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Grenof Water Technologies

Project Halogen Environmental Management Plan (DRAFT)

November 2025

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Glossary

Acronym	Meaning
ACCC	Australian Competition and Consumer Commission
ACH Act	<i>Aboriginal Cultural Heritage Act 2003 (Qld)</i>
APZ	Asset Protection Zones
AQP	Appropriately qualified person – means a person/s who has professional qualifications, training, skills and experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods or literature.
ASS	Acid sulfate soils
Biosecurity Act	<i>Biosecurity Act 2014 (Qld)</i>
CER	Clean Energy Regulator
CG	Coordinator-General
Cl ₂	Chlorine
CQG	CQ Environmental Pty Ltd trading as CQG Consulting
DCCEEW	Administering authority: Department of Climate Change, Energy, the Environment and Water
Development Scheme	GSDA Development Scheme May 2022
DA	Development application
DETSI	Department of Environment, Tourism, Science, and Innovation
DPI	Department of Primary Industries
DSDIP	Department of State Development, Infrastructure and Planning
EA	Environmental authority
EDQ	Economic Development Queensland
EMP	Environmental Management Plan (DRAFT)
EMS	Environmental management system
EP Act	<i>Environmental Protection Act 1994 (Qld)</i>
EP Reg	<i>Environmental Protection Regulation 2019 (Qld)</i>

Acronym	Meaning
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)</i>
EPP	Environmental protection policy
ERA	Environmentally relevant activity
ERP	GWT Emergency Response Plan
ESCP	Erosion and Sediment Control Plan
ESG	Environmental, social and governance
Fisheries Act	<i>Fisheries Act 1994 (Qld)</i>
FNBGGGTB	First Nations Bailai, Gurang, Gooreng Gooreng, and Taribelang Bunda
FSC	Fauna spotter catcher
GBR	Great Barrier Reef
GED	General environmental duty
GHG	Greenhouse gas
Grenof	Grenof Pty Ltd (ABN 17 166 936 894)
GSDA	Gladstone State Development Area
GWT	Grenof Water Technologies Pty Ltd (ABN 21 600 860 231)
HCl	Hydrogen chloride (gaseous) / hydrochloric acid (in solution)
km	Kilometres
KRA	Key result area
LGA	Local government area
m	Metres
mAHD	Metres with respect to Australian Height Datum
MCU	Material change of use
MEDQ	Minister for Economic Development Queensland
MHF	Major hazard facility
ML	Mining lease
MNES	Matters national environmental significance

Acronym	Meaning
MSES	Matters of state environmental significance
MTSC	Material Transport and Services Corridor (Precinct)
NaOCl	Sodium hypochlorite
NaOH	Caustic soda
NC Act	<i>Nature Conservation Act 1992 (Qld)</i>
NGER	National Greenhouse and Energy Reporting
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007 (Cwlth)</i>
OCG	Office of the Coordinator-General
OIR	Office of Industrial Relations
OPW	Operational works
PHWG	Project Halogen Working Group
Planning Act	<i>Planning Act 2016 (Qld)</i>
Planning Report	CQG (2025) Grenof Water Technologies Pty Ltd: Planning Report for MCU and RaL within the GSDA (Ref: 25054, Rev 1, 12 November 2025)
Planning Scheme	<i>Gladstone Region Planning Scheme: Our Place Our Plan (Version 2)</i>
QIC	Queensland Investment Corporation (ABN 95 942 373 762)
Qld	Queensland
RaL	Reconfiguring a Lot
RPEQ	Registered Professional Engineer of Queensland
RTAY	Rio Tinto Australia Yarwun
SDA	State Development Area
SDPWO Act	<i>State Development and Public Works Organisation Act 1971 (Qld)</i>
SMP	Species management program
SWMP	Stormwater management plan
SQP	Suitably qualified person under section 564 of the EP Act
t	Tonnes

Acronym	Meaning
The Site	Part of lots: Lot 1 on SP200899 and Lot 1 on MPH32292
tpa / tpd	Tonnes per annum / tonnes per day
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>
Water Act	<i>Water Act 2000 (Qld)</i>
WHSMP	GWT Workplace Health and Safety Management Plan
WHS Reg	<i>Work Health and Safety Regulation 2011 (Qld)</i>
WONS	Weeds of national significance
WSAA	Water Services Association of Australia
WWBW	Waterway barrier works

1 Introduction

1.1 Background

Grenof Water Technologies Pty Ltd (GWT) is a 50:50 venture between Grenof Pty Ltd (Grenof) and the Queensland Investment Corporation (QIC). GWT has been established to develop a chlor-alkali facility in the Gladstone State Development Area (GSDA) (Project Halogen). Grenof will operate the facility.

The driver for Project Halogen is the sovereign risk associated with chemicals vital for Australia's industrial, economic and public health sectors as follows:

- Chlorine (Cl₂):
 - no viable substitute for potable water disinfection;
 - single domestic producer with aging infrastructure, otherwise imported; and
 - current domestic stockpiles estimated to last in the order of four weeks only.
- Caustic soda (NaOH):
 - essential industrial chemical; and
 - total reliance on foreign supply.

Both products are currently imported into Gladstone for industrial use.

The criticality of the Proposal to the Queensland Government is evidenced through the QIC investment and the formation of the Project Halogen Working Group (PHWG); including representatives from the Department of State Development, Infrastructure and Planning (DSDIP), Office of the Coordinator-General (OCG), Office of Industrial Relations (OIR) and Economic Development Queensland (EDQ). The Commonwealth Government, through the Australian Competition and Consumer Commission (ACCC), granted authorisation to Water Services Association of Australia (WSAA) members to enhance the resilience of Australia's gaseous Cl₂ supply chain. The ACCC determination (AA1000657, valid until 14 June 2029) includes an authorisation to enable collective negotiation with suppliers of chlor-alkali products to construct a new gaseous Cl₂ bottling and drumming facility in Australia, including collective negotiation of supply contracts.

The Proposal will require a major hazard facility (MHF) licence as it will exceed the threshold for Cl₂ storage in Schedule 15 of the *Work Health and Safety Regulation 2011 (Qld)* (WHS Reg). The GSDA has been identified as a suitable location for the facility by the Coordinator-General (CG) given its identified purpose and buffer to sensitive land uses. EDQ has been assisting GWT with identifying an appropriate location within their GSDA landholdings, with a portion of Lot 1 on SP200899 and Lot 1 on MPH32292 (the Site, refer to **Figure 1.1**) recommended given its proximity to suitable transport routes and customers.

A development application (DA) for a material change of use (MCU) for a special industry and reconfiguring a lot (RaL) under the GSDA Development Scheme (CG 2022) (Development Scheme) will need to be approved by the CG prior to commencement of site works for the development. Operational works (OPW) for the clearing of regulated regrowth vegetation can be undertaken as a State Development Area (SDA) self-assessable development, where associated with a MCU and / or RaL authorised by an SDA approval.

An environmental authority (EA) for environmentally relevant activity (ERA) 7(6d) Chemical manufacturing: manufacturing, in a year, more than 100,000 tonnes (t) of inorganic chemicals prescribed under Schedule 2 of the *Environmental Protection Regulation 2019 (Qld)* (EP Reg) will be required prior to commencement of operations. This approval will be sought in parallel with, but can only be granted after, the SDA approval for a MCU.

Project Halogen will manufacture the following chemicals triggering the ERA (project capacities listed are based on a 100% chemical basis at plant capacity):

- NaOH – approximately 100 tonnes per day (tpd), diluted to 50% concentration (i.e. approximately 200 tpd), for direct delivery to Rio Tinto Australia Yarwun (RTAY) and used in sodium hypochlorite (NaOCl) generation process;
- Liquefied Cl₂ gas – approximately 90 tpd, for delivery to water authorities and used in the hydrochloric acid (HCl) generation process; and
- Derivative products manufactured using the abovementioned primary chemicals as inputs:

- NaOCl – approximately 40 tpd, diluted to a 12.5% concentration (i.e., approximately 320 tpd), for delivery to water authorities and other industrial customers; and
- HCl – approximately 40 tpd, diluted to a 33% concentration (i.e., approximately 120 tpd), for delivery to various industrial and mining applications.

1.2 Location

GWT has secured rights to land within the GSDA across portions Lot 1 on MPH32292 and Lot 1 on SP200899 owned by the Minister for Economic Development Queensland (MEDQ) (refer to **Figure 1.1** and **Figure 1.2**).

The Site is located within the Materials Transportation and Services Corridor (MTSC) Precinct of the Development Scheme prepared under the SDPWO Act.

The nearest sensitive residential receptors are identified in **Figure 1.3**, with the nearest sensitive environmental receptors identified in **Figure 1.4** (regulated vegetation) and **Figure 1.5** (essential habitat and waterways).

1.3 Purpose of this Document

This DRAFT Environmental Management Plan (EMP) has been prepared by CQG Consulting (CQG) as a supporting document to the Planning Report for a MCU and RaL (Planning Report), and the EA submission, for the Proposal.

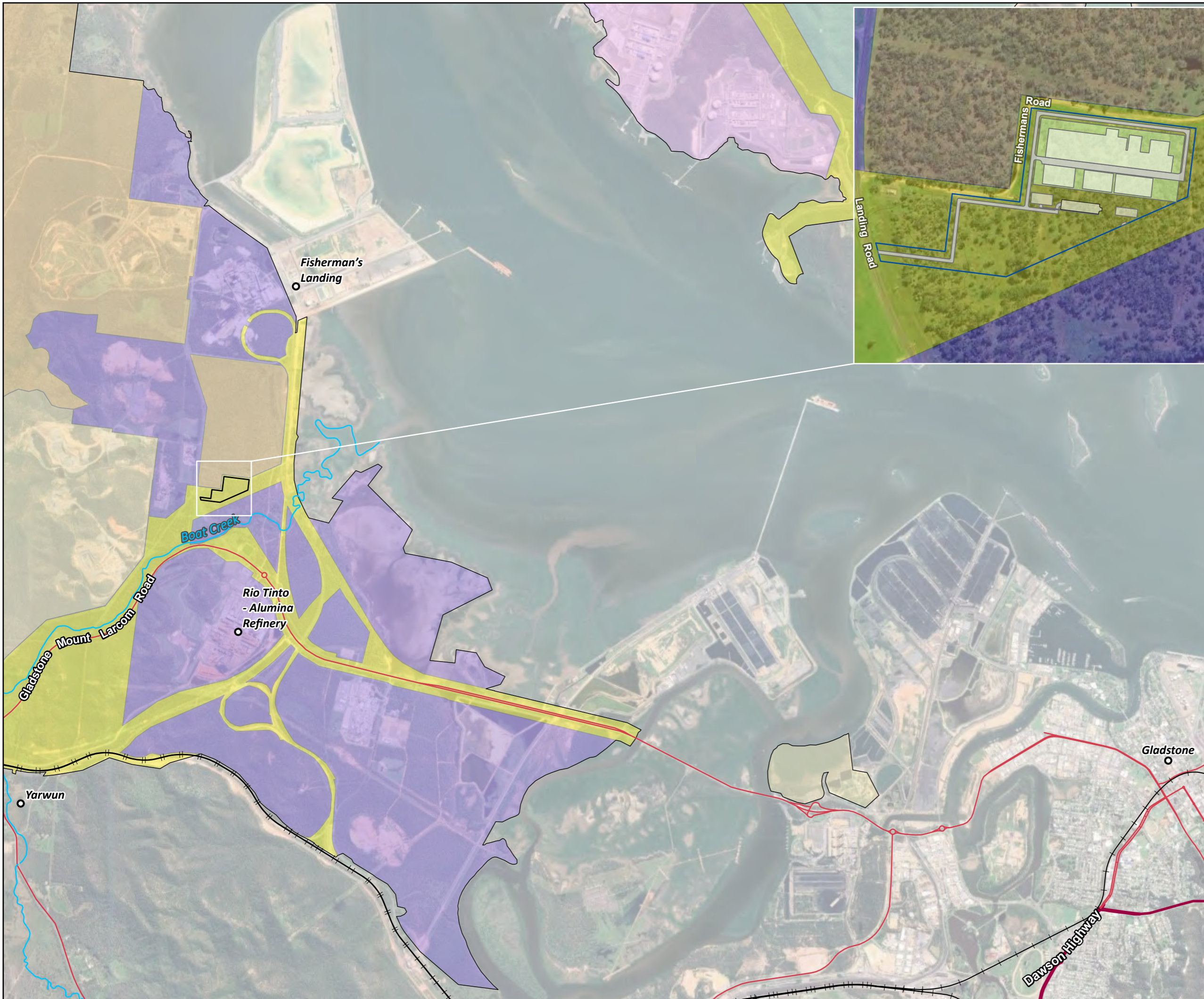
The document outlines how the Proposal will be managed in order to address the general environmental duty (GED) under section 319 of the *Environmental Protection Act 1994 (Qld)* (EP Act) (refer to **Table 3.1**) and to address a common condition (DES 2019) for an EA for prescribed ERAs as follows:

The activity must be undertaken in accordance with written procedures that:

- a) identify potential risks to the environment from the activity during routine operations and emergencies; and*
- b) establish and maintain control measures that minimise the potential for environmental harm; and*
- c) ensure plant, equipment and measures are maintained in a proper and effective condition; and*
- d) ensure plant, equipment and measures are operated in a proper and effective manner; and*
- e) ensure that staff are trained and aware of their obligations under the Environmental Protection Act 1994; and*
- f) ensure that reviews of environmental performance are undertaken at least annually.*

This DRAFT EMP will initially be updated on receipt of relevant approvals (refer to **Section 3**). Thereafter, the EMP will be reviewed annually and updated on an as needs basis as outlined at **Section 6**.

The EMP does not cover requirements under the MHF licence, or safety and emergency legislation more broadly. Management strategies relating to these aspects will be captured elsewhere, including but not limited to, the Proposal's Work Health and Safety Management Plan (WHSMP) and an Emergency Response Plan (ERP).



Legend

- Project Area
- North Coast Rail Line
- Boat Creek

Roads

- Highway
- Major Road

Gladstone SDA Precinct

- Port Related Industry Precinct
- Environmental Management Precinct
- High Impact Industry Precinct
- Industry Investigation Precinct
- Materials Transportation and Services Corridor Precinct
- Medium Impact Industry Precinct

N

Scale 1:40,000 (A3)

0 600 1,200 1,800

Metres

Coordinate System: GDA2020 MGA Zone 56

Figure 1.1

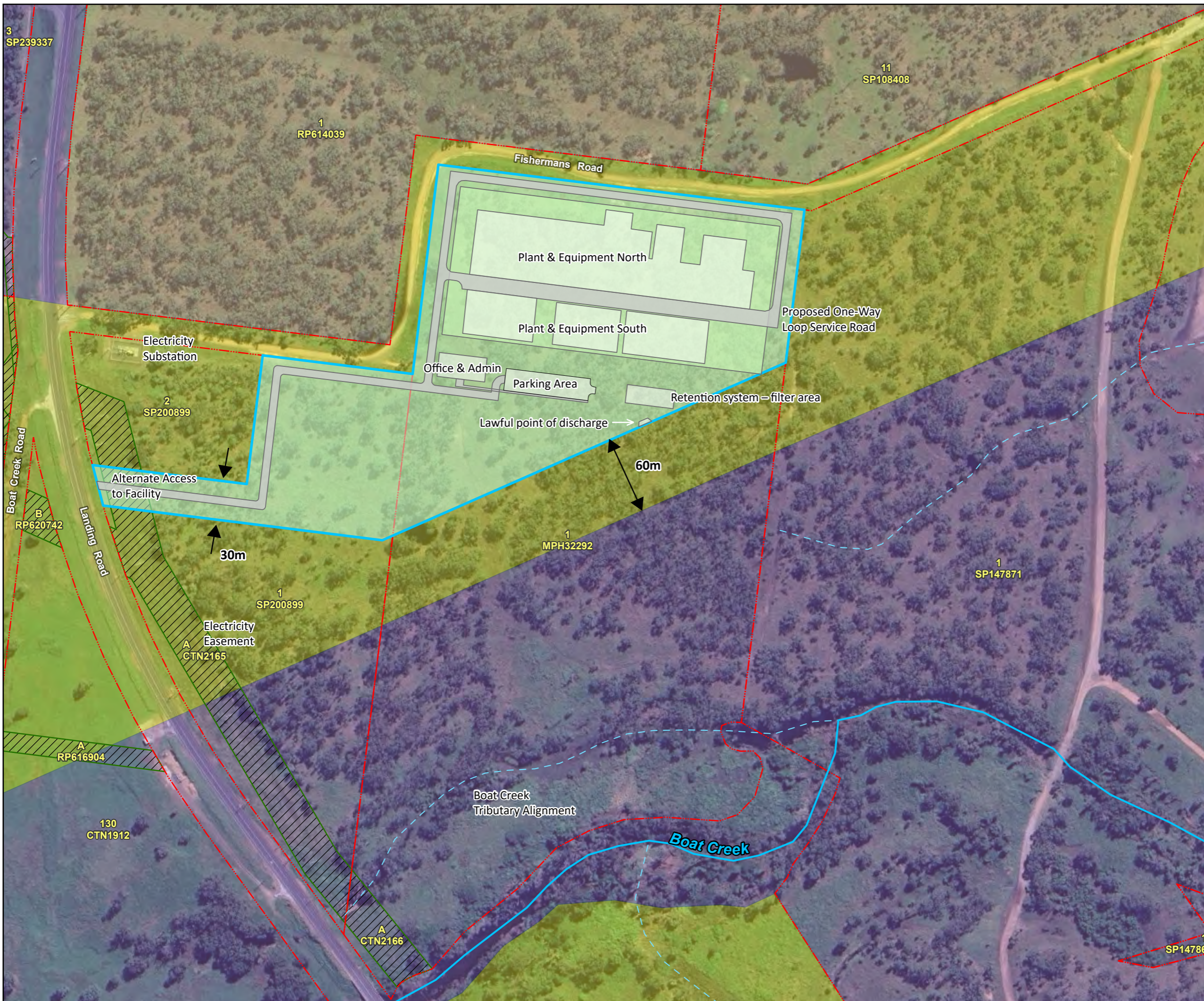
Project Halogen

Project Location

CQG Consulting

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 Ph: +61 7 4922 9252 Fax: +61 7 4922 0195

Project No: 25054
Map No: 25054-06
Revision: RevA
7 November 2025



Legend

- Project Area
- Easement
- Lot Type Parcel
- Named Waterways
- Unnamed waterways

Gladstone SDA Precinct

- Port Related Industry Precinct
- Industry Investigation Precinct
- Materials Transportation and Services Corridor Precinct (MTSC)

Disclaimer:
 CQG has relied upon data obtained from QSpatial and other public sources, as well as the client (Grenof).
 All internal access, maneuvering areas, and infrastructure are subject to engineering design

N

Scale 1:2,750 (A3)

0 41 83 124

Metres

Coordinate System: GDA2020 MGA Zone 56

Figure 1.2

Project Halogen

Conceptual Operations Site Layout
(MCU Submission)

GRENOF

Project No: 25054
 Map No: 25054-02
 Revision: RevA
 6 November 2025

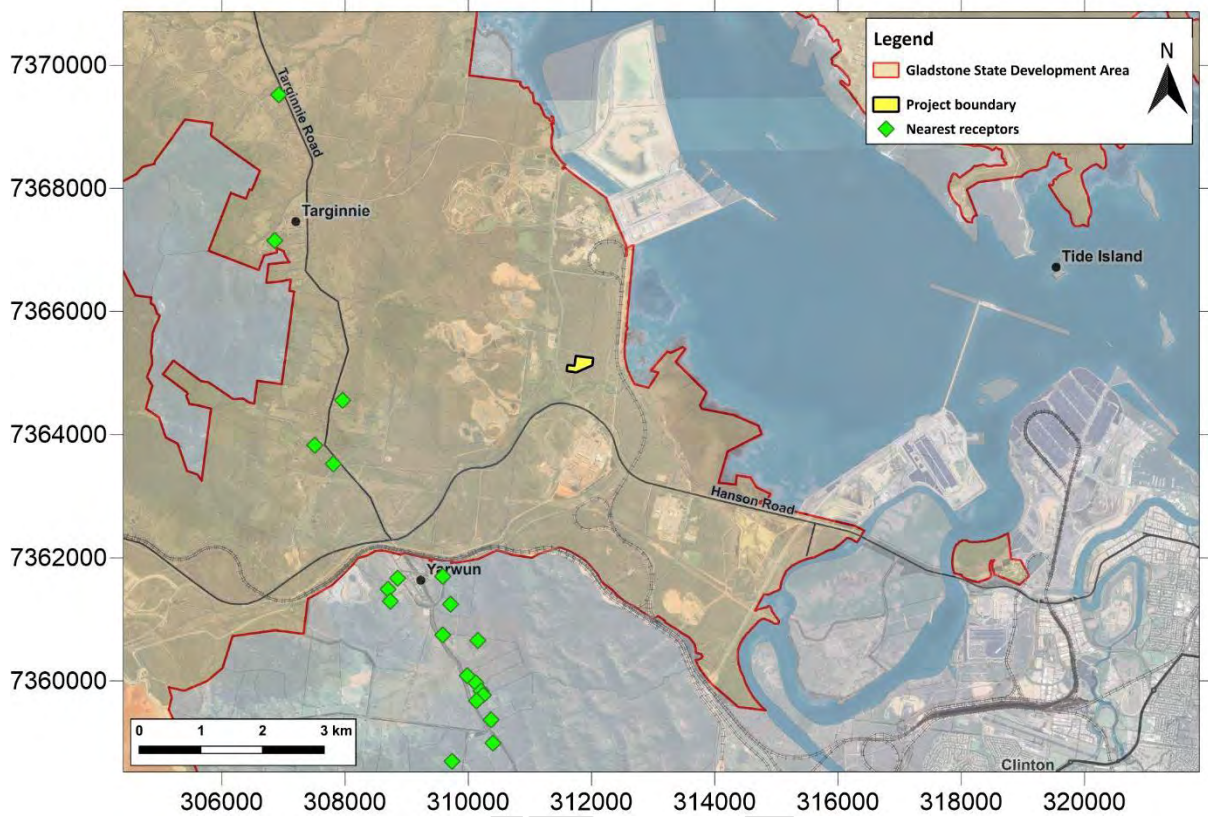


Figure 1.3: Location of nearest sensitive land uses (source: Katestone 2025a)



Legend

- Project Area
- Minor Road
- Materials Transportation and Services Corridor Precinct (MTSC)

MSES Vegetation

- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C- endangered or of concern)
- Regulated vegetation (category R- GBR riverine)

Watercourse lines

- Minor - perennial
- Minor - non perennial

N

Scale 1:3,000 (A3)

0 45 90 135

Metres

Coordinate System: GDA2020 MGA Zone 56

Figure 1.4

Project Halogen

MSES Vegetation

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Project No: 25054
Map No: 25054-24
Revision: RevA
10 November 2025



Legend

- Project Area
- Materials Transportation and Services Corridor Precinct (MTSC)
- Minor Road

Habitat

- Essential Habitat (Vegetation Management Act)
- MSES Wildlife habitat (special least concern animal)
- MSES Wildlife habitat (endangered or vulnerable)

Coastal Hazard Mapping

- Storm Tide Medium Hazard
- Storm Tide High Hazard

Waterway Barrier Works

Risk of Impact

- 2 - Moderate
- 4 - Major

N

Scale 1:3,000 (A3)

0 45 90 135

Metres

Coordinate System: GDA2020 MGA Zone 56

Figure 1.5
Project Halogen
Essential Habitat and Waterway Mapping

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Project No: 25054
Map No: 25054-25
Revision: RevA
10 November 2025

2 Project Description

2.1 Overview of the Proposal

2.1.1 Purpose

The Purpose of Project Halogen is to reduce Australia's sovereign risk associated with essential chemicals including Cl₂ (single domestic producer with aging infrastructure, also imported) and NaOH (reliance on foreign supply), which are vital for our nation's industrial, economic, and public health sectors.

2.1.2 Key elements

Key elements of the Proposal include:

- Chlor-alkali plant consisting of:
 - plant and equipment north – production area including the electrolyser room (refer to **Section 2.2.2.3** for further details); and
 - plant and equipment south – salt and product storage.
- Ancillary facilities:
 - office;
 - parking area;
 - utilities;
 - access intersection – options being Fisherman's or Landing Road, with the latter currently preferred (refer to **Section 2.2.2.1**);
 - entry gate and internal maneuvering area; and
 - secure fencing of the Site boundaries.

Refer to **Figure 1.2** and **Appendix A** for the Site conceptual layout plan.

2.2 Details of the Proposal

2.2.1 Construction phase

Key production components of the chlor-alkali facility will be delivered to the Site in modular arrangements via B-double heavy vehicles up to 26 metres (m) in length. No over-size over-mass vehicles are proposed (Premise 2025).

Plant components will be assembled on Site on concrete slabs. Refer to **Appendix A** for a conceptual layout of the facility.

Other construction phase activities will likely include:

- Clearing and grubbing activities;
- Filling and levelling of the Site;
- Establishment of internal construction access roads and drainage;
- Concrete batching and delivery of construction materials;
- Delivery of plant equipment to establish key elements (refer to **Section 2.1.2**); and
- Upgrade of construction access to full intersection design standards prior to operations (refer to **Section 2.2.2.1**). Prior to the availability of the operations intersection, an access treatment suitable to safely accommodate construction vehicles and equipment will be established by the Delivery Manager.

Hours of construction will generally be restricted to daytime hours (i.e., Monday to Saturday, excluding public holidays, from 6:30 am to 6:30 pm as per GRC n.d). However, night works may be required for large concrete pours, or other time sensitive construction activities. Nuisance to the nearest sensitive receptors is not anticipated given the significant buffer distance between (refer to **Figure 1.3**) and minimal number of activities that may potentially warrant night work activities outside standard building work hours.

2.2.2 Operations phase

2.2.2.1 Access intersection

The narrow width of the Fisherman's Road reserve (being 20 m wide) poses constraints to the access intersection design for B-double movement swept paths for the Proposal's ongoing operational needs.

Use of this intersection would likely require acquisition of land on the south-east corner of the intersection (portion of Lot 2 on SP200899) and relocation of Ergon power poles to accommodate the swept path design (Premise 2025).

Another access option, directly off Landing Road immediately south of Lot 2 on SP200899, has been identified as an alternative arrangement (refer to **Figure 1.2**). Given this arrangement would not require land acquisition or movement of power poles and is in-principle acceptable to MEDQ as the landowner (identified in the owners consent to lodge the DA), it is currently identified as the preferred option.

The access treatment is yet to be confirmed, however, will likely comprise compacted gravel with a nominal two coat bitumen seal treatment.

2.2.2.2 Key activities

Project Halogen will comprise a modular chlor-alkali production facility, manufacturing the following chemicals (project capacities listed are based on a 100% chemical basis at plant capacity):

- NaOH – approximately 100 tonnes per day (tpd), diluted to 50% concentration (i.e. approximately 200 tpd), for direct delivery to Rio Tinto Australia Yarwun (RTAY) and used in sodium hypochlorite (NaOCl) generation process;
- Liquefied Cl₂ gas – approximately 90 tpd, for delivery to water authorities and used in the hydrochloric acid (HCl) generation process; and
- Derivative products manufactured using the abovementioned primary chemicals as inputs:
 - NaOCl – approximately 40 tpd, diluted to a 12.5% concentration (i.e., approximately 320 tpd), for delivery to water authorities and other industrial customers; and
 - HCl – approximately 40 tpd, diluted to a 33% concentration (i.e., approximately 120 tpd), for delivery to various industrial and mining applications.

The base case is for product offtakes from the plant of 160,000 tpa (based on actual produced concentrations), but this may vary dependent on market demands for specific chemicals.

The proposed hours of operation are 24 hours a day, 7 days a week, with the following personnel assumed:

- 24/7 operations – 5 operators alternating over each 12 hour shift (four crews x 5 staff each in total); and
- Standard business hours – 14 management and administrative support staff.

Key activities that will be undertaken during operation include:

- Plant operation;
- Delivery of inputs to plant (salt and chemicals);
- Storage for input salt and chemicals and output chemicals and wastes;
- Transport of outputs from plant (chemicals and waste products);
- Security – including fencing and surveillance systems;
- Subcontractor management – coordinating with subcontractors for specialised maintenance or repair tasks;
- Data analysis and reporting – analysing data to optimise output production and other key performance metrics e.g., environmental, social and governance (ESG) metrics (including, but not limited to, greenhouse gas (GHG) abatement key result areas (KRAs), refer to **Appendix B**); and
- Waste management:
 - segregate waste streams; and
 - any waste generated that cannot be reused in the process will be transported offsite by an appropriately licensed contractor.

2.2.2.3 Process summary

The electrolytic process uses electricity to convert high-purity brine into Cl₂ gas, H₂ gas and NaOH, with a membrane separating the resulting products (refer to **Figure 2.1**). The entire facility will have a closed loop design and consequently will not have any fugitive air releases. A potential fugitive source based on facilities elsewhere is the electrolyser room. In the case of the Proposal, the electrolyser room will be designed so that any leaks will be immediately identified by the control system due to the monitoring of pressure on either side of each electrolyser. The control system will have the capability to detect leaks as small as a pinhole.

A schematic view of the chlorine electrolysis cells is provided in **Figure 2.2**. In comparison to the alternative electrolysis techniques (diaphragm cell process and the mercury cell process), the membrane cell process has the following benefits:

- Low total energy consumption;
- Low investment and operating costs;
- Does not use mercury or asbestos; and
- High-purity chemical production.

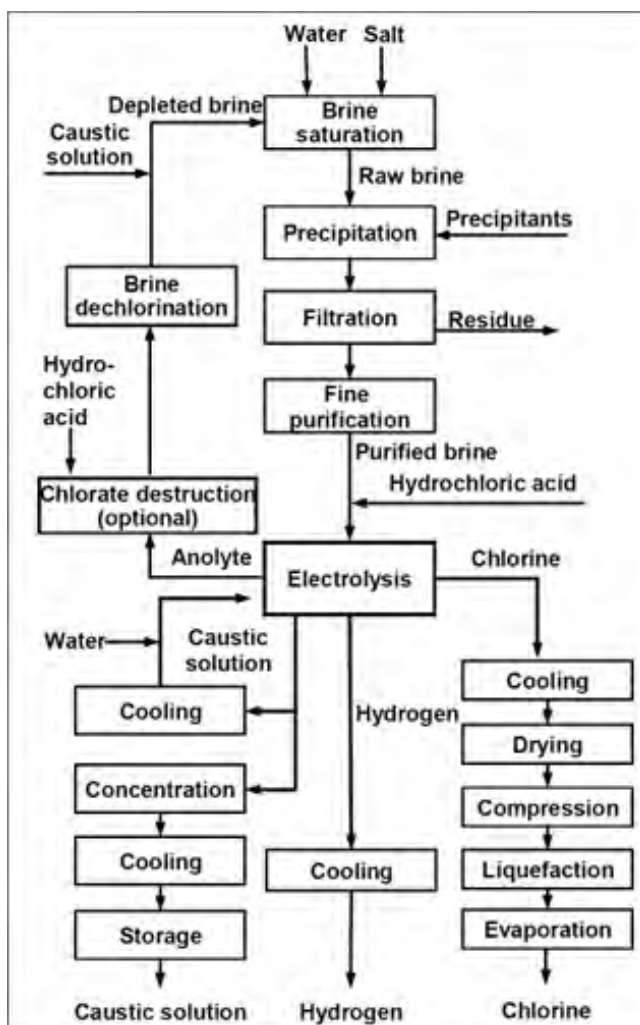


Figure 2.1: Typical flow diagram of the membrane cell technique (source: European Commission 2014)

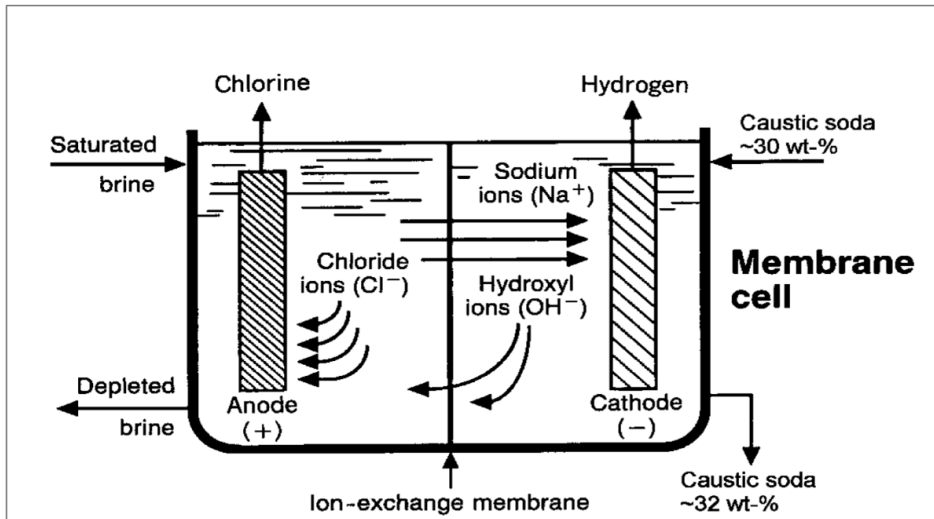


Figure 2.2: Schematic view of chlorine electrolysis cells for membrane cell technique (source: European Commission 2014)

2.2.3 Decommissioning phase

The estimated life of the chlor-alkali facility is approximately 50 years (lease period to be negotiated with MEDQ).

