PERDAMAN
INDUSTRIES
CHEMICALS & FERTILISERS

Acid Sulfate Soils Management Plan

Project Ceres

Burrup Peninsula, Western Australia

PCF-PD-EN-ASSMP

Proponent:
Perdaman Chemicals and Fertilisers Pty Ltd
ABN: 31 121 263 741

Date: 26 March 2025

Ministerial Statement: 1180

Assessment No:
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2018/8383 (Commonwealth)

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PCF1	06/06/2023	Issued for Construction	[redacted]	[redacted]
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Acknowledgement of Country

"As the Chairman of Perdaman Chemicals and Fertilisers, I would like to acknowledge the Traditional Custodians of Murujuga, namely the Ngarluma, Yindjibarndi, Yaburara, Mardudhunera and Wong-Goo-Tt-Oo people and pay our respects to their Elders past and present"

- [redacted]

Executive Summary

Proposal Title	Project CERES
Proponent Name	Perdaman Chemicals and Fertilisers Pty Ltd.
Assessment Number	2184 (WA) & 2018/8383 (Commonwealth)
Ministerial Statement No.	Ministerial Statement Number 1180
Construction & Operations Commencement Dates.	Construction is scheduled to commence October 2023 Operation of the facility is proposed to commence August 2027.
Purpose of the ASSMP	This ASSMP has been prepared to meet the requirements of the Department of Water and Environmental Regulation's guideline: Treatment and management of soil and water in acid sulfate soil landscapes (DER, 2015). In accordance with ministerial condition (MS 1180) 7-2 this Plan shall demonstrate it has met the requirements detailed within conditions 7-2. This Overarching Acid Sulfate Soil Management Plan (ASSMP) applies to all Project sites during the Planning, Design, Construction, Commissioning and Operations of the Perdaman Urea Project. This includes, but is not limited to, works at Site C, Site F, the causeway, the conveyor corridor, Port side storage, product transfer and ship loading areas. A short description of these areas is provided in Section 1.1 above.
Key environmental factors and objectives	The EPA identified the Key environmental factors for the Project as including *Flora & Vegetation, Terrestrial Fauna, Inland Waters, Air Quality, Greenhouse Gas Emissions, Coastal Processes, Social Surroundings and Marine Environmental Quality*. This Plan addresses the Inland Waters key environmental factor. Perdaman has identified five environmental factors as communicated by the EPA that specifically link with the exposure and improper management of Acid Sulfate Soils and Inland Water values on the Project. In addition, Perdaman have identified that Acid Sulfate Soils specifically relates to the Factor ***Terrestrial Environmental Quality***.
Condition clauses	**Condition 7-1 and Condition 7-2 of MS 1180.**
Key provisions inthe plan	Section 4 Section 9 Section 11

Foreword

This Acid Sulfate Soils Management Plan (ASSMP) is a sub-plan of the overarching Project Environmental Management Plan (PEMP) for Project CERES. An overview of the structure of the PEMP and associated management plans is illustrated in Figure 0-1, with the position of the ASSMP highlighted within the overall structure.

This Plan shall be reviewed and updated as necessary throughout the construction, operation and decommissioning phases of the project. The review process is detailed in Section 15 of the PEMP: *Review and Continual Improvement*.

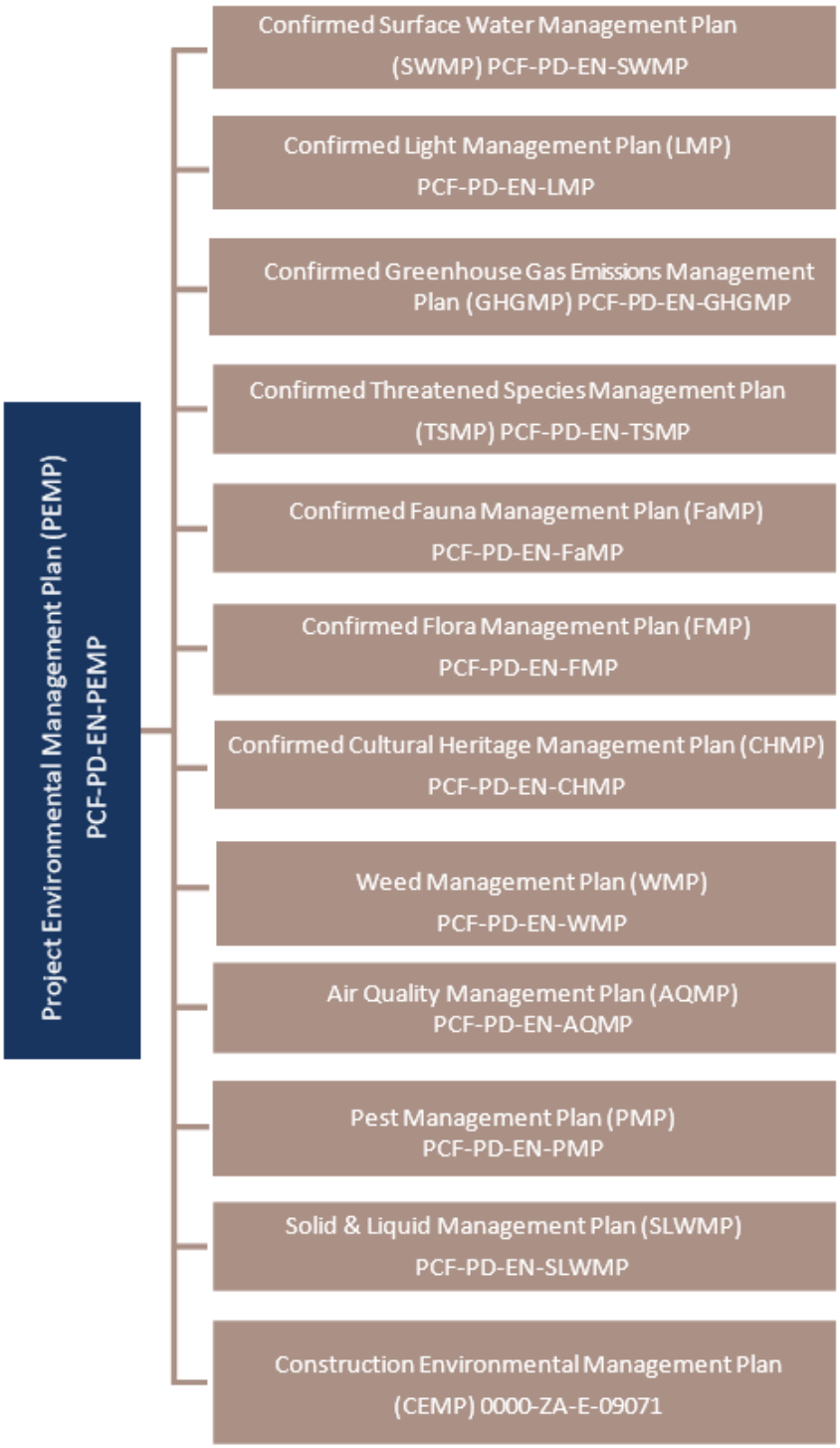

Figure 0-1 Structure of the Project Environmental Management Plan and supporting sub-plans

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1 Context & Scope

1.1 Project Description

Perdaman plans to construct and operate a state-of-the-art urea plant with a production capacity of approximately 2 million tonnes per annum (Mtpa) on the Burrup Peninsula in the Northwest of Australia Figure 1 2 (the Project).

The Project infrastructure including the main production facility (urea plant), administration, maintenance and storage infrastructure, conveyor and port storage and shiploading facilities are situated within the Burrup Strategic Industrial Area (Burrup SIA) approximately 8 km from Dampier and 20km north-west of Karratha on the Burrup Peninsula. The Burrup SIA has established industrial facilities including Yara Pilbara Fertilisers and Nitrates plants and Woodside's Pluto LNG plant. The estate's proximity to gas, port and other key infrastructure makes it an ideal location for the Project.

The Burrup SIA is located in close proximity to the Murujuga National Park which covers an area of 4,913ha on the Burrup Peninsula. The area is considered to host the largest concentration of ancient rock art in the world. As such, the Project will apply effective management strategies that minimise or abate, actual or potential impacts on the environment, heritage and cultural values of the region.

The Project involves piping natural gas from the nearby Woodside operated LNG facility to the Project site under a long term commercial off-take agreement. Natural gas is converted to urea and the final granulated product is transported by conveyor to the Dampier Port by closed conveyor along the East West Service route, where new facilities will include an enclosed stockpile shed and ship loading facilities.

Proven Urea production technology underpins each of the key stages of this Project. The technologies being applied to the plant are equivalent to the industry best for the specific applications and successfully operate elsewhere in the world. The processing plant can be broadly considered in four sections, or Blocks, namely:

- Gas Block
- Product Block
- Utility Block
- Infrastructure and Logistics

Each of the Process Blocks is made up of process units or physical sections of the plant. The major process sections are described in Figure 1-1 below.

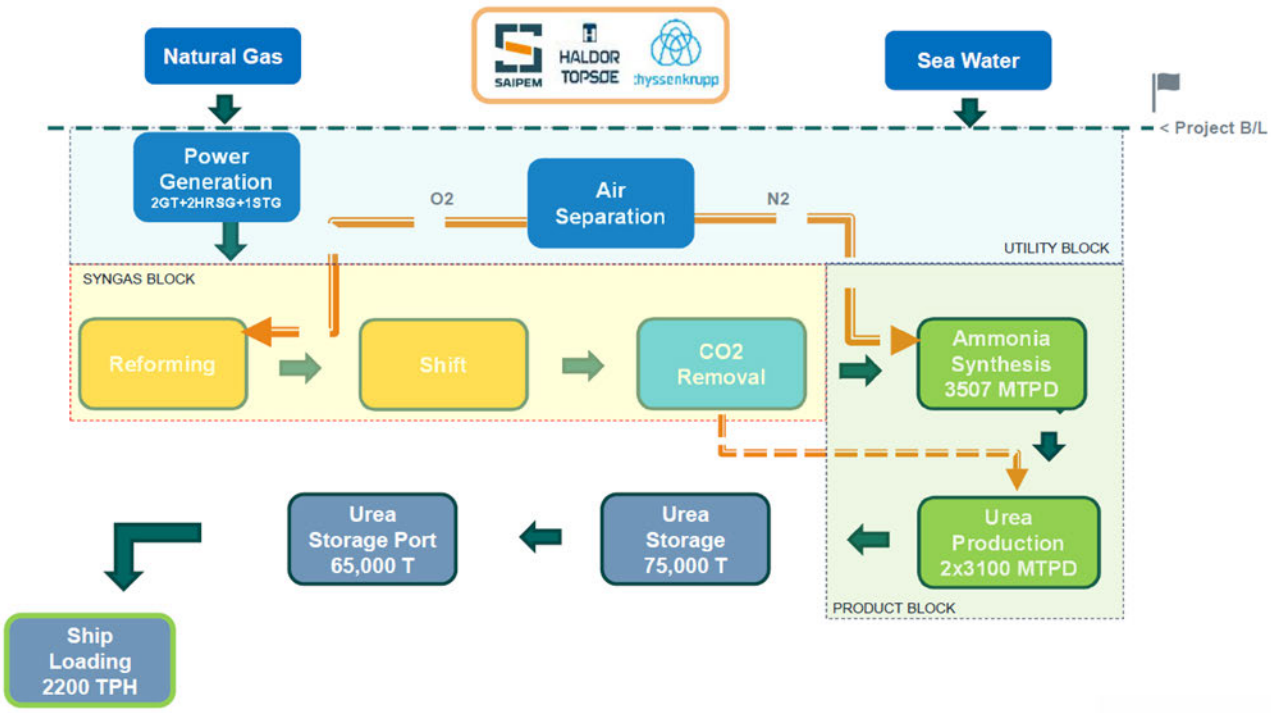

Figure 1-1 Process Block Diagram

The Project area, including Sites C and F, the causeway, conveyor and Port storage and loading facilities, extends east-west approximately 3.4km covering approximately 105 hectares in area. As illustrated in Figure 1-2.

Site C

Site C is relatively undeveloped with the exception of a few access roads. The site is situated adjacent to the Yara Ammonia Plant to its east, to the north are steep rocky outcrops and to the south the supra-tidal flat area. Surface water from the site flows in a southerly direction towards the supra-tidal flat between Hearson Cove and King Bay.

Once developed Site C will include the main process plant and a 75,000-tonne urea storage shed.

Site F

Site F is situated to the south of Site C, on the opposite side of the supra-tidal flat area. It includes Hearson Cove Road and a significant proportion of previously disturbed area (now rehabilitated). Surface water from this area flows primarily north into the supra-tidal flat.

This area will be used as laydown for equipment and modules, and for shutdown/ maintenance activities. The east portion of Site F will include the Project's administration, maintenance, storage and warehousing facilities.

Causeway

The causeway, which links Sites C and F, extends across the supra-tidal flat area.

The causeway will be built up above the supra-tidal flat area to a road height of approximately 6m AHD with regular culverts to ensure the structure does not impede natural surface water or tidal flows.

Conveyor

The 3.2km conveyor will transport urea from the storage shed at Site C to the Port loading shed.

From Site C the conveyor will be constructed on relatively undisturbed land, to the west of the existing Water Corp pipeline corridor. It will extend north, connecting to the existing Burrup East West Services Corridor (EWSC).

The EWSC is a bitumen sealed corridor which already includes the Yara Pilbara Fertiliser's ammonia pipeline which extends to the Dampier Bulk Liquids Berth (DBLB) adjacent to the Project's Port facilities. The Project's conveyor will be positioned within this corridor and where possible use existing culverts to avoid roads and other infrastructure. Where the conveyor crosses Woodside's Haul Road the road will be built up to allow the conveyor to pass under.

Surface water in the EWSC will be managed via existing surface water systems for the EWSC infrastructure.

Port Area

The Port Area includes a 75,000-tonne storage shed, covered conveyor and ship loader. The storage shed will be located within an existing quarry and the shiploader on a wharf which will be constructed by Pilbara Port Authority (PPA). The Conveyor will be situated on cleared area associated with the new wharf and quarry, and a small section of rocky ground between these two areas.

To maintain product integrity, it is imperative that urea is kept dry throughout the storage, transfer and loading process. As such, urea will remain isolated from rainfall and stormwater which will be managed through existing surface water channels.

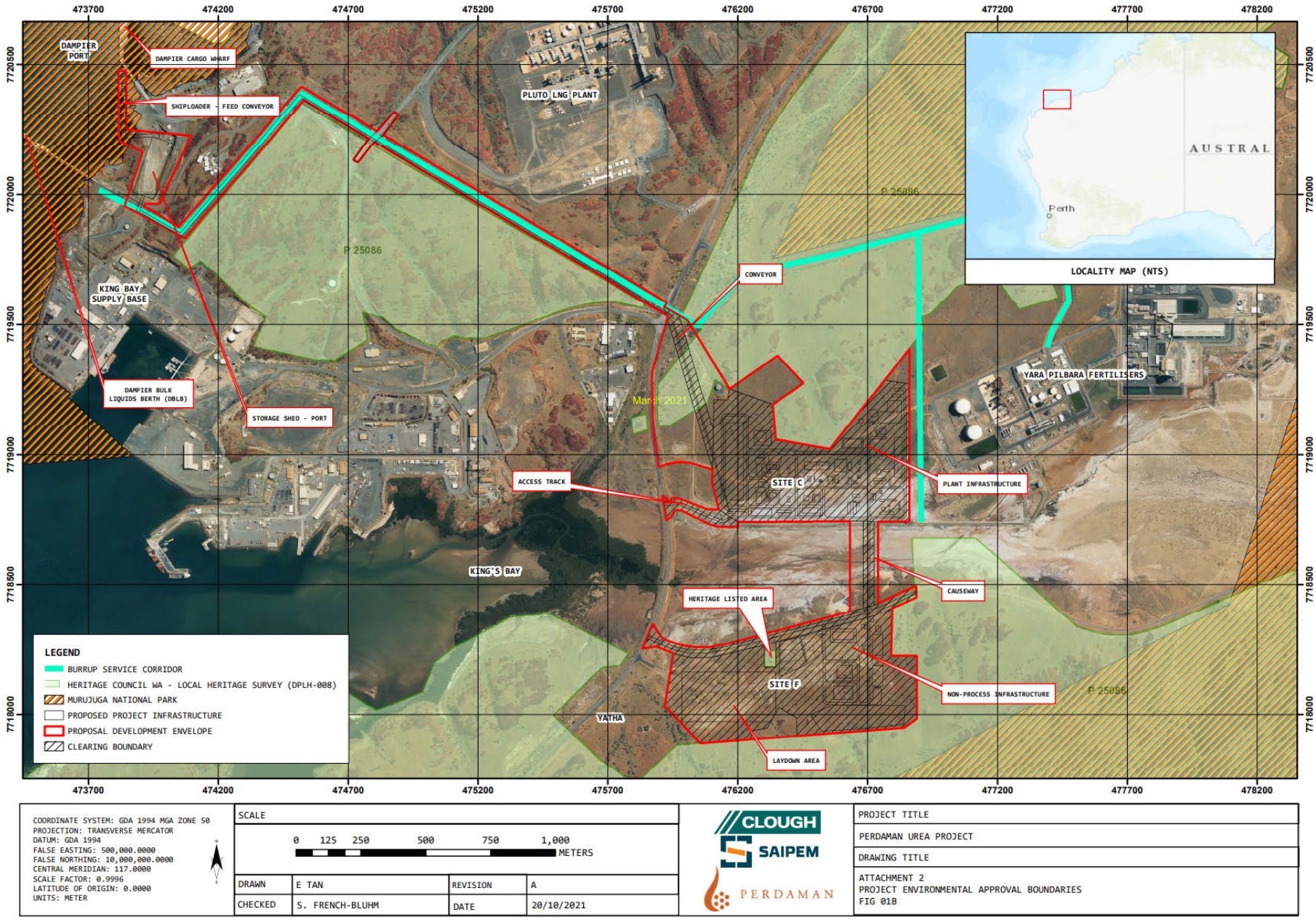

Figure 1-2 Project Site Layout & Adjoining Facilities

1.2 Scope & Requirement for the Plan

This Overarching Acid Sulfate Soil Management Plan (ASSMP) applies to all Project sites during the Planning, Design, Construction, Commissioning and Operations of the Perdaman Urea Project. This includes, but is not limited to, works at Site C, Site F, the causeway, the conveyor corridor, Port side storage,product transfer and ship loading areas. A short description of these areas is provided in Section 1.1 above.

This ASSMP has been prepared to meet the requirements of the Department of Water and Environmental Regulation's guideline: *Treatment and management of soil and water in acid sulfate soil landscapes (DER, 2015*). In accordance with ministerial condition (MS 1180) 7-2 this Plan shall demonstrate it has met the requirements detailed within conditions 7-2.

Specifically, the ASSMP applies to the following:

- Design considerations for controls based on environmental setting and site conditions including geology, gradient, groundwater environment, surface water features and ground cover;
- All ground disturbing activities associated with site establishment, infrastructure installation and excavations;
- All earthworks and cut and fill activities including batter formation and stabilisation;
- Stockpiles and soil management;
- All erosion control measures;
- All pollution control measures;
- All stormwater and wastewater management measures;
- Culverts at the causeway;
- Outlet discharge structures; and
- Site rehabilitation activities.

This document will be periodically updated as new approvals are received and compliance requirements are determined. This document will be updated following construction to apply to updated operational aspects of the Project.

The scope of this overarching ASSMP does not include the construction of port facilities such as the jetty or infill of the coastal area for the provision of a wharf. These Works are to be managed by the Pilbara Port Authority (PPA) and are subject to separate approvals. The area in which the conveyor, shiploader and storage shed will be constructed is a highly disturbed area.

This Overarching ASSMP provides the environmental management requirements for the identification, management, treatment, storage, stockpiling, validation and disposal of ASS and Potential Acid Sulfate Soils (PASS). It includes a series of specific management strategies that will be applied across the construction, operation and decommissioning phases of the project to avoid and mitigate impacts.

A suite of performance criteria and related response actions, management strategies and monitoring programs will be implemented throughout the construction and operational phases of the project to minimise or abate ASS related impacts.

1.3 Responsibility

The responsibility for acid sulfate soils sits primarily with Perdaman. Perdaman has appointed an Engineering Procurement and Construct (EPC) Contractor comprising Saipem and Clough in a joint venture (SCJV). The SCJV will ensure that the obligations and management strategies presented in this plan shall be adhered to during construction and appropriate inductions, training and communication of this Plan will be provided to all Project Personnel.

It is the responsibility of all Project Personnel to understand their scope of works and how acid sulfate soils management applies to their activities.

It is the responsibility of the proponent (Perdaman) to ensure that this Plan satisfies the requirements of condition 7-2 of MS 1180.

1.4 Key Environmental Factors

The EPA identified the Key environmental factors for the Project as including *Flora & Vegetation, Terrestrial Fauna, **Inland Waters**, Air Quality, Greenhouse Gas Emissions, Coastal Processes, Social Surroundings and Marine Environmental Quality*. This Plan addresses the Inland Waters key environmental factor.

Perdaman has identified five environmental factors as communicated by the EPA that specifically link with the exposure and improper management of Acid Sulfate Soils and Inland Water values on the Project. In addition, Perdaman have identified that Acid Sulfate Soils specifically relates to the Factor *Terrestrial Environmental Quality*, and therefore this factor has also been included within the Table below. This Plan has been developed to **meet the objectives** of the EPA's environmental factors as outlined in Table 1-1.

