HANCOCK PROSPECTING PTY LTD

Alpha Coal Project Environmental Impact Statement

11 Surface Water

Section 11 Surface Water

11.1 Introduction

This section describes the existing environment for water resources that may be affected by the Alpha Coal Project (Rail) (herein referred to as the Project) in the context of environmental values as defined in such documents as the *Environmental Protection Act 1994* (EPA), *Environmental Protection (Water) Policy 2009* (EPP Water), the *National Water Quality Management Strategy 2000* (NWQMS) Australian and New Zealand Environment and Conservation Council (ANZECC), the Environmental Protection Agency (EPA) Guideline: *Establishing Draft Environmental Values and Water Quality Objectives* and the *Queensland Water Quality Guidelines 2006.* The definition of waters in the EPP (Water) includes the bed and banks of waters, so this section shall address impacts on benthic environment, as well as the water column.

For the purposes of this assessment, the *study area* refers to all waterways and related catchments that are intersected by the Project, both upstream and downstream from the Alpha Coal Mine to the Port of Abbot Point.

The majority of the Project is located within the approximately 130,000 km^2 Burdekin Basin catchment. The northern part of the Project is located within the much smaller Don River catchment which spans across 3,885 km^2 of land (refer to Figure 11-1). The Burdekin Basin catchment is divided into six sub-catchments or sub-basins, three of which are crossed by the Project:

- Belyando Suttor sub-basin;
- Bowen Broken sub-basin; and
- Lower Burdekin sub-basin.

The Belyando River rises just west of Emerald and flows northwards until it crosses the Suttor River. From the confluence (just upstream of the intersection with the Gregory Development Road) the river continues as the Suttor River, which flows into the Burdekin Falls Dam (BFD). The Burdekin River continues north-eastwards to the Gorge Weir and the Blue Valley Weir. At the Blue Valley Weir the Bowen River, coming from the south, joins with the Burdekin River and continues towards the coast in a north-eastward direction. Table 11-1 shows an overview of the sub-catchments and their major tributaries and streams.

Waters crossed by the Project are almost all freshwaters. Immediately before the terminal of the Project at Abbot Point, the Project skirts the Caley Valley Wetlands, a system that is tidally influenced (see also

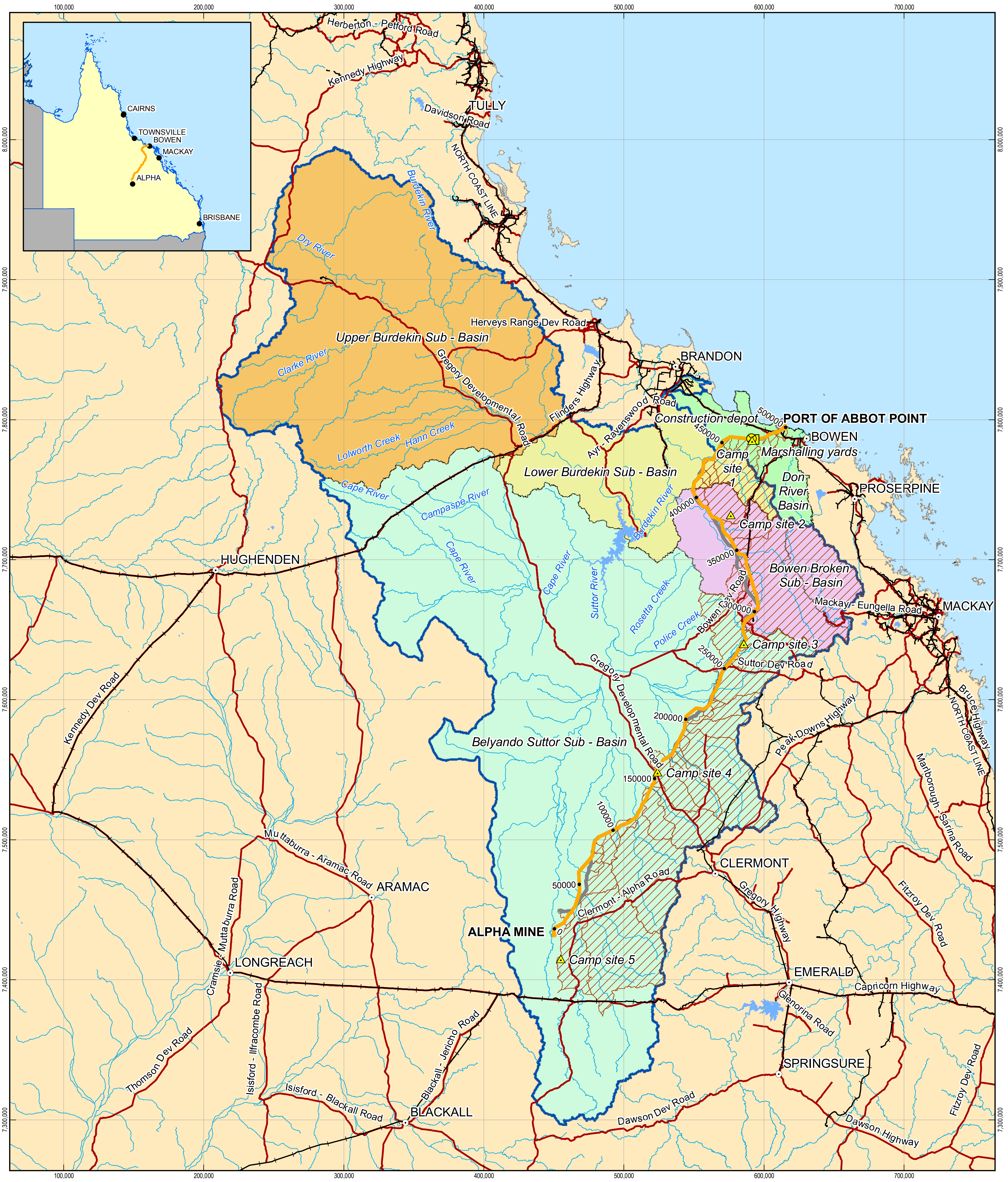
Table 11-1: Burdekin sub-catchments and major tributaries and streams

Sub-catchment	Major tributaries and streams
Belyando/Suttor	• Belyando, Cape, Suttor, and Rollston rivers; and • Mistake, Diamond and Logan Creeks.
Bowen/Broken	• Bowen and Broken Rivers, Lower Burdekin River; and • Pelican Creek.
Lower Burdekin	• Bogie and Burdekin Rivers.

Sub-catchment	Major tributaries and streams
Don River	• Haughton, Don and Elliot Rivers; and • Majors Creek.

It should be noted that at the time of writing this section analysis was undertaken on the basis of an earlier version of the Project alignment, being the alignment that was submitted for the Infrastructure Facility of Significance application (refer to Volume 3, Section 6.2.3 of this EIS). While these amendments may result in some minor changes to sub-catchment areas and areas of impact, these are not expected to be significant in terms of the overall assessment of impact significance.

The methodology for identifying waterway classifications and defining the study area is detailed further in Volume 6, Appendix G2.



LEGEND

- Town
- Camp
- Marshalling Yards
- Depot
- Proposed Alignment (Version 9)
- Proposed Alignment (Version 6)
- State Road
- Existing Railway
- Watercourse
- Waterbody
- Subcatchment (Derived for Project)
- Burdekin River Basin
- Don River Basin
- Belyando Suttor Sub Basin
- Bowen Broken Sub Basin
- Lower Burdekin Sub Basin
- Upper Burdekin Sub Basin

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1:2,500,000 (at A3)

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

BURDEKIN BASIN - SUBCATCHMENTS

Job Number	41-22090
Revision	A
Date	21-09-2010

Figure: 11-1

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11.2 Description of Environmental Values

11.2.1 Water Quality

The *Environmental Protection Policy (Water) 2009* provides a framework for managing water, including identification of environmental values associated with water and setting of water quality objectives.

Environmental values identified for waters in the study area are:

- farm water supply
- stock watering and irrigation
- human consumption of aquatic foods (recreational fishing)
- primary and secondary recreation
- visual recreation
- suitability for raw drinking water supply (the Burdekin dam services Townsville-Thuringowa, Bowen and surrounding towns)
- cultural and spiritual values.

An in depth water quality monitoring program was not carried out for the Project EIS as:

- many of the streams are ephemeral
- potential impacts on water quality are limited to variables that can be readily measured during construction (acidity, dissolved oxygen, turbidity) and are best managed through real time comparison of upstream (background) samples and downstream (impact area) water quality.

Water quality was examined at aquatic ecosystem survey sites as part of aquatic ecosystem studies and results are provided in Volume 3, Section 10.2.5 of this EIS.

The EPP Water does not identify any specific water quality indicators for the Burdekin Catchment. Water quality guideline values for the Central Coast region relevant to potential impacts of the Project are shown in Table 11-2.

Table 11-2: Water Quality Guideline Values– Central Coast Region

Indicator	Upper Estuarine (Caley Valley Wetland)	Lowland Streams	Upland Streams
Dissolved oxygen (% saturation)	70-100	85-110	90-110
Turbidity (NTU)	25	50	25
pH	7-8.4	6.5-8.0	6.5-7.5

For the purposes of managing Project impacts, the following water quality objectives have been set as shown in Table 11-3.

Table 11-3: Water Quality Management Objectives

Variable	Management Objective
Dissolved oxygen (% saturation)	The lessor of: • 70% • 90% of upstream value
Turbidity (NTU)	The lesser of: • Upstream value less 2 NTU • 90% of upstream value
pH	No less than 6.5

11.2.2 Wetlands

There are several wetlands within the Burdekin Basin and the Don Basin. Wetlands in the vicinity or downstream of the Project are mentioned and described in the following sections that describe each of the sub-basins. For all wetlands the most pressing problem for conservation is to redress the continuing loss and degradation resulting mainly from localised land-use decisions associated with rural, urban and industrial developments and accompanying land management practices. Common forms of disturbance include alterations to water regime and water chemistry, siltation and weed invasions.

Special attention has been given to the Caley Valley Wetland that the Project will cross. Because of the national importance of the wetland, HPPL has decided to create a hydrologic model to detail any surface water (including storm tide aspects) related consequences. The modeling exercise has been separately reported and is included in Volume 6, Appendix G1.

