Waratah Coal

Galilee Coal Project SEIS
Water Quality Monitoring Program

November 2012

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1. Introduction

The Galilee Coal Project (GCP), also known as the China First Project, is a proposed new coal mine and rail link development, for which Waratah Coal is the proponent. The mine Exploration Permit for Coal areas (EPC 1040 and EPC 1079) are located around 30km north of the township of Alpha.

Waratah Coal proposes to mine 1.4 billion tonnes of coal from EPC 1040 and 1079. The mine would comprise four longwall underground mines, two open cut mines and two coal preparation facilities (CHPP). The proposed rail construction associated with the GCP is between the mine and future stockpiling and loading facilities within the Port of Abbot Point and the Abbot Point State Development Area. Due to uncertainty regarding the location of future stockpiling and loading facilities, the limit of assessment is the boundary of the Abbot Point State Development Area. As such, the length of the rail alignment is 453km. The rail facility would include state of the art, heavy duty standard gauge rail to support 25,000 tonne haul trains. The final rail easement would cover both rail and adjacent service road infrastructure.

An Environmental Impact Study (EIS) was developed and released by Waratah Coal in August 2011 for public comment (henceforth referred to as Waratah Coal, 2011). There were 1842 submissions received (15 from government agencies) indicating significant public interest in the GCP.

Subsequent to those comments being received, Waratah Coal sought to carry out a supplementary EIS (SEIS) to address these comments. To that end, GHD were engaged to assist Waratah Coal develop the GCP Water Quality Monitoring Plan. At this stage, the Water Quality Monitoring Program relates to the waterways within and adjacent to the GCP Mine Lease Application area (MLA).

2. Mine Lease Application Area

2.1 Study Area Characteristics

The GCP MLA is located within the Sandy Creek catchment, which is part of the Belyando River system within the Burdekin Basin. The GCP MLA is in the headwaters of Sandy Creek catchment. The Sandy Creek catchment to the junction with the Belyando River covers an area of approximately 7,700 km^2 (Hancock Prospecting, 2011).

Six key streams have been identified within the GCP area, including Tallarenha Creek, Beta Creek, Malcolm Creek, Pebbly Creek, Spring Creek and Lagoon Creek. All are ephemeral, upland, freshwater streams. Lagoon Creek and a portion of Spring Creek are declared watercourses under the *Water Act 2000*. Tallarenha Creek flows into Lagoon Creek then Sandy Creek, which then flows into the Belyando River.

The abovementioned watercourses are ephemeral streams characterised by extended periods of no surface flow and flows of short duration following rainfall events. According to Hancock Prospecting (2011), the mean annual rainfall for the region is approximately 500 mm/year, while the mean annual evaporation is approximately 2,300 mm/year. The mean annual runoff is estimated to be only 17 mm/year (approximately 3 to 4% of rainfall).

Adjacent catchment land use is predominantly low intensity grazing, but this activity still represents an existing disturbance with respect to the environmental values associated with watercourses within and adjacent to the GCP MLA.

2.2 Relevant Environmental Values

The GCP MLA is located within the Belyando River sub-catchment of the Burdekin River Basin. Draft waterway Environmental Value's (EVs) were developed for 7 different sub-catchments within the Belyando River catchment by Dight (2009):

- Upper Belyando River;
- Native Companion Creek;
- Sandy Creek;
- Mistake Creek;
- Fox Creek;
- Carmichael River; and
- Belyando Floodplain.

The sub-catchments relevant to the receiving waterways of the GCP MLA are:

- Sandy Creek – includes mine site and immediate receiving waterways of Lagoon Creek and Sandy Creek, and
- Belyando Floodplain – includes lower reach of Belyando River downstream of Sandy Creek/Native Companion Creek.

The following draft EVs were identified for the Sandy Creek sub-catchment:

- Aquatic ecosystems (Slightly to Moderately Disturbed),
- Stock watering, and
- Cultural and spiritual values of the Bidjara traditional owners.

Draft EVs for the Belyando Floodplain are the same, but also include Irrigation.

Based on the above, under the *Water Act 2000*, Waratah Coal will be required to ensure that these EVs are protected. The study area contains some sensitive waterways, particularly wetlands, but the majority of the waterways lie adjacent to grazing land and have been disturbed through a combination of vegetation clearing (including riparian vegetation clearing), bed and bank trampling by cattle, soil erosion and road and causeway construction. As such, the results of GCP water quality monitoring were assessed against relevant guideline ranges / trigger levels set out in the following:

- ANZECC and ARMCANZ (2000) Water Quality Guidelines (slightly to moderate disturbed freshwater ecosystems of Tropical Australia –i.e. 95% ecosystem level protection level);
- QLD Water Quality Guidelines 2009 (DERM, 2009a) (95% ecosystem level protection level for Central QLD freshwater ecosystems);
- ANZECC and ARMCANZ (2000) Water Quality Guidelines (livestock drinking water); and
- ANZECC and ARMCANZ (2000) Water Quality Guidelines (irrigation).

2.3 Water Quality Data

Surface water quality data for the watercourses through the GCP MLA is limited. Water quality baseline data for these waterways and for adjacent non-affected waterways to the east of the GCP MLA formed the preliminary basis for characterising existing water quality conditions. The baseline water quality sampling carried out to date is outlined below.

2.3.1 EIS Sampling

E3 (2010a) carried out water quality monitoring at 24 sites in the Belyando Basin, including 11 sites in the Sandy Creek sub-catchment (WQ-38, WQ-41, WQ-44 to WQ-52) and one site in the Belyando Floodplain sub-catchment (WQ-37). The remainder were in adjacent sub-catchments not potentially impacted by the GCP, including Native Companion Creek and Fox Creek sub-catchments. Site location details for E3 (2010a) water quality sampling sites are given in Table 2-1 and also shown in Figure 2-1. Sampling was carried out on two sampling occasions, the first being in the pre-wet season (October 2009) and the second during the post-wet season (April/May 2010) two weeks after cyclone Ului, when the water level at some sites was at bank full level. A total of 25 samples were collected across these two surveys, 22 of which were collected during the 2010 post-wet season survey. The lack of water to sample during the pre-wet season occasion highlights the highly ephemeral nature of the waterways in the Belyando Basin and the challenges in collecting water quality data in these systems.

Table 2-1: Location of Belyando Basin monitoring sites sampled by E3 (2010a).

Site	Mistake Creek	Latitude	Longitude
WQ29	Mistake Creek	22° 1.694'	146° 59.569'
WQ30	Mistake Creek	22° 8.420'	147° 2.776'
WQ31	Middle Creek	22° 9.369'	146° 55.981'
WQ32	Middle Creek	22° 16.183'	146° 51.678'
WQ33	Sixteen Mile Creek	22° 23.774'	146° 46.312'
WQ34	Lascelles Creek	22° 23.551'	146° 54.213'
WQ35	Sandy Creek	22° 36.823'	146° 40.932'
WQ36	Native Companion Creek	23° 7.263'	146° 40.980'
WQ37	Belyando River	23° 2.253'	146° 47.023'
WQ38	May Creek	23° 9.679'	146° 57.787'
WQ39	Belyando River - Pebbly Creek	23° 15.809'	146° 52.688'
WQ40	Malcolm Creek	23° 20.443'	146° 29.605'
WQ41	Saltbush Creek	23° 21.605'	146° 29.288'
WQ42	Lagoon Creek	23° 21.096'	146° 28.526'
WQ43	Spring Creek	23° 20.028'	146° 22.324'
WQ44	trib. of Spring Creek	23° 21.036'	146° 17.825'
WQ45	Pebbly Creek	23° 23.105'	146° 14.072'
WQ46	Tallarenha Creek	23° 23.882'	146° 27.703'
WQ47	Beta Creek	23° 30.524'	146° 22.440'
WQ48	Tallarenha Creek	23° 33.366'	146° 28.305'

2.3.2 SEIS Sampling

A total of nine sites were sampled for water quality as part of the GCP SEIS near mine surface water aquatic ecology study carried out by GHD in April 2012 (see Table 2-2, Figure 2-1). These nine sites were distributed across six catchments: Tallarenha Creek, Lagoon Creek (locally referred to as 'Monks' Creek where it intersects the Monklands property), Beta Creek, Malcolm Creek, Spring Creek and Pebbly Creek; all of which intersect the GCP MLA and/or represent potential receiving waters in relation to the GCP MLA. The location details for these sites are given in Table 2-2. Sites with 'Alt' in the site code represent sites sampled by GHD that were nearby alternative sites to the corresponding E3 (2010b) aquatic ecology sampling sites. Many of the sites sampled by E3 (2010b) could not be sampled in April 2012 due to access restrictions, but the same waterways were sampled on each sampling occasion.

