to restrict the width of the open excavation and maintain local access.

Valve Installation

Where air or drain-down valves are required, minor excavated areas will be left open to enable valve installation by separate crews following the pipe-laying operations.

Construction Maintenance Crews

Minor works or ‘punch listing’ crews will be employed to redress minor faults (ie damage to pipe coatings, etc.) throughout the construction phase. Minor rectification works could involve excavations after the main construction front has moved through; however, these works are expected to be isolated and of a short duration.

Crossings/Tunnelling

Where the preferred corridor intersects road and rail infrastructure, waterways or significant topographical features, a number of construction methods are available to complete crossings. A description of each method and its advantages and disadvantages is provided below.

Open Cut (Trenching)

Trenched crossings use the same ‘dig, lay and bury’ methodology described above to lay pipe across waterways and local roads. Waterway banks are first cleared of vegetation and bulk earthworks constructed to allow access into the bed of the waterway. The width of the ROW is generally restricted to 15–20 m within the stream bed; however, the overall width of the excavation may be greater to allow for standard access grades. Where access is restricted, temporary coffer dams are constructed by pushing earth through the waterway to create access for construction traffic.

Erosion and sediment controls (ie silt curtains, berms, etc) are installed prior to construction to minimise the impact of sediment upstream and downstream of the crossing point. Where required, stream flows are maintained through the use of pumps or flume pipes installed through the temporary coffer dams to maintain connectivity during construction.

While this method has a high localised impact, it has the advantage of minimising the duration of construction in a given area. Construction of trenched crossings can be completed in as little as 1–2 days for roads or 7–10 days for waterway crossings. Temporary access disruptions may occur as a result of construction, and alternative arrangements will be made for residents and road-users in accordance with road-owner approval conditions.

At this stage, trenching is the preferred method for completing all waterway crossings for the NPI Stage 2. Assessment of waterway crossing locations has been undertaken as part of the preparation of this EIS and is included in Section 3.4 of this document.

Preliminary risk assessment workshops have been held to assess the costs and benefits associated the various crossing methodologies for major crossings (ie Petrie Creek, North Maroochy and South Maroochy Rivers). The criteria used to assess each of the crossing methodologies included:

- environmental impacts—aquatic and riparian flora and fauna, and habitat values;
- cost of crossing construction;
- hydraulics—velocity, depth and volume of flows and seasonal variations/patterns;
- constructability of crossings—geotechnical substrate, erosion potential, bank stability;
- stakeholder and community concerns—local council, affected landholders, local community interest groups; and
- risk—likelihood and consequence of any potential risks.

Results of these preliminary risk assessment workshops indicate that trenching is far more cost-effective and the construction time frame is far less compared to piling and microtunnelling. For example, the construction time frame for a trenched crossing of the North Maroochy River is estimated at one week, compared to up to six weeks for the construction of a piled crossing. Longer construction time frames associated with piling and tunnelling will likely increase the time between construction and reinstatement and increase the risk of sediment erosion and adverse impacts on water quality.

The cost of piling the South Maroochy River is estimated to be $850,000 and would likely have significant impacts on visual amenity; however, a trenched crossing will have no visual impact following reinstatement and revegetation, and is estimated to cost $300,000.

Based on these preliminary results, trenching is the currently preferred crossing methodology for all waterways within the NPI Stage 2 project area. Scheduling construction during periods of low precipitation and implementation of appropriate environmental management plans will assist in minimising the potential impacts associated with trenched waterway crossings.

Table 2.5 outlines the potential impacts on aquatic environments associated with the different crossing methodologies. Further impact assessment is also provided at Sections 3.3, 3.4, and Appendix D.

Table 2.5 Potential impacts of crossing methodologies on aquatic environments

Construction method	Potential impacts
Trenching	▪ direct loss of structural habitat features such as macrophytes and snags ▪ indirect changes to physico-chemical habitat features, such as water temperature, dissolved oxygen etc as a result of disturbance to riparian vegetation ▪ increased turbidity or smothering of habitat features due to increased entrained sediment after the completion of works ▪ the creation of temporary barriers across flowing waterways with the potential to block fish passage ▪ introduction and spread of aquatic pest species ▪ refuelling or other activities that may result in spills in the bed of the waterway, causing pollution or degradation of waterways
Piling	▪ reduced direct impacts to streambed with piles driven into the bed of the waterway; potential for localised loss of structural habitat features ▪ potential for release of sediment to waterways from work areas in the riparian zone ▪ some disturbance to riparian vegetation, with flow-on effects to physico-chemical habitat features (temperature, dissolved oxygen etc)
Span bridging	▪ no direct impacts to streambed as pipe is suspended above waterway channel ▪ potential for release of sediment to local waterways from work areas in the riparian zone ▪ some disturbance to riparian vegetation, with flow-on effects to physico-chemical habitat features (temperature, dissolved oxygen etc)
Microtunnel/ underbore	▪ no direct impacts as pipe is drilled under streambed ▪ potential for release of bentonite (a support and lubricant for the slurry material surrounding the microtunnel) ▪ minor potential for release of sediment to local waterways from work areas

Piling or Span Bridging

Piling or span bridging involves the construction of pipe supported by piles or a truss bridge across a waterway, dam or gully. Waterway banks are first cleared and graded for construction access. Where piles are to be driven into the stream bed, a temporary platform is required to allow access for pile driving plant. This could involve pushing material through the bed of the waterway or erecting a temporary structure (such as a steel bridge).

Piling has the advantage of maintaining flows through a waterway at all times and minimising excavation works in the stream bed. However, this method requires disturbance of the riparian area similar to that required for trenching and at a greater cost. Further, the pipe is then a permanent obstruction which has an ongoing visual impact, has the potential to influence flooding characteristics, and may be prone to damage. A longer construction duration is required for this methodology due to the different equipment and processes required.

Preliminary investigations of the corridor have identified two farm dams where piling will be used as the preferred crossing method.

Microtunnelling or Thrust Bores

Tunnelling involves the placement of pipe through hydraulic tunnelling methods or thrust boring. These methods will be used for crossing major road and rail infrastructure and the Woombye and Pringle Hill tunnels.

Microtunnelling requires the excavation of portals or launch and receival shafts at either end of the proposed tunnel. These shafts are anticipated to be around 10 m deep for the NPI Stage 2 but excavations may be as deep as 30 m, depending on local conditions.

Once the launch shaft has been established, thrust restraints for support of the pipe jacking equipment are installed. A tunnel boring machine (TBM) is then lowered into the shaft. The tunnel is excavated by drilling through the substrate and jacking concrete encasement pipes behind the boring machine. Once the drill reaches the receival shaft, a crane is used to retrieve the TBM. Carrier pipes are then inserted through the concrete jacking pipe and connected to the main pipeline using welded joints. Finally, the void between the concrete encasement pipe and the carrier pipe is filled with grout.

Tunnelling is generally employed as a construction method to avoid difficult construction areas or minimise the impact on the environment, community or existing infrastructure. The feasibility of using tunnels or thrust bores is strongly limited by site conditions such as soil stability, slope, access, available work areas and the nature of subsurface rock. This method is also significantly more expensive than other construction methods and may take substantially longer due to lower average production of approximately 6 m per day in optimum ground conditions, depending on the local conditions and the length of the tunnel. Where microtunnelling is employed, construction will operate 24 h/d until the operation is complete.

Facilities and Structures

Structures such as pump stations, balance tanks and the WQMF will be established as individual work fronts. Construction works required for the NPI Stage 2 facilities include:

- survey and fencing—to mark out the work area and secure the site;
- clear and grade—clear vegetation, strip vegetation and topsoil and stockpile;
- bulk earthworks—cut and fill and compaction of the work area;
- foundation works—where concrete foundations or piles are required, these will be undertaken by subcontractors;
- civil works—these include base slabs for all structures;
- building—erecting buildings, pre-cast panels and structural steel;
- mechanical and piping fit-out, including the installation of pumps, piping and large diameter valves etc;
- electrical and installation fit-out; and
- commissioning.

Table 2.6 outlines the proposed facilities and structures required for the NPI Stage 2, their locations along the pipeline and estimated construction and clearing footprints. Indicative examples of construction layouts for a pump station, balance tank and WQMF are included below (Figures 2.5a, 2.5b, 2.6 and 2.7) as final layout and design for these facilities is yet to be finalised.

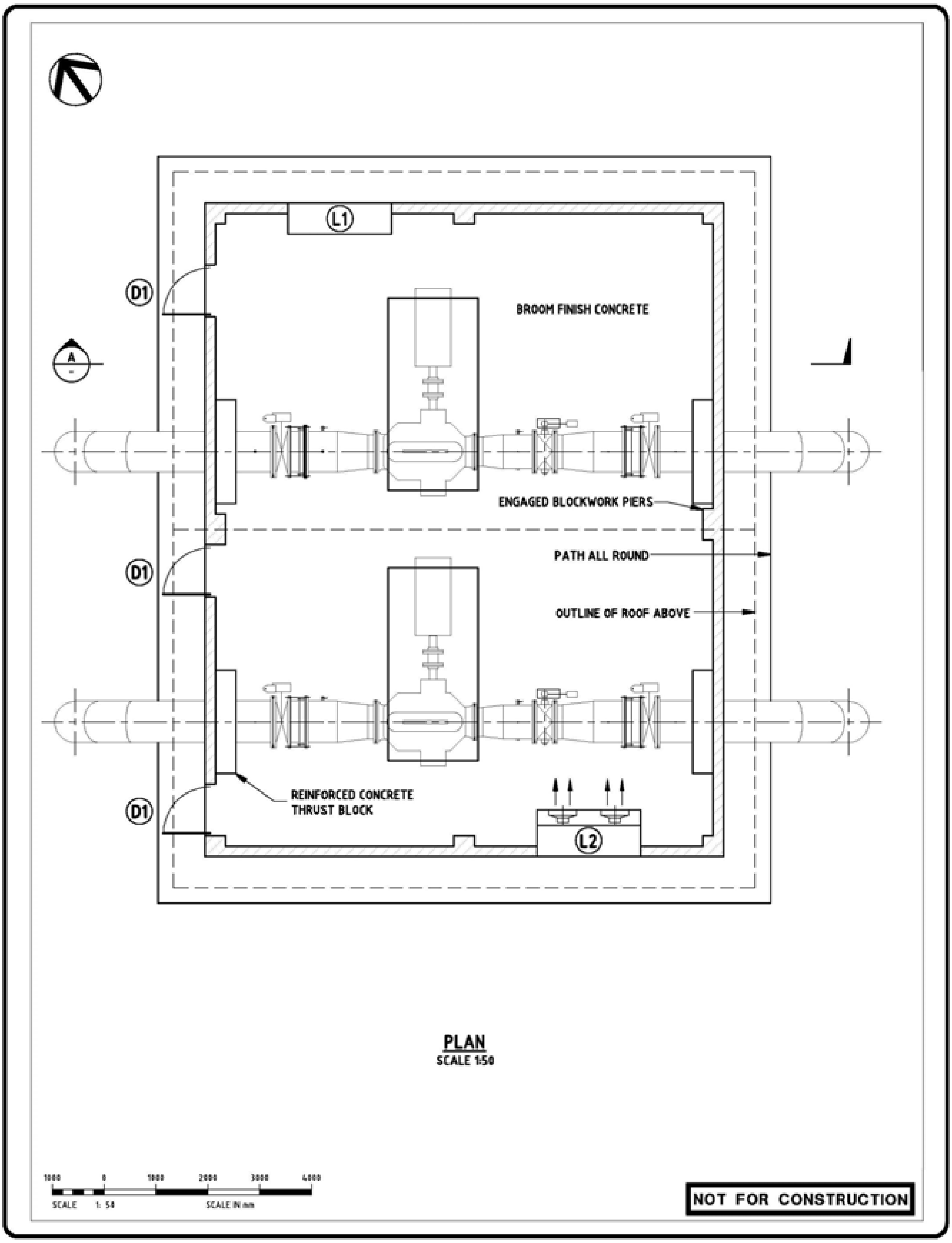

Figure 2.5a
INDICATIVE EXAMPLE OF A PUMP STATION PLAN

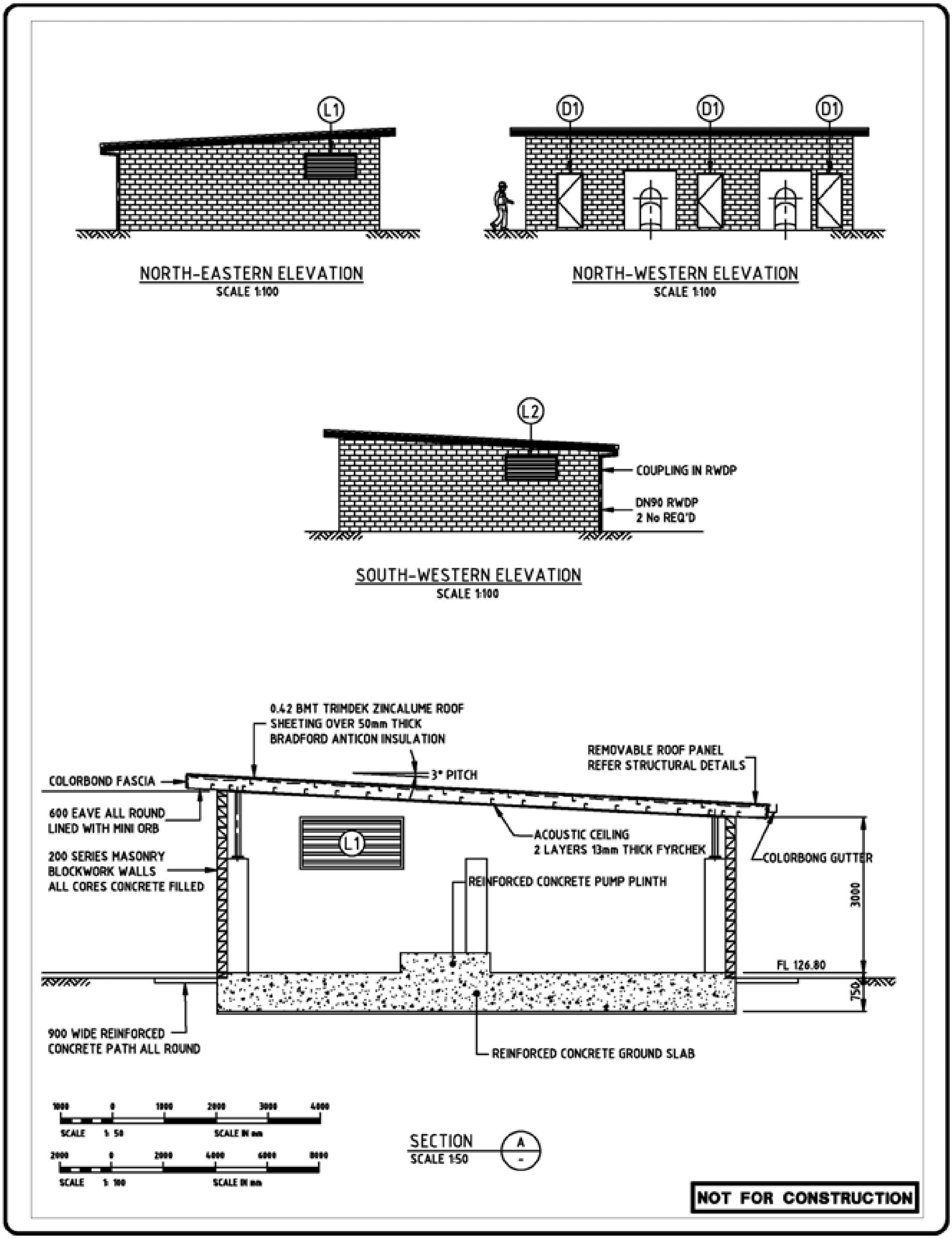

Figure 2.5b
INDICATIVE EXAMPLE OF A PUMP STATION SECTION AND EXTERNAL ELEVATIONS

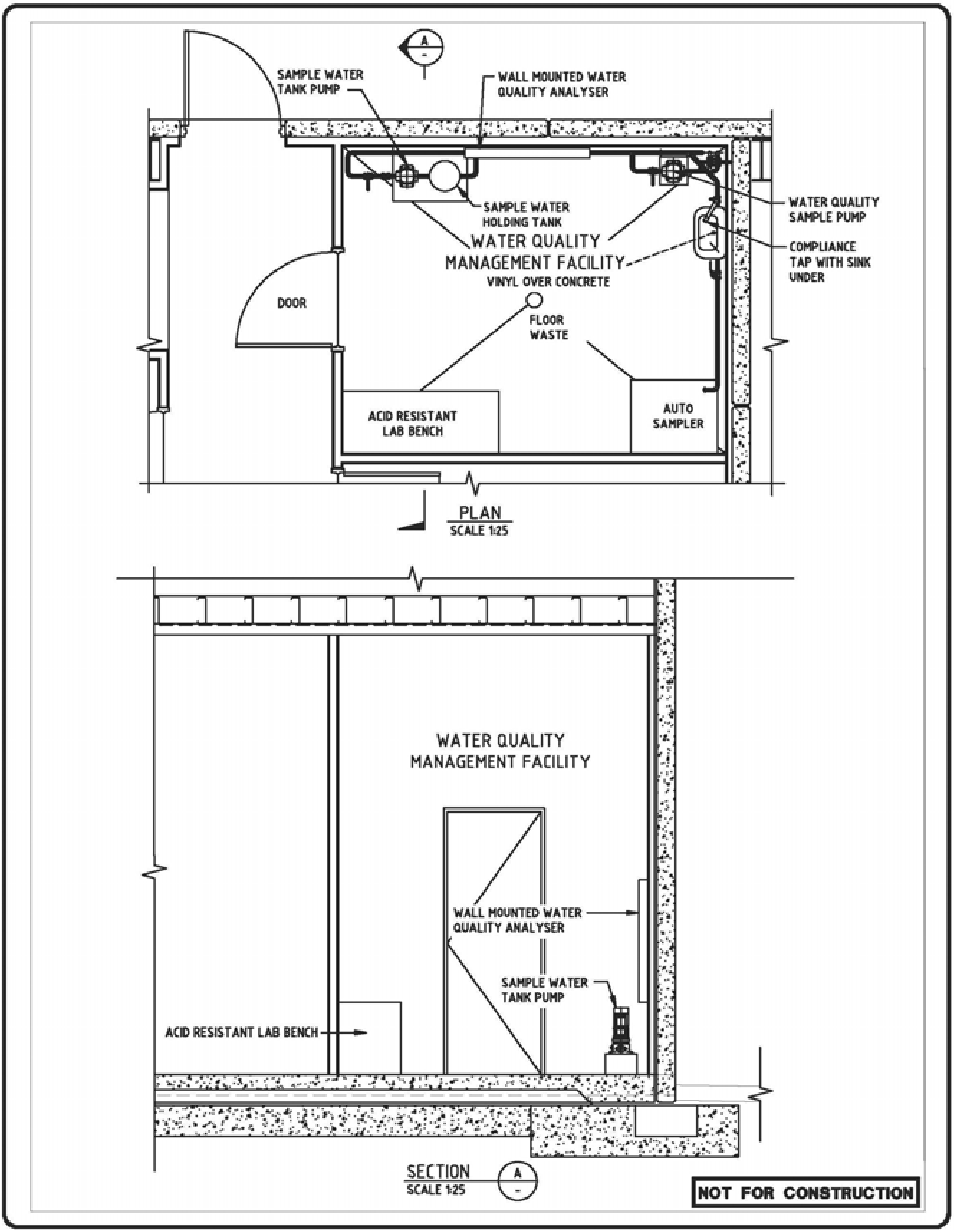

Figure 2.6
INDICATIVE EXAMPLE OF A WATER QUALITY MANAGEMENT FACILITY

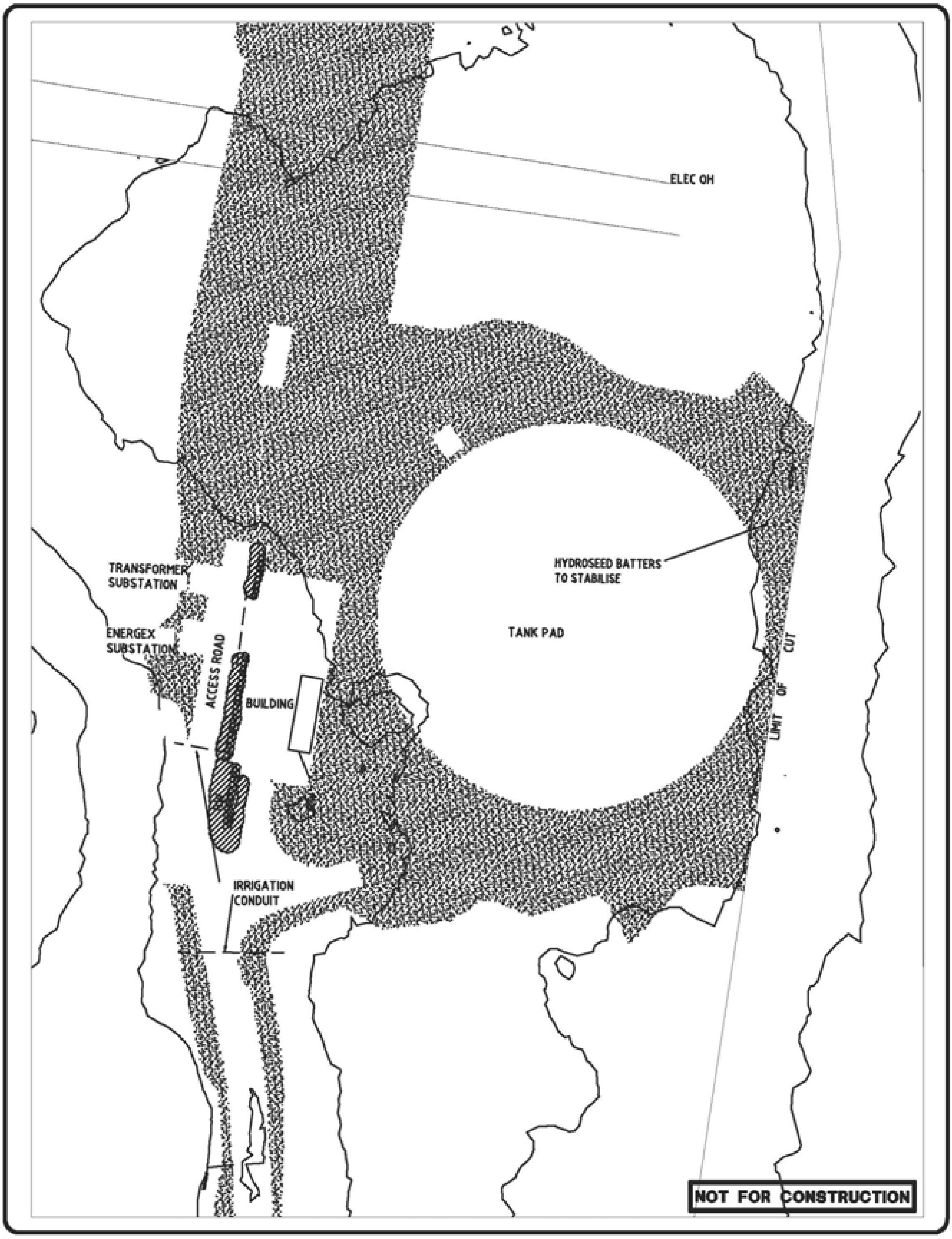

Figure 2.7
INDICATIVE EXAMPLE OF A BALANCE TANK

Table 2.6 Proposed facilities and structures for the NPI Stage 2

Facility/structure	NPI Stage 2 pipeline chainage (km)	Land tenure	Estimated construction footprint	Vegetation clearing footprint*
Mooloolah pump station	1 km south of NPI Stage 2 pipeline	Road reserve and/or easement	597 m^2	No clearing of remnant vegetation
Eudlo pump station	0	Freehold	597 m^2	Approximately 597 m^2
Upgrade to Landsborough WQMF	0		0 m^2 (upgrades to existing WQMF)	No clearing of remnant vegetation
Mainline valve and flow meter	5.1	Easement and freehold	127 m^2	No clearing of remnant vegetation
Future offtake valve	10.9	Easement and freehold	Below ground surface footprint	No clearing of remnant vegetation
Future offtake valve	14.0	Easement and freehold	Below ground surface footprint	No clearing of remnant vegetation
Pigging station, future offtake valve and mainline valve	14.0 – 14.75	Easement and freehold	54 m^2	No clearing of remnant vegetation
Balance tank and WQMF	19.0	Both eastern and western options are freehold	Approximately 8 ha	Approximately 4 ha (area can facilitate future bulk flow infrastructure requirements)
Mainline valve and future offtake valve	22.6	Easement and freehold	Below ground surface footprint	No clearing of remnant vegetation
Pigging station, future offtake valve and mainline valve	28.0	Easement and freehold	54 m^2	No clearing of remnant vegetation
Mainline valve and future offtake valve	34.5	State-owned freehold	Below ground surface footprint	No clearing of remnant vegetation
Pigging station	43.3	State forest (existing powerlines)	54 m^2	No clearing of remnant vegetation
Noosa pump station	47.5	Road reserve	597 m^2	No clearing of remnant vegetation

** Clearing refers to remnant vegetation as defined under the Vegetation Management Act 1999 (Qld)*

The proposed facility sites have been located within easements or on freehold land where possible. Access requirements and safety considerations are taken into account during the site selection process. Access may be required to facilities on a regular basis during operation and maintenance, and both freehold and easement tenures provide security of ongoing access (to varying degrees). Construction of facilities on freehold land may involve the purchasing of whole or part of an existing property parcel.

Construction timing will be scheduled to minimise impacts on local residents and to minimise impacts associated with increased traffic volumes. In a number of locations, facilities have been co-located to minimise the overall construction footprint and to reduce encumbrance on affected landholders.

The estimated times required for the construction of above-ground facilities are:

- balance tank—five months;
- pump stations and water quality management facilities—six to eight months each; and
- pigging station—three months (including construction and commissioning).

Site selection for these facilities and operational requirements are discussed further in this section.

Access

The Sunshine Coast has an established road network, and existing roads will be used for haulage of pipe, machinery and spoil where appropriate. However, there are some sections of the route where existing access is not adequate for construction. In these locations, construction of access roads will be required to access work sites. The exact location of these roads is currently under investigation and will be finalised prior to construction.

Specific haulage routes for delivery of pipe and materials and removal of spoil are discussed at Section 3.8 of this EIS.

Excavation Waste (Spoil)

A significant amount of construction waste will be generated in the form of spoil and rock during excavation and tunnelling works. As a general rule, 2500 m^3 of surplus spoil is generated for every kilometre of pipe laid.

A number of spoil disposal options will be considered, including:

- spreading spoil across the ROW prior to replacement of topsoil;

- identifying opportunities to dispose of spoil at disused quarries; and
- disposal of spoil at local council landfill facilities.

The use of spoil on site is preferred as it minimises costs associated with additional haulage and impacts on traffic volumes.

Rocky waste may be generated as the result of blasting when laying pipe through certain terrain. It is difficult to estimate the amount of rocky waste that will be generated during construction until the detailed design phase of the project has been completed; however, these volumes are not expected to be problematic. While the reuse options for this material are more limited than spoil due to the size of the particulates, there will be adequate opportunities for reuse in the construction of haulage roads, drainage channels and other effective reuses.

Emergency Management Plan

Where the construction, commissioning, operation and maintenance of the overall NPI have the potential to result in emergency situations, they will be governed by an incident response plan (IRP). The IRP will:

- set out the steps to be undertaken in the event of an emergency;
- allocate lines of responsibility for overall management of emergency responses;
- identify when to instigate the emergency management;
- identify the roles and responsibilities of all staff in instigating and implementing incident responses;
- identify training and reporting requirements; and
- identify contact details for all responsible parties and emergency services.

The primary response concept is to deal with protection of people from harm, injury or death, and the overall project objective is to complete each day without incident.

2.3.3 Commissioning

The NPI Stage 2 will be hydrostatically tested for strength, integrity and to identify potential leaks by filling it with water and increasing the pressure to approximately 125% of the maximum allowable operating pressure. As a general rule, 1 ML/km of water is required for hydrotesting of 1.3 m diameter pipe. Depending on the final location of section valves, 5–12 km of pipe at a time will be tested, requiring 5–12 ML of water per testing event.

The pipeline will also be cleaned or 'pigged' prior to commissioning to remove any material accumulated during construction. This process involves a flexible foam insert or 'pig' being passed through the pipeline under pressure. Pigging/cleaning pits will be located at intervals along the pipeline to allow launch and retrieval of the 'pig'.

Disinfection of the pipeline will be undertaken by adding disinfectant to water drawn from the local distribution system. After disinfection, the system is flushed until disinfectant concentration is reduced to an acceptable standard.

Water Discharge Management

As part of the testing, commissioning, operation and ongoing maintenance requirements of the NPI Stage 2, water will be discharged from the pipeline and associated infrastructure into the environment. Discharges from the pipeline can be grouped into the following three categories:

- planned discharges—the result of scheduled maintenance of the pipeline, drain-down valves, balance tanks or pump stations;
- unplanned discharges—typically the result of pipeline breaks, leaks or overflows that may occur as the result of systems or structural failures during pipeline operation; and
- emergency discharges—may occur as a consequence of water main flushing as a management response to increases in coliform counts, taste or odour complaints from customers or other similar situations. Such occurrences are highly unlikely during the operation of the NPI Stage 2 due to the implementation of a preventative maintenance program.

A summary of the process adopted for managing water discharges from the NPI Stage 2 is included at Appendix I.

2.3.4 Operation

Maintenance Program

Based on current estimates for the SRWP, it is estimated that maintenance of the overall NPI will cost $7.6 million per annum. This figure excludes variable costs—largely power consumption—and the following assessment is therefore primarily concerned with pipe maintenance.

Input–output analysis indicates that ongoing annual economic impacts of pipe maintenance would be approximately:

- $14 million in additional expenditure, including $6.4 million in indirect expenditure;

- 55 full-time equivalent positions, including 33 indirect full-time equivalent positions; and
- $5.9 million in value added, including $3.3 million in indirect value added.

This is unlikely to be significant in the context of the Sunshine Coast regional economy.

The Bulk Water Transport Authority (BTA) trading as LinkWater, will engage the LinkWater Operation and Maintenance (O&M) Alliance to operate and manage the pipeline and associated facilities. Table 2.7 summarises anticipated maintenance activities for the NPI Stage 2 and preliminary assessments of their frequency of occurrence.

Table 2.7 Preliminary maintenance schedule for the NPI Stage 2

Maintenance activity	Occurrence frequency
Pigging/cleaning	Once on commissioning of the pipeline and approximately once every following five years
Drain-down valve maintenance	Approximately once every two years
Balance tank cleaning	Once after 10 years, and approximately every five years thereafter
Routine maintenance of pipeline corridor	Minor tree clearing on an as-required basis

The arrangements for providing water into the SEQ water grid can be found in Section 2.4.3 and 2.4.4. These sections include a full description of water treatment facilities, associated infrastructure and water treatment methods.

Decommissioning

The NPI Stage 2 will be designed for a 75-year operational life and will have a life expectancy of between 75 and 100 years. Should maintenance costs begin to escalate to an uneconomical degree, the pipeline would most likely be reconditioned for further use. The current method of reconditioning old pipe is to insert a new pipe inside the old or to reline the existing pipe with the latest materials. However, in 75 years' time there may be more appropriate methods for reconditioning old pipelines. Removing the pipe from the ground is unlikely to be an environmentally or commercially viable option.

2.3.5 Rehabilitation

Reinstatement and Revegetation

Initially, reinstatement crews will assess the need for materials to be brought on site to replace spoil removed from trenches and cuttings. This will be followed by the respreading of topsoil from stockpiles along the ROW to utilise the natural biological processes in the soil to encourage rapid rehabilitation and reduce soil erosion.

The level and type of revegetation will be negotiated with individual landholders and will include one or a combination of the following, depending on the nature of the area to be revegetated:

- respreading of stockpile brush and shredded trees;
- placing jute matting on steep inclines to prevent erosion;
- reseeding or hydro-mulching; and
- planting seedlings.

Marker plates to identify the location of the pipeline will also be installed along the route at this time. Where feasible, reinstatement will commence within two weeks of pipe being laid. However, timing for reinstatement may be influenced by a number of factors including:

- forecast weather conditions;
- local soil or ground conditions (eg waterlogged soils);
- topography (ie steep areas or waterways where loss of topsoil may result from heavy rain or flooding); and
- post-construction access requirements.

Collaboration with Higher Education Facilities

With the University of the Sunshine Coast (USC) and the Sunshine Coast TAFE in close proximity to the project, there is an opportunity to create positive partnerships between the Alliance and each education institution. Opportunities to create partnerships include guest lecturing, work experience/internships, research, community projects and on the job training.

Griffith University has completed a pilot study investigating potential restoration ecology opportunities on the project. This will be developed into a full scale restoration ecology monitoring project as a joint venture between LinkWater/NNA and Griffith University.

2.4 Associated Infrastructure Requirements

2.4.1 Workforce and Accommodation

A workforce of approximately 430 people (first year of construction) is anticipated for construction and operation to complete the works for the NPI Stage 2. This will comprise semi-skilled or unskilled labourers and trades assistants. A workforce of approximately 55 people will be sought for ongoing maintenance of the pipeline and associated facilities.

Training opportunities will be made available to all personnel, and it is anticipated that a number of employees will leave with additional qualifications. The project will also work with trade schools and TAFE colleges to provide opportunities for students in suitable trades.

It is estimated that around one third or more of the workforce would be sourced from the Sunshine Coast, with the remaining two thirds employed from the wider south-east Queensland region.

A site office at Chevallum has been established under lease agreement with the landowner. A construction camp is not necessary for the NPI Stage 2 as it is not a remote location.

2.4.2 Transport

Transport routes required for the construction of the project are mostly determined by the proximity of the proposed pipeline corridor and the possible use of existing roads (eg haulage) and/or potential new temporary access points from existing roads (eg access to ROW and/or facility areas). The ROW is the cleared corridor that will accommodate the pipeline.

Project haulage and travel routes will be a combination of roads ranging from National (eg Bruce Highway), state-controlled collector roads and local government-controlled collector and local roads. Where possible, construction traffic will use the pipeline ROW rather than local roads. This will help minimise temporary disturbance to road users, local residents and physical impact to roads. Full details of transport volumes, modes and routes are provided in Section 3.8.

The proposed corridor is often parallel to, or within 5 km of, the Brisbane to North Coast railway line. Investigations have been undertaken into the use of rail transport; however, road haulage is the preferred transport method due to the current lack of appropriate rail sidings and infrastructure (loading and unloading sites).

It is anticipated that many materials will be initially transported or shipped to Brisbane and then transferred to the Sunshine Coast via road. Road transport will also include transport around and to the project corridor.

A preliminary assessment of vehicles, machinery and equipment that may be required during construction and operation of the project is summarised in Table 2.8. It is noted that chemical deliveries to WQMFs will occur separately as a safety precaution. Full details of haulage routes are provided in Section 3.8 of this EIS.

Table 2.8 Anticipated plant requirements

Project element	Anticipated requirement
CONSTRUCTION	
Clear and grade	3 x excavators 3 x bulldozers 3 x graders 6 x dump trucks 3 x mulchers 3 x water carts
Pipeline construction	9 x excavators 3 x bulldozers 6 x front-end loaders 6 x water carts 6 x pipe trucks 25 x truck and dogs
Tunnel bores	2 x tunnel bore machines
Waterway crossings	3 x excavators 3 x dump trucks 2 x bulldozers
Spoil removal	3 x bulldozers 3 x excavators 6 x dump trucks
Balance tanks, pump stations and other facilities	30–50 t RT crane 1x excavator 1 x backhoe Concrete trucks
OPERATION	
Chemical deliveries (Landsborough WQMF)	Increased frequency of chemical deliveries from those required for the NPI Stage 1 (3–4 days) using: 2 x 9000 L rigid tankers 1 x 13,500 L rigid tanker with dog trailer 1 x 18,000 L semi-trailer
Chemical deliveries (Ferntree WQMF)	Chemical deliveries will occur every 7–10 days using: 2 x 9000 L rigid tankers
Maintenance crews	Light vehicles Crane trucks Backhoes and excavators

2.4.3 Water Distribution and Treatment Systems

Water Resource Planning Assessment Process

The Department of Natural Resources and Water (NRW) developed the *Water Resource (Mary Basin) Plan 2006* (Mary Basin WRP) in accordance with the provisions of the *Water Act 2000*. An integral input to the WRP process was the independent technical advisory panel advice on the potential flow-related environmental impacts of taking water from the Mary Basin.

The environmental assessments undertaken by the technical advisory panel to develop the environmental flow objectives (EFOs) of the Mary Basin WRP consisted of three main phases:

- current condition assessment of the existing environment;
- development of an environmental flow assessment framework; and
- assessment of the likely environmental implications of possible future water resource management scenarios.

The technical advisory panel assessed the implications of full water resource development in the Mary Basin (the full development scenario) to the current use scenario. This advice was a key input into the formulation of the outcomes and objectives of the Mary Basin WRP, including the EFOs which are included in the WRP. These EFOs seek to protect environmental assets of the Mary Basin including the Lungfish, Mary River Cod and Mary River Turtle and other matters of national environmental significance (MNES).

The technical advisory panel recommended the suite of performance indicators to be used in the Mary Basin WRP, as they were considered to best represent key attributes of the flow regime, including low, medium and high flows and flow seasonality. These EFOs established in the WRP seek to minimise changes to important characteristics of the flow regime, including flow variability and seasonality, and have been set in accordance with precautionary principles.

It is unlikely that all entitlements would be fully utilised at any given time. However the introduction of water trading makes this a possibility in the future, and flow requirements have been legislated under the *Water Act 2000* to protect the environment even if a full-use scenario were to occur.

Since 2003, the announced allocations for Borumba Dam have increased over the water year to 100%. Under the Mary Basin WRP this assumes that 100% of entitlement has been utilised. Noosa Shire has never utilised this full allocation. The announced allocations for Borumba Dam since 2002 are (pers. comm. NRW):

- 2002/2003—25% (data for July only);
- 2003/2004—100%;
- 2004/2005—100%;
- 2005/2006—100%;
- 2006/2007—100%; and
- 2007/2008—100%.

Target Volumes for Drought Contingency Flows

The completed NPI (Stage 1 and Stage 2) will supply a target volume of 65 ML/d of potable fresh water to existing storage facilities at Elimbah and Morayfield for distribution to localities in the greater Brisbane region. Successful completion of Stage 2 will include a number of integration works with the NPI Stage 1 in order to operate the project as a whole. Further, the NPI Stage 2 will support the regional growth initiatives on the Sunshine Coast described by the QWC (QWC 2008).

Completion of the NPI Stage 1 at the end of 2008 will initially supply the full 65 ML/d drought contingency flows from Baroon Pocket Dam via the Landers Shute water treatment plant (WTP). Completion of Stage 2 will connect the NPI to additional existing water sources (supplying up to 18 ML/d), thereby reducing the reliance on water drawn from the Baroon Pocket Dam to supply drought contingency flows. The connection of Stage 2 to additional water sources therefore increases the security of water supply for the NPI. This is important to ensure a sustainable yield of water from existing sources until a future bulk supply is available on the Sunshine Coast.

Stage 2 Water Supply Strategy

The previous water supply strategy for the NPI Stage 2 proposed the abstraction of approximately 40 ML/d of water from the Mary River which would be sought through new entitlements under the Mary Basin WRP. As this proposed entitlement was not included within the establishment of the Mary Basin WRP, any impacts associated with the new allocation would require assessment against relevant state and federal environmental legislation.

A comprehensive description of the potential impacts on MNES associated with this supply strategy was produced and is included in Appendix H. The key findings of the report identified that:

- the extraction of 40 ML/d would not result in a significant change in the frequency or duration of flows predicted for seasonally high and low-flow periods in the Mary River; and

- under the 40 ML/d extraction scenario, the reduction in mean duration of flow providing for the '10 cm and 30 cm above cease to flow objectives' would not result in significant impacts on the ecological requirements of MNES.

Following the review of the previous water supply strategy for Stage 2, a new strategy (now the current water supply strategy) was proposed. The factors influencing the new water supply strategy included:

- improvements in the regional water supply situation following good rainfall over the summer of 2007–08 and in early June 2008, which resulted in spillway overflows at all Sunshine Coast dams;
- recent short-term water balance modelling completed by QWC, which showed that the transfer of 65 ML/d from Baroon Pocket Dam to the SEQ water grid was sustainable until the end of 2011; and
- enhancement of water supply security in SEQ through the completion of a number of key drought contingency projects by the end of 2008.

The Stage 2 water supply strategy proposes to transport water that is extracted from the Mary River under an existing utilised allocation (6500 ML/a), and treated at the Noosa WTP. Up to 55% of this allocation (3600 ML/a) has been utilised by the (previous) Noosa Shire Council to supply local urban demand since the allocation was authorised in 2000.

The existing entitlement comprises a 6500 ML/a interim water allocation (high priority) held by the SEQ Water Grid Manager (SEQWGM) within the Upper Mary River Water Supply Scheme. Impact assessment for the full use of the 6500 ML/a allocation occurred during the establishment of the Mary Basin WRP under the agreed WRP process.

Under the currently proposed water supply strategy (ie utilisation of existing entitlements), NPI Stage 2 will have the capacity to deliver up to 6500 ML/a (18 ML/d). The obvious advantages of this water supply strategy are:

- the impacts to the environmental values of this entitlement have been assessed and as a result the allocation was authorised under the Mary Basin WRP;
- no new water entitlements are being sought and there are no resulting anticipated impacts on EVR species or MNES in the Mary River;
- water entitlements have been previously utilised and established under the WRP. This is consistent with the EFOs of the WRP;
- reduced reliance on Baroon Pocket Dam for drought contingency flows;
- no changes to the existing infrastructure on the Mary River; and

- more easily managed from a risk management perspective, resulting in a more streamlined approvals process.

Hydraulic Grade

For water to flow it needs a source of energy. When gravitational energy is not enough to move water in a pipe over large distances or over hills, additional energy is required to boost the flow. This additional energy can only be achieved by pumping to increase the pressure in the pipeline.

The hydraulic grade line (HGL) is a measure used by engineers to ensure there is enough pressure in a pipeline to allow water to continue to flow in the intended direction. The HGL gradually decreases over the length of a pipeline due to pipe wall friction and bend or fitting losses. The HGL can be boosted with the addition of pump stations to the system which instantaneously raise the level of the HGL.

In designing the pipeline, these pump stations are strategically placed before the HGL drops too low or ground elevations rise so as to always keep positive pressure in the pipeline. When higher flows are needed, the amount of pumping is increased to boost flow through the pipeline.

Pipe Length and Operability

The majority of energy or hydraulic grade in the pipeline is lost through pipe wall friction, with fitting losses (ie bends, valves) also contributing. A longer pipeline results in greater friction losses; and therefore pumping requirements are higher. A shorter route minimises friction losses, increases hydraulic efficiency and reduces pumping requirements, which in turn minimises the operational cost over the life of the infrastructure. Minimising energy inputs has the added benefit of reducing carbon emissions associated with the operation of the pipeline.

The primary objective in selecting the route for the NPI Stage 2 was to adopt the shortest, and therefore most efficient, route having regard to social, environmental and constructability constraints.

Apart from the pipeline itself, the NPI Stage 2 drought project requires a number of associated facilities to enable the overall water supply scheme to operate. These facilities include a balance tank, pump stations and water quality facilities. These are discussed in further detail below.

Mainline Pipe Facilities

Mainline pipe facilities are required to maintain the integrity of the pipeline and maximise operational efficiency. These facilities include the following:

- offtakes;
- section or gate valves;
- drain-down valves;
- air valves; and
- pigging/cleaning pits.

Provision will be made along the overall NPI for connections to supply future customers in the Sunshine Coast region. Table 2.9 summarises those locations where provision of offtakes will be made for connection to existing or future water distribution networks.

Table 2.9 Provision for supply offtakes along the NPI

NPI Stage 2 project area	NPI Stage 1 project area
Eumundi (future)	Caloundra (constructed)
Yandina (future)	Elimbah (constructed)
Nambour (future)	Morayfield (constructed)
Pringle Hill (future)	
Paynter Creek (future)	

Section valves are designed to isolate sections of pipeline during scheduled maintenance activities or emergency events. These facilities ensure operational flexibility and minimisation of water losses. Section valves are located at intervals of several kilometres and will be buried with the pipeline. Some of these valves will have above-ground components which allow them to be turned on and off mechanically, while others will be operated electronically from a remote control area.

Drain-down valves are installed at low sections of the pipeline to allow sections of the pipe to be emptied of water during scheduled maintenance activities or emergency events. Water emptied from the pipeline will typically be released through a manhole or pit within the pipeline easement. Air valves are installed at high points to remove trapped air from the pipeline and improve hydraulic efficiency. These valves require regular maintenance and will be installed in pits to facilitate maintenance access.

Pigging/cleaning pits are installed to allow launch and retrieval of a foam ‘pig’ for cleaning of the pipeline. All facilities will be located within the permanent NPI Stage 2 easement.

Balance Tanks

A balance tank provides a level of protection against wear and tear on infrastructure due to water hammer surge within the pipeline. They also split the overall scheme into workable sections that can operate as a local supply in isolation from the rest of the pipeline. Sections can be taken offline for maintenance and repair, with balance tanks providing storage for continuous supply of remaining online pipe sections. This ultimately provides a more robust and flexible network.

Potential balance tank locations are largely dictated by the elevations of available peaks within close proximity to the pipeline. The presence of a 'head point' at intermediate locations along the pipeline allows gravity flow to occur over the downstream segments of pipeline up to the gravity capacity of the system. Provided the balance tank is sited at sufficient elevation, downstream peaks can be cleared without pipe drills or additional pumping, reducing electricity consumption and associated greenhouse gas production.

A balance tank is required for the NPI Stage 2 project to act as a break point for the hydraulic grade within the pipeline and to provide a head point for supply pumps to pump to. The optimum elevation for this balance tank, based on hydraulic studies, is 145 m RL. The preferred tank site should be also able to accommodate future infrastructure associated with increased flow volumes from the bulk water sources e.g. Traveston Crossing Dam or a desalination plant on the Sunshine Coast (should either be approved).

In 2007, a siting study identified two locations for a balance tank. The sites were identified on the basis of specific engineering requirements. One site in an uncleared road reserve at Eudlo (Nobels Road) was ruled-out in 2008 due to a range of factors.

Two potential balance tank sites are being investigated at a site in Kulangoor. Figure 2.8 shows the location of the two tank sites currently under investigation. Both sites are assessed for the purposes of this EIS. The following will be considered in determining the final location of the tank:

- the location of future infrastructure;
- the extent of earthworks required for construction;
- optimal pipeline routes connecting the tank to the main pipeline;
- the ability to co-locate a future pump station;
- the ability to co-locate a future WQMF at the tank site;
- the need to provide access to facilities in accordance with design standards; and
- the ecological sensitivity of any habitat areas to be cleared.

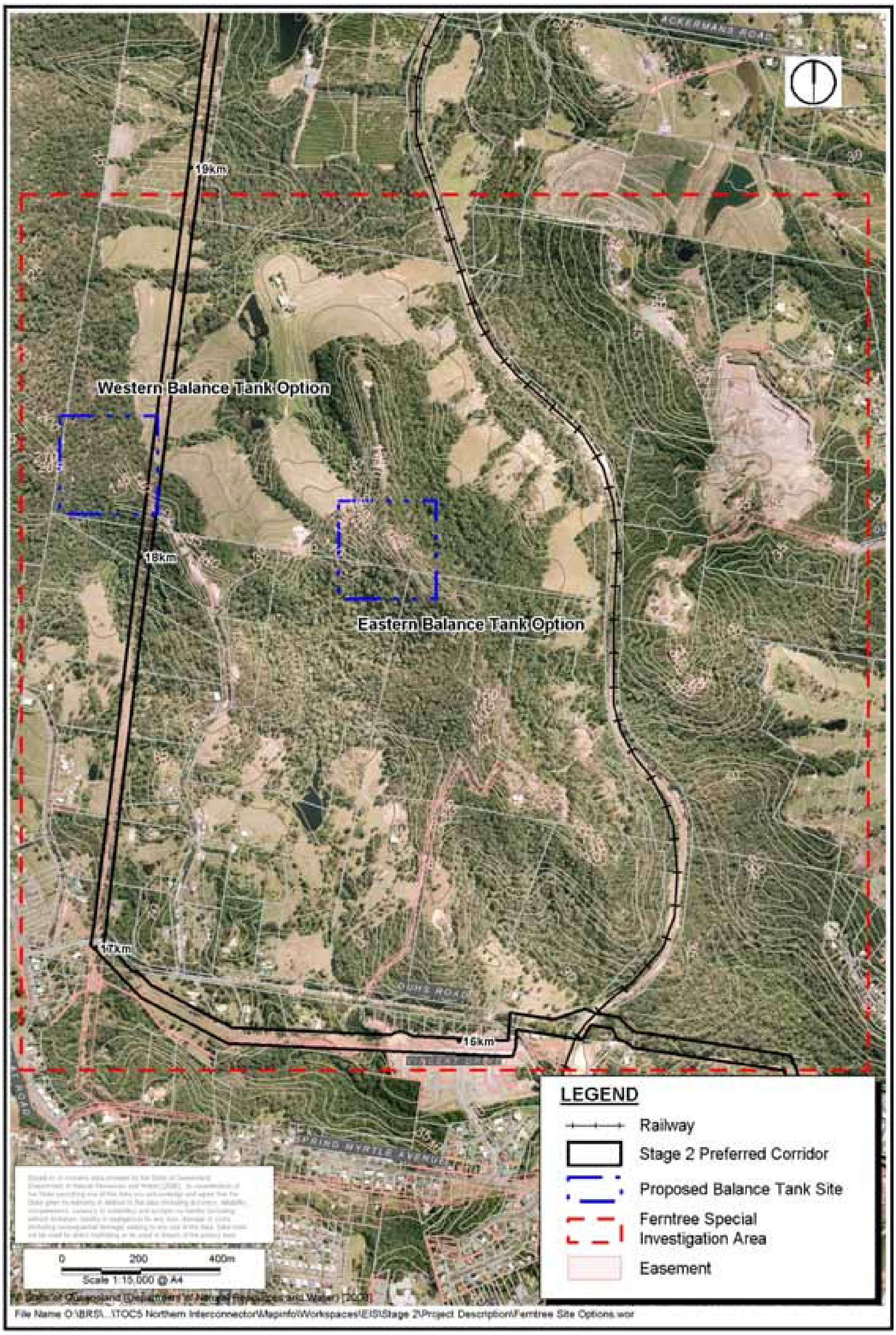

Figure 2.8
FERNTREE BALANCE TANK SITE OPTIONS

Pump stations

Three new pump stations are proposed for the NPI Stage 2 project. These pumps are able to supply a range of flows and are required to boost flows along the pipeline or boost branch main supplies into the NPI main line. Details of individual pump stations are summarised in Table 2.10.

Commissioned operations will be unmanned and monitored via a remote control system on a 24-hour basis, with electricity for pump operation supplied from the power grid.

Table 2.10 Preliminary sizing and flow requirements of pump stations

Pump station	Pump configuration	Pump size (kW)	Design flow (ML/d)	Design head (m)
Noosa PS	Centrifugal 2 duty	215	32.1	85
Eudlo PS	Centrifugal 2 duty	104	44	14
Mooloolah PS	Centrifugal 2 duty	123	44	16.5

Water Quality Management

While the NPI will transfer water from treated sources, this water will have an increased retention time due to the length of the traverse (up to 100 km for water from Noosa WTP) and the low pressure within the pipe. The Landsborough WQMF, constructed as part of the NPI Stage 1 project, will be upgraded as part of the NPI Stage 2 works to maintain the quality of water in the pipeline for all offtakes and ultimate delivery to Brisbane. An additional WQMF is potentially required along the main pipeline. If required, this facility would be co-located with other infrastructure at the Ferntree balance tank site. Preliminary estimates of on-site chemical storage requirements for water quality management at these sites are summarised in Table 2.11.

Approvals for an environmentally relevant activity (ERA) will be sought from the Environmental Protection Agency (EPA) for chemical storage associated with the WQMF.

Table 2.11 Preliminary on-site chemical storage requirements

Chemical	Nominal concentration	Landsborough WQMF Nominal stored quantity-NPI Stage 1 (kL)	Landsborough WQMF Nominal stored quantity-NPI Stage 2 (kL)	Ferntree WQMF Nominal stored quantity (kL)	Storage type
Sodium hypochlorite	10%	72.4	94.1	18.2	Bunded tanks
Sodium hydroxide	32%	18.8	22.9	–	Bunded tanks
Aqueous ammonia	25%	23.3	26.1	–	Bunded tanks
Sulfuric acid	60%	–	34.2	8.6	Bunded tanks

Other Design Features

Pipeline corrosion will be prevented by the protective external coating and cathodic protection systems. The cathodic protection system will be checked regularly to ensure that the protection voltages are within limits and to monitor any likely areas of corrosion activity. The cathodic protection system and external coating work independently to protect the pipeline from corrosion.

The pipeline network will have a supervisory control and data acquisition system (SCADA) which will continually monitor pipeline conditions such as pressure, temperature, water flow in and out, valve status, storage tank levels, pump station performance, cathodic protection and water quality. A fibre optic cable will be used as the primary form of communication for the system. The SCADA system will enable the pipeline controller to instantly open or close actuated valves, alter operating pressures and start or stop equipment as required at sites along the pipeline.

2.4.4 Water Supply and Storage

Water Use and Storage

Water will be required during construction and commissioning for:

- hydrotesting and commissioning the pipeline—supply of this water will be determined by the design specifications for the pipe material being tested. The estimated volume required for these purposes will be 50–70 ML;

- dust suppression—will most likely involve the use of recycled water sourced from approved localities. The total volume required will depend on local climatic conditions; and
- domestic use at site offices etc (will be less than 1 ML/d).

A range of water sources for hydrostatic testing, including raw and recycled water, will be considered for their suitability against relevant Australian Standards and design parameters. However, water from potable supplies is likely to be preferred for hydrostatic testing. As the NPI is a treated potable water pipeline, the use of potable water sources ensures there is no contamination of the pipe during testing.

Volumes of water can be transferred to the pipeline for hydrostatic testing, reused a number of times, then treated to an acceptable standard and safely re-released to the source supply once testing is complete. Where alternative sources are used for hydrotesting, additional investigations will be required to determine the most appropriate disposal method in consultation with the Queensland EPA, Department of Primary Industries and Fisheries (DPI&F) and NRW.

