Initial Advice Statement
Water for Bowen Project

2136473A-001 May 2006

SunWater
Making Water Work

Contents

List of tables

List of figures

List of appendices

List of abbreviations

(1)	Reference 1, references are provided in full in Section 7.
AHD	Australian Height Datum
ASS	Acid Sulphate Soils
CAMBA	Chinese Australian Migratory Bird Agreement
CID	Community infrastructure designation
COAG	Council of Australian Governments
CoG	Coordinator-General
DEH	Department of Environment and Heritage
DNRM	Department of Natural Resources and Mines
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environment Protection Agency
EPBC Act	*Commonwealth Environment Protection and Biodiversity Conservation Act 1999*
GBRMP	Great Barrier Reef Marine Park
HDPE	High density polyethylene
IAS	Initial Advice Statement
IDAS	Integrated Development Assessment System
IPA	Integrated Planning Act 1997
IRR	Internal Rate of Return
JAMBA	Japan Australian Migratory Bird Agreement
KPI	Key Performance Indicator
LA90T	The A weighted noise level exceeded for 90% of the specified measurement period (T).
LGA	Local Government Areas
LWMP	Land and Water Management Plan
NRMW	Natural Resources Mines and Water
PB	Parsons Brinckerhoff Australia
SDPWO Act	*State Development and Public Works Organisational Act 1971*
The project	The Water for Bowen project – significant project declaration to be sought
ToR	Terms of Reference
VMA	*Vegetation Management Act 1999*
WDC	Water Delivery Charge
WRP	Water Resource Plan
WTC	Water Transport Charge

1. Introduction

1.1 Purpose of this initial advice statement

The intent of an initial advice statement (IAS) is to provide an introduction to a project that includes consideration of triggers or criteria for further environmental impact assessment and identifies the process that is most suitable for the proposal.

This IAS has been prepared by Parsons Brinckerhoff Australia (PB) for SunWater for the Water for Bowen project (the Project). This IAS is to provide information to government to:

- provide information to the Coordinator-General to aid in the decision making process on a declaration of the Project as a 'significant project' under Section 26 of the *State Development and Public Works Organisational Act 1971 (SDPWO Act),* which would initiate the statutory impact evaluation procedures of Part 4 of the SDPWO Act
- introduce the project, it's need, extent and provide initial identification of environmental issues relating to it's development
- assist the Coordinator-General to prepare draft Terms of Reference (ToR) for the Project's Environmental Impact Statement (EIS)
- enable stakeholders to determine the nature and level of their interest in the Project.

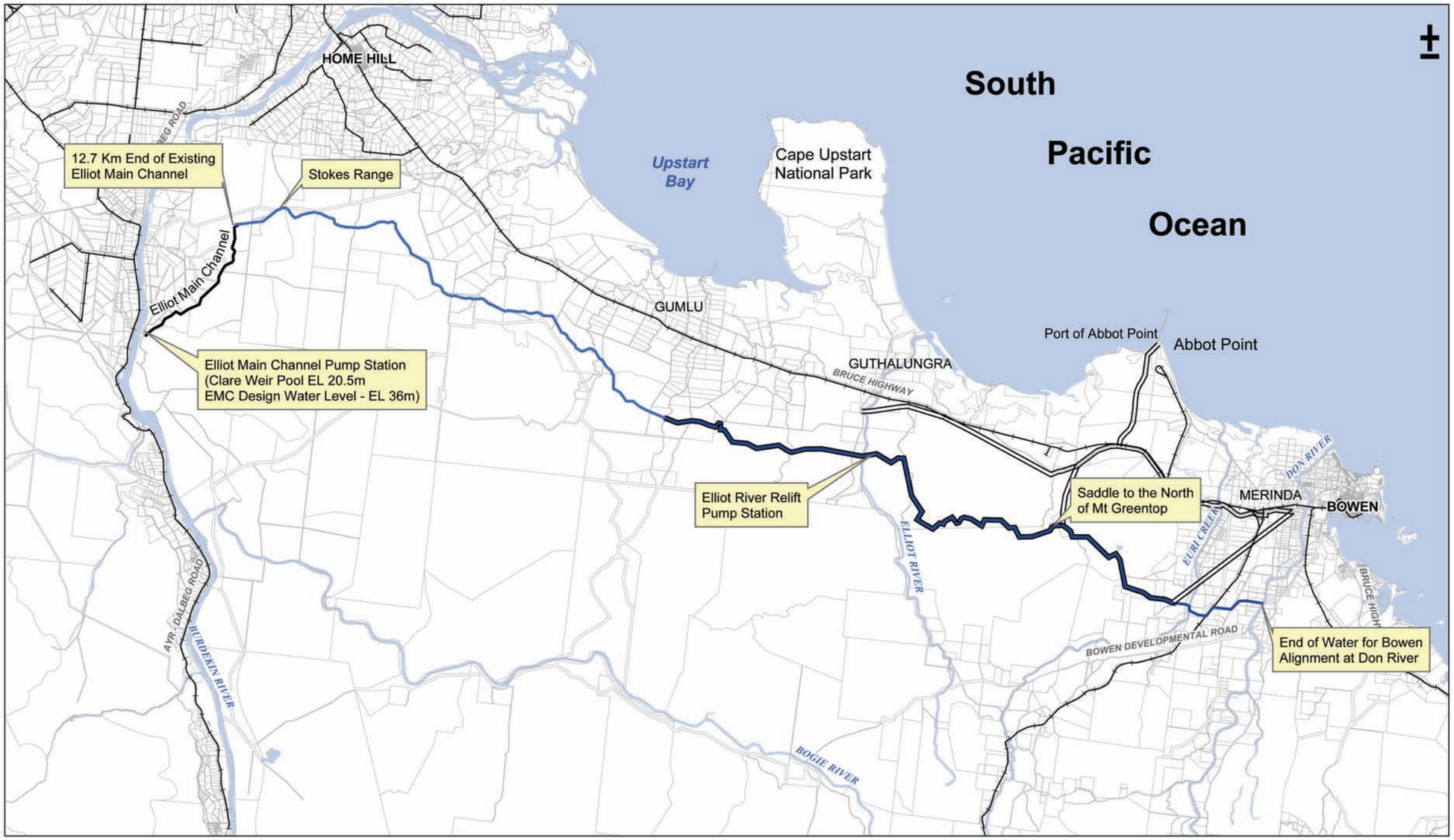
1.2 The Project

It has become evident that regional development or expansion opportunities on land between Bowen and the Burdekin River have been limited due to limited local water resources. In the past a variety of studies have indicated that a new water supply scheme for the Bowen area is technically feasible and could lead to growth in a number of different industries. However, owing to lack of commercial viability at the time, and environmental concerns, none of these studies were progressed. In light of changing water economics and increasing water supply demand, SunWater and Bowen Collinsville Enterprise are developing plans to re-examine the viability of establishing a new water supply scheme for the Bowen region, to bring water from the Burdekin River, down the coastal plain to Bowen. For this project SunWater is the proponent and the Bowen Collinsville Enterprise is a key member of the Project's steering committee.

The Water for Bowen Project (the Project) involves the development, maintenance and operation of a new water transport scheme between the Burdekin River (originating at Clare Weir) and the Bowen area. The proposed development corridor is approximately 130 km long and will involve construction of a water transport network of channels and/or pipeline.

The water supply will provide water for irrigation, agricultural and industrial purposes along the proposed corridor via a number of spurs to delivery points. The Project size is currently estimated to be up to 65,000 ML per annum supplied from Clare Weir, falling to about 30,000 ML delivered to Bowen.

A regional locality plan and adopted alignment of the proposed development is shown in Figure 1-1.



Legend

- Existing Elliot Main Channel
- Adopted Water for Bowen Alignment

Kilometres

0 3 6 12 18 24

Sources
Cadastre - NRM (2004)
Topography - Geoscience Australia (2003)

Figure 1-1 Project Locality		Datum: GDA94 Scale: Not to Scale Author: GL Checked: PF
Project: IAS - Water for Bowen		File: 9_Drafting\GIS\Figure 1-1.mxd
Client: SunWater		
Job Number: 2136473A	Revision:	
Date: 27 Apirl 2006	Drawing Number:	

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Figure 1-1: Project locality

1.3 The proponent

The proposed new water scheme would be built and operated by SunWater. SunWater owns and operates the Queensland Government's bulk water supply and distribution infrastructure located throughout regional Queensland. It supplies approximately 40% of the water used commercially in Queensland via 27 water supply schemes. Water supply customers number over 6,000 and include irrigators, water boards, local governments, power stations and mining, industrial and manufacturing companies. SunWater operates the Burdekin, Emerald and Bowen/Broken River water supply schemes.

SunWater provides a range of services including infrastructure ownership, water delivery, operation and maintenance of infrastructure and engineering consultancy services. SunWater specialises in design, construction, maintenance and operation of water infrastructure, as well as supply of bulk water to rural, urban and industrial customers, SunWater has a long, proud tradition of providing quality services for over 80 years.

Over the last 80 years, SunWater has built and now owns and operates a regional network of water supply infrastructure throughout Queensland which supports irrigated agriculture, mining, power generation, industrial and urban development. As a specialist water service provider, SunWater has extensive expertise in operating and maintaining dams and weirs, pump stations, pipelines, open channels and drainage systems.

SunWater's water storage and distribution infrastructure has a replacement value of $2.7billion and includes:

- 26 major dams
- 81 weirs and barrages
- 72 major pumping stations
- more that 2,500 km of pipelines and open channels.

Contact details for the Project proponent are:

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1.4 Legislation requirements

1.4.1 Commonwealth approvals

In January 2006, SunWater submitted a referral to the Department of Environment and Heritage (DEH) for the Project under requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It states that the Project triggers two controlling provisions i.e. threatened species or ecological communities and migratory species. Consequently SunWater advocate that the Project be considered as a "controlled action".

1.4.2 State approvals

The Commonwealth Department of Environment and Heritage (DEH) made a determination, on 25 January 2006 that the Water for Bowen Project is a controlled action under Section 75 of the EPBC Act. The assessment requirements can therefore proceed under two general paths:

- Assessment through a process determined by DEH based on a preliminary information submission by the proponent. Assessment options include assessment based on preliminary documentation, public environmental report, Environmental Impact Statement and public enquiry.
- Assessment through a bilateral agreement through an accredited state process - of which the most applicable is the *State Development and Public Works Organisation Act 1971* (SDPWOA) process.

The Project has been declared a "controlled action" under the EPBC Act. It is therefore SunWater's intent to seek approval to undertake a significant project Environmental Impact Study (EIS) under Section 26 of the SDPWOA. The EIS under the SDPWOA will be undertaken in accordance with the bilateral agreement between the Australian Government and Queensland Government, which accredits Queensland's assessment process for significant projects under the SDPWOA. An overview of the assessment process is presented in Figure 1-3.

Assuming the Project is declared to be a "significant project" under the SDPWOA, upon the Coordinator General finalising the assessment report for the EIS, there is the option to seek Designation of the subject land for community infrastructure (water cycle management infrastructure). This is an alternate option to lodging a development application with the relevant local government/s.

Recent amendments to the IPA 1997 recognise the EIS process under the SDPWOA as an 'adequate environmental assessment and public consultation process' for the purposes of a CID.

In terms of IPA approval process options, the CID process is the most applicable for the approval and protection of linear infrastructure that passes through two Local Government Areas (LGAs), Bowen Shire Council and the Burdekin Shire Council. A variety of tenures exist of the project area, such as freehold and leasehold land.

A CID requires the approval of a Minister. In addition SunWater will seek gazettal by Governor in Council, pursuant to the SDPWOA that the Project be designated Infrastructure Facility of Significance to enable resumption of land, if necessary. The CID process advantages include:

- protection of the rights of affected landowners
- requirement for LGAs to recognise and make provision in future planning schemes for the community infrastructure.

The recommended project approval process is declaration as a project of state significance and assessment under the SDPWOA which concurrently picks up the assessment requirements of the EPBC Act through the bilateral agreement between the Queensland Government and the Commonwealth. Following approval under the SDPWOA it is recommended that the infrastructure is declared as community infrastructure under IPA.

It is important that the SDPWOA and CID consider all construction activities and associated structure and facilities to reduce the possibility of separate future approvals being required for project components, e.g. construction.

At or prior to the Project inception, SunWater will engage in detailed discussions with Natural Resources Mines and Water (NRMW) and/or The Coordinator General (CG) to determine whether they would entertain a community infrastructure designation for the Project. This would determine the applicability of the Designation process to the Project.

Figures 1-2 and 1-3 below illustrate the two potential pathways under the SDPWOA EIS process. For the Project, Figure 1-2 is the preferable pathway.

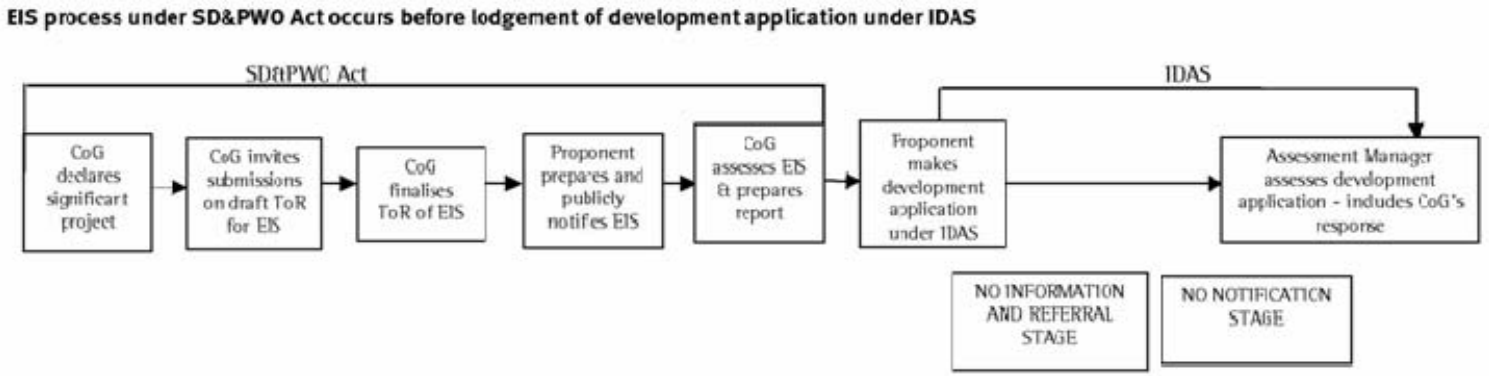


Figure 1-2: Flowchart of the preferred option of the SDPWO Act 1971 EIS process

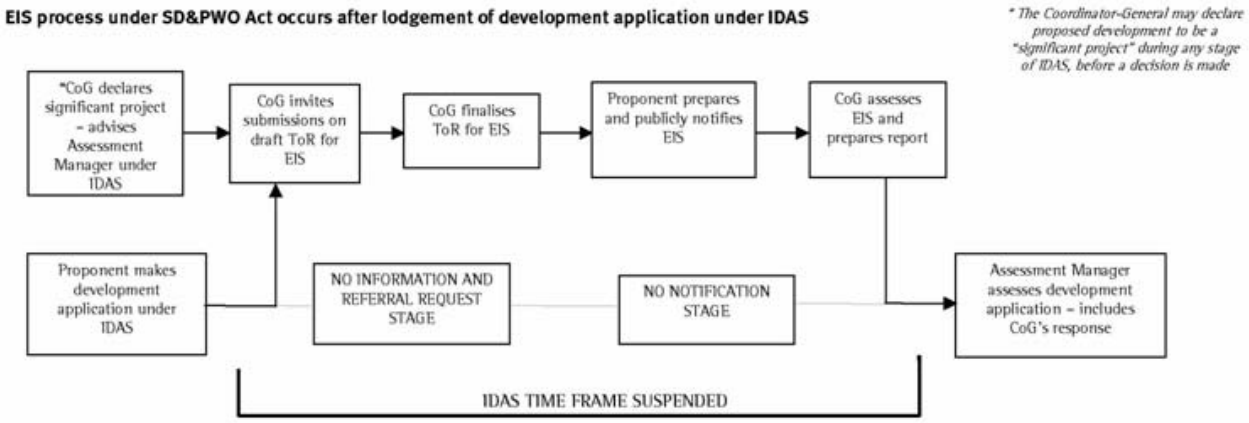


Figure 1-3: Flowchart of the alternative option of the SDPWO Act 1971 EIS process

1.4.3 Other approval requirements

The construction and operation of the proposed water transport scheme will require a number of statutory planning and environmental approvals that will address the complexity of approvals such as, multiple Local Government Areas, infrastructure providers and land holders. Table 1-1 highlights the key approval considerations only. The information presented in Table 1-1 highlights key legislation only that needs to be considered for the approval process and is not to be considered as complete. Additional information on legislation is listed in Section 6, with Cultural Heritage considerations provided in Section 5.19.

Table 1-1: Summary of key approval considerations

Key project issue	Key legislation	Application
Vegetation clearance	*Vegetation Management Act 1999*	In March 2004, new amendments to Queensland's clearing legislation were introduced which consolidated all the existing vegetation protection laws into the *Vegetation Management Act 1999* (VMA). Carrying out operational work that is the clearing of native vegetation on freehold or leasehold land is assessable development under the *Integrated Planning Act 1997.* A decision on the proposal's preferred option for the planning approval process and final corridor selection, and further investigations into the exiting land tenure, will be required to confirm precise vegetation clearing requirements. All approval processes would generally require approval for vegetation clearing. It should be noted that declaration of the proposal as a significant project under the SDPWO Act could mean that the clearing permit may be obtained concurrently with the conclusion of the EIS process.
Marine zoning	*Coastal Protection and Management Act 1995*	Approvals under the *Coastal Protection and Management Act 1995* (Coastal Act) would be necessary under the IDAS process, however, the assessment of a significant project under SDPWO Act could allow this process to occur concurrently.
	Great Barrier Reef Marine Park Act 1975	The *Great Barrier Reef Marine Park Act 1975* is a Commonwealth law that ensures the protection and management of the Great Barrier Reef. This Act and its Regulation creates a zoning plan for the Great Barrier Reef.
	Marine Parks Act 1981	The Queensland *Marine Parks Act 1981* identifies gazettes and manages protected areas as Marine Parks and preserves marine species. The Act and its associated Regulation implements zoning plans for management of Marine Parks, and a permit system for activities to be undertaken in the Marine Parks. The Act is related to the *Great Barrier Reef Marine Park Act 1975*.

Key project issue	Key legislation	Application
Water permits	*Water Act 2000*	The *Water Act 2000* outlines several permits which may be required for the proposal, including: Riverine Protection Permit for any works crossing a freshwater watercourse that interferes with the bed or banks. Taking water from a watercourse will require a licence to take water from the catchment. Interfering with a watercourse is required for interfering, taking and/or controlling the flow of water in a watercourse. Approval for development in a declared catchment will require concurrence agency approval from the Department of Natural Resources and Mines. This approval remains a trigger for referral coordination under the *Integrated Planning Act 1997*
	Fisheries Act 1994	Section 51 of the *Fisheries Act 1994* identifies that a permit to remove or disturb marine plants may also be required for all potential approval options. If the permit is triggered, consultation will be required with Department of Primary Industries and Fisheries for the design of the proposed linear water infrastructure.
Statutory planning policies	The following state environmental planning policies may be relevant to the environmental assessment of the proposal	*State Planning Policy – 1/92 Development and Conservation of Agricultural Land*. The proposal would be located on properties predominantly utilised for rural purposes. *State Planning Policy –1/02 Development in the Vicinity of Certain Airports and Aviation Facilities* will need to be considered in assessing the land use planning implications of the proposal under the environmental assessment. *State Planning Policy – 2/02 Planning and Managing Development Involving Acid Sulphate Soils* applies to coastal areas below 5 m Australian Height Datum where acid sulphate soils commonly occur. The region has been identified as possessing acid sulphate soils or potential acid sulphate soils. The policy will need to be considered, as operational or infrastructure works involving acid sulphate soils will need to be planned and managed to avoid the release of potentially harmful contaminants into the environment. Acid Sulphate Soil Management Plan must be prepared prior to the commencement of works. *State Planning Policy – 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide.* An assessment of this policy would also be required with consideration to natural hazards of flood, bushfire and landslide and ensure these matters are adequately addressed when carrying out the development. *State Coastal Management Plan* provides a framework to address and manage pressures on the coastal zone and as part of its core topics, emphasises that development should occur in an ecologically sustainable manner. The State Coastal Management Plan applies to the coastal zone defined in Section 11 of the Coastal Protection and Management Act 1995. As there is the potential for a link between the location of the proposal and the coast or coastal resources, this Plan is should be considered. *Draft State Planning Policy for the Protection of Extractive Resources.* This Policy may be applicable to the proposal if the subject site is identified as a Key Resource Area. It is intended to maintain the long term availability of major extractive resources.

1.5 Native title

Specialist subconsultants Northern Archaeological Consultancies (NAC) were commissioned to undertake a desktop study for the cultural heritage and native title component of the Review of Environmental Factors (REF) (1).