The policy outcome sought by the Temporary State Planning Policy 1/10 (SPP 1/10) *Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments* can be stated as:

> *Development in or adjacent to wetlands of high ecological significance in Great Barrier Reef catchments is planned, designed, constructed and operated to minimise or prevent the loss or degradation of the wetlands and their values, or enhances these values.*

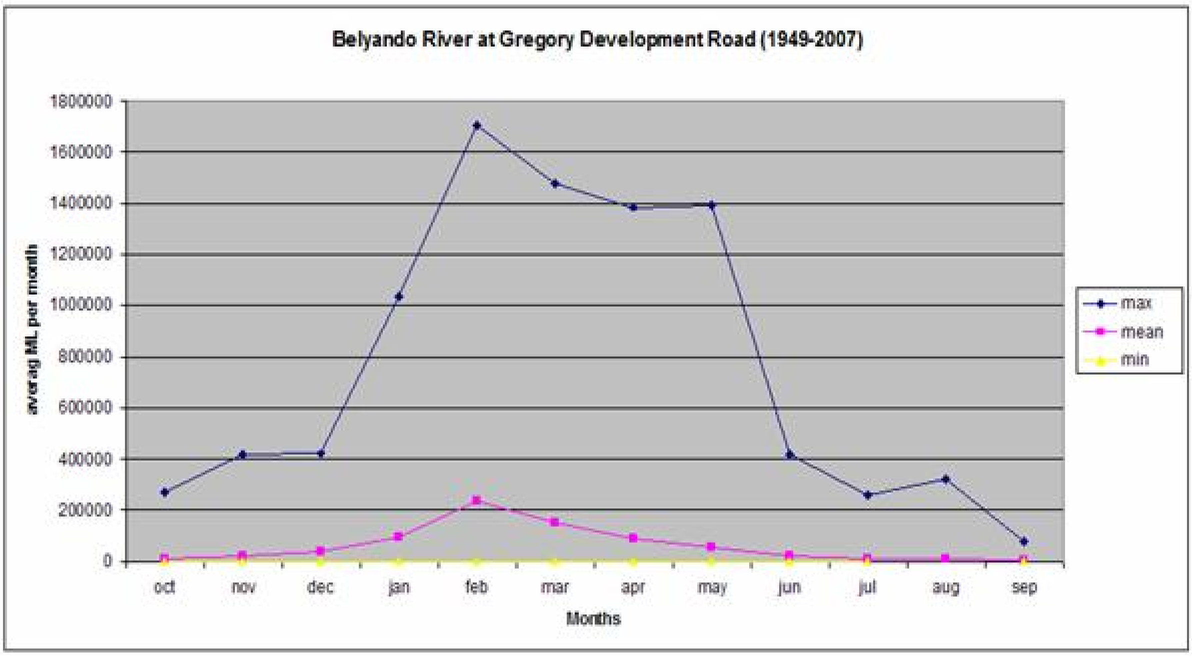
11.2.3 Belyando and Suttor sub-basins

11.2.3.1 Characteristics

The majority of the Project is located within the Belyando (35,000 km^2) and Suttor sub-basins that stretch over approximately 18,000 km^2 of land (refer to). The Belyando and Suttor sub-basins represent a dry, variable and typically semi-arid landscape producing markedly seasonal stream flow and contributing comparatively less to the overall discharge from the Burdekin Basin than other sub-basins within the basin. It is common for more than 80% of the annual stream flow of the waterways in the Belyando/Suttor sub-basins to occur between December and April, with no flow between May and November.

Stream flow data from Belyando River at Gregory Development Road confirms the rainfall pattern (refer to Figure 11-2).

Figure 11-2: Stream flow data Belyando River at Gregory Development Road (DERM, 2010)



Land use is predominantly grazing land. Less than 5% of the land area is set-aside for conservation and minimal use, or given over to forestry. The condition of riparian habitats throughout the basin have undergone a major decline over the last 30 years, principally due to floodplain clearing, and are mostly assessed to be very poor.

There is no existing major water infrastructure located within the sub-basin and there are no significant wetlands in the vicinity or downstream of the Project.

11.2.3.2 Geomorphologic situation

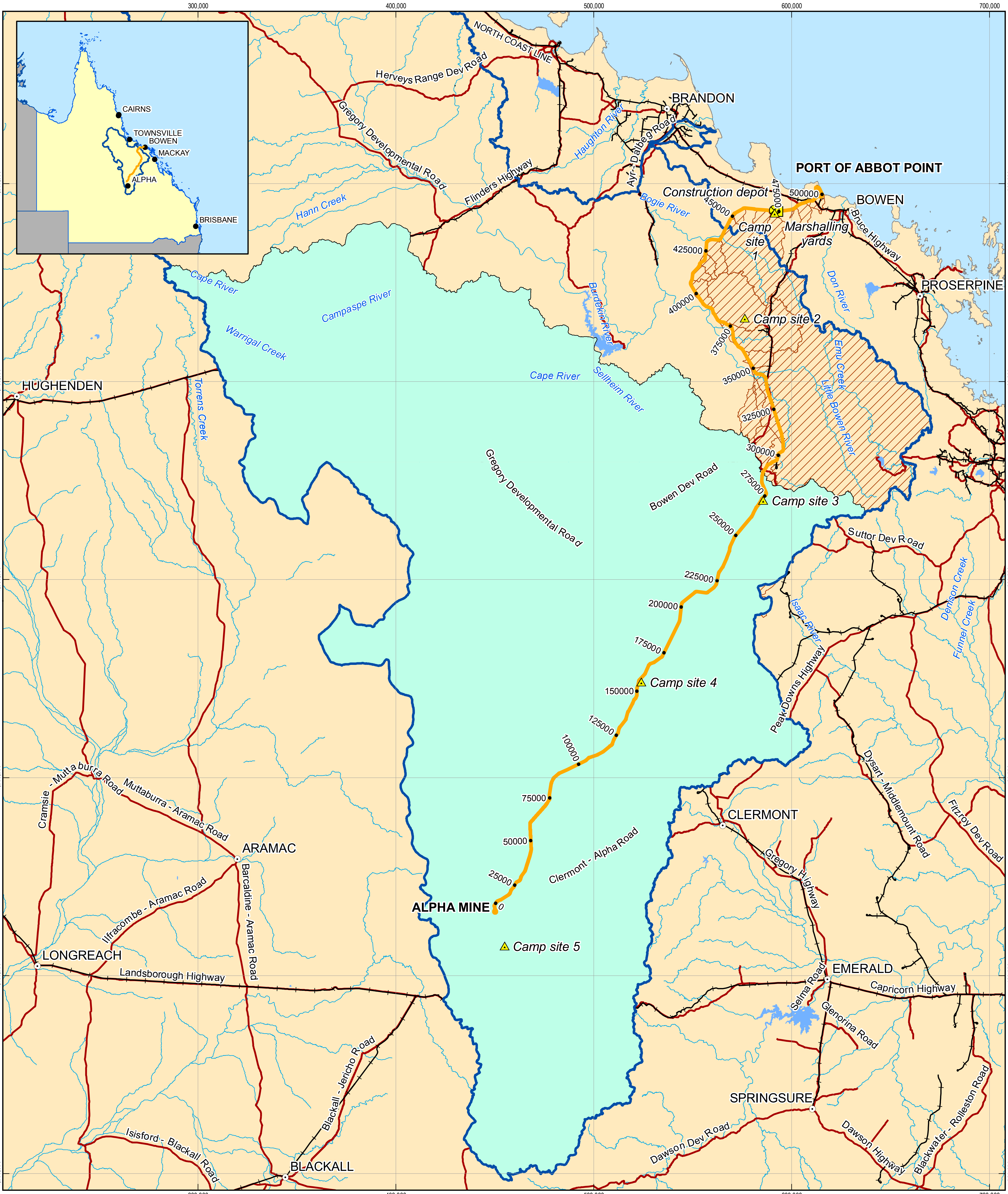
Most of the Belyando/Suttor sub-catchment consists of a series of remnant sedimentary basins. In the Suttor River alluvial deposits of Quaternary age (less than 1.8 million years) sand, gravel and soil are present. Sedimentary formations and isolated granite intrusions occur over many thousand square km. The relatively low rainfall and high evaporation typical of this region largely eliminates leaching in all but the most permeable coarse-textured soils. The accumulation of organic matter (including nitrogen) is low due to seasonal aridity, high temperatures and low humidity. Cracking clay soils predominate throughout the sub-catchment due to the presence of basic igneous rocks, clay-containing sedimentary rocks and fine textured hill slope and river bank deposits. Soils include grey/brown clays and red/yellow earths, widespread throughout the Belyando and Suttor River catchments. However, large areas remain without any detailed soil information. This is of concern because of the relatively high incidence of salinity hazard in the south-eastern section of the Belyando/Suttor sub-catchment.

Hill slope erosion is identified as the major source of sediment and particulate nutrients affecting water quality within the Belyando sub-basin, while gully erosion is also identified as a significant contributor. Information regarding sediments is contradictive. Natural Resources Management (NRM, 2002) states that the rate of soil loss is predicted to be moderate and above the Basin average, while the total amount of soil loss from the sub catchment to waterways is comparatively high. CSIRO (2002) states that the Belyando and Suttor rivers contribute relatively little suspended sediment due to extensive lowland floodplains and lower sediment supply to streams. Given their catchment area, low sediment transport capacities are predicted in the Belyando and Suttor rivers as a result of both low slope and low discharge.

An important (artificial) factor in the sediment delivery process of the Belyando / Suttor sub-basin is the BFD. It is predicted that 90% of the sediment delivered to the BFD is trapped by the dam (CSIRO 2002).

11.2.3.3 History of Flooding

The Bureau of Meteorology (BoM) provides summary data of flood events. A period of 30 years, from 1980 to 2009 has been checked for flood events (refer to Volume 6, Appendix G2 for a list of all flood events). The Belyando and Suttor rivers have only flooded three times in this period. The flood events were consistent with rainfall occurrence statistics and took place in the months of December to April.



