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7.1 INTRODUCTION

This chapter provides an assessment of freshwater aquatic ecology at the project mine site. In doing so it describes the existing aquatic flora and fauna and the relevant habitats across the site. This report identifies the potential for the Project to impact on existing aquatic flora and fauna in areas directly within or adjacent to the infrastructure footprint. The scope of the study included:

- a literature review and desktop assessment of publicly available databases, research publications and grey literature relevant to aquatic flora and fauna in the study area; and
- undertake field investigations of the aquatic flora and fauna and associated habitat within the project area.

7.2 LEGISLATIVE AND PLANNING FRAMEWORK

Volume 1, Chapter 2 of this Environmental Impact Statement (EIS) provides a comprehensive review of legislation applicable to the China First Project. Of particular relevance to Aquatic Ecology are the following sections of Volume 1, Chapter 2:

- s2.2.1.2 *Environment Protection and Biodiversity Conservation Act 1999*;
- s2.2.2.7 *Fisheries Act 1994* and *Fisheries Regulation 2008*;
- s2.2.2.10 *Nature Conservation Act 1992*; and
- s2.2.2.16 *Water Act 2000*.

The mine study area is not located within a declared Wild Rivers area.

7.3 ASSESSMENT METHODS

7.3.1 DESKTOP ASSESSMENT

Desktop assessments were conducted prior to the commencement of the field survey to document the existing environment of the study area and to identify any listed species of flora and fauna or other matters of Commonwealth or Queensland significance that may be associated with aquatic ecosystems in the project area. The assessments undertook searches of the following databases and literature sources:

- DSEWPC Protected Matters Search Tool to identify species listed under the Commonwealth EPBC Act that are predicted to occur within the study area;
- Commonwealth Government's ERT Database to obtain additional information on aquatic species of threatened status and invasive species of national significance associated with aquatic ecosystems predicted to occur within the study area;
- DSEWPC's on-line Australian Wetland Database for Wetlands that are listed Ramsar sites or listed in the Directory of Important Wetlands In Australia (DIWA);
- DERM Wildlife Online database to identify aquatic flora and fauna species including threatened species listed under the NC Act that have been historically recorded in the study area;
- DERM RE and Essential Habitat Mapping (Version 5.0, 2005) protected under the VM Act to determine the type and extent of remnant riparian and wetland vegetation as well as such areas recognised as essential habitat within the study area;
- DERM's on-line Moratorium mapping facility to determine if any areas within the study area contained regrowth riparian and / or wetland vegetation protected under the *Vegetation Management (Regrowth Clearing Moratorium) Act 2009*;
- DERM Queensland Wetland Program Wetland Mapping and Classification base mapping (1:100,000);
- DERM Wetland Info "Wetland Summary Information" (including listed plant and animal species) for river Basins (Burdekin and Don);
- DERM Wetland Info "Legislation and Planning Maps" specifically for referable wetlands identified on the map as Great Barrier Reef (GBR) Wetland Protection Areas (WPA) and Wetland Management Areas (WMA);
- DEEDI Declared Fish Habitat area plans;
- Alluvium Consulting. 2007. Burdekin Dry Tropics NRM Region Fish Passage Study, Report to Burdekin Dry Tropics NRM;
- Australian Centre for Tropical Freshwater Research (1999) "Environmental Study of a Proposed Dam at Mt. Douglas on the Belyando River", ACTFR unpublished Report 99/28 prepared for the Queensland Department of Natural Resources;
- Burrows, D., Davis, A., and Knott, M., (2009) "Survey of the Freshwater Fishes of the Belyando Suttor System, Burdekin Catchment, Queensland" Australian Centre for Tropical Freshwater Research, James Cook University, Townsville, unpublished Report 09/08 prepared for the North Queensland Dry Tropics NRM Board;

- Carter, J. and Tait, J. 2008. “Freshwater Fishes of the Burdekin Dry Tropics NRM Region”, Burdekin Dry Tropics and Alluvium Consulting, Townsville;
- Consortium of National Centre for Tropical Wetland Research and Centre for Riverine Landscapes web based Freshwater Fish Atlas of Northern Australia outputs for Burdekin and Don River Basins; and
- North Queensland Bulk Ports (2009) Terrestrial and Aquatic Ecological Assessment, Report for Proposed Abbot Point Multi Cargo Facility. Unpublished report prepared for North Queensland Bulk Ports Corporation Limited.
- A review was undertaken of the Temporary Planning Policy: Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments. The review assessed the existence of any wetlands mapped as being of high ecological significance occurring in close proximity to both the mine and rail alignment. The assessment interpreted the terrestrial vegetation mapping for wetland associated RE’s to identify wetlands that may be impacted by the project.

7.3.2 FIELD SURVEYS

Field surveys and sampling were conducted to identify aquatic species and communities within the project area, fill information gaps in areas poorly served by available survey data and to verify the likelihood of the occurrence of EPBC Act and NC Act listed species identified via desktop searches as having the potential to occur within the study area. Verification was based on direct observation of flora, fauna, REs present or suitable habitat.

The primary aquatic ecological survey was conducted during the post wet season (May 2010) which provided optimum timing in terms on vehicular access, fauna activity, flora inflorescence and persistence of seasonal stream and water bodies.

7.3.2.1 Selection of Sites

Most of the project area is remote, poorly served by road networks, under freehold or leasehold land tenure and includes floodplain and hilly dissected terrain inaccessible even by 4wd vehicle. The aquatic flora and fauna survey was dependent upon vehicle based mobilisation of survey equipment and this restricted the selection of survey sites to areas accessible by the available road and track network and subject to landholder permission. Rapid Aquatic Habitat Assessment were carried out at nine sites within and directly adjacent to the study area, and one more detailed aquatic habitat assessment was undertaken at site AQ14. The location of the aquatic sampling sites relative to the mine site is shown in Figure 1.