A 'Native Title party' for an area is a registered Native Title claimant for the area. On this basis (from the 2004 search) there would appear to be one Native Title party for at least part of the Project area. The relevant Native Title party is the **Bindal people** (claim QC99/21). The Bindal Native Title claim is relevant for the northern sector of the Project area in the vicinity of Clare Weir and the Burdekin region, but extending no further south than Gumlu.

Neighbouring Native Title claims include the Gia people (QC99/24), the Birri Gubba people (QC97/19) and the Birri people (QC98/12). The northernmost boundary of the Gia Native Title claim appears to run along the southern banks of the Don River. On this basis, the Gia claim appears to be outside the proposed project area.

The Birri Gubba claim includes Cape Upstart National Park only and not the Project area. The northernmost boundaries of the Birri Native Title claim appear to be located well south of the Project area.

Therefore, there would appear to be no registered Native Title claims over a substantial portion of the proposed project area.

This assessment was undertaken in 2004, no additional studies have been undertaken for the Project since that time. Consequently, the search information will need to be revisited as part of the EIS process.

1.6 Project need

Additional water is needed to support the existing activities of the Bowen farming industry, and to enable the development of a range of other industry opportunities already identified by the Bowen Collinsville Enterprise.

Water from the Water for Bowen scheme will be used to supplement existing farmers' groundwater allocations and also allow for some planned growth in irrigation. The Project will not replace existing water allocations.

To sustain current production levels, the Bowen farming industry needs a secure, supplementary water supply. The industry is currently using more water than can be reliably supplied by the groundwater systems. As a consequence of the over-pumping of the groundwater systems, the groundwater table has steadily fallen and subsequently salinisation is becoming an increasing problem. This is of particular relevance in the Bowen region. Without a source of supplementary water supply, the $250m per year farming industry at Bowen is not sustainable in the long term at its current level. Declining water quality in the existing ground water supply from the Don River and Euri Creek aquifer systems will impact directly on farm yields, viability, and the local Bowen economy.

Availability of a secure supplementary water resource will also enable industry developments in aquaculture, food processing, medium to heavy industry, as well as tourism and urban growth to proceed in the Bowen area.

1.6.1 Industry

Access to an adequate, reliable water supply is a critical issue for industry growth and development.

The Bowen Coastal region has historically missed out on a number of large-scale key industrial developments in the past because the water was simply not available. Access to water for industry will provide the foundation for the future economic and community development of the region, from Home Hill to Bowen and potentially as far as Proserpine.

The Queensland government has identified the port of Abbot Point as an ideal location for future industrial development. But without adequate access to water, future job-creating industries are likely to bypass the Bowen Shire for other areas where a secure water supply is available. Bowen Shire Council and Bowen Collinsville Enterprise has commenced a scoping study process to establish a major medium to heavy industrial precinct in the Abbot Point area, which will host a range of future industrial development projects. Access to a secure water supply is critical to the success of this process. There is currently no water available at Abbot Point for future development. It is also likely that there will be insufficient water available at Abbot Point to service the proposed Stage II and Stage III expansions of the Abbot Point coal terminal that currently under consideration.

Industries that are currently examining Abbot Point as a future site for development, subject to the availability of water, include an aluminium refinery and steel smelter (2).

1.6.2 Aquaculture

Two new large scale aquaculture projects are already operating within the Bowen region and another two are expected to be constructed. Water is a key input for the aquaculture industry, and the current water supply system will struggle to meet these demands.

Bowen Collinsville Enterprise has identified a further two green field aquaculture sites in the Water for Bowen area that are suitable for large scale commercial aquaculture developments, and will maintain an ongoing industry development program with the aquaculture industry. The development of aquaculture businesses on these two sites (Salisbury Plains and Mt. Luce), will be restricted by the current availability of water in the area.

1.6.3 Farming and horticulture

The horticulture industry needs additional water even to continue operating at current levels. Over the past ten years there has been an overall decline in the water levels in the Don River and Euri Creek aquifers, which has resulted in rising groundwater salinity levels. Without a supplementary water supply, it is likely that the Bowen farming industry will not be able to continue operating at its current level, and that irreversible damage could be inflicted on the groundwater aquifer and the soils of the Bowen region.

Access to a reliable supplementary water supply will provide security of existing cropping ventures. The water may provide an opportunity to have an extended cropping period for some established crops, and will provide the capacity for farmers to make better use of rotational cropping and cover cropping during fallow periods, providing greater protection for soils from wind and rain erosion. The Bowen dry tropics region has an ideal climate for farming; however, water continues to be the limiting factor.

Supplementary water supply may also enable a diversification of the crop types grown in the region. This has the potential to relieve some market pressure from the mainstay crops, namely tomatoes, capsicums, beans, corn and melons. An additional water source will also enable a wider use of rotational crops in the farming industry.

1.6.4 Food processing

Over the past five years Bowen Collinsville Enterprise has dealt with several large food processing companies seeking suitable sites for new food manufacturing operations. On each occasion, Bowen was ruled unsuitable because the required water was unavailable. Access to an additional reliable water supply would make Bowen an attractive location for these types of businesses.

1.6.5 Tourism and urban development

Over the coming years Bowen will witness the construction of a large number of tourism accommodation unit developments, residential sub-divisions, and new business developments. All of these activities will place increased demands on the available water supply system. Ongoing growth in the Whitsundays will also place additional pressures on the Peter Faust dam at Proserpine, where Bowen's current water supply is sourced.

The tourism growth and potential development of the region has been highlighted in *The Whitsunday, Hinterland and Mackay Regional Planning Project* (WHAM). The WHAM is a joint government and community project to develop a long term strategic plan for the region (3).

The Water for Bowen Scheme will provide additional water to the Bowen community, which may enable Bowen to reduce it's reliance on the Peter Faust Dam at Proserpine, thereby freeing up additional water allocations for use within the growing Whitsundays area.

Water for Bowen will also facilitate the linking of the Burdekin Water Supply Scheme and the Proserpine River (Peter Faust Dam) scheme. The Water for Bowen Scheme can link with Bowen Shire Council's existing Proserpine Pipeline, which may provide the opportunity to send Water for Bowen water beyond Bowen to supplement future supplies in the Whitsundays.

1.7 Project alternatives

It is considered that the Project is without feasible alternatives. A brief summary of other water supply options that have been examined include:

- An alternative to the current proposal is a pipeline across from Collinsville. This option is likely to be cost prohibitive as it would also need a pipeline from Blue Valley Weir to Collinsville. Even a pipe transporting 20,000 ML would cost significantly more than the current proposal and would not be commercially viable.
- Peter Faust Dam does not have sufficient allocation to support the increasing demands of the region.
- There are no other suitable existing surface water infrastructure projects in the region.
- There are no groundwater resources suitable for development in the immediate area.

1.8 Summary of claims

The Water for Bowen Project (the Project) involves the development, maintenance and operation of a new water transport scheme between the Burdekin River (originating at Clare Weir) and the Bowen area. The proposed development corridor is approximately 130 km long and will involve construction of a water transport network of channels and/or pipeline.

The proposed new water scheme would be built and operated by SunWater.

The Commonwealth Department of Environment and Heritage (DEH) made a determination, on 25 January 2006 that the Water for Bowen Project is a controlled action under Section 75 of the EPBC Act. Due to the nature of this project, it will involve a complex approvals process. Therefore, it is SunWater's intent to seek declaration of the Water for Bowen project for which an Environmental Impact Study (EIS) under Section 26 of the SDPWOA.

2. Community and stakeholder consultation

The consultation and community involvement plan for the Project is currently being developed by SunWater in conjunction with specialist subconsultants (PB). This plan will articulate consultation and communication activities for the duration of the Project. During the EIS community consultation will be conducted in accordance with statutory requirements and is expected to take the form of individual meetings with surrounding property owners and the distribution of a public information newsletter/brochure. This will be in addition to the public notification of the EIS required by the SDPWOA process.

Community and stakeholder consultation will be carried out to ensure that all relevant bodies are aware of the Project and have the opportunity to comment on issues of relevance to them. A draft key stakeholder list was prepared subsequent to an environmental workshop help in October 2004; this list is provided in Appendix A.

Whether perceived or actual impacts develop as a result of the Project, the local community will be kept informed of the Project and the implications for their region. SunWater will establish an open line of communication with the surrounding community, to address the issues raised, ensure a strong relationship into the future and reduce the potential for disruption to the Project.

The *Integrated Planning Act 1997* (IPA) and the *State Development and Public Works Organisational Act 1971* (SDPWO Act) highlight that property owners should be notified of potential issues relating to the Project. In addition, it is SunWaters's intent to negotiate access to land upfront with the possibility of seeking recourse to the powers for compulsory acquisition under the under the SDPWO Act, if required. SunWater's consultation will focus on awareness of issues such as:

- impact to existing land use
- groundwater impacts and allocations
- impacts to flora and fauna
- health and safety
- noise during construction and operation
- visual impact
- timing of development
- long term management
- implications for industry

Consultation, as a minimum, will take the form of a project steering committee, stakeholder referral group, regular newsletters and webpage facilitation. These activities are already in place and have been from the Project inception. SunWater are committed to providing an effective and interactive community consultation program. Additionally, SunWater will consult with all key stakeholders such as government agencies and native title groups during the EIS process, as coordinated by the Coordinator-General.

Existing (and ongoing) community and stakeholder consultation activities include:

- monthly steering group and stakeholder meetings
- website hosting of published reports (eg, excerpt of the Review of Environmental Factors, Stage 1 Report) and information sheets.
- a range of other consultation meetings with local industry representatives.

Additional community consultation information is provided in Appendix A.

3. Community benefit

In addition to rescuing the over-stretched groundwater system, one of the key drivers for the Project is the potential for significant community benefit.

A key positive of the Project is the potential for increased direct employment opportunities within the area as a result of the capacity to expand irrigation development, light industry developments currently restricted by water supply, facilitate future aquaculture developments on identified sites, and remove the current water supply constraint on the development of major industrial projects at the Abbot Point industrial precinct.

While the priority of the Project is to supplement existing water supply availability, there will be potential flow-on effects. These include increased opportunities for service industries, and the potential for expansion of cropped areas, improving employment opportunities in crop production and processing industries, both locally and throughout the region.

Flow-on effects, particularly in the rural population centres, such as increases in service industries, are likely to provide benefit to the area. However, careful strategic planning by local governments is required to ensure increasing pressures on facilities such as schools, housing, hospitals and community facilities are managed and mitigated appropriately. These impacts may be exacerbated in the construction stage as a result of the influx of the Project workforce. Similarly, during operation, once development of the area commences in terms of increased agriculture, light industry and support industries, current resources may be insufficient.

One of the key economic challenges facing the Bowen Shire is the seasonal nature of the existing employment intensive industries. Those industries that employ significant numbers of people (horticulture, fishing, tourism) are all currently seasonal industries with employment peaks during the winter months, and shutdown periods during the summer months. This seasonal cycle places significant pressure on families in the community, and has a dramatic impact on the viability of the small business sector.

The Water for Bowen scheme will assist to address this strong seasonality by introducing a wider diversity of industry to the local economy. A secure and adequate water supply will support the diversification of the horticulture industry and foster the development of industrial projects at the Abbot Point Industrial Precinct, which over time will broaden the local economic base.

4. Project description

4.1 Project background

Historically, regional development of (on land) expansion opportunities between the town of Bowen and the Burdekin River have been restricted due to limited water resources. The Elliot Main Channel project was included in the original concept plan for the Burdekin Irrigation Scheme (now referred to as the Burdekin Houghton Water Supply System (BHWSS)). The proposal was to construct an open channel distribution system southwards from the Burdekin River towards Bowen to service horticulture and aquaculture developments.

In the early 1990's a number of environmental issues were identified with the proposal in respect to sub-surface drainage and the underlying groundwater table in the Inkerman region, as a consequence construction of the channel was halted after 12.7 km, pending further investigations (4).

In 2003 SunWater conducted new pre-feasibility studies into the Project with a view to determining whether the Project held commercial potential (SunWater 2003). Whilst these studies concluded that the channel could be constructed at a cost that was within the capacity to pay for horticulture, there was insufficient demand demonstrated at that time to make the Project viable from a commercial standpoint. The feasibility study also concluded that although there were a number of environmental concerns, these were now considered manageable given appropriate development controls on irrigation practices (for example Land and Water Management Plans). The project was therefore considered "not commercial" and placed on low priority until demand was noted to have increased.

More recently, growers in Bowen have demonstrated the viability of using water for irrigation at a price of up to $400 /ML, inferring that the Project may be "close to" commercial status. Demand increases have also been noted from aquaculture, industry (Abbot Point), tourism (Bowen and points south), and domestic (Bowen Shire). In addition, the aquifer system associated with the Don River and Euri Creek rivers, that has supported a $200 M horticultural economy for nearly 20 years, is now demonstrated to be suffering the effects of over-pumping, with consequent deterioration of groundwater quality (5).

As a result of these factors, renewed interest has occurred from the local water users, industries with a potential to move into the region if water were available and the State. In October 2004 SunWater embarked on a new feasibility study of the potential for bringing water from the Burdekin to Bowen.

The feasibility study is being undertaken in two stages:

Stage 1 – This stage focused on estimating current and future water demands in the area, developing a concept scheme size and delivery method, broad engineering costs and environmental factors. This stage is now complete.

Stage 2 – This stage will comprise a full Environmental Impact Assessment (EIS) and detailed design report. This IAS forms part of the Stage 2 component.

The Project will bring water from the Burdekin River, southeast to the town of Bowen and potentially beyond. Various routes have been evaluated as part of the Stage 1 study and the current proposal, based on cost considerations, is for a channel to be extended from the end of the existing section of the Elliot Main Channel, across Stokes range, along grade to the Elliot River, a small re-lift and then along grade to the saddle to the south of Mt Greentop, and into the Don River Valley.

The Project will be a water transport scheme that is owned and operated by SunWater. Customers will hold contracts with SunWater to provide water transport capacity. The proposed Project will provide the additional water required to support the existing activities of the Bowen farming industry, and to allow for growth in irrigation and overall improvement of productivity as well as enable the development of a range of other industry opportunities that have been identified by Bowen Collinsville Enterprise. It is emphasised that water from the Project will be used to supplement existing the available water supplies in the region and allow some planned growth in irrigation. It will not replace existing water allocations as water intended for the Project will be sourced from water that is currently unallocated.

The Water for Bowen water transport scheme is acknowledged in Queensland's State Infrastructure Plan1 relating to future directions in infrastructure development.

4.2 Project details

Key project parameters include:

- Construction of a water transport scheme using a channel and/or network pipeline, supply of raw water for irrigation and industrial purposes along the proposed corridor via a number of spurs to delivery points along the way.
- A delivery capacity estimated to be approximately 65,000 ML from Clare Weir, falling to 30,000 ML delivered to Bowen.
- Water from the Project will be used to supplement existing farmer's groundwater allocations and allow some planned growth in irrigation.
- Water would be sourced from the existing location of the Elliot Pump Station and travel 12.7 km to the end of the existing channel. The proposed channel would continue into a deep cut into Stokes Range, and from there adopt a gradual downhill route to a re-lift pumping station near Elliot River. The re-lift at Elliot River will allow the water to flow via gravity for the remainder of its passage to Bowen.
- Based on the timing of the approvals process, if the Stage 1 and Stage 2 study outcomes prove to be favourable, the target date for water supply construction commencing would be early 2008.
- Reticulation to customers from the main channel would mainly be achieved using gravity feed via buried high density polyethylene (HDPE) pipelines.
- The irrigation practices within the Project area result in zero discharge operations. By the time the Project is constructed, a Water Resource Plan (WRP) for the region will be in place which will require all irrigators to develop and operate under a Land and Water Management Plan (LWMP). Accordingly, there is no reason to believe that the zero-discharge outcome will change as a result of the Project.

[1] Queensland Government: State Infrastructure Plan Implementation Report – 2004/05.

Activities involved in the proposed action will include:

- construction of access tracks to proposed development and severed properties
- vegetation clearing for the construction of the pipeline/channel
- channel/pipeline maintenance
- construction/excavation of the pipeline/channel and associated structures (for example, farm access crossings, road crossings, in-line channel controls)
- use and rehabilitation of borrow areas and quarry sites
- stockpiling of materials and cleared topsoil
- construction and operation of pumping stations
- easement restoration/rehabilitation.

SunWater is developing initial indicative concepts for methods to deliver water to the customer's gates via pipelines. Those clients who have already built their own water distribution systems or on-farm storages will be taken into account.

The scheme will be designed to supply the quantity of water that the potential customers have indicated that they will need. There will be some spare capacity built into the system for future growth, based on current estimations of likely demand.

Overall, the concept presented above is now considered to present the best value for money option for delivering water over an extended period ("trickle flow" rates) to a large number of customers and the lowest possible capital cost per ML capacity per year. (SunWater 2005).

4.3 Corridor selection

The proposed water transport infrastructure corridor is approximately 130 km in length (Figure 1-1) and is located near the major townships of Bowen, Home Hill and Ayr within the Burdekin Shire and Bowen Shire. The proposed corridor commences where the existing Elliot Main Channel terminates, runs in a northerly direction for approximately 2.3 km and then traverses through a saddle in Stokes Range.

Beyond Stokes Range the channel is proposed to proceed south-east parallel to the Bruce Highway, and following the foothills of the Bobawaba Range up to Rocky Ponds Creek. From this point the proposed corridor crosses country with a general slope toward the north of about 1 in 150, to the Elliot River. From the Elliot River the corridor follows a grade through undulating country, passing through the saddle at Mount Greentop Range, before crossing the relatively flat country of the valley associated with Euri Creek and the Don River.

The land use within the investigation corridor consists primarily of agricultural land located on the coastal plains, floodplains and river levees. The drier upland areas are generally grazing areas. The current investigation corridor is a total of 7,000 Ha, however the actual potentially impacted Project area within this corridor will be approximately 1,100 Ha. The downstream area that might have irrigation water applied as a result of the Project in the long tem is estimated to 22,000 Ha. An additional area of approximately 3,000 Ha of freehold grazing land adjacent to the existing coal port of Abbot Point has been identified by Bowen Shire Council as suitable for industrial development should water become available within the area. The tenure of the final alignment will be identified as part of the EIS.

4.4 Proposed infrastructure

Final infrastructure works are still to be finalised. However, as a minimum, the Project will require the following infrastructure listed in Table 4-1 .

Table 4-1: Minimum infrastructure requirements

Channel access road(s)	Telemetry and controls
Fencing	Cross drainage
Pipelines	Balancing storages
Pumping stations	Reticulation
Balancing storages	Farm access road
Earthworks – including: ▪ Clearing and grubbing ▪ Topsoil strip and replace ▪ Catch drains ▪ Earthwords Cut ▪ Earthworks Fill ▪ Cut from borrow areas ▪ Cut in fresh rock ▪ Cut in weathered rock ▪ Haulage ▪ Lining costs.	Channel structures – including: ▪ Bank overflows (Spillway) ▪ Farm access crossings ▪ In-line channel control ▪ Lateral regulator ▪ Road crossings

4.5 Project timing

Based on the timing of the approvals process the construction of the Project is scheduled for commencement in early 2008 and completion by mid-late 2009 a duration of approximately 22 months.

Preliminary water supply is expected within nine months from completion of construction. Initial works will include a cut into Stokes Range and an upgrade of the Elliot Main Channel. A pumping station will then be constructed.

It is anticipated that water will then be available to customers in the Inkerman area, while the remaining construction works are completed.

4.6 Cost and financing

The following information has been sourced from the Water for Bowen Project Stage 1 Report, November 2005, SunWater (Section 7):

http://www.sunwater.com.au/current_projects_Bowen_stage1.htm .

“The project will require to be progressed on a commercial basis, and accordingly all water pricing will reflect the full costs of infrastructure provision. This will include an appropriate return on capital invested in the Project, as well as the recovery of the ongoing costs of service provision.

SunWater proposes that the Project be a water transport scheme only, in which the "Water Transport Charge" (WTC) would include charges to cover:

- The cost of providing new infrastructure, including an appropriate internal rate of return (IRR)
- The full cost of service provision captured in the fixed and variable costs of operations
- Maintenance and administration
- The costs associated with providing water at Clare Weir to provide for distribution losses in the new scheme.

In the development of the estimated WTC it was assumed that the Project would be authorised to proceed once 75% of the scheme's capacity had been assigned by contracts. It was further assumed that the foundation customers would be entitled to a small WTC discount for the opening years of the service. Both these assumptions have the effect that the estimated WTC is higher than would be the case if these conditions did not prevail.

The 95%ile WTC (that which is estimated to have a 95% confidence of fully recovering all capital and operating costs) varies between $230 /ML and $295 /ML for the different water delivery zones. This cost estimate range can be considered the current estimate of the "maximum likely" charge that SunWater would have to apply, based on the state of knowledge of the Project at this time.

However, the true cost of water delivered to the customer's gate will include the WTC and the costs associated with having entitlement to the water to be transported by the scheme. If it is assumed that the customers with potentially the least ability to pay for water are the irrigators that would be serviced by this scheme, then testing the viability of the irrigators to pay for water at the true price of water (referred to herein as the Water Delivery Charge, WDC) can be used as a test of the potential appetite for water at the indicated price.