LEGEND

- Town
- Camp
- Marshalling Yards
- Depot
- Proposed Alignment
- State Road
- Existing Railway
- Watercourse
- Waterbody
- Burdekin River Basin
- Belyando Suttor Sub Basin
- Subcatchment (Derived for Project)

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1:1,800,000 (at A3)

0 25 50

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

BELYANDO SUTTOR SUB BASIN

Job Number 41-22090
Revision A
Date 21-09-2010

Figure: 11-3

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Field assessment

In the Belyando and Suttor sub-basin eight waterways where assessed on site, as follows:

1. Native Companion Creek;
2. Belyando River;
3. Star of Hope Creek;
4. Sixteen mile Creek;
5. Mistake Creek;
6. Myra Creek;
7. Eagle Field Creek; and
8. Suttor River.

The actual field assessment locations are shown in Volume 6, Appendix G2.

Plate 11-1: Belyando River

European land clearance has resulted in altered hydrological regimes which have had an impact on the morphological character of many of the waterways within the vicinity of the Project.

Land clearance can have impacts on catchment and waterway character and behavior. Catchment responses to land clearance include increased runoff, increased drainage density, increased erosion and sediment yields within the catchment. In response to altered hydrological regimes channel morphology changes can occur as the result of bank erosion, channel incision and floodplain scour, which are generally associated with increasing stream power and sediment transport capacity.

All waterways along the Project (within the Belyando and Suttor sub-basin) are considered to be relatively geomorphologically stable. This is a reflection of the landscapes and type of waterway systems the Project traverses.

Banks are generally stable under the current flow regimes, many of which are stabilised by pasture grasses. Some limited bank instabilities are evident at all waterways, but in particular at the upstream end of the sub-basin. Native Companion Creek and Belyando River show the worst signs of erosion. More downstream waterways like Eagle Field Creek and Suttor River show less signs of erosion. All waterways show signs of degradation from cattle causing bank erosion.

The assessed waterways show no or limited signs of headward erosion. Headward erosion ('headcut') is defined as erosion which occurs along a channel in the opposite direction to water flows. This causes down cutting or incision of the bed of a stream and can alter the longitudinal profile of the waterway. Erosion can result in increased rates of sediment to be transported downstream.

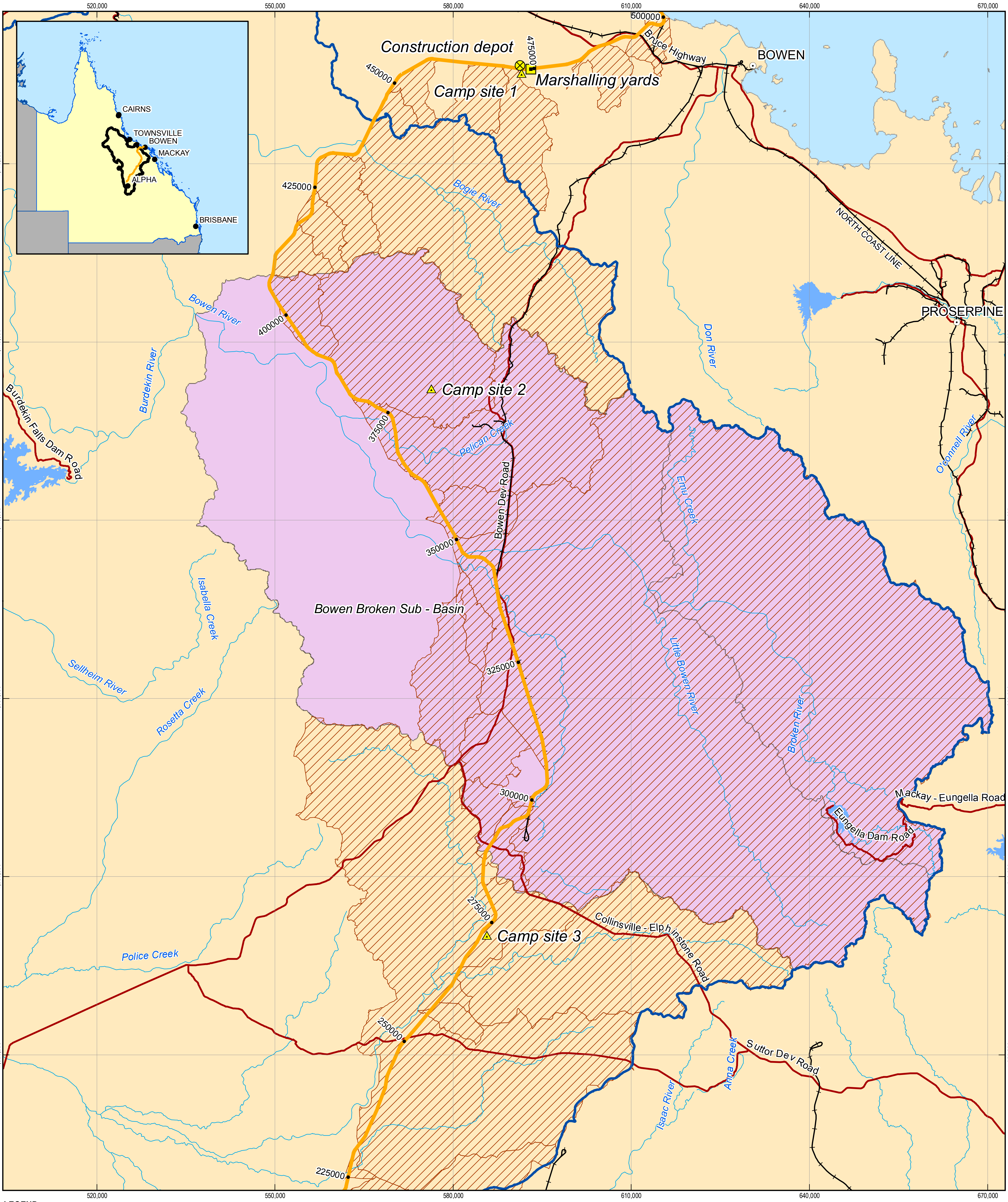
11.2.4 Bowen Broken sub-basin

11.2.4.1 Characteristics

The section of the Project around Collinsville is located in the north-western part of the Bowen Broken sub-basin (approximately11,700 km^2) (refer to Figure 11-4). Most land use is predominantly grazing on natural pastures. However, approximately 24% of the land area is set aside for conservation and minimal use, most of which lies within the Broken River sub-catchment. While the condition of riparian habitat varies between sub-catchments, from good (A) to very poor (D), there has been a general decline in condition over the last 30 years, principally due to clearing along streams and floodplains. Similarly, there is great diversity in the value of aquatic habitats, and knowledge of their condition and ecology between sub-catchments. Waterways vary between largely sandy, dry ephemeral creek systems to perennial clear-water rivers and creeks that originate in mountain rainforest of the Eungella and the Paluma Range (BDT online).

Although covering only seven percent of the total Burdekin catchment area, the Bowen/Broken catchment contributes substantially to stream flows at Clare (approximately 11%). It should be noted, however, that contributions from different sub-catchments vary considerably throughout the year, and from year to year, and are dependent on rainfall patterns, particularly cyclonic and monsoonal activity across the catchment (NRM, 2002).

The Broken River drains some of the high rainfall country in the Clarke Range to the north-east, and the lower rainfall country in the Broken River Range to the south-west. The average rainfall at the catchment is 760 mm (BoM, 2010). There are five water storages located along the Bowen/Broken river with a total storage capacity of approximately 230,000 ML. Eungella Dam, some 40 km west of Mackay on the Broken River, is the largest with a capacity of 112,400 ML. It covers an area of 890 ha when full.



LEGEND

- Town
- Camp
- Marshalling Yards
- Depot
- Proposed Alignment
- State Road
- Existing Railway
- Watercourse
- Waterbody
- Burdekin River Basin
- Bowen Broken Sub Basin
- Subcatchment (Derived for Project)

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1:600,000 (at A3)

0 15 30

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N W E S

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Alpha Coal Project
Environmental Impact Statement

BOWEN BROKEN SUB BASIN

Job Number | 41-22090
Revision | A
Date | 20-09-2010

Figure: 11-4

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Located approximately five kms downstream of the crossing with the Bowen River is the Birralee - Pelican Creek Aggregation wetland (DEWHA, 2008). This wetland has been classified as an important wetland in Australia. In concerns a 15 km section of the Bowen River approximately 27 km west of Collinsville. This wetland provides outstanding representative examples of a range of riverine wetlands. A large permanent waterhole is likely to be of importance as a drought refuge. Eight species of conservation significance have been recorded on the site. Of these eight, two are listed as vulnerable in State and/or Commonwealth Legislation.

At the junction of the Burdekin and the Broken River is the 'Burdekin-Bowen Junction and Blue Valley Weir Aggregation' (DEWHA, 2008) Wetland. This wetland is downstream of the Project and is of national importance. The wetland provides an outstanding example of a large tropical river emerging from a valley incised into a mountain range onto its terminal floodplain. The site and its surrounds constitute the largest and least impacted natural area remaining on the lower Burdekin (DEWHA, 2008).

11.2.4.2 Geomorphologic Situation

The Bowen/Broken sub-catchment contains sedimentary and volcanic rocks. Sandstones, mudstone, siltstone and conglomerates are the main rock layers in the sedimentary basins, while conglomerates and quartz-rich sandstones form ridges and escarpments. Formations containing a high proportion of easily weathered minerals result in the gentle rises and rolling plains common to the lower Bowen valley. Limestone, originating from marine reefs formed by corals, juts out prominently and has subsequently been cut into rugged gorges. Prominent soil types along the eastern margin are the red-brown earths and yellow podsolics/soloths. On the drier western slopes of the Clarke Ranges around Dalrymple Heights, the strongly undulating landscape is covered by yellow soils derived from weathered intermediate rocks. Much of the eastern slopes of the Leichhardt Ranges to the west are covered by shallow, gravely/sandy soils associated with granite or sandstone parent material. Areas of black earths lie between Collinsville and the Burdekin and Bowen Rivers, with smaller isolated areas at Exe Creek near Redcliffe and the Broken River at Emu Plains.