7.3.2.2 Aquatic Habitat

The aquatic habitat sites were assessed using the Australian River Assessment System (AusRivAS) rapid assessment technique developed under the National River Health Program by the Commonwealth Government in 1994. This technique broadly defines stream morphology; available aquatic habitats, vegetation and observed land use impacts. Stream morphology provides information such as flow characteristics, bed morphology, bed substrate, bed width and any seasonal variations.

Description of survey site habitats included aquatic physical and biotic features and adjoining riparian vegetation communities. These were derived from wetland associated RE mapping, application of State of the Rivers (Anderson 1993a and 1993b) reporting pro-forma protocols and additional qualitative description of observed habitat features. This information was stored on a Trimble Data Logger. Qualitative habitat descriptions were structured by a consistent set of descriptors across all sites including geomorphic setting, riparian vegetation structure and dominant overstorey, emergent and submergent plant species, available aquatic habitats, substrate type, hydrological regime, weeds and other disturbance factors and observed water clarity.

7.3.2.2.1 Aquatic Habitat Types

Aquatic ecosystems within the study area can be divided into four broad habitat types; estuarine, lacustrine, palustrine and riverine.

Estuarine habitats occur where freshwater from riverine habitats mixes with oceanic waters to produce a brackish environment. Estuarine habitats within the study area include saltwater wetlands (including mudflats and samphire wetlands) and adjacent tidal creeks. These habitats are located in coastal regions such as Abbot Point and therefore will not be affected by works associated with the mine.

Lacustrine habitats are open water bodies such as lakes and artificial dams. These habitats are generally deep and still or slow-flowing and are often utilised by fauna species during the dry season as a refuge when other water sources have dried up.

Palustrine habitats are primarily off-stream habitats such as wetlands, gilgais and billabongs that generally support a high abundance of emergent vegetation. Palustrine habitats are inundated during the wet season and gradually dry out as rainfall declines and water levels in the main river channel subside (depending on specific site conditions these habitats may or may not completely dry out). Due to their shallow depth and still water conditions, palustrine habitats can support a high diversity of in-stream habitat in form of detritus, fallen branches and logs.

Riverine habitats include all aquatic habitat types that occur within a channel (i.e. rivers and creeks) and may be periodically or permanently inundated by flowing water. This is the predominant habitat type within the study area.

Where relevant these areas have been identified through regional mapping tools and referred to during site assessment.

7.3.2.3 Water Quality

Water quality samples were not taken as part of this work. The water quality of the project area was assessed and is described in Volume 2, Chapter 9. A total of nine sites in the vicinity of the mine site had physical and chemical properties analysed for both wet and dry seasons. Aquatic sampling sites were selected to be as close as possible to water quality sites; however, as a result of needing to use a motor vehicle to access the sites selected for aquatic ecology sampling exact replication of sites was not possible (a helicopter was used for surface water sampling).

7.3.2.4 Aquatic Flora

Aquatic macrophytes observed at each sites including emergent, submergent and floating forms were described as part of site habitat descriptions. The relative abundance, growth habit and preferred habitat of observed macrophytes were recorded. Plants were identified to species levels by reference to field guides (Sainty and Jacobs 2003, Stephens and Dowling 2003, Cowie, *et al.*, 2000), photographed and checked against lists of listed species known or predicted to occur in the project area.

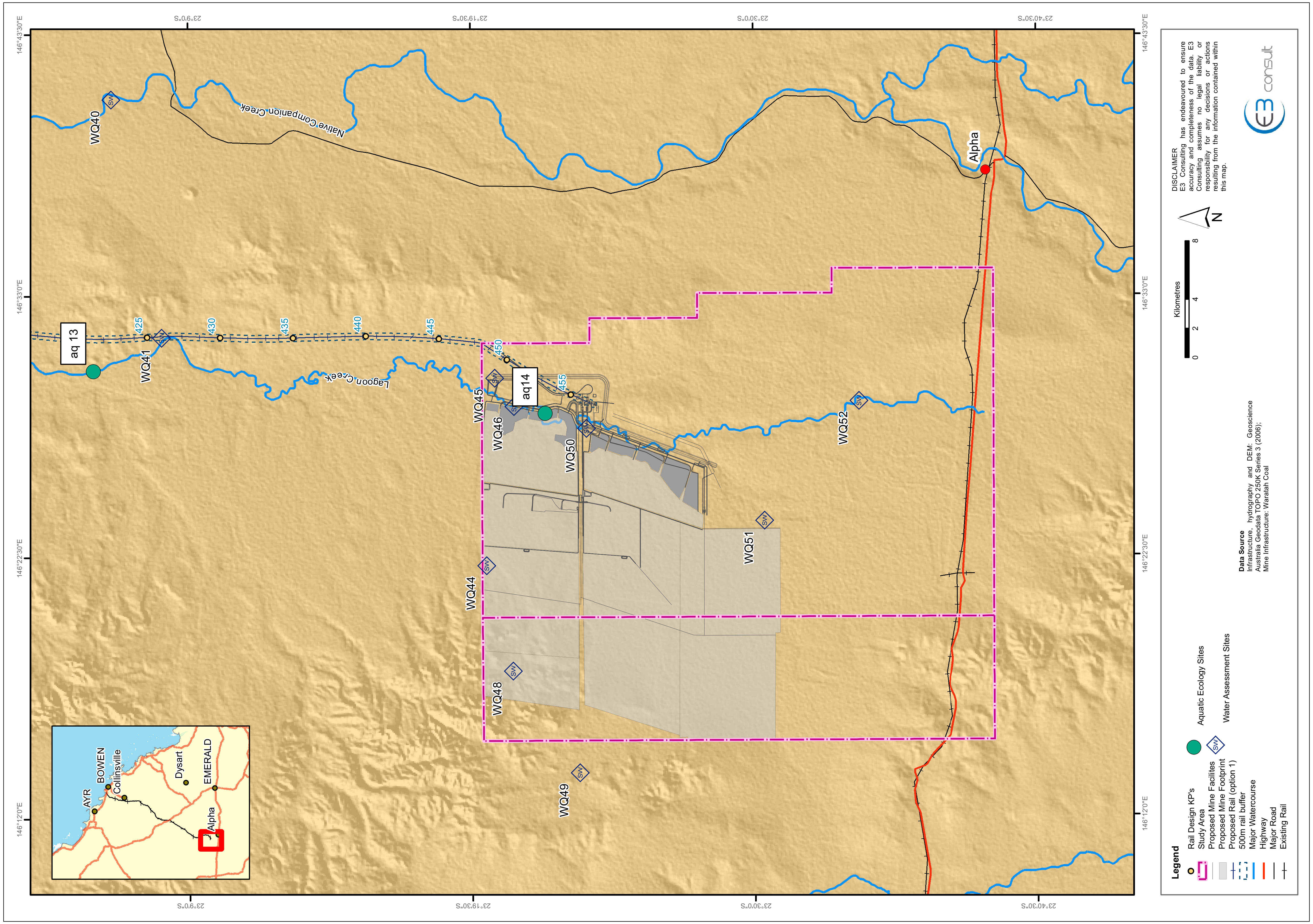
7.3.2.5 Aquatic Macro Invertebrate Communities