The construction site office is connected to town water supply, with water tanks installed to reduce dependence on mains supply. Water for dust suppression will typically come from suitable recycled water sources. Potable water will be kept separate from construction activity water. A comprehensive water efficiency plan will be developed for the construction phase of the project and any permits necessary to take water from natural watercourses, bores or other regulated areas will be obtained as appropriate.

Modelling for the SEQ region indicated that spare capacity is available in existing entitlements to water in the Mary River, Lake Macdonald and Wappa Dam that can be made available to the NPI Stage 2 for transport to Brisbane.

Initial planning for the NPI Stage 2 identified the need for the project to be completed by mid-2009 to augment supplies drawn from Baroon Pocket Dam for the NPI Stage 1. However, the implementation of the NPI Stage 2 is now being influenced by a number of factors including:

- improvements in the regional water supply situation following good rainfall over the summer of 2007–08 and in early June 2008, which resulted in spillway overflows at all Sunshine Coast dams;
- recent short-term water balance modelling completed by QWC, which shows that the transfer of 65 ML/d from Baroon Pocket Dam is now sustainable until the end of 2011; and
- enhancement of water supply security in SEQ through the completion of a number of key drought contingency projects by the end of 2008.

2.4.5 *Electricity and Telecommunications*

Pump stations for the NPI Stage 2 will be powered using metered electricity supply from the grid. Any upgrades to existing electricity infrastructure would be undertaken by Energex in accordance with the *Electricity Act 1994*. It is anticipated that only upgrades to the existing lines from the Cooroy substation to Noosa WTP to supply the Noosa pump station are required.

3 ENVIRONMENTAL VALUES AND MANAGEMENT OF IMPACTS

Section 3 describes all relevant aspects of the environment within the area likely to be affected by the NPI Stage 2 project. It identifies and analyses potential impacts on the existing environmental values arising from the project during its construction and operational phases. These impacts cover natural, economic, cultural and social environments. Measures are recommended to mitigate any potential adverse effects of the project on the environment and project benefits.

Environmental Management

General environmental management practices apply to construction in all locations and relate to but are not limited to:

- vegetation clearing;
- construction of waterway crossings;
- sediment and erosion control from stockpiles and cleared areas; and
- dust suppression.

The project is currently in the process of developing a soil and water management plan in consultation with the EPA and local government authorities. The soil and water management plan will address erosion and sediment control. The project is in the process of engaging an external specialist to undertake soil risk analysis along the pipeline alignment. The soil risk analysis includes evaluation of soil types, topography and anticipated construction activities. This analysis will inform site-specific erosion and sediment control plans. These plans will be in compliance with the *Maroochy Manual for Erosion and Sediment Control* (Maroochy Shire Council 2007).

A construction environmental management plan (CEMP) will detail the process for meeting legislative requirements for environmental management and minimising impacts during the construction program. A planning EMP (PEMP) is included in this EIS (see Appendix Q).

Potential impacts on listed threatened or migratory species and ecological communities are addressed at Section 3.3 and further at Appendix D.

3.1 Climate and Natural Disasters

The climatic characteristics of south-east Queensland (SEQ) are influenced by the region's position:

- at a subtropical latitude; and
- in close proximity to the coast.

A subtropical latitude results in coastal lands being influenced by both the tropical zone to the north and the temperate zone to the south. These two zonal influences interact to give SEQ a relatively even climate with few extremes of temperature or rainfall.

Subtropical climates have two main seasons. They are dominated by humid, warm to hot temperatures and high precipitation during summer and early autumn. The coolest and driest time of year is winter to early spring. Average monthly temperatures range from around 21°C in winter to 29°C in summer, becoming slightly cooler with increasing altitude (see Figure 3.1).

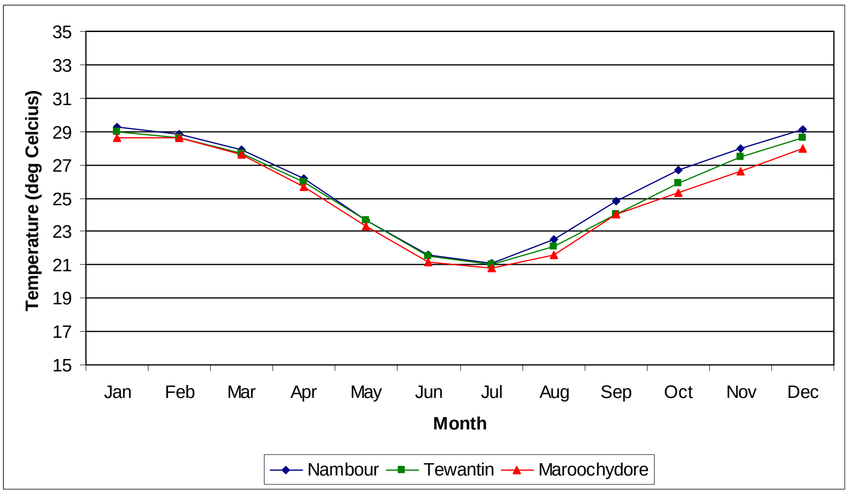

Figure 3.1
AVERAGE MAXIMUM MONTHLY TEMPERATURE
Source: BOM 2008

SEQ's proximity to the coast generally ensures that rainfall is adequate, although some parts of region have been subject to ongoing drought conditions over the past decade.

The landscape of the Sunshine Coast experiences relatively high run-off and regular flooding. Average annual rainfall in the project area is between 1200 mm and 1700 mm, varying dramatically due to changes in altitude, latitude and slope direction (see Figure 3.2). For example, Nambour's summer rainfall falls between November and March, providing approximately 65% of average annual rainfall (Capelin 1987). Evaporation exceeds rainfall only between the months of August and December (Capelin 1987).

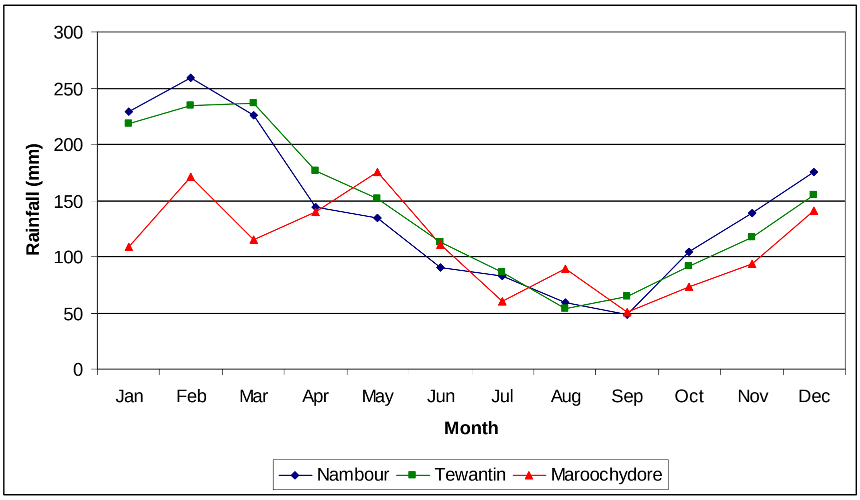

Figure 3.2
AVERAGE TOTAL MONTHLY RAINFALL
Source: BOM 2008

Bushfire

The main bushfire season for SEQ typically extends from mid to late winter through early summer. The greatest danger occurs towards the end of winter, particularly if a good summer wet season promoting the growth of grass and other fuel is followed by a winter of low rainfall and dry westerly winds. Serious fire seasons occur once every five years on average (Granger and Hayne 2000).

Areas of medium bushfire hazard correspond with vegetated areas on ridges between Woombye and Nambour (see Figure 3.3). Patches adjacent to the Bruce Highway between North Arm and Cooroy also pose a medium bushfire hazard. As the right of way (ROW) is generally cleared of all vegetation prior to the commencement of construction activity on the site and welding of pipe is undertaken inside the trenches, the risk of fire as a result of normal construction activities is low.

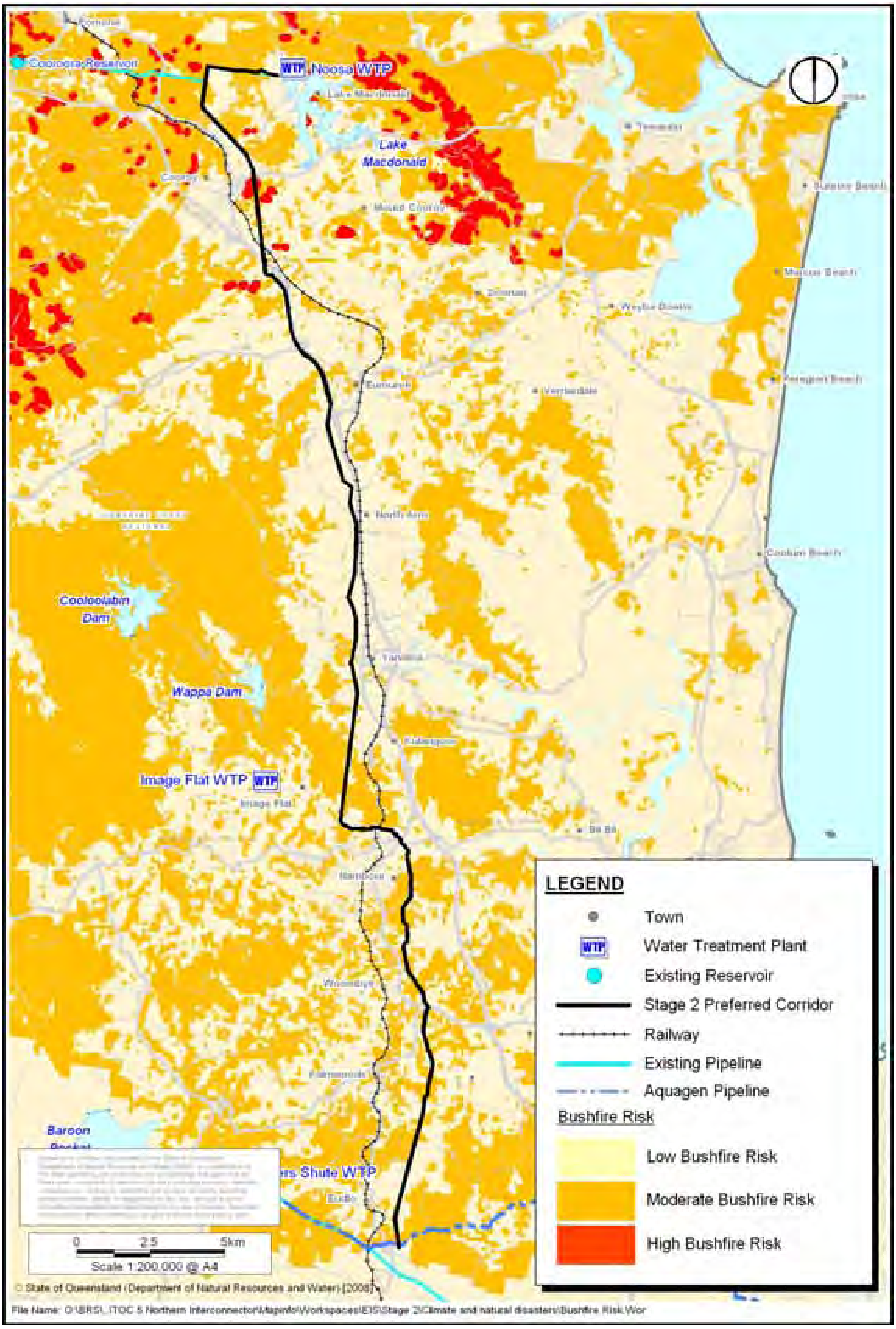

Figure 3.3
BUSHFIRE HAZARD

Floods

On average, SEQ has more properties exposed to inundation from floods with an average recurrence interval of 100 years than any other area in Australia (Granger and Hayne 2000). Minor flood-prone areas in the study area are associated with Petrie Creek and its tributary, Paynter Creek. The potential for flooding during construction is addressed at Section 3.4 of this EIS.

Landslip

While steeper slopes are often at greater risk of landslip, underlying geology is also an important contributing factor. A review of landslip hazard mapping prepared by Maroochy and Noosa shires (NSC 1996) was undertaken to determine those sections of the project area at greatest risk (see Figure 3.4).

Route planning has included the avoidance of slip-prone country, primarily the steep basaltic slopes of the Blackall Range.

Cyclones

On average, 1.2 tropical cyclones pass within 500 km of Brisbane each year, with 15 cyclones in the last century approaching to within 100 km of downtown Brisbane (Granger and Hayne 2000). Most cyclone damage is caused by strong wind gusts; however, associated flooding may also present a risk for the NPI Stage 2 project, particularly with multiple watercourses draining through the study area.

Earthquakes

SEQ is more than 1500 km from the plate boundary between the Australian and Pacific tectonic plates, although earthquakes measuring up to magnitude 5 on the Richter scale have occurred in the region. The risk from earthquakes in the region is largely from low probability, high consequence events (Jones et al. 2000).

Because there is a risk that structures could fail as a result of a strong earthquake, structures are to be designed in accordance with the relevant Australian standard with respect to earthquake loads (AS 1170.4–1993: *Minimum design loads on structures, Part 4: Earthquake loads*).

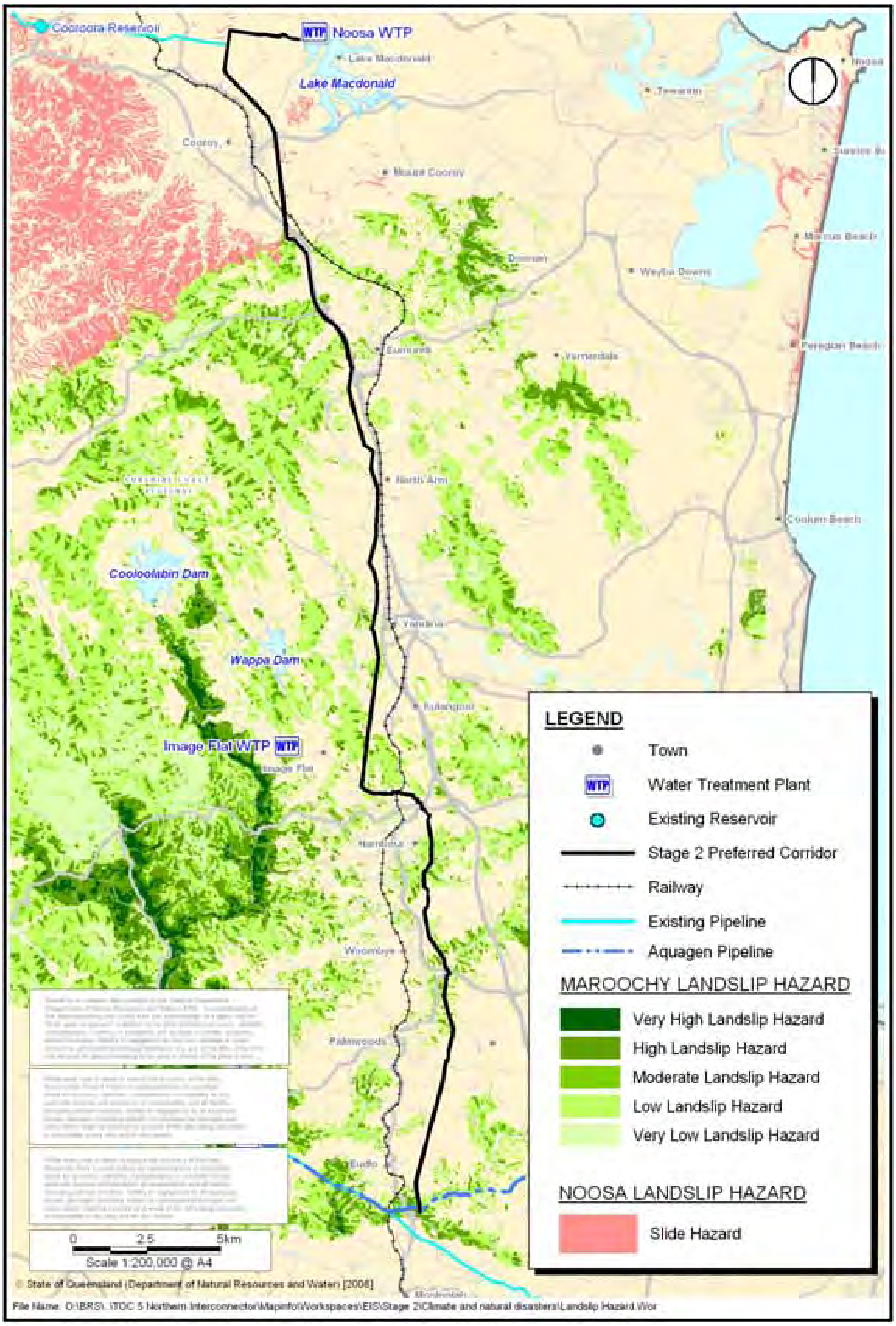

Figure 3.4
LANDSLIP HAZARD

Potential Impacts and Mitigation Measures

The preferred corridor has been selected to minimise the extent of pipeline in high-risk areas for landslip, bushfire or flooding. Residual risks identified for the NPI Stage 2 project with respect to climate and weather include:

- susceptibility of high or moderate bushfire risk areas to fires started as a result of construction activity;
- erosion and sedimentation due to high wind or flooding conditions;
- mobilisation of dust during windy conditions;
- destabilisation of slopes in high-hazard zones for landslip as a result of excavations or bulk earthworks; and
- injury to persons or property or environmental harm caused as a result of extreme weather events such as cyclones.

Mitigation strategies to be adopted for the project will include:

- monitoring daily and weekly weather predictions during construction;
- suspending operations when extreme weather is forecast and securing worksites in accordance with the project incident response plan;
- implementing adequate dust and erosion management controls;
- maintaining adequate fire breaks when undertaking activities (welding, smoking etc) with the potential to start fires;
- using water carts employed for dust suppression in the event of fire;
- undertaking construction works in and adjacent to waterways only when favourable weather conditions are forecast;
- minimising the extent of soil exposed/stockpiled at any one time, particularly in flood-prone areas;
- burying the pipeline at a suitable depth to avoid potential damage from flooding;
- employing specialist soil conservation consultants to provide site-specific advice with regard to land stabilisation;
- diverting drainage from worksites in accordance with recommendations provided by soil conservation consultants;
- briefing all new personnel with respect to site-specific risks prior to commencement of construction activity; and
- developing and implementing an incident response plan in case of flood, fire, cyclone or landslip.

3.2 Land

3.2.1 Topography and Geomorphology

Description of Environmental Values

The Stage 2 project area takes in the eastern edge of the Blackall Range, traversing a number of ridges which run west-east towards the coast. The pipeline corridor runs in a north-south direction, commencing in the rolling hills around Lake Macdonald and descending onto the floodplain of the North Maroochy River to the south. To the west of Eumundi, the route crosses a steep ridge adjacent to the Bruce Highway and traverses the western edge of Yandina township onto the South Maroochy River floodplain.

South of the Yandina, the route crosses two high coastal ridges and the middle reaches of Petrie and Paynter creeks. The corridor rises again before descending onto the flats around Eudlo Creek and ascending steeply to connect with the Stage 1 works at Nobels Road.

Elevations within the study area vary locally from 102 mAHD around Lake Macdonald to approximately 106 mAHD at the Nobels Road termination point. The intervening terrain varies between a low point of around 4.5 mAHD and the highest points at Pringle Hill (140 mAHD) and the Ferntree balance tank site (136 mAHD) (see Figure 3.5)

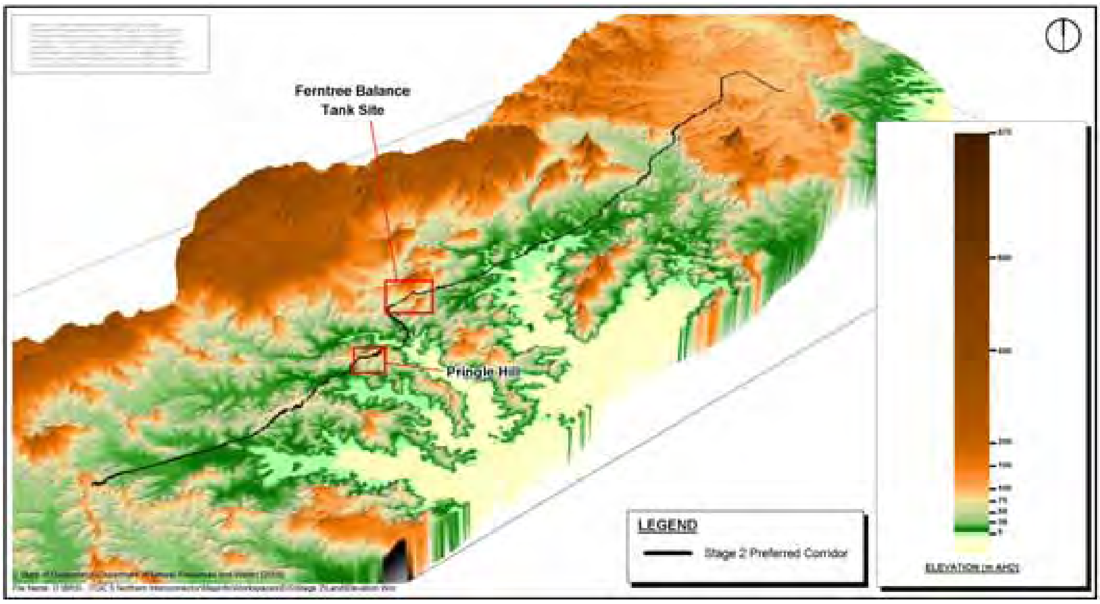

Figure 3.5
ELEVATION

Key landscape features within or in close proximity to the study area include:

- coastal waterways and associated floodplains, particularly the North and South Maroochy rivers, Petrie Creek, Paynter Creek and Eudlo;
- high ridges at Image Flat (Ferntree balance tank site) and Nambour (Pringle Hill);
- elevated undulating terrain around Lake Macdonald, including the upper catchment of Six Mile Creek;
- steep terrain to the west of Eumundi and north to Cooroy, including a steep cutting where the Bruce Highway passes under the Eumundi–Noosa road; and
- steep terrain at the connection point with the Stage 1 works at Nobels Road.

Gradients along the pipeline route vary from the relatively level alluvial terraces of the floodplains to steeply undulating terrain near Nambour and Eudlo. Figure 3.6 presents the slope categories for the route, which are summarised below in Table 3.1.

Table 3.1 Slope categories for pipeline route

Slope category (%)	Length of route (km)	Main areas of route
0–3	14.4	Alluvial terraces of major and minor streams
3–6	8.9	Mainly cleared horticultural and grazing lands in the area between Yandina and the Noosa WTP
6–9	5.6	
9–12	5.1	
12–15	4.0	Mainly lands to the east of Cooroy and east of Palmwoods
15–25	6.1	
25–35	2.0	Near Nobels Road, Pringle Hill and the Ferntree balance tank site
35–50	1.3	
> 50	0.2	

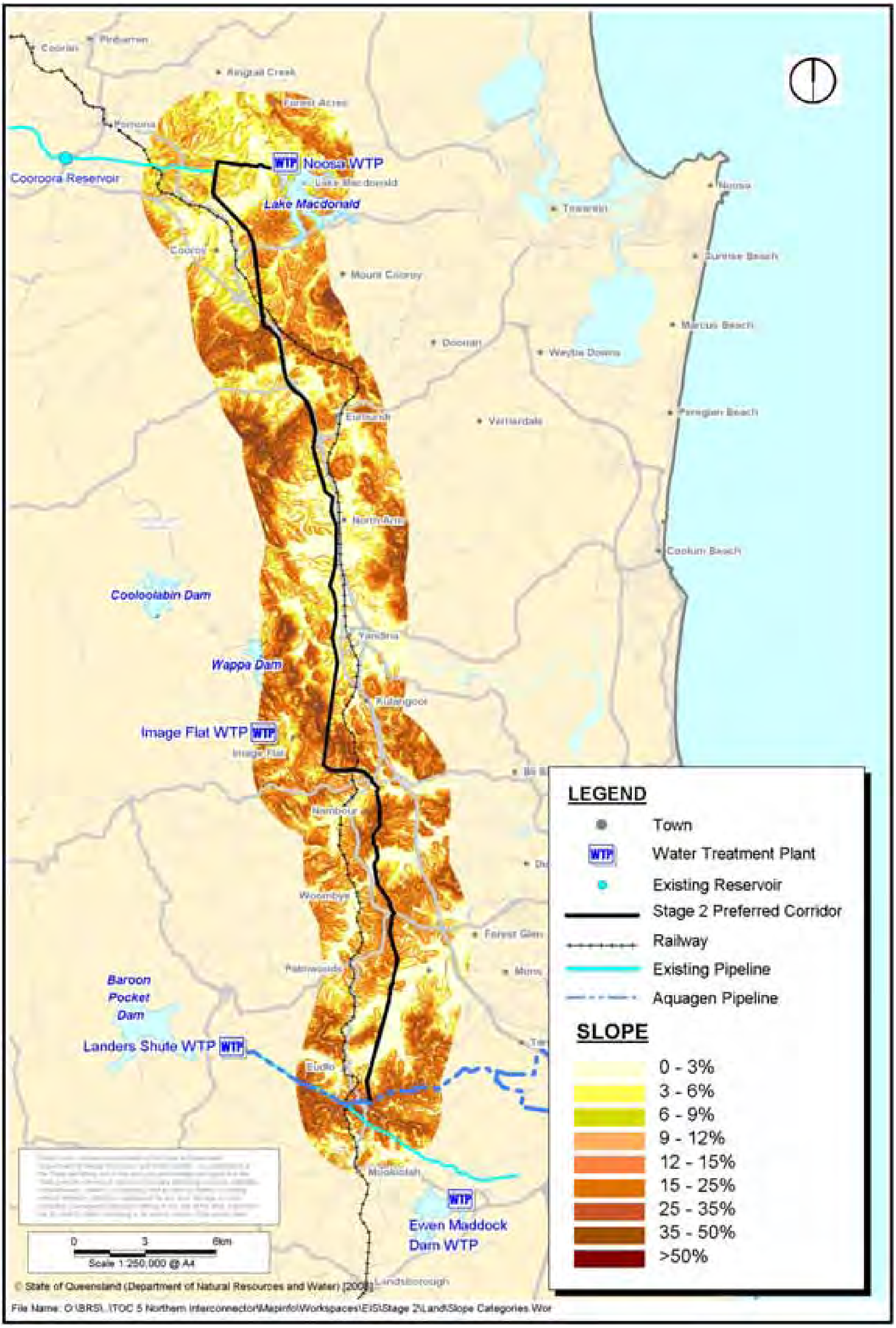

Figure 3.6
SLOPE CATEGORIES

Potential Impacts and Mitigation Measures

Topography

The key landscape features affecting pipeline operation and construction are steep ridges and side slopes within the corridor. Where the pipeline is required to cross high ridges, pumping requirements are much greater and therefore contribute to the operational costs over the life of the pipe. As such, it is proposed to tunnel under Pringle Hill. This will minimise potential erosion issues associated with establishment of the right of way (ROW) within this section of pipeline.

Pipe installation also requires the creation of an even platform to allow vehicles and equipment to move safely through the corridor. In steep terrain, additional earthworks may be required to create stable batters adjacent to the work area. Wherever possible, the width of the ROW will be limited in steep terrain to avoid costly earthworks, limit the potential for slope instability and minimise the extent of reinstatement works. On completion of construction, landforms will be reinstated as close as possible to their original contours and monitored in accordance with a project-specific rehabilitation plan.

Reinstatement of local landform features such as gullies and drainage lines within the easement will also be undertaken in accordance with the NPI rehabilitation plan. Revegetation works will incorporate the use of plant species endemic to particular locations.

No watercourses will be diverted as part of pipeline construction and any minor works within watercourses will be carried out in accordance with appropriate Department of Natural Resources and Water (NRW) conditions. Further, crossing points will be located at areas of existing disturbance and the corridor clearing width minimised where intact communities are present.

A range of waterway crossing construction methods have been assessed as part of the environmental impact assessment. The trenching methodology was determined to be the most appropriate method for waterway crossings as it minimises impacts on waterways along the NPI Stage 2 alignment.

3.2.2 Geology and Soils

Description of Environmental Values

Geological features and soil characteristics in the study area have been described largely through a desktop study of published and unpublished data. Preliminary assessment of the geotechnical conditions and soil types in the project area was based on:

- examination of available mapping (1:100,000 Geological Series Maps of Nambour Special and Gympie Special);
- a review of land suitability studies for the Sunshine Coast region;
- review of stereo air photos of the proposed route;
- helicopter aerial survey of the terrain and adjoining landform features; and
- limited walkover survey to examine key crossings and features and accessible areas of the proposed route.

Geological Formations and Land Resource Areas

The preferred corridor traverses the geological formations of the Nambour Basin, Post-Organic Volcanics and Gympie Province. Within these areas, the route generally traverses hills and ridges composed primarily of residual soils overlying sedimentary sandstone or igneous rhyolitic tuff. There are no significant fault structures prone to significant seismic activity within the project area.

The pipeline route comprises four distinct geological units, including the Pomona Beds and the Kin Kin Beds of the early to middle Triassic area in higher terrain around Cooroy and the North Arm Volcanics between Eumundi and Nambour. A small section of the project area around Yandina traverses the western edge of the Maroochy floodplain which is dominated by alluvium associated with fluvial processes. Figure 3.7 shows the geology of the study area.

The hills in the south of the project area form part of the Landsborough Sandstone formation, while sections of the route near Yandina are composed of Myrtle Creek Sandstone. Sections of the project area may contain varying depths of colluvium; however, more detailed geotechnical investigations are required to confirm this.

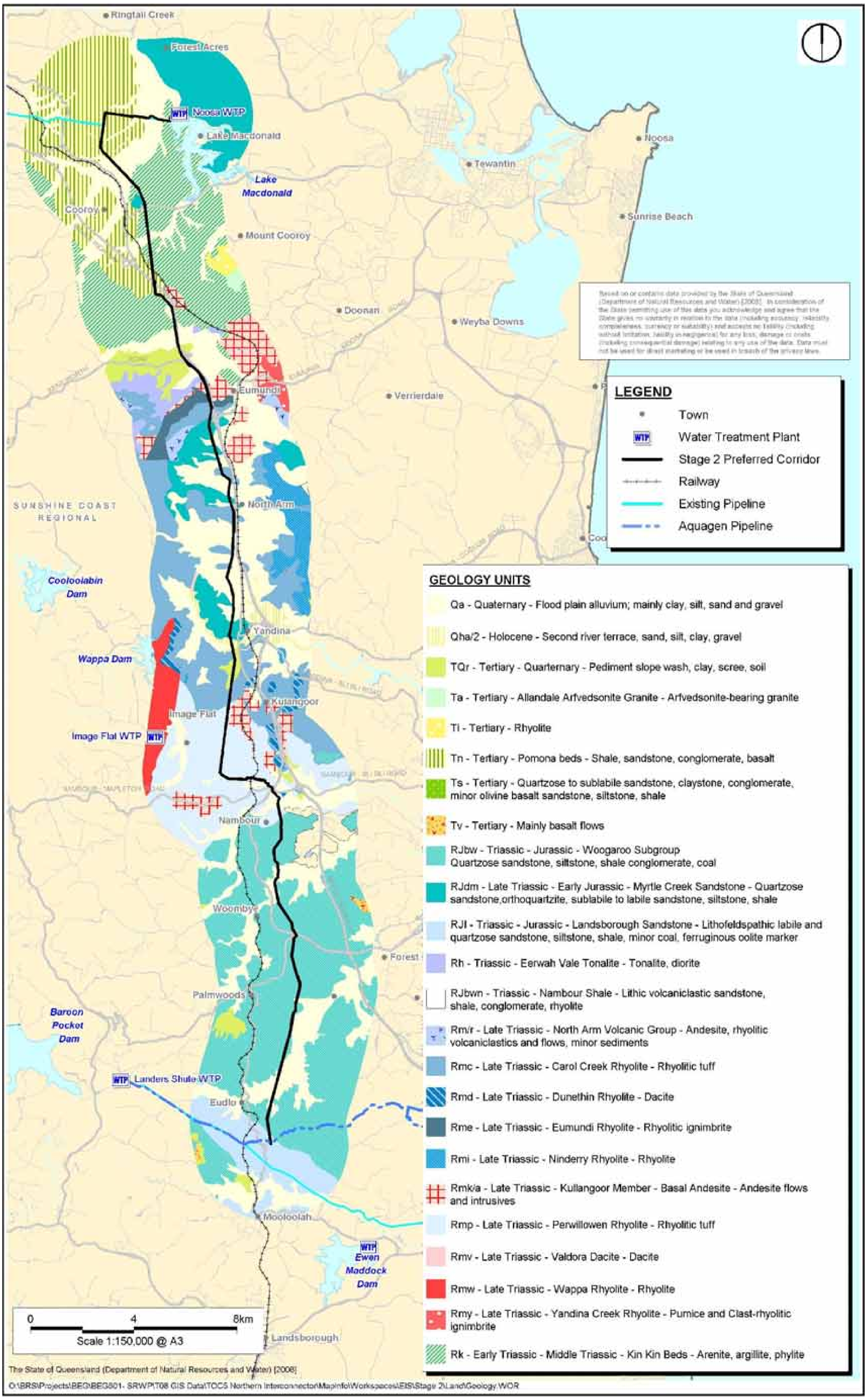

Figure 3.7
GEOLOGY

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Table 3.2 presents the land resource areas of the route as interpreted from Capelin (1987).

Table 3.2 Land resource areas along the Stage 2 route (Capelin 1987)

Land resource area	Location	Geology	Landform	Vegetation
Q2	Stream alluvia and floodplains	Undifferentiated Quaternary alluvium of gravel, sand, silt and clay	Level to undulating plains and rises	Forest red gum open forest and tea–tree open forest
J1	South of Nambour to Eudlo	Laterised Triassic to Jurassic Landsborough Sandstone	Undulating to steep low hills and hills	Blackbutt and bloodwood open forest
J3	Southwest and northwest of Landsborough to Eudlo	Triassic to Jurassic Landsborough Sandstone	Undulating to steep hills	Blackbutt and bloodwood open forest
R1	Between Eumundi and North Arm	Laterised Triassic rhyolite	Gentle undulating and rolling hills	Remnants of grey gym and tallowwood open forest
R2	North of Nambour	Triassic andesite and rhyolite; diorite and tonalite intrusions	Undulating low hills	Blackbutt and grey gum open forest
R3	North of Eumundi	Miscellaneous Palaeozoic metamorphics and volcanics	Undulating low hills	Spotted gum and ironbark open forest

Soil Types

Figure 3.8 presents the soil types for the route as derived from council databases. Alluvial soils within the floodplains of the main watercourses are variable in depth, texture, fertility and drainage characteristics. Gravelly loams can be prevalent in the narrow floodplains adjacent to lower order streams in the upper catchment areas while deep uniform textured or gradational clays (including black earths and prairie soils) are common in the broad floodplains of the major streams. Most alluvial soils are relatively resistant to erosion, due primarily to the low gradient position in the landscape, but may be prone to stream bank erosion.

Red and yellow podzolic soils are texture contrast soils generally associated primarily with Landsborough Sandstone parent material. The soils have a sandy or loam surface horizon with a clay subsoil, and there may be a significant gravel component in the subsoil. These soils are highly susceptible to erosion, particularly where slopes exceed 8%. Red and yellow earths are uniform textured soils also associated with Landsborough Sandstone parent material. While still erosion prone, they are generally less susceptible than red and yellow podzolic soils.

Gleyed podzolic and humic gleys (poorly drained acid soils) are found in some of the lower terraces of the alluvium. Krasnozems are deep uniform or gradational soils which, within the project area, are confined mainly to the land around Eumundi and North Arm. These soils are relatively resistant to erosion and are used for growing ginger.

Lithosols (mainly shallow gravelly soils with minimal profile development) are common in steeper sections of the project area where grades exceed 10%. They are highly susceptible to erosion although the severity of this risk may be mitigated by the significant stone component within the soil matrix.

Minor sections of the route are located on the floodplains of the major watercourses. Soils of the upland areas are predominantly shallow, texture contrast soils that may have a significant component of stone within the profile. Table 3.3 provides a summary of the soil characteristics and good quality agricultural land (GQAL) along the pipeline route.

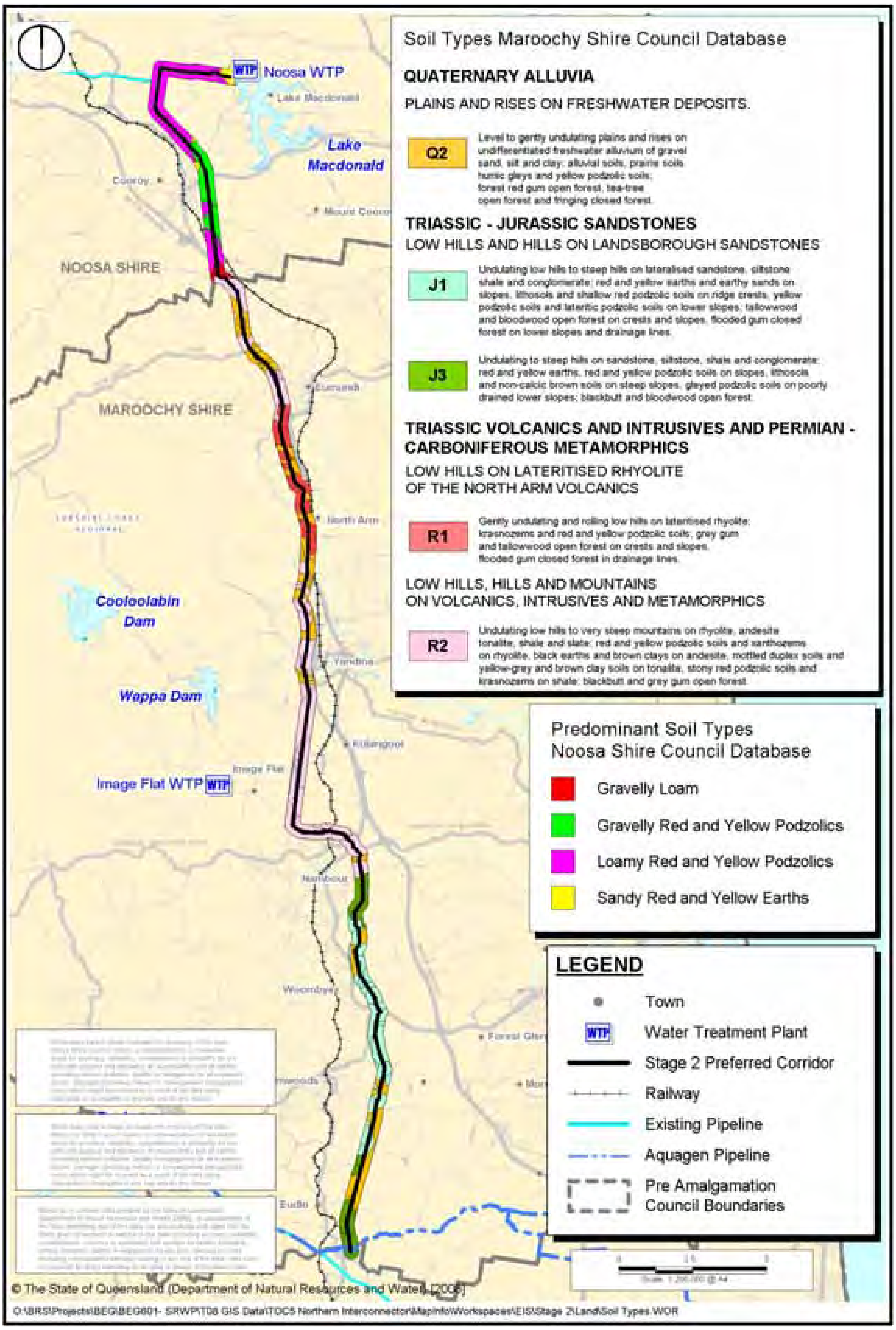

Figure 3.8
SOIL TYPES

Table 3.3 Soils and GQAL assessment—NPI Stage 2

Chainage (km)	LRA*	Terrain	Predominant soil type	GQAL category (km)** A	B	C	D	Erosion risk ***	Land use	Comments
Start to 0.7	J3	Steeply undulating to steep	Shallow podzolics/lithosols	–	–	0.3	0.3	H–VH	Partly forested and cleared—mainly small lot holdings	Area of significant erosion risk with fragmented drainage pattern
0.7–1.5	J3	Gently undulating	Shallow podzolics		0.6	0.2		M	Mainly cleared pastoral land on small lot holdings	No significant land management issues
1.5–2.7	Q2	Low sloping alluvium	Moderately deep yellow/grey earths (alluvial soils)	0.8	0.3		0.1	L	Cleared pastoral land; some previously cultivated	No significant land management issues
2.7–3.5	Q2	Low sloping alluvium	Moderately deep yellow/grey earths (alluvial soils)—significant disturbance from existing infrastructure	–	0.5	0.3		M	Mainly cleared with small lot holdings	Issues with management of watercourse erosion and stabilisation
3.5–4.8	J1/Q2	Low to gently undulating	Deep yellow earths and podzolics	–	–	1.3	–	L	Primarily within power line corridor	No significant land management issues
4.8–5.5	J1	Moderately undulating	Shallow podzolics	–	0.3	0.4	–	M	Partly forested and cleared—mainly small lot holdings	No significant land management issues
5.5–6.2	Q2	Low sloping alluvium	Moderately deep yellow/grey earths (alluvial soils)		0.2	0.2	0.3	L	Adjacent to power line corridor—heavily forested fringes	Potential flooding issues and effects on adjacent vegetation

Table 3.3 (continued)

Chainage (km)	LRA*	Terrain	Predominant soil type	GQAL category (km)**				Erosion risk ***	Land use	Comments
				A	B	C	D			
6.2–8.4	J1	Moderately to steeply undulating	Mainly shallow podzolics with patches of deeper red and yellow podzolics	1.0	0.7	0.4	0.1	H(VH in drainage lines)	Patchwork of cleared tree crop land or pastoral land with heavily vegetated gully lines	Effects on horticultural production/tree cropping. Fragmented drainage with significant erosion issues in local gully lines.
8.4–8.7	J1	Moderately to steeply undulating	Mainly shallow podzolics—significant disturbance from existing infrastructure	–	–	–	0.3	H(L–tunnel)	Mainly developed area with infrastructure/roads and parking areas	No significant land management issues; car park to be tunnelled
8.7–9.9	J1	Moderately to steeply undulating	Mainly shallow podzolics with patches of deeper red and yellow podzolics	0.7	0.3	0.1	0.1	H–VH	Patchwork of cleared tree crop land or pastoral land with minor heavily vegetated gully lines	Effects on horticultural production/tree cropping. Fragmented drainage with significant erosion issues in local gully lines.
Subtotal				**2.5**	**2.9**	**3.2**	**1.2**			
9.9–10.4	Q2	Low sloping alluvium	Deep sandy alluvial soils/earths	0.4	–	–	0.1	Mainly L	Former caneland with vegetated fringes of Paynter Creek	Generally low erosion risk except streambank
10.4–10.8	J1	Gently to steeply undulating	Deep podzolics and clays	0.2	–	0.1	0.1	M	Primarily agricultural land—formerly cane land	Generally moderate erosion risk with short steep area)—minor land management issues

Table 3.3 (continued)

Chainage (km)	LRA*	Terrain	Predominant soil type	GQAL category (km)** A	B	C	D	Erosion risk ***	Land use	Comments
10.8–11.4	J1/R2	Steeply undulating to steep	Complex of shallow gravelly yellow and red podzolics and lithosols	0.2	0.5	0.4	1.3	VH	Mainly within powerline corridor adjacent to dense vegetation; some cleared or partially cleared pastureland (to amend for tunnel)	Very high erosion risk with incised fully lines and ridges (to amend for tunnel)
13.8–14.8	Q2/R2	Low sloping alluvium and low ridge	Deep alluvial soils—complex of sandy earths, deep podzolics and clays with minor lithosols	–	–	–	1.0	L	Mainly developed area and infrastructure plus Petrie Creek channel	Generally low erosion risk except for creek crossing (depending on crossing method used)
14.8–16.0	Q2/R2	Low sloping alluvium and low ridge	Deep alluvial soils—complex of sandy earths, deep podzolics and clays with minor lithosols	–	–	–	0.8	L/M	Mainly developed area and infrastructure.	Generally low erosion risk except for creek crossing (depending on crossing method used)
16.0–16.5	R2	Moderately undulating	Complex of shallow gravelly yellow and red podzolics and lithosols	–	–	0.5	–	M	Patchwork of cleared areas and regrowth	No significant land management issues.
16.5–17.6	R2	Moderately to steeply undulating to very steep	Mainly gravelly lithosols	–	–	0.8	0.3	H	Patchwork of cleared areas and regrowth.	No significant land management issues.
Subtotal				**3.3**	**3.4**	**5.0**	**6.0**			

Table 3.3 (continued)

Chainage (km)	LRA*	Terrain	Predominant soil type	GQAL category (km)**				Erosion risk ***	Land use	Comments
				A	B	C	D			
18.4–20.8	R2	Moderately undulating	Complex of shallow gravelly yellow and red podzolics and lithosols	0.3	1.8	–	0.3	M	Fragmented holdings with horticulture	Land management issues associated with horticultural activities
20.8–22.5	Q2	Low sloping alluvium	Deep alluvial soils—complex of sandy earths, deep podzolics and clays	0.9	–	0.4	0.4	L	Former cane land with some infrastructure	No significant land management issues except creek crossings and South Maroochy River crossing
22.5–23.0	Q2/R2	Gently undulating	Deep podzolic soils	–	–	0.2	0.3	M	Adjacent to town infrastructure	No significant land management issues
23.0–23.8	Q2/R2	Low sloping alluvium	Moderately deep yellow/grey earths—some disturbance from existing infrastructure	–	0.3	–	0.5	M	Mainly cleared with grazing and some forest	Issues with management of watercourse erosion and stabilisation
23.8–25.5	Q2/R1	Complex of low sloping alluvium and gently undulating rises	Deep alluvial soils—complex of sandy earths, deep podzolics and clays; some moderately deep red and yellow earths	1.5			0.2	L	Agricultural	No significant land management issues; effects on GQAL
25.5–26.6	Q2	Low sloping alluvium	Deep alluvial soils—complex of sandy earths, deep podzolics and clays	1.0			0.1	L	Agricultural—former cane land	No significant land management issues

Table 3.3 (continued)

Chainage (km)	LRA*	Terrain	Predominant soil type	GQAL category (km)** A	B	C	D	Erosion risk ***	Land use	Comments
26.6–28.7	R2/Q2	Gently undulating	Moderately deep gravelly yellow podzolic soils; minor alluvium	0.4	0.6		0.1	L	Mainly small lot rural holdings	No significant land management issues
28.7–30.9	R1/Q2	Gently undulating	Complex of krasnozems and deep red and yellow podzolic soils; minor alluvium	1.6		0.1	0.5	L	Agricultural land—used mainly for ginger growing plus drainage/water supply	Issues with integration with agricultural activities—no other significant land management issues; effects on GQAL
Subtotal				**9.2**	**6.1**	**5.7**	**8.4**			
30.9–31.6	R2	Gently undulating	Moderately deep gravelly yellow podzolic soils			0.4	0.3	M	Mainly small lot rural	No significant land management issues—some erosion issues
31.6–33.0	R2	Moderately to steeply undulating	Shallow gravelly podzolics and lithosols		0.3	0.2	0.9	H	Adjacent to road corridor	Integration with road drainage control—attend to erosion control required
33.0–36.1	R2/Q2	Gently to moderately undulating with some low sloping alluvium—various incised drainage channels	Moderately deep gravelly yellow podzolic soils and shallow alluvium		0.4	0.3	2.4	M	Adjacent to road corridor; complex of infrastructure and small holdings	No significant land management issues—some erosion issues with integration with existing infrastructure; Crossing of North Maroochy River issue

Table 3.3 (continued)

Chainage (km)	LRA*	Terrain	Predominant soil type	GQAL category (km)** A	B	C	D	Erosion risk ***	Land use	Comments
36.1–41.7	R3/Q2	Gently to steeply undulating; minor alluvium	Complex of shallow to moderately deep gravelly yellow and red podzolics and lithosols; some shallow alluvial soils		2.0	3.0	0.6	H	Mainly within power line easement	No significant land management issues—some erosion issues in steeper sections
41.7–43.1	Q2	Low sloping alluvium	Deep alluvial soils—complex of sandy earths, deep podzolics and clays	0.8	0.5	–	0.1	L	Within power line easement—on flats associated with Six Mile creek	No significant land management issues except creek crossing
43.1–46.2	No equivalent on Tertiary sediments	Gently undulating to undulating	Shallow to moderately deep yellow podzolics and soloths	1.6	0.9	0.5	0.1	M	Regrowth plus dryland cropping and pasture	No significant land management issues
46.2–47.6	T1/some Tertiary sediments	Low sloping alluvium	Deep alluvial soils—complex of sandy earths, deep podzolics and clays; minor shallow podzolics		0.8	0.4	0.1	L	Mainly heavily forested area associated with Six Mile Creek	No significant land management issues
Total–GQAL classes				**11.4**	**11.0**	**10.5**	**12.9**			

* *LRA: Land Resource Area —as per Capelin 1987.*
** *Refer State Planning Policy 1/92—Development and conservation of agricultural land.*
*** *Erosion risk—VH: very high risk; H: high risk; M: moderate risk; L: low risk.*

Good Quality Agricultural Land

Good quality agricultural land (GQAL) (see Figure 3.9) is land which is capable of sustainable use for agriculture without causing significant degradation of land or other natural resources. Four agricultural land classes are recognised in Queensland. Of these, Class A land is suitable for current and potential crops with minimal limitations and is considered to be GQAL in all areas. Class B and higher quality Class C land are marginal areas for cropping but may be considered as GQAL in areas where agricultural land is scarce or pastoral industries are predominant (DPI/DHLGP 1993).

A variety of agricultural products are grown in the study area, including ginger, pineapples, passionfruit, bananas and a range of tree crops. The corridor also traverses the western edge of the former assigned cane-growing areas. Some sugar cane is still grown for the supply of mulch and other uses, although much of this land has an uncertain future in terms of cane production due to the closure of the Nambour mill in 2003. A proposed ‘biocane’ project may reinvigorate cane growing in much of the former assigned caneland. This will involve cane growing to produce ‘cow candy’ for use in overseas feedlots.

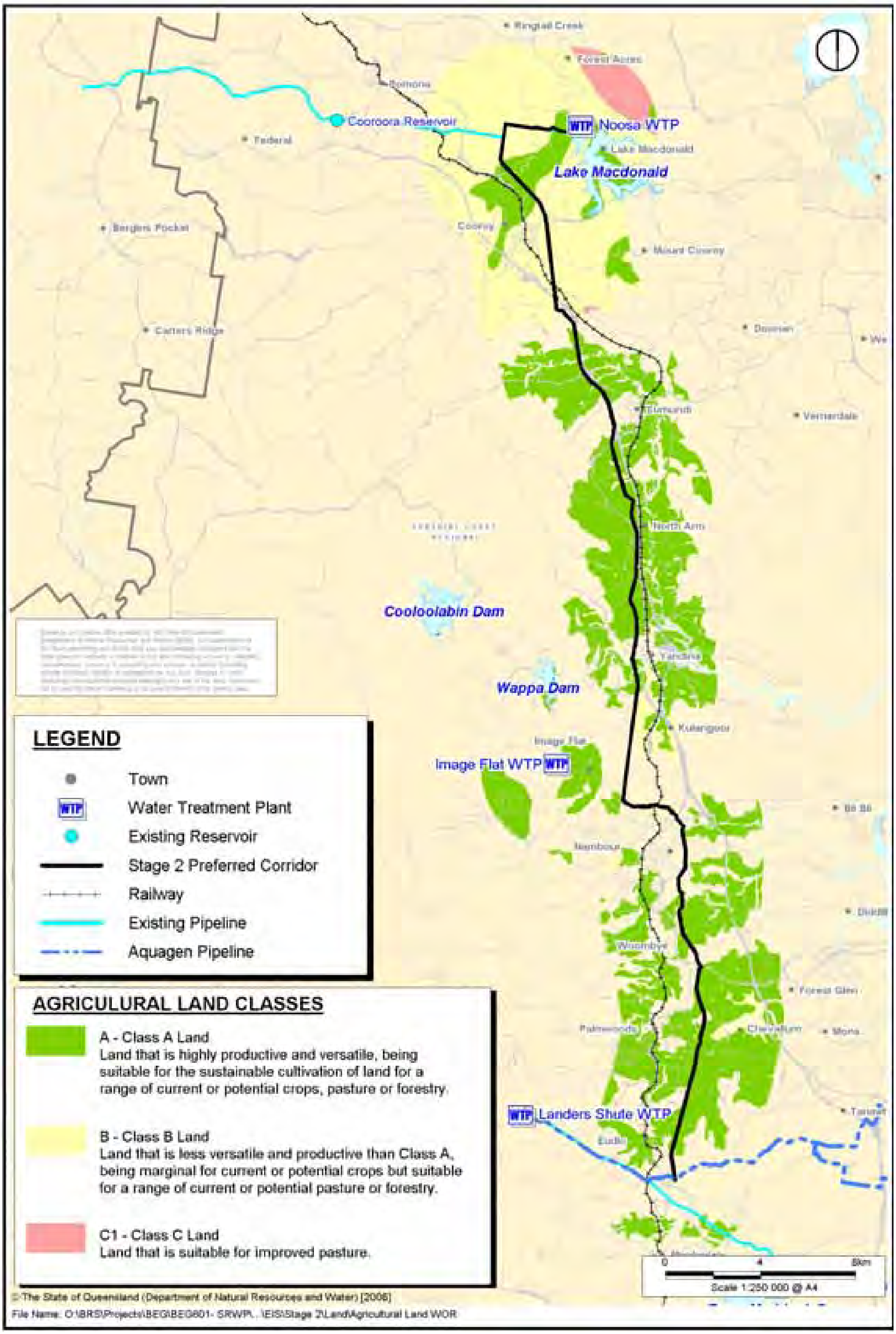

Figure 3.9
GOOD QUALITY AGRICULTURAL LAND

Acid Sulfate Soils

Acid sulfate soils (ASS) occur naturally in low-lying coastal areas, below 5 mAHD. ASS are formed naturally under anaerobic conditions and are generally associated with estuarine clays, although they also occur as sands and gravels in some areas. When exposed to oxygen (in the presence of moisture), ASS oxidise to produce sulfuric acid and iron compounds which can be detrimental to the environment.