Table 1-1 Key Environmental Factors & Potential Impacts (EPA)

Key Environmental Factor	Potential Impacts
Inland Waters	To maintain the hydrological regimes and quality of **groundwater and surface water** so that environmental values are protected.
Terrestrial Environmental Quality	"To maintain the quality of land and soils so that environmental values are protected".
Flora and Vegetation	"To protect flora and vegetation so that biological diversity and ecological integrity are maintained."
Coastal Processes	"To maintain geophysical processes that shape coastal morphology so that the environmental values of the coast are protected."
Marine Environmental Quality	"To maintain the quality of water, sediment and biota so that environmental values are protected."
Marine Fauna	"To protect marine fauna so that biological diversity and ecological integrity are maintained."

2 Legislative Framework

Perdaman has sought approvals for the Perdaman Urea Project under both State and Commonwealth legislative frameworks. The two main legislative Acts that relate to this Project and provide the overall framework for environmental management for the Project are as follows:

- Environment Protection and Biodiversity Conservation Act, 1999 - Commonwealth
- Environmental Protection Act 1986 - State

2.1 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act 1986) provides for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing.

To prevent environmental harm, the EP Act 1986 established under Section 50A, states that:

A person who –

a. causes serious environmental harm; or

b. allows serious environmental harm to be caused - commits an offence.

Accordingly, all parties to a development must show that the environmental risk associated with the development has been assessed and minimised where possible.

The Perdaman Urea Project was referred to the Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986* in accordance with Section 38 Part IV. Pursuant to section 45 of the EP Act, it has been agreed that this proposal may be implemented under the conditions of Ministerial Statement 1180, as of the 24th of January 2022.

2.2 Environmental Protection & Biodiversity Conservation Act 1999

The Australian Government's key environmental legislation is the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act protects and manages matters of national environmental significance (MNES) which include nationally and internationally important flora, fauna, ecological communities, and heritage places.

The EP Act provides for "**the prevention, control and abatement of pollution and environmental harm**, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing".

The Project was also referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (formerly the Department of the Environment and Energy) under the EPBC Act on the 21st of December 2018 (Reference: 2018/8383) through the s.87 accreditation provisions. The Commonwealth DAWE determined on 28th March 2019 that the Proposed Action was a "Controlled Action" under s.75 of the EPBC Act. The EPBC Act referral 2018/8383 considered the relevant controlling provisions to be National Heritage Places, Listed Threatened Species and Communities; Listed Migratory Species and Commonwealth Marine Species

2.3 Aboriginal Heritage Act 1972

In Western Australia the *Aboriginal Heritage Act (1972*) (AHA) is the legislation for the protection of Indigenous heritage places and objects with the Department of Planning, Lands and Heritage (DPLH) responsible for administering the AHA. Consents, with or without conditions, are the responsibility of the state minister for Indigenous Affairs. The AHA Section 18 Consent was undertaken to clearly define the heritage sites the Project potentially would impact and develop strategies to avoid and minimize impact and retain the inherent heritage values. The Section 18 Consent was provided with conditions under AHA from the Minister for Aboriginal Affairs.

During construction in the context of cultural heritage management; stages of works will be implemented to the requirements of the Ground Disturbance Permit. This will require all GDAs undertaken on the Project to be monitored by a MAC ranger, initiated through compliance with condition 2 of the S.18 Consent. If any impacts to Heritage sites occur, reporting requirements as per conditions 3 and 4 will be implemented.

2.4 Rights in Water & Irrigation Act 1914

According to DWER guidance, Perdaman may require licencing under the Rights in Water and Irrigation Act 1914 (RIWI 1914), for the taking of any groundwater for construction where water will be taken at a rate of more than 10 litres per second over a period of more than 30 consecutive days, with the total volume exceeding 25,000 kL.

The construction of the causeway will obstruct, interfere or destroy the bed or banks of a watercourse, therefore a further licence under the RiWI Act may be required, where an exemption cannot be sought.

Licences under the RiWI Act are yet to be applied for, however at such time as Perdaman is granted licences, as applicable, this ASSMP will be updated to ensure any additional conditions are adhered to.

Obtain the following licenses:

- Licences to take water under s 5C of the *RIWI Act 1914*.
- Licences to construct or alter a well under s 26D of the *RIWI Act 1914*.

2.5 Other Legislation

Additional legislation relevant to surface water management on the Project includes, but is not limited to:

- Soil and Land Conservation Act 1945

In addition to the above legislation, this ASSMP will be developed and regularly reviewed to comply with the commitments and legal obligations arising from the Project's environmental approvals process.

2.6 Regulatory Setting

This ASSMP has been prepared in accordance with the following regulatory guidance:

- *Environmental Protection Act 1986.*
- **DWER, 2015a**. 'Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes, Perth, Western Australia'. Department of Water and Environmental Regulation (DWER), 2015.
- **DWER, 2015b**. 'Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes, Perth, Western Australia'. Department of Water and Environmental Regulation (DWER), 2015.
- **DWER, 2019**. 'Landfill Waste Classification and Waste Definitions'. Department of Water and Environmental Regulation (DWER), 1996 (as amended 2019).

2.7 Part IV Approval Condition Requirements

Pursuant to section 45 of the *Environmental Protection Act 1986* (EP Act), it has been agreed that the proposal, as described in Section 1.1 of this Plan and subject to changes approved under Section 43A of the EP Act on March 20th 2020, February 10th 2021, and May 13th 2021 may be implemented subject to the implementation conditions and procedures detailed therein.

Appendix 1 details the Ministerial Statement conditions relating to Acid Sulfate Soils in which Section of the ASSMP each condition is addressed.

As the Project has the potential to impact aspects with both State and Federal significance, the respective regulatory bodies (EPA and DCCEEW) have imposed conditions associated with environmental approval (MS 1180) for the Project. The proponent must ensure all details and procedures included in this management Plan are in alignment with the conditions provided.

In relation to **Acid Sulfate Soils**, the conditions 7-1 and 7-2 state:

- The proponent shall undertake intrusive acid sulfate soils investigations in accordance with the requirements of the Department of Water and Environmental Regulation's guideline on the Identification and investigation of acid sulfate soils and acidic landscapes (DER 2015) at least six months prior to Ground Disturbing Activities.
- In the event that acid sulfate soils are disturbed during the implementation of the proposal, the proponent shall treat and manage acid sulfate soils in accordance with the requirements of the Department of Water and Environmental Regulation's guideline on the Treatment and management of soil and water in acid sulfate soil landscapes (DER, 2015).

3 Roles & Responsibilities

Role specific environmental responsibilities for the Perdaman Project team are outlined below.

3.1 Project Director

Project Ceres Director will be responsible for and will have the authority to:

- Provide environmental leadership and ensure adequate resources are provided to effectively implement this plan;
- Be an emergency contact for Project Ceres and provide required information to the Perdaman Board of Directors; and
- Endorse and support the Environment Policy and this plan.

3.2 Manager

Project Ceres Manager is accountable for implementation of this plan on site. Responsibilities include:

- Ensuring that the requirements of this plan are implemented, maintained and communicated;
- Provide environmental leadership and ensure adequate resources are provided to effectively implement this plan;
- Participate in investigation of incidents and non-conformances and reviews of this plan; and
- Ensure work is planned and executed in compliance with environmental requirements.

3.3 Environment & Heritage Manager

The Environment and Heritage Manager is a site based Environmental Representative who has the authority and responsibility for reporting the implementation, compliance and effectiveness of this plan to the Management Team. The Environment and Heritage Manager will:

- Be an emergency contact and available to be contacted by Perdaman's other senior representatives;
- Communicate the requirements of this plan to site personnel;
- Provide documentation and support to managers and supervisors;
- Ensure project inductions are undertaken as per this plan;
- Managing Project Ceres's environment and heritage monitoring programs;
- Review and monitor corrective and preventative actions resulting from audits, incidents and non-conformances;
- Ensure identified risks are analysed and evaluated according to agreed criteria. Regularly review identified risks and controls and maintain a risk register.
- Oversee the implementation and management of the GDP process;
- Ensure regular inspections, observations, monitoring and audits are conducted to check the effectiveness of controls and that compliance is maintained;
- Review Project performance and compliance with site environmental and heritage requirements;
- Lead investigation and reporting of environmental and heritage incidents, non-conformances and response to community complaints;
- Inform external stakeholders of any relevant non-conformances, environmental and heritage incidents or public complaints and assist with regulator liaison, if required;
- Identify and implement corrective and preventative actions after incidents and share lessons learned within Project Ceres team;
- Manage the submission and attainment of environmental and heritage approvals;
- Prepare a monthly Project environment and heritage report, presenting an update on key performance indicators, project outcomes, issues and incidents;
- Oversee review of existing and preparation of additional environmental management documentation, as required;
- Assure all Project activities are in accordance with statutory, approval and Project environmental and heritage requirements; and
- Attend and participate in regular Project meetings.

3.4 Environment Coordinator

The Environment Coordinator is a site based Environmental Representative of Perdaman responsible for:

- Coordination of the GDP process on site including preparing GDPs in consultation with the relevant Managers, issuing and releasing GDPs, verifying clearing boundaries, monitoring clearing works, and closing out GDP permits;
- Presenting Project environmental inductions to Project Personnel;
- Conducting regular inspections and audits in accordance with this plan;
- Consolidating emissions, consumption and monitoring data into a Monthly Environmental Report;
- Verifying rehabilitation works have been completed in accordance with the Rehabilitation Management Protocol;
- Providing environmental advice and information to Project Ceres management team;
- Supporting the Environment and Heritage Manager with environmental incident investigations;
- Providing advice to the Environment and Heritage Manager about implementing, maintaining and reviewing this plan and associated documents; and
- Fulfilling the responsibilities of the Environment and Heritage Manager when they are on leave from site.

3.5 Construction Manager

The Construction Manager is accountable for implementation of this plan on site during Project Ceres's construction phase. Their responsibilities include:

- Planning construction Works in a manner that avoids or minimises impact to environment in line with this plan;
- Ensuring a GDP application is submitted and a GDP Permit is issued in a timely manner prior to the commencement of any ground disturbing works or activities being undertaken;
- Ensuring any ground disturbing works or activities undertaken are within the limits specified in the Works specific GDP;
- Providing environmental leadership and ensuring adequate resources are allocated to effectively implement this plan;
- Stopping all work immediately if an unacceptable impact on the environment is likely to or has occurred;
- Ensuring that the appropriate level on induction and training has been provided to all site staff to minimise environmental impacts from Project works;
- Participate in investigations relating to construction related incidents resulting in breaches of environmental regulatory, licence or approval requirements; and
- Regularly liaise with the Environment and Heritage Manager regarding environmental aspects and impacts.

3.6 Operations Manager

The Operations Manager is responsible for the implementation of this plan during the construction and operational phases of Project Ceres, including:

- Planning the commissioning and ongoing facility operations in a manner that avoids or minimises impact to environment in line with this plan;
- Providing environmental leadership and ensuring adequate resources are allocated to effectively implement this plan immediately if an unacceptable impact on the environment is likely to or has occurred;
- Ensuring that the appropriate level on induction and training has been provided to all site staff to minimise environmental impacts of Project Ceres's commissioning activities and ongoing facility operations;
- Participate in investigations relating to construction related incidents resulting in breaches of environmental regulatory, license or approval requirements; and

Regularly liaise with the Environment and Heritage Manager regarding environmental aspects and impacts. In addition to these Perdaman personnel, Contractors engaged by Perdaman will provide adequate, tertiary qualified (in environmental management or similar qualification) and experienced site-based personnel to coordinate the management of environmental issues relevant to their scope of works.

4 Rationale & Approach

4.1 Assessment of Acid Sulfate Soils Conditions

4.1.1 Previous ASS Investigations

Several geotechnical studies have been conducted to date. SNC-Lavalin prepared a geotechnical desktop study which was issued for information in April of 2019 (SNC Lavalin, 2019a). SNC-Lavalin recommended that after completion of geotechnical site investigations and geological mapping, an interpretive geotechnical report should be prepared. The interpretive report will supersede the desk-top study and the project design should then be revised considering the site-specific geotechnical information.

Geotechnical information for all Project areas can be found in 140436-0000-4GER-0001 – Geotechnical Desktop Study (**Attachment A**) of this Plan. In addition, information has been referenced from the Coffey Perdaman Urea Geotechnical Investigation (Interpretive Report) prepared for Clough on the 17 November 2020 (**Attachment C**) and the combined factual / interpretive report dated 7 October 2020 (Ref. 754-PERGE271567-R05).

4.1.1.1 Tetra Tech Coffey ASS Investigation

In accordance with condition 7-1 of MS1180, an ASS investigation was conducted in general accordance with *DER 2015 guidelines*, where ASS was identified as occurring within the supratidal zone of Site C and the causeway. In 2022 the EPC Contractor (Saipem & Clough) engaged Tetra Tech, Coffey to conduct a Detailed Site Assessment for Acid Sulfate Soils.

The Coffey Detailed Site Assessment for ASS (Coffey 2022a) noted the following findings:

- No actual acidity exists in the form of S-TAA indicating that there is no soluble and exchangeable acidity within the soil profile.
- Analysis for maximum peroxide 'oxidisable' sulfur present in the soil (SPOS) exceeded the *DER ASS guideline* of 0.03 %S in nine samples, and
- Potential Acid Sulfate Soils have been confirmed, however are located within the Supratidal zones.

The DSI for ASS (refer to **Attachment H**) has been used to confirm the Proposals requirements associated with Acid Sulfate Soils.

Refer to **Appendix 3A** for the environmental risk assessment for the Project, which includes updated information for groundwater, surface water values and risk and in addition ASS risks.

4.1.1.1.1 ASS Field Screening

During the Coffey investigation (Coffey, 2022a) Acid Sulfate Soil field screening was conducted on 165 soil samples collected from 22 soil sample locations across the full vertical soil profile from ground surface to a nominal depth of 3 mBGL or to refusal. ASS field testing was conducted in general accordance with the *DER 2015b guidelines* and soil samples were analysed as follows:

- All 165 soil samples were prepared in a deionized water solution at the laboratory and measured for pH.
- All 165 soil samples were prepared in a peroxide and sodium hydroxide solution and measured for pH.

Field screening of the samples collected at 0.25 m intervals from ground surface to 1 m below maximum depth of disturbance allowed preliminary indication of depths at which ASS may be encountered and provided a basis for the selection of samples for quantitative laboratory testing (i.e., SCR and SPOCAS testing). The specified testing suite is consistent with DWER requirements.

4.1.1.1.2 ASS Laboratory Analysis

SPOCAS Suite

As detailed in *DER Guidelines* (2015b), the SPOCAS method is a self-contained ABA test. The complete SPOCAS method provides 12 individual analytes (plus five calculated parameters), enabling the quantification of some key fractions in the soil sample, leading to better prediction of its likely acid-generating potential. It involves the measurement of pH, titratable acidity, sulfur and cations on two soil sub-samples. One soil sub-sample is oxidised with hydrogen peroxide and the other is not. The differences between the two values of the analytes from the two sub-samples are then calculated.

During the Coffey (2022a) investigation 27 samples in total were submitted for SPOCAS analysis.

- Buffering/acid-neutralising capacity exists as indicated by the S-TPA net result in the soil profile across the site. All S-TPA results were reported below the laboratory limit of reporting (LOR) of <0.005%S.
- No actual acidity exists in the form of S-TAA indicating that there is no soluble and exchangeable acidity within the soil profile. All S-TAA results were reported below the laboratory LOR of 0.005%S.

- Analysis for maximum peroxide 'oxidisable' sulfur present in the soil (SPOS) exceeded DER ASS guidelines of 0.03 %S for nine samples.
- Highest net acidity (excluding ANC) was 0.111 %S at ASS6_0.25 (i.e. at a depth of 0.25 to 0.35 mBGL).
- Exceedances were identified in red-brown Clayey GRAVEL or SANDY GRAVEL, brown CLAY, brown, orange SAND soil horizons, in shallow surface soil between 0.0 mBGL to 0.75 mBGL.

The Coffey report (Coffey, 2022a) noted that due to the daily inundation of the supratidal area of Site C and the Causeway with seawater that the deposition of sulfate ions and soluble magnesium could possibly influence net acidity in soil samples tested using SPOCAS. When the tide rises and falls seawater is left to evaporate across the supratidal zone. Sulfate ions and magnesium crystalise on the ground surface and shallow surface soil can accumulate magnesium sulfate which can contribute to acidity in ASS samples. It is also possible that Net Acidity detected by SPOCAS analysis is organic in nature due to the accumulation of organic based materials on the ground surface across the supratidal zone.

Chromium Reducible Sulfur Suite (Scr Suite)

The chromium reducible sulfur suite is a set of independent analytical methods each of which determines a component of the Acid Base Accounting (ABA). Only specific components of the ABA are measured using this approach. The initial step in the chromium reducible sulfur suite is to measure the reduced inorganic sulfur content (by the chromium reducible sulfur (SCR) method) to estimate the potential sulfidic acidity. Measurements of existing acidity and ANC are also made.

During the Coffey investigation (Coffey, 2022a) forty-five primary samples were submitted for the SCR suite of analysis. Each sample was split and SCR was tested on both ground and unground portions of samples.

- Measurement of reduced inorganic sulfur content (SCR) to estimate potential sulfidic acidity shows two samples exceeding the DER ASS criteria of 0.03 %S.
- Highest net acidity was 0.341 %S (ASS06_1.0) at a depth of 1.0 mBGL.
- Nine samples reported a detectable concentration of SCR greater than the laboratory LOR (0.005 %S) at depths from 0.0 m and 2.5 mBGL.
- Net acidity excluding ANC in ASS06_1.0 and ASS7_0.25 was reported >0.03 %S with correlates with SCR results suggesting evidence of reduced inorganic sulfur.
- Exceedances were identified in black-grey Clay and red-brown Sandy Gravel beneath the causeway area of the Site. The highest net acidity as associated with the black-grey Clay layer at a depth of approximately 1.0 mBGL.

Acid Neutralising Capacity (ANC)

Acid neutralising capacity (ANC) is a measure of the soil's inherent ability to buffer acidity and resist the lowering of the soil pH. Acid buffering in the soil may be provided by dissolution of calcium and/or magnesium carbonates (e.g. shell or limestone), cation exchange reactions, and by reaction with the organic and clay fractions. The effectiveness of these buffering components in maintaining soil pH at acceptable levels (e.g. pH 6.5-9.0) will depend on the types and quantities of clay minerals in the soil, and on the type, amount and particle size of the carbonates or other minerals present.