Prior to decommissioning GWT is to confirm the final land use with the landowner (MEDQ). Given the Site is within the GSDA, it is expected this will require the land to be left in a fit state suitable for future industrial purposes consistent with the Development Scheme. In any case the Site must be left safe, stable and non-polluting.

The current decommissioning plan would involve:

- Removal of all specific Project Halogen infrastructure, equipment and waste materials to ensure no sources of ongoing environmental harm or nuisance. Safe, stable and non-polluting hardstand or sealed surfaces, and non-specific Project Halogen infrastructure including service connections, may be retained in consultation with the landholder; and
- The acceptance criteria for handover to the landholder assumes the Site has been assessed as stable by a Registered Professional Engineer of Queensland (RPEQ) and non-polluting by a suitably qualified person (SQP) under the EP Act.

No progressive rehabilitation can occur during operations, with rehabilitation works only to commence in the decommissioning phase.

3 Regulatory Context

The Proposal is defined as a special industry within the MTSC Precinct under the Development Scheme, meaning that it is assessable development. The OCG will be the assessment agency for the land use, and the Department of Environment, Tourism, Science, and Innovation (DETSI) will be the assessment agency for the operating ERA (ERA 7(6d) – Chemical manufacturing: manufacturing, in a year, more than 100,000 tonnes of inorganic chemicals).

The EMP will be reviewed and updated, as required, on receipt of approval conditions (refer to **Section 6**).

Key environmental legislation considerations for the Proposal is listed in **Table 3.1**.

Table 3.1: Key environmental legislation

Legislation	Summary
Commonwealth	
<p><i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)</p> <p>Administering authority: Department of Climate Change, Energy, the Environment and Water (DCCEEW)</p>	<p>Establishes an assessment and approval framework for activities that have the potential for significant environmental impacts on matters of national environmental significance (MNES).</p> <p>The Site is located with the Great Barrier Reef (GBR) catchment area. This is relevant to the following three MNES matters under the EPBC Act:</p> <ul style="list-style-type: none"> • World heritage values of a declared world heritage property; • National heritage values of a declared national heritage place; and • GBR Marine Park. <p>The Proposal will not result in significant impacts to the GBR, if appropriate erosion and sediment control and stormwater management strategies are implemented (refer to Table 5.3, Appendix C and Appendix D).</p> <p>No MNES flora or fauna were observed during the ecological investigation conducted on 12 to 13 August 2025 (habitat assessments), although suitable habitat for the following MNES fauna was identified and further targeted fauna assessments for these species recommended (CQG 2025a):</p> <ul style="list-style-type: none"> • Koala (<i>Phascolarctos cinereus</i>) – endangered; • Squatter pigeon (<i>Geophaps scripta scripta</i>) – vulnerable; and • Osprey (<i>Pandion haliaetus</i>) – migratory and marine. <p>Targeted fauna surveys identified that Koala are unlikely, Squatter pigeon likely and Osprey known (identified during a diurnal survey flying overhead) to be present at the Site (CQG 2025b).</p> <p>The ecological assessments (CQG 2025a and 2025b) determined that the Proposal will not result in a significant impact to these MNES species if appropriate avoidance and mitigation strategies are implemented.</p>
<p><i>National Greenhouse and Energy Reporting Act 2007</i> (NGER Act)</p> <p>DCCEEW</p>	<p>The NGER Act provides for the reporting and dissemination of information related to GHG emissions, GHG projects, energy production and energy consumption. The NGER scheme is a single national framework for reporting company information as required under the NGER Act, administered by the Clean Energy Regulator (CER).</p> <p>NGER registration and emissions reporting of Scope 1 (GHG emissions released as a direct result of the activity) and Scope 2 (GHG emissions related to the use of power by the activity that is generated elsewhere) are mandatory for corporations or facilities that have energy production, energy use or GHG emissions that exceed the following annual thresholds:</p>

Legislation	Summary
	<ul style="list-style-type: none"> GHG emissions: 25,000 t CO₂-e (facility) or 50,000 t CO₂-e (corporation); or Energy production and / or consumption: 100 terajoules (TJ) (facility) or 200 TJ (corporation). <p>Scope 3 (indirect GHG emissions, other than Scope 2 emissions i.e., not controlled by the facility), are not included in NGER reporting due to the potential for double counting.</p> <p>The GHG assessment (Katestone 2025b) determined that the Proposal will exceed the facility thresholds and trigger mandatory reporting under the NGER scheme.</p>
State	
<p><i>Aboriginal Cultural Heritage Act 2003</i> (ACH Act)</p> <p>Administering authority: Department of Women, Aboriginal and Torres Strait Islander Partnerships and Multiculturalism</p>	<p>The ACH Act provides for recognition, protection and conservation of Aboriginal cultural heritage.</p> <p>A cultural heritage search included in the Planning Report did not identify a record of any Aboriginal or Torres Strait Islander cultural heritage on the Site of interest to the First Nations Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda (FNBGGGTB) People.</p> <p>The ACH Act protects all indigenous cultural heritage in Queensland, whether or not it has been recorded in a database.</p> <p>All works must be undertaken in accordance with the cultural heritage duty of care: A person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal or Torres Strait Islander cultural heritage.</p> <p>Consistent with the cultural heritage duty of care, GWT is required to report unexpected finds to the FNBGGGTB People Native Title Group.</p> <p>Failure to comply with the duty of care is an offence, including unlawfully harming, excavating, relocating, taking away and possessing indigenous cultural heritage.</p>
<p><i>Biosecurity Act 2014</i> (Biosecurity Act)</p> <p>Administering authority: Department of Primary Industries (DPI)</p>	<p>The Biosecurity Act provides a biosecurity system framework which aims to minimise biosecurity risk, and facilitate responses to biosecurity impacts.</p> <p>Under the Biosecurity Act a general biosecurity obligation is placed on all persons to undertake all reasonable and practicable measures to prevent or minimise biosecurity risk. Additionally, the movement of biosecurity matter must comply with movement restrictions associated with each relevant biosecurity zone, and biosecurity instrument permits are required for the movement of biosecurity matter which cannot comply with movement restrictions.</p> <p>The following Category 3 restricted invasive flora species listed under the Biosecurity Act and weeds of national significance (WONS) were recorded on the Site during the ecological investigation:</p> <ul style="list-style-type: none"> Lantana (<i>Lantana camara</i>); and Rubber vine (<i>Cryptostegia grandiflora</i>). <p>Evidence of use by the following Category 3, 4 and 6 restricted invasive animals was recorded on the Site during the ecological investigation:</p> <ul style="list-style-type: none"> Feral pigs (<i>Sus scrofa</i>); Foxes (<i>Vulpes vulpes</i>) – also classified as a Category 5 restricted invasive animal; and

Legislation	Summary
	<ul style="list-style-type: none"> • Wild dogs (<i>Canis familiaris</i>, <i>C. familiaris dingo</i>, <i>C. lupus familiaris</i>, <i>C. lupus dingo</i>). <p>The restricted invasive category requirements under the Biosecurity Act relevant to these species are as follows:</p> <ul style="list-style-type: none"> • Category 3: the invasive plant or animal must not be distributed either by sale or gift, or otherwise releasing it into the environment; • Category 4: the invasive animal must not be moved; • Category 5: the invasive animal must not be kept; and • Category 6: the invasive animal must not be fed.
<p>EP Act Administering authority: DETSI</p>	<p>The object of this Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).</p> <p>The three primary environmental duties that apply to everyone in Queensland are:</p> <ul style="list-style-type: none"> • GED – a person must not carry out any activity that causes, or is likely to cause environmental harm, unless all reasonable and practicable measures to prevent or minimise the harm have been taken. Environmental harm is defined in Section 14 of the EP Act as any 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; • Duty to restore the environment – where an incident involving contamination of the environment has occurred, a person must, as soon as reasonably practicable after the incident happens, take measures, as far as reasonably practicable, to rehabilitate or restore the environment to its condition before the harm; and • Duty to notify of environmental harm – a person must inform the administering authority and landowner or occupier when an incident has occurred that may have caused or threatens serious or material environmental harm that is not authorised. <p>The EP Act regulates activities that will or may have the potential to cause environmental harm and prescribes several mechanisms to ensure that objectives are met. The Proposal involves the following prescribed ERA under Schedule 2 of the EP Reg that will require an approved EA to commence; ERA 7(6d) – Chemical manufacturing: manufacturing, in a year, more than 100,000 tonnes of inorganic chemicals.</p> <p>The Site is located within the GBR catchment which triggers assessment again section 41AA of the EP Reg, related to the release of fine sediment and / or dissolved inorganic nitrogen from the Site. The Proposal will not result in a residual impact as defined under section 41AA(4) of the EP Reg, if appropriate erosion and sediment control and stormwater management strategies are implemented (refer to Table 5.3, Appendix C and Appendix D).</p> <p>The following environmental protection policies (EPPs) have been made under section 26 of the EP Act to identify values and objectives for the specified aspect:</p> <ul style="list-style-type: none"> • EPP (Air); • EPP (Noise); and • EPP (Water and Wetland Biodiversity).

Legislation	Summary
<p><i>Fisheries Act 1994</i> (Fisheries Act)</p> <p>Administering authority: DPI</p>	<p>To provide for the use, conservation and enhancement of the community's fisheries resources and fish habitat.</p> <p>There are no waterways mapped under the Fisheries Act on the Site, with no direct impacts on waterways to result from the Proposal e.g., waterway barrier works (WWBW) or impacts to marine plants.</p> <p>The Site drains to Boat Creek, which is identified as a purple (major risk to fisheries) waterway approximately 250 m to the south of the Site. An unnamed tributary of Boat Creek, identified as an amber (moderate risk to fisheries), is located between the Site and Boat Creek. Refer to Figure 1.5 for the location of these waterways with respect to the Proposal.</p> <p>The Proposal will minimise indirect impacts to mapped waterways, if appropriate erosion and sediment control and stormwater management strategies are implemented (refer to Table 5.3, Appendix C and Appendix D).</p>
<p><i>Nature Conservation Act 1992</i> (NC Act)</p> <p>Administering authority: DETSI</p>	<p>The NC Act is the primary legislation governing the protection and management of native wildlife, habitat and protected areas in Queensland.</p> <p>The protected plants flora survey trigger map identifies high risk areas for protected plants to occur and must be used to determine whether a targeted flora survey is required for a particular area. The Site is not located within the protected plants flora survey trigger map area.</p> <p>Refer to EPBC Act for a summary of the ecological assessment findings, noting the Koala and Squatter pigeon are also NC Act listed species (i.e. matters of state environmental significance (MSES)).</p> <p>Pre-clearance surveys will be required prior to commencement of clearing. Should active breeding places be observed, a species management program (SMP) must be obtained and implemented. Dependent upon the species to be disturbed, either a low risk SMP (least concern species only), or a high risk SMP (all protected wildlife) may be required.</p>
<p><i>Planning Act 2016</i> (Planning Act)</p> <p>Administering authority: DSDIP</p>	<p>To provide an efficient, effective, transparent, integrated, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability in Queensland.</p> <p>Although the SDPWO Act is the assessment instrument for land within an SDA, this process is aligned with the Planning Act. <i>Planning Regulation 2017 (Qld)</i> (Planning Regulation) referral triggers relevant to the SDPWO Act process are identified as:</p> <ul style="list-style-type: none"> • Planning Regulation – Schedule 10, Part 5, Division 4, Table 2 – Non-devolved environmentally relevant activities (refer to EP Act responses); • Planning Regulation – Schedule 10, Part 9, Division 4, Subdivision 1, Table 1 – State transport infrastructure generally (triggered given The Proposal special industry use will transport more than 10,000 tpa on state-controlled roads); • Planning Regulation – Schedule 10, Part 9, Division 2, Table 1 and 2 – RaL and MCU subject to an easement or near a substation site (associated with the Ergon Energy easement on Landing Road and Boat Creek Substation); and • Planning Regulation – Schedule 10, Part 7, Division 3 – Hazardous chemical facility (refer to Section 1.1).

Legislation	Summary
<p>SDPWO Act</p> <p>Administering authority: OCG</p>	<p>To provide for State planning and development through a coordinated system of public works organisation, for environmental coordination.</p> <p>The Site is located within the GSDA and is subject to the Development Scheme prepared under the SDPWO Act.</p> <p>A DA for a MCU for a special industry and RaL will be assessed against the Development Scheme and need to be approved by the CG prior to commencement of site works for the development. OPW for the clearing of regulated regrowth vegetation (refer to VM Act comments) can be undertaken as a SDA self-assessable development, where associated with a MCU and / or RaL authorised by an SDA approval.</p> <p>An assessment against the strategic visions, overall objectives, preferred development intent of the MTSC Precinct and SDA wide assessment criteria for the Proposal MCU and RaL, and SDA self-assessable requirements for OPW for native vegetation clearing, is provided in the Planning Report.</p>
<p><i>Vegetation Management Act 1999</i> (VM Act)</p>	<p>To regulate the clearing of vegetation in a way that conserves remnant of concern regional ecosystems.</p> <p>The Queensland Herbarium regulated vegetation management map identified vegetation categories that are used to determine if clearing of native vegetation is considered assessable development requiring a permit.</p> <p>The Site is mapped as Category C (regrowth) vegetation, which was verified through a habitat assessment undertaken for the Site (CQG 2025a). OPW for the clearing of regulated regrowth vegetation can be undertaken as a SDA self-assessable development in the GSDA, where associated with a MCU and / or RaL authorised by an SDA approval (refer to SDPWO Act comments).</p>
<p><i>Waste Reduction and Recycling Act 2011</i></p> <p>Administering authority: DETSI</p>	<p>To establish a framework for waste management and resource recovery practices in Queensland. It promotes the waste hierarchy i.e., avoid, reduce, reuse, recycle, recover and treat, with disposal only considered when there is no viable alternative.</p> <p>Minimal waste will be generated by the Proposal with these to be managed in consideration of the waste hierarchy and in accordance with requirements under the EP Act.</p>
<p><i>Water Act 2000</i> (Water Act)</p> <p>Administering authority: DETSI</p>	<p>To provide a framework for the sustainable management and efficient use of Queensland's water resources.</p> <p>There are no watercourses identified under the Water Act watercourse identification map on the Site, with no direct impacts to watercourses to result from the Proposal.</p> <p>The Site drains to Boat Creek, which is identified as a watercourse approximately 250 m to the south of the Site. Two unnamed tributaries of Boat Creek, located between the Site and Boat Creek are identified as drainage features (not defined as a watercourse under the Water Act).</p> <p>The Proposal will minimise indirect impacts to mapped watercourses and drainage features, if appropriate erosion and sediment control and stormwater management strategies are implemented (refer to Table 5.3, Appendix C and Appendix D).</p> <p>Overland flow water that is collected within the operational area may be reused as part of the proposal where available and practicable. In accordance with section 97</p>

Legislation	Summary
	of the Water Act, overland flow of water may be collected and retained as part of the Proposal to satisfy the requirements of the EA under the EP Act.
Local	
<p><i>Gladstone Region Planning Scheme: Our Place Our Plan (Version 2) (Planning Scheme)</i></p>	<p>The Site is within the GRC local government area (LGA). The Planning Scheme has been developed to regulate land use planning and development assessment within the GRC LGA in accordance with the Planning Act. The Site is zoned Special Purposes zone under the Planning Scheme, identifying that development assessment for this area is managed by the CG in accordance with the Development Scheme under the SDPWO Act, rather than under the Planning Scheme.</p> <p>However, applicable Planning Scheme overlays are as follows:</p> <ul style="list-style-type: none"> • Acid sulfate soils (ASS) 5 to 20 metres with respect to Australian Height Datum (mAHD); • Airport buffer 8 to 13 kilometres (km); • Bushfire hazard – Medium Potential Bushfire Intensity; • Mining leases (ML) – associated with ML80081 (Queensland Energy Resources Pty Ltd); and • Regional infrastructure – associated with the Ergon Energy easement.
<p>Local laws</p>	<p>The <i>Local Government Act 2009</i> (Qld) allows for Councils to create laws and regulate specific matters within their LGA in accordance with their function or power under the Act.</p> <p>GRC has various local laws that may apply to the development e.g. related to local government controlled roads, community and environmental management and waste management.</p> <p>It is anticipated that approval will be required for works in a road reserve for access to the Site and any required upgrades (refer to Section 2.2.2.1), and potentially for trade waste disposal.</p> <p>GWT will take further advice from GRC and the OCG with respect to any requirements regarding OPW for site works, or otherwise as required during the referral stage.</p>

Once GWT receive relevant approvals, this EMP will be updated to reflect the respective approval conditions.

4 Management System

4.1 Site responsibilities

All GWT personnel and their contractors are responsible to ensure the GED under the EP Act (refer to **Section 3**). The key roles and responsibilities under the EMP to meet the GED are outlined in **Table 4.1**.

Table 4.1: Roles and Responsibilities

Role	Responsibility
Operations Manager	<p>The Operations Manager is responsible for overseeing the EMP performance, and shall:</p> <ul style="list-style-type: none"> • Have in place all relevant approvals to allow the works to proceed; • Ensure the operational team is adequately resourced to implement the EMP; • Ensure appropriately qualified / competent personnel are engaged to conduct operational activities and / or engage external technical support, as required; • Ensure personnel are trained and aware of their obligations under the EMP, EP Act, general biosecurity obligation, cultural heritage duty of care and site-specific approvals (DA, EA and MHF licence); • Lead annual management performance reviews and authorise material amendments to the EMP; and • Notify OCG, DETSI, GRC and other external stakeholders, as required.
Site Supervisor	<p>The Site Supervisor is responsible for implementing the EMP on a day-to-day basis, and shall:</p> <ul style="list-style-type: none"> • Ensure personnel are familiar with the Site-specific requirements and comply with the EMP, EP Act, general biosecurity obligation, cultural heritage duty of care and site-specific approvals (DA, EA and MHF licence); • Coordinate ongoing reviews of compliance with the EMP, including site inspections and audits; • Sign off on any site approvals required for works e.g. ground disturbance permit, permit to dig, hot work permit etc; • Coordinate near miss, incident, non-compliance, emergency and complaint corrective actions, reports and investigations, and on-report to the Operations Manager, as required; • Oversee corrective and preventative actions; and • Assist the Operations Manager with performance reviews and notifications to external stakeholders, as required.
Environmental Consultant (CQG)	<p>The Environmental Consultant is responsible for advising the Operations Manager and Site Supervisor on the implementation of the EMP on an as needs basis, including the provision of appropriately qualified person/s (AQP/s) for site inspection and / or audit, preclearance survey and fauna-spotter catcher services.</p>
Indigenous Engagement Officer	<p>The Indigenous Engagement Officer is responsible for advising the Operations Manager and Site Supervisor on Indigenous engagement matters generally, and cultural heritage matters specifically (including as outlined in Section 5.5). This person may be an external consultant.</p>

Role	Responsibility
All personnel	All personnel (including contractors) are responsible for working in accordance with the EMP and reporting any near-misses, incidents, non-compliances and complaints.

4.2 Competence, training, and awareness

Personnel employed, including contract personnel, are to be deemed competent in their role(s), with the relevant qualifications, skills and experience (e.g., licences / tickets, as required).

All personnel (including contractors) will complete a site safety and environmental induction prior to commencing works on the Site. The induction will include an overview of their obligations under the GED, general biosecurity obligation, cultural heritage duty of care (refer to **Section 3**) and this EMP. The induction will also outline incident / complaint / hazard communication and reporting protocols, correct use of emergency equipment and consequences for non-conformances.

Pre-start and toolbox talks will be held routinely. These meetings offer the opportunity to periodically refresh the workforce on their GED and associated EMP obligations as well as provide status updates on any environmental near misses, incidents, non-compliances or complaints reported. They also provide the opportunity for the workforce to raise environmental concerns and identify opportunities for improvement.

The Operations Manager and Site Supervisor will be provided with further training regarding the implementation of the EMP, if necessary.

Records of all qualifications, inductions, pre-start meetings, toolbox talks and other training provided will be maintained.

4.3 Incident management

4.3.1 Incident recording

Management of near-misses, incidents, non-compliances and emergencies is important to reduce the risk of the hazard occurring, or the severity of the hazard where it has occurred, to the environmental, cultural heritage or social values of the Site.

These may be defined as:

- A near-miss is any event that could have resulted in an injury or illness to people, danger to health, and / or damage to property or the environment;
- An incident is any event that has resulted in an injury or illness to people, danger to health, and / or damage to property or the environment; and
- An emergency is a major incident that requires an immediate response to preserve life, property and environment, including fire, significant spills, road accidents, natural disasters and civil disturbances (bomb threat).

In the event that a near-miss or incident occurs, the following steps will be followed immediately by a competent person:

- Prevention of further pollution, or harm to environmental, cultural heritage or social values;
- Clean-up and / or control of polluting substance(s) or environmental, cultural heritage or social harm;
- Implementation of mitigation measures to prevent recurrence of a similar incident;
- Instigate incident investigation as appropriate commensurate with the level of risk and / or harm; and
- Notification of the incident – can occur in parallel with steps above, noting the limited timeframe for DETSI notification, where required (refer to **Section 4.3.2**) and should emergency services assistance be required to manage the incident.

All near-misses, incidents, non-compliances and emergencies must be recorded in a site register including the following information at a minimum:

- Time, date, duration and cause of any incident;
- Any resultant environmental harm; and
- Immediate clean up and corrective actions taken.

The Operations Manager will oversee further corrective and preventative actions and lead investigations associated with any near misses, incidents, non-compliances or emergencies with input from the Site Supervisor and workforce involved. A report will be prepared in accordance with GWT's incident management system, to ensure an adequate response to managing any non-compliance with the EA or GED, adverse environmental impacts and to avoid a recurrence.

4.3.2 Notification of incidents and emergencies

Emergencies likely to cause off-site impacts or significant environmental harm may require immediate contact with emergency services. The Operations Manager will make such contact as required.

Under the *Work Health Safety Act 2011 (Old)* any incident that results in the death, serious injury or serious illness of a person, or involves a dangerous incident must also be reported to Workplace Health and Safety Queensland. Such notifiable incidents must be reported immediately on becoming aware of the incident (refer to the GWT WHSMP and ERP for the Site for further details).

DETSI will be provided details of a notifiable environmental event within 24 hours of GWT becoming aware of the event. The following are events notifiable to DETSI under the EP Act¹:

- Material environmental harm as defined in section 16 of the EP Act i.e. environmental harm, that is not trivial or negligible in nature, extent or context;
- Serious environmental harm as defined in section 17 of the EP Act i.e. environmental harm that is irreversible; has a high impact or widespread effects to the environment or is caused to an area of high conservation significance; and
- A breach of a condition of the EA, whether any environmental harm has been caused or not.

DETSI can be contacted via either of the following options:

- Phone: 24/7 Pollution Hotline – 1300 130 372 (Option 2) – pollution incidents can be reported via this method 24 hours a day, 7 days a week; OR
- Online: Environmental reporting form, available here: <https://www.qld.gov.au/environment/management/pollution-management/environmental-nuisance/reporting-form> – note: this option is only manned from 8:30am to 5:00pm on standard business days. For any emergency release use the 24/7 Pollution Hotline option listed above.

After the notification, DETSI may request further information to assist in their assessment and investigation within a certain timeframe. GWT will respond to the DETSI request accordingly.

4.4 Complaint management

Complaints must be handled promptly and professionally to resolve the issue fairly and effectively for all concerned.

Complaints are to be recorded in a site register including the time, date, complainant contact details, reason for the complaint, any investigation undertaken, conclusion and actions taken to address the matter.

The Operations Manager will be responsible for communications with external stakeholders (including complainants) and ensure proposed resolution actions are implemented, as required.

¹ In addition, material environmental harm is identified as costing between \$10,000 and \$100,000, with serious greater than \$100,000, for the actual or potential loss or damage to property or to prevent or minimise the harm and rehabilitate or restore the environment to its condition before the harm. These values were based on the financial year ending 30 June 2023. For subsequent financial years, the preceding financial years value is to be increased by the consumer price index for the previous financial year.

4.5 Non-conformances and corrective actions

Any non-conformance with this EMP will be reported to the Operations Manager as soon as possible (noting as per **Section 4.3.2** a non-conformance with the EA is a notifiable event). A major non-conformance may result in the Site / activities being shut down until the non-conformance is rectified.

Corrective and preventative actions may include:

- Review and improvement of existing environmental controls and procedures;
- Site rehabilitation;
- Increased site inspections and monitoring;
- Modification of operational activity/ies; and
- Increased environmental awareness including retraining and toolbox talks.

Any non-conformance must be recorded in a site register and investigated commensurate with the risk identified to allow specific corrective and/or preventative actions to be identified, actioned and closed out. Actions are to be addressed and implemented within the time period specified by the incident investigation, assigned based on the identified level of risk.

4.6 Performance reviews

4.6.1 Routine inspections

Routine inspections will be carried out by the Site Supervisor to ensure the integrity and adequacy of management measures, including but not limited to, sediment and erosion / stormwater control systems, chemical and waste storage areas, housekeeping and other controls used to minimise the risk to the receiving environment or of non-compliances with the Site EA.

As outlined in **Section 5**, these routine inspections will include:

- Daily visual surveillance inspections of all key risk areas and controls; and
- Weekly inspections of key risk areas and controls, including the completion of a formal checklist.

Any areas of concern and recommended corrective actions will be documented. Any non-compliances, including against performance criteria outlined in **Section 5**, shall be recorded as per the procedure outlined in **Section 4.5**.

4.6.2 Event based inspections and monitoring

Weather forecasts will be checked daily to provide an early warning of potential inclement weather. Where severe weather or natural disasters (e.g., cyclones, bushfires etc) are forecast, the Site is to be inspected and assessed to ensure that there is adequate capacity in the sediment basin, there are no potentially contaminating materials exposed and emergency equipment is readily available and appropriately maintained (e.g. spills kits, firefighting equipment etc).

During periods of rainfall producing runoff, an inspection will be conducted at the lawful point of discharge to confirm the potential requirement to release. Stormwater releases from the sediment basin will be monitored as outlined in **Section 5** to ensure there is no risk of material or serious environmental harm to the receiving environment. In the case contaminants are released to the environment, the event would be managed as outlined in **Section 4.3**.

Immediately following periods of runoff occurring, site inspections will be conducted to ensure the integrity of access, sediment and erosion / stormwater control systems, chemical and waste storage areas, housekeeping and any other controls used to minimise the risk to the receiving environment or of non-compliances with the Site EA.

The inspections will be completed by the Operations Manager and / or the Site Supervisor and documented.

4.6.3 Auditing

Site audits of compliance with the EA and / or this EMP should be conducted routinely by an AQP not involved with the day-to-day management of the Site.

The frequency of the Site audit will be determined based on the activities being conducted, but should not be less frequently than six-monthly during the construction and commissioning phases.

GWT has committed to achieving ISO 14001 certification for the operational environmental management system (EMS). This will ensure that the EMS is routinely audited by an AQP i.e., surveillance audits conducted annually, and recertification audits every three years during operations and decommissioning.

4.7 Risk Management

Risks associated with the Proposal, with performance targets and controls identified to manage these risks are outlined in **Section 5**.

A site risk register will be maintained for the Site activities, with the EMP updated as required based on this (refer to **Section 6**).

4.8 Documentation

This EMP, and other relevant documentation (including the GWT WHSMP and ERP) will be readily available and accessible to all personnel.

All documentation and records required under the EA and / or the EMS will be maintained for the life of the operation. Such records include, but are not limited to, training records (including personnel records and internal training and awareness materials), monitoring results (including calibration records, field sheets and laboratory reports), inspection checklists, site risk register and site incident, complaint and non-conformance register.

Relevant information can be provided by GWT's Operations Manager to the OCG, DETSI or GRC on request.

5 Operational Controls

Management procedures and controls to manage potential impacts during construction, operation and closure of the Site as outlined in **Section 2.2**, are provided in the following **Tables 5.1 to 5.7**.