The streambeds consist primarily of gravel, leaf litter, macropyhtes, sand and stones. Samples of invertebrates were taken from all habitats including riffles, runs and pool using a 250 mm dip net. Three replicate samples were taken by placing the net immediately below a sampled area and allowing the water flow to transport the sample into the net. Fist-sized stones (Phi Scale -7) were sampled by lifting the stone from the substrate, taking care not to include any accumulation of organic material underneath the stone and placing it in the net; a spray bottle was then used to remove the invertebrates from the stone. Kick samples were taken from the surface of sandy substrates by placing the net downstream of the sampler and disturbing a 10 x 10 cm^2 section of the substrate, and then moving the net through the disturbed substrate to collect the disturbed invertebrates. Leaf litter was collected by placing the net immediately downstream of the leaf litter pack, and picking up a 10 x 10 cm^2 section of leaf litter and placing it into the net. All invertebrate samples (n = 36) were preserved in 70% ethanol and returned to the laboratory for processing. Macro invertebrates were screened through a 2 mm, 1 mm, 300 µm and 180 µm sieve and sorted based on the location within each sieve. Macro invertebrates were counted and identified under a stereo dissecting microscope. All taxa were identified using published keys (e.g. Williams, 1980) and reference collections obtained from the University of Queensland library and those held by staff at E3. Where the number of individuals of a family in a sample / sieve equaled greater than 50, the count was stopped for that particular family.

Stream Invertebrate Grade Number – Average Level (SIGNAL) scores were also calculated for all of the sites sampled using the order – class – phylum methodology outlined in Chessman (2003). SIGNAL scores provide an indication of waterway health with higher scores generally associated with healthier waterway ecosystems. The calculated SIGNAL scores were then compared to Gooderum and Tsyrlin (2002) to identify the relative health of the sampled stream. Signal scores were split into the following categories:

- greater than 6 – healthy habitat;
- between 5 and 6 – mild pollution;
- between 4 and 6 – moderate pollution; and
- less than 4 – severe pollution.

Figure 1. Aquatic Ecology Sample Sites



7.3.2.6 Fish and Macro Crustacea Communities

Fish and macro crustacea sampling was conducted using a site applicable subset of standardised quantitative and qualitative sampling methods. These methods included:

- gill netting;
- fyke netting;
- electrofishing;
- baited box traps;
- drag seine netting; and
- visual observation / spotlighting.

Fish and macro crustacea samples obtained by each method were identified to species level and counted in the field and released where possible. Where species identification was not possible, representative specimens were preserved and shipped to Brisbane for formal identification by the Queensland Museum. Up to 20 randomly selected specimens of each species from each sampling device were measured for length frequency data in the following manner: Fish fork length to the nearest mm; prawn postorbital carapace length, to the nearest 0.1 mm; and crab carapace width to the nearest 0.1 mm. Once 20 individuals had been measured, they were only counted for overall catch data.

7.3.2.7 Turtle Communities

During the field based aquatic surveys, the available in-stream habitat including edge, bank, macrophyte beds and riparian habitat at each site was thoroughly inspected for the presence of turtles, their nests or pathways. Opportunistic sampling was undertaken and a number of individuals were caught, identified and measured. Turtles were identified through keys prepared by Cann (1998).

7.3.2.8 Artesian Spring Communities – Stygofauna

Stygofauna sampling was undertaken at 12 sites over the mine area during groundwater sampling. These samples were for the assessment of any stygofauna that may exist within the subterranean aquifers. The samples were collected following best practice guidelines published by the Western Australian Environmental Protection Authority – *Guidance for the Assessment of Environmental Factors No. 54* (December 2003) and *No. 54a* (August 2007).

7.3.2.9 Other Aquatic Vertebrates

During the aquatic surveys, the available in-stream habitat including edge, bank, macrophyte beds and riparian habitat at each site was thoroughly inspected for the presence of other vertebrate fauna. Opportunistic sampling was undertaken and data collected. No dedicated trapping effort was undertaken at any of the sites for amphibians and / or avian fauna utilising these habitats.