The weighted average 95%ile WDC - estimated "all inclusive" charge including cost of the water entitlement, is $285 to $365 /ML. The lower charge is that for irrigation water and is close to the charge that would apply at Bowen itself, and the upper charge is that for high priority water for industrial use and would mainly apply at Abbot Point.

The comparison of the estimated WDC to irrigation demand for water at different price points indicates a significant gap between the price point upon which the Base Demand Case was established and the current 95%ile estimates of WDC. However, it is concluded that the current market environment and other mitigating circumstances will probably result in a strong demand for water at the estimated water delivery charge."

Finance for this project will be obtained through a combination of:

- Debt facility to be provided to SunWater by Queensland Treasury Corporation (QTC)
- Additional equity provided by shareholders;
- Potentially, cash contributions towards capital from the future customers of the scheme
- SunWater's cash reserves.

5. Project setting and key issues

5.1 Regional setting

The proposed corridor is described previously in Section 4.3 and Figure 1-1. The project area is defined within the coordinates provided in Table 5-1:

Table 5-1: Regional setting

From		To	From		To
19°48'S	–	20°07'S	147°33'E	–	148°19'E

Based on the timing of the approvals process the construction of the Project is scheduled for commencement in early 2008 and completion by late 2009 a duration of approximately 22 months.

In total six potential water supply zones have been nominally identified. The six key areas are defined as follows:

- Inkerman,
- Gumlu,
- Guthalungra
- Abbot Point
- Salisbury/Summer Hill
- Bowen Valley (Don River and Euri Creek areas).

The water demand zones are shown on Figure 5-1, below.

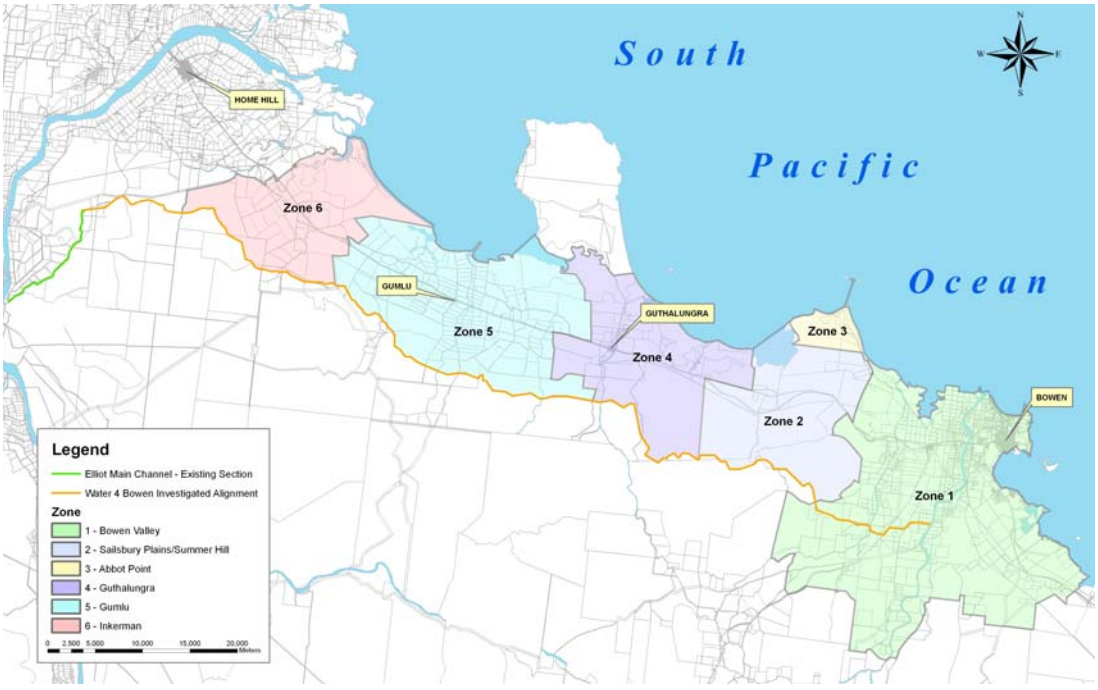


Figure 5-1: Water demand zones

5.2 Land use

5.2.1 Existing land use

The land use within the development area consists primarily of agricultural land located on the coastal plains, floodplains and river levees. The drier upland areas are generally grazing areas.

Information provided by the National Land and Water Resources Audit (1996/1997) (prepared by the Bureau of Rural Sciences) anticipates that any impacts associated with the proposed channel network and/or pipeline will be minimal as the proposed corridor traverses primarily grazing and agricultural areas. In broad terms these existing land uses generally include:

- livestock grazing
- grazing modified pastures
- irrigated horticulture

Extensive horticulture is prominent around Bowen, including satellite horticulture areas in Gumlu and Guthalungra. The horticulture comprises predominately groundwater irrigated tomato, capsicum and sweet corn growing but also supports other small crops such as melons, beans, pumpkins. Several aquaculture developments also exist or are under development in coastal areas around Bowen.

Future industry developments have been forecast for Bowen and include food processing, additional aquaculture development, medium to heavy industry, tourism and urban growth.

In support of the industrial growth in the area, land at Abbot Point has previously been identified by the Department of State Development and Innovation (DSDI) (now The Coordinator General) as ideally suited for future development (8). A scoping study is commenceing in May 2006 to assess options to establish a State Development Area adjacent to Abbot Point to facilitate future industrial development in the area.

In addition to existing landuse practices, the Project has the potential to aid in expansion of existing industries that may currently be restricted in growth due to water supply or development of new industries. For example, Pacific Reef Fisheries (Bowen) Pty Ltd is proposing to develop a prawn aquaculture facility on an 800 Ha site adjacent to the Elliot River near Guthalungra, approximately 40 km north of Bowen. The proposal includes up to 260 Ha of grow-out ponds, seafood processing facilities and support infrastructure. Production is estimated to be 1,650 tonnes of penaeid prawns per annum with turnover of $29 million by 2008 (9) and has the potential to take up to 2,000 ML/a if water from this Project alone. The Water for Bowen Stage 1 report provides further discussion of the potential water demand for aquaculture.

5.2.2 Key land use issues

5.2.2.1 Land acquisition

The land likely to be affected by the Project is dependent on the final alignment selection.

It is anticipated that easements will be commercially negotiated over land required for the Project. If SunWater follows reasonable steps to negotiate and purchase by agreement but cannot secure some of the necessary land, last resort acquisition powers may be available under the SDPWO Act. Use of these powers is subject to a number of process safeguards.

5.2.2.2 Compensation

For the purposes of compensation, the proposed channel network and/or pipeline has the potential to impact both positively and negatively upon existing and future land uses. Compensation is expected to be due for land acquisition or significant impairment of land use as a result of new infrastructure title encumbrance.

Given that water supply availability generally creates commercial opportunities, the overall likely impact of the proposal on property values can be expected to be positive.

Compensation to affected land owners will be determined while the EIS and detailed design work is underway.

5.2.2.3 Cumulative impacts of linear developments existing and future land uses

With a development of this nature (i.e. linear development) there may be impacts upon existing and future land uses and the local community during both construction and operational phases.

It is anticipated that any impacts will be minimal as the proposed corridor traverses primarily grazing and agricultural areas.

These existing land uses generally include:

- livestock grazing
- grazing modified pastures
- irrigated horticulture

There is no expectation of any clearing to allow use of the water that will be brought into the region from the Project (e.g. to support increased irrigation).

Where possible, existing private and public heavy vehicle access tracks will be utilised during the construction and maintenance stages to minimise any adverse impacts. The construction of any new tracks will be undertaken in a manner to ensure the least disturbance to the existing surface and vegetation.

Rehabilitation will be undertaken in a rolling schedule as construction proceeds, so as to minimise any adverse impacts on the area.

5.2.2.4 Construction phase

The construction phase will only have an impact upon current rural land uses if construction activities intrude upon or limit the normal functional or rural management for the land uses i.e. temporarily restricted property access. In most cases the proposed development should have minimal impacts on current land uses, as construction activities will not unduly inhibit normal functional or operational land use abilities, over an ongoing, long-term period.

5.2.2.5 Operational and maintenance phase

Operation of the proposed channel network and/or pipeline has the potential to impact upon the properties it will traverse by way of:

- Influencing future development potential. Properties over which the development extends that exhibit physical characteristics (i.e. soil type and groundwater conditions), favourable for irrigation are likely to experience significant positive benefits in terms of expansion of or conversion to intensive agriculture of potentially high quality crops with high gross margins.
- Properties that are unable to capitalise on the new water source, either as a result of land characteristics that do not support irrigation practices, or inability to afford purchasing the water, will also have access to water for other uses, i.e. grazing, should horticulture not be feasible.
- The trading process will allow late entrants to the scheme customers and future flow rate entitlements. An increase in the value of properties. As a result of the likely enhancement of future development potential for the immediately affected properties (see above), there is the potential for escalation of the property value on which the infrastructure is located.
- Altering to operational ability of current land uses, due to the minor development footprint associated with the proposal. It is anticipated that the proposed development will have a limited impact in the restriction of future agricultural or rural pursuits or development on such land. In addition, the proposal will be generally compatible with the nature of the existing rural uses. Access facilities are expected to mitigate any loss of function to existing irrigation areas.
- It should also be noted that stakeholders will always be able to enter the scheme at a later date, should they not wish to become foundation customers. However, the cost of late entry may come at a premium, depending on competition for capacity in the scheme at that time.

5.3 Geology and soils

Soil mapping information was provided by SunWater from mapping ranging in scale from 1:25,000 to 1:100,000. Soils in the Project area vary from uniform cracking and non cracking clays to sodic duplex soils and alluvium deposits. Soil quality varies considerably with different degrees of suitability for agriculture, and by inference, for construction.

Highly erodable sodic soils are found scattered widespread throughout the Project area. Erosion is exacerbated by relatively steep gradients and concentration of existing runoff in gullies and channels. Although these soils are generally still manageable, future agriculture on these soils should be carefully managed with the aim of containing any escalation in salinity and sodicity.

For those properties participating in the Project, Land and Water Management Plans will be developed during the construction phase in accordance with guidelines established by the Natural Resources Mines and Water (NRMW). Where required, SunWater and NRMW will assist local growers and property owners to develop these plans as part of the EIS process.

5.3.1 Inkerman area

The Inkerman area is located east of Stokes Range, bounded by the proposed corridor of the Water for Bowen Channel, the Bruce Highway, and Wangaratta Creek, the area slopes uniformly to the north at 0.5% and has significant erosion evident on the plains.

Soil maps used for this desktop review indicate that the Inkerman area is predominantly made up of the Koberinga and other cracking clays located on the alluvial plains. Above this unit in the topo-sequence, red sandy clays overlay intermediate intrusives, which have been subject to intensive dyking. The upper sections of the rock are weathered and have some capability for water transmission although the capacity for water storage is negligible. These upslope soils are far more permeable than the soils in the lower profile, and provide good surface to groundwater connectivity. If not appropriately managed, this has the potential to overload the transmission ability of the lower profile, leading to raising of the regional groundwatertable.

There are intermittent areas of dryland salinity, which may have been aggravated by land clearance. In some areas, particularly along the drainage lines, the soils are highly dispersive with minimal capacity for water storage. In the lower profile, salinisation has led to a degradation of soil structure.

5.3.2 Gumlu area

The soil maps provided to PB identify two major soil groups in the Gumlu area:

- along the major drainage lines, alluvial soils varying from uniform silts to sandy slightly sodic soils (some of which are unusable for agriculture) are identified
- further away from the channels, heavy alluvial/colluvial clays are present.

Outside the area of impact, thin alluvial and coastal sediments overlie the heavily weathered base strata and provide limited fresh groundwater resources. Closer to the coast line, the water bearing sediments are generally thicker and may contain brackish or saline groundwater in localised areas.

5.3.3 Guthalungra

The Guthalungra area is comprised of two major soils groupings. The first is the area to the west of the Elliott River. Near the river, this is alluvial sequences associated with the river development. An area of in-situ weathered sandy clay, similar to the uplands behind the Inkerman and Gumlu area also intersects the middle of this area near the highway crossing. Further to the west area areas of grey clays with little agronomic potential.

The second major grouping is in the area east of the Elliott River where the major soil type is of the Dalrymple clay loam soils, common throughout the upper sections of the Elliot River. Generally these soils are considered favourably for cropping, however it needs to be investigated whether landowners would make a business case for irrigation as they would, unlike Gumlu, need to clear (where required) and prepare their land prior to any agriculture taking place.

5.3.4 Salisbury/Summer Hill

These two areas, while combined for the purposes of the demand survey work, are somewhat dis-similar. The Salisbury area refers mainly to the lower lying alluvial plains, with clay and duplex soils cracking alluvial clay with questionable drainage properties. Some more attractive self mulching clay soils are located to the immediate east of Splitters Creek.

Even the alluvial areas are dissected by the many drainage channels and gullies, including Saltwater Creek, Kangaroo Creek, Plain Creek and Spitters Creek. One key limitation to suitability for irrigation development in the east of Salibury is the depth of soil profile and limited drainage potential.

The Summer Hill area, to the east of Salisbury Plains, features in-situ derived soils in elevated plains and dissected rises on acid to intermediate intrusives. The aquifer is generally developed in the weathered zone of these intrusives.

5.3.5 Abbot Point

Abbot Point is located to the north of Salisbury Plains, refer Figure 1-1. Documentation reviewed (refer reference list) has not confirmed (on a local scale) Acid Sulphate Soils (ASS) within the Project area, although development involving ASS has the potential to be an issue around Abbot Point.

ASS drainage flows, if they occurred, could be detrimental to Upstart Bay. If potential ASS areas exist, their water management should be considered in isolation to ensure that potential ASS remain undisturbed. An ASS Management plan will be developed during the construction period of the Project if any areas of disturbance are considered to contain such soils.

5.3.6 Bowen (the Don River and Euri Creek)

As documented in DNRM report (5), the geology of the lower Don River in the Bowen area consists of a basement of various plutonic rocks ranging between diorite, granite and adamellite. The age of these granitic rocks has been interpreted to be of Carboniferous to Cretaceous age (5). The overlying sediment that has been deposited in the incised bedrock is comprised of alluvial material from the Pleistocene and Holocene, This sediment consists of clay, silt, sand and gravel.

The Pleistocene alluvial deposits comprises the more extensive Pleistocene floodplain deposits and includes some underlying fluvial channel deposits (5). Sediment thickness varies considerably depending on the location of buried channels. Intersections of up to 26 metres have been made, while those in the range of 15 to 20 metres are more common (4).

The Holocene alluvium consists of fluvial channel and deltaic deposits with some floodplain and overbank flow deposits. These deposits cover an area of approximately 3,100 hectares (5). The floodplain and overbank component of these sediments is typically in the finer particle size range such as clay and silt.

The alluvial system consists of a network of interbraided and paleochannels that have resulted in a complex system of interbedded deposits.

5.3.7 Key geology and soils issues

The provision of additional water into areas along the proposed Project investigation corridor is likely to have a varied impact. The additional water will support the sustainable development of agriculture, light industrial and commercial development.

The addition of new water to a system requires careful consideration. If not appropriately managed, the additional water may contribute towards increased shallow water levels and salinity and potentially contribute to a decline in productivity and environmental health.

It is therefore requisite that careful consideration is given to the water management within each soil type and each geographical area, to ensure that the water supplied enhances the proposed areas and their downstream catchments.

Key potential impacts to be considered include:

- increased inflow may cause water logging and salinity
- long/short term salt issues such as, leaching of existing salt loads, (resulting from irrigation of the soil profile with low quality water
- changes in hydrogeology due to changing drainage patterns.

As key deliverables of the EIS process, SunWater will develop groundwater and surface water vulnerability mapping and land use suitability mapping. This mapping will equip customers with information to ascertain land use suitability. SunWater also intends to assist in developing Land and Water Management Plans (LWMP) in conjunction with NRMW and monitor performance against the plans.

5.3.8 Additional issues to consider during construction

Prior to construction, detailed topographical and geotechnical investigations will be required. The impact of any investigations, including access arrangements, provision of reference points, geotechnical and soils investigations, etc will need to be assessed and appropriate mitigation measures determined. For example, to mitigate the potential impact of the investigation boreholes themselves, in particular along the drainage lines the boreholes may required to be backfilled with low permeability backfill.

The selected alignment will need to be cleared of any vegetation and topsoil prior to construction taking place. Topsoil should be stockpiled appropriately for reuse or replacing at a later stage. Adequate storage locations need to be identified and appropriate methodology determined to cause minimum impact to the available top soils.

Earth handling and movement itself may destroy the structure of the soil, making it unsuitable for construction or agriculture. In particular some of the saline and sodic soils found, (as well as areas with the potential for ASS) in the Project area could easily be destabilised, effecting structural integrity. These soils should be identified during the EIS and appropriate measures and methodology determined to avoid loss of soil structure.

Suitable borrow areas for construction materials will need to be identified as part of the geotechnical investigations. The impact of these borrow areas on the environment will need to be investigated and measures to restore these borrow areas appropriately determined.

Suitable extraction areas will need to be identified to ensure suitable gravels and sands for construction. The impact of these activities on the environment will need to be investigated, in a similar manner to that of the borrow areas.

5.4 Surface water

The project area comprises a coastal strip, traversed by many rivers, creeks and gullies. The key surface water channels relevant to the Project are highlighted in bold (Table 5-2).

Table 5-2: Key channels

Key Channels (from west to east of proposed alignment)
Burdekin River
Sandy Creek (Alma Creek)
Yellow Gin Creek
Cabbage Tree Creek
Wangaratta Creek
Slater Creek
Arrow creek
Wilson Creek
Rockey Ponds Creek
Gates Creek
RM Creek
Molongle Creek
Armstrong Creek
Cape Creek
Big Jack Creek
Elliot River
Saltwater Creek
Kangaroo Creek
Plain Creek
Splitters Creek
Split Creek
Greentop Creek
Sheep Station Creek
Euri Creek and tributaries
Sandy Creek
Don River

The drainage channels are ephemeral and only occasionally convey flood events, after which they dry out. Only the Burdekin River (following the construction Burdekin Falls Dam) carries water all year round and provides a source for water supply, either straight to water supply systems via channels and pipelines or through groundwater recharge, replenishing augmenting the groundwater from which water is extracted throughout the year.

Whilst some rivers and creeks are gauged, there is limited data available to assess the flow patterns of the rivers and creeks in the Project area. An assessment of the potential impact of the Project will be required as part of the EIS.

Equally, the impact of the Project crossing the river and creek catchments should be considered and the effect this may have on the natural runoff in the area. In the case of open channels, the concentration of flows at culverts needs to be considered and the resulting concentration of peak runoff to areas immediately downstream of the channel alignment.

5.4.1 Key surface water issues

The impact of the Project on surface water systems and associated environment might be extensive, although such impacts can generally be adequately mitigated. The following list sets out potential impacts which will require to be addressed by either design or management practices:

- effect of channel crossings with respect to existing flows, causing hydrological and hydrogeological changes
- erosion and siltation due to changes in hydrology, having a possible secondary impact on the channels
- pollution of existing surface waters as a result of the additional water supplied into the area, i.e. due to newly developed and expanded commercial enterprise within the project area the potential for increased leaching of soils (salt), additional use of herbicides and pesticides, by-products from horticulture, aquaculture, fish farms may occur

5.5 Groundwater

For the purpose of this IAS, groundwater description for the Project has been presented for four separate areas:

- Inkerman
- Gumlu to Salisbury Plains
- Summer Hills
- Bowen.

All information presented is based on existing literature only, provided by SunWater, and is presented as an overview of each region listed above. The complexity of the hydrogeology of the full Project area is not detailed in full in this IAS. The EIS phase of this project will provide detailed assessment on the groundwater environment.

5.5.1 Review of groundwater conditions

Inkerman

Limited hydrogeological information is available for this region. The key source of information has been sourced from Water Resources Commission (4) report Preliminary Report on Hydrosalinity Investigations West Inkerman Section Burdekin River Irrigation Area; and Hair (1990) Report on the First Leichhardt Dewatering Trail.

Local geology

The bedrock within the Inkerman area consists of a highly complex series of weathered and fractured high grade regional metamorphic rocks that have been pervasively intruded by structurally controlled multiphase dyke swarms (4).

The bedrock is overlain in the upland areas which flank Stokes Range, by skeletal, relatively permeable soil complexes and in the low lying swampy areas by a sequence of dominantly clayey and poorly permeable colluvium and alluvium deposited on an undulating bedrock surface of the margins of the Burdekin Delta alluvium proper (4).

Local hydrogeology

As the major strata in this region is either of igneous or metamorphic origin, potential for groundwater flow is via secondary pathways created from either weathering, jointing or shearing. WRC (1988) document that *the metamorphics in this area appear to be of relatively low permeability, except where locally heavily jointed or sheared*.