5.1 Land management

Table 5.1: Land degradation controls

Element	Description
Potential risk	<ul style="list-style-type: none"> Land degradation through erosion, sedimentation or contamination. <p>NOTE: the residual risk of land degradation is considered moderate if managed in accordance with this EMP, given the following inherent risks:</p> <ul style="list-style-type: none"> Potential for erosion and sedimentation – high during construction when soil is exposed, noting although the Site is relatively flat, sodic soils have been identified on the Site which are highly likely to be dispersive (refer to Appendix C). The risk will be significantly reduced during operations when the Site surface will be stabilised (refer to Appendix D); and Potential for contamination – high given volumes of hazardous chemicals are to be stored on the Site during operations. A baseline assessment undertaken does not indicate the presence of contaminated soils or acid sulfate soils (ASS) at the Site (CQG 2025c).
Objective	To comply with the GED under the EP Act (refer to Section 3).
Performance targets	<ul style="list-style-type: none"> No significant signs of erosion or contamination; No notifiable incidents (refer to Section 4.3.2); No complaints related to visual amenity; and Achievement of rehabilitation acceptance criteria on decommissioning.
Management strategies	<p>General controls:</p> <ul style="list-style-type: none"> High-risk activities (such as vegetation clearing and excavation) must be provided with a site approval prior to commencement, with relevant controls outlined in this EMP verified as being in place prior to commencement; The Site will remain tidy with chemical storage, wastes, laydown materials, erosion, weeds etc to be visually assessed on an ongoing basis and managed as outlined throughout this EMP; Hazardous materials will be substituted wherever practicable with non-hazardous, or less hazardous materials; All chemicals and fuels in containers of greater than 15 litres must be stored within secondary containment, roofed wherever possible to prevent stormwater ingress, and in accordance with relevant Australian Standards (including segregation of incompatible substances). Any material captured within the secondary containment is to be managed as a hazardous waste (refer to Table 5.7); Spills outside designated bunds will be cleaned up immediately, with reporting and monitoring undertaken, where necessary; Refuelling of vehicles will occur in designated areas, supervised at all times with drip trays used and spill kits readily available; Spill kits and other emergency equipment is to be located within a suitable distance from hazardous material storages. All equipment is to be clearly labelled, identified on the Site emergency plans and maintained to ensure adequate supplies in the case of an emergency spill; Site personnel are to be trained in the correct use of emergency equipment and management of contaminated materials;

Element	Description
	<ul style="list-style-type: none"> • Vehicles and equipment are to be serviced and maintained in accordance with manufacturer's specifications; and • Daily (on use) pre-starts are to be undertaken for all vehicles and equipment to identify any wear and tear which may contribute to a failure and result in a spill. Any plant leaking fuel or oil is to be tagged out and repaired prior to further use. <p>Construction phase specific controls:</p> <ul style="list-style-type: none"> • Exposed areas on the Site will be minimised and stabilised as soon as possible; • Erosion and sediment controls must be in place prior to commencement of construction. The controls will be designed, installed, maintained and monitored in accordance with the Erosion and Sediment Control Plan (ESCP) provided at Appendix C, to be further informed by the detailed design including a Dispersive Soil Management Plan; and • Should strong sulfuric "rotten egg" odours or black oozing soils, or evidence of contamination otherwise, be encountered during disturbance and excavation, works should immediately cease, soils be covered and advice sought from an AQP and / or SQP with experience in managing ASS and / or contaminated land. <p>Operational phase specific controls:</p> <ul style="list-style-type: none"> • The Site will be stabilised on commencement of operations, with stormwater controls to be designed, installed, maintained and monitored in accordance with the Stormwater Management Plan (SWMP) provided at Appendix D; and • All bulk chemicals are to be stored and handled in accordance with the General controls, and specific requirements of the EA and MHF licence. <p>Decommissioning phase specific controls:</p> <ul style="list-style-type: none"> • Prior to decommissioning GWT is to confirm the final land use with the landowner (MEDQ). Given the Site is within the GSDA, it is expected this will require the land to be left in a fit state suitable for future industrial purposes consistent with the Development Scheme. In any case the Site must be left safe, stable and non-polluting; and • The current decommissioning plan would involve: <ul style="list-style-type: none"> ○ removal of all specific Project Halogen infrastructure, equipment and waste materials to ensure no sources of ongoing environmental harm or nuisance. Safe, stable and non-polluting hardstand or sealed surfaces, and non-specific Project Halogen infrastructure including service connections, may be retained in consultation with the landholder; and ○ the acceptance criteria for handover to the landholder assumes the Site has been assessed as stable by a RPEQ and non-polluting by a SQP under the EP Act.
Performance review	<ul style="list-style-type: none"> • Routine and event based inspections and auditing as outlined in Section 4.6; and • Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6.
Reporting	<ul style="list-style-type: none"> • Any record or document generated through the implementation of this EMP must be retained for the life of the operation; • All incidents relating to land management shall be recorded in the Site incident, complaint and non-conformance register; and • Any non-compliances with the GED will be reported to the DETSI Pollution Hotline within the timeframe outlined in Section 4.3.2. Records must be kept including full details of the breach and any subsequent actions undertaken.

Element	Description
Contingency actions	<ul style="list-style-type: none"> Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

Table 5.2: Ecology controls

Element	Description
Potential risk	<ul style="list-style-type: none"> Disturbance of native flora, communities, fauna or habitat; and Introduction of restricted invasive flora or fauna. <p>NOTE: the residual risk of ecological impacts are considered low if managed in accordance with this EMP, given the following inherent risks:</p> <ol style="list-style-type: none"> Vegetation on the Site is largely regrowth vegetation with scattered remnant trees, reflecting a history of disturbance within an industrialised landscape; Suitable foraging and shelter habitat was identified for Koala, Squatter pigeon and Osprey. No other threatened species or communities were identified as likely to occur (CQG 2025a). Targeted fauna surveys identified that Koala are unlikely, Squatter pigeon likely and Osprey known (identified during a diurnal survey flying overhead) to be present at the Site (CQG 2025b); and The Site lies within an area mapped under the Queensland State Planning Policy's Bushfire Prone Area mapping and the Planning Scheme bushfire hazard overlay; classified as of medium potential bushfire intensity and potential impact buffer (Blackash 2025). The Proposal will result in the Site being cleared of existing regrowth vegetation. None of the chemicals produced by the chlor-alkali plant are flammable except for hydrogen which is vented below the lower explosion limit (Blackash 2025).
Objective	To comply with the GED under the EP Act, the VMA, the NC Act and general biosecurity obligation under the Biosecurity Act (refer to Section 3).
Performance targets	<ul style="list-style-type: none"> No ground disturbance outside designated locations on the Site; No significant impact to native flora and fauna; including no direct mortality, disturbance of active breeding sites or bushfires; and No introduction of new, or spread of known, weed or pest species.
Management strategies	<p>General controls:</p> <ul style="list-style-type: none"> Project vehicles and personnel are to stay on the designated operational and access areas; Vehicle speed limits across the Site will be signed, these and speed limits on public roads will be adhered to; Outdoor lighting will be designed, installed and maintained in accordance with Australian Standard 4282: Control of the obtrusive effects of outdoor lighting; Ongoing weed inspections and management will be undertaken on the Site. Any chemicals used must be registered with the Australian Pesticides and Veterinary Medicines Authority, applied by licensed commercial operators for the intended use, at the suggested rates and only by methods registered on the label and safety data sheet. Non-residual and non-persistent herbicides are to be used to manage weeds onsite, to minimise the potential risk of harmful herbicide by-products entering the surface water receiving environment (refer to Table 5.3).

Element	Description
	<ul style="list-style-type: none"> • All vehicles and plant to be washed and inspected prior to entering the Site. Weed and seed hygiene certificates (signed by authorised personnel who have completed <i>AHC BIO203 - Inspect and clean machinery, tools and equipment to preserve biosecurity</i> or equivalent) and pre-mobilisation inspection must be provided for all vehicles and plant until the Site clearing is complete and ground adequately stabilised for construction purposes, after which time such certificates and inspections will only be required for ground disturbing equipment; • No materials to be brought on site that are likely to harbour weeds or diseases (such as topsoil, mulch or turf) unless provided with a weed hygiene certificate; • No domestic animals permitted onsite; • Personnel are not permitted to approach, interact with or feed fauna, and not to intentionally harm or kill fauna including snakes. A fauna spotter catcher (FSC) or the RSPCA 1300 ANIMAL (1300 264 625) should be contacted for advice should any injured, sick or orphaned animals be encountered; • A FSC will be engaged to undertake a daily inspection of any open excavations to remove inadvertently trapped fauna and / or to manually relocate fauna (e.g., snakes) to nearby suitable habitat if required; • Injured wildlife are to be taken to nearest wildlife carer or veterinary clinic by the FSC and reported to regulatory authorities as required; • Personnel (including contractors) will be made aware of the general biosecurity obligation with respect to weeds and pests, and the GED with respect to other matters, including but not limited to, fauna interactions, emergency response etc, during the induction and toolbox talks; and • Waste will be managed as outlined in Table 5.7 to avoid attraction of fauna. <p>Clearing phase specific controls:</p> <ul style="list-style-type: none"> • A site approval is required before clearing works can commence i.e., ground disturbance approval, with clearing controls outlined in this EMP verified as being in place prior to commencement; • Control restricted invasive weeds in the area prior to vegetation clearing in accordance with a Biosecurity Management Plan and the general biosecurity obligation under the Biosecurity Act (refer to Section 3); • Delineate clearing boundaries and no-go zones. Clearing will be restricted to Category C (regrowth) vegetation within the Site; • Pre-clearance surveys to be conducted ahead of clearing and ground disturbing activities (within one week of clearing commencing) by an AQP; • If animal breeding places are found during the pre-clearance survey, a SMP under the NC Act must be obtained prior to clearing in the area being permitted, and conditions complied with (refer to Section 3); • Maintain areas of land not required for immediate development undisturbed. Progressive vegetation clearing methods to be employed to enable fauna time to relocate without intervention; • A FSC must be present during all vegetation clearing and ground disturbance; • Fauna identified in the clearing footprint that do not relocate without intervention, must be manually relocated by a FSC to nearby suitable habitat; • Any potentially hollow-bearing limbs to be dismantled slowly and checked for fauna by the FSC; • Relocate fauna habitat features to adjacent undisturbed areas where possible i.e., fallen hollow logs, timber or rock piles; • Topsoil, subsoil and vegetative matter (excluding restricted invasive weeds) is to be removed from the disturbed area and stockpiled for use in operational landscaping areas where possible; and

Element	Description
	<ul style="list-style-type: none"> • All areas not required for operations and associated asset protection zones (APZ) (refer to Bushfire controls) are to be landscaped i.e. ripped to relieve compaction, subsoil, topsoil and mulch reinstated. If natural regeneration following this process is unsuccessful, the area should be planted using suitable local species. <p>Bushfire management controls:</p> <ul style="list-style-type: none"> • Hot works or other high-risk activities must be provided with a site approval prior to commencement e.g., permit to dig, hot work permit etc. with relevant controls outlined in this EMP verified as being in place prior to commencement. No such activities are to be undertaken during total fire ban periods; • A comprehensive construction and operations ERP, including Bushfire Emergency Management and Evacuation Plan, will be prepared in accordance with the requirements of Australian Standard <i>AS3745-2010 Planning for Emergencies in facilities</i>. The ERP will be developed in consultation with local emergency services; • All facilities and services (e.g., gas and electricity) are to be designed in accordance with relevant building codes and Australian Standards (e.g. for pressure vessels); • Hazardous material stores, transformers and control rooms are to be designed and operated to withstand credible bushfire conditions; • The Site will be using piped natural gas onsite for steam production. A small amount of LPG will be stored on site for emergency steam generation only when natural gas is not available; • Incompatible substances are to be segregated as required by Australian Standards; • APZs designed and maintained for the Site, requiring separation of structures from hazardous vegetation by a minimum of 10 m; • Access will be designed and maintained for emergency service vehicles to and within the Site (medium rigid vehicle up to 23 t at a minimum); • Water carts to be available onsite as additional firefighting equipment, during construction prior to installation of a reticulated water supply; • Smoking only allowed in designated smoking areas, with sufficient “butt out bins” (or similar) available; and • Daily (on use) pre-starts of plant and equipment, with servicing undertaken in accordance with manufacturers specifications to ensure they are operating efficiently. All project vehicles, equipment, and machinery to be fitted with a fire extinguisher that needs to be checked during the pre-start and serviced six-monthly at a minimum.
Performance review	<ul style="list-style-type: none"> • Routine and event based inspections and auditing as outlined in Section 4.6; and • Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6.
Reporting	<ul style="list-style-type: none"> • Any record or document generated through the implementation of this EMP must be retained for the life of the operation; • All incidents relating to ecology management shall be recorded in the Site incident, complaint and non-conformance register; and • Any non-compliances with the GED will be reported to the DETSI Pollution Hotline within the timeframe outlined in Section 4.3.2. Records must be kept including full details of the breach and any subsequent actions undertaken.

Element	Description
Contingency actions	<ul style="list-style-type: none"> Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

5.2 Water resource management

Table 5.3: Water resource controls

Element	Description
Potential risk	<ul style="list-style-type: none"> Loss of sediments into waterways due to erosion caused by overland stormwater flows; Water quality impacts caused by erosion and sedimentation from earthmoving activities; and Water contamination as a result of storage and handling of hazardous materials and wastes. <p>NOTE: the residual risk of water resource impacts is considered moderate if managed in accordance with this EMP, given</p> <ul style="list-style-type: none"> Those inherent risks outlined at Table 5.1; The Site is within the GBR World Heritage Area catchment, although no direct impact on waterways will occur from the Proposal (approximately 250 m from the nearest mapped watercourse in Boat Creek); and Geotechnical investigations conducted on 15 to 17 September 2025 (D&N Geotechnica 2025) identified groundwater seepage from three boreholes at between 6.2 m to 6.5 m below the ground surface. This is comparable with water-bed depths of 8 m and 13 m recorded from two groundwater bores on the Cleanaway Gladstone Industrial Waste Services site (151084 and 151082 respectively), developed on 21 September 2009 approximately 400 m to the west of the Site (Queensland Government 2025a).
Objective	To comply with the GED under the EP Act and the EPP (Water and Wetland Biodiversity) (refer to Section 3).
Performance targets	<ul style="list-style-type: none"> No direct impacts to waterways or groundwater; No overland flow releases outside criteria specified in Appendix C or Appendix D; and No notifiable incidents (refer to Section 4.3.2).
Management strategies	<p>General controls:</p> <ul style="list-style-type: none"> As per General controls in Table 5.1 and Table 5.7; No direct disturbance of mapped waterways is to occur; High-risk activities (such as sediment pond discharge) must be provided with a site approval prior to commencement e.g., permit to release with relevant controls outlined in this EMP (including Appendix C during construction or Appendix D during operations) verified as being in place prior to commencement; The quality of water to be released to the receiving environment will be monitored by an AQP prior to release from the sediment basin in accordance with the <i>Monitoring and Sampling Manual (DES 2018)F</i>;

Element	Description
	<ul style="list-style-type: none"> Water may be reused for where available and practicable, including for dust suppression and material conditioning during construction, and for watering of landscaped areas during operations; and Hazardous materials will be substituted wherever practicable with non-hazardous, or less hazardous materials e.g., non-residual and non-persistent herbicides are to be used to manage weeds onsite. <p>Construction phase specific controls:</p> <ul style="list-style-type: none"> Site establishment works should occur in the dry season, where possible; Construction controls as outlined in Table 5.1; Clearing controls as outlined in Table 5.2; and Site surfaces are to be stabilised as soon as possible to avoid erosion and sedimentation. <p>Operational phase specific controls:</p> <ul style="list-style-type: none"> As per Table 5.1; and Any wastewater generated that cannot be reused in the process will be transported offsite by an appropriately licensed contractor or treated onsite in the future if a suitable treatment system is identified. <p>Decommissioning phase specific controls:</p> <ul style="list-style-type: none"> As per Table 5.1.
Performance review	<ul style="list-style-type: none"> Routine and event based inspections and auditing as outlined in Section 4.6; and Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6.
Reporting	<ul style="list-style-type: none"> Any record or document generated through the implementation of this EMP must be retained for the life of the operation; All incidents relating to water resource management shall be recorded in the Site incident, complaint and non-conformance register; and Any non-compliances with the GED will be reported to the DETSI Pollution Hotline within the timeframe outlined in Section 4.3.2. Records must be kept including full details of the breach and any subsequent actions undertaken.
Contingency actions	<ul style="list-style-type: none"> Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

5.3 Air quality management

Table 5.4: Air quality controls

Element	Description
Potential risk	<ul style="list-style-type: none"> Nuisance to surrounding sensitive receptors resulting from dust associated with the construction, or Cl₂ and HCl emissions during operation (refer to Note 1); and Significant unabated greenhouse gas emissions (refer to Note 2). <p>NOTE (assuming engineering controls as specified):</p> <ol style="list-style-type: none"> The air quality assessment undertaken by Katestone (2025a) identified the key operational emission sources as the waste gas dechlorination stack (Cl₂

Element	Description
	<p>emissions) and HCl vent burner stack (Cl₂ and HCl emissions). Other potential sources were identified as negligible so were not included in the dispersion modelling. Both emissions complied with the relevant assessment criteria at the nearest sensitive receptor (residence) located 3.7 km to the west, with the highest concentration of either pollutant anywhere in the model domain predicted to be less than 0.3 % of the relevant air quality assessment criteria. Dust emissions during the construction phase were also identified as negligible; and</p> <p>2. The greenhouse gas (GHG) assessment undertaken by Katestone (2025b) identifies the Proposal as a medium to high emitter, with baseline operational Scope 1 and 2 GHG emissions estimated at 3,985 t CO₂-e and 56,413 t CO₂-e respectively annually. The Proposal is expected to reduce imported chemical shipping emissions by approximately 3,500 t CO₂-e to 22,000 t CO₂-e per annum depending on the shipping method considered.</p>
Objective	To comply with the GED under the EP Act, the EPP (Air) and NGER Act (refer to Section 3).
Performance targets	<ul style="list-style-type: none"> • No fugitive emissions from the Site activities observed to be impacting sensitive receptors; • No complaints related to air quality nuisance; and • Meeting GHG abatement measure KRAs.
Management strategies	<p>General controls:</p> <ul style="list-style-type: none"> • Avoid undertaking clearing, soil stripping or material handling activities during periods of high winds; • Loads shall be covered to reduce solid material escaping (dirt during construction, salt during operation etc). Chemicals will be transported in specifically designed hazardous material tankers to avoid loss of liquid or gas; • Waste to be contained and regularly removed from Site by appropriately licensed contractors to avoid odour generation (refer to Table 5.7); • Vehicles and equipment are to be serviced and maintained in accordance with manufacturer's specifications; • Daily (on use) pre-starts are to be undertaken for all vehicles and equipment to identify any wear and tear which may contribute to inefficient running and air emissions. Should such issues be identified the plant is to be tagged out and repaired prior to further use; • Vehicles and equipment to be turned off when not in use; • No burning will be permitted on the Site; and • Sustainable procurement guidelines will be applied to all preventative maintenance, repair and replacement works. <p>Construction phase specific controls:</p> <ul style="list-style-type: none"> • Maintain areas of land not required for immediate development undisturbed; • Erect solid screens or barriers around dust activities or the Site boundary; • Cover, seed or fence stockpiles and/or exposed surfaces to prevent wind erosion and stabilise exposed surfaces as soon as possible; • Seal site haul roads or apply water suppression and minimise vehicle speed on unsurfaced roads; • Use suitable dust suppression techniques (water sprays, local extraction, etc.) during use of cutting, grinding or sawing equipment; • Ensure an adequate water supply on the Site for effective dust and particulate matter suppression or mitigation, using non-potable water where possible and appropriate;

Element	Description
	<ul style="list-style-type: none"> • Use of rumble grid or a wheel washing system at property entrance points to reduce mud tracking on public roads; and • Speed limits will be signposted on the Site and where required to further control dust, these will be reduced. Vehicles must adhere to speed limits. <p>Operational phase specific controls:</p> <ul style="list-style-type: none"> • The Site will be stabilised on commencement of operations; • Minimise designated salt storage stockpile drop heights during loading/unloading activities; • The entire facility will have a closed loop design and consequently will not have any fugitive releases. The design of the facility is such that any potential sources of release will be minimal, easily identified, and immediately and automatically rectified; • Systematic collection and redirection of waste gas stream to the Cl₂ absorption unit to reduce Cl₂ to trace levels (< 1 mg/Nm³) prior to release, with the scrubber on HCl synthesis unit to reduce Cl₂ and HCl to low levels (≤ 5 mg/Nm³ and ≤ 30 mg/Nm³, respectively); and • Hydrogen and Cl₂ gas detector sensors will be installed in buildings and key locations across the Site that are linked to the plant operations to assist in identifying, managing and fixing leaks in a timely manner. Any fugitive releases will be detected and result in the immediate and automatic shutdown of that part of the plant and process. <p>Greenhouse controls:</p> <ul style="list-style-type: none"> • Implement the facility GHG abatement plan for Scope 1 and 2 emissions (refer to Appendix B); • Undertake periodic reviews of the technical readiness level and commercial readiness level of technology and process options that can improve the emissions intensity of production and/or provide new business models; • Investigate and implement measures to address Scope 3 emissions where economically viable and technically feasible e.g., contract transport and logistics providers based on their verified emissions intensity, procure goods and capital goods with lowest verified embodied emissions or reduce commuting emissions via car-pooling incentives, public transport support, and flexible work policies; and • Identify and utilise local suppliers of products and materials to reduce Scope 3 transportation associated emissions.
<p>Performance review</p>	<ul style="list-style-type: none"> • Routine and event based inspections and auditing as outlined in Section 4.6; • Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6; and • Routine review of GHG emissions and performance against KRAs (refer to Appendix B).
<p>Reporting</p>	<ul style="list-style-type: none"> • Any record or document generated through the implementation of this EMP must be retained for the life of the operation; • All incidents relating to air quality management shall be recorded in the Site incident, complaint and non-conformance register; • Any non-compliances with the GED will be reported to the DETSI Pollution Hotline within the timeframe outlined in Section 4.3.2. Records must be kept including full details of the breach and any subsequent actions undertaken; and • Annual reporting of GHG emissions to the CER as required under the NGER scheme.

Element	Description
Contingency actions	<ul style="list-style-type: none"> Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

5.4 Noise and vibration management

Table 5.5: Noise and vibration controls

Element	Description																																				
Potential risk	<ul style="list-style-type: none"> Nuisance to surrounding sensitive receptors resulting from noise and vibration associated with construction and operation. <p>NOTE (assuming engineering controls as specified):</p> <ol style="list-style-type: none"> The noise and vibration assessment undertaken by SEG (2025) identified that noise from the operation is expected to readily comply with the noise level goals and acoustic quality objectives at Yarwun Village located approximately 4 km to the south-west and have a “no response” response from shorebirds in the intertidal area located approximately 1.5 km to the east; and Vibration will be negligible with no blasting proposed and operational equipment that does not generate significant vibration. 																																				
Objective	To comply with the GED under the EP Act and the EPP (Noise) (refer to Section 3).																																				
Performance targets	<ul style="list-style-type: none"> No complaints related to noise or vibration; and No property damage as a result of vibration. 																																				
Management strategies	<ul style="list-style-type: none"> The occupational noise level from all plant and equipment is not to exceed 85 dB(A) at a distance of 1 m; Ensure all equipment complies with the sound power levels modelled by the noise and vibration assessment (SEG 2025) as provided below: <p>Table 8: Sound Power Levels ($L_{Aeq(1 hr)}$) in dB(A) for plant</p> <table border="1"> <thead> <tr> <th>Noise Source</th> <th colspan="8">Sound Power Level in dB in Octave band centre frequency (Hz)</th> </tr> <tr> <th></th> <th>63</th> <th>125</th> <th>250</th> <th>500</th> <th>1000</th> <th>2000</th> <th>4000</th> <th>8000</th> </tr> </thead> <tbody> <tr> <td>Process Plant</td> <td>141</td> <td>133</td> <td>126</td> <td>121</td> <td>115</td> <td>111</td> <td>105</td> <td>98</td> </tr> <tr> <td>Front End Loader</td> <td>104</td> <td>109</td> <td>95</td> <td>91</td> <td>101</td> <td>88</td> <td>83</td> <td>73</td> </tr> </tbody> </table> <ul style="list-style-type: none"> Vehicles and equipment are to be serviced and maintained in accordance with manufacturer's specifications, fitted with high performance mufflers in good condition and not having rattles, noisy bearings etc. Should such issues be identified the plant is to be tagged out and repaired prior to further use; Daily (on use) pre-starts are to be undertaken for all vehicles and equipment to ensure there are no excessive noise sources; Vehicles and equipment to be turned off when not in use; and Provide broad-band reversing audible alarms (rather than beepers) for mobile plant. 	Noise Source	Sound Power Level in dB in Octave band centre frequency (Hz)									63	125	250	500	1000	2000	4000	8000	Process Plant	141	133	126	121	115	111	105	98	Front End Loader	104	109	95	91	101	88	83	73
Noise Source	Sound Power Level in dB in Octave band centre frequency (Hz)																																				
	63	125	250	500	1000	2000	4000	8000																													
Process Plant	141	133	126	121	115	111	105	98																													
Front End Loader	104	109	95	91	101	88	83	73																													
Performance review	<ul style="list-style-type: none"> Routine and event based inspections and auditing as outlined in Section 4.6; and Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6. 																																				

Element	Description
Reporting	<ul style="list-style-type: none"> Any record or document generated through the implementation of this EMP must be retained for the life of the operation; All incidents relating to noise and vibration management shall be recorded in the Site incident, complaint and non-conformance register; and Any non-compliances with the GED will be reported to the DETSI Pollution Hotline within the timeframe outlined in Section 4.3.2. Records must be kept including full details of the breach and any subsequent actions undertaken.
Contingency actions	<ul style="list-style-type: none"> Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

5.5 Cultural heritage management

Table 5.6: Cultural heritage controls

Element	Description
Potential risk	<ul style="list-style-type: none"> Damage or destruction of cultural heritage items of significance to the FNBGGGTB People. <p>NOTE: the residual risk of cultural heritage impacts is considered low if managed in accordance with this EMP, given the following inherent risks:</p> <ol style="list-style-type: none"> Cultural heritage searches generated for the Planning Report (Queensland Government 2025b) did not identify any known heritage matters on the Site; and Under the ACH Act Duty of Care Guidelines (Queensland Government 2025c) the Proposal is classified as Category 5: Activities causing additional surface disturbance i.e., generally a high risk that it could harm Aboriginal cultural heritage.
Objective	To comply with the cultural heritage duty of care under the ACH Act (refer to Section 3).
Performance targets	<ul style="list-style-type: none"> Cultural heritage monitors to be present during earth disturbing works; No ground disturbance outside designated locations within the operational area; No damage or destruction of cultural heritage items; and No complaints related to management of unexpected finds.
Management strategies	<ul style="list-style-type: none"> A site approval is required before ground disturbing works can commence i.e., ground disturbance approval, with clearing controls outlined in this EMP verified as being in place prior to commencement; A cultural heritage assessment will be conducted prior to commencement of any ground disturbing activities in accordance with the ACH Act Duty of Care Guidelines (Queensland Government 2025c); Consultation to take place with the FNBGGGTB People to confirm if a cultural heritage management plan or similar is required. GWT to work with the FNBGGGTB People to develop the plan; A cultural heritage monitor will be onsite for all surface ground disturbance activities to a depth specified by the FNBGGGTB People. Records to be kept

Element	Description
	<p>of the names of the monitors, the date and area of works, along with details of any finds;</p> <ul style="list-style-type: none"> Should a potential article of cultural heritage be found, the Find – Stop – Notify – Manage procedure will be implemented i.e., FIND and item of potential cultural heritage, STOP all work at the location, the item shall not be removed or disturbed and the area flagged as a NO-GO zone, NOTIFY the FNBGGGTB People and MANAGE as agreed with the FNBGGGTB People; Should potential human remains be found these must not be disturbed and reported to the Queensland Police in the first instance; and No works can be undertaken in areas where an item of potential cultural heritage has been discovered until a formal all-clear is given by the relevant authority e.g., FNBGGGTB People and / or Queensland Police.
Performance review	<ul style="list-style-type: none"> Routine and event based inspections and auditing as outlined in Section 4.6; and Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6.
Reporting	<ul style="list-style-type: none"> Any record or document generated through the implementation of this EMP must be retained for the life of the operation; All incidents relating to cultural heritage management shall be recorded in the Site incident, complaint and non-conformance register; GWT to report unexpected finds to the FNBGGGTB People. Should it be considered possible that the find is of human remains, Queensland Police are to be informed immediately; and Records must be kept of any non-compliances with the cultural heritage duty, including full details of the breach and any subsequent actions undertaken.
Contingency actions	<ul style="list-style-type: none"> Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

5.6 Waste management

Table 5.7: Waste management controls

Element	Description
Potential risk	<ul style="list-style-type: none"> Environmental harm or nuisance caused by generated by the operation.
Objective	To comply with the GED under the EP Act and the waste hierarchy under the <i>Waste Reduction and Recycling Act 2011</i> (refer to Section 3).
Performance targets	<ul style="list-style-type: none"> Waste volumes stored on the Site to remain low at all times; No complaints related to wastes or visual amenity; No notifiable incidents (refer to Section 4.3.2); and Achievement of rehabilitation acceptance criteria on decommissioning.

Element	Description
Management strategies	<p>General controls:</p> <ul style="list-style-type: none"> • Operations will be managed in accordance with the waste hierarchy i.e., waste to first be avoided, then reduced, reused, recycled, recovered and treated, with disposal only considered when there is no viable alternative; • Wastes on the Site will be segregated to improve reuse and recycling opportunities and contained within dedicated receptacles to avoid contamination, litter or attraction of fauna; • All waste, including any hazardous wastes (e.g., hazardous goods packaging, liquid within secondary containment systems and sewage waste from pump out systems), will be contained and regularly removed from the Site by appropriately licensed contractors in accordance with requirements under the EP Act; • Waste materials are not to be buried or burnt on the Site; and • Cigarette butt disposal bins are to be provided in designated smoking areas. <p>Operational phase specific controls:</p> <ul style="list-style-type: none"> • As per Table 5.2. <p>Decommissioning phase specific controls:</p> <ul style="list-style-type: none"> • As per Table 5.1.
Performance review	<ul style="list-style-type: none"> • Routine and event based inspections and auditing as outlined in Section 4.6; and • Performance and proposed amendments (if any) will be reviewed annually as outlined in Section 6.
Reporting	<ul style="list-style-type: none"> • Any record or document generated through the implementation of this EMP must be retained for the life of the operation; • All incidents relating to waste management shall be recorded in the Site incident, complaint and non-conformance register; and • Any non-compliances with the GED will be reported to the DETSI Pollution Hotline within the timeframe outlined in Section 4.3.2. Records must be kept including full details of the breach and any subsequent actions undertaken.
Contingency actions	<ul style="list-style-type: none"> • Incidents and non-conformances will be investigated to determine the magnitude of the problem and identify and implement corrective and preventative actions; and • Should the management strategies as outlined in the EMP prove insufficient to meet the performance objectives the Operations Manager will further investigate and amend the EMP / communicate amendments accordingly.

6 Management Review

This EMP is a dynamic document that will be reviewed periodically to ensure it remains fit-for-purpose. The EMP is the guiding document for the broader Site EMS that is to be ISO 14001 certified for operations.

As noted in **Section 3**, this DRAFT EMP will be reviewed and updated, as required, on receipt of approval conditions.

Thereafter, the EMP will be reviewed annually at a minimum to ensure it remains fit-for-purpose, and updated as required. Triggers for revision include, but are not limited to:

- EA, legislation or other government policy / programme changes;
- Significant changes are made to GWT systems or personnel responsibilities relevant to environmental management;
- Deficiencies or inconsistencies are noted during implementation of the EMP;
- Corrective actions identified from near misses or incidents, including external complaints; and
- Inclusion of an additional contingency measures, to address items identified during incident investigations, various inspections, performance reviews and / or risk assessment findings.

Any material changes to this EMP will be communicated to the personnel responsible to implement the amended requirements, as soon as practicable after the update.

The Site's environmental performance, risk register and incident, complaint and non-conformance register will be reviewed annually. Performance against this EMP and any changes to the EMP (or EMS more broadly) triggered, would form a part of these discussions.

In addition, the success of the KRAs (refer to **Appendix B**), and other ESG performance metrics still to be agreed, will be tied to executive key performance indicators as appropriate to their level of delegation and operational control.

7 References

- Blackash Bushfire Consulting (Blackash 2025) Project Halogen: Chlor-Alkali Facility – Gladstone State Development Area (Ref: J4104, Version 1.2, dated 10 November 2025).
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- CQG Consulting (CQG 2025a) Project Halogen: Preliminary Significant Impact Assessment (Ref: 25054, Rev 1, 11 November 2025)
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Limitations

This report has been prepared for GWT, for issue to the CG within the context of the GSDA Development Scheme May 2022 SDA requirements and DETSI for the EA submission.

CQG¹ takes no responsibility and disclaims all liability for any loss or damage that any party may suffer as a result of using or relying on any such information or recommendations contained in this report.