7.3.2.10 Rapid Aquatic Ecology Habitat Assessment Sites

Visual observations of aquatic ecological habitats were undertaken as part of the water quality sampling using the AusRivas methodology to assess these habitats at waterways throughout the study area. Characteristics noted on site including stream morphology, dominant substrate type, flow regimes, vegetation structure and stream cover. A total of nine sites were observed at the mine site.

7.4 EXISTING ENVIRONMENT

The mine site is located within the Belyando Catchment, a sub-catchment of the Burdekin River. The Belyando Catchment encompasses an area of approximately 73,000 km^2 and is the largest sub-catchment of the Burdekin River Basin, comprising almost 60 % of the total area. Some of the major tributaries of the Belyando River include Mistake, Sandy and Native Companion Creeks.

The Belyando Catchment within the mine area is described with reference to the topography, land use, location of the sites sampled, aquatic habitat, protected species, wetlands, remnant vegetation, aquatic flora (algae and macrophytes), macro invertebrates, macro crustacean and fish, turtles and other vertebrate communities observed within the catchment.

7.4.1 CATCHMENT DESCRIPTION

7.4.1.1 Topography

The Belyando Catchment is predominately low relief floodplain with wide braided channels and alluvial plains. The Belyando River flows in a northerly direction and joins the Suttor River in its lower reaches. It is bounded by the Great Dividing Range in the west of Denham and Drummond Ranges to the east. General topography within the Belyando catchment differs from other sub-catchments in the Burdekin Basin, lacking high mountain conditions with a drier, typically semi-arid landscape (ANRA 2002).

The section of the catchment covering the mine is predominantly gently undulating plains with strongly undulating to hilly land in the north-east corner of the Exploration Permit Coal (EPC) 1040. Surface geology at the mine is dominated by unconsolidated Cainozoic sediments including sands, silts and clay, with thickness of up to 90 m in the eastern and central sections. Soils at the mine are structureless and are mostly well drained permeable soils. The soils have low fertility and land use is limited to grazing and native pastures. Grazing lands are susceptible to surface soil degradation such as hard setting and crusting even when grazing intensity is low (see Volume 2, Chapter 3).

7.4.1.2 Land Use

The Belyando catchment is predominantly agricultural land with cattle grazing on natural vegetation. Cropping and / or horticulture are not undertaken within the EPC. The vegetation within the mine open cut footprint is generally characterised as being in a degraded condition having been cleared and blade ploughed for grazing land.

7.4.2 AQUATIC HABITAT

The streams within the catchment are generally small with widths of less than five m except at major river systems and flood plain channels. These larger streams also have larger riparian areas which are up to 20 m wide and sparsely populated with mature eucalypts. The riparian areas at all sites sampled were in good condition with few obvious signs of anthropogenic impact outside of clearing for agriculture.

One site, AQ14 was sampled for comprehensive assessment of aquatic habitat, however, this site was dry at the time of sampling and therefore, no aquatic habitat remained. The site surveyed is a six m wide sand bed dominated stream channel. Riparian overstorey vegetation is dominated by woodland consisting of isolated river red gum (*Eucalyptus camaldulensis*) with an ecotone comprised of Australian blue cypress (*Callitris intratropica*). The channel is occluded with sand beds with a few emergent macrophyte species recorded on clayey channel margins. Dense stands of riparian grasses including black speargrass (*Heteropogon contortus*) and kangaroo grass (*Themeda australis*) were observed on the channel levees. No weeds were recorded and no significant erosion of channel banks was observed.

Habitat features present indicate that the seasonal aquatic habitats including shallow riffles, runs and pools, sand beds, undercut banks, root masses, leaf litter piles, clay banks and large woody debris. The substrate was dominated by coarse sand, though the channel margins were clayey. The hydrological regime of the site is highly seasonal. For example, only 40 days prior to the sampling, the stream had good flow. A detailed description of the sites including photos has been provided in the technical report (Volume 5, Appendix 13).

It is anticipated that site AQ14 (located on Lagoon Creek) would have the same diversity of site AQ13 (see Figure 1), which is located on Sandy Creek, around 30 km north of the AQ14. Sandy Creek links directly with Lagoon Creek. See Volume 3, Chapter 7 for a description of the values at site AQ13.

7.4.2.1 Rapid Aquatic Habitat Assessment

Rapid habitat assessments were carried out at nine sites (WQ44 – WQ52) within the proposed mining lease boundary during the water quality monitoring program. The assessments identified riparian areas in the catchment as generally consisting of a layer of mature Eucalypts including ironbark and other eucalypts species, one or two trees thick directly on the banks of the streams surrounded by a layer of saplings and shrubs before the landscape opens up into grazing paddocks. The majority of sites had highly disturbed vegetation and accordingly, trees less that 10 m and grass were the dominant vegetation.

Aquatic habitat at the sites generally had low complexity and was predominantly pooled water with a sandy substrate. An assessment for each site including photos has been provided in the technical report (Volume 5, Appendix 13).

7.4.3 WETLANDS

Wetlands were identified by RE type as defined by Sattler and Williams (1999) and mapped by Neldner et al (2005). AQ14 is not mapped as having any Wetland RE due to its small size. However, on the basis of data gathered during the site assessmenet,it has community affinities with RE10.3.13 (Fringing Wetland) which include silver-crowned paperbark (*Melaleuca fluviatilis*) and

/ or white paperbark (*M. leucadendra*) and / or river red gum open-woodland and woodland that occurs mostly as narrow bands along channels and on levees with sandy to clayey soils along larger watercourses. There are RE 10.3.13 wetland areas within the mine site that are classified as Great Barrier Reef (GBR) Wetland management Areas (WMA) and Wetland Protection Areas (WPA) which are also surrounded by a 100 m WMA and WPA trigger areas. Under the VM Act, the site is listed as being of Least Concern and has a Biodiversity status listed as Of Concern. However, as the site is extremely seasonal, it would not be classed as a wetland RE by Queensland Wetland Inventory methods. Local wetland mapping is shown in Figure 2 and Figure 3.

