Appendix J Dawson River Release ReceivingEnvironment Monitoring Program

Santos Ltd Dawson River Desalinated Release

Receiving Environment Monitoring Program

Prepared for:

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Contents

Tables

Maps

1 Introduction

Santos Ltd operates a number of gas fields in the Bowen and Surat Basins. The Fairview Arcadia Project Area (FAPA) is located in the upper Dawson River Sub-catchment in central Queensland. The FAPA is an operating gas field covering approximately 318, 297 ha.

The release of desalinated (permeate) produced water to a drainage feature tributary of the Dawson River of up to 18 megalitres per day (ML/day), not triggered by flow, is authorised in accordance with the FAPA Environmental Authority (EA) EPPG00928713[1] (formerly PEN100178208) (Appendix A):

The desalinated release is authorised from Reverse Osmosis Plant 2 (ROP2), which is in the south-east of the FAPA, to a tributary gully of the Dawson River, which joins the Dawson River midway between "Dawson's Bend" and "Yebna Crossing" (Map 4.1). This area between the tributary gully of the Dawson River, which joins the Dawson River midway between "Dawson's Bend" and "Yebna Crossing" located 8.5km downstream of the receiving wetland is known as the 'receiving environment' as defined by condition of the FAPA EA. The desalinated release is authorised to occur until 23 July 2026.

The water course releases include the following elements:

- produced water in the Hub Compressor Station No. 4 (HCS4) gathering network will be collected from the well pads via gathering lines and transported to a produced water management pond of 200 ML capacity, sized for 10 days storage at peak production;
- produced water will then be passed through ROP2 at HCS4 for treatment, and subsequently stored in a permeate pond (HCS04DWB1) of 340 ML capacity, sized for 15 days storage at peak production, before delivery at a maximum rate of 18 ML/day to the desalinated release outfall pipeline (which is the total capacity of the pipe and the maximum design flow for the release scheme);
- desalinated produced water will be released to surface waters as defined by the FAPA EA, at the contaminant release point described in the FAPA EA as ROP2. The coordinates for the release location are those described in condition - Schedule B, Table 3 – Contaminant Release Points of the FAPA EA;
- a 5.3km outfall pipeline will transfer the desalinated produced water from the permeate pond to the proposed outfall at the tributary gully;
- the released water will flow for 2.9 km down the tributary gully before discharging into the Waterbody, estimated to have a volume of approximately 500 ML; and

[1] EPPG00928713, dated 03 November 2022.

- the Waterbody overflows into a downstream section of the tributary gully, which flows for a further 1.8 km before discharging to the Dawson River.

The receiving environment of the desalinated release therefore contains two water types: the Waterbody and the Dawson River (Map 4.1)[2].

The EA requires that the release of desalinated produced water from ROP2 must not cause adverse environmental impacts on the species richness or species abundance of aquatic fauna in the receiving environment. To monitor water quality, and the species richness and abundance of aquatic fauna within the receiving environment, the EA requires the development and implementation of a Receiving Environment Monitoring Program (REMP) for the desalinated release. Table 1.1 defines the scope and content the REMP must address.

1.1.1 Background

The FAPA EA was amended on 31 May 2013 to authorise the desalinated release. The amended conditions of the FAPA EA required baseline biological assessments and biological monitoring to be undertaken prior to the release of contaminants to waters from ROP2. Seven baseline biological assessments and biological monitoring surveys were undertaken over a period of approximately 24 months commencing in August 2013 and finalising in January 2015. The findings from the baseline biological assessments and biological monitoring formulated the development of local water quality guidelines and a revision to the REMP originally developed.

The release of desalinated produced water from ROP2 to the Dawson River commenced on 23rd July 2015. The commencement of the release to waters enacted the commencement of the REMP.

Given the commencement of the release of desalinated produced water an EA amendment application was submitted to the Department of Environment and Sciences (DES) on 18 April 2018 which was later authorised on 11 June 2018. The amendment removed the conditions of the EA associated with the baseline biological assessment and biological monitoring (former EA conditions B19 – B24). The current EA is dated 3 November 2022.

[2] A comparative site on Hutton Creek, upstream of the receiving environment for desalinated release, is considered a third water type in the context of the biological monitoring program for desalinated release

1.2 Purpose and Scope

The REMP for Dawson River desalinated releases has been developed to monitor and record the effects of the release water on the receiving environment whilst it is being discharged, with the aim of identifying and describing the extent of any adverse environmental impacts on the receiving waters, as required by the EA.

This report presents the design of the REMP, with the scope of this design document having been guided by the Receiving Environment Monitoring Program Guideline – for use with Environmentally Relevant Activities under the Environmental Protection Act (1994) (EHP 2014), and the conditions of the EA including:

- a description of the release characteristics, including quality and quantity of the release
- an appraisal of the parameters assessed in the baseline monitoring program, and assessment of their efficacy for the REMP
- a description of the receiving environment attributes, including
  - a description of the spatial extent of the receiving waters
  - catchment area and surrounding land use, hydrology, geomorphology, aquatic habitats, background water and sediment quality, and key aquatic communities of waterways in the receiving environment
  - applicable environmental values (EVs), including hydrology, water quality guidelines and biological guidelines applicable to the receiving environment
- temporal context of the REMP, including the timing and frequency of sampling, and
- the monitoring program design.

1.2.1 Roles and Responsibilities

The roles and responsibilities relating to the development and implementation of the REMP are described fully in the EA, which includes the following conditions:

- Condition A5 – all REMP monitoring is undertaken by suitable qualified persons
- Condition A8 – all laboratory analyses and tests required must be undertaken by a laboratory that has NATA accreditation for such analyses and tests
- Condition A16 - the REMP must be implemented

- Condition A15 and B40 - the REMP design document must be certified by a suitably qualified person (Appendix B)

Conditions numbers are subject to change – refer to the EA referenced at the time of writing the report (Appendix A).

1.2.2 Environmental Authority Compliance Summary

Conditions B36 to B41 relate to the requirements of the REMP. Condition B41 specifies the scope and content of the REMP, with all clauses of this condition achieved by this REMP design document (Table 1.1 and Appendix A).

Table 1.1 Environmental authority compliance summary.

EA condition	Condition	Report section
(B41) (a)	Description of potentially affected receiving waters including key communities and background water quality characteristics based on accurate and reliable monitoring data that takes into consideration any temporal and spatial variation (e.g. seasonality)	Section 4.1 and 4.2.5
(B41) (b)	Description of applicable environmental values	Section 4.3
(B41) (c)	Description of water quality objectives to be achieved	Section 4.4.1
(B41) (d)	Any relevant reports prepared by other governmental or professional research organisations that relate to the receiving environment within which the REMP is proposed	Section 8
(B41) (e)	Water quality targets within the receiving environment to be achieved, and clarification of contaminant concentrations or levels indicating adverse environmental impacts during the REMP	Section 4.4.1, 6.1 and 6.2
(B41) (f)	Monitoring for any potential adverse environmental impacts caused by the release	Section 6.1 and 6.2
(B41) (g)	Monitoring for algal blooms	Section 6.2.2
(B41) (h)	Monitoring of stream flow and hydrology	Section 6.2.2
(B41) (i)	An assessment of bank stability, including monitoring for any potential adverse environmental impacts caused by the release including impacts to bank stability and erosion, and an evaluation of watercourse bank slumping	Section 6.2.2
(B41) (j)	Monitoring of physical chemical parameters as a minimum those specified in Schedule B, Table 4 – Contaminant Limits, Schedule B, Table 5 – Contaminant Limits for Protecting	Section 6.2.2

EA condition	Condition	Report section
	the Environmental Value of Drinking Water and Schedule B, Table 8 – Event-based release- Contaminant monitoring	
(B41) (k)	Monitoring biological indicators in accordance ANZECC & ARMCANZ 2000 (including Before, After, Control, Impact (BACI) Principal) and, where possible, consistent with methodologies specified by FRC Environmental Pty Ltd in their report titled Santos Coal Seam Gas Fields Aquatic Ecology Impact Assessment	Section 6.2.2
(B41) (l)	Monitoring metals/metalloids in sediments (in accordance with ANZECC & ARMCANZ 2000, A Guide To The Application Of The ANZECC & ARMCANZ Water Quality Guidelines In The Minerals Industry (BATLEY et al) and/or the most recent version of AS5667.1 Guidance on Sampling of Bottom Sediments) for permanent, semi-permanent water holes and water storages	Section 6.2.2
(B41) (m)[a]	Monitoring of a selection of invertebrate species (minimum of three from the local receiving environment) to assess ecosystem health (e.g. exoskeleton density) in respect to the availability of calcium and magnesium	Section 6.2.2
(B41) (n)	The methods for analysis and interpretation all monitoring results	Section 6.3; Appendix F
(B41) (o)	The locations of monitoring points (including the locations of proposed background and downstream impacted sites for each release point)	Section 6.2
(B41) (p)	The frequency or scheduling of sampling and analysis sufficient to determine water quality objectives and to derive site specific reference values within two (2) years (depending on wet season flows) in accordance with the Queensland Water Quality Guidelines 2009. For ephemeral streams, this should include periods of flow irrespective of mine or other discharges	Section 6.2.2
(B41) (q)	Monitoring of quality characteristics must include the limits specified in Schedule B, Table 4 – Contaminant Limits to assess the extent of the compliance of concentrations with water quality objectives derived through condition (B26)(p)	Section 6.1 and 6.2.2
(B41) (r)	Specify sampling and analysis methods and quality assurance and control	Section 6.3; Appendix F
(B41) (s)	Any historical data sets to be relied upon	Section 4
(B41) (t)	Description of the statistical basis on which conclusions are drawn	Section 6.1, 6.2, 7; Appendix F
(B41) (u)	Any control or reference sites	Section 6.2.1

EA condition	Condition	Report section
(B41) (v)	Recording of planned and unplanned releases to watercourses, procedures for event monitoring, monitoring methodology used and procedure to establish background surface water quality	Section 6.4

[a] (B41) (m) not applicable to event-based releases

2 Description of the Activity

For the purpose of the REMP, the activity is described as the controlled release of desalinated produced water from ROP2 to the Waterbody and the Dawson River via the tributary gully of up to 18 ML/day.

2.1.1 Release Characteristics and Potential Risks

2.1.2 Water Quality

Schedule B, Table 4 – Contaminant Limits of the EA presents the water quality parameters that are considered to have some level of risk to the environmental values of the receiving environment. However, the risk to aquatic ecosystems is considered to be low where the quality of the desalinated produced water or produced water to be released achieves these limits. Available water quality data for the desalinated produced water shows that the EA limits will be achieved (Appendix C).

At times of maximum release rate and low flow in the Dawson River, increases in total suspended solids, boron, ammonia, chloride, fluoride, sulphate, potassium and sodium are possible relative to baseline water quality conditions (Halcrow 2012a). However, these increases are likely to be minor and not result in an exceedance of the EA limit (Halcrow 2012a).

The Waterbody will have water quality characteristics that closely match the concentrations of the desalinated produced water after approximately three months of releases at the maximum daily rate in the absence of other inflows associated with rainfall (Halcrow 2012a). Maximum allowable releases of desalinated water (i.e. 18 ML/day) are likely to occur twice in the life of the desalinated release (i.e. in the first few years and after approximately five years of operating; Halcrow 2012), with the duration of each peak release being five to six months (Halcrow 2012b). Assessment of available data for the desalinated produced water in relation to baseline data collected from the receiving environment (Appendix C) show that all parameters are likely to comply with the limits set in the EA. However, two parameters were identified as being potentially lower than baseline levels:

- Turbidity – turbidity in the Waterbody is variable (see frc environmental 2015c), and at times of moderate to high turbidity; therefore, it is likely that the high turbidity inhibits algal (phytoplankton) growth. If turbidity becomes low for an extended

period, such as during high release of low turbidity water, then the growth of algae in the Waterbody may increase.

- Calcium – while the EA sets a minimum limit of 1.0 mg/L and the desalinated water to date has a concentration of calcium of approximately 4.0 mg/L (and hence achieves the EA limit), this is lower than natural concentrations of calcium in the Waterbody (i.e. approximately 40 mg/L, an order of magnitude higher than the desalinated water). Calcium is used by a range of invertebrate species (i.e. crustaceans and molluscs) to form exoskeletons, and a low concentration may result in sub-lethal (e.g. reduced reproduction) or lethal effects . As invertebrates form the basis of aquatic food webs, impacts to them may be transmitted to higher trophic levels (e.g. fish), resulting in a disturbed aquatic ecosystem. This risk will be carefully managed by rigorous monitoring of calcium within the receiving environment, and where necessary dosing of the release water with calcium throughout the life of the desalinated release.

Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water of the EA presents the limits for water quality parameters to be achieved at site S4 (see Map 4.1) for protecting drinking water. Review of baseline water quality data at site S4 against the contaminant limits for drinking water show that (Appendix D):

- the concentration of all parameters assessed at site S4 in the baseline program are below the EA limit, with many below the Limit of Reporting (LOR)
- the median and 80th percentile of total aluminium at site S1a were below the EA limit, however the 95th percentile (and maximum) were higher than the limit, and
- eight parameters relevant to the assessment of water quality for drinking water were not assessed, as drinking water parameters were not required to be assessed in the baseline program when it commenced in 2013.

Preliminary analysis of desalinated water indicates that the assessed parameters achieve the EA limits for drinking water. Limited data is available for disinfection by products as disinfection for the purpose of drinking water is not performed as part of the desalination treatment process (Appendix D). It is noted that Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water was amended into the EA on 18 June 2015 following the repeal of the coal seam gas water provisions from the *Water Supply (Safety and Reliability) Act* 2008. This is three years after the commencement of the baseline biological monitoring program (refer to Section 3 of this report).

2.1.3 Water Quantity

Condition B18 of the EA specifies that the maximum daily release must not exceed 18 ML per day from ROP2.

Modeling indicated a minor (i.e. 0.05 m) increase in water level under low flow conditions in the Dawson River at site S4 under a constant release of 18 ML/day, with negligible changes under moderate and high flows. Water levels in the Waterbody since releases commenced are overall higher than during the baseline program (noting that rainfall was lower during the baseline program, and that REMP monitoring of the Waterbody has indicated improved habitat conditions associated with higher water level). However, water levels in the Dawson River are not significantly changed from natural water levels under low flow and are unchanged from natural under moderate and high flow.

Condition B16 states that the release of contaminants from ROP2 must cease on or before 23 July 2026.

3 Historical Baseline Monitoring

A former condition of the EA required a baseline biological assessment to be undertaken, prior to the first release of desalinated produced water, to identify detectable aquatic flora and fauna of the receiving wetland. The baseline program included surveys of:

- aquatic flora
- aquatic macroinvertebrate communities
- fish communities
- frog communities
- turtle communities
- waterbird communities, and
- water quality for the parameters listed in *Schedule B, Table 4 – Contaminant Limits* of the EA.

A baseline biological assessment was undertaken from August 2013 to January 2015, over seven seasonal surveys (frc environmental 2015c), as follows:

- survey 1, winter: August 2013
- survey 2, spring: November 2013
- survey 3, summer: January 2014
- survey 4, autumn: April 2014
- survey 5, winter: July 2014
- survey 6, spring: November 2014, and
- survey 7, summer: January 2015.

The indicators assessed in each of the seven surveys were:

- water quality
- aquatic habitat
- sediment quality
- aquatic flora
- macroinvertebrates communities

- fish communities
- turtle communities
- frog communities, and
- waterbird communities.

Condition B41 of the EA specifies that the REMP must monitor:

- any adverse environmental impacts of the release
- algal blooms
- stream flow and hydrology
- bank stability, erosion and watercourse bank slumping
- water quality parameters listed in Schedule B, Table 4 – Contaminant Limits and Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water
- biological monitoring indicators in accordance with ANZECC & ARMCANZ (2000), including the before, after, control, impact (BACI) principal
- metals and metalloids in sediment, and
- a selection of invertebrate species to assess exoskeleton density.

With respect to the biological indicators, the EA does not specify which indicators to use, providing that they enable any adverse environmental impacts of the release be detected, and that they are monitored in accordance with ANZECC & ARMCANZ (2000) (superceeded by ANZG (2018)) and the BACI principal. ANZG (2018) adopts a weight-of-evidence approach, and so the REMP applies a range of indicators that may be directly (water and sediment quality) or indirectly (biological parameters) influenced by the desalinated release. The biological parameters include benthic macroinvertebrates and pelagic zooplankton (microinvertebrates), both of which may have potentially sensitive taxa, as well as fish that are at a higher tropic level than the invertebrates. Exoskeleton condition of crustacean taxa is included because early studies identified potential risk associated with low ion concentrations on the ability of these taxa to mineralise exoskeletons. Finally, turtles are included in the monitoring program because two species (white-throated snapping turtle and Fitzroy River turtle) that occur in the project area are threatened.

4 Description of Receiving Environment Attributes

4.1 Spatial Extent of the Receiving Environment

The EA defines the receiving environment as 'the waters of the Dawson River and connected or surrounding waterways (including the receiving wetland) up to Yebna Crossing, located 8.5 km downstream of the receiving wetland' (Map 4.1).

The receiving environment has two water types, the Waterbody and the Dawson River[3], described below:

- The Waterbody is a large semi-permanent oxbow lake with an approximate volume of 500 ML. There are several dry gullies upstream of the Waterbody, including the gully the release water will be discharged to. An ephemeral stream connects the Waterbody with the Dawson River downstream of the Waterbody. The Waterbody is a riverine wetland and is considered to be a wetland of General Ecological Significance (GES) under the *Environmental Protection Regulation* 2019 (EHP 2013a).
- The Dawson River is a major tributary of the Fitzroy River. The Dawson River and its tributaries cover an area of approximate 50,776 km2 (EHP 2013b). The stretch of the Dawson River in the receiving environment has a perennial flow regime.

The receiving environment for the REMP is in the upper Dawson River Sub-catchment (EHP 2013b).

4.1.1 Potentially Impacted Waterways

While the receiving environment extends as far downstream as Yebna Crossing (Map 4.1), previous studies have shown that potential impacts to water quality and aquatic ecology from the release of desalinated produced water from ROP2 are most likely to occur in the Waterbody, and that water quality in the Dawson River will be affected only if the river is in low flow during periods of peak release, and that this impact will be minimal (Halcrow 2012a).

Following the completion of the baseline biological assessments and biological monitoring, receiving environment monitoring within the Waterbody was removed from Schedule B,

[3] Hutton Creek contains a comparative site that will be monitored within the scope of the REMP for DRRS, although Hutton Creek is upstream from the receiving environment. Hutton Creek is considered a distinct water type on the basis of hydrological, geomorphological and biological attributes.

Table 4 of the EA. The EA specifies that surface water monitoring is to occur at the inlet to the release pipe (HCS04DWB1) and on the Dawson River (MP1). Site S4 on the Dawson River is specified as the monitoring location for assessment of water quality for protecting the environmental value of drinking water.

Receiving environment monitoring of the Waterbody and Dawson River will continue to be conducted as a part of this REMP as prescribed in Section 6 and Table 6.2.

149° E
149.05° E
149.1° E
149.15° E
149.2° E
149.25° E
25.65° S
25.7° S
25.75° S

PL 91
Dawson River
PL 232
Injune Road
Yebna Crossing
Hutton Creek
PL 92
PL 100
Dawsons Bend
Tributary Gully
Commissioner Creek
PL 99
Injune Road

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Dawson River Desalinated Release: Receiving Environment Monitoring Program

Map 4.1: Spatial extent of the receiving environment

SOURCES

Document Path: Y:\Utility\Mapping\Projects\2022\220905_EHS_Dawson_EPBC\Workspaces\220905_Map_4-1_Receiving_Env.mxd

LEGEND

- Release Point
- Receiving Environment as defined in EA EPPG00928713
- Waterbody
- Tributary Gully
- Major Waterway
- Fairview Project Area
- Local Road

N

SCALE

0 0.5 1 2 3 4
Kilometres

Scale: 1:80,000 @ A3

PROJECTION
Coordinate System: GCS GDA 1994
Datum: GDA 1994
Units: Degree

DATE
2022-11-29

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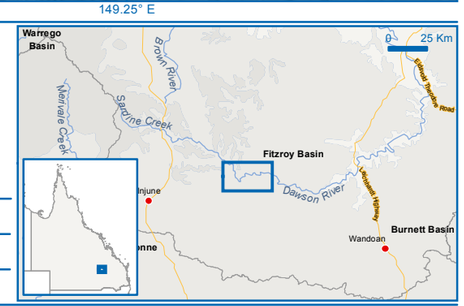

4.2 Current Condition of the Receiving Environment

4.2.1 Previous Surveys

Early studies of the aquatic ecology of the Waterbody were completed by Simmonds and Bristow (2012).

Between August 2013 and January 2015 seven baseline biological surveys were completed by frc environmental (summarised in frc environmental 2015c):

- survey 1, winter: August 2013
- survey 2, spring: November 2013
- survey 3, summer: January 2014
- survey 4, autumn: April 2014
- survey 5, winter: July 2014
- survey 6, spring: November 2014, and
- survey 7, summer: January 2015.

4.2.2 Hydrology

The flow regime of the Dawson River and its tributaries is dominated by 'unpredictable, highly intermittent summer flow' with some reaches having 'variable, extremely intermittent summer flow' (Kennard et al. 2010). Thus, the majority of flows (including high flow events) are most likely during the summer months, although the magnitude, duration and timing (i.e. early or late summer) of these flows can vary between years. The Dawson River is in low flow condition most of the time with intermittent flows generally occurring as large pulses.

Water levels in the Waterbody fluctuate between seasons and years, although historically there has generally been a significant volume of water in the Waterbody, with very few records of the Waterbody drying completely. The Waterbody may be filled when the Dawson River is in high flow, although not all high flow events fill the Waterbody (e.g. the flood flows in December 2014 did not fill the Waterbody). The occurrence of overspilling from the Waterbody to the Dawson River is rare, although not well documented.

Periods of low flow and zero flow in the Dawson River are likely to be the most important 'events' for the REMP, as the concentration of some water quality parameters may increase in the Dawson River at these times if there are also peak releases of desalinated produced

water (Halcrow 2012a), assuming that low concentrations of calcium in the release water is not causing impact at these times.

4.2.3 Geomorphology

The Dawson River originates in the south-east part of the Carnarvon George National Park in high elevation sandstone of the Central Queensland Highlands. The upper Dawson River (i.e. west of Taroom) has a dendritic channel pattern, with major tributaries including Hutton, Baffle and Eurombah Creeks. The upper Dawson River and its tributaries have predominantly confined valley settings, although the upper Dawson River also has partly-confined valley settings in places with small sections of floodplain, such as the floodplain area surrounding the Waterbody. The channel beds of these watercourses contain a mix of bedrock, cobble, gravel, sand and silt, which create a range of hydraulic features, such as pools, riffles, glides and runs when inundated. Stream banks within the receiving environment are dominated by silt and / or clay, and are of variable slope. Sand bars form in the upper Dawson River, with summer flood flows having a notable influence on the deposition and erosion of sand.

The Waterbody is on a small floodplain area near a partly-confined reach of the upper Dawson River. The bed and banks of the Waterbody are comprised of silt, and the banks have a low slope. The Waterbody connects to the Dawson River via a sinuous, ephemeral watercourse.

4.2.4 Aquatic Habitat Features

Aquatic habitat was assessed during each of the baseline surveys, and is summarised in Table 4.1.

The most obvious and important change in habitat conditions in the seven baseline surveys were changes to water levels and flow. Water levels progressively declined at all sites over surveys 1 – 3 (winter, spring and summer); rainfall prior to survey 4 (autumn) increased water levels at all sites (excluding WLMP4) and increased flow at site DRR1 (and presumably at sites DRMP1 and S4 as well, although these sites were not assessed during surveys 1 – 3). Water levels decreased again over surveys 5 (winter) and 6 (spring), and site WLMP4 was totally dry for these surveys. In the weeks leading up to survey 7 (summer) significant rainfall caused flooding in Hutton Creek and the Dawson River, and increased water levels in the Waterbody.

Table 4.1 Habitat characteristics of each water type [a].

Habitat Attribute	Habitat Characteristics		
	Waterbody	**Dawson River**	**Hutton Creek**
Bank stability	*moderate*: bank slope low to moderate vegetation cover highly variable, sometimes low significant cattle disturbances to bank	*moderate*: bank slope moderate to high some unstable and eroding sections of bank vegetation cover moderate some areas of cattle disturbance to bank	*moderate*: bank slope moderate to high some unstable and eroding sections of bank vegetation cover low to moderate some areas of cattle disturbance to bank
Bed stability	*high*: little scouring and deposition cattle disturbance to bed within shallow sections	*low*: significant scouring and deposition of sand following very high flow events	*low*: significant deposition of fine sediment
Substrate diversity	*low*: fine silt and clay	*high*: variable substrate types, including silt and clay, sand, and cobbles significant deposition of sand over cobbles after very high flow events means that substrate composition can vary	*low to moderate*: dominated by thick silt deposition overlying cobbles, pebbles and gravel; boulders that are not covered by silt represent approximately 5% of the site

Habitat Attribute	Habitat Characteristics		
	Waterbody	**Dawson River**	**Hutton Creek**
Riparian vegetation condition	*moderate*: some clearing for creating pasture native vegetation (*Eucalyptus* sp.) dominates canopy layer; no notable shrub layer ground stratum a mixture of native sedges and grasses, and introduced herbaceous weeds (e.g. thistle) recruitment of *Eucalyptus* sp. seedlings noted during the baseline survey	*moderate*: some clearing for creating pasture native vegetation (*Eucalyptus* sp., *Callistemon* sp., *Casuarina* sp.) dominates canopy and shrub layers ground stratum a mixture of native sedges, mat rushes and grasses, and introduced herbaceous weeds (e.g. thistle)	*moderate*: some clearing for creating pasture native vegetation (*Eucalyptus* sp. and *Callistemon* sp.) dominates canopy and shrub layers ground stratum of low cover, including native mat rushed and introduced herbaceous weeds (e.g. thistle) some recruitment of *Eucalyptus* sp. seedlings noted during the baseline survey
Flow habitats	*low*: non-flowing, lentic shallow and deep sections	*moderate*: low to high flow, depending on antecedent rainfall pools (low flow) and runs (low to moderate flow) dominate small sections of riffle also present shallow and deep sections	*low*: low to high flow, depending on antecedent rainfall pool (low flow, shallow to moderate depth water) habitat dominates, and for most of the baseline surveys, a small isolated pool was the only water present at the site site with many deep sections and variable flow habitats present after significant rainfall (observed in only 1 of the 7 baseline surveys)

Habitat Attribute	Habitat Characteristics		
	Waterbody	**Dawson River**	**Hutton Creek**
Physical habitat features	*low*: limited large woody debris limited aquatic plants in water no variation in substrate composition depth variation of non-flowing water provides limited habitat variation	*high*: moderate large woody debris generally moderate but highly variable (i.e. sometimes low) cover of aquatic plants in water undercut banks variation in substrate types range of flow habitats (pools, runs) depth variation	*low to moderate*: limited large woody debris undercut banks no aquatic plants in water substrate is impacted by sedimentation, but boulders provide habitat site often in a near-dry condition, when flow habitats and water depth (and overall amount of aquatic habitat) is very limited site with many deep sections and variable flow habitats present after significant rainfall (observed in only 1 of the 7 baseline surveys)

[a] source: frc environmental 2015c

4.2.5 Water Quality

Results for water quality measured in situ in the baseline surveys, with comparison to published water quality guidelines (WQG, EHP 2013b), can be summarised as follows (frc environmental 2015c):

- Temperature followed a typical seasonal pattern, and was lowest in the winter surveys and generally highest in the summer surveys, although flood flows reduced water temperature in summer 2014/2015 (survey 7). There is no WQG for the temperature of water, but the temperature range recorded over the four surveys is within the tolerance limits of freshwater fauna of the region.
- Electrical conductivity was consistently higher than the WQG at the Waterbody sites, except as sites WLMP1 and WLMP5 in survey 7 (summer 2014/2015) after significant rainfall had likely diluted the concentration of dissolved salts at these sites. Electrical conductivity achieved the WQG at sites on the Dawson River and Hutton Creek in all of the surveys, except for site DRR2 on Hutton Creek where electrical conductivity was higher than the WQG in surveys 1 (winter 2013) and 6 (spring 2014)
- The pH of water was within the WQG range at sites on the Dawson River and Hutton Creek in most of the surveys; only site S4 on the Dawson River had low pH in survey 5 and high pH in survey 6. Sites within the Waterbody were within the WQG range in most surveys, although pH was high at all sites on some surveys. There was no consistent season when pH values were high.
- Dissolved oxygen was not within the WQG range at the Waterbody sites in most of the surveys, and mostly was not within the WQG range at sites on the Dawson River and Hutton Creek.
- Turbidity did not achieve the WQG at the Waterbody sites in any of the surveys. Turbidity generally achieved the WQG at sites on the Dawson River, and generally did not achieve the WQG for the site on Hutton Creek (site DRR2).

Synthesis of baseline monitoring data for a broader suite of water quality parameters is presented in frc environmental (2015a; b).

-

4.2.6 In-stream Sediment Quality

Results for sediment quality in the baseline surveys showed that (frc environmental 2015c):

- for parameters that have a published guideline value (eight parameters), the trigger value was not exceeded by any parameter in any water type, and
- the Waterbody and Hutton Creek generally had notably higher concentrations of nutrients and metals in sediment than the Dawson River. This is likely due to the dominance of fine silts and clays at the Waterbody and Hutton Creek sites compared to the dominance of sand at two of the three Dawson River sites (i.e. DRMP1 and S4). Nutrients and metals bind to fine silts and clays to a greater degree than they bind to sand.

4.2.7 Macroinvertebrates

The Dawson River sites tended to have the highest diversity of macroinvertebrate taxa, which may be due to this water type having high cover of submerged aquatic plants in edge habitat. The Waterbody had the highest overall abundance of macroinvertebrates, indicating large numbers of individuals of relatively few taxa compared to the Dawson River sites (frc environmental 2015c). Macroinvertebrate diversity at the Hutton Creek site was similar to the Waterbody, although macroinvertebrate abundance at the Hutton Creek site was intermediate between the Waterbody and the Dawson River. The results for PET richness and SIGNAL-2 scores were generally similar to the results for taxonomic richness of macroinvertebrates, with the Dawson River having notably higher diversity than the Waterbody and Hutton Creek (frc environmental 2015c).

Macroinvertebrate communities were highly variable across the surveys and there were no consistent patterns of similarity between the three water types (other than the macroinvertebrate communities being partially to clearly differentiated between water types on most surveys). This high level of spatial and temporal variation in macroinvertebrate communities observed during the baseline monitoring program is expected for sub-tropical systems that have unpredictable flow regimes and variation habitat conditions (Kennard et al. 2010), especially when both lotic (flowing water systems) and lentic (still water systems, i.e. the Waterbody) are compared.

Differences in community structure between water types and between sites within water types was driven by differences in the abundance of Ceratopogonidae, Chironominae (non-biting midges), Corixidae (water boatmen), Thiaridae (snails), Dytiscidae (diving beetles) and Atyidae (glass shrimp). Thiaridae and Atyidae were important drivers of community differences for the Dawson River sites (e.g. S4, DRMP1 and DRR1). Overall, the

Waterbody sites had high abundances of Ceratopogonidae, Chironominae (non-biting midges) and Corixidae (water boatmen).

No macroinvertebrate taxon listed under the EPBC Act or NC Act was recorded during the baseline surveys.

4.2.8 Fish

A total of 15 species of native fish, and two exotic species (goldfish, *Carassius auratus,* and mosquitofish*, Gambusia holbrooki*), were caught during the baseline surveys (frc environmental 2015c).

Carp gudgeon (*Hypseleotris* spp.) was the most commonly caught species, in terms of both number of surveys and the number of sites at which it was caught, although the abundance of this species was highly varied. Eastern rainbow fish (*Melanotaenia splendida splendida*) had the highest abundance in the Dawson River. Variation in the abundance and / or presence of fish caught between sites and between surveys could be due to a range of factors, including:

- differences in habitat preferences between some of the species; for example some species of fish may prefer the riverine sites of the Dawson River compared to the Waterbody, e.g. Pacific blue-eyes with notable habitat differences between these water types relevant for this species being substrate composition, physical in-stream habitat cover, and flow variation (see Platten 2011), and
- differences in water levels between surveys, with very low water levels at site WLMP4 during survey 4 (autumn) resulting in no fish caught at this site during this survey (and absence of water during surveys 5 and 6 also meaning no fish were present at this site).

All of the native species that were caught are common and typical of the region. Two of the species (leathery grunter, *Scortum hillii* and southern saratoga, *Scleropages leichardti*) are endemic to the Fitzroy River Basin. No species of fish caught during the baseline surveys are listed under the EPBC Act or the NC Act.

Two exotic species of fish were caught during the baseline surveys: Goldfish (*Carassius auratus*) in the Waterbody, and mosquitofish (*Gambusia holbrooki*) in the Dawson River. These are two of the three exotic species of fish known from the Dawson River, and both species have been caught previously by frc environmental in the Dawson River and connected waterways (goldfish in Hutton Creek; mosquitofish elsewhere in the Dawson River) (frc environmental, unpublished data).

4.2.9 Turtles

Four species of turtle were caught across the baseline surveys:

- Krefft's river turtle (*Emydura macquarii*)
- white throated snapping turtle (*Elseya albagula*)
- saw-shelled turtle (*Wollumbinia latisternum*), and
- eastern long-necked turtle (*Chelodina longicolis*).

Six species of turtle have been caught during operational phase desalinated release REMP monitoring:

- Krefft's river turtle (*Emydura macquarii)*
- white throated snapping turtle (*Elseya albagula*)
- saw-shelled turtle (Wollumbinia latisternum)
- eastern long-necked turtle (*Chelodina longicolis*)
- broad-shelled river turtle (*Chelodina expansa*), and
- Fitzroy River turtle (*Rheodytes leukops*).

Two of these turtle species are threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*:

- white throated snapping turtle (*Elseya albagula*) – critically endangered, and
- Fitzroy River turtle (*Rheodytes leukops*) – vulnerable.

A single white-throated snapping turtle was recorded in the Waterbody in 2017; otherwise, these two threatened species have only been recorded in low abundance in the Dawson River and Hutton Creek. For example, the baseline mean abundance of white throated snapping turtle in both the Dawson River and Hutton Creek was 0.1.