CQG has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above. No other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

Where information has been provided to CQG, this has been referenced in the report. In preparing this report, CQG has relied upon, and presumed accurate, any information provided by GWT and sub-consultants on its behalf and / or from other sources as referenced within. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that the conclusions expressed in this report may change.

No assessment beyond that specified in the document has occurred.

These limitations must be read in conjunction with other limitations noted within the report, and attachments to the report.

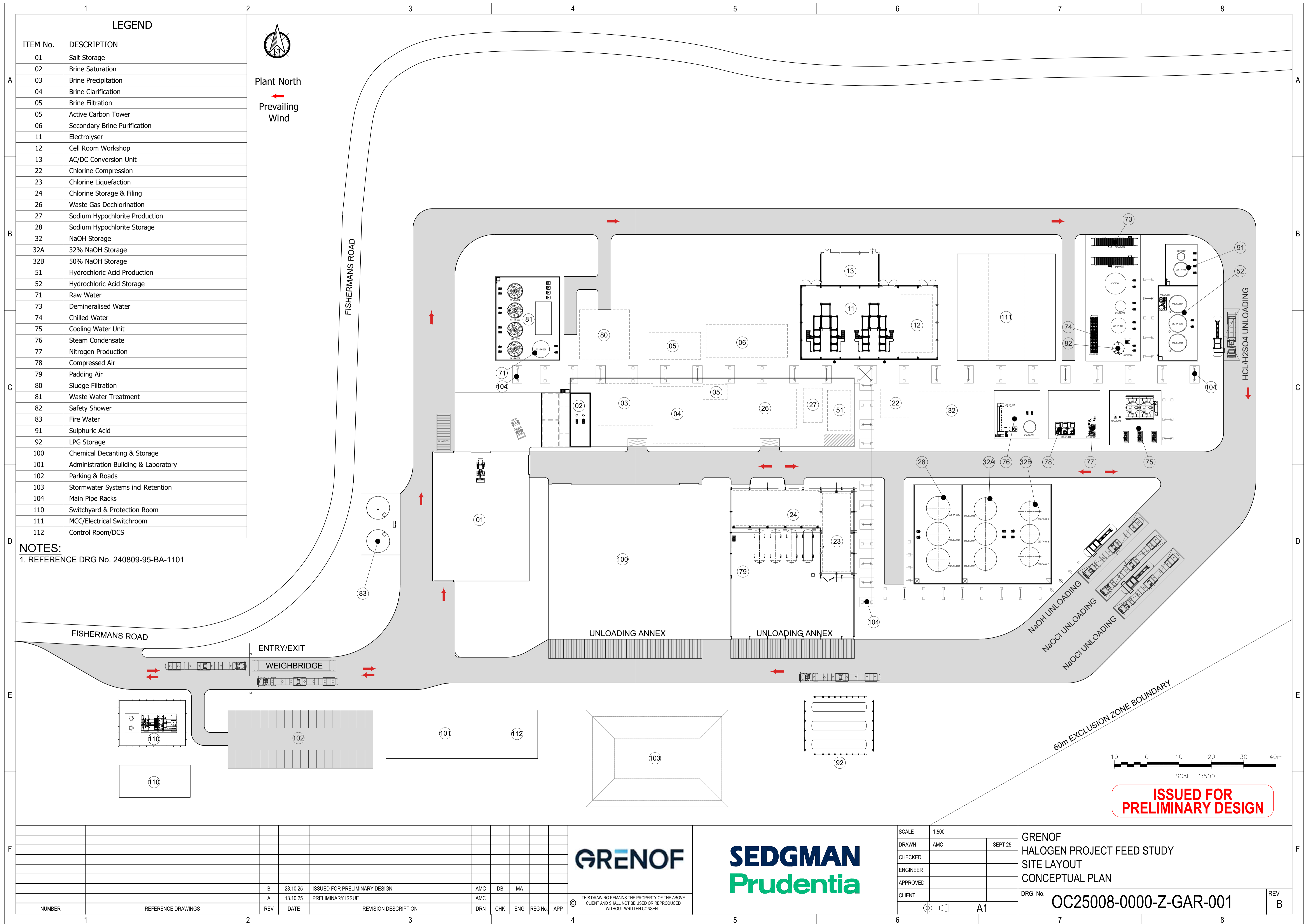
Should further information become available regarding the Project, CQG reserves the right to review the report in the context of the additional information.

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DRAFT

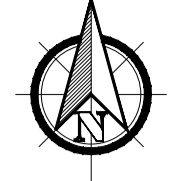
APPENDIX A:

Conceptual Design Layout



LEGEND

ITEM No.	DESCRIPTION
01	Salt Storage
02	Brine Saturation
03	Brine Precipitation
04	Brine Clarification
05	Brine Filtration
05	Active Carbon Tower
06	Secondary Brine Purification
11	Electrolyser
12	Cell Room Workshop
13	AC/DC Conversion Unit
22	Chlorine Compression
23	Chlorine Liquefaction
24	Chlorine Storage & Filing
26	Waste Gas Dechlorination
27	Sodium Hypochlorite Production
28	Sodium Hypochlorite Storage
32	NaOH Storage
32A	32% NaOH Storage
32B	50% NaOH Storage
51	Hydrochloric Acid Production
52	Hydrochloric Acid Storage
71	Raw Water
73	Demineralised Water
74	Chilled Water
75	Cooling Water Unit
76	Steam Condensate
77	Nitrogen Production
78	Compressed Air
79	Padding Air
80	Sludge Filtration
81	Waste Water Treatment
82	Safety Shower
83	Fire Water
91	Sulphuric Acid
92	LPG Storage
100	Chemical Decanting & Storage
101	Administration Building & Laboratory
102	Parking & Roads
103	Stormwater Systems incl Retention
104	Main Pipe Racks
110	Switchyard & Protection Room
111	MCC/Electrical Switchroom
112	Control Room/DCS



Plant North
 ←
 Prevailing Wind

NOTES:
 1. REFERENCE DRG No. 240809-95-BA-1101



ISSUED FOR PRELIMINARY DESIGN

NUMBER	REFERENCE DRAWINGS	REV	DATE	REVISION DESCRIPTION	DRN	CHK	ENG	REG No.	APP
		B	28.10.25	ISSUED FOR PRELIMINARY DESIGN	AMC	DB	MA		
		A	13.10.25	PRELIMINARY ISSUE	AMC				



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SCALE	1:500
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CHECKED	SEPT 25
ENGINEER	
APPROVED	
CLIENT	
	A1

GRENOF	REV
HALOGEN PROJECT FEED STUDY	B
SITE LAYOUT	
CONCEPTUAL PLAN	
DRG. No.	
OC25008-0000-Z-GAR-001	

DRAFT

APPENDIX B:

GHG Abatement Plan KRAs (excerpt from Katestone 2025b)

Table 10 Assessment of proposed GHG mitigation measures

KRA	Mitigation measure	Timeframe	Risks	Opportunities	Industry Standard	Emissions reduction estimate for the LOP (t CO ₂ -e)
KRA 1	Reduce production technology electricity use by 25% against the base case	Immediate	<ul style="list-style-type: none"> High capital costs lead to procurement of less efficient production technologies 	<ul style="list-style-type: none"> Installation of highest efficiency production technologies provides best return on investment through optimal chemical production and reduced emission intensity of production 	Best	817,199
KRA 2	Reduce Scope 2 emissions with investment in renewable energy technology where feasible and cost-effective	Immediate	<ul style="list-style-type: none"> Inadequate capacity to support electricity demand if not correctly sized in design leading to higher emission intensity of production Cost overruns, due to high consumption or underestimation of initial costs, delays causing extra labour or equipment costs Increased maintenance demands or poorly integrated backup systems 	<ul style="list-style-type: none"> Greater self-reliance through on-site generation and storage enabling new revenue streams (e.g. selling of electricity) and reduces exposures to future grid price volatility Eligibility of incentives and green financing, strengthening tender competitiveness and stakeholder confidence against climate risks 	Best	TBD
KRA 3	Reduce emissions from onsite LPG combustion for boiler by <15% from the base case	Immediate	<ul style="list-style-type: none"> Cost overruns from workforce training, lead times in procurement and design and construction requirements 	<ul style="list-style-type: none"> Greater energy self - reliance (when paired with KRA 4) improves margins 	Best	33,425

KRA	Mitigation measure	Timeframe	Risks	Opportunities	Industry Standard	Emissions reduction estimate for the LOP (t CO ₂ -e)
			<ul style="list-style-type: none"> Complete electrification and hydrogen fueled options may have low TRLs and CRLs 			
KRA 4	Reduce GHG emissions due to transport fuel combustion by <95% through use of EVs	Immediate	<ul style="list-style-type: none"> Additional charging and electrical-upgrade requirements can drive cost overruns and added labour Reduced overall fire incidence, however fire from misuse or damage can be more intense and harder to extinguish 	<ul style="list-style-type: none"> Lower reliance on fossil fuels and less exposure to volatile fuel supply chains Lower operating cost from higher drivetrain efficiency 	Best	139,025
KRA 5	Reduce potential fugitive refrigerant leakage emissions by > 600 t CO ₂ -e per annum	Immediate	<ul style="list-style-type: none"> Additional system requirements and workforce training can drive cost overruns 	<ul style="list-style-type: none"> Improved low temperature energy performance, increasing production efficiency Natural refrigerants support lower emission production, increasing green investment opportunities and lowers supply chain risks associated with HFC phase down 	Best	31,820
KRA 6	Investigate offsetting residual emissions where necessary and cost-effective	As practicable	<ul style="list-style-type: none"> Current technical and economic feasibility inadequate 	<ul style="list-style-type: none"> Building sustainability strategy and goals 	Emerging	TBD

DRAFT

APPENDIX C:

Erosion and Sediment Control Plan (Construction Phase)

**EROSION &
SEDIMENT CONTROL PLAN (ESCP)**
FISHERMANS ROAD, YARWUN
PROJECT HALOGEN CHLOR-ALKALI FACILITY



CLIENT: CQG CONSULTING

REFERENCE: 25-0204/R4211

VERSION: C

DATE: 12-11-2025



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1 SCOPE

Topo were engaged by CQG Consulting to develop a Certified Professional in Erosion and Sediment control (CPESC) certified Erosion and Sediment Control Plan (ESCP) for works associated with the construction of the proposed Chlor-Alkali Facility at Fishermans Road, Yarwun.

CQG Consulting has been engaged to prepare a development application (DA) for a material change of use (MCU) for a concurrence environmentally relevant activity (ERA) 7(6d) Chemical manufacturing: manufacturing, in a year, more than 100,000 tonnes of inorganic chemicals (proposed Chlor-Alkali facility). The project is referred to as 'Project Halogen'. The project is located within the Gladstone State Development Area (GSDA). This ESCP only covers the construction phase of the project. During operations the site will be stabilised and managed in accordance with the separate Stormwater Management Plan (SMP).

1.1. GUIDELINES

This ESCP has been prepared in accordance with the following documents:

- + Best Practice Erosion and Sediment Control (International Erosion Control Association (IECA), 2008)
- + Best Practice Erosion and Sediment Control (BPESC) - Appendix B – Sediment Basin Design and Operation (IECA, 2018)
- + Guideline Stormwater and environmentally relevant activities (Department of Environment and Science (DES), 2014)
- + Queensland Urban Drainage Manual (QUDM) (Institute of Public Works Engineering Australia Queensland (IPWEAQ), 2017)

1.2. CERTIFICATION

I, Steven Chamberlain, certify that this Erosion and Sediment Control Plan (ref: R4211) has been prepared to satisfy the intent and minimum standards nominated within the guidelines listed in Section 1.1.




CPESC No: 6,599 – RPEQ No: 15,545

1.3. REVISION

VERSION	DATE	AUTHOR	REVIEWER	APPROVED
DRAFT	14-08-2025	R. Kleijn	S. Chamberlain	S. Chamberlain
A	13-10-2025	R. Kleijn	S. Chamberlain	S. Chamberlain
B	29-10-2025	R. Kleijn	S. Chamberlain	S. Chamberlain
C	12-11-2025	R. Kleijn	S. Chamberlain	S. Chamberlain

2 PROJECT DESCRIPTION

2.1. LOCATION

The proposed Chlor-Alkali Facility will be constructed within Lot 1 on MPH32292 (56 Fishermans Road, Yarwun) and Lot 1 on SP200899 (26 Landing Road, Yarwun). The facility includes upgrading the access along Fishermans Road between the facility and the intersection with Landing Road.

The project area is approximately 7.65 ha which includes plant and ancillary facilities. The project components will consist of a chlor-alkali plant and ancillary facilities, including office, car parking and utilities.

The general locality of works is highlighted within Figure 1.



Figure 1 - Site Locality Project Halogen (Source: CQG Consulting)

2.2. PROJECT WORKS

The plant will have a product capacity of 160,000 tonnes per annum (tpa), with product outputs consisting of sodium hydroxide (NaOH) (caustic soda), liquid chlorine (Cl₂), hydrogen chloride (HCl), and sodium hypochlorite (NaOCl). The chlor-alkali production facility will also produce derivative chemicals from the primary products, which include sodium hypochlorite (NaOCl) and hydrochloric acid (HCl).

The design will ensure a fully contained water management system with no contaminated wastewater discharged to the environment. Comprehensive bunding, collection and treatment systems will be designed to prevent contamination during spill scenarios.

Works associated with the project include, but may not be limited to:

- + Clearing and grubbing,
- + Topsoil stripping,
- + Bulk earthworks, cut to fill operations generally in line with the bulk earthworks strategy. Civil design will aim to balance the cut and fill such that earthworks will not require importation of fill material,
- + Stockpiling and management of any borrow and/or fill areas,
- + Installation of open drains and detention / sediment ponds for site runoff,
- + Structural works associated with buildings and miscellaneous structures, and
- + Site access road and internal roads/tracks.

3 SITE DESCRIPTION

3.1. CLIMATE

Based on historic rainfall data the period between October to March presents the greatest rainfall with approximately 76 % of the annual rainfall typically occurring during this period. As far as practical, all efforts should be made to reduce exposed areas to that reasonably manageable during this period. Based on the estimated construction duration, the project will extend through at least one wet season.

Historic rainfall for the region, derived from data represented by the closest Bureau of Meteorology Station (Gladstone Airport, approximately 10 km from site) is presented below in Figure 2.

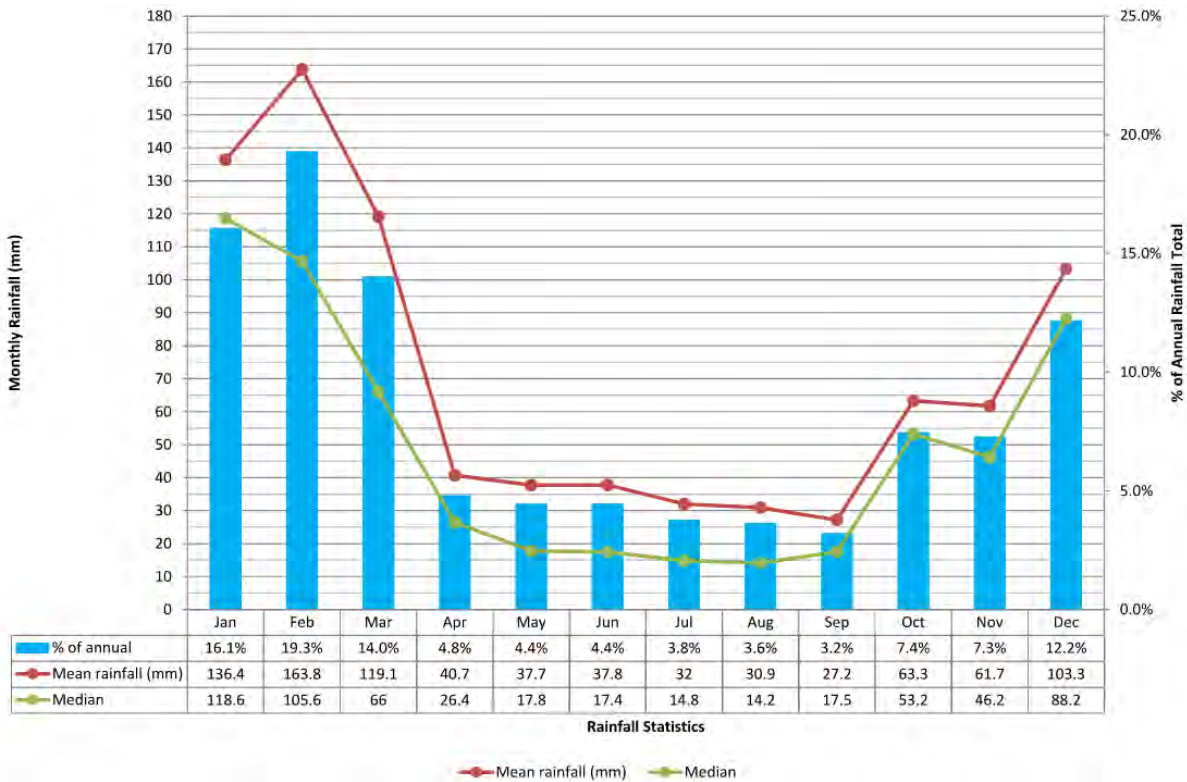


Figure 2 - Historic Rainfall (Source: BoM)

3.2. DRAINAGE & HYDROLOGY

The topography is quite consistent, and the site generally drains from northwest to southeast. Boat Creek runs along the southern boundary, approximately 250 m away from the site. Review of topographic data indicates external catchment to the west of Landing Road does not enter the site, but is directed to Boat Creek. Refer to Appendix A for further details.

The proposed works can be divided into two internal catchments; the access road works in Fishermans Road between Landing Road and the facility, and the facilities’ footprint itself. The drainage path along Fishermans Road intersects the two catchments, as illustrated in the catchment plan included as Figure 3.

An external catchment of approximately 6 hectares, comprising the southernmost portion of Lot 1 RP614039 and Fishermans Road, reports to the site’s western boundary. The intent of the ESCP is to divert any external catchments around the works, whilst maintaining that runoff as ‘clean water’.

The landscape within the project area is characterised by existing bushland.

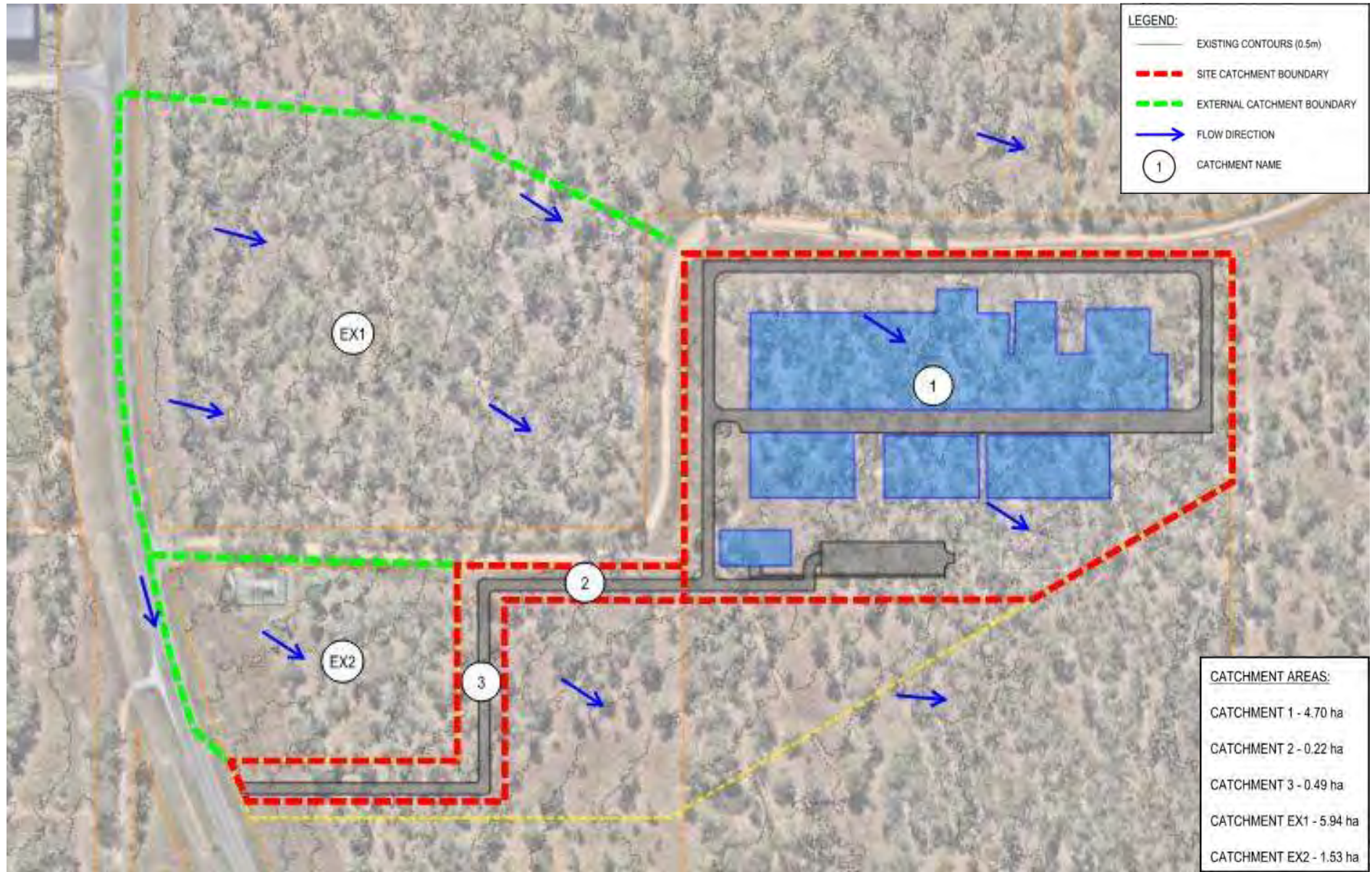


Figure 3 - Topography and Drainage Features – Chlor-Alkali Facility

3.3. SOILS

3.3.1. SOIL MAPPING

The soil survey of the Land Systems of the Calliope Area, covers parts of the Calliope and Gladstone areas at a 1:250,000 mapped scale. The survey was accessed via Queensland Globe and a single soil unit is located within the project area. A summary of the mapped soil unit is given in Table 1 and illustrated in Figure 4. The soil sample is classed as CCL382 and was taken nearby in Fishermans Road.

Table 1 - Summary of Soils

SOIL UNIT REF.	DESCRIPTION	CONCEPT	SPATIAL LOCATION
Nu – Nullegai	Sodosol Brown Mottled-Subtranic Eutrophic	Fine sandy loam over silty loam	Majority of Proposed Facility

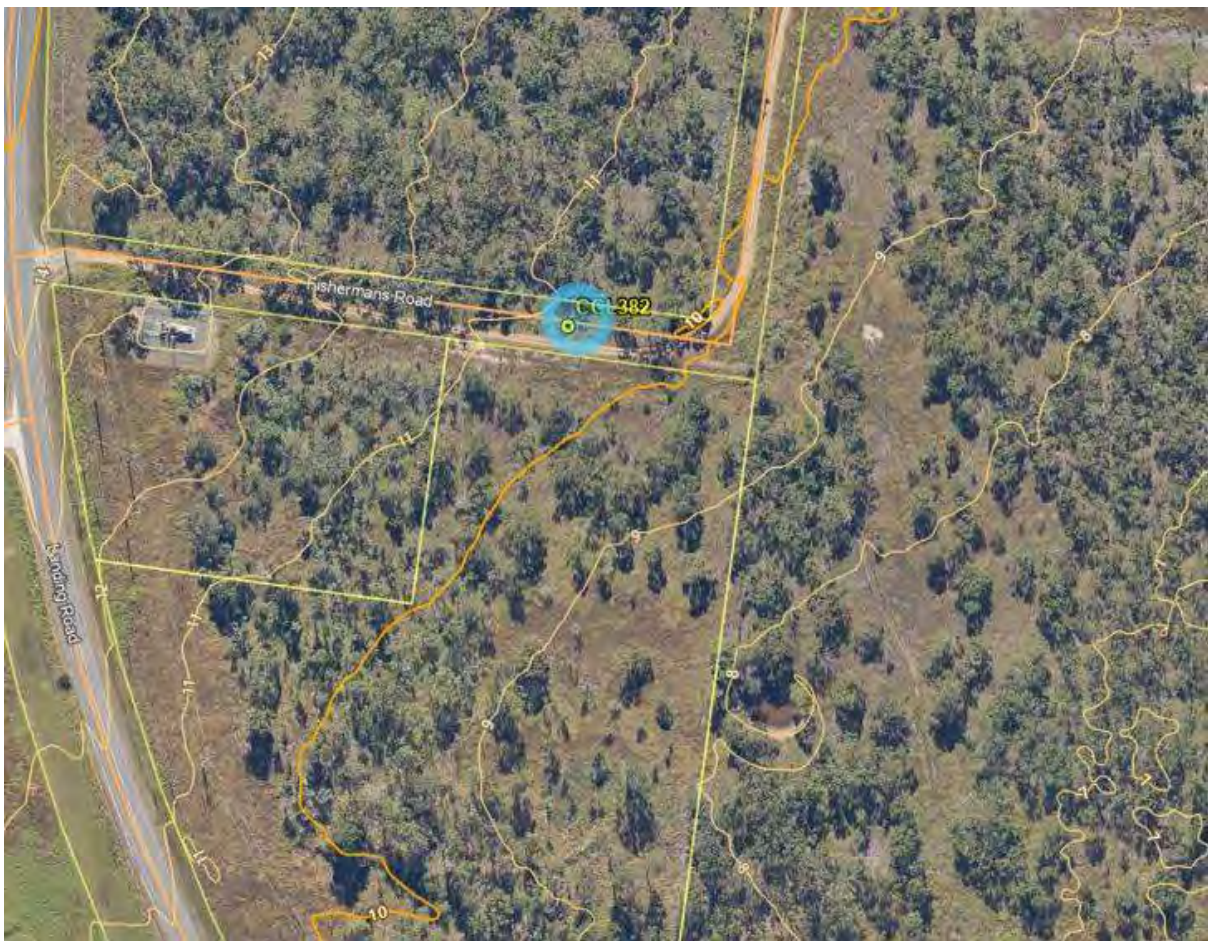


Figure 4 - Soil Site Mapping – Chlor-Alkali Facility (Source: Queensland Globe)

Sodosols are texture-contrast soils with impermeable subsoils due to the concentration of sodium. Generally, these soils have a low-nutrient status and are very vulnerable to erosion and dryland salinity when vegetation is removed.

3.3.2. SOIL SAMPLING AND ANALYSIS

A geotechnical investigation was performed by Grenof Water Technologies (B-0645.00 R1, dated 21 October 2025).

The mapped soil landscape unit for the area is Narrows (Nw), generally described as colluvial and alluvial fans below the coastal range along the Narrow Strat, north of Gladstone. Soils are typically bleached, loamy or silty surface soils with sodic texture contrasts. Vegetation is mostly eucalypt woodland, swamp mahogany, tea tree understorey, and gum-topped box woodland. The site is not within an area mapped as potentially containing acid sulfate soils.

Boreholes (BH01–BH03) were advanced to 15 m below ground level, encountering a consistent alluvial soil profile comprising cohesive and granular materials. Groundwater seepage occurred between 6.2 m and 6.5 m below ground level (BGL).

Table 2 - Soil Description

UNIT	ORIGIN	DESCRIPTION	TYPICAL DEPTH (m BGL)
1	Topsoil	Silty sand, fine to coarse, dark brown with roots.	0–0.05
2a	Cohesive Alluvial Soil	Silty clay (low–medium plasticity, some high), trace sand and gravel, very stiff–hard	~0–6.2
2b	Cohesive Alluvial Soil	Sandy clay (low–medium plasticity), with interbedded silty clay; very stiff–hard	~6.2–12.8
2c	Cohesive Alluvial Soil	Lower silty clay (medium–high plasticity), trace sand and gravel, very stiff–hard	Below ~12 m
3a	Granular Alluvial Soil	Silty sand with gravel, locally gravelly clay; medium dense–very dense	Up to 9.5
3b	Granular Alluvial Soil	Silty gravel with sand; dense–very dense	Extending > 15 m

Laboratory analyses included Atterberg limits, PSD, CBR, compaction, shrink–swell index, soil chemistry, and aggressivity. The key observations were:

- + Plasticity: Generally low–medium, locally high in cohesive units (silty clays)
- + CBR (soaked, 95 % SMDD): Typically 3 – 5 %, consistent with alluvial clay subgrades
- + Shrink–Swell Potential: Moderate, requiring attention for foundation design
- + Electrical Conductivity: 94–400 $\mu\text{S}/\text{cm}$ (non-aggressive to mildly aggressive)
- + pH: Neutral to slightly alkaline (6.8 – 8.6)
- + Chloride: 51 – 240 mg/kg (low)
- + Sulphate: < 30 – 36 mg/kg (low)
- + Exchangeable Sodium Percentage (ESP): 13 – 22 %, indicating strongly sodic soils
- + Cation Exchange Capacity: 3.5 – 18 meq/100 g (low to moderate)
- + Emerson Crumb tests indicating Emerson Class Numbers 1 and 2 (highly dispersive)

Based on the Emerson Class numbers, Exchangeable Sodium Percentage above 12 % and relatively low Cation Exchange Capacity, site soils are likely highly dispersive and will need to be managed accordingly during construction.

3.3.3. DISPERSIVE SOIL MANAGEMENT

As discussed, portions of the works comprise sodic soils, which are highly likely to be dispersive. In the event that dispersive soils are identified on the site, it is recommended a Dispersive Soil Management Plan (DSMP) be prepared prior to tendering and construction commencing. The following section summarises the proposed management and treatment to address dispersive soils on the project.

Identify and avoid – this approach is limited in terms of practical application to areas outside of project works. Consideration should be given to limiting disturbance and excavation of soils where not required, as a means to reduce the reliance on other management measures below.

Separation of topsoil and subsoil – good construction practices will dictate that topsoils be stripped and stockpiled separately to subsoils. Existing topsoil depths are sometimes sufficient to provide a protective layer of non-sodic material over subsoils.

Topsoil stockpiles which are planned to remain unused for prolonged periods of time should be stabilised using mulch, hydromulch or a permeable, biodegradable matting or mesh to allow sunlight and moisture to penetrate and maintain biological activity. Ensure stockpiles do not exceed 1.5 m height to prevent overheating.

Subsoil stockpiles should be compacted and covered using an impermeable cover such as plastic or have a layer of non sodic (and non erosive) material applied.

Chemical amelioration – this is the recommended approach as it addresses the underlying soil chemistry imbalance resulting in soil sodicity. Chemical amelioration by mixing of gypsum with identified subsoils is recommended. Reference should be made to the abovementioned technical note for gypsum application rates, or additional testing be undertaken to determine rates if not available.

Stockpiles of non sodic and sodic soils are to be clearly identified and kept separated at all times, to allow amelioration to occur efficiently.

3.3.3.1. SURFACE MATERIAL TREATMENT

Chemical amelioration shall be undertaken to address the underlying soil chemistry imbalance resulting in soil sodicity and ultimately dispersion. Chemical amelioration by mixing of gypsum with identified subsoils is recommended.

Treatment of dispersive soils typically requires gypsum application rates between 5 and 20 t/ha, however in severe cases this may be exceeded. Application rates consider a gypsum purity of 80 % to achieve a sodium percentage within soil of 5 % or less, which is considered non-sodic. Application rates are provided for treatment depths of 0.2 and 0.3 m, being the minimum and recommended depths respectively. It is recommended that application rates be correlated with sample depth and work areas to provide a suite of standardised treatments across the alignment based on degree of treatment required, stage of works and ultimate use of material.