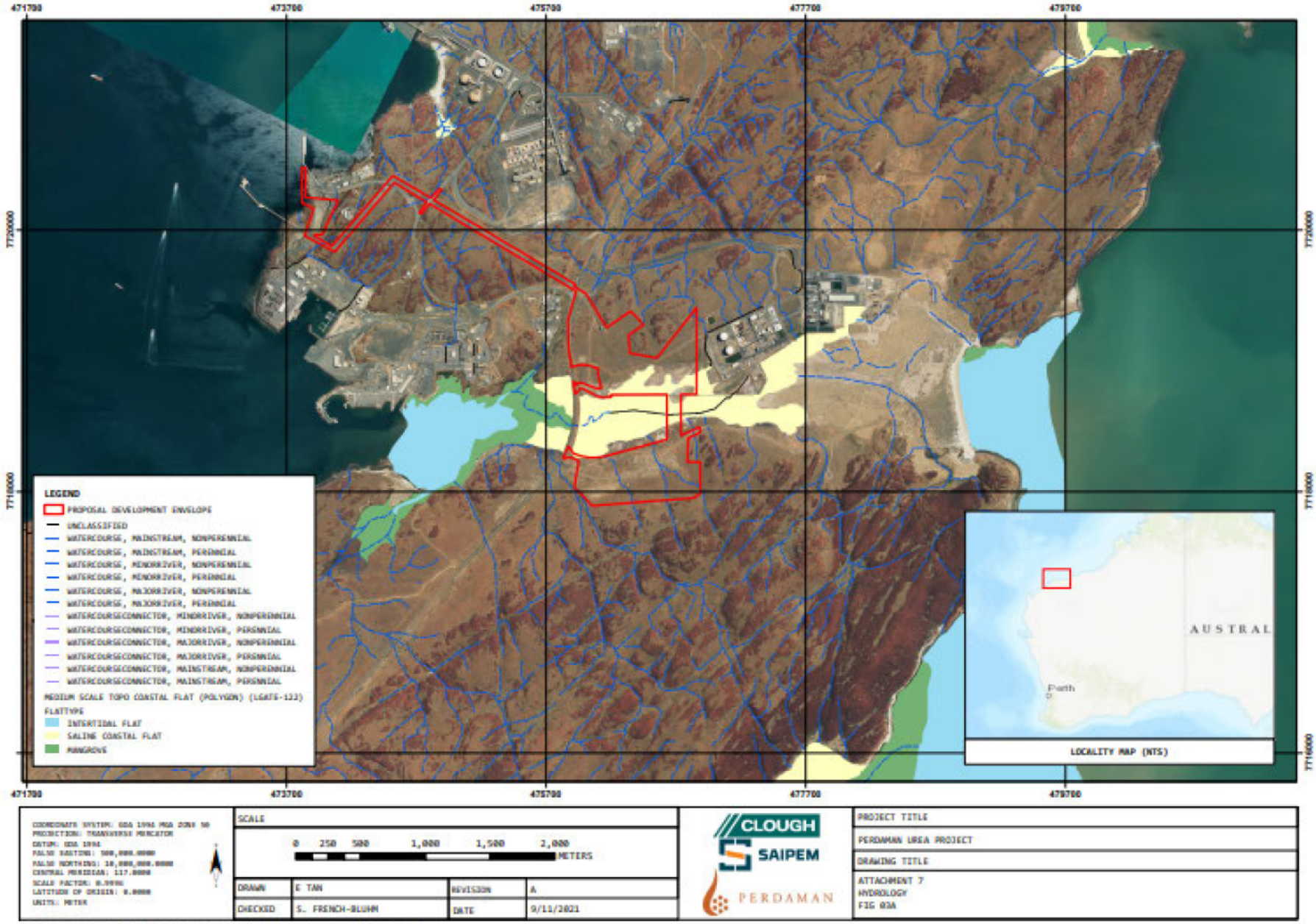

Figure 4-1 Hydrology Map of the Project Location

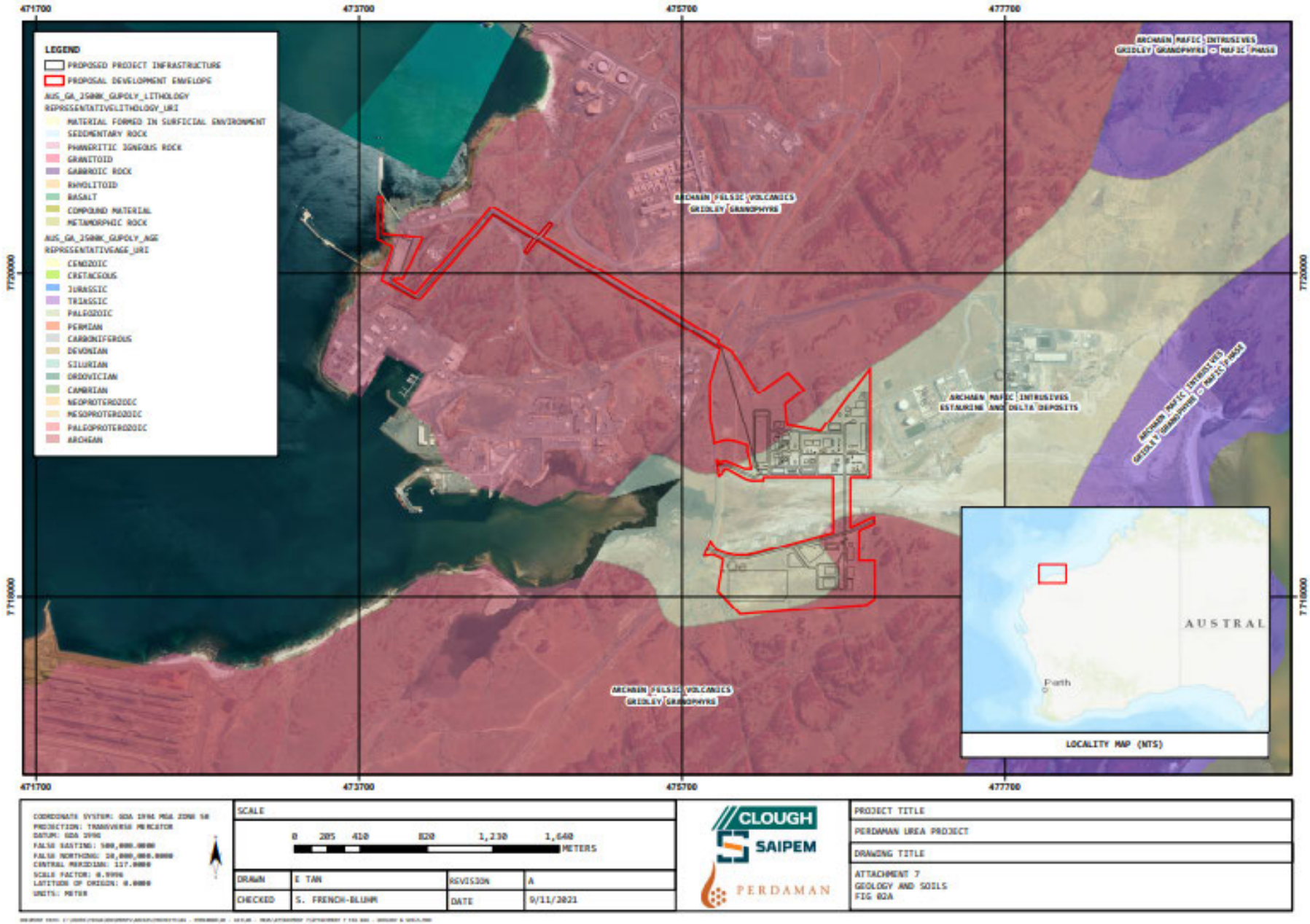

Figure 4-2 Geology and Soils of the Project Location

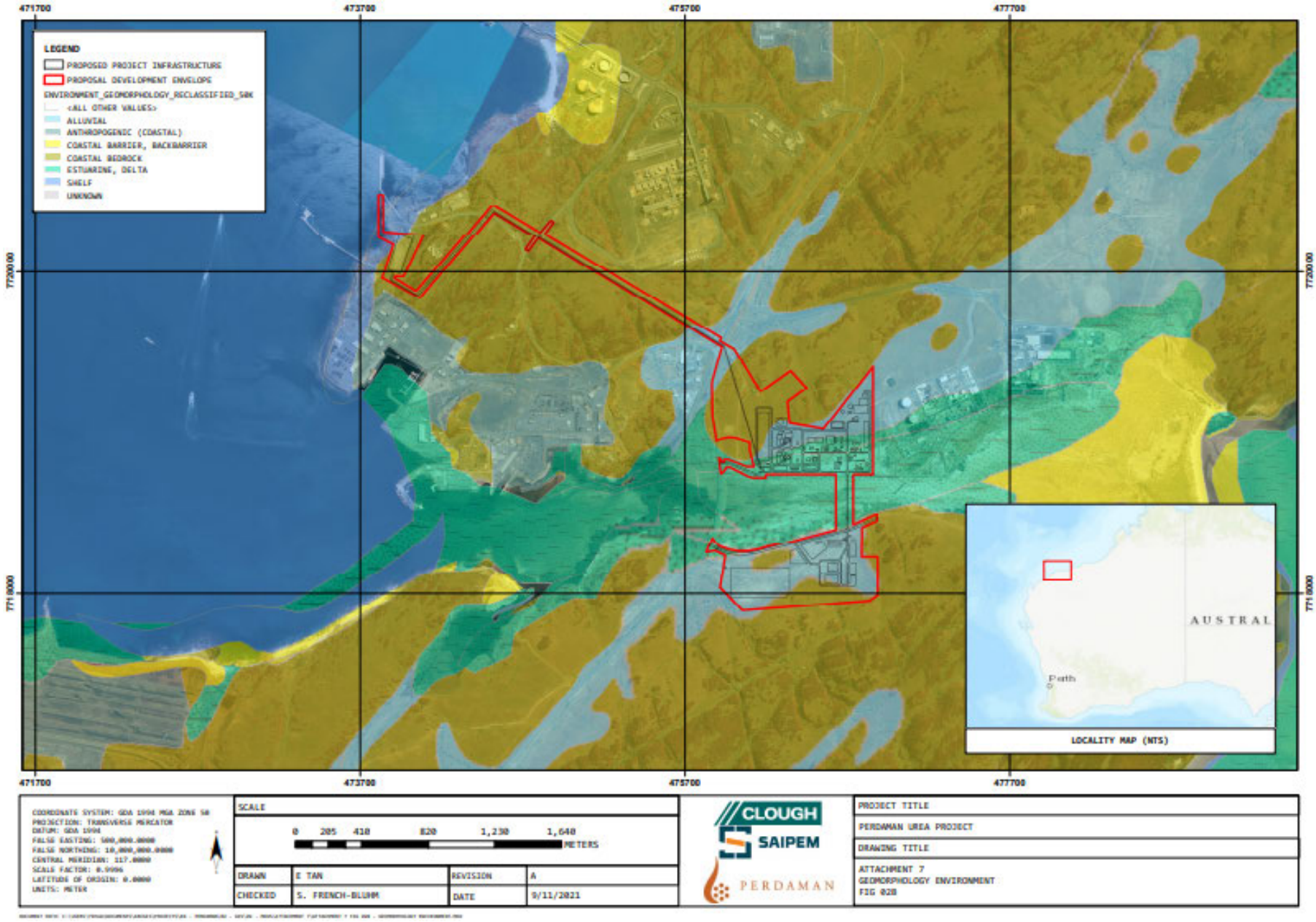

Figure 4-3 Geomorphology of the Project Location

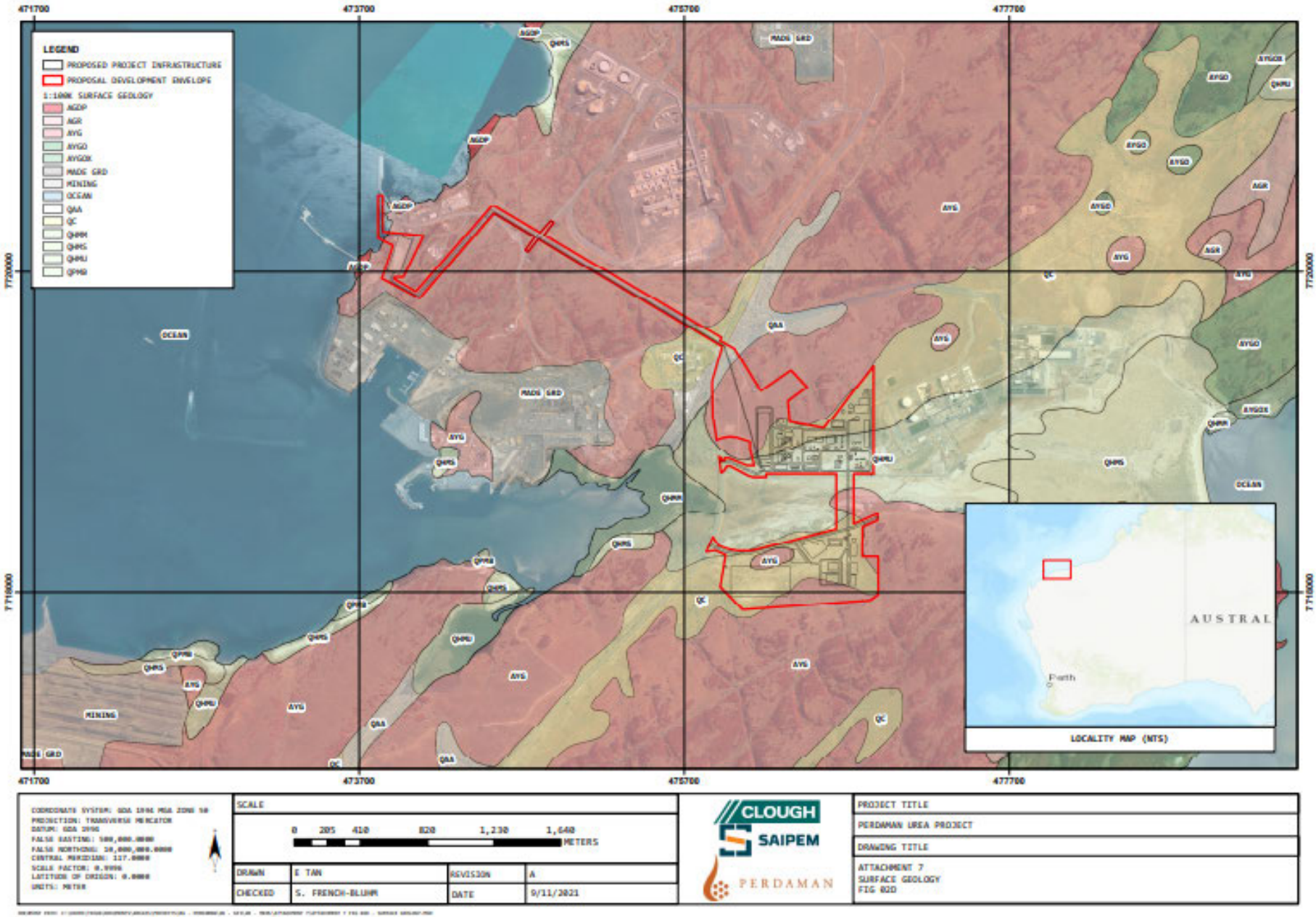

Figure 4-4 Surface Geology of the Project Location

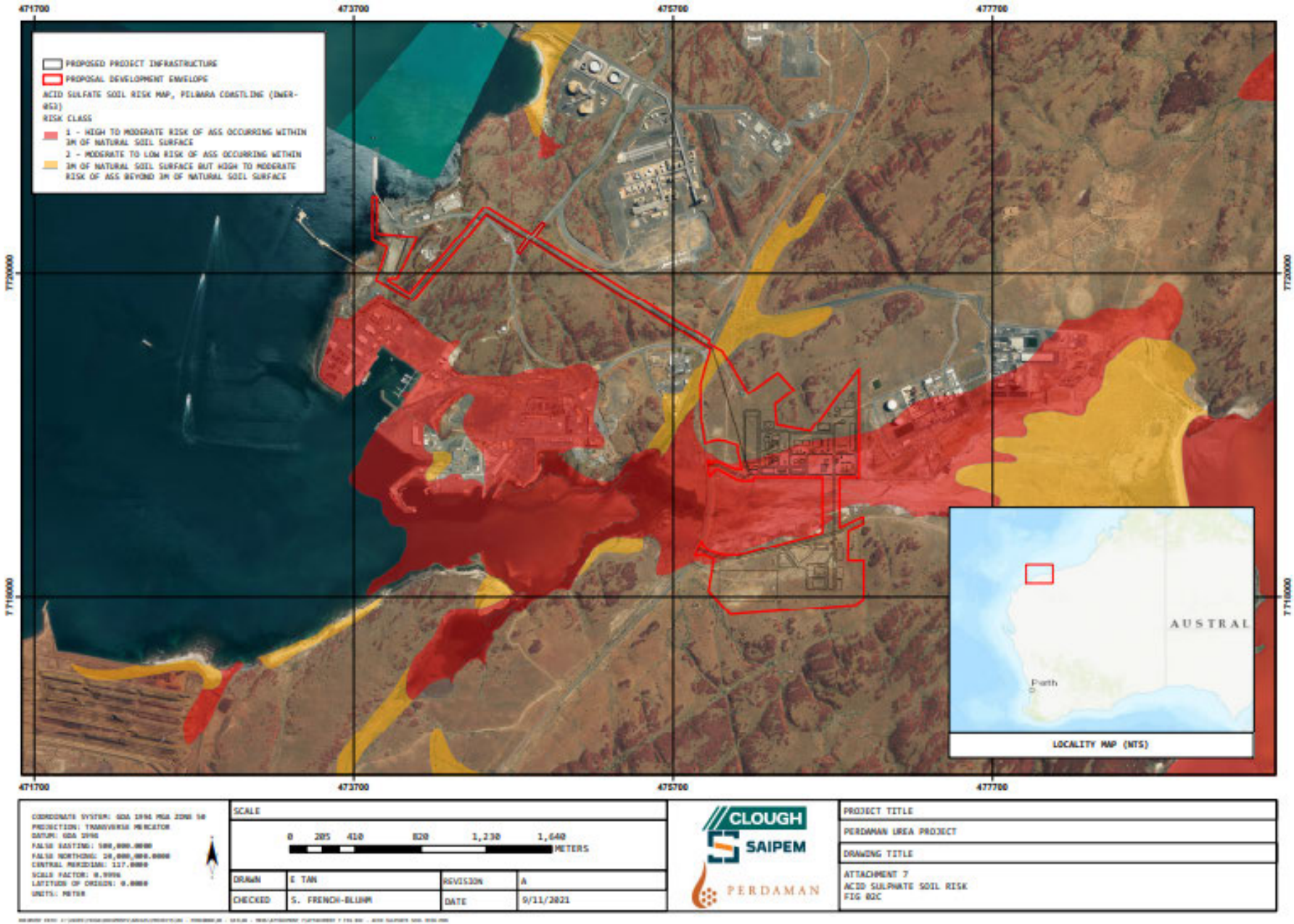

Figure 4-5 Potential Acid Sulphate Soils of the Project Location

4.2 Management Approach

The primary management objective during construction in relation to ASS is to avoid and eliminate the need for excavating ASS / PASS through adoption of construction methods and design strategies which aid in achieving this objective. Where ASS shall be intercepted, previous investigation information shall be utilised where available to calculate the liming rate for adequate treatment. Where insufficient information is available further samples shall be taken and analysed to identify the liming rate required for neutralisation, using the liming rate calculation provided in Section 4.2.1.3.

4.2.1 Management & Treatment of ASS Materials

Coffey (2022a) made several recommendations in regard to the management of ASS to comply with condition 7 of MS1180 in the event that ASS is disturbed during Project activities, and these will inform the Projects management of ASS. These were as follows:

- If disturbance of >1,000 tonnes of ASS occur at the causeway or Site C then soil should be treated at the reported maximum Net Acidity of 0.34 %S. Based on the Net Acidity, a safety factor of 1.5 and an ENV of 91.5% (Aglime of Australia Product information Sheet, 2022) a calculated liming rate of 19.95 kg/tonne should be adopted for neutralisation of ASS.
- If disturbance of <1,000 tonnes of ASS occur with stockpiling at the causeway or Site C, then soil can be stockpiled for up to 70 hours before soil has to be neutralised. If soil is to be stockpiled longer than 70 hours, then a risk assessment will be required and additional management measures such as leachate capture and periodic application of lime to neutralise acidity.
- For all stockpiling, a guard layer of crushed limestone should be used to protect underlying soils. The guard layer should also include a bund to contain any surface runoff in the event of rainfall. The base of the guard layer or treatment pad should be at least 300 mm thick with 150mm high bund walls to contain treated soils and any effluent associated with direct rainfall on stockpiles.
- For all ASS neutralisation, soil validation sampling should be conducted in accordance with (DER 2015) to ensure effective treatment and neutralisation of ASS. If soil validation sampling fails, then soils should be retreated and re-validated until results show Net Acidity <0.03 %S.

4.2.1.1 ASS Neutralisation Calculation

If disturbance of >1,000 tonnes of ASS occur at the causeway or Site C then soil should be treated at the reported maximum Net Acidity of 0.39 %S. Based on the Net Acidity, a safety factor of 1.5 and an ENV of 91.5% (Aglime of Australia Product information Sheet, 2022) a calculated liming rate of 19.95 kg/tonne should be adopted for neutralisation of ASS.

The following Liming Rate Equation will be utilised by the Project based on the current site information.

Liming rate (kg CaCO3/m3) = p x (%S x 30.59) x 1.02 x SF x 100 / ENV

Where:

P = bulk density of soil = 1.6 (is the bulk density of sandy loams to light clays) – will be adjusted accordingly.

%S = max net acidity −0.39% Refer to Attachment I (Coffey Investigation, 2022)

SF = Safety Factor = 1.5

ENV = Effective Neutralisation Value – 91.5%

4.2.1.2 ASS Treatment Area

During the design, implementation, and management of ASS spoil; the DER, 2015a Guidelines will be considered throughout.

4.2.1.2.1 Limestone Pad Construction

Where excavated ASS cannot be treated and replaced in-situ as it is excavated, a treatment pad shall be utilised. The pad shall be constructed with the following as a minimum:

- Designed to handle a capacity of approx. 5,000m^3 will be constructed comprising the following design criteria:
  - 300 mm crushed limestone base compacted to ensure a permeability of less than 10^{-9} m/s.
  - 150 mm high earthen bund wall enclosing the treatment pad.
  - Stockpile height not exceeding 2 m.

- Installation of a leachate and rainwater collection sump with pump and lay flat hose to settlement pond (sump to designed to accommodate a 1 year, 1 hr storm event at an average of 15.8 mm/hr).

The treatment pad will be bunded with compacted, non-ASS natural soils to contain potential leachate runoff from the treatment pad area and prevent surface water runoff entering the treatment pad area.

Signage will be erected at each stockpile, giving information on the source of the material, date of excavation, date of treatment etc. and any other relevant information.

4.2.1.3 ASS Neutralisation

The actual amount of neutralising material needed is calculated using the 'net acidity' of the soil. Net acidity can be calculated according to an acid-base account (ABA), expressed by the following equation:

Net acidity = potential acidity + existing acidity – acid neutralising capacity (ANC).

Treatment of the excavated ASS is to be undertaken as part of the earthworks and after stockpiling. To achieve adequate treatment of excavated ASS, high-grade aglime (or equivalent lime sand neutralising agent) will be mixed with the excavated ASS.

Given the limited samples investigated across the site, the highest net acidity (NA, %S) for each soil type observed across the site will be used to calculate the liming rate for treatment of ASS encountered. All excavated ASS will be treated on-site at the time of excavation and stockpiling. The amount of lime to be used for neutralisation will be calculated using the liming rate calculation provided in Section 4.2.1.2.

Table 4-1 provides the liming rate based on the bulk density of the soil identified in the various areas onsite during from the DSI's completed to date. As calculated using the DWER web-based 'Lime rate calculation tool' https://www.der.wa.gov.au/your-environment/acid-sulfate-soils/67-lime-rate-calculations-for-neutralising-acid-sulfate-soils

Table 4-1 Indicative Liming Rates

INVESTIGATION AREA	SOIL TEXTURE	DEPTH RANGE (mBGL)	MAXIMUM NET ACIDITY (%S)	KG OF 91% ENV AGLIME PER m3 SOIL
Supratidal Flats	Sandy loams to light clays	0 - 2	0.34*	17.35
Site C	Sandy loams to light clays	0 – 4	0.09*	4.58
Site F	Sandy loams to light clays	0 – 2	0.007*	Treatment Not Required

** - Refer to Table 3 of Coffey 2022*

The treatment shall be undertaken by following the below steps:

- Prior to treatment, the volume of soil on the treatment pad will be confirmed by survey pick up.
- Lime will be placed on the stockpiles and then blended using an excavator fitted with a screening bucket.
- The approx. volume of lime used will be tracked through recording the number of bucket loads.