4.2.10 Environmental Values

The receiving environment for the DRRS is in the Upper Dawson River Sub-catchment, in the 'Upper Dawson – Taroom area', which is the reach of the Dawson River that extends from Hutton Creek to Glebe Weir. The *Dawson River Sub–basin Environmental Values and Water Quality Objectives, Environmental Protection (Water) Policy 2009 (EPP Water)* (EHP

2013b) identifies the following environmental values (EVs) for this reach of the Dawson River:

- aquatic ecosystem (moderately disturbed waters)
- irrigation
- farm supply/use
- stock water
- aquaculture
- human consumption
- primary recreation
- secondary recreation
- visual appreciation
- drinking water
- industrial use, and
- cultural and spiritual values.

A brief discussion on the applicability of each potentially relevant EV, as identified in the EPP Water, is presented for each water type (i.e. the Waterbody and the Dawson River; Map 4.1) in Table 4.2. A search of the DNRM water entitlement dataset (DNRM 2016) indicates that the closest surface water impoundment entitlement (specific purpose not stated in database) on the Dawson River main channel is situated more than 350 km downstream.

Additional references to the EVs of the Upper Dawson River catchment are detailed in the report *Environmental Values for the Fitzroy: Community Consultation September 2010* (FBA 2010).

A comparison of the potential EVs as presented within the Dawson EPP and the summary of Draft Human Use Environmental Values as determined through community consultation throughout the Fitzroy Basin (Feb-Mar 2010), as well as the applicable EVs determined by Santos, are provided in Table 4.3.

Table 4.2 Environmental Values Assessment for the Waterbody and Dawson River.

Environmental Value	Discussion	Applicability / Level	
		Waterbody	**Dawson River**
Aquatic Ecosystems	Recent assessments of aquatic ecology of the Waterbody, by suitably qualified personnel, indicated that the Waterbody is a moderately to highly disturbed system, as the Waterbody and its immediate surrounds have been adversely affected by human activity (grazing, stock access). Several species of waterbird listed as Migratory under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* frequent the Waterbody, although these species are unlikely to be residents at the Waterbody. The assessment of the Dawson River indicated the presence of White Throated Snapping Turtle (*Elseya albagula*), which is listed as Critically Endangered under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*.	Applicable – moderate	Applicable – moderate to high
Irrigation	There is currently no irrigation in the immediate vicinity of the Waterbody, with the closest irrigation being approximately 5km to the west. There is a water supply scheme in the Dawson River that supplies water to irrigators, although this scheme is further downstream than the extent of the receiving environment. There is limited extraction of water for irrigation from the Dawson River in the vicinity of the receiving environment.	Not applicable	Applicable – low
Farm Supply/Use	The Waterbody is currently not used for irrigation, nor is it considered to be used to supplement water for other farm based uses (e.g. milking sheds, fruit packing etc.). There is limited extraction of water for general farm supply from the Dawson River in the vicinity of the receiving environment.	Not Applicable	Applicable – low

Environmental Value	Discussion	Applicability / Level	
		Waterbody	Dawson River
Stock Watering	Stock access to large portions of the Waterbody is permitted and has been observed. The banks of the Waterbody are severely degraded and lack riparian vegetation due to cattle access/activity. Similarly, cattle access the Dawson River for water at numerous places within and downstream of the receiving environment.	Applicable – high	Applicable – high
Aquaculture	There is currently no aquaculture in or within the immediate vicinity of the Waterbody or the receiving environment of the Dawson River.	Not Applicable	Not Applicable
Human Consumption	Human consumption (of wild or stocked) aquatic species is considered applicable to the Waterbody and the Dawson River. However it is noted that the Waterbody is in a remote location and on private land, as such is not accessible to the public. The likelihood of human consumption of aquatic species from the Waterbody is considered to be very low. Similarly, there are few public access points to the receiving environment reach of the Dawson River, although fish species such as saratoga (a non-eating species) may be caught by local landholders in this reach of the Dawson River.	Applicable – low	Applicable – low
Primary Recreation	The Waterbody is in a remote location and on private land, as such is not accessible to the public. The likelihood of primary recreation (e.g. swimming, etc.) within the Waterbody is considered to be very low. Similarly, public access to the receiving environment reach of the Dawson River is limited. It is possible but not well-known if local landholders use this reach of the Dawson River for swimming.	Applicable – low	Applicable – low

Environmental Value	Discussion	Applicability / Level	
		Waterbody	Dawson River
Secondary Recreation	The Waterbody is in a remote location and on private land, as such it is not accessible to the public. The likelihood of secondary recreation (e.g. fishing, sailing or other water sports etc.) within the Waterbody is considered to be very low. Similarly, the receiving environment reach of the Dawson River has few public access points, and while there may be some fishing by local landholders in this reach of the Dawson River, other forms of secondary recreation are unlikely.	Applicable – low	Applicable – low
Visual Appreciation	The Waterbody is in a remote location and on private land, as such it is not accessible to the public. Visual appreciation of environmental values, including picnicking, bush walking etc. are therefore not considered applicable to the Waterbody. Similarly, the receiving environment reach of the Dawson River has few public access points, and no established picnic areas or parklands are near this reach of the Dawson River.	Not Applicable	Not Applicable
Drinking Water	The extraction of raw water from the Waterbody for drinking water is not considered applicable. The closest residential property to the Waterbody is approximately 5.5 km to the east of the Waterbody. Drinking water is sourced from the Dawson River at Theodore Weir which is located approximately 240 km downstream from the receiving environment. Drinking water is therefore considered applicable to the Dawson River, although it is assessed as only low due to the very large distance downstream that water is extracted for drinking supply.	Not Applicable	Applicable – low
Industrial Use	The Waterbody is in a remote location and on private land, as such it is not accessible to the public. The property holder does not currently use the Waterbody for industrial purposes (e.g. power generation, manufacturing etc.). Consequently, the industrial use EV is not considered applicable.	Not Applicable	Not Applicable

Environmental Value	Discussion	Applicability / Level	
		Waterbody	Dawson River
	Similarly, there are no industrial uses of water in the vicinity of the receiving environment reach of the Dawson River		
Cultural and Spiritual Values	Cultural and spiritual purposes are considered applicable to the Waterbody and the Dawson River. While there are no mapped/documented Cultural Heritage Exclusion Zones within the immediate vicinity of the Waterbody, there are several cultural heritage zones in the vicinity of the Dawson River.	Applicable – moderate	Applicable – high

Table 4.3 Comparison of Environmental Values for the Dawson River and Waterbody.

	Aquatic Ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumption	Primary recreation	Secondary recreation	Visual appreciation	Drinking water	Industrial use	Cultural and spiritual values
Environmental Values												
EPP Water Dawson River Sub-basin Environmental Values and Water Quality Objectives, Basin No.130 (part), including all waters of the Dawson River Sub-basin except the Callide Creek Catchment, September 2011												
Upper Dawson (Injune Area) main channel (upstream of Hutton Creek junction) – developed areas	✓			✓		✓	✓	✓	✓	✓		✓
Upper Dawson (Injune Area) main channel (upstream of Hutton Creek junction) – undeveloped areas	✓			✓		✓	✓		✓	✓		✓
Upper Dawson (Taroom Area) main channel downstream of Hutton Creek junction) – developed areas, including Glebe Weir	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Human Use Environmental Values as determined through community consultation throughout the Fitzroy Basin (Feb – Mar 2010)												
Values for the Fitzroy: Community Consultation September 2010 (FBA, 2010)												
Values: ✓ – Present, X – Absent, H – High, M – Medium, L – Low												
40 – Upper Dawson main channel/immediate tributaries (Injune Workshop)	✓	X	X	✓	X	✓L	✓L	✓L	✓L	✓L	X	✓L
Santos Determined/Assessed Environmental Values												
Values: ✓ – Present, X – Absent, H – High, M – Medium, L – Low												
Dawson River (within vicinity of release point)	✓M	X	X	✓L	X	✓L	X	✓L	✓L	✓L	X	✓
Waterbody	✓L	X	X	✓L	X	✓L	✓L	✓L	X	X	X	✓L

4.3 Water Quality Guidelines

4.3.1 Water Quality

Local, project specific water quality guidelines for the Environmental Value of Protection of Aquatic Ecosystems have been developed for the parameters listed in *Schedule B, Table 4 – Contaminant Limits* of the EA (frc environmental 2015a; b). The local guidelines for the Waterbody and the Dawson River for the parameters that have monitoring points in the receiving environment are presented in Table 4.4.

Local water quality guidelines could not be developed for Hutton Creek because data was only available from one reference site (a minimum of three reference sites are needed where two years of data are available (EHP 2013c)). Therefore, the applicable water quality guidelines for Hutton Creek are those published in the Dawson EPP (EHP 2013b) (Table 4.4). However, baseline water quality data from site DRR2 on Hutton Creek was summarised to aid in the interpretation of water quality data collected at this site during REMP events (Appendix E).

The guidelines for parameters relating to the protection of drinking water, as specified in *Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water*, are presented in Appendix D.

Table 4.4 Local water quality guidelines developed from baseline data as per the QWQG.

Parameter	**Unit**	**Local Water Quality Guideline**		**Default Water Quality Guidelines** [a]
		Dawson River	**Waterbody**	**Hutton Creek**
Physical Chemical				
temperature [b]	°C	19.0 – 29.3	15.8 – 27.1	–
Dissolved Oxygen [b]	mg/L	6.4 – 16.1	6.4 – 16.1	6.4 – 16.1
Electrical Conductivity @ 25°C	µS/cm	627	500	500
pH [a]	pH Unit	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Suspended Solids	mg/L	128	50	50
Turbidity [b]	NTU	monitor only	monitor only	monitor only
Nutrients				
Ammonia as N [a]	mg/L	0.9	0.9	0.9
Total Nitrogen as N	mg/L	3.93	0.62	0.62

Parameter	Unit	Local Water Quality Guideline		Default Water Quality Guidelines [a]
		Dawson River	Waterbody	Hutton Creek
Total Metals and Metalloids				
Boron	µg/L	2900 [c]	2900 [c]	2900 [c]
Zinc	µg/L	12	8	8
Dissolved Metals and Metalloids				
Boron	µg/L	2900 [c]	2900 [c]	2900 [c]
Zinc	µg/L	8	8	8

source: frc environmental 2015b

[a] default guideline as presented in *Schedule B, Table 4 – Contaminant Limits* of the EA.

[b] based on field data

[c] refer to Appendix A, based on direct toxicity assessment of total boron(AECOM 2019)

4.3.2 In-stream Sediment Quality

Local, project specific sediment quality guidelines were developed for selected parameters, including metals and metalloids as specified in Condition B41 (l) of the EA (frc environmental 2015c) (Table 4.5).

Table 4.5 Local sediment quality guidelines (trigger values) for metals and metalloids in each water type.

Parameter	Units	Trigger Value [a]	SQG-High [a]	LOR	Waterbody			Dawson River			Hutton Creek		
					count	median	80th percentile	count	median	80th percentile	count	median	80th percentile
Aluminium	mg/kg	–	–	0.5	63	7097	13933	45	1874	5191	21	6290	11800
Arsenic	mg/kg	20	70	1	63	2.57	3.5	45	1.33	2.36	21	2.5	4.5
Boron	mg/kg	–	–	5	63	9.97	18.8	45	5.15	17.9	21	12	25
Cadmium	mg/kg	1.5	10	0.5	54	<0.5	<0.25	42	<0.5	<0.25	18	<0.5	<0.25
Chromium	mg/kg	80	370	1	63	10.0	12	45	3.78	6.42	21	8.3	15
Copper	mg/kg	65	270	1	63	9.07	14	45	2.37	5.93	21	7	11
Iron	mg/kg	–	–	2	63	10727	17867	45	4050	9353	21	12100	20700
Lead	mg/kg	50	220	1	63	13.7	17.6	45	4.38	8.72	21	11.5	16
Manganese	mg/kg	–	–	1	63	466	648	45	92.4	230.5	21	264	337
Mercury	mg/kg	0.15	1	0.5	63	<0.5	<0.25	45	<0.5	<0.25	21	<0.5	<0.25
Nickel	mg/kg	21	52	0.5	63	7.57	11.5	45	2.7	5.53	21	5.4	9
Selenium	mg/kg	–	–	1	63	<1	1	45	<1	1.73	21	<1	1
Zinc	mg/kg	200	410	5	63	33.6	51.3	45	9.92	25.1	21	25.3	45

LOR = analytical limit of reporting

Blue shading denotes trigger values for each water type; where the published trigger value was adopted it applied to all three water types.

[a] Trigger Values and SQG- High values as published in Simpson et al. 2013

[b] the range for pH was taken as the mean 20th and 80th percentile of baseline data for each water type.

4.3.3 Biological Guidelines

Local, project specific biological guidelines for the Environmental Value of Protection of Aquatic Ecosystems have been developed (frc environmental 2015c):

- macroinvertebrates (Table 4.6), and
- fish:
  - Waterbody: four species (i.e. ≥ 4)
  - Dawson River: five species (i.e. ≥ 5)
  - Hutton Creek: two species (i.e. ≥ 2)
- white-throated snapping turtle and Fitzroy River turtle: monitor only, comparing raw monitioring data with baseline data (see Section 4.2.9).

Table 4.6 Local biological guidelines for macroinvertebrates for each water type.

Macroinvertebrate index	Waterbody	Dawson River	Hutton Creek
Abundance	92.3 – 252.8	39.9 – 152.0	23.0 – 207.4
Taxonomic Richness	5.67 – 10.8	9.93 – 16.9	4.0 – 10.0
PET richness	0.0 – 1.2	1.47 – 4.0	0.0 – 1.0
SIGNAL-2 Score	2.65 – 3.20	3.46 – 4.00	2.90 – 3.30

Source: frc environmental 2015c

5 Temporal Context of the REMP

Temporal considerations are important for the Dawson River Watercourse Releases REMP:

- periods of desalinated release: REMP monitoring is implemented as per design presented in this report, adhering to post-wet and pre-wet monitoring where possible (i.e. high river flows may require flexibility in monitoring of some parameters)
- periods where there have been no desalinated releases for 6 months: the frequency of REMP monitoring reduces to annually (post-wet season), and
- following ceasation of the desalinated releases (noting EA Condition B16 states desalinated releases will cease on or before 23 July 2026): two-years of post-release monitoring then ceassation of monitoring program.

6 Monitoring Program Design

6.1 Monitoring Program Components

Release of desalinated produced water may:

- directly influence certain water quality and sediment quality parameters within the receiving environment
- directly influence bank stability
- indirectly influence algae blooms in the Waterbody, and
- indirectly influence biological communities (i.e. threatened turtle species, fish, macroinvertebrates and zooplankton) within the receiving environment.

Therefore the monitoring components of the Dawson River Desalinated Release REMP are:

- hydrology
- geomorphology (bed and bank stability)
- water quality
- sediment quality
- algae blooms
- biology:
  - white-throated snapping turtle and Fitzroy River turtle
  - fish
  - macroinvertebrates
  - zooplankton
  - crustacean exoskeleton condition.

These monitoring components align with those required under Condition 41 of the EA.

The Dawson River Desalinated Release REMP has a two tier approach towards detecting adverse environmental impacts on the local environmental values of the aquatic ecosystem of the receiving environment:

1. Tier 1: an investigation would be triggered where there is a non-compliance with any of the local WQGs for water quality (Table 4.4), sediment quality (Table 4.5) and / or biological parameters (Table 4.6) at any receiving environment monitoring site. The approach would include:
   - a root cause review of the exceedances with appropriate corrective / preventative actions
   - a review of any other available information, such as non-project site specific influences, and
   - reporting in accordance with the FAPA EA.
2. Tier 2: a response will be triggered where the results of the tier 1 approach indicate a potential impact to the receiving environment. The tier 2 response would include:
   - rapidly re-sampling relevant parameters at appropriate monitoring locations to ensure the data is representative, and
   - response and reporting in accordance with SMS-HSS-OS05-PD01 – Crisis, Incident Management & Emergency Response Procedure (Santos 2022) and Conditions K1, K2, K4 and K5 of the FAPA EA.

6.1.1 Monitoring Component Information

6.1.2 Monitoring Sites

Hydrology will be monitored at sites WLMP1, DRMP1 and S4, and at the control site DRR1.

Monitoring for geomorphology (bed and bank stability) to ensure compliance with Condition B24 of the EA will involve assessment of bed and bank stability using the Sustainable Rivers Audit physical habitat methodology at sites WLMP1, WLMP4, WLMP5, DRMP1 and S4.

Water quality and algal blooms will be monitored at (Table 6.1, Map 6.1):

- sites WLMP1, WLMP2, WLMP3, WLMP4, WLMP5 and DRMP1 in the receiving environment;, and
- site S4 at the downstream end of the receiving environment as nominated in Schedule B, Table 5.

Schedule B, Table 4, of the EA also mandates monitoring of certain water quality parameters at the Inlet to Release Pipe (HCS04DWB1) for ROP2 (see frc environmental 2015a). This monitoring is not considered part of the REMP, although the data generated by this monitoring will aid in the interpretation of REMP data.

Sediment and biological parameters (including crustacean exoskeleton condition) will be monitored at sites WLMP1, WLMP4, WLMP5, DRMP1, and S4 in the receiving environment (Table 6.1, Map 6.1).

Two control sites upstream of the defined receiving environment (i.e. sites DRR1 and DRR2; Table 6.1, Map 6.1) will also be monitored within the scope of the REMP to enable control site – test site comparisons, and implementation of BACI (before-after-control-impact) analyses if needed.

Table 6.1 Description of REMP Monitoring Sites for Desalinated Releases Program.

Site	Description	GDA94	
		Latitude	Longitude
Waterbody sites within the Receiving Environment			
WLMP1 [a]	Waterbody; 200 m downstream of where the tributary gully discharges into the Waterbody.	-25.708	149.146
WLMP2 [b]	Waterbody; 450 m upstream of where the tributary gully discharges into the Waterbody.	-25.706	149.143
WLMP3 [c]	Waterbody; 300 m downstream of where the tributary gully discharges into the Waterbody.	-25.707	149.149
WLMP4 [d]	Waterbody; 1.5 km upstream of where the tributary gully discharges into the Waterbody.	-25.698	149.139
WLMP5 [e]	Waterbody; 1.0 km downstream of where the tributary gully discharges into the Waterbody.	-25.701	149.153
Dawson River sites within the Receiving Environment			
DRMP1	Dawson River; 3.5 km downstream of where the tributary gully discharges into the Waterbody and 200 m downstream of the confluence of the tributary gully and the Dawson River.	-25.6905	149.1675
S4	Dawson River at Yebna Crossing; 9.8 km downstream of where the tributary gully discharges into the Waterbody and 8 km downstream of the confluence of	-25.692	149.216

Site	Description	GDA94	
		Latitude	Longitude
	the tributary gully and the Dawson River. Represents the downstream extent of the receiving environment.		
Control Sites Upstream of the Receiving Environment			
DRR1 [f]	Dawson River; 550 m upstream of the confluence of the tributary gully and the Dawson River.	-25.688	149.156
DRR2 [g]	Hutton Creek; 34 km upstream of the confluence of the tributary gully and the Dawson River	-25.718	148.971

Baseline site represented by: [a] = WMP1, [b] = WMP2, [c] = WMP3, [d] = WMP4, [e] =WMP5, [f] = RS1, [g] = RS2

149° E
149.05° E
149.1° E
149.15° E
149.2° E
25.65° S
25.7° S
25.75° S

PL 91
Dawson River
PL 232
Hutton Creek
PL 92
PL 100
PL 99
DRR1
DRMP1
S4
WLMP4
WLMP5
WLMP2
WLMP1
WLMP3
DRR2
Injune Road
Tributary Gully
Commissioner Creek
Sids Pocket Road

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Dawson River Desalinated Release: Receiving Environment Monitoring Program

Map 6.1: Monitoring sites for the Santos Dawson River Watercourse Releases Receiving Environment Monitoring Program

SOURCES

Document Path: Y:\Ulily\Mapping\Projects\2022\220905_EHS_Dawson_EPBC\Workspaces\220905_Map_6-1_Monitoring_pts.mxd

LEGEND

Monitoring Sites
- Dawson River sites
- Hutton Creek sites
- Waterbody sites

Waterbody

Tributary Gully

Major Waterway

Fairview Project Area

Local Road

N

SCALE

0 1 2 4
Kilometres

Scale: 1:75,000 @ A3

PROJECTION
Coordinate System: GCS GDA 1994
Datum: GDA 1994
Units: Degree

DATE
2022-11-29

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VERSION
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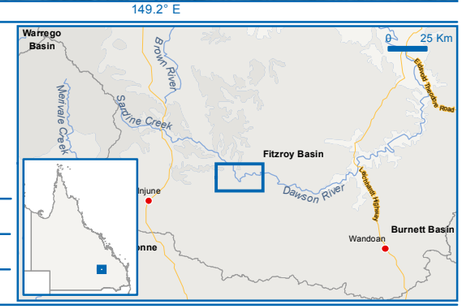

6.1.3 Indicators to be Monitored and Frequency of Monitoring

The indicators to detect adverse environmental impacts on the local environmental values of the aquatic ecosystem of the receiving environment are provided in Tables 4.4, 4.5 and 4.6, as per the tier response in Section 6.1. Other indicators are monitored only without comparison to guidelines.

The hydrological indicator will be daily flow in megalitres with potential to use longer timeframes for longer term comparisons. Gauging stations are located at sites WLMP1 and S4. Visual observations will be conducted twice each year, adhering to a pre-wet and post-wet schedule, where possible at sites WLMP1 and DRMP1.

The frequency of monitoring for water quality will be in accordance with Schedule B, Tables 4 and 5 of the EA. Water quality monitoring for the purposes of the REMP will be conducted in accordance with Table 6.2. Where the results of monitoring exceed the derived Local Water Quality Guidelines prescribed in Table 4.4, the two tier approach towards detecting adverse environmental impacts on the local environmental values of the aquatic ecosystem of the receiving environment will be undertaken in accordance with that described in Section 6.1.

Algal blooms will be assessed visually during water quality monitoring assessments, with additional assessment undertaken if deemed necessary (Table 6.2).

Geomorphological monitoring (bed and bank stability) will comprise assessment of bed and bank stability using the Sustainable Rivers Audit physical habitat methodology at sites WLMP1, WLMP4, WLMP5 and DRMP1, which will be monitored twice each year, adhering to a pre-wet and post-wet schedule, where possible.

Sediment quality will be monitored twice each year, adhering to a pre-wet and post-wet schedule, where possible (Table 6.2).

Biological parameters will be monitored twice per year, adhering to a pre-wet and post-wet schedule, where possible (Table 6.2).

Control sites will be monitored twice per year, adhering to a pre-wet and post-wet schedule, where possible (Table 6.2).

A detailed explanation of the methods is provided in the procedures for aquatic ecological monitoring (Appendix F). If unsafe conditions (e.g. river flows following rain events) prevent the safe application of the procedures (e.g. fish / turtle netting), the frequency of monitoring components may be altered.The frequency of monitoring may also be altered if no release occurs in the 6 month period related to each pre-wet and post-wet schedule.

REMP monitoring is proposed to cease two years post cessation of the desalinated releases (i.e. 4 monitoring rounds completed after releases cease).

Table 6.2 REMP design for Dawson River Watercourse Releases Desalinated Releases Program.

Monitoring Component	Parameter	Monitoring Site	Monitoring Frequency	Action Level
Hydrological Components				
stream flow	discharge (m^3/s) and water level (m)	gauging stations located at receiving environment sites WLMP1, and S4	Discharge monitored daily but accessed as needed	Monitor only as per section 6.1
		WLMP1, DRMP1 and control site DRR1	Visual observations twice per year (notionally pre-wet and post-wet season)	
Geomorphology Components				
bed and bank stability	assessment of bed and bank	receiving environment sites WLMP1, WLMP4, WLMP5, DRMP1 and S4; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per section 6.1
Water Quality Components – Aquatic Ecosystems [a]				
physico-chemical parameters	temperature, pH, electrical conductivity, turbidity, dissolved oxygen	receiving environment sites WLMP1, WLMP4, WLMP5 and DRMP1; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.4 and Section 6.1

Monitoring Component	Parameter	Monitoring Site	Monitoring Frequency	Action Level
	total suspended solids	receiving environment sites WLMP1, DRMP1 and control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.4 and Section 6.1
nutrients	total nitrogen	receiving environment sites WLMP1, WLMP2, WLMP3, WLMP4 and WLMP5 control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.4 and Section 6.1
	ammonia	receiving environment sites WLMP1, WLMP2 and WLMP3 control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.4 and Section 6.1
metals and metalloids	total and dissolved boron	receiving environment site DRMP1 receiving environment sites WLMP1, WLMP4, WLMP5 and DRMP1; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.4 and Section 6.1
	dissolved zinc	receiving environment site DRMP1 receiving environment sites WLMP1, WLMP4, WLMP5 and DRMP1; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.4 and Section 6.1

Monitoring Component	Parameter	Monitoring Site	Monitoring Frequency	Action Level
	dissolved metals and metalloids (Al, As, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se)	receiving environment sites WLMP1, WLMP4, WLMP5 and DRMP1; control sites DRR1 and DRR2	Required if triggered by exceedances	Monitor only as per Section 6.1
major ions	total Ca, Cl, Fl, Mg, K, Na, SO_4	receiving environment sites WLMP1, WLMP4, WLMP5 and DRMP1; control sites DRR1 and DRR2	Required if triggered by exceedances	Monitor only as per Section 6.1
algae	visual inspection	receiving environment sites WLMP1, WLMP2, WLMP3, WLMP4 and WLMP5	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Section 6.1
Water Quality Components – Drinking Water Quality [a]				
drinking water components	alpha activity, aluminium, ammonia, antimony, arsenic, barium, benzene, beta activity, bisphenol A, boron, bromide, cadmium, chromium, copper, cyanide, ethylbenzene, fluoride, iodide, lead, manganese, mercury, molybdenum, nickel, nonylphenol, PAH (as B(a)P TEF), selenium, silver, strontium, toluene, TPH, vanadium, xylenes, zinc	receiving environment site S4	first release day of each quarter	Monitor only as per Schedule B, Table 5 of the EA

Monitoring Component	Parameter	Monitoring Site	Monitoring Frequency	Action Level
Sediment Quality Components				
metals and metalloids	total metals and metalloids (As, B, Cr, Cu, Fe, Mn, Ni, Pb, Se, Zn)	receiving environment sites WLMP1, WLMP4, WLMP5, DRMP1 and S4; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.5 and Section 6.1
Biological Components				
threatened turtle species	Monitor only (compare raw monitoring data with baseline data)	receiving environment sites WLMP1, WLMP4, WLMP5, DRMP1 and S4; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only Section 6.1
macroinvertebrates	richness of aquatic macroinvertebrate taxa identified to the lowest practical taxonomic level; density of exoskeleton of crustaceans and molluscs	receiving environment sites WLMP1, WLMP4, WLMP5, DRMP1 and S4; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Table 4.6 and Section 6.1
fish	richness of species	receiving environment sites WLMP1, WLMP4, WLMP5, DRMP1 and S4; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Section 6.1
zooplankton	taxonomic diversity; presence of *Ceriodaphnia* cf *dubia*	receiving environment sites WLMP1, WLMP4, WLMP5, DRMP1 and S4; control sites DRR1 and DRR2	twice per year (notionally pre-wet season and post-wet season)	Monitor only as per Section 6.1

[a] only water quality monitoring relating to the receiving environment is presented. Refer to the EA for monitoring requirements for Inlet to Release Pipe (HCS04DWB1) for ROP2.

6.2 Quality Assurance and Quality Control

In accordance with Conditions A5, A15 and B40 of the EA, the REMP will be maintained, certified (Appendix B) and undertaken by suitably qualified persons. The monitoring, analysis and reporting, will have regard to the procedures and quality assurance / quality control (QA/QC) requirements set out in the following documents:

- Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC & ARMCANZ 2000; ANZG 2018);
- Monitoring and Sampling Manual 2009, Environmental Protection (Water) Policy 2009 (EHP 2013a)
- AS 3778.3.1 Measurement of Flow in Open Channels
- Sustainable Rivers Audit physical habitat methodology (MDBC 2004b)
- Australian / New Zealand Standard AS5667.1 Water Quality – Sampling
- AS/NZ5667.12 Guidance on Sampling of Bottom Sediments
- Handbook for Sediment Quality Assessment (Simpson et al. 2005)
- Queensland Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual (DNRM 2001)
- SMS-HSS-OS05-PD01 – Crisis, Incident Management & Emergency Response Procedure (Santos 2022), and
- procedures for aquatic ecological monitoring (Appendix F).

Further details of the QA/QC procedures for each parameter are provided in the water sampling manual and procedures for aquatic ecological monitoring documents.

6.2.1 Recording of Planned and Unplanned Releases and Procedure for Event Monitoring

Condition B41(v) of the EA requires the recording of planned and unplanned releases to watercourses, procedures for event monitoring, monitoring methodology used and procedure to establish background surface water quality.

Condition B18 of the EA authorises the planned release of up to 18 ML/day of desalinated produced water to the Waterbody. The quantity of desalinated released will be measured and recorded by maintenance staff.

Conditions B18 and B41(v) will be appropriately managed through the SMS-HSS-OS05-PD01 – Crisis, Incident Management & Emergency Response Procedure (Santos 2022). This procedure also documents any reporting and notification requirements, as detailed in EA Conditions K1, K2, K4 and K5.

6.2.2 Assumptions and Qualifications

To allow for comparisons with baseline conditions, the proposed desalinated release monitoring sites are based on the location of baseline monitoring sites.

Some sites (e.g. WLMP4) may be dry in some surveys, depending on factors such as antecedent rainfall. Where sites are dry, bank stability and sediment quality will still be sampled during the desalinated release monitoring program.

7 Data Analysis and Reporting

7.1 Interim Analysis and Reporting

An interim geomorphological and biological monitoring report will be completed once per year to document a summary of survey results against seasonal baseline biological conditions. Interim reports will present the methods and results for applicable survey events, and will report data for Conditions B41(i), B41(k), B41(l) and B41(m), against relevant guideline values. The surveys will follow procedures defined for aquatic ecological monitoring for the desalinated release (Appendix F).

7.1.1 Annual Analysis and Reporting

Santos Ltd will report incidents and non-conformances as required per Conditions K1, K2, K4 and K5 of the EA, as described in section 6. An annual supplementary geomorphological and biological monitoring report will be prepared as required in Conditions B41(i), B41(k), B41(l) and B41(m), which will integrate the results of all desalinated releases biological monitoring undertaken during the reporting period.

Data analyses and statistical procedures to be used are detailed in the procedures for aquatic ecological monitoring (Appendix F).

8 References

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Simpson, S.L., Batley, G.E., Chariton, A.A., Stauber, J.L., King, C.K., Chapman, J.C., Hyne, R.V., Gale, S.A., Roach, A.C. & Maher, W.A., 2005, *Handbook for Sediment Quality Assessment*, CSIRO, Lucas Heights, NSW.

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Appendix A Environmental Authority

Permit

Environmental Protection Act 1994

Environmental authority EPPG00928713

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act1994.

Environmental authority number: EPPG00928713

Environmental authority takes effect on 03/11/2022.

Environmental authority holder(s)

Name(s)	Registered address
PAPL (Upstream) Pty Limited	c/- Addisons Commercial Lawyers Level 12, 60 Carrington Street SYDNEY NSW 2000
KGLNG E&P Pty Ltd	Level 11 28 The Esplanade PERTH WA 6000
SANTOS TPY, LLC	Santos Centre G, 60 Flinders Street ADELAIDE SA 5000
SANTOS QUEENSLAND, LLC	Ground Floor, Santos Centre 60 Flinders Street ADELAIDE SA 5000 Australia
Total E&P Australia	BGC Centre Level 13, 28 The Esplanade PERTH WA 6000
SANTOS TPY CSG, LLC	Ground Floor, Santos Centre 60 Flinders Street ADELAIDE SA 5000 Australia
Total E&P Australia II	BGC Centre, Level 13 28 The Esplanade PERTH WA 6000
SANTOS TOGA PTY LTD	Ground Floor, Santos Centre 60 Flinders Street ADELAIDE SA 5000 Australia
Bronco Energy Pty Limited	Ground Floor, Santos Centre 60 Flinders Street ADELAIDE SA 5000 Australia

ABN 46 640 294 485

Queensland Government

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Ancillary 63 - Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (b-i) more than 100 but not more than 1500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 63 - Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (a-i) 21 to 100EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 62 - Resource recovery and transfer facility operation 1: Operating a facility for receiving and sorting, dismantling, baling or temporarily storing- (c) category 2 regulated waste	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL236
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL100, PL232, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL234
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL100, PL232, PL420, PL421, PL90, PL91, PL92, PL99, PPL76, PPL92
Schedule 3 07: A petroleum activity involving injection of a wastefluid into a natural underground reservoir or aquifer	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92

Environmentally relevant activity/activities	Location(s)
Schedule 3 06: A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92
Schedule 3 08: A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92
Schedule 3 03: A petroleum activity that is likely to have a significant impact on a category A or B environmentally sensitive area	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92, PPL2066
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	ATP2012, PL100, PL232, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	ATP2012, PL100, PL232, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL421
Ancillary 64 - Water treatment 3: Treating 10ML or more raw water in a day	ATP2012, ATP526, PL100, PL1017, PL232, PL233, PL234, PL235, PL236, PL420, PL421, PL440, PL90, PL91, PL92, PL99, PPL76, PPL92
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	ATP526
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL420

Environmentally relevant activity/activities	Location(s)
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL235
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL233
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL1017
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL440
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL421
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	ATP2012
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL236
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL234

Environmentally relevant activity/activities	Location(s)
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL1017
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL440
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	ATP526
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL235
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL233
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	ATP2012
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL236
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL234

Environmentally relevant activity/activities	Location(s)
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL233
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL1017
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL440
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	ATP526
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL420
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL235
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL234
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL421
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following	PL236

Environmentally relevant activity/activities	Location(s)
quantity of category 2 regulated waste- (c) more than 10,000t	
Ancillary 14 - Electricity Generation 1: Generating electricity by using gas at a rated capacity of 10MW electrical or more	PL235
Ancillary 15 - Fuel burning Using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour	PL233
Non-Scheduled Petroleum Activity Water Monitoring Authority - WMA	WMA2020
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL1017
Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c)	PL440
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	ATP526
Ancillary 55 - Other waste reprocessing or treatment 2: Operating a facility for receiving and either reprocessing or treating, in a year, the following quantity of category 2 regulated waste- (c) more than 10,000t	PL420

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days);

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or

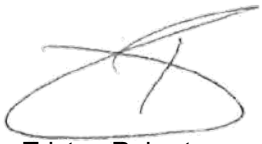
b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or

c) otherwise-on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Sustainable Planning Act 2009* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.