3.3.3.2. DRAINAGE PROTECTION

In the presence of dispersive soils, where practical, water should be diverted away from such materials. Drains must not be excavated into dispersive soils without either lining with an impermeable material, lining with non-erosive, non-sodic material or gypsum treated material placed and stabilised to handle maximum flow velocities for the connected catchment up to the design event. Construction of large (permanent) diversion drains must be undertaken offline (i.e. without potential for inflow) as much as possible and scheduled for the drier winter period.

The use of rock check dams (or similar velocity control measures) should not be used in locations with potential dispersive soils exposed within the drainage path, unless the drainage paths are lined with a layer of non-dispersive soils.

The use of rock protection at inlets and outlets of culverts, chute lining or other drainage locations should account for potential dispersive soils and incorporate a layer of gypsum treatment to underlying soils.



3.3.3.3. TEMPORARY EROSION CONTROL DURING EARTHWORKS

A focus on erosion control throughout the construction phase is considered the most effective approach. Considering the wet season – dry season nature, a risk based approach should be undertaken to manage the risk of dispersion during construction works. This approach will be dictated by activities onsite and should consider rainfall forecasts, upcoming works, potential to limit extent and duration of exposure during high rainfall risk periods and contingency measures which can be employed to manage areas in the event of rainfall. Such measures would include assessment of temporary drainage to divert (where practical) all runoff away from dispersive soils, compaction of exposed areas to limit soil / water interaction, application of gypsum or ground cover treatment and maintenance of downslope sediment controls.

3.3.3.4. REVEGETATION AND LANDSCAPING PREPARATION

Application of gypsum and potentially other soil ameliorants nominated within the landscaping specification shall be applied by ripping and incorporation to depths of 0.3 m and subsequent light re-compaction of subsoil prior to placement of topsoil and landscaping treatment. Consideration should be given to the use of landscaping treatments which provide immediate or very rapid stabilisation (i.e. hardstand or turf as opposed to grass seed) as a means to protect soils, reduce erosion and limit potential scouring and maintenance.

Reference shall be made to the project DSMP for additional guidance on soil characteristics, material handling, stockpiling and reuse and treatment.





4 EROSION RISK ASSESSMENT

An erosion risk assessment has been conducted using the Revised Universal Soil Loss Equation (RUSLE). The calculated soil loss is then used to determine the level of sediment control required, as well as stabilisation and staging requirements.

$$A = K \times R \times LS \times P \times C$$

Equation 1 (IECA 2008)

Where:

- A is the predicted soil loss per hectare per year
- K is the soil erodibility factor
- R is the rainfall erosivity factor
- LS is the slope length/gradient factor
- P is the erosion control practice factor
- C is the ground cover and management factor

4.1. K-FACTOR – SOILS

The soil erodibility factor (K-factor) is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Soil texture is the principal component affecting the K factor, but soil structure, organic matter and profile permeability also contribute.

To account for the variety of dispersive soil textures likely to be encountered, including in-situ and unknown imported fill properties, a K factor of 0.077 was determined for the site. This is considered representative of a range of soil textures including sodic clays. This is consistent with CSIRO mapping data source from the Queensland Spatial Catalogue (QSpatial – RUSLE K factor) but may need to be updated based on the results of specific soil testing.

4.2. R- FACTOR – RAINFALL

The rainfall erosivity factor (R factor), is a measure of the ability of rainfall to cause erosion. It is the product of two components (1) total energy and (2) intensity for each rainfall event. R factors are published for a range of locations throughout Queensland, including Rockhampton, which is considered reflective of the project area. Reference to Table E1 of IECA (2008) indicates an annual R factor value of 3,684.

Monthly R factor values are provided in Table 3. These values are provided for reference only but may be used in scheduling high risk works, such as those associated with major drainage for periods of lowest rainfall erosivity.

Table 3 - Monthly R-factor for Rockhampton (IECA, 2008)

J	F	M	A	M	J	J	A	S	O	N	D
769	806	497	144	166	92	66.2	69.9	58.9	169	276	570

4.3. LS - SLOPE-LENGTH

Slope length and slope gradient have substantial effects on soil erosion by water. The two effects are represented by the slope length factor (L) and the slope steepness factor (S). In application of RUSLE the two are evaluated together as a numerical representation of the length-slope combination (LS factor).

Slope (%) and length (m) are fairly consistent across the site, so an average factor has been attributed to each sub-catchment. Slope is around 1.5 % for the majority of the site and based on the recommendations of IECA (2008) for temporary cross drainage during construction, maximum slope lengths should be limited to 80 m during earthworks.





4.4. C-FACTOR - COVER

Within RUSLE, the C-factor measures the combined effect of all the interrelated cover and management variables adopted over the site. It also represents non-structural methods for controlling erosion (i.e. covering exposed areas with various erosion control products to minimise raindrop impact or stabilisation by temporary or permanent vegetation).

Soil loss estimates have adopted a default value of 1.0, representing an exposed surface with no ground cover. Considering the seasonal variability of the region a reliance on temporary erosion control throughout the wet season will be critical, with soil loss estimates adopting a conservative C factor of 0.1 where erosion control is applied. It is envisaged that a high level of temporary erosion control will be achieved (and maintained during active works) by a combination of industry accepted means including application of soil binder/polymer, erosion control mat (i.e. geotextile, jute, plastic sheeting), mulch and gravel sheeting.

4.5. P-FACTOR – PRACTICE

The P-factor measures the combined effect of all support practices and management variables. The P factor is decreased by practices that reduce both the velocity of runoff and the tendency of runoff to flow directly downhill. It also represents structural methods for controlling erosion. An industry accepted default value of 1.3 has been adopted as per Table E11 of IECA (2008) for all construction areas.

4.6. ESTIMATED SOIL LOSS SUMMARY

A detailed assessment of the erosion risk has been undertaken for the proposed facility to provide a simplified and standardised approach to managing erosion and identification of the minimum sediment control measures. The findings of this assessment are summarised in Table 4.

Table 4 - Erosion Risk Calculations

CATCHMENT ID	AREA (HA)	R	K	SLOPE (%)	LS ¹	P	C	A (t/ha/yr)	CONTROL
1	4.70	3,684	0.077	1.5	0.41	1.3	1	150	TYPE 1
2	0.22	3,684	0.077	1.5	0.31	1.3	1	114	TYPE 2
3	0.49	3,684	0.077	1.5	0.31	1.3	1	114	TYPE 2

Table Notes:

¹ Default slope length of 80 m conservatively applied Catchment 1, and 40 m for access roads (i.e. Catchments 2 & 3)





5 EROSION CONTROL

Erosion control refers to the management of the working area to prevent or reduce soil particles being mobilised or entrained in water. The soil loss estimates from Section 4.6 Estimated soil loss summary and resulting erosion risk specifies the extent of erosion control required on site. Given the seasonal variation in rainfall, as described in Section 3.1, implementation of erosion control measures should be based on monthly rainfall erosivity as presented in Table 4.4.4 of IECA (2008) for the Rockhampton region and presented here as Table 5.

Table 5 - Monthly Erosion Risk Rating Based on Monthly Rainfall Erosivity

LOCATION	J	F	M	A	M	J	J	A	S	O	N	D
Rockhampton	H	H	H	M	M	L	L	L	VL	M	M	H

E = Extreme, H = High, M = Moderate, L = Low, VL = Very Low erosion risk.

The standard best management practice requirements for erosion control are outlined below in Table 6.

Table 6 - Erosion Risk Rating Based on Soil Loss and Required Management (adapted from Table 4.4.7 of IECA, 2008)

EROSION RISK RATING	SOIL LOSS RATE (T/HA/YEAR)	ADVANCE LAND CLEARING ALLOWED (WKS WORK)	MAX DAYS TO STABILISATION AND % COVER	STAGED CONSTRUCTION AND STABILISATION OF EARTH BATTERS >6H:1V	STOCKPILES STABILISED
Very Low	0 to 150	8	30 (60%)		
Low	150+ to 225	8	30 (70%)		
Moderate	225 to 500	6	20 (70%)	✓	
High	500 to 1500	4	10 (75%)	✓	✓
Extreme	> 1500	2	5 (80%)	✓	✓

The following general erosion control strategy is proposed.

- + Retain existing vegetation for as long as possible, with an emphasis placed on existing drainage lines and flow paths,
- + Stage topsoil stripping to coincide with work program and limit to areas immediately prior to active earthworks,
- + Stabilise temporary diversion bunds with soil binder or other approved measures. Diversion drainage features to be formed with topsoil, non-sodic subsoils or gypsum ameliorated soils,
- + Establish stabilised site access points (where required and practical),
- + Progressively stabilise exposed areas by placement of gravel per final design. For locations known to comprise sodic soils, apply gypsum to 0.2-0.3 m of soil surface prior to placement of gravel material, and
- + Prior to rainfall, apply soil binder to exposed areas as a temporary measure with a heavy application being applied to high risk areas such as batters.

It should be recognised that application of the above strategy will greatly reduce the risk of erosion and reliance on sediment controls, as well as reducing ongoing maintenance of sediment control and removal/handling of sludge captured within the basins.





5.1. EROSION CONTROL DURING WORKS STAGES

Erosion control has been further separated into applicable project phases to identify controls relevant to each stage of construction, from clear and grub to landscaping.

5.1.1. CLEAR AND GRUB

- + Educate and inform site personnel about the presence of sodic soils and required management, including during stripping of topsoil,
- + Establish clearly flagged areas to prevent over-disturbance, and restrict stripping to approved areas only,
- + Stabilise diversion bunds and temporary drainage features with nominated measures,
- + Stage topsoil stripping to coincide with areas of active earthworks only,
- + Establish stabilised site access points, and
- + Stabilise any high traffic areas, such as haul routes or site facilities, with clean gravel, placed on non-dispersive or ameliorated material.

5.1.2. CUT AND FILL EARTHWORKS

- + Minimise occurrence and duration of stockpiling,
- + Maintain stabilised site access points, haul routes and facilities areas,
- + Carry out dust suppression and monitor air quality during high winds, noting that some works may be discontinued if excessive dust is observed,
- + Roughen earthworks areas, including batters,
- + Progressively stabilise steep batters if practical, using temporary erosion control (binders and blankets) or by expediting final treatment, and
- + Ameliorate or bury dispersive soils beneath non-dispersive material.

5.1.3. DRAINAGE STRUCTURES

- + Retain existing ground cover in drainage lines as long as possible, restricting disturbance to immediately before active works,
- + Expedite construction works in drainage lines, monitoring weather forecasts and maximising production during dry weather,
- + Implement temporary erosion control (erosion control mat or soil binder) prior to rainfall if permanent treatments are not complete, and
- + Incorporate gypsum treatment within drainage structures prior to placement of final treatment.

5.1.4. LANDSCAPING

- + Progressively complete landscaping throughout the facility wherever possible, ensuring site stabilisation is completed as soon after earthworks as possible
- + Combine temporary controls with long term stabilisation measures, such as binders, mulch or hydromulch to provide immediate stabilisation while landscaping establishes
- + Prior to high risk periods (i.e. wet season) seek to reduce exposed areas as much as practical and stabilise inactive work areas, considering the duration of inactivity and likelihood of significant rainfall
- + Rehabilitate all areas outside the main alignment, including haul routes, laydowns, stockpile areas and other facilities.



6 DRAINAGE CONTROL

Drainage control considers three main principles:

1. diverting external flow before it enters site,
2. directing site runoff to an appropriate sediment control, and
3. ensuring runoff is conveyed in a non-erosive manner.

6.1. DESIGN STANDARD

In accordance with IECA (2008) Table 4.3.1 and IECA (2018) Table B35 the recommended drainage design standard for temporary drainage works is summarised in Table 6. Where possible, it is recommended that drainage be constructed per the final design standards to reduce the need for re-work and reduce the likelihood of damage occurring during storm events that exceed the minimum design standards for temporary drainage works. The minimum temporary drainage design standard is the:

- + 2-year ARI for temporary drains which will be operational for less than 12 months,
- + 5-year ARI for temporary drains which will be operational for 12 to 24 months, and
- + 10-year ARI for temporary drains which will be operational for more than 24 months.

Table 7 - Drainage design standards

DRAINAGE FEATURE	DESIGN CRITERIA	ANTICIPATED DESIGN LIFE
Temporary drainage/diversions ^[1]	1 in 2-year ARI	< 12 months
	1 in 5-year ARI	12 – 24 months
	1 in 10-year ARI	> 24 months
Temporary culverts	1 in 1-year ARI	Minimum 1 in 1 year ARI hydraulic capacity wherever reasonable and practicable.
Sediment basin emergency spillways ^[2]	1 in 10-year ARI	< 3 months
	1 in 20-year ARI	3 - 12 months
	1 in 50-year ARI	> 12 months

Notes: [1] Minimum 150 mm freeboard to be provided to drains
 [2] Refer to IECA (2018) Table B35 for freeboard requirements

Existing table drains along Fishermans Road, pending their condition, are the preferred means of diverting external runoff. Given the confirmed presence of sodic subsoils and local topography, being relatively flat, the installation of diversion bunds on the extent of clear and grub works is considered the most effective means of achieving both clean and dirty water diversion. Bunds will assist drainage of site runoff where flat ground and local undulation makes drainage difficult to achieve. It is recommended to maintain the existing topsoil and vegetative cover as much as possible. Bunds are designed to prevent scour and convey runoff up to the design rainfall event. Further, bunds are considered to be the most practical option during fill operations as levels are continually changing.

Disturbance to existing drainage features is to be avoided where possible or for as long as possible. Works within these areas are to be undertaken immediately prior to requiring access and completed within a dry forecast unless contingency measures are applied. Where access crosses existing roadside drains, a temporary crossing incorporating a sized pipe will be installed.

Details regarding temporary drainage arrangement, staging and stabilisation of flow paths are presented within ESCPs.

7 SEDIMENT CONTROL

The calculated soil loss and associated erosion risk determines the minimum sediment control required in specific areas. In accordance with Table B1 of the revised BPESC - Appendix B (IECA 2018) and the soil loss assessments discussed in Section 5, Type 1 and Type 2 sediment controls are required throughout the project. Refer to Table 7 for the sediment control triggers.

Table 8 - Sediment Control Standard Based on Soil Loss (adapted from Table B1 of IECA, 2018)

AREA LIMIT (m ²)	SOIL LOSS RATE LIMIT (T/HA/YR)		
	TYPE 1	TYPE 2	TYPE 3
1,000	N/A	N/A	All cases
2,500	N/A	> 75	75
> 2,500	> 150	150	75
> 10,000	>75	N/A	75

Note: Based on Tables 4.5.1 and 4.5.3 of IECA (2008), adapted to suit Table B1 Revised Appendix B IECA (2018)

Examples of appropriate sediment controls are provided in Table 8 while the discharge criteria are provided in Table 9. Sediment controls are to be implemented ahead of clearing works and must be maintained (or upgraded) to suit site conditions.

Table 9 - Appropriate Sediment Controls

SEDIMENT CONTROL TECHNIQUE	ANTICIPATED SEDIMENT CONTROL TREATMENT MEASURE
Type 3	Sediment fence or Type 2
Type 2	Mulch bund, rock filter dam, filter tube dam, undersized basin/sump
Type 1	Sediment basin sized in accordance with BPESC - Appendix B – Sediment Basin Design and Operation (IECA, 2018)

7.1. ENVIRONMENTAL AUTHORITY CONDITIONS

The site will be subject to an Environmental Authority (EA), but the conditions in terms of discharge criteria and sediment control during construction are not known at this stage.

The 'Guideline for stormwater and environmentally relevant activities' (State of Queensland, 2014), in Part 1 for High Erosion Hazard sites states that (permanent) sediment basins must be designed for events up to and including a 24 hour storm event with an ARI of 1 in 10 years. For the purpose of this document, this is considered equivalent to the 10 % Annual Exceedance Probability (AEP).

Such use of a traditional capture, treat and release approach with a 10 % AEP, 24 hour storm design event implies capturing of **230 mm** rainfall depth within the facility. This option is considered to be impractical based on the long-term dosing requirements to achieve water quality treatment, as well as the available footprint and temporary nature of construction.

Based on the requirements of IECA (2008, 2018) and the Guideline Stormwater and environmentally relevant activities (DES, 2014), the water quality criteria specified in Table 9 are considered relevant to the project.

Table 10 - Project Discharge Criteria (expected)

PARAMETER	CONSTRUCTION DISCHARGE CRITERIA
Total Suspended Solids (TSS)	< 50mg/L for a 1 year ARI, 24 hour event (or equivalent turbidity)
Turbidity	Project specific. To be determined based on correlation to TSS limit via laboratory analysis correlating TSS to turbidity
pH	6.5 - 8.5
Hydrocarbons	No visible trace

7.2. HOW TO ACHIEVE DISCHARGE PARAMETERS

Unless otherwise specified for the construction stage within the EA, the project must provide sediment controls designed to achieve 80 % hydrologic efficiency (HE). A range of approaches are considered acceptable to achieve compliance with the 80% HE objective:

- + High Efficiency Sediment (HES) Basins in accordance with IECA (2018)
- + Large Traditional Sediment Basins (in accordance with Table 2 of HLW, 2018)
 - + These basins are much larger than traditional Type D basins required under the previous State Planning Policy and IECA (2008)
- + Total Capture – hold all water on site

A Type B High Efficiency Sediment (HES) sediment basin is proposed and has been sized in accordance with *Best Practice Erosion and Sediment Control (BPESC) - Appendix B – Sediment Basin Design and Operation* – Tables B2 and B7 (IECA, 2018).

Sizing of the HES basin was based on the 0.5 times the 1 year storm for the relevant time of concentration (approximately 15 minutes).

7.2.1. TYPE B BASIN OPERATIONAL REQUIREMENTS

Type B basins treat runoff as it passes through the system rather than following cessation of a rainfall event, as illustrated in Figure 5.

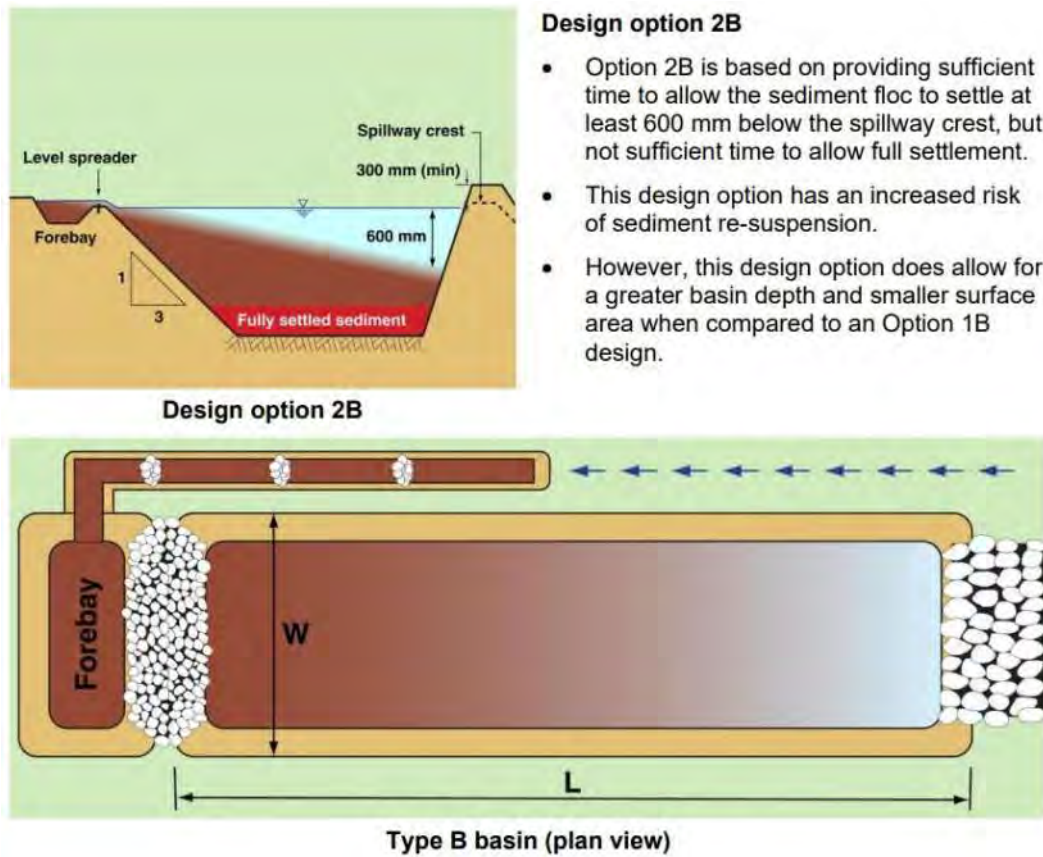


Figure 5 - Typical stages of operation for a Type B sediment basin (Source: Catchment and Creeks)

Type B basins are designed to automatically discharge clean runoff from the main basin cell over a wide, level spillway designed to “skim” clean runoff from the surface.

The preliminary sediment basin volume based on site catchments are provided in Table 11. Note that the design of these basins is dependant on the relevant catchment reporting to the basin, and any changes to the earthworks design are likely to require updated calculations to confirm the appropriate basin size.

Table 11 - Sediment Basin Preliminary Design Volumes

ID	AREA (ha)	VOLUME IN MAIN CELL (m ³)
SB1	4.70	1,823

7.3. TYPE 1

The nominated type and location of Type 1 controls (sediment basins) will be presented on ESCPs. Typical basin details and sections are included in Appendix A. Detailed design of the sediment basins will be required prior to construction and should be undertaken during the detailed design phase of the project.

7.4. TYPE 2 AND 3 CONTROLS

The nominated type and location of Type 2 and 3 sediment controls is presented in Appendix A. Minimum sizing for Type 2 sediment controls is based on best practice design standards. It is noted that Type 2 and 3 sediment controls do not achieve the specified discharge criteria and as such can only be implemented as supplementary or temporary controls, such as during construction of the sediment basins. Their use must be accompanied by increased erosion control standards over disturbed areas.

7.4.1. TYPE 2 SEDIMENT CONTROLS

Type 2 sediment controls (e.g. Rock Filter Dams (RFD), Filter Tube Dams (FTD) or Mulch Bunds) are proposed for locations that trigger the use of a Type 2 sediment controls along the access road. Several options for this type of control have been provided in the following sections.

7.4.1.1. ROCK FILTER DAMS

It is recommended that RFDs be constructed using a geotextile layer that can be easily removed and replaced when blocked with sediment. A typical section of the RFD with geotextile is presented as Figure 6. For further information and design considerations, reference should be made to the Catchments and Creeks Rock Filter Dam Fact Sheet (<https://www.catchmentsandcreeks.com.au/docs/RFD-1.pdf>). Again, the Type 2 sediment controls are not intended as a replacement for a Type 1 control, but in conjunction with an increased erosion control standard, are recommended where site constraints preclude the use of a Type 1 sediment control.

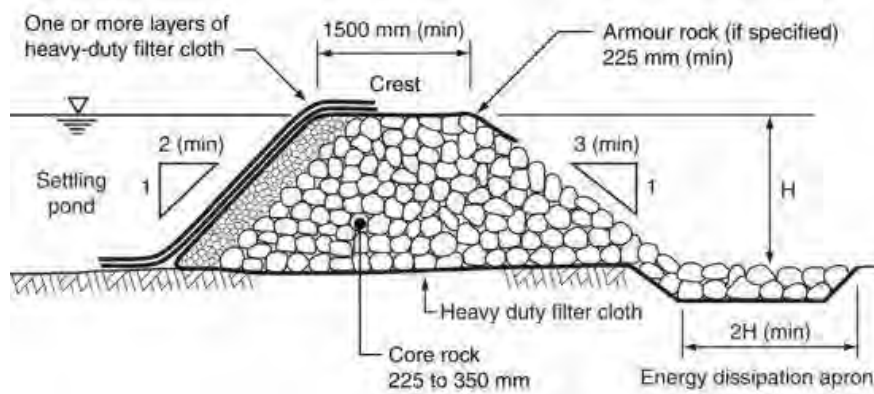


Figure 6 - Rock Filter Dam with Geotextile Filter (Source: Catchments and Creeks)

7.4.1.2. FILTER TUBE DAMS

Filter Tube Dams are an alternative to Rock Filter Dams. Figure 7 provides typical details of such a treatment system and proprietary devices are available. However, in both cases, consideration must be given to the expected flow rates and the structures designed accordingly. For further design considerations, refer the Catchment and Creeks Filter Tube Dam fact sheet <https://www.catchmentsandcreeks.com.au/docs/FTD-1.pdf>.

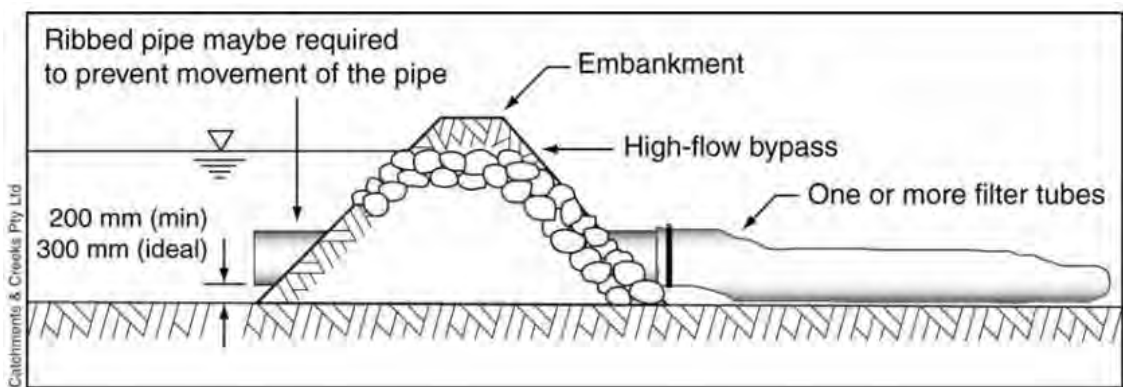


Figure 7 - Filter Tube Dam incorporated into Bund (Source: Catchments and Creeks)

7.4.1.3. MULCH BUNDS

Mulch filter bunds can be used to assist in filtering and settling coarse sediments from sheetflow and is achieved from runoff passing through the berm. The key design consideration is to maximise the surface area of ponding

up-slope of the bund such that coarse sediments are allowed to settle under gravity. It is therefore a requirement that the bund be placed along the contour in order to gain maximum benefit.

A typical bund section and placement recommendations are illustrated as Figure 8. Further details can be found within the Catchments and Creek fact sheet <https://www.catchmentsandcreeks.com.au/docs/MB-1.pdf>

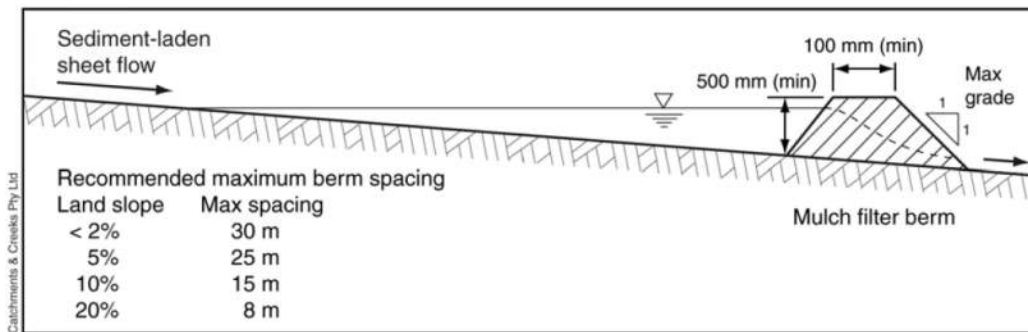


Figure 8 – Mulch Filter Bund Typical Section & Placement Details (Source: Catchments and Creeks)

7.4.2. COMPENSATORY MEASURES

Where Type 2 or 3 sediment control has been adopted in areas requiring Type 1 control the reduced standard shall be offset by increased erosion control in the catchment, typically soil binder or geotextile. A treatment train approach to sediment and drainage control will vary from location to location and on active works and current staging, but will generally include:

- 1) Sediment controls arranged in series to maximise treatment effectiveness.
- 2) Increased monitoring and maintenance (including desilting controls).
- 3) Passive treatment of drainage lines using gypsum, where relevant, taking care to ensure gypsum is fully dissolved prior to discharge from site.
- 4) Maximising detention/retention of runoff on site, utilising excavations and temporary bunding within the catchment (not just at discharge points).
- 5) Increased Type 2 design specification (grade) to increase ponding.
- 6) Application of compensatory Erosion Control.

7.5. SEDIMENT BASIN OPERATION

7.5.1. COAGULANT/FLOCCULENT

Prior to commencement of construction, jar tests are to be undertaken to determine the optimum coagulation or flocculant for site soils. Jar tests results are to be recorded in accordance with the Floc Report provided in Appendix B.

7.5.2. DEWATERING

Basins are used and these are to be treated and dewatered within 5 days of cessation of a rainfall event.

7.5.3. PERFORMANCE ASSESSMENT

A Performance review of the sediment basin is to be undertaken following rainfall in accordance with Figure 9 and Appendix C. Water quality discharge criteria for sediment basins was previously provided in Table 10.

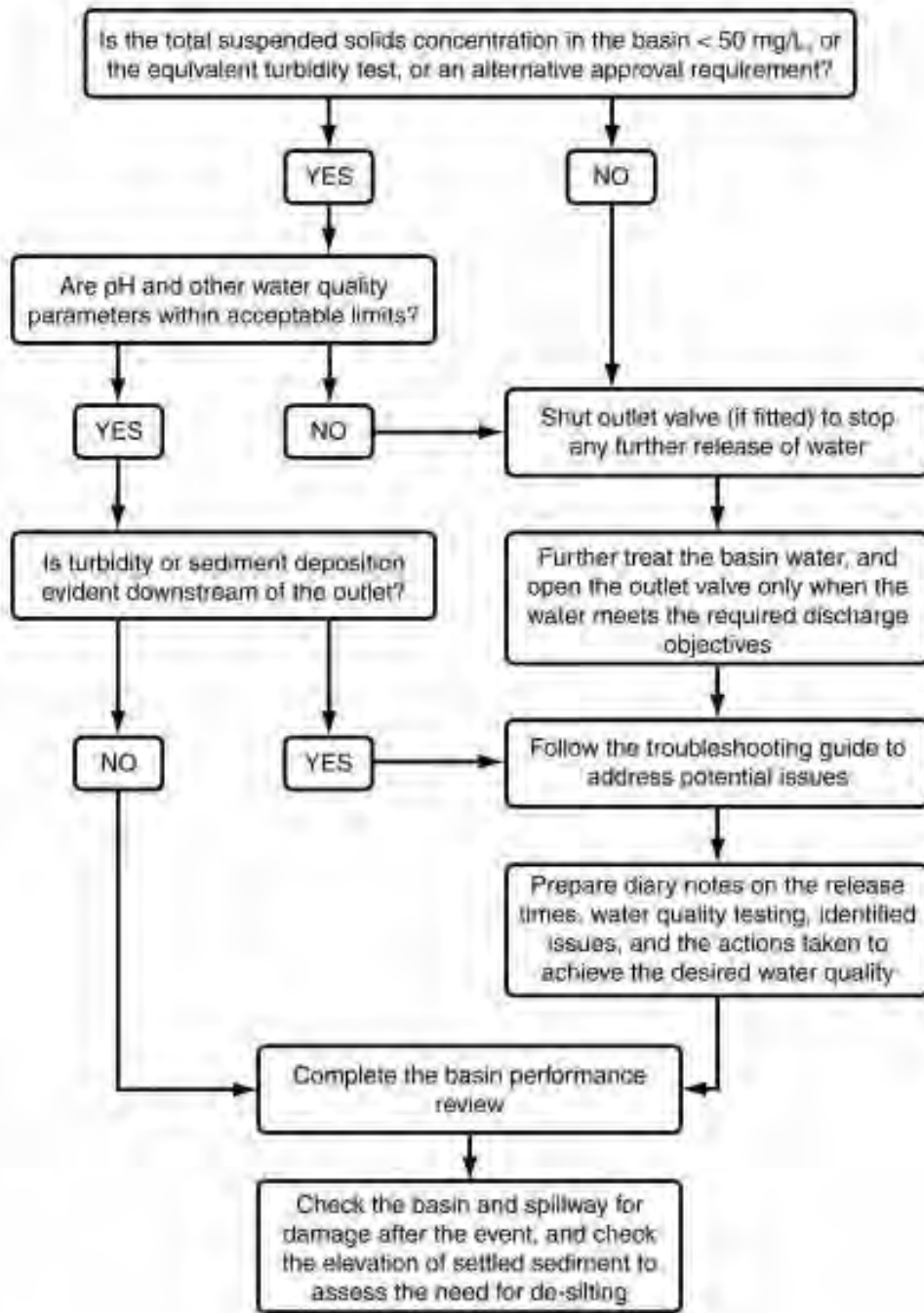


Figure 9 – Basin Performance Assessment Process (Source: IECA 2018)



8 ROLES AND RESPONSIBILITIES

Responsibilities of construction personnel in respect to ESC are outlined below. Reference should also be made to the contractors Construction Environmental Management Plan (CEMP).