7.4.4 REMNANT VEGETATION

AQ14 has a narrow corridor of remnant riparian vegetation surrounded by an extensively cleared landscape. There is some remnant vegetation although this has been subject to clearing in the past. The riparian zone would be no more than 5 m wide. Regional ecosystem mapping is shown in Figure 4 and is discussed in detail in the Terrestrial Ecology Chapter (Volume 2, Chapter 6).

7.4.5 AQUATIC FLORA

The site had no aquatic habitat at the time of sampling, although it is anticipated that when it is inundated, it would have similar flora to that contained in other upland streams in the Belyando Catchment, including aquatic grasses such as mud grass (*Pseudoraphis spinescens*) and sedges including variable flatsedge (*Cyperus difformis*), tall flat-sedge (*C. exaltatus*), bunchy sedge (*C. polystachyos*) and vicks plant (*Limnophila fragrans*).

7.4.6 AQUATIC MACRO INVERTEBRATE COMMUNITIES

The site had no aquatic habitat at the time of sampling, although it is anticipated that at the time when inundated, it would have similar macro invertebrate communities as that observed at other sites within the Belyando Catchment. At the other four sites within this catchments a total of 25 families of macro invertebrates were captured including a high abundance of (*Chironomidae*) and (*Ephemeroptera*) (refer to Volume 3, Chapter 7 for a detailed discussion on aquatic habitats at sites within the Belyando Catchment).

7.4.7 MACRO CRUSTACEA COMMUNITIES

The site had no aquatic habitat at the time of sampling, although it is anticipated that at the time when inundated, it would have similar communities as that observed at other sites within the Belyando Catchment where four species of macro crustacea were observed across the catchment including Australian river prawn (*Macrobrachium australiense*) which was observed at all sites with other species including redclaw (*Cherax quadricarinatus*), freshwater crab (*Austrothelphusa transversa*) and shrimp (*Caridina sp.*).

7.4.8 FISH COMMUNITIES

The site had no aquatic habitat at the time of sampling, although it is anticipated that at the time when inundated, it would have similar fish communities as that observed at other streams sampled within the Belyando Catchment had good fish diversity with the most abundant species caught being Hyrtl's tandan (*Neosilurus hyrtlii*), eastern rainbow fish (*Melanotaenia splendida*), spangled perch (*Leiopotherapon unicolor*) and sleepy cod (*Oxyeleotris lineolata*).

7.4.9 TURTLE COMMUNITIES

No turtles were observed at the site.

7.4.10 ARTESIAN SPRING COMMUNITIES – STYGOFAUNA

No stygofauna were observed in any of the 12 samples.