Hill slope erosion is identified as the major source of sediment and particulate nutrients affecting water quality within the Bowen Broken Bogie Basin, while gully and stream bank erosion are also identified as significant contributors. The rate of soil erosion for the Basin, overall, is predicted to be high and well above the regional average, with individual sub-catchments losing up to almost three times the regional average. The Bowen River is considered to be one of the dominant sources of sediment at the catchment outlet (CSIRO, 2002).

11.2.4.3 History of Flooding

BoM provides summary data of flood events. A period of 30 years, from 1980 to 2009, has been checked for flood events. No flood events occurred along the Bowen/Broken Rivers in this period.

11.2.4.4 Field Assessment

In the Bowen Broken sub-basin three waterways where assessed on site as follows:

1. Pelican Creek;
2. Table Mountain Creek; and
3. Cattle Creek.

For field assessment locations refer to Volume 6, Appendix G2.

Plate 11-2: Pelican Creek

Grazing intensity is, as might be expected due to differences in climate, higher in the Bowen Broken sub-basin compared with the Belyando Suttor sub-basin. These extensive changes in land use have had an impact on the morphological character of many of the waterways within the vicinity of the Project.

Land clearance for the Project construction can have impacts on catchment and waterway character and behavior. Catchment responses to land clearance include increased runoff, increased drainage density, increased erosion and sediment yields within the catchment. In response to altered hydrological regimes channel morphology changes can occur as a result of bank erosion, channel incision and floodplain scour which are generally associated with increasing stream power and sediment transport capacity.

All waterways along the Project (within the Bowen Broken sub-basin) are considered to be relatively geomorphologically stable under current flow regimes. This is mainly due to extensive vegetation cover of the banks. All waterways show signs of degradation from cattle causing bank erosion. The assessed waterways show no or limited signs of headward erosion.

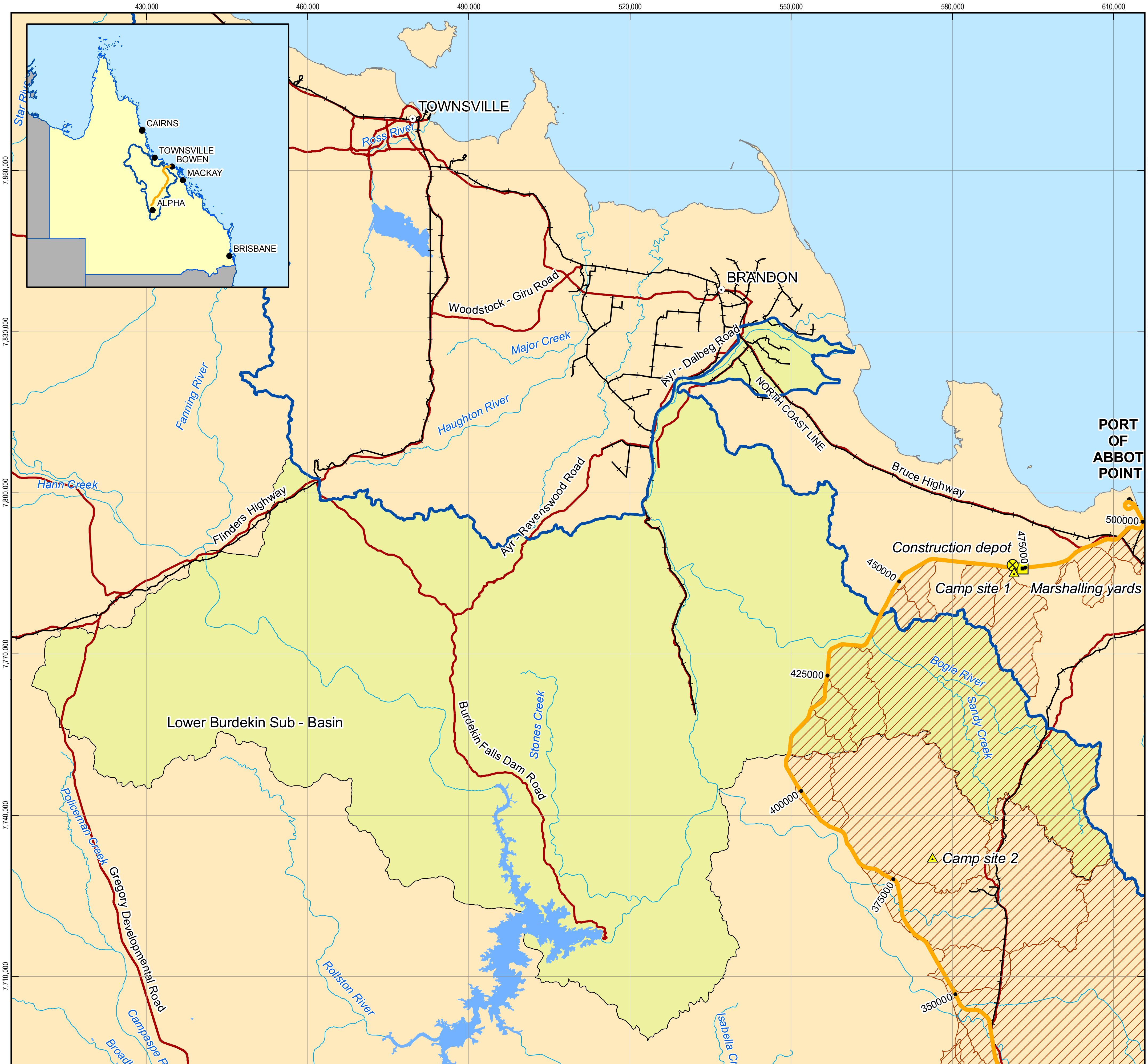
11.2.5 Lower Burdekin sub-basin

11.2.5.1 Characteristics

The Burdekin Falls Dam and three weirs greatly modify the river flow regime. Before construction of the dam in 1987, the Burdekin River at Clare Weir flowed for around 95% of the time; however, it now flows all year round. In addition to flowing all year round, low flows below the dam have been elevated, while medium to high flows have been reduced (refer to Figure 11-5 Lower Burdekin sub-basin). For example, before the dam was constructed, for 20% of the time flows were 2 m^3/s or less. However, after construction of the dam, for 20% of the time flows are now 10 m^3/s or less, an increase of around 8 m^3/s during low flow periods. Consequently, the river has changed from an intermittently flowing river into a perennial system with elevated dry season flows and a reduced magnitude of flood flows.

The land use of the lower Burdekin and the Coastal plains contains extensive agriculture which is centered on intensive irrigation. The region is well known for its sugar, cotton and horticulture production, with sugar being the dominant crop. About 20% of Australia's sugar production is located within the Lower Burdekin sub-basin (NRM, 2002).

The Burdekin Catchment flows into the Bowling Green Bay Ramsar Wetland via the Haughton River. The Bowling Green Bay Wetland is located 21 km north east of Ayr and has a total area of 35 500 ha. The wetland aggregation contains a diversity of habitats including: seagrass beds; coastal sand dunes; tidal flats; mangrove forests; highly saline supra-tidal salt pans; brackish to freshwater marshes; and lakes. The Bowling Green Bay Wetland is an internationally significant habitat for wader birds and provides important breeding and nursery habitat for commercially and recreationally important fish species such as barramundi (DEWHA, 2010). The Bowling Green Bay Wetland is located more than 100 km from the northern end of the Project.



LEGEND

- Town
- Camp
- Marshalling Yards
- Depot
- Proposed Alignment
- State Road
- Existing Railway
- Watercourse
- Waterbody
- Burdekin River Basin
- Lower Burdekin Sub Basin
- Subcatchment (Derived for Project)

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Environmental Impact Statement

LOWER BURDEKIN SUB BASIN

Job Number	41-22090
Revision	A
Date	20-09-2010

Figure: 11-5

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11.2.5.2 Geomorphologic situation

The Lower Burdekin and Coastal Plain study areas consist mainly of volcanic and sedimentary rocks. Superficial sand, gravel, silt and mud form plains in the Bowen coastal area, with small dissected table-lands of old basalt occur in the Bowen Basin. Higher rainfall in the coastal region has produced areas of deep, strongly weathered fine-textured soils on the foot-slopes. Many soils here have been subject to intense weathering and/or leaching, severely affecting their nutrient value. Within the Burdekin floodplain, soils are derived from very variable river deposits and include black cracking clays, sands and a range of duplex soils, some with a dispersive nature. Sand dunes, marine plains, deltas and sand bars form unique landforms close to the coast.

A rate of 300,000 m^3/a has been established as being representative of the actual rate of sediment transport prior to the construction of the BFD. Construction of the dam in 1987 has reduced sediment supply to downstream reaches through the physical trapping of material from upstream of the dam. This is likely to have a significant impact in the long term (greater than 50 years). It is estimated that the Bowen and Bogie Rivers, which are downstream of BFD, yield up to 60,000 m^3 of sediment annually (GHD, 2000).

In the short to medium term, it has been identified that the main impacts of BFD would occur upstream of the confluence of the Burdekin and Bowen Rivers (GHD, 2000). It was estimated that impacts to sediment transport rates at the mouth of the Burdekin River would be relatively small - in the order of 7,500 m^3/a - with a corresponding decrease at Clare Weir of about 15,000 m^3/a.

11.2.5.3 History of Flooding

BoM provides summary data of flood events. The data provided by BoM concerns both the Upper and the Lower Burdekin River. As might be expected Lake Dalryple (Burdekin Falls Dam) reduces peak flows coming from the Upper Burdekin. Most lower Burdekin floods therefore tend to be of medium to low severity. Over a period of 30 years, from 1980 to 2009, 13 flood events where recorded by BoM.

11.2.5.4 Field Assessment

In the Lower Burdekin sub-basin five waterways have been assessed on site as follows:

1. King Creek;
2. Herbert Creek;
3. Capsize Creek;
4. Bogie River; and
5. Brigalow Creek.

For field assessment locations refer to Volume 6, Appendix G2.

Land use surrounding the waterways all show signs of moderate grazing. Land clearance for cattle has resulted in altered hydrological regimes which have had an impact on the morphological character of many of the waterways within the vicinity of the Project.