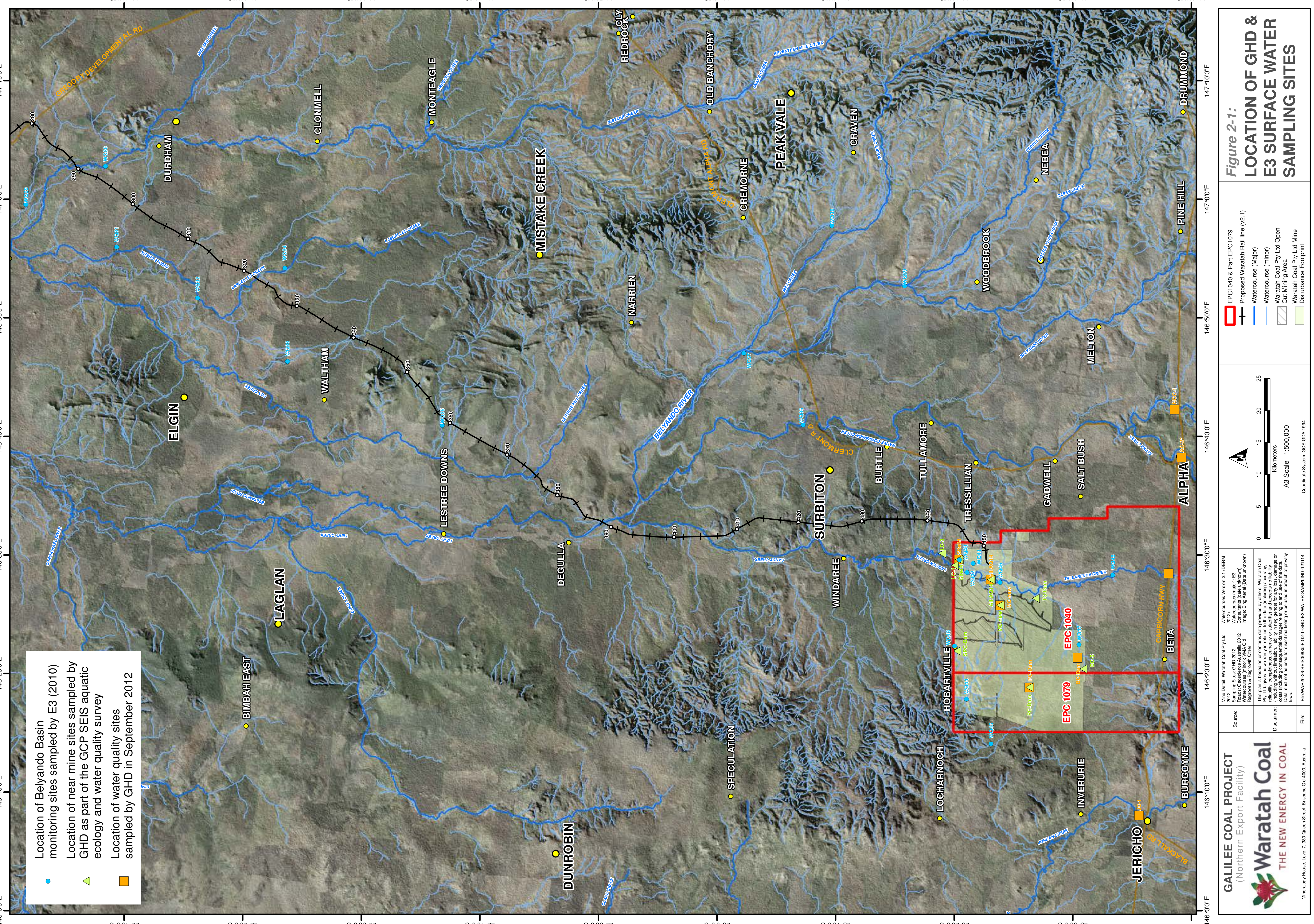
A second round of water quality sampling was carried out in September 2012. This round of water sampling was carried out to provide greater temporal characterisation of water quality in the study area. The program involved sampling at three of the established sites from the April 2012 event (Alt-AQ14, Site04 and PC-Dam), and an additional five new sites, some of which were nominated as potential future reference sites in relation to the GCP. The location details of the water quality monitoring sites sampled in September 2012 are given in Table 2-3.

Table 2-2: Location of near mine sites sampled by GHD as part of the GCP SEIS aquatic ecology and water quality survey. All GPS data are based on WGS84 datum.

Site Code	Sub-catchment	Latitude	Longitude	Description	Position Relative to GCP Infrastructure
LC-1	Lagoon Creek	23° 20.043' S	146° 29.120' E	Lagoon Creek 6 km d/s of causeway	d/s of pit and overburden emplacement areas
LC-3	Lagoon Creek	23° 18.963' S	146° 30.128' E	Lagoon Creek 8.7 km d/s of causeway	d/s of pit and overburden emplacement areas
MC-new	Malcolm Creek	23° 23.863' S	146° 25.758' E	Malcolm Creek at Kia Ora causeway	Within pit area
PC-Dam	Pebbly Creek	23° 26.333' S	146° 18.829' E	Pebbly Creek Dam	Within underground mining area
TC-Dam	Tallarenha Creek	23° 26.875' S	146° 26.336' E	Tallarenha Creek Wetland	Within / directly adjacent to overburden emplacement area
SPC-Dam	Spring Creek	23° 20.230' S	146° 21.892' E	Spring Creek Dam	Within underground mining area
Alt AQ14	Lagoon Creek	23° 23.086' S	146° 27.918' E	Lagoon ("Monks") Creek at causeway	Within overburden emplacement area
BC-5	Beta Creek	23°30.897' S	146° 20.387 E	Beta Creek	Within underground mining area
Site04	Saltbush Creek	23° 20.395' S	146° 29.609' E	Saltbush Creek Lagoon	d/s of TSF / decant water facility & rail loop

Table 2-3: Location of water quality sites sampled by GHD in September 2012. All GPS data are based on WGS84 datum.

Site Code	Sub-catchment	Latitude	Longitude	Description	Position Relative to GCP Infrastructure
PC-Dam	Pebbly Creek	23° 26.333' S	146° 18.829' E	Pebbly Creek Dam	Within underground mining area
Alt AQ14	Lagoon Creek	23° 23.086' S	146° 27.918' E	Lagoon ("Monks") Creek at causeway	Within overburden emplacement area
MC-new	Malcolm Creek	23° 23.863' S	146° 25.758' E	Malcolm Creek at Kia Ora causeway	Within pit area
Site04	Saltbush Creek	23° 20.395' S	146° 29.609' E	Saltbush Creek Lagoon	d/s of TSF / decant water facility &rail loop
BC-Dam	Beta Creek	23° 30.410' S	146° 21.321' E	Beta Creek Dam	Within underground mining area
JC-1	Jordan Creek	23° 35.592' S	146° 08.038' E	Jordan Creek at highway crossing	Potential control site
NCC-1	Native Companion Creek	23° 38.563' S	146° 42.250' E	Native Companion Creek at highway crossing	Potential control site
AC-2	Alpha Creek	23° 39.190' S	146° 38.222' E	Alpha Creek at highway crossing	Potential control site
TC-1	Tallarenha Creek	23° 38.093' S	146° 28.449' E	Tallarenha Creek at highway crossing	Potential control site