Tristan Roberts
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

3 November 2022

Enquiries:
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Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

SCHEDULE A- GENERAL

A1 This environmental authority authorises the carrying out of the following resource activity(ies):

(a) the petroleum activities listed in *Schedule A, Table 1 – Scale and Intensity for the Activities* tothe extent they are carried out in accordance with the activity's corresponding scale and intensity;

(b) incidental activities that are not otherwise specified relevant activities.

Schedule A, Table 1 – Scale and Intensity for the Activities

Tenure Numbers	Petroleum Activities and Infrastructure	GLNG Project		GFD Project	
		Scale (number of activities)	Intensity (maximum size in total)	Scale (number of activities)	Intensity (maximum size in total)
ATPs: 526/2012 PLs: 90, 91, 92, 99, 100, 232, 233, 234, 235, 236, 420, 421, 440, 1017 PPLs: 76, 92, 2066	Coal seam gas exploration, appraisal and development wells	1256 wells	2611 ha	1,711 ha	Up to 2,567 ha
	Stimulation activities	All wells are subject to stimulation activities			
	Injection Wells FV77 and FV82	2	6 ha	N/A	
	Gathering lines/transmission lines	N/A		As required	
	Access Roads	N/A		As required	Access road width: up to 30m
	Compressor Stations (below the threshold of 500kg of fuel per hour)	N/A		1	Up to 8ha
	Compressor Station(s)	11 A-CS-01 / ACS-02 ACS-03 CS1 CS2 CS3 F-HCS-04 F-HCS-05 F-NCS-04-01 F-NCS-04-02 F-NCS-05-01 F-NCS-05-02	360 ha	N/A	

ABN 46 640 294 485

Tenure Numbers	Petroleum Activities and Infrastructure	GLNG Project		GFD Project	
		Scale (number of activities)	Intensity (maximum size in total)	Scale (number of activities)	Intensity (maximum size in total)
	Regulated Structure(s)	N/A		4	Up to 64 ha
	Regulated Structure(s) (Dams) ≥400 megalitres	5	250 ha	N/A	
	Regulated Structure(s) (Dams) <400 megalitres	43	270 ha	N/A	
	Low Hazard Dam(s)	4910	1229 ha	N/A	
	Water Treatment Facilities that allow treated water to be released to waters other than seawater	7	≤50 ML/day	N/A	
	Water Treatment Facilities	6	≤25 ML/day	1	Up to 10 ha
	Sewage Treatment Plant(s)	N/A		11	>100 equivalent persons (EP) ≤ 450EP / As required
				26	>21 EP ≤ 100 EP / As required
	Sewage Treatment Plant(s) that discharge treated effluent to an infiltration trench or through an irrigation scheme, or to land for dust suppression or construction purposes	11	>100 equivalent persons (EP) ≤ 450 EP	N/A	
		26	>21 EP ≤ 100EP	N/A	

A2 The resource activities in condition (A1) are authorised subject to the conditions of this environmentalauthority.

A3 A register identifying infrastructure constructed and disturbance incurred under the GFD Project Environmental Impact Statement must be maintained. This register must be provided to the administeringauthority upon request.

A4 This environmental authority authorises a relevant act[1] to occur only to the extent that:

(a) the relevant act is an ordinary consequence of carrying out the resource activities authorised bythis environmental authority in accordance with its conditions; or

(b) the relevant act is specifically authorised by the conditions of this environmental authority and carrying out an activity which results in the relevant act does not contravene the conditions of this authority.

[1] See section 493A of the *Environmental Protection Act 1994*

Monitoring

A5 All monitoring required must be undertaken by a suitably qualified person.

A6 If requested by the administering authority in relation to investigating a complaint, monitoring must becommenced within 10 business days.

A7 The administering authority must be advised in writing of the results of the investigation (including an analysis and interpretation of the monitoring results) and actions proposed or undertaken to resolve the complaint within five (5) business days of completing the complaint investigation, unless a longer time isagreed to by the administering authority.

A8 All laboratory analyses and tests required must be undertaken by a laboratory that has NATAaccreditation for such analyses and tests.

A9 Notwithstanding condition (A8), where there are no NATA accredited laboratories for a specific analyte orsubstance, then duplicate samples must be sent to at least two separate laboratories for independent testing or evaluation.

A10 Monitoring and sampling must be carried out in accordance with the requirements of the followingdocuments (as relevant to the sampling being undertaken), as amended from time to time:

(a) for waters and aquatic environments, the Queensland Government's Monitoring and SamplingManual Environmental Protection (Water) Policy 2009.
(b) for groundwater, the Australian Government's Groundwater Sampling and Analysis - A FieldGuide and any applicable Australian Standard.
(c) for noise, the latest Department of Environment and Science Noise Measurement Manual andany applicable Australian Standard.
(d) for air, the Queensland Air Quality Sampling Manual and/or Australian Standard 4323.1:1995 Stationary source emissions method 1: Selection of sampling positions, as appropriate for therelevant measurement
(e) for soil, the Guidelines for Surveying Soil and Land Resources, 2nd edition (McKenzie et al. 2008), and/or the Australian Soil and Land Survey Handbook, 3rd edition (National Committeeon Soil and Terrain, 2009)
(f) for dust, Australian Standard AS3580.

Contingency Procedures for Emergency Environmental Incidents

A11 Petroleum activities involving significant disturbance to land cannot commence until the development of written contingency procedures for emergency environmental incidents which include, but are not necessarily limited to:

(a) A clear definition of what constitutes an environmental emergency incident or near miss for thepetroleum activity.
(b) Consideration of the risks caused by the petroleum activity including the impact of flooding and other natural events on the petroleum activity.

(c) Response procedures to be implemented to prevent or minimise the risks of environmental harm occurring.
(d) The practices and procedures to be employed to restore the environment or mitigate any environmental harm caused.
(e) Procedures to investigate causes and impacts including impact monitoring programs for releases to waters and/or land.
(f) Training of staff to enable them to effectively respond.
(g) Procedures to notify the administering authority, local government and any potentially impactedlandholder.

Maintenance of Plant and Equipment

A12 All plant and equipment must be maintained and operated in their proper and effective condition.

A13 The following infrastructure must be signed with a unique reference name or number in such a way that itis clearly observable:
(a) regulated dams and low consequence dams
(b) exploration, appraisal and development wells
(c) water treatment facilities
(d) sewage treatment facilities
(e) specifically authorised discharge points to air and waters
(f) any chemical storage facility associated with the environmentally relevant activity of chemicalstorage
(g) field compressor stations
(h) central compressor stations
(i) gas processing facilities; and
(j) pipeline compressor stations.

A14 Measures to prevent fauna being harmed from entrapment must be implemented during the constructionand operation of well infrastructure, dams and pipeline trenches.

Documentation

A15 A certification must be prepared by a suitably qualified person within 30 business days of completing every plan, procedure, program and report required to be developed under this environmental authority,which demonstrates that:
(a) relevant material, including current published guidelines (where available) have beenconsidered in the written document
(b) the content of the written document is accurate and true; and
(c) the document meets the requirements of the relevant conditions of the environmental authority.

A16 All plans, procedures, programs, reports and methodologies required under this environmental authoritymust be written and implemented.

A17 All documents required to be developed under this environmental authority must be kept for five (5) years.

A18 All documents required to be prepared, held or kept under this environmental authority must be providedto the administering authority upon written request within the requested timeframe.

A19 A record of all complaints must be kept including the date, complaint's details, source, reason for the complaint, description of investigations and actions undertaken in resolving the complaint.

Third Party Audit

A20 A third party auditor, nominated by the holder of this environmental authority and accepted by the administering authority, must audit compliance with the conditions of this environmental authority at a minimum frequency of every three (3) years.

A21 Notwithstanding condition (A20), and prior to undertaking the third party audit, the scope and content ofthe third party audit can be negotiated with the administering authority.

A22 An audit report must be prepared and certified by the third party auditor presenting the findings of eachaudit carried out.

A23 Any recommendations arising from the audit report must be acted upon by:

(a) investigating any non-compliance issues identified; and

(b) as soon as reasonably practicable, implementing measures or taking necessary action to ensure compliance with the requirements of this environmental authority.

A24 A written response must be attached to the audit report detailing the actions taken or to be taken on stated dates:

(a) by the holder to ensure compliance with this environmental authority; and

(b) to prevent a recurrence of any non-compliance issues identified.

A25 The audit report required by condition (A22) and the written response to the audit report required bycondition (A24) must be submitted with the subsequent annual return.

SCHEDULE B – WATER

General

B1 Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.

B2 The extraction of groundwater as part of the petroleum activities from underground aquifers must not directly or indirectly cause environmental harm to any watercourse or wetland.

Works in Watercourses and Wetlands

B3 Only construction or maintenance of linear infrastructure is permitted in or within a general ecologically significant wetland or in a watercourse.

B4 Despite condition (B3), the infrastructure and associated activities necessary for construction and/ormaintenance purposes specified in *Schedule B, Table 1 – Authorised Works in a Watercourse* are permitted in the locations specified in *Schedule B, Table 1 – Authorised Works in a Watercourse*.

Schedule B, Table 1 – Authorised Works in a Watercourse

Tenure	Description of Infrastructure/Works	Latitude	Longitude
PL232	Pipeline outfall location for ROP2 permeate	-25.732	149.136
PL232	Remedial works in tributary (Reach 1)	-25.732 to -25.729	149.135 to 149.138
PL232	Remedial works in tributary (Reach 2)	-25.729 to -25.726	149.138 to 149.140
PL232	Remedial works in tributary (Reach 3)	-25.726 to -25.726	149.140 to 149.141
PL232	Remedial works in tributary (Reach 4)	-25.726 to -25.718	149.141 to 149.142
PL232	Remedial works in tributary (Reach 5)	-25.718 to -25.715	149.142 to 149.143
PL232	Remedial works in tributary (Reach 6)	-25.715 to -25.710	149.143 to 149.145
PL232	Remedial works in tributary (Reach 7)	-25.710 to -25.708	149.145 to 149.145
PL232	Remedial works in tributary (Reach 8)	-25.708 to -25.705	149.145 to 149.146
PL232	Remedial works in wetland (Reach 9)	-	-
PL232	Remedial works in tributary (Reach 10)	-25.696 to -25.690	149.162 to 149.161
PL91	Fairview HCS-05 Flare Zone Area.	-25.6108068 -25.61055504 -25.61040637 -25.60988553 -25.60976285 -25.61083767 -25.60941074 -25.60942276 -25.60959198 -25.61022479	148.919138 148.9192011 148.9192646 148.9194891 148.9195311 148.9191318 148.919622 148.9195673 148.9192641 148.9187133
PL421	ASC-03 (centre point of facility)	-25.184184	148.838267

Note: Coordinates are decimal degrees as per Zone 56, GDA 94 datum

B5 The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within a general ecologically significant wetland must be conducted in accordance with the following order of preference:

a) conducting works in times when there is no water present;
b) conducting works in times of no flow;
c) conducting works in times of flow but in a way that does not impede low flow.

B6 The construction and maintenance of linear infrastructure authorised under condition (B3) and authorised works specified in Schedule B, Table 1 must comply with the water quality limits specified in *Schedule B,Table 2 – Release Limits for Construction or Maintenance of Linear Infrastructure"*

Schedule B, Table 2 - Water Release limits for Construction or Maintenance of Linear Infrastructure.

Water Quality Parameters	Units	Water Quality Limits
Turbidity	NTU	For a general ecologically significant wetland, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within 50m downstream of the construction or maintenance activity.
		For a general ecologically significant wetland, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within 50m downstream of the construction or maintenance activity.
Hydrocarbons	-	No visible sheen

B7 Monitoring must be undertaken at a reasonable frequency to ensure compliance with condition (B6).

B8 A register must be kept of all linear infrastructure construction and maintenance activities in a wetland ofother environmental value and watercourses, which must include:

(a) location of the activity (e.g. GPS coordinates (**GDA**94) and watercourse name)
(b) estimated flow rate or surface water at the time of the activity
(c) duration of work
(d) results of impact monitoring carried out under condition (B6).

B9 Petroleum activities must occur outside a wetland of high ecological significance.

B10 Petroleum activities must not negatively impact a wetland of high ecological significance.

B11 Linear infrastructure activities, other than linear infrastructure construction and/or maintenance activities,must not change the existing surface water hydrological regime of any general ecologically significant wetland.

B12 The construction and/or maintenance of linear infrastructure in any general ecologically significant wetland must not:

(a) prohibit the flow of surface water in or out of the wetland;
(b) impact surface water quality in the wetland unless specifically authorised by this environmental authority;
(c) drain the wetland;
(d) fill the wetland;
(e) impact bank stability; or
(f) result in the clearing of riparian vegetation outside of the required footprint.

Floodplains

B13 Where the petroleum activity is carried out on floodplains the petroleum activity must be carried out in away that does not:

(a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact; or
(b) divert flood flows from natural drainage paths and alter flow distribution; or
(c) increase the local duration of floods; or
(d) increase the risk of detaining flood flows.

Erosion and Sediment Control

B14 For activities involving significant disturbance to land, control measures that are commensurate to the site-specific risk of erosion, and risk of sediment release to waters must be implemented to:

(a) preferentially divert stormwater around significantly disturbed land, or allow stormwater to passthrough the site in a controlled manner and at non-erosive flow velocities;
(b) minimise soil erosion resulting from wind, rain, and flowing water;
(c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water;
(d) minimise work-related soil erosion and sediment runoff; and
(e) minimise negative impacts to land or properties adjacent to the activities (including roads).

Contaminant Release – Coal Seam Gas Water

B15 Subject to condition (B16), the release of contaminants to waters must only occur from the releasepoints specified in *Schedule B, Table 3 – Contaminant Release Points*.

Schedule B, Table 3 – Contaminant Release Points

Description	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Contaminant	Description of Receiving Waters
Reverse Osmosis Plant 1 "Pony Hills Water Treatment Plant" (ROP1)	-25.76870484	149.030008341	Treated coal seam gas water	Tributary of Hutton Creek
Reverse Osmosis Plant 2 (ROP2)	-25.73	149.14	Treated coal seam gas water	Tributary of the Dawson River

B16 The release of contaminants to waters from ROP2 in accordance with condition (B15) must cease on or before 23 July 2026.

B17 The release of contaminants to waters from ROP2 in accordance with condition (B15) must not cause an adverse impact on the species richness or species abundance of aquatic fauna.

B18 The maximum volume of contaminants released to waters under condition (B15) must not exceed:
(a) 5.1 ML per day for ROP1;
(b) 18 ML per day for ROP2.

Receiving Environment Monitoring

B19 The release of contaminants to waters authorised by condition (B15) must not exceed the limits specified in *Schedule B, Table 4 – Contaminant Limits* and drinking water limits specified in *Schedule B,Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water*.

B20 The release of contaminants to waters authorised by condition (B15) must be monitored at the locationsand for each quality characteristic and at the frequency specified in *Schedule B, Table 4 – Contaminant Limits* and *Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water*.

Schedule B, Table 4 – Contaminant Limits

Quality Characteristic	Monitoring Point (MP)	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Limit Type	Limit	Monitoring Frequency
Temperature	HCS04DWB1	-25.730	149.090	Monitor only	Monitor only	Daily during release from ROP2
pH	HCS04DWB1	-25.730	149.090	Range	6.5-8.5	
Electrical Conductivity	HCS04DWB1	-25.730	149.090	75th %ile	370 µS/cm	
	ROP1 end of pipe	-25.76870484	149.030008341	Maximum	500 µS/cm	Daily during release from ROP1
Turbidity	HCS04DWB1	-25.730	149.090	Maximum	50 (NTU)	Daily during release from ROP2
Dissolved Oxygen (85-110% Saturation)	HCS04DWB1	--25.730	149.090	Range	6.4-16.1 mg/L	Daily during release from ROP2
Total nitrogen	HCS04DWB1	-25.730	149.090	Maximum	620 µg/L	Weekly during release from ROP2
Ammonia	HCS04DWB1	-25.730	149.090	Maximum	0.9 mg/L	
Calcium	HCS04DWB1	-25.730	149.090	Minimum	1 mg/L	
Chloride	HCS04DWB1	-25.730	149.090	Maximum	175 mg/L	
Fluoride	HCS04DWB1	-25.730	149.090	Maximum	1 mg/L	
Magnesium	HCS04DWB1	-25.730	149.090	Monitor only	mg/L	Weekly during release from ROP2
Potassium	HCS04DWB1	-25.730	149.090	Monitor only	mg/L	
Sodium	HCS04DWB1	-25.730	149.090	Maximum	115 mg/L	
Sulphate	HCS04DWB1	-25.730	149.090	Maximum	5 mg/L	
Aluminium	HCS04DWB1	-25.730	149.090	Maximum	55 µg/L	
Total Arsenic	HCS04DWB1	-25.730	149.090	Maximum	13 µg/L	
Boron	HCS04DWB1	-25.730	149.090	Maximum	2.9mg/L ≤ 13.5ML/Day OR 2.5mg/L ≤18.0 ML/day	Weekly during release from ROP2
	Dawson River MP1	-25.690	149.163	Maximum	2.9 mg/L	Weekly during release from ROP1
Cadmium	HCS04DWB1	-25.730	149.090	Maximum	0.2 µg/L	
Chromium (VI)	HCS04DWB1	-25.730	149.090	Maximum	1 µg/L	Weekly during
Copper	HCS04DWB1	-25.730	149.090	Maximum	1.4 µg/L	
Iron	HCS04DWB1	-25.730	149.090	Maximum	300 µg/L	
Lead	HCS04DWB1	-25.730	149.090	Maximum	3.4 µg/L	
Manganese	HCS04DWB1	-25.730	149.090	Maximum	1,900 µg/L	

Quality Characteristic	Monitoring Point (MP)	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Limit Type	Limit	Monitoring Frequency
Mercury	HCS04DWB1	-25.730	149.090	Maximum	0.6 µg/L	release from ROP2
Nickel	HCS04DWB1	-25.730	149.090	Maximum	11 µg/L	
Selenium	HCS04DWB1	-25.730	149.090	Maximum	11 µg/L	
Zinc	HCS04DWB1	-25.730	149.090	Maximum	8 µg/L	
	Dawson River MP1	-25.690	149.163	Maximum	8 µg/L	Weekly during release from ROP1
Hardness (mg/L)	HCS04DWB1	-25.730	149.090	Monitor only	Monitor only	Weekly during release from ROP2

Note: All metals and metalloids must be measured as dissolved (filtered in the field).
Note: HCS04DWB1 refers to the inlet to release pipe of the dam identified as HCS04DWB1.

Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water

Quality Characteristic	Monitoring Point	Limit Type	Drinking Water Limit	Release Point	Monitoring Frequency
Alpha Activity	Dawson River S4 (coordinates: -25.6920, 149.2160)	Maximum	0.5 Bq/L	ROP1 and ROP2	First release day of each quarter
Aluminium			200 µg/L		
Ammonia			500 µg/L		
Antimony			3 µg/L		
Arsenic			10 µg/L		
Barium			2000 µg/L		
Benzene			1 µg/L		
Beta Activity			0.5 Bq/L		
Bisphenol A			200 µg/L		
Boron			4000 µg/L		
Bromide			7000 µg/L		
Cadmium			2 µg/L		
Chromium			50 µg/L		
Copper			2000 µg/L		
Cyanide			80 µg/L		
Ethylbenzene			300 µg/L		
Fluoride			1500 µg/L		
Iodide			500 µg/L		
Lead			10 µg/L		
Manganese			500 µg/L		
Mercury			1 µg/L		
Molybdenum			50 µg/L		
Nickel			20 µg/L		
Nonylphenol			500 µg/L		

Quality Characteristic	Monitoring Point	Limit Type	Drinking Water Limit	Release Point	Monitoring Frequency
PAH (as B(a)P TEF) TEF: Benz[a]anthracene 0.1 Benzo[b+j]fluoranthene 0.1 Benzo[k]fluoranthene 0.1 Benzo[a]pyrene 1.0 Chrysene 0.01 Dibenz[a,h]anthracene 5 Indeno[1,2,3-cd]pyrene 0.1			0.01 µg/L		
Selenium			10 µg/L		
Silver			100 µg/L		
Strontium			4000 µg/L		
Toluene			800 µg/L		
TPH			200 µg/L		
Vanadium			50 µg/L		
Xylenes			600 µg/L		
Zinc			3000 µg/L		
<u>Disinfection by-products:</u>					
Bromochloroacetonitrile	Dawson River S4 (coordinates: -25.6920, 149.2160)	Monitor only	Monitor only	ROP1 and ROP2	First release day of each quarter
Dichloroacetonitrile		Monitor only	Monitor only		
N-Nitrosodimethylamine		Maximum	0.1 µg/L		
Trihalomethanes (THM): Bromodichloromethane Bromoform Chloroform (Trichloromethane) Dibromochloromethane		Maximum	250 µg/L		

B21 Weekly monitoring for the quality characteristic of boron must be undertaken at S4 (Dawson River, coordinates: -25.6920, 149.2160) when the boron concentration of the release exceeds 2.0 mg/L at HSC04DWB1.

B22 If the quality characteristic of Boron at S4 is between 1.2 mg/L and 1.5 mg/L, all third parties that undertake irrigation using water from the Dawson River, up to a distance of 20km downstream of S4, must be notified.

B23 If the quality characteristic of Boron at S4 exceeds 1.5mg/L, all third parties downstream of S4 that undertake irrigation using water from the Dawson River upstream of the Glebe Weir (coordinates: -25.4647, 150.0349), must be notified.

B24 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.

B25 Notwithstanding any other condition of this environmental authority, there must be no release of any toxicsubstance in any amount or concentration, either alone or in combination with substances already in the receiving water or release, that cause acute toxicological effects to aquatic organisms in the receiving environment, with the exception of the release authorised in *Schedule B, Table 6 – Event-based ReleasePoint* within the receiving environment mixing zone presented in the Dawson River Event Release Technical Impact Assessment Report 2016 (AECOM).

Contaminant Release – Event-based release of Coal Seam Gas Water

B26 Subject to conditions (B26) to (B35), the release of contaminants to waters must only occur from the release point specified in *Schedule B, Table 6 – Event-based Contaminant Release Point.*

Schedule B, Table 6 – Event-based Contaminant Release Point

Description	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Contaminant	Description of Receiving Waters
Event-based release	-25.728583	149.093207	Coal seam gas water	Dawson River

B27 The release of contaminants to waters authorised by condition (B26) must only occur as a contingency measure to support the beneficial use of coal seam water during rainfall events.

B28 A diffuser outlet must be used at the contaminant release location specified in *Schedule B, Table 6 –Event-based Contaminant Release Point.*

B29 The release of contaminants must only occur during periods of natural flow events when the limits in *Schedule B, Table 7 – Event-based release – Limits for release* are met.

Schedule B, Table 7 – Event-based release – Limits for release

Quality Characteristic	Monitoring Point (MP)	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Limit Type	Limit	Monitoring Frequency
Receiving environment stream flow (m^3/sec)	Upstream Dawson River gauging station (S3A)	-25.7237	149.0915	Minimum	>1.16m^3/sec	Prior to release and continuous (15min intervals) during release
Electrical Conductivity	Upstream Dawson River gauging station (S3A)	-25.7237	149.0915	Monitor only	Monitor only	Prior to release and continuous (15min intervals) during release
Electrical Conductivity	Release location (i.e. at pumping source or inlet to pipe)	-25.728583	149.093207	Maximum	10,000 µS/cm	Prior to release and continuous (15min intervals) during release

B30 The release of contaminants to waters authorised by condition (B26) must not exceed the limits specified in *Schedule B, Table 8 – Event-based release – Contaminant monitoring* or *Schedule B, Table 9 – Event-based Release - Contaminant Limits for Protecting the Environmental Value of Drinking Water.*

B31 The release of contaminants to waters authorised by condition (B26) must be monitored at the locationsand for each quality characteristic and at the frequency specified in S*chedule B, Table 8– Event-based release – Contaminant* Limits and Schedule *B, Table 9 – Event based release - Contaminant Limits for Protecting the Environmental Value of Drinking Water.*

Schedule B, Table 8 – Event-based release – Contaminant monitoring

Quality Characteristic	Monitoring Point (MP)	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Limit Type	Limit	Monitoring Frequency
Volume of untreated CSG water	Release location (end of pipe)	-25.728583	149.093207	Monitor	ML	Continuous (15min intervals) during release
pH	Release location (end of pipe)	-25.728583	149.093207	Range	6.5 - 8.5	Within 2 hours of commencement of release, and daily during release thereafter
Temperature	Release location (end of pipe)	-25.728583	149.093207	Monitor	°C	

Quality Characteristic	Monitoring Point (MP)	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Limit Type	Limit	Monitoring Frequency
Turbidity	Release location (end of pipe)	-25.68836	149.15716	Monitor	Monitor (NTU)	Within 2 hours of commencement of release, and weekly during release thereafter
Total Nitrogen	Downstream monitoring point S1a	-25.72464	149.10405	Monitor	µg/L	
Ammonia	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	0.9 mg/L	
Chloride	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	175 mg/L	
Fluoride	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	2 mg/L	
Magnesium	Downstream monitoring point S1a	-25.72464	149.10405	Monitor	mg/L	
Potassium	Downstream monitoring point S1a	-25.72464	149.10405	Monitor	mg/L	Within 2 hours of commencement of release, and weekly during release thereafter
Sodium	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	115 mg/L	
Sulfate	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	5 mg/L	
Aluminium	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	150 µg/L*	
Arsenic (Total)	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	13 µg/L	
Boron	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	1.2 mg/L	
Cadmium	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	0.2 µg/L	

Quality Characteristic	Monitoring Point (MP)	Latitude (Decimal degrees GDA94)	Longitude (Decimal degrees GDA94)	Limit Type	Limit	Monitoring Frequency
Chromium (VI)	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	1 µg/L	
Copper	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	2.5 µg/L*	
Iron	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	350 µg/L	
Lead	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	3.4 µg/L	
Manganese	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	1,900 µg/L	
Mercury	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	0.6 µg/L	
Nickel	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	11 µg/L	
Selenium	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	11 µg/L	
Zinc	Downstream monitoring point S1a	-25.72464	149.10405	Maximum	15 µg/L^	
Hardness as CaCO3	Downstream monitoring point S1a	-25.72464	149.10405	Monitor	mg/L	
Receiving environment stream flow (m^3/sec)	Downstream monitoring point S1a	-25.72464	149.10405	Monitor (m^3/sec)	Monitor	Continuous (15min intervals) during release
Electrical Conductivity	Downstream monitoring point S1a	-25.72464	149.10405	95th Percentile	370 µS/cm	Continuous (15min intervals) during release

Note: all metals and metalloids must be measured as dissolved unless otherwise specified.

* Limit based on the protection of 80% of species (ANZECC, 2000)

^ Limit based on the protection of 90% of species (ANZECC, 2000)

Schedule B, Table 9 – Event based release- Contaminant Limits for Protecting the Environmental Value of Drinking Water

Quality Characteristic	Monitoring Point	Limit Type	Drinking Water Limit	Release Point	Monitoring Frequency
Alpha Activity	Dawson River S1a (coordinates - 25.72464, 149.10405)	Maximum	0.5 Bq/L	Schedule B, Table 6 Event-based Contaminant Release Point.	Following release on the first release day of each quarter
Aluminium			200 µg/L		
Ammonia			500 µg/L		
Antimony			3 µg/L		
Arsenic			10 µg/L		
Barium			2000 µg/L		
Benzene			1 µg/L		
Beta Activity			0.5 Bq/L		
Bisphenol A			200 µg/L		
Boron			4000 µg/L		
Bromide			7000 µg/L		
Cadmium			2 µg/L		
Chromium			50 µg/L		
Copper			2000 µg/L		
Cyanide			80 µg/L		
Ethylbenzene			300 µg/L		
Fluoride			1500 µg/L		
Iodide			500 µg/L		
Lead			10 µg/L		
Manganese			500 µg/L		
Mercury			1 µg/L		
Molybdenum			50 µg/L		
Nickel			20 µg/L		
Nonylphenol			500 µg/L		
PAH (as B(a)P TEF) TEF: Benz[a]anthracene 0.1 Benzo[b+j]fluoranthene 0.1 Benzo[k]fluoranthene 0.1 Benzo[a]pyrene 1.0 Chrysene 0.01 Dibenz[a,h]anthracene 5 Indeno[1,2,3-cd]pyrene 0.1			0.01 µg/L		
Selenium			10 µg/L		
Silver			100 µg/L		
Strontium			4000 µg/L		
Toluene			800 µg/L		
TPH			200 µg/L		
Vanadium			50 µg/L		
Xylenes			600 µg/L		
Zinc			3000 µg/L		

B32 The environmental authority holder must take all reasonable and practicable measures to maintain safe and practical access to monitoring locations specified in *Schedule B, Table 4 – Contaminant Limits, Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water*, *Schedule B, Table 8 – Event-based release – Contaminant monitoring* and *Schedule B, Table 9 – Event based releases - Contaminant Limits for Protecting the Environmental Value of Drinking Water.*

B33 If the release limits defined in *Schedule B, Table 9 – Event based releases - Contaminant Limits for Protecting the Environmental Value of Drinking Water-* or S*chedule B, Table 8 – Event-based release -Contaminant monitoring* are exceeded, the following events must occur:

(a) the release of contaminants to waters authorised by condition (B26) must cease within 24 hours of becoming aware of any exceedance: and

(b) the holder of the environmental authority must demonstrate to the administering authority a strategy for managing future releases without exceedances before undertaking further releases.

B34 If the quality characteristic of Boron of the release exceeds the release limit of 1.2 mg/L specified in and*Schedule B, Table 8 – Event- based release - Contaminant monitoring*, all third parties that undertake irrigation using water from the receiving waters up to a distance of 300km downstream must be notified.

B35 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters or cause a material build-up of sediment in such waters.

Receiving Environment Monitoring Program

B36 For the release authorised in *Schedule B, Table 3 – Contaminant Release Points*, a REMP must be developed to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised activity(ies) by 1 February 2014. The REMP must include periodic monitoring for the effects of the discharge on the receiving environment (under natural flow conditions) asa result of contaminant releases to waters from the site.

B37 For the release authorised in *Schedule B, Table 3 – Contaminant Release Points,* for the purposes of the REMP, the receiving environment is the waters of the Dawson River and connected or surrounding waterways (including the receiving wetland) up to Yebna Crossing, located 8.5 km downstream of the receiving wetland.

B38 For the release authorised in *Schedule B, Table 6 – Event Based Contaminant Release Point*, a Receiving Environment Monitoring Program (REMP) Design Document that addresses each criterionpresented in condition (B41), except criteria (B41)(m), must be prepared and submitted to the administering authority for approval prior to any release occurring under condition (B29). Due consideration must be given to any comments made by the administering authority on the REMP Design Document and subsequent implementation of implemented for the duration of the program.

B39 Conditions (B40) and (B41) apply to the releases authorised in *Schedule B, Table 3 – ContaminantRelease Points* and *Schedule B, Table 6 – Event-based Contaminant Release Point.*

B40 The REMP must be reviewed and certified by a suitably qualified person.

B41 The REMP must address but not be limited to the following:

a) description of potentially affected receiving waters including key communities and backgroundwater quality characteristics based on accurate and reliable monitoring data that takes into consideration any temporal and spatial variation (e.g. seasonality);

b) description of applicable environmental values, including but not limited to:
   i. hydrology (flow, duration, periodicity, connectivity with groundwater systems;
   ii. physiochemical properties;
   iii. the suitability of the water for supply as drinking water;
   iv. aquatic ecosystem parameters including flow and fauna habitat; and
   v. geomorphological features;

c) description of water quality objectives to be achieved;

d) any relevant reports prepared by other governmental or professional research organisations that relate to the receiving environment within which the REMP is proposed;

e) water quality targets within the receiving environment to be achieved, and clarification of contaminant concentrations or levels indicating adverse environmental impacts during theREMP.

f) monitoring for any potential adverse environmental impacts caused by the release;

g) monitoring for algal blooms;

h) monitoring of stream flow and hydrology;

i) an assessment of bank stability, including monitoring for any potential adverse environmentalimpacts caused by the release including impacts to bank stability and erosion, and an evaluation of watercourse bank slumping;

j) monitoring of physical chemical parameters as a minimum those specified in *Schedule B, Table4 – Contaminant Limits, Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water and Schedule B, Table 8 – Event-based release- Contaminant monitoring;*

k) monitoring biological indicators in accordance ANZECC & ARMCANZ 2000 (including Before,After, Control, Impact (BACI) Principal) and, where possible, consistent with methodologies specified by FRC Environmental Pty Ltd in their report titled *Santos Coal Seam Gas Fields Aquatic Ecology Impact Assessment*;

l) monitoring metals/metalloids in sediments (in accordance with ANZECC & ARMCANZ 2000, *AGuide To The Application Of The ANZECC & ARMCANZ Water Quality Guidelines In The Minerals Industry* (BATLEY et al) and/or the most recent version of AS5667.*1 Guidance on Sampling of Bottom Sediments*) for permanent, semi-permanent water holes and water storages;

m) monitoring of a selection of invertebrate species (minimum of three from the local receiving environment) to assess ecosystem health (e.g. exoskeleton density) in respect to the availability of calcium and magnesium;
n) the methods for analysis and interpretation all monitoring results;
o) the locations of monitoring points (including the locations of proposed background and downstream impacted sites for each release point);
p) the frequency or scheduling of sampling and analysis sufficient to determine water quality objectives and to derive site specific reference values within two (2) years (depending on wet season flows) in accordance with the *Queensland Water Quality Guidelines* 2009. For ephemeral streams, this should include periods of flow irrespective of mine or other discharges;
q) monitoring of quality characteristics must include the limits specified in *Schedule B, Table 4 – Contaminant Limits* to assess the extent of the compliance of concentrations with water quality objectives derived through condition (B28)(p);
r) specify sampling and analysis methods and quality assurance and control;
s) any historical data sets to be relied upon;
t) description of the statistical basis on which conclusions are drawn,
u) any control or reference sites; and
v) recording of planned and unplanned releases to watercourses, procedures for event monitoring,monitoring methodology used and procedure to establish background surface water quality.

Well Testing

B42 Subject to condition (B43) and condition (B44), the injection of CSG water or better quality groundwateris authorised in wells that are not exploration, appraisal or development wells, for the purposes of hydraulic testing, where such hydraulic tests are undertaken for no more than two (2) consecutive days.

B43 The maximum volume of CSG water or better quality groundwater injected for the purposes of hydraulic testing identified in condition (B42) must not exceed 1ML per hydraulic test.