For the purposes of this EIS, the term 'ASS' will refer to any soil that has either an actual or potential acidity (or both) resulting from the oxidation of pyritic material. More specifically, the term 'potential acid sulfate soil' (PASS) has been used to describe soils which have significant potential to generate acid on oxidation, but which have not yet been oxidised.

Desktop analysis, using existing data and mapping obtained from NRW (NRW 2002) as well as topographic data, was used to identify areas along the alignment that may have an increased risk of ASS occurrence. The preliminary analysis indicated that the NPI Stage 2 route traverses only limited low-lying areas where ASS has the potential to be encountered. The ASS mapping units along the pipeline route or in close proximity are summarised in Table 3.4 and shown on Figure 3.10.

Table 3.4 Acid sulfate soil units mapped in proximity to the corridor

Map unit	Location	Description
S	Close proximity to South Maroochy River	Land where ASS may occur within 5 m of the surface. Nearly all land in this category has an oxidisable sulfur percentage in at least one soil layer which exceeds the prescribed 'action level'. Some of these soils may also have extremely acidic layers with pH <4.0. S2 and S3 refer to the depth (in metres) at which PASS material is likely to be intercepted. Soil layers are likely to require treatment if disturbed.
LP	Petrie Creek crossing point	Land between the 5 mAHD contour and the outer limit of Holocene, estuarine ASS (ie land less than 5 mAHD) as mapped at this scale, with low probability of ASS occurrence. Limited field investigations have been carried out in these areas.

Source: NRW 2002.

The desktop assessment found that there is a risk of ASS occurring along the alignment at only two minor sections of the corridor where the pipeline crosses floodplain areas that lie below 5 mAHD. These are:

- the Petrie Creek crossing; and
- the South Maroochy River crossing.

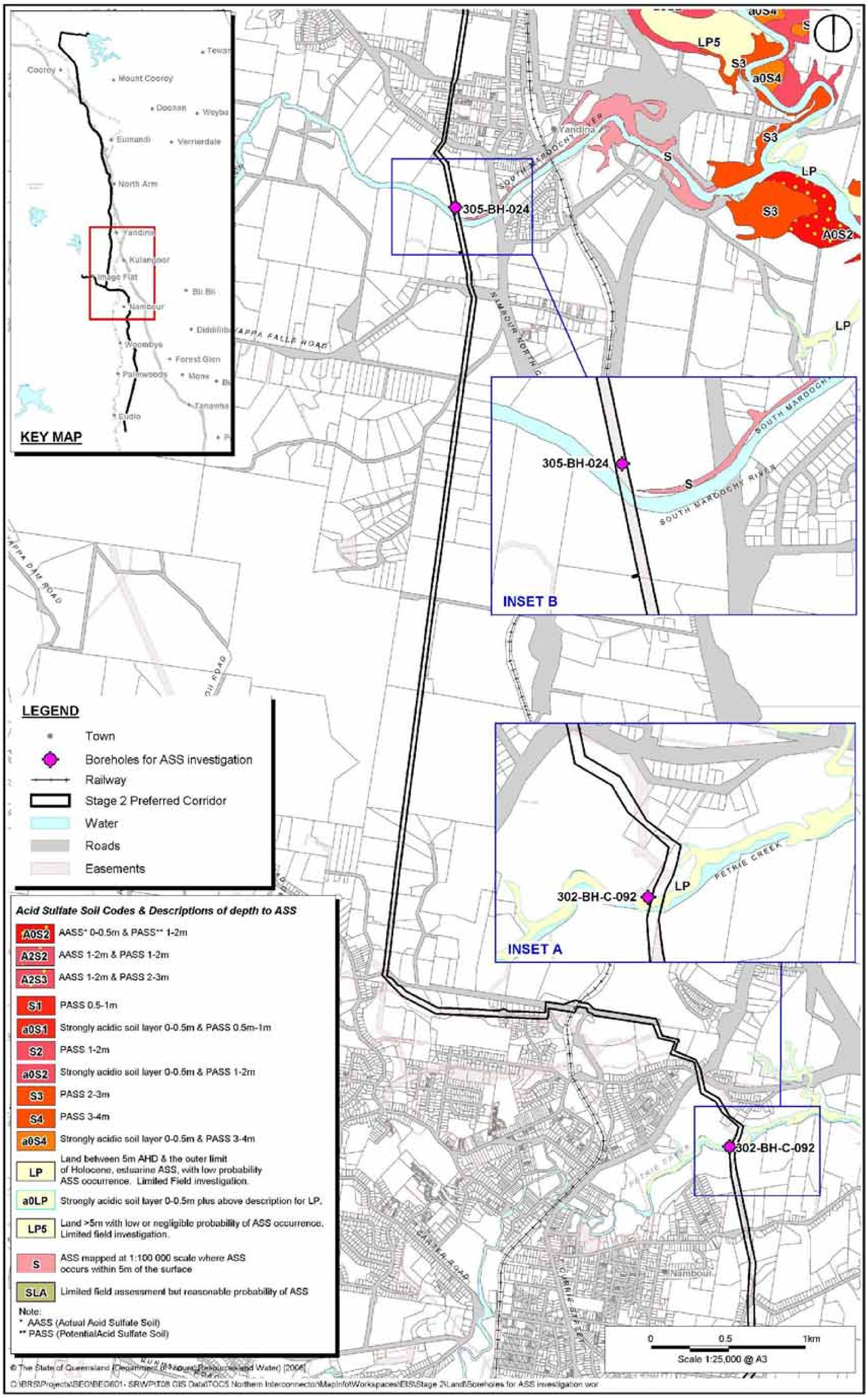

Figure 3.10
ACID SULFATE SOILS

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These areas of interest coincide with areas of Quaternary alluvium. The remainder of the proposed Stage 2 corridor crosses land at a greater elevation than 5 mAHD and is therefore unlikely to encounter significant areas of ASS. However, there is a low risk of encountering ASS in areas at 5–10 m elevation, particularly where trenching would disturb soil below 5 mAHD. It should be noted however that ASS are unlikely to occur at elevations above 1.5 mAHD. Allowance is made for landforms between this level and 10mAHD to account for burial of ASS by alluvial deposition processes.

Field Investigations for ASS

Field ASS investigations were carried out at the two crossing points noted above. Boreholes were established at both crossing points to provide an understanding of the soil layers present on site. The borehole locations; 305-BH-024 at South Maroochy River and 302-BH-092 at Petrie Creek are shown in Figure 3.10.

Samples were collected every 0.3–0.5 m down the core. All samples were analysed to determine field pH and field oxidised pH. Other tests undertaken on the samples were:

- total actual acidity (S_{POS}) (equivalent % oxidisable sulfur plus potential acidity); and
- retained acidity (S_{RAS}).

These tests were used to confirm field testing and determine the actual and potential acidity of the soils, as well as identify how much of that acidity is directly related to sulfur content. Sample collection, handling and storage was carried out in accordance with the '*Guidelines for sampling and analysis of lowland ASS in Queensland 1998 (Revision 4)*' (Ahern et al. 1998).

These investigations found that no ASS would be intercepted during construction at either location, based on the trenching method which is proposed at these locations. Trenching involves excavations to a depth of up to 4 m. Table 3.5 describes the depth of the boreholes and depth to PASS where all measurements are relative to mAHD. The Petrie Creek borehole detected PASS at –3.0 mAHD to –5.4 mAHD, however, this is well below the depth of trenching. Borehole logs and laboratory results are included at Appendix J.

Table 3.5 ASS characteristics for identified areas of interest

Location	Borehole	Ground level	Termination point	Depth of PASS
Petrie Creek	302-BHC-092	6 mAHD	–5.4 mAHD	–3.0 mAHD to –5.4 mAHD
South Maroochy River	305-BH-024	9.4 mAHD	2.6 mAHD	No PASS detected

Potential Impacts and Mitigation Measures

Soil Erosion

There is potential for accelerated erosion to occur as a result of trenching and earthworks for pipeline construction. The erosion risk for the study area is influenced by the extent of vegetation clearance and soil disturbance, slope and soil type, with the greatest risk occurring where slopes exceed 10%. There is also the potential for erosion of alluvial soils as a result of flooding around waterways during construction or destabilisation of creek and river banks.

Approximately 15 km of the corridor traverses high to very high risk areas for soil erosion (excluding Pringle Hill tunnel), with a further 15 km in medium risk areas. In particular, the poorer sandy soil types (which may overlay dispersive clay subsoils) which have developed on the steeper hills between Nambour and Yandina will be the most susceptible to erosive forces. Areas of side slope to the south of Yandina are also dissected by creek/drainage lines and there is a likelihood of encountering groundwater seepage in some locations. Swelling clays that lose strength on wetting also contribute to the risk of localised slumping of trench faces.

The potential for erosion in high risk areas will be higher during the summer months, when rainfall is generally higher or during localised flooding. Thunderstorms occurring during the summer wet season generally have larger raindrops and a higher terminal velocity (8–9 m/s) than winter rainfall events. It has been estimated that 50% of all erosive rainfall events in SEQ occur between December and February, with up to 80% occurring during the October to March period (QDPI 1980).

The erosion potential for soil types identified along the alignment is provided in Table 3.3 (Soils and GQAL assessment—NPI Stage 2). As such, mitigation measures in accordance with the *Maroochy Manual for Erosion and Sediment Control* (Maroochy Shire Council 2007) and the *Soil Erosion and Sediment Control—Engineering Guidelines for Queensland Construction Sites* (IEAust 1996) will be implemented during construction. The following are examples of mitigation measures to be implemented:

- tunnelling to avoid steep terrain at Pringle Hill;
- undertaking construction through the steep sections outside the December to February period, thereby reducing the probability of high intensity rainfall events causing a significant erosion hazard by around 50%;
- preparing and implementing special area sediment and erosion control plans for areas at high risk of erosion, to include measures such as rapid rehabilitation and modified construction techniques as appropriate (eg sediment fencing and logs and sediment basins); and
- mulching cleared native vegetation in situ to provide a level of cover over exposed soils.

The project is in the process of undertaking risk analysis to make recommendations for sediment control needs. This analysis uses data including soil types and characteristics, slope, aspect, topography, existing watercourses and proposed construction activities along the NPI Stage alignment. The outcomes of this risk analysis process will be used to develop site-specific sediment and erosion plans.

Good Quality Agricultural Land

Investigations carried out for this EIS indicate that approximately 24% of the route has been classified as Class A agricultural land and approximately 23% as Class B (see Table 3.3). Approximately 34 ha of Class A land and 33 ha of Class B land will be disturbed for the pipeline construction (assuming a 30 m wide corridor).

Clearing for pipeline construction will generally be 30 m wide, with topsoil over the trench area to be stockpiled separately. The disturbed area will be rehabilitated following construction and the productivity of the land restored as near as practicable to its former level.

In some cases, a cleared area 5–10 m wide may be required to maintain operational access to the pipeline and associated structures. However, the depth of cover (900–1200 mm) across the top of the pipe may allow the re-establishment of shallow-rooted crops such as ginger and pineapples across the entire easement. Mitigation strategies for agricultural properties and easement conditions are dependent on the type of crop affected, and will need to be negotiated with industry groups and/or individual landholders.

Acid Sulfate Soils

If not managed appropriately, ASS have the potential to create environmental impacts. These impacts may include disturbance to aquatic habitats, corrosion of infrastructure containing concrete and metal (eg culverts, bridges and stormwater drains) and elevated levels of sulfuric acid and heavy metals being leached from the soil and discharged to receiving waters.

Desktop and field investigations for NPI Stage 2 have identified that proposed trenching methods to be used during construction will not reach a depth that disturbs ASS. In the event that ASS is detected, an ASS Management Plan in accordance with the State Planning Policy 2/02—Planning and Managing Development Involving Acid Sulfate Soils—will be produced prior to construction (see Appendix P).

For the NPI Stage 2, management is likely to include a combination of all of these principles, such as:

- carrying out detailed ASS testing in the corridor's moderate–high risk areas prior to the commencement of excavations (ie low-lying land ≤10 mAHD listed);
- stockpiling PASS material separately to non-acidic material and using PASS material as the preferred trench fill where possible. If used as fill, a guard layer of lime should be placed in the bottom of the trench and PASS should be 'capped' by at least a 1 m layer of non-PASS;
- using non-ASS material for external bunding and ensuring that PASS material is stockpiled within bunded areas;
- placing a guard layer of lime around the bunds to neutralise any run-off after rain;
- treating all PASS material removed from site with the appropriate levels of agricultural lime. This will include constructing a treatment pad at the spoil disposal site for the treatment of PASS as per the Queensland 'Soil Management Guidelines' (Dear et al. 2002);
- water removed from trenches or other excavations will not be released directly to adjoining waterways or other sensitive receptors. Where possible, groundwater will be re-injected into the aquifer or treated before being released into surface water.

The most appropriate management or treatment strategy will depend on the sensitivity of the site, the proposed activity and the nature of the ASS material to be handled.

3.2.3 Land Use and Infrastructure

Description of Environmental Values

Land Uses in the Study Area

Broad land uses in the study area are shown on Figure 3.11. The ridges in the study area are steep and retain a large proportion of their original vegetation. Land uses are typically limited to low-density rural residential properties. At a landscape scale, these vegetated ridges extend east from Mapleton State Forest and surrounds to the coast, forming a series of corridors which facilitate wildlife movement.

Land in the valleys has been highly modified and is characterised by more intensives uses, including cropping, road and rail infrastructure, urban communities, industrial uses and rural residential properties. In these areas, vegetation typically persists as linear corridors along waterways or small isolated patches. Key land use features along the route include:

- medium density residential areas at Lake Macdonald–Cooroy, Yandina and Nambour;
- primary and secondary education facilities at Woombye;
- recreation reserves and associated community infrastructure at Yandina, Nambour, Woombye and North Arm;
- areas of agricultural land around Rocky Creek, Paynter Creek and the North Maroochy River;
- land either previously used for growing sugar cane around Kulangoor and Cooroy;
- a caravan park on the South Maroochy River at Yandina;
- industrial uses located at Chevallum, Forest Glen and to the west of Eumundi;
- mining leases (clay and shale) in the vicinity of Lake Macdonald, including the Cooroy Brickworks and a quarry, that are directly affected by the proposed route;
- an area of State Forest adjacent to the corridor at Cooroy; and
- an active cattle saleyard on Balsam Road at Eerwah Vale.

The preferred corridor does not traverse any areas of millable plantation forest, although it does traverse road reserve adjacent to State Forest in Cooroy.

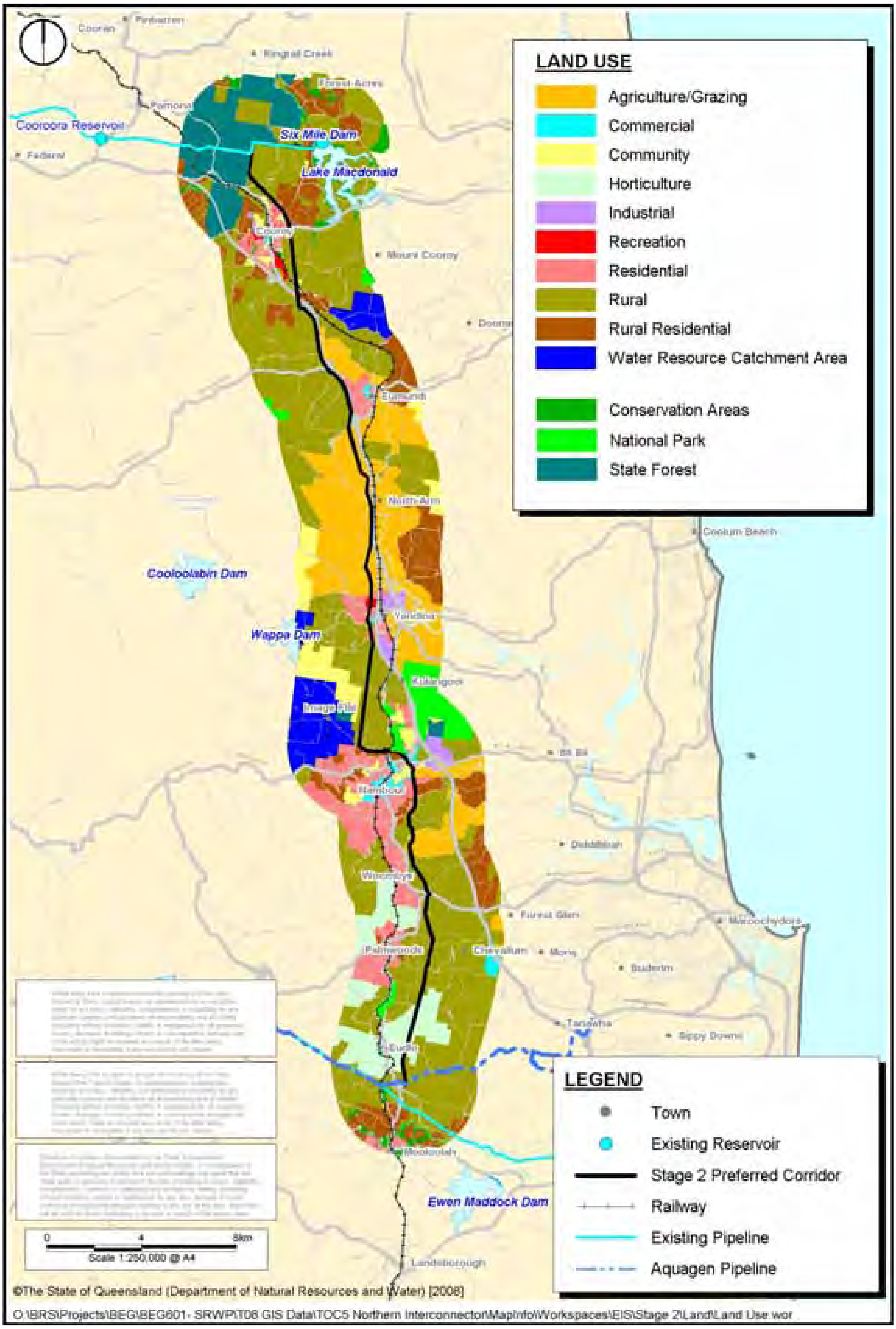

Figure 3.11
LAND USE

Land Tenure Types

Tenure for the NPI Stage 2 is anticipated to be achieved in one or more of the following ways:

- negotiated agreement with the landholder;
- obtaining a Critical Infrastructure Easement (CIE) over a current public utility easement;
- Notice of Intention to Resume (NIR) on land that is not encumbered by a Public Utility Easement; and
- entering into occupancy agreements with landholders to locate temporary construction and laydown facilities.

The preferred corridor is located within existing and cleared power easements (on land held in freehold) wherever possible to minimise additional encumbrance to landholders (Figures 3.12, 3.13 and 3.14). The preferred corridor also accommodates an easement in favour of the Australian Pipeline Trust (APT). The easement with APT is for the future development of a gas pipeline.

Native title is also recognised as a form of land tenure and is addressed in greater detail later within this section. Other affected tenure types include:

- leasehold;
- reserves;
- road reserves (major highways maintained by the Department of Main Roads and local roads maintained by local councils);
- state-owned land (includes railways); and
- unallocated state land present along most watercourses.

Table 3.6 outlines the proposed locations (chainage) for facilities and structures, land tenure types, and estimated vegetation clearing footprints. The majority of the facilities cleared land, either on freehold property or within easement.

Table 3.6 Proposed facilities and structures for NPI Stage 2

Facility/structure	Chainage (km)	Tenure	Vegetation clearing footprint*
Mooloolah pump station	1 km south of NPI Stage 2 pipeline	Road reserve and easement	No clearing of remnant vegetation
Eudlo pump station	0	Freehold	Approximately 597 m^2
Upgrade to Landsborough WQMF	0	Freehold	No clearing of remnant vegetation
Mainline valve and flow meter	5.1	Easement and freehold	No clearing of remnant vegetation
Future offtake valve	10.9	Easement and freehold	No clearing of remnant vegetation
Future offtake valve	14.0	Easement and freehold	No clearing of remnant vegetation
Pigging station, future offtake valve and mainline valve	14.0 – 14.75	Easement and freehold	No clearing of remnant vegetation
Balance tank and water quality management facility (WQMF)	19.0	Both eastern and western options are freehold	Approximately 4 ha (area can facilitate future bulk flow infrastructure requirements)
Mainline valve and future offtake valve	22.6	Easement and freehold	No clearing of remnant vegetation
Pigging station, future offtake valve and mainline valve	28.0	Easement and freehold	No clearing of remnant vegetation
Mainline valve and future offtake valve	34.5	State-owned freehold	No clearing of remnant vegetation
Pigging Station	43.3	State forest (existing powerlines)	No clearing of remnant vegetation
Noosa pump station	47.5	Road reserve	No clearing of remnant vegetation

* *Clearing refers to remnant vegetation as defined under the Vegetation Management Act 1999 (Qld).*

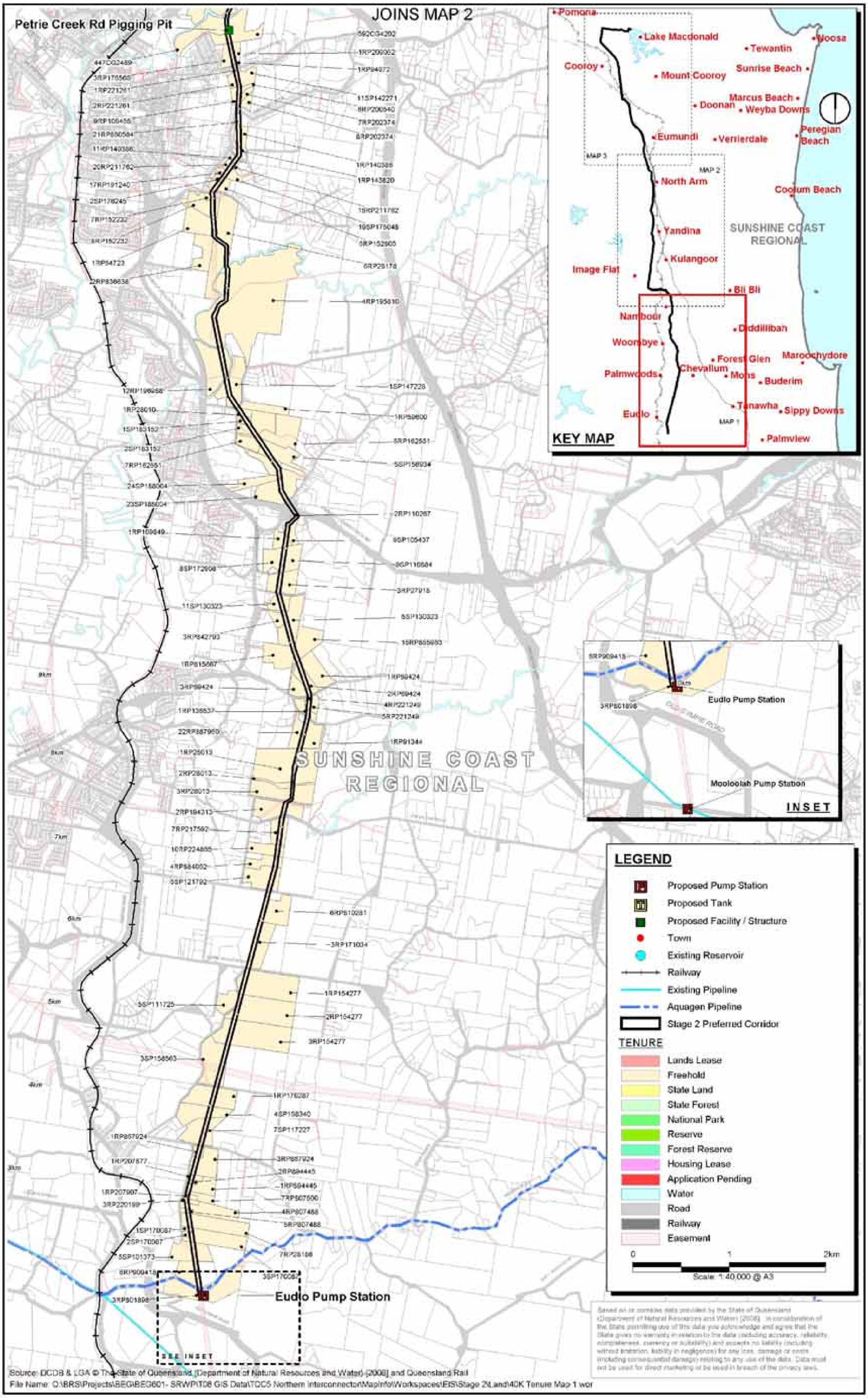

Figure 3.12
LAND TENURE (MAP 1)

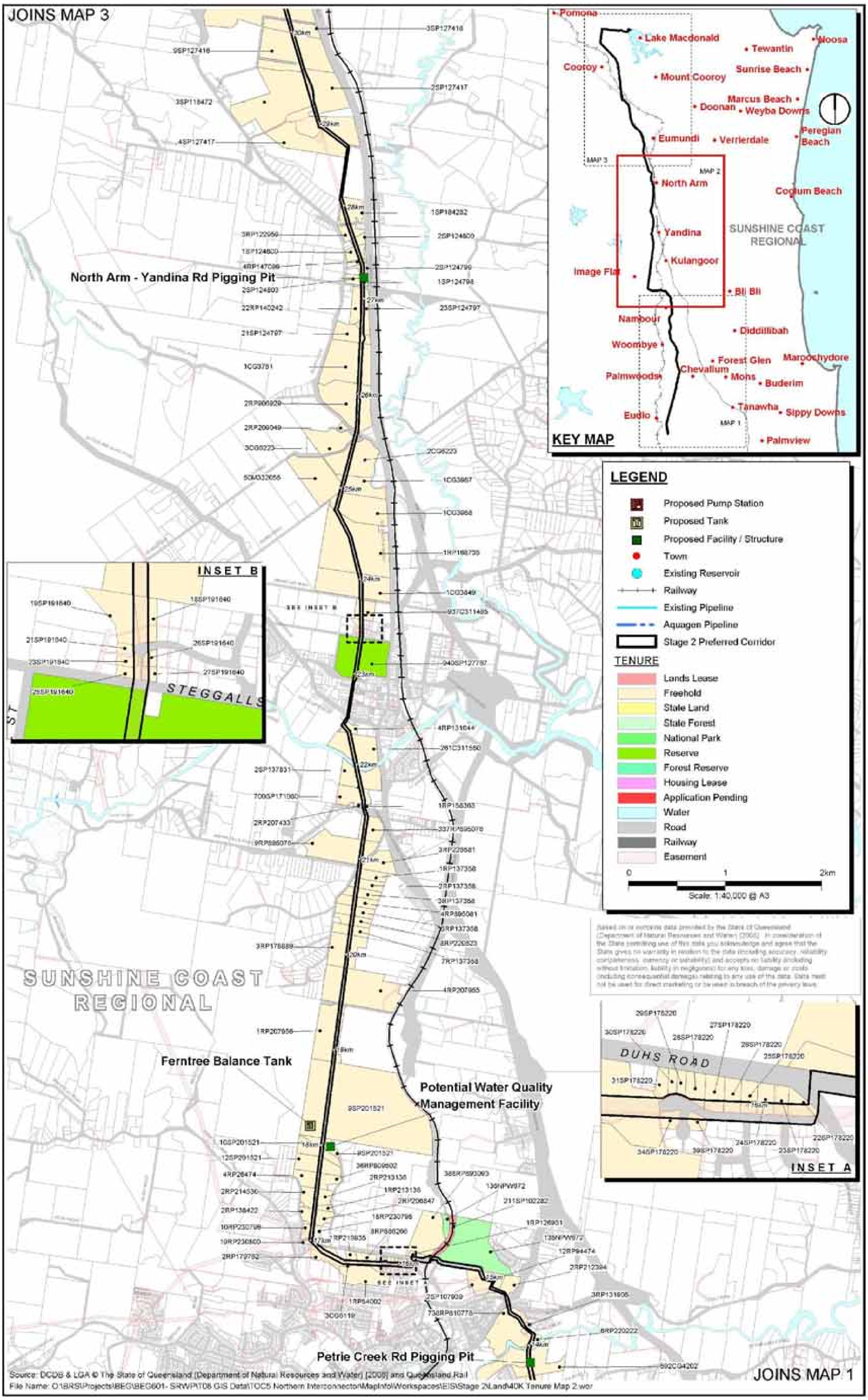

Figure 3.13
LAND TENURE (MAP 2)

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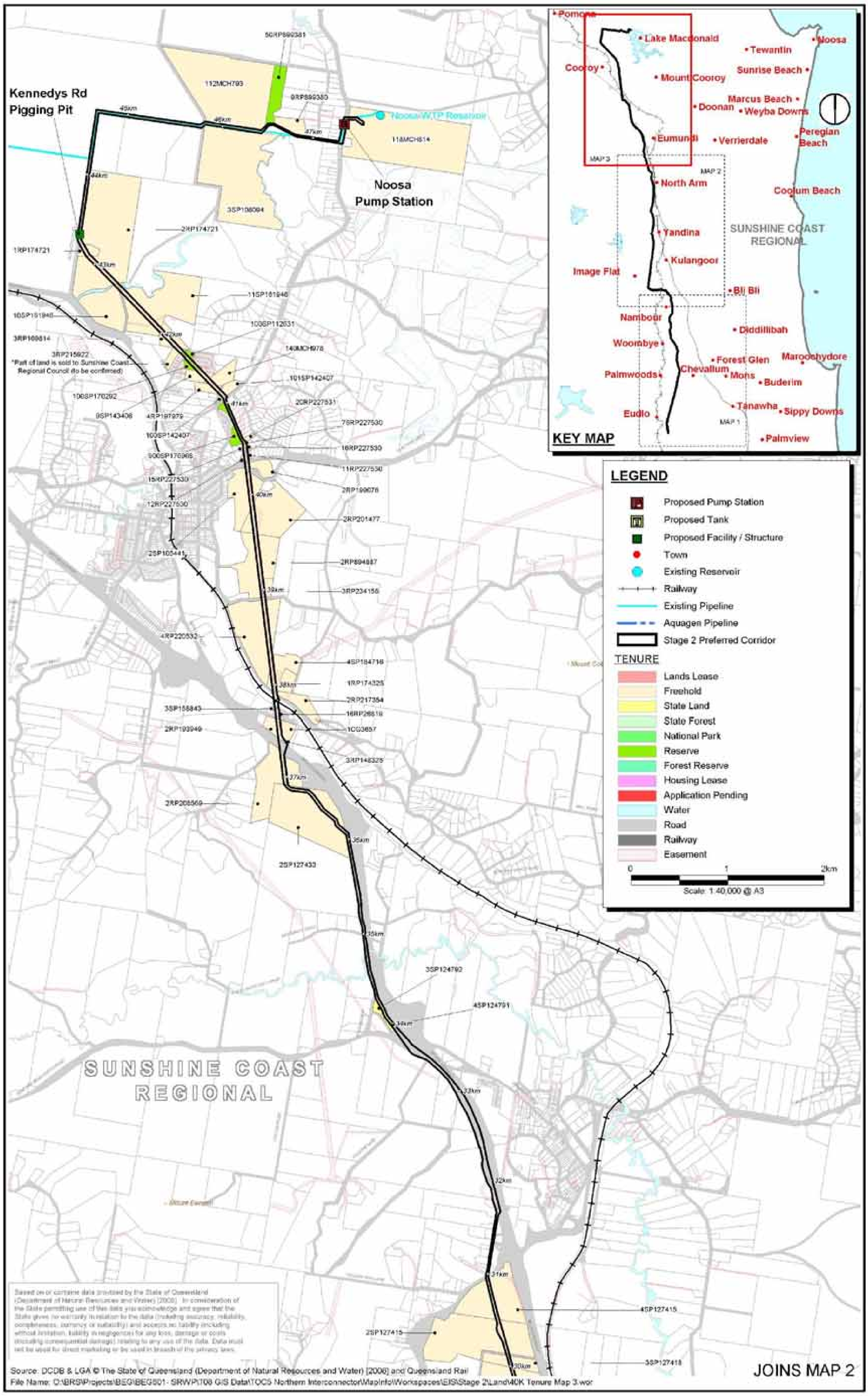

Figure 3.14
LAND TENURE (MAP 3)

Key Resource Areas

The locations of key resource areas are shown in Figure 3.15. Development within KRAs is regulated under State Planning Policy 2/07—Protection of Extractive Resources. However, the construction of the pipeline is considered Operational Works under the *Integrated Planning Act 1997* to which SPP 2/07 does not apply. Therefore it may be considered that the NPI Stage 2 pipeline is a compatible use within a buffer zone/separation area under Section 4 of SPP 2/07.

Although SPP 2/07 does not directly apply to the NPI Stage 2 project, it has been identified that the project may have an impact on, or restrict the future operations of, resource areas. Subsequently, the proponent, via Northern Network Alliance will carry out consultation with the affected key resource area operators to discuss any potential impacts to their operations.

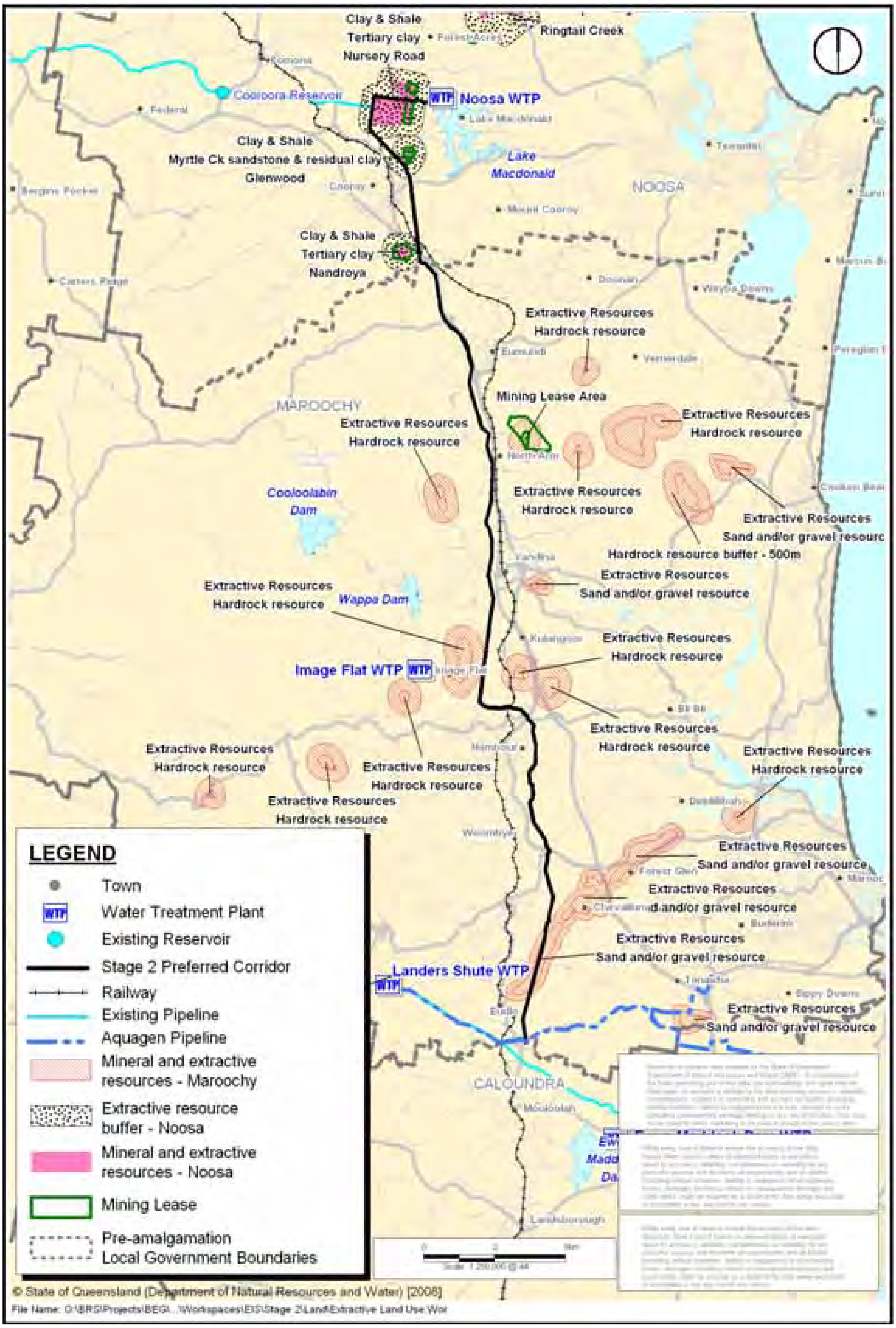

Figure 3.15
KEY RESOURCE AREAS

Infrastructure Locations

Infrastructure and services which have been considered as part of the planning and design of the NPI Stage 2 project include:

- power lines and associated infrastructure where the NPI Stage 2 corridor is co-located within existing power easements;
- the proposed Ferntree landfill development, which is currently being assessed by the Sunshine Coast Regional Council;
- existing State and local roads and future transport corridors gazetted by the Department of Main Roads;
- existing rail infrastructure, and future upgrades to the North Coast Rail Line between Landsborough and Nambour;
- potential development of a gas pipeline within the easement held by APT;
- the location of existing water and sewerage mains and other buried services, such as telecommunications infrastructure; and
- gates, fences, driveways and other private infrastructure associated with directly affected properties.

Discussions have been held with relevant agencies to ensure that any particular requirements are identified and resolved through refinements to the route or through the detailed design phase. A full list of the agencies consulted during the NPI Stage 2 concept design phase is included at Appendix F.

Local Government Zoning and Strategic Plans

The Stage 2 project area is located within the Sunshine Coast Regional Council Local Government Authority, formerly existing as the Maroochy Shire and Noosa Shire Councils. As such, the project affects two statutory instruments—Maroochy Plan 2000 and the Noosa Plan 2006—which are key land use planning documents for Sunshine Coast Regional Council.

These planning schemes will remain in force until such time as Sunshine Coast Regional Council develops a single planning scheme for the region. The respective planning schemes outline the preferred land use zones and precincts in the Sunshine Coast region and recognise the individual characteristics of the local authorities through the implementation of desired environmental outcomes.

Ordinarily, where development is considered ‘impact assessable’, the desired environmental outcomes (DEOs) set out in each scheme are used to guide the assessment. Development is to be considered in terms of the cumulative impacts, and the extent to which any such impacts may compromise the achievements of the DEOs. The relevant DEOs from each planning scheme are summarised in Tables 3.7 and 3.8.

The route alignment and design-specific measures are guided by the DEOs and broad outcomes within each of the precincts and preferred dominant land uses. Outcomes for specific areas will be achieved through detailed design and tenure negotiations; for example, through increasing the depth of cover to allow continuation of cropping over the pipeline or refining the route to avoid core areas for extractive industry resources.

Table 3.7 Relevant desired environmental outcomes for Maroochy Planning Scheme

Desired environmental outcome (DEO)	Addressed in EIS
Environmental management The shire's unique natural, open space, climatic, rural and scenic attributes are protected to maintain biodiversity, ecological processes, and visually attractive and varied landscapes and managed so as to provide a sustainable focus and setting for the shire's community and economic development	Environmental management issues are addressed in Sections 3.1 to 3/14 of the EIS. This includes climate and natural disasters (Section 3.1), land (Section 3.2), nature conservation (Section 3.3) and water resources (Section 3.4).
Economic sustainability A prosperous, productive and broad economy which reinforces the shire's strengths in tourism, commercial/business services, rural activities, educational and health facilities, and transport infrastructure, whilst diversifying this base in a manner consistent with the shire's character and the sustainable use of the shire's resources	The NPI Stage 2 is water supply infrastructure required under the drought emergency regulations. Assessment of the impacts of the project has considered the loss of good quality agricultural land and impact on the economic environment of the project area.
Physical infrastructure Orderly and sequenced development which allows for the efficient, affordable and environmentally acceptable provision of engineering infrastructure by service providers in a way which ensures the sustainable use of Maroochy's water and other resources and adequately serves community needs	The NPI Stage 2 is water supply infrastructure required under the drought emergency regulations. Assessment of the impacts of the project has considered the loss of good quality agricultural land and impact on the economic environment of the project area.

Table 3.8 Relevant desired environmental outcomes for Noosa Planning Scheme

Desired environmental outcome (DEO)	Addressed in EIS
Agriculture uses Focuses on the retention of agricultural activities in those areas where farming has been the traditional use and where environmental impacts may be successfully managed	Potential impacts on good quality agricultural land are addressed at Section 3.2
Heritage The indigenous and non-indigenous history, culture and traditions are reflected in the built and natural heritage of Noosa Shire and are preserved for future generations	Potential impacts on indigenous and non-indigenous heritage are addressed at Section 3.10 and Section 3.11 respectively
Industrial business uses Focuses on the management and preservation of extractive and mining resources in the shire	Potential impacts on industrial land uses are addressed at Section 3.2
Open space, environment and conservation functions Focuses on the conservation and management of open space, natural habitat, vegetated lands and riparian zones along waterways	Potential impacts on the protected areas and flora and fauna values are addressed at Section 3.3
Residential uses Focuses on the management of settlement patterns and the creation of sustainable residential land use; requires suitable separation from incompatible land uses	Potential impacts on residential land uses are addressed at Section 3.2
Infrastructure and services The efficient provision and use of services such as water, sewerage, power, telecommunications and waste disposal caters for residents and visitors; and the ongoing viability of existing infrastructure, services and facilities are protected from the impacts of future development	Potential impacts on existing infrastructure and services are addressed at Section 2.

The proposed Stage 2 route intersects predominantly rural and agricultural land uses, although small areas of the route traverse land intended for urban and industrial development. The precincts and zones defining intended land uses within the respective planning schemes relevant to the Stage 2 project are summarised in Table 3.9 and shown on Figure 3.16.

Route selection has aimed to minimise potential impacts on developable land and minor refinements will be considered to align the corridor with future road and infrastructure corridors within individual developments. The pipeline will be contained within an easement shown on the relevant land title and will not prevent future rezoning of any land in the project area.

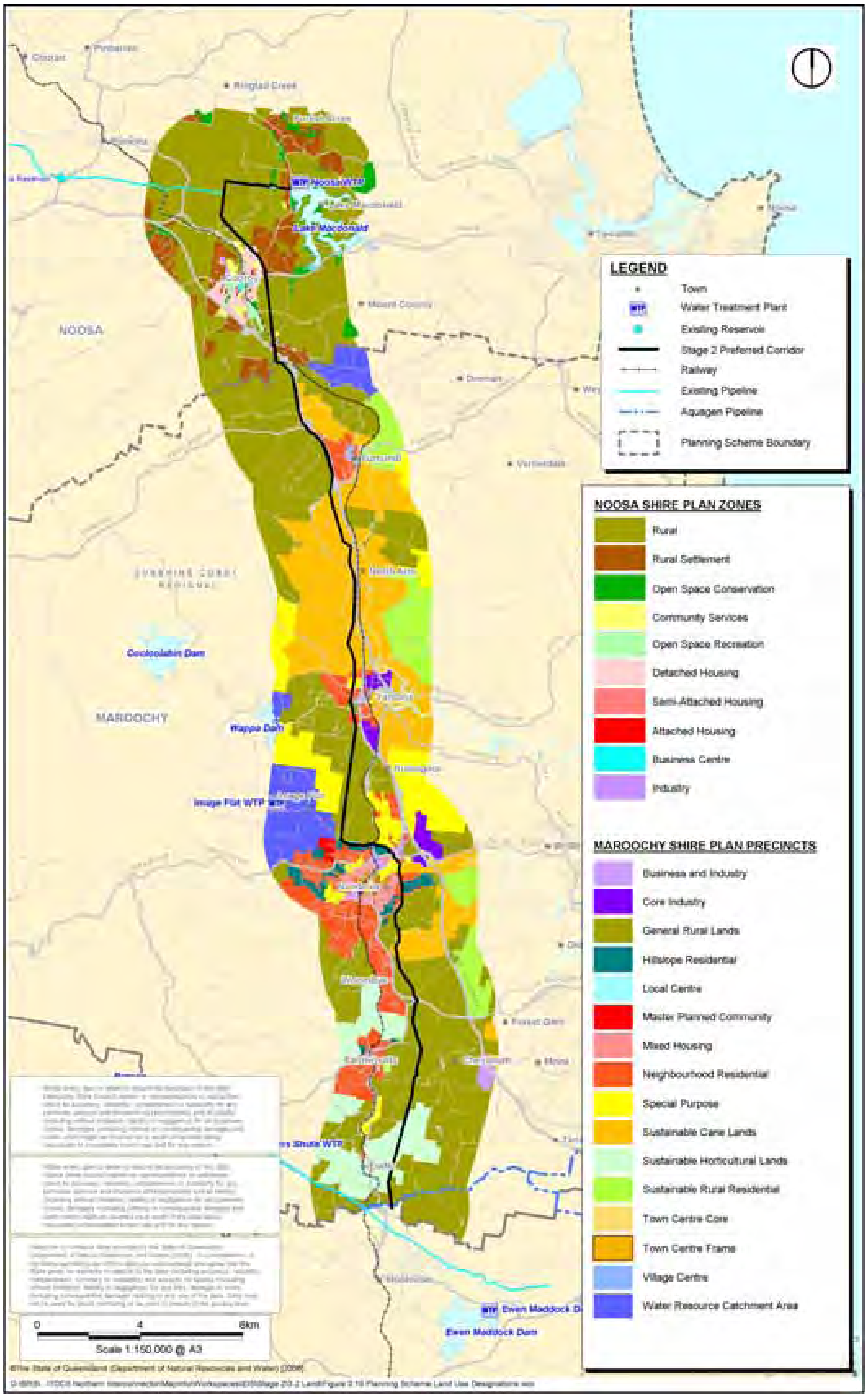

Figure 3.16
TOWN PLANNING ZONES AND PRECINCTS

Table 3.9 Precincts and zones intersected by the NPI Stage 2 corridor

Scheme	Precinct or zone	Planning intent	Compatibility with planning intent
Noosa Plan 2006	Rural settlement	Applied to detached housing on large lots to maintain the dominant building form to the general exclusion of other uses and contributes to the rural or semi-rural character and amenity of the area	The construction of the NPI Stage 2 will, generally, be of minimal disruption on Rural Settlement lots due to their large size. Upon completion of pipe laying, the corridor will be reinstated to existing conditions. Above-surface protrusions such as air valves may exist over properties; however, they will be designed and reinstated to blend in with the surrounding environment.
	Rural	Intended to ensure that rural land is protected for its scenic and environmental values, rural amenity and agricultural productivity and are not adversely impacted upon by development on or adjacent to the land	Where the NPI Stage 2 traverses Rural properties it is aimed that minimal disruption will be caused, generally by co-locating within an existing easement. In many cases, existing agricultural activities will be able to continue as usual, while in other instances it may be possible to increase the depth of the pipeline to allow existing activities to continue. It is not envisaged that the project will have significant long-term impact on the rural amenity.
	Detached housing	Applied to single detached housing to maintain low impact, low density development form of domestic scale and high levels of residential amenity	The NPI Stage 2 will only traverse a small amount of land zoned as Detached Housing. Where this occurs, every effort will be made to ensure minimal disruption to the community by following existing easements or locating within road reserves where possible.

Table 3.9 (continued)

Scheme	Precinct or zone	Planning intent	Compatibility with planning intent
	Open space conservation	To ensure that areas with natural environmental values of high order and warranting conservation status are protected and managed	The NPI Stage 2 traverses a small amount of land zoned as Open Space Conservation. Where this occurs a number of management plans will be implemented to ensure that environmental values of the area are protected and managed. Furthermore, the corridor will be reinstated to a level meeting or exceeding existing conditions.
	Community services	To ensure that land committed or planned for community purposes is protected and managed to enable the timely and efficient delivery of community services.	The only land zoned as Community Services the NPI Stage 2 affects is part of the North Coast Rail corridor. The pipeline will cross the rail corridor perpendicular to the rail line. Construction methodology for the crossing will be via a tunnel bore and cause no disruption to the surface.
Maroochy Plan 2000	Sustainable horticultural lands	Intended to protect land for commercial cropping, horticulture and other agricultural production.	Where the NPI Stage 2 traverses Sustainable Horticultural Lands it is aimed that minimal disruption will be caused, generally by co-locating within an existing easement or as close to property boundaries as possible, minimising impacts. In many cases, existing horticultural activities will be able to continue as usual, while in other instances it may be possible to increase the depth of the pipeline to allow existing activities to continue.

Table 3.9 (continued)

Scheme	Precinct or zone	Planning intent	Compatibility with planning intent
	Sustainable cane lands	Intended to protect land for sugar cane and other agricultural activities due to the agricultural values of the land.	Where the NPI Stage 2 traverses Sustainable Cane Lands, pipeline depth will generally be at a suitable level as to allow cane to continue to grow as usual upon construction completion.
	General rural lands	Intended to protect lands for appropriate agricultural, rural and ancillary activities	The construction of the NPI Stage 2 will, generally, be of minimal disruption on General Rural Lands due to their large size. Upon completion of construction, the corridor will be reinstated to existing conditions. Above-surface protrusions such as air valves may exist over properties; however, will be designed and reinstated to blend in with the surrounding environment.
	Neighbourhood residential	Intended to provide for development of low density urban, town and village residential purposes and compatible purposes directly servicing residents	The NPI Stage 2 will aim to traverse already burdened land, such as easements, wherever possible when affecting Neighbourhood Residential Lands. Construction timing and methodology will be targeted at reducing the disruption to the surrounding community.

Table 3.9 (continued)

Scheme	Precinct or zone	Planning intent	Compatibility with planning intent
	Hillslope residential	Applied to detached housing in urban areas on land with slopes greater than 15%. Intended to minimise impacts on natural landforms, remnant native vegetation and natural drainage patterns.	The NPI Stage 2 traverses a small portion of Hillslope Residential land. The section of corridor through this area follows an existing easement as not to affect additional land. Reinstatement subsequent to construction will ensure that land stability is maintained.
	Special purpose	Intended to provide for major land—extensive uses which are in reserves, on designated land or otherwise under the control of Commonwealth, State or Local government. Applies to outdoor sports facilities at Yandina and Nambour.	The NPI Stage 2 traverses the Special Purpose precinct in two areas. Construction will be timed as to cause minimal disruption to the activities which occur over the land. Upon construction completion, the corridor will be reinstated to existing conditions
	Water resource catchment area	Intended to manage land to maintain or improve the quality of water in water supply storages, ecological functions of natural waterways and drainage paths, and remnant vegetation with significant ecological value within the area.	A number of management plans will be implemented to maintain and mitigate impacts on ecological values of the project area.

Sunshine Coast Enterprise Needs Investigation and Bridges Investigation Project

The Sunshine Coast Enterprise Needs Investigation and Bridges Investigation Project has been undertaken by the DIP and OUM to determine the suitability of the Bridges area to the north of Yandina as a medium to long term enterprise precinct. This investigation concluded that, while the Bridges area is required for future enterprise development, its development will be delayed until late in the SEQ Regional Plan's 20-year time frame.

The NPI Stage 2 corridor is located within an existing power easement along the eastern edge of the Bridges Investigation Area, which will result in the registration of a CIE over the affected allotments. It is expected that the location of the pipeline would be acknowledged through a future detailed structure planning process for the study area.

Native Title

The *Native Title Act 1993* (Cwlth) (NT Act) commenced operation on 1 January 1994. The Act was part of the Commonwealth Government's response to the High Court decision in Mabo v Queensland No. 2, which found that Australian common law can recognise the rights and interests over land and water possessed by indigenous people under traditional laws and customs. Subsequent amendments made under the *Native Title Amendment Act 1998* (Cwlth) confirmed that native title rights may exist over land which is, or has been, subject to a pastoral lease or other forms of leasehold tenure.

The NPI Stage 2 easement falls largely within the external boundaries of former Native Title Determination Application QUD6034/99 (Gubbi Gubbi People #2) (see Figure 3.17). Gubbi Gubbi People #2 failed the registration test under the NT Act as applied by the National Native Title Tribunal. Although there are complex reasons for that failure, they relate mainly to overlapping claims by essentially the same (Gubbi Gubbi) group. Therefore, for the great majority of the project area, there are currently no registered native title claims, nor has there ever been a native title holder.

There are, however, currently two unregistered claims over the area proposed for the NPI Stage 2 and a third claim is being mooted. Further, the former native title representative body for the area has lost its representative status. Following legal advice, SRWP Co (now trading as LinkWater) has concluded that the registered native title claimant for Gubbi Gubbi #2 is currently the 'native title party' for all areas within the external boundaries of that claim where there are no current registered claims.

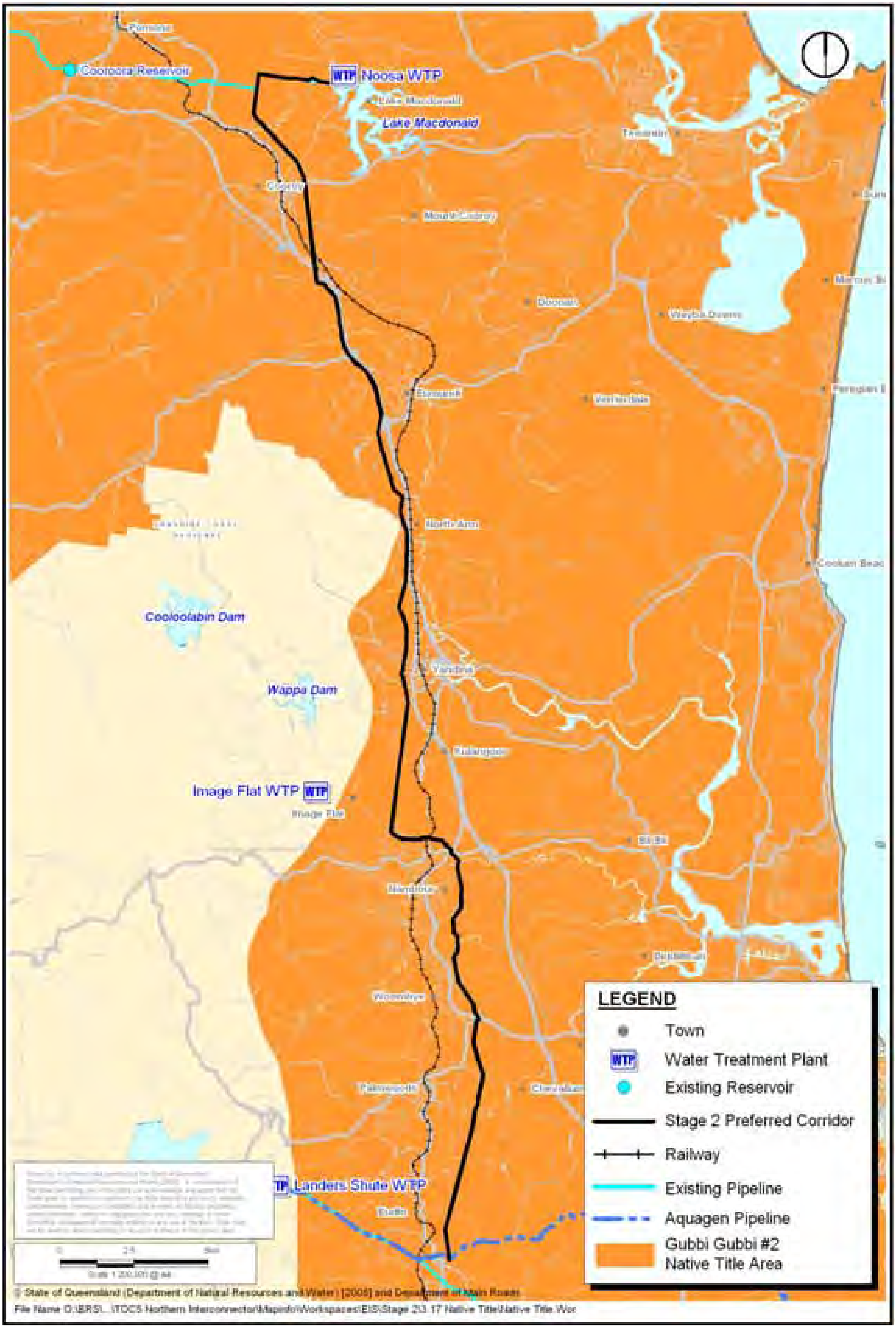

Figure 3.17
NATIVE TITLE

Potential Impacts and Mitigation Measures

The NPI Stage 2 easement establishes the infrastructure owner's right of access to the section of the affected land for continued operation and maintenance of the pipeline. The easement will be a permanent encumbrance on the land title, and compensation will be negotiated through the DIP. The co-location of services within existing maintained service corridors is intended to reduce the additional encumbrance on directly affected landholders.