GALILEE COAL PROJECT
(Northern Export Facility)
Waratah Coal
THE NEW ENERGY IN COAL
Figure 2-1:
LOCATION OF GHD & E3 SURFACE WATER SAMPLING SITES
EPC1040 & Part EPC1079
Proposed Waratah Rail line (v2.1)
Watercourse (Major)
Watercourse (minor)
Waratah Coal Pty Ltd Open Cut Mining Area
Waratah Coal Pty Ltd Mine Disturbance Footprint
A3 Scale 1:500,000
Kilometers
Coordinate System: GCS GDA 1994
Location of Belyando Basin monitoring sites sampled by E3 (2010)
Location of near mine sites sampled by GHD as part of the GCP SEIS aquatic ecology and water quality survey
Location of water quality sites sampled by GHD in September 2012
EPC1040
EPC1079
ALPHA
JERICHO
SURBITON
MISTAKE CREEK
PEAK VALE
ELGIN
LAGLAN
DUNROBIN
BELYANDO RIVER
CAPRICORN HWY

2.3.3 Parameters Monitored

For both the E3 (2010a) and GHD (2012) programs, water quality data were collected based on *in situ* measurements of physico-chemical water quality parameters and grab samples for analytical testing. As part of the EIS public submissions process, the Department of Environment and Heritage Protection (DEHP) recommended additional analytical measurement parameters be added to the GCP water quality monitoring program for the SEIS. In addition to these, organic pesticides were also added to the program in order to further characterise the effects of adjacent agricultural landuse on water quality. Table 2-4 provides a comparison between the range of parameters assessed as part of the GCP EIS and the range of parameters recommended by DEHP and monitored by GHD as part of the supplementary EIS. Note that *in situ* by E3 (2010a) and GHD (2012) included EC and pH, even though these two parameters are not listed among the analytical parameters monitored by E3 (2010a) for the EIS.

Table 2-4: Comparison between the range of analytical testing parameters monitored as part of the GCP EIS and the range of analytical testing parameters recommended by DEHP and monitored by GHD as part of the GCP SEIS survey.

Parameters Tested for as part of the GCP EIS	Parameters Recommended by DEHP	Parameters Monitored by GHD
Physical		
		EC
		pH
		TSS
		TDS
Major Ions	Major Ions	Major Ions
Alkalinity as $CaC0_3$	Alkalinity as $CaC0_3$	Alkalinity as $CaC0_3$
Sulphate	Sulphate	Sulphate
Chloride	Chloride	Chloride
Calcium	Calcium	Calcium
	Fluoride	Fluoride
Magnesium	Magnesium	Magnesium
Sodium	Sodium	Sodium
Potassium	Potassium	Potassium
Total Anions	Total Anions	Total Anions
Total Cations	Total Cations	Total Cations
Metals (Total concentration)		
	Aluminium	Aluminium
Arsenic	Arsenic	Arsenic
	Boron	Boron
Cadmium	Cadmium	Cadmium
Chromium	Chromium	Chromium
	Cobalt	Cobalt
Copper	Copper	Copper
Iron	Iron	Iron
Lead	Lead	Lead
	Manganese	Manganese

Parameters Tested for as part of the GCP EIS	Parameters Recommended by DEHP	Parameters Monitored by GHD
	Mercury	Mercury
	Molybdenum	Molybdenum
Nickel	Nickel	Nickel
	Selenium	Selenium
	Silver	Silver
	Uranium	Uranium
	Vanadium	Vanadium
Zinc	Zinc	Zinc
Metals (Dissolved)		
	Aluminium	Aluminium
	Arsenic	Arsenic
	Boron	Boron
	Cadmium	Cadmium
	Chromium	Chromium
	Cobalt	Cobalt
	Copper	Copper
	Iron	Iron
	Lead	Lead
	Manganese	Manganese
	Mercury	Mercury
	Molybdenum	Molybdenum
	Nickel	Nickel
	Selenium	Selenium
	Silver	Silver
	Uranium	Uranium
	Vanadium	Vanadium
	Zinc	Zinc
Nutrients		
Ammonia as N	Ammonia as N	Ammonia as N
Nitrate as N	Nitrate as N	Nitrate as N
Nitrite as N	Nitrite as N	Nitrite as N
TKN	TKN	TKN
TN	TN	TN
TP	TP	TP
		SRP
Primary Production		
Chlorophyll a	Chlorophyll a	Chlorophyll a
Organic Contaminants		
PCB	PCB	PCB
PAH	PAH	PAH
TPH (C10-36)	TPH (C10-36)	TPH (C10-36)
		BTEX
		O-C Pesticides
		O-P Pesticides

2.4 Main Results

Based on the combined sampling carried out by E3 and GHD, there are 42 data points collected over four sampling occasions for most parameters and 17 data points for parameters added to the monitoring program as part of the GCP SEIS process that were collected over two sampling occasions.

While results have been reported separately for baseline monitoring carried out by E3 and GHD in various technical reports (E3, 2010a; GHD, 2012), for the purpose of outlining the key baseline water quality monitoring results, the median and other key percentiles for parameters monitored consistently across the two studies were compared against relevant guideline ranges and trigger values. As per the ANZECC (2000) and DERM (2009a) specifications, the median value of each physico-chemical parameter (including *in situ* readings, nutrients and major ions) was compared to guideline ranges / trigger values, while for toxicants (i.e. metals), the 95th percentile value for the collected data was compared against the nominated trigger value.

Results of *in situ* monitoring carried out by E3 (2010a) and GHD (2012) are given in Table 2-5. These results show that the median pH for Belyando Catchment sites was within the guideline range for the protection of ecosystem values in slightly to moderately disturbed (SMD) Central Queensland upland streams (DERM, 2009a). By contrast, median values for Electrical Conductivity (EC), dissolved oxygen % saturation (DO%) and turbidity were all outside the recommended range for the protection of ecosystem values in SMD Central Queensland upland streams (DERM, 2009a). Results show that the water quality in waterways in and around the GCP MLA were generally characterised by elevated EC, low DO% and elevated turbidity. Note that DERM (2009a) advocate that the application of physico-chemical trigger values to ephemeral streams where pools are small and stagnating is inappropriate. However, in larger waterholes it would be expected that values would remain closer to guidelines. Few, if any of the sites monitored by GHD (2012) were small stagnant pools, while the bulk of the samples taken by E3 (2010a) were in the wet season following cyclone Ului, when streams were flowing.

Hancock Prospecting (2011) also found that low DO% was a consistent feature of the water bodies in region. This is likely due to the lack of flushing during low flow periods and the breakdown of allochthonous organic material entering these waterways during high flow periods. Hancock Prospecting (2011) also reported that turbidity was generally high. They regarded this finding as not unexpected given that high turbidity is typical of ephemeral streams and for catchments exhibiting natural erosion, such as those in the Galilee Basin, where dispersive soils and steep slopes combine to result in severe sheet and gully erosion in the upper reaches of the waterways assessed. Most of the sites sampled by Hancock Prospecting (2011) also recorded EC levels above the guideline level for the Belyando-Suttor catchment.

Table 2-5: Comparison of percentile ranges for in situ physico-chemical parameters measured in the Belyando Catchment as part of the GCP baseline monitoring program against the DERM (2009a) guidelines for Central Queensland upland streams.