B44 Written notification detailing the type and location (GPS coordinates) of any hydraulic testing undertaken in accordance with condition (B42) must be provided to the administering authority at least10 business days prior to the commencement of the hydraulic test.

Seepage Monitoring Program

B45 A seepage monitoring program must be developed by a suitably qualified person which is commensuratewith the site-specific risks of contaminant seepage from containment facilities, and which requires and plans for detection of any seepage of contaminants to groundwater as a result of storing contaminants byno longer than 3 months following the effective date of this environmental authority.

B46 The seepage monitoring program required by condition (B45) must include but not necessarily be limited to:

(a) identification of the containment facilities for which seepage will be monitored

(b) identification of trigger parameters that are associated with the potential or actual contaminantsheld in the containment facilities as provided for in condition (B47).

(c) identification of trigger concentration levels that are suitable for early detection of contaminant releases at the containment facilities

(d) installation of background seepage monitoring bores where groundwater quality will not havebeen affected by the petroleum activities authorised under this environmental authority to useas reference sites for determining impacts

(e) installation of seepage monitoring bores that:

i. are within formations potentially affected by the containment facilities authorised under this environmental authority (i.e. within the potential area of impact)

ii. provide for the early detection of negative impacts prior to reaching groundwaterdependent ecosystems bores, or water supply bores

iii. provide for the early detection of negative impacts prior to reaching migration pathwaysto other formations (i.e. faults, areas of unconformities known to connect two or more formations)

(f) monitoring of groundwater at each background and seepage monitoring bore at least annuallyfor the trigger parameters identified in condition (B47)

(g) seepage trigger action response procedures for when trigger parameters and trigger levels identified in conditions (B47) and (B46)(c) trigger the early detection of seepage, or upon becoming aware of any monitoring results that indicate potential groundwater contamination

(h) a rationale detailing the program conceptualisation including assumptions, determinations,monitoring equipment, sampling methods and data analysis; and

(i) provides for annual updates to the program for new containment facilities constructed in eachannual return period.

B47 Seepage monitoring bores identified in (B46) (b) must be monitored annually for the trigger parameter(s)specified in *Schedule B, Table 10 Seepage Monitoring Trigger Parameters*.

Schedule B, Table 10 Seepage Monitoring Trigger Parameters

Parameter	Units	Untreated Coal SeamWater	Permeate	Brine
Static Water Level	m	monitor	monitor	monitor
pH	pH unit	monitor	monitor	monitor
EC	µS/cm	monitor	monitor	monitor
Major Anions (sulphate,chloride)	mg/L	monitor	-	-
Major Cations (calcium, magnesium, sodium and potassium)	mg/L	monitor	-	-

Seepage Monitoring Bore Drill Log

B48 A bore drill log must be completed for each seepage monitoring bore in condition (B46) which must include:

(a) bore identification reference and geographical coordinate location
(b) specific construction information including but not limited to depth of bore, depth and length ofcasing, depth and length of screening and bore sealing details
(c) standing groundwater level and water quality parameters including physical parameter andresults of laboratory analysis for the possible trigger parameters
(d) lithological data, preferably a stratigraphic interpretation to identify the important featuresincluding the identification of any aquifers; and
(e) target formation of the bore.

SCHEDULE BA - FLUID INJECTION

BA1 The injection of treated coal seam gas water, treated water or brine into a groundwater aquifer is notauthorised unless stated under condition (BA2) of this environmental authority.

Injection of Brine from Pony Hills Water Treatment Plant into Timbury Hills Formation or CSG-DepletedSource Formations

Target Aquifers

BA2 The holder of this environmental authority is permitted to inject brine or CSG water (injection fluid), on PL90, PL91, PL92, PL99, PL100, PL232, PPL76 and PPL92, into:

(a) the Timbury Hills formation; or

(b) CSG-depleted source formations; provided the:

(i) injection zone formation is shown to be hydraulically isolated from water resource formations, as identified in Attachment 2: *Hydrogeology, 4 May 2008, Environmental Management Plan for the Fairview Project Area*, URS, through substantial and competentaquitards; and

(ii) the injection fluid shows inconsequential reactivity with the injection zone formation fluidsand the formation itself.

Area of Review

BA3 The holder of this environmental authority must identify and review the location of all known wells, faultsand other geologic features which could affect containment within 1,000 m of the well, and that penetrate the injection zone formation. If the review identifies the potential for migration of formation or injection fluids out of the injection zone formation, mitigating action to prevent such migration must be taken before using the injection well. Details of the mitigation measures are to be recorded and providedto the administrating authority as part of the Well Completion Report.

Minimum Construction Requirements

BA4 All injection wells must be cased and cemented to prevent the movement of injection fluids into or between water resource aquifers. The casing and cement used in the construction of each newly drilledwell shall be designed for the life expectancy of the well.

BA5 In determining and specifying casing and cementing requirements, at least the following must be considered:

(a) identification of formations and water resource aquifers;
(b) depth to the bottom of the lowest occurring water resource aquifer;
(c) quality of formation fluids;
(d) depth to the injection zone;
(e) estimated maximum and average injection pressures;
(f) external pressure, internal pressure and axial loading;
(g) hole size;
(h) size and grade of casing strings;
(i) class of cement; and
(j) thermal regime.

BA6 The injection well must include the following:

(a) surface casing fully cemented at least 20 m into competent impermeable strata of:
  (i) the uppermost occurring aquitard below the lowest occurring water resource aquifer; or
  (ii) the aquitard overlying the CSG-depleted source formation;
(b) production casing fully cemented into the injection zone formation;
(c) an annulus packer located within 30 m of the injection fluid release point;
(d) casing centralisers;
(e) inert fluid in the annulus;
(f) a fluid level detection system measuring the annulus fluid; and
(g) injection tubing extending through the packer to the injection zone.

Hydraulic Isolation and Well Completion Report

BA7 Upon completion of construction and development of an injection well, a Well Completion Report shall be submitted to the administering authority including logs and other tests conducted during the drilling and construction of the well. The report shall be prepared by an appropriately qualified practitioner and shall include:

(a) information considered in the design of the well and casing design;
(b) details of the “as constructed” well including but not limited to: lithology, injection zone formation fracture pressure, injection zone formation pressure prior to injection, casing strings, and cement type and volumes;
(c) substantiated commentary on the potential for reaction between the formation fluid and injectionfluid;
(d) a detailed interpretation of the logs against their specific objectives, for approval prior tocommencement of injection operations;
(e) temperature survey and a casing integrity assessment technique such as:
(f) radioactive tracer survey; or
(g) oxygen activation log; or
(h) cement integrity log; or
(i) an equivalent survey technique approved by the administering authority; and
(j) a completed well schematic diagram.

BA8 In the event of converting an existing well to an injection well, as well as the above, a full length casinginspection log must be run.

Mechanical Integrity

BA9 The holder of this environmental authority must demonstrate the internal and external mechanicalintegrity of the injection system. A well demonstrates mechanical integrity if:

(a) there is no significant leakage in the casing, tubing, or packer; and

(b) there is no significant fluid movement into a water resource aquifer through vertical channelsadjacent to the well bore hole.

BA10 Mechanical integrity must be demonstrated at the following times:

(a) prior to commencement of injection;

(b) every five years after commencement of operation;

(c) following well refurbishment after a demonstration of loss of hydraulic isolation or if the injection tubing has been disturbed; and

(d) if the injection well is unused for a continuous period of twelve months, prior torecommencement of use.

Operating Requirements

BA11 The rate and volume of injection fluid must not cause wellhead pressures to exceed 90 per cent of:

(a) the formation fracture pressure; or

(b) the pressure at which the hydraulic isolation logging was carried out.

BA12 Injection must only occur through the injection tubing.

BA13 The injection fluid must be demonstrated to be aseptic.

BA14 The injection fluid must not contain more dissolved oxygen than the formation fluid or 200 parts perbillion, whichever is the greater.

Existing Injection Wells

BA15 Wells currently in use as injection fluid disposal wells and not specifically authorised for that use mustbe either refurbished to meet the requirements of this environmental authority or plugged and abandoned in compliance with this environmental authority no later than three (3) years from the anniversary of issuance of this environmental authority.

Plugging and Abandonment

BA16 Prior to abandoning an injection well, the well must be plugged with cement which will not allow themovement of injection fluids into or between water resource aquifers. The cement plug(s) shall be placed by methods such as:

(a) the balance method; or
(b) the dump bailer method; or
(c) the two-plug method.

BA17 The well to be abandoned must be in a state of static equilibrium with the mud weight equalized top tobottom by circulating mud at least once prior to the placement of the cement plug(s).

Well Closure Plan

BA18 The holder of this environmental authority must, within three (3) months from the date of this approval,develop and submit a well closure plan including the following:

(a) the type and number of plugs to be used;
(b) the placement of each plug including the elevation of the top and bottom of each plug;
(c) the type, grade and quantity of material to be used in plugging;
(d) the method of placement of the plugs;
(e) any proposed test or measure to be made; and
(f) the estimated cost of closure.

Note: These requirements are in addition to any other requirements that may exist under other Acts [for example, *Minimum standards for the construction and reconditioning of water bores that intersect the sedimentsof artesian basins in Queensland,* Natural Resources and Mines, 2004, Queensland Government].

Well Integrity

BA19 Unless otherwise stated in the conditions of this environmental authority, injection wells must be constructed according to the current standards applicable to water bore drilling activities under the *Water Act 2000* (i.e. Minimum Construction Requirements for Water Bores in Australia [National WaterCommission, 2012 or subsequent revisions]).

BA20 Fluid injection authorised by this environmental authority must have appropriate records and documentswhich support and indicate mechanical integrity and which hold a certificate of mechanical integrity prepared and certified by a suitably qualified person, available for inspection such that:

(a) there is no significant leakage in the casing, tubing, or packer; and
(b) there is no significant fluid movement into a water resource aquifer through vertical channelsadjacent to the well bore hole.

BA21 Wells used for untreated coal seam water or brine fluid injection must have:
- (a) an annulus packer at the junction of the aquitard and the target formation within the production casing;
- (b) injection tubing installed which extends through the packer into the target formation;
- (c) an inert fluid in the annulus between the injection tubing and the production casing; and
- (d) a system installed to record any loss of containment of the inert fluid.

BA22 For fluid injection:
- (a) where injection tubing is required by condition (BA20), injection must only occur throughinjection tubing;
- (b) the injection pressure must not exceed the dry overburden pressure of the base of the overlyingaquitard for injection at depth less than 100 m or 90 per cent of the formation fracture pressure for injection at depth greater than 100 m.

Brine Injection Monitoring and Reporting

BA23 The holder of this environmental authority must:
- (a) monitor the nature of the injection fluid at sufficient frequency to yield data statistically representative of its characteristics. The sampling program shall have regard to changes in source of injection fluid, changes in flow rates from source aquifers and changes in any injectionfluid treatment train;
- (b) continuously record injection pressure, flow rate, and cumulative volume of the injection fluid;
- (c) record the annulus pressure each hour;
- (d) measure the standing volume of annulus fluid each six months;
- (e) undertake pressure testing of packer, casing and cement each six months;
- (f) undertake an annual packer isolation test; and
- (g) in the event of an anomalous pressure or volume recording, to inform the administeringauthority within 24 hours of the occurrence.

Injection Management Plan

BA24 An Injection Management Plan, prepared by a suitably qualified person, must be submitted to theadministering authority prior to any proposed fluid injection activity(ies).

BA25 The Injection Management Plan required by condition (BA24) must include but not necessarily belimited to:
- (a) estimated volumes and rates of fluid to be produced and injected;
- (b) a description of the physical, chemical and biological components and their concentrations ofthe fluid to be produced;
- (c) details of how and where the fluid will be produced, aggregated, stored and kept separate fromwaters until it is, treated and injected into the source aquifer;
- (d) details of where the fluid is proposed to be treated including a description of the treatmentprocess;
- (e) a demonstration that the injection fluid has inconsequential reactivity with the target formationand native groundwater it will come into contact with;
- (f) the characteristics of the receiving environment;

(g) identification of the water quality impact zone and the hydraulic impact zone;
(h) identification of all existing bores, lakes, wetlands, environmental assets and watercourses connected to groundwater, faults and other geologic features that occur within the water qualityimpact zone and the hydraulic impact zone;
(i) identification of proposed fluid injection wells;
(j) identification of the environmental values and water quality objectives of the potential water quality impact zone of the target formation in accordance with the *Environmental Protection Act 1994,* Environmental Protection Regulation 2008, *Environmental Protection (Water) Policy 1997and the Queensland Water Quality Guidelines 2006*;
(k) an assessment of the potential impacts on the environmental values of the receiving environment including migration of injection fluid or native groundwater out of the target formation through wells, bores, wetlands, connected watercourses, faults or other geologicfeatures likely to impact on other aquifers;
(l) a risk assessment consistent with the risk framework specified in *Australian Guidelines for Water Recycling: Managed Aquifer Recharge* identifying potential hazards, their inherent risk, preventative measures for the management of potential hazards and after consideration of theoperational monitoring to manage potential hazards identified in the risk assessment includingdetails on sampling and analysis methods including frequency and locations, and quality assurance and control;
(m) verification methods to assess performance of the injection activities;
(n) control measures that will be implemented for fluid storage, treatment and injection to prevent orcontrol the release of a contaminant or waste to the environment;
(o) the indicators or other criteria against which the performance of fluid injection will be assessed;
(p) procedures that will be adopted to regularly review the monitoring program and to report to management and the administering authority should unforeseen or non-compliant monitoringresults be recorded;
(q) procedures that will be implemented to prevent unauthorised environmental harm fromunforeseen or non-compliant monitoring results;
(r) procedures for dealing with accidents, spills, failure of containment structures, and otherincidents that may arise in the course of fluid injection; and
(s) a program to monitor impacts on the environmental values of the receiving environmentidentified by condition (BE25)(k).

SCHEDULE C – LAND

General

C1 Contaminants must not be directly or indirectly released to land except as permitted under thisenvironmental authority.

Top Soil Management

C2 Top soil must be managed in a manner that preserves its biological and chemical properties.

Land Management

C3 Land that has been significantly disturbed by the pipeline activities must be managed to ensure that gullyerosion or subsidence do not occur on that land.

Chemical Storage

C4 Chemicals and fuels stored, must be effectively contained and where relevant, meet AustralianStandards, where such a standard is applicable.

Pipeline Operation and Maintenance

C5 Contaminants authorised to be released to land under conditions (C6), (C8), (C14) and (C20) must becarried out in a manner that ensures:

(a) vegetation is not damaged;
(b) soil quality is not adversely impacted;
(c) there is no surface ponding or runoff beyond the designated release area;
(d) there is no aerosols or odours;
(e) deep drainage below the root zone of any vegetation is minimised;
(f) the quality of shallow aquifers is not adversely affected.

Pipeline Wastewater

C6 Contaminants that are hydrostatic test water from pipelines and contaminants from low point drains, maybe released to land in accordance with condition (C5).

C7 Produced water may be re-used in:

(a) drilling and well hole activities; or
(b) stimulation activities.

C8 Produced water may be released to land for the following purposes:

(a) dust suppression;
(b) construction and operational purposes for the petroleum activity authorised by thisenvironmental authority; and
(c) irrigation.

C9 Produced water irrigated to land must:

(a) not exceed the release limits specified in Schedule C, Table 1a Irrigation water qualitymonitoring; and

(b) be monitored at the frequency and for the quality characteristics at the monitoring pointspecified in *Schedule C, Table 1a - Irrigation water quality monitoring*; or

(c) the process under (C10) has been completed.

C10 Produced water for irrigation which does not meet criteria in condition (C9) (a) and (b) may be used forirrigation provided a report has been completed which:

(a) determines soil structure, stability and productive capacity will be maintained or improved;

(b) determines there are no toxic effects to crops;

(c) determines yields and produce quality are maintained or improved;

(d) states water quality criteria, which has been determined in accordance with the assessment procedures outlined in Schedule C, Table 1b Assessment procedures for water quality criteria;and

(e) includes a water monitoring program to ensure that condition (C10) (a)(b) and (c) are beingachieved.

Schedule C, Table 1a - Irrigation water quality monitoring

Quality Characteristic	Release Limit	Limit Type	Frequency	Monitoring Point
Electrical conductivity (EC)	<950 µs/cm^3	95th percentile over aone-year period	Fortnightly	At a location following final treatment and prior to release.
Sodium adsorption ratio (SAR) for heavy soils	≤6			
SAR for light soils	≤12			
pH	6.0 - 8.5			
Aluminium	20 mg/L	Maximum	Bi-annually	
Arsenic	2.0 mg/L			
Boron	Refer to table 9.2.18 of ANZECC	Refer to table 9.2.18 of ANZECC		
Cadmium	0.05 mg/L	Maximum		
Chromium	1 mg/L			
Cobalt	0.1 mg/L			
Copper	5 mg/L			
Fluoride	2 mg/L			
Iron	10 mg/L			
Lithium	2.5 mg/L			
Lead	5 mg/L			
Manganese	10 mg/L			
Mercury	0.002 mg/L			
Molybdenum	0.05 mg/L			
Nickel	2 mg/L			
Zinc	5 mg/L			

Schedule C, Table 1b Assessment Procedures for Water Quality Criteria

Water Quality Criteria	Assessment Procedure
electrical conductivity sodium adsorption ratio pH	Salinity Management Handbook, with reference to Chapter 11; and/or Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapter 4 and Volume 3 Chapter 9. The assessment should consider: • soil properties within the root zone to be irrigated (e.g. clay content, cation exchange capacity, exchangeable sodium percentage) • water quality of the proposed resource (e.g. salinity, sodicity) • climate conditions (e.g. rainfall) • leaching fractions • average root zone salinity (calculated) • crop salt tolerance (e.g. impact threshold and yield decline) • management practices and objectives (e.g. irrigation application rate, amelioration techniques) • broader landscape issues (e.g. land use, depth to groundwater) • any additional modelling and tests undertaken to support the varied water quality parameters.
heavy metals	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapters 3 and 4 and Volume 3 Chapter 9. The assessment should aim to derive site specific trigger values (e.g. cumulative contaminant loading limit) based on the methodology provided in the above mentioned procedure.

C11 Produced water may be used for domestic or stock purposes provided the water quality complies with thecriteria specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

C12 Produced water may be transferred to a third party to be used for the following purposes, subject tocondition (C13):

(a) dust suppression;
(b) construction and operational purposes; or
(c) domestic or stock purposes provided the water quality complies with criteria specified in theAustralian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC andARMCANZ 2000).

C13 If the responsibility of produced water is given or transferred to a third party in accordance with condition(C12), the holder of the environmental authority must ensure:

(a) the responsibility of the produced water is given or transferred in accordance with a writtenagreement (third party agreement);
(b) the third party is made aware of the General Environmental Duty under section 319 of the *Environmental Protection Act 1994*.

Sewage Treatment Works

C14 Greywater or treated sewage effluent from a treatment system with a daily peak design capacity of up to450 EP may be:

(a) released to land by sub-surface or spray irrigation provided it is to a fenced and signedcontaminant release area that is:

(i) a minimum distance of 50 metres from any watercourse, wetland or protected area;and

(ii) a minimum distance of 100 metres from any potable water supply or stock drinkingwater supply; and

(iii) kept vegetated with groundcover that is not a prohibited or restricted pest species;or

(b) used for dust suppression and construction purposes subject to condition (C21).

C15 When circumstances prevent the irrigation of treated sewage effluent to land, the contaminants must bedirected to on-site storage or lawfully disposed of off-site.

Sewage Treatment Works Between 100 EP and 450 EP

C16 Treated sewage effluent released to land must be monitored at the frequency and for the quality characteristics specified in *Schedule C, Table 2 Treated sewage effluent standards for release to landfrom sewage treatment works with a daily peak design capacity of greater than 100EP* for each qualitycharacteristic.

C17 Prior to construction of a sewage treatment works with a daily peak design capacity of greater than 100EP, the minimum area of land and location to be utilised for irrigation of treated sewage effluent,excluding any necessary buffer zones, must be nominated.

C18 All nominated locations and minimum areas of land in condition (C17) for sewage treatment works with adaily peak design capacity of greater than 100EP, must be determined using the Model for Effluent Disposal using Land Irrigation (MEDLI) program or recognised equivalent and use model inputs representative of the activity and release location including but not limited to effluent quality, soil and vegetation types, and climatic conditions.

C19 Treated sewage effluent must only be released to the nominated locations and minimum areas of landdetermined by the MEDLI program or recognised equivalent identified in condition (C18).

C20 Treated sewage effluent released to land must comply, at the monitoring point(s), with each of the releaselimits specified in *Schedule C, Table 2 Treated sewage effluent standards for release to land from sewage treatment works with a daily peak design capacity of greater than 100EP* for each quality characteristic.

Schedule C, Table 2 Treated sewage effluent standards for release to land from sewage treatment workswith a daily peak design capacity of greater than 100EP

Quality Characteristic	ReleaseLimit	Limit Type	Frequency	Monitoring Point
5-day Biochemical Oxygen demand (BOD)	20 mg/L	Maximum	Quarterly	Release pipe from sewage treatment works
E. coli	1000 cfu per 100 mL	80th percentile based on at least 5samples with not less than 30 minutes between samples		
	10,000 cfu per 100 mL	Maximum		
pH	6.0 - 8.5	Range	Monthly	
Dissolved Oxygen	2 mg/L	Minimum		
Electrical Conductivity		Monitor only		

Treated Sewage Effluent Use for Dust Suppression and Construction Purposes

C21 Treated sewage effluent may only be used for dust suppression and construction purposes provided that:

(a) access by the general public can be restricted while effluent is in use ;

(b) on local government controlled roads, written approval from the relevant Local Government hasbeen given to the holder of this environmental authority; and

(c) the treated sewage effluent quality:

(i) is monitored at the location and frequency specified *in Schedule C, Table 3 Treated Sewage Effluent Standards for Dust Suppression and Construction Purposes*; and

(ii) meets the release limits for each quality characteristic specified in Schedule C, *Table3 Treated Sewage Effluent Standards for Dust Suppression and Construction Purposes*.

Schedule C, Table 3 – Treated Sewage Effluent Standards for Dust Suppression and Construction Purposes

Quality Characteristic	Sampling and *In situ* Measurement Point Location	Limit type	Release Limit	Frequency
pH	Standpipe from the sewage treatment works	Range	6.0 to 8.5	Monthly
5-day Biochemical Oxygen Demand (BOD)		Median	20 mg/L	
Electrical Conductivity		Maximum	1600 uS/cm	
Total Suspended Solids		Maximum	30 mg/L	
E. coli		80th percentile based on at least5 samples with not less than 30 minutes between samples	<100 cfu per 100 mL	
		Maximum	1000 cfu per100mL	

SCHEDULE D – BIODIVERSITY VALUES

Confirming Biodiversity Values

D1 Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground environmentally sensitive areas and wetlands at that location must be undertaken by a suitably qualified person.

D2 A suitably qualified person must develop and certify a methodology so that condition (D1) can be complied with and which is appropriate to confirm on-the-ground environmentally sensitive areas and wetlands.

D3 Where areas mapped as environmentally sensitive areas and wetlands differ from those confirmed under conditions (D1) and (D2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on the- ground values.

D4 All documentation survey information photographs, field data or any material associated with the field validation requirements in (D1) must be maintained for the life of the environmental authority to demonstrate to the administering authority that surveys were conducted in a manner consistent with requirements contained in (D2).

D5 The location of the petroleum activity must be selected in accordance with the following site planning principles:

(a) maximise the use of areas of pre-existing disturbance
(b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value
(c) minimise disturbance to land that may result in land degradation
(d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and
(e) in order of preference, avoid then minimise clearing of native mature trees.

Disturbance to Land – Environmentally Sensitive Areas

D6 Petroleum activities must be carried out in accordance with *Schedule D, Table 1 – Petroleum Activities in Environmentally Sensitive Areas, Schedule D, Table 2 – Authorised Disturbance* and any other relevant conditions of this environmental authority.

Schedule D, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary Protection Zone of the ESA
Category A ESAs	No petroleum activities permitted	Only low impact petroleum activities permitted.	Limited petroleum activities permitted subject to condition (D10) **Limited impact camps** permitted subject to condition (D10) **Limited impact petroleum activities** permitted subject to condition (D10)
Category B ESAs excluding 'Endangered' Regional Ecosystems	Only low impact petroleum activities permitted	Limited petroleum activities permitted subject to condition (D10) Limited impact camps permitted subject to condition (D10) Limited impact petroleum activities permitted subject to condition (D10)	N/A
Category C ESAs that are Nature Refuges, Koala Habitat and/or Declared Catchment Areas	Only low impact petroleum activities permitted	Limited petroleum activities permitted subject to condition (D10) Limited impact camps permitted subject to conditions (D7) and (D10) Limited impact petroleum activities permitted subject to condition (D10)	N/A
Category B ESAs that are 'Endangered' Regional Ecosystems	Only limited petroleum activities permitted subject to conditions (D11a and D11b)	Limited petroleum activities permitted subject to condition (D10) Limited impact camps permitted subject to condition (D10) Limited impact petroleum activities permitted subject to condition (D10)	N/A

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary Protection Zone of the ESA
Category C ESAs that are Essential Habitat and/or 'Of Concern' Regional Ecosystems	Only limited petroleum activities permitted subject to conditions (D11a and D11b)	Limited petroleum activities permitted subject to condition (D10) Limited impact camps permitted subject to conditions (D7) and (D10) Limited impact petroleum activities permitted subject to condition (D10)	N/A
Category C ESAs that are Regional Parks (Resource Use Area)	Only limited petroleum activities permitted subject to conditions (D11a and D11b)	Limited petroleum activities permitted subject to condition (D10) Limited impact camps permitted subject to condition (D10) Limited impact petroleum activities permitted subject to condition (D10)	N/A
Category C ESAs that are State Forests and/or Timber Reserves	Limited petroleum activities permitted subject to conditions (D11a and D11b) Petroleum activities that are extraction activities and screening activities permitted.	N/A	N/A
	Limited impact camps permitted. Limited impact petroleum activities permitted subject to conditions (D8) and (D11a and D11b)		

Note: Approvals may be required under the Forestry Act 1959 where the petroleum activity(ies) is proposed to be carried out in ESAs that are State Forests or Timber Reserves.

Schedule D, Table 2 – Authorised Disturbances

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
Yebna North Temporary Camp	The area defined within the "Location of Development" point coordinates	149.164 149.165 149.166 149.166 149.166 149.166 149.166	-25.6443 -25.6436 -25.6439 -25.6444 -25.6448 -25.6452 -25.6455	N/A	2 ha	Primary Protection Zone of a Category C ESA (Of Concern Regional Ecosystem)
Dawson's Bend Road Widening and Co-located Power Lines	Section 1	-25.720723 to -25.719763	149.050898 to 149.048122	Length within PPZ of Category C ESA **283 m**	Area within PPZ of Category C ESA **1.11 ha**	PPZ of Category C ESA (Of Concern RE 11.10.7/ 11.10.9/11.3.25)
	Section 2	-25.71906 to -25.721033	149.040465 to 149.036057	Length within Category C ESA **70 m** Length within PPZ of Category C ESA **414 m**	Area within Category C ESA **0.23 ha** Area within PPZ of Category C ESA **1.53 ha**	Category C ESA (Of Concern RE 11.10.7/ 11.10.9/11.3.25)
	Section 3	-25.737755 to -25.742661	149.009531 to 148.998035	Length within PPZ of Category C ESA **1325 m**	Area withinPPZ of Category C ESA **3.82 ha**	PPZ of Category C ESA(Of Concern RE11.3.2/ 11.3.25)
	Section 4	-25.751823 to -25.75041	148.983035 to 148.947449	Length within Category C ESA **2580 m** Length within PPZ of Category C ESA **1280 m**	Area within Category C ESA **7.26 ha** Area within PPZ of Category C ESA **3.62 ha**	Category C ESA (State Forest/ Timber Reserve which is predominantly RE 11.10.9)

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
	Section 5	-25.727628 to -25.727588	149.075484 to 149.073348	Length within PPZ of Category C ESA **216 m**	Area within PPZ of Category C ESA **0.58 ha**	PPZ of Category C ESA(Of Concern RE 11.10.8)
Total for sections within ESA and PPZ				**6168 m**	**18.15 ha**	
Water to Grade Flowlines	FV36 (FV06-37)	-25.648185 to -25.649338	148.930447 to 148.92969	Length within PPZ of Category C ESA **354 m**	Area within PPZ of Category C ESA **0.38 ha**	Category C ESA (Essential Habitat within RE 11.10.1/ 11.10.13a and RE 11.9.4a)
	FV103 (FV06-38)	-25.644467 to -25.650721	148.936713 to 148.9391135	Length within PPZ of Category C ESA **735 m**	Area within PPZ of Category C ESA **0.89 ha**	Category C ESA (Essential Habitat within RE 11.10.1/ 11.10.13a and RE 11.9.4a)
	FV34 (FV06-32) and Connecting Flowlines	-25.641787 to -25.642241	148.943019 to 148.938051	Length within Category C ESA **685 m** Length within PPZ of Category C ESA **952 m**	Area within Category C ESA **0.83 ha** Area within PPZ of Category C ESA **1.4 ha**	Category C ESA (Essential Habitat within RE 11.10.1/ 11.10.13a)
		-25.641787 to -25.641818	148.943019 to 148.945227			
		-25.642471 to -25.642241	148.930648 to 148.938051			
		-25.642471 to -25.64314	148.930648 to 148.933636			
		-25.642241 to -25.64342	148.938051 to 148.936485			
		-25.641787 to -25.641818	148.943019 to 148.945227			
	FV10-03 (FV-WP-49)	-25.678885 to -25.680651	148.895576 to 148.900354	Length within PPZ of Category C ESA **659 m**	Area within PPZ of Category C ESA **1.3 ha**	Category C ESA (Essential Habitat within RE 11.10.1/ 11.10.13a)
Total for sections within ESA and PPZ				**3385 m**	**4.8 ha**	
Brine Dams	Brine DamA+B (as per 6399 – Fairview F-	-25.751025 -25.751261 -25.751242 -25.751220	149.073924 149.072946 149.072660 149.072508			

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
		-25.751156	149.072194			
	HCS-04 Remote Brine Pond A and B Constraints Mapping, dated 23 May 2012)	-25.751110 -25.750970 -25.750952 -25.750853 -25.750194 -25.749429 -25.749322 -25.749188 -25.749091 -25.749088 -25.748916 -25.748500 -25.748468 -25.747809 -25.747611 -25.747516 -25.747253 -25.747835 -25.748766 -25.749702 -25.750627 -25.750863	149.072048 149.071686 149.071650 149.071470 149.070739 149.070477 149.070469 149.070463 149.070475 149.070464 149.070189 149.069686 149.069628 149.068897 149.068825 149.068957 149.070644 149.070963 149.071797 149.071624 149.072405 149.073808		Area within PPZ of Category C ESA **6.72 ha**	PPZ Category C ESA (Of Concern RE) (11.10.8)
	Brine DamC+D (as per 6399 – Fairview F-HCS-04 Remote Brine Pond C and D Constraints Mapping, dated 23 May 2012)	-25.741196 -25.743597 -25.743510 -25.743221 -25.742409 -25.742232 -25.741825 -25.741343 -25.741210 -25.741173 -25.740292 -25.739765 -25.739636 -25.740474 -25.740806 -25.740891 -25.744807 -25.745344 -25.745153 -25.745059 -25.745042 -25.744835	149.073263 149.071490 149.071493 149.071507 149.071772 149.071901 149.072205 149.072807 149.073125 149.073226 149.073412 149.073637 149.073745 149.073879 149.074079 149.073333 149.070273 149.069394 149.069606 149.069814 149.069853 149.070173		Area within PPZ of Category C ESA **1.71 ha**	PPZ Category C ESA (Of Concern RE) (11.10.8)

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
	Flowline	-25.73526 to -25.746804	149.080295 to 149.068909	Length within PPZ of Category C ESA **2069 m**	Area within PPZ of Category C ESA **4.14 ha**	PPZ Category C ESA (Of Concern RE) (11.10.8)
Total for sections within ESA and PPZ				**2069 m**	**12.56 ha**	
	Brine dam E and F	-25.75103	149.08078		36	PPZ of Category B ESA (Endangered Regional Ecosystem)
		-25.75180	149.08151			
		-25.75180	149.08129			
		-25.75312	149.08084			
		-25.75312	149.08040			
		-25.75463	149.08013			
		-25.75509	149.08012			
		-25.75747	149.08050			
		-25.75765	149.08303			
		-25.75708	149.08422			
		-25.75718	149.08435			
		-25.75717	149.08440			
		-25.75708	149.08448			
		-25.75695	149.08448			
		-25.75676	149.08451			
		-25.75652	149.08464			
		-25.75638	149.08475			
		-25.75637	149.08481			
		-25.75644	149.08488			
		-25.75665	149.08491			
		-25.75684	149.08501			
		-25.75673	149.08512			
		-25.75584	149.08606			
		-25.75561	149.08621			
		-25.75478	149.08628			
		-25.75448	149.08623			
		-25.75440	149.08607			
		-25.75432	149.08555			

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
		-25.75469	149.08434			
		-25.75472	149.08315			
		-25.75456	149.08272			
		-25.75467	149.08181			
		-25.75456	149.08175			
		-25.75433	149.08182			
		-25.75371	149.08228			
		-25.75357	149.08264			
		-25.75332	149.08336			
		-25.75295	149.08411			
		-25.75269	149.08480			
		-25.75251	149.08539			
		-25.75220	149.08604			
		-25.75047	149.08491			
		-25.75038	149.08491			
		-25.75061	149.08405			
		-25.75063	149.08382			
		-25.75020	149.08357			
		-25.74984	149.08333			
		-25.74979	149.08333			
		-25.74911	149.08374			
		-25.74872	149.08409			
Brine transfer line	BL from Dam E and F to F-HCS04 (Dam A and B)	-25.75310 to -25.75094	149.08035 to 149.06923	678	1.2	PPZ of Category B ESA (Endangered Regional Ecosystem)
Total for sections within ESA and PPZ				**678 m**	**37.2 ha**	
	FV530/531/532 (FV07-10) and connecting flowlines			3755	8.146	In accordance with Appendix 1
	0	-25.65680	149.04005			– Well Pad FV530/531/532 (FV07-10) and connecting flowlines Category A ESA
	1	-25.65713	149.04038			
	2	-25.65714	149.04070			
	3	-25.65790	149.04230			
	4	-25.65826	149.04280			
	5	-25.65997	149.04311			