Land clearance for Project construction can have impacts on catchment and waterway character and behavior. Catchment responses to land clearance include increased runoff, increased drainage density, increased erosion and sediment yields within the catchment. In response to altered hydrological regimes channel morphology changes can occur as the result of bank erosion, channel incision and floodplain scour which are generally associated with increasing stream power and sediment transport capacity.

Plate 11-3: Bogie River

All waterways along the Project (within the Lower Burdekin sub-basin) are considered to be relatively geomorphologically unstable. Waterways show signs of high channel sinuosity, diversion channels and island forming.

Banks are generally stable under the current flow regimes, mainly due to good vegetation cover. All waterways show signs of degradation from cattle, which can lead to further bank erosion. The assessed waterways show no or limited signs of headward erosion.

11.2.6 Don River Basin

11.2.6.1 Characteristics

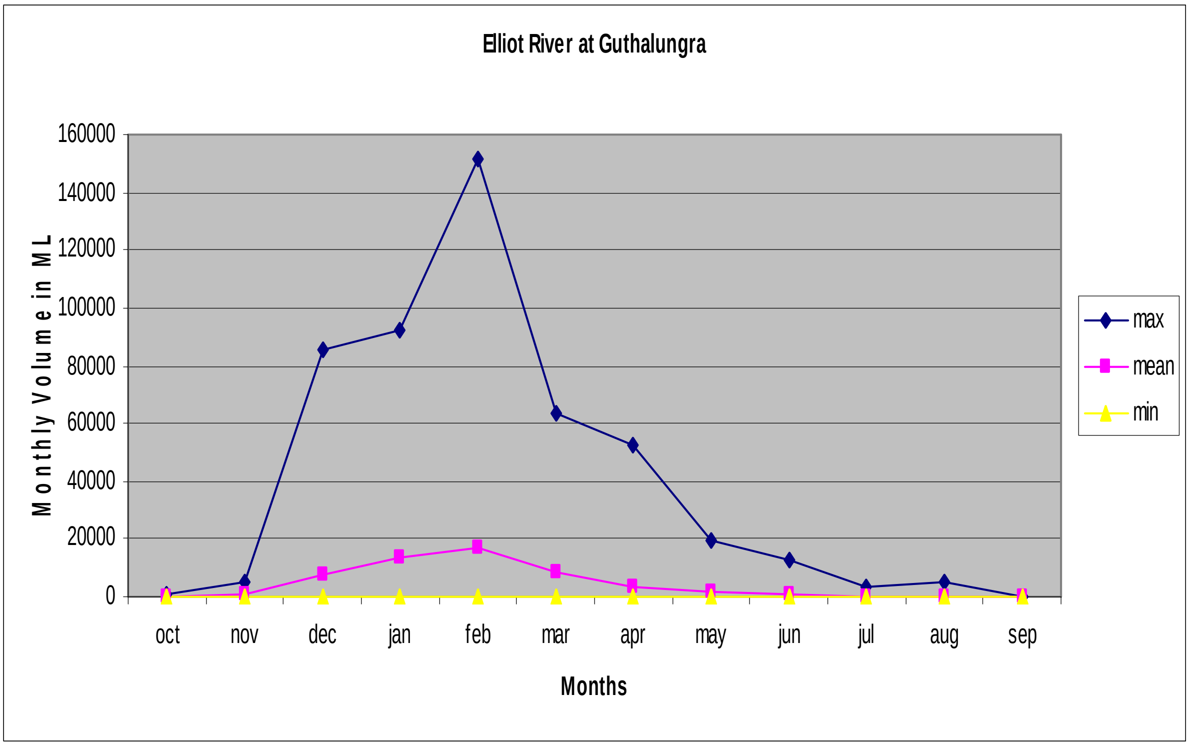
The northern part of the Project is located in the Don River basin (refer to Figure 11-7). It is a small basin with an area of approximately 3,885 km^2. The Don River Basin in North Queensland is bound by the Clarke Range and the catchment contains medium to scattered vegetation. The major town, Bowen, is located at the mouth of the Don River.

There are no major water storages in the basin. The major streams in the catchment are the Don River, Elliot River and Euri Creek (refer to Figure 11-5 Don River Basin).

Water is used for urban and horticultural purposes on the coastal flats. Mean annual rainfall ranges from 1,000 mm to 1600 mm across the catchment. Water is used for urban and horticultural purposes on the coastal flats.

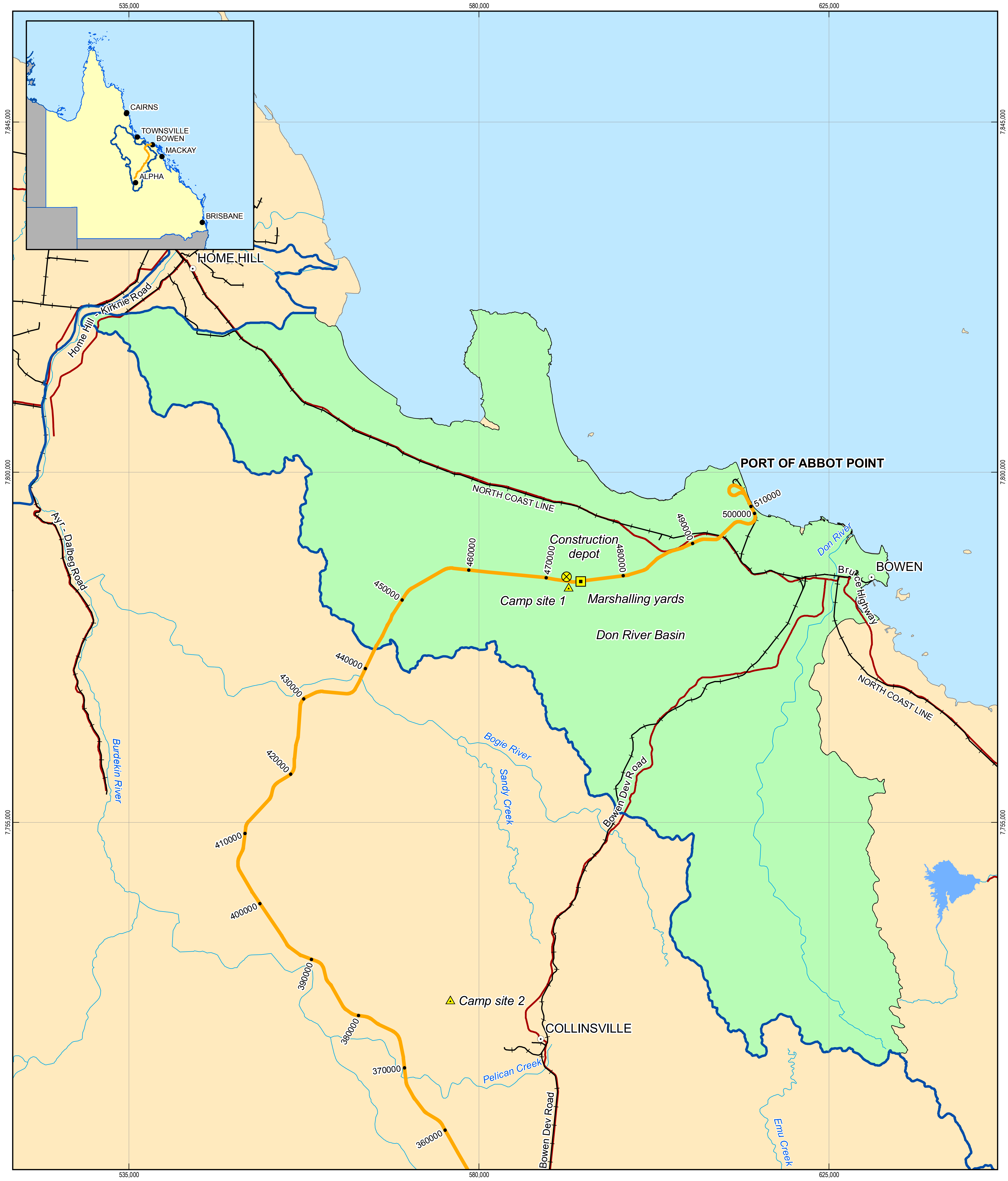
The Project does not cross the Don River or its floodplain, but crosses the Elliot River (within Don Basin). Stream-flow data from Elliot River at Guthalungra (intersection of Elliot River with Bruce Highway) shows a clear peak in flows during the wet season (DERM, 2010), which occurs between November and April (refer to Figure 11-6).

Figure 11-6: Streamflow Elliot River at Guthalungra (DERM, 2010)



Elliot River is listed in Schedule 1 of the EPP Water. The Environmental Values (EV) for Elliot River are described in the report: *Burrum, Gregory, Isis, Cherwell and Elliot Rivers Environmental Values and Water Quality Objectives March 2007 (EPA, 2007).* According to this report, environmental values (EV) for Elliot River include aquatic ecosystems, recreation, cultural heritage and aquaculture. These EVs lead to strict water quality objectives, which are described in Volume 3, Section 10 of this EIS.

The last section of the Project alignment crosses the Caley Valley Wetland at Abbot Point. The Caley Valley Wetland is included in the Directory of Important Wetlands in Australia (DEHWA, 2010). This wetland is 18 km long and up to six 6 km wide, covering an area of approximately 5,000 ha and comprising of a "complex continuous wetland aggregation of sub-tidal and intertidal marine and estuarine wetlands, with large fresh and brackish water wetlands within an artificial impoundment". The wetland contains a number of major habitats, including shallow water marine systems, beach ridges, mangrove creeks, intertidal and supra-tidal saline flats, fresh and brackish lake waters, and swamps. The impounded waters and the seasonal richness of the area as waterfowl and waterbird habitat justify the wetland's significance in Australia, and it is also considered one of the most important waterfowl localities in North Queensland (DEHWA, 2010).



LEGEND

- Town
- Camp
- Marshalling Yards
- Depot
- Proposed Alignment
- State Road
- Existing Railway
- Watercourse
- Waterbody
- Don River Basin
- Burdekin River Basin

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1:450,000 (at A3)

0 10 20

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

DON RIVER BASIN

Job Number | 41-22090
Revision | A
Date | 20-09-2010

Figure: 11-7

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As the Project will end at the Abbot Point it will cross the Caley Valley Wetland. At Abbot Point extensive port facilities exist. Due to the high demand for Queensland's resources several developments are planned within the Abbot Point with the most recent one being the Port of Abbot Point Multi Cargo Facility Project (MCF). The MCF involves the construction of a protected harbour at Abbot Point capable of handling multiple cargoes. The vision for the Port of Abbot Point is to become North Queensland's and northern Australia's premier port servicing northern Australia's major industrial hub (DIP, 2010).