Water Quality Parameters	Units	DERM (2009a) Upland Streams of Central QLD	Median	20th %-ile	75th %-Ile	80th %-ile
Temperature	°C	N/A	23.6	21.43	25.15	25.36
pH	pH Unit	6.5-7.5	7.06	6.60	7.60	7.67
Conductivity	mS/cm	168[1]	221.5	152.6	513.5	772.0
Dissolved Oxygen % Saturation	%	90-110	56	40.2	75.1	80
Turbidity	NTU	25	103	25	220	300

Table 2-6 shows that median values for Suspended Solids (SS), Ammonia as N, Total Nitrogen (TN) and Total Phosphorus (TP) all exceeded the DERM (2009a) guidelines for 95% ecosystem level protection of slightly-to-moderately disturbed (SMD) upland Central Queensland streams. Median TP and Total Alkalinity levels also exceeded the recommended ANZECC (2000) guideline level for Irrigation. None of the physical, major ion or nutrients listed in Table 2-5 exceeded ANZECC (2000) guideline trigger levels in relation to Stock Watering. While not shown in Table 2-5 (as this table only shows data for parameters monitored consistently over the E3 (2010a) and GHD (2012) sampling programs), median Soluble Reactive Phosphorus (SRP), as measured during the SEIS phase, was 0.02 mg/L, slightly exceeding the DERM (2009a) guideline trigger value of 0.015 mg/L for SMD Central Queensland upland streams.

Hancock Prospecting (2011) reported that nutrient concentrations were elevated relative to guideline trigger values. They postulated that the source of elevated nutrients was likely attributable to grazing land use and erosion in the catchment. However, based on testing done as part of the Alpha Coal Project EIS they found that the soils present in the area were largely deficient of major soil nutrients, so soil erosion was unlikely to be the dominant influence on nutrient levels in the local surface waters. The decay of organic matter would be considered a more likely source. As observed both in this study and by Hancock Prospecting (2012) for the Kevin's Corner SEIS, levels of inorganic Ammonia were much lower than TN, indicating that a significant portion of the nitrogen present was organic in nature. This provides further support for the above theory that the source of elevated nutrients was likely to be the breakdown of organic material. A salient point made by Hancock Prospecting (2011) in relation to the observed elevated nutrient concentrations was as follows:

"The exceedance of the guideline values for nutrient concentrations does not necessarily indicate that the levels are unsustainable or unnatural. Rather it draws attention to the limited scientific data available to characterise natural concentrations, speciation, and variability of nutrients in ephemeral streams and emphasises the need for the Project to maintain reference site water quality monitoring."

This statement also applies with respect to the GCP Water Quality Monitoring Program.

[1] EC trigger for the Belyando-Suttor system based on the 75th percentile EC value given in DERM (2009a).

Table 2-6: Comparison of percentile ranges for physical, major ion and nutrient parameters measured in the Belyando Catchment as part of the GCP baseline monitoring program against relevant guidelines for ecosystem protection, stock watering and irrigation EVs.

Parameter	Units	DERM (2009a) Upland Streams of Central QLD	ANZECC (2000) Stock Watering Guidelines	ANZECC (2000) Irrigation Guidelines	Median	20th %-ile	75th %-ile	80th %-ile
Total Dissolved Solids (est.)	mg/L		4000		160.5	116.6	262.3	292.4
Suspended Solids (SS)	mg/L	10			24	11.6	79	175
Total Alkalinity as $CaCO_3$	mg/L			60	70	49.8	77	88.2
Sulphate as $SO4^{-2}$	mg/L		1000		3	1.8	4	6
Chloride	mg/L				10	7	15.8	17
Calcium	mg/L		1000		11	7	15.8	16.8
Magnesium	mg/L				5	3	7	7
Sodium	mg/L				10	8	17	18
Potassium	mg/L				9	7	10.8	11.8
Ammonia as N	mg/L	0.02			0.04	0.02	0.07	0.11
Nitrite as N	mg/L		30		0.01	0.006	0.030	0.034
Nitrate as N	mg/L		400		0.020	0.016	0.035	0.040
Nitrite + Nitrate as N	mg/L				0.020	0.018	0.030	0.040
Total Kjeldahl Nitrogen as N	mg/L				0.85	0.50	1.53	1.72
Total Nitrogen as N	mg/L	0.25		5	0.9	0.5	1.6	1.7
Total Phosphorus as P	mg/L	0.05		0.05	0.145	0.050	0.258	0.350
Chlorophyll *a*	mg/m^3	5			3	2	6.5	8

Table 2-7 shows percentile range data for metals (total concentrations) measured consistently across the GCP baseline monitoring program and compares these against guideline trigger values for ecosystem protection and Stock Watering. Results in this table show that the 95th percentile for all metals listed in this table except Arsenic were above the ANZECC (2000) 95% level ecosystem guideline trigger values where these existed. However, the 80th percentile values were below those trigger values suggesting that at least 80% of the values recorded were within guideline levels. Hence comparisons based on the 95th percentile range were probably skewed by a few very high results at isolated sites. Further, where total metal concentrations are above ANZECC (2000) guideline values for ecosystem protection, this does not necessarily indicate that metals are at levels that might result in toxic effects to aquatic biota. Comparisons of dissolved metal concentrations against the ANZECC (2000) 95% level ecosystem guideline trigger values provides a better indication of this, as it is the bioavailable metal fraction that produce toxic effects or results in bioaccumulation occurring. Dissolved metal concentrations were measured by GHD (2012) are results are presented in Table 2-8.

None of the 95th percentile values exceeded the ANZECC (2000) Stock Watering guidelines. Median total concentrations of the metals listed in Table 2-7 were below the ANZECC (2000) guidelines for Irrigation except for iron. However, as above, it is the dissolved concentrations of metals that is likely to be more critical to the survival or success of crops, so the finding in relation to iron is not necessarily of concern.

Table 2-8 shows the results for metals added to the monitoring program for the SEIS phase, but only for those that recorded at least some values greater than the limit of reporting (LOR). The only metals for which the 95th percentile value exceeded the ANZECC (2000) guideline range for 95% level ecosystem protection were Aluminium and Chromium. Both total and soluble Aluminium concentrations were well in excess of the nominated trigger value, while only the 95th percentile dissolved Chromium value was in excess of the ANZECC (2000) ecosystem protection guideline, suggesting that this result may be an artefact of sample analysis. The level of dissolved Aluminium present in the waterways monitored also exceeded the guideline ranges for Stock Watering and Irrigation, while the levels of dissolved Iron were also above the nominated trigger levels given in ANZECC (2000) guidelines for Irrigation.

Hancock Prospecting (2011; 2012) reported exceedances of trigger values for protection of aquatic ecosystems in relation to soluble (bioavailable) Copper, Zinc and Aluminium. Exceedances for Copper, Nickel and Aluminium concentrations were consistent across all sites and occasions. Hancock (2011) attributed the elevated soluble concentrations of these metals to erosion of natural sediments from the catchment based on investigations for the Alpha Coal Project EIS showing that clay subsurface materials had Copper concentrations of 20-30 mg/kg, Zinc concentrations of 40-110 mg/kg, and Aluminium concentrations of 60,000 - 100,000 mg/kg.

While not shown here, no exceedances were recorded for any of the organic contaminant parameters (i.e. TPH, PAH, Organic-C and Organic-P pesticides, BTEX, etc.) during the surveys by GHD. Only a few samples recorded levels of TPH compounds above the LOR. Those instances may relate to runoff from roads or oil leaks from agricultural machinery. This finding was in accordance with observations made by E3 (2010a) who noted only a few instances where these compounds exceeded guideline levels in the Belyando Catchment (all in the wet season). Hancock Prospecting (2011) also noted that there were no readings for TPH above LOR. Combined, these results suggest that the waterways within and adjacent to the GCP MLA currently have negligible levels of organic contaminants present. This is not surprising given that the study area is remote, not near industrial landuse and most waterways sampled were not adjacent to highways and, therefore, not subject to organic contaminant input through road runoff.

Table 2-7: Comparison of percentile ranges for total concentrations of metals measured consistently as part of the GCP baseline monitoring program against relevant guidelines for ecosystem protection and stock watering.