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
	6	-25.66007	149.04279			Primary Protection Zone
	7	-25.66031	149.04262			
	8	-25.66068	149.04250			Category A ESA Secondary Protection Zone
	9	-25.66163	149.04183			
	10	-25.66179	149.04117			
	11	-25.66242	149.04013			
	12	-25.66330	149.04008			Category B ESA
	13	-25.66332	149.04061			
	14	-25.66371	149.04126			Category B ESA Primary Protection Zone
	15	-25.66401	149.04106			
	16	-25.66391	149.04086			
	17	-25.66475	149.03999			Category C ESA (State Forest, Timber Reserve or Of Concern RE)
	18	-25.66483	149.04021			
	19	-25.66515	149.04080			
	20	-25.66524	149.04127			
	21	-25.66545	149.04192			Category C ESA (Essential Habitat)
	22	-25.66576	149.04254			
	23	-25.66613	149.04278			
	24	-25.66721	149.04383			Category C ESA Primary Protection Zone (State Forest, Timber Reserve or Of Concern RE)
	25	-25.66738	149.04385			
	26	-25.66778	149.04434			
	27	-25.66837	149.04426			
	28	-25.66903	149.04445			
	29	-25.66963	149.04482			Category C ESA Primary Protection Zone (Essential Habitat)
	30	-25.67003	149.04508			
	31	-25.67181	149.04529			
	32	-25.67328	149.04556			
	33	-25.67380	149.04536			Category C ESA Secondary Protection Zone (Essential Habitat)
	34	-25.67399	149.04548			
	35	-25.67451	149.04725			
	36	-25.67489	149.04770			
	37	-25.67556	149.04918			
	38	-25.67666	149.05016			

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
	39	-25.67012	149.04373			
	40	-25.67015	149.04334			
	41	-25.67031	149.04265			
	42	-25.67005	149.04223			
	43	-25.67001	149.04171			
	44	-25.67002	149.04086			
	45	-25.66992	149.04049			
	46	-25.67025	149.03818			
	47	-25.67099	149.03503			
	48	-25.67150	149.03343			
	49	-25.67192	149.03286			

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
Access Track Upgrade	Way Point (WP) 27 to WP 38	-25.671168	149.139478	14500	0.0087	Category A ESA and PPZ (RE 11.10.1)
		-25.582716	149.074461			
Yebna Wells Access Road	Way Point (WP) 1 to 2	-25.6478 to -25.6491	149.1255 to 149.1176	N/A	1.02 ha	Category A PPZ (Expedition NP)
Belington Road	Way Point (WP) 2 to 3	-25.6491 to -25.6493	149.1176 to 149.1182	N/A	0.57 ha	
	Way Point (WP) 4 to 5	-25.6579 to -25.6612	149.1294 to 149.1334			
CDJV Temporary Workers Camp and Office	Point 1 to Point 33 as depicted in the plan titled F-HCS-04 CDJV Camp	-25.738082 to -25.736834	149.079144 to 149.079201	N/A	2.44ha	Primary Protection Zone of a Category C ESA (Of Concern Regional Ecosystem)
FKG Temporary Workers Camp	Point 1 to Point 14 as depicted in the plan titled F-HCS-04-FKG Camp	-25.714544 to -25.714518	149.042233 to 149.042306	N/A	3.19ha	Primary Protection Zone of a Category C ESA (Of Concern Regional Ecosystem)
Tenix Temporary Workers Camp	Point 1 to Point 45 as depicted in the plan titled F-HCS-04 Tenix Camp	-25.718279 to -25.714581	149.048019 to 149.048076	N/A	2.71	Primary Protection Zone of a Category C ESA (Of Concern Regional Ecosystem)
Temporary Castle Hill	Point 1 to 12 as depicted in the plan titled *Arcadia Valley Phase 1 Camp Proposed Infrastructure Project area*	-25.3303 to –25.3303	148.851 to 148.852			Primary Protection Zone of a Category C ESA (Of Concern Regional Ecosystem)

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
Camp and associated effluent disposal area*	Point 13-16 as depicted in the plan titled *Arcadia Valley Phase 1 Camp Proposed Infrastructure Project area*	-25.3288 to -25.3289	148.856 to 148.856	N/A	3.9	Primary Protection Zone of a Category B ESA (endangered regional ecosystem)
Pony Hills Long Distance Water Line	Flowline	-25.762684 to -25.765751	149.044457 to 149.043946	334	0.5	Category C ESA (State Forest)
Brine Transfer Pipeline	ROP1-ROP2	-25.76586952 to -25.76850752	149.0442076 to 149.0274380	1850 m	2.4 ha	Category C ESA (State Forest)
Communications Tower	N/A	-25.731826	149.059830	N/A	0.1	Primary Protection Zone of a Category C ESA (Of Concern Regional Ecosystem) (11.10.7)
		-25.731674	149.059648			
		-25.732094	149.059580			
		-25.731945	149.059386			
Multi-Well Pad FV530, 531, 532 (FV07-10,1,2,3	1	-25.6643180	149.0398467	N/A	1.76	Category C ESA (Essential Habitat) Category C ESA (State Forest or Timber Reserve or Of Concern RE) Category C Primary Protection Zone (State Forest or Timber Reserve or Of Concern
	2	-25.6637166	149.0402548			
	3	-25.6634887	149.0404102			
	4	-25.6640964	149.0414963			
	5	-25.6643332	149.0413410			
	6	-25.6649257	49.0409328			

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
						RE)
Mt Kingsley Well Pad	Multi directional well pad	- 25.23202138	148.90189708	N/A	0.78	
Mt Kingsley Pad to Mt Kingsley Dam water flow line	Flow line	-25.23193209 to -25.257497	148.90112716 to 148.872817	N/A	0.008	
Access Road Upgrade (FV87 FV03-15)	WP38 toWP77	-25.582716	149.074461	26000	0.0156	
		-25.544839	149.006555			
Access Road (Ironbark Gully	PSC 1 to PSC 4	-25.4887	148.8309	N/A	N/A	
		-25.4827	148.8775			
Bonnie Doon Road Upgrade (including Hutton Creek Crossing Upgrade section)	Bonnie Doon Road (including Hutton Creek Crossing Upgrade section)	-25.73179 to -25.74991	148.91978 to 148.92953	1200	0.68	Category C (Of Concern RE) ESA Primary Protection Zone of a Category C (Of Concern RE) ESA Primary Protection Zone of a Category B (Endangered RE) ESA

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
Access track upgrade and maintenance	Belington 1, Hungry Creek 1, Lynd Range 1 wells and the southern part of Lonesome Holding	Start: -25.64929998 Finish (at Belington 1): -25.56101196 Finish (at Lynd Range 1): -25.38941103 Finish (at southern part of Lonesome Holding): -25.542188	Start: 149.1181351 Finish (at Belington 1): 149.1062990 Finish (at Lynd Range 1): 149.0276311 Finish (at southern part of Lonesome Holding): 149.006971	Approximately 11.8km	N/A	Category A PPZ (Expedition Limited Depth NP)
	Access to northern part Lonesome Holding	Start: -25.48872297 Finish: -25.4774363	Start: 148.8311230 Finish: 148.8807696			
Lynd Range 1 Well	Lynd Range 1 well Pad	Centre point: -25.38981945	Centre point: 149.0275379	N/A	0.9ha	Category A PPZ (Expedition Limited Depth NP)
Belington 1 well	Belington 1 well pad	Centre point: -25.56157446	Centre point: 149.1067040	N/A	1.85 ha	Category A PPZ (Expedition Limited Depth NP)
Belington camp	Belington camp	Centre point: -25.56016299	Centre point: 149.1068372	N/A	0.46	Category A PPZ (Expedition Limited Depth NP)
Water Gathering Line	IR4 to AWAF1	-25.74917 to -25.76212	148.95110 to 149.05015	7,195 m	12.35 ha	Category C ESA (State Forest)
				195 m	0.35 ha	Category C ESA (Essential Habitat Squatter Pigeon)

Authorised Activity	Authorised Activity Section	Location of Development (GDA94)		Size of Development		ESA
		Latitude	Longitude	Length (m)	Area of Disturbance (ha)	
				115 m	0.20 ha	Category C ESA (Of Concern Regional Ecosystem 11.9.7)
				2,330 m	4.75 ha	Category C ESA PPZ (Of Concern Regional Ecosystem and Essential Habitat)
				350 m	0.80 ha	Category B ESA (Endangered Regional Ecosystem) (11.9.5, 11.9.10)
				2,480 m	6.35 ha	Category B ESA PPZ (Endangered Regional Ecosystem)
Total for sections within ESA and PPZ				**12,665 m**	**24.8 ha**	
WMA 2020	Surface Water Monitoring Location	-25.693	149.213		0.02	Category C ESA (Of Concern Regional Ecosystem) Category C ESA (Essential Habitat)

* Temporary Castle Hill Camp Infrastructure must be removed on or before 31 December 2021
Note: PPZ = Primary Protection Zone, BL = Brine transfer line, the values listed in the table under “Size of Development” have been rounded up to the nearest 5 m or 0.5 ha.

D7 Limited impact camps must not be located within a primary protection zone of Category C ESA (EssentialHabitat) or Category C ESA (Nature Refuges).

D8 Limited impact petroleum activities must not be located within areas that contain commercial species.

D9 Despite condition (D6) decommissioning petroleum activities are authorised within all ESAs other thanCategory A ESAs, and within all ESA protection zones when conducted in accordance with the land disturbance planning principles provided in condition (D5).

D10 Limited petroleum activities, limited impact camps or limited impact petroleum activities located within a primary protection zone or secondary protection zone of an environmentally sensitive area in accordance with *Schedule D, Table 1 – Petroleum Activities in Environmentally Sensitive Areas,* and activities listed in *Schedule D, Table 2 – Authorised Disturbances* must not negatively affect the adjacent environmentallysensitive area.

D11a Prior to carrying out limited petroleum activities or limited impact petroleum activities undertaken within environmentally sensitive areas in accordance with *Schedule D, Table 1 Petroleum Activities in Environmentally Sensitive Areas*, it must be demonstrated that:

a) No reasonable or practicable alternative exists for carrying out the activities within the environmentally sensitive area
b) The activities are preferentially located in pre-existing areas of clearing or significant disturbance

D11b In addition to condition D11a, linear infrastructure construction corridors that are a limited petroleum activity or limited impact petroleum activity authorised in environmentally sensitive areas must:

a) maximise co-location
b) be minimised in width to the greatest practicable extent, taking into account the following matters:
    i. safe vehicle movement
    ii. drainage devices installed are of a type that is appropriate for the access track / road type and location
    iii. erosion and sediment control measures installed are in accordance condition (B14); and
    iv. power line stays have been preferentially located within the pipeline right of way where possible.
c) be no greater than 40 m total width; and
d) where more than 2 linear infrastructure services are to be co-located in a linear infrastructure construction corridor in accordance with (a) and (c), an additional 11 m is authorised to be added to the construction corridor width for each additional co-located linear infrastructure service, up to a maximum corridor width of 62m.

Offset Delivery

D12 An Offset Plan must be prepared in accordance with section 5 of the Offset Strategy at Appendix AB of the final environmental impact statement (EIS) decided by the Coordinator- General on 3 September 2015. After a decision under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and three (3) months prior to any construction activities, the proponent must submit the Offset Plan to the Department of Environment and Science. The Offset Plan must consider offsets for any significant residual impacts to the following prescribed environmental matters:

(i) remnant regional ecosystems listed as endangered (*Vegetation Management Act 1999* [VM Act] Class)
(ii) remnant regional ecosystems listed as of concern (VM Act Class)
(iii) essential habitat for the species listed in schedule D, Table 4.
(iv) wetlands of general ecological significance.

The Offset Plan must:

(a) detail how the specific offset requirements conditioned by the Commonwealth Minister for the Environment in any approval for the project under the EPBC Act will be delivered
(b) detail proposed offsets to address any significant residual impacts for the prescribed environmental matters at condition (D12) (i)-(iv)
(c) include, but not necessarily be limited to:
    (i) a detailed description of the land to which the plan relates, the matters affected and the extent and likely timing of impact on each matter
    (ii) evidence that impacts to the prescribed environmental matters in D12(i)-(iv) can be offset
    (iii) for the prescribed environmental matters listed in D12 (i)-(iv), the method for delivering the offset in accordance with the *Environmental offsets Act 2014*, including consideration of land-based offsets, direct benefit management plans, offset transfers and/or offset payments and other tenure activities
(d) ensure a legally binding mechanism to protect and manage offset areas
(e) include a staging plan to demonstrate how offsets will be delivered and managed over the life of the project
(f) consider existing, proposed and future offsets prepared and/or planned under the existing environmental authorities pertaining to the project area.

Maximum Disturbance

D13 Disturbance to ecological receptors listed in *Schedule D, Table 4 Maximum disturbance limits*, must not exceed the relevant maximum disturbance limits.

Schedule D, Table 4 Maximum disturbance limits

Ecological Receptor	Proposed disturbance area for Fairview Arcadia Project Area (ha)
Environmental Matter	
Endangered Regional Ecosystems (remnant and high value regrowth) (VM Act Class)	220
Of-concern Regional Ecosystems (remnant and high value regrowth) (VM Act Class)	1065.3
Essential habitat (*Chalinolobus dwyeri* (Large-eared pied bat))	3
Essential habitat (*Nyctophilus corbeni* (South -eastern long eared bat))	3
Essential habitat (*Melaleuca irbyana*)	74
Essential habitat (*Eriocaulon carsonii subsp. orientale*)	2.5
Wetlands (general ecological significance)	24.7
Protected Areas	
Resource reserves	252
State forest and timber reserves	1183.2

D14 No Significant Residual Impacts are authorised to occur on the Short-beaked Echidna (*Tachyglossus aculeatus*) or the Platypus (*Ornithorhynchus anatinus*).

D15 An environmental offset made in accordance with the *Environmental Offsets Act 2014* and Queensland Environmental Offsets Policy, as amended from time to time, must be undertaken for the maximum disturbance limits detailed in *Schedule D, Table 4 Maximum disturbance limits*, for each of the following prescribed environmental matters unless a lesser extent of the impact has been approved in accordance with condition D17 for staged offsets:

(i) remnant regional ecosystems listed as endangered (VM Act Class);
(ii) remnant regional ecosystems listed as of concern (VM Act Class);
(iii) essential habitat for the species listed in schedule D, Table 4; and
(iv) wetlands of general ecological significance.

D16 Environmental offsets required by condition D15 may be carried out in stages. An environmental offset can be delivered for each stage of the impacts to prescribed environmental matters.

D17 A notice of election for the staged environmental offset referred to in condition D16, if applicable, must be provided to the administering authority no less than three months before the proposed commencement of that stage, unless a lesser timeframe has been agreed to by the administering authority.

D18 Conditions D12 to D17 apply only to disturbances associated with the GFD project.

SCHEDULE E – WASTE

General Waste Management

E1 Measures must be implemented so that waste is managed in accordance with the waste andresource management hierarchy and the waste and resource management principles.

E2 Waste, including waste fluids, but excluding waste used in closed-loop systems, must be transported off-site for lawful re-use, remediation, recycling or disposal, unless the waste is specifically authorised by conditions (B21), (B30), (BA2), (E3), (E7), (E8), (C6), (C8) and (C14) to be disposed of or used on site.

E3 Unless otherwise authorised by the conditions of this EA to be released to land, Waste fluids, other than flare precipitant stored in flare pits, or residual drilling material, or drilling fluids stored in sumps, must becontained in either:

(a) an above ground container; or
(b) a structure which contains the wetting front.

E4 Vegetation waste may be burned if it relates to a state forest, timber reserve or forest entitlement areaadministered by the *Forestry Act 1959* and a permit has been obtained under the *Fire and Rescue Service Act 1990*.

Brine and Salt Management

E5 Following the completion of the petroleum activity(ies), any residual brine and / or solid salt present in anystructure must be removed and transported to a facility that can lawfully reuse, recycle or dispose of suchwaste under the *Environmental Protection Act 1994*.

Investigation into Alternative CSG Water Management Options

E6 The Salt and Brine Management Plan must be developed by December 2019 that has investigated thefollowing:

(a) the viability of waste reuse or recycling through chemically processing or treating brine or saltresidues to create useable or saleable products;
(b) the viability of the injection of brine into a natural underground structure that is geologicallyisolated and does not contain groundwater and does or could supply water for potable or agricultural purposes;
(c) the outcomes of the investigations and proposed actions forward, and identified methods for thebeneficial use and of brine and salt; and
(d) procedures for identifying and implementing opportunities to improve the CSG watermanagement practices.

Residual Drilling Materials

E7 If sumps are used to store residual drilling material or drilling fluids, they must only be used for the duration of drilling activities.

E8 Residual drilling material can only be disposed of on-site:

(a) by mix-bury-cover method if the residual drilling material meets the approved quality criteria; or

(b) if it is certified by a suitably qualified third party as being of acceptable quality for disposal toland by the proposed method and that environmental harm will not result from the proposeddisposal.

E9 Records must be kept, to demonstrate compliance with condition (E7) and condition (E8).

SCHEDULE F – NOISE

F1 Petroleum activities must not cause environmental nuisance at a sensitive place, other than where analternative arrangement is in place.

F2 Notwithstanding condition (F1), emission of noise from the petroleum activity at levels less than those specified in *Schedule F, Table 1 Noise nuisance limits* are not considered to be environmental nuisance.

Schedule F, Table 1 Noise nuisance limits

Time period	Metric	Short term noise event	Medium term noise event	Long term noise event
7:00am 6:00pm	LAeq,adj,15 min	45 dBA	43 dBA	40 dBA
6:00pm 10:00pm	LAeq,adj,15 min	40 dBA	38 dBA	35 dBA
10:00pm 6:00am	LAeq,adj,15 min	28 dBA	28 dBA	28 dBA
	Max LpA,15 min	55 dBA	55 dBA	55 dBA
6:00am 7:00am	LAeq,adj,15 min	40 dBA	38 dBA	35 dBA

Note: The noise limits in Table 1 have been set based on the following deemed background noise levels (LABG):7:00am - 6:00 pm: 35 dBA
6:00pm - 10:00 pm: 30 dBA
10:00pm - 6:00 am: 25 dBA
6:00am - 7:00 am: 30 dBA

F3 If the noise subject to a valid complaint is tonal or impulsive, the adjustments detailed in *Schedule F, Table 2 Adjustments to be added to noise levels at sensitive receptors* are to be added to the measurednoise level(s) to derive LAeq, adj, 15 min.

Schedule F, Table 2 Adjustments to be Added to Noise Levels at Sensitive Receptors

Noise characteristic	Adjustment to noise
Tonal characteristic is just audible	+ 2 dBA
Tonal characteristic is clearly audible	+ 5 dBA
Impulsive characteristic is detectable	+ 2 to + 5 dBA

F4 Notwithstanding condition (F2), emission of any low frequency noise must not exceed either (F4(a)) and (F4(b)), or (F4(c)) and (F4(d)) in the event of a valid complaint about low frequency noise being made tothe administering authority:

(a) 60 dB(C) measured outside the sensitive receptor; and
(b) the difference between the external A-weighted and C-weighted noise levels is no greater than20 dB; or
(c) 50 dB(Z) measured inside the sensitive receptor; and
(d) the difference between the internal A-weighted and Z-weighted (Max LpZ, 15 min) noise levels is nogreater than 15 dB.

F5 A Blast Management Plan must be developed for each blasting activity in accordance with AustralianStandard 2187.

F6 Blasting operations must be designed to not exceed an airblast overpressure level of 120 dB (linearpeak) at any time, when measured at or extrapolated to any sensitive place.

F7 Blasting operations must be designed to not exceed a ground-borne vibration peak particle velocity of10mm/s at any time, when measured at or extrapolated to any sensitive place.

SCHEDULE G – AIR

Fuel Burning or Combustion Equipment

G1 If compressor stations meet the definition of fuel burning or combustion equipment, the design of the equipment must be capable of achieving air quality objectives for each environmental value stated in the*Environmental Protection (Air) Policy 2019*.

G2 Fuel burning or combustion equipment must:

(a) not be operated unless it is listed in *Schedule G, Table 1 – Authorised Releases ofContaminants to Air from Point Sources;*
(b) not exceed the release limits specified in *Schedule G, Table 1 – Authorised Releases ofContaminants to Air from Point Sources;*
(c) be monitored for the release limits at the release point locations and at the monitoring frequencyspecified in *Schedule G, Table 1 – Authorised Releases of Contaminants to Air from Point Sources.*

Schedule G, Table 1 – Authorised Releases of Contaminants to Air from Point Sources

Resource Authority	Facility	Release Point Locations	Release Limits			Monitoring Frequency
			Minimum Release Height (m)	Minimum Efflux Velocity (m/sec)	NOx as Nitrogen Dioxide Maximum Mass Emission Rate (g/s)	
PL91	CS1	Compressor 1 (K048)	5.5	24	2	At least one release point must be monitored per year on a rotational basis.
		Compressor 2 (K044)	6.0	33	2	
PL420 & 421	A-CS-01 / ACS-02	Compressor 1 (K049)	6.0	23	2	At least one release point must be monitored per year on a rotational basis, with all release points monitored at least
		Compressor 2 (K046)	6.0	23	2	
		Compressor 1	7.0	17	2	
		Compressor 2	7.0	17	2	
		Compressor 3	7.0	17	2	
		Compressor 4	7.0	17	2	

Resource Authority	Facility	Release Point Locations	Release Limits			Monitoring Frequency
			Minimum Release Height (m)	Minimum Efflux Velocity (m/sec)	NOx as Nitrogen Dioxide Maximum Mass Emission Rate (g/s)	
		Compressor 5	7.0	17	2	once in a 3 year period.
		Compressor 6	7.0	17	2	
		Compressor 7	7.0	17	2	
		Compressor 8	7.0	17	2	
		Generator 1	7.5	17	2	
		Generator 2	7.5	17	2	
		Generator 3	7.5	17	2	
		Generator 4	7.5	17	2	
		Generator 5	7.5	17	2	
PL92	CS2	Compressor A (K057)	6.0	23	2	At least one release point must be monitored per year on a rotational basis.
		Compressor B (K058)	6.0	23	2	
		Compressor C (K059)	6.0	23	2	
		Compressor D (Ko55)	8.1	17	2	
		Compressor E (K056)	8.1	17	2	
		Compressor F (K050)	10.0	17	10	At least one release point must be monitored per year on a rotational basis.
		Compressor G (K051)	10.0	17	10	
		Compressor H (K052)	10.0	17	10	
		Compressor J (K053)	10.0	17	10	
PL421		Compressor 1	12.3	17	2	All release points must be monitored during
		Compressor 2	12.3	17	2	

Resource Authority	Facility	Release Point Locations	Release Limits			Monitoring Frequency
			Minimum Release Height (m)	Minimum Efflux Velocity (m/sec)	NOx as Nitrogen Dioxide Maximum Mass Emission Rate (g/s)	
	ACS-03	Compressor 3	12.3	17	2	commissioning of the facility. Thereafter, at leastone release point must be monitoredper year on a rotational basis, with all release points monitored atleast once in a 6 year period.
		Compressor 4	12.3	17	2	
		Compressor 5	12.3	17	2	
		Compressor 6	12.3	17	2	
		Compressor 7	12.3	17	2	
		Compressor 8	12.3	17	2	
		Generator 1	8.0	17	2	
		Generator 2	8.0	17	2	
		Generator 3	8.0	17	2	
		Generator 4	8.0	17	2	
PL92	CS3	Compressor 1 (K063)	8.3	17	2	At least one release point must be monitored per year on a rotational basis, with all release points monitored at least once in a 6 year period
		Compressor 2 (K064)	8.3	17	2	
		Compressor 3 (K065)	8.3	17	2	
		Compressor 4 (K066)	8.3	17	2	
		Compressor 5 (K067)	8.3	17	2	
		Compressor 6 (K068)	8.3	17	2	
		Compressor 7 (K069)	8.3	17	2	
		Compressor 8 (K070)	8.3	17	2	

Resource Authority	Facility	Release Point Locations	Release Limits			Monitoring Frequency
			Minimum Release Height (m)	Minimum Efflux Velocity (m/sec)	NOx as Nitrogen Dioxide Maximum Mass Emission Rate (g/s)	
PL232	F-HSC-04	Hub GTC1	15.0	18	2	All release points must be monitored during commissioning of the facility. Thereafter, at leastone release point must be monitoredper year on a rotational basis, with all release points monitored atleast once in a 6 year period.
		Hub GTC2	15.0	18	2	
		Hub GTC3	15.0	18	2	
		Hub GTC4	15.0	18	2	
		Hub GTC5	15.0	18	2	
		Hub GTA1	15.0	20	2	
		Hub GTA2	15.0	20	2	
		Hub GTA3	15.0	20	2	
		Hub GTA4	15.0	20	2	
		Hub GTA5	15.0	20	2	
PL91	F-HSC-05	Hub GTC1	15.0	18	2	All release points must be monitored during commissioning of the facility. Thereafter, at leastone release point must be monitoredper year on a rotational basis, with all release points monitored atleast once in a 6 year period with all release points monitored at least once in a 6 year period.
		Hub GTC2	15.0	18	2	
		Hub GTC3	15.0	18	2	
		Hub GTC4	15.0	18	2	
		Hub GTA1	15.0	20	2	
		Hub GTA2	15.0	20	2	
		Hub GTA3	15.0	20	2	
		Hub GTA4	15.0	20	2	
		Hub GTA5	15.0	20	2	
		Hub GTA6	15.0	20	2	

Note: The above NOx release limits are applicable during all timings except start-up, shut down and calibration of emission monitoring devices. The start-up duration is allowed up to 30 minutes.

Venting and Flaring

G3 Unless venting is authorised under the *Petroleum and Gas (Production and Safety) Act 2004* or the *Petroleum Act 1923*, waste gas must be flared in a manner that complies with all of (G3(a)) and (G3(b))and (G3(c)), or with (G3(d)):

(a) an automatic ignition system is used, and

(b) a flame is visible at all times while the waste gas is being flared, and

(c) there are no visible smoke emissions other than for a total period of no more than 5 minutes inany 2 hours, or

(d) it uses an enclosed flare.

SCHEDULE H – REGULATED STRUCTURES

Assessment of Consequence Category

H1 The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for assessing consequence categories and hydraulic performanceof structures* (ESR/2016/1933[1]) at the following times:

a) prior to the design and construction of the structure, if it is not an existing structure; or

b) prior to any change in its purpose or the nature of its stored contents.

H2 A consequence assessment report and certification must be prepared for each structure assessed andthe report may include a consequence assessment for more than one structure.

H3 Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for assessing consequence categories and hydraulicperformance of structures* (ESR/2016/1933).

Design and Construction of a Regulated Structure

H4 Conditions H5 to H9 inclusive do not apply to existing structures.

H5 All regulated structures must be designed by, and constructed[2] under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933).

H6 Construction of a regulated structure is prohibited unless:

a) the holder has submitted a consequence category assessment report and certification to theadministering authority; and

b) certification for the design, design plan and the associated operating procedures has beencertified by a suitably qualified and experienced person in compliance with the relevant condition of this authority.

H7 Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the *Manual for assessing consequence categoriesand hydraulic performance of structures* (ESR/2016/1933) and must be recorded in the Register of Regulated Structures.

[1] This is the publication number, which can be used as a search term to find the latest version of thepublication at www.des.qld.gov.au.

[2] Certification of design and construction may be undertaken by different persons.

H8 **Regulated structures** must:

a) be designed and constructed in compliance with the *Manual for assessing consequencecategories and hydraulic performance of structures* (ESR/2016/1933);

b) be designed and constructed with due consideration given to ensuring that the design integritywould not be compromised on account of:

i. floodwaters from entering the regulated dam from any watercourse or drainage line;and

ii. wall failure due to erosion by floodwaters arising from any watercourse or drainageline.

c) have the floor and sides of the dam designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides ofthe dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.

H9 Certification by the suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, andstate that:

a) the 'as constructed' drawings and specifications meet the original intent of the design plan forthat regulated structure

b) construction of the regulated structure is in accordance with the design plan.

Notification of Affected Persons

H10 All affected persons must be provided with a copy of the emergency action plan in place for eachregulated structure:

a) for existing structures that are regulated structures, within 6 months of this condition takingeffect;

b) prior to the operation of the new regulated structure; and

c) if the emergency action plan is amended, within 5 business days of it being amended.

Operation of a Regulated Structure

H11 Operation of a regulated structure, is prohibited unless the holder has submitted to the administeringauthority in respect of regulated structure, all of the following:

a) one paper copy and one electronic copy of the design plan and certification of the 'design plan'in accordance with condition H6;

b) a set of 'as constructed' drawings and specifications;

c) certification of the 'as constructed drawings and specifications' in accordance with condition H9;

d) where the regulated structure is to be managed as part of an integrated containment system forthe purpose of sharing the DSA volume across the system, a copy of the certified system design plan;

e) the requirements of this authority relating to the construction of the regulated structure havebeen met;

f) the holder has entered the details required under this authority, into a Register of RegulatedStructures; and

g) there is a current operational plan for the regulated structure. A current operational plan is notrequired for existing structures.

H12 Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in compliance with the current operational plan and, if applicable, thecurrent design plan and associated certified 'as constructed' drawings.

Mandatory Reporting Level

H13 Conditions H14 to H16 inclusive only apply to Regulated Structures which have not been certified as lowconsequence category for 'failure to contain – overtopping'.

H14 The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that duringroutine inspections of that dam, it is clearly observable.

H15 The holder must, immediately on becoming aware that the MRL has been reached, act to prevent theoccurrence of any unauthorised discharge from the regulated dam.

H16 The holder must record any changes to the MRL in the Register of Regulated Structures.

Design Storage Allowance

H17 The holder must assess the performance of each regulated dam or linked containment system over thepreceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.

H18 By 1 November of each year, storage capacity must be available in each regulated dam (or network oflinked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA)volume for the dam (or network of linked containment systems).

H19 The holder must, immediately on becoming aware that a regulated dam (or network of linked containmentsystems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.

Annual Inspection Report

H20 Each regulated structure must be inspected each calendar year by a suitably qualified and experiencedperson.

H21 At each annual inspection, the condition and adequacy of all components of the regulated structure mustbe assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include a recommendations section, with any recommended actions to ensure the integrity of the regulated structure or a positive statement that no recommendationsare required.

H22 The suitably qualified and experienced person who prepared the annual inspection report must certify thereport in accordance with the *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933).

H23 The holder must within 20 business days of receipt of the annual inspection report, provide to theadministering authority:

a) The recommendations section of the annual inspection report; and
b) If applicable, any actions being taken in response to those recommendations; and
c) If, following receipt of the recommendations and (if applicable) recommended actions, the administering authority requests a copy of the annual inspection report from the holder, providethis to the administering authority within 10 business days of receipt of the request.

Transfer Arrangements

H24 The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment,design plan and other supporting documentation, to a new holder on transfer of this authority.

Decommissioning and Rehabilitation

H25 Regulated structures must not be abandoned but be either:

a) decommissioned and rehabilitated to achieve compliance with condition H26; or
b) be left in-situ for a use by the landholder provided that:
    i. it no longer contains contaminants that will migrate into the environment; and
    ii. it contains water of a quality that is demonstrated to be suitable for its intended use(s);and
c) the holder of the environmental authority and the landholder agree in writing that the;
    i. dam will be used by the landholder following the cessation of the environmentallyrelevant activity(ies); and
    ii. landholder is responsible for the dam, on and from an agreed date.

H26 Before surrendering this environmental authority the site must be rehabilitated to achieve a safe, stable,non-polluting landform and be suitable for the relevant final land use.

Register of Regulated Structures

H27 A Register of Regulated Structures must be established and maintained by the holder for each regulatedstructure.

H28 The holder must provisionally enter the required information in the Register of Regulated Structures whena design plan for a regulated dam is submitted to the administering authority.

H29 The holder must make a final entry of the required information in the Register of Regulated Structuresonce compliance with condition H11 has been achieved.

H30 The holder must ensure that the information contained in the Register of Regulated Structures is currentand complete on any given day.

H31 All entries in the Register of Regulated Structures must be approved by the chief executive officer for theholder of this authority, or their delegate, as being accurate and correct.

SCHEDULE I – WELL CONSTRUCTION, MAINTENANCE AND STIMULATIONACTIVITIES

Drilling Activities

I1 Oil based or synthetic based drilling muds must not be used in the carrying out of the petroleum activity(ies).

I2 Drilling activities must not result in the connection of the target gas producing formation and another aquifer.

I3 Practices and procedures must be in place to detect, as soon as practicable, any fractures that have or may result in the connection of a target gas producing formation and another aquifer as a result of drilling activities.

Stimulation Activities

I4 Polycyclic aromatic hydrocarbons or products that contain polycyclic aromatic hydrocarbons must not beused in stimulation fluids in concentrations above the reporting limit.

I5 Stimulation activities must not negatively affect water quality, other than that within the stimulation impact zone of the target gas producing formation.

I6 Stimulation activities must not cause the connection of the target gas producing formation and anotheraquifer.

I7 The internal and external mechanical integrity of the well system prior to and during well stimulation must be ensured such that there is:

a) no significant leakage in the casing, tubing, or packer; and
b) there is no significant fluid movement into another aquifer through vertical channels adjacent tothe well bore hole.

I8 Practices and procedures must be in place to detect, as soon as practicable, any fractures that cause theconnection of a target gas producing formation and another aquifer.

Stimulation Risk Assessment

I9 Prior to undertaking well stimulation activities, a risk assessment must be developed to ensure that stimulation activities are managed to prevent environmental harm.