The liming rate will therefore need to be corrected for the ENV of the neutralising material used, which is based on the neutralising value (NV) of the material (related to the $CaCO_3$ content) and particle size distribution of the neutralising material selected (DER 2015b). The characteristics of the neutralising material selected are generally obtained from a lime certificate provided by the supplier of the neutralising material.

Agricultural lime typically has a pH of 8.5 to 9, therefore care should be taken during the process not to over-lime the soil.

4.2.1.4 Stockpile Monitoring Program

The following monitoring will be undertaken for all soils stockpiled on the treatment pad:

- Untreated soil will be monitored daily for visual signs of acid generation (e.g. – formation of the buttery, yellow-coloured mineral jarosite or other iron oxides). Representative soil samples will be collected daily from the surface of the stockpile (minimum two samples per stockpile face) and tested for pH_F.
- Treated soil will be sampled at a rate in accordance with the WA DWER's waste classification guidelines (DWER 2019). Samples will be tested for pH_F and pH_{FOX} for clearance prior to reuse at the site. 25% of field samples will be sent to the laboratory for confirmatory analysis by the chromium reducible sulfur suite (SCr) method (with the inclusion of the total potential acidity measurement (TPA) from the SPOCAS suite); and

    - If present, leachate run-off from the stockpiles will be field tested for pH, EC, temperature and total acidity prior to determine an appropriate dosing rate if necessary.

4.2.1.5 Soil Validation Criteria

Table 4-2 below summarises the performance criteria to be adopted for stockpiles of treated soil during the monitoring programme. In addition, the neutralising material used must be thoroughly mixed with the soil to be treated.

Table 4-2 Soil Validation Criteria

MEDIUM	ACCEPTABLE THRESHOLD (MEAN VALUE + 1 STANDARD DEVIATION)
Treated topsoil (trigger value $pH_F < 4.0$)	$pH_F > 5.0$
Treated soil	$pH_F > 6.0$ and $pH_F < 8.5$
	$pH_{FOX} > 5.0$
	TPA[1] < TAA[2] < 18.7 mol H+/tonne
Leachate and run-off	8.5 > pH > 6.5
	TTA[3] < 40 mg/L

[1]*TPA – Titratable Peroxide Acidity, where ASS is a sand soil type, TPA should be <LOR.*

[2]*TAA – Titratable Actual Acidity*

[3]*TTA – Total Titratable Acidity*

4.2.1.6 On-site Treatment

On-site excavations will leave some residual ASS in-situ in the walls and bases of excavations. All in-situ ASS that are exposed during excavation should be coated with a neutralising material compliant with this plan to provide some buffering capacity. This is to be undertaken to the extent practicable based on the angle and depths of exposed faces.

4.2.1.7 Off-site ASS Treatment & Disposal

As per the guidelines DWER's preference is for treated ASS to be re-used on-site. If there is limited space on-site to treat ASS, ASS must be disposed off-site to an approved licensed facility.

If the soils are to be disposed off-site:

- Acceptance of ASS for disposal at a licensed facility must be in accordance with the DWER Landfill Waste Classification Definitions 2019.
- Prior to disposal, soils will be tested at a rate in accordance with the WA DWER's Waste Classification guidelines (DWER 2019) or a minimum of 4 samples for aluminium (Al), arsenic (As), chromium (Cr(VI)), cadmium (Cd), iron (Fe), manganese (Mn), lead (Pb) and zinc (Zn). Australian standard leaching procedure (ASLP) testing will also be undertaken for any samples that exceed the respective CT2 criteria. It should be noted at additional analysis maybe required for waste disposal if soils are excavated from known areas of the site which are impacted with asbestos in soils contamination.
- The receiving facility must be notified in writing of the acid generating capacity of the soils to be disposed, including provision of laboratory certificates of analysis.
- Waste disposal documentation and total volumes of soil disposed must be recorded and provided to DWER within an Initial Closure Report.

4.2.1.8 Quality Assurance & Quality Control

For the proposed management of ASS, the following quality assurance and quality control (QA/QC) measures should be implemented:

- The collection of duplicate soil samples in the field, at a ratio of one duplicate for every 20 samples collected from the site.
- "Blind" labelling of the duplicates to ensure that the laboratory is not aware which samples are duplicated.
- Analysis of the samples by a NATA accredited analytical laboratory for the analyses required. The internal quality procedures of the laboratory(s) should be checked to ensure that the results provided are reliable.
- Analysis of the duplicate samples and calculation of the relative percentage difference (RPD). Assessment of RPDs will indicate whether the sampling and analytical precision conforms to certain prescribed limits.

4.2.1.9 Contingencies

4.2.1.9.1 Contingency Plan 1:

If soils encountered during excavation works are not representative of the soils previously encountered at the site (as described in Section 4.1), the soils should be:

- Sampled and analysed at 0.25 m depth intervals for field pH (pH_F and pH_{FOX}) and at 0.5 m depth intervals by SCr (with the inclusion of %S TPA from the SPOCAS suite). If the soils are determined to be acid generating and likely to be disturbed, the soils should be lime dosed, calculated using the highest net acidity (%S) recorded for that soil type; or
- Treated as acid generating and lime dosed based on existing highest net acidity (%S).

4.2.1.9.2 Contingency Plan 2:

If an ENV is not provided with the neutralising material, one sample for every 500 m^3 of lime will be sampled and analysed for Calcium Carbonate Equivalence by a NATA accredited laboratory to determine the ENV of the material.

4.2.1.9.3 Contingency Plan 3:

If the following stockpile performance criteria are exceeded, the following actions should be implemented:

- If, due to unforeseen circumstances, the duration of the earthworks activities is extended, a reassessment of the management strategies will be undertaken and implementation of a higher level of soil management will be adopted if warranted.
- If pH_F and pH_{FOX} results of soil stockpile validation samples are below the acceptable thresholds, further lime treatment of soils will be undertaken prior to submission of samples to the laboratory;
- If analytical results from treated stockpile soil samples are outside of TPA and/or TAA criteria, further lime treatment of soils will be undertaken prior to re-use on-site, and revalidation of these samples will occur to ensure adequate neutralisation occurs; and
- Lime dosing of leachate run-off will be undertaken, prior to release to the environment, if pH of the water is less than 6.5 or TTA > 40 mg/L.

4.2.1.9.4 Contingency Plan 4:

Should the rate of excavation exceed the rate of treatment, soils will be treated prior to being transported from the excavation (e.g. in-situ treatment).

4.2.2 Management of Monosulfidic Back Ooze (MBO)

Monosulfidic black ooze (MBOs) is formed in the reaction between sulfide and dissolved ferrous iron in the presence of organic matter. The construction of the causeway has been completed and to date there has been no incident of MBOs being identified onsite. However, MBOs may potentially form on the supra-tidal flat and in the culverts under the causeway. The causeway culverts have been designed and constructed to meet the MS1180 condition 1 which requires culvert outflow velocities of less than 1.0 m/s to be maintained. Ideally maintaining the flows should minimise the risk of MBOs accumulating, however MBOs tend to accumulate during long periods of minimal flow due to tides and floodwaters, which the supra-tidal flat is susceptible to.

Should MBOs be discovered in the culverts, supratidal flats or in other low-lying areas within the Project envelope, management strategies based on the risk, cause, size and locations of the MBO occurrence will be assessed and appropriately adopted. There are currently no policies within Australia that deal with the management of MBOs in waterways. Therefore, the management approach outlined below may be reviewed and amended upon further understanding of best practise management relating to MBO's and in addition the scope and risk associated with any MBO's identified on the Project site. In preparing the management approach for the Project, the *National Acid Sulfate Soils Guidance: Overview and management of Monosulfidic black ooze accumulations in waterways and wetlands (MBO) (June 2018*) was considered as the primary resource.

Where MBOs are identified within the Project area and are deemed to require more targeted management, the Project will consider the *National Acid Sulfate Soils Guidance: Overview and management of Monosulfidic black ooze accumulations in waterways and wetlands* and any other relevant documents to prepare a more robust management, sampling and monitoring strategy.

4.2.2.1 Identification of MBOs

MBOs can be identified in the field based on several characteristics:

- Gel-like consistency
- Black or dark grey in colour
- Oily appearance
- Rotten-egg smell

The identification of MBOs can be confirmed by:

- pH testing (MBOs will generally have a pH of 7-8)
- Assessment of enrichment in acid volatile sulfur with field screening tests which are then confirmed through laboratory analysis.

4.2.2.2 Prevention Management Strategies

The Project considers the risk of MBO's to be low, now that the causeway has been constructed. Any prevention strategies adopted on the Project, will be where field based characteristics of MBO's have been identified in low lying areas and/or where surface water monitoring results have indicated a risk of MBO formation and or accumulation.

If required the formation of MBOs can be prevented through liming of known ASS areas, flushing of waterways by erosive flows of water and additional practices which minimise the production and accumulation of organic materials. Furthermore, adhering to the confirmed surface water management plan (PCF-PD-EN-SWMP), the completion of the causeway and culverts to meet the requirements of condition 1 (MS1180) and ensuring regular inspections of known ASS areas, particularly in the supra-tidal zone which is a known moderate-high risk area for the formation of ASS and MBOs will aid in the prevention of MBO formation.

The Project will carry out surface water monitoring in accordance with the Confirmed Surface Water Management Plan (PCF-PD-EN-SWMP), which includes monitoring of water quality within the supratidal area, diversion channels, hold ponds and other standing water following heavy rainfall events. Parameters being analysed would indicate whether MBO accumulation and potential mobilisation was a risk.

4.2.2.3 Off-site Disposal

As per the *National Acid Sulfate Soil Guidance: Overview and management of Monosulfidic black ooze (MBO) accumulations in waterways and wetlands (2018*), stockpiling of MBOs is not an acceptable disposal or storage option. Therefore, should MBOs occur within the PDE they will be disposed off-site to an approved, licenced facility.

The method to remove MBOs will be dependent on where they occur and the size of the occurrence. Should MBOs be identified in pooling water or the supratidal flats, reed buckets and excavators may be considered. If MBOs are discovered in and around the culverts, a vacuum truck may be considered for removal.

4.3 Performance Criteria

4.3.1 Environmental Criteria 1 – Soil Assessment Criteria

4.3.1.1 ASS Field Assessment Criteria

Soil samples collected will be analysed in the field for ASS field parameters pH_F and pH_{FOX} in accordance with the DWER guidelines for the identification of ASS and sulfide content in Western Australia (DER 2015b).

Three factors require consideration in arriving at a positive identification for ASS based on field tests; these are:

- The strength of reaction with hydrogen peroxide (H_2O_2). Reaction strength can be categorised as low (L), moderate (M), high (H), extreme (X), or volcanic (V)
- The difference between field (pH_F) and peroxide (pH_{FOX}) measurements (ΔpH).
- The absolute values of pH_F and pH_{FOX}.

In addition to the above criteria, Table 4-3 presents the assessment criteria (DER, 2015b) normally applied to assist in the preliminary identification of actual acid sulfate soils (AASS), potential acid sulfate soils (PASS) and/or non-acid sulfate soils (NASS).

Table 4-3 Assessment Criteria for pH (DWER, 2015b)

Field pH Parameter	AASS	PASS
pH_F	<4	>4
pH_{FOX}	<4	<3

The DWER ASS guidelines (DER, 2015) for interpretation of results will not exclusively be on these guidelines to assess ASS because of unique site-based influences which can skew the interpretation of ASS data if adjustments are not made to the screening criteria. The DWER guidelines (DER, 2015) are generally accurate for assessment of ASS in regions such as Perth and the south-west of Western Australia where typically an ASS field result will show actual acidity or potential acidity. However, in northern regions such as the Pilbara and Kimberley, coastal soils are generally influenced by variables such as buffering from the periodic inundation of soil from seawater, hypersaline soil, and groundwater due to evapo-concentration of salts and complex hydrogeochemical processes including precipitation and dissolution of minerals which can influence the pH of soil with typical ASS field results recorded being >7 PH_F and pH_{FOX} >6. If criteria in Table 4-3 were applied without further testing i.e. SPOCAS or SCR then most ASS samples would not show AASS or PASS, and ASS interpretation could be misled.

It is possible for Pilbara coastal soils to not show AASS or PASS but to have a relatively high sulfur content which generally correlates with potential acidity, but the chemical reactions simulated by ASS field testing are effectively supressed by the buffering effects of seawater or armouring from hypersaline water supressing oxidation and will not show acidity or potential acidity.

During the 2022 investigation by Tetra Tech Coffey, site specific field assessment criteria was adopted that accounts for the aforementioned and historical investigative data from other sites within the Pilbara area, which demonstrated the variations between Perth and Pilbara soils and groundwater conditions. Tetra Tech placed more emphasis on the observed reaction when H_2O_2 is added to soil and the calculated pH delta measured between pH_F and pH_{FOX}. Table 4-4 below summaries the site-specific assessment criteria.

Table 4-4 Pilbara Region Assessment - Adopted Site Specific Criteria

Field pH Parameter	AASS	PASS	pH (Delta)	Observed Reaction
pH_F	<4	>7.0	1	Low, Moderate, Extreme, Volcanic
pH_{FOX}	<3	>6		

4.3.1.2 Laboratory Analysis Assessment Criteria

Table 4-5 details the action criteria in accordance with DER, 2015b Guidelines. The assessment criteria adopted for ASS in Western Australia are the texture-based ASS assessment criteria based on net acidity, excluding the consideration of acid-neutralising capacity (ANC). The suspension peroxide oxidation combined acidity and sulfur (SPOCAS) or chromium reducible sulfur (SCR) suite of analysis is used to assess ASS presence/absence. Action Criteria represent the critical net acidity values (expressed in units of equivalent % pyrite sulfur, or equivalent mol H+ /t), for different soil texture groups and sizes of soil disturbance that trigger the need for ASS management as tabulated in Table 4-5. The highest laboratory result is used to assess against the assessment criteria.

The expected soil disturbance will occur across the causeway and within the southern half of Site C requiring the excavation of >1,000 tonnes of soil, so for the purpose of this ASSMP the Action Criteria adopted is >1000 tonnes, medium texture soils and based on equivalent Sulfur of 0.03 %S. Samples exceeding this concentration are validated or confirmed as ASS and will require management in accordance with section 4.2 of this document.

Table 4-5 Texture Based ASS Action Criteria

TYPE OF MATERIAL		ACTION CRITERIA IF <1,000 TONNES OF MATERIAL IS DISTURBED		ACTION CRITERIA IF >1,000 TONNES OF MATERIAL IS DISTURBED	
		Existing & Potential Acidity		Existing & Potential Acidity	
Texture Range	Approx. Clay Content (%<0.002mm)	Equivalent Sulfur (%S)	Equivalent Acidity (mol H+/tonne)	Equivalent Sulfur (%S)	Equivalent Acidity (mol H+/tonne)
Coarse – sands to loamy sands	<5%	0.03	18	0.03	18
Medium – sandy loams to light clays	5–40%	0.06	36	0.03	18
Fine – medium to heavy clays and silty clays	>40%	0.1	62	0.03	18

5 Site Characterisation

The Project area (shown in Figure 1-2) extends east-west approximately 3.4 km covering about 105 hectares. The Project Development Envelope can be separated into five key areas, being including Sites C & F, the causeway, conveyor and Port storage and loading facilities.

5.1 Geology

5.1.1 Regional Geology

Regional maps of the sites underlying, and surface geology is presented in Figure 5-1 and Figure 5-2 below. The Interpreted Bedrock geology map (Geological Survey of Western Australia, 2016) indicated that the site is underlain by Gidley Granophyre described as fine to medium-grained granophyre, commonly porphyritic and underlain by gabbro.

The surface geology of the site is described by Geoscience Australia 1:250,000 Dampier geological map sheet as Quaternary (Qc and Qs) and detailed as:

- Colluvium – sand, silt and gravel in outwash fans, scree and talus, proximal mass-wasting deposits;
- Aeolian sand – red-yellow, wind-blown sand, local sand ridges; and
- Dolerite and Gabbro dykes may also occur.

Saline flats are in a sediment filled strait between King Bay and Hearson Cove. The soils of the mudflat area are typically alkaline due to the high carbonate content originating from marine sand and underlying calcrete bedrock.

A key to the geological units presents in the Burrup region are presented in Table 5-1 below.

Table 5-1 Geological Units of the Burrup Peninsula

Geology abbreviation	Description
AgDp	Porphyritic granite to granodiorite, well foliated.
Agr	Partly remelted granitoid; occurs in GIDLEY GRANOPHYRE and AyGo.
AyGo	Gabbro
AyG	GIDLEY GRANOPHYRE: fine- to medium grained granophyre, commonly porphyritic.
Qaa	Alluvium - sand and gravel in rivers and creeks; clay, silt, and sand in channels on floodplains.
Qc	Colluvium-sand, silt, and gravel in outwash fans and scree
Qhmm	Marine mud and silt; intertidal with mangroves
Qhms	Shelly sand in coastal dunes and old beach deposits; contains *Anadara granosa*.
Qhmu	Silt and mud in supratidal to intertidal flats and lagoons.
Qpmb	Coastal limestone; lime-cemented shelly sand, dune sand, and beach conglomerate.
Made Ground	Developed surface.

5.1.2 Local Geology

Geological mapping of the area shows the site to be underlain by Colluvium of sand, silt, and gravel, which is in turn underlain by the Gidley Granophyre. The supratidal areas are shown to be underlain by silt and mud in supratidal and intertidal lagoons. These are represented by outwash fans that have a soil profile associated with a low energy marine depositional environment. These sediments are typically organically rich and often contain a thin veneer of shelly lenses. A curved thrust fault extends through Site C, which generally reflects topography.

The granophyre is the dominant rock type, which is characterised by extremely high intact rock strength. When exposed to weathering, the rock surface forms a characteristic surface of boulders that may become loose from the rock mass. Previous investigations near site indicated a greater degree of weathering than normal for this unit, which is consistent to its proximity to an incised channel. Recent investigations undertaken by Tetra Tech Coffey (Coffey 2022a) revealed the following succession:

- Fill: Gravelly clayey sand, mixture of granophyre and calcrete gravel. Difficult to establish boundary of fill and underlying colluvial gravel. It is understood that these are present mainly across the northwestern area of Site F.
- Intertidal deposits: Loose sand, pale brown, calcareous with shells and soft to very soft clay. These intertidal deposits are mainly sand or a mixture of sand and calcrete gravel. Clay layers are located toward the centre of the tidal flats.
- Calcrete (tidal area) pale grey to red or gravel, vughy.
- Colluvial gravel: clayey gravel present across majority of site, which includes granophyre boulders.
- Weathered granophyre, present across areas of the site.
- Brecciated/Cemented Granophyre: Secondary cementation by $CaCO_3$, not uniformly distributed, mainly found on colluvial slopes adjacent to the tidal flats.
- Fresh Granophyre.
- Dolerite: Extremely weathered to residual clayey gravel, present in localised areas in the northern area of Site C.

5.1.3 Elevation & Slope

Site C

Site C slopes from approximately 28m AHD in the north-west to 2m AHD at its lowest point on the southern boundary. As shown in **Attachment A - Project Surface water Schematic and Plot Plan**, the battery limits of the Project will avoid the steeper and higher areas in the north-west.

During the earthworks phase, the majority of the Site C which will contain the urea production plant and storage shed will be cut and filled to a level of approximately 6m AHD. The north-east sector which includes the desalination and demineralisation plants will be tiered at approximately 10m AHD.

The catchment area to the north of the site drains towards the southern boundary and an ephemeral creek line on the west portion of the site.

Initial earthworks will include a surface water diversion system to redirect natural runoff around the Project site and into the supra-tidal flat area.

Site F

Site F slopes generally from south to north from approximately 12m to 28m AHD along the southern boundary, down to approximately 6m and 10 m AHD respectively at the northern boundary, adjacent to the supra-tidal flat area.

Where possible permanent infrastructure and laydown areas will avoid the higher, steeper areas along the southern boundary.

Causeway

The supra-tidal flat area slopes from about 4m AHD at its lowest point. The causeway will be a formation built up to approximately 6m AHD as it extends across the supra-tidal flat area and is then graded to join at the finished levels of Sites C and F.

Conveyor

The eastern segment of the conveyor route starts at approximately 8m AHD at the southern transfer station, up to 18m AHD as it extends north, then back down to approximately 8m AHD at the northern transfer station. At this point it is routed through an existing culvert under Burrup Road where it follows the EWSC which rises from 8m up to approximately 62m AHD at its highest point.

The conveyor will follow the EWSC which drops down to approximately 21m AHD where it borders the southern section of the existing quarry which will contain the Project's Port storage shed.

Port Area

The floor level of the Port storage shed located in the existing quarry will be built up from natural ground level of approximately 5m AHD up to approximately 10m AHD.

The ship loader will be constructed on the wharf which will be built by PPA.