Table 12 - Roles and Responsibilities

ROLE	RESPONSIBILITY
Project Manager	<ul style="list-style-type: none"> + Overall responsibility of ESC implementation + Notify the Administrator of any non-compliance with ESCP + Ensure the prompt implementation of measures to mitigate erosion and sediment generation
Site Supervisor/Foremen	<ul style="list-style-type: none"> + Undertake inspection of all control measures, discharge points and boundary of works per inspection requirements + Monitor daily rainfall + Notify Environmental Advisor/Consultant when runoff generating rainfall occurs in the previous 24 hours + Maintain current records of rainfall, storage volumes, water quality, treatment practices, discharge volumes (as appropriate) + Installation and maintenance of ESC + Ensure floc tests (Appendix B) and Basin Performance Inspections (Appendix C) are conducted (as required).
Project Team	<ul style="list-style-type: none"> + Provide design information as required + Conduct in-situ monitoring (as required) + Collect and submit samples to laboratory (as required) + Collate results and prepare reports (as required) + Conduct site inspections and audits (as required) + Inspect ESC installation and maintenance + Inspect offsite impacts and management + Provide advice regarding ESC site improvement (as required)
Appointed CPESC	<ul style="list-style-type: none"> + Undertake site inspection and reporting at the nominated frequency or as requested by client
All Personnel	<ul style="list-style-type: none"> + Report any damage to ESC devices and any potential or actual environmental harm in line with Duty to Notify under the requirements of the <i>Environmental Protection Act 1994</i>





9 SITE INSPECTION AND MONITORING

Site inspections, monitoring and maintenance activities are to be conducted in accordance with the CEMP.

Management and reporting of non-conformances and incidents relating to erosion and sediment control shall be as per requirements for environmental non-conformances and incidents (to be specified in the CEMP). Notification to the Administrator or the Principal does not in any way negate the requirements on the Contractor to notify DETSI, other regulatory authorities and landowners under the Environmental Protection or other Acts.

Reference should be made to Sections 6.17 and 7.4 of the Best Practice Erosion and Sediment Control Document (IECA, 2008) as detailed below as well as any CEMP requirements.

ESCPs should be considered live documents that in some instances will require review and updating as site conditions change, or if the adopted measures fail to achieve the required treatment standard. When a site inspection detects a notable failure in the adopted ESC measures, the source of this failure must be reported, investigated and appropriate amendments made to the site and the ESCP.

Best practice site management requires all ESC measures to be inspected at the following frequencies and include the following checks as a minimum:

Daily site inspections (during rainfall)

- + All drainage, erosion and sediment control measures. If inspection identifies maintenance of control measures is required to improve performance effectiveness proactively or reactively, then maintenance must be undertaken as soon as reasonably practicable
- + Occurrences of excessive sediment deposition (whether on-site or off-site)
- + All site discharge points (including dewatering activities as appropriate)

Weekly site inspections (even if work is not occurring on-site)

- + All drainage, erosion and sediment control measures. If inspection identifies maintenance of control measures is required to improve performance effectiveness proactively or reactively, then maintenance must be undertaken as soon as reasonably practicable
- + Occurrences of excessive sediment deposition (whether on-site or off-site)
- + Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
- + Litter and waste receptors
- + Oil, fuel and chemical storage facilities

Prior to anticipated runoff producing rainfall (within 24 hours of expected rainfall)

- + All drainage, erosion and sediment control measures. If inspection identifies maintenance of control measures is required to improve performance effectiveness proactively or reactively, then maintenance must be undertaken as soon as reasonably practicable
- + All temporary flow diversion and drainage works

Following runoff producing rainfall (within 18 hours of rainfall event)

- + All drainage, erosion and sediment control measures. If inspection identifies maintenance of control measures is required to proactive or reactively improve performance effectiveness than maintenance must be undertaken as soon as reasonably practicable
- + Occurrences of excessive sediment deposition (whether on-site or off-site)
- + Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
- + Performance assessment of the sediment basin as per Section 7.5.3 and Appendix B





10 SEVERE WEATHER

The controls indicated in ESCPs are to be designed in accordance with criteria specified in IECA (2008, 2018) guidelines. These specifications are adopted based on the project duration and sensitivity of the receiving environment/community, with consideration given to the constraints of the project locality (e.g. seasonally high rainfall, constrained linear infrastructure etc) and practical implementation of best practice ESC. The controls, and any other sediment, drainage or erosion control installed on site may fail in rain events greater than those specified.

To reduce the impacts arising from a greater than design event, or other severe weather, a brief risk assessment has been completed.

10.1. RESPONSE TO SIGNIFICANT WEATHER

Following significant weather, the contractor will conduct a site-wide inspection of erosion, sediment and drainage controls and implement the following response strategy:

1. Identify maintenance items, including;
 - a. damaged or scoured drains
 - b. ripped or damaged drain lining and erosion controls
 - c. excessive sediment deposition (whether on-site or off-site)
 - d. construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
 - e. water levels and sediment captured in sediment controls
2. Schedule corrective actions by order of priority, noting that the safety of project personnel and the public shall always take precedence
3. Dewater sediment controls and work areas in accordance with the nominated discharge criteria.
4. Carry out water quality monitoring in accordance with the EA and this ESCP.
5. Track closed out and outstanding items in a corrective action register
6. Present the corrective action register with water quality monitoring results as part of project records
7. Amend erosion and sediment control plans if necessary to account for any changes that may be required.

A severe weather management plan may be prepared for the project, identifying additional response measures to significant rainfall. This ESCP should be reviewed prior to the wet season with the intent of capturing any developing risks that may be identified since original issue.



Table 13 - Severe Weather Risk Assessment

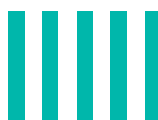
HAZARD	LIKELIHOOD	IMPACT	CONTROL
Type 1 sediment controls fail	Low	Releases turbid water to the environment	<ul style="list-style-type: none"> + Undertake monitoring and investigation per requirements of this ESCP. Notify to the regulator if release of turbid water warrants. + Remove deposited sediment from within and downslope of work area (without causing further disturbance) and reinstate control measures. + Review measures and consider if changes are required to meet the intent of this ESCP, and + Demonstrate all reasonable measures have been undertaken to prevent the release.
Type 2 or Type 3 sediment controls fail	Medium	Releases turbid water to the environment	<ul style="list-style-type: none"> + Undertake monitoring and investigation per requirements of this ESCP. Notify to the regulator if release of turbid water warrants. + Remove deposited sediment from within and downslope of work area (without causing further disturbance) and reinstate control measures. + Review measures and consider if changes are required to meet the intent of this ESCP and demonstrate all reasonable measures have been undertaken to prevent the release.
Temporary drainage fails	Medium	Clean and dirty water combine, releases turbid water to the environment. Scour in drains	<ul style="list-style-type: none"> + Due to highly dispersive soils, actively stabilise drainage features in accordance with the specification. Inspect and maintain regularly.
Surface treatment does not effectively stabilise surfaces	Low to medium	Surfaces will be exposed and subject to ongoing erosion.	<ul style="list-style-type: none"> + Temporary or permanent surface treatments to be installed per specifications. Where flow velocities may exceed the allowable maximum, install additional measures to either reduce flow velocity or secure treatment (i.e. pinning of turf). + Rock treatments to be recessed and suitably installed to limit displacement. + Stabilisation by placement of temporary erosion control or permanent stabilisation (including landscaping) to be progressively undertaken to allow greater establishment. + Appropriate QA/QC of treatment application must be undertaken (even including temporary binder or hydromulching). + Monitor surfaces and flow paths for signs of failure. If flow velocities appear to exceed surface treatments, consider installation of temporary velocity controls to reduce shearing effects whilst vegetation establishes and/or consider alternative treatments. + It should be noted that use of velocity control measures (i.e. rock check dams, or similar) should only be used where dispersive soils are not present, or the channel base has been treated (either by burying below non-dispersive material, gypsum amelioration or use of an impermeable liner) as per guidance.
Dust generation	Low to high	Release to the environment and surrounding users	<ul style="list-style-type: none"> + Increase dust suppression during high winds. Reduce traffic and machinery movement. Stabilise exposed areas.

It should be noted that the most effective control measure in the event of severe weather is to secure and stabilise as much exposed area as possible. This can also be achieved by scheduling high risk activities (such as stripping, or drainage work) to low risk periods of time (with limited rain forecast). Prior to forecasted severe weather (or any rainfall) all efforts should be made to secure the work area by temporary or permanent means.



APPENDIX A

EROSION AND SEDIMENT CONTROL PLANS





EROSION AND SEDIMENT CONTROL DRAWINGS

FISHERMANS ROAD, YARWUN CHLOR-ALKALI FACILITY



COUNCIL - GLADSTONE CITY COUNCIL

- DRAWING LIST:
- D00 - COVER SHEET
 - D01 - BOAT CREEK LOCAL CATCHMENT PLAN
 - D02 - CATCHMENT PLAN - SITE
 - D03 - CLEAR AND GRUB CONTROLS
 - D04 - TOPSOIL STRIP CONTROLS
 - D05 - BULK EARTHWORKS CONTROLS
 - D06 - FINAL LEVELS CONTROLS
 - D07 - SEDIMENT BASIN SB1 DETAILS
 - D08 - SEDIMENT BASIN TYPICAL DETAILS
 - D09 - CALCULATIONS AND DRAINAGE SECTIONS
 - D10 - STANDARD DRAWINGS

REFER TO REPORT (REFERENCE: R4211) FOR ADDITIONAL DETAILS RELATING TO GUIDELINES USED, PROJECT AND SITE DESCRIPTION, CLIMATE, TOPOGRAPHY, SOILS, EROSION RISK ASSESSMENT, EROSION, SEDIMENT AND DRAINAGE CONTROL SPECIFICATIONS, SEDIMENT BASIN OPERATION, ROLES AND RESPONSIBILITIES AND SITE INSPECTION AND MONITORING

PROPOSED TEMPORARY DESIGN PROVIDED FOR CONSTRUCTION PHASE EROSION, SEDIMENT & DRAINAGE CONTROL ONLY. THE CLIENT IS RESPONSIBLE FOR ENSURING THE INSTALLATION OF ANY CONTROLS PROPOSED HEREIN CAN BE INSTALLED & OPERATED SAFELY FOR PEDESTRIANS, VEHICLES, WORKERS, CONTRACTORS, ADMINISTRATORS & MEMBERS OF THE PUBLIC



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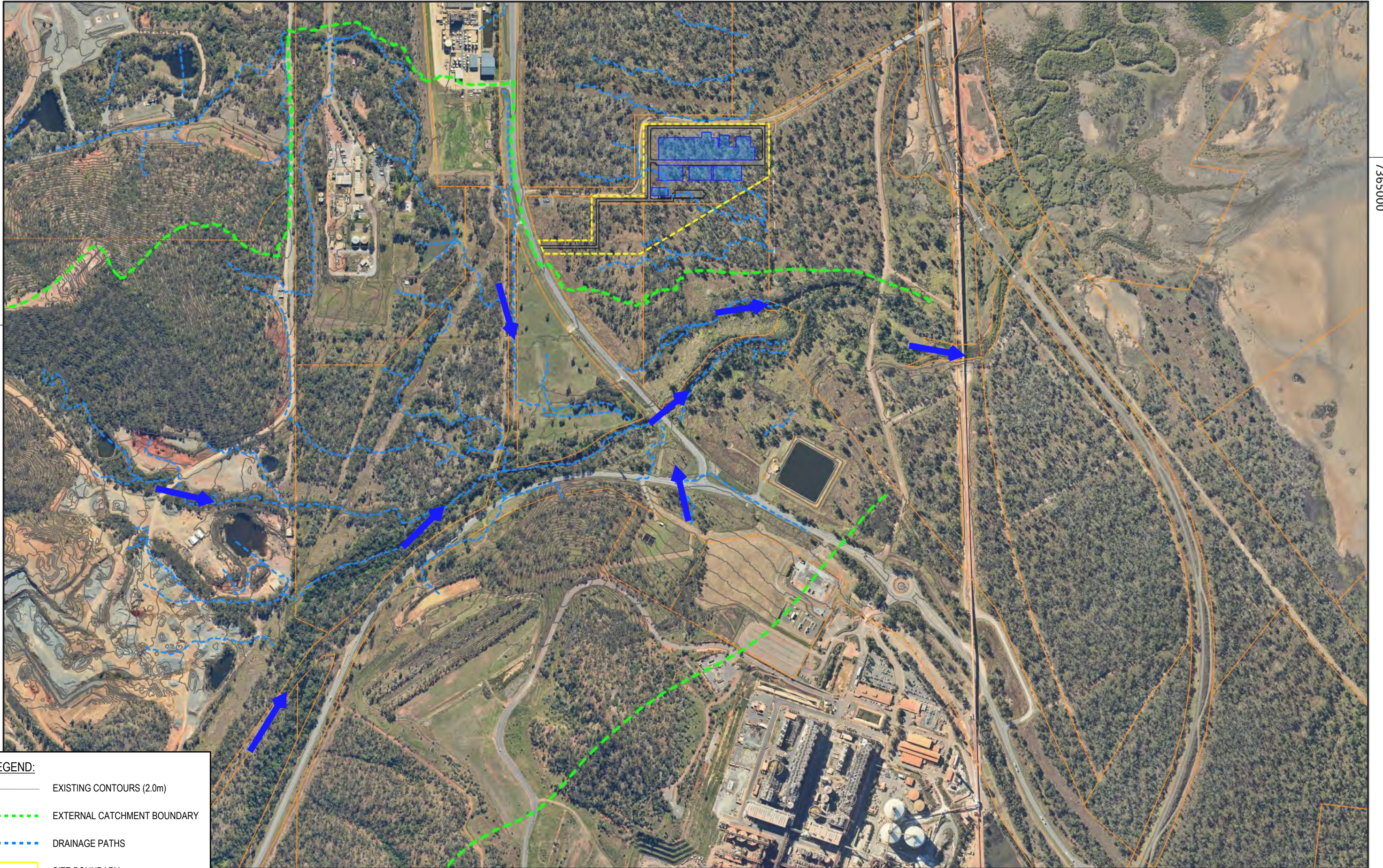
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CPESC NO. 6,599 RPEQ NO. 15,545		

PROJECT		
FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE		
EROSION AND SEDIMENT CONTROL PLAN COVER SHEET		
PROJECT No	DRAWING No	REVISION
25-0204	D00	C

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LEGEND:

- EXISTING CONTOURS (2.0m)
- EXTERNAL CATCHMENT BOUNDARY
- DRAINAGE PATHS
- SITE BOUNDARY



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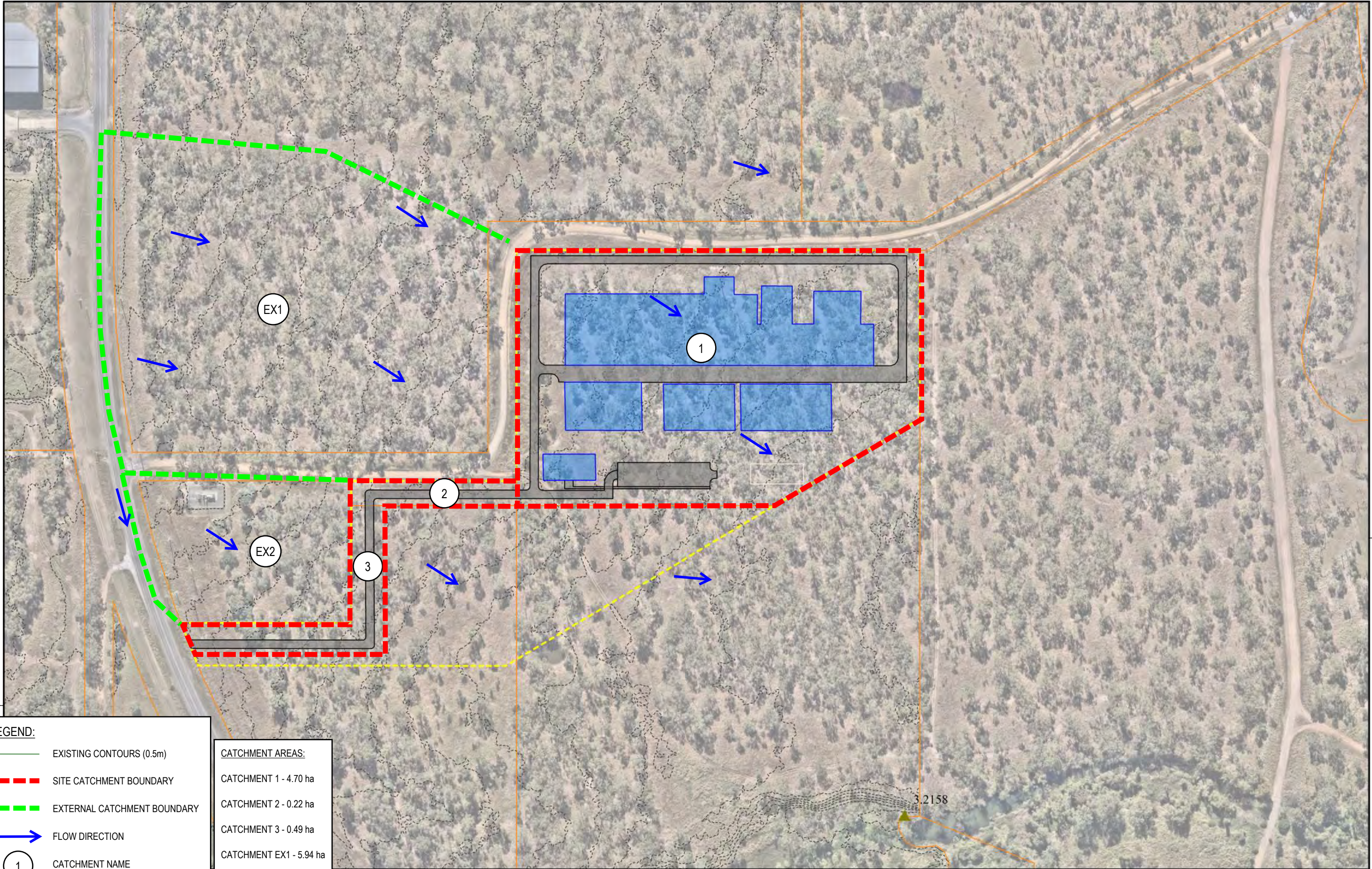
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CPESC NO. 6,599 RPEQ NO. 15,545		

PROJECT FISHERMANS ROAD - CHLOR-ALKALI FACILITY
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN BOAT CREEK LOCAL CATCHMENT PLAN
PROJECT No 25-0204
DRAWING No D01
REVISION C



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LEGEND:

- EXISTING CONTOURS (0.5m)
- SITE CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- FLOW DIRECTION
- CATCHMENT NAME

CATCHMENT AREAS:

CATCHMENT 1	- 4.70 ha
CATCHMENT 2	- 0.22 ha
CATCHMENT 3	- 0.49 ha
CATCHMENT EX1	- 5.94 ha
CATCHMENT EX2	- 1.53 ha



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SCALE 1:2500

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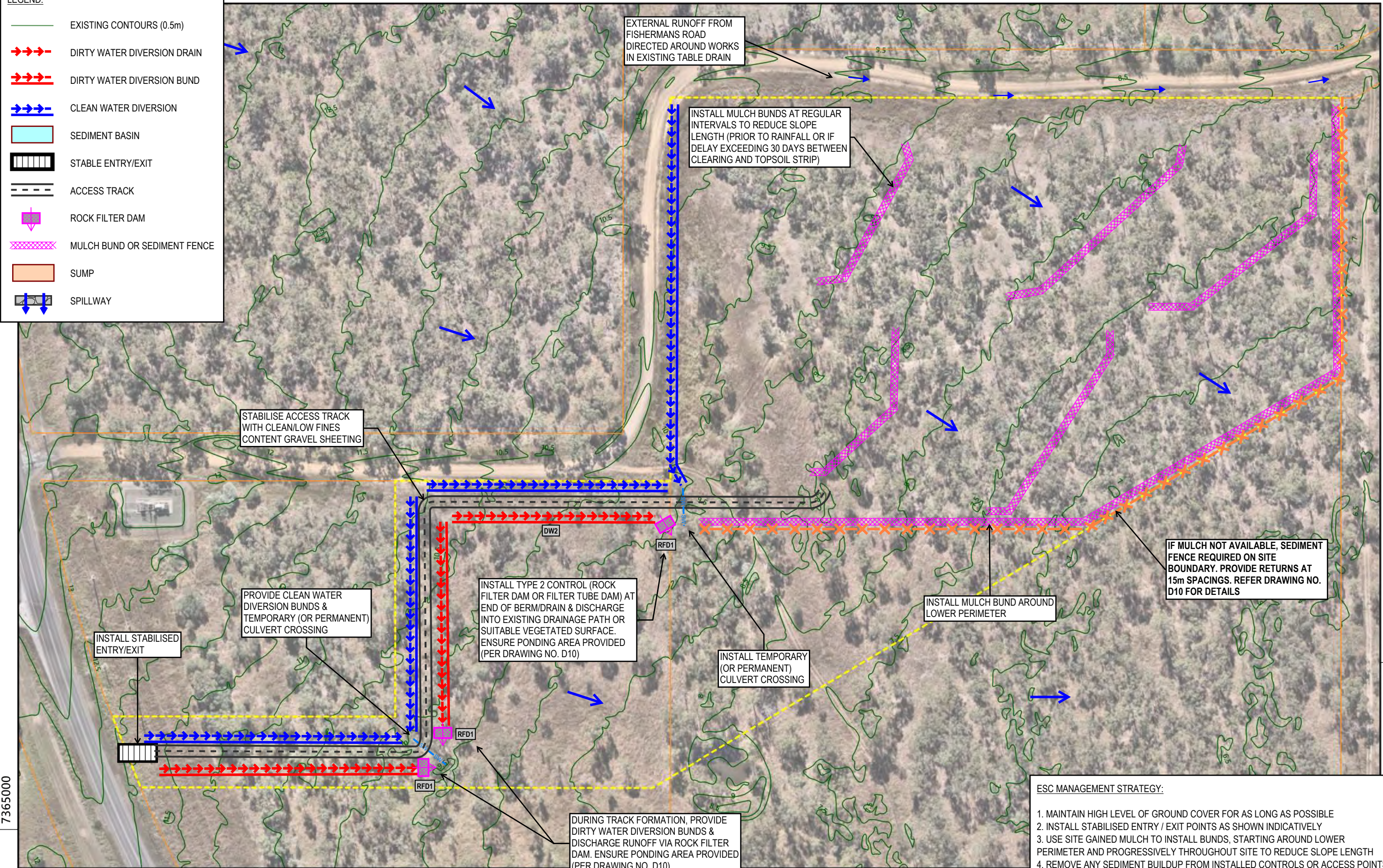
CLIENT CQG CONSULTING		
DRAWN RK	DESIGNED SC	DATE 13/10/2025
RPEQ / SIGNATURE (IF REQUIRED) 		

PROJECT FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN CATCHMENT PLAN - SITE		
PROJECT No 25-0204	DRAWING No D02	REVISION C

CPESC NO. 6,599 RPEQ NO. 15,545

LEGEND:

	EXISTING CONTOURS (0.5m)
	DIRTY WATER DIVERSION DRAIN
	DIRTY WATER DIVERSION BUND
	CLEAN WATER DIVERSION
	SEDIMENT BASIN
	STABLE ENTRY/EXIT
	ACCESS TRACK
	ROCK FILTER DAM
	MULCH BUND OR SEDIMENT FENCE
	SUMP
	SPILLWAY

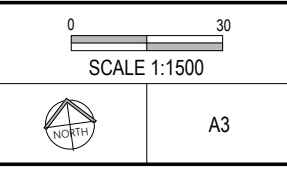


IF MULCH NOT AVAILABLE, SEDIMENT FENCE REQUIRED ON SITE BOUNDARY. PROVIDE RETURNS AT 15m SPACINGS. REFER DRAWING NO. D10 FOR DETAILS

- ESC MANAGEMENT STRATEGY:**
1. MAINTAIN HIGH LEVEL OF GROUND COVER FOR AS LONG AS POSSIBLE
 2. INSTALL STABILISED ENTRY / EXIT POINTS AS SHOWN INDICATIVELY
 3. USE SITE GAINED MULCH TO INSTALL BUNDS, STARTING AROUND LOWER PERIMETER AND PROGRESSIVELY THROUGHOUT SITE TO REDUCE SLOPE LENGTH
 4. REMOVE ANY SEDIMENT BUILDUP FROM INSTALLED CONTROLS OR ACCESS POINTS AS SOON AS IDENTIFIED.



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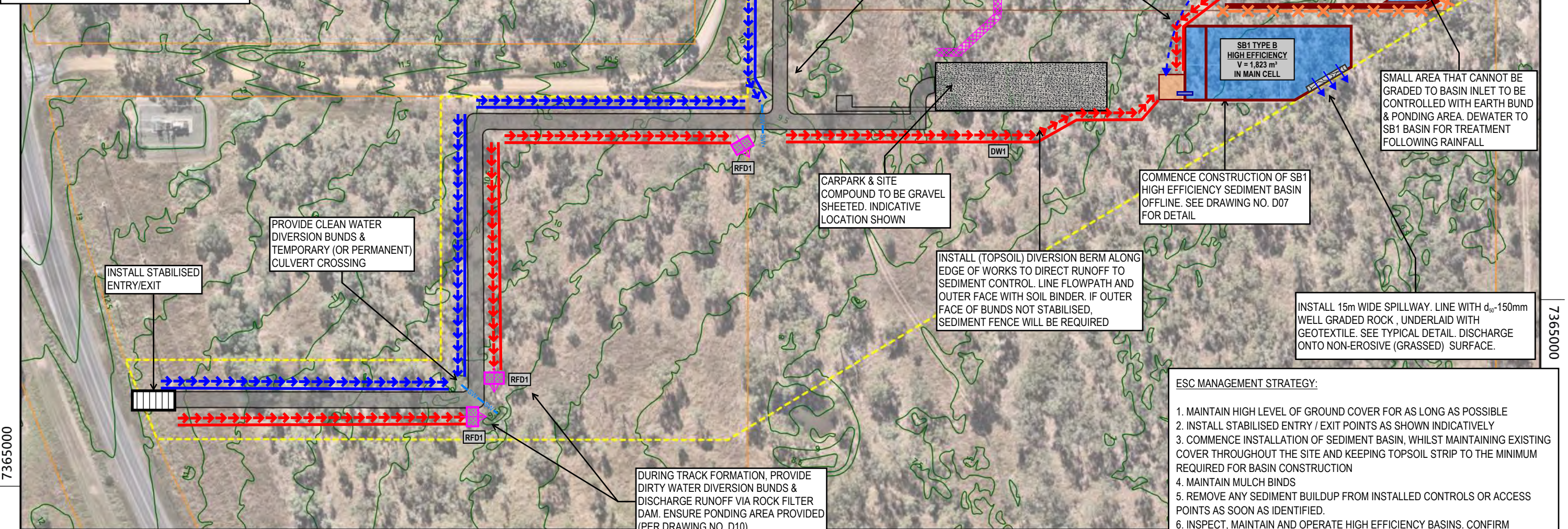
PROJECT FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN CLEAR AND GRUB CONTROLS		
PROJECT No 25-0204	DRAWING No D03	REVISION C

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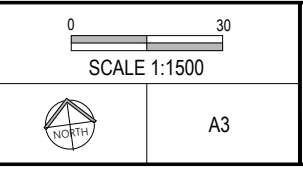
-  EXISTING CONTOURS (0.5m)
-  DIRTY WATER DIVERSION DRAIN
-  DIRTY WATER DIVERSION BUND
-  CLEAN WATER DIVERSION
-  SEDIMENT BASIN
-  STABLE ENTRY/EXIT
-  ROCK FILTER DAM
-  MULCH BUND
-  SUMP
-  SPILLWAY
-  PUMPED FLOWS
-  CROSS DRAINAGE
-  SEDIMENT FENCE
-  EARTH BUND



- ESC MANAGEMENT STRATEGY:**
1. MAINTAIN HIGH LEVEL OF GROUND COVER FOR AS LONG AS POSSIBLE
 2. INSTALL STABILISED ENTRY / EXIT POINTS AS SHOWN INDICATIVELY
 3. COMMENCE INSTALLATION OF SEDIMENT BASIN, WHILST MAINTAINING EXISTING COVER THROUGHOUT THE SITE AND KEEPING TOPSOIL STRIP TO THE MINIMUM REQUIRED FOR BASIN CONSTRUCTION
 4. MAINTAIN MULCH BINDS
 5. REMOVE ANY SEDIMENT BUILDUP FROM INSTALLED CONTROLS OR ACCESS POINTS AS SOON AS IDENTIFIED.
 6. INSPECT, MAINTAIN AND OPERATE HIGH EFFICIENCY BASINS. CONFIRM ADEQUATE CAPACITY IN SEDIMENT STORAGE ZONE.