As mentioned previously, due to the national importance of the wetland and the combination of infrastructure developments HPPL have decided to create a hydrologic model to detail any surface water (including storm tide aspects) related consequences. The modeling exercise has been separately reported in Volume 6, Appendix G1.

11.2.6.2 Geomorphologic situation

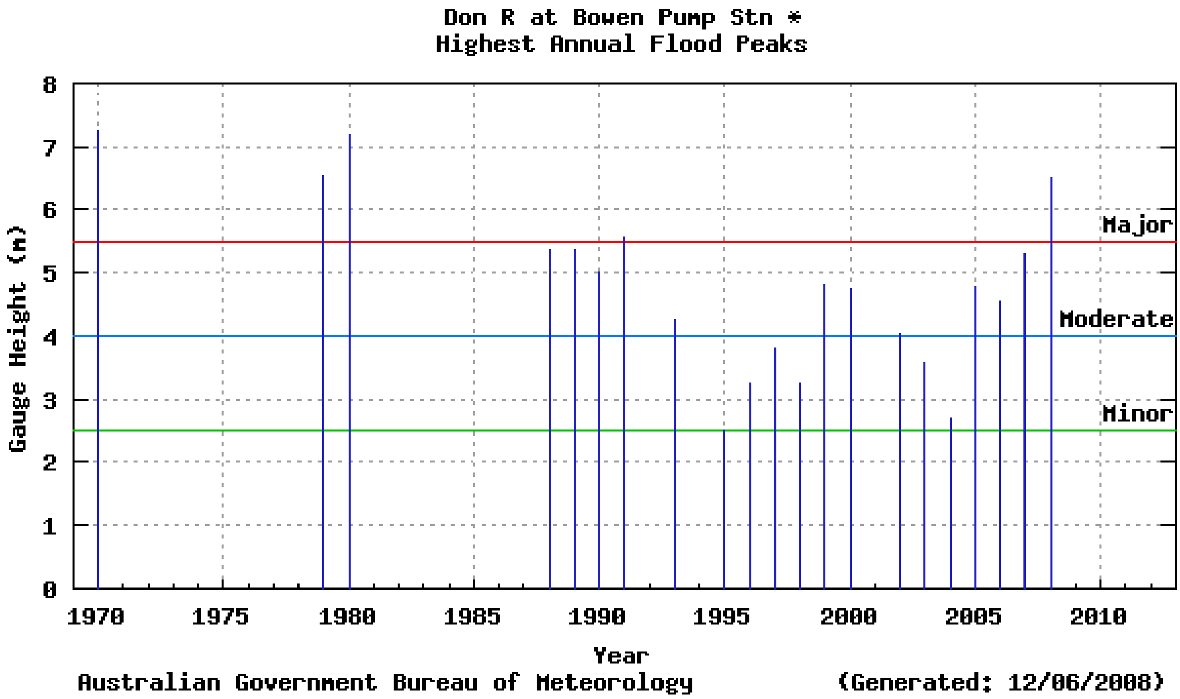
The Don River basin contains acid volcanic, acid igneous and sedimentary rocks. A contiguous Quaternary coastal plain formed from superficial sand, gravels and silt deposits backed by coastal hills and mountain ranges, extends to the northern and southern margins of the region having its broadest expression at the lower Burdekin floodplain, which extends inland almost to the base of the Leichhardt Range.

Granite basement rock outcrops form isolated coastal hills, rocky capes and off shore continental islands and have their greatest expression in the isolated massif of Mt Elliot which lies between the Ross and Haughton River catchments and at 1234 m represents the fifth highest peak in Queensland. Other coastal land forms of significance include extensive marine plains with salt pans, tidal creek channels and estuary complexes, elevated beach ridge and dune systems, beaches, sand spits, and shallow embayments with off shore continental islands including Magnetic and the Palm group having fringing reefs. The edge of the continental shelf, 80-100 km offshore, forms the foundation for the Great Barrier Reef enclosing the Great Barrier Reef lagoon which receives the discharge from the Burdekin River and the smaller coastal catchments (Burdekin Dry Tropics Board, 2005).

11.2.7 History of Flooding

Of the major tributaries and streams within the Don River Basin the Project only crosses the Elliot River. No historic flood information has been found for this river. However, the frequency of flood events in the nearby Don River suggests the occasional flood event is likely once every 20 to 30 years (refer to Figure 11-8).

Figure 11-8: Floods in the DON River (BoM)



11.2.8 Field Assessment

In the Don River basin two waterways have been assessed on site as follows:

1. Elliot River; and
2. Splitters Creek.

For field assessment locations refer to Volume 6, Appendix G2.

European land clearance has resulted in altered hydrological regimes which have had an impact on the morphological character of many of the waterways within the vicinity of the Project.

Land clearance can have impacts on catchment and waterway character and behavior. Catchment responses to land clearance include increased runoff, increased drainage density, increased erosion and sediment yields within the catchment. In response to altered hydrological regimes channel morphology changes can occur as a result of bank erosion, channel incision and floodplain scour which are generally associated with increasing stream power and sediment transport capacity.

All waterways along the Project (within the Don River basin) are considered to be relatively geomorphologically stable. Banks are stable under the current flow regimes, despite flood marks signalling high flood events. Both waterways show limited signs of degradation from cattle causing bank erosion. The assessed waterways show no or limited signs of headward erosion.

Plate 11-4: Elliot River

11.2.9 Water Use within Study Area

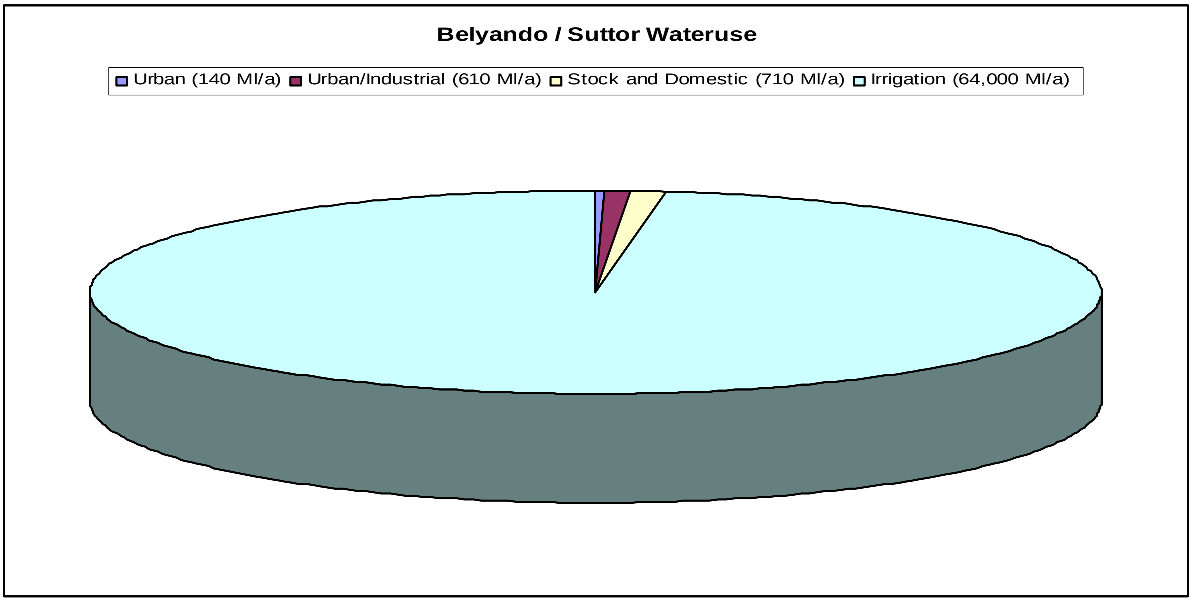
11.2.9.1 Belyando and Suttor Sub-basins

Within the Belyando and Suttor sub-basin there is no existing major water infrastructure, however, a number of private weirs, pumps and off-stream storages licensed for water-harvesting and irrigation have been constructed to take advantage of the intermittent un-supplemented supplies.

Approximately 6,400 ha is currently licensed for irrigation with about half of this in the Mistake Creek region in the Belyando and Suttor sub-basin. Licensed irrigators tend to be concentrated in areas with suitable alluvial plains adjacent to the Suttor and Belyando rivers and their tributaries. Most licenses are for stream pumps with or without off-stream storages. Only around one third of this (i.e. 21,000 Ml/y) is actually used.

Present water harvesting schemes are privately funded developments. Financial constraints within this sector may inhibit the effective utilisation of available water and land resources. Further land suitability, agro-economic assessments and water resource assessments will be necessary to define the true agricultural potential for the region (NRM, 2002). For an overview of the water users refer to Figure 11-9.