Generally the groundwater source from the bedrock in the Inkerman area is low yielding, of relatively poor quality and is unsuitable for irrigation purposes (4). However the groundwater is generally of suitable quality for stock and has an average electrical conductivity range of 2000-8500μS/cm (4). Therefore groundwater from fractured rock, supplies are used only for stock watering (WRC, 1988). Larger supplies recorded are mainly due to intersection of well fractured fine grained andesite dykes (4).

Gumlu to Salisbury Plains

Limited hydrogeological information is available for this region. The key source of information has been sourced from NRM report (11) Preliminary Groundwater Investigations of the Salisbury Plains and Summer Hills Areas.

Local geology

Basement (or parent) rock within this region is typically plutonic rock documented as Upper Carboniferous to Lower Permian (12). In the Salisbury Plains region, there are a number of low lying flats that are alluvial in origin. They are composed of sediment eroded from each of the geological units in the region (12).

Local hydrogeology

Aside from localised high-yield aquifers, there is limited groundwater use in the Gumlu-Salisbury Plains area with only a minor number of stock bores existing due to the low flows available in fractured rock aquifers within the basement rocks (12).

The upper slopes of this region have limited soil cover, over massive bedrock (12). Lower areas however, have significant soil development, (not in-situ derived), but are generally located on strata of limited internal drainage. Overall, the drainage from the total area is very limited.

Summer Hills

The Summer Hill area, to the east of Salisbury Plains, has an established agricultural industry which is widely supported by groundwater extraction (11). There is a dependence on the availability of groundwater to maintain the productivity of many of these farms.

The aquifer is reported to be generally weathered granite and granodiorite. The yields from some of these bores can be in excess of 30 L/s according to local irrigators, however, these bores 'dry out' during periods of high demand for this irrigation water.

*As with the Gumlu-Salisbury area, t*he aquifers are similarly located in the lower topographical areas within the catchment (12).

Bowen (Don River and Euri Creek)

Information provided below for the Bowen groundwater region is sourced from a report provided by the Department of Natural Resources and Water (at the time of publication DNRM, 5). An extensive amount of literature is available for the Bowen region; however, for the purpose of this IAS, the above mentioned report by DNRM is applied as a key data source.

Bowen is a highly valued horticultural area producing approximately $250 million annually in fruit and vegetables. The area has suffered a decline in available groundwater due to several years of below average rainfall coupled with increased irrigation demand resulting from a gradual expansion of irrigated crop areas (5).

The main watercourse in the Bowen district is the Don River which drains an area of about 1,200 square kilometres. The source of the river is in the Clark Ranges and it generally flows northward for about 60 kilometres before discharging to sea at Bowen. The alluvium associated with the Don River and Euri Creek forms for the aquifer that supports the horticultural activities that have been developed in the region.

In some regions, groundwater abstraction has increased to the point where it exceeds the volume that the aquifer can sustainably supply (5). DNRM monitoring of groundwater use shows there is a need to review the overall performance of the groundwater system in order to address the risk of seawater intrusion to the aquifer, and water quality and quantity decline throughout the system (5).

Declining groundwater levels and water quality deterioration have caused an increasing focus on the sustainability of the system with respect to the current levels of development and extraction within the Don River and Euri Creek groundwater system. Although planned groundwater investigations, including a sub-regional groundwater modelling exercise are yet to be carried out, NRMW believe that the sustainable yield of the Bowen area alluvial aquifers might be in the order of 13,300 ML/a, or 70% of the current groundwater allocations when at full announced allocation. The introduction of a surface water scheme would aid in the sustainability of groundwater extraction within this region and would also indirectly induce (with time) a recovery of the water levels and water quality in these aquifers.

Without a supplementary source of water for the horticulture industry, it is likely that the ongoing decline in water quality and levels in the Don River/Euri Creek aquifer systems will continue, jeopardising the medium to long term future of the horticulture industry at it's current production levels. A decline in the horticulture industry would have a significant impact on the local Bowen economy and community.

Local geology

The geology of the lower Don River in the Bowen area consists of a basement of various plutonic rocks ranging between diorite, granite and adamellite. The age of these granitic rocks has been interpreted to be of Carboniferous (330 million years ago) to Cretaceous age (100 million years ago).

The overlying sediment that has been deposited in the incised bedrock is comprised of alluvial material of Pleistocene and Holocene age (4). This sediment consists of clay, silt, sand and gravel in varying percentages.

The Pleistocene alluvial deposit comprises the more extensive Pleistocene floodplain deposits and includes some underlying fluvial channel deposits. Sediment thickness varies considerably depending on the location of buried channels. Intersections of up to 26 metres have been made, however, those in the range of 15 to 20 metres are more common (4).

The Holocene alluvium consists of fluvial channel and deltaic deposits with some floodplain and overbank flow deposits. These deposits cover an area of approximately 3,100 Ha (4). The floodplain and overbank component of these sediments is typically in the finer particle size range such as clay and silt.

Local hydrogeology

The alluvial aquifers associated with palaeo-channels from the Don River and Euri Creek are as a result of deposition from creek flows. The alluvial aquifers are the main water storage units within the area and the varying nature of the sediment has resulted in most of these aquifers being semi confined.

The main recharge mechanism is from direct rainfall infiltration; however, when there are flows in the river there is also recharge from the river to the aquifer system.

Although the main unit for water storage is the alluvial material, the underlying bedrock can also be a source of groundwater. There is a clay layer that has formed through physical and chemical processes at the contact of the alluvial and the basement material. The upper part of this basement is heavily fractured, however the weathering zone has resulted in clay blocking these fractures and reducing the ability for water storage. Beneath this weathering zone exists fractures that are relatively free of clay and have some limited capacity for water storage. These supplies are usually suitable for stock and domestic use only.

It appears that when a succession of medium flows pass through the Don River, with potential overbank flow, the groundwater system is partially recharged. The longer the duration and/or height of these flows, the greater the recharge event.

Information provided by DNRM (5) suggests that Bowen has been in drought conditions, with respect to groundwater recharge, for a period of approximately five years without any significant recharge event. Lack of recharge and continued demand has highlighted the need for various management options to ensure the long-term sustainability of the aquifer system.

Groundwater Management

The current level of allocation in the Bowen Groundwater Area exceeds the average annual sustainable yield of the system (5). Existing groundwater quality impacts are likely to be a result of:

- salt water intrusion
- upward leakage of poor quality groundwater from the underlying granitic fractured rock basement
- irrigation salinity caused by continued reuse and recycling of groundwater without a 'flushing' mechanism from recharge (some farmers are using water with conductivities of 5000 uS/cm)

The Bowen Shire was constituted as a Declared Groundwater Area by Order in Council dated 6 August 1964. This gave the authority to the then Commissioner of Water Resources to licence and control all bores that were to be used for irrigation, town water, industrial and stock supplies.

The subartesian area within the Bowen Shire was proclaimed for all groundwater uses except domestic on 6 August 1964. The proclamation resulted from reducing yields and the possible intrusion of seawater. A complete history may be found in the Water Resources Commission "Review of Water Resources - Bowen Area", completed in November 1988. Meters were installed on all irrigation facilities in 1985 and 1986.

A licensing policy to assist in the management of the area was drafted in 1993. The aim of this policy was "for the efficient and equitable use of groundwater and surface water resources in the Bowen Groundwater Area." This policy has recently been reviewed following the amount of new information gathered since 1993 and changes to water regulations and delivery arrangements (5). The new policy will be announced shortly and includes measures to regulate all forms of water use in the area, including overland flow.

In order to monitor the behaviour of the groundwater in response to the usage over time, a network of observation bores has been established. Construction of observation bores commenced in 1965 with the latest bores constructed in August 2004 as replacement for some of the earlier ones. There are now over 200 observation bores utilised for the monitoring of groundwater properties including groundwater levels and quality.

5.5.2 Key groundwater issues

A high reliance is currently placed on groundwater extraction within the Bowen area. Current extraction appears to exceed sustainable yield from the groundwater system. One of the key objectives of the Project will be to provide a potential supplementary water supply to the region and therefore aid in decreasing the current over-pumping placed on the groundwater system, while allowing for the current horticultural industry to remain sustainable for the future.

Historically, areas to the west of Bowen have been restricted in relation to extensive irrigation development due to availability of water supply. The Inkerman and Gumlu to Salisbury regions have seen only limited development, due to limited sustainable water supply from local alluviums and bedrock aquifers and poor groundwater quality.

Without appropriate management, the introduction of additional water into the area has potential to contribute to a rise in the groundwater table and associated salinity problems. However, any such potential impacts will be investigated during the EIS process and approved management measures developed and documented.

To manage the impacts that may accompany the introduction of new water into a system, management plans, such as Land and Water Management Plans (LWMP) required under The Water Act (2000) will be developed in conjunction with the EIS process. Established guidelines for developing LWMP are discussed further in Section 5.8.

The following list sets out potential impacts that need to be investigated or confirmed as part of the EIS phase of the Project (but not limited to):

- Clearly understand existing groundwater conditions within the Bowen region (such as the existing declining groundwater levels and quality) that although not being a direct consequence of this project, may need to be addressed to fully understand and manage the proposed introduced water.
- The elevation of some of the downstream extent of the Salisbury to Inkerman areas are very low as the areas are adjacent to coastal flats. It may be possible that the introduction of a surface supply scheme may result in excess water being present in the groundwater system which may not have an appropriate gradient to flow naturally from the system. This could result in potential waterlogging and eventual salinisation issues (13).
- Assess the leakage potential of the channel as part of design criteria.
- Assessment of the implications of conjunctive use arrangements with proposed development.
- As documented in DNRM (13), the slightly elevated topographic levels documented at one site in the Salisbury area may suggest that there is Potential Acid Sulphate Soils (PASS). It could also suggest the existence of sulphide deposits in the area (13). The existence of sodic soils, PASS and ASS needs to be investigated as past of the EIS, and further, whether the proposed changes in land use might cause acid release in these areas.
- Assessment of groundwater vulnerability to a range of issues including those listed above.

5.6 Irrigation and drainage

Irrigation has been practiced in the Project area for some considerable time. A key feature has been the rise of low-rate watering techniques and this feature must be retained for sustainability of this Project.

Existing water supply in the Project area is generally extracted from the groundwater as this provides a more reliable source of water year-round; however this extraction is predominantly concentrated within the Bowen region and along the major drainage lines between Gumlu and Summer Hill. During flood events, water may also be extracted from the rivers and creeks, water harvesting, and sometimes stored in off stream storage reservoirs.

- The Inkerman area currently does not support any irrigation development, with the area primarily used for cattle grazing
- The Gumlu area is a major area of irrigation of capsicum, pumpkins and melon crops as well as supporting cattle grazing, Crops are generally short term and consequently can be planted to take advantage of water availability. Water is sometimes harvested from overland flows but generally moderate to low yield bores (i.e.<5L/s) along the principal drainage lines are used to extract ground water.
- Salisbury Plains show no evidence of irrigation and are generally used for cattle grazing.

Under the *Water Act 2000* in any area subject to Water Resource Plan irrigators are required to develop and adhere to a LWMP (www.nrm.qld.gov.au). Appropriate water management would increase yields and reduce water efficiency, whilst also reducing soil degradation.

5.6.1 Key irrigation and drainage issues

The impact of increased irrigation needs to be reviewed in a wide spectrum, taking account of existing practice and efficiencies and relating it to surface and ground water as well as soil conditions. Although SunWater proposes that provision of a LWMP approved by DNRM, with regular monitoring and feedback to improvement of the plan will be a condition of being a customer of this scheme, there is significant concern in the regulatory, scientific and wider community that the impacts of new or increased irrigation require to be thoroughly understood and attended to on the new LWMPs.

Key aspects that need to be reviewed include:

- existing and future on-farm water efficiencies/losses
- existing and future on-farm drainage practice
- impact on groundwater/salinisation
- contribution to groundwater recharge and effects on the potential for saltwater intrusion
- surface and groundwater pollution as a result of new agricultural, commercial and industrial enterprise attracted by the Project.

5.7 Coastal waters

The coastal strip and in particular Upstart Bay is considered an environmentally sensitive area. The bay is enclosed by Station Hill and Cape Upstart. Appropriate measures will be documented in LWMPs to ensure that zero discharge is maintained regardless of the availability of new water allocations. Departure from the stipulations of the LWMPs could result in mis-management of water allocations potentially to resulting in change in water discharges from land to the sea, impacting on marine life (1).

5.7.1 Key coastal waters issues

If not managed appropriately, an increased water supply to the areas draining to the coastal zone could result in run-off and drainage. Any run-off or drainage could result in pollutants discharging to sea.

The prospect of ASS being disturbed by any development and discharging out to sea should also be explored and measures defined to avoid such an occurrence.

An analysis of existing and future impacts and ways to mitigate the effects of additional flows and associated pollutants is essential to ensure that the coastal waters remain protected.

The southern section of Upstart Bay is designated Great Barrier Reef Marine Park (GBRMP) (General Use Area B). Potential impacts (both direct and indirect) on the coastal environment in this area should be assessed in terms of, the *Great Barrier Reef Marine Park Act 1975,* the GBRMP Environmental Impact Management Policy (October 2004), the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

5.8 Land and water management

The Department of Natural Resources, Mines and Water (NRMW) has developed state guidelines for LWMPs (14). Under the Water Act 2000, the requirement to develop a LWMP is triggered by circumstances that are specified in the Act, and explained in the guidelines.

As specified by NRMW (15) a Land and Water Management Plan is required before the use of water for irrigation purposes in the following circumstances:

- Purchase of a water allocation or interim water allocation through water trading arrangements
- Acquisition of a new water allocation or interim water allocation
- Regular use of water acquired under temporary transfer arrangements
- Water taken under a water licence where specified in a resource operations plan
- Acquisition of an enterprise where the requirement already existed
- Where specified in a Water Use Plan prepared under the Water Act 2000.

The purpose of such a plan is to ensure that irrigation water-use practices are sustainable. Where certain water entitlements are acquired for irrigation, the landholder must prepare a LWMP, which then must be approved by DNRM before the

water is used.

These guidelines set out the requirements of (DNRM) to be addressed in the preparation of Land and Water Management Plans (LWMP). These requirements stem from the Council of Australian Governments (COAG) water reform agenda and the allocation of water under the *Water Act 2000* to achieve the sustainable use of land and water resources.

Key issues that are to be addressed in an LWMP include:

- land, soils, topography and natural landscape features
- water, i.e. sources, quantity and quality
- current and proposed farm land use and infrastructure
- irrigation systems: pumping, storage and distribution
- field layout and erosion control
- stormwater, drainage, farm run-off, flood risk
- crop water requirements
- soil erosion management
- irrigation application, performance and management
- chemical and fuel management
- riparian zone management
- farm runoff, drainage and water quality
- monitoring and reporting.

5.8.1 Water quality

The LWMPs will need to take account of existing water quality criteria as well as key targets set to improve water quality where possible.

Where appropriate, lesser quality water from groundwater can be re-used after mixing with newly supplied water. The impact of reuse or lack thereof should be evaluated to ensure that the benefits are understood.

As previously discussed in Section 5.5.1, without appropriate management, the introduction of additional water into the region has potential to contribute to a rise in the groundwater table and consequent salinity problems. To control these potential impacts that may accompany the introduction of new water into the system and maintain the zero discharge from irrigation practices, management plans, such as LWMPs will be implemented.

5.8.2 Key land and water management issues

The EIS will review the Project in the light of the DNRM guidelines to ensure that all relevant issues are considered and that appropriate measures to ensure compliance are met, both at farm level and at distribution level.

In particular, the monitoring, evaluation and reporting is critical, to ensure the long-term sustainability of the scheme. It is proposed that the EIS sets a range of Key Performance Indicators (KPI) which will determine the Project's health at local and farm level and allow water allocations to be managed to the benefit of the environment. Additionally SunWater will prepare groundwater and surface water vulnerability mapping and assist in the preparation of LWMPs.

5.9 Marine environment

Marine flora and fauna species identified as potentially occurring in the coastal and marine areas downstream of the Project area are listed in full in the Project REF (1).

The southern section of Upstart Bay is designated Great Barrier Reef Marine Park (GBRMP) (General Use Area B). As such any usage (either direct or indirect) is required to be consistent with guidelines and legislative requirements, including management plans for this designated marine park (*Great Barrier Reef Marine Park Act 1975,* the GBRMP Environmental Impact Management Policy (October 2004), JAMBA, CAMBA and the EPBC Act.

The coastal marine and estuarine environments of the region have been assessed in a number of studies that are principally concerned with fishery values (17, 18, and 19). These reports identify the presence of seagrass beds in Upstart Bay which are reported to be critical for the trawling industry as they support a high density of juvenile commercial penaeid prawns. Banana, endeavour and tiger prawns, bugs and black mud crabs are the primary catches in the area, as well as barramundi and blue salmon (QFISH 1996 as cited in 7).

Marsh et al (1987) reports that the seagrass beds in Upstart Bay also provide feeding habitat for the state and federally listed *Dugong dugon*. In addition the southern section of the bay is classified as a Class A Dugong Sanctuary.

Three major coastal wetland systems are located within the Project area, namely; Abbot Point-Caley Valley, Burdekin Delta Aggregation and Southern Upstart Bay (19).

5.9.1 Key marine environment issues

The Project has potential to create indirect impacts to the marine environment, particularly Upstart Bay, which is known to support seagrass beds that are critically important for the trawling industry and as dugong feeding habitats (19). Upstart Bay is known to provide resources for the trawling industry and disturbance of this area in terms of increased sediment or nutrient load could result in declines in catches and resulting economic consequences.

Departure from current zero-discharging practices and the consequent release of water into any of the intermittent streams has the capacity to affect aquatic habitats and modify existing ecosystems in the process, particularly the nationally recognised wetland areas situated downstream of the Project area. The ACTFR Report (7) indicated that the proposed Gumlu irrigation area may have direct impacts on these wetlands if drainage from the area into the nearby creeks (such as Rocky Ponds, RM, Gumlu and Armstrong Creeks) occurs as these ultimately empty direct into Upstart Bay. However, as discussed previously this is unlikely given the requirement for implementation of LWMPs.

As part of the EIS process potential impacts will need to be assessed in term of compliance with relevant legislation, guidelines and management plans for the GBRMP area.

5.10 Flora

The following database searches and background literature reviews were undertaken in October 2004 during the preparation of the Review of Environmental Factors report (1). The intent was to determine flora, vegetation communities and ecosystems that may potentially occur within the wider Project area. Field flora surveys to ground truth the information presented are will occur during the EIS process. It should be noted that updated database searches and confirmation of the Regional Ecosystem conservation status will be undertaken as part of the EIS process.

5.10.1 Queensland Herbarium database review

A search was undertaken of the Queensland Herbarium (HERBRECS) for the area encompassing the proposed channel network and/or pipeline. A search of the Herbarium database was obtained using the grid coordinates provided in Section 5.1 (Table 5-1).

Results of the Queensland Herbarium 'HERBRECS' database search included 850 native and 137 exotic flora species. These species are listed in Appendix F. Nine significant flora species, listed under the Queensland Nature Conservation (Wildlife) Regulation 1994 and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, (EPBC Act) were identified in the database search for the site and surrounding areas. These species are listed in Table 5-3.

It is important to note that the records represent only the plant specimens held in the Queensland Herbarium for the nominated grid search area. These results indicate the potential for the species to occur with the investigation corridor. Similarly, the absence of particular species from the available data does not imply that the species does not occur within the specified area. Ground-truthing during a detailed field survey will be required to confirm the presence or absence of the identified species. A field survey will also provide an opportunity to identify species that have not been recognised as part of this database search. A detailed flora survey will form part of the EIS process. A full list of database results is presented in the Project REF (1).

Table 5-3: Threatened flora identified by Queensland Herbarium database search for the Project area

Scientific name	Status (NCA Wildlife Reg 1994)	Status (EPBC Act 1999)	Common name
Aponogeton queenslandicus	Rare	-	No common name
Aristida granitica	Endangered	Endangered	No common name
Corchorus hygrophilus	Rare	-	No common name
Croton magneticus	Vulnerable	Vulnerable	No common name
Dichanthium setosum	Rare	Vulnerable	No common name
Eucalyptus raveretiana	Vulnerable	Vulnerable	Throzets box
Livistona drudei	Vulnerable	-	Palm
Peripleura scabra	Rare	-	No common name
Senna acclinis	Rare	-	No common name

5.10.2 Department of Environment and Heritage database review

The Department of Environment and Heritage (DEH) database assists in identifying the locations of places, which may be relevant in determining obligations under the Commonwealth EPBC Act. The database holds mapped locations of World Heritage properties, RAMSAR wetlands, threatened migratory species, including marine species and protected areas. RAMSAR wetlands are protected under an international treaty that seeks to protect habitat areas, rather then specific species. A RAMSAR wetland is either:

- an Australian Wetland on the List of Wetlands of International Importance under the RAMSAR convention
- a wetland declared to be a RAMSAR wetland by the Commonwealth Environment Minister.

A search of the DEH database was undertaken for the Project area. Records for the database were obtained using the grid coordinates provided in Section 5.1 (Table 5-1).