Figure 2. GBR Referrable Wetlands

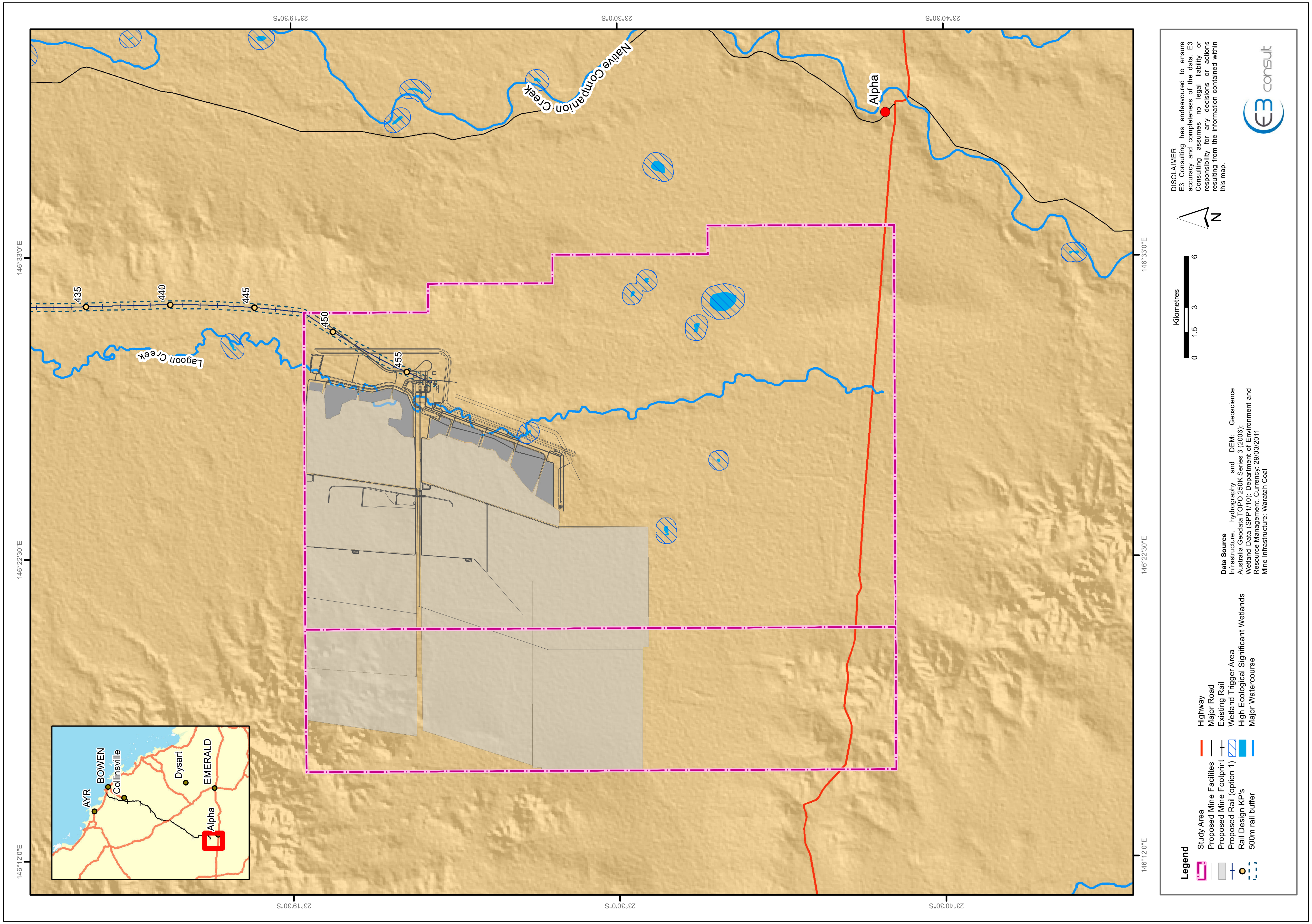


Figure 3. Wetland Associated REs

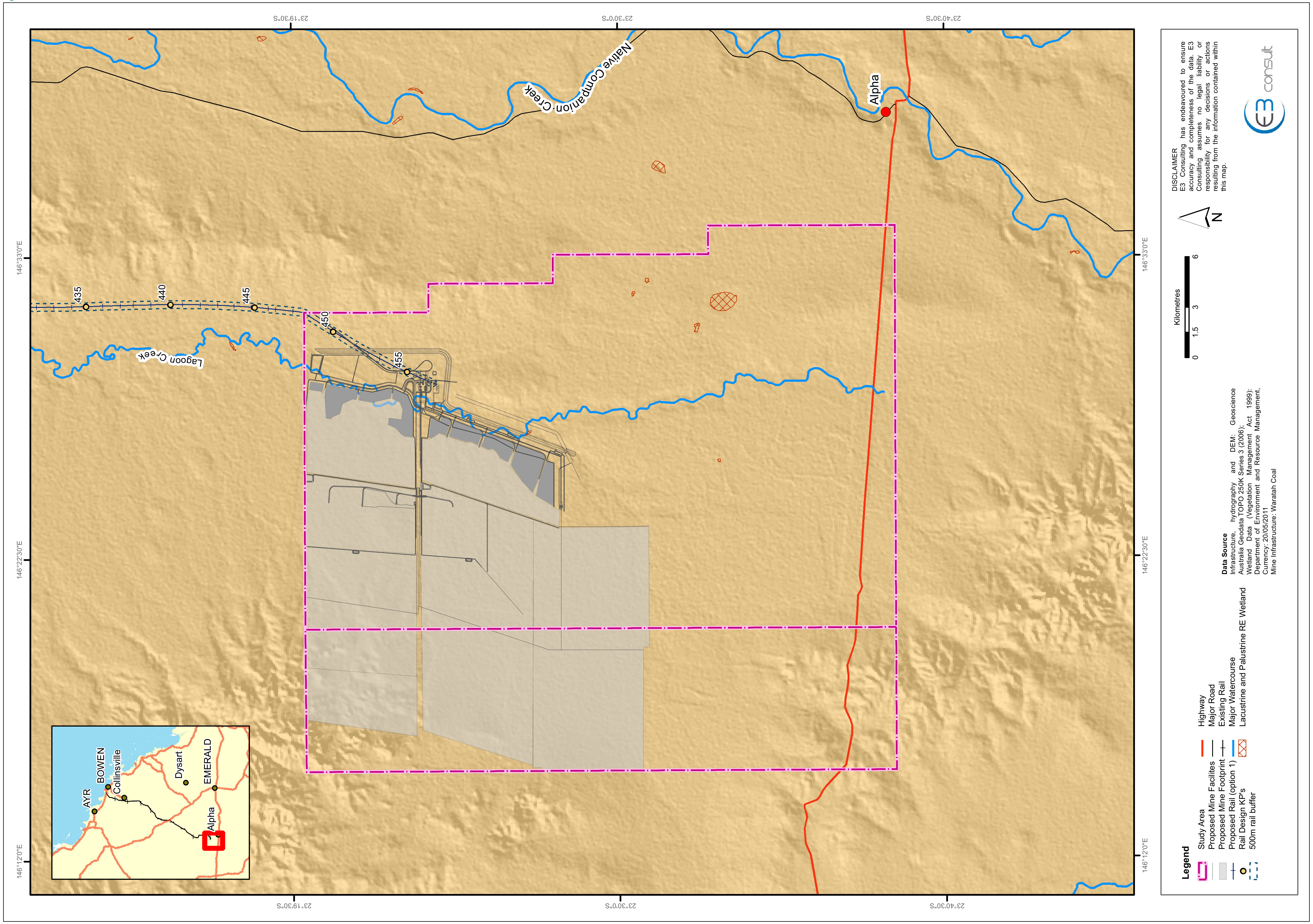
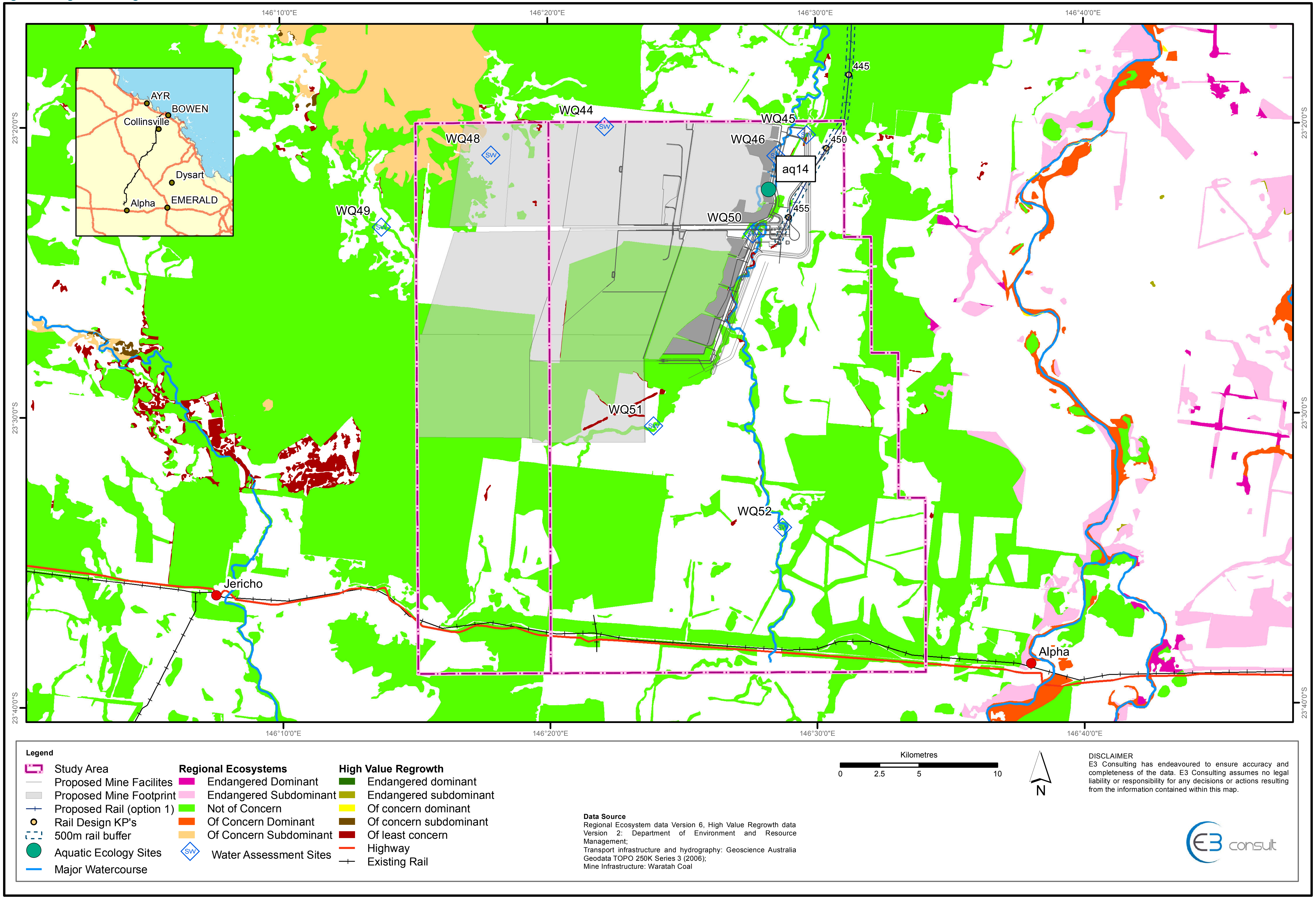