Figure 11-9: Water use with in the Belyando and Suttor sub-basin (NRM, 2002)



11.2.9.2 Bowen/Broken Sub-basin

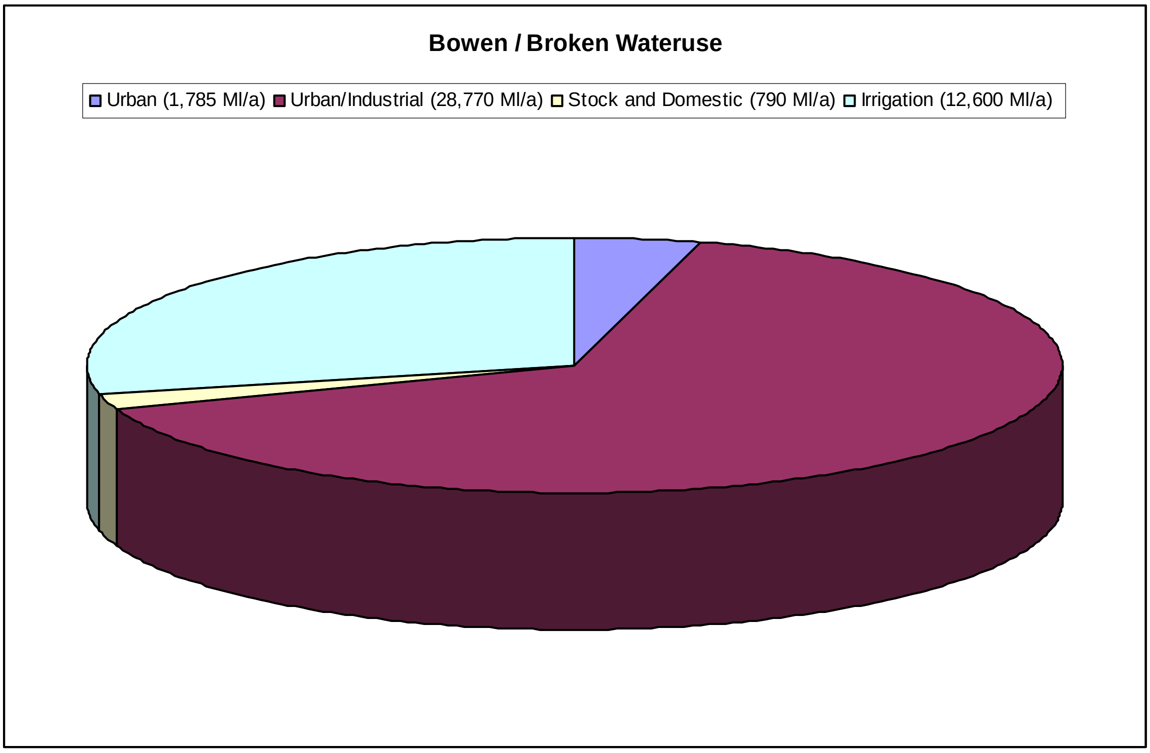
In contrast with other sub-basins, current water use within the Bowen/Broken sub-basin is dominated by industrial use, principally associated with coal mining activities. Eungella Dam supplies coal or other mining developments and associated urban infrastructure within the Bowen Basin around Moranbah and Goonyella, while Collinsville Weir supplies mining operations at Newlands and Collinsville, irrigation users and urban demand of about 1,800 ML/a.

Irrigated agriculture in the Bowen/Broken sub-basin is generally limited to riparian lands adjacent to the upper reaches of the Broken River and to a lesser extent along lower Pelican Creek, south-west of Collinsville. Currently, licensed irrigation for both supplemented and un-supplemented use is some 12,600 ML/a; however, only about 7,800 ML/a is actually used. Of 5,800 ML/a licensed for supplemented users via Collinsville Weir only 1,800 ML/a is actually used (NRM 2002 ,DNR, 1999a).

Water for coal mining developments within the Central Queensland Coal Fields is derived from a number of sources. In addition to the Eungella Dam pipelines, water to the region is sourced from the Braeside groundwater area (east of Moranbah) via the Riverside pipeline and the Bingegang Weir on the Mackenzie River via the Saraji pipeline.

Current commitments from Collinsville Weir total 15,900 ML per annum, while those from Eungella Dam total 21,600 ML per annum. Allocations from Collinsville Weir for both the Collinsville power station (2,500 ML per annum) and Xstrata's Newlands mine (3,900 ML per annum) are expected to be sufficient to cater for projected growth to 2030. Collinsville Mt Isa Mines (MIM) mine is due to close in 2015, which will release about 1,100 ML and if the Newlands mine closes it will provide an additional 3,900 ML from the system by 2020 (NRM, 2002). Figure 11-10 shows an overview of the water users.

Figure 11-10: Water use Bowen/Broken sub-basin (NRM 2002)



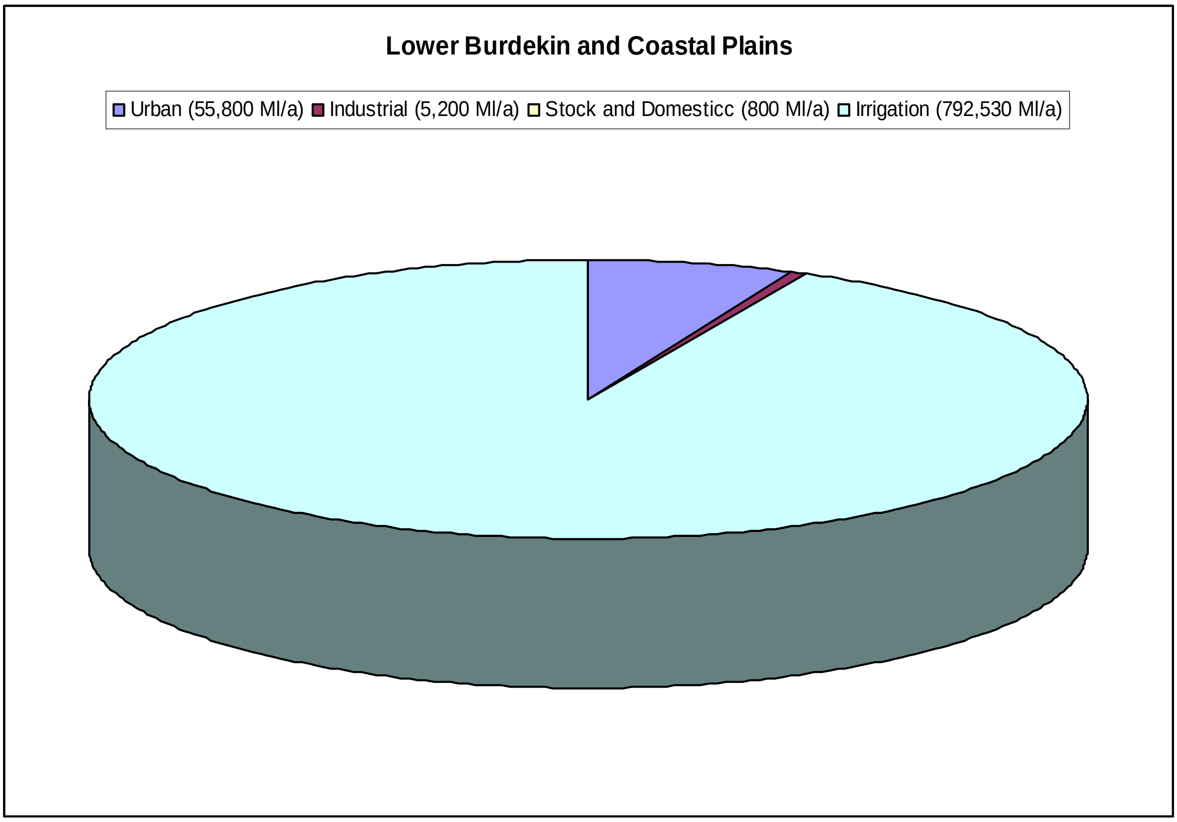
11.2.9.3 Lower Burdekin sub-basin and Don River Basin

Water use information for the individual basins of the Lower Burdekin and Don rivers has not been found. Most data sources combine the two basins in the Lower Burdekin and Coastal Plains region. The following section describes this combined region.

The construction of BFD and the subsequent development of the Burdekin-Haughton Water Supply Scheme (BHWSS) led to a significant area under irrigation in the Lower Burdekin catchment. The area is approximately 103,120 ha predominately comprising of 46,850 ha in the BHWSS and the North Burdekin Water Board and South Burdekin Water Board areas (37,200 ha). However, a significant proportion of the water from the BFD is released from Clare Weir and is directed to the North and South Burdekin water boards to supplement groundwater supplies (NRM, 2002).

There are also a number of industrial users including quarries and sugar mills (SunWater, 2010). The BFD also provides a significant amount of urban water for the population centres in the Don River Basin. The urban and industrial water use in Townsville and Thuringowa is significant. Water use in Townsville and Thuringowa is approximately 55,800 ML/a (NRM, 2002). Figure 11-11 shows an overview of the water users.

Figure 11-11: Water use within Lower Burdekin and Coastal Plains (NRM, 2002)



11.2.10 Marine Waters

The waterways of the Burdekin Basin and Don River Basin drain into the Great Barrier Reef World Heritage Area (GBRWHA) and Great Barrier Reef Marine Park (GBRMP).

The Great Barrier Reef has significant ecological, scientific and landscape values, as recognized in its World Heritage listing.

The Burdekin catchment is the largest single source of sediment to the Great Barrier Reef lagoon. Annual sediment discharge from the catchment is estimated to range between 0.2 and 20 million tonnes, with the average being 3.8 million tonnes.

Major sediment discharges are associated with extreme rainfall events during cyclones and only occur every five to ten years. Sediment plumes from such events may be dispersed as far north as Cairns (CSIRO, 2002).

11.3 Potential Impacts

11.3.1 Increased Sediment Load in Runoff

Construction phase activities include clearing of vegetation, cut and fill, construction of waterway crossings, drainage and other earth works. These activities will disturb the soil surface and increase the potential for erosion. Once soil is de-stabilised erosive processes have the potential to transport sediment to receiving waters. If a waterway is dry during construction impacts to water quality, as a result of sedimentation, may be delayed until the on-set of rainfall events, when there is sufficient water to cause erosion from disturbed banks, soil stockpiles and cleared areas.

Besides a possible mobilisation of sediment, cut and fill activities have the potential to alter the natural flow path of a waterway either temporarily or permanently. In all cases this is considered a negative impact.

Trapping and redirection of overland flow (diversion drains) may alter the functioning of downstream ecosystems. Overland flow may also transport contaminants into downstream environments. An increase in sediments and contaminants has the potential to have a negative impact on the environmental values of a waterway.

Any construction work in the waterway bed or on waterway banks is potentially a high risk activity. Works in these areas are likely to create instability and erosion which in turn leads to sedimentation. Especially significant are construction activities at waterway crossings (bridges or culverts). The construction of these has the potential to destabilise the bed and banks causing scour and erosion around the structures. Culverts have the potential to change the slope of the stream bed and can cause changes in stream flow direction and velocity, resulting in erosion upstream (local whirlpools) and downstream of culverts (increase in velocity).

All construction activities in or within the vicinity of a waterway have the potential to impact on the quality of the downstream receiving environment. An increase in the sediment load will have a negative impact on water users, for instance by causing extra maintenance work to channels and structures.