The search revealed the likely presence of two matters of national significance:

- Bowling Green Bay (located approximately 45 – 50 km Northwest of the Burdekin River).
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions.

The search boundary is also within a 10 km range of a wetland of international significance; (World Heritage Area - The Great Barrier Reef). However, it should be noted that the Project area is a greater distance from the reef, i.e. up to 60 km. Any potential impacts to these important areas will be assessed as part of the EIS process.

It is important to note that the results of this database search are indicative only, and as a result of the methods of data entry, the extracted results are typically an over-estimation of the species area requested. The search area also extends over some of Upstart Bay and therefore has identified some marine and migratory species that have the potential to be affected by downstream impacts of the Project.

The EPBC Act on-line database search identified six threatened plant species protected by the EPBC Act, as potentially occurring within one kilometre of the Project area. These species are presented in Table 5-4. A full list of search results is presented in the Project REF (1).

Table 5-4: Threatened flora identified by the Department of Environment and Heritage database search for the Project area

Scientific name	Presence type	Status (EPBC Act 1999)
Aristida granitica	Species or species habitat likely to occur within area	Endangered
Croton magneticus	Species or species habitat likely to occur within area	Vulnerable
Eucalyptus raveretiana (Black Ironbox)	Species or species habitat likely to occur within area	Vulnerable
Leucopogon cuspidatus	Species or species habitat likely to occur within area	Vulnerable
Ozothamnus eriocephalus	Species or species habitat likely to occur within area	Vulnerable
Tylophora williamsii	Species or species habitat likely to occur within area	Vulnerable

5.10.3 Regional Ecosystem review

Regional Ecosystems (REs) are part of a state wide hierarchical classification system based on geology, soils, vegetation and climate described by Sattler and Williams 1999. REs are legislatively recognised by the State government through the Queensland *Vegetation Management Act 1999* (VMA) and Vegetation Management Regulation 2000 (VMR). Clearing of native vegetation is prohibited unless it falls within one of the exemptions in Schedule 8 of IPA, the VMA, or a development permit for operational works has been obtained for the clearing.

Conservation status for each RE is assigned as one of three categories; 'endangered', 'of concern', and 'not of concern' under the VMR. A desktop review of the RE mapping for the Project area was undertaken. The 16 REs described in Table 5-5 have been mapped for the Project area. Of these, two have an ‘of concern’ conservation status. No REs classified as ‘endangered’ have been mapped at 1:100,000 scale for the Project region. A field survey as part of the EIS process will provide an opportunity to ground-truth the RE mapping. The mapping is at a scale of 1:100,000 and is predominately based on aerial photography. Any discrepancies identified during field surveys may result in a remapping application being lodged with DNRM. A search of the RE conservation status was undertaken as part of the REF process (1). A review of revised status’ will be undertaken during the EIS process.

Figure 5-2 presents the RE conservation status through the Project area. The RE that were identified were found to have number of areas classified as RE 11.3.25 (*Eucalyptus camaldulensis* or *E. tereticornis* open-forest to woodland) which often fringes major and minor stream channels. REs that were regularly identified during the desktop review, included:

- RE 11.3.30
- RE 11.3.35
- RE 11.3.32.

All of these REs are found on Cainozoic alluvial plains and older floodplain complexes.

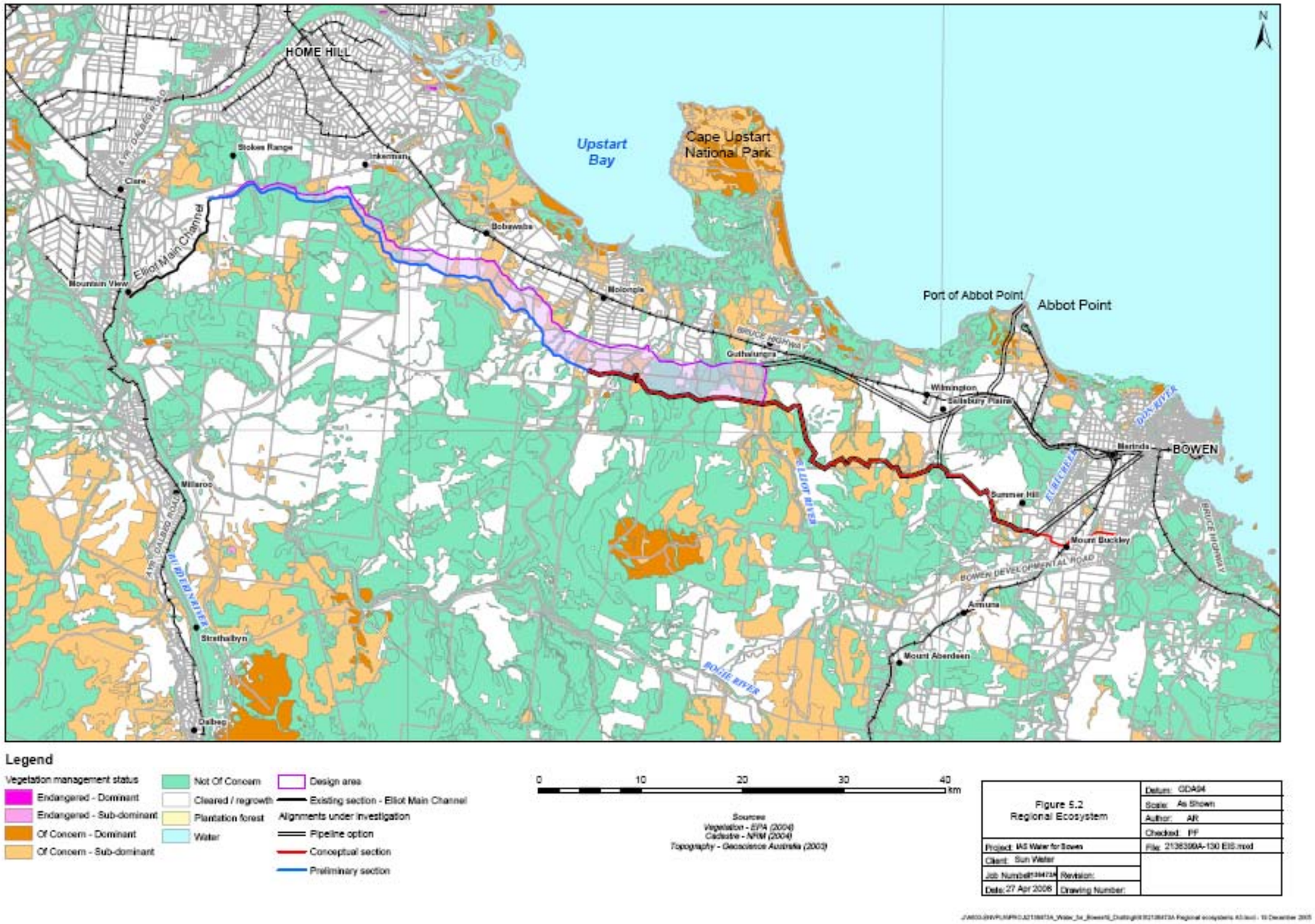


Figure 5-2: Regional ecosystem conservation status throughout the study area.

Table 5-5: Regional Ecosystems mapped by the EPA within the Project area

Regional Ecosystem Code	Description	Status (VMR 2000)
11.3.7	*Corymbia clarksoniana*, *Corymbia tessellaris* and *Corymbia dallachiana* tall woodland to open woodland (13-17m high).There is usually a low open woodland tree layer (7-11m high) dominated by species such as *Acacia salicina*, L*ysiphyllum hookeri* or *Grevillea striata*.	Not of concern
11.3.9	*Eucalyptus platyphylla* and/or *Corymbia clarksoniana* and/or *Corymbia intermedia* and/or *Eucalyptus tereticornis* and/or *Lophostemon suaveolens* woodland on Cainozoic alluvial plains.	Not of concern
11.3.10	*Eucalyptus brownii* grassy woodland on Cainozoic alluvial plains.	Not of concern
11.3.13	*Grevillea striata* open-woodland on Cainozoic alluvial plains.	Of concern
11.3.25	*Eucalyptus camaldulensis* or less often *Eucalyptus tereticornis* open-forest to woodland. Other tree species such as *Casuarina cunninghamiana*, *Melaleuca bracteata*, *Callistemon viminalis*, and *Angophora floribunda* are commonly present and may be locally dominant. Fringes major and minor stream channels on Cainozoic alluvial plains.	Not of concern
11.3.29	*Eucalyptus crebra*, *Eucalyptus exserta*, *Corymbia dallachiana. Corymbia intermedia* woodland usually with a low tree understorey of *Melaleuca viridiflora* and *Melaleuca nervosa*. Occurs on broad plains and fans formed from Quaternary alluvium. Usually associated with bleached sodic duplex soils.	Not of concern
11.3.30	*Eucalyptus crebra* or *Eucalyptus paedoglauca* and *Corymbia dallachiana* woodland on Cainozoic alluvial plains. Older floodplain complexes.	Not of concern
11.3.32	*Allocasuarina luehmannii* low open-woodland on Cainozoic alluvial plains. Older floodplain complexes.	Not of concern
11.3.33	*Eremophila mitchellii* low open-woodland on Cainozoic alluvial plains.	Of concern
11.3.34	*Acacia tephrina* low woodland on Cainozoic alluvial plains. Older floodplain complexes.	Not of concern
11.3.35	*Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on Cainozoic alluvial plains. Older floodplain complexes.	Not of concern
11.3.31	*Ophiuros exaltatus* and *Dichanthium spp.* grassland and/or *Eucalyptus platyphylla* emergent trees. Occurs on older floodplain complexes on Cainozoic alluvial plains.	Not of concern

Regional Ecosystem Code	Description	Status (VMR 2000)
11.12.1	*Eucalyptus crebra* and/or *Eucalyptus melanophloia* and/or *Corymbia erythrophloia* shrubby woodland on ranges on Mesozoic to Proterozoic igneous rocks.	Not of concern
11.12.4	Semi-evergreen vine thicket and microphyll vine forest and/or *Araucaria cunninghamii*. *Eucalyptus moluccana* often associated with lower slopes on andesites. Occurs on low hills, ranges and boulder strewn slopes formed from Mesozoic to Proterozoic igneous rocks including granite.	Not of concern
11.12.7	*Eucalyptus crebra* woodland with patches of semi-evergreen vine thicket. Occurs on boulder strewn hills formed on Mesozoic to Proterozoic igneous rocks.	Not of concern
11.12.9	*Eucalyptus platyphylla*, *Corymbia dallachiana*, *Corymbia tessellaris* and *Eucalyptus drepanophylla* woodland on Mesozoic to Proterozoic igneous rocks. Lower slopes.	Not of concern

5.10.4 General literature review

The Australian Centre for Tropical Freshwater Research (ACTFR), James Cook University of North Queensland, Townsville, was previously engaged by the Department of Natural Resources and Mines to undertake a flora and fauna survey of five general areas along the proposed corridor. These areas have previously been identified by SunWater as having physical characteristics that are favourable for irrigation development. The findings of the survey are summarised and presented in Appendix B.

5.10.5 Key flora issues

The interactive effects on terrestrial and aquatic ecosystems may include waterlogging, soil salinisation, erosion and sedimentation, increased nutrient loads, feral animal and weed invasion which are likely to result in degradation to remnant vegetation communities. In addition, continued habitat disturbance will occur from the increased agricultural pressures that will result from increased water availability.

Potential impacts to remnant native vegetation potentially associated with the Project may include some vegetation clearance for the final alignment. These issues will be addressed in the Terms of Reference (ToR) and assessed as part of the EIS process.

During operation and maintenance works a key environmental consideration will be weed and pest ingression. Vehicle movements and tracks create a vector for transport of introduced species and controls such as washdown points may be required for maintenance to control the spread of weed and pest species that have the potential to out-compete native species. An Environmental Management Plan will be required to control vehicular movements and limit the potential for weed and pest ingression.

5.10.5.1 Construction phase

During construction works clearing of vegetation may potentially impact on the integrity of remnant REs and possibly individual species of significance. Construction works have the potential to reduce connectivity of vegetation communities as well as decrease the extent of habitat for native fauna species. Impacts to vegetation communities would be assessed as part of the EIS process. To minimise vegetation impacts there would be a preference to contain impacts to areas of cleared ground. The potential for weed ingression as a result of construction vehicle movement will also be a key consideration. These impacts will require further investigation and management consideration during the EIS process. Impacts will be dependent on the final alignment corridor.

Earthworks may result in temporary increased sediment loads and erosion potential, which may in turn lead to negative impacts of remnant terrestrial and aquatic vegetation communities. Environmental Management Plans will be required during the construction phase to limit sediment loading and impacts to aquatic communities.

5.10.5.2 Operation and maintenance phase

Increased agricultural intensity is expected as a result of a more reliable water source at the completion of the Project. In turn agricultural practices such as the use of herbicides and pesticides and changes to the hydrological regime within the area will also potentially affect downstream vegetation communities, including possibly the seagrass beds of Upstart Bay (Figure 1-1) and the three listed wetlands of international importance within the area.

During operation, maintenance works may also result in potential weed and pest ingression along the Project alignment. Vehicle movements and tracks create a vector for transport of introduced species, which if not appropriately managed, can lead to further degradation of remnant communities. The development of Environmental Management Plans will document controls for vehicular movement, limiting the influence of these transport vectors.

5.11 Fauna

The following database searches and background literature reviews were undertaken in October 2004 as part of the REF process (1) to determine fauna, vegetation communities and ecosystems that may potentially occur within the wider Project area. Field fauna surveys were beyond the scope of this IAS. Revised database searches will be undertaken as well as a field survey to ground truth the results as part of the EIS process.

5.11.1 Queensland Museum and Queensland Parks and Wildlife Service database review

The Queensland Museum and Queensland Parks and Wildlife Service database records were searched for possible fauna recorded in and around the subject area. The search identified 15 amphibians, 393 bird, 15 bony fish, 65 mammals, and 64 reptile species that have been recorded for the area (1).

Threatened species under the Nature Conservation Act (Wildlife) Regulation 1994 or EPBC 1999, identified from this search are presented in Table 5-6.

It is important to note that the Queensland Museum records represent only the fauna specimens held in the Queensland Museum for the nominated grid area. The presence of a species does not confirm that the species is located within the search area and likewise, the absence of particular species from the available data does not imply that the species does not occur within the specified area. A full list of fauna database results is presented the Project's REF (1).

Table 5-6: Threatened fauna identified by the Queensland Museum and Queensland Parks and Wildlife database search for the study area

Scientific Name	Common Name	Status (NCA Wildlife Reg 1994)	Status (EPBC Act 1999)
Amphibians			
Litoria revelata	Whirring Tree Frog	Rare	
Birds			
Accipiter novaehollandiae	Variable Goshawk	Rare	
Calyptorhynchus lathami	Glossy Black-cockatoo	Vulnerable	Endangered
Casuarius casuarius johnsonii (southern population)	Southern Cassowary	Endangered	Endangered
Collocalia spodiopygius	White-rumped swiftlet	Rare	
Ephippiorhynchus asiaticus	Black-Necked Stork	Rare	
Esacus neglectus	Beach Stone-curlew	Vulnerable	
Haematopus fuliginosus	Sooty Oystercatcher	Rare	
Lathamus discolor	Swift parrot	Endangered	Endangered
Lophoictinia isura	Square-tailed Kite	Rare	
Melithreptus gularis	Black-chinned Honeyeater	Rare	
Melithreptus gularis laetior	Golden-backed Honeyeater	Rare	
Neochmia phaeton	Crimson Finch	vulnerable	Vulnerable
Neochmia phaeton iredalei	Crimson Finch (eastern form)	Vulnerable	
Neophema pulchella	Turquoise Parrot	Rare	
Nettapus coromandelianus	Cotton Pygmy-goose	Rare	
Ninox rufa queenslandica	Rufous Owl	Vulnerable	
Ninox strenua	Powerful owl	Vulnerable	
Numenius madagascariensis	Far Eastern Curlew	Rare	
Psephotus pulcherrimus	Paradise Parrot	Presumed extinct	Extinct

Scientific Name	Common Name	Status (NCA Wildlife Reg 1994)	Status (EPBC Act 1999)
Rallus pectoralis	Lewin's Rail	Rare	
Rostratula benghalensis	Greater-painted Snipe	Vulnerable	
Sterna albifrons	Little Tern	Endangered	
Stictonetta naevosa	Freckled Duck	Rare	
Tadorna radjah	Radjar Shelduck	Rare	
Tyto novaehollandiae kimberli	Masked owl (northern)	Vulnerable	Vulnerable
Mammals			
Dugong dugon	Sea cow	Vulnerable	
Pteropus poliocephalus	Grey-headed Flying-fox	Common	Vulnerable
Saccolaimus saccolaimus nudicluniatus	Bare-rumped sheathtail bat	Endangered	Critically endangered
Sousa chinensis	Indo-Pacific humpback dolphin	Rare	
Taphozous australis	Coastal sheath tail-bat	Vulnerable	
Reptiles			
Crocodylus porosus	Estuarine crocodile	Vulnerable	
Delma labialis	Striped tailed delma	Vulnerable	Vulnerable
Simoselaps warro	Robust Burrowing Snake	Rare	
Varanus semiremex	Rusty Monitor	Rare	

5.11.2 Department of Environment and Heritage database review

The results of the Department of Environment and Heritage database search revealed the potential presence of 21 threatened species within one kilometre of the Project area and 27 species protected by the migratory provisions of the EPBC Act 1999. A list of threatened fauna identified from the database search is provided in Table 5-7. A full list of threatened, migratory and marine species identified by the search is presented in the REF (1).

It is important to note that the results of this database search are indicative only, and as a result of the methods of data entry, the extracted results are typically an over-estimation of the species area requested. The search area also extended into Upstart Bay, to capture migratory and marine species that may be affected by potential impacts to the marine environment.

Table 5-7: Threatened fauna identified by the Department of Environment and Heritage database search for the Project area

Scientific name	Common name	Presence type	Status (EPBC Act 1999)
Birds			
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta	Squatter Pigeon (southern)	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus	Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Neochmia ruficauda ruficauda	Star Finch (eastern), Star Finch (southern)	Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta	Black-throated Finch (southern)	Vulnerable	Species or species habitat likely to occur within area
Pterodroma neglect a neglecta	Kermadec Petrel (western)	Vulnerable	Species or species habitat may occur within area
Rostratula australis	Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Mammals			
Balaenoptera musculus	Blue Whale	Endangered	Species or species habitat may occur within area
Dasyurus maculatus gracilis	Spotted-tailed Quoll or Yarri (North Queensland subspecies)	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable	Species or species habitat may occur within area
Pteropus conspicillatus	Spectacled Flying-fox	Vulnerable	Species or species habitat may occur within area
Xeromys myoides	Water Mouse, False Water Rat	Vulnerable	Species or species habitat may occur within area
Reptiles			
Caritas caretta	Loggerhead Turtle	Endangered	Species or species habitat may occur within area
Chelonia mydas	Green Turtle	Vulnerable	Species or species habitat may occur within area
Delma labialis	Striped-tailed Delma	Vulnerable	Species or species habitat likely to occur within area

Scientific name	Common name	Presence type	Status (EPBC Act 1999)
Dermochelys coriacea	Leathery Turtle, Leatherback Turtle, Luth	Vulnerable	Species or species habitat may occur within area
Egernia rugosa	Yakka Skink	Vulnerable	Species or species habitat likely to occur within area
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Species or species habitat may occur within area
Lepidochelys olivacea	Pacific Ridley, Olive Ridley	Endangered	Species or species habitat may occur within area
Natator depressus	Flatback Turtle	Vulnerable	Breeding likely to occur within area
Sharks			
Rhincodon typus	Whale Shark	Vulnerable	Species or species habitat may occur within area

5.11.3 Birds Australia database review

Birds Australia (BA) began life as the Royal Australasian Ornithologists Union (RAOU) in 1901. BA is dedicated to the conservation, study and enjoyment of Australia's native birds and their habitats. Activities include research and monitoring of rare and threatened bird species, national bird counts, and fund raising enterprises for the conservation of habitats in Australia. A search was conducted of the BA database for the Project area.

This desktop review identified a total of 246 bird species were identified within the Project area. Eight of these species are threatened and listed under the Nature Conservation (Wildlife) Regulation 1994. None are listed under EPBC Act 1999. Threatened species identified in the search are listed in Table 5-8. Information on migratory bird species is available from the Department of Environment and Heritage database search (Table 5-7). No species of Commonwealth significance were identified in the database search.

Table 5-8: Threatened bird species identified by the Birds Australia database search for the Project area

Scientific name	Common name	Status (NCA Wildlife Reg 1994)
Ephippiorhynchus asiaticus	Black-necked Stork	Rare
Esacus neglectus	Beach Stone-curlew	Vulnerable
Haematopus fuliginosus	Sooty Oystercatcher	Rare
Neochmia phaeton	Crimson Finch	Vulnerable
Nettapus coromandelianus	Cotton Pygmy-goose	Rare
Numenius madagascariensis	Eastern Curlew	Rare
Rostratula benghalensis	Painted Snipe	Vulnerable
Sterna albifrons	Little Tern	Endangered

5.11.4 General literature review

ACTFR (21) indicates that at the time of their study there had been no systematic fauna survey undertaken in the Brigalow Belt bioregion and in particular the Bowen area. Studies prior to the ACTFR study in the general region included those by Lavery and Johnson (22) and Lavery and Seton (23). Both of these studies were conducted in the lower Burdekin Delta and excluded amphibian and reptile fauna groups.