Management within sensitive environmental areas will include the development of Sensitive Area Plans (SAPs) (see Section 3.3.1), reduction of easement widths and reduction of vegetation clearing where possible.

The location of mining and extractive resources is determined by geological conditions. Investigations undertaken for this EIS have shown that the NPI Stage 2 corridor traverses four key resource areas (KRAs). The pipeline itself will be buried for the majority of its alignment to minimise disruption to existing land uses in the project area. The depth of burial will be determined by the pipe material, design specifications for the location and negotiations with landholders, and the conditions of easement established by LinkWater as the asset-owner.

The construction of NPI Stage 2, where applicable, will be compatible with the intent of the Noosa and Maroochy planning schemes (see Tables 3.7 and 3.8).

The potential impacts on residential and other uses relate primarily to the construction phase of the project. Construction impacts on land use are typically localised and temporary and may include road closures, temporary removal of structures (eg play equipment, fences, gates) and access restrictions across the corridor. Specific impacts, including noise, vibration and dust, are addressed in the relevant sections of this EIS, this includes the treatment of pest species associated with temporary sites utilised by the project.

Once construction works are complete, normal activities will generally be able to resume across the pipeline. However, some activities will need to be restricted to maintain the integrity of the pipe. Important restrictions include:

- the exclusion of deep ripping, blasting, earthworks, quarry operations and the like over the pipeline; and
- no planting of deep-rooted vegetation (including large native or plantation vegetation and some agricultural crops) within 5–10 m of the pipeline.

The location of pipeline facilities and structures will accord with the nature and intent of local government planning schemes, and where possible, will be located in areas remote from residential use and preferably in areas designated for Industrial, Rural or Open space use.

Land tenure requirements for the facilities and structures associated with the pipeline have been determined according to a number of factors including: frequency of access required to the site, the potential for nuisance to surrounding environment (eg noise, light), area of land required for the facility (above or below ground), level of security required and safety considerations. Where major facilities or structures are required (eg balance tank), the preferred tenure is freehold, as larger structures cannot typically be accommodated within existing easements. Acquisition of either a whole or part of an existing property may be undertaken for large facilities such as balance tanks and for facilities requiring regular access and/or high levels of security (eg pump stations, water quality management facilities).

Minor structures (eg underground mainline valves) will also be assessed in order to determine whether a freehold property is to be acquired or whether the provisions of an easement are appropriate (for both the landholder and for operational and maintenance requirements).

Where it is not possible to avoid existing infrastructure, specific strategies will be implemented to manage interactions within the corridor including:

- boring underneath major road and rail infrastructure to preserve its safety and integrity;
- development of co-use agreements with Energex (and other utility providers) to set the terms of the shared easement arrangement in existing power corridors;
- establishment of a ‘dial before you dig’ register and engaging specialist service locators to determine the location of existing underground services prior to construction; and
- maintaining exclusion zones and clearances from overhead transmission lines and other electricity infrastructure.

The route of the proposed alignment of the pipeline ROW will be discussed with the Department of Main Roads, Sunshine Coast Regional Council and Queensland Rail with the view to ensuring that the pipeline does not affect any known future upgrades of transport infrastructure.

Construction impacts on land adjacent to the construction site will be managed where possible through the implementation of the construction environmental management plan (CEMP) and sub-plans (eg the Weed and Disease Management Plan).

The proponent is preparing a native title compliance schedule for the project to fulfil the procedural rights of native title parties under the NT Act. Native title compliance assessment begins with identifying those lots where there is a possibility that native title rights and interests continue to exist. No native title can exist in those lots where, by operation of law, native title has been extinguished (ie freehold lots).

Once all lots along the pipeline route have been determined as either 'extinguished', 'not extinguished' and/or 'exempt', the compliance schedule will be used as a supporting tool for notification to the appropriate native title holders. Procedural rights under s. 24KA of the NT Act can be satisfied by notifying the relevant native title parties. The Northern Network Alliance (NNA), on behalf of Linkwater Projects, will notify the relevant native title parties and will invite comment on the potential impact of the NPI Stage 2 on any rights conferred by the existence of native title. NNA will give notice to all claimants who have unregistered or failed claims over the project area. This will occur prior to the commencement of construction.

3.2.4 Land Contamination

Description of Environmental Values

For the purposes of the *Environmental Protection Act 1994* (EP Act), contaminated land refers to land contaminated by hazardous substances which may pose a risk to human health or to the environment. The Queensland EPA maintains two public access registers that contain land use planning information with respect to contaminated lands. These are:

- the Environmental Management Register (EMR), which records properties that have been or are being used for a 'notifiable activity' under the Act and;
- the Contaminated Land Register (CLR), which records sites proven to contain contamination which may cause, or is causing, serious environmental harm. This register also records known sites of unexploded ordinances.

Searches of both registers were undertaken using real property descriptions of directly affected lots on the route. This search identified properties listed on the EMR and two adjacent to an affected property (see Table 3.10) but returned no records for sites on the CLR. Property descriptions of EMR-listed sites were then submitted to the EPA for review and/or confirmation of any contamination.

It should be noted that sites recorded on the EMR generally pose a low risk to human health and the environment under the current land use. Further, the listing criteria may only apply to a small part of the total land portion within the registered lot number. The inclusion of land on the register does not require that the land must undergo remediation or that the current land use must stop.

Table 3.10 Properties listed on the Environmental Management Register

Notifiable activity	Site	Real property description	Current land use
Petroleum product or oil	300 Kennedys Road, Lake Macdonald	3SP108094	Active quarry site
Petroleum product or oil	44 Nandroya Road, Cooroy	2RP193949	Transport depot
Abrasive blasting	33 Wappa Falls Road, Yandina	800SP171080*	Old speedway
Hazardous contaminants	Railway corridor, Cooroy	231CP827043*	Queensland Rail
Hazardous contaminants	Railway corridor, Nambour	211SP102282	Queensland Rail

* *Adjacent to an affected property.*

Potential Impacts and Mitigation Measures

Adverse environmental impacts can potentially occur from the excavation or displacement of soil containing environmentally significant levels of one or more contaminants. Soil disturbance has the potential to mobilise soil contaminants and potentially result in the spread of contamination beyond the immediate location to the receiving environment (eg waterways). Although the Stage 2 pipeline does not traverse any registered contaminated land sites, the following mitigation measures will be implemented in the event that contaminated land is encountered during construction.

During and after construction, the increased permeability of the pipeline trench means that minor contaminant material disturbed or intercepted in construction may potentially migrate along the gradient of the trench as this is likely to be a pathway of higher permeability. In such cases, impermeable trench breakers will be inserted (foam walls around the pipe and across the trench).

The storage and handling of fuels, chemicals (including those stored at facility areas) and wastewater have the potential to pollute surface waters and contaminated soils, for example:

- structural damage to storage facilities resulting in fuels leakage of fuels to the surrounding environment;

- incorrect storage of fuel and/or chemical containers (ie not in a contained area protected from weather conditions); and
- incorrect refuelling methods resulting in spillage.

Storage areas for fuels, oils and chemicals used during construction will be covered and contained within an impervious bund to retain any spills of more than 120% of the volume of the largest container in the bunded area. Storage methods and storage areas will comply with the relevant Australian Standards and the Queensland EPA requirements for bunding and spill management. Any spillage will be immediately contained and absorbed with a suitable absorbent material.

Materials safety data sheets (MSDS) for all chemicals stored on site will be made available to site personnel, with workers informed of their location as part of site inductions.

Refuelling of mobile vehicles, plant and equipment will be undertaken no closer than 40 m from a watercourse and using approved fail-safe couplings in hoses. Spill kits and absorbent materials will be provided on site to clean up in the event of a spillage or leak. In the event of accidental hydrocarbon spills, an incident response plan will be enacted. The incident response will be in accordance with a project-specific incident response plan which has been developed in consultation with the relevant emergency service providers.

If any previously unknown sites are identified during later stages of investigation or during the route establishment phase, the following actions will occur:

- the Queensland EPA and relevant local authorities will be notified; and
- Level 1 assessments will be undertaken by a registered soil contamination scientist.

Other mitigation measures can include the following:

- pre-construction soil surveys to isolate contaminated sections of affected lots so they can be avoided;
- minimising disturbance of intact soils and localised placement of excavated material;
- implementation of general soil conservation and erosion prevention measures in accordance with a project-specific soil and water management plan;
- the use of impermeable trench breakers to prevent migration along trench gradients made more permeable by soil disturbance;

- employment of a registered soil contamination scientist to provide management recommendations where previously unknown sites are identified during later stages of investigation; and
- early consultation with the Queensland EPA and local authorities, as appropriate, with respect to any previously unknown sites.

The mainline pigging (cleaning) facilities incorporate specific draindown infrastructure for dewatering during pigging. Discharges of water to the environment, associated with both commissioning and operational phases, will be managed to ensure there are no adverse impacts on the environment and/or receiving waters. Preliminary site assessment has been undertaken for draindown infrastructure site options, taking into account the existing environmental values (eg water quality of existing waterways and presence of sensitive areas or species); people and properties that might be affected by water discharge; other existing infrastructure and utilities (stormwater and telecommunications); and other sources and loads of contaminants within the catchment (cumulative impacts). To avoid or minimise environmental impacts, the following factors will be established prior to discharge of water:

- appropriate timing of discharge to ensure the receiving environment has the capacity to receive discharge volume;
- temporary or permanent measures associated with sediment and erosion control;
- approval for required drainage works;
- site access; and
- program for monitoring of discharge and receiving environment.

3.3 Nature Conservation

The NPI Stage 2 project area encompasses a variety of landforms which influence regional vegetation patterns. The project traverses the eastern footslopes of the Blackall Range, including a number of ridges which run west-east towards the coast. These vegetated ridges extend through Nambour and Kulangoor, with the remainder of the project area characterised by low elevation ridges, hills and valleys. Landforms in the study area are discussed in detail in Section 3.2.

The vegetation once covering the upper valley floors and lower plains of the Sunshine Coast included vast tidal and freshwater floodplains, dense subtropical rainforest in lowland areas, and wet sclerophyll and dry eucalypt forests and woodlands on more elevated slopes and ridgelands with poorer soils and better drainage. Native vegetation communities on fertile deep alluvial and volcanic soils were extensively cleared during early settlement of the coastal plains north of Brisbane and development of important agricultural areas.

Remnant vegetation within the study area is now largely restricted to hill tops, ridgelines and narrow, discontinuous riparian fringing forests. Many of the remaining vegetation types, or regional ecosystems (REs), are listed as 'of concern' or 'endangered' as a result of their present distribution. The route intersects a number of remnant areas supporting vegetation or fauna associations now uncommon or rare in the region. Most are associated with riparian and floodplain forest remnants that occur where the corridor intersects permanent freshwater streams. The Ferntree balance tank site also supports several vegetation and habitat types of moderate to high conservation significance within a relatively small area. Remnant vegetation communities and more mature areas of regrowth provide important terrestrial and riparian habitats for a wide range of plant and animal species. These species include many protected under State and/or Commonwealth legislation.

Study Area

The study area supports a number of endangered, vulnerable or rare (EVR) plant and animal species which are protected under one or both of the following Commonwealth and State pieces of legislation:

- the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act); and
- the *Nature Conservation Act 1992* (Qld) (NCA).

The EPBC Act only lists species as vulnerable, endangered or critically endangered with no provision for a 'rare' category similar to the NCA. The EPBC Act also protects migratory species listed under international agreements such as the China Australia Migratory Bird Agreement (CAMBA) and the Japan Australia Migratory Bird Agreement (JAMBA). A separate discussion of all species of national environmental significance under the EPBC Act relevant to the project is provided at Appendix D.

The study area comprises land and environments between Eudlo and Cooroy/Lake Macdonald within 0.5 km of the preferred corridor. For the purposes of database searches a much larger area was used to identify species and communities potentially impacted by the project, the study area is defined by the following coordinates:

- Latitude: 26° 22' 19.92", 26° 45' 15.48"; and
- Longitude: 152° 52' 4.8", 153° 3' 4.09".

Database search results for this rectangular area have been refined to exclude species which are known to occur in habitats not represented in or adjacent to the preferred corridor. Protected flora and fauna species considered relevant to the NPI Stage 2 are addressed at Section 3.3.2 and Section 3.3.3 respectively. Information on the habitat requirements of all EVR and migratory species identified through preliminary assessments of the route is provided in Appendix K, with results summarised in Table 3.11.

Table 3.11 EVR/Migratory species summary

Category	Total EVR	Migratory	EPBC-listed	NCA-listed
FLORA	35	–	22	17
FAUNA				
Birds*	27	16	19	10
Amphibians	10	–	3	10
Reptiles	7	–	2	5
Mammals	5	–	4	1
Insects	2	–	1	1
Fish	4	–	4	–
Total	**90**	**16**	**55**	**44**

* *Three bird species are listed as EVR as well as migratory species.*

Assessment Approach

Methodologies for assessing flora and fauna values in the study area are addressed in greater detail in the sections below. However, the broad approach adopted for assessing ecological features in the study area combined initial desktop reviews with subsequent field studies to ascertain the potential for impact on ecological communities and individual species.

This approach comprises four key components:

- identifying the type and location of vegetation communities and potential habitat areas from a combination of aerial photography and existing mapping (eg regional ecosystem mapping);
- compiling lists of EVR/migratory species and their habitat requirements through a combination of database searches and literature reviews (see Appendix K);
- undertaking reconnaissance surveys to ground-truth RE types and record the presence of EVR species or suitable habitat; and
- undertaking a detailed flora and fauna survey in areas of high sensitivity or where valuable habitat features could be adversely affected by the NPI Stage 2 project.

Detailed investigations have been conducted at key areas. Prior to construction field verification will be completed to ensure flora and fauna values are appropriately managed.

3.3.1 Environmentally Sensitive Areas

Description of Environmental Values

NPI Stage 2 will not traverse sites covered by international treaties or agreements (eg Ramsar). For the purposes of the NPI project, a particular location is considered environmentally sensitive if it:

- supports a remnant vegetation type classified as endangered under the Queensland *Vegetation Management Act* (VMA);
- supports, or contains habitat for, a rare or threatened species listed under the EPBC Act or the Queensland NCA;
- is a protected area reserved under the Queensland NCA; and
- forms part of a wildlife corridor of state, regional or local significance.

Based on the above criteria, environmentally sensitive areas have been identified for NPI Stage 2 and are discussed in the following sections.

Conservation and Forestry Areas

Figure 3.18 shows the location of lands with conservation or forestry tenures in the study area. The preferred corridor is located in close proximity to:

- Ferntree Creek National Park near Nambour (gazetted under the NCA); and
- Yurol State Forest near Cooroy (gazetted under the *Forestry Act 1959*).

The southern extent of Ferntree Creek National Park is included in the Ferntree special investigation area and has been assessed in detail for the purposes of this EIS.

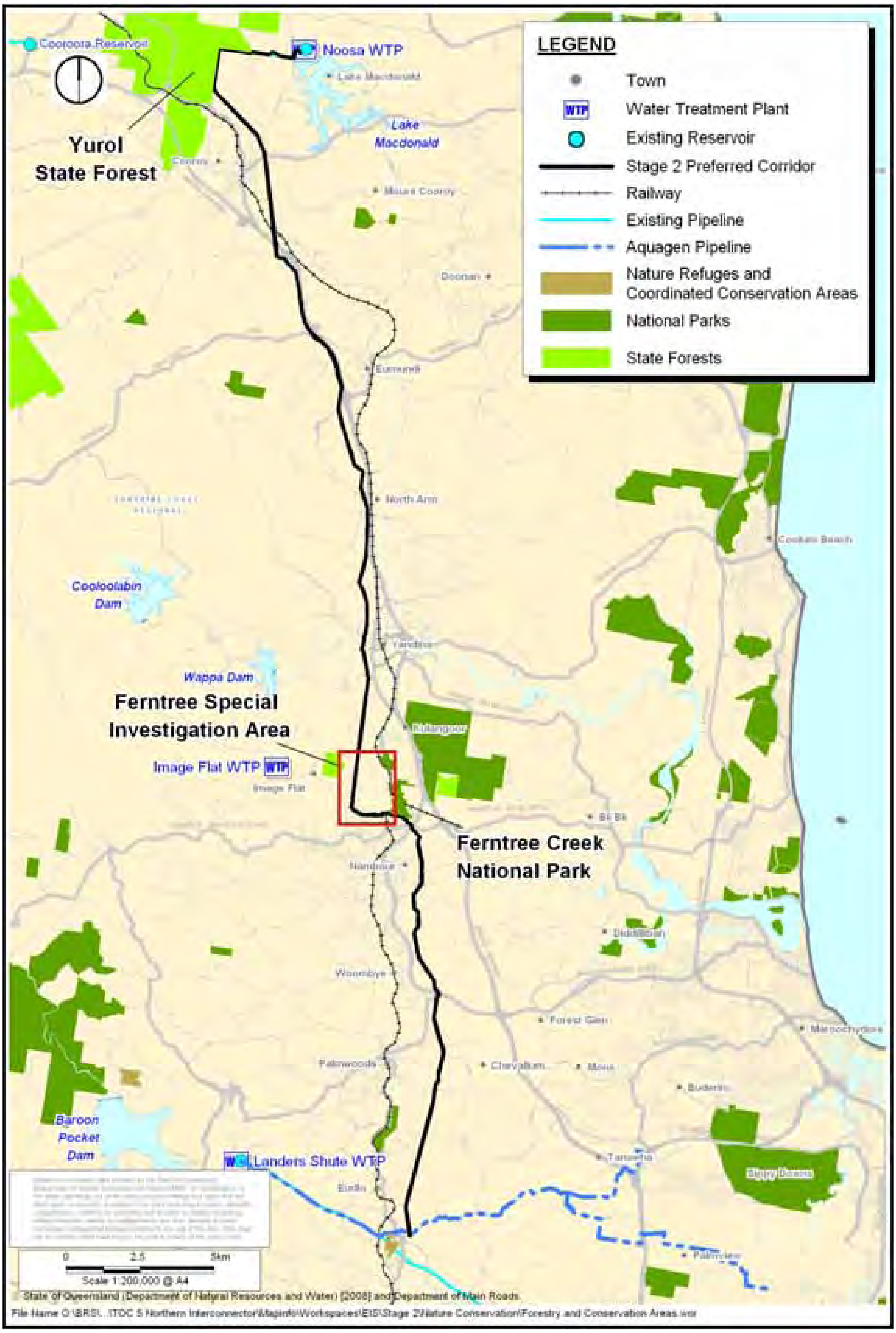

Figure 3.18
LAND WITH CONSERVATION AND FORESTRY TENURES

The preferred corridor is located in road reserve adjacent to the Yurol State Forest. Disturbance to any land within the state forest boundary will be in accordance with the requirements of Forestry Plantations Queensland.

Matters of National Environmental Significance

The NPI Stage 2 was referred to the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) in September 2007. On 24 October 2007, the federal Minister determined that the project is a 'controlled action' under the EPBC Act as it was likely to have a significant impact on the following matters protected under that Act:

- listed threatened species and communities—ss. 18 and 18A; and
- listed migratory species—ss. 20 and 20A.

A detailed assessment of potential impacts on matters of national environmental significance (MNES) has been prepared following the Significant Impact Guidelines formulated by DEWHA and is presented at Appendix D. In addition to these guidelines, a buffering capacity of 40 ML/d above the full resource development scenario for the Mary Basin (as established under the WRP) was included in the overall assessment of impacts. Whilst exceeding the assessment required for the proposed water supply strategy (ie 6500 ML/a (18 ML/d)), this level of assessment provides a greater level of confidence in determining the magnitude of impacts relative to unseasonal fluctuations and extreme events within the Mary Basin. This satisfies the objectives of both the *Water Resource (Mary Basin) Plan 2006* (Mary Basin WRP) and the established environmental flow objectives (EFOs), and the provisions determining the significance of impacts on MNES under the EPBC Act.

The following sections provide a summary of the key findings of this assessment. Mitigation measures outlined are consistent with the EFOs established under the Mary Basin WRP as well as to avoid impacts on MNES under the EPBC Act.

Table 3.12 lists the key relevant MNES within the NPI Stage 2 project area (including the main channel of the Mary River downstream of the Noosa intake tower at Coles Crossing), as determined through detailed desktop and field survey (see Appendix D for methodology). Table 3.12 also outlines the potential impacts and the measures proposed to avoid (in the first instance), minimise and mitigate potential impacts associated with the construction, operation (including full use of the 6500 ML/a (18 ML/d) entitlement) and maintenance of the Stage 2 pipeline and facilities.

Table 3.12 Matters of national environmental significance—key species for the NPI Stage 2 project

Species	EPBC status	Likelihood of occurrence within the project area	Impact assessment	Mitigation measures
Flora				
Phaius tancarvilleae, Swamp Lily, Greater Swamp Orchid	Endangered	**Present**—recorded in and adjacent to riparian vine forest at Paynter Creek (northern section). Further field investigation to be conducted for corridor refinements/options.	No significant impacts on population of *P. tancarvilleae* within the project area. Impacts for this species are expected to be temporary and localised, and can be avoided or mitigated.	- Map location of individual trees within and adjacent to the corridor prior to construction - Refine corridor route and width to avoid or limit the number of individual plants to be removed during construction at Paynter Creek - Use a constrained corridor (less than 30 m) at northern crossings of Paynter Creek to avoid/minimise impacts on suitable habitat - Translocate and/or propagate individual trees for use in revegetation
Xanthostemon oppositifolius, Southern Penda	Vulnerable	**Present**—recorded in riparian vine forest at several locations around Six Mile Creek and Lake Macdonald. Further field investigation required if any corridor refinements/options	The project will not have significant impacts on populations of *X. oppositifolius*. All potential impacts will be temporary and localised and will be confined to existing cleared or disturbed areas where possible.	- Map location of individual trees within and adjacent to the corridor prior to construction - Refine corridor route and width to avoid or limit the number of individual trees to be removed during construction - Constrain corridor (less than 30 m) at crossing locations on Six Mile Creek to minimise clearing of suitable habitat (ie regional ecosystem 12.3.1) - Translocate and/or propagate individual trees for use in revegetation

Table 3.12 (continued)

Species	EPBC status	Likelihood of occurrence within the project area	Impact assessment	Mitigation measures
Terrestrial fauna				
MIxophyes iteratus, Giant Barred Frog	Endangered	**High**—suitable habitat identified at a number of locations including Mount Combe Creek, Sandy Creek, North Maroochy River and Paynter, Petrie and Tuckers creeks. Known from the similar habitats in the district.	The project will not have significant impacts on populations of *M. iteratus*. The majority of waterway crossings that have been identified as potential *M. iteratus* habitat are located within existing disturbed areas, with potential impacts to habitat expected to be localised and temporary.	- Schedule waterway crossings and construction near important habitat areas appropriately to avoid breeding and high-flow periods - Implement sediment and erosion control measures for all works - Reinstate banks and replace structural habitat features (eg woody debris) following construction of waterway crossings - Commence rehabilitation efforts as soon as practicable following construction
Aquatic fauna				
Elusor macrurus, Mary River Turtle	Endangered	**Moderate**—not detected during field survey. Potential suitable habitat identified in the main channel of Six Mile Creek. Not previously recorded in Six Mile Creek although may occur in the mid to lower reaches of the main channel. Known to occur in the Mary River at and downstream of the existing Noosa intake tower at Coles Crossing.	The project may result in temporary and localised impacts on sub-optimal habitat for the Mary River Turtle within the main channel of Six Mile Creek. No significant impacts are expected for this species as a result of the Six Mile Creek crossing. No significant long-term impacts are expected for this species or its critical habitat as a result of the full utilisation of the existing 6500 ML/a (18 ML/d) entitlement on the Mary River.	- Constrain waterway crossings identified as potential habitat areas to minimise the area of disturbance - Implement appropriate sediment and erosion control measures for all works, stockpiles and bunds adjacent to waterways - Minimise clearing of riparian vegetation and replace instream structural habitat features such as logs - Ensure the storage and loading areas for chemicals and fuels are located away from waterways - Develop and implement a habitat monitoring program for the main channel of the Mary River downstream of the Noosa intake tower at Coles Crossing to monitor changes in habitat condition and availability

Table 3.12 (continued)

Species	EPBC status	Likelihood of occurrence within the project area	Impact assessment	Mitigation measures
Maccullochella peelii mariensis, Mary River Cod	Endangered	**Moderate**—established populations likely in the mid to lower reaches of Six Mile Creek. Suitable habitat identified during field survey in the main channel of Six Mile Creek, and sub-optimal habitat in Six Mile Creek left branch. Known to occur in the Mary River at and downstream of the existing Noosa intake tower at Coles Crossing.	The project may result in temporary and localised impacts in Six Mile Creek main channel and left branch. The crossing location on the left branch of Six Mile represents sub-optimal habitat (see Hydrobiology Pty Ltd's report in Appendix H) and is unlikely to support significant populations of Mary River Cod. Impacts will be transient and have no medium or longer term significance to populations of the Mary River Cod in this waterway. Potential restriction to the movement of large cod between deep pools in the Mary River during the dry period. This will not result in significant long-term impacts on this species or its critical habitat.	- Time crossings of Six Mile Creek appropriately to avoid construction during periods when cod are most likely to move through the catchment waterways - Constrain waterway crossings identified as potential habitat areas to minimise the area of disturbance - Reinstate banks and replace structural habitat features such as woody debris and overhanging vegetation within the corridor - Develop and implement a habitat monitoring program for the main channel of the Mary River downstream of the Noosa intake tower at Coles Crossing to monitor changes in habitat condition and availability
Nannoperca oxleyana, Oxleyan Pygmy Perch	Endangered	**Moderate**—slow-flow conditions and pH levels in Six Mile Creek (left branch) fall within the preferred range, with sufficient leaf litter to act as an alternative source of cover in the absence of macrophyte growth. Potential sub-optimal habitat areas within the left branch of Six Mile Creek	The project will not result in significant or long-term impacts on Oxleyan Pygmy Perch populations or habitat critical to their survival. Six Mile Creek (left branch) represents sub-optimal habitat for this species (see Hydrobiology Pty Ltd's report in Appendix H), and potential impacts to this habitat will be temporary and localised.	- Constrain waterway crossings identified as potential habitat areas to minimise the area of disturbance - Implement appropriate sediment and erosion control measures for all works, stockpiles and bunds adjacent to waterways

Table 3.12 (continued)

Species	EPBC status	Likelihood of occurrence within the project area	Impact assessment	Mitigation measures
Neoceratodus forsteri, Australian Lungfish	Vulnerable	**Moderate**—species not detected during field survey, however occasional records from main channel of Six Mile Creek. Known to occur in the Mary River at and downstream of the existing Noosa intake tower at Coles Crossing.	Although this species has been recorded within the main channel, these individuals were likely to be visitors, rather than permanent residents of this reach of Six Mile Creek. Potential reduction of connectivity between deep pool habitat at and downstream of the extraction point at Coles Crossing will not have significant long-term impacts on populations of the Lungfish. Breeding of Lungfish in the Mary River will not be adversely affected by the project.	- Constrain waterway crossings identified as potential habitat areas to minimise the area of disturbance - Implement appropriate sediment and erosion control measures for all works, stockpiles and bunds adjacent to waterways - Develop and implement a habitat monitoring program for the main channel of the Mary River downstream of the Noosa intake tower at Coles Crossing to monitor changes in habitat condition and availability

The results of impact assessment for the extraction of water under a new entitlement (ie 40 ML/d scenario) indicated there were no significant impacts on populations of the Mary River Turtle, Mary River Cod and Lungfish or critical habitat for these species (see Hydrobiology Pty Ltd's report in Appendix H). Using this impact assessment as a basis for comparing full use of the 6500 ML/a (18 ML/d) entitlement, there remains very low likelihood of impacts on these species or their habitat. This is further supported by the WRP process which has established EFOs to mitigate any impacts on EVR or MNES species, even under the 'full resource development' scenario where all of the entitlements and allocations are assumed to be fully utilised.

Based on the information presented in Table 3.12 and in Appendix D, all potential impacts on MNES associated with NPI Stage 2 will be localised and temporary. The implementation of proposed mitigation measures, some of which are outlined in Table 3.12, will ensure that all potential impacts on terrestrial and aquatic MNES will be minimised.

Potential Impacts and Mitigation Measures

Sensitive Area Plans

Sensitive Area Plans (SAPs) will be developed on a site by site basis and will provide detailed information for individual species as relevant to the project. The SAPs will include information on the specific habitat values that are important to the species, any potential impacts and mitigation measures for each species for both construction and post-construction phases. The SAPs will be implemented through the verification procedure, which is applicable to all sections of the ROW or other construction sites on the project.

3.3.2 Terrestrial Flora

Description of Environmental Values

Assessment Methodology

The initial desktop study focused on identifying RE types reported and mapped for the region and areas of intersection with the preferred corridor. Specific REs likely to be encountered along the route were noted for more intensive investigation. In particular, coastal lowland and valley REs are recognised as sites of high ecological significance as they are usually type localities for several of the EVR species listed by EPBC and HERBRECS (Queensland Herbarium).

Preliminary field assessments undertaken by LAMR Pty Ltd in October 2007 and February 2008 were followed up with more detailed assessments at sites of higher environmental significance. Relevant material from the preliminary assessments undertaken by LAMR is addressed in the report 'Assessment of Impacts on Flora' (see Appendix H). This report addresses the flora values of the preferred corridor at an earlier stage of investigation and has been superseded in part by subsequent amendments to the corridor.

Mapping of vegetation communities along the pipeline route followed the same criteria as RE mapping provided by the Environmental Protection Agency (EPA 2007) by describing the dominant species, community structure, landform and geology. Further detail included appraisal of and extent of weedy species, biological condition, and nature and extent of disturbance where present. These more detailed studies defined sensitive ecosystem elements at a finer resolution than available in current published RE mapping (Version 5.2).

EVR flora species likely to occur in the study area were identified by searching the EPBC Online Protected Matters search tool (DEWHA) and Wildlife Online database (EPA). These results were cross-referenced with records held by HERBRECS and the review of RE mapping to define target areas for more detailed field investigation.

A final phase of investigation will be conducted to confirm the most appropriate corridor where there is potential for impact on rare or threatened plant species.

Land Zones

Seven of the 12 recognised land zones occurring within Queensland (as defined by Sattler & Williams [1999]) are present in the study area. These are summarised in Table 3.13. These land zones represent the underlying geophysical characteristics that are a major determinant of the vegetation types found in the study.

Table 3.13 Land zones in the study area

Land zone	Description
3	Cainozoic alluvial plains and piedmont fans. Includes terraces, levees, swamps and channels of Quaternary alluvium and palaeo-estuarine deposits, and older floodplain complexes and piedmont fans with palaeo-stream channels. Soils include deep cracking clays, loams, earths and poorly developed alluvial soils.
6	Cainozoic inland dunefields, interdune areas and degraded dunefields. Excludes alluvial systems (land zone 3) which may traverse this zone. Soils are predominantly sands and earths, with clay soils in some interdune areas.

Table 3.13 (continued)

Land zone	Description
8	Cainozoic igneous rocks, including extrusive and intrusive types. Predominantly flood basalts forming extensive plains and occasional low scarps, but including hills, cones and plugs on trachytes and rhyolites, and minor interbedded sediments. Associated soils include black earths, krasnozems, shallow clays and lithosols of generally moderate to high fertility. Excludes alluvial soils derived from these rocks, as well as springs (land zone 3).
9	Cainozoic to Proterozoic consolidated, fine-grained sediments with little or no deformation. Siltstones, mudstones, shales, calcareous sediments and lithic sandstones are typical rock types although minor interbedded volcanics may occur. Usually undulating landscapes with fine textured soils of moderate to high fertility.
10	Cainozoic to Proterozoic consolidated, medium to coarse grained sediments with little or no deformation. Includes siliceous sandstones and conglomerates forming ranges, plateaus and scarps with shallow soils.
11	Mesozoic to Proterozoic moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. Ranges, hills and lowlands with lithosols and shallow texture contrast soils of low to moderate fertility. Includes low- to high-grade metamorphics such as shales, slates, gneisses of indeterminate origin, and minor areas of associated serpentinite.
12	Mesozoic to Proterozoic igneous rocks. Predominantly granitoids and intermediate to acid terrestrial volcanics, forming ranges, hills and lowlands with lithosols and texture contrast soils of usually low fertility. Includes granites, granodiorites, andesites and rhyolites, as well as minor areas of interbedded sediments and basic rock types such as gabbros.

Vegetation Communities

The majority of the pipeline route traverses heavily disturbed urban areas, agricultural lands and cleared public utility easements. However, intact stands of vegetation still persist on ridges and steep slopes and along waterways. Areas of remnant vegetation in the study area can be grouped into the following types:

- intact gallery rainforest (RE 12.3.1), sometimes with eucalypt emergents (RE 12.3.2), occurring along waterways;
- patches of reasonable size of lowland gallery rainforest now rare within SEQ;
- small areas of Melaleuca wetlands in riparian depressions such as those around Eudlo Creek and its tributaries; and
- large areas of tall open eucalypt forests along coastal ridges, often contained within national parks and forest reserves.

The conservation status of REs within the study area was assessed according to the Queensland *Vegetation Management Act 1999* (VMA). Of the 15 RE types occurring in the study area, nine are classified as 'not of concern', five as 'of concern', and one as 'endangered'. Details of each RE type are summarised in Table 3.14. This table also includes areas of vegetation not mapped as remnant under the VMA, but identified in the field survey program as having ecological values that may be impacted by the pipeline.

Table 3.14 RE types present in the study area

RE type	Status	Description	Comments
12.3.1	Endangered	Complex to simple gallery rainforest (notophyll vine forest) on alluvial plains	Occurs as fringing riparian forest along waterways, with some larger remnants persisting adjacent to the corridor. This RE type typically has a dense canopy and is therefore more sensitive to disturbance than more open forest types encountered in the study area. Clearing of this RE type is also required at waterway crossing locations. EVR flora species recorded from this vegetation type are *Phaius tancarvilleae* (at Paynter Creek), *Symplocos harroldii* (at Racehorse Lane) and *Xanthostemon oppositifolius* (at Six Mile Creek). This RE is also high value habitat for EVR fauna species such as Giant Barred Frog, Tusked Frog and Elf Skink.
12.3.2	Of concern	*Eucalyptus grandis* tall open forest on alluvial plains	Occurs as small to medium patches in low lying areas around waterways and gullies, often mixed with RE 12.3.1. This RE is high value habitat for EVR fauna species such as Giant Barred Frog, Tusked Frog and Elf Skink. Clearing of this RE type is also required at waterway crossing locations.
12.3.5	Not of concern	*Melaleuca quinquenervia* tall open forest on coastal alluvial plains	While currently classified as 'not of concern' this RE is likely to fall below the 30% trigger area in 5–10 years. Occurs in depressions around Eudlo Creek, often mixed with RE 12.3.2. Minimal clearing of this RE type is anticipated (< 1 ha).
12.3.6	Not of concern	*Melaleuca quinquenervia*, *Eucalyptus tereticornis*, *Lophostemon suaveolens* woodland on coastal alluvial plains	This RE has a limited distribution in the study area and only occurs adjacent to the corridor near the South Maroochy River and near Eudlo. Minimal clearing of this RE type is anticipated (< 1 ha).
12.3.11	Of concern	*Eucalyptus siderophloia*, *E. tereticornis*, *Corymbia intermedia* open forest on alluvial plains near coast	This RE occurs in small areas around the North and South Maroochy rivers, mixed with RE 12.3.2 on alluvial floodplains Minimal clearing of this RE type is anticipated (< 1 ha).

Table 3.14 **(continued)**

RE type	Status	Description	Comments
12.9-10.1	Of concern	Tall shrubby open forest often with *Eucalyptus resinifera*, *E. grandis*, *C. intermedia* on sedimentary rocks (coastal)	This RE has a limited distribution and only occurs adjacent to the easement near Palmwoods mixed with RE 12.9-10.14. Minimal clearing of this RE type is anticipated (< 1 ha).
12.9-10.14	Not of concern	*Eucalyptus pilularis* tall open forest on sedimentary rocks	Occurs on slopes between Eudlo and Petrie Creek. Minor clearing is likely to be required along the edges of the easement in steep areas where the corridor needs to be widened to create safe construction access.
12.9-10.16	Of concern	Araucarian microphyll to notophyll vine forest on sedimentary rocks	This RE only occurs in the study area as a small patch south of Petrie Creek. Minimal clearing of this RE type is anticipated (< 1 ha).
12.9-10.17	Not of concern	Open forest complex often with *Eucalyptus acmenoides*, *E. major*, *E. siderophloia* ± *Corymbia citriodora* on sedimentary rocks	Occurs on elevated terrain around Eudlo and Cooroy (in Yurol State Forest). Minimal clearing of this RE type is anticipated (< 1 ha).
12.9-10.17d	Not of concern	Open forest generally with *Eucalyptus siderophloia* & *E. propinqua* on sedimentary rocks	Occurs in small patches on and adjacent to the corridor at Eudlo and Nambour. Minimal clearing of this RE type is anticipated (< 1 ha).
12.11.2	Not of concern	Tall open forest with vine forest understorey ('wet sclerophyll'). Canopy species include *Eucalyptus saligna* or *E. grandis, E. microcorys, E. acmenoides, Lophostemon confertus*	Occurs adjacent to the corridor around Cooroy. The EVR species *Alyxia magnifolia* was recorded in this RE type. Some clearing may be required to accommodate safe working areas under the existing power line; however, clearing will be restricted to minimise impact on this species/RE type.
12.11.10	Not of concern	Notophyll vine forest ± *Araucaria cunninghamii* on metamorphics ± interbedded volcanics	Mapped for the study area but not confirmed on or adjacent to the route during field survey.
12.12.2	Not of concern	*Eucalyptus pilularis* tall open forest on Mesozoic to Proterozoic igneous rocks, especially granite	Mapped for the study area but not confirmed on or adjacent to the route during field survey.

Table 3.14 (continued)

RE type	Status	Description	Comments
12.12.12	Of concern	*Eucalyptus tereticornis*, *E. crebra* or *E. siderophloia*, *Lophostemon suaveolens* on granite	Occurs on slopes and ridges around Nambour and Yandina. Some minor clearing may be required along the edges of the cleared power easement but no significant impact is anticipated.
12.12.15	Not of concern	*Eucalyptus siderophloia*, *E. propinqua*, *E. acmenoides* open forest on/near coastal hills on Mesozoic to Proterozoic igneous rocks	Occurs on slopes and ridges at the Ferntree balance tank site as 12.12.15 and forms part of a regional wildlife corridor. This RE type has an open canopy structure and is less sensitive to disturbance than other closed forest types. However, a significant area of clearing (approx. 4 ha) will be required in this RE type to accommodate the proposed balance tank and future infrastructure regardless of its final position.
12.12.15a	Not of concern	*Eucalyptus grandis* tall open-forest ± vine forest understorey in wet gullies on Mesozoic to Proterozoic igneous rocks	Gully variant of RE 12.12.15 which occurs adjacent to the pipeline corridor within the Ferntree special investigation area. This RE provides suitable habitat for EVR fauna species—Giant Barred Frog, Tusked Frog and Elf Skink. Clearing in this RE type will be associated with pipeline routes to/from the balance tank; however, the ultimate clearing area will depend on the final location of the preferred corridor.
12.12.16	Not of concern	Notophyll vine forest on Mesozoic to Proterozoic igneous rocks with *Araucaria bidwillii, A. cunninghamii*	High potential for EVR flora species associated with this RE type. Mapped in gullies at the Ferntree balance tank site but not recorded during field survey. Mapped areas were recorded as gully variants of RE 12.12.15 (12.12.15a).

Riparian Vegetation

Riparian zones with intact native tree canopies provide stream bank stability, act as wildlife movement corridors, prevent erosion and improve water quality in associated aquatic ecosystems (McDonald et al. 2006). Table 3.15 describes the key characteristics of riparian vegetation communities typical of the project area. Values of intact riparian vegetation include:

- preventing the establishment of invasive exotic species requiring well lit conditions (eg smothering legumes, Cabomba);
- providing corridors for local fauna movement through areas otherwise devoid of native vegetation;
- lowering water temperatures; and
- providing shelter and a source of debris for in-stream habitats.

Table 3.15 Typical emergent communities along waterways

Community type	Characteristic emergent species
RE 12.3.1 (Vine forest)	*Waterhousia floribunda* dominant fringing stream channels with *Eucalyptus* emergents (eg *E. grandis*) and *Araucaria cunninghamii*. Key habitat for amphibians (eg Tusked Frog [*Adelotus brevis*], Giant Barred Frog [*Mixophyes iteratus*])
RE 12.3.2 (Wet sclerophyll forest)	*Eucalyptus grandis* often with a rainforest understorey. Overhanging vegetation provides habitat for amphibians (eg Tusked Frog [*Adelotus brevis*], Giant Barred Frog [*Mixophyes iteratus*])
Melaleuca open forest	Understorey varies with degree of waterlogging—sedges and bungwall fern in wetter areas; grasses and shrubs in drier microhabitats. Potential Wallum Froglet (*Crinia tinnula*) habitat. Only limited occurrence in the study area.

Source: Regional Ecosystems Description Database (REDD), Queensland EPA.

Areas of significant riparian vine forest vegetation occur along most of the permanent waterways intersected by the pipeline. These include:

- Paynter Creek (northern crossings)—RE 12.3.1;
- both Six Mile Creek (left branch) and its anabranch—RE 12.3.1/12.3.2;
- remnant corridors along the South and North Maroochy Rivers—RE 12.3.1; and
- Eudlo Creek and tributaries, Tuckers Creek and Petrie Creek—all support elements of the two riparian community types with varying degrees of disturbance (Petrie Creek has degraded RE 12.3.1/12.3.2 with Camphor Laurel [*Cinnamomum camphora*]) (see Figure 3.19).

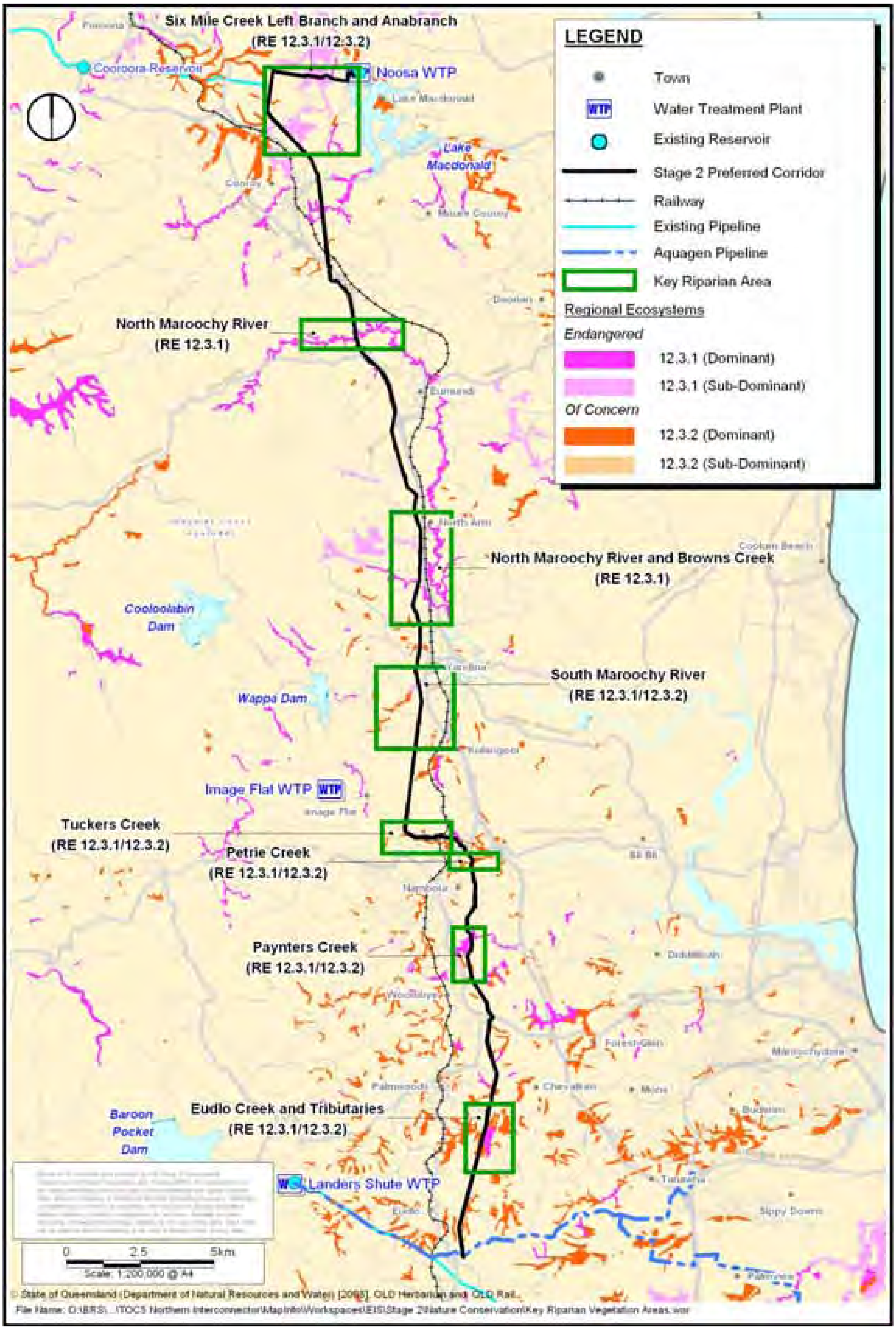

Figure 3.19
RIPARIAN VEGETATION

Protected Flora Species

Botanical survey located four listed EVR plant species within the proposed corridor (see Table 3.16 and Figure 3.20), three of which occur along or adjacent to waterways within or adjacent to the power easement. Plant species of national environmental significance are also addressed in more detail in Appendix K.

Table 3.16 EVR plant species recorded in the study area

Species	Status	Location/s	Comment
Xanthostemon oppositifolius, Southern Penda	Vulnerable (EPBC)	Six Mile Creek (left branch) and anabranch, Lake Macdonald	Mature trees and juveniles located during field survey. Locally common within vine forest remnants (RE 12.3.1/12.3.2) in the northern part of the project area. Potential for impact where plants occur within the corridor.
Phaius tancarvilleae, Swamp Orchid	Endangered (EPBC, NCA)	Paynter Creek (northern section)	Located on the margins of RE 12.3.1, adjacent to cleared easement. Potential for impact where individuals occur within the corridor.
Alyxia magnifolia, Large-leaved Chain Fruit	Rare (NCA)	South of Cooroy Mountain Road	Growing along the edge of a cleared easement (RE 12.11.2). Some potential for impact in the event clearing is required outside the corridor.
Symplocos harroldii, Hairy Hazelwood	Rare (NCA)	Pearsons Road (near crossing of Six Mile Creek (left branch))	Recorded within small drainage reserve within a recent subdivision at Racehorse Lane. Minor potential for impact as directly adjacent to the corridor.

Potential impacts and mitigation measures

One of the key criteria in selecting the preferred corridor was to identify the shortest feasible route that limits the environmental impacts of the NPI Stage 2 project. To achieve this, the route follows existing disturbed easements and road reserves wherever possible to minimise additional disturbance to native vegetation and habitat areas.

However, in some locations clearing will be required to enable construction of the pipeline and associated facilities. It is estimated that clearing of approximately 20.5 ha of remnant vegetation is required for the NPI Stage 2 project. Table 3.17 summarises estimated clearing areas for each of the RE types identified in Table 3.14. These areas are based on the following:

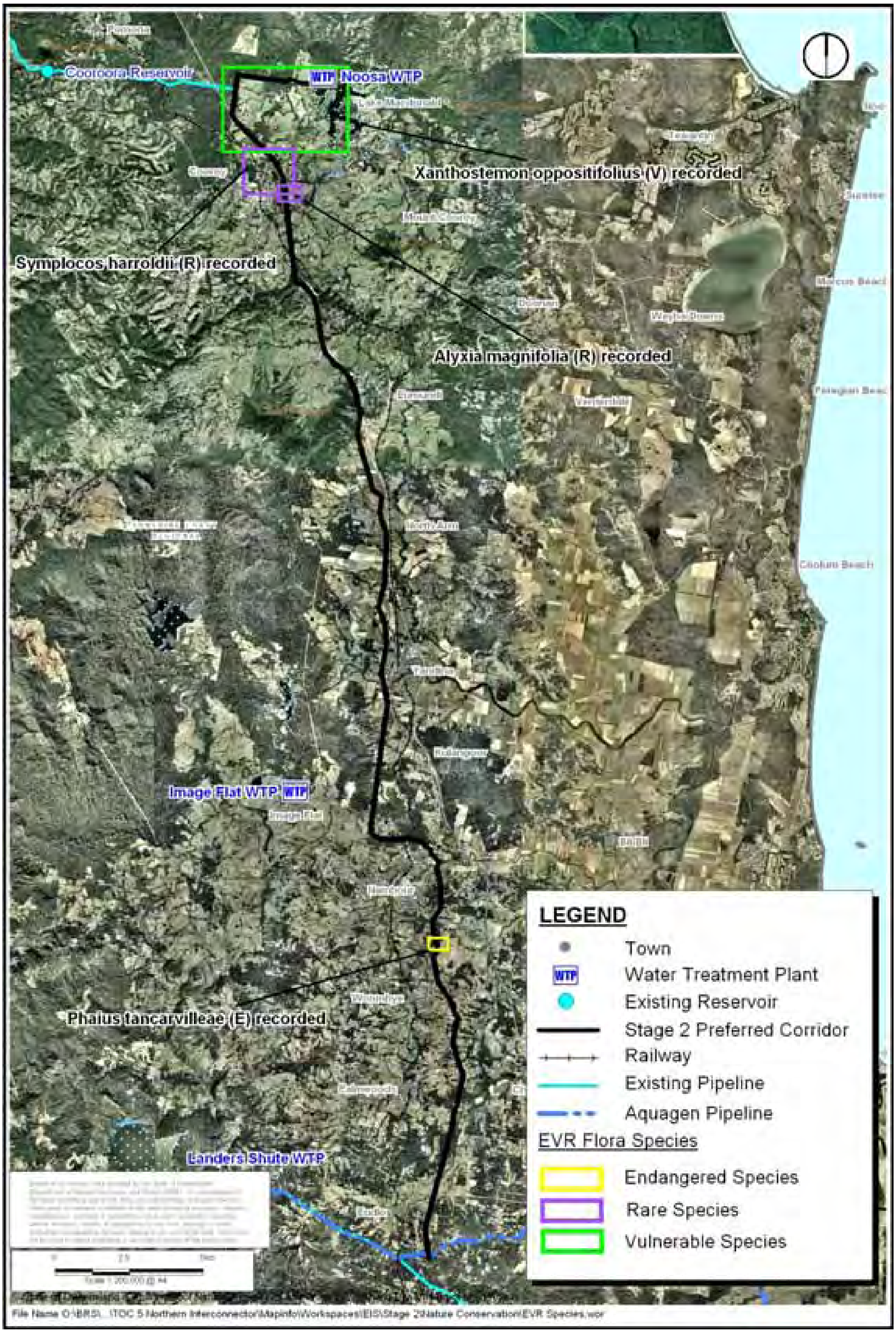

Figure 3.20
PROTECTED FLORA SPECIES

- a maximum corridor width of 40 m; and
- approximately 4 ha of clearing for the Ferntree balance tank.

Table 3.17 Estimated clearing areas of remnant vegetation

Regional ecosystem	Conservation status	Clearing area (ha)	% clearing of right of way (183.90 ha)	% clearing of SEQ bioregion 2003 remaining area
12.3.1	Endangered	2.15	1.17	0.02%
12.3.2	Of concern	3.94	2.14	0.05%
12.3.5	Not of concern	0.47	0.26	<0.01%
12.3.6	Not of concern	0.11	0.06	<0.01%
12.3.11	Of concern	0.29	0.16	<0.01%
12.9-10.1	Of concern	1.00	0.54	0.02%
12.9-10.14	Not of concern	3.14	1.71	0.02%
12.9-10.16	Of concern	0.57	0.31	<0.01%
12.9-10.17	Not of concern	0.91	0.49	<0.01%
12.11.2	Not of concern	0.01	0.005	<0.01%
12.11.10	Not of concern	0.31	0.17	<0.01%
12.12.2	Not of concern	0.02	0.01	<0.01%
12.12.12	Of concern	0.40	0.22	<0.01%
12.12.15	Not of concern	7.12	3.87	0.01%
12.12.16	Not of concern	Nil	Nil	0.00%
	Total	**20.43 ha**	**11.11 % of ROW**	

* *Source information: Accad et al. 2006,* Remnant vegetation in Queensland: Analysis of remnant vegetation 1997–1999–2000–-2001–2003, including regional ecosystem information, *Queensland Herbarium, Environmental Protection Agency, Brisbane.*

The primary residual impacts on terrestrial flora values associated with the NPI Stage 2 identified through this assessment are:

- clearing of remnant vegetation at the Ferntree balance tank site;
- clearing of remnant riparian vegetation along waterways; and
- damage to individual plants or suitable habitat for the EVR flora species listed in Table 3.17 above.