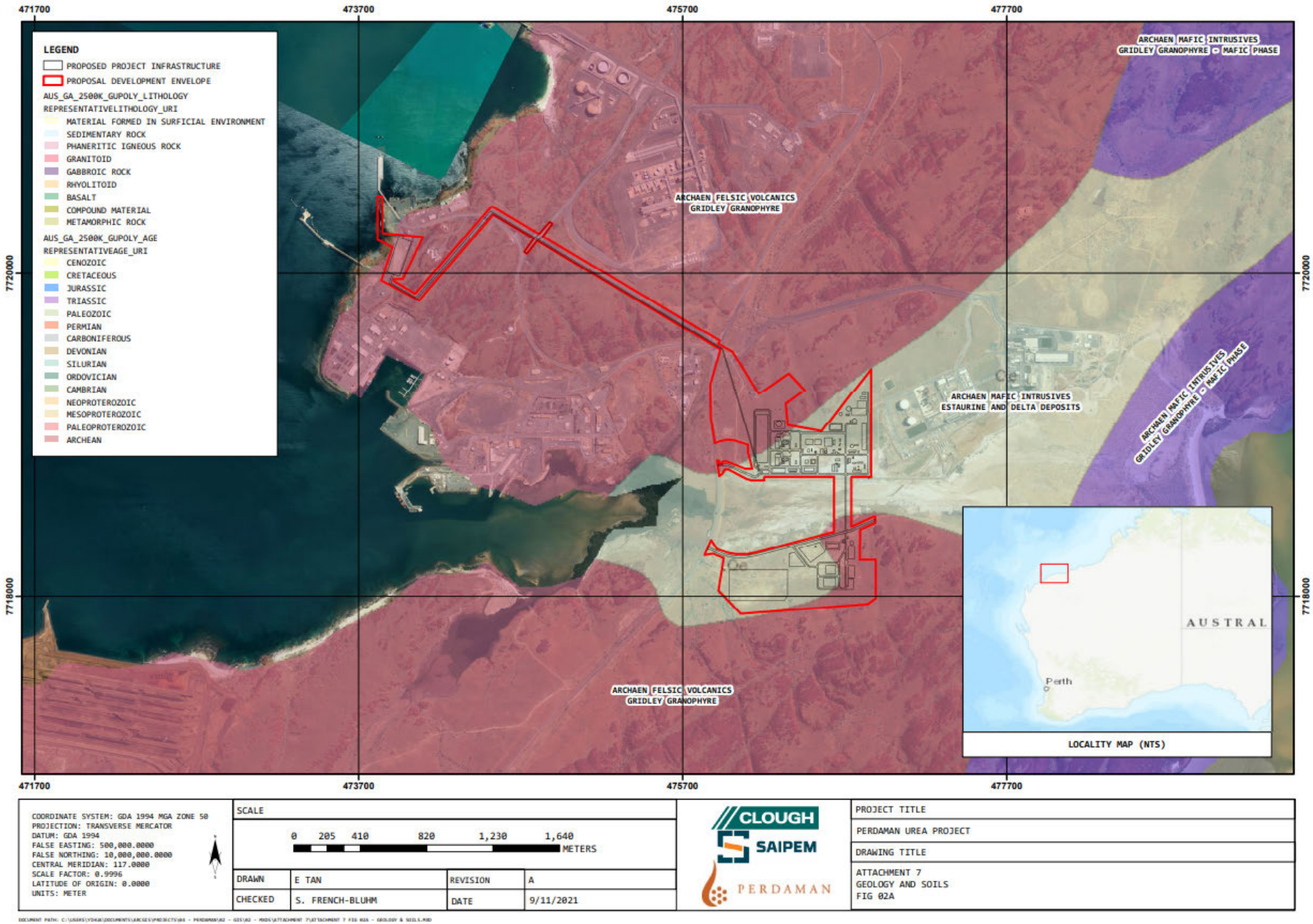

Figure 5-1 Geology and Soils

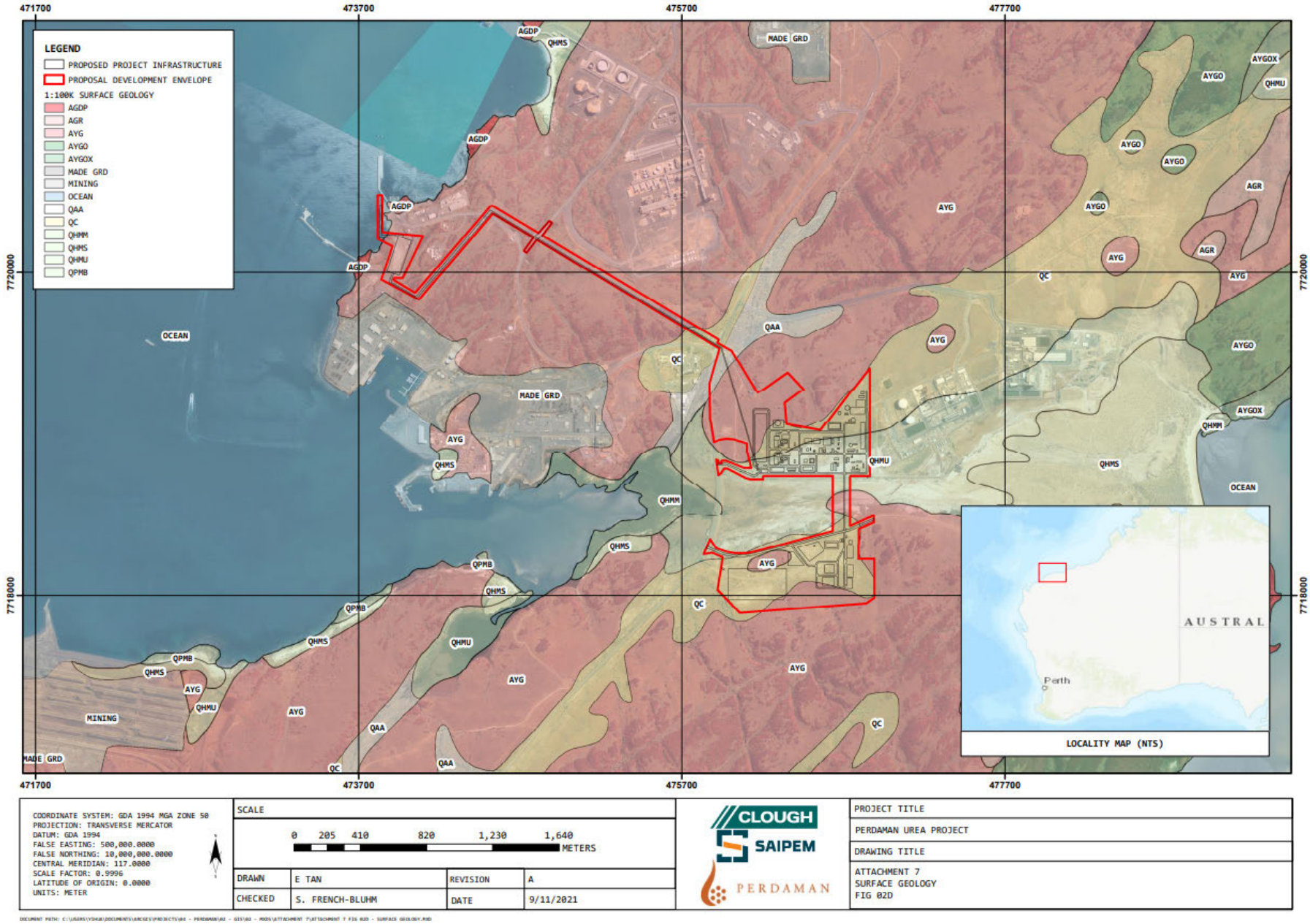

Figure 5-2 Surface Geology

5.2 ASS Risk Mapping

A review of the ASS Risk Map, Pilbara Coastline (DWER-053) indicates the occurrence of High to moderate risk ASS within the supratidal zone of Site C and causeway. A moderate to low-risk ASS area is also observed in the northwest corner of Site C (refer to Figure 4-5 for ASS risk map). Additionally, the ASRIS National ASS Atlas was reviewed to validate accuracy of the DWER ASS risk map, and a High probability of Occurrence features. In summary, the two sources correlate with each other.

It is noted in the DWER guidelines (DER, 2015b) that the risk maps are not intended to depict actual acid sulfate soil risk at an individual property level and is used in this study as a broad-scale planning tool. As such, the DWER stipulates that sites should be investigated further, if “lowering of the water table, whether temporary or permanent” is proposed in areas depicted in an ASS risk map as Class II as a “moderate to low risk of AASS or PASS occurrence within 3m of natural soil surface” and particularly at sites situated within a mapped “moderate to high” risk area (generally associated with wetlands).

6 Potential Impacts & Risks

6.1 Potential Acid Sulfate Soils

When PASS is disturbed, either by excavation or lowering of the water table below natural seasonal levels, sulfides present are exposed to air, allowing oxidisation and consequently, the formation of sulfuric acid (H2SO4). AASS can generate acidity in situ in their natural state; disturbance is not required for acidic discharges to develop. As a result of the presence of AASS, or the oxidation of PASS, surrounding land (soil) and nearby waterways may become acidic (pH<6.5). Under acidic conditions, metals such as aluminium (generally at pH<4.5) and iron, as well as trace heavy metals (including arsenic), become more mobile in the environment and can be taken up by infiltrating waters. Disturbance of ASS impacted areas may release hydrogen sulfide gas which typically settles within confined spaces and excavations such as trenches and/or depressions. Hydrogen sulfide gas has the potential to reach toxic levels and appropriate occupational health and safety measures may require to be implemented within areas of depressions and/ or during excavation of confined spaces.

6.2 Monosulfidic Black Oozes (MBOs)

MBOs may form onsite in low-lying parts of the site are likely to be periodically subjected to tidal inundation (i.e. supratidal flats). Should an excess of organic matter and iron sulfides build up, MBOs may also form in and around the culverts under the causeway. The area may be at higher risk as DWER have indicated a high nutrient supply in the upper and lower supra-tidal flats as a result of upstream ammonia/nitrate impacts from the Yara Pilbara Nitrates Pty Ltd TANPF that could accelerate the growth of sulfate-reducing bacteria that produce MBOs in these sediments (2024). The construction of the causeway has been completed and there were no incidents where the pooling of water for long periods within the tidal area had indicated that MBOs had formed and mobilised. The causeway culverts outflow velocities have been designed in accordance with the MS 1180 condition 1, which will maintain flow of water to the supratidal areas. However, following tidal inundations, heavy rain events and flooding the risks of the formation of MBOs and potential accumulation and mobilisation increases.

The formation of MBOs can pose severe risks to the marine environment and marine fauna. Where MBOs accumulate they may cause deoxygenation, acidification, benthic community modification and impacts to nutrient cycling leading to harmful algal blooms, eutrophication and potential fish deaths within King Bay. MBO formation may also alter the hydraulic functioning of waterways, reducing water flow and further enhancing MBO accumulation.

Potential Impacts to inland waters and the terrestrial environmental quality have been summarised in Table 6-1.

6.3 Potential Sensitive Receptors

The Project is located on the Burrup Peninsula directly adjacent to the Murujuga National Park and within the Pilbara bioregion of the Interim Biogeographical Regionalisation for Australia (IBRA) classification and the Roebourne IBRA sub-region, of which only 3.45% is currently reserved for conservation.

The EPA Report 1705, 2021 considers that the likely residual impacts of the Project on inland waters are:

- *Potential impacts to surface water and groundwater from the disturbance of acid sulfate soils, which is likely to be consistent with the EPA objective for inland waters, provided appropriate management measures are implemented.*

The Proposals location within a coastal area supports a distinct correlation between the surface waters and groundwater environment. The main aquifer bodies (refer to Section 5) is overlain with supratidal deposits and both are unconfined in nature and in hydraulic connection with groundwater discharge within the intertidal zone (Coffey, 2022b). Previous studies have supported this with confirmed groundwater quality to be hypersaline with TDS concentrations greater that seawater (HLA Envirosciences, 1999). Groundwater levels are noted to be particularly shallow within the supratidal areas and are noted to be expressed as surface waters during periods of high rainfall.

Groundwater levels are also stated to be particularly affected by tidal variation in this area and this is very likely to affect groundwater flow direction with groundwater flow likely to be reversed during periods of high tide (Coffey, 2022b).

Table 6-1 Environmental Impacts to Inland Waters by Project Activities

Key Environmental Factor – Inland Waters and Terrestrial Environmental Quality		
"To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected." *"To maintain the quality of land and soils so that environmental values are protected".*		
Project Activities	**Inland Waters & Terrestrial Environment Associated Values**	**Potential Impact**

Clearing, grubbing, excavations, cut & fill	Fresh water quality maintaining health of surrounding ecosystems and supporting fauna which utilise these ecosystems. Natural drainage channels and temporary watercourses supporting local vegetation and habitat values for conservation significant fauna. Natural microbial presence, composition, and distribution in soil layers. Natural topsoil chemistry and formation of soil horizons. Natural species richness and composition of seeds within topsoil/subsoil.	Short and long-term alteration of surface drainage and water flow pathways, including surface, ground and tidal water flow to supratidal vegetation. Elevated levels of suspended solids or contaminants in surface water runoff affecting the health of surrounding vegetation and associated fauna habitat, foraging and food sources. Changes to topsoil and subsoil chemistry may hinder rehabilitation survival rates. Increased turbidity of surface waters. Low risk (however still some risk) of exposing ASS during works within Site F, including potential heave and expulsion of pore water and stockpiling ASS material. ASS exposure has potential to cause significant environmental and economic impacts including fish kills and loss of biodiversity in waterways where sediments are mobilised. ASS exposure may cause contamination of groundwater by mobilisation of acids, arsenic, heavy metals and other contaminants and corrosion of concrete and steel infrastructure by acidic soil and water.
Construction of the Causeway	Conservation significant marine birds and waders that utilise the samphire shrublands / supratidal flat habitats, including (but not limited to): Curlew Sandpiper Red Knot Lesser Sand Plover Bar-tailed Godwit Australian Fairy Tern Great Knot Eastern Curlew King Bay mangrove community. Natural drainage channels and temporary watercourses supporting local vegetation and habitat values for conservation significant fauna. Nearshore marine environments and marine fauna.	Impacts to tidal water flow movements within the King Bay / Hearson Cove supratidal to intertidal flat area, restricting rewetting and drying regimes and potential drying out and oxidation of ASS. Changes to the wetting and drying cycles in the causeway could elevate the risk of MBO formation. Changes to tidal flows (i.e. minimal flows) may lead to the accumulation of MBO's. Pooling water left to sit in low-lying parts of the tidal area for long periods could increase risk of MBO formation. Risk of mobilisation of MBOs following heavy rainfall or large tidal outflows with the potential for anoxic fish kill events and harm to the nearshore marine environment. Erosion from tidal flows (after disturbance of the area) may cause sediment deposition, impacting intertidal and supratidal vegetation and benthic communities, including the King Bay mangrove community. Increased turbidity of surface waters surrounding the causeway. Causeway construction exhibits risk of ASS disturbance, impacting marine water quality and samphire habitat for conservation significant marine birds and waders. Potential changes to tidal flows (restricting rewetting and drying regimes and potential drying out and oxidation of ASS.
Stockpiling imported raw materials, and local topsoil and subsoils during	Natural microbial presence, composition and distribution in soil layers. Natural topsoil chemistry and formation of	Run-off from stockpiles may cause sedimentation and deposition of foreign/introduced/contaminated material

construction.	soil horizons. Natural species richness and composition of seeds within topsoil.	into the environment (particularly ASS stockpiles) Elevated levels of suspended solids or contaminants in surface water runoff affecting the health of surrounding vegetation and associated fauna habitat, foraging and food sources. Changes to topsoil and subsoil chemistry may hinder rehabilitation survival rates. Increased turbidity of surface waters.
Storage and handling of Aglime associated with treatment of ASS.	King Bay mangrove community. Fresh water quality maintaining health of surrounding ecosystems and associated fauna, including conservation significant marine birds and waders that utilise the samphire shrublands / supratidal flat habitats, including (but not limited to): Curlew Sandpiper Red Knot Lesser Sand Plover Bar-tailed Godwit Australian Fairy Tern Great Knot Eastern Curlew	Potential for spills or leaks to contaminate the surrounding surface water quality within and surrounding the site. Potential for spills or leaks to contaminate surrounding soils and impact natural chemistry. Pollution Impacts to the supratidal zones (Hearson Cove and King Bay) during the construction of the proposed causeway between sites F and C. Potential impacts to the mangrove communities at King Bay where spills and contaminants are delivered to the supratidal to intertidal areas Changes to topsoil and subsoil chemistry may hinder rehabilitation survival rates.
Post Construction	Fresh water quality maintaining health of surrounding ecosystems and supporting fauna which utilise these ecosystems. Natural microbial presence, composition and distribution in soil layers. Natural topsoil chemistry and formation of soil horizons. Natural species richness and composition of seeds within topsoil/subsoil. Conservation significant marine birds and waders that utilise the samphire shrublands / supratidal flat habitats. King Bay mangrove community.	Degradation of water quality from elevated levels of suspended solids or contaminants (metals, acids) in surface water runoff; Increased turbidity of surface waters due to soil erosion and/or the transport of mobilised sediments from excavation activities (i.e. cut and fill) and imported fill material; Increased acidity within surface and groundwater from disturbance of Potential Acid Sulfate Soils (PASS); Undetected leaching of ASS material into surface and/or groundwaters, causing deleterious long-term impacts. Indirect impact on the mangrove communities of King Bay as a result of potential water quality changes.
Project design elements disturbing ASS or PASS material.	Fresh surface and ground water quality maintaining health of surrounding ecosystems and supporting fauna which utilise these ecosystems. Natural microbial presence, composition and distribution in soil layers. Natural topsoil chemistry and formation of soil horizons. King Bay mangrove community. Conservation significant marine birds and waders that utilise the samphire shrublands / supratidal flat habitats	Impacts to soil and water properties if ASS is disturbed. Acidic corrosion of construction materials. Release of dissolved metals (i.e., aluminium) and oxidised sulphates. Contamination of surrounding flora and vegetation, leading to vegetation health decline and potential causes of indirect impacts to fauna utilising the impacted habitat(s). Leachate transported downstream to the supratidal flats and to King Bay through tidal movements.

6.4 Risk Assessment

Perdaman applied a standard risk assessment matrix to its operations, whereby the 'likelihood' and 'consequence' of events is considered, with management and mitigation actions identified to control the level of risk. The overall risk register for geotechnical and geoenvironmental risks were compiled by SNC-Lavalin (SNC Lavalin, 2019a) during the geotechnical desktop study for the project. In addition, a risk and mitigation table are provided within **Appendix 3** of this ASSMP.

7 Training and Awareness

All Project personnel shall be aware of and competent to implement the environmental requirements of the ASSMP when performing their individual tasks. A competent person is a person who is qualified, because of knowledge, training and experience, to organise the work and its performance.

7.1 Project Inductions

Prior to commencing any work on site, all personnel working on Project Ceres will undertake an environmental induction which will include Project Ceres's aspects, impacts and mitigations for the protection of threatened species. The environmental induction developed by Perdaman, will be delivered to personnel by the Environmental Representative, or delegated person, and shall include, but not be limited to the following:

- Project approvals and associated conditions;
- Key legal obligations;
- Regulatory penalties and impacts of non-compliance;
- Process for authorising ground disturbance via the GDP process;
- Land access restrictions;
- Aboriginal heritage sites and cultural awareness;
- Dust management;
- Identification of weeds, management measures and reporting requirements;
- Protection of fauna, identification of threatened fauna species and reporting requirements (sightings and injuries);
- Identification of feral fauna species and reporting requirements;
- Water management and water use efficiency;
- Fire risk management and response;
- Erosion systems and management;
- Hazardous materials storage and use;
- Spill management including use of spill kits;
- Waste management;
- Asbestos materials management;
- Emissions management;
- Incident and hazard reporting;
- Any special requirements relevant to specific work locations e.g.: Port related aspects and impacts.

7.2 Training Records

Training records shall be maintained on site and include the following as a minimum:

- Records of training attendance e.g.: induction training, toolbox meetings;
- Copies of training materials;
- Competency assessments (where relevant);
- Training matrix.

7.3 Ground Disturbance Permits

A Ground Disturbance Permit (GDP) is a permit issued by Perdaman for enabling works within defined batterylimits, which have the potential to impact native vegetation, fauna, heritage or other environmentally sensitivevalues.

The GDP provides Project Ceres personnel responsible for managing the ground disturbing activities with a summary of the key approval commitments and obligations obtained by or issued to Perdaman by regulators,tenure holders and other third parties.

Activities covered in the GDP include but are not limited to clearing and grubbing, grading open ground, movement of plant, equipment and vehicles and any other activity which will disturb or damage soil, waterways,habitat and, or vegetation.

A GDP could be issued through a standalone process or included in an overall approval to work procedure developed for Project Ceres.

It is the responsibility of all project Personnel to ensure they submit to Perdaman an application form requesting a GDP at least two weeks prior to requiring access to the area being the subject of the GDP.

8 Non-Conformance & Incident Management

8.1 Environmental Incident Response

An environmental incident on Project Ceres that could impact a key environmental factor, is any situation where a gas, liquid or solid emission release occurs that does, or could, pose a threat to environmental values, or be a breach of a Project approval or regulatory requirement. As a guide, this could include:

- Spill to open ground, waterway or marine system of a known or potentially contaminating liquid or solid material.
- Clearing or grubbing vegetation outside an approved area.
- Release of gas or vapours to atmosphere.
- Injury or death of fauna.
- Introducing weed contaminated soil or vegetation into uninfected areas.
- Erosion or deposition of sediment outside Project Ceres's battery limits.
- Any uncontrolled fire.
- Uncovering naturally occurring hazardous or contaminating materials such as acid sulphate soils.
- Excessive dust generation.
- Excessive noise emissions.
- Waste not being stored, managed or disposed of appropriately.