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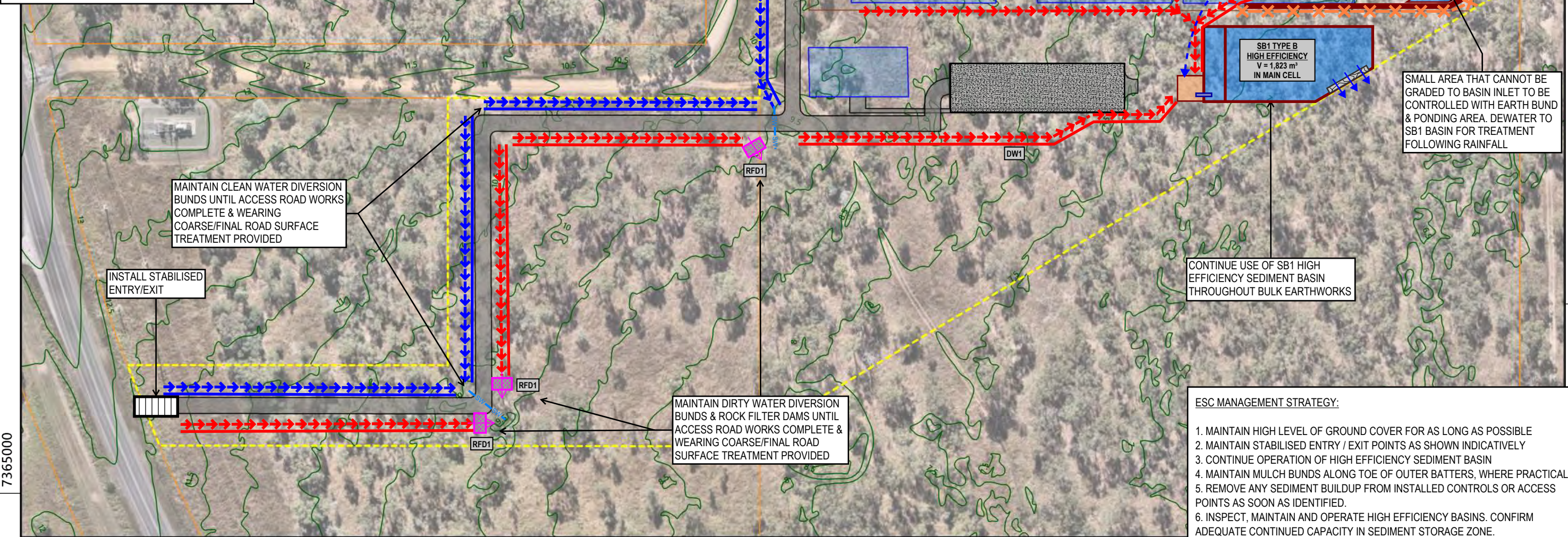
PROJECT	FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE	EROSION AND SEDIMENT CONTROL PLAN TOPSOIL STRIP CONTROLS		
PROJECT No	DRAWING No	REVISION	
25-0204	D04	C	

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LEGEND:

-  EXISTING CONTOURS (0.5m)
-  DIRTY WATER DIVERSION DRAIN
-  DIRTY WATER DIVERSION BUND
-  CLEAN WATER DIVERSION
-  SEDIMENT BASIN
-  STABLE ENTRY/EXIT
-  ROCK FILTER DAM
-  MULCH BUND
-  SUMP
-  SPILLWAY
-  PUMPED FLOWS
-  CROSS DRAINAGE
-  SEDIMENT FENCE
-  EARTH BUND



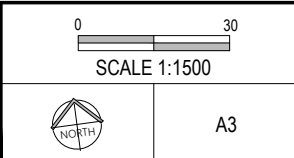
- ESC MANAGEMENT STRATEGY:**
1. MAINTAIN HIGH LEVEL OF GROUND COVER FOR AS LONG AS POSSIBLE
 2. MAINTAIN STABILISED ENTRY / EXIT POINTS AS SHOWN INDICATIVELY
 3. CONTINUE OPERATION OF HIGH EFFICIENCY SEDIMENT BASIN
 4. MAINTAIN MULCH BUNDS ALONG TOE OF OUTER BATTERS, WHERE PRACTICAL
 5. REMOVE ANY SEDIMENT BUILDUP FROM INSTALLED CONTROLS OR ACCESS POINTS AS SOON AS IDENTIFIED.
 6. INSPECT, MAINTAIN AND OPERATE HIGH EFFICIENCY BASINS. CONFIRM ADEQUATE CONTINUED CAPACITY IN SEDIMENT STORAGE ZONE.
 7. REMOVE SEDIMENT FROM SUMP AND FOREBAY ON A REGULAR BASIS

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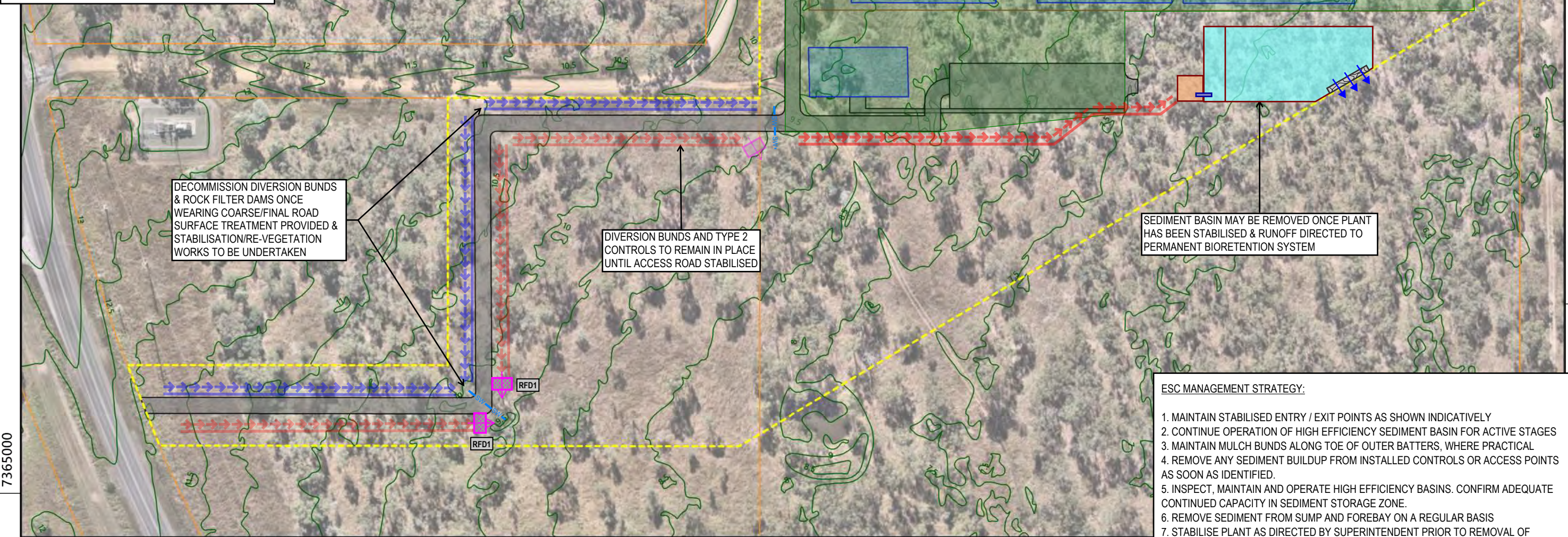
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PROJECT	FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE	EROSION AND SEDIMENT CONTROL PLAN BULK EARTHWORKS CONTROLS		
PROJECT No	DRAWING No	REVISION	
25-0204	D05	C	

LEGEND:

-  EXISTING CONTOURS (0.5m)
-  DIRTY WATER DIVERSION DRAIN
-  DIRTY WATER DIVERSION BUND
-  CLEAN WATER DIVERSION
-  SEDIMENT BASIN
-  STABILISED AREA / EROSION CONTROL
-  ROCK FILTER DAM
-  MULCH BUND
-  SUMP
-  SPILLWAY
-  PUMPED FLOWS
-  CROSS DRAINAGE
-  SEDIMENT FENCE
-  EARTH BUND



ESC MANAGEMENT STRATEGY:

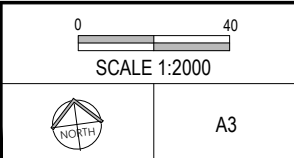
1. MAINTAIN STABILISED ENTRY / EXIT POINTS AS SHOWN INDICATIVELY
2. CONTINUE OPERATION OF HIGH EFFICIENCY SEDIMENT BASIN FOR ACTIVE STAGES
3. MAINTAIN MULCH BUNDS ALONG TOE OF OUTER BATTERS, WHERE PRACTICAL
4. REMOVE ANY SEDIMENT BUILDUP FROM INSTALLED CONTROLS OR ACCESS POINTS AS SOON AS IDENTIFIED.
5. INSPECT, MAINTAIN AND OPERATE HIGH EFFICIENCY BASINS. CONFIRM ADEQUATE CONTINUED CAPACITY IN SEDIMENT STORAGE ZONE.
6. REMOVE SEDIMENT FROM SUMP AND FOREBAY ON A REGULAR BASIS
7. STABILISE PLANT AS DIRECTED BY SUPERINTENDENT PRIOR TO REMOVAL OF SEDIMENT BASIN

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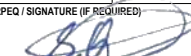


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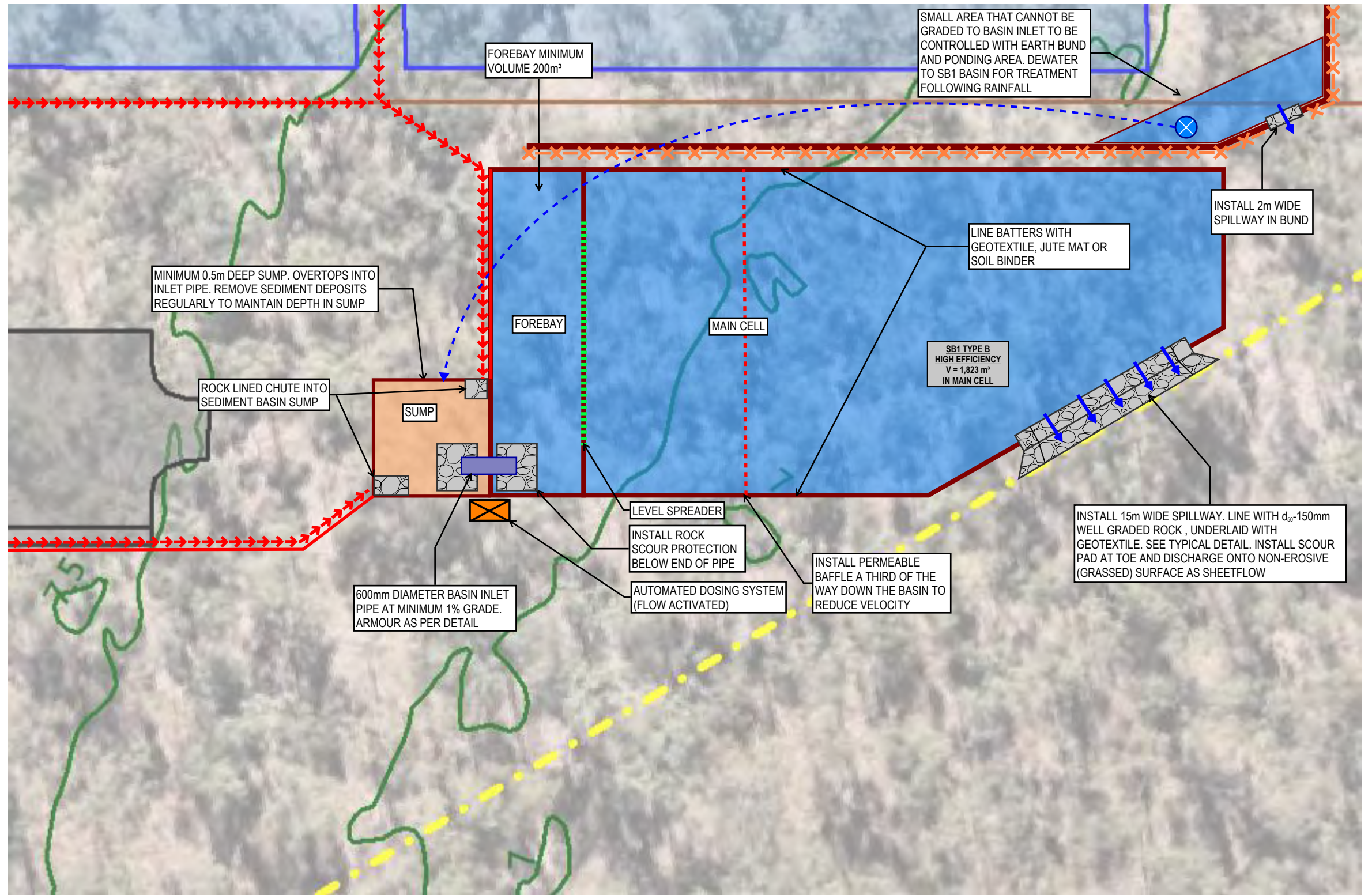
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PROJECT FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN PROGRESSIVE FINAL LEVELS CONTROLS		
PROJECT No 25-0204	DRAWING No D06	REVISION C

LEGEND:

	DIRTY WATER DIVERSION
	AUTOMATED DOSING SYSTEM
	SEDIMENT BASIN
	SPILLWAY
	SCOUR PROTECTION / ROCK LINING
	BASIN SUMP
	LEVEL SPREADER
	PERMEABLE BAFFLE
	INLET PIPE
	CLEAN WATER DIVERSION
	SEDIMENT FENCE
	PUMPED FLOWS
	EARTH BUND

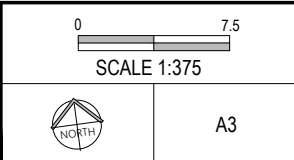


INDICATIVE LEVELS (PENDING SITE SURVEY):
 MAIN SPILLWAY RL 6.5
 MAIN CELL BASE RL 5.0
 LEVEL SPREADER RL 6.7
 PIPE USIL RL 7.0 DSIL RL 6.9

SEDIMENT BASIN LAYOUT AND LEVELS TO BE CONFIRMED WITH 3D MODEL BY SURVEYOR. MAY BE ADJUSTED TO SUIT ON SITE IN CONSULTATION WITH THE CPESC. IMPORTANTLY CASCADING THROUGH BASIN NEEDS TO BE MAINTAINED



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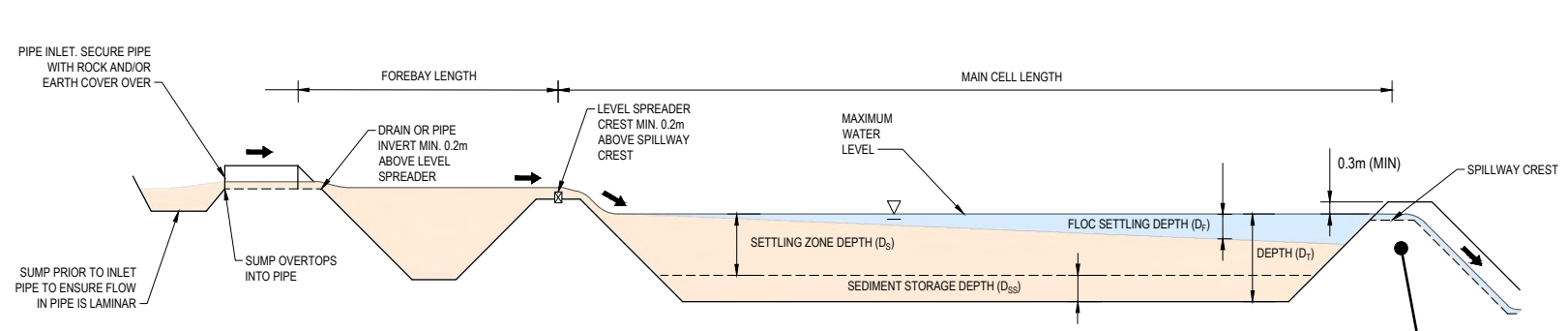


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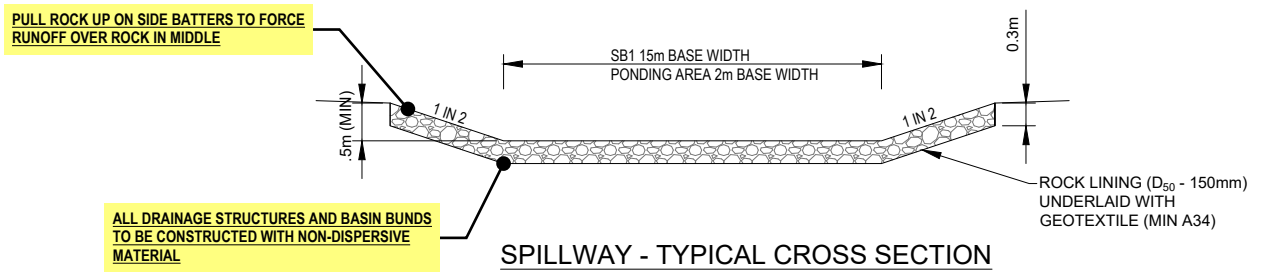
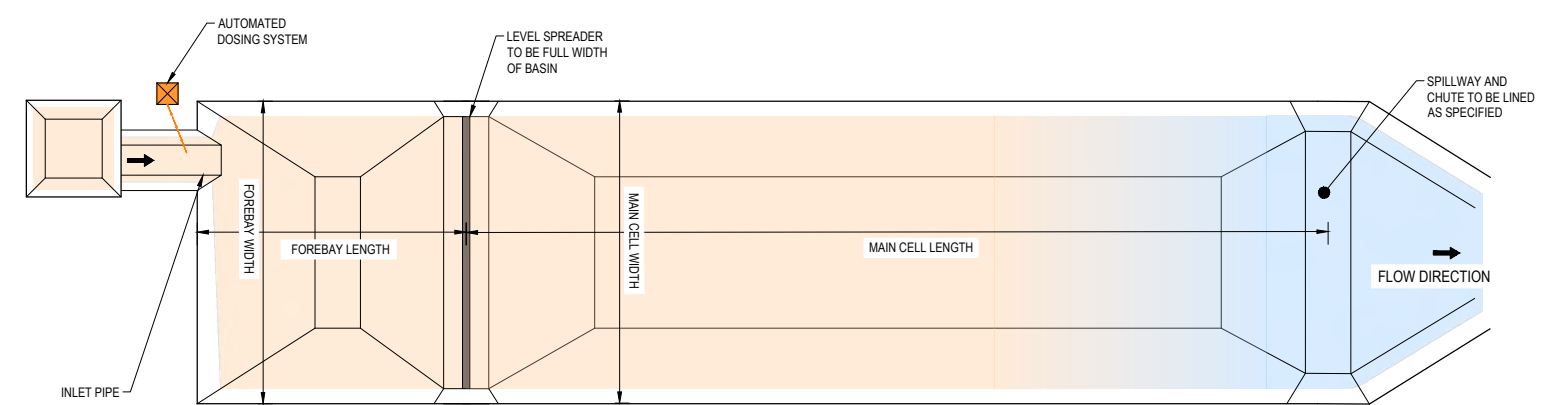
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CPESC NO. 6,599 RPEQ NO. 15,545		

PROJECT FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN SEDIMENT BASIN SB1 DETAILS		
PROJECT No 25-0204	DRAWING No D07	REVISION C

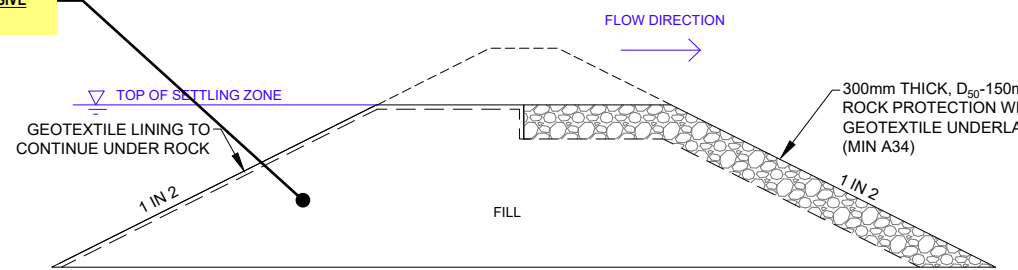


TYPE B SEDIMENT BASIN TYPICAL SECTION (nts) - FLOW ACTIVATED DOSER

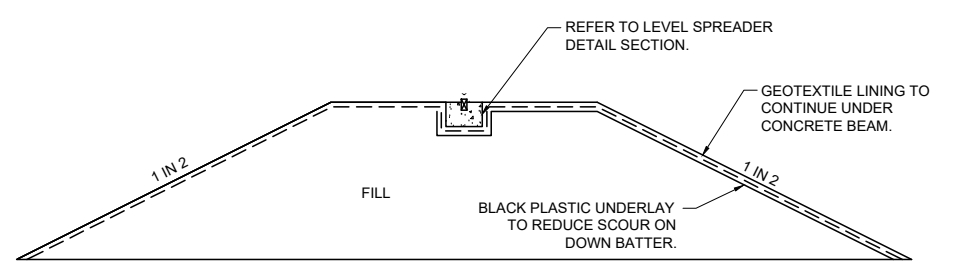


SPILLWAY - TYPICAL CROSS SECTION

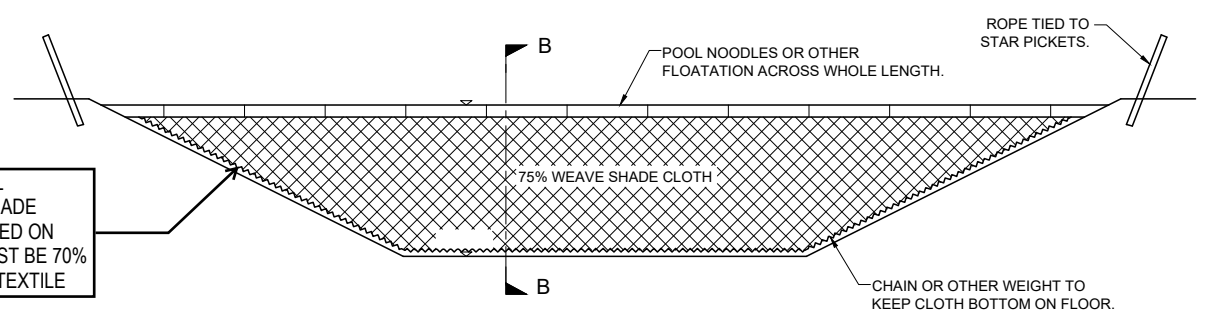
ALL DRAINAGE STRUCTURES AND BASIN BUNDS TO BE CONSTRUCTED WITH NON-DISPERSIVE MATERIAL



SPILLWAY TYPICAL SECTION

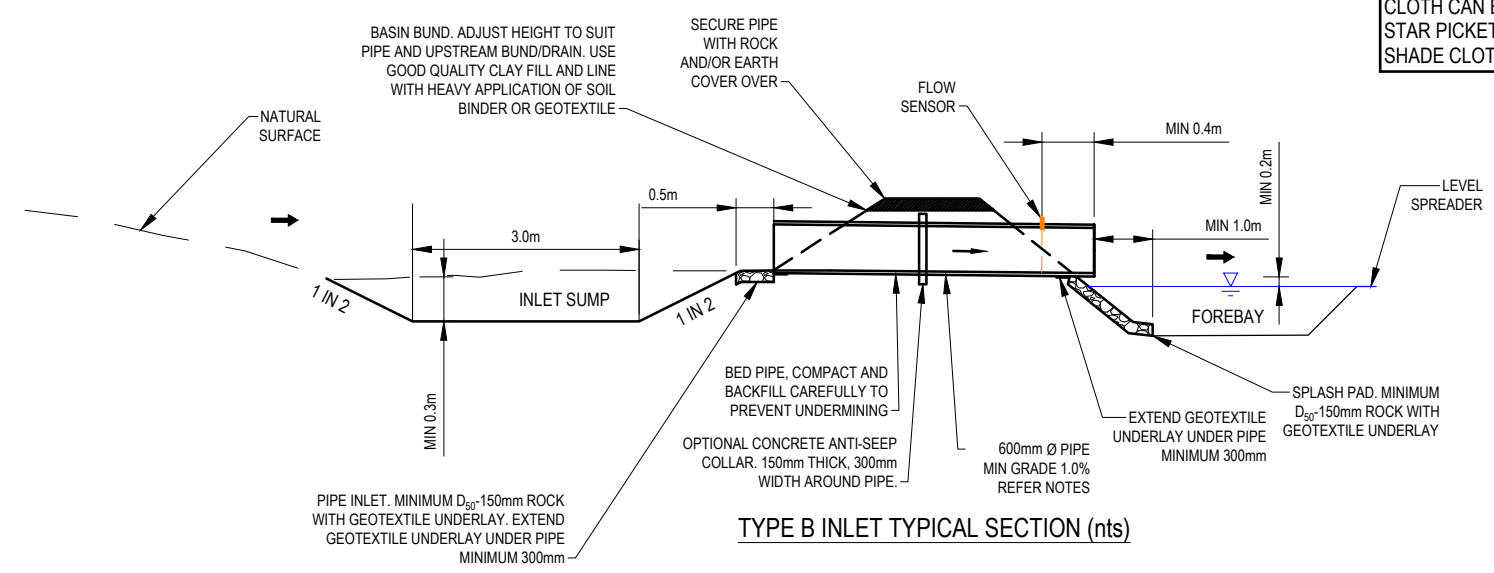


LEVEL SPREADER TYPICAL SECTION

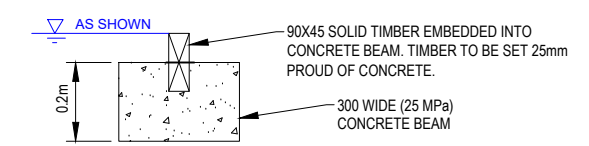


PERMEABLE BAFFLE SECTION

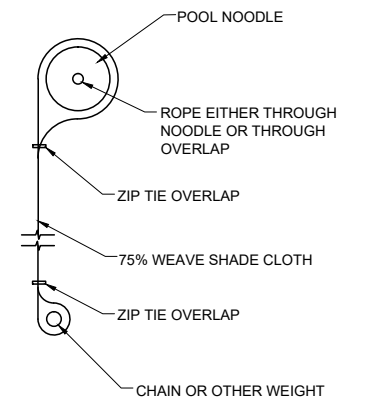
ALTERNATIVELY TO POOL NOODLES AND CHAIN, SHADE CLOTH CAN BE SUSPENDED ON STAR PICKETS. NOTE MUST BE 70% SHADE CLOTH, NOT GEOTEXTILE



TYPE B INLET TYPICAL SECTION (nts)



LEVEL SPREADER DETAIL SECTION



PERMEABLE BAFFLE SECTION B



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CLIENT	CQG CONSULTING
PROJECT	FISHERMANS ROAD - CHLOR-ALKALI FACILITY
DRAWN	RK
DESIGNED	SC
DATE	13/10/2025
PROJECT No	25-0204
DRAWING No	D08
REVISION	C

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PROJECT: FISHERMANS ROAD - CHLOR-ALKALI FACILITY
DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
SEDIMENT BASIN TYPICAL DETAILS
PROJECT No: 25-0204
DRAWING No: D08
REVISION: C

PERMEABLE BAFFLE SECTION B

BASIN SIZING CALCULATIONS - TYPE B HIGH EFFICIENCY

BASIN ID	CATCH AREA (HA)	BATTERS (1 IN X)	L:W RATIO	SETTLING DEPTH D _s (m)	C _t	TIME OF CONC (MINS)	I _i (mm/hr)	0.5Q _i (m ³ /s)	JAR TEST SETTLE AFTER 15 MINUTES (mm)	FLOC SETTLE DEPTH D _f (m)	MINIMUM A _s (m ²)	ACTUAL V _s (m ³)	SCOUR CHECK	SEDIMENT STORAGE				APPROX. DIMENSIONS					
														SED STORAGE OPTION?	RUSLE SOIL LOSS (t/ha/yr)	CLEAN OUT FREQUENCY (MONTHS)	MIN SED. STORAGE VOLUME (m ³)	APPROX. REQ SED STORAGE DEPTH (m)	APPROX. LENGTH AT SPILLWAY (m)	APPROX. WIDTH AT SPILLWAY (m)	APPROX. DEPTH AT SPILLWAY (m)	SETTLING VOLUME (m ³)	TOTAL VOLUME AT SPILLWAY (m ³)
SB1	4.7	2	2	1.10	0.56	15	80	0.292	150	0.60	1276	1404	BAFFLE	30% VEST			421	0.4	54.9	27.5	1.5	1404	1823

NOTES:
1. SEDIMENT BASIN IS SIZED BASED ON A SETTLEMENT RATE OF 150MM IN 15 MINS. DUE TO TIME CONSTRAINTS, NO JAR TESTS HAVE BEEN UNDERTAKEN. SETTLEMENT RATE IS TO BE VERIFIED PRIOR TO CONSTRUCTION OF SEDIMENT BASINS

BASIN SIZING CALCULATIONS - ALTERNATIVE TYPE D BASIN - ERA 10Y/24H SIZING

BASIN ID	CATCH AREA (HA)	BATTERS (1 IN X)	L:W RATIO	SETTLING DEPTH D _s (m)	10Y / 24HR RAINFALL DEPTH	CV	V _{SET}	SED STORAGE OPTION?	V _{SS}	APPROX. REQ SED STORAGE DEPTH (m)	APPROX. LENGTH AT SPILLWAY (m)	APPROX. WIDTH AT SPILLWAY (m)	APPROX. DEPTH AT SPILLWAY (m)	SETTLING VOLUME (m ³)	TOTAL VOLUME AT SPILLWAY (m ³)
SB1 (ERA - 10Y/24HR)	4.7	2	3	1.20	230	1	9736	50% VSET	4868	0.6	163.2	54.4	1.8	9736	14604