Figure 4. High Value Regrowth and Remnant REs



7.5 POTENTIAL IMPACTS

Construction and ongoing operation of the mine has the potential to impact on streams in the region. The activities with the highest risk of causing impacts to aquatic ecosystems include:

- the clearing of vegetation and topsoils from work sites and stockpiling of overburden on site resulting in sediment movement though overland flow;
- the storage of chemicals on site (e.g. hydrocarbons, detergents, degreasers, etc) during construction and operations and the movement of these to streams;
- the storage, seepage and overtopping of potentially contaminated water such as tailings water or pit process water in dams and basins at the mine site;
- the construction and operation of underground mines which may result in subsidence impacting drainage in the immediate area;
- the construction of two diversions to divert Tallarenha Creek from the open cut mine areas;
- proposed damming of Tallarenha Creek approximately six km south of the mine industrial area at the confluence of Beta Creek and Tallarenha Creek (for a catchment area of 866 km^2) (See Volume 2, Chapter 9.)

7.5.1 CLEARING AND STOCKPILES

The clearing of vegetation and construction of mine infrastructure (open cut areas, dams, supporting infrastructure, etc) has the potential to increase sediment deposition in streams offsite and therefore reduce the quality and availability of aquatic ecosystems. Overburden dumps have the highest potential to impact surrounding streams in the event of large storm events prior to full rehabilitation. Potential impacts include:

- siltation of watercourses and aquatic habitat;
- irregular and unstable land forms due to gully, channel and bank erosion;
- adverse ecological effects from de-silting streams;
- reduced ecology and aesthetic value of streams and riparian vegetation;
- increased turbidity in the streams;
- clogged drainage infrastructure and increased localised flooding;
- silting and bank damage to trench works and drainage structures; and
- increased downtime during construction after storm events while these areas are rehabilitated.

7.5.2 CHEMICAL AND WATER STORAGE

Inappropriately stored and handled chemicals and other hazardous substances have the potential to impact aquatic ecosystems in and around the mine site during construction and operations. Chemical spills or low-level exposure of the aquatic environment to chemicals (e.g. run-off from machinery, including potential vehicle accidents) would most likely involve hydrocarbon products such as fuels and lubricants. Fuels and chemicals will be stored, transported, handled and used in accordance with relevant legislation, regulations, standards and guidelines. As such, the risk of spillage would be low.