The immediate response to all incidents is to make the area safe and undertake measures to prevent further environmental harm.

The process outlined in Section 8.2 below will be followed by all Project personnel if an environmental incident occurs.

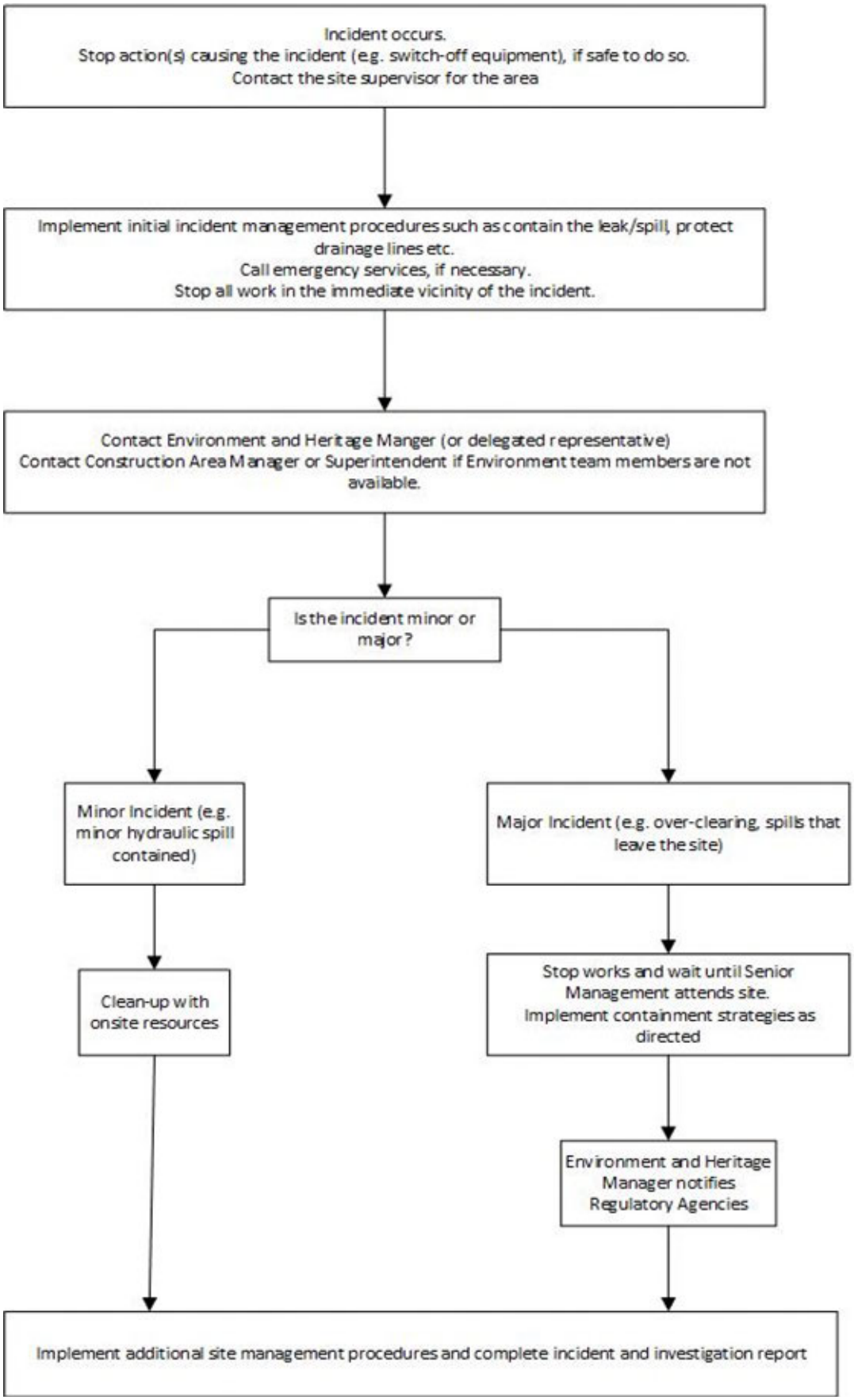

Figure 8-1 Flow chart for environmental incident response

8.2 Incident Reporting & Investigation

When an environmental incident occurs, regardless of its scale or nature, the Environment and Heritage Manager (or their representative) is to be notified of the incident as soon as possible.

The Environment and Heritage Manager will inform Project Ceres Director of the incident, and actions taken to mitigate impact to the environment. Reporting to Project Ceres Director must occur within 24 hours. The incident and response will be recorded in Perdaman's incident reporting system, within 24 hours of occurrence.

For externally reportable and / or high potential incidents, root cause(s) must be established using the IncidentCause Analysis Methodology (ICAM). The final incident investigation report must be submitted within 14 days,or as stipulated by Project Ceres Director, depending on the level of investigation required.

In the event that an environmental incident results in the offsite discharge of contaminants to the environment, the Environment and Heritage Manager, in consultation with Project Ceres Director, will contact the appropriate regulatory agencies.

All high-potential environmental releases must be reported to the Perdaman Chairman within 24 hours of occurrence, or sooner if practicable.

The site supervisor responsible for the area in which the incident occurred is to complete an incident report form and provide it to the Environment and Heritage Manager as soon as practicable after the incident.

Depending on the nature of the incident, reporting and notification of incidents may need to be provided to external agencies or Regulators.

All incidents will be investigated at a level commensurate with the actual or potential consequence. Incidents with an actual consequence of high and above, including those that breach regulations, licence or approval conditions will include the relevant Construction or Operations Manager in the incident's investigation.

Section 4.2 includes management actions, where failure to comply with that action constitutes an incident. Where this occurs, these incidents are to be reported in writing to the CEO and DCCEEW as soon as practicable and no later than seven business days after becoming aware of the incident, in accordance with Condition 8-5 of MS1180.

8.3 Non-Conformance Management

In the event that the environmental outcomes specified in Conditions 8-1 of MS 1180 are exceeded, or monitoring or investigations at any time indicate an exceedance of threshold criteria specified in this plan, the following actions will be taken in accordance with Condition 8-2 MS 1180:

1) demonstrate how the environmental objective in condition 8-1 will be achieved
2) specify the treatment and management of potential acid sulfate soils inaccordance with the requirements of condition 7-1 and condition 7-2;
3) specify trigger criteria that will trigger the implementation of management and/or contingency actions to prevent direct or indirect impacts;
4) specify threshold criteria to demonstrate compliance with condition 8-1;
5) specify monitoring methodology to determine if trigger criteria and threshold criteria have been met;
6) specify management and/or contingency actions to be implemented if the trigger criteria required by condition 8-2(3) and/or the threshold criteria required by condition 8-2(4) have not been met; and
7) provide the format and timing for the reporting of monitoring results against trigger criteria and threshold criteria to demonstrate that the objective in condition 8-1 has been met over the reporting period in the Compliance Assessment Report required by condition 15-6.

Non-conformances may be identified from a number of sources, including but not limited to incident investigations, audits, inspections, monitoring programs and management reviews. Corrective actions will be systematically implemented and reviewed to ensure they adequately resolve the issue and minimise the risk of reoccurrence of the incident.

A corrective action register shall be maintained on site by Perdaman and shall record all corrective actions identified and implemented, including review of corrective actions and close out details. The close out details shall include the date closed and the name of the person verifying completion of the required action.

Corrective actions where the initial risk level is high or extreme must be prioritised and closed in a timely manner.

Where relevant, corrective actions identified may be included in periodic revision of the PEMP.

8.4 Emergency Management

Project Ceres's PCF-PD-PN-ERMP Emergency Response Management Plan shall be implemented, addressinghealth, safety and environmental issues. The plan will include methods for managing major environmental incidents, including but not limited to, large scale release of hazardous materials or gases, fire, cyclone and flood events.

9 Environmental Reporting & Compliance Requirements

Compliance with this ASSMP will be reported in a timely manner to the Perdaman Environment and Heritage Manager. Corrective actions will be recorded and monitored as per the non-conformance tracking system to ensure continual improvement and enable the close out of incidents.

Annual reports will be prepared by Perdaman for submission to the appropriate Regulators. These will include general conformance, new risks and hazards identified, corrective actions implemented, sampling results, incident and investigation reports.

9.1 Environmental Reporting

Perdaman is responsible for the preparation of overall Project related environmental reports including compiling data from monitoring programs.

An ASS closure report will be prepared once all associated ground excavations for the site works has been completed. The closure reports will detail the following components:

- Scope of work.
- Site identification and details of re-development.
- Existing environment and setting.
- Management measures undertaken at the site.
- Total volumes and extent of disturbed soils.
- The results of all monitoring programs (including validation results).
- A discussion of the effectiveness of management strategies employed at the site.
- A discussion of any potential risks to human health or the environment.
- Proposed future monitoring and/or reporting programs.
- Proposed remediation measures if needed.

9.2 Compliance Assessment Report (CAR)

Perdaman shall assess the compliance with ministerial conditions in accordance with the Projects Confirmed Compliance Assessment Plan. The first Compliance Assessment Report (CAR) is due for submission to the CEO fifteen months from the date of issue of the Ministerial Statement (1180).

In accordance with condition 15-7 of the MS 1180, each CAR shall:

- be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf;
- include a statement as to whether the proponent has complied with the conditions;
- identify all potential non-compliances and describe corrective and preventative actions taken;
- be made publicly available in accordance with the approved Compliance Assessment Plan; and
- indicate any proposed changes to the Compliance Assessment Plan required by condition 15-2.

10 Stakeholder Consultation

This Confirmed Acid Sulfate Soils Management Plan has been prepared in consultation with Murujuga Aboriginal Corporation (MAC) in accordance with Condition 8-2 of Ministerial Statement 1180. Reviews and revision of the ASSMP will be done in consultation with MAC, with submissions to be sent to the CEO and the DCCEEW as directed by the CEO.

Perdaman shall provide for the relevant traditional owners to be invited to observe any Ground Disturbing Activities and during construction activities and take reasonable steps to facilitate the observation of those activities by those persons.

Perdaman has carried out stakeholder consultation with key stakeholders since February 2019 to enable the development of Management Plans. A consultation register summarising consultation is presented in Appendix 5. The register summarises the consultation and Perdaman responses, and the most recent consultations with the Murujuga Aboriginal Corporation are included as Attachment D Attachment E, Attachment F and Attachment G of this plan.

10.1 Internal & External Communication

Regular updates of environmental issues and related matters will be communicated to all Project personnel. This communication will include the induction process, through regular team meetings and toolbox talks, and via written communications including emails and newsletters disseminated electronically or in hard copy.

All external communications will be managed by Project Ceres Director. No other Project personnel or Contractors are to provide comment or information to external organisations or individuals without the consent of Project Ceres Director.

10.2 External Incident Notification

Only the Environment and Heritage Manager, in consultation with Project Ceres Director, is authorised to notify external regulatory agencies of any Project related environmental incidents.

This communication will be in accordance with individual agencies' reporting and notification requirements

11 Adaptive Management & Review

11.1 Adaptive Management

Perdaman will employ adaptive management throughout the Project to incorporate knowledge from the implementation of mitigation measures, monitoring, validation and evaluation of data against trigger and threshold criteria to meet the environmental objectives and ASS assessment and action criteria that assesses the effectiveness of treatment and management. The adaptive management approach of reviewing the management targets for ASS management and groundwater where it relates to ASS management on the Project and evaluating and monitoring the applied management and mitigation measures against the objectives will be done in response to monitoring the targets, triggers and thresholds.

The following approach will be implemented:

- Monitoring data will be systematically evaluated and compared to baseline data or survey data on an annual basis to verify whether groundwater, surface water quality responses to the construction and operation activities are same or similar to the impacts from ASS as predicted.
- Re-evaluate risk assessments annually.
- Incorporate additional knowledge as it comes to hand to address assumptions and uncertainties to gain a greater understanding of groundwater characteristics and site hydrology / hydrogeology that may impact the exposure and subsequent management of ASS/PASS.
- Complete review of risk-based priorities after annual monitoring is completed.
- Undertake revision when management measures are not as effective as predicted, or trigger levels do not have the outcome anticipated or required.
- Incorporate alternative techniques, technologies and methodologies to enhance and improve the program;
- Incorporate and modify the program to include any external changes during the life of the Project (e.g. changes to the sensitivity of the vegetation, climate change, implementation of other activities in the area, etc.).
- Incorporate and modify ASS management and treatment where validation and/or monitoring results demonstrate the current methodologies are not effective.

Potential adaptive management actions may include, but are not limited to:

Exceedance of trigger or threshold criteria for groundwater or surface water quality or level (as they relate to ASS):

- Determine/investigate cause/source.
- Improve and implement additional trigger level actions or threshold contingency actions as necessary.
- Monitor the success of remedial actions.

Identification of LOR equivalent trigger criteria (Soils or Water) value exceedance:

- Determine/investigate cause/source.
- Conduct different laboratory analysis with lower LOR value below trigger level value.
- Revise trigger level value as necessary.
- Improve and implement additional trigger level actions or threshold contingency actions as necessary.
- Monitor the success of remedial actions.

11.2 ASS Management Plan Review

This ASSMP will be reviewed an updated where changes are required following the evaluation of monitoring data, review of assumptions and uncertainties, re-evaluation of risk assessment, increased understanding of the environmental setting, or changes to the Project scope or technology. In addition, the ASSMP will be reviewed at least annually.

12 Changes to the ASSMP

This Plan has been amended from the previous version PCF-PD-EN-ASSDMP_PCF1_RevA to ensure that all commitments and Conditions required in accordance with Ministerial Statement 1180 are captured and addressed.

All changes to this ASSMP post-assessment must be provided separate to compliance reports and submitted to registrar@dwer.wa.gov.au.

Table 12-1 Changes to the ASSMP

Complexity of changes:	**Minor Revisions ☒**	**Moderate Revisions ☐**	**Major Revisions ☐**	
Number of Key Environmental Factors:	**One ☐**	**2-3 ☒**	**> 3 ☐**	
Date revision submitted to EPA, DCCEEW and DBCA:				
Proponent's operational requirement timeframe for approval of revision:	**< One Month ☒**	**< Six Months ☐**	**> Six Months ☐**	**None ☒**
Reason for Timeframe:				

Item No.	EMP Section No.	EMP Page No.	Summary of change	Reason for change
1	ALL	ALL	Document updated to include updated document references and correct legislative reporting requirements	Updated document references and legislative requirements.
2.	ALL	ALL	Formatting changes to whole Plan (including cover image, text, headers/footers and tables).	To align all Perdaman EMPs and improve readability and document usability.
3.	-	iv	Added "Foreword" section.	To align all Perdaman EMPs.
4.	3	8	Added "Roles & Responsibilities" section.	To align all Perdaman EMPs.
5.	7	31	Added "Training & Awareness" section.	To align all Perdaman EMPs.
6.	8	32	Added "Non-conformance & Incident Management" section.	To align all Perdaman EMPs.
7.	10	37	Added "Stakeholder Consultation" section.	To align all Perdaman EMPs.
8.	App 5	60	Added Appendix 5 "Stakeholder Consultation Register".	To align all Perdaman EMPs.
9.	ALL	ALL	Restructuring throughout whole document using the FaMP structure as reference.	To align all Perdaman EMPs and improve readability and document usability.
10.	ALL	ALL	Correct all references to sections, tables, figures, appendixes, and attachments to reflect the new structural changes.	To align all Perdaman EMPs.
11.	4.2.2 6.2		Included information concerning the identification, potential impacts and management of Monosulfidic black ooze.	Feedback from DWER.

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14 Definitions

Contractor

The Contractor on the Project is any individual or party engaged directly or indirectly by Perdaman, that is notan employee of Perdaman, to carry out the Project.

Environmental Representative

The Environmental Representative includes Perdaman's Environment and Heritage Manager, theEnvironmental Coordinator or their delegated representative.

Environment and Heritage Manager

The Environment and Heritage Manager is Perdaman's site based Environmental Representative who has the authority and responsibility for managing the implementation, compliance and effectiveness of the Project's environmental and heritage requirements.

Ground Disturbance Permit

A Ground Disturbance Permit (GDP) is a permit issued to a Subcontractor, by the Contractor, enabling Workswithin defined battery limits to manage any impacts on native vegetation, heritage or other environmentally sensitive values. It includes the key approval commitments and obligations obtained by or issued to the Contractor or Owner by regulators, tenure holders and other third parties.

May

Indicates that the Subcontractor is permitted to do something, or the Contractor reserves the right to dosomething according to the text.

Must

Indicates a requirement or action that must be followed to comply with legal framework for the Project and environmental approval conditions.

Perdaman

Perdaman Chemicals and Fertilisers Pty Ltd is the proponent of the Project.

Project Personnel

Project Personnel includes all persons working on the Project directly employed by Perdaman, or its Contractors.

Project Work Sites

The Project work sites include Area C, Area F, the causeway linking these two areas, the conveyor corridor tothe Port and the Port storage and loading infrastructure. It can also include any other Project relevant locationunder operational control of Perdaman.

No-Go Zones

No-Go Zones are defined areas within the Project's footprint which are not entered and or disturbed by Project activities. These areas are established to protect environmental, cultural heritage, infrastructure and other values from damage or other detrimental impacts.

Shall

Indicates that a statement is mandatory.

Should

Indicates a recommendation.

Weed

A weed is a plant that is regarded as not endemic and considered undesirable in a particular location or region.

Will

Indicates a requirement or action that Perdaman or the Contractor will be implementing or complying with during the Project activities to ensure compliance with legal framework for the Project and environmental approval conditions.

Works

Works includes all work which SCJV and or its Subcontractors are required to perform to comply withits obligations under the Contract during construction.

15 Abbreviations

Table 15-1 Abbreviations & Acronyms

Abbreviation	Description
AASS	Actual Acid Sulfate Soils
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment Conservation Council
ARI	Average Recurrence Interval
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
BSIA	Burrup Strategic Industrial Area
CAR	Compliance Assessment Report
CEO	CEO of the Environmental Protection Authority
COPC	Contaminants of Potential Concern
DBLB	Dampier Bulk Liquids Berth
DCCEEW	Department of Climate Change, the Environment, Energy and Water
DoEE	Department of Environment and Energy
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
DER	Department of Water and Environmental Regulation, *previously Department of Environmental Regulation.*
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EPC	Engineering, Procurement and Construction
ERD	Environmental Review Document
ESCP	Erosion and Sediment Control Plan
ESWMP	Erosion and Surface Water Management Protocols
EWSC	East West Services Corridor
FEED	Front End Engineering and Design
GDA	Ground Disturbing Activities
GDP	Ground Disturbance Permit
mBTOC	Meters Below Top of Casing
mBGL	Meters Below Ground Level
MBO	Monosulfidic Black Ooze
MRWA	Main Roads Western Australia
Mtpa	Million tonnes per annum
MUBRL	Multi-User Brine Return Line
PASS	Potential Acid Sulfate Soils

PDE	Project Development Envelope
PEMP	Project Environmental Management Plan
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PPA	Pilbara Ports Authority
PPM	Parts per million
SCJV	Saipem Clough Joint Venture
SWMP	Surface Water Management Plan
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons

16 Project Delivery Applicability

Table 16-1 Project Delivery Applicability

☐	Proposals	☒	EPC	☒	Construction
☐	Studies	☒	Project Management	☒	Commissioning
☐	Preliminary Engineering	☐	Technical Services	☐	Site Services
☐	FEED	☐	Procurement	☒	Ops and Maintenance
☒	Detailed Design	☒	Construction Management	☐	

Appendix 1 – Ministerial Statement (MS) Conditions Relevant to Acid Sulfate Soil

<table>
<tr><th>Condition No.</th><th>Condition</th></tr>
<tr><td>1</td><td>When implementing the proposal, the proponent shall ensure the proposal does not exceed the following extents or ranges:
<table>
<tr><th>Proposal element</th><th>Location
(as defined by the proposal amended under s 43A (12 May 2021))</th><th>Maximum extent or range</th></tr>
<tr><td colspan="3">Physical elements</td></tr>
<tr><td>Development envelope (Site C and F)</td><td>Figures 1, 2, 3 & 4</td><td>106.7 ha</td></tr>
<tr><td>Disturbance footprint (Site C and F)</td><td>Figures 1, 2, 3 & 4</td><td>73.05 ha.
Avoiding Cultural Heritage Sites IDs 9439, 26008, 9296, and MAC 004.</td></tr>
<tr><td>Laydown Area (Site F)</td><td>Figure 2</td><td>6.8 ha (temporary and episodic use).</td></tr>
<tr><td>Utility Block (Site C)</td><td></td><td>Power generation (installed Combined Cycle Gas Turbine – 100 MW capacity and installed solar – 3.5 MW capacity).</td></tr>
<tr><td colspan="3">Operational elements</td></tr>
<tr><td>Urea production plant</td><td>Figure 2</td><td>6,200 t/day</td></tr>
<tr><td>Ammonia plant</td><td>Figure 2</td><td>3,500 t/day</td></tr>
<tr><td>Saline water discharge</td><td></td><td>20 GL/yr (including excess treated wastewater) discharged into the existing Water Corporation Multi-User Brine Return Line.</td></tr>
<tr><td>Product storage areas</td><td>Figure 2</td><td>Urea (plant site): 75,000 t capacity, fully enclosed shed.
Urea (Dampier Port site): 75,000 t capacity, fully enclosed shed.</td></tr>
<tr><td>Urea shiploading system</td><td>Figure 2</td><td>Loading capacity of 2,200 t/h</td></tr>
<tr><td>Causeway</td><td>Figure 2</td><td>Culvert outflow velocities of less than 1.0 m/s</td></tr>
<tr><td colspan="3">Timing elements</td></tr>
<tr><td>Project life</td><td></td><td>Up to 80 years from date of this Statement</td></tr>
</table>
</td></tr>
<tr><td>7-1</td><td>The proponent shall undertake intrusive acid sulfate soils investigations in accordance with the requirements of the Department of Water and Environmental Regulation's guideline on the Identification and investigation of acid sulfate soils and acidic landscapes (DER 2015) at least six months prior to Ground Disturbing Activities.</td></tr>
<tr><td>7-2</td><td>In the event that acid sulfate soils are disturbed during the implementation of the proposal, the proponent shall treat and manage acid sulfate soils in accordance with the requirements of the Department of Water and Environmental Regulation's guideline on the treatment and management of soil and water in acid sulfate soil landscapes (DER, 2015).</td></tr>
</table>