Parameter	Unit	ANZECC (2000) 95% Ecosystem Protection	ANZECC (2000) Stock Watering	ANZECC (2000) Irrigation	Median	20th %-ile	75th %-ile	80th %-ile	95th %-ile
Arsenic	mg/L	0.013	0.5-5[2]	0.1	0.002	0.002	0.002	0.002	0.0058
Chromium	mg/L	0.001	1		0.003	0.002	0.005	0.005	0.024
Copper	mg/L	0.014	0.4-5	0.2	0.003	0.002	0.005	0.005	0.0146
Nickel	mg/L	0.011	N/A	0.2	0.003	0.002	0.004	0.004	0.0189
Lead	mg/L	0.0034	0.1		0.0030	0.0020	0.0045	0.0045	0.0156
Zinc	mg/L	0.008	20	2	0.009	0.007	0.011	0.011	0.04
Iron	mg/L	N/A	N/A	0.2	2.68	1.268	5.505	5.505	12.398

Table 2-8: Comparison of percentile ranges for metals added to the SEIS monitoring program against relevant guidelines for ecosystem protection, stock watering and irrigation.

Parameters	ANZECC (2000) 95% Ecosystem Protection	ANZECC (2000) Stock Watering	ANZECC (2000) Irrigation	Median	20th %-ile	80th %-ile	95th %-ile
Dissolved Metals (GHD Study only)							
Aluminium	0.055	5	5	0.55	0.2	2.172	5.389
Arsenic	0.013	5	0.1	0.001	0.001	0.002	0.002
Chromium	0.001	1		0.0025	0.0016	0.0034	0.00385
Copper	0.014	0.4-5	0.2	0.002	0.001	0.0026	0.0034
Cobalt	N/A	1	0.05	0.001	0.001	0.001	0.001
Nickel	0.011	1	0.2	0.002	0.001	0.002	0.004
Lead	0.0034	N/A	N/A	0.0015	0.0012	0.0018	0.00195
Zinc	0.008	20	2	0.007	0.007	0.007	0.007
Manganese	1.9	N/A	0.2	0.005	0.0022	0.0458	0.1128
Boron	0.37	5	0.5	0.06	0.06	0.072	0.078
Iron	N/A	N/A	0.2	0.615	0.36	1	2.225
Total Metals (GHD Study only)							
Aluminium	0.055	5	5	1.6	0.204	3.84	18.82
Cobalt	N/A	1	0.05	0.002	0.001	0.009	0.0188
Manganese	1.9	N/A	0.2	0.229	0.104	0.3332	0.6264
Vanadium	N/A	N/A	0.1	0.035	0.02	0.05	0.05
Boron	0.37	5	0.5	0.085	0.064	0.096	0.1195

[2] Depends on the species of stock in question.

2.4.1 Comparison with Neighbouring Coal Mine Project Monitoring Data

Hancock Prospecting (2011) presented median and 95th percentile data for various analytes for each site monitored. Those values were based on seven rounds of sampling at each site, of which there were 15 sites in total. In order to establish how the median and 95th percentile values obtained for various parameters as part the GCP baseline water quality monitoring program compare to median values for corresponding analytes obtained by Hancock Prospecting (2011), the following was done. The mean, minimum and maximum values for Hancock Prospecting (2011) median values for each parameter were calculated by summarising across the median values obtained at each of their monitoring sites. The median and 95th percentile values derived from the GCP baseline water quality monitoring program were then compared against those values, as appropriate. Results of these comparisons are shown below in Table 2-9 and Table 2-10. Note that results for major ions and cations are not presented as Hancock Prospecting (2011) presented 95th percentile data for these parameters, whereas this study did not regard these parameters as contaminants, so instead presented median value data for them. Note also that the metals listed in Table 2-10 are only those for which at least one sample recorded a value greater than the LOR. Further, GCP median values presented in this table contain a mixture of those derived for total metals across the E3 and GHD sampling rounds (n=42, four rounds of sampling) and those relating only to sampling carried out by GHD as part of the GCP SEIS (n=17, two rounds of sampling).

Results presented below show that apart from median dissolved lead concentrations, the median values obtained for all physico-chemical, nutrient and metal parameters listed in Table 2-7 and Table 2-8 were within the ranges for median values recorded among the 15 sites monitored as part of the Alpha Coal Project EIS. On this basis, it is concluded that the water quality data collected as part of the GCP baseline water quality monitoring program are broadly consistent with those collected as part of the Alpha Coal Project EIS. This finding was expected given that the two projects are regionally directly adjacent to one another and that some of the same waterways were sampled as part of the two studies. However, it is important in the context of potentially being able to adopt the interim local WQO's put forward by Hancock Prospecting (2011) as the interim Environmental Authority (EA) trigger levels for the GCP.

Table 2-9: Comparison between GCP median values and Alphas Coal Project median values for select physico-chemical and nutrient parameters

Parameter	GCP baseline Median	Alpha Coal Project Medians		
		Mean	Min	Max
Temperature	23.6	25.17	21.7	30.65
pH	7.06	7.32	6.92	7.64
Conductivity	221.5	148.6	91.4	238
Dissolved Oxygen	56	67.6	20.6	96.5
Turbidity	103	121.5	37	212
Suspended Solids	24	32.6	12	78
Nitrite + Nitrate	0.02	0.019	0.01	0.03
Ammonia	0.04	0.031	0.015	0.05
Chlorophyll-a	3	1.6	1	4
Total Phosphorus	0.145	0.073	0.01	0.2
SRP	0.02	0.015	0.01	0.05
Total Nitrogen	0.9	0.8	0.4	1

Table 2-10: Comparison between GCP median values and Alphas Coal Project median values for select metal parameters

Parameter	GCP 95th %-ile	Alpha Coal Project 95th %-iles		
		Mean	Min	Max
Dissolved Metals				
Aluminium	0.550	1.012	0.335	5.593
Arsenic	0.001	0.0015	0.001	0.003
Boron	0.06	0.07	0.05	0.10
Chromium	0.0025	0.001	0.001	0.004
Cobalt	0.001	0.001	0.001	0.002
Copper	0.002	0.003	0.002	0.005
Iron	0.615	1.074	0.339	2.618
Lead	0.0015	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.004
Zinc	0.007	0.0964	0.005	0.915
Total Metals				
Aluminium	1.600	2.415	0.478	9.468
Arsenic	0.002	0.002	0.001	0.003
Boron	0.085	0.061	0.001	0.088
Chromium	0.003	0.003	0.001	0.008
Cobalt	0.002	0.002	0.001	0.003
Copper	0.003	0.007	0.003	0.040
Iron	2.680	3.360	1.560	6.807
Lead	0.003	0.002	0.001	0.003
Manganese	0.229	0.155	0.037	0.342
Nickel	0.003	0.003	0.002	0.006
Zinc	0.009	0.014	0.005	0.055

2.5 Draft Local Water Quality Objectives

Based on the above, there are a number of water quality parameters that routinely exceed the nominated trigger values in the relevant guidelines. Hence, in order to derive suitable discharge license criteria under an EA for the GCP, there is a need to develop local water quality objectives (WQOs) for waterways intersecting and downstream of the GCP MLA. The development of WQOs needs to be done according to instructions given in ANZECC (2000) and DERM (2009a).

Firstly, data need to be collected at suitable reference sites. Reference site criteria given in DERM (2009a) are as follows:

- No intensive agriculture within 20 km upstream (irrigation, widespread soil disturbance, use of agrochemicals and pine plantations). Dry-land grazing does not fall into this category;
- No major extractive industry within 20 km upstream;
- No major urban area (>5,000 population) within 20 km upstream;

- No significant point source wastewater discharge within 20 km upstream;
- Seasonal flow regime not greatly altered;

Most of the sites monitored as part of the GCP baseline water quality monitoring program comply with these criteria. The only ones that might not are those associated with farm dams (e.g. SPC-Dam, PC-Dam, BC-Dam), due to the fact that seasonal flow regimes have been significantly altered. Site Alt-AQ14 may also fall into this category as it represents artificially ponded water impounded behind a causeway. Nonetheless, given the remoteness of the study area and the lack of any significant pressures on water quality at those sites, at this stage these sites have been designated as being suitable reference sites for monitoring when establishing local water quality objectives for the GCP project area. Further, the limited alternative site options in the streams these sites are located on necessitate that they be given this status.