SPILLWAY SIZING CALCULATIONS

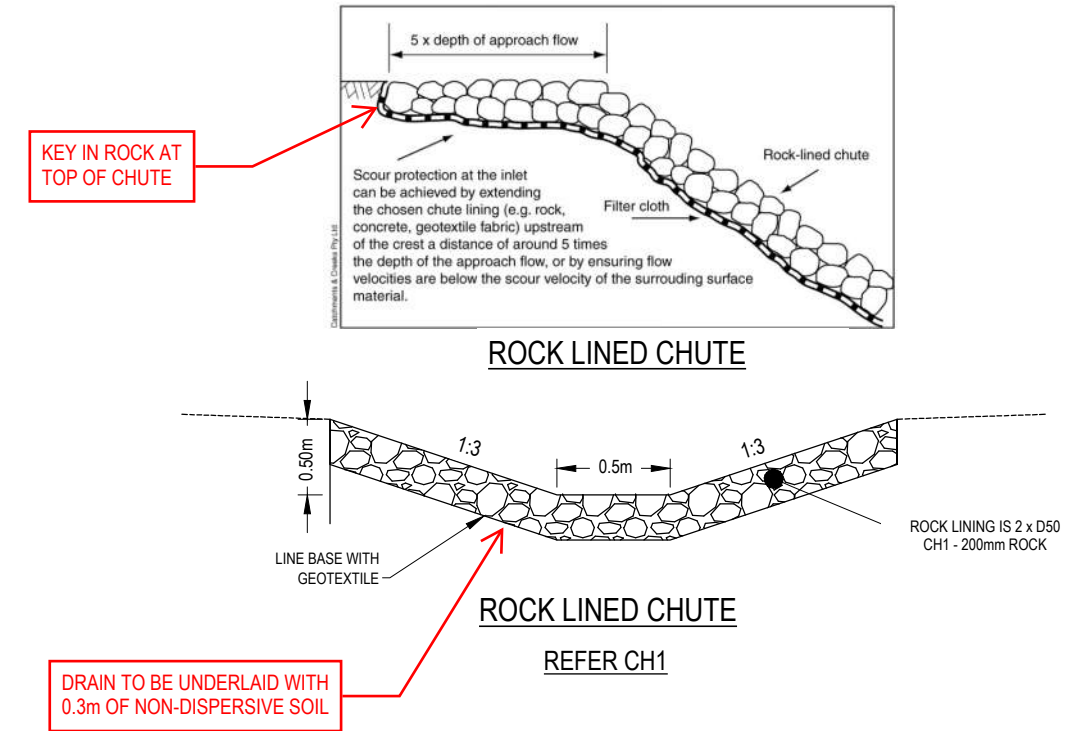
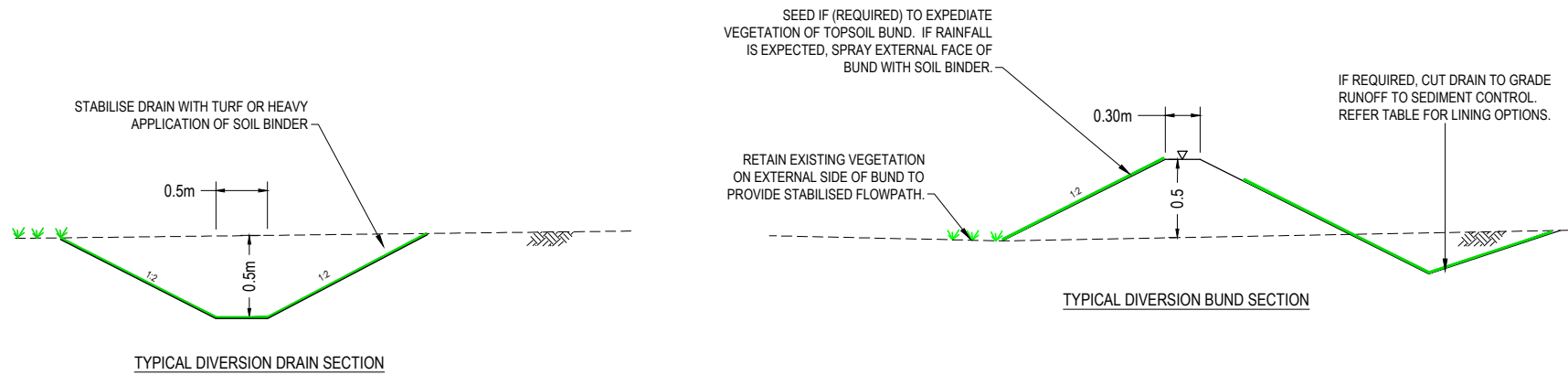
BASIN ID	CATCH AREA (HA)	ARI	C _{ARI}	TIME OF CONC (MINS)	I _{ARI}	FLOW - Q (m ³ /s)	WEIR					CHUTE					DISSIPATER					
							BASE WIDTH	SIDE SLOPE 1 (1 in x)	U/S WATER LEVEL (m)	FREEBOARD (m)	MIN. HEIGHT SPILLWAY TO TOB (m)	TOP WIDTH (m)	LONG. SLOPE (m/m)	LINING	MANUAL MANNING ROUGH COEFF	DESIGN VEL (m/s)	DEPTH OF FLOW (m)	DEPTH WITH F/BOARD (m)	MEAN ROCK SIZE - D50 (mm)	WIDTH 1 (m)	WIDTH 2 (m)	LENGTH (m)
SB1	4.7	50	0.805	15	178	1.87	15	2	0.17	0.3	0.47	16.89	0.5	d50-150mm ROCK	0.117	1.28	0.10	0.40	100	17.2	17.2	1.3
PONDING AREA	0.5	50	0.805	5	249	0.28	2	2	0.17	0.3	0.47	3.88	0.5	d50-150mm ROCK	0.117	1.21	0.10	0.40	100	4.2	4.5	1.3

DRAIN SIZING CALCULATIONS

DRAIN ID	CATCH AREA (HA)	ARI	C _{ARI}	TIME OF CONC (MINS)	I _{ARI}	FLOW - Q (m ³ /s)	LONG. SLOPE (m/m)	BASE WIDTH	SIDE SLOPE 1 (1 in x)	SIDE SLOPE 2 (1 in x)	LINING	MANNING ROUGH COEFF	MAX PERM VEL (m/s)	DESIGN VEL (m/s)	DEPTH OF FLOW (m)	DEPTH WITH F/BOARD (m)	DRAIN TOP WIDTH (m)	OK / NOT OK
DW1	2.5	10	0.7	15	136	0.66	0.01	0	2	50	Vital HR - 2L/m2	0.02	2.5	0.94	0.16	0.31	16.12	OK
DW2	0.5	10	0.7	5	190	0.18	0.01	0	2	50	Vital HR - 2L/m2	0.02	2.5	0.69	0.10	0.25	13.00	OK
CW1	5	10	0.7	15	136	1.32	0.01	0	2	50	Vital HR - 2L/m2	0.02	2.5	1.12	0.21	0.36	18.72	OK
CW2	0.5	10	0.7	5	190	0.18	0.01	0	2	50	Vital HR - 2L/m2	0.02	2.5	0.68	0.10	0.25	13.00	OK

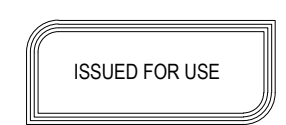
DRAIN SIZING CALCULATIONS - ROCK LINED CHUTE

DRAIN ID	CATCH AREA (HA)	ARI	C _{ARI}	TIME OF CONC (MINS)	I _{ARI}	FLOW - Q (m ³ /s)	LONG. SLOPE (m/m)	BASE WIDTH	SIDE SLOPE 1 (1 in x)	SIDE SLOPE 2 (1 in x)	ROCK SIZE - D50 (mm)	MANNING ROUGH COEFF	DESIGN VEL (m/s)	DEPTH OF FLOW (m)	FREEBOARD (m)	DEPTH WITH F/BOARD (m)	TOTAL DRAIN WIDTH (m)
CH1	2.5	10	0.7	15	136	0.66	0.25	1	3	3	d50-200mm ROCK	0.113	1.40	0.26	0.15	0.41	3.46



REVISION	DESCRIPTION	APPROVED BY	DATE
C	UPDATE FOR REVISED ACCESS	SC	12/11/2025
C	UPDATE FOLLOWING REVIEW	SC	29/10/2025
A	ORIGINAL ISSUE	SC	13/10/2025

A3



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DRAWN	RK	DESIGNED	SC
DATE	13/10/2025		
RPEQ / SIGNATURE (IF REQUIRED)			

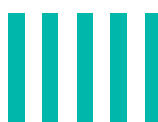
PROJECT	FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE	EROSION AND SEDIMENT CONTROL PLAN CALCULATIONS AND DRAINAGE SECTIONS		
PROJECT No	25-0204	DRAWING No	D09
REVISION	C		

CPESC NO. 6,599 RPEQ NO. 15,545



APPENDIX B

FLOC REPORT (TO BE PREPARED)





Floc Performance Report

BASIN IDENTIFICATION CODE/NUMBER:

SITE / PROJECT:

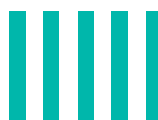
PREPARED BY: DATE:

Chemical name:		Soil description:				
Dose rate:	0.00 Control					
Starting pH						
Starting turbidity						
Clarity ^[1] after 5 mins (mm)						
Clarity ^[1] after 15 mins (mm)						
Clarity ^[1] after 30 mins (mm)						
Clarity ^[1] after 60 mins (mm)						
Final pH						
Final turbidity						

Chemical name:		Soil description:				
Dose rate:	0.00 Control					
Starting pH						
Starting turbidity						
Clarity ^[1] after 5 mins (mm)						
Clarity ^[1] after 15 mins (mm)						
Clarity ^[1] after 30 mins (mm)						
Clarity ^[1] after 60 mins (mm)						
Final pH						
Final turbidity						

Note:

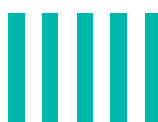
[1] For the purposes of a floc report, 'clarity' is defined as a level of turbidity that is likely to meet discharge requirements at a depth from the water level surface in the beaker. Clarity can be estimated visually or with the use of a turbidity meter.





APPENDIX C

BASIN PERFORMANCE REPORT



BASIN PERFORMANCE REPORT

Site / basin identification: _____

Inspector: _____

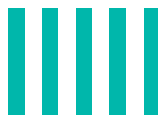
Date / time: _____

Recent rainfall: _____

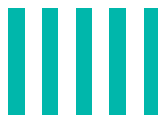
Water quality in basin: NTU: _____ pH: _____

Water level in basin: _____

Issue Item		Potential Issue / Action Required (Y/N)	Comments/Action Undertaken
Inflow channel	Channel/pipe overtopped		
	Scour in channel		
	Chemical not mixing with inflow runoff		
	Catchment bypassing channel		
	Lateral inflow to main basin cell		
	Other		
Chemical & dosing	Chemical not working		
	No dosing		
	Incorrect dose rate		
	Other		
Fore bay	Sediment re-suspension		
	Other		
Level spreader	Concentrated flow over level spreader		
	Scour on backside of level spreader		
	Other		



Issue Item		Potential Issue / Action Required (Y/N)	Comments/Action Undertaken
Settling pond	Flow short circuiting in main basin		
	Erosion on side of basin batters		
	Other		
In-line baffles	Flow concentrating to one side of baffle		
	Flow conveyed over the top of the baffle		
	Flow restricted through baffle too much		
	Flow passes through baffle too quickly		
	Other		
Decant system	Decant sinks below surface		
	Decant raised above water level		
	Decant dropped on one side		
	Decant blocked		
	Decants concentrating flow in basin		
	Other		
Emergency spillway	Concentrated flow on spillway		
	Spillway too low		
	Spillway too high		
	Other		
Other General Comments			



DRAFT

APPENDIX D:

Stormwater Management Plan (Operational Phase)



STORMWATER MANAGEMENT PLAN

FISHERMANS ROAD, YARWUN

PROJECT HALOGEN CHLOR-ALKALI FACILITY



CLIENT: CQG CONSULTING

REFERENCE: 25-0204/R4331

VERSION: C

DATE: 12-11-2025



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1 INTRODUCTION

Topo were engaged by CQG Consulting to develop a Stormwater Management Plan (SMP) for the operational phase of the proposed Chlor-Alkali Facility at Fishermans Road, Yarwun.

CQG Consulting has been engaged to prepare a development application (DA) for a material change of use (MCU) for a concurrence environmentally relevant activity (ERA) 7(6d) Chemical manufacturing: manufacturing, in a year, more than 100,000 tonnes of inorganic chemicals (proposed Chlor-Alkali facility). The project is referred to as 'Project Halogen'. The project is located within the Gladstone State Development Area (GSDA).

This report identifies the stormwater quality management objectives for the operational phase (post-construction phase) of the proposed development. Construction based stormwater quality management objectives have been addressed in the CPESC certified Erosion and Sediment Control Plan (ESCP) prepared by Topo.

1.1. GUIDELINES

This SMP been prepared in accordance with:

- + *MUSIC Modelling Guidelines (Water by Design, 2018),*
- + *Water Sensitive Urban Design WSUD Technical Guidelines (Water by Design, 2006),*
- + *Guidelines for the Construction and Establishment of Bioretention Systems and Wetlands (Water by Design, 2023), and*
- + *Burnett-Mary Stormwater Quality Modelling - Development of Rainfall Datasets (DesignFlow, 2010).*

1.2. REVISION

VER.	DATE	AUTHOR	APPROVED
A	15-10-2025	S. CHAMBERLAIN	S. CHAMBERLAIN RPEQ NO. 15,545
B	29-10-2025	S. CHAMBERLAIN	S. CHAMBERLAIN RPEQ NO. 15,545
C	12-11-2025	S. CHAMBERLAIN	S. CHAMBERLAIN RPEQ NO. 15,545



2 PROJECT DESCRIPTION

2.1. LOCATION

The proposed Chlor-Alkali Facility will be constructed within Lot 1 on MPH32292 (56 Fishermans Road, Yarwun) and Lot 1 on SP200899 (26 Landing Road, Yarwun). The facility includes upgrading the access along Fishermans Road between the facility and the intersection with Landing Road.

The project area is approximately 7.65 ha which includes plant and ancillary facilities. The project components will consist of a chlor-alkali plant and ancillary facilities, including office, car parking and utilities.

The general locality of works is highlighted within Figure 1.



Figure 1 - Site Locality Project Halogen (Source: CQG Consulting)



3 SITE DESCRIPTION

3.1. CLIMATE

Based on historic rainfall data the period between October to March presents the greatest rainfall with approximately 76 % of the annual rainfall typically occurring during this period. As far as practical, all efforts should be made to reduce exposed areas to that reasonably manageable during this period.

Historic rainfall for the region, derived from data represented by the closest Bureau of Meteorology Station (Gladstone Airport, approximately 10 km from site) is presented below in Figure 2.



Figure 2 - Historic Rainfall (Source: BoM)

3.2. TOPOGRAPHY & DRAINAGE

The site topography is quite consistent, falling from northwest to southeast at grades typically less than 1.5 %.

Boat Creek runs along the southern boundary, approximately 250 m away from the site. Review of topographic data indicates the external catchment to the west of Landing Road does not enter the site, but is directed to Boat Creek. Mapping of the Boat Creek catchment was undertaken using the 1 second DEM-H elevation data derived from the Shuttle Radar Topography Mission (SRTM). The DEM-H is the hydrologically enforced DEM and has drainage lines imposed and further smoothed. Based on this analysis, the Boat Creek catchment is approximately 3800 ha, as illustrated in Figure 3.

Further review of the topography using 1 m LIDAR tiles in the immediate vicinity of the site confirms the external catchment to the west of Landing Road does not enter the site, but is directed to Boat Creek. Refer to Figure 4 for further details.

3.3. LAWFUL POINT OF DISCHARGE

In the operational phase of the development, the external catchment from the eastern side of Landing Road will be diverted around the site, passing through a culvert under Fishermans Road. Therefore, all external catchment runoff will be diverted around the site and will not enter the proposed bioretention system. Refer to Appendix A for details in relation to the existing drainage features and conceptual drainage works to be undertaken as part of the development.

The Lawful Point of Discharge (LPD) will be located on the southern site boundary. All site runoff from the bioretention system will be conveyed by a vegetated swale to the LPD, with scour protection and a level spreader provided at the site outlet to ensure runoff exiting the site does not cause erosion and scour downstream of the LPD.



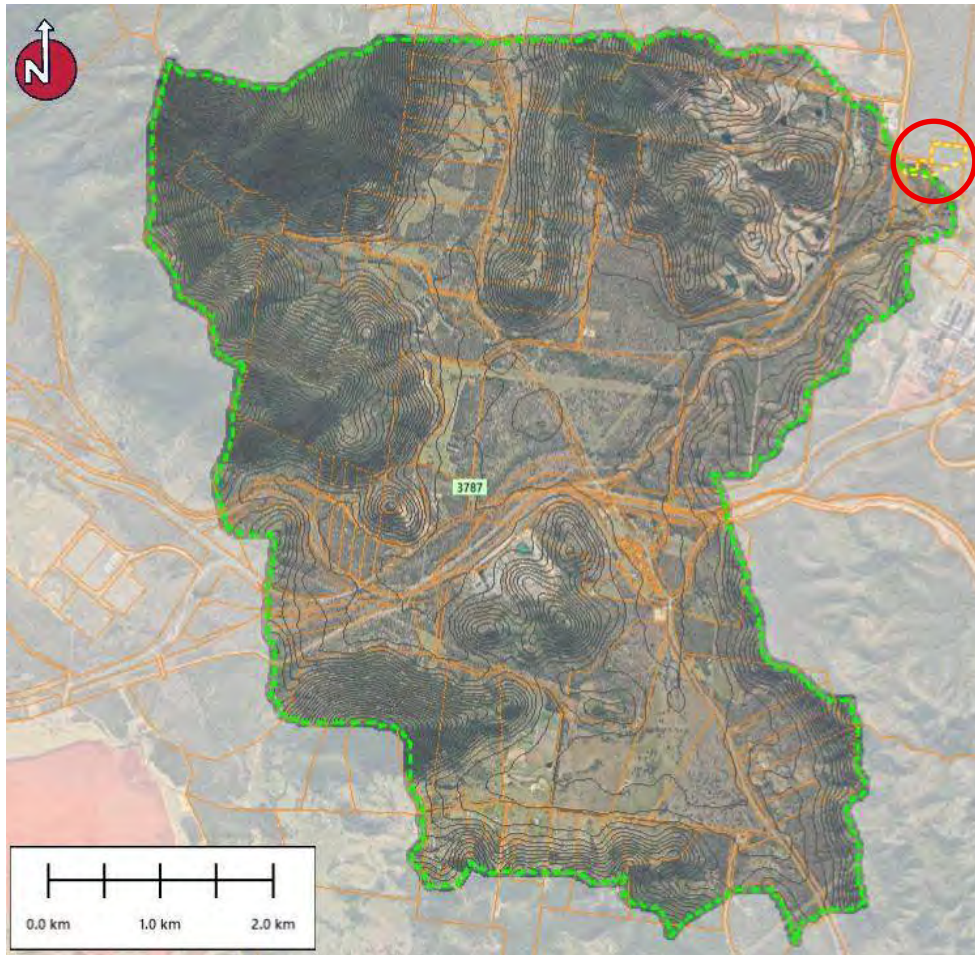


Figure 3 – Boat Creek Catchment (the Site identified by the red circle)

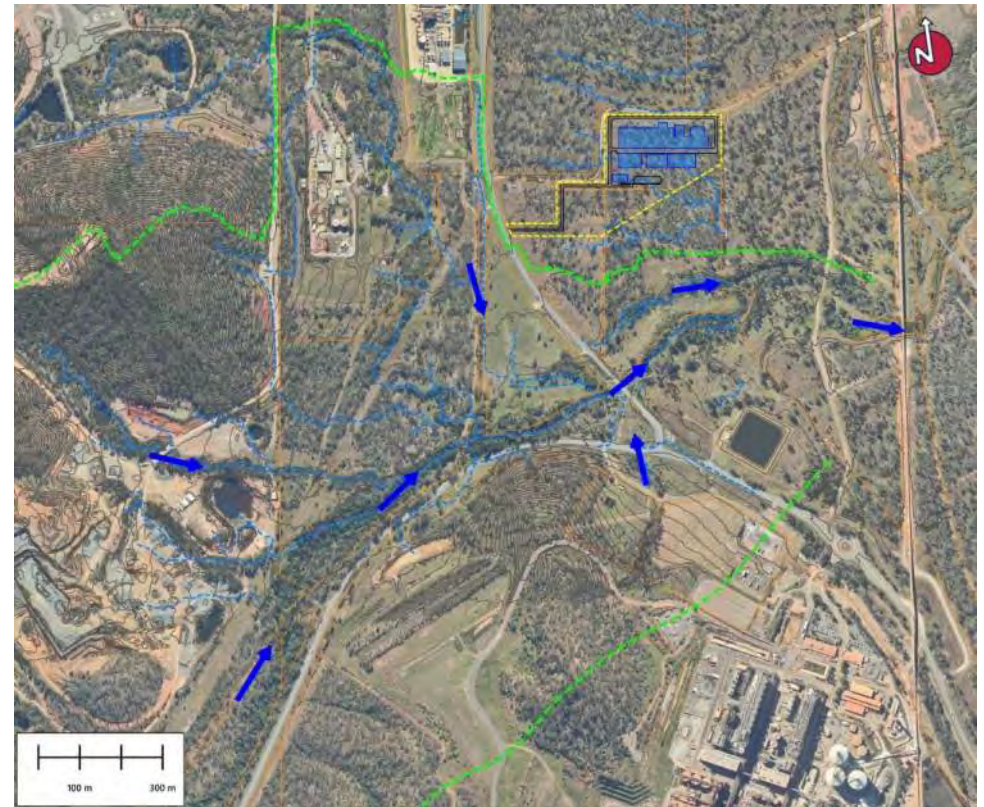


Figure 4 – Boat Creek and Local Catchment



4 WATER QUANTITY

4.1. DESIGN OBJECTIVES

The design objective is to demonstrate no actionable nuisance in terms of drainage as a result of the development. Stormwater detention requirements are generally waived in the following situations:

- + Where the development will not cause adverse impacts or nuisance to neighbouring properties,
- + If the site discharges directly into the ‘ultimate’ receiving waters and flooding is already controlled by river flooding or storm tide, and
- + For sites that discharge directly into lower catchments of creeks or major drains where detention is considered undesirable.

While the development of Project Halogen has the potential to increase flow rates for the local catchment as a result of additional impervious areas, these will have no impact on peak water levels at the site or for adjacent properties. This is due to the magnitude and lag time of peak flows generated within the external catchments and storm surge conditions that dictate flooding and the Defined Flood Level for the site. Runoff for the site and local catchment will have entered Boat Creek and passed downstream prior to the peak of the external catchment flows passing the site.

Detaining flows on site increases the likelihood of the site’s peak discharge coinciding with the peak of the external catchments. This could result in an increased peak flow rate downstream of the site.

Therefore, on-site detention is considered unnecessary for this development.

5 STORMWATER QUALITY

5.1. DESIGN OBJECTIVES

This report identifies the stormwater quality management objectives for the operational phase of the development. The load-based Water Quality Objectives (WQOs) stipulated for the specified for central Queensland South region, as defined in the Burnett–Mary Stormwater Quality Modelling guidelines, are summarised in Table 1.

Table 1 – Water Quality Design Objectives

MINIMUM REDUCTIONS IN MEAN ANNUAL LOAD FROM UNMITIGATED DEVELOPMENT (%)			
TOTAL SUSPENDED SOLIDS (TSS)	TOTAL PHOSPHORUS (TP)	TOTAL NITROGEN (TN)	GROSS POLLUTANTS > 5 mm
85	70	45	90

This report identifies the stormwater quality management objectives for the operational phase (post-construction phase) of the proposed development. Construction based stormwater quality management objectives has been addressed in the CPESC certified Erosion and Sediment Control Plan (ESCP) prepared by Topo.

5.2. MODELLING AND TREATMENT STRATEGY

Stormwater runoff quality from the proposed development site has been assessed using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). It is proposed to treat stormwater runoff from the site in a bioretention system sized to ensure compliance with the load-based reduction targets.

5.2.1. CATCHMENTS

Modelling has been undertaken using a “lumped” catchment modelling approach. The catchment definition is included in Table 2.





Table 2 – Catchment Definition

CATCHMENT ID	LAND USE	AREA (Ha)	FRACTION IMP. (%)
A	Industrial-Lump Node	5.1	80 %

5.2.2. MUSIC MODEL PARAMETERS

The parameters utilised in the MUSIC model are provided in Table 3 to Table 6 and comply with the MUSIC Modelling Guidelines (Water by Design, 2018).

Table 3 – Meteorological and Rainfall Runoff Data

INPUT	DATA USED IN MODELLING
Rainfall station	GLADSTONE– Station No 39123
Time step	6 minutes
Modelling period	1/01/1981 to 31/12/1990
Mean annual rainfall (mm)	915
Evapotranspiration (mm)	1,721
Rainfall runoff parameters	Industrial
Pollutant export parameters	Industrial

Table 4 – Rainfall Runoff Parameters

PARAMETER	SOURCE NODES
Landuse	Industrial
Rainfall threshold (mm)	1
Soil storage capacity (mm)	18
Initial storage (% capacity)	10
Field capacity (mm)	80
Infiltration capacity coefficient a	243
Infiltration capacity coefficient b	0.6
Initial depth (mm)	50
Daily recharge rate (%)	0
Daily baseflow rate (%)	31
Daily deep seepage rate (%)	0

Table 5 – Pollutant Export Parameters

LAND USE	FLOW TYPE	TSS (LOG ₁₀ mg/L)		TP (LOG ₁₀ mg /L)		TN (LOG ₁₀ mg /L)	
		MEAN	ST. DEV.	MEAN	ST. DEV.	MEAN	ST. DEV.
Industrial	Baseflow	0.78	0.45	-1.11	0.48	0.14	0.20
	Stormflow	1.92	0.44	-0.59	0.36	0.25	0.32





Table 6 – Bioretention System Parameters

PARAMETER	BIO 1
Surface area (m ²)	750
Extended detention depth (mm)	0.30
Filter area (m ²)	700
Unlined filter media perimeter (m)	106
Saturated hydraulic conductivity (mm/hr)	200
Filter depth (m)	0.5
TN content of filter media (%)	400
Orthophosphate content of filter media (mg/kg)	30
Is the base lined?	No
Effectiveness of plant TN removal	Effective
Overflow weir width (m)	17
Exfiltration rate (mm/hr)	0
Underdrain present?	Yes
Submerged zone with carbon present?	No
Depth of submerged zone (m)	N/A
Confirmation that K and C* remain default	Yes

NOTE: * measured at half the extended detention depth

5.2.3. RESULTS

The results of the MUSIC model indicate the treatment train achieves the required design objectives, as summarised in Table 7 and Figure 5.

Table 7 – MUSIC Results

LOCATION	POLLUTANT	INFLOWS (KG/YR)	OUTFLOWS (KG/YR)	REDUCTION ACHIEVED (%)	WATER QUALITY OBJECTIVES (%)
Outlet	TSS	5,250	789	85	85
	TP	14.1	3.51	75.2	70
	TN	87.2	41.6	52.3	45
	GP	897	0	100	90

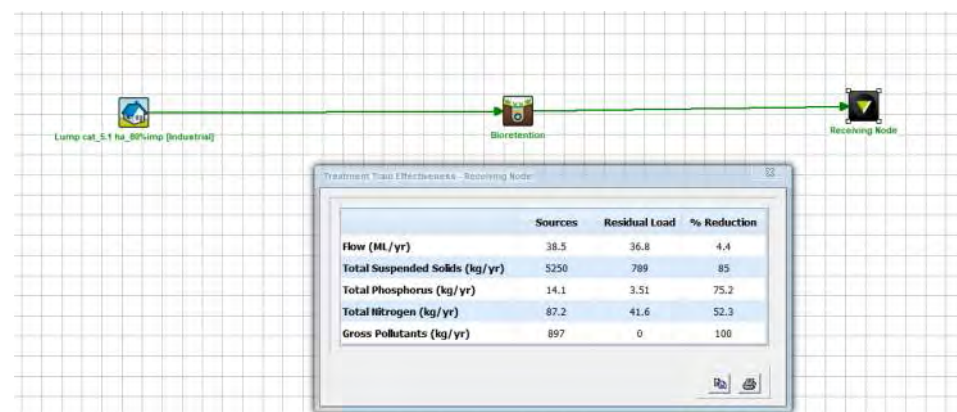


Figure 5 – Results & MUSIC Model

A typical bioretention system section is provided in Appendix A.





6 CONCLUSION

An increase in peak flow rates can be expected from any development resulting in an increase in impervious surfaces.

The design objective is to ensure no actionable drainage nuisance results from the development. While Project Halogen will increase impervious surfaces, this will not affect peak water levels for adjacent properties. Flooding at the site is governed by external catchment flows and storm surge, with local runoff entering Boat Creek and passing downstream before the peak flow of the external catchment arrives at the site.

The development will cause no loss of flood storage and no adverse flood impacts.

The water quality objectives for the Central Coast - South region will be met through a bioretention system with 700 m² of filter media (0.5 m depth, 0.3 m extended detention). Final design and modelling will confirm compliance during detailed design.

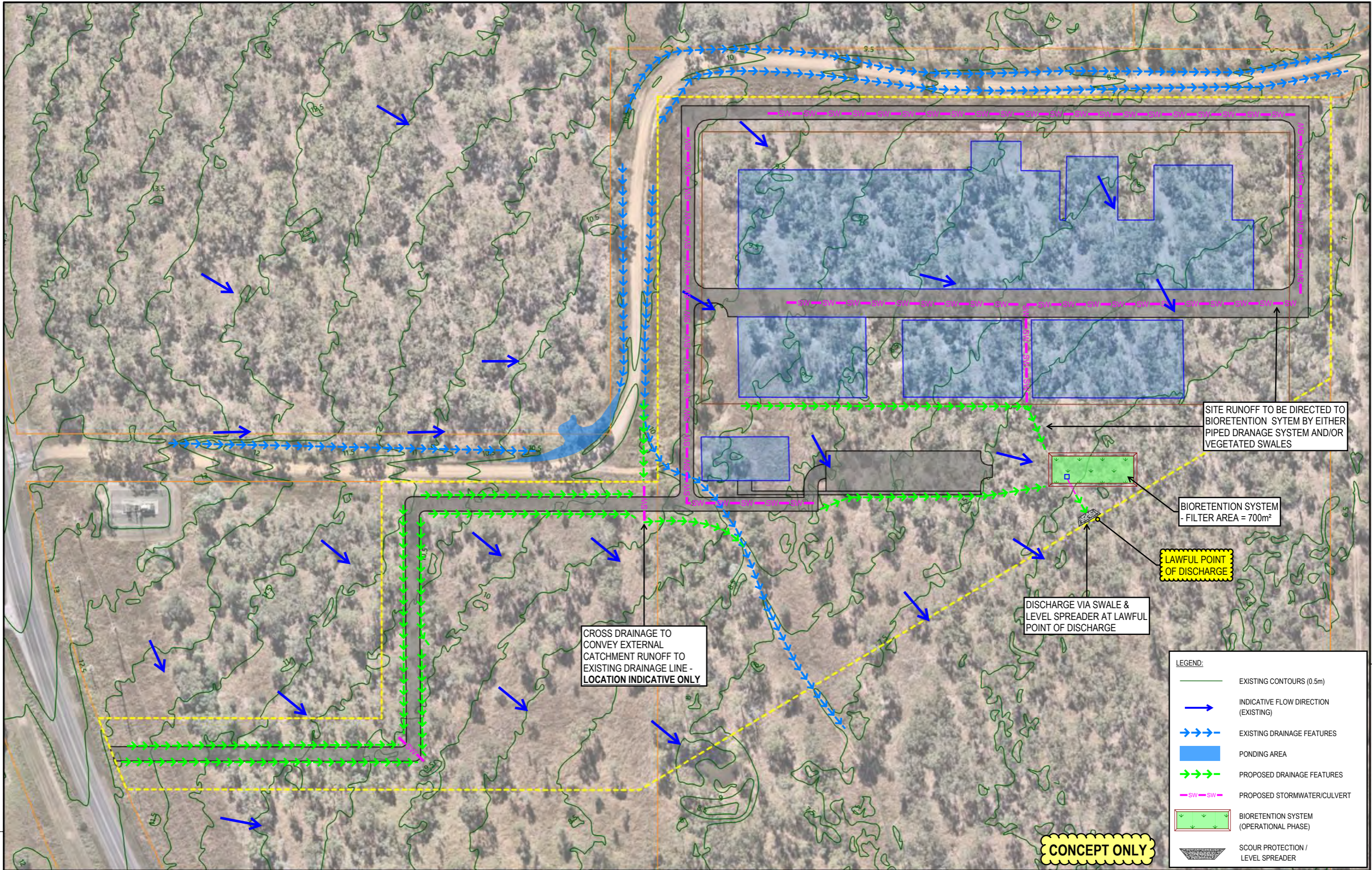




APPENDIX A

OPERATIONAL CONTROL CONCEPT PLAN





LEGEND:

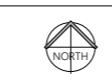
	EXISTING CONTOURS (0.5m)
	INDICATIVE FLOW DIRECTION (EXISTING)
	EXISTING DRAINAGE FEATURES
	PONDING AREA
	PROPOSED DRAINAGE FEATURES
	PROPOSED STORMWATER/CULVERT
	BIORETENTION SYSTEM (OPERATIONAL PHASE)
	SCOUR PROTECTION / LEVEL SPREADER

7365000

7365000



REVISION	DESCRIPTION	APPROVED BY	DATE
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RPEQ / SIGNATURE (IF REQUIRED)			
CPESC NO. 6,599 RPEQ NO. 15,545			

PROJECT	FISHERMANS ROAD - CHLOR-ALKALI FACILITY		
DRAWING TITLE	STORMWATER MANAGEMENT PLAN - DRAINAGE FEATURES & OPERATIONAL CONTROL CONCEPT PLAN		
PROJECT No	DRAWING No	REVISION	
25-0204	D01	B	

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