A 1994 survey by ACTFR of the lower Burdekin are included reptiles, amphibians, mammals and avifauna. The above-mentioned studies listed in total 292 birds, 56 mammals, 34 reptiles and 10 amphibians, which can all be considered as potentially occurring in the Water for Bowen Project area (21). These species are listed in each of the studies discussed above. Of these species five were then identified to have a significant conservation status. These species are presented in Table 5-9, their status is based on current legislation.

Table 5-9: Vertebrate fauna species previously recorded during fauna surveys of the Project area

Species name	Common Name	Conservation Status (NCA Wildlife Reg 1999)	Conservation Status (EPBC Act 1999)
Petaurus norfolcensis	Squirrel glider	Common	-
Petauroides volans	Greater glider	Common	-
Lagorchestes conspicillatus	Spectacled hare-wallaby	Common	-
Phascolarctus cinereus	Koala	Common	-
Erythrotriorchis radiatus	Red goshawk	Endangered	Vulnerable
Melithreptus gularis	Black-chinned honeyeater	Rare	-
Poephila cincta cincta	Black-throated finch	Rare	Vulnerable
Coracina maxima	Ground cuckoo-shrike	Common	-
Pseudomys patrius	Pebble-mound mouse	Common	-
Leggadina lakedownensis	Lakeland downs mouse	Common	-
Furina barnardi	Yellow-naped Snake	Rare	-
Delma labialis	Pygopodid lizard	Vulnerable	Vulnerable

5.11.5 Key fauna issues

There is potential for impacts to native fauna both within the Project area and immediately downstream. These may include some potential loss of habitat due to vegetation clearance along the channel alignment and possibly other disruption to connectivity between habitat areas as a result of the infrastructure construction. However, this will be dependent on the final alignment corridor.

5.11.5.1 Construction phase

During construction, clearing of vegetation of the investigation corridor may result in severance of existing fauna corridors and habitat connectivity. This may significantly impact on species populations, many of which have been identified as threatened under state and Commonwealth legislation.

5.11.5.2 Operation and maintenance phase

Interbasin transfer of flora and fauna species (both pests and native i.e. noxious fish or other organisms), may be an issue and as mentioned previously, increased sediment and erosion near water courses including the coastal area, which has the potential to disturb riparian habitats and therefore the fauna species inhabiting these areas.

5.12 Air quality

The Project area comprises primarily agricultural and grazing areas as well as areas of remnant vegetation. The existing air quality for the Project area is expected to be of relatively good quality with some potential localised areas of lower quality in the vicinity of major transport routes (e.g. Bruce Highway), near the sugar cane mills and near Abbot Point, which supports a major international coal loading terminal.

The air quality in and around Bowen may on occasion be of marginally lower quality than the remainder of the proposed corridor due to the light industrial activities of the town, however, no site-specific data is currently available but will be assessed as part of the EIS.

The closest air quality monitoring sites monitored by the Environmental Protection Agency (EPA) are located at Stuart (approximately 190 km to the north of the Project area) and West Mackay (approximately 200 km south of the Project area). Both these sites are located in light industrial areas of major regional centres of Townsville and Mackay and are therefore not expected to provide representative air quality data in terms of type and quantity of air pollutant to that of the predominately rural corridor alignment.

5.12.1 Key air quality issues

Minor air quality impacts to the local air shed are likely to occur during the construction phase from dust and vehicle emissions, however, these impacts are expected to generally be localised. Operational impacts are also expected to be minimal.

5.12.1.1 Construction phase

Temporary air quality impacts during the construction phase may occur during the following activities:

- site preparation (vegetation clearance, levelling, channel excavation and construction works, pipeline construction works, access track preparation, vegetation mulching, chipping etc)
- pump station site earthworks, excavation and installation
- associated construction vehicle and equipment movement and exhaust emissions.

Potential air quality impacts may arise from dust or particulate matter, as well as odours from exhaust emissions. All impacts are expected to be short in duration and restricted to the local area around construction works.

5.12.1.2 Operation and maintenance phase

The operation of the proposed channel network and/or pipeline should not impact significantly upon air quality. Maintenance activities may have minimal localised impacts from operations such as easement and access track maintenance, as well as maintenance and repair to the channel/pipeline and pump station. These activities will take place infrequently and only when required.

Key air quality issues likely to be associated with this Project that will require assessment as part of the EIS process include construction related emissions such as dust, odour, particulate matter and vehicle exhaust emissions.

5.13 Greenhouse gas inventory

A significant amount of the land along either side of the corridor alignment still supports remnant vegetation in the form of open woodland. The requirement for clearance of this vegetation for the inclusion of the proposed channel network and/or pipeline has not yet been determined and will depend on the final alignment. While the clearing width will be minor the total area impacted directly by the water scheme infrastructure is estimated be in the order of 260 Ha. The resultant greenhouse gas emissions and potential impacts to the greenhouse gas inventory from clearance solely for the channel network and/or pipeline is expected to be minor.

Existing vegetation and its greenhouse offset value has not been determined at this stage but will be a requirement of the EIS. Likewise, the potential greenhouse offset value arising from new irrigation shall also require assessment. An assessment of the net effect on greenhouse gas inventory as a result of clearance of the remnant vegetation and loss of sequestration potential, and new growth will, however, be required as part of the EIS study.

In addition emissions associated with energy use for construction works and the pump station operation will also require evaluation, as will the positive impacts of increased plant growth and potentially reduced pastoral activity.

5.14 Noise

The proposed channel network and/or pipeline passes through rural and agricultural areas with generally low background noise levels. Exceptions to this include sections of the proposed routes close to major noise generating areas or activities comprising major traffic routes, i.e. the Bruce Highway.

The corridor does not pass through, or near to any areas that are considered more sensitive to noise generation. Noise sensitive places as defined by the Environmental Protection (Noise) Policy 1997 (EPP (Noise)) include:

- dwellings
- library, childcare centre, kindergarten, school, college, university or other educational institution

- hospital, surgery or other medical institution
- protected areas, or an area identified under a conservation plan as a critical habitat or an area of major interest, under the *Nature Conservation Act 1992*
- parks or gardens that are open to the public for use other than for sport or organised entertainment.

The only noise sensitive receptors identified within the Project area are dwellings, however the proposed corridor does not pass within close proximity to any of these. Table 5-10 provides estimated average background A-weighted sound pressure levels (LA90,T) for different areas containing residences in Australia. This information can be used as a guideline to indicate the likely background noise levels along the proposed corridor alignment.

Table 5-10: Estimated average background A-weight sound pressure levels ($L_{A90,T}$)

Noise area category	Description of neighbourhood	Average background A-weighted sound pressure levels					
		Monday to Saturday			Sunday and Public Holidays		
		0700-1800	1800-2200	2200-0700	0900-1800	1800-2200	2200-0900
R1	Areas with negligible transportation.	40	35	30	40	35	30
R2	Areas with low density transportation.	45	40	35	45	40	35
R3	Areas with medium density transportation or some commerce or industry.	50	45	40	50	45	40
R4	Areas with dense transportation or with some commerce or industry.	55	50	45	55	50	45

Source: Australian Standard AS 1055.3-1997.

The majority, if not all of the corridor alignment is expected to belong to category R1. Areas immediately adjacent to major transport routes such as the Bruce Highway belong to category R3 or R4.

5.14.1 Key noise issues

Impacts on the ambient noise environment due to the proposed channel network and/or pipeline and associated pump station is expected to be minimal.

Noise impacts are expected during the construction phase, however these impacts will be localised and of short duration. The considerable distance of existing dwellings from the proposed alignment also acts to reduce the impact of noise during construction. As part of this requirement of the EIS, the location of potential noise sensitive receptors in relation to the line will also be determined.

5.14.1.1 Construction phase

During construction the major noise impacts would be associated with the following activities:

- site preparation (vegetation clearance, excavation, levelling, access track and haul road preparation etc)
- pump station site clearance, foundation excavation and installation
- channel/rock excavation works
- associated construction vehicle and equipment movement
- construction access to the proposed alignment may potentially cause noise impacts if any of the access tracks pass by residences.

5.14.1.2 Operation and maintenance phase

The proposed channel network and/or pipeline should have limited impacts on ambient noise levels in the region during its operational phase. Noise should be limited to maintenance vehicles using the access tracks, which will be infrequent and temporary in nature. Noise from the pump station during operation may be audible if built near to any local residents, however this is highly unlikely.

Any pump station is likely to emit minor, although constant noise emissions, as well as minor vibration, however its location will be situated in a rural area away from sensitive receptors. For example, during the operational phase transport is expected to be negligible, however, pumping stations are likely to be a persistent source of noise. However, the existing Elliot Main Pumping Station (at the beginning of the alignment) which will be upgraded and the Elliot River Pumping Station are both located more than a kilometre from any dwelling, so this impact is expected to be minimal.

5.15 Traffic

5.15.1.1 Construction phase

The corridor alignment is not situated within an existing road or rail reserve. However, access all along the corridor is available intermittently via the local road network and private access tracks. Haul roads and access tracks will need to be constructed in some areas and a maintenance track will be required within the easement, however no significant access issues are anticipated during construction. Where the proposed channel network and/or pipeline runs near existing roads or property tracks there may be minor inconveniences to the local traffic resulting from construction vehicles travelling along and parking beside the roads.

The proposed channel network and/or pipelines will cross the Bruce Highway, and the nearby railway line. However, traffic on neither route is expected to be impacted by the construction phase of the Project.

Any requirement for wide or long loads for the movement of large items of equipment may result in temporary disruptions to local traffic, particularly along the Bruce Highway.

There may be some perceived safety issues for community and stock as a result of the increased construction vehicles in the region given a large number of the properties to be traversed are cattle grazing properties. A traffic management plan will be developed as part of the construction planning.

5.15.1.2 Operation and maintenance phase

The operation and maintenance phase for the channel network and/or pipeline should not impact significantly on traffic, rail or amenity. Maintenance activities will require vehicle access to the channel network and/or pipeline and pump station, however, the short duration of these activities will mean that the impacts will be minimal and temporary in nature.

5.16 Visual amenity

The proposed water transport scheme corridor is approximately 130 km in length, given the size and extent of the Project area, it was not considered feasible to undertake a detailed assessment of visual amenity as part of Stage 1, which was a desktop based scoping study. This will be addressed in the Terms of Reference (ToR) and assessed as part of the EIS process.

5.17 Waste management

Waste management is not anticipated to be a significant issue for the Project. It will be considered as part of the EIS process. It is likely that there will also be provisions in an Environmental Management Plan for waste management measures.

5.18 Socio-economics

The development of the Water for Bowen Scheme will have socio-economic impacts, both positive and negative, on the surrounding landholders, local community, regional community and the broader Queensland population.

The proposed Water for Bowen scheme traverses the two local government areas of Burdekin and Bowen Shire's. However, the majority of the water to be delivered by the scheme will be used within the Bowen Shire, with only the Inkerman sub-area lying within the Burdekin Shire. Accordingly, the majority of the socio-economic impacts will be felt within the Bowen Shire, particularly in the town of Bowen itself and the villages of Gumlu and Guthalungra.

5.19 General socio-economic description

At the 2001 ABS Census of Population and Housing, the Bowen Shire had a total population of 13,698 persons, of which approximately 8550 were resident in Bowen, 2000 in Collinsville, 250 in Gumlu and 30 in Guthalungra.

The township of Bowen is the main administrative centre for the Shire, with Bowen being a key service centre for the surrounding rural and mining areas.

Bowen has experienced an ongoing period of economic decline which has seen in excess of 2500 jobs shed from the local economy over a 15 year period from the traditional industries that supported the community (mining, power generation, meat processing, railways, and fishing).

The main industries that support Bowen and the surrounding rural areas are horticulture, coal mining and bulk shipping, power generation, fishing, tourism, grazing and aquaculture. Most of these industries have undergone structural change over an extended period, causing disruption to employment and fundamental change to the structure of the local economy.

The horticulture, fishing and tourism industries, three of the largest employment producing sectors of the local economy, all suffer from a severe annual seasonal cycle, with employment available during the winter months from April to October, and very little work available during summer months. This seasonal cycle has a dramatic impact on the local economy, particularly on the Bowen small business sector.

With the economic downturn that has occurred in the Bowen Shire, there has been an observed trend for younger families to leave the community in search of employment opportunities in larger centres, this is supported by an ongoing decline in school enrolments, falling from 2356 in 1996 to 2092 in 2005, refer Figure 5-3.

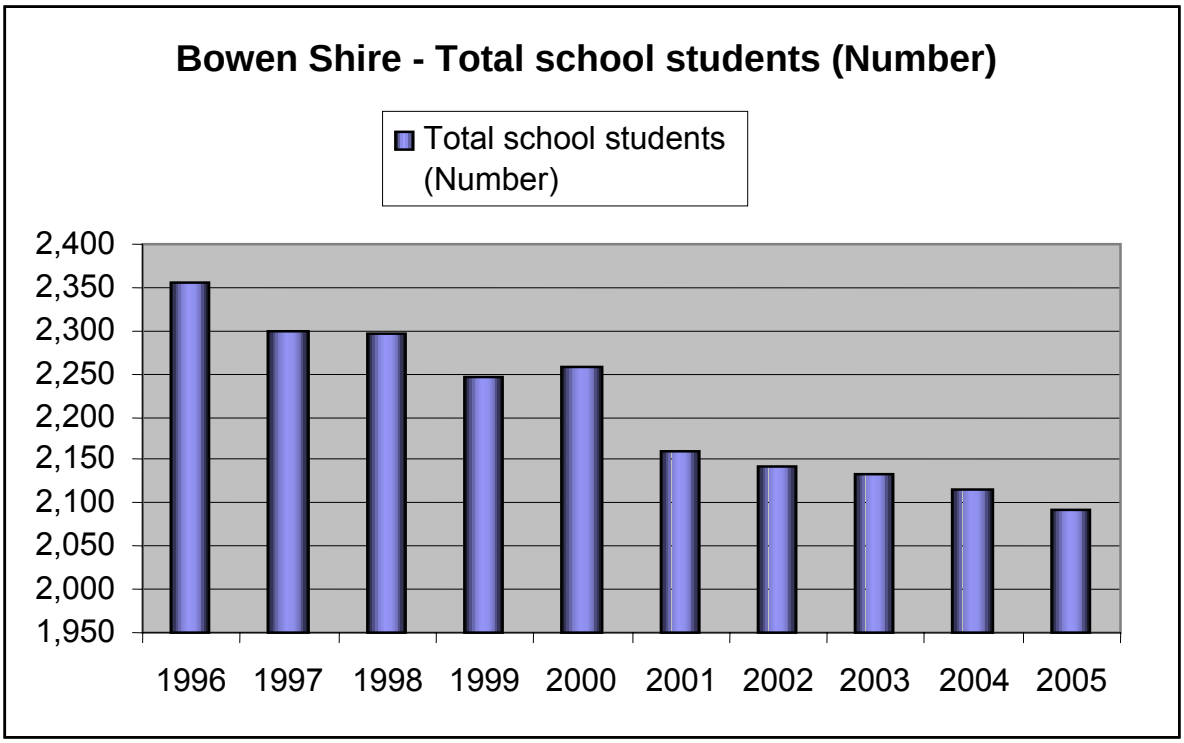


Figure 5-3: Total school students in the Bowen Shire

Whilst younger families have moved away from Bowen, there has also been a trend for older retiree "sea change" couples to move in. During the period from the 1991 census to the 2001 census, the number of persons aged 65+ increased from 1,754 to 2,207, or a 25.8% increase. The number of persons aged 14 or younger fell from 3269 in 1991 to 2625 in 2001, a 19.7% decrease. The number of people living in a household described as "Couple Family with Children" fell from 6,977 in 1991 to 5,341 in 2001, whereas "Couple Family without Children" (i.e. predominantly retiree couples) rose from 2,387 in 1991 to 2,632.

The average household size (number of persons in each household) fell from 2.8 persons per dwelling to 2.6 from 1991 to 2001, and the median age of the population in Bowen Shire increased from 33 years to 40 years. Over the same time period, the median age for Queensland as a whole only increased from 32 to 35 years, reinforcing the hypothesis that Bowen is experiencing incoming migration of retirees.

Bowen Shire has a relatively large indigenous population, with 748 persons or 5.5% of the population being of Aboriginal or Torres Strait Islander descent. This compares with 3.1% for Queensland as whole.

Bowen has a very multicultural population, with a total of 1680 persons (12.3 %) being born overseas. Bowen celebrates the wide variety of cultures and nationalities within the community with a multicultural festival each year.

A number of new industry sectors are emerging in the Bowen economy, with aquaculture, tourism, and call centre industries developing in the region.

New projects which are currently underway in Bowen include:

- Aquaculture development (2 new large scale developments to be built in 2006):
  - Pacific Reef Fisheries $35 million marine prawn farm to employ 120 people
  - Aquacrab $18 million crab & barramundi farm to employ 55 people
- Tourism industry growth - Bowen is on the doorstep of the Whitsunday's, and is emerging as an attractive visitor destination. New major resort and hotel developments will proceed in 2006 as follows:
  - Horseshoe Bay Resort Development – 160 units
  - Santa Barbara Apartments – 18 units on Santa Barbara Pde.
  - SeaCove – a 70 unit development adjacent to Harbourside Hotel.
  - Rod & Reel development – a 60 unit development on the beach at beautiful Grays Bay.
  - Rose Bay Resort Spa – a 22 unit luxury spa unit development at Rose Bay beach.
- Residential sub division development – Bowen has seen strong development in the residential property markets. Several new residential sub divisions have been completed in 2004/05, with a range of new sub divisions scheduled for 2005/06:
  - Whitsunday Shores – Stage II subdivision (complete) 160 blocks
  - Gloucester Views Estate – Soldiers Rd (complete) 37 blocks
  - Cattalina Grove Estate (under construction) 34 blocks
  - Bowen Heights sub divisions (Stage 1 complete) 62 blocks
  - Kirkpatrick Court (complete) 26 blocks
  - Mt Nutt sub division (complete) 18 blocks
  - Afrikander Rd sub division (Stage 1 complete) 120 blocks
  - Bryant Ave sub division (complete) 31 Blocks

- Mullers Lane sub division (under development) 6 blocks
- Drays Rd (completed) 18 blocks

- Call centre development - Bowen Collinsville Enterprise has established a 25 seat fee-for-service call centre to incubate the call centre industry in Bowen. This centre is fully operational employing 50 people, and will be expanded during 2006 to 50 seats which will then employ 120 people).
- IGA Supermarket Development – a major 5000sqm shopping centre development in Bowen's CBD ($4 million) completed June 2004.
- QLD Pork is currently expanding their piggery operation outside of Bowen from a 2000 sow piggery to 10,000, including the development of an abattoir, processing and smallgoods plant. This project will employ 120 new workers at full development.

Confidence is returning to the local economy, with the following developments recently completed:

- Bowen Central Shopping Village – a 10 shop strip development on Bowen's main street ($1 million).
- New nursing home & aged care facility ($2.3m)
- Bowen Backpackers Resort – 80 bed backpacker accommodation ($800,000)
- Village Life aged living development – 44 unit aged accommodation ($2.4 million)
- Rose Bay Unit Development – 24 room multi-story unit development ($3.2 million)
- Grand View Hotel redevelopment (complete restoration & expansion) ($600,000)
- Central Hotel redevelopment – Stage 1 ($ 400,000)
- Centrepoint Plaza shopping centre redevelopment ($1.2 million)
- Flagstaff Hill Interpretive Centre & Restaurant Development ($600,000).