DERM (2009a) recommend that in order to be statistically representative, where there are 3 or more reference sites being monitored, at least 12 data points are required per site and those data should be collected over at least a 12 month period, but preferably over 24 months or more. A minimum of 8 sampling events at each reference site carried out over a minimum of a 12 month period is required to establish interim local water quality objectives.

Clearly, the GCP baseline water quality monitoring carried out to date does not meet the data requirements for the number of sampling points taken at each site. Most E3 monitoring sites were only sampled effectively once due to the fact that most were dry during the October 2009 sampling round. Further, only 3 of the sites sampled by GHD were sampled twice. Moreover, for some of the parameters recommended by DEHP during the public submissions phase, there are only 17 data points. However, Hancock Prospecting (2011) collected 7 sampling rounds of data at 15 sites, most of which were considered as fulfilling the reference site criteria. Based on these data all but fulfilling the minimum requirements to derive interim water quality objectives they put forward interim water quality objectives for a range of parameters. Given that GCP baseline water quality monitoring program data collected thus far are broadly consistent with those collected by Hancock Prospecting (2011) from the reference sites used to derive their interim water quality objectives, it is proposed that those interim water quality objectives be adopted for the GCP until such time as the GCP baseline water quality data are sufficient to derive final water quality objectives for waterways within and adjacent to the GCP MLA. Details of the interim water quality objectives put forward by Hancock Prospecting (2011) are given in Table 2-11 and Table 2-12 below.

Table 2-11: Interim Local Water Quality Objectives for physico-chemical parameters put forward by Hancock Prospecting (2011).

Parameter	Suggested Interim Local Value	Comment
pH	6.5-7.5	Based on 20th and 80th %-ile of sampling results
Turbidity (NTU)	207	Based on 80th %-ile of sampling results
EC (µS/cm)	250	Based on ANZECC (2000) guidelines
Total Suspended Solids (mg/L)	123	Based on 80th %-ile of sampling results
DO%	55.1-85	Based on 20th and 80th %-ile of sampling results
Sulphate (mg/L)	1.3	Based on 80th %-ile of sampling results
Ammonia (mg/L)	0.05	Based on 80th %-ile of sampling results

Table 2-12: Interim Local Water Quality Objectives for metals, nutrients and major ion parameters put forward by Hancock Prospecting (2011).

Parameters	Units	Suggested Interim Local WQOs	Rationale
Total Phosphorus	mg/L	0.21	Based on 80th %-ile of sampling results
Total Nitrogen	mg/L	0.91	Based on 80th %-ile of sampling results
Calcium	mg/L	14.2	Based on 80th %-ile of sampling results
Nitrite + Nitrate	mg/L	0.076	Based on 80th %-ile of sampling results
Fluoride (mg/L)	mg/L	0.1	For aquatic ecosystem protection, based on LOR for PC Titrator
Aluminium	mg/L	0.65	Based on 80th %-ile of sampling results
Arsenic	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Boron	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Cadmium	mg/L	0.0001	For aquatic ecosystem protection, based on LOR for ICP-MS
Chromium	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Copper	mg/L	0.002	Based on 80th %-ile of sampling results
Cobalt	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Iron	mg/L	1.19	Based on 80th %-ile of sampling results
Lead	µg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Manganese	mg/L	0.13	Based on 80th %-ile of sampling results
Mercury	mg/L	0.0001	For aquatic ecosystem protection, based on LOR for ICP-MS
Molybdenum	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Nickel	mg/L	0.002	For aquatic ecosystem protection, based on LOR for ICP-MS
Selenium	mg/L	0.01	For aquatic ecosystem protection, based on LOR for ICP-MS
Silver	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
Zinc	mg/L	0.14	Based on 80th %-ile of sampling results
Vanadium	mg/L	0.01	For aquatic ecosystem protection, based on LOR for ICP-MS
Uranium	mg/L	0.001	For aquatic ecosystem protection, based on LOR for ICP-MS
TPH (C6-C9)	mg/L	20	Based on Analytical LOR (ALS Method EP080/071)
TPH (C10-36)	mg/L	100	Based on Analytical LOR (ALS Method EP080/071)

2.6 Flow Release Triggers and Contaminant Release Limit Considerations

The current design plan for the GCP mine would see limited releases of mine affected water off site, with the only releases expected to occur being associated with controlled releases from sediment ponds under heavy rainfall/high flow conditions. Such releases are expected to occur on average only one in every four years of mine operation.

Typically, Environmental Authorities (EAs) for mine sites stipulate the flow conditions in the receiving environment under which controlled releases are able to occur and contaminant release limits. Most contemporary EAs do not specify a fixed magnitude trigger flow for releases. The release flow trigger is usually expressed as a multiple of the release flow rate (e.g. receiving waterway flow rate must be a minimum of 20 times the release flow rate at the time of release) in order to achieve a satisfactory dilution rate. Contaminant release limits are typically expressed in relation to ANZECC (2000) and/or DERM (2009a) trigger values or as some percentile of reference site water quality (e.g. 80th percentile of reference). At this stage there are insufficient data to determine flow release triggers and contaminant release limits. In order for these to be determined, the following will be carried out:

- Further baseline monitoring to determine local water quality objectives; and
- Monitoring at upstream reference sites in relation to release points in order to establish reference data to potentially help inform the contaminant release limits.
- Further modelling of release rates from the various sediment ponds under different conditions; and
- Regular (minimum of monthly) monitoring of sediment dams in order to determine the quality of the water potentially released.

The first two tasks are discussed in more detail below.

2.7 Monitoring Commitments

Two forms of additional water quality monitoring will be undertaken as part of the GCP Water Quality Monitoring Plan. These are:

1. further baseline monitoring, and
2. ongoing compliance monitoring.

The former is required to generate sufficient data to be able to derive water quality objectives for waterways within and adjacent to the GCP MLA. The latter is required to assess impacts of mine-related activities on water quality in the receiving waters downstream of the mine. All sampling would be done in accordance with the DERM (2009b) Monitoring and Sampling Manual.

2.7.1 Further Baseline Monitoring

As discussed in section 2.5, the current GCP baseline water quality monitoring data set is not sufficient to derive even interim water quality objectives as it stands. At least a further seven rounds of sampling is required for most of the established sites, and the sampling periods, in its entirety, needs to cover at least 12 months. Therefore, based on some sites only sampled in September this year, the baseline monitoring program will potentially need to extend to September 2013.

DEHP's preferred approach is to ideally have water quality sampling carried out under flowing conditions. A key challenge in collecting baseline water quality sampling data in ephemeral streams such as those present within and adjacent to the GCP MLA is the short-lived nature of surface water in those streams. A stream flow gauging station was not installed for the Galilee Coal Project. The nearest Queensland Government (Department of Natural Resources and Mines) stream flow gauging stations to the mine are detailed below in Table 2-13.

Table 2-13: DNRM Stream gauging stations in vicinity of the GCP MLA.

Station Number	Station Name	Catchment Area (km^2)	Period of Record	Location
120305A	Native Companion Creek at Violet Grove	4,065	1967 to current	30 km SE of mine
003305A	Mistake Creek at Wololla	66	1974 to 1988	58 km SW of mine

Median (50th percentile) monthly flows at these gauging stations are provided below in Table 2-14 and indicate that stream flows are most likely to occur during the months November to March. Note the Native Companion Creek has prolonged flow periods compared to the smaller systems within and adjacent to the GCP MLA based on visual and anecdotal evidence, so the values presented for Native Companion Creek in Table 2-14 are not necessarily representative of flows systems with and adjacent to the GCP MLA. Values for Mistake Creek are likely to be more representative of these systems, based on visual observations made during site visits (Jamie Corfield, GHD, pers. obs.) which indicated that Native Companion Creek was still flowing at times when systems closer to the GCP MLA were not. Further to the above, the duration of stream flows is likely to vary significantly between different waterways due to different in soil and groundwater characteristics. The duration of inundation in reaches of creeks containing waterholes (e.g. Lagoon Creek), however, will be longer than the duration of stream flows and this provides opportunities for a somewhat extended sampling period for those systems.