Erosion related impacts are further discussed in Volume 3, Section 5.3.3 of this EIS. Related impacts on aquatic ecosystems are discussed in Volume 3, Section 10.3.2 of this EIS.

With erosion and sediment control plans in place, this impact will be able to be managed such that impacts on environmental values are minor.

11.3.2 Stormwater Discharge and Flow Redirection

Temporary or permanent changes to the hydrology of the area surrounding the Project may impact on the quantity and quality of freshwater influx in downstream areas. Fresh water influx is important to the health of aquatic ecosystems and riparian zones and the Belyando and Suttor rivers are a major contributor to the Burdekin Falls Dam. Alteration or impediment to flow through the creation of a temporary impoundment will alter the physical dynamics of the aquatic system and will have an impact on water users (Water Supply Schemes).

The Project will not result in any major changes to topography such that downstream flows are significantly affected. Detailed design will incorporate drainage requirements where local catchments are affected; however these are expected to be minimal.

11.3.3 Other Construction Water Quality Impacts

Other impacts on construction water quality may arise from spills or leaks of fuels and oils from construction equipment, vehicles and fuel/oil storage areas.

A hazard and risk assessment has been undertaken and measures to minimize risk of spills and respond in the event that a spill occurs are discussed in Volume 3, Section 24.4.2 and 24.5 of this EIS.

With these measures in place, risk of water quality degradation from spills and leaks of fuels and oils is low.

11.3.4 Water Use

During construction water will be required for several activities, including the following:

- Water of reduced quality:
  - moisture conditioning of earthworks;
  - dust suppression; and
  - vehicle wash down.
- High quality water:
  - concrete batching; and
  - construction campsite and offices.

It has been estimated that approximately 11 x 10^9 litres will be required for construction purposes. As long as the construction water does not interfere with the natural waterways, impacts on surface water will be non existent.

During the operational phase water supply for operating the rail will be minimal. Marine Waters

Direct impacts on marine waters will not arise as a result of the Project. Indirect impacts may arise from:

- reduced freshwater flows to estuarine areas
- releases of contaminants, particularly sediments to marine waters.

The Project is not anticipated to cause any measurable changes in surface water flows. Construction water will be obtained under existing water allocations that are allowed for in the catchment Water Resource Plan/Resource Operations Plan (refer to Volume 3, Section 1.11.3.5 of this EIS).

As discussed in Section 11.3.6 , detailed design will address sizing of culverts and bridges such that flows are not impeded.

While cumulative impacts of sediment releases from the Burdekin catchment can be significant in terms of impacts on the Great Barrier Reef, with normal erosion and sediment control measures in place, and allowing that parts of the affected catchment flow into the Burdekin Falls Dam it is not expected that the Project will contribute to sediment loads to the Great Barrier Reef. This is discussed further in 11.3.1. Erosion and sediment controls are discussed in Volume 3, Section 5.3.3 of this EIS.

11.3.5 Wetlands

An assessment of Project related impacts on wetlands has been undertaken in Volume 3, Section 10.3 of this EIS. Indirect impacts may arise from:

- Changed flow regimes in wetland areas
- releases of contaminants, particularly sediments to marine waters.

As discussed in Section 11.3.6, detailed design will address sizing of culverts and bridges such that flows are not impeded.

With erosion and sediment control measures in place, it is expected that sediment releases to wetlands along the alignment can be managed. Erosion and sediment controls are discussed in Volume 3, Section 5.3.3 of this EIS.

11.3.6 Potential Hydraulic Impacts (Operating Phase)

The construction and the subsequent presence and operation of the Project are likely to impact natural stream levels (afflux[1]) and may cause local erosion (scouring). Selection of the final crossing type for waterways will need to recognize the need to protect the integrity of the watercourse.

A preliminary drainage assessment study was undertaken and included the following:

- identification and location of waterways intercepting the Project;
- establishment of local drainage catchments for each waterway intercepting the Project;
- determination of peak flood discharges at each intersection using the Rational Method; and
- hydraulic analysis of waterway crossing requirements.

It should be noted that the actual number of waterway crossings, especially culverts will be much higher than the crossings listed in Volume 6, Appendix G2. The preliminary drainage assessment only considered the major waterways. Small local drainage lines and diversion drain requirements will be identified in the detailed design phase of the Project. The actual number of culverts is at this stage expected to be in the hundreds. For a better understanding of the flows, the 50 year Average Recurrence Interval (ARI) flow rates have been calculated with the Rational Method. Results are presented within Volume 6, Appendix G1.

For the surface water drainage the following design criteria have been adopted:

- environmental culverts:
  - 600 mm diameter culvert located every 400 m where fill embankment exceeds 1.2 m high; and
  - provided to assist in maintaining sheet flow.
- minor culverts:
  - locations with flow up to 50 m^3/s;
  - designed for 1:20 year ARI Storm;
  - 300 mm freeboard to top of formation; and
  - no overtopping of rail up to 1:50 year ARI storm.
- major culverts:
  - locations with flow from 50 m^3/s to 250 m^3/s;
  - designed for 1:50 year ARI Storm;
  - 300 mm Freeboard to Top of Formation; and
  - No overtopping of rail up to 1:50 year ARI Storm + 300 mm.
- bridge structures:

[1] Afflux is defined as the change in water surface levels due to the presence of a structure as a bridge or a culvert.

  - locations with flow over 250 m3/s;
  - designed hydraulics for 1:50 year ARI Storm; and
  - 500 mm freeboard to underside of beams.
- afflux limited to ensure no damage to upstream infrastructure:
  - adopted mainline maximum allowed afflux = 1.5 m; and
  - port maximum allowed afflux = 0.15 m.

Drawings indicating the proposed bridge locations are included in Volume 6, Appendix G2. It should be noted that more detailed assessment of stream hydraulics will be carried out in the detailed design phase of the Project and this may affect the length and height of bridges.

The design of any culvert crossings will consider appropriate passage requirements, for example as set out in Fish Habitat Management Operational Policy FHMOP 008 (DEEI 2009) and Fish habitat Guideline 006 Fisheries Guidelines for Fish-Friendly Structures (DEEDI 2006).

11.3.7 Other Operation Water Quality Impacts

The use of low residual chemicals (glycophosphate based) for weed and vermin control may impact on surface water. Impacts arising from these chemicals are expected to be minimal due to short half life of residuals, and the small quantities that would be used.

Water quality impacts may arise from spills or leaks of fuels and oils from locomotives and maintenance equipment, vehicles and fuel/oil storage areas.

A hazard and risk assessment has been undertaken and measures to minimize risk of spills and respond in the event that a spill occurs are discussed in Volume 3, Section 24.4.2 and 24.5 of this EIS. With these measures in place, risk of water quality degradation from spills and leaks of fuels and oils is low.

Spills of coal from trains may enter watercourses if these occur at or near stream crossings. Coal itself is of low toxicity in the aquatic environment, but can cause smothering and reduced light penetration which can affect aquatic ecosystems.

Sediment releases from unsealed access roads and areas along the alignment where rehabilitation has not been successful will contribute to sediment loads in waterways. This may bee exacerbated around stream crossings if the stream bed and banks have not been fully stabilized after construction.

This impact can be minimized by drainage design along any access tracks as well as routine inspection of the alignment for erosion and prompt repairs to areas where erosion is occurring.

11.4 Mitigation Measures

Mitigation measures to protect environmental values from degradation for the design, construction and operation phase of the Project are set out in Table 11-4, Table 11-5 and Table 11-6.

Table 11-4: Design phase mitigation measures

Potential Impact	Mitigation Measure
Hydraulic impacts.	• undertake detailed hydraulic modelling at the design stage to minimise the effects of increased flood heights and local flow velocity as the result of new bridges and culverts. • analyse scour potential at stream crossings and incorporate appropriate measures to stabilise bed and banks of streams into designs
Stormwater discharge and flow redirection.	• design earthworks to minimise changes in drainage paths

Table 11-5: Construction phase mitigation measures

Potential Impact	Mitigation Measure
Increase in sediment loads.	• develop and implement an erosion and sediment control plan as described in Volume 3, Section 5.3.5 of this EIS. • conduct ongoing maintenance of erosion and sediment control measures • retain erosion and sediment controls until reinstatement success criteria have been achieved • where practicable undertake major earthworks during the dry season; • isolate and remediate existing erosion areas in the immediate vicinity of the construction works to prevent further damage; • where possible use existing (access) tracks to avoid new ground and soil instability problems; • stabilise and rehabilitate completed areas as soon as possible; • stabilise bed and banks of streams as immediately after construction • as far as possible construct stream crossings in the dry season • restore drainage patterns as closely as possible post construction.
Stormwater discharge and flow redirection.	• minimise any filling, draining, damming or alteration of waterways
Construction water use.	• obtain construction water from existing allocations where possible.

Table 11-6: Operation phase mitigation measures

Potential Impact	Mitigation Measure
Hydraulic impacts.	• undertake detailed hydraulic modelling at the design stage to minimise the effects of increased flood heights and local flow velocity as the result of new bridges and culverts.
Water quality	• minimise use of pesticides and use only pesticides with low residual impacts • monitor the alignment, and particularly stream crossings and drainage lines for erosion and repair any eroded areas promptly. Undertake drainage modifications if required to prevent recurrence • clean up any coal spills immediately

With these measures in place, it is expected that all Project related impacts on surface water resources can be avoided or managed such that there will not be any degradation of environmental values associated with water resources.

11.5 Conclusions

The majority of the Project is located within approximately 130,000 km^2 Burdekin Basin catchment. The northern part of the Project is located within the smaller Don River catchment that spans over 3,885 km^2 of land. The Burdekin Basin catchment is divided into six sub-catchments or sub-basins, of which the Project crosses the following three sub-basins:

- Belyando Suttor sub-basin;
- Bowen Broken sub-basin; and
- Lower Burdekin sub-basin.

The following potential impacts to surface water were identified for the construction and operation phases of the Project:

- increased sediment load in runoff;
- stormwater discharge and flow redirection;
- construction water use; and
- hydraulic impacts.

With design, construction and operation measures in place, impacts on water resources are not expected.