I10 The stimulation risk assessment must be carried out for every well to be stimulated prior to stimulation activities being carried out at that well and address issues at a relevant geospatial scale such that
changes to features and attributes are adequately described and must include, but not necessarily be limited to:

a) a process description of the stimulation activity to be applied, including equipment and acomparison to best international practice;
b) provide details of where, when and how often stimulation is to be undertaken on the tenures covered by this environmental authority;
c) a geological model of the field to be stimulated including geological names, descriptions and depths of the target gas producing formation(s);
d) naturally occurring geological faults;
e) seismic history of the region (e.g. earth tremors, earthquakes);
f) proximity of overlying and underlying aquifers;
g) description of the depths that aquifers with environmental values occur, both above and below the target gas producing formation.
h) identification and proximity of landholders' active groundwater bores in the area where stimulation activities are to be carried out;
i) the environmental values of groundwater in the area;
j) an assessment of the appropriate limits of reporting for all water quality indicators relevant to stimulation monitoring in order to accurately assess the risks to environmental values of groundwater;
k) description of overlying and underlying formations in respect of porosity, permeability, hydraulic conductivity, faulting and fracture propensity;
l) consideration of barriers or known direct connections between the target gas producing formation and the overlying and underlying aquifers;
m) a description of the well mechanical integrity testing program;
n) process control and assessment techniques to be applied for determining extent of stimulation activities (e.g. microseismic measurements, modelling etc);
o) practices and procedures to ensure that the stimulation activities are designed to be contained within the target gas producing formation;
p) groundwater transmissivity, flow rate, hydraulic conductivity and direction(s) of flow;
q) a description of the chemicals used in stimulation activities (including estimated total mass, estimated composition, chemical abstract service numbers and properties), their mixtures and the resultant compounds that are formed after stimulation;
r) a mass balance estimating the concentrations and absolute masses of chemicals that will be reacted, returned to the surface or left in the target gas producing formation subsequent to stimulation;

s) an environmental hazard assessment of the chemicals used including their mixtures and theresultant chemicals that are formed after stimulation including:
   (i). toxicological and ecotoxicological information of chemicals used;
   (ii). information on the persistence and bioaccumulation potential of the chemicals used;
   (iii). identification of the stimulation fluid chemicals of potential concern derived from the risk assessment;

t) an environmental hazard assessment of use, formation of, and detection of polycyclic aromatichydrocarbons in stimulation activities;

u) if used, identification and an environmental hazard assessment of using radioactive tracerbeads in stimulation activities

v) an environmental hazard assessment of leaving stimulation chemicals in the target gasproducing formation for extended periods subsequent to stimulation;

w) human health exposure pathways to operators and the regional population;

x) risk characterisation of environmental impacts based on the environmental hazard assessment;

y) potential impacts to landholder bores as a result of stimulation activities;

z) the determination of the likelihood of causing interconnectivity and/or negative water quality as aresult of stimulation activities undertaken in close proximity or each other; and

aa) potential environmental or health impacts which may result from stimulation activities includingbut not limited to water quality, air quality (including suppression of dust and other airborne contaminants), noise and vibration.

Water Quality Baseline Monitoring

I11 Prior to undertaking any stimulation activity, a baseline bore assessment must be undertaken of thewater quality of:

(a) all landholders' active groundwater bores (subject to access being permitted by the landholder)that are spatially within a two (2) kilometre horizontal radius from the location of the stimulationinitiation point within the target gas producing formation; and

(b) all landholders' active groundwater bores (subject to access being permitted by the landholder)in any aquifer that is within 200 metres above or below the target gas producing formation and is spatially located with a two (2) kilometre radius from the location of the stimulation initiation point; and

(c) any other bore that could potentially be adversely impacted by the stimulation activity(ies) inaccordance with the findings of the risk assessment required by conditions (I9) and (I10).

I12 Prior to undertaking stimulation activities at a well, there must have sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include, as a minimum,the results of analyses for the parameters in condition (I13).

I13 Baseline bore and well assessments must include relevant analytes and physicochemical parameters tobe monitored in order to establish baseline water quality and must include, but not necessarily be limitedto:

(a) pH
(b) electrical conductivity [µS/m]
(c) turbidity [NTU]
(d) total dissolved solids [mg/L]
(e) temperature [°C]
(f) dissolved oxygen [mg/L]
(g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulfide) [mg/L]
(h) alkalinity (bicarbonate, carbonate, hydroxide and total as CaCO3) [mg/L]
(i) sodium adsorption ratio (SAR)
(j) anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) [mg/L]
(k) cations (aluminium, calcium, magnesium, potassium, sodium) [mg/L]
(l) dissolved and total metals and metalloids (including but not necessarily being limited to: aluminium, arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride,lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc) [µg/L]
(m) total petroleum hydrocarbons [µg/L]
(n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and totalxylene) [µg/L]
(o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene,phenanthrene, benzo[a]pyrene) [µg/L]
(p) sodium hypochlorite [mg/L]
(q) sodium hydroxide [mg/L]
(r) formaldehyde [mg/L]
(s) ethanol [mg/L]; and
(t) gross alpha + gross beta or radionuclides by gamma spectroscopy [Bq/L].

I14 Despite condition I13, baseline bore and well assessment undertaken prior to 13 April 2021 must include the minimum water quality analytes and physico-chemical parameters identified in the BaselineAssessment Guideline (EHP) and any restricted stimulation fluids as defined in the *Environmental Protection Act 1994*, as amended from time to time, in order to establish baseline water quality.

Stimulation Impact Monitoring Program

I15 A Stimulation Impact Monitoring Program must be developed prior to the carrying out of stimulation activities which must be able to detect adverse impacts to water quality from stimulation activities andmust consider the findings of the risk assessment required by conditions (I9) and (I10) that relate to stimulation activities and must include, as a minimum, monitoring of:

(a) the stimulation fluids to be used in stimulation activities at sufficient frequency and whichsufficiently represents the quantity and quality of the fluids used; and

(b) flow back waters from stimulation activities at sufficient frequency and which sufficientlyrepresents the quality of that flow back water; and

(c) flow back waters from stimulation activities at sufficient frequency and accuracy to demonstratethat 150 per cent of the volume used in stimulation activities has been extracted from the stimulated well; and

(d) all bores in accordance with condition (I11) at the following minimum frequency:

i. monthly for the first six (6) months subsequent to the stimulation activities beingundertaken; then

ii. annually for the first five (5) years subsequent to the stimulation activities being undertaken or until analytes and physico-chemical parameters listed in condition (I13)are not detected in concentrations above baseline bore monitoring data on two (2) consecutive monitoring occasions.

I16 The Stimulation Impact Monitoring Program must provide for monitoring of:

a) analytes and physico-chemical parameters relevant to baseline bore and well assessments toenable data referencing and comparison including, but not necessarily being limited to the analytes and physico-chemical parameters in condition (I13); and

b) any other analyte or physico-chemical parameters that will enable detection of adverse waterquality impacts and the inter-connection with a non-target aquifer as a result of stimulation activities including chemical compounds that are actually or potentially formed by chemical reactions with each other or coal seam materials during stimulation activities.

I17 The results of the Stimulation Impact Monitoring Program must be made available to any potentiallyaffected landholders upon request by that landholder.

SCHEDULE J – REHABILITATION

Rehabilitation Planning

J1 A Rehabilitation Plan must be developed by a suitably qualified person and must include the:

(a) rehabilitation goals; and

(b) procedures to be undertaken for rehabilitation that will:

(i). achieve the requirements of conditions (J2) to (J6) inclusive; and(ii). provide for appropriate monitoring and maintenance.

Transitional Rehabilitation

J2 Significantly disturbed areas that are no longer required for the on-going petroleum activities, must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. aflood event) prevents this timeframe being met) and be maintained to meet the following acceptance criteria:

(a) contaminated land resulting from petroleum activities is remediated and rehabilitated;

(b) the areas are:

(i). non-polluting;

(ii). a stable landform;

(iii). re-profiled to contours consistent with the surrounding landform

(c) surface drainage lines are re-established;

(d) top soil is reinstated; and

(e) either:

(i). groundcover, that is not prohibited or restricted pest species , is growing; or

(ii). an alternative soil stabilisation methodology that achieves effective stabilisation isimplemented and maintained.

Remaining Dams

J3 Where there is a dam, (including a low consequence dam) that is being or intended to be used by the landholder or overlapping tenure holder, the dam must be decommissioned to no longer accept inflow from the petroleum activity(ies) and the contained water must be of a quality suitable for the intended on-going uses(s) by the landholder or overlapping tenure holder.

Pipeline Activities

J4 Pipeline trenches must be backfilled, and topsoils reinstated within three months after pipe laying.

J5 Reinstatement and revegetation of the pipeline right of way must commence within 6 months aftercessation of petroleum activities for the purpose of pipeline construction.

J6 Backfilled, reinstated, and revegetated pipeline trenches and right of ways must be:

(a) a stable landform
(b) re-profiled to a level consistent with surrounding soils
(c) re-profiled to original contours and established drainage lines; and
(d) vegetated with groundcover which is not a prohibited or restricted pest species , and which isestablished and growing.

Final Rehabilitation Acceptance Criteria

J7 All significantly disturbed areas caused by petroleum activities which are not being or intended to be utilised by the landholder or overlapping tenure holder, must be rehabilitated to meet the following finalacceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use:

(a) greater than or equal to 70 per cent of native ground cover species richness
(b) greater than or equal to the total per cent ground cover
(c) less than or equal to the per cent species richness of prohibited or restricted pestspecies
(d) where the adjacent land use contains, or the pre-clearing land use contained, one or moreregional ecosystem(s), then:
    (i). at least one Regional Ecosystem(s) from the same broad vegetation group, as demonstrated by the predominant species in the ecologically dominant layer, must bepresent; and,
    (ii). the Regional Ecosystem present in (J7)(d)(i) must possess an equivalent or higher conservation value (biodiversity status) than the Regional ecosystem(s) in either theadjacent land or pre-disturbed land.

Final Rehabilitation Acceptance Criteria in Environmentally Sensitive Areas

J8 Where significant disturbance to land has occurred in an environmentally sensitive area, the followingfinal rehabilitation criteria as measured against the pre-disturbance biodiversity values assessment (required by conditions (J1) and (J2)) must be met:

(a) greater than or equal to 70% of native ground cover species richness
(b) greater than or equal to the total per cent ground cover
(c) less than or equal to the per cent species richness of Prohibited or restricted pest species
(d) greater than or equal to 50% of organic litter cover
(e) greater than or equal to 50% of total density of coarse woody material; and
(f) all predominant species in the ecologically dominant layer, that define the pre-disturbanceregional ecosystem(s) are present.

SCHEDULE K – NOTIFICATION

K1 The administering authority must be notified through the Pollution Hotline as soon as reasonablypracticable, but within 48 hours after becoming aware of:

(a) any unauthorised significant disturbance to land; or

(b) any unauthorised release of contaminants greater than:

(i) 200 L of hydrocarbons; or

(ii) 200 L of stimulation additives; or

(iii) 500 L of stimulation fluids; or

(iv) 1,000 L of brine; or

(v) 5,000 L of coal seam gas water; or

(vi) 10,000 L of sewage effluent;

(vii) 100,000 L of irrigation-quality coal seam gas water, released inside a designated irrigation area authorised by condition (C8)(c).

(c) a potential or actual loss of structural or hydraulic integrity of a dam; or

(d) when the level of the contents of any regulated dam reaches the mandatory reporting level; or

(e) when a regulated dam will not have available storage to meet the design storage allowance onthe 1 November of any year; or

(f) any incident where there is a potential or actual loss of well integrity (e.g. when the annulus pressure during stimulation increases by more than 3.5 MPa from the pressure immediatelypreceding stimulation); or

(g) any detection of restricted stimulation fluids from stimulation fluid monitoring; or

(h) any analyses result from baseline bore, well or stimulation impact monitoring that exceeds awater quality objective for the protection of an environmental value of that water resource; or

(i) any analyses result from groundwater monitoring that exceeds trigger action investigationlevels, if provided in this environmental authority.

K2 In the event that a drinking water quality parameter limit is exceeded in *Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value of Drinking Water* or *Schedule B, Table 9 – Event based release- Contaminant Limits for Protecting the Environmental Value of Drinking Water,* thefollowing events must occur within 24 hours of becoming aware of any noncompliance:

(a) the administering authority must be notified on the Pollution Hotline; and

(b) the holder of this authority must telephone any affected drinking water service provider;

K3 In the event that a water quality parameter limit is exceeded in *Schedule B, Table 8 – Event-based release – Contaminant monitoring*, the administering authority must be notified on the Pollution Hotlinewithin 24 hours of becoming aware of any noncompliance.

K4 The notification of emergencies or incidents as required by condition (K1) must include but not be limitedto the following information:

(a) the environmental authority number and name of the holder;
(b) the tenure type and number where the emergency or incident occurred;
(c) the name and telephone number of the designated contact person;
(d) the location of the emergency or incident (GDA94);
(e) the date and time that the emergency or incident occurred;
(f) the date and time the holder of this environmental authority became aware of the emergency orincident;
(g) details of the nature of the event and the circumstances in which it occurred;
(h) the estimated quantity and type of any contaminants involved in the incident;
(i) the actual or potential suspected cause of the emergency or incident;
(j) a description of the land use at the site of the emergency or incident (e.g. grazing, pasture, forest etc.) and/or the name of any relevant waters and other environmentally sensitive features;
(k) a description of the possible impacts from the emergency or incident;
(l) a description of whether stock and/or wildlife were exposed to any contaminants released andmeasures taken to prevent access for the duration of the emergency or incident;
(m) any sampling conducted or proposed, relevant to the emergency or incident;
(n) landholder details and details of landholder consultation;
(o) immediate actions taken to control the impacts of the emergency or incident and howenvironmental harm was mitigated at the time of the emergency or incident; and
(p) whether further examination/root cause analysis is required and if so, the expected date bywhen this examination will be completed and reported to the administering authority.

K5 Within 10 business days following the initial notification under conditions (K1), (K2), (K3) and (K4) unlessa longer time is agreed to by the administering authority, a written report must be provided to the administering authority, including the following (where relevant to the emergency or incident):

(a) the root cause of the emergency or incident;
(b) the confirmed quantities and types of any contaminants involved in the incident;
(c) results and interpretation of any analysis of samples taken at the time of the emergency orincident (including the analysis results of any impact monitoring);
(d) a final assessment of the impacts from the emergency or incident including any actual or potential environmental harm that has occurred or may occur in the longer term as a result ofthe release;
(e) the success or otherwise of actions taken at the time of the incident to prevent or minimise environmental harm;
(f) results and current status of landholder consultation, including commitment to resolve any outstanding issues / concerns; and
(g) actions and / or procedural changes to prevent a recurrence of the emergency or incident.

SCHEDULE L – DEFINITIONS

"Adjacent Land Use(s)" means the **ecosystem function** adjacent to an area of significant disturbance, or where there is no ecosystem function, the use of the land. An adjacent land use does not include an adjacentarea that shows evidence of edge effect.

"Administering Authority" means:

(a) for a matter, the administration and enforcement of which has been devolved to a local governmentunder section 514 of the *Environmental Protection Act 1994* the local government; or
(b) for all other matters the Chief Executive of the Department of Environment and Science; or
(c) another State Government Department, Authority, Storage Operator, Board or Trust, whose role is toadminister provisions under other enacted legislation.

"Affected Person" is someone whose drinking water can potentially be impacted as a result of discharges froma dam or their life or property can be put at risk due to dwellings or workplaces being in the path of a dam break flood.

"AHD" means Australian Height Datum and is the datum used for the determination of elevations in Australia.The determination uses a national network of benchmarks and tide gauges and sets mean sea level at zero elevation.

"Alternative Arrangement" means a written agreement about the way in which a particular environmental nuisance impact will be dealt with at a sensitive place, and may include an agreed period of time for which thearrangement is in place. An alternative arrangement may include, but is not limited to, a range of nuisance abatement measures to be installed at the sensitive place, or provision of alternative accommodation for the duration of the relevant nuisance impact.

"Analogue Site" means an area of land which contains values and characteristics representative of an area tobe rehabilitated prior to disturbance. Such values must encompass land use, topographic, soil, vegetation, vegetation community attributes and other ecological characteristics. Analogue sites can be the pre-disturbed site of interest where significant surveying effort has been undertaken to establish benchmark parameters.

"Analytes" means a chemical parameter determined by either physical measurement in the field or bylaboratory analysis.

"**Annual Exceedance Probability or AEP**" the probability that at least one event in excess of a particularmagnitude will occur in any given year.

"Annual Inspection Report" means an assessment prepared by a suitably qualified and experienced personcontaining details of the assessment against the most recent consequence assessment report and design plan(or system design plan):

(a) against recommendations contained in previous annual inspections reports;
(b) against recognised dam safety deficiency indicators;
(c) for changes in circumstances potentially leading to a change in consequence category;
(d) for conformance with the conditions of this authority;
(e) for conformance with the 'as constructed' drawings;
(f) for the adequacy of the available storage in each regulated dam, based on an actual observation orobservations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);
(g) for evidence of conformance with the current operational plan.

"Appraisal Well" means a petroleum well to test the potential of one (1) or more natural underground reservoirs for producing or storing petroleum. For clarity, an appraisal well does not include an exploration well.

"Approved Quality Criteria" for the purposes of residual drilling materials, means the residual drilling materialmeet the following quality standards:

Part A In all cases:

Parameter	Maximum concentration
pH	6-10.5 (range)
Electrical Conductivity	20 dS/m (20,000 µS/cm)
Chloride*	8000 mg/L

*Chloride analysis is only required if an additive containing chloride was used in the drilling process.The limits in Part A must be measured in the clarified filtrate of oversaturated solids prior to mixing.

Part B If any of the following metals are a component of the drilling fluids, then for that metal:

Parameter	Maximum concentration
Arsenic	20 mg/kg
Selenium	5 mg/kg
Boron	100 mg/kg
Cadmium	3 mg/kg
Chromium	400 mg/kg
Copper	100 mg/kg
Lead	600 mg/kg

The limits in Part B and Part C refer to the post soil/by-product mix. Part C If a hydrocarbon sheen is visible, thefollowing hydrocarbon fractions:

TPH	Maximum concentration
C6 – C10	170 mg/kg
C10 – C16	150 mg/kg
C16 – C34	1300 mg/kg
C34 – C40	5600 mg/kg
Total Polycyclic Aromatic Hydrocarbons (PAHs)	20 mg/kg
Phenols (halogenated)	1 mg/kg
Phenols (non-halogenated)	60 mg/kg
Monocyclic aromatichydrocarbons (Total sum of benzene, toluene, ethyl benzene, xylenes including otho, para and meta xylenes) and styrene)	7 mg/kg
Benzene	1 mg/kg

"Areas of Pre-existing Disturbance" means areas where environmental values have been negatively impacted as a result of anthropogenic activity and these impacts are still evident. Areas of pre-disturbance may include areas where legal clearing, logging, timber harvesting, or grazing activities have previously occurred, where high densities of weed or pest species are present which have inhibited re-colonisation of native regrowth, or where there is existing infrastructure (regardless of whether the infrastructure is associated with the authorised petroleum activities). The term 'areas of pre-disturbance' does not include areas that have beenimpacted by wildfire/s, controlled burning, flood or natural vegetation die-back.

"**Assessed or Assessment**" by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspectsare addressed and are sufficient to allow an independent audit of the assessment:

(a) exactly what has been assessed and the precise nature of that determination;
(b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;
(c) the relevant data and facts on which the assessment has been based, the source of that material,and the efforts made to obtain all relevant data and facts; and
(d) the reasoning on which the assessment has been based using the relevant data and facts, and therelevant criteria.

"Associated Water" means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority,such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.

"Associated Works" in relation to a dam, means:

(a) operations of any kind and all things constructed, erected or installed for that dam; and
(b) any land used for those operations.

"Australian Standard 2187" means Australian Standard 2187.0:1998 Explosives—Storage, transport and use,Part 0, Australian Standard 2187.1:1998 Explosives—Storage, transport and use Part 1 and Australian Standard 2187.2:2006 Explosives—Storage and use, Part 2 or any updated versions that becomes available from time to time.

"Australian Standard 3580" means any of the following publications:

- AS3580.10.1 Methods for sampling and analysis of ambient air - Determination of particulatematter - Deposited matter - Gravimetric method.
- AS3580.9.6 Methods for sampling and analysis of ambient air Determination of suspendedparticulate matter PM10 high volume sampler with size-selective inlet Gravimetric method
- AS3580.9.9 Methods for sampling and analysis of ambient air Determination of suspendedparticulate matter PM10 low volume sampler Gravimetric sampler.

"Australian Standard 4323" means Australian Standard 4323.1:1995 Stationary source emissions method 1:Selection of sampling positions.

"Authority " means an environmental authority.

"Background Noise Level" means the sound pressure level, measured in the absence of the noise underinvestigation, as the L A90,T being the A-weighted sound pressure level exceeded for 90 per cent of the measurement time period T of not less than 15 minutes, using Fast response.

"Bed and Banks" for a watercourse or wetland means land over which the water of the watercourse or wetlandnormally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.

"Being or Intended to be Utilised by the Landholder or Overlapping Tenure Holder" for significantlydisturbed land, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use of the land such that rehabilitation standards forrevegetation by the holder of the environmental authority are not required.

For dams, means there is a written agreement (e.g. land and compensation agreement) between the landholderor the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use for the dam such that rehabilitation standards for revegetationby the holder of the environmental authority are not required.

"Beneficial use" means

- with respect to dams, that the current or proposed owner of the land on which a dam stands, has found ause for that dam that is:
  - of benefit to that owner in that it adds real value to their business or to the general community,
  - in accordance with relevant provisions of the *Waste Reduction and Recycling Act 2011*,
  - sustainable by virtue of written undertakings given by that owner to maintain that dam, and
  - the transfer and use have been approved or authorised under any relevant legislation. Or,
- with respect to coal seam gas water, refer to the Department of Environment and Heritage Protection's *Guideline – Approval of Coal Seam Gas Water for Beneficial Use*.

"Bore" means a water observation bore or a water supply bore that is either sub-artesian or artesian.

"Brine" means saline water with a total dissolved solid concentration greater than 40,000 mg/l.

"Brine dam" means a regulated dam that is designed to receive, contain or evaporate brine.

"BTEX" means benzene, toluene, ethylbenzene, ortho-xylene, paraxylene, meta-xylene and total xylene.

"Bund or bunded" in relation to spill containment systems for fabricated or manufactured tanks or containers designed to a recognised standard means an embankment or wall of brick, stone, concrete or other imperviousmaterial which may form part or all of the perimeter of a compound and provides a barrier to retain liquid. Sincethe bund is the main part of a spill containment system, the whole system (or bunded area) is sometimes colloquially referred to within industry as the bund. The bund is designed to contain spillages and leaks from liquids used, stored or processed above ground and to facilitate clean-up operations. As well as being used to prevent pollution of the receiving environment, bunds are also used for fire protection, product recovery and process isolation.

"Business Day" has the meaning in the *Acts Interpretation Act 1954* and *Environmental Protection Act 1994* and means a day that is not—

- a Saturday or Sunday; or
- public holiday, special holiday or bank holiday in the place in which any relevant act is to be or maybe done; or
- a business day that occurs during the period starting on 20 December in a year and ending on 5January in the following year.

"Category A Environmentally Sensitive Area" means any area listed in Schedule 12, Section 1 of the *Environmental Protection Regulation 2008*.

"Category B Environmentally Sensitive Area" means any area listed in Schedule 12, Section 2 of the *Environmental Protection Regulation 2008*.

"Category C Environmentally Sensitive Area" means any of the following areas:

- Nature Refuges as defined under the *Nature Conservation Act 1992*;
- Koala Habitat Areas as defined under the *Nature Conservation (Koala) Conservation Plan 2006*;
- State Forests or Timber Reserves as defined under the *Forestry Act 1959*;
- Regional parks (resource use area) under the *Nature Conservation Act 1992*;
- An area validated as "Essential Habitat" from ground-truthing surveys in accordance with the Vegetation Management Act 1999 for a species of wildlife listed as endangered or vulnerable underthe *Nature Conservation Act 1992*;
- Of Concern Regional Ecosystems that are remnant vegetation identified in the database called 'REdescription database' containing Regional Ecosystem numbers and descriptions.

"Certifying or Certify or Certified or Certification" in relation to a dam, means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this Manual, including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with theBoard of Professional Engineers of Queensland Policy Certification by RPEQs (ID: 1.4 (2A))

"Certifying or Certify or Certified or Certification" in relation to any matter other than a design plan, 'as constructed' drawings or an annual report regarding dams means, a Statutory Declaration by a suitably qualified person or suitably qualified third party accompanying the written document stating:

- The person's qualifications and experience relevant to the function;
- that the person has not knowingly included false, misleading or incomplete information in thedocument;
- that the person has not knowingly failed to reveal any relevant information or document to theadministering authority;
- that the document addresses the relevant matters for the function and is factually correct; and
- that the opinions expressed in the document are honestly and reasonably held.

"Clearing" for vegetation:

(a) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning,flooding or draining; but

(b) does not include destroying standing vegetation by stock, or lopping a tree.

"Closed-Loop Systems" means using waste on site in a way that does not release waste or contaminants inthe waste to the environment.

"Coal Seam Gas Water" means underground water brought to the surface of the earth, or moved undergroundin connection with exploring for, or producing coal seam gas.

"Commercial species" means species as listed in parts 1, 2 and 3 of Schedule 6 of the *Vegetation Management Regulation 2012*, which are above the diameters / sizes specified in this Schedule for each listedspecies.

"Consequence" in relation to a structure as defined, means the potential for environmental harm resulting fromthe collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

"Consequence Category" means a category, either low, significant or high, into which a dam is assessed as aresult of the application of tables and other criteria in the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).

"Construction or Constructed" in relation to a dam includes building a new dam and modifying or lifting anexisting dam, but does not include investigations and testing necessary for the purpose of preparing a designplan.

"Control Measure" has the meaning in section 47 of the *Environmental Protection Regulation 2008* and meansa device, equipment, structure, or management strategy used to prevent or control the release of a contaminantor waste to the environment.

"Daily Peak Design Capacity" for sewage treatment works, has the meaning in Schedule 2, section 63(4) ofthe *Environmental Protection Regulation 2008* as the higher equivalent person (EP) for the works calculated using each of the formulae found in the definition for EP.

"Dam" means a land-based structure or a **void** that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or voidand **associated works**.

"Dam Crest Volume" means the volume of material (liquids and/or solids) that could be within the walls of a dam at any time when the upper level of that material is at the crest level of that dam. That is, the instantaneousmaximum volume within the walls, without regard to flows entering or leaving (for example, via spillway).

"Design Plan" is a document setting out how all identified consequence scenarios are addressed in theplanned design and operation of a regulated structure.

"Design Storage Allowance or DSA" means an available volume, estimated in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published bythe administering authority, must be provided in a dam as at 1 November each year in order to prevent a discharge from that dam to an annual exceedance probability (AEP) specified in that Manual.

"Development Well" means a petroleum well which produces or stores petroleum. For clarity, a developmentwell does not include an appraisal well.

"Document" has the meaning in the *Acts Interpretation Act 1954* and means:

- any paper or other material on which there is writing; and
- any paper or other material on which there are marks; and
- figures, symbols or perforations having a meaning for a person qualified to interpret them; and
- any disc, tape or other article or any material from which sounds, images, writings or messages arecapable of being produced or reproduced (with or without the aid of another article or device).

"Ecologically Dominant Layer" has the meaning in the Methodology for Surveying and Mapping of RegionalEcosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means the layer making the greatest contribution to the overall biomass of the site and the vegetation community (NLWRA 2001). This is also referred to as the ecologically dominant stratum or the predominant canopy in woody ecosystems.

"Ecosystem Function" means the interactions between and within living and nonliving components of an ecosystem and generally correlates with the size, shape and location of the vegetation community.

"Emergency Action Plan" means documentation forming part of the operational plan held by the holder or a nominated responsible officer, that identifies emergency conditions that sets out procedures and actions that willbe followed and taken by the dam owner and operating personnel in the event of an emergency. The actions are to minimise the risk and consequences of failure and ensure timely warning to affected persons and the implementation of protection measures. The plan must require dam owners to annually review and updatecontact information where required.

"Enclosed Flare" means a device where the residual gas is burned in a cylindrical or rectilinear enclosure thatincludes a burning system and a damper where air for the combustion reaction is admitted.

"Environmental Harm" has the meaning in section 14 of the *Environmental Protection Act 1994* and meansany adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude,duration or frequency) on an environmental value, and includes environmental nuisance. Environmental harm may be caused by an activity

(a) whether the harm is a direct or indirect result of the activity; or
(b) whether the harm results from the activity alone or from the combined effects of the activity andother activities or factors.

"Environmental Nuisance" has the meaning in section 15 of the *Environmental Protection Act 1994* andmeans unreasonable interference or likely interference with an environmental value caused by

(a) aerosols, fumes, light, noise, odour, particles or smoke; or
(b) an unhealthy, offensive or unsightly condition because of contamination; or
(c) another way prescribed by regulation.

"Equivalent Person" or **"EP"** has the meaning under section 3 of the Planning Guidelines For Water Supply and Sewerage, 2005, published by the Queensland Government. It is calculated in accordance with Schedule 2,Section 63(4) of the *Environmental Protection Regulation 2008* where:

- EP = V/200 where V is the volume, in litres, of the average dry weather flow of sewage that can betreated at the works in a day; or
- EP = M/2.5 where M is the mass, in grams, of phosphorus in the influent that the works are designed totreat as the inlet load in a day.

'**Essential Habitat'** for EA Conditions D12 to D17 means vegetation in which a species that is listed under the *Nature Conservation Act 1992* (QLD) as Endangered or Vulnerable has been known to occur. Essential habitat for the GFD project for EA Conditions D12 to D17 is limited to areas mapped in version 3.1 of the Essential Habitat map as provided in Chapter 18 of the Environmental Impact Statement for the Santos Gas Fields Development Project. For all other Conditions under this EA '**Essential Habitat'** has the same meaning as defined in the VM Act.

"Existing" means constructed prior to 13 April 2021.

"Exploration Well" means a petroleum well that is drilled to:

- explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum; or
- obtain stratigraphic information for the purpose of exploring for petroleum. For clarity, an exploration well does not include an appraisal or development well.

"Flare Pit" has the meaning in the *Manual for Assessing Consequence Categories and Hydraulic Performanceof Structures* (*ESR/2016/1933)*, and means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted, The flare pit is only used during the drilling and work over process on a petroleum well.

"Flare Precipitant" means waste fluids which result from the operation of a flare.

"Floodplains" has the meaning in the *Water Act 2000* and means an area of reasonably flat land adjacent to awatercourse that:

- is covered from time to time by floodwater overflowing from the watercourse; and
- does not, other than in an upper valley reach, confine floodwater to generally follow the path of thewatercourse; and
- has finer sediment deposits than the sediment deposits of any bench, bar or in-stream island of thewatercourse.

"Flowable Substance" means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, ora mixture that includes water and any other liquids fluids or solids either in solution or suspension.

"Fuel Burning or Combustion Facility" means a permanent fuel burning or combustion equipment which in isolation, or combined in operation, or which are interconnected, is, or are capable of burning

more than 500 kgof fuel in an hour.

"GDA" means Geocentric Datum of Australia.

"Geophysical survey" means a systematic collection of geophysical data.

"Great Artesian Basin (GAB) spring" means an area protected under the *Environment Protection andBiodiversity Conservation Act 1999* because it is considered to be a Matter of National Environmental Significance and identified as a:

- community of native species dependent on natural discharge of groundwater from the GreatArtesian Basin; or
- Great Artesian Basin spring; or
- Great Artesian Basin discharge spring wetland.

A GAB spring includes a spring vent, spring complex or watercourse spring and includes the land to which waterrises naturally from below the ground and the land over which the water then flows.

Note: The Australian Government's Protected Matters Search Tool should be used to get an indication ofwhether the area of interest may contain an MNES spring.

Note: The GAB springs dataset can be requested from the Queensland Government Herbarium

"Greywater" means wastewater generated from domestic activities such as laundry, dishwashing, and bathing.Greywater does not include sewage.

"Groundwater Dependent Ecosystems (GDE)" means ecosystems which require access to groundwater on apermanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. For the purposes of the environmental authority, groundwater dependent ecosystems do not include thosemapped as "unknown".

"Growing" means to increase by natural development, as any living organism or part thereof by assimilation ofnutriment; increase in size or substance.

"high value regrowth" vegetation means vegetation located—

(a) on freehold land, indigenous land, or land subject of a lease issued under the *Land Act 1994* for agricultureor grazing purposes or an occupation licence under that Act; and

(b) in an area that has not been cleared (other than for relevant clearing activities) for at least 15 years, if thearea is—

  i. an endangered regional ecosystem; or
  ii. an of concern regional ecosystem; or
  iii. a least concern regional ecosystem.

"Holder" means any person who is the holder of, or is acting under, that environmental authority.

"Hydraulic fracturing" means a technique used to create cracks in underground coal seams to increase the flow and recovery of gas or oil out of a well. It involves pumping a fluid, comprised largely of water and sand, under pressure, into a coal seam. This action fractures the coal seam which provides a pathway that increasesthe ability for gas to flow through the coal.

"Hydraulic Performance" means the capacity of a regulated dam to contain or safely pass flowable substances based on the design criteria specified for the relevant consequence category in the *Manual forassessing consequence categories and hydraulic performance of structures (ESR/2016/1933)*.

"Hydraulic Testing" means the testing of a geological formation to evaluate the hydrogeological characteristicsof the formation.

"Impulsive (for noise)" means sound characterised by brief excursions of sound pressure (acoustic impulses)that significantly exceed the background sound pressure. The duration of a single impulsive sound is usually less than one second.

"Incidental Activity" for this environmental authority means an activity that is not a specified relevant activity and is necessary to carry out the activities listed in Schedule A, Table 1 – Scale and Intensity for the Activities.

"Infrastructure" means plant or works including for example, communication systems, compressors, powerlines, pumping stations, reservoirs, roads and tracks, water storage dams, evaporation or storage ponds and tanks, equipment, buildings and other structures built for the purpose and duration of the conduct of the petroleum activity(ies) including temporary structures or structures of an industrial or technical nature, including,for example, mobile and temporary camps.

Infrastructure does not include other facilities required for the long term management of the impact of those petroleum activities or the protection of potential resources. Such other facilities include dams other than waterstorage dams (e.g. evaporation dams), pipelines and assets, that have been decommissioned, rehabilitated, and lawfully recognised as being subject to subsequent transfer with ownership of the land.

"LAeq,adj, 15mins" means the A-weighted sound pressure level of a continuous steady sound, adjusted for tonalcharacter, that within any 15 minute period has the same square sound pressure as a sound level that varieswith time.

"Lake" means:

- a lagoon, swamp or other natural collection of water, whether permanent or intermittent; and
- the bed and banks and any other element confining or containing the water.

"Land Degradation" has the meaning in the *Vegetation Management Act 1999* and means the following:

- soil erosion
- rising water tables
- the expression of salinity
- mass movement by gravity of soil or rock
- stream bank instability
- a process that results in declining water quality.

"Landholders' Active Groundwater Bores" means bores that are able to continue to provide a reasonableyield of water in terms of quantity for the bores authorised purpose or use. This term does not include monitoring bores owned by the administering authority of the *Water Act 2000*.