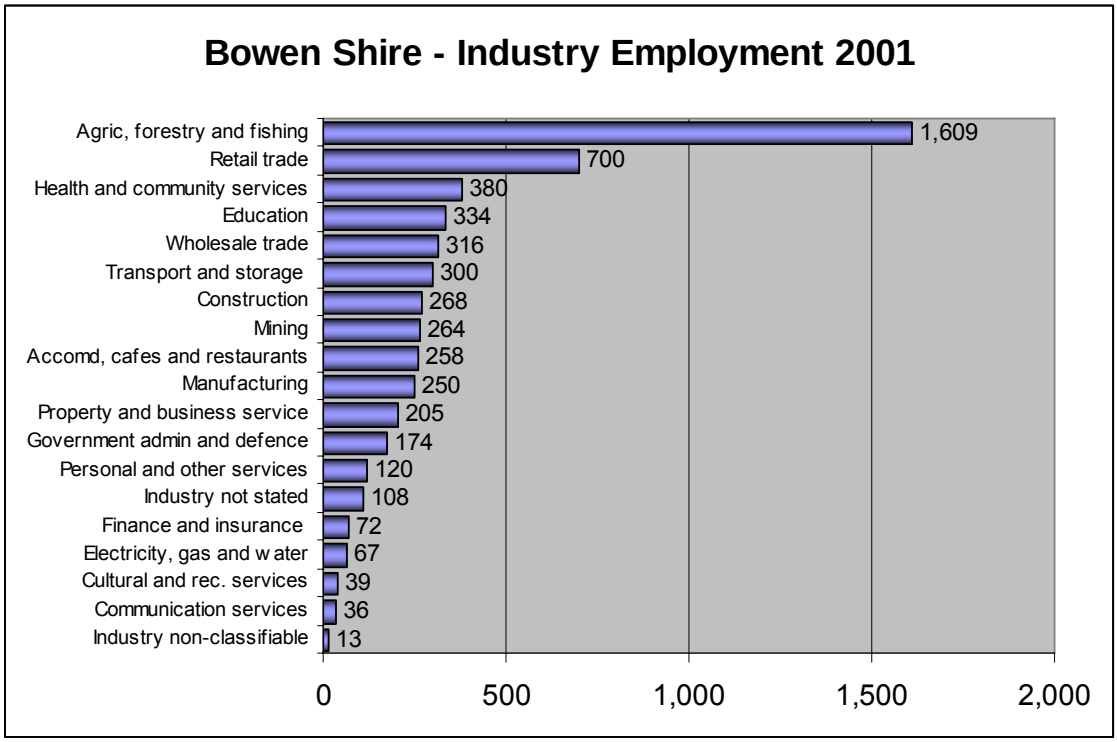
5.20 Industry, employment and labour force

Bowen Shire has traditionally had a very diverse local economy, with a wide range of employment opportunities across diverse industry sectors. However, as discussed earlier, these have been in gradual decline in employment terms over the past 15 years, and to some degree, Bowen has lost this employment diversity.

Bowen has experienced high levels of unemployment over the past 10 years in line with the industry decline described above. However, the number of unemployed persons has fallen to 521 persons or 7.6% of the labour force (December quarter 2005). Unemployment peaked at 16.9% in the March quarter 1995.

However, Bowen Shire also harbours a high level of underemployment, with evidence suggesting more people would enter the workforce if the prospects of securing work were better. In December quarter 2005, the labour force participation rate in Bowen Shire (the proportion of the working age population who either have a job or are actively looking for work) was 50.7%, which is much lower than the Queensland wide participation rate of 57.5%. This suggests that a significant proportion of the work force have given up the search for work.

At the 2001 Census, 1609 persons, or 29.2% of the Bowen Shire workforce were employed in the Agriculture, Forestry and Mining Industry classifications this compares with only 4.9% for Queensland as a whole). This was followed by retail trade with 12.7% of the workforce, and Health and Community Services at 6.9%, refer to Figure 5-4.



Source: ABS Census 2001 Table B26B Bowen Shire

Figure 5-4: Industry employment 2001 in the Bowen Shire

The domination of agriculture, forestry and fishing industry sectors in employment numbers reflects the traditional importance of these sectors to the Bowen economy. The proposed Water for Bowen scheme will add value to thee sectors through removing the water supply impediment to new industry development.

Bowen Shire has a dominance of workers in the “Labourers and Related occupations” (1,448 or 26.2% of the workforce, compared to only 9.7% for Queensland as a whole), followed by Intermediate production and Transport at 13.7% of the workforce. This again highlights the significance of the horticulture industry to the local economy, refer Figure 5-5.

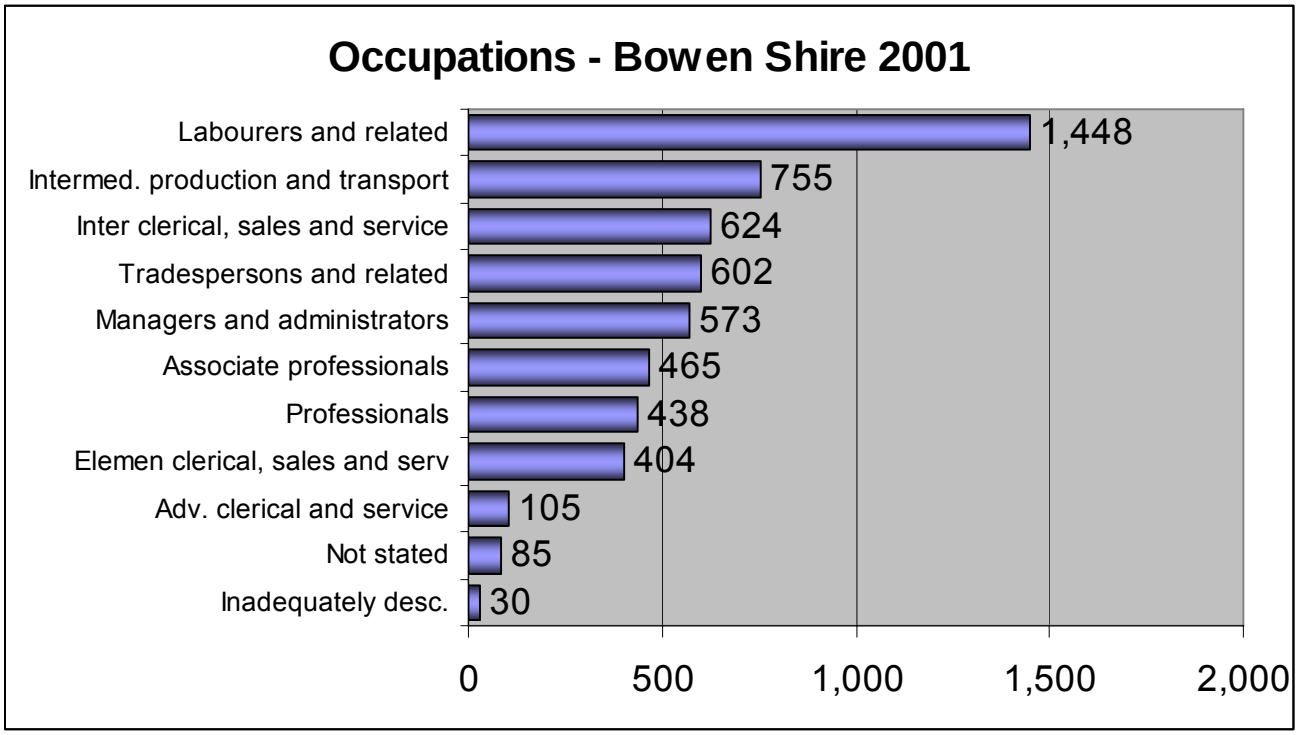


Figure 5-5: Occupations in the Bowen Shire

Burdekin Shire has a relatively low unemployment rate compared to the state average, while Bowen Shire is close to the reported average (24). The strong performance of the Burdekin Shire is attributed to the irrigation-based development that has occurred over the past 20 years. In general, population growth, employment opportunities and household incomes in the Bowen Shire are less than the neighbouring Burdekin. Irrigators in the Bowen area attribute much of this to the need for additional surface water to supplement groundwater available from local aquifers and provide the opportunity for direct reticulation of irrigation water.

The Project has the potential to alleviate this problem, while also potentially enabling some expansion of irrigated agriculture along the coastal strip in areas such as Inkerman, Gumlu and Salisbury Plains. Considerable social benefits have been attributed to irrigation development in Bowen in the past, with economic stimulus and job creation seen as significant.

5.20.1 Key employment issues

The proposed development is likely to have a positive impact on employment opportunities within the area. The capacity to expand irrigation development will occur into areas that have the physical characteristics suitable for irrigation, but are currently restricted by water supply. Water supply availability is declining in the Bowen area due to decreased announced Allocations, imposed by the NRMW, in response to declining water quality. The increased water that the Project will bring to the area is expected to assist in the creation of sustainable agriculture.

The Water for Bowen scheme will support industry growth and employment generation in the agriculture, aquaculture, food processing and associated industries, as well as in medium to heavy industrial projects developed at the proposed Abbot Point Industrial Precinct.

Employment growth from new industrial projects will assist to relieve the current seasonality issues faced by the local economy. For example, should the currently proposed Chalco Alumina refinery project be located at Abbot Point, this would provide over 500 full time, year round jobs in the local economy. This project could not proceed without the proposed Water for Bowen project.

5.20.2 The horticulture industry in the Bowen Shire

The climatic conditions in the Water for Bowen project area are ideal for horticulture production (long day length, minimal cloud cover & annual rainfall, and long warm winters). These conditions, coupled with a consistent irrigation supply, will enable the horticulture industry in the project area to produce high quality crops with high yields. Main agricultural land use includes beef cattle and irrigated horticulture.

The last detailed crop production figures and values for Bowen Shire were collated in 2000, with a total farm gate value of production of $229 million, with tomatoes providing a gross return of $104.6m , capsicums $48 m, beans $19.09m, and sweet corn $10.7m (Pers Comm Noel Meurant, DPI, April 2006). Over the past 6 years there has been steady growth in the production of tomatoes and sweet corn in particular.

Rationalisation within the horticultural industries in the region in recent years has seen the reduction in the number of farms and an increase in farm sizes. Large-scale investments in packing facilities are a feature of the horticultural industries. The region accounts for more than 60% of Queensland's total tomato production and approximately 60% of Queensland's capsicum supplies. In addition, processors in the region have replaced almost all of Australia's frozen capsicum imports. Other processing opportunities are currently under development. About 48% of Queensland's rockmelon supplies originate from the Burdekin/Bowen area.

Burdekin Shire's good performance is attributed to the development linked to irrigation over the past 20 years (24). This appears substantiated by feedback from irrigators in the Bowen area indicating a need for additional surface water to supplement groundwater from local aquifers, while providing direct reticulation of irrigation water. Submissions to the Water Infrastructure Task Force highlighted that the water limitations prevent irrigation expansion and impact the viability of present production levels (24).

5.20.3 Key economic issues

A high level of return will potentially be available from an expansion of irrigated agriculture as proposed by this development. Key crops will be tomatoes, capsicums, beans, rockmelons, mangoes, bananas, peanuts and maize, where economics are still favourable. In addition, various sites along the coastal strip have been identified as potential aquaculture sites growing tiger prawns and/or barramundi. The production of all these crops is presently limited by the availability of water.

Apart from the positive impacts of channel network and/or pipeline construction, such as direct employment with the various contractors and the flow on effects to service industries, the potential for expansion of cropped areas will in turn improve employment opportunities in crop production and processing industries, both locally and throughout the region.

5.20.4 Social environment

Bowen has well developed community and industry infrastructure, with sufficient facilities to absorb a large amount of additional economic growth. During the construction of the Newlands – Collinsville – Abbot Point project in the 1980's, the Bowen community supported a construction workforce of 2400 workers and their families. There is evidence of excess capacity in schools, hospital and other community facilities to cater for a much larger resident population.

The economic impact of the proposed Water for Bowen project will foster employment and population growth in the project area. This increased resident population will place additional pressures on community services, but given the period of economic and population decline that Bowen has been through, it is unlikely that the Water for Bowen project will result in growth beyond the capacity of the existing community infrastructure to cope. Consideration of the community infrastructure impacts will be assessed in detail as part of the EIS process, including detailed consultation with Bowen Shire Council and the broader community.

5.20.4.1 Construction phase

Consideration should be given to the few residences and businesses along or near the Project area. The construction of the proposed water transport scheme is likely to affect the immediate community through temporary increases in noise and dust. Construction of the proposed scheme is unlikely to affect the demographic profile of the area.

The occasional emission of dust from the clearance of vegetation and the use of machinery should be controlled as much as possible and will be temporary and transient in nature. Noise impacts may also develop as a result of machinery use and increased traffic movements required for construction. These impacts may cause some disruption to local residents as where possible already existing tracks and cleared areas will be used during construction. The rural nature of the area could mean that impacts on local businesses in the nearby regional centers are likely to be less of a concern.

Lay down, parking and storage areas, as well as excavation works during construction may impact on the local viewshed of nearby properties.

Construction may also temporarily limit or block normal access to some rural properties.

5.20.4.2 Operation and maintenance phase

The intention of the proposed development is to assist in meeting the current and future water supply needs of the local area, which will aid in the future economic development of the region. The operation and maintenance of the proposed Project is unlikely to impact the demographic profile of the area.

The perceived visual impact of the Project will be minimal or negligible during operation, particularly after rehabilitation of the alignment has occurred. Consideration should be given to the cumulative effect of the development on residents and businesses and how they perceive their local area. The attachment that some residents feel towards their local area may change as a result of increased infrastructure. These changes may lead to stress and concern for some residents. However, when potential future industrial development is taken into account, the development is likely to be well received in general by the community given the potential economic flow on benefits.

The broader issues of resource equity, the distribution of capital investment and regional wealth creation are all pertinent issues raised by local communities where access to the BHWSS style infrastructure is not provided (24).

5.21 Cultural heritage

5.21.1 Cultural Heritage Assessment process (CHA)

The CHA process usually involves:

- detailed consultation with the relevant Aboriginal stakeholders
- systematic archaeological field surveys of developmental impact areas in conjunction with Aboriginal representatives
- preparation of a cultural heritage report on the results and recommendations of archaeological field surveys and Traditional Owner consultation
- preparation of a Cultural Heritage Management Plan.

Specialist subconsultants Northern Archaeological Consultancies (NAC) were commissioned to undertake a desktop study for the cultural heritage and native title component of the REF (1).

The purpose of the initial desktop cultural heritage investigation was to provide preliminary advice on existing and potential cultural heritage issues and/or constraints associated with the Project. This information provides some preliminary advice on the indigenous stakeholder groups likely to have Native Title and/or cultural heritage interests in the Project area. It also provides initial advice on the scope and direction of future cultural heritage work that will be required to identify, document and manage cultural heritage sites, features and values. This report takes into account both indigenous and non-indigenous (historical) cultural heritage.

It should be noted that at this initial phase of the desktop cultural heritage investigations no consultation has been undertaken with indigenous stakeholder groups and/or representatives.

The principal objectives of the desktop study were to:

- provide initial information about Native Title applicants, Traditional Owner groups and other indigenous representative bodies and/or stakeholder groups that are likely to have interests in the Project area
- provide initial information on known cultural heritage sites, places and values by undertaking a literature review of existing and readily accessible cultural heritage information
- explore the types of cultural heritage sites, places and values that may be expected to occur within the Project area
- provide a preliminary assessment of the potential impacts of the proposed project on cultural heritage sites and values
- provide preliminary advice about cultural heritage protocols, the cultural heritage assessment process and cultural heritage management and impact mitigation measures relative to the proposed Project.

5.21.2 Pertinent legislative issues for the proposed project

The provisions of the new *Aboriginal Cultural Heritage Act 2003* are specifically relevant for indigenous cultural heritage investigations for the Water for Bowen Project. SunWater (as the development proponent) will be bound by the provisions of this Act when undertaking the cultural heritage component of an EIS. Summaries of some pertinent sections of this Act are listed below. These sections of the Act in particular, should be consulted closely prior to undertaking any indigenous cultural heritage investigations.

Part 3, Section 23 (1): A person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the **'cultural heritage duty of care'**).

Part 4, Sections 34 to 37 - Native Title Parties, Aboriginal Parties and Aboriginal Cultural Heritage Bodies.

Part 6, Sections 52 to 73 – Cultural Heritage Studies.

In particular, **Section 61** states:-

1. This section applies if, for a part of the study area:
   - there is no Aboriginal cultural heritage body
   - there is no Aboriginal party that is a Native Title party for the part.
2. The sponsor must ensure that a **public notice** is published in a newspaper circulating generally in the relevant part.
3. If there is an approved form for the public notice the notice must be in the approved form.
4. The public notice must be published as close as practicable to the time the written notice (proposed study) is given.
5. The public notice (proposed study) must:
   - be directed to Aboriginal parties for the relevant part
   - advise the sponsors name and contact details, including the sponsors address for service
   - advise that the sponsor intends to carry out the cultural heritage study:
     a) describe the study area for the study and identify its location, including to the extent appropriate and practicable in the circumstances, by describing the study areas location in relation to the nearest town, using bearings and approximate distances
     b) describe the relevant part, if it is less extensive that the study area
     c) advise that if an Aboriginal party for the relevant part wishes to take part in the study, it must give written notice to the sponsor that the party wishes to take part in the study.

- state the notice day for the study, and advice the time by which the sponsor must be given the written notice that the party wishes to take part in the study
- advise that an Aboriginal party might not be endorsed to take part in the study if it does not give the sponsor the written notice within the required time.

Part 7, Sections 80 to 109 – Cultural Heritage Management Plans.

In particular, **Section 87** states:-

Cultural heritage management plan needed if EIS needed

This section applies to a project if:

- under an Act other than this Act, a lease, license, permit, approval or other authority is required for the Project
- under the operation of the Act under which the authority is required, or under the operation of another Act, an EIS is required for the Project.

5.21.3 European heritage

No assessment has been undertaken during Stage 1. European heritage will be addressed in the ToR and assessed as part of the EIS.

5.21.4 Indigenous heritage

Identification of indigenous stakeholders and interest groups is a crucial first step in undertaking any cultural heritage investigations for a proposed development project.

Part 4 (Sections 34 to 37) of the *Aboriginal Cultural Heritage Act 2003* defines what constitutes a '**Native Title party**', an '**Aboriginal party**' and an '**Aboriginal Cultural Heritage Body**' under the provisions of this Act.

The following information regarding the likely and potential indigenous stakeholder and interest groups for the proposed project has been compiled with direct reference to Part 4 of the Act.

5.21.4.1 Relevant Aboriginal stakeholder groups

Specialist subconsultants Northern Archaeological Consultancies (NAC) were commissioned to undertake a desktop study for the cultural heritage and native title component of the REF (PB, 2005).

A 'Native Title party' for an area is a registered Native Title claimant for the area.

On this basis, there would appear to be one Native Title party for at least part of the Project area. The relevant Native Title party is the **Bindal people** (claim QC99/21). The Bindal Native Title claim is relevant for the northern sector of the Project area in the vicinity of Clare Weir and the Burdekin region, but extending no further south than Gumlu.

Neighbouring Native Title claims include the Gia people (QC99/24), the Birri Gubba people (QC97/19) and the Birri people (QC98/12). The northernmost boundary of the Gia Native Title claim appears to run along the southern banks of the Don River. On this basis, the Gia claim appears to be outside the proposed project area.

The Birri Gubba claim includes Cape Upstart National Park only and not the Project area. The northernmost boundaries of the Birri Native Title claim appear to be located well south of the Project area.

Therefore, from the assessment undertaken in 2004, there would appear to be no registered Native Title claims over a substantial portion of the proposed project area. However this will need to be revisited with current searches as part of the EIS process.

From the 2004 assessment, NAC suggested that there will be two local indigenous Reference Groups who will claim to represent the interests of the Traditional Owners of the Burdekin-Bowen project area (and specifically the Bindal, Juru (and possibly Gia) Traditional Owners).

These groups are:

- Gudjuda Reference Group Aboriginal Corporation (Ayr)
- Giru Dala Council of Elders Aboriginal Corporation (Bowen)

It is highly likely that other individual Bindal and Juru family groups will respond to the issue of a public notice for the proposed project, and will therefore seek involvement in the cultural heritage project as an endorsed parties for the Project. This information will need to be updated and reassessed as part of the EIS process.

5.21.5 Key issues for cultural heritage

This preliminary desktop cultural heritage report highlights the following key issues:

- In the first instance, the development proponent should seek to identify the relevant indigenous stakeholders/parties via the issuing of a public notice in local Townsville, Ayr and Bowen newspapers, as per the provisions of the *Aboriginal Cultural Heritage Act 2003.*
- It is noted that the indigenous stakeholders/parties will include the Bindal people (as a Native Title party for part of the Project area). The Gudjuda Reference Group Aboriginal Corporation and the Giru Dala Council of Elders Aboriginal Corporation are also likely to have members/individuals with cultural heritage interests in the Project area.
- A Cultural Heritage Assessment (CHA) should be carried out for the proposed project, including detailed consultation with the Aboriginal stakeholders/parties, cultural field surveys of the proposed development area and formulation of appropriate recommendations to manage identified and/or potentially existing cultural heritage sites, places and values.
- The first phase of the CHA should include a meeting with the relevant Aboriginal stakeholders/parties to discuss the proposed project and to plan for the carrying out of cultural heritage field surveys of developmental impact areas.
- The CHA should culminate in the formulation of a CHMP for the proposed project. The CHMP should include appropriate and effective mechanisms for the protection and management of identified and potentially existing cultural heritage sites and values.