The mitigation strategies to be employed for the NPI Stage 2 project with respect to terrestrial flora values are discussed below. A separate discussion of the Ferntree balance tank site is provided at Section 3.3.5 of this EIS.

Specific Mitigation Measures

The following specific mitigation measures will be implemented to minimise impacts on terrestrial flora values in the study area:

- Riparian vegetation communities—crossing points will be located at areas of existing disturbance and the corridor clearing width minimised where intact communities are present. At Paynter Creek and Six Mile Creek, where particular flora values have been identified, additional investigations will be carried out to determine the most appropriate corridor and construction methodologies.
- *Phaius tancarvilleae* (Paynter Creek)—individual plants will be tagged and mapped to confirm the most appropriate final alignment. Where disturbance of individual plants is required, translocation plans will be prepared for submission to the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA). Translocation of individual plants will be undertaken by suitably qualified professionals in consultation with the Queensland Herbarium and/or plants will be propagated for use in revegetation of the corridor.
- *Alyxia magnifolia* (Cooroy)—final alignment of the pipe will be restricted to the western side of the power easement to avoid disturbance to this species. In the event that clearing is required, detailed survey will be undertaken to confirm the location of plants on the eastern side of the easement and translocation/propagation of individual plants will be undertaken by a qualified professional in consultation with the Queensland Herbarium.
- *Symplocos harroldii* (Cooroy)—clearing areas will be restricted adjacent to vegetation near Racehorse Lane.
- *Xanthostemon oppositifolius* (Six Mile Creek)—individual plants will be tagged and mapped to confirm the most appropriate final alignment. Where disturbance of individual plants is required, translocation plans will be prepared for submission to DEWHA. Translocation of individual plants will be undertaken by suitably qualified professionals in consultation with the Queensland Herbarium and/or plants will be propagated for use in revegetation of the corridor.

Where required, relocation of EVR species will be undertaken in accordance with the *Guidelines for Translocation of Threatened Plants in Australia* (Vallee et al. 2004).

General Mitigation Measures

The following general mitigation measures will be implemented to minimise impacts on terrestrial and riparian flora values in the study area:

- where possible, minimising the corridor width in localised areas of remnant vegetation or significant species' habitat;
- clearly designating boundaries within which clearing can occur prior to the commencement of construction activities. This would include on-site marking and geographic mapping of important remnant vegetation onto design drawings;
- preventing fires and controlling weeds at all stages of the project activities;
- sensitively locating all equipment, stockpiles, site offices and allied infrastructure well away from remnant vegetation;
- fully rehabilitating waterways at crossing points including erosion and sediment control measures during construction and immediately post construction;
- undertaking baseline monitoring to ensure compliance for post-construction assessment of conservation and rehabilitation efforts. This would include photographic detail to guide rehabilitation planting and post-construction photography to track growth rates and establishment of cover; and
- there will be an opportunity to source local seed stock and tube including site-specific indigenous species

Gaining of approval under the Queensland VMA will require compliance with the current Policy for Vegetation Management Offsets. Where vegetation offsets are required, the DIP will enter into an agreement to provide offset areas through the strategic acquisition of land for conservation purposes.

3.3.3 Terrestrial Fauna

Description of Environmental Values

Assessment Methodology

Terrestrial fauna species likely to occur in the study area were identified by searching the following databases:

- EPBC Online Protected Matters search (DEWHA); and
- Wildlife Online database (EPA).

These searches identified a total of 55 EVR fauna species and 16 migratory species with the potential to occur. These results were cross-referenced with species records obtained from the Queensland Museum and Birds Australia to determine a likelihood of occurrence within the study area. A review of essential habitat mapping (EPA) and available literature was subsequently undertaken to determine the habitat requirements of each species.

Preliminary habitat assessments were conducted by Biodiversity Assessment and Management (October and November 2007) and Queensland Fauna Consultancy (February 2008) (see Appendix H). Known habitat requirements for EVR fauna species were then compared with the results of this assessment to determine locations/species requiring further attention.

Preliminary assessments were followed up with more detailed mapping of vegetation communities and habitat types at sites of higher environmental significance (see Section 3.3.2). On the basis of these assessments, 13 terrestrial EVR fauna species are considered relevant to the NPI Stage 2 project and these are discussed under 'Protected Fauna Species' below.

The migratory species identified through the desktop study are highly mobile bird species that will not be significantly impacted by the NPI Stage 2 project. As such, they are not considered further in this assessment. All EVR and migratory species of national environmental significance (ie MNES) are discussed in Appendices K and D.

Landscape Connectivity

In highly fragmented landscapes, such as SEQ, wildlife corridors provide an important link between otherwise isolated habitat areas. These links can facilitate the colonisation of newly emerging habitats (ie regrowth vegetation) and support genetic diversity by allowing movement of individual animals between distinct populations of a species.

Many species recorded from these linear features are now of restricted distribution due to fragmentation of formerly widespread lowland forests. Three regionally significant corridors have been identified for the study area:

- Nambour Regional Corridor—this comprises relatively intact forested ridgelands and narrow valleys of state, regional and local significance, including Ferntree Creek National Park;
- Blackall Range Corridor—a series of local and regional corridors located north of the proposed North Maroochy River waterway crossing. The proposed alignment intercepts some of the corridors on the lower eastern-most slopes of the ranges; and
- Cooroy and Six Mile Creek corridors—a series of corridors of local, regional and state significance located close to or intersected by the

proposed terminus of the pipeline at Lake Macdonald in the Six Mile Creek catchment.

Habitat Types in the Study Area

The preferred corridor traverses a number of habitat types suited to a wide range of common native fauna. These habitats include:

- Melaleuca forest on alluvial plains, that buffer the effects of flooding, create specialist frog habitats and also provide seasonal forage for a wide range of wildlife;
- mature tall open eucalypt forests along ridge lines that blend into canopy species for understorey vine forests on slopes and in the gullies, creating habitats and movement corridors for a range of species;
- lowland freshwater creeks with seasonal meanders and temporary wetlands; and
- man-made farm dams and regional water supply reservoirs that support fringing vegetation providing habitat for amphibians and semi-aquatic bird species whose permanence and diversity depend upon the nature and frequency of disturbance.

Habitats that have a limited distribution or support more diverse or unique features have an associated potential to support less common fauna species and are considered of high conservation significance for the purposes of this EIS. Remnant habitat types of significance identified in this assessment are:

- narrow riparian gallery rainforests along waterways (RE 12.3.1), sometimes with eucalypt emergents (RE 12.3.2), which have been extensively cleared in the SEQ bioregion;
- reasonably sized patches of lowland gallery rainforest with a high diversity of plant species, many of which provide valuable forage resources for specialist fauna; and
- hillslope communities of the upper valleys and foothills of the Blackall Range.

These remaining areas are localised or fragmented; however, others retain a narrow but reasonably intact linear structure connecting areas across a wide geographic region. Such linear remnants typically reflect local physiographic features such as ridges, footslopes and waterways.

Regional Fauna Assemblages

A total of 184 terrestrial vertebrate species were recorded in regional databases for the project area. The distribution of these species across the major fauna groups is listed in Table 3.18.

Table 3.18 Database search results for major fauna groups

Group	Total recorded species
Amphibians	11
Reptiles	18
Birds	141
Mammals	14
Total number of species	**184**

The persistence of common fauna species in the fragmented landscapes of the study area typically reflects their ability to utilise a wide range of habitat types and forage in disturbed areas or along habitat edges. Common species are not specifically considered as part of this assessment; however, any measures adopted to mitigate impacts on vegetation communities and/or EVR species are also taken to benefit fauna in general.

Protected Fauna Species

On the basis of desktop investigations and habitat assessments conducted for this EIS, 13 EVR fauna species are considered relevant to the NPI Stage 2 project. The habitat requirements of these species and potential impacts are summarised in Table 3.19. Highly mobile EVR and migratory bird species which occur in the study area but are unlikely to be significantly impacted by the project are discussed in Appendix K.

Table 3.19 EVR fauna species relevant to the NPI Stage 2

Species	Status	Habitat and ecology	Potential impacts
Giant Barred Frog, *Mixophyes iteratus*	Endangered (EPBC, NCA)	Deep, slow-flowing creeks with overhanging banks in lowland vine forest and riparian gallery forest habitat. High potential to occur at waterways supporting RE 12.3.1 (see Figure 3.19) and to the south of the Ferntree balance tank site (see Section 3.3.5). Most movements are restricted to within 20 m of the stream. Breeding occurs in spring and summer, often on leaf litter near streams and ponds.	No significant impacts on populations of *M. iteratus* within the project area. Impacts on potential habitat expected to be localised and temporary. Minimal potential impacts associated of sediment release into waterways.
Tusked Frog, *Adelotus brevis*	Vulnerable (NCA)	Occurs in slow-flowing creeks and dams, often within riparian vine forest remnants, but utilises a wide range of habitats including disturbed/degraded areas. Associated with areas supporting gallery rainforest understorey, occurring in the study area as RE 12.3.1 and 12.3.2 (see Figure 3.19) and the Ferntree balance tank site (see Section 3.3.5). Breeding occurs between September and April, when males construct nests in concealed sites at the edge of pods or stream pools.	No significant impacts on populations of *A. brevis* within the project area. Temporary loss of existing habitat within the easement associated with clearing of vegetation. Potential impacts to water quality are expected to be localised.
Grey-headed Flying Fox, *Pteropus poliocephalus*	Vulnerable (EPBC)	A camping site for this species is located on the eastern side of the Bruce Highway. While this site will not be impacted, this species is likely to utilise a wide range of habitats in the study area for foraging including rainforests, open eucalypt forests and woodlands.	No direct impacts on populations of this species. Potential loss of intermittent food resources will be localised. No significant impacts expected for this species.
Koala, *Phascolarctos cinereus*	Vulnerable (NCA)	Uses a variety of trees for feeding, shelter and breeding purposes but are generally associated with open eucalypt habitat types in Queensland. Suitable habitat was recorded adjacent to waterways along the corridor (see Section 3.4) and a designated Koala conservation area is located near Cooroy.	No significant impacts on Koala populations within the project area. Potential impacts may include localised loss of food trees and temporary disruption to movement corridors.
Short-beaked Echidna, *Tachyglossus aculeatus*	Culturally significant (NCA)	Uses a wide range of habitat types and shelters in logs, crevices, burrows and leaf litter. Mating takes place in July and August, with juveniles seen from September. Suitable habitat recorded at the North Maroochy River (see Section 3.4).	No significant impacts on populations of *T. aculeatus.* Potential loss of burrows and sediment release into aquatic habitats associated with waterway crossings.
Platypus, *Ornithorhynchus anatinus*	Culturally significant (NCA)	Generally found in clearer water areas with sandy gravel to sandy silty bottom sediments that better suit foraging behaviour. Constructs stream bank burrows around slow-moving water. Mating season occurs around August in Queensland, with young weaned around 4-5 months after hatching. Suitable habitat recorded at the South Maroochy River, North Maroochy River and Six Mile Creek (left branch) (see Section 3.4).	No significant impacts on Platypus populations within the project area. Potential for disturbance to burrows and bank structure during waterway crossings is expected to be minimal.

Table 3.19 (continued)

Species	Status	Habitat and ecology	Potential impacts
Richmond Birdwing Butterfly, *Ornithoptera richmondia*	Vulnerable (NCA)	Associated with subtropical rainforest, littoral rainforest and gallery forest (RE 12.3.1) in upland and lowland areas. Occurs predominantly on volcanic soils where the larval food plants (*Pararistolochia praevenosa*) also occur. This species has been recorded within the Ferntree special investigation area (see Section 3.3.5).	No significant impacts on *O. richmondia* populations within the project area. Potential loss of suitable habitat in Ferntree area is expected to be minimal (if at all).
Elf Skink, *Eroticoscincus graciloides*	Rare (NCA)	Requires damp leaf litter, logs and stones for shelter and forages in shaded, moist environments. Breeding occurs spring–summer. This species is confirmed at the Petrie Creek crossing, with suitable habitat recorded in gullies at the Ferntree balance tank site (see Section 3.3.5) and other locations in the study area.	No significant impacts on *E. graciloides* populations within the project area. Potential disturbance of suitable habitat is expected to be temporary and localised.
Common Death Adder, *Acanthophis antarcticus*	Rare (NCA)	Uses a wide range of habitats, including rainforest, shrublands, heaths and woodlands. Requires undisturbed forested areas with heavy leaf litter substrate. Often associated with rocky outcrops and forested slopes at wet/dry sclerophyll forest ecotones, similar to that recorded at the western Ferntree balance tank site option (see Section 3.3.5).	No significant impacts on *A. antarcticus* populations within the project area. Potential loss of habitat for this species at the western balance tank site.
Coxen's Fig Parrot, *Cyclopsitta diophthalma coxeni*	Endangered (EPBC, NCA)	Uses lowland subtropical rainforest and dense canopy eucalypt forest habitat. Food resources include *Ficus* spp. and other native fruit and nectar-bearing trees and plants. Potential food resources are associated with remnant riparian vegetation (see Figure 3.19).	No significant impacts on populations of this species within the project area. Potential impacts would be limited to localised loss of isolated food resources.
Glossy Black Cockatoo, *Calyptorhynchus lathami lathami*	Vulnerable (NCA)	Requires large tree hollows for nesting (generally over-mature eucalypts). Preferred food resources are the cones of she-oaks (*Allocasuarina* spp.), particularly large-fruited varieties (eg *A. littoralis*, *A. cuninghamii*). Breeding occurs from March to August; with chicks fledging after 60 days. Potential food resources for this species have been recorded at the western Ferntree balance tank site (see Section 3.3.5). Large tree hollows have been recorded at both sites, although there were no confirmed sightings in this area during preliminary field survey.	No significant impacts on Glossy Black Cockatoo populations within the project area. Potential loss of food trees at the western balance tank site.
Lewin's Rail, *Rallus pectoralis*	Rare (NCA)	Nests and forages in swamplands, wet heaths and wet grass lands with dense vegetation. Forages a range of insects, crustaceans and plant matter. This species was recorded in riparian vegetation adjacent to the South Maroochy River (see Figure 3.19). Temporary disturbance to reed-beds during construction would represent only a minor impact for this mobile wetland species. No significant impact would result from the project.	No significant impacts on *R. pectoralis* populations within the project area. Potential impacts on habitat are expected to be temporary and localised,

Table 3.19 (continued)

Species	Status	Habitat and ecology	Potential impacts
Powerful Owl, *Ninox strenua*	Vulnerable (NCA)	Forages along the margins of dense wet sclerophyll forest along coastal uplands and hills. Requires large tracts of intact forest to support prey and breeding sites in hollow-bearing trees. Suitable foraging areas are associated with upland riparian areas (see Figure 3.19) with large tree hollows present at the Ferntree balance tank site (see Section 3.3.5). Potential for disturbance to hunting habitats and loss of large tree hollows at the Ferntree balance tank site.	No significant impacts on *N. strenua* populations within the project area. Potential impacts on foraging habitat associated with vegetation clearing.

Areas of high faunal significance are concentrated around riparian forests along major creeks and the Ferntree balance tank site. Of particular significance are the relatively intact, remnant riparian forests fringing Eudlo Creek, Paynter Creek, Tuckers Creek, South Maroochy River, North Maroochy River and Six Mile Creek. Smaller creeks with less consistent flow patterns and with more disturbed riparian fringing vegetation in which exotic vegetation species were more prominent were considered to be of lower faunal significance (see also Section 3.4).

Potential Impacts and Mitigation Measures

As described in Section 2, one of the key route selection criteria for the NPI Stage 2 was to avoid areas of environmental significance, including habitat for EVR species. Disturbance to habitats of conservation significance is minimised by locating the preferred corridor within existing cleared power easements. However, the following residual impacts on terrestrial fauna values may result from the NPI Stage 2 project:

- fragmentation of fringing riparian vegetation, which provides habitat for EVR fauna species listed in Table 3.20 and movement corridors between habitats;
- clearing in intact open eucalypt forest (RE 12.12.15) and wet sclerophyll forest (RE 12.12.15a) at the Ferntree balance tank site, which forms part of a regional wildlife corridor and provides potential habitat for a range of fauna, including the EVR species noted in Table 3.20;
- removal of mature native trees, including hollow-bearing trees which provide nesting and foraging resources for a range of fauna species;
- some loss of refuge areas for small ground-dwelling animals through clearing and construction works;
- temporary disturbance of dry-season fauna refuges, predominantly associated with creeks and dams;

- temporary disturbance to fauna movement through service corridors associated with clearing of regrowth vegetation in easements and road reserves;
- temporary barriers created by pipe trenches that may act as large pitfall traps for small reptiles, small mammals and domestic stock; and
- increased fauna mortality as a result of increased construction traffic, particularly in previously uncleared areas such as the Ferntree balance tank site.

A common outcome of the construction of linear infrastructure such as the proposed pipeline is the potential to cause loss of habitat or more frequently the fragmentation of previously intact or regionally connected linear habitats such as riverine associations. The outcomes of such disruptions can be far greater than the apparent minor loss of area of a particular vegetation association and its physical attributes. Effects include reductions in plant-specific food resources, loss of particularly suited shelters or breeding sites and the creation of barriers to safe movement along a distribution range for a regional faunal population.

However, unlike above ground linear infrastructure, pipelines are underground; thus most impacts occur during the construction period and seldom remain as longer term significant issues over the operational phase of projects such as proposed for the NPI.

With anticipated management practices, disturbance to regional ecological corridors will almost certainly be minimal. With appropriate attention to rehabilitation post construction, effects on the ecological functioning of intersected corridors should be transient and, in the medium to longer term, undetectable against those already imposed by existing infrastructure.

Specific Mitigation Measures

In addition to the measures outlined in the EMP, the following species-specific mitigation measures will be implemented to minimise impacts on terrestrial fauna values in the study area:

- Giant Barred Frog and Tusked Frog—impacts on these species have been minimised by selecting waterway crossing points at sites of greatest disturbance (see Section 3.4). Further detailed survey will be undertaken during breeding times (generally September–February) to confirm the presence/absence of these species in potential habitat areas identified through this assessment. Where this species is confirmed, construction of waterway crossings will be timed to avoid summer breeding times wherever possible.

- Elf Skink—fauna spotters will be employed prior to the commencement of clear and grade activities to undertake targeted survey for this species.
- Richmond Birdwing Butterfly—further survey will be undertaken at the Ferntree balance tank site to determine the location of any individual *Pararistolochia praevenosa* plants. These will be avoided where possible or relocated if appropriate. This species may also be propagated for use in revegetation at the site.
- Platypus—targeted survey will be undertaken prior to construction to identify the location of any burrows at sites identified through this assessment. Where the presence of this species is confirmed, sensitive area plans will be prepared to identify the most appropriate construction methodologies and timing.
- Glossy Black Cockatoo—further survey of the Ferntree balance tank site will be undertaken to determine whether this area is used by this species. If the presence of this species is confirmed, tree hollows will be retained on site where possible. *Allocasuarina* spp. may also be propagated for use in revegetation at the site.

General Mitigation Measures

Experience of the proponent with other regional pipeline projects (eg Southern Regional Water Pipeline) has provided valuable experience in predicting and managing environmental interactions. As is evident from preceding sections, this previous experience has been used to best effect in choosing the alignment and will carry through to advising upon supervision of residual clearing where needed. Management instructions and supervision guidelines have been included in the Fauna Management Plan. The intent of these inputs is to ensure construction and post-construction processes result in a stable, minimal maintenance outcome.

A short summary of likely environmental control procedures in a construction environmental management plan (CEMP) for the pipeline is contained in the PEMP at Appendix Q.

3.3.4 Aquatic Flora and Fauna

Description of Environmental Values

Assessment Methodology

Previous sections have described regionally significant habitat corridors, most of which are associated with riparian forests along major creeks and rivers. This section will describe existing aquatic environmental attributes of the rivers and creeks potentially affected by the NPI Stage 2 project.

Potential impacts of the NPI Stage 2 on aquatic habitat and their associated fauna assemblages that could arise include:

- disturbance from construction of waterway crossings; and
- longer term disruption from vegetation clearing near waterways.

Potential impacts on aquatic environments associated with water supply to the NPI Stage 2 pipeline have been assessed as part of this EIS in previous sections and at Appendix D. The current Stage 2 water supply strategy (ie transport of spare capacity water under existing entitlements) is not expected to cause significant adverse impacts on aquatic species or habitat as impacts are expected to be temporally and spatially restricted.

The NPI Stage 2 will transport water under existing entitlements for the Noosa Shire (authorised under the *Water Resource (Mary Basin) Plan 2006* (Mary Basin WRP)). NRW data shows that up to 55% or 3600 ML/a of this existing entitlement has been used by Noosa Shire in the past. No new entitlements to harvest water from the Mary River will be sought for the NPI Stage 2 project. Subsequently, no significant impacts are expected for aquatic species (ie Mary River Cod, Mary River Turtle and Lungfish) or critical habitat within the main channel of the Mary River.

As part of the impact minimisation process, aerial photographs were examined and databases were searched to provide a basic understanding of likely key aquatic habitats and potentially significant aquatic species that could be encountered in the study area. From this background information, field investigations were then undertaken to determine the present conditions at the nominated crossing points as well as compile descriptions of habitat features relevant to key species (see Hydrobiology Pty Ltd report in Appendix H).

A comprehensive assessment of the potential impacts on aquatic species protected under the EPBC Act is provided at Appendix D. The following sections discuss potential impacts on aquatic species and their habitat relative to waterway crossings.

Aquatic Habitats

A wide range of waterways will be crossed along the proposed pipeline route. All are lowland freshwater systems and many are permanent, supporting remnant riparian vegetation of varying ecological value (see Table 3.20). None of the proposed waterway crossings are within the coastal management district (CMD). Detailed descriptions of the major creek and river crossings including brief assessments of their principal ecological features are contained in Appendix L.

Table 3.20 Summary of the characteristics of significant waterways within the proposed pipeline corridor

Waterway	Waterway characteristics
South Maroochy River	Freshwater, steep banks, permanent, slow-flowing, rocky substrate, degraded riparian rainforest, potential significant habitat values, regional corridor values
North Maroochy River	Freshwater, permanent, slow-flowing, steep banks, extensive floodplain, degraded riparian rainforest, potential significant habitat values, regional corridor values
Six Mile Creek (left branch)	Freshwater, permanent, narrow shallow channel, significant intact riparian vegetation, significant species habitat and regional corridor values
Petrie Creek	Freshwater, permanent shallow water, narrow channel, narrow riparian zone, potential tidal influence on flood levels for severe storm events, potential for significant habitat values, regional corridor values
Paynter Creek	Freshwater, steep banks, permanent shallow water, narrow channel, endangered remnant vegetation (degraded), potential significant habitat values, regional corridor values
Running Creek, Steggalls Creek, Eudlo Creek	Freshwater, permanent but generally very low base flow, narrow shallow drainage line, narrow riparian zone with some remnant riparian vegetation, supports lesser regional or local corridor values

A large number of small ephemeral tributaries of all of the main creeks and rivers listed above are also intercepted by the pipeline. These have not been specifically listed as almost all have been cleared of their remnant riparian vegetation and have degraded poorly defined drainage pathways. The location of these tributaries is illustrated in Figure 3.22 (see Section 3.4 (Water Resources)).

Protected Species

Database searches identified five aquatic fauna species of conservation significance listed under the EPBC Act and the Queensland NCA. This included four fish species and one reptile. Within the project area, aquatic species of conservation significance (see Table 3.21) are restricted to Six Mile Creek, a waterway in upper south eastern headwaters of the Mary River catchment. No significant aquatic flora species were identified as part of the desktop or field surveys.

Preliminary field investigations of species were qualitative in nature with likely presence or absence being recorded. In some cases, further work will be required to undertake monitoring of populations of species of conservation significance during and after construction of the pipeline.

A number of EPBC-listed marine birds were listed as having the potential to occur within the study area. However, these species were observed overflying the area thus the proposed works would not disturb critical habitat for these species.

Reflecting the listing of species of particular conservation significance, aquatic habitat assessments were conducted for Six Mile Creek along the main channel, the left branch and the anabranch. These assessments were carried out to determine the likelihood of occurrence of significant aquatic species recorded in Six Mile Creek. Target species with potential to occur within the project area are listed in Table 3.21.

Table 3.21 Significant aquatic fauna potentially occurring within the study area

Species	EPBC status	NCA status
Mary River Cod, *Maccullochella peelii mariensis*	Endangered	–
Australian Lungfish, *Neoceratodus forsteri*	Vulnerable	–
Mary River Turtle, *Elusor macrurus*	Endangered	–
Oxleyan Pygmy Perch, *Nannoperca oxleyana*	Endangered	Vulnerable
Honey Blue-eye, *Pseudomugil mellis*	Endangered	Vulnerable

Table 3.22 describes the habitat characteristics of all branches of Six Mile Creek in proximity to the pipeline crossing locations, and provides an outline of the ecological importance of the main habitat features as relevant to the target species.

Flow rates of the main channel of Six Mile Creek are regulated by Lake Macdonald, with connection between pools being maintained by low base flows and sub-surface flow through the alluvial deposits of the stream bed. Pool habitat were noted with depths commonly exceeding 1 m.

Stream banks of Six Mile Creek are steep and generally well vegetated. The dam wall of Lake Macdonald presents a barrier to fish passage upstream as does the causeway immediately downstream.

Table 3.22 Habitat features of Six Mile Creek relevant to significant aquatic fauna and potential impacts

Habitat feature	Ecological relevance	Presence within Six Mile Creek at/adjacent to crossing locations
Fringing riparian vegetation	• Provides extensive stream shading, leaf litter, snag and tree root habitat • Oxleyan Pygmy Perch and Honey Blue-eye require leaf litter cover and acidic/tannin-stained water	**Left branch, anabranch and main channel** • Mature vegetation, typically less than 30 m wide • Some damage due to recent storm (December 2006) and some areas of this reach are exposed to higher levels of sunlight • Acidity of left branch and anabranch suitable for Oxleyan Pygmy Perch and Honey Blue-eye, less typical of preferred range downstream of spillway
Macrophyte growth	• Used by Lungfish for breeding and nursery areas—substantial cover required • Provide food sources for Mary River Turtle	**Left branch, anabranch and main channel** • Macrophyte growth is limited by riparian shading
Woody debris (in-stream)	• Used for shelter by some species and hollow logs assumed to be spawning sites for Cod	**Left branch and anabranch** • Woody debris present in left branch, less abundant in anabranch **Main channel** • Abundance of submerged large woody debris
Deep pools	• Important habitat for Cod, Lungfish	**Left branch and anabranch** • Dominated by shallow pools, no deep refugia pools **Main channel** • Deep pools (~ 2 m deep)

Table 3.22 (continued)

Habitat feature	Ecological relevance	Presence within Six Mile Creek at/adjacent to crossing locations
Riffle and run zones	• Important for maintaining connectivity between pools and tributaries, particularly during breeding times • Oxygenates water in adjacent pools • Habitat areas for juvenile turtles	**Left branch, anabranch and main channel** • Occasional riffle zones
Elevated base flows	• Required to trigger movement during breeding periods for Cod, Pygmy Perch and Lungfish • Required to inundate areas for Lungfish habitat	**Left branch, anabranch and main channel** • Occurs in all reaches
Stream bank morphology (ie undercut banks)	• Potential spawning sites for Cod and Lungfish • Sand banks required for turtle nest sites	**Left branch and anabranch** • Limited presence of undercut banks **Main channel** • Undercut banks present

Based on habitat assessments, the left branch and anabranch of Six Mile Creek are not representative of optimal habitat for any of the significant aquatic species relevant to this project (see Hydrobiology Pty Ltd's report in Appendix H). The key findings of the habitat assessments for Six Mile Creek left branch and anabranch (relevant to the crossing locations) are:

- It would be a non-preferred habitat for the Lungfish, Oxleyan Pygmy Perch and Honey Blue-eye due to lack of macrophyte cover.
- The acidity observed is below the tolerance range for the Lungfish.
- Adult Mary River Cod may move into these reaches during high flow events when pools of a suitable depth are present.
- The Oxleyan Pygmy Perch may use these reaches as suggested by the presence of leaf litter habitat and observed acidity within the tolerance range of the species (ie slightly wallum/tannin-stained).
- The Mary River Turtle may potentially use the habitat, but significant populations are unlikely to be supported in these reaches.

The Mary River Cod is known to occur in the main channel of Six Mile Creek, and due to the presence of deep pools, abundance of submerged woody debris and suitable water quality it is expected to occur throughout this reach (see Hydrobiology Pty Ltd's report in Appendix H). One adult Mary River Cod was sighted in the main channel during field investigations. The Mary River Turtle and Lungfish are likely to occur in the mid reaches of Six Mile Creek and to its confluence with the Mary River where deeper pools and riffle-run habitat is more suitable; both species may be occasional visitors to the upper reaches, particularly during high flow periods (see Appendix H). Although occurring in the left branch and anabranch, the Pygmy Perch and Honey Blue-eye are not likely to occur within the main channel, as habitat requirements are not present (eg slightly acidic water, macrophyte cover).

Aquatic Pest Species

A number of significant terrestrial and aquatic weed species were identified through the *Maroochy Pest Management Plan 2006–10* as potentially occurring along the alignment, and a number of these species were identified during flora survey (see Table K.2 in Appendix K).

A number of aquatic weeds were recorded during field survey. Of these, *Cabomba* (*Cabomba caroliniana*) is an aggressive weed which invades nutrient-rich freshwater systems and can rapidly dominate native vegetation and obstruct creeks, lakes and dams. Regeneration by seed has not been observed in Australia where new growth starts from dislodged stem pieces (NRW 2006). *Cabomba* is a significant problem in Lake Macdonald and Six Mile Creek, particularly where riparian vegetation has been disturbed. Disturbed areas provide higher light conditions at the water surface and therefore more favourable conditions for the establishment and growth of *Cabomba* (Jeff Black, Noosa Shire, pers comm.).

Other aquatic pest weeds recorded during the field survey include *Salvinia* (*Salvinia molesta*), water hyacinth (*Eichornia crassipes*) and *Hygrophila* (*Hygrophila costata*).

Cane Toads

Cane toads (*Bufo marinus*) were the most common terrestrial vertebrate pest species recorded along the alignment. They occurred wherever suitable habitat was present (well-lit pools and slow-flowing creeks with limited riparian vegetation) but are less likely to occur in cool well-shaded creeks where preferred forage species are less common. Other pest species included escaped domestic animals (dogs, cats, pigs) and exotic birds.

The introduced Mosquito Fish (*Gambusia holbrokii*) is known from a number of streams in the project area. This species is known to eat native frog eggs and tadpoles and is considered to contribute to the decline of frog species, particularly in modified waterways (NPWS 2003). *G. holbrokii* is recognised as a threatening influence for the Tusked Frog (*Adelotus brevis*). The eggs of the Giant Barred Frog (*Mixophyes iteratus*) will not be impacted by the presence of Mosquito Fish as its eggs are found on rocks, leaves and grasses above the waterline.

Mosquitoes

Freshwater habitats also provide a range of breeding opportunities for mosquitoes of public health importance. Generally, mosquitoes from the genera *Culex* and *Coquillettidia* deposit egg rafts containing up to hundreds of eggs while members of the genera *Ochlerotatus* and *Anopheles* lay individual eggs close to a water source. Once eggs have hatched, larvae progress through a number of immature stages and emerge as adults in as little as 5–6 days. Given the speed at which mosquitoes can colonise and reproduce, large numbers of mosquitoes may be sourced from suitable freshwater habitats, potentially posing a risk of transmission of mosquito borne diseases such as dengue fever to surrounding human populations.

Potential Impacts and Measures

Specific Mitigation Measures

Mitigation strategies specific to aquatic habitats include:

- using a constrained corridor (less than 30 m) when working within the bed of a waterway;

- stockpiling soils in floodplain areas well clear of the waterway to minimise the potential for sediment release to waterways and provide additional control measures (eg silt fences, diversion drainage);
- minimising the time of obstruction of waterways, maintaining flows by using diversion pipelines and obtaining permits under the *Fisheries Act 1994* for waterway barrier works, as appropriate;
- reinstating waterway banks as close as possible to their original condition to avoid altering stream hydrology as soon as possible upon completion of the construction program; and
- implementing a pest species and weed management plan to limit the spread of aquatic pest species to new systems.

Waterway Crossings

Potential construction-linked impacts of the pipeline on aquatic environments will be mainly associated with waterway crossings, and may result from changes to channel morphology and/or water quality.

There are three main methods for crossing waterways: excavating and laying pipe through the bed of the waterway (trenching); raising the pipe on a structure above the channel (piling or span bridging); or tunnelling under the stream bed (by microtunnel or thrust bore). Trenching is the preferred method for crossing.

The potential impacts of waterway crossings associated with trenching are summarised in Table 3.23.

Table 3.23 Potential impacts of trenching on aquatic environments

Construction method	Potential impacts
Trenching	▪ Direct loss of structural habitat features such as macrophytes and snags. ▪ Indirect changes to physico-chemical habitat features, such as water temperature, dissolved oxygen etc. as a result of disturbance to riparian vegetation. ▪ Increased turbidity or smothering of downstream habitats after the completion of works due to destabilisation of the bed of the waterway resulting in increased mobilisation of sediments. ▪ The creation of temporary barriers across flowing waterways with the potential to block the passage of fish through the system. ▪ Introduction and spread of aquatic pest species. ▪ Potential for pollution or degradation of waterways associated with poor management of refuelling or other activities that may result in spills on or immediately adjacent to the waterway.

Aquatic Pest Species

The project has developed a weed and disease management plan and a fauna management plan in consultation with the EPA and local government authorities. Together these plans will assist to manage weed and pest species. The project will use external specialists to undertake pre-construction surveys to identify existing weed and pest species along the alignment and to make recommendations for their management. A map of the location of declared pest plants along the alignment will be included in the weed and disease management plan. The management plans have been developed in accordance with the *Maroochy Pest Management Plan 2006–10*.

Mosquitoes

Of particular relevance to Stage 2 of the NPI is the potential for the creation of habitats suitable for mosquito breeding. This would primarily occur during the construction and operational phases of the project. However, given the prevalence of mosquitoes within the natural environment, it is unlikely that the project would significantly contribute to these populations provided no significant new breeding habitat is created during the construction program.

In the event that control of natural or unnatural breeding populations of mosquitoes is required, a number of strategies are available. Currently, the treatment of larval mosquito habitats with insecticides is the preferred method of control in freshwater systems in Australia. Insecticides of choice include an insect growth regulator and microbial insecticides. These insecticides generally result in acceptable, short-term environmental impacts. Any control program would require the development of a mosquito mitigation strategy to fully understand the natural and potential breeding conditions for particular species.

These, and other relevant mitigation measures, will be incorporated into a project-specific waterway crossings management plan (to be incorporated into the overall EMP) for implementation during construction. Sensitive area plans will also be prepared where the presence of significant aquatic species is confirmed.

3.3.5 Ferntree Special Investigation Area

The Ferntree special investigation area (see Figure 3.21) is located to the north of Duhs Road, Nambour, and encompasses both proposed balance tank site options (see Section 2.4.3) and two alternative corridor options (see Section 2.1). This investigation area was identified through desktop assessment and preliminary field survey as having potentially high environmental values and was flagged for further environmental investigation.

Stage 2 requires the construction of a balance tank with a 5 ML capacity, however, the selected balance tank site must be able to accommodate infrastructure requirements associated with future bulk water sources (see Section 2.4.3). It is acknowledged that in selecting the Stage 2 balance tank site, future infrastructure would be co-located at this site.

Figure 3.21 shows the locations of the eastern and western balance tank site options, and the two corridor options for the Ferntree investigation area. Currently, the Stage 2 corridor (western corridor option) follows the existing easement through the west of the investigation area, and the eastern corridor option traverses through Ferntree Creek National Park and adjacent to the existing rail corridor.

Assessment Methodology

Initially, a desktop assessment was completed to identify potential important habitat features and EVR species which may potentially occur within the Ferntree special investigation area.

Following on from the desktop assessment, preliminary field investigations were undertaken to determine the environmental values and constraints of the investigation area. Preliminary field investigations included:

- general foot traverse recording remnant vegetation types present;
- identification of habitat features within the investigation area;
- identification of environmental constraints; and
- targeted investigation of sensitive areas within the investigation area (ie waterways, Ferntree Creek National Park, regional ecosystems with high potential for EVR species).

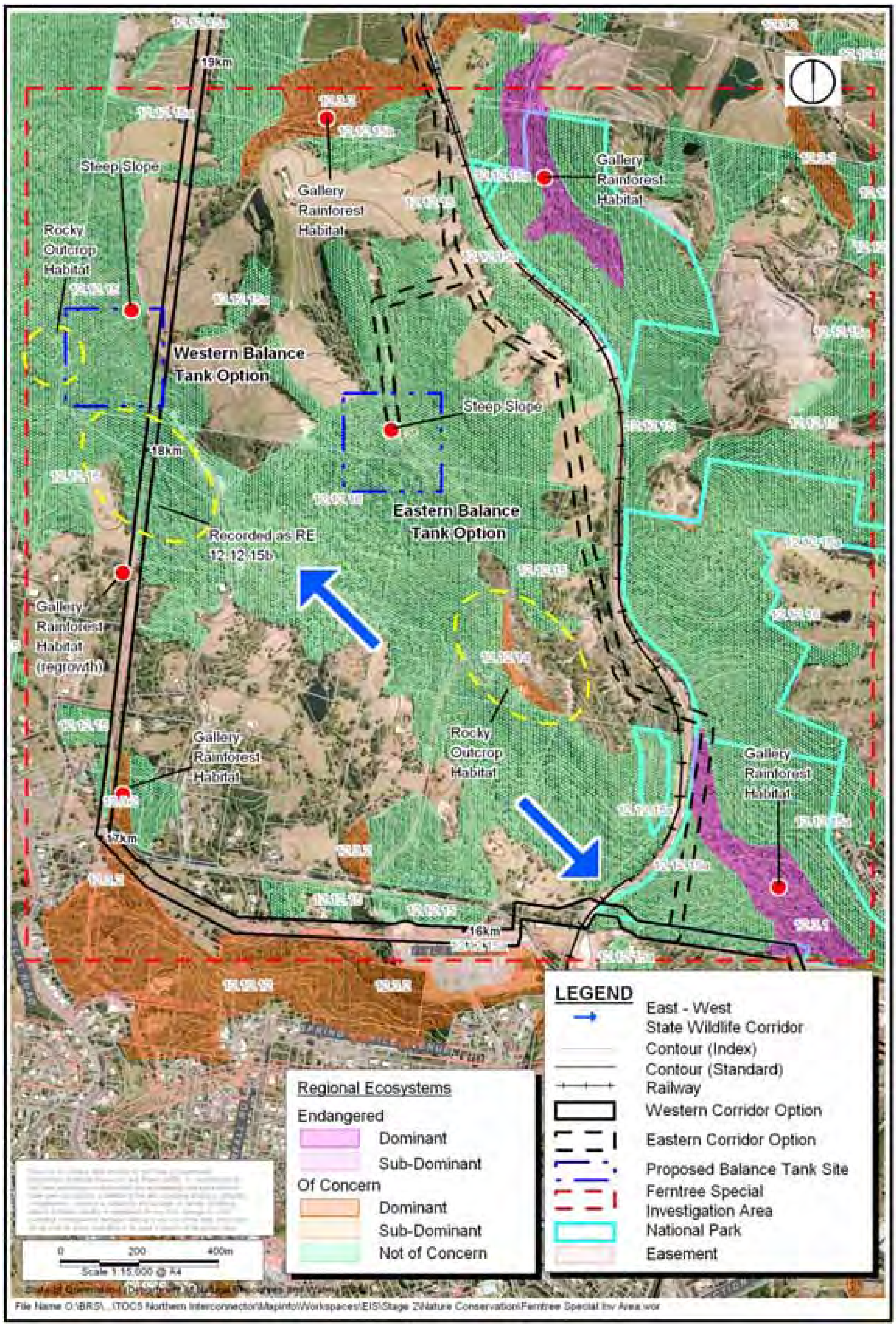

FIGURE 3.21
FERNTREE SPECIAL INVESTIGATION AREA

Information collected during preliminary field investigations will be used to comparatively assess the potential impacts associated with the proposed balance tank sites and corridor options (see Table 3.26). The key criteria used to assess the potential impacts are:

- potential impacts on wildlife corridors;
- estimated extent of clearing of remnant vegetation;
- potential impacts on EVR species habitat;
- potential impacts on waterways; and
- soil erosion potential.

Information presented in this assessment represents an early stage of knowledge at this investigation area, and further detailed investigations may be required to confirm the ecological values discussed below.

Site Description

This section outlines the findings of the desktop assessment and preliminary field investigations for the Ferntree investigation area. Further, Figure 3.21 highlights the key habitat features and environmental constraints for the investigation area which are discussed in further detail below.

Regional Ecosystem Types

The key RE types mapped for the Ferntree investigation area are listed in Table 3.24. The desktop assessment indicated potential habitat for a number of EVR rainforest plant species within areas mapped as RE 12.12.16 (notophyll vine forest). However, during field investigations these areas were confirmed as tall eucalypt forest (RE 12.12.15 or associated major communities), and are not expected to support significant populations of EVR flora species.

The dominant RE types recorded were tall eucalypt forest RE 12.12.15, including the lower slope and gully variants, and riparian gallery rainforest communities RE 12.3.1 and 12.3.2. Intact areas of RE 12.3.1 are typically restricted to the Ferntree Creek National Park, although regrowth of this RE was recorded along a waterway south of the proposed balance tank sites. These riparian communities provide local corridors for wildlife movement and are likely to be important habitat for flora and fauna species within the investigation area. Further investigation may be required to identify EVR flora species within the investigation area.

Table 3.24 Regional ecosystems mapped for the Ferntree special investigation area

RE type	Description	Occurrence
12.3.1	Gallery rainforest (or vine forest) on alluvial plains	Occurs along drainage lines in Ferntree Creek National Park and as regrowth along a waterway south of balance tank options
12.3.2	Gallery rainforest on alluvial plains with eucalypt emergents	Occurs along drainage lines within the Ferntree special investigation area, and within Ferntree Creek National Park
12.12.2	*Eucalyptus pilularis* tall open forest on Mesozoic to Proterozoic igneous rocks especially granite	Not recorded during field survey
12.12.15	*Eucalyptus propinqua, E. siderophloia, Corymbia intermedia* on Mesozoic to Proterozoic igneous rocks	RE 12.12.15 occurs on ridgelines, with variants RE 12.12.15a and RE 12.12.15b (wet sclerophyll) occurring on lower slopes and in gullies
12.12.16	Notophyll vine forest on Mesozoic to Proterozoic igneous rocks	Characteristic species include *Araucaria spp.* and *Argyrodendron* spp. and others, none of which were recorded during field survey. Mapped areas of this RE were typically recorded as RE 12.12.15a or RE 12.12.15b

Habitat Features

The investigation area supports a range of habitat types, including habitats that have a limited distribution or are associated with less common fauna species. Important habitat types:

- tall open eucalypt forests and rocky outcrops on ridgelines and upper slopes; and
- riparian gallery rainforest, sometimes with eucalypt emergents fringing waterways.

The Nambour Regional Corridor extends through the investigation area (east-west) and is comprised of relatively intact remnant vegetation, including forested ridges, slopes and gullies and enables the movement of fauna between habitat areas within the region.

Protected Fauna Species

From desktop and field investigations, several EVR fauna species have been identified as potentially occurring within the investigation area. Table 3.25 lists the EVR species and the habitat types and features within the investigation area that they are likely to be associated with. Further field investigation may be required to confirm the presence/absence of EVR species.

Table 3.25 EVR fauna species and potential habitat within the Ferntree special investigation area

Species	Associated habitat within the Ferntree investigation area
Giant Barred Frog, *Mixophyes iteratus*	Gallery rainforest and regrowth (RE 12.3.1/12.3.2) recorded along some waterways within the Ferntree investigation area. Potential for Giant Barred Frog to occur in waterways south of the balance tank sites.
Tusked Frog, *Adelotus brevis*	Vegetation communities supporting vine forest understorey (RE 12.3.1/12.3.2). This species occurs in slow-flowing creeks and dams. Potential for Tusked Frog to occur in waterways south of the balance tank sites.
Richmond Birdwing Butterfly, *Ornithoptera richmondia*	Littoral rainforest and gallery forest (RE 12.3.1) in upland and lowland areas. Potential for Richmond Birdwing Butterfly and larval food plant to occur on lower slopes, in gullies and in riparian vegetation communities.
Elf Skink, *Eroticoscincus graciloides*	Vegetation communities with damp leaf litter layer, logs and stones for shelter. Potential habitat for the Elf Skink to occur in gullies within the Ferntree special investigation area.
Common Death Adder, *Acanthophis antarcticus*	Utilises a wide range of habitats including rainforest and forested areas with a dense leaf litter layer, to rocky outcrops at wet/dry forest ecotones. Similar habitat has been recorded at the western balance tank site and along some ridgelines within the investigation area.
Glossy Black Cockatoo, *Calyptorhynchus lathami lathami*	Species feeds on the cones of she-oaks (*Allocasuarina spp.*), particularly the large-fruited varieties (eg *A. littoralis, A. cunninghamii*) Potential food resources recorded at the western balance tank site.
Powerful Owl, *Ninox strenua*	Forages along the margins of dense wet sclerophyll forest, requiring large areas of intact vegetation to support prey. The large areas of intact vegetation within the investigation area may provide foraging habitat for the Powerful Owl.

Site Impact Assessment

Based on the results of the preliminary investigations, the potential impacts associated with the balance tank site options and corridor options are discussed below. Table 3.26 summarises the potential impacts associated with the balance tank and corridor options.

Table 3.26 Ferntree special investigation area impact assessment

Balance tank option/ corridor route	Impact assessment
Western balance tank option	• Clearing of intact vegetation within the wildlife corridor—no utilisation of existing disturbed areas • Larger estimated vegetation clearing footprint compared with the eastern site option • High potential for disturbance to EVR species habitat in waterways and wetter gullies • Greater potential for erosion compared to the eastern site option due to steep cross-slopes
Eastern balance tank option	• Maximises use of existing disturbed areas within the wildlife corridor—although some clearing of intact vegetation will be required • Smaller estimated vegetation clearing footprint compared with the western site option • Moderate–high potential for disturbance to EVR species habitat in waterways and wetter gullies • High erosion potential due to steep cross-slopes—smaller erosion potential compared to the western site option
Western corridor route	• Clearing footprint estimated to be marginally higher as existing easement requires widening (low power lines) • Low impact on Ferntree Creek National Park. No clearing of intact 'endangered' gallery rainforest (RE 12.3.1) • Low potential for impacts on EVR species/habitat • Low impact on waterways—10 of the 11 waterway crossings are located in existing disturbed areas • High erosion potential and steep cross-slopes
Eastern corridor route	• Clearing footprint is marginally smaller compared with the western corridor route • Greater impact on Ferntree Creek National Park. Clearing of endangered gallery rainforest (RE 12.3.1) within the National Park • High potential for impacts on EVR species/habitat • High impacts on waterways—none of the 12 waterway crossings are located within easement, and 8 have remnant riparian vegetation • High erosion potential

Western Balance Tank Site Option

This option is likely to require clearing of intact remnant vegetation which forms part of the Nambour Regional wildlife corridor. The presence of steep cross-slopes at the balance tank site (see Figure 3.21) is also likely to increase the vegetation clearing and earthworks footprints.

Further, the construction of a balance tank at this site is likely to have a greater impact on EVR species compared to the eastern balance tank site option. Rocky outcrop habitat recorded at the balance tank site, and gullies and waterways directly to the south of the site are potential EVR habitat areas. Vegetation clearing, earthworks and sediment erosion associated with the construction of a balance tank at the western site option may potentially remove or disturb these important habitat types.

Eastern Balance Tank Site Option

The eastern balance tank site option is likely to have a smaller vegetation clearing footprint as some vegetation at the site has been previously cleared or disturbed. Location of the balance tank along the ridgeline (opposed to on the slope for the western site option) will potentially reduce the earthworks and clearing footprints associated with this option.

Potential impacts for EVR species and/or habitat may occur if sediment is transported down the slope and into surrounding waterways or drainage lines. However, the erosion potential for this option is significantly less compared to the western option as less vegetation will be cleared and significant earthworks on the slopes are not likely to be required.

Western Corridor Option

The estimated clearing footprint for this option is expected to be marginally larger than for the eastern option as the existing easement will need to be widened due to low powerlines within the easement.

Although the clearing footprint is likely to be larger, the western option avoids clearing of intact 'endangered' gallery rainforest (RE 12.3.1) within the National Park. Some clearing of vegetation within the National Park is expected; however, during field investigations the area to be cleared was recorded as disturbed vegetation due to the presence of weedy species and an existing cleared access track.

This corridor option maximises the use of existing cleared or disturbed areas and the impacts on EVR species and habitat are expected to be minimal as a result. Any potential impacts on EVR species and habitat will typically occur where vegetation clearing is required to widen the existing easement.

Eastern Corridor Option

Unlike the western option, the eastern option does not utilise existing cleared easements, although the route does make use of some existing cleared/disturbed areas on the western side of the railway corridor. The clearing footprint associated with this corridor is likely to be smaller than the western corridor, however the potential impacts on EVR species and habitat are likely to be greater compared to the western corridor.

This corridor option will require the clearing of intact 'endangered' gallery rainforest habitat (RE 12.3.1) within the National Park. Clearing of this vegetation may remove or disturb important EVR species habitat, and may potentially dissect the wildlife corridor and restrict the movement of wildlife between habitat areas in the region.

This corridor option is also likely to have a greater impact on waterways and riparian vegetation as all of the waterway crossings are located outside of existing easement. Most of the crossing points are located within remnant riparian vegetation, and the removal of this vegetation may be expected to have adverse impacts on terrestrial and aquatic habitat for EVR species such as the Tusked Frog or Giant Barred Frog.

Conclusion—Ferntree Special Investigation Area

The environmental information provided in the above sections will be considered in the selection of the final balance tank site and corridor route. Environmental values and constraints will be considered along with a number of other construction, social, engineering and cost factors in selecting the most appropriate balance tank site and corridor route for the Ferntree investigation area. The criteria that will be adopted are:

- minimise the number of affected landholders where possible;
- avoid or minimise the impact on areas of environmental significance such as intact remnant vegetation or habitat for rare and threatened species;
- minimise the visual impact of the project;
- minimise the potential for disruption to residents and the community during construction (such as air, noise and vibration impacts and access restrictions);
- minimise the earthworks required for construction; and
- minimise construction/operational costs.

Further environmental investigation may be required at the Ferntree investigation area to provide additional information regarding the balance tank and corridor route options.

3.3.6 Nature Conservation Conclusion

The proposed route of the pipeline is a significant item of linear infrastructure commencing at Eudlo in the south to the proposed terminus at the water treatment plant at Lake Macdonald in the north. In the near future, this pipeline will also form a central section of the connection transferring water from the proposed Traveston Crossing Dam on the Mary River, approximately 60 km north of Lake Macdonald, to consumers in the greater Brisbane region.

In the course of passage through this central section, a large number of small tributaries, larger creeks and rivers in their freshwater reaches are crossed. These waterways include several of high conservation significance. Their significance not only reflects their characteristics as waterways but also as the sites of significant fauna corridors through the landscape. These values are supported by the higher diversity of plant species within the riparian vegetation remaining on the banks and floodplains. All of these features are remnants of former widespread regional vegetation that have been cleared as part of development of agriculture and human settlement of the Sunshine Coast regional hinterland.

By deliberate choice, the pipeline has avoided, wherever possible, remaining stands of significant vegetation and followed previously cleared powerline and road corridors through these sensitive areas. Where some disturbance of more intact and/or regrowth vegetation is unavoidable, detailed management plans and minimal disturbance construction procedures will be developed together with local-scale detail on the final positioning of the pipeline. Similar detail design will apply for control structures associated with pipeline operations.

A major feature of a pipeline, compared with other types of linear infrastructure, is that it will be located underground, enabling regrowth over most the disturbed area. Some control structures will still be surface features but these are well separated and comprise small isolated items such as air valves and water scour valves.

Overall, some small losses will occur to the regional attributes but over a relatively short time (less than 5 years) the greater part of these losses will re-establish and existing attributes will be maintained. The information collected for this appraisal has also added to the body of knowledge of the regional environment and, through application in projects such as this, contributed to improved management of regional resources.

3.4 Water Resources

Surface Waters in the Study Area

The NPI Stage 2 corridor traverses the freshwater section of the Maroochy River catchment and the south-eastern headwaters of the Mary River catchment within the Six Mile Creek sub-catchment. Sub-catchments within the Maroochy River system have been defined by the former Maroochy Shire waterways monitoring program (Webb et al. 2008) and those traversed by NPI Stage 2 (from north to south) are as follows: the North Maroochy River, South Maroochy River, Upper Maroochy Estuary, Petrie Creek, Paynter Creek and Eudlo Creek.

The NPI Stage 2 project requires the construction of the pipeline across a number of rivers and creeks in both catchments. All surface waterways to be crossed by the pipeline are lowland freshwaters (larger slow-flowing freshwater streams and rivers below 150 m altitude) as defined by the EPP (Water).

Figure 3.22 shows the Maroochy and Mary River catchments, sub-catchments and waterways in relation to the NPI Stage 2 corridor. This figure also shows the extent of the coastal management district (CMD) as defined by the EPA under the *Coastal Protection and Management Act 1995*. None of the proposed creek or river crossings are located within the boundaries of the CMD or have any tidal vegetation associations.

Under the currently proposed water supply strategy, described in Section 2, no new water entitlements will be sought for NPI Stage 2. The project will be supplied water under an existing utilised allocation (up to 55% or 3600 ML/a has been used by the Noosa Shire in the past) owned by the SEQ Grid Manager.

As only existing utilised entitlements will be utilised, there are no new or additional anticipated impacts from the project on significant species in the Mary River. As a result the Mary River is not discussed in this section; however, information about the Mary River catchment (eg water quality objectives) is discussed where relevant.

3.4.1 Description of Environmental Values

Waterway Crossings Assessment Methodology

Individual waterways and their catchments and existing surface drainage patterns were assessed through a review of available literature and GIS data sets, followed by field surveys of key crossing locations.