7.5.3 UNDERGROUND MINES

The construction and ongoing operations of the underground mines have the potential to cause subsidence directly above the mining areas. Potential impacts would include changed drainage due to ground depressions which may have an effect on the existing hydraulics of surface waters near the mine and thus the aquatic ecosystems. This may also result in the creation of low lying relief areas where water pooling occurs, potentially providing breeding habitat for mosquitoes.

Drawdown from the extraction of ground water from the underground mines may also impact on recharge of the wetlands above and in areas surrounding the mine site. There are very few wetlands within the vicinity of the mine and those that do exist are generally ephemeral therefore are naturally dry during winter months. However; wetlands that currently retain some water and act as refugia during the dry season may be affected by drawdown.

7.5.4 DIVERSIONS

The diversion of Tallarenha Creek would impact on drainage in the region with higher flows caused by the diversion potentially impacting on hydrology and increasing flooding risk of the creeks downstream of the diversions thus reducing the quality and availability of aquatic ecosystems. Potential impacts to hydrology are addressed in the flooding technical report; however, increased flows have the potential to have a number of downstream impacts including:

- erosion and sedimentation within the diverted creeks if opened before vegetation is established and stabilised;
- increase in water velocity in the diverted creek, with the potential for scour erosion if not managed correctly; and
- increased upstream and downstream flood levels due to increased flow rates. Existing and planned infrastructure such as roads and rail will need to undergo design reviews to ensure they will not be affected by flooding.

7.5.5 DAMMING

The proposed dam at the confluence of Tallarehna Creek and Beta Creek will modify the aquatic habitat from a predominantly riverine habitat to lacustrine habitat, with a follow on shifts in resident species. The hydrological impacts of this are dealt with in Volume 2, Chapter 9. This habitat may be used as a refuge during the dry season when other water sources have dried up.

7.6 MITIGATION AND MANAGEMENT

A mine specific EMPs will be developed for the construction and operational phases of the mine. Management measures addressing aquatic ecology issues will include:

- avoid disturbing broad diverse riparian vegetation assemblages, high value habitat nodes and corridors in highly fragmented landscapes to remove linkages across semi contiguous and contiguous corridors through placement of site infrastructure;
- commit to best practice maintenance of fish passage via appropriate structures (Cotterell, 1998) – section 76G of the *Fisheries Act 1994* requires that new waterway barriers must adequately provide for fish passage;
- develop of ESCPs for the mine detailing control measures to be implemented, construction details, dimensions, materials used, expected outcomes and staging of erosion and sediment control once construction is complete;
- all stockpiled material is to be kept inside bunded / sediment fenced areas with delineated access points;
- identify any wetlands that act as refugia prior to construction and monitor for impacts resulting from drawdown. If required artificially recharge aquifers that supply these so that they can maintain their current role in the ecosystem;
- temporary sediment control fences will be installed around any stockpiles in place for more than one week;
- limit vehicle access during construction to access tracks and designated construction areas;
- sediment on vehicle should be prevented from being carried out from the site onto local roads. A vehicle shakedown area at the entrance to work sites will ensure sediment is removed before accessing off-site road networks;
- wash down of plant and equipment shall be undertaken only where there are appropriate handling facilities. If on-site wash down is unavoidable, a bunded, impervious receptacle will be used;
- ensure safe and effective fuel, oil and chemical storage and handling on site;
- develop storm water management plans for each component of the construction. These should consider the use of storm water tanks and re-use of grey water; and
- where works are to be carried out within the streams themselves (i.e. diversion of Tallarenha Creek) sediment sampling will be carried out to identify potential contaminants.

An aquatic ecosystem monitoring program will be included in the EMP requirements. The monitoring program will incorporate the following:

- impact monitoring criteria will be included in the EMP;
- monitoring will include visual inspections of construction areas and surrounding waters for evidence of spills; and
- physical and chemical water quality monitoring will be carried out up and down stream of work sites within the study area.

7.7 CONCLUSION

Baseline aquatic ecology investigations were undertaken at the mine site. There are several wetlands listed as GBR WPAs and WMAs within the mine footprint. The sample site at the mine did not contain any water at the time of sampling therefore investigations were limited to observational assessments of aquatic habitat.

Construction works that have the most potential to impact on aquatic ecosystems include:

- the clearing of vegetation and topsoils from work sites and stockpiling of overburden on site resulting in sediment movement though overland flow;
- the storage of chemicals on site (e.g. hydrocarbons, detergents, degreasers, etc) during construction and operations and the movement of these to streams;
- the storage, seepage and overtopping of potentially contaminated water such as tailings water or pit process water in dams and Basins at the mine site;
- the construction and operation of underground mines which may result in subsidence impacting drainage in the immediate area;
- the construction of two diversions to divert Tallarenha Creek from the open cut mine areas, and
- proposed damming of Tallarenha Creek approximately six km south of the mine industrial area at the confluence of Beta Creek and Tallarenha Creek.

Management measures include:

- variations on design (including bridge structures and fishways),
- the development of an ESCP to reduce potential impacts resulting from the works
- an assessment prior to construction of important perennial waterholes that may act as refugia during dry seasons, and
- implementing ongoing monitoring of these areas to assess impacts from drawdown.

It is expected that with the implementation of the mitigation measures in the EMP the impacts to aquatic ecosystems resulting from the works will be reduced.

7.8 COMMITMENTS

Waratah Coal commit to undertaking the following actions:

- develop an ESCP prior to the commencement of construction;
- carry out studies to identify any wetlands that act as refugia prior to construction;
- investigate requirements for fishway design on the proposed dam;
- develop surface water and storm water management plans for the mine site; and
- develop an EMP incorporating monitoring requirements for surface waters.