Appendix 2 – Key Survey & Study Findings

Table 2A - Key Investigations & Assessments in the Project Area (Burrup Peninsula)

Key Environmental Factor	Report	Key Findings
Weather and tides	Plenty River Corporation Limited. Burrup Peninsula World Scale Ammonia / Urea Plant - Consultative Environmental Review. Woodward Clyde; October 1998.	Tropical cyclones are a common occurrence in summer, from November to April. On average, two cyclones cross the Pilbara coast per year. During cyclones, wind speeds up to 250 km/h, heavy swells and torrential rain can be experienced. On average, a cyclone threatens Dampier every two years (Bowman Bishaw Gorham, 1994). The tidal regime at Dampier is moderate and semi-diurnal in nature. The tides in King Bay range from 0.1 m (LAT) to 5.2 m (HAT), which corresponds to -2.7 mAHD to 2.4 mAHD. The extreme climatic conditions experienced on the Burrup Peninsula have the potential to impact the Project, during both the construction and operation phases. Strong winds, waves and currents generated by cyclones have the potential to interrupt the installation of the sea water intake and pipeline, and onshore facilities. Cyclone activity can also result in heavy rainfall and storm surge, which can cause widespread flooding. The saline tidal flats occur immediately to the east of the zone of mangroves. These areas are devoid of mangroves and other large shrubs due to the extreme groundwater salinities and infrequent tidal recharge. Algal mats made up of microscopic blue-green algae are present on some areas of the tidal flats
Groundwater	King Bay/Hearson Cove and Maitland Industrial Estates, Phase 1 Geotechnical Investigation Report; Soil and Rock Engineering; February, 1999.	Groundwater was encountered in all boreholes in Soil and Rock Engineering's 1999 geotechnical investigation, ranging from 0.15m bgl to 0.6m bgl (approximately 2m AHD to 6m AHD). Groundwater level is considered to be at ground level in the intertidal flats, and within 0.5m of ground level in the lower slopes. There is no available information on groundwater level at the granophyre ridge crests, however the presence of dry ephemeral channels and low permeability of the bedrock indicate that groundwater level may rise rapidly in adverse weather
Groundwater	King Bay/Hearson Cove and Maitland Industrial Estates, Phase 2 Geotechnical Investigation Report; Soil and Rock Engineering; August, 1999.	An intrusive ground investigation was conducted by Soil and Rock Engineering (1999b) comprising of six boreholes. However, it should be noted that only two boreholes are located within the Project's site, and within the warehouse structure location. Borehole KB-HC201 is located towards the northern boundary of Site F within the colluvium and granophyre, and KB-HC205 is located at the southern extent of Site C within the intertidal flats.
Groundwater and Geology	Syntroleum Proposed Gas to Synthetic Hydrocarbon Plant, Consultative Environmental Review; HLA Envirosciences; November, 1999.	Visual observations of the prevailing sediments and geology suggest that the soils and underlying bedrock display high permeability properties. Two groundwater monitoring bores were installed in the proposed GTS plant site by Astron Environmental (1999) on behalf of Syntroleum for the Project. The bores were installed within the mudflats to the north of the proposed GTS plant site and groundwater was encountered during drilling at approximately 0.5 metres in both bores. Freshwater seepage has been observed entering the mud flat from beneath calcrete benches during previous investigations (V&C Semeniuk. 1994) and has been identified as an important aspect for maintaining the northern mangrove shorelines of King Bay (Gordon 1988). Surface seepage water was not visible alone the calcrete benches during the recent investigation. Tidal and seasonal fluctuations are important features influencing the presence of seepage water and the elevation of the ground water table. No hydrocarbons or organic compounds were detected in either of

		the water samples taken from the ground water monitoring bores and all concentrations of metals, sulfates and p1-l were within regulatory guidelines. Although sulfate levels were shom to be relatively high, p11 levels (approximately 7.4) were within the normal range. This indicates that the high sulfate concentrations recorded had not developed as a result of acid sulfate conditions. The plentiful reserves of calcium carbonate in the soils are likely to "buffer" acid generation.
Marine Water Quality	BHP Petroleum Methanol Plant Site – Burrup Peninsula, Preliminary Geotechnical Design Criteria; BHP Engineering; May, 1996.	The proponent has undertaken sampling and analysis of the seawater in King Bay and Mermaid Sound and preliminary results suggest the concentration of copper and other metals in the seawater to be extremely high. However, such high metals concentrations are not consistent with results of other background seawater studies undertaken in marine waters around Australia. The acute and chronic toxicity of methanol was assessed by the proponent in consultation with the DEP. It was concluded that algae/diatoms were the most sensitive to methanol and a 99% species protection trigger value of 11mg/L was recommended, which is well above the estimated methanol concentration in the brine and wastewater discharge (0.23 mg/L).
Inland Waters	SNV-Lavalin, 2019. Geotechnical Desktop Study – Revision B1. Prepared for Perdaman Chemicals and Fertilisers.	Given the proposed construction earthworks for the site which includes a Cut and Fill methodology for the northern section for Site C (as per memo: William Woolnough, SNC-Lavalin, 2019). It is recommended that field screening during investigation and laboratory testing for the presence ASS, should be conducted in low lying areas of the site. According to sample test results taken from the two groundwater monitoring bores installed within the mudflat region located in Site F, the water quality is uncontaminated with no hydrocarbon or organic compound detected and all metal concentrations, sulfates and pH are within regulatory guidelines (HLA Envirosciences, 1999). However, the water quality were shown to be significantly saline which is typical given the intertidal nature of the mudflat region.
Groundwater and Geology	Perdaman Urea Geotechnical Investigation – Interpretive Report; Coffey Services Australia Pty Ltd; November, 2020.	Groundwater level is expected to be associated with tides. The tidal range was about 2m at the end of August 2020 and 3.5m between peaks at the beginning of November. The measurements indicate that the groundwater response to tides at neap times is very weak. In general groundwater is expected to mirror the water level in the tidal flats close to the shore, and an allowance of up to 1m above these levels should be made in design. It should be noted that the ground encountered by the boreholes, test pits and hand augered boreholes represent the ground conditions at the location where the tests have been undertaken and as such are an extremely small proportion of the site to be developed. Accordingly, variations to the ground conditions are likely and allowance should be made for variability in the design and construction budgets. The near surface ground conditions are expected to be high permeability due to the prominence of voids and open jointing. The permeability is likely to reduce with depth as the defects in the rock become closed. The subsurface layers generally follow the same profile as the ground surface, hence subsurface drainage will follow the same trend as surface drainage.

Ground and surface water	Perdaman Urea Project – Project Destiny. Baseline Hydrogeological Assessment. Tetra Tech Coffey, 2022.	Tetra Tech Coffey Pty Ltd (Tetra Tech) was engaged by Clough to provide a Baseline Hydrogeological Assessment for input into a Final Investment Decision (FID) for 'Project Destiny'. The following was concluded based on findings from the investigation: • The CSM identifies two hydrostratigraphic units beneath the site consisting of a low yielding granophyre bedrock aquifer overlain by a shallow superficial aquifer consisting of a variety of deposits including clays, gravels and calcrete. Both units are unconfined and hydraulically connected. • Groundwater flow is to the southwest in Site C and to the northwest on Site F, with discharge to the supratidal area and eventually into King Bay to the west. Groundwater is influenced by tidal variations, and it is likely that flow direction is altered during periods of high tides. • The depth to groundwater varies between 0.41 mBTOC and 21.61 mBTOC with surface waters being an expression of groundwater in the supratidal area during periods of groundwater in the supratidal area during periods of high rainfall and following tidal inundation. • Groundwater in both the granophyre and superficial deposits is of Na-K-Cl type and is brackish to saline in nature with the superficial deposits being significantly more saline due to direct tidal interaction. • Due to either the low yielding nature of the aquifer (granophyre aquifer) or the high level of salinity (superficial aquifer) groundwater in the area is considered to be of limited beneficial use and environmental value other than for industrial use or supporting marine ecosystems. • It is understood that no dewatering is to occur during construction and therefore, there is no risk of impacts to groundwater, surrounding groundwater users and the environment from abstraction. However, if dewatering and/or general abstraction are planned, the current monitoring network may be used to gain further data on the groundwater regime (i.e. from aquifer testing) that maybe then used in future analyses (i.e. modelling) to further assess any impacts to the surrounding environment. • Contamination in groundwater is localised and unlikely to pose a significant risk to surrounding receptors due to the low yield of the granophyre aquifer, which will greatly retard contaminant flow. Other contamination identified within surface water and groundwater (PFAS and Nutrients) are likely to be derived from off-site upgradient sources, (YPN plant). • The current groundwater monitoring network is considered adequate for assessing both groundwater level and quality variations through time. A groundwater quality monitoring program should be provided to ensure that any impacts during and following development are identified and, if necessary, managed or mitigated.

Acid Sulfate Soils	Perdaman Urea Project – Project Destiny. Detailed Site Assessment for Acid Sulfate Soils. Tetra Tech Coffey, 2022.	Tetra Tech Coffey Pty Ltd (Tetra Tech) was engaged by Perdaman Chemicals & Fertilisers Pty Ltd c/- Clough Saipem Joint Venture to undertake a Detailed Site Assessment (DSA) for Acid Sulfate Soil (ASS), for input into a Final Investment Decision (FID) for 'Project Destiny'. Based on the analytical finding's the following statements apply: • Soil located beneath the causeway from ground surface to ~1.0 mBGL is a PASS with evidence of reduced inorganic sulfur content in two samples. • Soils located in proximity to sample locations ASS10, ASS11, ASS12, ASS13 and ASS14 have confirmed PASS with Net Acidity excluding ANC reported in ground surface samples and other samples collected to an approximate depth of 0.5 mBGL. • The lateral extent of ASS is defined with surface samples at ASS20 and ASS21 reporting net acidity excluding ANC >0.04 %S. • Exceedances for SCR were associated with red-brown clayey GRAVEL or grey-black and brown CLAYs between 0 and 1.0 mBGL across the causeway (soil descriptions adopted from supplementary Geotechnical test pit logs) • Exceedances for the SPOS was associated with red and brown clayey GRAVEL between 0.0 and 0.5 mBGL across the supratidal zone in Site C (soil descriptions adopted from supplementary Geotechnical test pit logs). • Groundwater chemistry in the area generally indicates a hydrogeological system that has a low vulnerability to acidification in its undisturbed state. • ASS indicators that suggest minimal influence from historical acidification and a relatively low vulnerability to acidification include groundwater pH values within a neutral range across the site, low acidity values at most locations i.e., <40 mg/L, and high to very high alkalinity indicating some inherent buffering capacity is naturally present. • Dissolved aluminium is a key indicator of historical oxidation of sulfide minerals (i.e. pyrites) and was not detected in groundwater wells except at BH22 and MW10 with concentrations of 0.05 mg/L and 0.02 mg/L respectively. These minor detections are below ASS criteria. • The chloride:sulfate ratios complied with DWER acidification guidelines across the site indicating a groundwater system that has not been affected by oxidation of sulfides. No actual acidity exists in the form of S-TAA indicating that there is no soluble and exchangeable acidity within the soil profile. Potential acidity is present at the Site, due to 99% of soil samples displaying soil pHFOX values greater than pH 6.0 with equivalent %S content between 0.032-0.341 %S. No samples recorded a pHF to pHFOX change or delta greater than 3.0 which amplifies potential acidity issues for the Site. Analysis for the SPOCAS suite shows that generally soil has existing buffering/acid-neutralising capacity as indicated by all S-TPA results reported as non-detect (<0.005%S) and the soil containing excess ANC with % reported between 0.536%S to 19.3%S through the soil profile across the site. Analysis for maximum peroxide 'oxidisable' sulfur present in the soil (SPOS) exceeded the DER ASS guideline of 0.03 %S in nine samples. SCR exceedances displayed evidence of reduced inorganic sulfur content in two samples.

Appendix 3A – Environmental Risk Assessment & Process Matrix

Risk Assessment Process	Description	Methodology	Application						Reference Procedures	
			Corporate	Business Division	New Opportunity	Project Planning	Project Execution	Project Close-out		
Business Risk Assessment - HSSE Impacts	Identify, assess and control potential HSSE impacts of conducting Contractor business	Bow-tie	■	■	■	■			Risk Management Procedure	CORP-RA-PR-G-0001
Major Accident Event Hazard Assessment	Identify, assess and control Major Accident Events Hazards	MAE Bow-ties	■		■	■	■	■	MAE Hazard Management Procedure	CORP-HSE-PR-G-0068
Technical HSSE Assessments										
Design risks	Identify, assess and document inherent design risks	HAZID, HAZOP, FMEA			■	■		■	Safety in Design Procedure	CORP-ENG-PR-G-0016
Design reviews - construction, operation, maintenance	Identify, assess and mitigation of HSSE hazards introduced by the design when facility being constructed, operated or maintained	HAZID, HAZOP			■	■			Safety in Design Procedure	CORP-ENG-PR-G-0016
Human Factors analysis	Identify, assess and control potential ergonomic, health impacts of operation as part of design	Human Factors Analysis Study			■	■			Safety in Design Procedure	CORP-ENG-PR-G-0016
Fire & Explosion analysis	Identify, assess and control potential sources of fire & explosion, and consequence mitigation through	Fire and Explosion Study			■	■			Safety in Design Procedure	CORP-ENG-PR-G-0016

	design									
Threat Specific HSSE Hazard Assessment (where applicable to Project)										
Health Risk Assessment	Identify, assess and mitigate health exposures - travel and site based	HRA							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072
Environmental / Social Impact Assessment	Identify, assess and mitigate environment and community impacts	EIA, HAZID, Social Impact Study							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072
Natural Disasters Assessment (Emergency Events)	Identify, assess and mitigate potential natural disaster events which may affect the site (e.g. cyclone, wild fire, tsunami)	HAZID							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072
Task Based HSSE Hazard Assessment										
Project HSSE Assessment	Identify, assess and control potential HSSE impacts specific to the Project & Site	HAZID							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072
Construction Package HSSE Assessment	Identify, assess and control potential HSSE impacts specific to the Construction package	HAZID							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072
Subcontractor HSSE Assessment	Assess the HSSE capability of subcontractors to inform management strategy Identify, assess and control potential HSSE impacts of contract scope	PRE-QUAL / HAZID							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072

Work Team Task Assessment	Work teams identify, assess and control HSSE hazards of planned work	JHA							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072
Personal Task Assessment	Individuals identify, assess and control HSSE hazards of planned task	TAKE 5							HSSE Risk Management Procedure	CORP-HSE-PR-G-0072

HSSE Risk Matrix

Descriptor		Actual / Potential Consequence				
		Insignificant (5)	Minor (4)	Moderate (3)	Major (2)	Catastrophic (1)
Probability	Has Occurred /Almost Certain	9	16	18	23	25
	Likely	4	11	17	20	24
	Possible	3	10	13	19	22
	Unlikely	2	6	12	14	21
	Rare	1	5	7	8	15

Key			HSSE Risk Response Guide
Risk Level	Rating Range		
Low	1	8	Confirm no further control measures are required to demonstrate the risk ALARP. Responsible Supervisor to ensure all identified control measures are in place prior to the work progressing.
Moderate	9	15	Action is required to identify control measures to reduce the risk to ALARP. Work can only progress at this risk level with approval of Project Management.
High	16	22	Immediate action is required to identify control measures to reduce the risk to ALARP. Risk must be added to Project Risk Register for monitoring. Work can only progress at this risk level with approval of the Project Manager or Clough Senior Management.
Very High	23	25	This denotes unacceptable event or level of risk. Immediate action is required to identify control measures to reduce the risk to ALARP. Risk must be added to Project Risk Register for monitoring.

*The HSSE Risk Matrix and Guidelines DO NOT replace the requirements for risk assessment and treatment carried out in accordance with the Risk Management and Assurance Operating Standard (CORP-RA-OS-G-0003) and should only be used when performing HSSE Risk Assessment at a Project Level.

**The HSSE Risk Matrix shall be used to determine the level and timing of incident notification, classification and investigation. Events rated 19 or above (highlighted by shading and bold border) are considered High Potential Incidents and shall be reported accordingly.

HSE Risk Matrix

HSSE Consequence / Severity Table

Consequence	Health & Safety	Environmental Impact	Security	Business Risk	Financial impact	Murray & Roberts Injury Consequences
Catastrophic	Multiple fatalities, Multiple serious disabling injuries.	Release of pollutants capable of causing irreversible environmental harm requiring national / international resources for remediation.	One or more fatalities Terrorists attacks. Inability to conduct any business.	Company prosecuted. Loss of future work. Project shutdown. Violation of Company policy. Widespread dissatisfaction resulting in legal action.	>$30 Million	**Critical (Level 5)** Fatal injury. Incident has the potential for more than one fatal injury.
Major	Single fatality, serious injury resulting in permanent disability. Multiple injured parties.	Release of pollutants to sensitive areas; Immediate off-site contamination requiring state / regional external resource for remediation. Long term impact (6-12 months)	Deliberate attacks on staff and family resulting in severe injuries. Kidnapping. Severe delays to business operations. Rape.	Adverse national media coverage. Significant reduction in customer satisfaction. Threat to project success with potential for legal action.	$10M - $30M	
Moderate	Lost Time Injury Restricted Duties Injuries Injury reportable to Regulatory body	Environmental harm reportable to Government authority. Breach of licence conditions / lease. Onsite contamination with the potential to cause offsite contamination. Medium term impact (1-6 months)	Threat and intimidation of staff. Assault resulting in minor/no injury. Theft/vandalism/ sabotage of equipment that cannot easily be replaced. Short delays or interruptions to operations.	Local media coverage. Failure causing customer dissatisfaction with moderate delay, rework or extra work requiring additional resource. Client forced to impose penalties.	$2M - $10M	**Major (Level 4)** Incident has the potential for fatal injury **Serious (Level 3)** Lost time injuries. Incident has the potential for permanent disablement.
Minor	Medical Treatment	Minor onsite pollution not within confines of protected area. No long term impact. Clean up within 1 month.	Crime with minimal impact. Theft / Vandalism of nuisance value only. No lasting impact on business operations	Telephone or written complaints. Failure causing slight customer concern and inconvenience, resolved with current levels of resource.	$50K – $2M	**Minor (Level 2)** Medical treatment injuries
Insignificant	First Aid Treatment No treatment required	Localised / Contained impact / Immediate complete fix	Insignificant crime Theft of insignificance. No impact on business operations.	Minimal or no impact to project delivery.	Less than $50K	**Low (Level 1)** First aid treatment injuries

Probability

Probability	Description
Almost Certain	This event is expected to occur or is known to have occurred frequently at Clough in similar situations.
Likely	This event may occur or is known to have occurred at Clough in similar circumstances.
Possible	This event might occur or is known to have occurred at Clough in additional circumstances.
Unlikely	This event could occur or is known to have occurred in the industry but not at Clough.
Rare	This event may only occur in exceptional circumstances or is not known to have occurred in the industry.