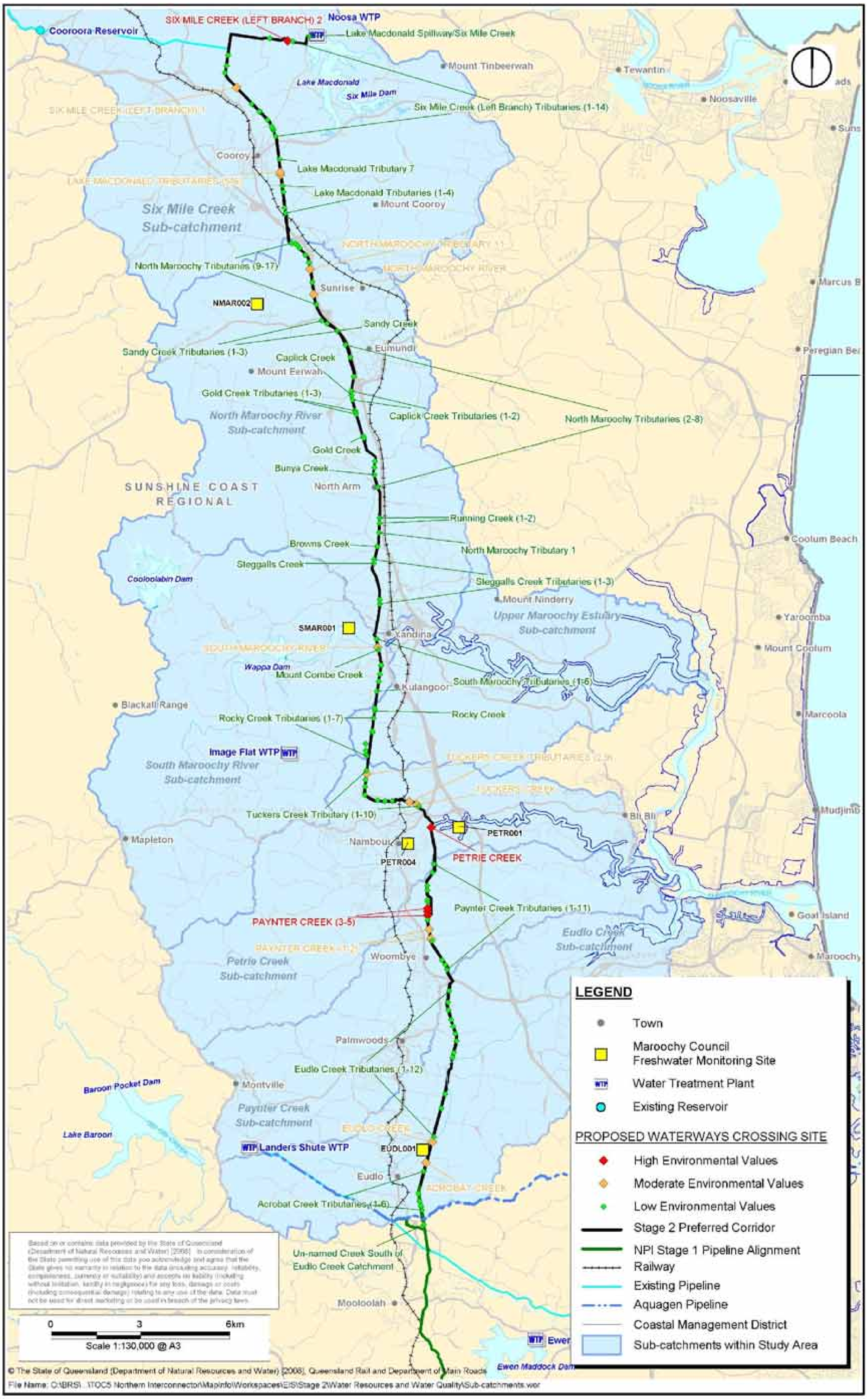

Figure 3.22
SURFACE WATERS IN THE STUDY AREA

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The information compiled from a review of literature included nutrient status, physical and chemical status, aquatic processes, in-stream biota and habitat characteristics for key waterways affected by the pipeline. Field information consisted of physical characteristics including channel and stream width, depth, flow and erosion potential together with habitat characteristics including riparian vegetation and significant species. Details of bank structure and integrity were also gathered. This information has been used to rank the significance of waterways and to undertake the assessment of potential impacts to the hydraulic and water quality features of these systems.

A list of all the waterway crossings intersected along the corridor and a ranking of environmental values at each is shown in Table 3.27. The criteria defining the ranking categories, ie low, moderate and high environmental values, are listed below, and an example photograph of each is shown in Figure 3.23.

Low environmental values:

- within an existing cleared easement or cleared at crossing point;
- no significant environmental features that may be impacted by trenching (eg significant species, 'endangered' or 'of concern' regional ecosystem (RE)); and
- low stream order (less than 3).

Moderate environmental values:

- within an existing cleared easement but retaining some intact riparian vegetation at and/or adjacent to the crossing point or not within an existing easement and supporting some intact riparian vegetation;
- 'endangered' or 'of concern' RE at or adjacent to crossing point or other environmental features which may be impacted by trenching (eg significant species); and
- moderate stream order (3 or greater).

High environmental values:

- not within an existing cleared easement;
- crossing point supports intact riparian vegetation;
- 'endangered' or 'of concern' RE at or adjacent to the crossing point;
- other environmental features that may be impacted by trenching (eg significant species); and
- moderate to high stream order (3 or greater).

Low environmental values:

Browns Creek is an example of a waterway with low environmental values. It is cleared at the crossing point and disturbed by an existing road.

Moderate environmental values:

Paynter Creek (southern crossing) is an example of a waterway with moderate environmental values. Note the break in riparian canopy through the easement. Regrowth is slowly occurring under a cover of woody weeds.

High environmental values:

Petrie Creek is an example of a crossing with high environmental values.
Left photo: The creek and the weedy regrowth on the south bank.
Right photo: The degraded RE 12.3.1 vegetation on the north bank, which provides habitat values.

Figure 3.23
EXAMPLE CROSSING LOCATIONS

Table 3.27 Summary of waterways crossings along Stage 2 NPI

Sub-catchment	Low environmental values	Moderate environmental values	High environmental values
Six-Mile Creek	Five tributaries of Lake Macdonald, fourteen tributaries of Six Mile Creek (left branch), Six Mile Creek at the Lake Macdonald Spillway	Two tributaries of Lake Macdonald and Six Mile Creek (left branch) (southern crossing)	Six Mile Creek (left branch) (northern crossing)
North Maroochy River	Steggalls Creek and three of its tributaries, Browns Creek, a tributary of North Maroochy River, Running Creek (two crossings), Bunya Creek, Gold Creek and three of its tributaries, six tributaries of North Maroochy River, Caplick Creek and two of its tributaries, Sandy Creek and three of its tributaries and seven tributaries of North Maroochy River	North Maroochy River and one tributary of North Maroochy River	None
South Maroochy River	Mount Combe Creek and six tributaries of South Maroochy River	South Maroochy River	None
Upper Maroochy Estuary	Seven tributaries of Rocky Creek and Rocky Creek	None	None
Petrie Creek	Ten tributaries of Tuckers Creek	Tuckers Creek and two tributaries of Tuckers Creek	Petrie Creek
Paynter Creek*	Eleven tributaries of Paynter Creek	Paynter Creek (two southern crossings)	Paynter Creek (three northern crossings)*
Eudlo Creek	Un-named creek south of Eudlo Creek sub-catchment, six tributaries of Acrobat Creek, twelve tributaries of Eudlo Creek	Acrobat Creek and Eudlo Creek	None
South of Eudlo Creek	Un-named creek south of Eudlo Creek sub-catchment		

* *The above table and following information describes the three northern crossings of Paynter Creek within the existing easement. The corridor in this section has not been fixed pending further investigation.*

As shown in Table 3.27, most waterway crossing points have low environmental values. Consequently, most waterway crossings did not need further field investigation. Field investigations were only undertaken at waterway crossing points that were classed as having moderate or high environmental values.

The findings of the waterway crossing assessments are summarised in this EIS and discussed in greater detail at Appendix L. Aquatic and riparian flora and fauna values are addressed in Section 3.3 (Nature Conservation), and only relevant extracts of this information are referred to in this section.
As listed in Table 3.27, three creek crossings along the NPI Stage 2 route were identified as areas of high environmental value requiring detailed assessment and specific planning to mitigate and minimise impacts associated with placement of the pipeline.

The key characteristics of waterways of moderate and high environmental values at the point of the proposed pipeline crossing, and recommendations for their management, are briefly described in Tables 3.28 and 3.29 respectively. Greater detail is provided in Appendix L.

Table 3.28 Description of crossings through areas of moderate environmental values

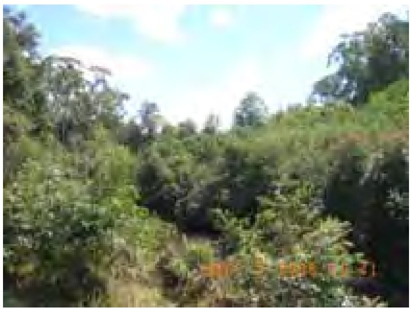
Waterway at crossing point	Summary of issues and proposed management
SIX MILE CREEK SUB-CATCHMENT	
 Six Mile Creek (left branch) (southern crossing)	Located within power line easement, the crossing point supports disturbed vegetation with weed infestations, and cattle graze to the water's edge on the western bank. Erosion potential is moderate due to steep banks. Intact RE 12.3.2/12.3.1 is present either side of the crossing. The stream is approximately 9 m wide and slow flowing. Significant species have not been detected; however, a number of significant fish species may potentially occur, as well as the Platypus (see Section 3.3.4 of Nature Conservation and Appendix D). The general mitigation measures discussed below will be applied with specific strategies implemented to manage any impacts on endangered, vulnerable or rare (EVR) species where the presence of these is confirmed. Specific strategies will be presented in the full EMP for the project (refer to Section 4).
 Two tributaries of Lake Macdonald	At the crossing point, the tributaries are narrow streams through the power line easement, with RE 12.3.1/12.3.2 regrowth dominated by *Acacia disparrima*. The general mitigation measures discussed below will be applied.

Table 3.28 (continued)

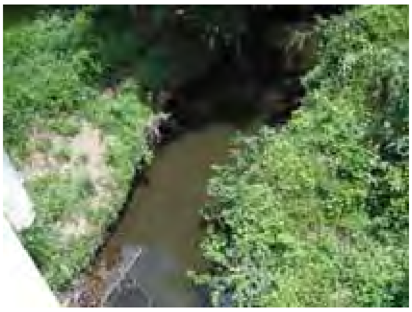
Waterway at crossing point	Summary of issues and proposed management
North Maroochy River Sub-catchment	
 Tributary of North Maroochy River	Crossing point is not within an easement and will require limited clearance of previously disturbed riparian vegetation. A detailed management plan for this small section will be presented in the final EMP to avoid large trees in existing riparian vegetation.
 North Maroochy River	Here the river has a narrow, slow-flowing channel with a steep south bank (~5 m high). Erosion potential is moderately high due to the steepness of banks but offset by the relatively stiff alluvial deposits of clayey silts. The crossing is located within an existing power easement and adjacent to a three-lane bridge crossing of the Bruce Highway and a local road (Strong Lane). There is intact riparian vegetation (RE 12.3.1) upstream and downstream; however, vegetation structure at the actual crossing location has been highly disturbed as a result of previous infrastructure works. The waterway and riparian vegetation in proximity to this crossing point has been identified as potential habitat for the Giant Barred Frog, Tusked Frog, Elf Skink, Echidna and Platypus (see Section 3.3.4). The proposed crossing location is preferred as it corresponds with areas of existing disturbance and has the least impact on remnant vegetation and habitat for EVR species. The general mitigation measures discussed below will be applied with specific mitigation strategies documented in the final EMP to manage any impacts on EVR species where the presence of these is confirmed. Stockpiling of the stiff alluvial material and placement with compaction to re-establish the former profile at the crossing will stabilise the disturbance and optimise revegetation.

Table 3.28 (continued)

Waterway at crossing point	Summary of issues and proposed management
SOUTH MAROOCHY RIVER SUB-CATCHMENT	
 South Maroochy River	The South Maroochy is a wide, slow-flowing river, shallow at the crossing point with a rocky substrate. Erosion potential is moderate to high due to steep banks. Riparian vegetation is degraded RE 12.3.1, with disturbed banks and extensive weed invasion. Field surveys have identified potential habitat in proximity to crossing point for the Giant Barred Frog, Tusked Frog, Elf Skink, Platypus and Koala. The general mitigation measures discussed below will be applied with specific mitigation strategies implemented to manage any impacts on EVR species where the presence of these is confirmed.
PETRIE CREEK SUB-CATCHMENT	
 Tributary of Tuckers Creek	This tributary is a very narrow, slow-flowing channel within the existing easement. Riparian vegetation is rainforest sub-storey, with a tea tree margin, and approximately 3–5 m wide. The stream is choked with in-stream vegetation, leaf litter and small fallen branches. Field investigations have confirmed there is potential habitat in proximity to crossing point for the Tusked Frog and Giant Barred Frog. The general mitigation measures discussed below will be applied with specific mitigation strategies implemented to manage any impacts on EVR species where the presence of these is confirmed.
Tributary of Tuckers Creek	Tuckers Creek tributary just north-west of Tuckers Creek is an intermittent stream with pools. It is adjacent to Duhs Road, alongside which the pipeline will run. The vegetation at this site is mapped as RE 12.15.15a; however, field investigation found palms and some rainforest species along the stream. There was some disturbance from the adjacent road and residential development. Rubbish (eg fuel cans, tyres, sheet metal etc) was apparent. A detailed management plan for this small section will be prepared as part of the final EMP for the project to avoid clearing rainforest species along the stream and to put sediment and erosion controls in place, due to close proximity to the stream for the length of Duhs Road.

Table 3.28 (continued)

Waterway at crossing point	Summary of issues and proposed management
Tuckers Creek	The crossing at Tuckers Creek is not within the easement. It has a narrow section of non-remnant riparian vegetation with some rainforest species in the understorey. A detailed management plan for this small section will be prepared in the next phase of the project to avoid significant species in existing riparian vegetation.
  Paynter Creek (two southern crossings)	The two southern crossings of Paynter Creek are within the easement where the creek is slow-flowing and narrow. The main feature is the riparian vegetation (RE 12.3.2) which is intact adjacent to the power easement. While the canopy is generally absent through the easement, rainforest regrowth has occurred on the easement and grades into continuous but thinner vegetation. Field investigations have confirmed potential habitat in proximity to the crossing site for the Giant Barred Frog and Elf Skink in adjacent vegetation. The general mitigation measures discussed below will be applied with specific mitigation strategies to be described in the final EMP and implemented to manage any impacts on EVR species where the presence of these is confirmed.
Waterway at crossing point	Summary of issues and proposed management
EUDLO CREEK SUB-CATCHMENT	
 Eudlo Creek	At the crossing, the creek has a narrow, slowing-flowing channel, which has a narrow riparian zone characterised by non-remnant re-growth adjacent to the power easement. Both banks are heavily disturbed, with weedy regrowth and grasses along the easement. Although disturbed at the crossing point, it is a high priority reach for rehabilitation and management by Sunshine Coast Regional Council as it is associated with ecologically significant areas in the lower reaches. The general mitigation measures discussed below will be applied.

Table 3.28 (continued)

Waterway at crossing point	Summary of issues and proposed management
 Acrobat Creek	Acrobat Creek has a narrow channel like Eudlo Creek, but with degraded RE 12.3.2 riparian vegetation. It has similar values to those described for Eudlo Creek, including being a high priority reach due to downstream values. The general mitigation measures discussed below will be applied, and measures taken to avoid RE 12.3.2 adjacent to the crossing point.

Table 3.29 Description of crossings through areas of high environmental values

Waterway at crossing point	Summary of issues and proposed management
SIX MILE CREEK SUB-CATCHMENT	
 Six Mile Creek (left bank) (northern crossing)	The crossing point over Six Mile Creek (left branch) is of moderate width (5–6 m) and slow flowing, with a broad and shallow profile contained within stable silty clay banks. The crossing is downstream of the junction where an anabranch rejoins the stream. To avoid as much of the intact riparian vine forest associations (RE 12.3.2/12.3.1) in this area, the pipeline follows agricultural land and crosses immediately adjacent to an existing pipeline. Biological investigations have confirmed the presence of the EPBC-listed Southern Penda (*Xanthostemon oppositifolius*) in this area as well as the NCA-listed Tusked Frog (*Adelotus brevis*) (see Sections 3.3.2 and 3.3.3 of Nature Conservation and Appendix D). Specific surveys of aquatic fauna have suggested the potential for significant aquatic species—the Platypus, Mary River Turtle, Mary River Cod, and Oxleyan Pygmy Perch—to occur in Six Mile Creek (left branch), (see Section 3.3.4 of Nature Conservation and Appendix D). This area requires further detailed investigation to identify a crossing point where potential impacts on significant species will be minimised. Specific management strategies will then be developed as part of the preparation of the final EMP.

Table 3.29 (continued)

Waterway at crossing point	Summary of issues and proposed management
Petrie Creek Sub-catchment	
  Petrie Creek	At the proposed Petrie Creek crossing adjacent to the Nambour showgrounds, creek-side vegetation is heavily disturbed. On the south bank Camphor laurel (*Cinnamomum camphora*) dominates the riparian vegetation. However, on the north bank degraded RE 12.3.1 is present. Fauna investigations have confirmed that the Elf Skink (*Eroticoscincus graciloides*) is present and the Giant Barred Frog (*Mixophyes iteratus*) and Tusked Frog (*Adelotus brevis*) have the potential to occur in proximity to the crossing. The cross-section at the crossing point is 35–40 m bank to bank, and the stream is 3–5 m wide, less than half a metre deep. The south bank of Petrie Creek is relatively steep, with the initial decline broken by a terrace that gently grades into the narrow stream. It is a slow flowing run with large woody debris present, as well as urban litter such as a car tyre and sheets of metal. This area requires further investigation to identify a crossing point where potential impacts on significant species will be minimised. Specific management strategies will then be developed as part of the preparation of the final EMP.

Table 3.29 (continued)

Waterway at crossing point	Summary of issues and proposed management
PAYNTER CREEK SUB-CATCHMENT	
  Paynter Creek (three northern crossings	Previous route options had the pipeline route following the existing cleared power line easement. However, the current alignment was chosen to avoid multiple crossings of Paynter Creek. Further detailed investigation is required at the proposed new crossing point to fully identify all relevant environmental values and incorporate these in a site-specific management plan for the crossing. Present information gathered for the existing power line easement confirms that the riparian vegetation for three northern crossings of Paynter Creek consists of weedy regrowth. However, adjacent intact RE 12.3.1 is continuous on the western side and semi-continuous to the east upstream and downstream of these crossing points, other than for a break through to cleared land. The bank width along the northern crossings is 10–15 m wide, the stream 5–6 m wide and less than one metre deep. Erosion potential is low to moderate due to moderate slopes. Significant flora and fauna known to be in proximity to the northern crossings include the Swamp Orchid (*Phaius tancarvilleae*) and the Tusked Frog (*Adelotus brevis*) while the Giant Barred frog (*Mixophyes iteratus*) has the potential to occur in the general area as suitable habitats are present along the creek. This area requires further investigation to identify a crossing point where potential impacts on significant species will be minimised. Specific management strategies will then be developed as part of the preparation of the final EMP.

Flooding

The major flood-prone areas encountered along the pipeline route are associated with Petrie and Paynter creeks. The broad floodplain of Paynter Creek in particular is prone to frequent flooding, with the flooding extent of low recurrence events (ie 2-year ARI) being very similar to that of the 100-year ARI flood.

Approximately a 1 km length of the preferred corridor is located within the Paynter Creek 2-year ARI flood zone, with a further 200 m within the 2-year ARI flood zone for Petrie Creek. Approximately 2 km of the corridor is located with the 100-year ARI flood zone of both waterways.

Groundwater

Although there are no known significant aquifers in the region (QWC 2007), there is the potential to encounter groundwater tables in low-lying areas adjacent to waterways. The elevation of the Petrie Creek and South Maroochy River crossing locations (less than 5 mAHD) in particular, suggest that groundwater may be encountered during trenching activities.

The EVs of groundwater resources in the project area as described by the EPP (Water) are summarised in Table 3.30

Table 3.30 Environmental values of groundwater resources in the study area

Catchment	Environmental values (EPP [Water])
Mary River catchment	Aquatic ecosystems, drinking water, irrigation, stock water, farm supply
Maroochy River catchment	Aquatic ecosystems, drinking water, irrigation, stock water, farm supply

Source: Environment Protection Policy (Water).

It should be noted that there is negligible risk of acid sulfate soil (ASS) occurring in low-lying areas of the Paynter Creek and Petrie Creek floodplains. Potential issues associated with ASS are addressed in Section 3.2.2.

3.4.2 Potential impacts and mitigation measures

The potential impacts on water resources in the project area from the construction and operation of the NPI Stage 2 are associated with two main areas:

- waterway crossings; and
- flooding.

The potential impacts and mitigation measures for these are discussed below. Groundwater which is unlikely to be significantly impacted is also discussed.

Waterway Crossings

Potential impacts and impact mitigation strategies are discussed with reference to the environmental values (EVs) for each waterway system as defined by the EPP (Water). Table 3.31 summarises these EVs for each catchment unit, eg North Maroochy River has EVs for aquatic ecosystem, human consumer, recreation, visual recreation, cultural and spiritual values, irrigation, stock water and farm supply.

Table 3.31 Environmental values for major waterways in the study area as defined by the EPP (Water)

Catchment unit	Environmental values (EPP [Water])										
	Aquatic ecosystem	Human consumer	Recreation	Visual recreation	Cultural & spiritual values	Industrial use	Irrigation, stock water, farm supply	Drinking water	Aqua-culture	Oystering	Seagrass
Six Mile Creek (freshwater)	✓	✓	✓	✓	✓		✓	✓	✓		
North Maroochy River (freshwater)	✓	✓	✓	✓	✓		✓				
South Maroochy River (freshwater)	✓		✓	✓	✓		✓				
Other freshwater tributaries (not included in the above)	✓	✓	✓	✓	✓	✓			✓		✓
Petrie Creek (freshwater)	✓		✓	✓	✓	✓	✓		✓		
Paynter Creek (freshwater)	✓		✓	✓	✓	✓	✓		✓		
Eudlo Creek (freshwater)	✓		✓	✓	✓	✓	✓				

Source: *Environment Protection Policy (Water).*

The intent of the impact mitigation program is to maintain the existing integrity of the aquatic and riparian ecosystems. These require compliance with water quality standards to be maintained (or EVs). By having this focus, the discussion in the following sections regarding aquatic environmental values effectively addresses all other values as listed in Table 3.31.

General Description of Construction Activities

Waterway crossings will be achieved by excavating and laying pipe through the bed of the waterway (construction method known as trenching). At this stage, trenching is the preferred method for completing all waterway crossings for the NPI Stage 2 following the results of preliminary risk assessment workshops for waterway crossings.

The workshops were held to assess the costs and benefits associated with the various crossing methodologies for major crossings (ie Petrie Creek, North Maroochy and South Maroochy rivers). The criteria used to assess each of the crossing methodologies included:

- environmental impacts—aquatic and riparian flora and fauna, and habitat values;
- cost of crossing construction;
- hydraulics—velocity, depth and volume of flows and seasonal variations/patterns;
- constructability of crossings—geotechnical substrate, erosion potential and bank stability;
- stakeholder and community concerns—local council, affected land-holders and local community interest groups; and
- risk—likelihood and consequence of any potential risks.

Results of these preliminary risk assessment workshops indicate that trenching is far more cost-effective and the construction time frame is far less compared with piling and microtunnelling. For example, the construction time frame for a trenched crossing of the North Maroochy River is estimated at one week, compared with up to six weeks for the construction of a piled crossing. Longer construction time frames associated with piling and tunnelling will likely increase the time between construction and reinstatement and increase the risk of sediment erosion and adverse impacts on water quality.

The cost of piling the South Maroochy River is estimated to be $850,000 and would likely have significant impacts on visual amenity; however, a trenched crossing will have no visual impact following reinstatement and revegetation, and is estimated to cost $300,000.

The costs associated with a tunnel-bore of the major waterways would be in excess of $1 million per crossing. In addition, the tunnel-boring methodology may impose additional environmental risks at the crossing location compared to the mitigation measures that can be applied for trenching alone. These environmental risks could include contamination of the waterway and the need to dispose of greater volumes of spoil.

Based on these preliminary results, trenching is the currently preferred crossing methodology for all waterways within the NPI Stage 2 project area. Scheduling construction during periods of low precipitation and implementation of appropriate environmental management plans will assist in minimising the potential impacts associated with trenched waterway crossings.

Table 3.32 outlines the potential impacts on aquatic environments associated with the different crossing methodologies. Further impact assessment is also provided at Sections 3.3, 3.4, and Appendix D.

Table 3.32 Potential impacts of crossing methodologies on aquatic environments

Construction method	Potential impacts
Trenching	▪ direct loss of structural habitat features such as macrophytes and snags ▪ indirect changes to physico-chemical habitat features, such as water temperature, dissolved oxygen etc. as a result of disturbance to riparian vegetation ▪ increased turbidity or smothering of habitat features due to increased entrained sediment after the completion of works ▪ the creation of temporary barriers across flowing waterways with the potential to block fish passage ▪ introduction and spread of aquatic pest species ▪ refuelling or other activities that may result in spills in the bed of the waterway, causing pollution or degradation of waterways
Piling	▪ reduced direct impacts to streambed with piles driven into the bed of the waterway; potential for localised loss of structural habitat features ▪ potential for release of sediment to waterways from work areas in the riparian zone ▪ some disturbance to riparian vegetation, with flow-on effects to physico-chemical habitat features (temperature, dissolved oxygen etc.)
Span bridging	▪ no direct impacts to streambed as pipe is suspended above waterway channel ▪ potential for release of sediment to local waterways from work areas in the riparian zone ▪ some disturbance to riparian vegetation, with flow-on effects to physico-chemical habitat features (temperature, dissolved oxygen etc.)
Microtunnel/ underbore	▪ no direct impacts as pipe is drilled under streambed ▪ potential for release of bentonite. Bentonite serves as a support and lubricant for the slurry material surrounding the microtunnel ▪ minor potential for release of sediment to local waterways from work areas

During construction there will be temporary interruptions to existing drainage characteristics resulting from clearing, grading and trenching activities, diversion bunding and temporary detention ponds/dams. Post-construction, all barriers and/or dams installed during construction will be removed and the site returned to its original profile and flow pattern. Over time revegetation that also forms an important part of the restoration process will result in a reforming of the riparian vegetation cover.

Potential issues and impacts associated with trenching are:

- high impact on bed and banks, requiring clearing 20–25 m and diversion/drainage of any minor flows;
- physical changes to channel morphology;
- removal of stabilising riparian vegetation making banks susceptible to erosion;

- possible short-term increases of sediment in waterways, especially after rain events; and
- accidental releases of hydrocarbons, sewage or wastewater to surface waterways.

These impacts have the potential to affect water quality through the mobilisation of sediments, nutrients and pathogens, and accidental releases of hydrocarbons, chemicals and wastewater. Should they occur, they could result in changes in key water quality parameters, particularly water temperature, turbidity and dissolved oxygen, and associated impacts to the quality of aquatic habitats. Control measures to limit the possibility of these events occurring are described in the mitigation measures in the next section.

These potential impacts as described above are generally localised and temporary, with the zone of disturbance around a waterway generally restricted to 20–25 m wide. However, the cumulative effect of numerous point disturbances in an already disturbed system has the potential to have an impact upon sensitive downstream environments and in-stream habitats.

A primary benefit of adopting trenching as the preferred method for pipeline crossing is that this technique involves a disturbance for a limited period and rapid reforming of the banks and bed of the stream minimising any additional sediment load. Disturbed material would be limited in volume, exposed for a limited period, be comparable to levels experienced during flooding and be readily flushed from the system with little if any medium to longer term effects.

A number of mitigation strategies have been employed in the route selection study to minimise potential impacts:

- Route selection has focused on minimising the number of waterway crossings wherever practical.
- Waterway crossing points have also been selected for their low flow velocity, position in a straight section of the waterway channel and to avoid:
  - unstable banks;
  - channel bends;
  - deep pools; and
  - confluences with other channels.
- Where multiple crossings are proposed, refinements to the corridor that would minimise the number of crossing points are being considered. For example, a detailed scale assessment is currently planned for the Paynter Creek northern crossings.

Project-specific waterway crossings management strategies will be developed for the final EMP for implementation during construction. The CEMP will also include a soil and water management plan and rehabilitation plan. Mitigation measures will include:

- establishing water quality baseline characteristics prior to construction to allow changes in water quality to be measured during works; the key parameter will be turbidity with other parameters recorded as appropriate;
- developing detailed erosion and sediment control plans (ESCPs). These plans will show the location of sediment fences, rock check dams, stormwater diversions and other control measures for individual construction sites. In their general form these will follow existing Shire guidelines;
- delaying clearing of slopes leading to watercourses until crossing construction is imminent to reduce the risk of sedimentation and erosion;
- using mechanical slashers for clearing work areas in riparian areas where practical rather than bulldozers;
- restricting work within waterways and riparian areas to minimise the possible extent of disturbance;
- avoiding the unnecessary removal of mature riparian trees—only those for which there are no other options;
- pre-stripping and stockpiling of topsoil and bed material and storing separately for reuse within a three month period to maintain seedbed viability and avoid damage or burial;
- using existing access roads wherever possible;
- ensuring that storage and loading areas for fuels and chemicals are bunded and located outside flood-prone areas;
- monitoring regional weather conditions and river flow levels during construction;
- installing scour protection measures as appropriate, including rock blankets, limited use of bank riprap or gabion structures in critical locations;
- using dam-and-pump or dam-and-flume-methods when trenching across flowing waterways to ensure continuity of flow within the watercourse downstream of the work area;
- maintaining and monitoring all vehicles and machinery working within watercourses to minimise opportunities for contamination;

- reinstating bed and banks to original contours to ensure no localisation of turbulence during high flow events thereby minimise scour and erosion potential;
- reinstating riparian vegetation cover using fast-growing grasses and sedges to stabilise banks with advanced stage planting of riparian tree species to help re-establish canopy cover (with low growing species to prevent hindering powerline operations when in a power easement);
- ongoing weed control works within and adjacent to the corridor; and
- ensuring all construction and maintenance crew inductions include information about the environmental values of the stream, erosion risk and management, weed hygiene and fuel and chemical storage and handling.

Baseline monitoring will be undertaken at all significant waterway crossing points to record the pre-construction condition of each crossing. Following construction, reinstatement works will be monitored on a weekly basis until established and then visited every three months until successful stabilisation is evident. Reinstatement efforts will be guided by the objectives set out in the EPP (Water) for riparian areas, as reproduced in Table 3.33.

Table 3.33 EPP (Water) water quality objectives for riparian areas

Water type	Riparian function		
	Ecological processes	Habitat	Bed and bank stability
Lowland freshwater	Maintain or restore vegetation to achieve: • shade over near bank areas • some moderation of temperature and dissolved oxygen extremes • transformation of diffuse nitrogen inputs.	Eradicate weeds and maintain or restore: • in-stream woody debris for fish and invertebrates • native trees, shrubs and groundcover on banks • tree roots to provide stable undercut banks.	Maintain or restore bank vegetation: • Maintain large woody debris for channel shape and form • Manage cattle access to maintain or restore bank stability and bank vegetation.

Source: Environment Protection Policy (Water).

Preliminary monitoring of basic water quality parameters will also be undertaken before, during, and after construction to record any substantial changes in water quality. Monitoring of water quality upstream and downstream of crossing points will include:

- observation of sediment plumes and surface sheen; and
- measurement of turbidity, suspended solids, pH and dissolved oxygen.

The water quality objectives (WQOs) set out by the EPP (Water) will be adopted as objectives for the project, and be referenced to existing conditions in a given waterway. Table 3.34 summarises the water quality objectives defined by the policy for the two catchments.

Table 3.34 EPP (Water) key water quality objectives relevant to the NPI

Catchment unit	Water quality objectives (EPP [Water]) pH	Turbidity	Suspended solids	Dissolved oxygen
Mary River catchment—lowland freshwater (ecosystem slightly to moderately disturbed)	6.5–8.0	<50 NTU	<6 mg/L	85–110% saturation
Maroochy catchment—lowland freshwater (ecosystem slightly to moderately disturbed)	6.5–8.0	<50 NTU	<6 mg/L	85–110% saturation

Source: Environment Protection Policy (Water).

Specific objectives for each significant waterway will be developed based on the above and complemented by baseline data.

Flooding

While only relatively short sections of the NPI will traverse flood-prone areas, there is a possibility that flooding could occur during construction.

Flood modelling data provided by Maroochy Shire Council (now merged into the Sunshine Coast Regional Council) shows that the 2-year ARI flood for Paynter Creek is similar in extent to the 100-year ARI event, with larger events increasing flood depth rather than flooding extent. While the corridor traverses the floodplain for approximately 1 km, there is still a possibility of flooding during construction as a result of low recurrence interval events.

Scheduling construction to avoid high rainfall times of the year will significantly reduce the risk of normal trenching activities interacting with floodwaters. Given the limited length of pipe within the floodplain, the risk is considered low. However, should flooding occur, the potential impacts include:

- excessive sediment transport from soil stockpiles along the right of way;
- reductions in floodplain capacity and floodwater displacement as a result of all-weather access tracks and bunding around work areas; and
- displacement of floodwaters where above-ground crossings are proposed.

Pipe laying in these flood-prone areas can proceed very quickly (up to 120 m/d per crew) due to the flat, open nature of the terrain. Depending on the actual site conditions at a particular work front, a section of trench (nominally 40 m) will be excavated to allow for 2–3 pipe lengths, the pipe laid and trench backfilled before excavating the next section (see Section 2).

As only small sections of trench are open at any given time and thus limited areas (maximum 40 m x 40 m) would need to be protected from flooding. In the event that flooding occurs, two options have been identified for managing worksites:

- using soil stockpiles as bunding along the edge of the corridor, and sealing the work area against floodwaters on all four sides. The trench would remain open and all construction equipment would be left in place; or
- backfilling the trench prior to evacuating the worksite, removing construction equipment and spoil from the work front.

The approach that would be adopted would depend largely on the time available to secure the worksite (given advanced warning of imminent flooding) and the potential severity of flooding. Weather reports would be closely monitored and where adverse weather conditions were identified, worksites would be secured as quickly as possible. Other mitigation measures include:

- having trench spoil or sandbags available to seal off the work area in the event of flooding; and
- covering of bunds in medium to high velocity flood areas to prevent scour.

Groundwater

Works associated with the project are not generally anticipated to adversely impact groundwater quality or levels, although trenching, in low-lying areas immediately adjacent to waterways may require pumping and disposal of seepage from the local groundwater table.

Excavation up to 4 m below the existing surface level is anticipated but, due to the mean elevation of the proposed corridor, intersection with any groundwater tables is likely only around South Maroochy River and Petrie Creek. If dewatering is required, pumping rates will be determined by aquifer thickness and permeability. If necessary, dewatering investigations would be carried out during the detailed design phase of the project.

If groundwater is to be pumped, it will be subject to checking prior to discharge to ensure it meets water quality objectives. If it does not meet the objectives, the groundwater will undergo appropriate treatment to ensure it does not pose a hazard to any waterways receiving the discharge.

Treatment measures would include sedimentation ponds and vegetated low gradient swales for return of pumped flows to a nearby watercourse.

3.5 Air Quality

3.5.1 Description of Environmental Values

The existing air quality environment in the project area is influenced by regional pollutant sources (mainly transport and industry related), with minor contributions from local traffic, construction and commercial/industrial sources. Variations in local air quality will occur due to the proximity of sources such as major roads, regional events such as bushfires and dust storms, and variations in meteorological conditions such as wind speed, wind direction and atmospheric stability.

Table 3.35 summarises the results of air quality monitoring undertaken by the Environmental Protection Agency (EPA) at Mountain Creek, approximately 13 km east-north-east of Eudlo. This monitoring measures concentrations of ozone (O_3), nitrogen oxides (NOx) and particulate matter 10 µ or smaller (PM10); with the latter two parameters considered relevant to construction air quality impacts.

Table 3.35 Air quality data for EPA Mountain Creek monitoring site

Parameter	2005	2006
Average nitrogen dioxide NO_2 (ppm)	0.005	0.005
Ambient PM_{10} (µg/m^3)	14.5	14.5

The parameters in Table 3.35 fall well within the recommended air quality indicators and goals; therefore the existing air quality environment for the project area is considered to be in good condition. Ambient air quality monitoring also indicates there is capacity within the regional air shed for atmospheric emissions to be assimilated without compromising air quality goals (Appendix M).

Much of the route will traverse sparsely populated rural residential areas; however, there are some locations where the route passes close to residences and community facilities. Air quality will be managed in accordance with the recommendations outlined in the assessment in Appendix M, the objectives and targets set in the planning environmental management plan (PEMP) (Appendix Q) and requirements established in the air quality, noise and vibration management plan (to be used during construction).

3.5.2 Potential Impacts and Mitigation Measures

Pump stations will be powered by electricity, with back-up diesel generators used only in the event of a power outage on the connecting grid. As such, gaseous emissions to the local air shed during operation of the NPI Stage 2 are expected to be minimal. Electricity demands for pumping during the operational phase are likely to be the most significant project-related source of greenhouse gas emissions (see below).

Air quality impacts will be primarily associated with construction activities such as the generation of dust during earthmoving operations such as excavation, vegetation clearing, vehicle movement and wind erosion of exposed areas. Earthmoving activities and wind erosion generally give rise to coarser dust fractions, which are frequently more significant in terms of nuisance and amenity than human health. Seasonal variations in wind speed and direction are discussed in further detail in Appendix M.

Table 3.36 sets out the relevant national and state compliance goals for air quality which will be adopted as an upper limit for construction of the NPI Stage 2.

Table 3.36 Air quality limits—EPP (Air) 1997 and NEPM air quality goals

Pollutant	Averaging period		Ambient air guideline
Carbon monoxide	8 hours	EPP (Air) 1997	8 ppm (10 mg/m^3)
		Ambient Air NEPM 1998	9 ppm (11 mg/m^3)
Nitrogen dioxide	1 hour	EPP (Air) 1997	0.16 ppm (320 µg/m^3)
		Ambient Air NEPM 1998	0.12 ppm (246 µg/m^3)
	4 hours	EPP (Air) 1997	0.046 ppm (95 µg/m^3)
		Ambient Air NEPM 1998	n/a
	Annual	EPP (Air) 1997	0.01 ppm (30 µg/m^3)
		Ambient Air NEPM 1998	0.03 ppm (62 ug/m^3)
PM_{10}	24 hours	EPP (Air) 1997	150 µg/m^3
		Ambient Air NEPM 1998	50 µg/m^{3}n
Total suspended particulate (TSP)	Annual	EPP (Air) 1997	90 µg/m^3

The impact of a 'worst case' construction scenario was assessed by a specialist consultant using the Ausplume computer dispersion model developed by the Victorian EPA. Based on this modelling and in reference to compliance limits, minimal impacts from particulate matter emissions are expected.

The greatest distance at which relevant air quality goals are likely to be exceeded is approximately 15–20 m for normal construction activity and 50–60 m for blasting. An air quality, noise and vibration management plan has been developed to ensure construction activities within close proximity to sensitive receptors, including residences, other buildings and sensitive environmental sites, are managed to minimise dust generation.

Mitigation measures proposed to manage construction activities include, but are not limited to the following:

- identifying sensitive land uses/sensitive receivers prior to works commencing;
- ensuring size of areas to be cleared is minimised. The clearing limit will be clearly delineated before construction starts;
- regularly watering the corridor, tracks and roads during dry conditions (maintaining a damp surface will minimise opportunities for dust generation affecting surrounding sensitive uses, and ensure that dust concentrations will be well inside acceptable limits at all sites);
- mulching/chipping cleared vegetation for use on cleared areas to minimise wind-generated dust;
- keeping stockpiles as low as possible and covering or wetting down on site, including surge stockpiles on tunnel sites as appropriate;
- covering loads for transport where these have the potential to generate dust;
- reducing vehicle speeds on unsealed roads when visible dust generation is noted;
- considering the use of wind breaks (earth banks or other screens) where appropriate to reduce the capacity of wind to raise dust from open areas; and
- siting construction equipment powered by internal combustion engines as far downwind from sensitive receptors (residents and businesses) as possible.

Air pollutants associated with the project are mostly emitted during construction in the form of particulates, with very minor contributions of carbon monoxide (CO) and nitrogen oxides (NOx) associated with fuel combustion from vehicles and plant. No direct impacts are likely to occur as a result of tunnelling or boring activities as these works are conducted below the surface, and no other major air contaminants are anticipated to result from the construction phase.

Greenhouse Gas Emissions

Human-induced climate change is now recognised as a key impact associated with the use of energy for domestic purposes and development. The four largest sources of greenhouse gases in Queensland are power production, petroleum fuel use, land clearing and methane production by livestock. The Queensland Greenhouse Strategy estimates that around 867 kg of carbon dioxide (CO_2) is released for every megawatt of electricity produced.

The federal Department of Climate Change (DCC) divides greenhouse gas (GHG) emissions into direct (or point source) emissions and indirect emissions. Direct emissions are produced from sources within the boundary of an organisation and as a result of that organisation's activities, while indirect emissions are defined as those generated in the wider economy as a consequence of that activity (DCC 2008).

The primary sources of GHG emissions associated with the NPI Stage 2 project include:

- Burning of diesel fuels for vehicles, plant and machinery during construction (direct emissions);
- The use of electricity for site offices during construction (indirect emissions); and
- Ongoing electricity requirements for the operation of pump stations (indirect emissions).

Clearing of vegetation at a landscape scale also has the potential to result in the loss of 'carbon sinks', thereby reducing opportunities for reabsorbing carbon released into the atmosphere. However, the clearing footprint associated with the NPI Stage 2 is relatively minor and will be partially offset by revegetation efforts and the provision of vegetation offsets in accordance with the *Vegetation Management Act 1999* (VMA).

Estimation of GHG emissions associated with the project was undertaken in accordance with the National Greenhouse Accounts Factors (NGAF) workbook prepared by DCC. The scope that emissions are reported under is determined by whether the activity is within the organisation's boundary (direct or Scope 1) or outside it (Scope 2 and Scope 3).

In accordance with the NGAF, GHG emissions were calculated using:

- direct (or point source) emission factors—these give the kilograms of CO2 equivalent (CO2-e) emitted per unit of activity at the point of emission release and are used to calculate Scope 1 emissions;
- indirect emission factors—these are used to calculate Scope 2 emissions from the generation of the electricity purchased and consumed as kilograms of CO2-e per unit of electricity consumed.

The major source of direct construction-related emissions will be as a result of the use of diesel fuel for vehicles, plant and machinery, with indirect (Scope 2) emissions occurring as a result of electricity use at site offices. These emissions are summarised over the life of the project in Table 3.37.

Table 3.37 Estimated greenhouse gas emissions during construction

Emissions scope	Source	Estimated usage	GHG emissions (t of CO_2-e)
Scope 1 (direct)	Diesel fuel use	3,000,000 L	8,100
Scope 2 (indirect)	Electricity for site offices	86003 kW/h (0.086 GW.h)	78
Total			**8,178**

Pumps are needed to fulfil the initial operational requirements of the overall NPI once Stage 2 is complete. Maximum energy consumption for all pumps is estimated at around 6.5 GW.h/a. This is roughly equivalent to the energy consumption requirements of a large shopping centre or apartment complex (see Table 3.38). Assessment of renewable energy alternatives indicates that such sources are not adequate to supply the full amount of electricity required to operate pump stations.

Table 3.38 Electricity consumption of major electricity users in Queensland

Energy user type*	Estimated annual energy use	Estimated annual GHG emissions (t CO_2-e)
Desalination plant	200 GW.h/a	202,225
Coal mine	100–200 GW.h/a	99,630–199,261
Major road tunnel infrastructure	35–45 GW.h/a	34,870–44,833
Major hotel/resort	10–15 GW.h/a	9,963–14,944
Large high rise unit complex	5–10 GW.h/a	4,981–9,963
Large shopping centre	5–10 GW.h/a	4,981–9,963
Theme park	1–5 GW.h/a	996–4,981

* *Energy consumption statistics sourced from Gold Coast Water 2006*

Table 3.40 shows the preliminary sizing for each pump station. Anticipated GHG emissions associated with these pumping requirements were calculated using the indirect emission factors as outlined in the NGAF and assumed that pumps would operate for 23 h/d for 365 d/a. Based on these calculations, electricity used to operate the pump stations is predicted to generate approximately 3400 t of CO_2-e per annum.

Table 3.39 Estimated greenhouse gas emissions from pump stations

Pump station	Pump configuration	Pump size (kW)	Estimated annual energy use (GW.h/a)	Maximum total GHG emissions (t CO_2-e)
Noosa PS	2 duty operating for 23 hours	215	1.80	1,642
Eudlo PS	2 duty operating for 23 hours	104	0.87	795
Mooloolah PS	2 duty operating for 23 hours	123	1.03	940
Total			**3.71**	**3,377**

Optimisation of pump design and use will have significant impact on operational energy use. The pipeline and future pumping facility locations have been optimised to minimise fuel and energy requirements, reducing the greenhouse impacts of the project.

As part of the optimisation process, consideration has been given to:

- selecting routes to reduce maximum head consumption and overall materials consumption (see Section 2 of this EIS);
- selecting pipe diameter to minimise head loss (within water supply and economic limitations); and
- use of high efficiency pumps and motors.

Additional mitigation measures to be implemented during construction and operation of the NPI Stage 2 project include:

- sourcing labour and products from local communities to reduce fuel consumption associated with transport of plant, vehicles and machinery;
- regular servicing and tuning of vehicles used during the construction and operation of the pipeline, reducing the GHG emissions from these sources;
- use of reused or recycled materials (including office supplies) where practical, reducing the pipeline's lifecycle GHG emissions;

- use of vegetation cleared from a site as a mulch layer post-construction to promote regeneration and increase organic carbon levels in the soil. This avoids the production of methane which occurs when organic matter is placed into landfill or when biomass is burnt;
- use of vegetation offsets (up to 1:4) under the Queensland VMA to create CO2 sinks and offset GHG emissions;
- fostering a culture of innovation and rewarding ideas resulting in a decrease in GHG emissions associated with the project;
- setting challenges among staff to become 'greenhouse friendly';
- investigating the feasibility of sourcing products from other companies with a 'greenhouse friendly' accreditation;
- use of teleconferencing to reduce the need for travel between site offices; and
- use of alternative energy sources and water tanks at site offices.

Greenhouse gas production can also be mitigated by using lower greenhouse production energy forms or by purchasing 'credits' from renewable energy production for conventional coal fired power (Gold Coast Water 2007). For the NPI Stage 2, this may include the use of renewable energy power sources in the regional water supply system or the purchase of credits or offsets, such as green power or forestry sequestration, amongst others. A greenhouse abatement scheme for the operation of the NPI will be developed and implemented by the proponent as part of the operating rules for the pipeline.

3.6 Noise and Vibration

3.6.1 Description of Environmental Values

In order to determine the existing noise environment, background noise monitoring was undertaken by a specialist consultant at 13 locations along the proposed alignment (see Appendix M). While there are some activities in the project area that would cause vibration, these are not expected to have significant interaction with project-generated vibration levels. As such, no monitoring of background vibration levels was undertaken for the project area.

Substantial areas of the corridor are located in low density rural residential areas; however, there are a number of individual residences located close to construction works. Medium density residential areas are located at Nambour, Yandina and Lake Macdonald. Table 3.40 indicates the approximate number of residences within 200 m of the proposed corridor.

Table 3.40 Approximate number of residences adjacent to the corridor

Offset distance	Approximate number of homes
50 m	201
100 m	322
200 m	557

Noise monitoring locations were selected to represent the densest residential areas or the most sensitive receivers adjacent to the route, with monitoring also conducted at pump station locations. For the purposes of the NPI project, the term ‘sensitive receivers’ generally refers to residential properties along the proposed route.

Certain noise level descriptors, in particular the L_{A90} noise levels and $L_{Aeq(1hour)}$ noise levels will be described in this section. The L_{A90} noise level is representative of the average minimum background sound level (in the absence of the source under consideration), while the $L_{Aeq(1hour)}$ levels are a measure of the typical average noise level.

Noise monitoring at selected sites was undertaken using Acoustic Research Laboratories Types EL-316 and EL-215 environmental noise loggers programmed to record various statistical noise levels over consecutive 15-minute intervals. All noise measurements were conducted in general accordance with the Environmental Protection Agency’s Noise Measurement Manual and AS 1055.1–1997: Acoustics—Description and measurement of environmental noises: General procedures. Table 3.41 summarises the results of background noise monitoring for key sites on the preferred corridor.

Table 3.41 Background (L_{A90}) noise levels for noise monitoring locations (unattended noise logging)

Site ID	Location	Attended monitoring—comments	Rating background level L_{A90} (dBA)		
			Day	Evening	Night
Con 1	Leafy Lane, Woombye	Constant traffic noise from highway	50	43	35
Con 3	Retirement community Zealey Road, Nambour	Occasional traffic noise; distant substation noise (transformer)	37	38	34
Con 4	92 Sheanans Road, Yandina	Constant traffic noise from Bruce Hwy; farm animal noise	49	50	39

Table 3.41 (continued)

Site ID	Location	Attended monitoring—comments	Rating background level L_{A90} (dBA)		
			Day	Evening	Night
Con 5	Yandina Caravan Park, Old Bruce Highway, Yandina	Distant traffic noise from Old Bruce Highway	38	40	35
Con 6	2 Low Street, Yandina	Occasional local road traffic noise; distant road traffic from highway	38	35	28
Con 7	121 Holts Road, Cooroy	Constant traffic noise from highway	49	45	38
Con 8	39 Nandroya Road, Cooroy	Occasional traffic noise from Nandroya Road; distant traffic noise from highway	39	44	33
Con 9	19 Swift Drive, Cooroy	Local road traffic noise from Swift Drive and Tewantin Road	39	39	29
Con 10	6 Woombye-Palmwoods Road, Woombye	Road traffic noise from Nambour Connection Road	46	40	34
Con 11	102 Pringle Hill, Nambour	Distant road traffic noise from Bruce Highway	41	38	33
Op 4	415 Lake Macdonald Drive, Lake Macdonald	*Day/evening*—occasional traffic noise from Lake Macdonald Road; noise from water treatment plant *Night*—noise from water treatment plant; insect noise	34	35	32

The typical $L_{Aeq(1hour)}$ for each daytime, evening and night-time period was also noted for the locations potentially affected by operational noise from the pipeline. The Lake Macdonald pump station is the largest of the pump stations on the alignment and is therefore being used as the representative for the additional stations until further monitoring is undertaken prior to construction. The $L_{Aeq(1hour)}$ is representative of the typical average noise level for each period. The results of this monitoring are summarised in Table 3.42.

Table 3.42 Representative measured average [$L_{Aeq(1hour)}$] noise level for pump station location

Location	Measured $L_{Aeq(1hour)}$ noise levels (dBA)		
	Day	Evening	Night
Op 4–415 Lake Macdonald Road, Lake Macdonald	60	54	48

3.6.2 Potential Impacts and Mitigation Measures

Construction Noise

Noise levels during construction will be highly dependent on the type of construction activities undertaken, their duration and location. The intention during the construction phase is to meet the objectives of the Environmental Protection (Noise) Policy 1997. This will be implemented via the Noise and Vibration Management Plan. The project is currently developing this plan in consultation with the EPA and local government authorities. The most significant noise source will be mechanical plant operation. Table 3.43 provides sound power levels and anticipated noise levels at given offset distances from the pipeline alignment and assumes no acoustic shielding (ie from topography, buildings or noise barriers etc.) between the activity and the receiver. Blasting is not included in this table given the variable nature of the factors involved (eg charge, strength of rock, etc.).

Table 3.43 Acoustic footprint of construction activities

Construction equipment	Maximum sound power level (dBA)	Construction noise levels (dBA)					
		SPL[1] @ 5 m	SPL[1] @ 10 m	SPL[1] @ 20 m	SPL[1] @ 50 m	SPL[1] @ 100 m	SPL[1] @ 200 m
Excavator	110	83	77	71	63	57	51
Cranes	105	78	72	66	58	52	46
Tip truck	111	84	78	72	64	58	52
Generator	107	80	74	68	60	54	48
Backhoe	107	80	74	68	60	54	48
Bored piling rig	116	89	83	77	69	63	57
Rock breaker	137	110	104	98	90	84	78
Directional drilling rig	115	88	82	76	68	62	56

1 *L_{A10} Sound Pressure Level (derived by subtracting 5 dBA from the maximum sound pressure level).*

The noise levels presented in Table 3.43 indicate that, as expected, the impact would be highest on those receptors closest to the construction activity. The degree of impact will also be dependent on the time of day these works are undertaken. Sound levels experienced by people in day-to-day life typically range from around 30 dBA in a bedroom (very quiet) to 80 dBA on a busy street (loud) to 110 dBA near an activity such as steel grinding (extremely noisy).

With respect to the non-human environment, very little information is available on the effects of noise and vibration on flora and fauna. It is expected that noise levels acceptable to humans are unlikely to have a negative impact on other species.

It is anticipated that major road and rail infrastructure and steep ridges (ie Pringle Hill near Nambour), will be crossed by microtunnelling and may result in extended work hours. The potential impacts associated with drilling or tunnelling works are generally associated with air-borne noise from the tunnel pits as well as regenerated noise inside nearby buildings. The latter are highly dependent on the tunnel/hole diameter and the proximity of residents to drilling operations. Further investigation will be undertaken prior to construction in order to quantify the potential impacts surrounding nearby residents.

Noise impacts are usually minimised by limiting the hours of operation and scheduling the noisiest activities to occur at times when they would generate least disruption. Wherever possible, construction hours will generally be limited to the hours shown below (as outlined in the air quality, noise and vibration management plan) to avoid unreasonable impact on surrounding sensitive uses:

- 6.30 am to 5.00 pm, Monday to Friday; and
- 8.00 am to 1.00 pm on Saturdays.

Specific noise limits are not generally warranted for construction work during normal daytime hours provided all mechanically powered plant are fitted with appropriate mufflers. For construction works extending outside normal working hours the following generic limits will be adhered to:

Monday to Friday:

- 6.00 pm to 10.00 pm—background + 10 dBA LAmax, adj,15min; and
- 10.00 pm to 7.00 am—sleep awakening criterion of 45 dBA LAmax internal.

Saturday:

- 1.00 pm to 10.00 pm—background + 10 dBA LAmax, adj,15min; and
- 10.00 pm to 7.00 am—sleep awakening criterion of 45 dBA LAmax internal.