"Levee" means an embankment that only provides for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from releasesfrom other works, during the progress of those stormwater or flood flows or those releases; and does not storeany significant volume of water or flowable substances at any other times.

"Limited Impact Camps" mean accommodation camps that:

- are temporary (no more than 6 months);
- are located within pre-existing areas of clearing or significant disturbance;
- are up to 2 ha or located within well sites; and
- may involve sewage treatment works that are no release works or release works that involve anirrigation release within pre-existing areas of clearing or significant disturbance.

"Limited Impact Petroleum Activities" means petroleum activities that are located within areas that are not aregional ecosystem and:

- are single well sites (includes observation, pilot, injection and production wells) greater than 1 ha;or
- are multi-well sites greater than 1 ha; and
- may involve construction of new access tracks that are required as part of the construction or servicing a petroleum activity that can be lawfully carried out within an ESA or its protection zone;and
- may involve upgrading or maintenance of existing roads or tracks; and
- may include power and communication lines; and
- may include gas gathering lines from a well site to the initial compression facility; and
- may include water gathering lines from a well site to the initial water storage or dam.

"Limited petroleum activities" mean any low impact petroleum activity, and:

- single well sites (includes observation, pilot, injection and production wells) up to 1 ha and associated infrastructure (water pumps and generators, sumps, flare pits or dams) located on the well site or up to 1.25 ha if the well pad includes the use of a tank (minimum 1ML) for above groundfluid storage,
- multi-well sites up to an additional (in addition to single well site above) 0.25 ha per additional welland associated infrastructure (water pumps and generators, sumps, flare pits, dams or tanks) located on the well site to a maximum of 3 ha,
- well sites >1 ha when the well site intersects a slope of >4 %,
- construction of new access tracks that are required as part of the construction or servicing apetroleum activity that can be lawfully carried out within an ESA or its protection zone
- upgrading or maintenance of existing roads or tracks,
- power and communication lines,
- gas gathering lines from a well site to the initial compression facility,
- water gathering lines from a well site to the initial water storage or dam,
- camps within well site that may involve sewage treatment works that are a no release works,
- activities necessary to achieve compliance with the conditions of the EA in relation to anotherlimited petroleum activity (e.g. sediment and erosion control measures, rehabilitation),
- geophysical, geotechnical, geological, topographic and cadastral surveys (including seismic,sample /test / geotechnical pits, core holes).

"Linear Infrastructure" means powerlines, pipelines, flowlines, roads and access tracks.

"Linear Infrastructure Services" means powerlines, power line stays, communication lines, pipelines, flowlines, roads and access tracks, turnaround bays, and other work areas necessary for linear infrastructure construction

"Long Term Noise Event" means a noise exposure, when perceived at a sensitive receptor, persists for aperiod of greater than five (5) days, even when there are respite periods when the noise is inaudible within those five (5) days.

"lopping" a tree, means cutting or pruning its branches, but does not include —

- removing its trunk; and
- cutting or pruning its branches so severely that it is likely to die.

"Low Consequence Dam" means any dam that is not a high or significant consequence category as assessedusing the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)*.

"Low flow" means flow up to the one month average recurrence interval.

"Low Impact Petroleum Activities" means petroleum activities which do not result in the clearing of native vegetation, earthworks or excavation work that cause either, a significant disruption to the soil profile or permanent damage to vegetation that cannot be easily rehabilitated immediately after the activity is completed.Examples of such activities include but are not necessarily limited to:

- chipholes
- coreholes
- geophysical surveys
- seismic surveys
- soil surveys
- topographic surveys
- cadastral surveys
- ecological surveys
- installation of environmental monitoring equipment (including surface water)

"Mandatory Reporting Level or MRL" means a warning and reporting level determined in accordance with thecriteria in the *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933) published by the administering authority.

"Manual" in reference to dams means the *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933) published by the administering authority, as amended from time totime.

"Map of Queensland wetland environmental values" means the statutory map under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. It identifies wetlands of high ecological significance(HES) and general ecological significance (GES) across the state.

"Max $L_{pA, 15\ min}$" means the absolute maximum instantaneous A-weighted sound pressure level, measured over15 minutes.

"Max $L_{pZ, 15\ min}$" means the maximum value of the Z-weighted sound pressure level measured over 15 minutes.

"Medium Term Noise Event" is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than five (5) days and does not re-occur for a period of at least four (4) weeks. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a difference source or source location.

"Methodology" means the science of method, especially dealing with the logical principles underlying the organisation of the various special sciences, and the conduct of scientific inquiry.

"Mix-Bury-Cover Method" means the stabilisation of residual drilling solids in the bottom of a sump by mixingwith subsoil and which occurs in accordance with the following methodology:

- the base of the subsoil and residual solid mixture must be separated from the groundwater table byat least one metre of a continuous layer of impermeable subsoil material (kw=10 8m/s) or subsoil with a clay content of greater than 20%; and
- the residual solids is mixed with subsoil in the sump and cover; and
- the subsoil and residual solids is mixed at least three parts subsoil to one part waste (v/v); and
- a minimum of one metre of clean subsoil must be placed over the subsoil and residual solidsmixture; and
- topsoil is replaced.

"Month" has the meaning in the *Acts Interpretation Act 1954* and means a calendar month and is a periodstarting at the beginning of any day of one (1) of the 12 named months and ending:

- immediately before the beginning of the corresponding day of the next named month; or
- if there is no such corresponding day at the end of the next named month.

"NATA Accreditation" means accreditation by the National Association of Testing Authorities Australia.

"Operational Plan" includes:

(a) normal operating procedures and rules (including clear documentation and definition of processinputs in the DSA);

(b) contingency and emergency action plans including operating procedures designed to avoid and/orminimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.

"Overburden pressure" means the pressure or stress imposed on a layer of soil or rock by the weight of overlying material. The overburden pressure at a depth z is given by $p(z) = p0 + g \int 0 \approx p(z)\, dz$ where p(z) is thedensity of the overlying rock at depth z and g is the acceleration due to gravity. p0 is the datum pressure, like the pressure at the surface.

"Pipeline Waste Water" means hydrostatic testing water, flush water or water from low point drains.

"Pre-Disturbed Land Use" means the function or use of the land as documented prior to significant disturbance occurring at that location.

"Predominant Species" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a species thatcontributes most to the overall above-ground biomass of a particular stratum.

"Prescribed Environmental Matter" has the meaning in section 10 of the *Environmental Offsets Act 2014*. Prescribed Environmental Matters for the GFD project are limited to the following Matters of State Environmental Significant:

(i) remnant regional ecosystems listed as endangered (VM Act Class)
(ii) remnant regional ecosystems listed as of concern (VM Act Class)
(iii) essential habitat for the species listed in schedule D, Table 4;
(iv) wetlands of general ecological significance.

"Primary Protection Zone" means an area within 200m from the boundary of any Category A, B or C Environmentally Sensitive Area.

"Produced Water" has the meaning in Section 15A of the *Petroleum and Gas (Production and Safety) Act 2004* and means CSG water or associated water for a petroleum tenure.

"Prohibited or Restricted Pest Species" means any pest that is:

(a) a plant or animal, other than a native species of plant or animal, that is

i. invasive biosecurity matter under the Biosecurity Act 2014 (Qld); or

Notes—
1 See the Biosecurity Act 2014, schedule 1, part 3 or 4 or schedule 2, part 2; and
2 See the note to the Biosecurity Act 2014, schedules 1 and 2.

ii. controlled biosecurity matter or regulated biosecurity matter under the Biosecurity Act 2014 (Qld)
iii. tramp ants listed in schedule 1 and schedule 2 of the Biosecurity Act 2014 (Qld)

(b) a pest declared under a local law by the local government for the Land to be a pest because the pest iscausing, or has the potential to cause, an adverse environmental, economic or social impact in all or part of the local government area.

"Quarter" in relation to *Schedule B, Table 5 – Contaminant Limits for Protecting the Environmental Value ofDrinking Water*, means the following periods of a calendar year:

- 1 January to 31 March inclusive;
- 1 April to 30 June inclusive;
- 1 July to 30 September inclusive;
- 1 October to 31 December inclusive.

"Receiving wetland" for the purposes of conditions (B18) to (B30) means the receiving water that has thefollowing characteristics: off-stream ephemeral oxbow wetland system subject to grazing land use.

"Reference wetland" means a wetland that has the similar characteristics to the receiving wetland locatedwithin 50 km of the receiving wetland.

"Regional ecosystem(s)" has the meaning in the *Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Version 3.2 August 2012) and means a vegetation community in a bioregion that is consistently associated with a particular combination geology, landform and soil. Regional ecosystems of Queensland were originally described in Sattler and Williams (1999). The RegionalEcosystems Description Database (Queensland Herbarium 2013) is maintained by Queensland Herbarium and contains the current descriptions of regional ecosystems.

"Register of Regulated Structures" includes:

(a) Date of entry in the register;
(b) Name of the structure, its purpose and intended/actual contents;
(c) The consequence category of the dam as assessed using the *Manual for assessing consequencecategories and hydraulic performance of structures* (ESR/2016/1933);
(d) Dates, names, and reference for the design plan plus dates, names, and reference numbers of alldocument(s) lodged as part of a design plan for the dam;
(e) Name and qualifications of the suitably qualified and experienced person who certified the design planand 'as constructed' drawings;
(f) For the regulated dam, other than in relation to any levees –
    i. The dimensions (metres) and surface area (hectares) of the dam measured at the footprint of thedam;
    ii. Coordinates (latitude and longitude in GDA94) within five metres at any point from the outside of thedam including its storage area
    iii. Dam crest volume (megalitres);
    iv. Spillway crest level (metres AHD).
    v. Maximum operating level (metres AHD);
    vi. Storage rating table of stored volume versus level (metres AHD);
    vii. Design storage allowance (megalitres) and associated level of the dam (metres AHD);
    viii. Mandatory reporting level (metres AHD);
(g) The design plan title and reference relevant to the dam;
(h) The date construction was certified as compliant with the design plan;
(i) The name and details of the suitably qualified and experienced person who certified that theconstructed dam was compliant with the design plan;
(j) Details of the composition and construction of any liner;
(k) The system for the detection of any leakage through the floor and sides of the dam;
(l) Dates when the regulated dam underwent an annual inspection for structural and operational adequacy,and to ascertain the available storage volume for 1 November of any year;
(m) Dates when recommendations and actions arising from the annual inspection were provided to theadministering authority;
(n) Dam water quality as obtained from any monitoring required under this authority as at 1 November ofeach year.

"Regulated Structure" means any structure in the significant or high consequence category as assessed usingthe *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933) published by the administering authority. A regulated structure does not include:

- a fabricated or manufactured tank or container, designed and constructed to an Australian Standard thatdeals with strength and structural integrity of that tank or container;
- a sump or earthen pit used to store residual drilling material and drilling fluid only for the duration ofdrilling and well completion activities;
- a flare pit.

"Rehabilitation or Rehabilitated" means the process of reshaping and **revegetating** land to restore it to astable landform and in accordance with acceptance criteria and, where relevant, includes remediation of contaminated land. For the purposes of pipeline rehabilitation, rehabilitation includes reinstatement, revegetation and **restoration**.

"Reinstate or Reinstatement" for pipelines, means the process of bulk earth works and structural replacementof pre-existing conditions of a site (i.e. soil surface typography, watercourses, culverts, fences and gates and other landscape(d) features) and is detailed in the APGA Code of Environmental Practice: Onshore Pipelines Revision 4 (2017).

"Remnant vegetation" means vegetation, part of which forms the predominant canopy of the vegetation—

- covering more than 50 per cent of the undisturbed predominant canopy; and
- averaging more than 70 per cent of the vegetation's undisturbed height; and
- composed of species characteristic of the vegetation's undisturbed predominant canopy cover.

"Reporting Limit" means the lowest concentration that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes, the reporting limit is selected as the lowest non-zero standard in the calibration curve. Results that fall below the reporting limit will be reported as "less than" the value of the reporting limit. The reporting limit is also referred to as the practical quantitation limit or the limit of quantitation. For polycyclic aromatic hydrocarbons, the reporting limit must be based on super-ultra trace methods and, depending on the specific polycyclic aromatic hydrocarbon, will rangebetween 0.005 ug/L 0.02 ug/L.

"Residual Drilling Material" means waste drilling materials including muds and cuttings or cement returnsfrom well holes and which have been left behind after the drilling fluids are pumped out.

"Resource activity(ies)" has the meaning in section 107(d) of the *Environmental Protection Act 1994.*

"Restoration" means the replacement of structural habitat complexity, ecosystems processes, services andfunction from a disturbed or degraded site to that of a pre-determined or analogue site. For the purposes of pipelines, restoration applies to final rehabilitation after pipeline decommissioning.

"Restricted stimulation fluids" means fluids used for the purpose of stimulation, including fracturing, thatcontain the following chemicals in more than the maximum amounts prescribed under section 81B of the Environmental Protection Regulation 2008:

- petroleum hydrocarbons containing benzene, ethylbenzene, toluene or xylene; or
- chemicals that produce, or are likely to produce, benzene, ethylbenzene, toluene or xylene as thechemical breaks down in the environment.

The amount of any chemical is not measured in relation to water included in the restricted stimulation fluid. Forclarity, the term restricted stimulation fluids only applies to fluids injected down well post-perforation.

"Revegetation or Revegetating or Revegetate" means to actively re-establish vegetation through seeding orplanting techniques in accordance with site specific management plans.

"Secondary Protection Zone" in relation to a Category A or Category B ESA means an area within 100 metres from the boundary of the primary protection zone.

"Sensitive Place" means:

- a dwelling (including residential allotment, mobile home or caravan park, residential marina or otherresidential premises, motel, hotel or hostel);
- a library, childcare centre, kindergarten, school, university or other educational institution;
- a medical centre, surgery or hospital;
- a protected area;
- a public park or garden that is open to the public (whether or not on payment of money) for use other thanfor sport or organised entertainment;
- a work place used as an office or for business or commercial purposes, which is not part of the petroleumactivity(ies) and does not include employees accommodation or public roads; and
- for noise, a place defined as a sensitive receptor for the purposes of the *Environmental Protection (Noise)Policy 2019*.

"Sensitive Receptor" is defined in Schedule 2 of the *Environmental Protection (Noise) Policy 2019*, and meansan area or place where noise is measured.

"Short Term Noise Event" is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than eight hours and does not re-occur for a period of at least seven (7) days. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location fora period of one hour or more, even if it originates from a different source or source location.

"Significantly Disturbed or Significant Disturbance or Significant Disturbance to Land or Areas" has themeaning in Schedule 12, section 4 of the *Environmental Protection Regulation 2008*. Land is significantly disturbed if:

(a) it is contaminated land; or
(b) it has been disturbed and human intervention is needed to rehabilitate it
    i. to a condition required under the relevant environmental authority; or
    ii. if the environmental authority does not require the land to be rehabilitated to a particular condition tothe condition it was in immediately before the disturbance.

"Site" means the relevant petroleum activity(ies) to which the environmental authority relates.

"Species Richness" means the number of different species in a given area.

"Specified Relevant Activities" for this environmental activity means an activity that:

(a) but for being carried out as a resource activity, would otherwise be an activity prescribed under section19 of the *Environmental Protection Act 1994* as an environmentally relevant activity; or
(b) stimulation activities; or
(c) extracting material other than by dredging

"Spillway" means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges formthe dam, normally under flood conditions or in anticipation of flood conditions.

"Stable" has the meaning in Schedule 5 of the *Environmental Protection Regulation 2008* and, for a site,means the rehabilitation and **restoration** of the site is enduring or permanent so that the site is unlikely tocollapse, erode or subside.

"Stimulation" means a technique used to increase the permeability of a natural underground reservoir that is undertaken above the formation pressure and involves the addition of chemicals. In includes hydraulic fracturing/ hydrofraccing, fracture acidizing and the use of proppant treatments.

"Stimulation Fluid" means the fluid injected underground to increase permeability. For clarity, the termstimulation fluid only applies to fluid injected down well post-perforation.

"Stimulation Impact Zone" means a 100m maximum radial distance from the stimulation target location withina gas producing formation.

"Structure" for the purpose of Schedule H means dam or levee.

"Suitably Qualified and Experienced Person" in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional EngineersAct 2002*, and has demonstrated competency and relevant experience:

- for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety anddam design
- for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design offlood protection embankments.

Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design orengineering hydrology.

"Suitably Qualified Person" means a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis to performance relative to the subject matters using the relevant protocols, standards, methods orliterature.

"Suitably Qualified Third Party" means a person who:

(a) has qualifications and experience relevant to performing the function including but not limited to:
   i. a bachelor's degree in science or engineering; and
   ii. 3 years' experience in undertaking soil contamination assessments; and
(b) is a member of at least one organisation prescribed in Schedule 8 of the *Environmental ProtectionRegulation 2008*; and
(c) not be an employee of, nor have a financial interest or any involvement which would lead to a conflict ofinterest with the holder(s) of the environmental authority.

"Sump" means a pit in which waste residual drilling material or drilling fluids are stored only for the duration ofdrilling activities.

"Synthetic Based Drilling Mud" means a mud where the base fluid is a synthetic oil, consisting of chemical compounds which are artificially made or synthesised by chemically modifying petroleum components or otherraw materials rather than the whole crude oil.

"System Design Plan" means a plan that manages an integrated containment system that shares the requiredDSA and/or ESS volume across the integrated containment system.

"Third Party Auditor" means a suitably qualified person who is either a certified third party auditor or an internal auditor employed by the holder of the environmental authority and the person is independent of the dayto day management and operation of the petroleum activity(ies) covered by this environmental authority.

"Top Soil" means the surface (top) layer of a soil profile, which is more fertile, darker in colour, better structured and supports greater biological activity than underlying layers. The surface layer may vary in depth depending on soil forming factors, including parent material, location and slope, but generally is not greater thanabout 300mm in depth from the natural surface.

"Total Density of Coarse Woody Material" means the total length of logs on the ground greater than or equalto 10cm diameter per hectare and number of logs on the ground greater than or equal to 10cm diameter per hectare.

"Transmissivity" means the rate of flow of water through a vertical strip of aquifer which is one unit wide andwhich extends the full saturated depth of the aquifer.

"Valid complaint" means all complaints unless considered by the administering authority to be frivolous,vexatious or based on mistaken belief.

"**Vegetation Management Act 1999 (VM Act) Class**" has the meaning provided in Division 7A of the *Vegetation Management Act 1999.* The VM Act class for each Regional Ecosystem is provided in the Vegetation Management Regulation 2012.

"Void" means any constructed, open excavation in the ground.

"Waste and Resource Management Hierarchy" has the meaning provided in section 9 of the *Waste Reduction and Recycling Act 2011* and is the following precepts, listed in the preferred order in which waste andresource management options should be considered:

(a) AVOID unnecessary resource consumption;
(b) REDUCE waste generation and disposal
(c) RE-USE waste resources without further manufacturing
(d) RECYCLE waste resources to make the same or different products
(e) RECOVER waste resources, including the recovery of energy
(f) TREAT waste before disposal, including reducing the hazardous nature of waste
(g) DISPOSE of waste only if there is no viable alternative.

"Waste and Resource Management Principles" has the meaning provided in section 4(2)(b) of the *WasteReduction and Recycling Act 2011* and means the:

(a) polluter pays principle
(b) user pays principle
(c) proximity principle
(d) product stewardship principle.

"Waste Fluids" has the meaning in section 13 of the *Environmental Protection Act 1994* in conjunction with thecommon meaning of "fluid" which is "a substance which is capable of flowing and offers no permanent resistance to changes of shape". Accordingly, to be a waste fluid, the waste must be a substance which is capable of flowing and offers no permanent resistance to changes of shape.

"Water monitoring" means all water quality parameters and samples, discharge flow rates, volume of discharge per event, duration of discharge event, flow rate of receiving water for surface water and groundwaterlevel required under conditions (B7), (B26), (B27), (B36), (B41), (B42), (B45) – (B48), and (I11-I13).

"Watercourse" has the meaning in Schedule 4 of the Environmental Protection Act 1994 and means:

1) a river, creek or stream in which water flows permanently or intermittently
   a) in a natural channel, whether artificially improved or not; or
   b) in an artificial channel that has changed the course of the watercourse.
2) Watercourse includes the bed and banks and any other element of a river, creek or stream confiningor containing water.

"Waters" includes all or any part of a creek, river, stream, lake, lagoon, swamp, wetland, spring, unconfined surface water, unconfined water in natural or artificial watercourses, bed and bank of any waters, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, andunderground water.

"Well infrastructure" means infrastructure required for the construction and completion of a well including butnot limited to cellar pits, dams and drill sumps.

"Wetland of General Ecological Significance or general ecologically significant wetland" is a wetland thatmeets the definition of a wetland and that is shown as a wetland of 'general ecological significance' on the Map of Queensland wetland environmental values.

"Wetland of High Ecological Significance" otherwise known as "high conservation value wetland", is a wetland that meets the definition of a wetland and that is shown as a High Ecological Significance wetland onthe Map of Queensland wetland environmental values.

"Wet Season" means the time of year, covering one or more months, when most of the average annual rainfallin a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.

"Well Integrity" means the ability of a well to contain the substances flowing through it.

"Well Site" means a maximum area of land disturbance for the purposes of constructing, installing and operating an exploration, appraisal or development well or such wells as part of a multi-well arrangement andincludes well lease infrastructure.

"Wetland" for the purpose of this environmental authority, wetland means:

- areas shown on the Map of Queensland wetland environmental values, which is a statewide statutorymap under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019; and
- areas defined under the Queensland Wetlands Program as permanent or periodic / intermittent inundation, with water that is static or flowing fresh, brackish or salt, including areas of marine water, the
- depth of which at low tide does not exceed six (6) metres, and possess one or more of the followingattributes:
  - at least periodically, the land supports plants or animals that are adapted to and dependent on living inwet conditions for at least part of their life cycle, or
  - the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough todevelop anaerobic conditions in the upper layers, or
  - the substratum is not soil and is saturated with water, or covered by water at some time.

The term wetland includes riverine, lacustrine, estuarine, marine and palustrine wetlands; and it does notinclude a Great Artesian Basin Spring or a subterranean wetland that is a cave or aquifer.

"year" means a period of 12 months.

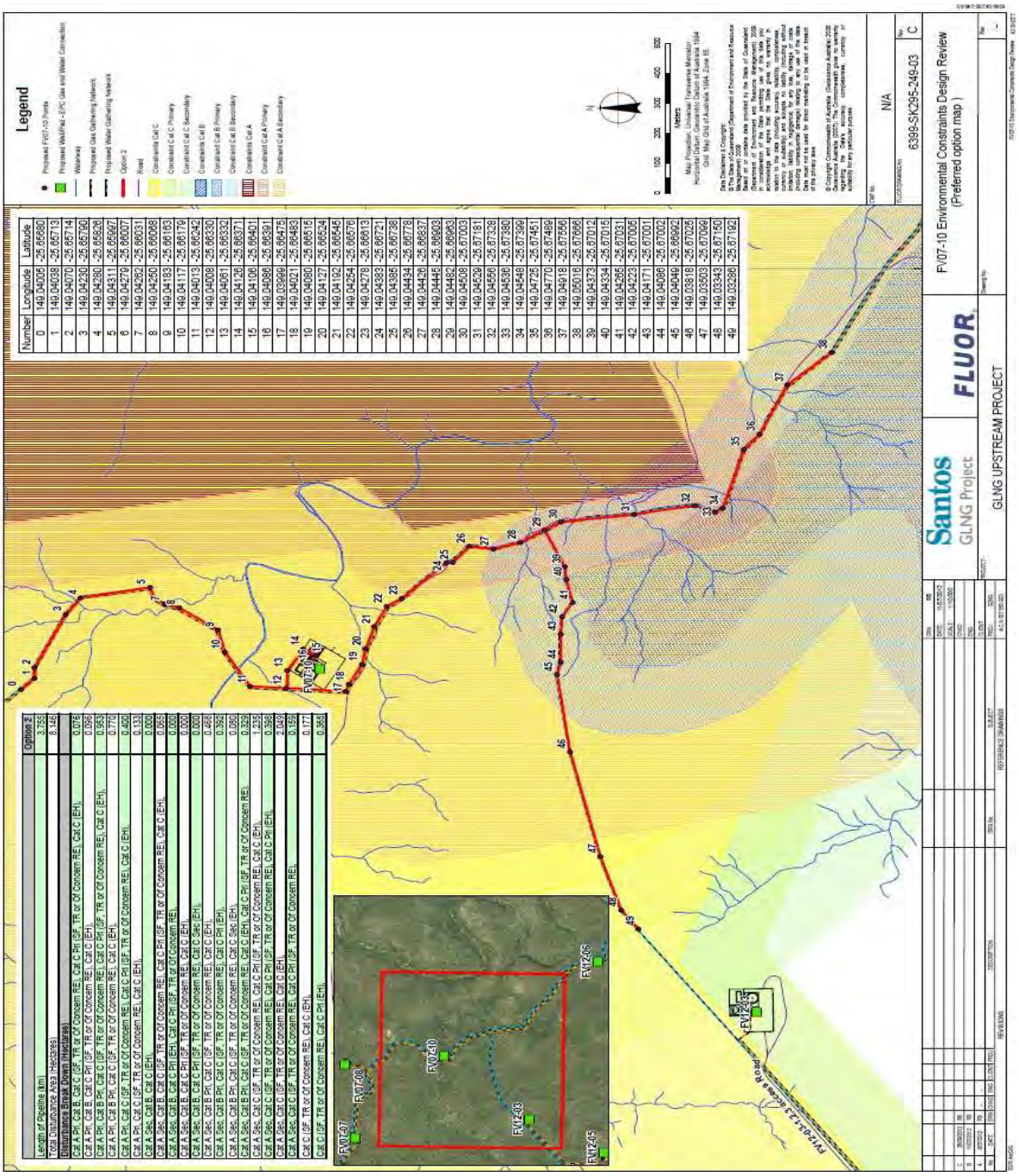
"80th percentile" in relation to release limits means that not more than one (1) of the measured values is toexceed the stated release limit for any five (5) consecutive samples where:

- the consecutive samples are taken over a five (5) month period; and
- the consecutive samples are taken at approximately equal periods.

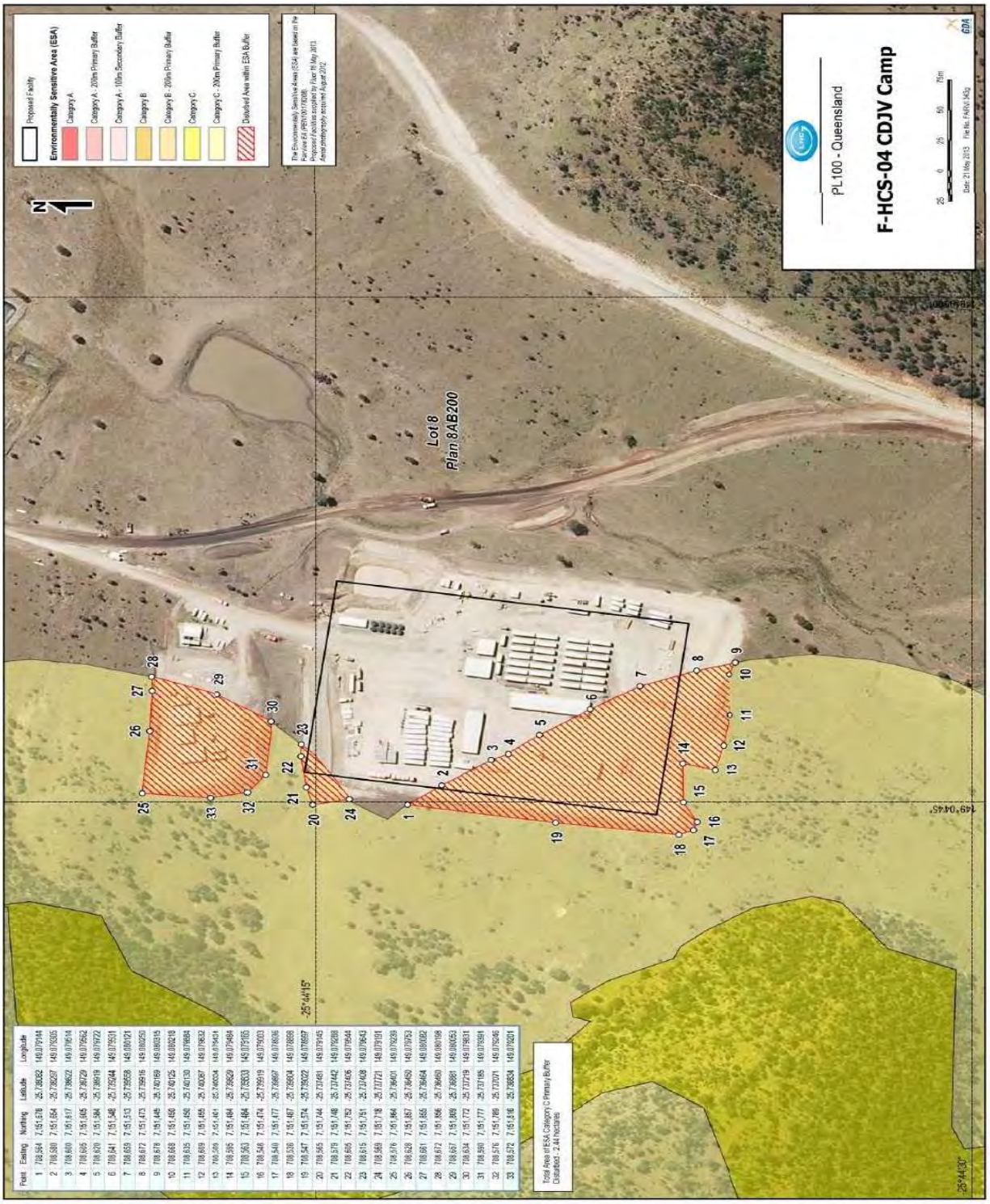
"95th percentile" in relation to release limits means calculating the 95th percentile of all samples recorded overeach 24 hour period for the duration of the release the result of which cannot exceed limits outlined in ScheduleB, Table 8.