6. Legislation

Legislation expected to be relevant to the Project includes:

Commonwealth

Environmental Protection and Biodiversity Conservation Act 1999

Queensland

Aboriginal Cultural Heritage Act 2003

Acquisition of Land Act 1967

Environment Protection (Noise) Policy 1997

Environment Protection Act 1994

Great Barrier Reef Marine Park Act 1975

Integrated Planning Act 1997

Land Act 1994

Native Title (Queensland) Act 1993

Nature Conservation (Wildlife) Regulation 1994

Nature Conservation Act 1992

State Development and Public Works Organisation Act 1971

Vegetation Management Act 1999

Vegetation Management Regulation 2000

Water Act 2000

7. References

1. Parsons Brinckerhoff Australia: Review of Environmental Factors. The Water for Bowen Project. (PB REF: 2108109A-RPT001-C-tz:rf) January 2005.
2. S Davidge pers comm. SunWater February 2006
3. www.lgp.qld.gov.au
4. WRC (1988): Hydrosalinity Investigations West Inkerman Section Burdekin River Irrigation Area. Water Resources Commission, Northern Regional Office. December 1988.
5. Department of Natural Resources and Mines (January 2005): Groundwater Review of the Bowen Area. Draft Report. Gary Jensen.
6. SunWater (November 2005) Water for Bowen Project Stage 1 Report. W4B-001
7. ACTFR (date uncited) Water Quality Planning Elliot Main Channel. Final Report No. 99/04. Australian Centre for Tropical Freshwater Research, James Cook University.
8. GHD (for the Department of State Development) (October 2003): 'Whitsunday Hinterland and Mackay Region Industrial Land Study – Stage 2 Final Report'
9. Pacific Reef Fisheries 2006 (http://www.pacificreef.com.au/)
10. National Land and Water Resources Audit (1996/1997) prepared by the Bureau of Rural Sciences
11. Department of Natural Resources and Mines (then Department of Natural Resources, Engineering Services), February 1999), Elliot Main Channel Extension Study Final Report.
12. Department of Natural Resources and Mines (then Department of Natural Resources), (June 1999): Preliminary Groundwater Investigations of the Salisbury Plains and Summer Hill Areas. Gary Jensen, Department of Natural Resources State Water Projects, June 1999.
13. Department of Natural Resources and Mines (then Department of Natural Resources, Engineering Services), (February 1999): Elliot Main Channel Extension Study Final Report.
14. www.nrm.qld.gov.au/land/management/pdf/state_guidelines.pdf
15. www.nrm.qld.gov.au/planning/plans
16. Coles R.G., Lee Long, W.J., Helmke, S.A., Bennet, R.E., Miller, K.J. and Derbyshire, K.J. (1989) Seagrass beds and juvenile prawn and fish nursery grounds: Cairns to Bowen. QDPI Information Series. QDPI, Brisbane.
17. Danaher, K. (1995) Coastal wetlands resources investigation for the Burdekin delta for declaration as fisheries reserves. Report to Ocean Rescue 2000. QDPI, Brisbane.
18. Ludescher, C.M. (1997) Fisheries resources between Bowen and Tully – an Inventory. Queensland Fisheries Management Authority, Brisbane.

19. Blackman, J.G., Perry, T.W., Ford, G.I., Craven, S.A., Gardiner, S.J. and Delai, R.J. (1996) Important Wetlands of Queensland. In: A Directory of Important Wetlands in Australia. Second Edition. Australian Nature Conservation Agency, Commonwealth of Australia.

20. ACTFR (1998) Flora and Fauna Survey of the Inkerman and Gumlu Blocks, Burdekin River Irrigation Area, Right Bank. Final Report No. 97/24. Australian Centre for Tropical Freshwater Research, James Cook University.

21. ACTFR (1998) Reconnaissance Flora and Fauna Survey of Three Areas Near Bowen Associated with the Proposed Elliot Channel Extension. Final Report No. 97/23. Australian Centre for Tropical Freshwater Research, James Cook University.

22. Lavery, H.J. and Johnson, P.M. (1974) Mammals and birds of the lower Burdekin district, North Queensland. 1. Introduction and mammals. Queensland Journal of Agriculture and Animal Science. 31: 97-104.

23. Lavery, H.J. and Seton, D. (1974) Mammals and birds of the lower Burdekin district, North Queensland. 2. Birds. Queensland Journal of Agriculture and Animal Science. 31: 371-82.

24. SunWater (January 2003), Prefeasibility Study Extension of Elliot Main Channel.

25. DPI (Department of Primary Industries), 1999, Burdekin Agro-economic Study, submitted to the Department of Natural Resources.

7.1 Additional resources

AS 1055.3-1997: Acoustics - Description and measurement of environmental noise - Acquisition of data pertinent to land use

Sattler and Williams (1999): The Conservation Status of Queensland Bioregional Ecosystems, Environmental Protection Agency. Brisbane, Qld.

Appendix A

Additional community consultation information

Project Steering Committee and stakeholder referral group

As part of the Water for Bowen Project a Steering Committee has been formed comprising representatives from SunWater, Department of Natural Resources and Mining (NRM), Department of State Development and Innovation (DSDI), the Bowen Collinsville Enterprise (BCE), and the Don River/Euri Creek Water Advisory Committee.

The organisations within the steering committee have been chosen because of their ability to lead and coordinate aspects of the Proposal's development, and to provide direction for the Project. The Steering Committee will meet regularly throughout the Project.

Exchange of information between the Steering Committee and the community, including potential participants in the proposed scheme once developed, will be via a Stakeholder Referral Group.

Newsletters and webpage

A webpage for the Project has been prepared and can be accessed at http://www.sunwater.com.au/project-Bowen.htm. This website will continue to be updated by SunWater throughout the Project. The webpage will inform interested parties of the progress with the Project, upload studies and reports as they become available, and highlight upcoming events related to the Project such as information sessions.

In October 2004, SunWater distributed a newsletter to potential customers of the scheme. This newsletter provided background information about the Project.

Community Consultation Workshop

An environmental workshop was held at 'The Loft', Burdekin Theatre, Queen Street, Ayr on Thursday 14 October 2004. A total of 27 participants from various organisations attended the workshop, including three SunWater and three PB representatives.

The key aim of the workshop was to identify the primary and secondary environmental issues associated with the Project.

The outcomes of the workshop have been included in the REF for this Project (PB, 2005) where appropriate. In addition, the Workshop Outcomes Report is presented in Appendix E and is available on the SunWater website at http://www.sunwater.com.au/project-Bowen_info.htm.

Key Stakeholders – Draft list only

A draft list of interest groups and key stakeholders were identified during the October 2004 workshop in Ayr. The key stakeholders and interest groups will be confirmed during the EIS process. These groups include the following:

<u>Australian Government</u>

- Department of Environment and Heritage (DEH)
- Agricultural Forestry and Fisheries (AFFA)
- Great Barrier Reef Marine Part Authority (GBRMPA)

State Government

- Department of State Development and Innovation (DSDI)
- Department of Natural Resources and Mines (DNRM)
- Environmental Protection Agency (EPA)
- Department of Primary Industries and Fisheries (DPI&F)
- Department of the Premier and Cabinet
- Department of Local Government, Planning, Sport and Recreation (DLGPSR)
- Queensland Treasury
- Department of Main Roads (DMR)
- Queensland Rail (QR)
- Ergon Energy

Local Government

- Bowen Shire Council
- Burdekin Shire Council
- Chamber of Commerce
  - Burdekin
  - BCE
  - Home Hill Chamber of Commerce

Fisheries

- Queensland Commercial Fisheries Organisation (QCFO)
- Queensland Seafood Industry Association (QSIA) Sunfish
- Various Manage Advisory Committees (FISH MACS)
- Burdekin Fisheries Stocking Association
- Australian Prawn Farmers Association

Research Organisations

- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- James Cook University (JCU)
- Cooperative Research Centres (CRCs)
  - Agriculture and Rural Based Manufacturing
  - Australian Cotton CRC
  - CRC for Sustainable Aquaculture of Finfish

  - CRC for Sugar Industry Innovation through Biotechnology
  - CRC for Catchment Hydrology
  - CRC for Coastal Zone, Estuary and Waterway Management
  - CRC for Freshwater EcologyHYPERLINK "http://www.reef.crc.org.au/" \t "_blank"
  - CRC for Plant-based Management of Dryland Salinity
  - CRC for Water Quality and Treatment
- Australian Institute of Marine Science
- Local marine advisory committees

Industry

- Burdekin Cane Growers
- CSR
- Water Boards
- Home Hill Cane Growers
- Grow Comm
- Bowen Growers
- Gumlu Local Producers
- Burdekin Fruit and Vegetable Growers
- Mango Growers
- Qff/Agforce
- ACFA (Australian Cane farmers Association)
- Burdekin Irrigators
- Elliot Main Channel Landowners Association
- Horticulture Australia
- Burdekin Tourism Association
- Bowen Collinsville Enterprise

Non Government Organisations

- World Wildlife Fund (WWF)
- Country Women's Association
- Bowen Land Care
- Lower Burdekin Land Care
- Indigenous groups

- Burdekin River Improvement Trust
- Don River Improvement Trust
- QLD Conservation Council
- Coral Reef Society

The table below lists the messages that would be conveyed to the community and stakeholders (SunWater 2005).

Primary messages
1. The project is dependant on the involvement of local stakeholders. Stage Two will not proceed unless there is sufficient commitment to the project from potential future customers.
2. The Water for Bowen Project requires firm and long-term commitment from all stakeholders to be viable.
3. SunWater is actively listening to stakeholders and is interested in their feedback on the Water for Bowen project.
4. Customers will contract with SunWater for delivery capacity in the scheme. Customers will need to procure access to water allocation via sale, lease or other methods for transport in the scheme. However, they may do so independently of SunWater, if they so require.
5. The Queensland government is supportive of the Water for Bowen project and is taking an active role in studies relating to the project.
Secondary messages
6. The Water for Bowen project has a much greater chance of success than previous versions of the project. Additional water is needed to support existing agricultural and industrial activities, and to provide for growth opportunities. Current studies show that the Water for Bowen project is potentially commercially feasible.
7. SunWater has developed a two-stage study process to determine the viability of the Water for Bowen project. The first stage looked at estimating current and future water demands in the area and developing concept plans. The second stage will include the completion of an environmental impact statement, detailed engineering and the development of contracts.
8. Water from the project will be used to supplement existing water sources.
9. Sustainability principles will be used in the project study and development process.
10. There is ample water to supply the Water for Bowen Scheme. The scheme will be designed to supply the quantity of water that potential customers have indicated they will need. There may also be some capacity built into the system for future use, based on estimations of growth of demand.
11. As a government owned corporation (GOC), SunWater operates in a competitive marketplace on an equal commercial footing with private sector providers. SunWater is responding to customer and market demands in a professional and innovative manner.
12. Customer satisfaction, business growth, long-term asset serviceability and sound environmental management are recognised as critical elements to ensure SunWater's business success.

Appendix B

Additional flora information

General literature review

The survey was undertaken and reported as two studies. The initial study by ACTRF (20) assessed two parcels of land:

- Inkerman
- Gumlu.

The second study by ACTFR (21) surveyed three additional areas:

- Salisbury Plains West (referred to in ACTFR study as Area 1)
- Salisbury Plains East (referred to in ACTFR study as Area 2)
- Summer Hill (referred to in ACTRF study as Area 3).

These potential irrigation development areas lie within the Brigalow Belt bioregion, a large and complex area that encompasses much of the 500–700 mm per annum rainfall country from the Queensland – New South Wales border to Townsville.

Within the Brigalow Belt bioregion the major threats to vegetation community diversity have been identified as ongoing vegetation clearance, intensive grazing pressures and ingression and proliferation of weed species, particularly prickly acacia, *Acacia nilotica, Stachytarpheta jamaicensis, Chloris inflate and Sida rhombifolia* (20,21).

Since the ACTFR vegetation surveys no further flora studies have been undertaken in the Project area. In addition the field surveys undertaken, ACTFR were commissioned to concentrate on the potential additional irrigation areas, and did not consider the remainder of the proposed corridor alignment or the pump station site.

Vegetation descriptions from the ACTFR vegetation surveys are provided in Table B1-B6 (Appendix B). The Regional Ecosystem Code and conservation status have been updated to reflect current classifications and legislation (VMR 2000). All references to conservation status in this report are reflective of current legislation.

Inkerman – The study by ACTFR (20) identified eleven vegetation types, one of which is of conservation significance. There was a wetland located in Inkerman which supports some native species not found elsewhere on the block. The wetland is partially artificial and the majority of the species are exotic weeds.

Vegetation types in this block are predominately grasslands, many disturbed by weed infestation. There were also areas of vine thicket identified that still maintained a diverse ground flora. REs identified in the Inkerman block are listed in Table B1.

Table B1: REs described by ACTFR (20) for the Inkerman Block

Regional Ecosystem Code	Description	Status (VMR 2000)
11.3.4	*Corymbia tessellaris* woodland on terrace flats on alluvial plains	Of concern
11.3.9	*Eucalyptus platyphylla* woodland with grassy *Bothriochloa pertusa* dominated understorey on lower alluvial fans	Not of concern
11.3.25	*Melaleuca* spp., and vine thicket species woodland on creeklines	Not of concern
11.3.27	Wetland (partially artificial)	Not of concern
11.3.31	*Iseilema* grassland on deep dark cracking clay soils on alluvial plains	Not of concern
11.3.31	*Bothriochloa pertusa* grassland on heavy clay soils on alluvial plains	(Species are introduced thus site may not be remnant)
11.3.31	*Acacia nilotica* and *Ziziphus mauritiana* shrubland on heavy clay soils on alluvial plains	(Species are introduced thus site may not be remnant)
11.12.4	Vine thicket on granite hillslopes	Not of concern
11.12.9	*Eucalyptus platyphylla, Corymbia dallachyana* woodland with grassy Bothriochloa pertusa dominated understorey on granodiorite rises	not of concern
none	*Acacia nilotica* shrubland over *Chloris inflate* grassland on lower terraces and floodways	(Species are introduced thus site may not be remnant)
Cleared areas	none	None

Gumlu – The study by ACTFR (20) divided the areas into two areas, A and B. In Gumlu A, six vegetation types were identified, one of which is of conservation significance. Four the vegetation types were considered highly susceptible to weed infestation which may lead to a loss of structure integrity. A summary of REs identified at Gumlu A are listed in Table B2.

Table B2: REs described by ACTFR (20) for the Gumlu A Block

Regional Ecosystem Code	Description	Status (VMR 2000)
11.3.4	*Corymbia dolichocarpa, Corymbia dallachyana, Corymbia tessellaris, Grevillea striata* woodland on seasonally inundated pale clay alluvial plains	Of concern
11.3.9	*Eucalyptus platyphylla, Corymbia tessellaris, Corymbia dolichocarpa* woodland on ancient alluvial plains	Not of concern
11.3.25	*Melaleuca* spp., *Corymbia tessellaris* and vine thicket species on creek banks	Not of concern
11.3.31	*Bothriochloa pertusa, Themeda triandra* grassland on gilgaid clay alluvial plains	Not of concern
11.3.32	*Allocasuarina leuhmannii* woodland on reddish sandy clay ancient alluvial plains	Not of concern
Cleared areas	none	None

Gumlu B comprises eight vegetation types, two of which are of conservation significance. The vegetation communities identified were rated between good and poor condition. There were several communities that had been subject to weed invasion, although several of the communities were also noted to have a significant diversity of native species. Mangrove estuaries were also identified over Gumlu B. This vegetation type was described as being a widespread vegetation type in good condition. REs identified in Gumlu B are listed in Table B3.

Table B3: REs described by ACTFR (20) for the Gumlu B Block

Regional Ecosystem Code	Description	Status (VMR 2000)
11.1.1/11.1.2	*Sporobolus virginicus* and fleshy herb saltpans	Not of concern
11.1.4	Mangrove estuaries	Not of concern
11.3.4	*Corymbia tessellaris* woodland with *Acacia salicina* and *Grevillea* striata over grassy ground-stratum on pale clay alluvial plains, seasonally inundated	Of concern
11.3.9	*Eucalyptus platyphylla, Corymbia tessellaris, Corymbia dolichocarpa* with shrubby, grassy understorey on well-drained prior streams	Not of concern
11.3.13	*Bursaria incana* and *Grevillea striata* shrubland with emergent *Corymbia tessellaris*	Of concern
11.3.25	*Melaleuca* spp., *Corymbia tessellaris* and vine thicket species on creek banks	Not of concern
11.3.35	*Eucalyptus platyphylla* woodland with grassy understorey on alluvial clay plains	Not of concern
Cleared areas	None	None

Salisbury Plains East – The study by ACTFR (21) identified ten vegetation types within this area, three of which are of conservation significance (Table B4). The vegetation communities at the time of assessment were rated between very good and poor condition in terms of invasive weed species, mechanical disturbance and grazing impacts. REs identified for Salisbury Plains East are listed in Table B4.

Table B4: REs described by ACTFR (21) for the Salisbury Plains East Block

Regional Ecosystem Code	Description	Status (VMR 2000)
11.1.1/11.1.2 (11.1.1 – *S. virginicus* dominant; 11.1.2 – Samphire forbland, saltpan)	*Sporobolus virginicus* and chenopod forbland on saline flats	Not of concern
11.3.4	*Corymbia tessellaris, Pandanus* sp. woodland on sandy levees and creeks	Of concern
11.3.4	*Corymbia dolichocarpa, Corymbia tessellaris* and *Corymbia dallachiana* open woodland on cracking black clays of alluvial terraces	Of concern
11.3.9	*Eucalyptus platyphylla, Corymbia dolichocarpa* open woodland on bleached sandy clay loam of ancient alluvial plains	Not of concern

Regional Ecosystem Code	Description	Status (VMR 2000)
11.3.31	*Iseilema vaginiflorum, Bothriochloa* sp. natural grassland on cracking black clays on alluvial plains.	Not of concern
11.3.32	*Allocasuarina leuhmannii* low open woodland on bleached fine sandy rises associated with ancient alluvial soils	Not of concern
11.3.32	*Allocasuarina leuhmannii* and *Melaleuca viriflora* low open woodland on bleached fine sandy clay loams on ancient alluvial soils	Not of concern
11.3.34	*Acacia tephrina* on heavy dark clays on alluvial soils	Not of concern
(Could be REs 11.11.1, 11.11.6 or 11.12.16 depending on remnant status)	*Lophostemon grandiflorus, Melaleuca* spp., *Acacia* spp., and vine thicket species on narrow streams	11.11.1 – Not of concern 11.11.6 – Not of concern 11.12.16 – Of Concern
Cleared areas	None	None

Salisbury Plains West (Red) – ACTFR (21) identified seven vegetation types within this area, two of which have a conservation rating. The REs described are listed in Table B5. Most vegetation communities at the time of this assessment were reported to be in moderate to excellent condition, with minimal weed invasion and minor soil disturbance as a result of overgrazing or soil erosion.

Table B5: REs described by ACTFR (21) for the Salisbury Plains West Block

Regional Ecosystem Code	Description	Status (VMR 2000)
11.3.4	*Corymbia tessellaris, Pandanus* sp. woodland on sandy levees and creeks	Of concern
11.3.12	*Melaleuca viriflora* woodland with *Eucalyptus platyphylla* on poorly drained alluvial soils.	Not of concern
11.3.32	*Allocasuarina leuhmannii* low open woodland on bleached fine sandy rises associated with ancient alluvial soils	Not of concern
11.3.33/11.3.34 (11.3.33 is *E. mitchellii* dominant; 11.3.34 is *A. tephrina* dominant)	*Acacia tephrina, Eremophila mitchellii* thicket on heavy dark clays on old residual alluvial soils	11.3.33 – Of concern 11.3.34 – Not of concern
11.11.1	*Eucalyptus crebra* open forest with *Bothriochloa* sp. understorey on gently undulating country overlying metamorphosed sedimentary rocks	Not of concern
11.12.1	*Eucalyptus crebra* open forest with *Bothriochloa* sp. understorey on gently undulating country overlying acid intrusive rocks	Not of concern
Cleared areas	none	None

Summer Hill – Seven vegetation types were identified in the Summer Hill area by ACTFR (21). Of these two exhibit a conservation rating under the VMR 2000. Communities at the time of assessment ranged in condition from very good to poor, with most exhibiting some signs of weed invasion, overgrazing and mechanical disturbance. REs identified in the Summer Hill Block are listed in Table B6.

Table B6: REs described by ACTFR (21) for the Summer Hill Block

Regional Ecosystem Code	Description	Status (VMR 2000)
11.3.4	*Corymbia dolichocarpa, Corymbia tessellaris and Corymbia dallachiana* open woodland on cracking black clays of alluvial terraces	Of concern
11.3.4	*Corymbia tessellaris, Pandanus* sp. woodland on sandy levees and creeks	Of concern
11.3.9 (although may be 11.3.35)	*Eucalyptus platyphylla, Corymbia dolichocarpa, Melaleuca viridiflora* open woodland on bleached sandy clay loam of ancient alluvial plains	11.3.9 - Not of concern 11.3.35 – Not of concern
11.3.31	Grassland on dark clay soils	Not of concern
11.3.32	*Allocasuarina leuhmannii* low open woodland on bleached fine sandy rises associated with ancient alluvial soils	Not of concern
11.12.1	*Eucalyptus crebra* open forest with *Bothriochloa* sp. understorey on gently undulating country overlying acid intrusive rocks	Not of concern (Could also be 11.3.30 – only other one with the two sp. mentioned)
Cleared areas	None	None