Sunday/Public Holidays:

- sleep awakening criterion of 45 dBA LAmax internal.

The $LA_{max,\ adj,15min}$ noise limit refers to the average maximum A-weighted noise level from the construction activity measured over a 15-minute period. Table 3.44 applies these criteria to the monitoring locations to obtain a construction noise criterion at each location.

Table 3.44 Construction noise criteria at monitoring and operational locations

Time	Criteria—by monitoring location $LA_{max, adj, 15 min}$ (dBA)											
	Con1	Con3	Con4	Con5	Con6	Con7	Con8	Con9	Con10	Con11	Op4	Op5
MONDAY TO FRIDAY												
7.00 am to 6.00 pm							No limit					
6.00 pm to 10.00 pm	53	48	60	50	45	55	54	49	50	48	45	49
10.00 pm to 7.00 am				50							50	
SATURDAY												
7.00 am to 1.00 pm							No limit					
1.00 pm to 6.00 pm	53	48	60	50	45	55	54	49	50	48	45	49
6.00 pm to 10.00 pm	53	48	60	50	45	55	54	49	50	48	45	49
10.00 pm to 7.00 am					50						50	
SUNDAY & PUBLIC HOLIDAYS												
All periods					50						50	

Where generic noise limits for periods outside normal hours exceed the limits specified for particular locations during normal construction hours, the more restrictive limits should apply. In addition to the above set criterion, Tables 8 and 9 in Appendix Q outline generic construction background levels according to AS 1055.2–1997 *Acoustics—Description and measurement of environmental noise*, which are to be used as a guide for further monitoring in areas where construction activities are anticipated outside normal designated working hours.

For all construction works, comprehensive noise mitigation strategies will be incorporated into the air quality noise and vibration management plan. In addition, site-specific work method statements (WMS) will also detail site mitigation measures.

Mitigation measures will include but are not limited to the following:

- selecting equipment to result in the lowest noise impact wherever possible;
- fitting equipment with appropriate noise abatement devices (eg mufflers, silencers and screens) and maintaining these in good working order;

- informing local residents of potential noise from project activities prior to the commencement of construction in their area;
- consulting with residents and scheduling excessively noisy activities for periods likely to result in the least noise nuisance, wherever possible;
- conducting noise monitoring as appropriate; and
- using the project freecall number to register noise complaints from affected landholders and undertaking appropriate investigation and remedial action where required.

Operational Noise

The main source of continuous noise from the operation of the NPI Stage 2 will be from the pump stations. These will be acoustically designed buildings (‘pump halls’) housing up to two pumps which are required to facilitate the transfer of water south to Brisbane.

Criteria for the assessment of the operational noise emissions are determined in accordance with the EPA’s Ecoaccess Guideline ‘Planning for Noise Control’. This guideline requires prior knowledge of the ambient noise environment and takes into account four factors: the control and prevention of background creep; determination of planning noise levels; containment of short-term emissions; and sleep disturbance. The limiting criteria and predicted noise levels emitted from the pump stations are summarised in Table 3.45.

Table 3.45 Predicted noise emissions from proposed pump stations

Location	Approximate distance to nearest receiver (m)	$LA_{90\ (1\ hr)}$ limiting criteria (dBA)	Predicted noise level (dBA)		
			Pump hall	Fans and A/C	Transformer
Lake Macdonald (Noosa) PS	350	25	24	19	4

To ensure compliance with the criteria outlined above, the following noise control measures, amongst others, will be reviewed:

- increasing separation distances between pump stations and sensitive receptors wherever possible;
- absorption in the pump hall in the form of an acoustic tile ceiling or custom absorptive treatments on the walls to reduce reverberant noise;
- increased ceiling/roof insulation; and
- detailed design of the transformer enclosure.

Vibration Impacts

The primary impacts of vibration on human environments relate to structural damage and the effects on human comfort. Humans can detect vibration levels well below those causing any risk of damage to a building or its contents. Vibration of 0.15 mm/s is at the threshold of human perception, while vibration of 14 mm/s would be very noticeable.

Vibration levels associated with general construction activities, such as microtunnelling, piling and general traffic movement, will not result in any damage to buildings or human comfort impacts. For example, measurements taken at a tunnel site on the Southern Regional Water Pipeline project recorded a vibration level between 0.3 mm/s and 1.0 mm/s directly above the tunnel bore machine at 5.5 m depth. Vibration levels decrease with distance from the source, and levels such as these will not result in any damage to surrounding structures.

The major potential sources of ground vibration are more intensive construction activities, particularly blasting (if required), bulldozers and the use of hydraulic rock breakers. Blasting has a high potential for impact on human comfort and will only be considered where the geology is too hard for the use of an excavator. Limited blasting is expected for the project, and in the event that blasting activities are to be conducted, a qualified operator will be engaged. The operator will be instructed to adhere to the project-specific blast management plan to ensure the potential impacts are minimised. This will be developed in accordance with the EPA's Ecoaccess Guideline 'Noise and vibration from blasting'.

Rock breakers generally create high vibration levels at close distances; however, buildings and their occupants are less susceptible to higher frequency vibration. Based on the levels summarised in Table 3.46 and the offset distances to the nearest residences, no building damage or human comfort impacts are expected from the use of rock breakers for the project. Bulldozers are also unlikely to generate any noticeable effect.

Table 3.46 Rock hammering vibration in hard sandstone

	Vibration level (mm/s) at given distance					
	5 m	10 m	20 m	30 m	40 m	50 m
Heavy rock hammering	4.50	1.30	0.40	0.20	0.14	0.10

To ensure impacts from project-related vibration are monitored, building condition surveys may be undertaken prior to the commencement of activities such as blasting, pile driving, excavation by hammering or ripping, dynamic compaction or demolition of structures in close proximity to sensitive receptors. No vibration impacts are expected as a result of the operation of the NPI Stage 2.

3.7 Waste

3.7.1 Waste Generation

Construction Waste

Waste from pipeline installation is likely to include a range of construction wastes, some of which are regulated or trackable materials in accordance with Section 17 and Schedule 1 of the Environmental Protection (Waste Management) Regulation 2000.

The waste streams and volumes presented in this EIS have been estimated on the basis of known volumes produced by the Southern Regional Water Pipeline (SRWP) and NPI Stage 1 projects. These projects have similar construction methodologies and are indicative of the types of waste expected for the NPI Stage 2 works.

Table 3.47 summarises the different types of waste likely to be generated from construction of the Stage 2 works.

Table 3.47 Anticipated construction waste sources for the NPI Stage 2

Waste	Source
SITE OFFICE AND WORK SITES	
Glass/plastic/cans/paper/cardboard	Construction compound/site office
Plastic wrapping/containers—collected and litter	Construction compound/site office/worksite areas
Scrap metal	Construction compound/steel yards/structural sites
Domestic waste	Food scraps etc. from site office
Printer cartridges	Site office
Sanitary systems waste	Site office/worksite areas
GENERAL CONSTRUCTION WORKS	
Green waste/mulched timber	Vegetation from worksite clearing and grubbing
Weeds	Clearing works
Excavated material (topsoil/spoil/rock)	Surface excavation, haul road establishment, construction
	Approx. 30% excess from pipeline works
Slurry cuttings containing some bentonite	Tunnelling

Table 3.47 (continued)

Waste	Source
WASTE	
Concrete wastes	Waste concrete from pours and washouts
Scrap metal	Construction activity wastes
Cables/parts	Construction and fit outs
Timber	Framework/off-cuts/packaging
Road maintenance wastes	Asphalt maintenance materials
Plastic wrapping/containers/ packaging	Construction activities
Plastic plant pots/fertiliser containers	Landscaping/revegetation works
Solids (sediment)	Sediment collected from sediment fences and other devices
Sediment fences/timber/metal/concrete	Decommissioning of site environmental controls
PLANT MAINTENANCE/CHEMICAL MANAGEMENT	
Drums and containers	Maintenance (oil and lubricants etc.) of plant and equipment/drums and containers from concrete works
Chemical wastes	Wastes from painting, maintenance, spill cleanup, herbicides and pesticides
Waste oil/grease/lubricants/oily rags/filters	Maintenance of plant and equipment

Many of the waste materials generated by pipeline construction can be reused or recycled rather than being transported to landfill. These wastes can be minimised by quantifying material requirements accurately during the planning and procurement for each stage of the project. Table 3.48 (over page) describes some of the major waste streams likely to be generated by construction of the Stage 2 works and their treatment.

Wastes which cannot be reused or recycled will be disposed of in an environmentally responsible manner at a licensed facility (see Figure 3.24). The waste management plan will detail the aspects of waste management, including handling, segregation and transport to landfill.

Table 3.49 gives an indication of the waste quantities generated by the SRWP project, which comprises construction of approximately 100 km of pipe, three pump stations and three balance tanks. The NPI Stage 2 comprises 48 km of pipe, three pump stations and one balance tank, and it is expected that compared to the SRWP project, approximately half the volume of waste will be generated during construction.

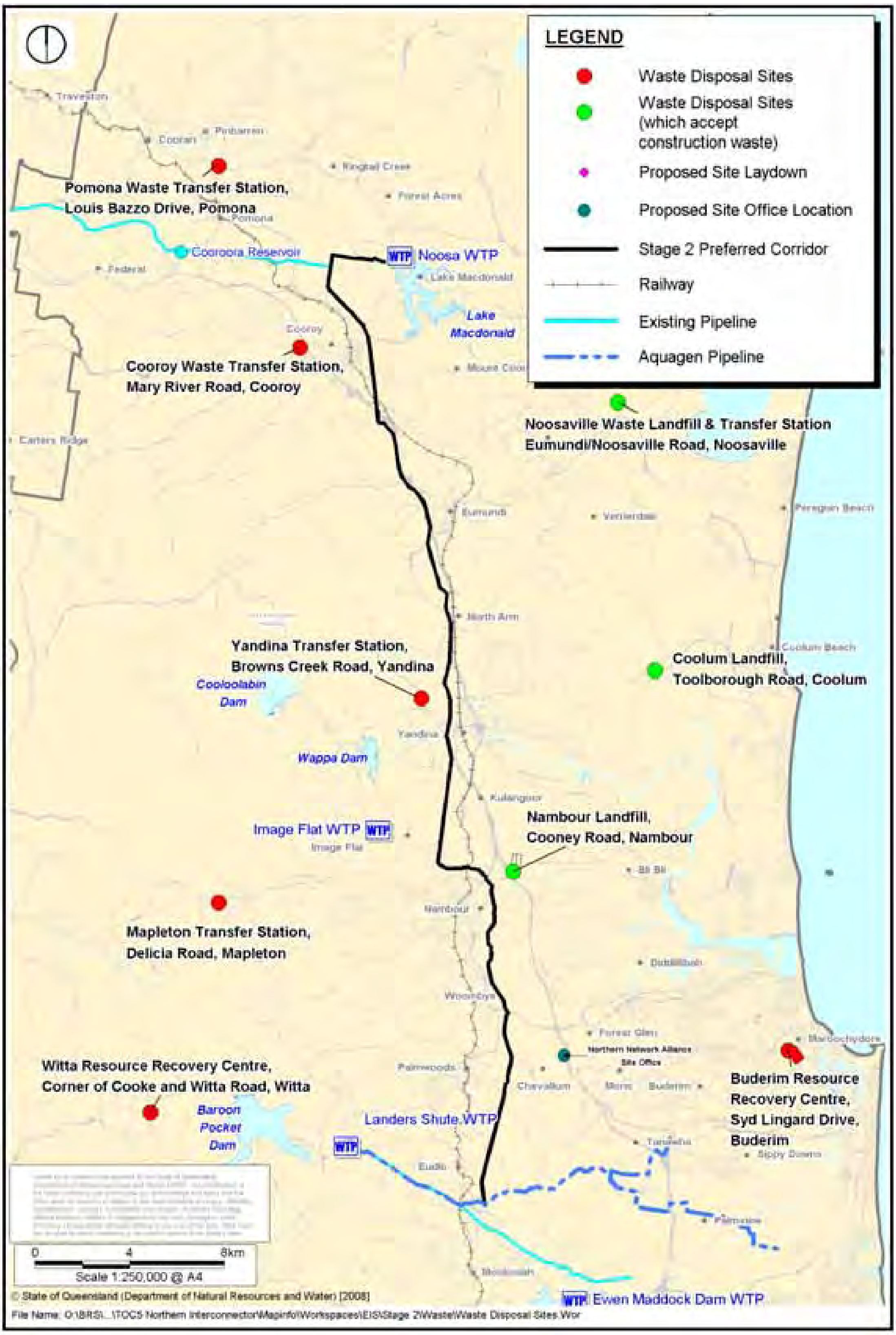


Figure 3.24
LANDFILL AND TRANSFER STATION LOCATION MAP

Table 3.48 Waste quantities to landfill for the SRWP to April 2007

Monthly waste quantity (m^3)						
Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07
96	48	96	155	309	178	99

The management of large or problematic waste streams such as those resulting from excavation, hazardous materials and water usage are discussed separately below.

Table 3.49 Key construction waste streams and potential treatment methods

Waste separation on site	Reuse/recycling/disposal method	Target reuse/ recycle	Waste type
Topsoil—weed-free and suitable for reuse on site or off site	Where possible, reserve land for topsoil stockpiling for duration of project for use in landscaping	100%	Inert
Spoil from excavations—suitable for reuse on site or off site (based on engineering suitability and waste classification)	Beneficial reuse on site or off site Balance cut and fill earthworks, where possible, to optimise reuse on project	100%	Varied depending on contamination investigations
Other spoil from earthworks	Beneficial reuse at another site or used on site for landscaping/earth-bunding	100%	Based on contamination investigation report findings
Paper/cardboard/ plastic	Off-site recycling	100%	Inert
Glass/bottles/cans	Off-site recycling	100%	Inert
Cleared vegetation/green waste	Reuse on site/send to green waste recycling centre	100%	Solid
Concrete products	Crushed and reused as backfill or as road base for site access/used for site levelling or stabilisation/sent off site	100%	Inert
Timber (formwork)	Reuse on site where possible/off-site recycling	100%	Inert
Steel (reinforcement)	Off-site recycling	100%	Inert
Asphalt	Reused for road base during construction or off-site recycling	100%	Inert

Table3.49 (continued)

Waste separation on site	Reuse/recycling/disposal method	Target reuse/ recycle	Waste type
Hydrocarbons (oils/grease)	Off-site recycling	100%	Non-aqueous liquid waste
Oily rags	Off-site recycling	100%	—
Paints/solvents	Off-site disposal at approved facility	Not recycled	Non-aqueous liquid waste
General solid waste (site skip bins for general waste)	Off-site disposal at approved facility	Not recycled	Solid
Chemical wastes	Off-site disposal at approved facility	100% if recyclable	Hazardous
Printer cartridges	Off-site recycling	100%	Hazardous
Sanitary wastes	Sewer is available Hygiene services to be used as appropriate	n/a	n/a

Excavation Waste (Spoil)

A significant amount of construction waste will be generated in the form of spoil and rock during excavation and tunnelling works. As a general rule, 2500 m^3 of surplus spoil is generated for every kilometre of pipe laid; however, most of this material can be reused on or off site and is not likely to require disposal to municipal landfill.

Rocky waste may be generated as the result of blasting when laying pipe through certain terrain. It is difficult to estimate the amount of rocky waste that will be generated during construction until the detailed design phase of the project has been completed; however, these volumes are not expected to be problematic. While the reuse options for this material are more limited than spoil due to the size of the particulates, there will be adequate opportunities for reuse in the construction of haulage roads, drainage channels and other effective reuses.

Site Office Waste

The NPI Stage 2 construction site office is located at the end of Sunridge Farm Road in Chevallum, and will remain in operation for the duration of the project.

The amount of waste expected to be generated can be approximated using available data for the SRWP Alliance (NPI 1) site office (see Table 3.50).

Table 3.50 Waste outputs at NPI 1 construction site office, Caboolture

Waste stream	Quantity
Solid waste disposal	94 m^3/a
Solid waste to recycling	130 m^3/a
Wastewater	22,412 L/a

The NPI Stage 1 site office comprises one large demountable building designed to accommodate approximately 90 office staff, plus four smaller demountable buildings (including bathrooms). The NNA site office will be designed to accommodate a similar number of staff and is therefore expected to have comparative waste outputs.

As with the Caboolture site, water saving devices (aerated taps, dual flush toilet systems and water efficient appliances etc.) are used at the NNA offices to minimise the amount of wastewater generated. Recycling receptacles will also be made available to reduce the amount of solid waste to landfill.

Hazardous Waste

Hazardous materials likely to be present on site are herbicides used to control vegetation regrowth and weeds, diesel fuel, other machinery fuels and oils and hydraulic fluids. With these materials there is the potential to generate hazardous wastes in the event of any spillage. The following measures will be implemented to limit the possibility of a spill occurring and to manage the resulting waste should such an incident occur:

- All construction equipment and vehicles entering the site will undertake decontamination procedures prior to entering the construction corridor or before starting work.
- Storage, safeguarding and warning signs will be in accordance with regulations and Australian Standards and the *Dangerous Goods Safety Management Act 2001* and Regulations. All hazardous goods, fuels and oils are to be stored at the work depots in appropriately signed, segregated and bunded sites.
- Materials Safety Data Sheets (MSDS) for all chemicals stored on site will be made available; site personnel will be informed of their location as part of the site induction.
- An appropriate emergency response contingency plan will be in place to manage containment and rehabilitation of contaminated areas, and disposal of contaminated material.

- Distribution of herbicides will be undertaken by, or under the direct supervision of, a licensed commercial operator, using approved equipment, in accordance with the *Agricultural Chemicals Distribution Control Act 1966*.

There is also the potential to generate hazardous waste as the result of excavating sites previously contaminated with hazardous substances. Initial investigations have not revealed any registered contaminated lands along the proposed route; however, it is possible that areas of contaminated soil may be identified during construction. In this case, the excavated material will be transported and disposed of in a manner appropriate for the particular contaminant and in accordance with EPA guidelines. The environmental controls and procedures for managing contaminated land will be detailed in the contaminated land management plan.

Wastewater

As the NPI Stage 2 will carry potable water, the majority of operational discharges will be water that has been treated to Australian Standards for drinking water. Potable water discharges may be the result of:

- overflows from balance tanks in the event of a system failure;
- depressurising or dewatering of pipeline sections for maintenance;
- pressure relief in the event of a system failure; and
- regular valve maintenance.

Non-potable water discharges from the NPI Stage 2 may result from:

- hydrostatic testing prior to commissioning;
- cleaning and pre-disinfection stages of commissioning for the new pipeline; and
- cleaning of the pipeline as part of the regular maintenance program.

Water discharges and appropriate management of wastewater from the NPI Stage 2 are addressed in further detail at Appendix I of this EIS.

Operation and Maintenance Activities

Small amounts of waste will be generated as a direct result of ongoing operation and maintenance of the pipeline and associated facilities. This waste is likely to include:

- used oil from vehicle oil changes;

- replaced pump bearings and other worn mechanisms;
- replaced failed equipment;
- materials common to a typical fieldwork environment, such as waste paper, food scraps and packaging; and
- green waste from ongoing maintenance of the corridor and access tracks.

Chemical storage will be required at dosing and water quality monitoring facilities; therefore, chemicals will be delivered to these facilities in tankers and pumped directly into bunded bulk containers (approximately 100 L). This practice restricts the potential for exposing chemicals to the environment and eliminates the need to dispose of containers. The normal operation of these facilities is not expected to generate waste streams of any type. Should an accident occur, incident response plans (IRPs) will be enacted to manage any spills.

3.7.2 Waste Management

Specific waste management strategies have been outlined above within each individual sub-section. It should be noted that prior to commencement of works, a comprehensive waste management plan will be developed.

3.8 Transport

3.8.1 Transport Methods and Routes

Transport methods for the project will predominantly be by road however alternatives have been considered and are discussed in this section.

The transport of construction machinery and materials to site will be by via a combination of both road and rail. It is anticipated that many materials will be initially transported or shipped to Brisbane and then transferred to the Sunshine Coast via road. Road transport will also include transport around and to the project corridor.

The proposed corridor is often parallel to, or within 5 km of, the Brisbane to North Coast railway line, and rail transport has therefore been investigated. Road haulage is the preferred transport method, however. Rail transport is hampered by the current lack of appropriate rail sidings and infrastructure (loading and unloading sites) and the need for double handling when transporting to and from the rail network.

The main items requiring transport will be plant, pipes and associated materials. ‘Plant’ in this instance refers to all types of heavy construction machinery (eg excavators and dozers). Materials will include line pipe, pipe fittings (eg pipe bends and large gate valves), pumps, pipeline backfill material, concrete and structural steel. Both these types of plant and materials will be transported on semi-trailers to temporary laydown areas. The number of fittings per truck load will be dependent upon the size and nature of the particular fitting being transported. It is estimated that approximately 10–15 loads of materials will be delivered to laydown areas per day.

The length of pipe to be transported is estimated to be 48 km. Pipe will be delivered regularly if not daily (dependent upon manufacturing schedule) to designated laydown areas with pipe sections then transferred to worksites on an as-needed basis. Estimated truck movements for the delivery of pipes and fittings are outlined in Table 3.51. The number of truck movements for the 1290 mm diameter pipe will increase during transporting pipe from the stockpile onto the right of way (ROW) as only one pipe per truck will be transported along the pipeline ROW. The lengths of the mild-steel, cement-lined (MSCL) pipe are likely to generate oversize loads, which will be transported in accordance with the Department of Main Roads *Guidelines for Excess Dimensions—Vehicles Carrying Indivisible Articles* (DMR 2008)

Table 3.51 Delivery of pipe and fittings—number per truck movement

Pipe type	Diameter (mm)	Standard length (m)	Number per truck	Approximate load/truck (t)
MSCL	1,290	12.0	2	15.0
DICL	450	5.5	12	12.5
DICL	500	5.5	10	11.7
Pipe fittings	–	–	6–10	–

MSCL—Mild -steel, cement -lined; DICL—ductile-iron, cement-lined.

Project construction will also involve transfer of construction personnel between worksites and ‘floating’ project services, such as pipeline backfill material deliveries, fuel trucks and water carts. Project work crews may include:

- pipe-laying crews;
- crews constructing bored crossings of road and rail crossings; and
- pipeline tie-in crews completing short sections of pipeline installation and facilities (eg pump stations and balance tank).

Current program scheduling has identified there will be a number of work crews operating along the alignment at any one time during the construction phase. Forecast vehicle number movements (trips) and vehicle types associated with construction are summarised in Table 3.52.

Table 3.52 Construction transport requirements (other than pipe transport)

Category	Likely origin	Transport method	Approximate trips generated
Workforce transfer	Sunshine Coast/ Brisbane	Dual and single cab four-wheel drives	100 fleet vehicles; 50 km/d per vehicle; around 200 km/d for workers from Brisbane or elsewhere in SEQ
Bedding material	Moy Pocket	Heavy (14 ton) tipper (truck and dog)	60 trucks per day
Concrete	Local batch plants	Agitator trucks	6–10 m^3 per delivery; up to 25 trucks per day for pipe and 50+ trucks per day for structures
Structural steel	Overseas suppliers	Ship/prime mover and trailer	Average 15 t per delivery for balance tank & pump stations; and 9 truck trips per facility
Plant	Local suppliers	Low-loaders	Average 10 trips per day across all work fronts (up to 6 pipe-lay work fronts)
Tunnel boring machines	Sunshine Coast (NPI Stage 1)	prime mover and trailer	Average 2 trips per day across all work fronts (4 work fronts)
Service vehicles (fuel; water carting)	Chevallum site office	16,000 L fuel truck and water trucks	6 vehicles up to 4 trips each or 250 km/d
Spoil disposal	Individual work fronts	Heavy (14 ton) tipper	15 trucks per day per work front

Hazardous materials that are to be transported regularly include diesel fuel, spoil (dust) and minor volumes of chemicals used for construction. These hazardous materials will be managed through compliance with relevant legislation including transport, storage and handling procedures and the projects environmental management plans.

Construction Routes Overview

Transport routes required for the construction of the project are mostly determined by the proximity of the proposed pipeline corridor and the possible use of existing roads (eg haulage) and/or potential new temporary access points from existing roads (eg access to ROW and/or facility areas). The ROW is the cleared corridor that will accommodate the pipeline.

Project haulage and travel routes will be a combination of roads ranging from National (eg Bruce Highway), State-controlled collector roads and Local Government-controlled collector and local roads. Where possible, construction traffic will use the pipeline ROW rather than local roads. This will assist to minimise temporary disturbance to road users, local residents and physical impact to roads. A summary of the major roads likely to be affected by construction is provided, listing from northern to southern limits of the corridor, in Table 3.53 and shown in Figure 3.25.

Table 3.53 Summary of major roads utilised by the NPI Stage 2 construction

Road name	Controlling road authority	Road category	Nature of potential impact	AADT (2007)
Lake Macdonald Drive	#SCRC	Local collector	Haulage route/road crossing	Not known
Tewantin Road	*State	Collector	Haulage route/road crossing	≈ 8500
Eumundi Range Road	#SCRC	Local collector	Haulage route	Not known
Bruce Highway at Cooroy	*State	Regional arterial	Haulage route/road crossing	≈ 16,000
Eumundi–Kenilworth Road	*State	Collector	Haulage route/road crossing	≈ 2400
Eumundi–Noosa Road	*State	Collector	Potential haulage route	≈ 5300
Bruce Highway at Yandina/Chevallum	*State	Regional arterial	Haulage route	≈ 25,400 ≈ 43,600
Yandina-Bli Bli Road	*State	Collector	Potential haulage route	≈ 1200
Duhs Road	#SCRC	Local collector	Haulage route/road crossing	Not known
Petrie Creek Road	#SCRC	Local collector	Haulage route/road crossing	Not known
Nambour–Bli Bli Road	*State	Collector	Haulage route/road crossing	≈ 9000
Nambour Connection Road	*State	Collector	Haulage route/road crossing	≈ 25,000
Diddillibah Road	#SCRC	Local collector	Haulage route/road crossing	Not known
Chevallum Road	#SCRC	Local collector	Haulage route/road crossing	Not known
Sunridge Farm Road (service road)	#SCRC	Local	Site office access	Not known
Old Gympie Road	#SCRC	Local collector	Haulage route	Not known

* *DMR manages State-controlled roads.*
\# *Sunshine Coast Regional Council.*
Note: *AADT traffic volumes obtained from DMR North Coast Region 2007 Traffic Census.*

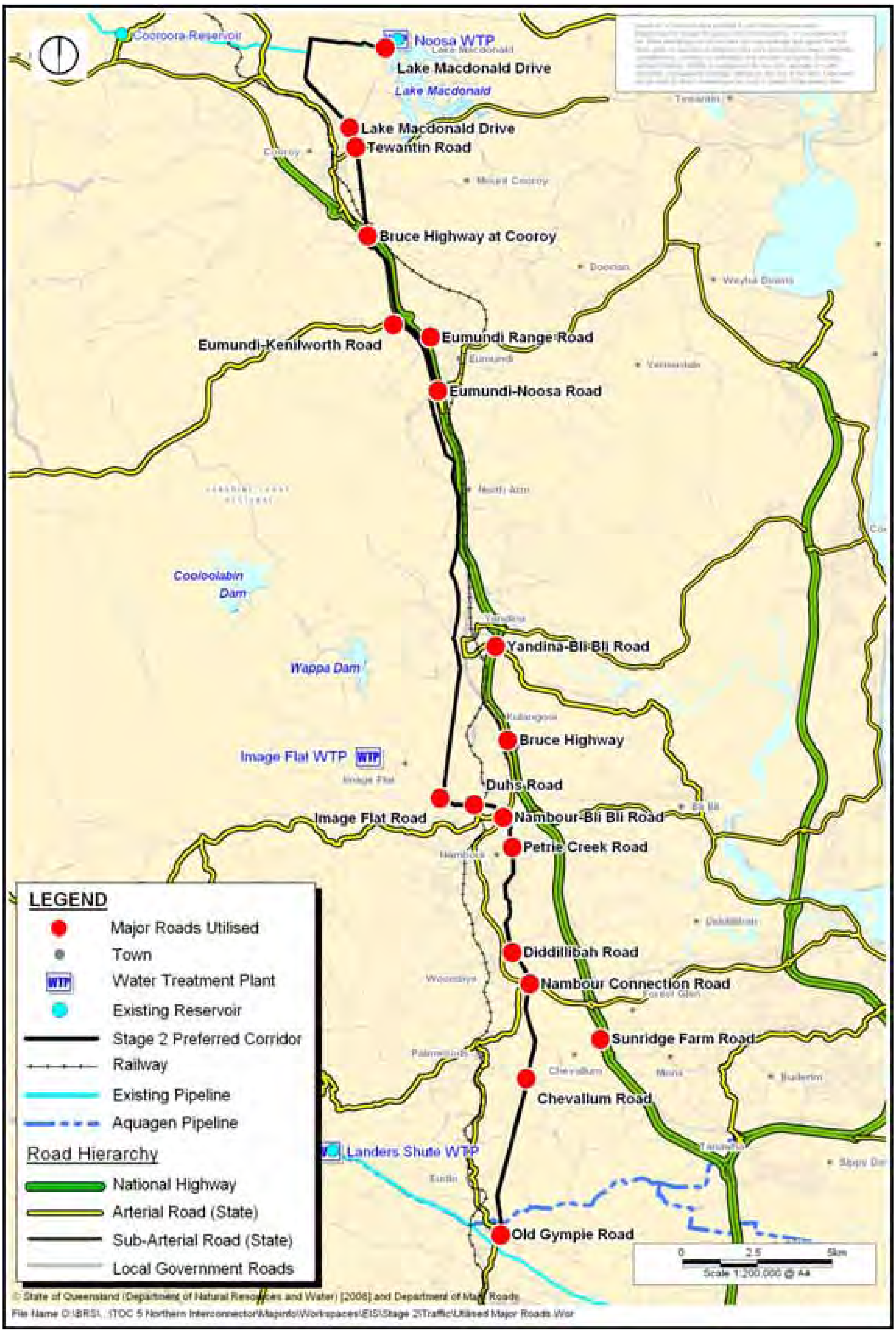


Figure 3.25
MAJOR ROADS UTILISED

'Laydown areas' will be used to store delivered pipe. Where possible it is preferable for laydown areas to adjoin the project ROW to enable the direct transport of pipe to the laying point rather than using local roads. Security fencing and patrols will be used at laydown areas to prevent public access to construction access ways that are not public roads. The locations of laydown areas are yet to be finalised.

Plant will be delivered directly to the worksites. Plant will be sourced from local contractors wherever possible to minimise road haulage. Following delivery, plant and vehicles will travel along the ROW where possible.

Quarry material for pipe-laying bedding, and sediment and erosion control will be sourced locally where possible and delivered directly to the worksite where suitable access for road trucks is available. However, where small sections of the route traverse steep terrain it may be necessary to deliver materials to stockpiles for transport along the corridor by specialised haulage vehicles.

Concrete for encasing of the pipe is generally only required at crossing locations or where the pipeline corridor intersects existing service corridors. The number of truck concrete trips will vary between approximately 2 and 25 trips per day depending on the final length of pipe to be concrete encased. Concrete deliveries for facility structures (eg balance tank, pump station and water quality management facility) will occur for the pouring of the foundation slabs and are likely to involve 40–50 truck trips as a single campaign for each structure..

Structural steel required for facility structures will be delivered directly to the established facility sites. The figures presented in Table 3.52 are based on approximately 400 t of steel being delivered across three sites. Generally 15 t will be delivered for each truck trip.

For the majority of the route, topsoil and subsoil material excavated from the trench will be stockpiled along the ROW. Where a reduced corridor is used, spoil will be moved a short distance and stockpiled. Spoil not used for trench reinstatement and rehabilitation will need to be removed permanently for reuse or disposal at approved locations.

Although all facilities will be located outside the 1 in 100 ARI flood inundation the construction of all-weather tracks is being considered at key locations along the pipeline route where prone to flooding. All-weather tracks would potentially enable access to some flood-prone worksite areas such as near the South Maroochy River.

All-weather access tracks will typically be dismantled after use. Initial discussions have been held with Energex, however, with regard to leaving some roads sections in place to facilitate construction of the SunCoast Power Project. In the instance that these access tracks remain in place, it is anticipated that Energex construction crews will be responsible for dismantling these roads once works are complete. In some cases LinkWater may elect to maintain these roads to facilitate access for operation and maintenance of the pipeline. Additional flood modelling may be undertaken to determine whether sections of the access tracks could be maintained in specific locations.

Site-specific Construction Routes

Potential construction site-specific routes have been identified. It should be noted that a number of factors may determine final site-specific routes. It is likely that the worksites described below will each have an individual traffic management plan developed to mitigate any potential impact. Individual traffic management plans will be developed prior to the commencement of construction.

Proposed transport routes and associated access points are summarised in Table 3.54 and shown in Figure 3.26. These are based on anticipated worksites and locations, including:

- laydown areas (eg pipe stockpiles)—locations are yet to be finalised;
- a balance tank, water quality management facility and pump station, which may be required for the project to maximise hydrologic operating efficiencies. These project facilities are currently being considered near Kulangoor with the access point yet to be finalised;
- work areas defined as ‘anticipated longer term operations’ (eg tunnels and areas with a reduced corridor). Anticipated work areas include Buckle Street, Yandina; Nambour Showground; Pringle Hill, Nambour; and Christian College, Woombye; and
- NNA Chevallum Site Office, Chevallum.

Figure 3.26
WORK ZONES

Table 3.54 Transport routes and associated access points

Worksites	Proposed routes	Proposed access points	Comments
Laydown Areas (eg pipe stockpiles)	Initially Bruce Highway, exit to proposed site	Yet to be determined	Landowner negotiations yet to be completed
Balance tank, water quality management facility and pump station	Initially Bruce Highway, exit at Nambour Connection Road, then to proposed site	Kulangoor with access point yet to be finalised	—
Buckle Street, Yandina	Initially Bruce Highway, exit at Nambour connection Road, then to proposed site	Access point yet to be finalised. Potentially any of the surrounding roads including Old Gympie Road and/or Cooloolabin Road	Provision of temporary alternative transport for Buckle Street residents may be considered (eg provided mini bus with driver)
Nambour Showground	Initially Bruce Highway, exit at Nambour connection Road, then to proposed site; and/or Initially Bruce Highway, exit at Bli Bli Road Nambour, then to proposed site	Access point yet to be finalised. Potentially Bli Bli Road, Coronation Avenue and/or Crusher Park Drive	—
Pringle Hill, Nambour	Initially Bruce Highway, exit at Bli Bli Road Nambour, then to proposed site	Access point yet to be finalised. Potentially any of the surrounding roads including Petrie Creek Road	—
Christian College, Nambour	Initially Bruce Highway, exit at Nambour connection Road, then to proposed site; and/or Initially Bruce Highway, exit at Bli Bli Road Nambour, then to proposed site	Access point yet to be finalised. Potentially McKenzie Road	—
NNA Chevallum Site Office, Chevallum	Initially Bruce Highway, exit at Chedvallum	Sunridge Farm Road, Chevallum	—

Operation and Routes

'Operation methods' in this instance refers to the transport requirements of the operation and maintenance (O&M) phase. The O&M of the completed pipeline and related infrastructure will LinkWater's responsibility to resource. O&M follows completion of the construction phase.

It is anticipated that the transport method used for the O&M will be via road vehicles on existing roads, easements and the ROW. Access will be required for scheduled and any unexpected maintenance. Similar routes and associated access points will be used as identified for the construction phase (see above).

3.8.2 Potential Impacts and Mitigation Measures

The following activities associated with the construction and operation and maintenance of the pipeline and facilities have the potential to impact on the road network and traffic operations:

- employee home-based work trips to the construction depots;
- transport of construction personnel between the depots and the worksites each day;
- servicing trips associated with the depots;
- transport of pipe materials to the various laydown areas as well as the transport of pipe materials from the laydown areas to the pipeline trench;
- transport of quarry product to the works site;
- transportation of spoil from the works site;
- construction of road crossings of the pipeline; and
- pipeline inspections during the operation phase and ongoing maintenance of the pipeline.

The preliminary traffic assessment has been undertaken to identify the potential impacts of the pipeline construction activities on the road network. These impacts are categorised as follows:

- increased traffic volumes on particular roads and volumes of heavy vehicles affecting road users as well as pedestrians and cyclists;
- disruption to normal traffic by either traffic diversions or delays at worksites; and
- potential deterioration of road pavements by increases in heavy vehicle movements.

Construction Impacts

Transport related impacts for the construction and operation phases of the project will be:

- increased traffic volumes along particular roads and the interaction of motorists, cyclists and pedestrians with construction traffic;
- potential accelerated physical deterioration to roads;
- delays to traffic negotiating around worksites where construction activities associated with the pipeline occur within the road reserves;
- construction vehicles accessing the road network from the pipeline ROW affecting safety to road users; and
- constraints imposed on any future infrastructure (eg road and rail) to maintain the integrity of the pipeline.

The traffic generated by the construction of the pipeline is expected to have minimal impact on the Bruce Highway and the Nambour Connection Road. The impact of the increased traffic volumes associated with the Chevallum Site Office on Sunridge Farm Road will be sustained for the duration of the construction period. The majority of the increased traffic on Sunridge Farm Road will be associated with employee home-based work trips and work-based work trips in light vehicles.

Small volumes of construction traffic will use Petrie Creek Road for the duration of the tunnel bore which may take up to two years to complete. The tunnel bore will be undertaken by small crews working around the clock. Progress of boring is expected to be slow, and therefore trips associated with the supply of materials to the site and removal of spoil from the drill is expected to be less than 10 trips per day.

Construction traffic associated with the construction of the balance tank, water quality management facility and pump station will use access roads over a sustained period of time until the completion of the structures.

For the majority of the other roads affected by the construction of the pipelines, the traffic increases will be over relatively short time frames as the work front progresses (eg several months).

The accelerated deterioration of the pavements is a potential consequence of heavy vehicles using lightly constructed pavements. Where practical, heavy vehicles will use the pipeline ROW in preference to travelling along local roads with lightly constructed pavements.

The construction of the pipeline within or alongside roadways will impact on the traffic operation. A preliminary assessment of anticipated traffic impacts in these instances for specific roads and road categories has been undertaken (Appendix N). The report produced by TTM Consulting (Qld) Pty Ltd is an initial traffic impact assessment for the project. The purpose of this report was to provide advice on the most appropriate construction and traffic management techniques to minimise the impact of the pipeline construction on traffic along the route. The report includes:

- vehicle per day data (VPD);
- proposed project work zones including schematic figures; and
- likely traffic impacts for particular roads (eg work zones within carriageways and estimated traffic delays in minutes when passing these work zones).

The project corridor has been designed to minimise the potential for impact on existing and future transport infrastructure with major road and rail crossings to be constructed via tunnel boring. Where possible State-controlled roads will be maintained at 100% capacity, resulting in no disruption to 'normal' pre-construction traffic flows.

Some short-term minor impacts as a result of the construction phase are anticipated (Appendix N). No long-term impact on the road system is expected. Potential impacts on road access and deterioration resulting from the construction program will be managed directly with the relevant state and local authorities. It is likely that government agencies (eg DMR and/or local government authorities) will be engaged to repair any deterioration of the existing road system resulting from the project. Any impacts will be addressed through individual traffic management plans.

As this project is authorised under the *State Development and Public Works Organisation Act 1971*, the Department of Main Roads has the power to set conditions under the *Transport Infrastructure Act 1994* for the State-controlled network. The Department has published *Guidelines for Assessment of Road Impacts of Development* (DMR 2006). The guidelines assist developers to undertake a road impact assessment (RIA) if required and ensure that the assessments are in accordance with an agreed methodology. The threshold for an RIA is a 5% or greater use of the life of the pavement or 5% or greater increases in traffic volumes of heavy vehicle volumes on a particular section of the road network. The need for an RIA applies more to a project that generates significant traffic movements after the facility is completed and less applicable for projects that generate little traffic after the construction phase, as is the case with NPI Stage 2. In NPI Stage 2 there will be significant increases in traffic along particular routes over a relatively short time.

Impact on Future Public Transport Infrastructure

The route of the proposed alignment of the pipeline ROW will be discussed with the Department of Main Roads, Sunshine Coast Regional Council and Queensland Rail with the view to ensuring that the pipeline does not affect any known future upgrades of transport infrastructure.

Accelerated Pavement Deterioration for Sunshine Coast Regional Council Roads

A condition assessment will be undertaken prior to construction commencing as well as after construction is completed. Remedial treatment, if required, will be negotiated between the proponent and the council. Where practical, the pipeline ROW will be used instead of local roads for haulage of materials.

An assessment of the need for an RIA will be undertaken for the State-controlled road network in liaison with DMR. Negotiations on the impact will be negotiated with the DMR if an RIA is needed.

Traffic Operations

An overall traffic management plan will be prepared as a sub-plan under the Construction Management Plan for the project. The Traffic Management Plan sets out the procedure for the management and control of traffic around each work zone on each road affected by the construction of the pipeline in accordance with the following criteria:

- the requirements for public notification of changes to traffic operations, potential delays, and if applicable, alternative routes for each site. This will be undertaken via letter box drops and media articles as part of the project community engagement process;
- the preparation of specific traffic control plans showing traffic lane arrangements, and traffic control devices including signs and traffic controllers for each site. This plan will be submitted to the relevant roads authority for approval. Plans will also address requirements for obtaining the Queensland Police Service permits;
- the release of the site to the construction team and traffic control personnel once all permits are obtained and the community engagement requirements are completed;
- the recording requirements for the implementation of each traffic control plan;
- the monitoring of the implementation of traffic control measures in accordance with the approved traffic control plan; and
- procedures for managing incidents should they arise.

Planning transport routes will be undertaken in consultation with local and state authorities. This will include maximising the use of major roads as haulage routes for the transport of plant, materials and vehicles. Routes will also consider the impact on other users, pedestrians and cyclist, especially in areas near schools and recreational facilities.

3.9 Indigenous Cultural Heritage

3.9.1 Description of Environmental Values

The Aboriginal inhabitants of the Maroochy district were the people of the Gubbi Gubbi language group. Existing documentation indicates that this group might consist of a number of groups including the Nalbo, Kabi, Dallambara and Undanbi (MSC 2007). The proposed NPI Stage 2 corridor falls almost entirely within the boundaries of the Gubbi Gubbi People #2. The native title claim registered by Gubbi Gubbi People #2 extends south to the Pine River, north to the Burrum River and west as far as Kilkivan.

Indigenous cultural heritage sites could include axe grinding grooves, quarries, physical signs of past camp places, burial places, scarred trees and rock art. However, the main cultural heritage items in the project area are expected to be stone artefacts. Eighteen state registered Aboriginal cultural heritage sites were identified through the Aboriginal Cultural Heritage Register maintained by the Department of Natural Resources and Water (NRW 2007), none of which will be directly impacted by the Stage 2 project. Information contained in this register is considered culturally sensitive and is not publicly available.

A number of sites have also been identified by Gubbi Gubbi #2 representatives, and these will be managed in partnership with the traditional owners. Potential also exists for unexpected finds of indigenous cultural heritage items/sites as a result of construction activities in the project area.

No Australian or local government sites were identified within or near the project area. Search results are included in the cultural heritage management plan (CHMP) for this project, which has been agreed with and endorsed by the Aboriginal party and approved by NRW.

A CHMP has been agreed and approved for the NPI project and covers both Stage 1 and Stage 2 corridors. A CHMP is an agreement developed under Part 7 of the ACH Act between a land user ('the sponsor') and a traditional owner ('the endorsed party'). The approved CHMP complies with the ACH Act and *Torres Strait Islander Heritage Protection Act 1984* (Commonwealth) thereby meeting the cultural heritage duty of care.

The CHMP was developed using the following methodology:

- Engagement with the NRW Cultural Heritage Coordination Unit (CHCU) and consultation with a CHMP and native title specialist were undertaken to identify legislative compliance needs including relevant guidelines and fact sheets.
- A native title search was carried out for the whole project area, with additional searches and notifications to be undertaken in the event of changes to the corridor.
- Searches of the NRW CHCU database were carried out using affected property details for the proposed corridor and associated facilities.
- Written notices informing potentially affected landowners of the project were sent to over 700 recipients (landholders and traditional owners) in February 2007, with the notice period closing on 7 March 2007. The CHCU were informed of this process, including time frames.
- Endorsement of the Aboriginal party was obtained in April 2007 ratifying the successful engagement to reach agreement on the detailed CHMP.
- Approval of the CHMP by the NRW pursuant to Part 7 of the ACH Act was obtained prior to the finalisation of this EIS (meeting the cultural heritage duty of care).

3.9.2 Potential Impacts and Mitigation Measures

For the purposes of this assessment, indigenous cultural heritage is defined in accordance with the *Aboriginal Cultural Heritage Act 2003* (ACH Act) as:

- a significant Aboriginal or Torres Strait Islander area in Queensland;
- a significant Aboriginal or Torres Strait Islander object; and
- archaeological or historic evidence of Aboriginal or Torres Strait Islander occupation of an area.

The primary mechanism for mitigating impact to indigenous cultural heritage and demonstrating 'duty of care' will be the implementation of the approved CHMP for the NPI Stage 2 project (see above).

Potential cultural heritage impacts of the project are largely associated with the construction phase. These include burial of or damage to shallow artefacts, subsurface material and significant vegetation as a result of construction activities (eg clear and grade, trenching). Where possible cultural heritage items will be managed in situ (left in place). However, where impacts are unavoidable, items will be relocated or removed in compliance with the approved CHMP.

Agreed measures for managing cultural heritage include:

- ongoing communications with the endorsed Aboriginal party under the CHMP and/or nominated representatives;
- survey of the proposed corridor by the endorsed Aboriginal party to identify cultural heritage site/objects and to nominate particular sites for monitoring during construction;
- cultural heritage clearance prior to clear and grade activities; and
- attendance of all construction personnel at cultural heritage inductions and briefings.

3.10 Non-indigenous Cultural Heritage

3.10.1 Description of Environmental Values

Non-indigenous cultural heritage values were identified in the first instance by searching the Australian Heritage Database; the Queensland Heritage Register; local government heritage registers (for the former Maroochy and Noosa shires); and consulting with local historical societies (see Appendix F).

Database searches have been completed for all directly affected properties. Search results identified 17 heritage sites registered by the Queensland EPA within 3 km of the preferred corridor (see Figure 3.27). Subsequent investigations carried out by a specialist heritage consultant identified a further 10 unregistered potential heritage sites within 1 km of the proposed corridor; however, none of these sites met the criteria for entry on the Queensland Heritage Register (see Appendix H). The location of these sites is noted; however, no further assessment has been undertaken for this EIS.

3.10.2 Potential Impacts and Mitigation Measures

While a number of registered heritage sites were identified in proximity to the corridor, none of these will be directly affected by the NPI Stage 2 project. However, there is potential for previously unknown sites or items of heritage significance to be discovered during construction.

All construction personnel will receive inductions and pre-start briefings to assist them to identify items of potential heritage significance. If any unexpected sites or artefacts are located, the following actions will be taken:

- the site supervisor will be notified immediately;
- all works in the immediate area will cease;
- the Queensland EPA and relevant local authorities will be notified; and
- the relevant Aboriginal Party will be engaged for assessment.

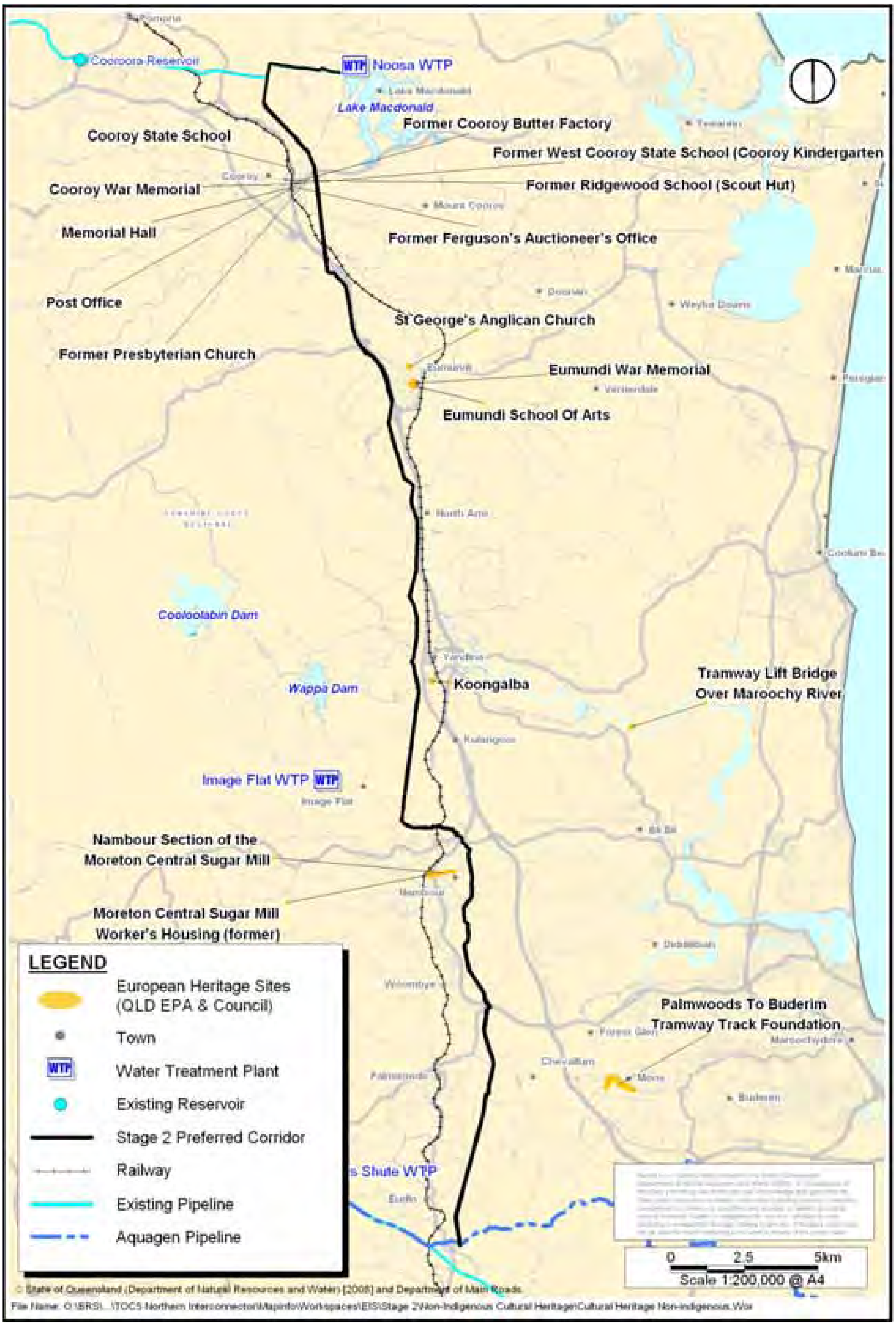


Figure 3.27
NON-INDIGENOUS CULTURAL HERITAGE SITES

3.11 Social and Economic Environment

3.11.1 Description of Environmental Values

Stage 2 of the NPI will traverse the newly amalgamated Sunshine Coast Regional Council, which comprises Maroochy, Caloundra City and Noosa. In recent years, the Sunshine Coast has recorded population growth exceeding the average rate for SEQ.

Overall, the population of the Sunshine Coast is projected to increase by an average annual rate of 2.5% to 451,255 persons in 2026. The Maroochy area, in particular, is one of the fastest-growing areas in Australia, with its population expected to increase significantly over the next 20 years (see Table 3.55). The Noosa area is also expected to experience population growth, albeit at a lower rate (ABS 2007).

Table 3.55 Population trends in the Noosa and Maroochy areas

Local government area	1996	2006	Projected population growth to 2026	Projected average growth rate (%) to 2026
Noosa area	34,969	45,832	55,154	0.9%
Maroochy area	104,137	142,839	239,017	2.6%

Source: ABS 2007.

Community and Social Structure

In 2006, Maroochy Shire was the largest local government area (LGA) on the Sunshine Coast, with 142,839 persons or 51.7% of the Sunshine Coast population. The Sunshine Coast in turn accounted for 10.7% of the population of the SEQ region. Key statistical data presented below is summarised in Table 3.56, with further detail provided in the report at Appendix P.

The average age of Sunshine Coast residents (40.3 years) exceeded the SEQ average of 37.3 years, with the youngest average age in the region (39.4 years) recorded in the Maroochy area. All Sunshine Coast LGAs recorded an increase in the average age between 1996 and 2006, which was consistent with the trend for SEQ.

The average household size on the Sunshine Coast in 2006 at 2.1 persons per household was lower than the SEQ average of 2.4 persons per household. The lowest average household size was recorded in the Noosa area at 1.8 persons per household.

In 2006, the average weekly household income on the Sunshine Coast was $1063, which is below the SEQ average of $1258. However, the Sunshine Coast had a relatively high proportion of fully owned households when compared with SEQ.

Average monthly housing loan repayments in 2006 were lowest in Noosa at $1489 compared with $1502 on the Sunshine Coast and $1529 in SEQ. Conversely, average rent payments were highest at Noosa ($240 per week) when benchmarked against the SEQ average of $235 per week.

Existing land uses in the project area are addressed at Section 3.2.3 of this EIS.

Table 3.56 Community structure

Statistic	Noosa Shire			Maroochy Shire		
	1996	2001	2006	1996	2001	2006
Population	34,969	41,866	45,832	104,137	121,705	142,839
Average age (years)	37.7	39.6	41.4	36.6	38.3	39.4
Average household size	1.90	1.87	1.77	2.18	2.17	2.13
Average weekly household income	–	–	$1025	–	–	$1087
Average monthly loan repayment	–	–	$1505	–	–	$1504
Average weekly rent payment	$145	$173	$240	$135	$159	$234

Source: Economic Associates (see Appendix P).

Workforce Characteristics

In March 2007, the total labour force on the Sunshine Coast was 143,172 persons, increasing at an average annual rate of 2.2% from March 2002. Growth in the size of the labour force has been significantly stronger in Caloundra City and Maroochy Shire relative to Noosa Shire, and exceeded the average rate for Queensland in 2006–07.

The unemployment rate in the region fell from 11.8% in the year ended March 2002 to 5.8% in the year ended March 2007. While the unemployment rate on the Sunshine Coast has remained above the Queensland average, the rate of decline in unemployment has exceeded it. The lowest unemployment rate was recorded for Maroochy Shire at 5.7%.

Table 3.57 Workforce characteristics

	Labour force			Unemployment		
	March 06	March 07	% growth	March 06	March 07	% change
Noosa Shire	24,137	25,280	4.7	6.6%	6.1%	–0.5
Maroochy Shire	72,663	76,104	4.7	6.1%	5.7%	–0.4

Source: Economic Associates (see Appendix P).