Appendix 3B – Acid Sulfate Soils Risk Assessment

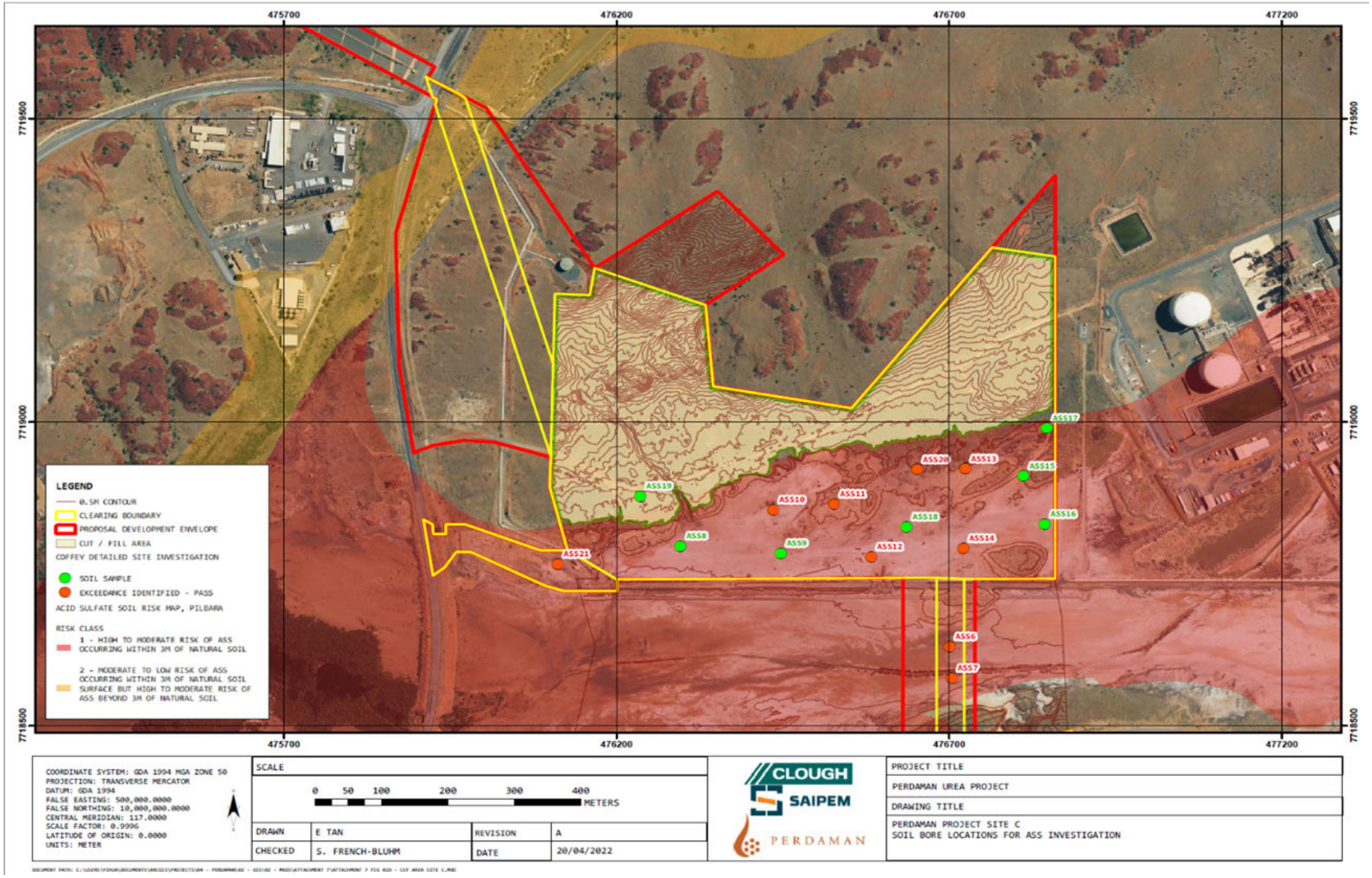
Table 3B – Acid Sulfate Soil Risk Assessment

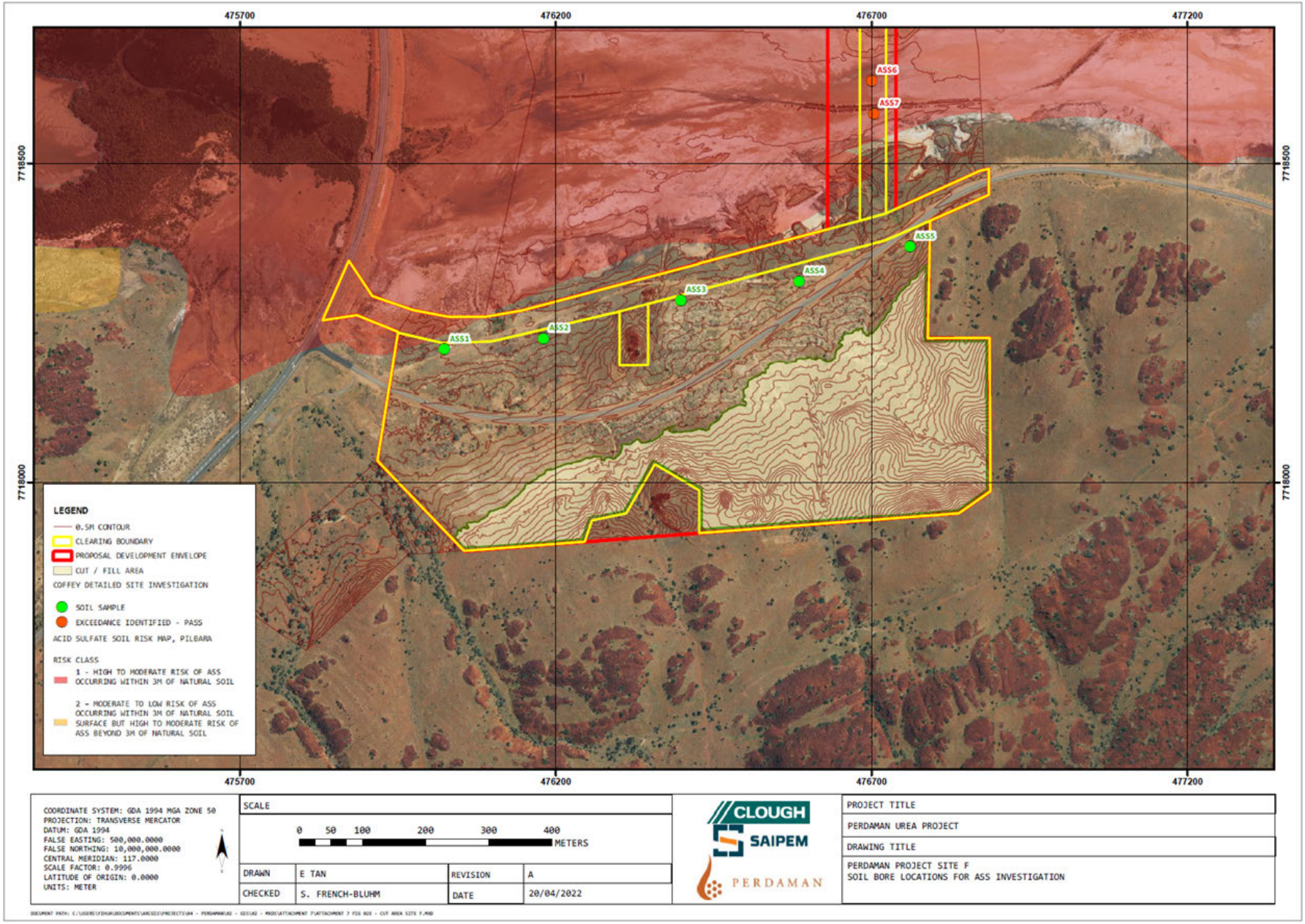
Potential Impact	Mitigation Measures	Likelihood	Consequence	Residual Risk
OBJECTIVE: *To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected*				
Construction of the Causeway • Monosulfidic Black Ooze formation. • Disturbance of Acid Sulfate Soils. • Potential to cause significant environmental and economic impacts including fish kills and loss of biodiversity in waterways. • Contamination of groundwater by mobilisation of acids, arsenic, heavy metals and other contaminants and corrosion of concrete and steel infrastructure by acidic soil and water. • Construction of the causeway in low-lying parts of the site causing water to pool for long periods within the tidal area in combination with the highly elevated nitrogen levels in the sediments of the upper and lower supra-tidal flats as a result of upstream ammonia/nitrate impacts from the Yara Pilbara Nitrates Pty Ltd TANPF that could accelerate the growth of sulfate-reducing bacteria that produce MBOs in these sediments. • The conditions that would	• Causeway design to be applied during the construction that will avoid need to dewater or excavate ASS soils. • Construction of causeway culverts in accordance with MS 1180 Condition 1 (Culvert outflow velocities of less than 1.0 m/s). • Surface Water monitoring as per the Confirmed SWMP, particularly following heavy rain events and evidence of pooling water. • Visual identification of potential MBO indicators during construction via environmental inspections. • Implementation of this ASSMP Management Approach (Section 4) if MBO's are suspected and where surface water monitoring or visual monitoring indicate such. • Regular review of most recent MBO management strategies and prevention approaches that could be applied to the project.	Unlikely	Major	14

lead to the formation of MBOs would also cause the degradation of pore-water quality in sediments that could cause the loss of mangroves and other vegetation in the area.				
Excavations Exposing ASS • Disturbance of Acid Sulfate Soils. • Monosulfidic Black Ooze formation and accumulation. • Potential to cause significant environmental and economic impacts including fish kills and loss of biodiversity in waterways. • Contamination of groundwater by mobilisation of acids, arsenic, heavy metals and other contaminants and corrosion of concrete and steel infrastructure by acidic soil and water. • Mobilisation of MBO's following rain events and large tidal outflows that may cause anoxic fish-kill events in the adjacent near-shore marine environment.	• Determine risks of ASS / PASS prior to conducting excavations. • Cut and Fill activities will not be carried out in the causeway between sites F and C (shown in Figure 4-5 to be high risk of ASS). Refer to Appendix 4 for Cut and Fill locations against the ASS risk areas (Coffey, 2022). • The upper and lower supra-tidal flat will be visually monitored regularly for MBO formation. • Surface Water monitoring as per the Confirmed SWMP, particularly following heavy rain events and evidence of pooling water. • Implementation of this ASSMP Management Approach (Section 4) if MBO's are suspected and where surface water monitoring or visual monitoring indicate such. • Identify, manage and treat ASS in line with the DER 2015 Guidelines. • Causeway design to be applied will avoid need to dewater or excavate ASS soils. • The base of the causeway will be approximately 2 mAHD which is existing ground surface level within the supratidal and intertidal zone. Approximate three meters of sand bedding will be applied above this level with concrete culverts embedded within sand to permit the flow of stormwater from east to west across the supratidal and intertidal areas of the Site. A compacted fill layer 1.7 m thick will then be placed on top of the sand bedding layer to provide a base for final causeway road layers such as crushed aggregate and asphalt. Fill material will be used primarily on top of sand bedding to stabilise the causeway surface before final layers such as crushed aggregate, granular materials and asphalt are applied. The finished grade will be 6.15 mAHD. • Where previously unknown areas of ASS are identified during the construction works, works must cease immediately, and the environmental team shall be present to identify the presence of ASS. • Visual identification can be conducted and Field sampling and supporting Laboratory analysis (NATA accredited Laboratory) will likely be required to confirm visual and olfactory indications. • All analysis must be conducted at a NATA accredited Lab. • Where treatment is required, a containment and treatment facility (treatment pad) will be developed onsite. Management will be in accordance with the Management Actions in Section 4.2 and in accordance with DER 2015 Guidelines. • Implement controls pertaining to the Acid Sulfate Soils Management Protocol and the	Unlikely	Major	14

	Management Actions for treatment of ASS and PASS in Section 4.2.1of this Plan. • Obtain the following licenses: - Licenses to take water under s 5C of the RIWI Act. - Licenses to construct or alter a well under s 26D of the RIWI Act.			
Re-use of Material (ASS/PASS material).	• Undertake intrusive ASS Investigations, including laboratory sampling and testing. • Contamination risk assessments to be conducted for each work area upon design finalisation and construction methodology being adopted. • Reuse of contaminated materials (ASS) will not be reused unless treatment and remediation of soils. • Materials deemed contaminated will be separately stockpiled and labelled. • Reuse materials will be separated and labelled. • All materials will be included within the MTS. • Verification of soil status prior to reuse shall be sort. (i.e. through documentation, MTS and Laboratory reports).	Unlikely	Major	14

Appendix 4 – Cut & Fill Locations and ASS Risk Areas




475700
476200
476700
477200
7718500
7718000
ASS1
ASS2
ASS3
ASS4
ASS5
ASS6
ASS7
LEGEND
0.5M CONTOUR
CLEARING BOUNDARY
PROPOSAL DEVELOPMENT ENVELOPE
CUT / FILL AREA
COFFEY DETAILED SITE INVESTIGATION
SOIL SAMPLE
EXCEEDANCE IDENTIFIED - PASS
ACID SULFATE SOIL RISK MAP, PILBARA
RISK CLASS
1 - HIGH TO MODERATE RISK OF ASS OCCURRING WITHIN 3M OF NATURAL SOIL
2 - MODERATE TO LOW RISK OF ASS OCCURRING WITHIN 3M OF NATURAL SOIL SURFACE BUT HIGH TO MODERATE RISK OF ASS BEYOND 3M OF NATURAL SOIL
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
FALSE EASTING: 500,000.0000
FALSE NORTHING: 10,000,000.0000
CENTRAL MERIDIAN: 117.0000
SCALE FACTOR: 0.9996
LATITUDE OF ORIGIN: 0.0000
UNITS: METER
SCALE
0 50 100 200 300 400
METERS
DRAWN
E TAN
REVISION
A
CHECKED
S. FRENCH-BLUHM
DATE
20/04/2022
CLOUGH
SAIPEM
PERDAMAN
PROJECT TITLE
PERDAMAN UREA PROJECT
DRAWING TITLE
PERDAMAN PROJECT SITE F
SOIL BORE LOCATIONS FOR ASS INVESTIGATION

Appendix 5 – Stakeholder Consultation Register

Date	Stakeholder	Consultation Type	Issues, Topic Raised	Perdaman Response
November 2023	Murujuga Aboriginal Corporation (MAC) and Circle of Elders	MS 1180 EPA Plans annual review and consult session	• Flora Management Plan • Fauna Management Plan • Threatened Species Management Plan • Light Management Plan • Cultural Heritage Management Plan • Surface Water Management Plan	
August 2023	Murujuga Aboriginal Corporation (MAC) and Circle of Elders	MS 1180 EPA Plans review and consult session	• Flora Management Plan • Fauna Management Plan • Threatened Species Management Plan • Light Management Plan	None required.
April 2022 (various follow up meetings during this period)	Murujuga Aboriginal Corporation (MAC) and Circle of Elders	Site visit / Presentation / Endorsement of salvage and relocation methodology	Presentation on the proposed salvage and relocation methodology for sites ID18615, ID19239 and ID19874, and the process for detailed salvage assessments. Addition of Cultural Significance and Cultural Risk sections to the detailed salvage assessments. Endorsement of the detailed salvage assessments and methodology for salvage and relocation by MAC and the Circle of Elders.	MAC endorsed and approved proposed relocation strategy of sites to Reserve 43195. MAC request that Perdaman engage the services of a Marban man to oversee relocation of site ID18615 to ensure cultural safety of those involved in the relocation process. Perdaman to engage MAC to monitor all salvage and relocation activities.
30 Mar 2022	Murujuga Aboriginal Corporation (MAC) and Circle of Elders	Presentation / Meeting	Presentations on design modifications applied to avoid Cultural Heritage Sites in the PDE.	Commitment by Perdaman to engage in further meetings held on country to gain a further understanding of sites endorsed for salvage and relocation.
31 Jan 2022	Murujuga Aboriginal Corporation (MAC) and Circle of Elders	Presentation / Meeting / Endorsement of CHMP	Presentation of the salvage and relocation proposal for the CHMP (Cultural Heritage Management Plan).	Endorsement of the amended CHMP and of the salvage and relocation methodology.
24 Jan 2022	Murujuga Aboriginal Corporation (MAC)	Site visit/ Presentation	MAC Board Presentation of key aspects of this amended Surface Water Management Plan for discussion. Opportunities Potential challenges and solutions.	None Required.
2019 & 2020	Hon. Alannah	Presentation / Meeting	Project update including: - Community stakeholder consultation & feedback	Details discussed including potential social and economic

(Various times during this period)	MacTiernan		- Environmental Impact Assessment - Common-user infrastructure - Social benefits - Employment opportunities - Training opportunities	benefits Commercial arrangements with Pilbara Ports Authority and the Water Corporation
January 2020	MAC	In principle Endorsement of Heritage Charter	Perdaman Urea Project Overarching Position for Heritage Interaction and management, including Rock Art and Murujuga.	In principle (subject to final Part IV approval of Project) endorsement of Proponent commitment to its overarching position which will underpin Aboriginal Heritage Management Plans, protocols and actions for life of Project Ceres
November & December 2019	Hon. Mark McGowen, Premier	Presentation / Meeting	Project update including - Community stakeholder consultation & feedback - Social benefits - Employment opportunities - Training opportunities - Environmental Impact Assessment - Common-user Infrastructure	Details discussed including potential social and economic benefits Commercial arrangements with the Pilbara Ports Authority and the Water Corporation
November 2019	Hon. Ben Morton, Assistant Minister to the Prime Minister and Cabinet	Presentation / Meeting	Project update including - Community stakeholder consultation & feedback - Social benefits - Employment opportunities - Training opportunities - Environmental Impact Assessment - Common-user Infrastructure	Details discussed including potential social and economic benefits Commercial arrangements with State GTEs and common-user infrastructure requirements
27 November 2019	MAC	Agreement Signing	Signing of Commercial Agreement, transformative opportunities	Agreement on mutual support for future aspirations of both parties
14 October 2019	Kevin Michel MLA, Karratha	Briefing	Update on the Environmental Impact Assessment Update on liaison with other community stakeholders	Details discussed
14 October 2019	City of Karratha, PDC	Meeting	Update on the Environmental Impact Assessment Discussions about the housing strategy, City of Karratha is supportive of a strategy that will provide long-term benefits to the community	Details discussed Accommodations for Project Ceres will be integrated to the local community rather than building isolated camps

14 October 2019	Circle of Elders	Presentation / Meeting	Access to the meeting site in the south-west corner to Site F Location of the proposed infrastructure on site Transformative opportunities	The fence that will be installed aims at preventing site workers to access the cultural site and will not block access for the Traditional Owners (TO) Refer to Figures in Appendix A of the ERD Commercial Agreement to be signed with MAC
14 October 2019	MAC	Workshop	Commercial Agreement, transformative opportunities	Further discussions to be held between MAC and the Proponent
September 2019	Hon. Ben Wyatt, Treasure	Presentation / Meeting	Update on Project including the Environmental Impact Assessment	Details discussed including potential social and economic benefits
20 September 2019	MAC & Advisors	Meeting	Commercial Agreement, transformative opportunities	Further discussions to be held between MAC and the Proponent
4 September 2019	MAC & Advisors	Meeting	Commercial Agreement, transformative opportunities	Further discussions to be held between MAC and the Proponent
June-August 2019	Pilbara Ports Authority (PPS)	Online form, letter	Panamax size vessels Capacity of the shed at the Port	The Proponent will be using high tides to access the berth Storage capacity at the port changed to 65,000 tonnes
05 July 2019	MAC	Presentation / Meeting	Assessment timeline clarification Plant design	The Proponent provided clarification regarding the environmental approval processes The Proponent provided an update on the plant design MAC advised that they support the draft ESD and confirmed Project Ceres aligns with their core objectives (ref. email to the EPA of the 8th July 2019).
June 2019	Karratha, Roebourne, Dampier and Wickham Community	Information booths, online form	Project timeline Employment opportunities	Refer to Section 2.3.7 of the ERD.
16 May 2019	Pilbara Development Corporation (PDC)	Meeting	PDC indicated a preference for flexible working hours for employees so they can pursue activities/sports Visual amenity	The Proponent is committing to give the opportunity to all employees to request flexibility to pursue nominated activities / hobbies / sports. Refer to Section 4.9.5 (ERD)
16 May 2019	NYFL	Presentation / workshop	Approach to monitoring and detriment to rock art NYFL Chairman requested information about continuous access for Aboriginal people to NHL area thought to be associated with “Fish Thalu” site within the boundary of site F. Any changes to access into Ngajarli as a result of Hearson Cove Road realignment. Access to the meeting site in the south-west corner of	The Proponent worked with Woodside to obtain a comprehensive regional airshed model (Section 4.8.5 and Appendix D (ERD)). An Air Quality Management Plan and Heritage Management Plan have been developed (Appendix K (ERD)). The Proponent will make access arrangements whereby those with connection to the NHL site would be met at the gate and escorted to the sacred site. The sacred “Fish Thalu” site is

			site F. Visual aspects and opportunities.	outside the operational site boundary (refer to plan layout, Figure 3, Appendix A of the ERD). Hearson Cove Road will be realigned to its official gazetted alignment. Access to Ngajarli will be maintained. The construction-phase boundary has been modified to ensure this cultural site is outside of the fenced area and its use is not impaired. Discussed opportunities to use the wall surfaces of Project buildings and facilities as a medium for Aboriginal artworks and as a visual medium to communicate heritage stories.
April 2019	Woodside	Meeting	Air Quality modelling	Data share agreement
February 2019	Senator Michaelia Cash, Federal Minister for Employment, Skills, Small and Family	Meeting	Update on Project including –Potential social benefits –Potential employment & training opportunities –Potential economic opportunities	Details discussed
25 February 2019	Water Corporation	Letter	Discharge in the MUBRL and seawater intake	Appendix J of the ERD
12 February 2019	Murujuga Aboriginal Corporation (MAC) City of Karratha	Site visit / Presentation	MAC: Construction phase, Site preparation, Plant erection Potential Heritage issues Plant emissions / impacts on Burrup Rock Art General processing plant understanding Employment, training and business opportunities MAC could benefit from Work undertaken to evaluate a Project location at Maitland City of Karratha: The City of Karratha would prefer that the Dampier public wharf be used, and the shed located north of proposed options A & B.	Section 2.3.3 of the ERD Section 2.2.4 of the ERD Third option ‘C’ added to the Port infrastructure location options. Refer to Section 2.2.6 of the ERD

Attachment A – Geotechnical Desktop Study

140436-0000-4GER-0001

See Attachment Below

Attachment B – Detailed Site Investigation for Acid Sulfate Soils

Tetra Tech Coffey 2022a

See Attachment Below

Attachment C – Perdaman Urea Geotechnical Investigation (Interpretive Report)

See Attachment Below

Attachment D – Letter to EPA for MAC Consultation on Project Destiny

See Attachment Below

Attachment E – MAC Consultation – January 2022

See Attachment Below

Attachment F – MAC Consultation – August 2023

See Attachment Below

Attachment G – MAC Consultation – January 2024

See Attachment Below