Table 2-14: Median Monthly Flows (ML) for gauging stations near the GCP MLA.

Month	Native Companion Creek	Mistake Creek
Jan	1,458	58
Feb	4,448	0
Mar	454	0
Apr	1	0
May	0	0
Jun	0	0
Jul	0	0
Aug	0	0
Sep	0	0
Oct	0	0
Nov	7	33
Dec	232	40

To overcome the short-lived nature of surface water presence in the waterways of interest, it is proposed that an intensive sampling program between the wet season and post-wet season period (i.e. December through to May) is carried out, whereby sampling is conducted on a fortnightly basis following the first flush event of the wet season. Beyond this period, monthly monitoring will continue at sites with remaining surface water until September 2013. This will provide the best opportunity to collect sufficient data for generating local water quality objectives to inform the derivation of EA license conditions.

Notwithstanding access issues or absence of surface water at the time of sampling, monitoring would be carried out at the 20 sites listed in Table 2-15. The nominated sites cover all major waterways within and adjacent to the GCP MLA. The parameters monitored will be those listed in Table 2-4 that were tested for as part of the SEIS round of sampling carried out by GHD. It should be noted that sites within the Native Companion Creek sub-catchment have been included as part of baseline monitoring despite GHD finding that the water quality in this system was quite different to that of most of the waterways sampled within and adjacent to the GCP MLA. The reason for this was because this system flows into the Sandy Creek catchment, so it is considered important to monitor Native Companion Creek to understand its contribution to the water characteristics downstream of the GCP MLA.

In order to quickly obtain data for highly variable parameters such as EC, pH and DO% and stream height, the installation of gauging stations with automated water quality loggers will be investigated for sites in Lagoon Creek, the main receiving water in relation to the GCP MLA. Ideally these would be located upstream and downstream of the Lagoon Creek release point and/or the confluence of Malcolm Creek and Lagoon Creek. Data loggers can be set up to take readings continuously at 15 minute intervals, so the volume of data generated for EC, pH and DO% is guaranteed to be to be sufficient to derive local water quality objectives for these parameters 12 months after installation. Further, continuous readings for DO% will provide a much better understanding of diel variation in DO%, which is critical to understanding aquatic ecosystem condition and functioning.

Table 2-15: Proposed Baseline Monitoring Sites

Site	Mistake Creek	Latitude	Longitude
WQ36	Native Companion Creek	23° 7.263' S	146° 40.980' E
WQ37	Belyando River	23° 2.253' S	146° 47.023' E
WQ41	Saltbush Creek	23° 21.605' S	146° 29.288' E
WQ42	Lagoon Creek	23° 21.096' S	146° 28.526' E
WQ43	Spring Creek	23° 20.028' S	146° 22.324' E
WQ44	Trib. Spring Creek	23° 21.036' S	146° 17.825' E
WQ45	Pebbly Creek	23° 23.105' S	146° 14.072' E
WQ46	Tallarenha Creek	23° 23.882' S	146° 27.703' E
WQ47	Beta Creek	23° 30.524' S	146° 22.440' E
WQ48	Tallarenha Creek	23° 33.366' S	146° 28.305' E
LC-1	Lagoon Creek	23° 20.043' S	146° 29.120' E
MC-new	Malcolm Creek	23° 23.863' S	146° 25.758' E
PC-Dam	Pebbly Creek	23° 26.333' S	146° 18.829' E
Alt AQ14	Lagoon Creek	23° 23.086' S	146° 27.918' E
BC-5	Beta Creek	23° 30.897 S	146° 20.387 E
Site04	Saltbush Creek	23° 20.395' S	146° 29.609' E
JC-1	Jordan Creek	23° 35.592' S	146° 08.038' E
NCC-1	Native Companion Creek	23° 38.563' S	146° 42.250' E
AC-2*	Alpha Creek	23° 39.190' S	146° 38.222' E
TC-1	Tallarenha Creek	23° 38.093' S	146° 28.449' E

2.7.2 Ongoing Monitoring

The purpose of ongoing monitoring is to assess the potential impacts of the GCP by carrying out monitoring in reaches upstream and downstream of the mine and determining whether or not:

a) the agreed local water quality objectives/license conditions have been met;

b) the quality of the water entering the mine has been altered excessively as it passes through the mining lease.

For this monitoring component, the intention is to retain baseline monitoring sites where possible so that before and after as well as upstream versus downstream comparisons can be made when assessing potential impacts. However, some baseline monitoring sites may no longer be accessible once the mine goes ahead, so cannot be included as part of the ongoing monitoring program.

Note that due to likely access issues with regards to carrying out sampling within the Alpha Coal Project ML (ML 70426), the downstream extent of monitoring in Spring Creek and Lagoon Creek has been truncated such that the most downstream sites are at the northern boundary of the GPC MLA. A similar issue is likely to occur with respect to accessing potential reference sites on Tallarenha Creek within the SGCP MLA (EPC 1049) (see Figure 2-2). However, to assess cumulative impacts, it is suggested that sampling is carried out in Sandy Creek and the Belyando River downstream of the Alpha Coal Project MLA. Further, should the SGCP go ahead, the reaches of Tallarenha Creek between the SGCP boundary and the GCP boundary could be impacted by activities associated with the SGCP. This could potentially result in water entering the GCP MLA that is already degraded to an extent that it does not meet the conditions required to maintain local EVs. Nonetheless, monitoring of this reach of Tallarenha Creek is required to determine whether or not there has been any further degradation of water quality as it exits the GCP MLA (via Lagoon Creek).

Typically, EAs for coal mines recommend that ongoing monitoring include release point (EoP) monitoring and sites upstream or downstream of these. At this stage, the location of release points have not been established, but it is assumed likely that there will be at least two: one on Malcolm Creek and the other on Lagoon Creek near the north-eastern boundary of the GCP MLA. With that in mind, a number of potential monitoring sites have been nominated for Lagoon Creek, but these may be removed/moved depending on the location of the release points and the availability of alternative sites with surface water present. Precise release point locations will be determined during the detailed design phase.

The sites chosen for ongoing monitoring from the baseline monitoring sites are listed in Table 2-16. In addition to these sites, it recommended that an additional upstream Beta Creek site be sampled as a reference site in relation to potential subsidence impacts that might occur in Beta Creek (most likely this site would be located at the Capricorn Highway Crossing at Beta). It is also recommended that a site be sampled at the junction of Sandy Creek and Belyando River in order to assess the cumulative impacts associated with the GCP, Alpha Coal Project and the SGCP, should it go ahead. Finally, an extra site may need to be added further downstream on Jordan Creek to assess the impacts of stormwater runoff from the GPC into this system. A locality map showing both the baseline and ongoing monitoring sites is presented in Figure 2-2.

Ongoing monitoring would occur following significant rainfall that generates flows in the systems being assessed and would be repeated fortnightly for as long as flows persist. Monitoring would also automatically take place in the event that controlled releases of mine affected water occur, with a daily monitoring program at the release points activated for the duration of the release; and additional monitoring taking place at sites upstream and downstream of those release points on the first day the release commences and then weekly until the release ceases.

The parameters monitored would be identical to those listed for the baseline monitoring program, but results would be compared against draft and final local water quality objectives as these are developed and, eventually, to trigger levels listed in the EA once this is in place. Where downstream values exceed these trigger levels, the downstream values would be compared to the upstream values to assess if an impact warranting further investigation has occurred.