Appendix 1 – Plans Referenced in Schedule E, Table 2 – Authorised Disturbance

Well Pad FV530/531/532 (FV07-10) and Connecting Flowlines

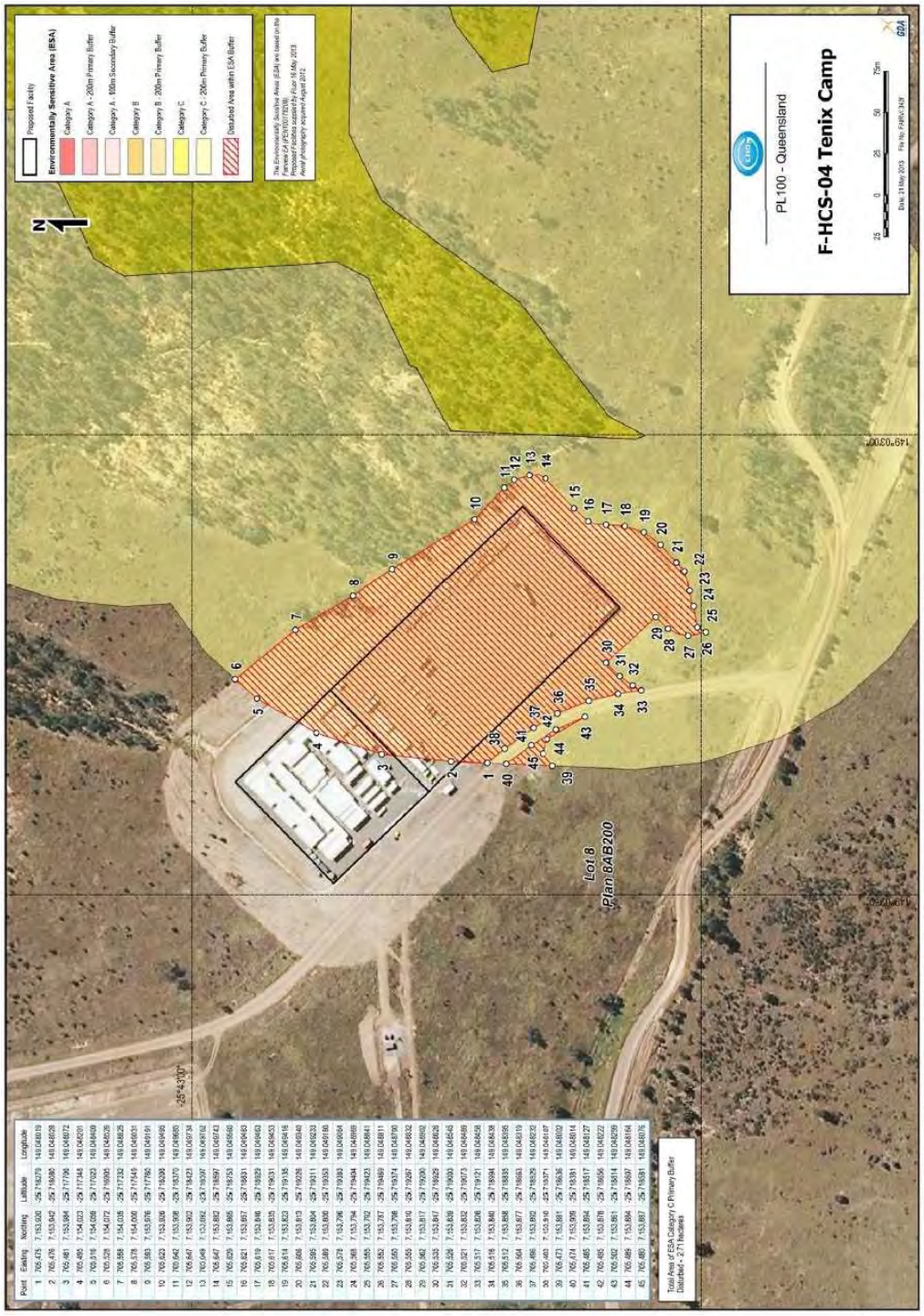


CDJV Temporary Workers Camp and Office



Queensland Government

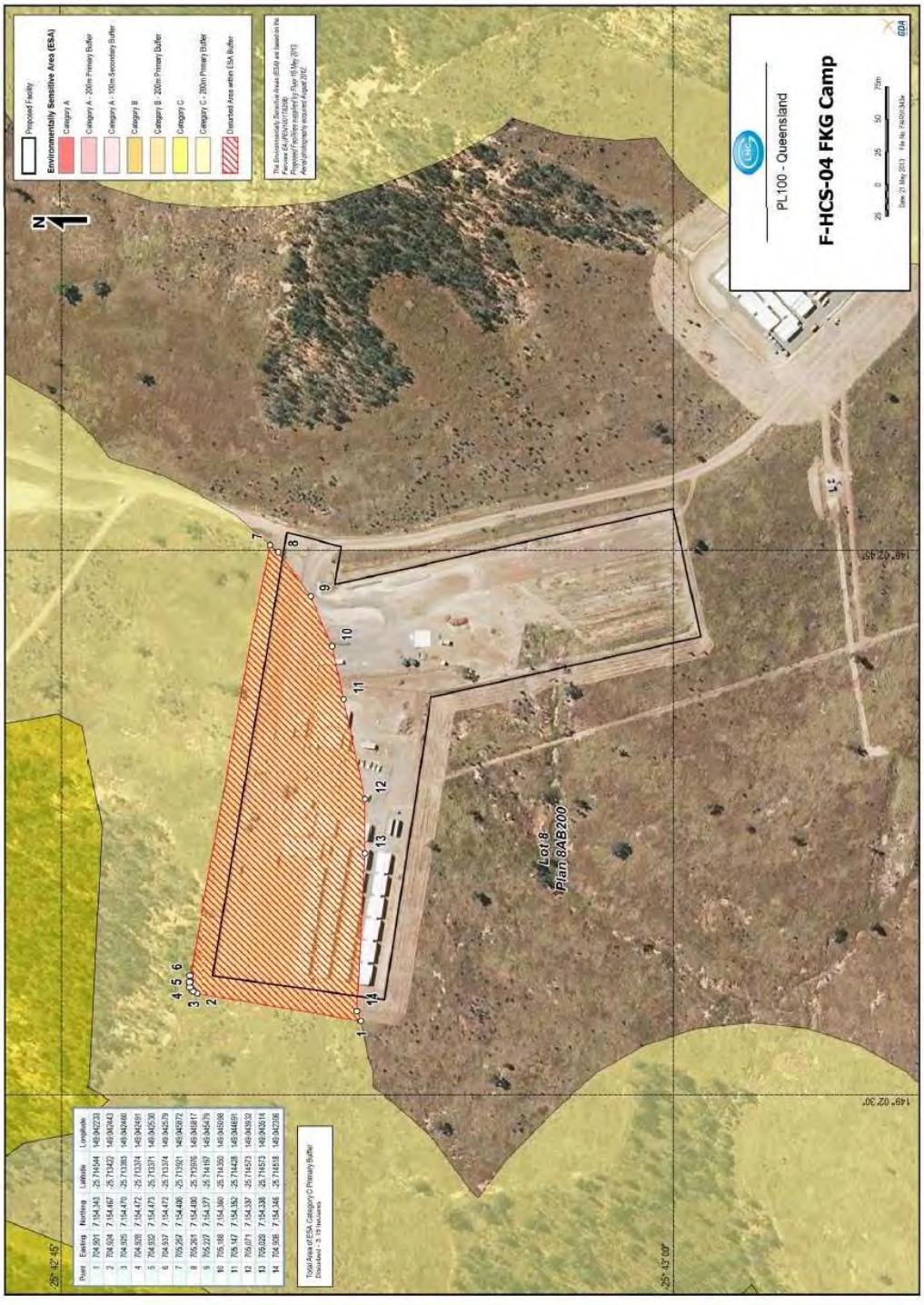
Tenix Temporary Workers Camp



Point	Easting	Northing	Latitude	Longitude
1	705 475	7 153 000	-25.716279	149.048819
2	705 476	7 153 042	-25.716080	149.048838
3	705 481	7 153 084	-25.715736	149.048872
4	705 493	7 154 023	-25.711744	149.048731
5	705 516	7 154 058	-25.711622	149.048469
6	705 528	7 154 072	-25.711565	149.048325
7	705 558	7 154 038	-25.711732	149.048225
8	705 578	7 154 000	-25.711949	149.048631
9	705 593	7 153 976	-25.712162	149.048191
10	705 622	7 153 926	-25.712599	149.049496
11	705 642	7 153 908	-25.712670	149.049685
12	705 647	7 153 902	-25.712623	149.049734
13	705 649	7 153 892	-25.712697	149.049702
14	705 647	7 153 882	-25.712697	149.049743
15	705 629	7 153 865	-25.712753	149.049566
16	705 621	7 153 857	-25.712831	149.049493
17	705 619	7 153 848	-25.712822	149.049463
18	705 617	7 153 838	-25.712831	149.049453
19	705 614	7 153 823	-25.712938	149.049416
20	705 608	7 153 813	-25.713028	149.049340
21	705 595	7 153 804	-25.713011	149.049233
22	705 589	7 153 800	-25.713033	149.049186
23	705 578	7 153 796	-25.713093	149.049094
24	705 568	7 153 794	-25.713434	149.049089
25	705 555	7 153 792	-25.713623	149.048941
26	705 552	7 153 787	-25.713489	149.048811
27	705 550	7 153 798	-25.713374	149.048790
28	705 559	7 153 810	-25.713287	149.048832
29	705 562	7 153 817	-25.713200	149.048902
30	705 535	7 153 847	-25.713029	149.048628
31	705 526	7 153 858	-25.713003	149.048545
32	705 521	7 153 872	-25.713073	149.048488
33	705 517	7 153 886	-25.713121	149.048636
34	705 518	7 153 898	-25.713094	149.048636
35	705 512	7 153 898	-25.713038	149.048595
36	705 504	7 153 877	-25.713083	149.048319
37	705 496	7 153 892	-25.712829	149.048232
38	705 483	7 153 916	-25.713071	149.048147
39	705 473	7 153 881	-25.713638	149.048002
40	705 474	7 153 876	-25.713591	149.048014
41	705 485	7 153 894	-25.713517	149.048127
42	705 495	7 153 878	-25.713656	149.048222
43	705 502	7 153 851	-25.713814	149.048299
44	705 489	7 153 897	-25.713697	149.048184
45	705 480	7 153 897	-25.713581	149.048076

Total Area of ESA Category C Primary Buffer Disturbed = 2.71 Hectares

FKG Temporary Workers Camp



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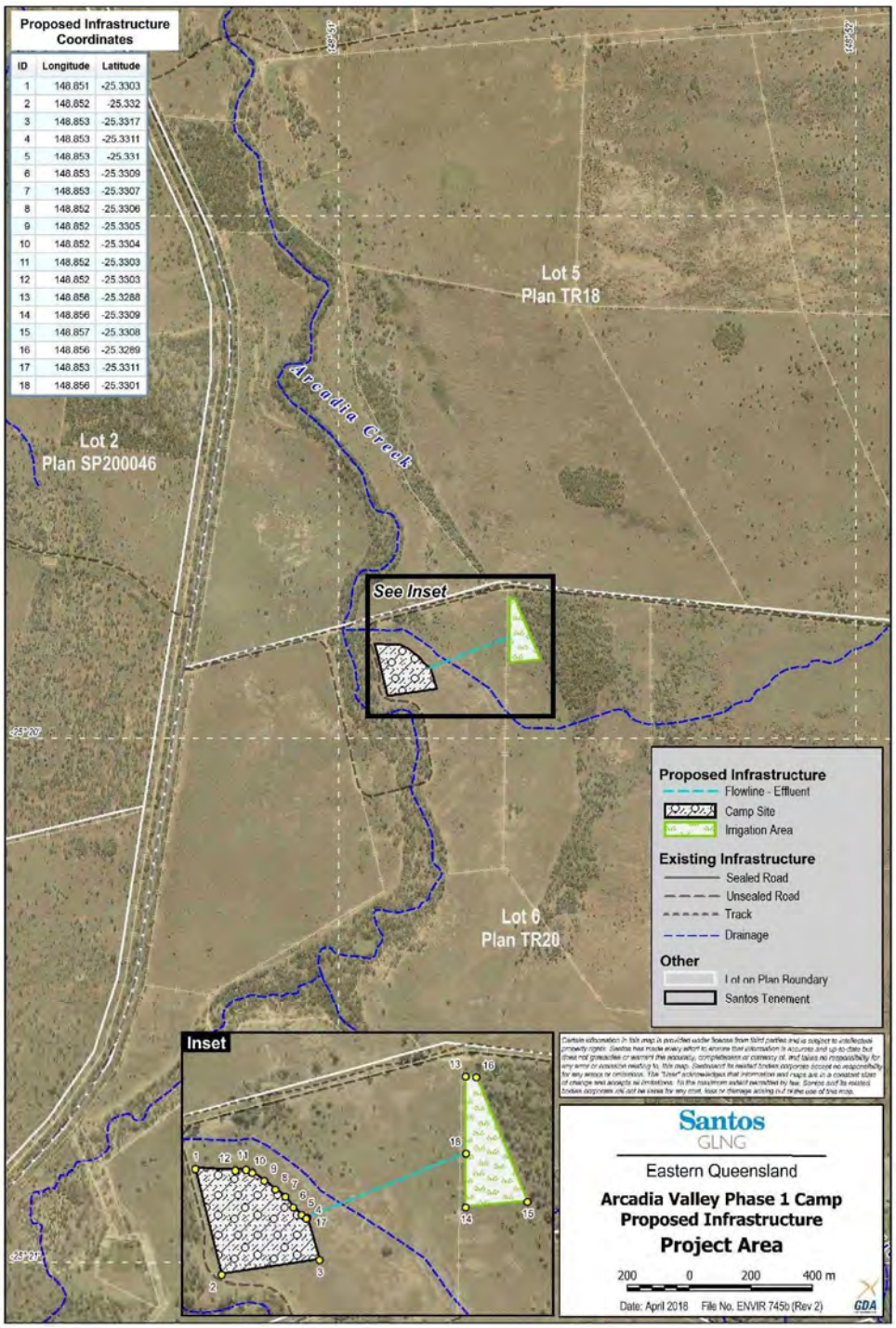
Castle Hill Camp and Effluent Irrigation Area



END OF ENVIRONMENTAL AUTHORITY

Appendix B REMP Certification Document

Appendix C Comparison of Water Quality of Permeate with Applicable Water Quality Guidelines for Protection of Aquatic Ecosystems

Direct assessment of the quality characteristics of the produced water with the receiving environment Water Quality Guidelines (WQG) is presented in Table C1. These data indicate that the desalinated (permeate) water achieves the WQG for each parameter.

Table C.1 Comparison of Water Quality of Permeate with Applicable Water Quality Guidelines for Protection of Aquatic Ecosystems – Parameters for Receiving Environment Monitoring.

Parameter	Unit	Local Water Quality Guideline		Default Water Quality Guidelines [a]	Permeate Water Quality				
		Dawson River	Waterbody	Hutton Creek	11/4/15	8/5/15	24/5/15	31/5/15	6/6/15
Physical Chemical									
Dissolved Oxygen [b]	mg/L	6.4 – 16.1	6.4 – 16.1	6.4 – 16.1	8.71	9.13	9.40	9.16	9.62
Electrical Conductivity @ 25°C	µS/cm	627	500	500	232	127	117	108	99
pH [a]	pH Unit	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	8.49	7.99	7.75	7.75	7.56
Suspended Solids	mg/L	128	50	50	< 5	< 5	< 5	< 5	< 5
Turbidity [b]	NTU	monitor only	monitor only	monitor only	–	–	–	–	–
Nutrients									
Ammonia as N	mg/L	0.9	0.9	0.9	0.01	0.11	0.05	0.10	0.07
Total Nitrogen as N	mg/L	3.93	0.62	0.62	0.3	0.3	0.2	0.2	0.1
Total Metals and Metalloids									
Boron	µg/L	2900 [c]	2900 [c]	2900 [c]	0.33	0.31	0.30	0.40	0.38
Zinc	µg/L	12	8	8	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Metals and Metalloids									
Boron	µg/L	2900 [c]	2900 [c]	2900 [c]	0.22	0.32	0.32	0.30	0.32
Zinc	µg/L	8	8	8	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

Source of guidelines see frc environmental 2015a

[a] default guideline as presented in *Schedule B, Table 4 – Contaminant Limits* of the EA.

[b] based on field data

[c] based on direct toxicity assessment of total boron (AECOM 2019).

Table C.2 Comparison of Water Quality of Permeate with Applicable Water Quality Guidelines for Protection of Aquatic Ecosystems – Parameters for ROP2 Monitoring.

Parameter	Units	Current EA limit	Calculated mean 80th percentile- Waterbody	Calculated mean 80th percentile - Dawson River	Permeate Water Quality				
					11/4/15	8/5/15	24/5/15	31/5/15	6/6/15
Physical Chemical									
Electrical Conductivity @ 25°C – Lab	µS/cm	500	627	303	232	127	117	108	99
Major Cations and Anions									
Chloride	mg/L	175	92	27.7	25	17	13	14	12
Fluoride	mg/L	1.0	0.3	0.2	0.2	0.3	< 0.1	< 0.1	< 0.1
Calcium [a]	mg/L	1.0	41.1	16.8	4	4	4	4	4
Magnesium	mg/L	monitor only	18	7	< 1	< 1	< 1	< 1	< 1
Potassium	mg/L	monitor only	33	3	1	< 1	< 1	< 1	< 1
Sodium	mg/L	115	73	34	44	20	20	17	16
Sulfate as SO_4	mg/L	5.0	3.0	1.6	1	< 1	1	1	2
Total Hardness as CaCO3	mg/L	monitor only	165	69	7	10	10	10	10

Parameter	Units	Current EA limit	Calculated mean 80th percentile- Waterbody	Calculated mean 80th percentile - Dawson River	Permeate Water Quality				
					11/4/15	8/5/15	24/5/15	31/5/15	6/6/15
Total Metals and Metalloids									
Aluminium	µg/L	55	1828	158	< 0.01	0.01	< 0.01	< 0.01	0.01
Arsenic [b]	µg/L	13	5.3	< LOR	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Boron [c]	µg/L	2900	134	< LOR	0.33	0.31	0.30	0.40	0.38
Cadmium	µg/L	0.20	< LOR	< LOR	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	µg/L	1.0	1.0	< LOR	0.001	< 0.001	0.002	< 0.001	< 0.001
Copper	µg/L	1.4	2.8	2.2	0.001	< 0.001	< 0.001	0.001	< 0.001
Iron	µg/L	300	3198	826	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Lead	µg/L	3.4	2.4	< LOR	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Manganese	µg/L	1900	1137	170	0.002	0.002	0.002	0.001	0.001
Mercury	µg/L	0.60	< LOR	< LOR	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	µg/L	11	3.6	< LOR	< 0.001	< 0.001	< 0.001	0.001	< 0.001
Selenium	µg/L	11	< LOR	< LOR	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	µg/L	8.0	11.8	< LOR	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Metals and Metalloids									
Aluminium	µg/L	55	47	33	< 0.01	< 0.01	0.01	< 0.01	< 0.01
Arsenic [b]	µg/L	13	3.7	< LOR	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Boron [c]	µg/L	2900	116.4	350	0.22	0.32	0.32	0.30	0.32

Parameter	Units	Current EA limit	Calculated mean 80th percentile-Waterbody	Calculated mean 80th percentile - Dawson River	Permeate Water Quality				
					11/4/15	8/5/15	24/5/15	31/5/15	6/6/15
Cadmium	µg/L	0.20	< LOR	< LOR	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	µg/L	1.0	< LOR	< LOR	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper	µg/L	1.4	2.44	1.8	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Iron	µg/L	300	< LOR	291	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Lead	µg/L	3.4	< LOR	< LOR	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Manganese	µg/L	1900	208.9	134					
Mercury	µg/L	0.60	< LOR	< LOR	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	µg/L	11	2.4	< LOR	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Selenium	µg/L	11	< LOR	< LOR	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	µg/L	8.0	8.8	5.6	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

[a] The current EA limit for calcium is a minimum

[b] The guideline for As IV was conservatively used as it is the lower value.

[c] based on direct toxicity assessment of total boron (AECOM 2019).

Blue shading indicates the recommended EA contaminant limit (see frc environmental 2015b).

Appendix D Comparison of Water Quality at Monitoring Site S4 and Permeate Water Quality with EA Contaminant Limits for Drinking Water

Table D.1 Baseline water quality data at monitoring site S4 on the Dawson River compared to EA contaminant limits for drinking water.

Quality Characteristic		Units	Drinking Water Limit	Median	80th %ile	95th %ile
Alpha Activity		Bq/L	0.5	–	–	–
Aluminium		µg/L	200	90	150	1306
Ammonia		µg/L	500	<0.01	44	68
Antimony		µg/L	3	–	–	–
Arsenic		µg/L	10	<LOR	<LOR	2.0
Barium		µg/L	2000	98	112.4	4078
Benzene		µg/L	1	<LOR	<LOR	<LOR
Beta Activity		Bq/L	0.5	–	–	–
Bisphenol A		µg/L	200	–	–	–
Boron		µg/L	4000	<LOR	<LOR	124
Bromide		µg/L	7000	–	–	–
Cadmium		µg/L	2	<LOR	<LOR	<LOR
Chromium		µg/L	50	<LOR	<LOR	<LOR
Copper		µg/L	2000	<LOR	<LOR	01.8
Cyanide		µg/L	80	–	–	–
Ethylbenzene		µg/L	300	<LOR	<LOR	<LOR
Fluoride		µg/L	1500	100	200	200
Iodide		µg/L	500	–	–	–
Lead		µg/L	10	<LOR	<LOR	1.8
Manganese		µg/L	500	91	186.4	297.8
Mercury		µg/L	1	<LOR	<LOR	<LOR
Molybdenum		µg/L	50	<LOR	<LOR	<LOR
Nickel		µg/L	20	<LOR	<LOR	<LOR
Nonylphenol		µg/L	500	–	–	–
PAH (as B(a)P TEF)	TEF:	µg/L	0.01	<LOR [a]	<LOR [a]	<LOR [a]
Benz[a]anthracene	0.1					
Benzo[b+]fluoranthene	0.1					
Benzo[k]fluoranthene	0.1					
Benzo[a]pyrene	1.0					

Quality Characteristic		Units	Drinking Water Limit	Median	80th %ile	95th %ile
Chrysene	0.01					
Dibenz[a,h]anthracene	5					
Indeno[1,2,3-cd]pyrene	0.1					
Selenium		µg/L	10	<LOR	<LOR	<LOR
Silver		µg/L	100	<LOR	<LOR	<LOR
Strontium		µg/L	4000	336	370.6	10123.6
Toluene		µg/L	800	<LOR	<LOR	<LOR
TPH		µg/L	200	–	–	
Vanadium		µg/L	50	<LOR	<LOR	<LOR
Xylenes		µg/L	600	<LOR	<LOR	<LOR
Zinc		µg/L	3000	<LOR	<LOR	0.86
Disinfection by-products:						
Bromochloroacetonitrile		–	Monitor only	–	–	–
Dichloroacetonitrile		–	Monitor only	–	–	–
N-Nitrosodimethylamine		µg/L	0.1	–	–	–
Trihalomethanes (THM):		µg/L	250	–	–	–
Bromodichloromethane						
Bromoform						
Chloroform (Trichloromethane)						
Dibromochloromethane						

[a] baseline monitoring assessed total polycyclic aromatic hydrocarbons (PAHs); the results of < LOR is for total PAH.

– indicates parameters that have not been assessed in the baseline monitoring of water quality.

Table D.2 Permeate (desalinated) water quality compared to EA contaminant limits for drinking water.

Quality Characteristic		Units	Drinking Water Limit	Permeate Water Quality													
				11/4/15	8/5/15	24/5/15	31/5/15	6/6/15	8/7/18	15/7/18	19/8/18	26/8/18	14/9/18	23/9/18	13/10/18	13/10/18	15/12/18
Alpha Activity		Bq/L	0.5	–	–	–	–	–	< 0.05	< 0.05	< 0.13	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aluminium		mg/L	0.2	< 0.01	0.01	< 0.01	< 0.01	0.01	0.02	< 0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04
Ammonia		mg/L	0.5	0.01	0.11	0.05	0.10	0.07	0.02	< 0.01	< 0.01	0.05	0.02	< 0.01	0.02	0.02	0.03
Antimony		mg/L	0.003	–	–	–	–	–	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Arsenic		mg/L	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Barium		mg/L	2	–	–	–	–	–	0.009	0.008	0.005	0.005	0.003	0.003	0.002	0.002	0.011
Benzene		µg/L	1	–	–	–	–	–	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Beta Activity		Bq/L	0.5	–	–	–	–	–	< 0.10	< 0.10	< 0.26	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Bisphenol A		µg/L	200	–	–	–	–	–	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Boron		µg/L	4000	330	310	300	400	380	500	580	550	520	530	620	640	670	870
Bromide		mg/L	7	–	–	–	–	–	0.041	0.034	0.035	0.026	0.026	0.048	0.024	0.024	0.051
Cadmium		mg/L	0.002	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium		mg/L	0.05	0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper		mg/L	2	0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cyanide		mg/L	0.08	–	–	–	–	–	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Ethylbenzene		µg/L	300	–	–	–	–	–	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Fluoride		mg/L	1.5	0.2	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Iodide		mg/L	0.5	–	–	–	–	–	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.014
Lead		mg/L	0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Manganese		mg/L	0.5	0.002	0.002	0.002	0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Mercury		mg/L	0.001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0005
Molybdenum		mg/L	0.05	–	–	–	–	–	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel		mg/L	0.02	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nonylphenol		µg/L	500	–	–	–	–	–	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
PAH (as B(a)P TEF)	TEF:	µg/L	0.01	–	–	–	–	–	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Benz[a]anthracene	0.1																
Benzo[b+]fluoranthene	0.1																
Benzo[k]fluoranthene	0.1																
Benzo[a]pyrene	1.0																
Chrysene	0.01																
Dibenz[a,h]anthracene	5																
Indeno[1,2,3-cd]pyrene	0.1																

Quality Characteristic	Units	Drinking Water Limit	Permeate Water Quality												
			11/4/15	8/5/15	24/5/15	31/5/15	6/6/15	8/7/18	15/7/18	19/8/18	26/8/18	14/9/18	23/9/18	13/10/18	13/10/18	15/12/18
Selenium	mg/L	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Silver	mg/L	0.1	–	–	–	–	–	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Strontium	mg/L	4	–	–	–	–	–	0.013	0.015	0.010	0.008	0.006	0.005	0.004	0.004	0.018
Toluene	µg/L	800	–	–	–	–	–	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
TPH	µg/L	200	–	–	–	–	–	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	70
Vanadium	mg/L	0.05	–	–	–	–	–	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Xylenes	µg/L	600	–	–	–	–	–	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zinc	mg/L	3	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Disinfection by-products:																
Bromochloroacetonitrile	mg/L	Monitor only	–	–	–	–	–	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dichloroacetonitrile	mg/L	Monitor only	–	–	–	–	–	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
N-Nitrosodimethylamine	µg/L	0.1	–	–	–	–	–	< 0.003	< 0.003	< 0.003	< 0.003	0.009	< 0.003	< 0.003	< 0.003	< 0.003
Trihalomethanes (THM):	mg/L	0.25	–	–	–	–	–	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Bromodichloromethane																
Bromoform																
Chloroform (Trichloromethane)																
Dibromochloromethane																

[a] baseline monitoring assessed total polycyclic aromatic hydrocarbons (PAHs); the results of < LOR is for total PAH.

– indicates parameters that have not been assessed for permeate water quality to date.

Appendix E Synthesis of Baseline Water Quality Data from Site DRR2 on Hutton Creek

Table E.1 Synthesis of baseline data for water chemistry parameters for Hutton Creek (site DRR2 or S16A)

Parameter	Units	LOR	5th %ile	20th %ile	80th %ile	95th %ile	Count
Physical Chemical							
Dissolved Oxygen - Field	mg/L	–	7.82	8.16	12.85	16.10	4
Electrical Conductivity @ 25°C	µS/cm	1.00	413.80	437.20	871.00	948.60	5
pH - Field	pH Unit	–	7.01	7.38	8.40	8.69	6
Suspended Solids	mg/L	5.00	19.20	34.80	132.60	164.40	5
Turbidity - Field	NTU	–	0.00	0.00	302.40	534.60	5
Nutrients							
Ammonia as N	mg/L	0.01	0.01	0.02	0.08	0.10	5
Total Nitrogen as N	mg/L	0.10	1.00	1.30	1.82	1.88	5
Total Metals and Metalloids							
Boron	µg/L	50.00	<50	<50	102.00	108.00	5
Zinc	µg/L	5.00	<5	7.70	18.20	18.80	5
Dissolved Metals and Metalloids							
Boron	µg/L	50.00	<50	53.00	114.00	126.00	5
Zinc	µg/L	5.00	<5	<5	8.00	8.00	5

Appendix F REMP Monitoring Procedures

The REMP monitoring procedures presented below are based on, and consistent with, methods presented in the Monitoring and Sampling Manual (DES 2018) .

The hydrological components of the REMP (i.e. discharge and water depth) are monitored daily by automated gauging stations at the specified sites. Hydrographs of the release volumes recorded at the discharge location and stream flow data recorded at gauging stations will be produced for the entire year.

The procedures for monitoring of geomorphological, sediment and biological components of the REMP are presented below.

8.1 Geomorphological Component – Bank Stability

Bank stability will be monitored using the Sustainable Rivers Audit physical habitat methodology (MDBC 2004a), which is consistent with the methodology used in the Environmental Impact Statement (EIS) for the Santos GLNG Project (which includes the FPA) and the methods used in the baseline surveys. The assessment will include characterisation of the following bank features at each site:

- bank shape
- bank stability, noting areas of erosion or bank failure
- bed stability
- artificial bank protection measures
- factors affecting bank stability
- valley shape
- channel shape, and
- channel and wetted width.

A visual record of the left and right banks at each site will be made using photographs, with left and right banks determined while facing downstream

Results of field observations of bank stability will be tabulated for each site along with comments about the stability of the bank, and any changes of bank stability over time. Photographs of banks at each site will also be included in bank stability reporting for each survey.

8.1.1 Sediment Monitoring

Where the water is shallow (<0.5 m deep), sediment samples will be collected from the top 0.30 m of sediment on the bed using a stainless steel trowel, with the sediments transferred directly into the sampling jar provided by a NATA accredited analytical laboratory.

Where the water is deep or the sediment is too soft to walk in, surface sediment from the bed (to 0.30 m depth) will be collected using a stainless steel corer. Any core samples will be emptied into a bucket or other intermediate container, which has been thoroughly washed with ambient site water prior to sampling. The sediment will be mixed thoroughly and placed into the sample jar using a stainless steel trowel.

Field sampling will be undertaken by a suitably trained and competent person in accordance with Australian / New Zealand Standard AS/NZ5667.12 Guidance on Sampling of Bottom Sediments, and the Handbook for Sediment Quality Assessment (Simpson et al. 2005). In summary:

- powderless gloves will be used when collecting all sediment samples, and care will be taken not to touch the inside of any sampling containers, or to place open bottles / jars or their lids onto the ground or other potentially contaminated surfaces
- sediment samples will be collected straight into the sample bottle wherever possible, and the bottles will not be rinsed prior to sample collection
- if the sample cannot be collected straight into the sample bottle, the container it is collected in (such as a stainless steel bucket or other form of sampler) will be thoroughly rinsed with ambient site water to ensure is not contaminated
- a field duplicate will be collected from one site during each sampling event, to assess within site variation
- samples will be placed into an esky with ice and should be kept refrigerated until delivered to the laboratory within the appropriate holding time (as advised by the analytical laboratory)
- a chain of custody form will be completed for all samples sent to the laboratory for analysis, and
- samples will be analysed by a NATA-accredited laboratory, and laboratory duplicates will be analysed in accordance with NATA-accredited protocols.

Sediment quality data will be entered, and the results reviewed after each survey. This review will include comparisons of sediment quality at each site with the local sediment quality guidelines to give preliminary indication of any changes to sediment quality in the

receiving environment. If the concentration of a parameter is below the local sediment guideline, then sediment quality is considered to be low risk for that parameter and no further action is required. If the concentration of a parameter is higher than the local guideline, then further investigation of background levels for that parameter in the area would be required.

At the end of each annual reporting period, the median, 80th percentile and 100% percentile for each parameter for each water type will be calculated, and compared to the local sediment quality guidelines. If the median concentration of a parameter is below the local sediment guideline, then sediment quality is considered to be low risk for that parameter and no further action is required. If the median percentile concentration of a parameter is higher than the local guideline, then further investigation of background levels for that parameter in the area would be required. If the median percentile concentration of a parameter is consistently higher than the local guideline, then further investigation of background levels for that parameter in the area would be required. If the 80th percentile concentration of a parameter is consistently higher than the local guideline, then further investigation of background levels for that parameter in the area would be required. If the 100% percentile concentration of a parameter is higher than the 100% percentile of baseline data, then further investigation of factors affecting the bioavailability of that parameter may be required (ANZG 2018).

8.1.2 Macroinvertebrate Monitoring

Seven macroinvertebrate samples will be collected from 'clean' edge habitat at each site using a Surber sampler that has a square 0.3 m x 0.3 m frame and 250 µm mesh size. The location of samples will be random within each site. Each sample will be collected with one edge of the Surber sampler parallel to and within a few centimetres of the water's edge. The substrate within the Surber sampler frame will be disturbed (large rocks will be cleaned or organisms inside the Surber net and finer substrates will be gently disturbed by hand or a tool) and the sample will be collected by sweeping the net up through the disturbed area. The sample will be transferred into a screw-top jar and preserved using ethanol to be transported back to the laboratory and identified to the lowest practical taxonomic level (family in most cases).

Macroinvertebrate sampling will be undertaken by a trained ecologists and will be completed in accordance with the Smartrivers methodology (Smart Rivers 2013).

Individuals from two of the commonly occurring invertebrate species (*Macrobrachium australiense* and *Caridina* spp.) will be examined for signs of potential calcium and

magnesium deficiencies: the strength, apparent thickness and colour of the exoskeletons and shells will be recorded, and the reproductive status of specimens will be recorded.

Macroinvertebrate samples will be processed in accordance with the National River Health Program protocols outlined in Monitoring and Sampling Manual 2009 (DERM 2009). Enumeration and identification of samples will be done by trained and accredited ecologists. Sorting, enumeration and data entry will be cross checked by a second ecologist for 10% of the samples. An error rate of > 10% will be considered unacceptable and will result in a further 10% of samples being checked by a second ecologist, and so on.

The following indices will be calculated for the macroinvertebrate communities at each site:

- *abundance*; abundance is the total number of individuals in a sample. The abundance of each family, and the overall abundance of macroinvertebrates, will be calculated for each site.
- *taxonomic richness*; taxonomic richness is the number of taxa (in this assessment, generally families). Taxonomic richness is a basic, unambiguous and effective diversity measure. However, it is affected by arbitrary choice of sample size. Where all samples are of equal size, taxonomic richness is a useful tool when used in conjunction with other indices. Richness does not take into account the relative abundance of each taxon, so rare and common taxa are considered equally.
- *PET richness*; while some groups of macroinvertebrates are tolerant to pollution and environmental degradation, others are sensitive to these stressors (Chessman 2003). Plecoptera (stoneflies), Ephemeroptera (mayflies), and Trichoptera (caddisflies) are referred to as PET taxa, and they are particularly sensitive to disturbance. There are typically more PET families within sites of good habitat condition and water quality than in sites of degraded condition. PET taxa are often the first to disappear when water quality or environmental degradation occurs (EHMP 2007). The lower the PET score (i.e. number of families within the Plecoptera, Trichoptera and Ephemeroptera orders), the greater the inferred degradation.
- *SIGNAL-2 scores*; SIGNAL-2 (Stream Invertebrate Grade Number — Average Level) (Chessman 2003) scores are also based on the sensitivity of each macroinvertebrate family to pollution or habitat degradation. Each macroinvertebrate family has been assigned a grade number between 1 and 10 based on their sensitivity to various pollutants, and SIGNAL-2 scores are weighted for abundance. A low number means that the macroinvertebrate is tolerant of a range of environmental conditions, including common forms of water pollution (e.g. suspended sediments and nutrient enrichment).

These indices will be calculated for each site, and the median for each calculated for each water type. Where the median for an index complies with or is higher than the local biological guideline for that water type, then it is considered that there is no impact to macroinvertebrate communities. Where the median for an index is lower than the local biological guideline for a water type, then multivariate statistical analysis of macroinvertebrate data that conforms to a before-after-control-impact (BACI) design may be needed. Where this test indicates an impact to macroinvertebrate communities in the receiving environment, then further investigation to the factors that influence macroinvertebrate communities may be needed.

8.1.3 Fish

Fishing will involve two fyke nets set overnight at each site, with one net being of fine mesh size (approximately 4 mm) and the other being of a larger mesh size (approximately 10 mm). Nets will be set facing upstream and downstream directions at all sites, and nets will be set to ensure that air-breathing species (e.g. turtles) have access to the surface at all times, with floats also used to ensure air-breathing species can access the surface.

The sampling of fishes will be conducted under appropriate General Fisheries Permits and Animal Ethics Approvals.

At each site, the species present and the abundance of each species by life history stage (juvenile, intermediate, adult) will be recorded and the apparent health of individuals will be noted. Identifications of fish will be made in the field by experienced ecologists. Specimens that cannot be identified in the field will be euthanized and returned to the laboratory for identification and if necessary they will be sent to the Queensland Museum for a confirmed identification. Any exotic species caught will be recorded and euthanized in accordance with ethics approvals.

The richness of native and exotic fish species will be determined for each water type (observed number of species), and this will be compared to the expected number of species for that water type (i.e. the local biological guideline for fish) as a ratio. Where the ratio ≥ 1, then it is considered that there has been no impact to fish. Where is ratio < 1, then the diversity of fish is lower than expected, and an investigation of the factors affecting fish communities may be needed.

8.1.4 Turtles

Survey of turtles will involve two fyke nets set overnight at each site, with one net being of fine mesh size (approximately 4 mm) and the other being of a larger mesh size (approximately 10 mm). Nets will be set facing upstream and downstream directions at all sites, and nets will be set to ensure that air-breathing species (e.g. turtles) have access to the surface to breathe at all times, with floats also used to ensure air-breathing species can access the surface. Additionally, two baited cathedral traps will be securely set over-night at each site, ensuing turtles and other air-breathing species have access to the surface to breathe at all times. Finally, snorkelling the full 100 m length of each site will also be used to survey turtles, recording observations of turtles.

The sampling of turtles will be conducted under appropriate Scientific Permits and Animal Ethics Approvals.

At each site, the species present and the abundance of each species will be recorded and the apparent health of individuals will be noted. Identifications of turtles will be made in the field by experienced ecologists.

Raw turtle data for all species will be tabulated and compared to baseline data.