The structure of the economies in the project area can be broadly characterised by examining the main employment sectors on the Sunshine Coast. The top three enterprise types by industry were construction, property and business services, and retail trade. In comparison with Queensland, enterprise activity is relatively high in construction and property and business services, but below the state average for agriculture, forestry and fishing, and transport and storage.

Over the period 2001 to 2005, employment on the Sunshine Coast is estimated to have increased by 4.4% per annum (SunROC 2006). Over this period, the most significant growth occurred in the communication services (19.6% p.a.), construction (15.6% p.a.) and finance and insurance (9.1% p.a.) industries (see Table 3.58). Conversely, employment in the agricultural, forestry and fisheries sector declined by 8.9% per annum, the manufacturing sector by 4.3% per annum and wholesale trade by 2.5% per annum.

The Sunshine Coast regional economy has traditionally had a relatively large workforce in the construction industry compared with SEQ. It is anticipated that this factor, combined with strong population growth, may result in continued growth in the construction industry workforce to enable the demand for construction works generated by Stage 2 of the NPI to be met.

Table 3.58 Trends in key employment sectors for selected years 2001–2005

Industry	2001	2003	2005	Average annual growth (%)
Construction	5,391	5,347	9,614	15.6
Retail trade	15,707	17,930	18,801	4.6
Agriculture, forestry and fishing	3,195	4,252	2,204	-8.9
Accommodation, restaurants and cafes	7,196	6,097	8,327	3.7
Property and business services	7,508	7,614	10,567	8.9
Health and community services	8,622	9,408	8,884	0.8
Transport and storage	2,191	2,329	2,763	6.0

Source: ABS 2004.

Accommodation

The volume of house sales on the Sunshine Coast increased consistently between 1996 and 2002, peaking at 8448 sales in 2002. The volume of house sales remained strong in 2003, before falling significantly between 2004 and 2007. The unit and townhouse market has experienced considerably more volatility over the same period. However, median sale prices have generally increased (see Appendix P).

In the June 2007 quarter, the median weekly rent for a two bedroom unit was $250, marginally below the Queensland average of $260. However, the median weekly rent for a three bedroom house was $320, which exceeded the state average of $285. Nonetheless, trends show that rents on the Sunshine Coast have been increasing at a slower rate than the Queensland average.

The Sunshine Coast has 174 hotels, motels and serviced apartments with five or more rooms, 28 caravan parks, 4385 holiday flats, units and houses and nine hostels. The majority of capacity is located in Maroochy Shire. Demand for hotel, motel and serviced apartments on the Sunshine Coast has been particularly strong in the three most recent quarters, after recovering from a low of 49.3% in the June 2006 quarter. Conversely, the average room occupancy rate at caravan parks and hostels significantly exceeded Queensland averages.

Health Status and Sensitive Groups

The general health status of people in the Sunshine Coast region is quite high, with high numbers of people rating their health as excellent, very good or good in surveys undertaken by Queensland Health (2004). Conversely, a large percentage of those who stated poor health status were people who were also in disadvantaged socio-economic groups. Queensland Health (2004) identifies the following groups as likely to be vulnerable or sensitive:

- socio-economically disadvantaged groups, particularly children;
- females, particularly older females;
- elderly people, particularly as their health deteriorates;
- non-English speaking residents; and
- the indigenous population.

Table 3.59 summarises the number of people in these categories for both Noosa and Maroochy shires.

Table 3.59 Sensitive groups

Group	Noosa Shire	Maroochy Shire
Aged females (65–75+)	3,889	11,766
Aged males (65–75+)	3,731	10,130
Indigenous people	422	1,772
Non-English speaking people	1,229	3,346

Source: Queensland Health 2004.

Agricultural Communities

A large proportion of the project area comprises rural and agricultural lands. The most significant crop in the study area is ginger; however, there are also properties growing pineapples, passionfruit and tree fruit crops, two turf farms, two plant nurseries, a fish hatchery, an apiary and lots with cattle and horses.

Until 2003, sugar cane was one of the primary agricultural industries in the Sunshine Coast region. In 2003, the Moreton sugar mill in Nambour closed, removing a market for local cane growers that had existed for more than a hundred years. According to a recent CSIRO study (McDonald 2006), some farmers face a limited set of alternative farming or forestry opportunities. While some growers have already diversified, others are having greater difficulty doing so. At present, there are areas of abandoned cane lands along the proposed corridor, and little evidence of cane cultivation. It appears that former canelands in some of the higher areas are now being used for alternative agricultural products.

The closure of the mill had direct and indirect effects across a broad cross-section of the Sunshine Coast community. Close consultation with growers will be undertaken to ensure these impacts are not unreasonably intensified through the establishment of an easement across formerly productive land, or where growers have adapted by planting other crops.

Facilities and Services

The region is serviced by a wide range of community and emergency services, including Fire, State Emergency Services, Police and Ambulance. The project area includes a number of tourist and recreational facilities. There is also a diverse range of religious groups and institutions in the area.

Health Facilities

The pipeline traverses the Sunshine Coast and Cooloola Health Service District, which includes the Nambour General Hospital in close proximity to the alignment. Other institutions in the project area include the Noosa Hospital (public and private) and Nambour Selangor Private Hospital. These hospitals offer a range of services, including general and emergency medicine, surgery and intensive care amongst others. There are also numerous health and medical practitioners in the main centres along the route, including five medical practices at Nambour and two at Cooroy.

Education and Child Care

The proposed corridor falls within the Sunshine Coast North education district and includes five state primary schools, two state high schools, one special education unit, Noosa Christian College and Sunshine Coast Christian Outreach College in reasonable proximity. The proposed corridor directly affects two schools: the Sunshine Coast Christian Outreach Centre and College and Nambour State School. There are also numerous kindergartens and child care centres operating within the study area. These have the potential to experience nuisance effects associated with construction, including disruptions to access, noise and dust impacts.

3.11.2 Potential Impacts and Mitigation Measures—Social Environment

The overall aim of the SEQ water grid, of which the NPI project is part, is the provision of a secure water supply for the SEQ region. This is a positive outcome for communities currently facing critical water shortages, as well those communities that may face potential shortages in the future.

However, construction and operation of the pipeline also has the potential to cause changes to the social environment of communities along the route. Key impacts for the proposed NPI corridor include:

- loss or encumbrance of residential, commercial and agricultural uses;
- potential indirect impacts on agricultural landholders resulting from a decline in surface or groundwater quality;
- restricted access due to construction traffic and traffic diversions;
- potential for local traffic congestion;
- temporary amenity impacts for businesses and residents, including potential dust and noise impacts; and
- associated social impacts, including stress or anxiety for affected landholders and community members.

Effective community and stakeholder engagement is critical to taking community needs into account in construction planning. Consultation with affected communities will be undertaken in accordance with a project-specific community and stakeholder management plan.

If residents have specific concerns, the project complaints register will be accessed either through direct communications to the project freecall (1800) number, the project web site or via direct mail to the project. The freecall information line will be monitored during construction hours and will remain operational until the end of the project. All calls will be returned within 24 hours by a staff member with specific knowledge of the project.

As there will be few permanent restrictions on land use, families or workers on affected properties will not be unduly affected by the project in the long term. Similarly, Aboriginal contemporary use and enjoyment of land will remain unaffected by the subterranean pipeline.

Impacts on Affected Landholders

While every effort will be made to minimise impacts on individual landholders, construction of the NPI Stage 2 will result in some temporary and permanent impacts on landholders.

Where the route crosses freehold land, an easement will be established to ensure access for construction and maintenance. In accordance with the *Acquisition of Land Act 1967*, the state government (through the Department of Infrastructure and Planning) will be responsible for acquiring easements over land, based on design justification for the pipeline route and associated facilities.

Financial compensation will be paid to individual landholders, including any tourism facilities, for the disruption to their use and enjoyment of land. Easements will be assessed by independent valuers at no cost to the landholder.

Agricultural Landholders

The extent of impact on agricultural landholders is largely dependent on the nature of the crop or other agricultural product, as set out in Table 3.60. The current situation with respect to equine influenza and its potential impact on agricultural and other rural landholders is also recognised. During construction, a comprehensive policy consistent with Department of Primary Industry and Fisheries (DPI&F) recommendations will be implemented to minimise the potential risk of spreading the virus to unaffected properties.

Table 3.60 Agricultural uses potentially affected by the corridor

Industry	Potential impact	Impact mitigation
Ginger	Annual crop with bulbs sown in spring and harvested in autumn (April to May)	Consultation with affected growers; route selection to avoid areas of highest impact; timing construction to avoid harvest times where possible; compensation for permanent losses
	Potential for subsurface irrigation pipelines on individual farms	Post-construction reinstatement of affected infrastructure
Sugar cane	Interruption of harvest period between June and December where cane is still grown	Consultation with affected growers; route selection to avoid areas of highest impact; timing construction to avoid harvest times where possible; compensation for permanent losses
	Potential for subsurface drainage or irrigation pipelines on individual farms	Post-construction reinstatement of affected infrastructure
Pineapples	Perennial crop, sown all year round. Each plant produces a second or 'ratoon' crop	Consultation with affected growers; route selection to avoid areas of highest impact; timing construction to avoid harvest times where possible; compensation for permanent losses
	Potential for subsurface irrigation pipelines on individual farms (for larger operations)	Post-construction reinstatement of affected infrastructure
Passionfruit	Fruit harvested continually once vines start producing (every couple of days). Vines are normally replanted every 4 years – fruiting within 12 to 18 months	Consultation with affected growers; route selection to avoid areas of highest impact; timing construction to avoid harvest times where possible; compensation for permanent losses
	Potential permanent loss of vines within a 'sterile zone' to be defined	Compensation for permanent losses
Tree fruits	Temporary loss of trees within construction corridor	Consultation with affected growers to minimise impact; route selection to avoid areas of highest impact
	Potential permanent loss of trees within a 'sterile zone' to be defined	Compensation for permanent losses

Table 3.60 (continued)

Industry	Potential impact	Impact mitigation
	Disturbance of poles and netting to protect fruit	Post-construction reinstatement of affected infrastructure
Plant Nursery	Temporary loss of production area	Consultation with affected operator; timing construction to minimise disruption; compensation for permanent losses
	Potential for damage to permanent infrastructure within the easement	Minor refinements to route to avoid infrastructure; consultation with affected farmer to minimise disruption to operation and permanent impact; compensation for permanent losses
Fish hatchery	Potential for damage to ponds and other permanent infrastructure within the easement	Minor refinements to route to avoid infrastructure; consultation with affected farmer to minimise disruption to operation and permanent impact; compensation for permanent losses
Apiary	Potential requirement for the temporary relocation of hives	Post-construction reinstatement of affected infrastructure
Turf farm	Temporary loss of production area	Consultation with affected operator; timing construction to minimise disruption; compensation for permanent losses

Temporary Disruptions during Construction

Table 3.61 summarises the potential impacts on community facilities in the project area. Residents on the pipeline route may also be affected by a range of nuisance impacts, particularly related to noise, dust and traffic and access disruptions. Mitigation strategies are outlined below, with further discussion of specific impacts contained within other sections of this EIS as indicated.

Disruption to Community Facilities and Events

Where community facilities are directly affected by the proposed pipeline, the affected stakeholders will be consulted extensively to minimise impacts. Potential mitigation measures include the timing of construction outside peak usage times for sporting fields, and assistance with alternative arrangements for the duration of works.

Health, Safety and Amenity

Direct impacts on community health, safety and amenity will arise primarily from construction and include dust generation, construction noise and vibration from blasting. The duration for which specific residents and communities are exposed to these disruptions will be minimised to the greatest extent possible to minimise anxiety and distress. Specific mitigation strategies are discussed in the sections of this report relating to the air environment (Section 3.5) and noise and vibration (Section 3.6).

Traffic and Access Disruptions

The project will result in a moderate increase of traffic in the area surrounding the proposed route. Temporary access restrictions may also be required where the pipeline crosses a road, path or driveway although the pipeline will not result in any permanent loss of access to public or private land. Affected communities will be consulted to minimise access impacts and give early notification of any disruptions. Traffic and access disruptions along the route will be managed in accordance with traffic management plans developed for local areas (see Section 3.8).

Table 3.61 Facilities and institutions potentially affected by the project

Suburb	Facility	Location	Impact
Cooroy	Cooroy State School	Elm Street, Cooroy	Elm Street is a potential major haulage route—minor traffic and access disruptions may occur
	Cooroy Special Education Unit	Elm Street, Cooroy	Elm Street is a potential major haulage route—minor traffic and access disruptions may occur
	Tadpoles Childcare	Lake Macdonald Drive, Cooroy	Lake Macdonald Road is a potential major haulage route—minor traffic and access disruptions may occur
	Cooroy Community Kindergarten	Maple Street, Cooroy	May be affected by construction traffic
	Noosa District High	Myall Street, Cooroy	Myall Street is a potential major haulage route—minor traffic and access disruptions may occur
Yandina	Wonga Park Sports Facility (also used for weekend markets)	North Street, Yandina	Directly affected property—temporary interruption of facilities and potential disruption to community and sporting events
	Yandina Caravan Park	Nambour North Connection Road, Yandina	Directly affected property—temporary interruption of facilities and access
	Australasian Country Music Association Hall of Fame	Steggalls Road, Yandina	Adjacent to the proposed corridor; time construction to avoid Annual Country Music Festival in October
	Yandina State School	School Road, Yandina	May be affected by construction traffic
	Coolabah Early Childhood Development Centre	Low Street, Yandina	May be affected by construction traffic
	Yandina Educare Centre	Low Street, Yandina	May be affected by construction traffic
North Arm	Children’s playground	Monak Road, North Arm	Access restrictions for playground users during construction
	North Arm Rural Fire Brigade	Monak Road, North Arm	Restricted access to Monak Road

Table 3.61 (continued)

Suburb	Facility	Location	Impact
Nambour	Sanctuary Park Retirement Community	Brockhurst Road/Duhs Road, Nambour	Minor traffic and access disruptions may occur, and noise and dust impacts during construction
	Residential development	Vincent Drive, (off Brockhurst Road), Nambour	Some lots directly affected; minor traffic and access disruptions may occur, and noise and dust impacts during construction
	Sun City Child Care and Preschool Centre	City View Terrace, Nambour	May be affected by construction traffic
	Kameruka Child Care Centre	Quarry Street, Nambour	May be affected by construction traffic
	Nambour State School (Primary & Secondary)	Coronation Avenue, Nambour	School oval (at edge of property) directly affected by pipeline—temporary interruption of facilities and access. Safety issues for school children. Time construction to avoid school hours/term
	Nambour Showground and Sportsground	Coronation Avenue, Nambour	Directly affected property—temporary interruption of facilities and access
Woombye	Sunshine Coast Christian Outreach Centre and College	Kiel Mountain Road, Woombye	Directly affected property—the pipeline traverses directly through the school—temporary interruption of facilities and access. Safety issues for school children. Time construction to avoid school hours/term
	Woombye Primary School	Pine Grove Road, Woombye	May be affected by construction traffic
Chevallum	Chevallum State Primary School	Chevallum Road, Chevallum	Chevallum Road is a potential haulage route

Government Policies

LinkWater (formerly SRWP Co) is a private corporation wholly owned by the Queensland Government. The company is not a government agency but is a public sector entity for the purposes of the *Financial Administration and Audit Act 1977* (Qld). As the project is government funded, it will comply with all state government construction employment policies in Queensland. It is expected that a variation will be sought to the Building and Construction Contracts Structured Training Policy (the 10% policy), due to the short duration of the construction period and the specialised nature of pipeline construction activities.

3.11.3 Potential Impacts and Mitigation Measures—Economic Environment

While Stage 2 of the NPI will be located within the boundaries of Maroochy and Noosa shires, the project is likely to stimulate economic activity throughout the broader Sunshine Coast region. As such, the Sunshine Coast regional economy—comprising the Caloundra, Maroochy and Noosa local economies—is the region evaluated for the purposes of the economic assessment.

The expenditure directly related to the NPI and ongoing indirect expenditure represents an economic stimulus (or economic impact) to the economy. The stimulus from additional economic activity has two levels of impact:

- first round impacts, or direct impacts, that arise as the capital budget for the development of the pipeline is expended on goods from other industries, causing an expansion of output in those industries; and
- second round impacts, or indirect impacts, that arise as industries supplying inputs to the project increase their purchases to meet additional demand generated by the project.

The extent of these impacts can be represented by multipliers calculated in aggregate for the SEQ regional economy and the Queensland and Australian economies. There are commonly four multipliers used to measure impact: output, income, employment and value added (see Appendix P). The value added, or gross regional product (GRP), is the preferred measure of economic impact resulting from a stimulus and is used to describe the net impact of the event. Estimated expenditure for the project is summarised in Table 3.62. This information is indicative only and will be superseded by the development of a detailed cost estimate for the project.

Table 3.62 Project purchases by category and origin

	2008		2009		Total	
Category	SEQ ($m)	Interstate ($m)	SEQ ($m)	Interstate ($m)	SEQ ($m)	Interstate ($m)
Design costs	50	–	–	–	50	–
Construction costs	150	–	50	–	200	–
Iplex pipes	–	45	–	15	–	60
Total	**200**	**45**	**50**	**15**		

Source: Economic Associates (see Appendix P).

Economic stimulus will be generated by the project through inter-industry purchases in two phases: construction, and operation and maintenance. Relevant expenditure items have been allocated to the relevant industry sectors used in input–output tables. Only inter-industry purchases are identified as stimuli; wages and salaries are excluded.

Construction

It is important to note that Stage 2 of the NPI is not the only major infrastructure project proposed for the region over the next five years. Other major projects, including Stage 1 of the NPI, the Traveston Crossing Dam (if approved) and upgrades to the Bruce Highway, are likely to put pressure on regional labour markets. The most significant issues facing the Sunshine Coast regional economy in relation to the construction of the NPI Stage 2 are:

- the capacity of the Sunshine Coast labour market to meet the demand for construction and associated workers generated by the project; and
- the capacity of the Sunshine Coast accommodation and housing markets to accommodate non-resident workers.

Employment

The total employment impact for the NPI Stage 2 is expected to be 1280 full-time equivalents (FTE). A significant amount of this employment will be generated outside the Sunshine Coast region, but still within SEQ. Much of the employment impact is likely to be absorbed by the labour market over time, rather than resulting in the creation of new employment opportunities. New opportunities would be created ‘at the margin’; for example, the project may increase the work program of small contractors such that it generates the need for an additional worker.

A first-year construction expenditure of $150 million is expected to generate 622 FTEs. Based on an average weekly shift of 55 hours for workers on the Southern Regional Water Pipeline (SRWP), this translates to approximately 430 workers. It is estimated that approximately 290 workers would be sourced from outside the Sunshine Coast region, indicating that around 140 workers would need to be sourced from the local area.

The unemployment rate for the Sunshine Coast regional economy as at June 2007 was 5.8% (approximately 8300 persons). Given the specialist skills required for pipeline construction, it is unlikely that a significant number of those persons currently unemployed would be directly employed during the construction phase. However, the movement of employed persons from their current industry of employment to pursue opportunities created by the Stage 2 construction may create lower skilled employment opportunities for those currently unemployed.

The transition of workers onto major construction projects on the Sunshine Coast will require training of a number of prospective workers. However, given the number of large infrastructure projects foreshadowed in the region, trained workers will likely continue to be employed in the region's construction industry. Local workers, including indigenous people, are generally sourced by advertising in local papers, such as the Sunshine Coast Daily and through local job networks. Further, the project's employment policies will align with existing State government employment initiatives. The project's website will also include information on available positions.

Accommodation

Peak accommodation demand on the Sunshine Coast is in the September and December quarters of each year, although the number of vacant beds in hostels was particularly low in the March quarter 2007 (see Appendix P). An analysis of the availability of commercial accommodation on the Sunshine Coast during peak demand times is presented in Table 3.63.

Table 3.63 Commercial accommodation availability during peak demand

		2005		2006		Average	
Category	Total capacity	Sept quarter	Dec quarter	Sept quarter	Dec quarter	Sept quarter	Dec quarter
Hotels, motels and serviced apartments (rooms)	5,924	2,044	2,026	2,174	2,184	2,059	2,105
Caravan parks	4,273	1,217	1,780	1,010	1,534	1,114	1,657
Holiday flats, units and houses	4,385	1,285	1,513	1,471	1,459	1,378	1,486
Hostels	783	275	271	357	201	325	236

Source: Economic Associates (see Appendix P).

It is estimated that approximately 290 construction workers will be sourced from outside the Sunshine Coast and may require accommodation during the construction phase. Short-term accommodation is normally required during the week rather than peak-demand weekends. Other workers will opt for longer term rental accommodation while working in the region. As such, it is likely that the commercial accommodation market will have the capacity to accommodate the required non-resident workforce.

Operation and maintenance

Based on current estimates for the SRWP, which comprises three pump stations and two balance tanks, it is estimated that maintenance of the overall NPI will cost $7.6 million per annum. This figure excludes variable costs—largely power consumption—and the following assessment is therefore primarily concerned with pipe maintenance.

Input-output analysis indicates that ongoing annual economic impacts of pipe maintenance would be approximately:

- $14 million in additional expenditure, including $6.4 million in indirect expenditure;
- 55 full-time equivalent positions, including 33 indirect full-time equivalent positions; and
- $5.9 million in value added, including $3.3 million in indirect value added.

This is unlikely to be significant in the context of the Sunshine Coast regional economy.

Workers associated with the operation and maintenance of the Stage 2 pipeline will most likely be part of a larger entity charged with management of the SEQ water grid. It is expected that work crews would be likely to rotate through SEQ to provide operational and maintenance support. While the number of water grid workers based on the Sunshine Coast is unknown, it is unlikely that this number would be significant.

3.12 Hazard and Risk

3.12.1 Hazard and Risk Assessment

This section describes the hazards and risks associated with the construction, commissioning, operation and decommissioning of the NPI Stage 2. The risk assessment has been undertaken as a desktop exercise. A comprehensive risk assessment will be undertaken prior to construction to consider a range of natural or accidental hazards, such as flooding or the accidental release of water, as well as other health, safety and environmental risks. The risk assessment will be undertaken in accordance with Australian Standard AS/NZS 4360: 2004—*Risk management*. These analyses will be incorporated into a risk management plan and incident response plans that are specific to the project.

The purpose of this hazard and risk assessment is to identify potential risks, to quantify those risks where possible, identify potential controls and develop mitigation strategies. In environmental risk management, it is not always appropriate to base the analysis of risk on a worst case scenario as this may lead to inappropriate resource allocation. This analysis adopts a conservative estimate as a method of producing a realistic assessment.

The key risks identified for the NPI Stage 2 and likely management strategies are summarised below. Numerous other risks have been identified in association with the NPI Stage 2 and these will be addressed during detailed design and development of the construction environmental management plan (CEMP). Detailed risk assessments will also be undertaken for pump stations and balance tanks at this stage. In addition, analysis of risks or hazards associated with the integration of the system with the chemical dosing facility will be undertaken. Risks associated with natural hazards and their management are discussed in previously are not included in this section.

High-voltage Power Lines

During construction, the potential exists for machinery and materials to come into contact with high-voltage power lines when work is occurring within or adjacent to existing electricity easements. The NPI Construction Safety Plan applies in all such situations, and work method statements will be developed to address potential safety issues. Construction personnel will be provided with specific training when working in proximity to potentially dangerous electricity infrastructure.

Protest Activity

Protest activity may occur as a result of political opposition to the pipeline. Contacts will be maintained with the Queensland Police throughout construction. In the event of any protest activity at construction sites, the police will be informed as appropriate.

Trench Collapse

The potential exists for trenches to collapse due to a lack of coherent soil structure in waterlogged areas, or due to deep excavation. Standard mitigation strategies to prevent collapse of trench walls include the use of trench boxes in wet areas and benching in accordance with Australian Standards.

Hazardous Materials

Hazardous materials stored on site will be restricted to diesel fuels, machine and vehicle oils and hydraulic fluids. These chemicals will be stored in appropriate containers and locations in accordance with Schedule 1 of the Environmental Protection Regulation 1998. Chemical storage will also be required for the purposes of water quality dosing (under both hydrotesting and transport scenarios). An approval for this Environmentally Relevant Activity will be gained from the Environmental Protection Agency (EPA).

Incident response plans will be enacted for any accidental spills. Initially, the type, source and extent of the spill will be determined, and the spill isolated, contained and controlled using response equipment stored on site. Construction supervisors and project offices will be notified immediately and emergency services alerted as required.

Wildlife Hazards

The key hazard for project workers with respect to wildlife is snake bite. The services of trained and qualified wildlife handlers will be retained for the duration of construction works so that any snakes can be removed from open trenches safely.

There is also the potential for conflict between wildlife and vehicular traffic moving to and from construction sites. Speed limits will be established in the vicinity of construction sites and all personnel advised to drive cautiously, particularly around dusk and dawn.

Pipeline Failure

Key risks associated with pipeline operation relate to potential pipeline failure. The pipeline is designed to accommodate a maximum allowable operating pressure of 1.6 MPa and, while there is a low risk, pipe failure has the potential to cause major damage to persons and property. There can also be localised flooding and erosion with the potential to cause catastrophic damage with little or no warning.

Other natural hazards associated with flooding, bushfire and landslip are possible. However, the Alliance will implement an integrated communication system with relevant state agencies to ensure early waning of any potential natural hazards.

3.12.2 Emergency Services

Police Stations

North Coast Region

- Pomona, Cooroy, Eumundi, Nambour, Palmwoods, Noosa Heads, Coolum Beach, Maroochydore.

Fire Stations

Maroochydore Area

- Buderim, Coolum, Cooran, Cooroy, Maroochydore, Noosa Heads, Pomona, Tewantin.

Ambulance Stations

North Coast Region

- Buderim, Kawana, Maroochydore, Nambour, Cooroy, Tewantin, Noosa, Gympie.

State Emergency Services

North Coast Region

- Gympie Area, Caloundra, Cooloola, Maroochy, Noosa.

3.12.3 Emergency Management Plan

Where the construction, commissioning, operation and maintenance of the overall NPI have the potential to result in emergency situations, they will be governed by an incident response plan (IRP). The IRP will:

- set out the steps to be undertaken in the event of an emergency;
- allocate lines of responsibility for overall management of emergency responses;
- identify when to instigate the emergency management;
- identify the roles and responsibilities of all staff in instigating and implementing incident responses;
- identify training and reporting requirements; and
- identify contact details for all responsible parties and emergency services.

The primary response concept is to deal with protection of people from harm, injury or death, and the overall project objective is to complete each day without incident.

3.13 Cumulative Impacts

When considered individually, many development activities may appear to have relatively minor impacts on the environment. However, when considered collectively, the impacts on the environment may be more significant. Cumulative impact assessment focuses on the emergent effects of these individual impacts in combination.

Cumulative impacts can be defined as the combined, incremental effects of human activity that pose a serious threat to the environment. While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of resources (US EPA 1999). Any cumulative impacts of NPI Stage 2 will be within acceptable limits identified in applicable policy.

Key threatening processes associated with linear infrastructure such as habitat fragmentation or downstream impacts on water quality often result from the accumulation of relatively small and often indirect effects. These effects may accumulate in the same location, at the same time, or in different locations and/or over a period of time.

This section provides a consideration of the types and likelihood of cumulative impacts for the NPI Stage 2 project. In order to define these impacts relative to the project, the following criteria have been applied to this assessment:

- the assessment is confined to those environmental features that are likely to be significantly impacted by the NPI Stage 2;
- the effect on those features must be likely to have a lasting impact on the receiving environment and operate cumulatively with the effects of other activities; and
- the cumulative impact must occur between 2008/09 (baseline condition) and 2021 (or when the NPI Stage 2 has been operating for 10 years) (QG 2008).

The assessment of cumulative impacts is focused on the key environmental issues associated with the NPI Stage 2. While a range of issues have been identified in the earlier sections of this document, many of these are short-term construction related impacts that will be managed through the implementation of work method statements (WMS) and construction environmental management plans (EMPs), which are outlined in the planning environmental management plan (PEMP) (see Appendix Q).

Table 3.64 provides a summary of potential environmental impacts for each of the environmental aspect assessed. These individual impacts in combination constitute the cumulative impact of the project. This assessment also considers the emergent effects of certain impacts of the project in combination, as well as in combination with impacts from other infrastructure projects.

Table 3.64 Summary of environmental impacts and significance of each impact

Environmental element	Summary of impacts	Mitigation measures	Likelihood of occurrence
Climate and natural disasters	Potential to ignite bushfires during construction activity in right of way (ROW) Storm events during summer months may mobilise unprotected soils	Workforce to follow fire awareness procedures for risk activities (eg welding and smoking) Minimise areas of exposed soil, especially during summer months when storms are more likely Implement sediment and erosion controls	Unlikely
Soils and geology	Potential to cause landslip as the result of constructing in steep terrain Erosion from ROW in steep terrain Sterilising good quality agricultural lands (GQAL) Disturbance of acid sulfate soils (ASS)	Manage problem soils, rehabilitation and revegetation through appropriate EMP Design alignment to avoid GQAL where possible Manage ASS through EMP	Possible
Land use	Partial or complete resumption of a number of properties for an easement Loss of some agricultural assets Loss of other productivity Sterilised areas for extractive industry	Employ provisions for properties impacted by resumptions or productivity loss	Possible
Flora	Clearing of remnant and regrowth vegetation (particularly RE 12.3.1) Reduced habitat for listed species Environmental weeds occur in places along the existing alignment	Maintain corridor within existing easement or other cleared areas Rehabilitate and revegetate cleared and disturbed areas as soon as practical (EMP) Implement measures to minimise the spread of environmental weeds (EMP)	Likely Likely Possible
Fauna	Potential impact on listed threatened species Some reduction in habitat and corridor values in project area Improvement in habitat values through the removal of environmental weeds	Ensure fauna monitor present during the clearing of vegetation Develop monitoring programs and species-specific management plans as required (EMP)	Possible Likely Possible

Table 3.64 (continued)

Environmental element	Summary of impacts	Mitigation measures	Likelihood of occurrence
Surface water and flooding	Some riparian vegetation will be removed causing bank destabilisation and impacting water quality Potential for erosion of exposed banks during flood events	Regenerate and revegetate riparian areas Undertake water quality monitoring pre-construction and during (EMP)	Likely
Air quality	There is potential for dust generation from earth-moving activities, vehicle movement and direct erosion from exposed surfaces	Implement dust suppression measures (EMP) Minimise the area of exposed soil	Possible
Greenhouse gas (GHG) emissions	Emissions from vehicles and machinery during construction Ongoing emissions from operating pump stations	Ensure vehicles and machinery are well maintained and running efficiently Incorporate energy efficient design for pump stations	Likely
Noise and vibration	Construction noise may impact surrounding properties No significant impact from vibration during construction expected	Limit construction times Undertake community liaison and advise of noisy periods Use acoustic buffers and other methods to reduce noise (EMP)	Possible
Waste	Generation of construction waste Generation of domestic waste Generation of wastewater	Implement waste management plan (EMP) Reuse waste products where possible Reuse water where possible	Likely
Transport	Increased delivery movements during construction Disruption to local traffic flows during construction	Develop traffic management plan and sub-plans Develop traffic management plan and sub-plans	Likely Possible
Cultural heritage	No impact on state or Commonwealth heritage sites Limited likelihood of disturbance to indigenous cultural heritage	Involve traditional owners in monitoring works in likely heritage areas (developed cultural heritage management plan and EMP)	Rare
Socio-economic	Disruption to traffic during the construction phase Economic stimulation	Undertake consultation in accordance with the community consultation plan Publicise opportunities for local workforce, plant hire and purchase of materials	Possible Likely

Table 3.65 provides a summary of these emergent effects, the individual impacts operating in combination and their expected sources. Many of these impacts are localised and short term and it is expected that mitigation strategies in place to minimise individual impacts will also reduce the effects of these impacts in combination. Those environmental elements most likely to be subject to these cumulative effects have been identified as flora and fauna; surface water; air environment; and local communities.

Table 3.65 Summary of potential for cumulative impacts in the study area

Environmental aspect	Impact source	Isolated impacts	Cumulative impacts
Bushfire	NPI Stage 2 + subsequent infrastructure projects in the area	Construction activity in ROW near where eucalypt ridges have been ignited	Vegetation unable to regenerate after frequent fire intervals
Soil and geology	NPI Stage 2 + subsequent linear infrastructure projects (and/or existing land use practices)	Construction and other development and agriculture activities destabilising soil Erosion in ROW in steep terrain	Continual erosion of topsoil reducing opportunities for regrowth
Land use	NPI Stage 2 + subsequent linear infrastructure projects	Sterilising GQAL within the infrastructure easement	Multiple projects using existing easement may increase sterile zone
Flora	NPI Stage 2 + and other developments including infrastructure	Vegetation clearing of RE 12.3.1 Loss of individual plants (eg Southern Penda)	Overall reduction in the amount of RE 12.3.1 in SEQ reducing habitat for threatened listed flora species
Fauna	NPI Stage 2 including waterway crossings + other developments including infrastructure	Clearing of riparian vegetation and bank destabilisation Clearing remnant vegetation and regrowth	Decreasing habitat for threatened listed species Threatening less mobile species (eg Southern Giant Barred Frog)
Surface water	NPI Stage 2 corridor intersecting Paynter Ck three times	Mobilisation of sediments	Changes to stream morphology
	NPI Stage 2 + subsequent linear infrastructure projects	Clearing of riparian vegetation Bank destabilisation	Overall degradation of waterway due to continual disturbance of banks and riparian vegetation
Air environment	NPI Stage 2 activities+ other emissions sources	GHG emissions from the operation of vehicles and machinery Emissions from ongoing operation pump stations and other infrastructure	Increase in total GHG emissions contributing to climate change

Table 3.65 (continued)

Environmental aspect	Impact source	Isolated impacts	Cumulative impacts
Noise and vibration	NPI Stage 2 + subsequent infrastructure projects	Vibration from construction activity destabilising structures in the project area	Continuing vibration in a specific area causing structures to deteriorate
Waste	NPI Stage 2 + subsequent infrastructure projects	Generation of construction and other waste	Pressure on local landfill sites to accommodate accumulating waste
Transport	NPI Stage 2 + other infrastructure projects (including local council)	Increase in local traffic volumes and disruptions during construction	Degradation of roadways from continual heavy vehicle traffic and increase in traffic volumes
Local communities	Ongoing communication for different stages of the project NPI Stage 2 + previous and subsequent linear infrastructure projects	Contacting affected residents to inform and consult before and during construction Direct and indirect disruption to community facilities and events during construction	Consultation fatigue Distress from ongoing community disruption

Due to the complexity of cumulative effects, monitoring is critical to assess the accuracy of the predictions and monitor the effectiveness of mitigation measures. Monitoring will be undertaken to demonstrate compliance with applicable legislation through the implementation of the EMP across a suite of environmental aspects. Additional performance methodologies might also be adopted to monitor incremental aspects (eg photographic records).

Other proposed infrastructure projects

Other proposed infrastructure projects that have been identified in or near the project area include the North Coast rail upgrade (Landsborough to Nambour) and the Gatton–Gympie Gas Pipeline.

North Coast Rail Upgrade (Landsborough to Nambour)

As identified in the *South East Queensland Regional Plan 2005–26* (DIP 2008b) and *South East Queensland Infrastructure Plan and Program 2008–26* (DIP 2008c), the North Coast rail line is to be upgraded to improve passenger services and freight rail operations between Caboolture and Nambour. Planning for the section between Landsborough and Nambour is in process. It is anticipated that Queensland Transport will announce the preferred route during 2008. Construction is expected to be completed prior to 2026 (QT 2008; DIP 2008d).

The preferred corridor for NPI Stage 2 traverses to the east of the existing rail line and proposed upgrades between Eudlo and Nambour. Early discussions have been held with Queensland Rail to identify future infrastructure requirements.

Similar to NPI Stage 2, the rail upgrade will be linear within an existing easement. However, specific impacts of the rail project could differ from the NPI project because the rail infrastructure is above ground (eg waterway crossings).

Gatton–Gympie Gas Pipeline

The rights to the defunct Gatton to Gympie gas pipeline easement were sold by the Queensland State Government to the Australian Pipeline Trust (APA Group) during 2006. The defunct gas easement overlays the proposed NPI Stage 2 corridor in several sections between Eudlo and Cooroy. Should APA resume this easement, impacts from the construction of this gas pipeline have the potential to interact with impacts from the Stage 2 NPI, particularly where the easement is shared. Ideally the co-location of infrastructure has the potential to reduce the need for new sites and corridors, thereby reducing the overall cost to the community (SEQ Regional Plan 2005-26).

Little detail is available on the gas pipeline including potential construction time frames. However it is likely that the underground gas pipeline may be built within the next 10 years.

Additional Proposed Infrastructure Projects

Additional infrastructure projects that are noteworthy, however outside of the NPI Stage 2 project area, are acknowledged. The SEQ Infrastructure Plan and Program 2008–26 identifies proposals for various upgrades to the Bruce Highway and the Traveston Crossing Dam Stage 1. The Traveston Crossing Dam project is proposed to form part of the SEQ water grid and is currently being assessed by the Queensland and Commonwealth governments under the EIS process (QWI 2007).

NPI Stage 2 is designed to integrate with the proposed Northern Regional Pipeline (NRP) and will be required to connect existing and future bulk water sources on the Sunshine Coast (including the proposed Traveston Crossing Dam, if approved) to the SEQ water grid. Future works associated with the NRP will include the construction of two pipelines to connect the NPI with a future bulk water source and the greater Brisbane region (ie Stages 3 and 4). The construction of facilities would also be required to accommodate bulk flows (eg balance tank, water treatment plant).

Design of the NPI Stage 2 pipeline included a preliminary route assessment for Stages 3 and 4 of the NRP. This route assessment was undertaken to identify potential corridor routes (for future pipelines) in consideration of the following:

- existing corridors;
- topography;
- local communities;
- environmental impacts; and
- existing land uses.

The risks and opportunities were evaluated for each of the potential route options, and preferred routes were identified for Stages 3 and 4. These options are described below.

Stage 3 Preferred Route

The preferred Stage 3 route will connect North Pine WTP to NPI Stage 1 at Morayfield. This route option follows an existing transfer pipe corridor from North Pine WTP, crossing North Pine River, Dayboro Road and traverses the edge of Lake Kurwongbah. The route then follows the Powerlink easement and Energex easement to the connection point with NPI Stage 1. This option maximises the use of existing cleared or disturbed areas, aligning with the Powerlink and Energex easement and road reserves for the majority of the route.

Stage 4 Preferred Route

The Stage 4 preferred route option has been selected to connect the NRP with the proposed Traveston Crossing Dam, although it could be designed to connect with other future bulk water sources. The preferred Stage 4 follows the existing Mary River raw water corridor until it reaches the Bruce Highway realignment, and then follows the Bruce Highway realignment to the proposed Traveston Crossing Dam WTP. This route was selected as the preferred option as it utilises existing disturbed areas, reduces the overall number of potentially affected landholders, and would incur lower operational and maintenance costs.

Although preliminary route and cumulative impact assessments have been conducted for Stages 3 and 4, detailed field investigations will be required to verify pipeline routes and potential risks and opportunities.

Future Bulk Flow Facilities

Assessment of cumulative impacts for NPI Stage 2 also included the selection of facility sites which could accommodate infrastructure requirements for both drought and future bulk water flows. While the construction of additional facilities will be required to transport and distribute future bulk flows, these facilities are able to be co-located with the proposed NPI Stage 2 facility sites. As a result, the overall construction footprint of future infrastructure facilities, and the potential social, economic and environmental cumulative impacts have been minimised.

Generally, adverse impacts on environmental, social and economic values which may occur as a result of these future projects can be avoided/ minimised by utilising existing road reserves, public utility easements and other existing cleared or disturbed areas. This will minimise potential cumulative impacts on waterways, riparian vegetation, matters of national environmental significance and other significant flora and fauna assemblages within the broader SEQ region.

Policy Requirements

Requirements of relevant policies (eg state planning policies, environmental protection policies, national environmental protection measures, water resource planning, and any other policies relevant to the project) have been reviewed and discussed throughout the EIS. The identification of environmental attributes within the project area was achieved through the review of applicable policy and guiding documents along with literature reviews and field investigations.

Key Cumulative Impacts

Flora and Fauna

The fragmentation of landscapes at a regional level restricts the migration of species between suitable habitat areas. Where once SEQ supported largely continuous areas of vegetation, substantial areas have been cleared for urban and rural land uses and public infrastructure (eg roads and rail).

The incremental effects of these developments often mean that rare or threatened species and communities become more vulnerable to changes in their environment. In a connected landscape, individual fauna and flora species are capable of re-populating areas following disturbance. In a fragmented landscape source populations are unable to recolonise disturbed areas.

As discussed in this EIS, route selection for the project has focused on avoiding large intact areas of remnant vegetation wherever possible. Co-location of the pipeline within existing cleared infrastructure easements will mean that minimal vegetation clearance is required. However, cumulative effects may occur where other linear infrastructure projects deviate from the shared easement. This may result in potentially increasing the total amount of vegetation cleared in the region and further fragmenting existing habitat. Significant risks arising from potential cumulative impacts in the project area are:

- reduction in the extent of the endangered regional ecosystem RE 12.3.1 (see Section 3.3);
- disturbance and/or loss of habitat for the EPBC-listed endangered *Mixophyes iteratus* (Southern Giant Barred Frog) and vulnerable *Xanthostemon Oppositifolius* (Southern Penda, Luya's Hardwood); and
- disturbance and/or loss of habitat for NCA-listed flora and fauna species (see Section 3.3).

RE 12.3.1 is present within the project area and occurs as narrow riparian strips along waterways. For potential infrastructure developments including the Gatton–Gympie gas pipeline, the North Coast rail upgrade (Landsborough to Nambour) and NPI Stage 2 impacts to this RE will be associated with waterway crossings. Clearing and disturbance increases the vulnerability of vegetation to threatening processes such as weeds, however is unlikely to result in local or regional extinction of this RE type.

Pending final location of the North Coast rail upgrade there is potential to remove some frog habitat (Southern Giant Barred Frog *Mixophyes iteratus*, Tusked Frog *Adelotus brevis*) along Petrie and Paynter creeks. The construction the Gatton–Gympie gas pipeline between Eudlo and Cooroy could have a similar impact on riparian habitat. NPI Stage 2 construction near Six Mile Creek may also threaten RE 12.3.1 including populations of Southern Penda.

As vegetation can be largely re-established over the NPI Stage 2, loss of habitat will be temporary. Vegetation clearing for the project will be offset and/or rehabilitated and revegetated (NRW 2007). Unfortunately the removal of regrowth through shared easements may also pose impact to populations.

Surface Water

Constructing linear infrastructure across waterways removes riparian vegetation, potentially destabilising banks and increasing the risk of erosion during flood events. Trenching through creek beds to lay below-ground pipe may mobilise large amounts of sediments and disrupt the natural flow regime of the waterway. While these impacts are usually localised and temporary, the cumulative effects of crossing the same waterway at multiple locations or repeatedly over a certain period can be more significant.

The proposed alignment for NPI Stage 2 crosses Paynter Creek three times between Nambour and Woombye. Paynter Creek supports RE 12.3.1 along the riparian zone and provides potential habitat for listed frog species. Multiple crossings within such a short distance could alter stream morphology, affect water quality and cause overall degradation of the waterway both locally as well as further downstream.

The shared easement with the Gatton–Gympie gas pipeline and the location of the North Coast rail upgrade within close proximity to the NPI Stage 2 may result in multiple crossing events in similar locations along waterways. Mitigation strategies for NPI Stage 2 includes route selection to minimise the number of waterway crossings wherever practical. Waterway crossing points have also been selected at low velocity, straight sections of the channel and have been designed to avoid unstable banks, channel bends, deep pools and confluences with other channels. They have also been selected in areas where riparian vegetation has previously been cleared.

Other key mitigation strategies include:

- selection of water crossing methodologies;
- detailed erosion and sediment control plans;
- reinstatement of bed and banks to original contours to minimise scour and erosion potential during high flow events;
- stabilising banks with fast-growing grasses and sedges, geo-fabric and rocks;
- using dam-and-pump or dam-and-flume-methods when trenching across flowing waterways to ensure continuity of flow within the watercourse; and
- establishing water quality baselines prior to construction to allow changes in water quality to be measured during and on completion of works.

Air Environment

The most noticeable impacts on the air environment during the construction of the NPI Stage 2 will be airborne dust raised by direct mechanical action. Dust will be also be mobilised where disturbed ground is exposed to vehicle movement or winds. These impacts are expected to be temporary and localised and will be mitigated through the use of water carts. In the longer-term, dust will be mitigated through reinstatement and revegetation.

Less noticeable but significant in the long term are the project's greenhouse gas (GHG) emissions, both during constriction and as a result of the ongoing operation of the pipeline. Carbon released directly into the atmosphere when burning petroleum products to run vehicles and machinery, and indirectly from electricity consumption, can remain in the atmosphere for centuries. It is widely recognised that the cumulative impact of global GHG emissions has resulted in human-induced climate change.

Clearing of vegetation also has the potential to result in the loss of 'carbon sinks', thereby reducing opportunities for the re-absorption of carbon from the atmosphere. However, as previously discussed, the clearing footprint associated with the project is not considered to be significant.

Mitigation measures will be implemented during construction of the project to increase energy efficiency and reduce the amount of GHG emissions where possible. The pipeline and future pumping facility locations have been optimised to minimise fuel and energy requirements, therefore reducing greenhouse impacts of the project. Optimisation of pump design and use will also have a significant impact on energy use during operation. Additional measures will include a greenhouse abatement scheme for the operation of the project, to be developed and implemented by the proponent as part of the operating rules for the pipeline. Vegetation clearing will also be offset, and rehabilitation and revegetation will be undertaken (NRW 2007).

Local Communities

Cumulative effects on local communities may result from disruption to community facilities intersected by the project route during construction of the pipeline and/or subsequent linear infrastructure projects. While the impacts of construction of the NPI Stage 2 on individual facilities will be temporary, disruption to multiple facilities over the duration of the project may have a cumulative effect on particular community members or groups.

The NPI Stage 2 project will also result in a moderate increase of traffic in the area surrounding the proposed route, as well as some access restrictions during construction across roads. Increased traffic over the duration of the project may result in the accelerated deterioration of road pavements. This effect may be compounded by the additional traffic generated by other current or subsequent infrastructure projects in the area.

The cumulative effect of temporary impacts on facilities, increased local traffic, and other nuisance impacts such as noise and dust generation (within legal limits) has the potential to cause stress within some communities. Therefore strategic community consultation will be essential to minimise the overall impacts of the project on the social environment (see Section 3.11).
Mitigation measures will include consultation with affected communities in accordance with a project-specific community and stakeholder management

plan. Traffic and access disruptions along the route will be managed in accordance with traffic management plans developed for local areas. To minimise the cumulative impacts on roadway pavements, the Northern Network Alliance (NNA) will work with road stakeholders (eg DMR and local government) to determine the pre-construction condition and identify the required process in the event of maintenance required as a result of the project.

Community Consultation and Communication

While necessary to minimise disruption, continual consultation by external parties over a long period can have a negative impact upon communities. The cumulative effect of over-consultation, sometimes referred to as 'consultation fatigue', can result in apathy, distrust or even distress for individuals and communities. Depending on their location along the project route, residents might be contacted by representatives of the state government and NNA several times during the project to inform them of upcoming events, invite feedback, request permission for property access or provide other information. Consultation might be in the form of letters, phone calls, feedback/information sessions, or visits to residents' properties. Consultation may occur prior to and during construction.

Community consultation for the project may coincide with or be in addition to consultation activity from other infrastructure projects (eg the North Coast rail upgrade—Landsborough to Nambour; the Gatton–Gympie gas pipeline; Bruce Highway upgrades; and Traveston Dam). To minimise the occurrence of consultation fatigue, the NNA communication strategy will take into consideration these infrastructure projects and other factors when assessing the quantity and timing of community consultation and communication in relation to the project.

While communities may experience temporary inconvenience during construction, it should be noted that the project is likely to stimulate economic activity throughout the Sunshine Coast region resulting in economic benefits to local communities.

Conclusion

Construction of the NPI Stage 2 has the potential to result in some short-term environmental impacts that will be mitigated through the implementation of the environmental management plan (EMP). The EMP will assist the project to meet or exceed legislative requirements across a suite of environmental aspects.

Cumulative impacts of the project can be minimised where efforts are made to reduce environmental impact for any or all environmental aspects (eg a 'reduced footprint' approach). Cumulative impacts will also be mitigated through the implementation of the EMP.

Impacts and cumulative impacts from sources other than the NPI Stage 2 can be difficult to positively influence. Project impacts and cumulative impacts, and other source impacts and cumulative impacts can be significantly influenced by variables (eg extreme weather conditions; interrelationships between impacts; scale and intensity; duration and frequency).

NPI Stage 2 could mitigate impacts to some extent by offsetting environmental impacts both inside and outside the project area (eg where pre-construction and or existing environmental conditions are improved).

There is opportunity for further investigation to determine options for mitigation of cumulative impacts, including opportunities for environmental efficiencies.

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4 ENVIRONMENTAL MANAGEMENT PLANS

An overarching planning environmental management plan (PEMP) has been developed for NPI Stage 2 and provides the structural template for the future construction environmental management plan (CEMP). The PEMP addresses environmental issues associated with construction including maintenance and rehabilitation of the project sites. The implementation of the PEMP will ensure that NNA maintains best practice standards throughout the life of the project (see the PEMP included in Appendix Q).

Key components of the PEMP include introduction, planning, objectives and targets, environment management team, environmental process and management controls, environmental training, monitoring, inspections and audits, incident/complaint management, corrective and preventative actions, reporting and communication and environmental management plan review and improvement.

A series of more detailed environmental management plans (EMPs) have been developed to augment this PEMP to address specific environmental issues associated with each element of the project. These include:

- heritage management plan;
- vegetation management plan;
- fauna management plan;
- soil and water management plan;
- rehabilitation and revegetation management plan;
- contaminated land management plan;
- waste management plan;
- acid sulfate soils management plan;
- air quality, noise and vibration management plan; and
- weed and disease management plan.

The EMPs listed above are currently in draft version and awaiting comment from statutory agencies, eg EPA. They are included in Appendix Q. The EMPs will be finalised prior to commencement of construction.

The aims of the EMPs are to identify potential impacts on environmental issues, outline mitigation strategies and relevant monitoring and ensure that appropriate corrective actions are implemented. A review of the EMPs will be undertaken prior to the commencement of construction works.

The PEMP has been developed in accordance with principles of AS/NZS ISO 1400, the international standard for environmental management systems.

5 CONCLUSION AND RECOMMENDATION

This environmental impact statement (EIS) has been prepared by the Northern Network Alliance (NNA) on behalf of the proponent, LinkWater Projects, in accordance with the terms of reference (ToR) provided by the Coordinator-General. The EIS is prepared under the *State Development and Public Works Organisation Act 1971* to address the requirements of state legislation and the assessment requirements of the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In preparing this document, the proponent has intended to inform the community and other stakeholders about the need for the Northern Pipeline Interconnector (NPI) Stage 2 project, to identify the potential environmental impacts associated with the construction and operation of the project, and to address how these issues might be managed.

Need for the Project

The NPI project is critical to the delivery of the Queensland Government's major regional initiative—the SEQ water grid. The water grid will combine new and existing supply sources with interconnecting pipelines to ensure that, in future, the SEQ region makes the most of the rain it receives to protect it from periods of drought.

As an interim drought contingency measure, the NPI (Stage 1 and Stage 2) will secure additional treated potable water supplies in the short term in case of ongoing drought conditions in Brisbane's catchment areas. This project is consistent with legislation introduced as part of the Regional Drought Strategy, and is required to be constructed under the *Water Act 2000*. The Stage 2 pipeline will also be designed to integrate with a future Northern Regional Pipeline (NRP) to take water from the proposed Traveston Crossing Dam or other future bulk water sources on the Sunshine Coast.

The Queensland Government's integrated approach to regional water management is also consistent with its obligations under the water reform framework agreed by the Council of Australian Governments (COAG) in 1994, and with the National Water Initiative (NWI). These encourage urban water reform to encourage innovation in water supply sourcing, treatment and storage and the integrated management of water for environmental and other public benefit outcomes. The proponent is a division of LinkWater, which was recently established as a water entity under the *South East Queensland Water (Restructuring) Act 2007*, a result of the NWI.

System Configuration and Route Options

The preferred corridor assessed in this EIS has incorporated design standards required for the hydraulic operation of a treated water pipeline, taking account of the need to:

- co-locate facilities wherever possible to minimise the project footprint;
- maximise the operational efficiency of the pipeline through adopting the shortest feasible route that would limit the environmental and social impacts of the project; and
- accommodate a 5 ML balance tank at 145 m RL with provision to accommodate future infrastructure (ultimately, two 35 ML balance tanks) associated with increased flow volumes associated with the proposed Traveston Crossing Dam

A number of route options were developed on the basis of engineering, environmental, geotechnical, topographic and community constraints. A multi-criteria analysis (MCA) approach was adopted to compare the benefits and constraints across all options. Through this MCA, the preferred corridor was adopted on the basis that it minimises the social and environmental impacts of the NPI Stage 2 project because it:

- is significantly shorter;
- makes greater use of existing public utility easements;
- minimises the number of directly affected landholders;
- minimises the potential for interaction with acid sulfate soils (ASS);
- minimises the potential for interaction with groundwater;
- minimises the number of major waterway crossings; and
- avoids sensitive areas of wetland vegetation.

Project Impacts and Impact Mitigation

The primary residual impacts on the natural, social and built environments will arise from the establishment of the construction right-of-way and permanent easement. However, impacts also have the potential to arise from the following phases of the project:

- planned or unplanned discharges of water during commissioning and operation; and
- ongoing supply of electricity to NPI Stage 2 pump stations.

This EIS identifies a range of impacts associated with all phases of the project. However, through detailed route selection and the use of existing disturbed easements, landscapes and road infrastructure, construction of the NPI Stage 2 is unlikely to result in significant long-term impacts on the physical, biological or social features of the project area.

The impacts identified in this EIS have been assessed as:

- temporary impacts which are related directly to construction and will cease once the pipeline is commissioned; and
- semi-permanent or permanent impacts that are spatially or temporally restricted, and do not represent a significant impact on the overall environmental values of the project area.

It is therefore concluded that all impacts will be adequately managed through the implementation of the mitigation strategies discussed in the preceding sections. These measures will form the basis of detailed environmental management plans (EMPs) that will address the full range of potential impacts as discussed in Section 4.

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6 REFERENCES

1 Introduction

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