Table 2-16: Proposed Ongoing Monitoring Sites

Site	Mistake Creek	Latitude	Longitude	Rationale
WQ36	Native Companion Creek	23° 7.263'	146° 40.980'	Unimpacted stream that flows into Sandy Creek – potential reference site (particularly in relation to assessing cumulative impacts)
WQ37	Belyando River	23° 2.253'	146° 47.023'	Unimpacted stream that flows into Sandy Creek – potential reference site (particularly in relation to assessing cumulative impacts)
WQ42	Lagoon Creek	23° 21.096'	146° 28.526'	Potential monitoring site in relation to release points
WQ43	Spring Creek	23° 20.028'	146° 22.324'	Downstream impact monitoring site in relation to subsidence
WQ44	trib. of Spring Creek	23° 21.036'	146° 17.825'	Upstream reference site or second impact site in relation to subsidence
WQ45	Pebbly Creek	23° 23.105'	146° 14.072'	Upstream reference site in relation to subsidence
WQ46	Tallarenha Creek	23° 23.882'	146° 27.703'	Potential monitoring site in relation to release points
WQ47	Beta Creek	23° 30.524'	146° 22.440'	Impact site in relation to subsidence
WQ48	Tallarenha Creek	23° 33.366'	146° 28.305'	Potential reference site in relation to mine runoff on Tallarenha Creek (Option 1)
LC-1	Lagoon Creek	23° 20.043’	146° 29.120’	Downstream impact monitoring site in relation to release points
MC-new	Malcolm Creek	23° 23.863’	146° 25.758’	Impact site in relation to stream diversion and/or release point
PC-Dam	Pebbly Creek	23° 26.333’	146° 18.829’	Impact site in relation to subsidence
Alt AQ14	Lagoon Creek	23° 23.086’	146° 27.918’	Potential monitoring site in relation to release points
Site04	Saltbush Creek	23° 20.395’	146° 29.609’	Reference site in relation to mine runoff/releases
JC-1	Jordan Creek	23° 35.592’	146° 08.038’	Reference site in relation to mine runoff

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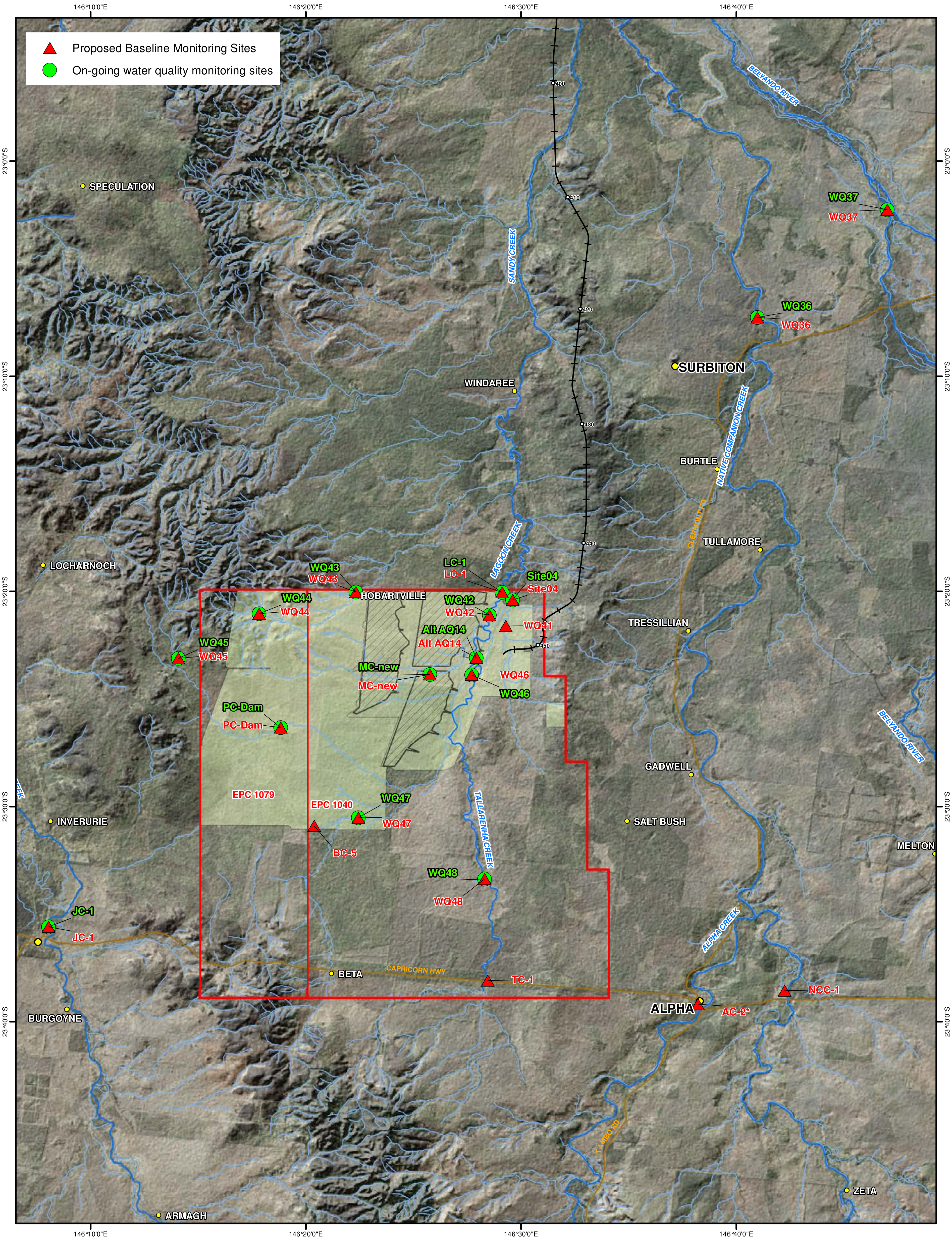

GALILEE COAL PROJECT

(Northern Export Facility)

Waratah Coal

THE NEW ENERGY IN COAL

Mineralogy House, Level 7, 380 Queen Street, Brisbane Qld 4000, Australia

Source:	Mine Detail: Waratah Coal Pty Ltd 2012 Proposed Baseline and On-going Monitoring Sites: GHD - Environmental (Water Resources Group) 2012 Roads: Geoscience Australia 2012 Watercourses (minor): VMA Qld Regrowth & Regrowth Other Watercourses Version 2.1 (DERM 2012) Watercourses (major): E3 Consultants (date unknown) Image: Bing Aerial (Date unknown)
Disclaimer:	This plan is based on or contains data provided by others. Waratah Coal Pty. Ltd. gives no warranty in relation to the data (including accuracy, reliability, completness, currency or suiability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to and use of the data. Data must not be used for disect marketing or be used in breach of privacy laws.
File:	File:WAR20-26-SEIS0067a-FIG2-2-BASELINE-ONGOING-MONITORING-

0 5 10 15 Kilometers

A3 Scale 1:280,000

Coordinate System: GCS GDA 1994

- EPC1040 & Part EPC1079
- Proposed Waratah Rail line (v2.1)
- Watercourse (Major)
- Watercourse (minor)
- Waratah Coal Pty Ltd Open Cut Mining Area
- Waratah Coal Pty Ltd Mine Disturbance Footprint

Figure 2-2:
LOCATION OF PROPOSED BASELINE AND ONGOING WATER QUALITY MONITORING SITES UNDER THE GCP WATER QUALITY MONITORING PLAN

2.7.3 Sample QA/QC

All procedures for collecting, labelling, transporting and storing samples and necessary ancillary field data and constituent will be carried out in accordance with the Australian Standard 5667.6 (1998) and the DERM Monitoring and Sampling Manual (2009b). The following will also be carried out:

- decontamination of reused sampling equipment involved a thorough rinse in distilled water;
- blind duplicates to be taken and analysed to assess the precision and repeatability of the primary laboratory;
- samples to be stored appropriately and submitted to the laboratory within holding times where practicable;
- a NATA accredited laboratory will be used to perform the required analysis for this monitoring program;
- the laboratory will carry out and report on its own internal QA/QC checks, including matrix spike and surrogate spike that assess the accuracy of the results provided; and
- suitably qualified staff will review the data from the laboratory as soon as practical after receipt to check for any outlier results.

2.7.4 Database Management

Waratah Coal commits to developing and maintaining a water quality monitoring database that will capture all data collected, including meta-data on data integrity, which will be used to track trends in water quality as part of its ongoing annual reporting commitments and to support any long-term statistical analysis of the water quality data required to assess potential impacts.

3. References

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Document Status: Final

Rev No.	Author	Reviewer		Approved for Issue		
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