Appendix E – Soil & Water Management Plan

PROJECT

SOIL AND WATER MANAGEMENT PLAN TWEED SAND PLANT EXPANSION, CUDGEN NEW SOUTH WALES

PREPARED FOR

HANSON CONSTRUCTION MATERIALS

DATE

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SYNOPSIS This soil and water management plan (SWMP) was prepared for the Tweed Sand Plant expansion proposal. This SWMP establishes procedures and responsibilities for the management of soil and water related aspects of the TSP operations, including acid sulfate soil management, erosion and sediment control, surface water and groundwater monitoring programs and cyanobacteria (blue-green algae) management.

REVISION HISTORY

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1	02/2021	E. Holton	E. Holton & L. Varcoe

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SUMMARY

Hanson Construction Materials Pty Ltd (Hanson) commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare a Soil and Water Management Plan (SWMP) for the proposed expansion of its Tweed Sand Plant (TSP) operation located in Cudgen, New South Wales.

Prepared to satisfy relevant matters included in the Secretary's Environmental Assessment Requirements (SEAR) issued for the Project in December 2019, this management plan establishes procedures and responsibilities for the management of soil and water related aspects of the proposed TSP expansion including:

- acid sulfate soil management;
- erosion and sediment control;
- surface water and groundwater monitoring programs; and
- cyanobacteria (blue-green algae) management
- waste management, and
- contaminated lands.

This plan constitutes an updated version of the site's existing SWMP, which has been implemented at the site since mid 2006. Current site practices for soil and water management have proven effective over the long term in avoiding environmental impacts associated with the operation. Building on the success of the current management practices, this update of the existing SWMP aligns the management measures with the scale and nature of impacts associated with the expansion proposal.

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LIST OF DRAWINGS

DRAWING NO.	DESCRIPTION
12035-001	Existing Tweed Sand Plant Operation
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1 Introduction

Hanson Construction Materials' (Hanson) Tweed Sand Plant (TSP) operation is located off Altona Road in Cudgen, New South Wales. Sand extraction has been undertaken at this location since 1983 with Hanson assuming operation of the site in 2006. The current site and operations are depicted in Drawing No. 12035-001.

TSP's current operations are managed under an approved Soil and Water Management Plan (SWMP) implemented at the site since 2006. The SWMP has been regularly reviewed since its inception to ensure the site achieves a high standard of environmental management consistent with current policies and legislation.

Current practices for soil and water management have proven effective over the long term in avoiding environmental impacts associated with the operation. Building on the success of the current management practices, this plan constitutes an update of the existing SWMP to align the management measures with the scale and nature of impacts associated with the expansion proposal. The proposed site expansion is depicted in Drawing No. 12035-002.

This SWMP establishes procedures and responsibilities for the management of soil and water related aspects of the TSP operations including:

- acid sulfate soil management;
- erosion and sediment control;
- surface water and groundwater monitoring programs; and
- cyanobacteria (blue-green algae) management
- waste management, and
- contaminated lands.

Secretary's Environmental Assessment Requirements (SEARs) were issued for the proposed expansion on 17 December 2019 and form the basis of the Tweed Sand Plant Expansion (SSD – 10398) Environmental Impact Study (EIS), of which this SWMP is a part.

The SWMP requirements detailed in the SEARS are reproduced below in Table 1.1.1. For ease of reference, this table also cites where each requirement is addressed in this report. Where the requirements of the SEARs overlap between disciplines, a specific issue may be addressed under separate cover (as indicated in the table).

1.1 Scope

Table 1.1.1 – SEARS relevant to this SWMP

Department/Agency	Secretary's Environmental Assessment Requirement	Section
DPIE – Biodiversity and Conservation Division	**Attachment A** 11. The EIS must assess the impacts of the development on water quality, including: a) The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the WQO over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction. b) Identification of proposed monitoring of water quality including how the waterbodies will be managed and water quality will be maintained post quarrying.	a) Sections 2.1, 2.2.3, 2.3, 2.4.3, and 3 b) Sections 3.9 and 3.10 and 3.11. c)NA

Department/Agency	Secretary's Environmental Assessment Requirement	Section
	c) Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan).	
	Attachment A 12 (g) Identification of proposed monitoring of hydrological attributes	Sections 3.9 and 3.10
	Attachment B – Acid sulfate soils 3. Describe mitigation and management measures that will be used to prevent, control, abate or minimise potential impacts from the disturbance of acid sulfate soils associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This must include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented. 4. Describe the contingency plan, incorporating a commitment to appropriate monitoring.	3. Sections 2.2 and 3.8 4. Sections 2.2 and 3.8
	Attachment B – Water and soils 4. The EIS must include a water quality and aquatic ecosystem monitoring program that includes: a) Adequate data for evaluating maintenance, or progress towards achieving, the relevant WQOs. b) Measurement of pollutants identified or expected to be present.	Sections 3.9, 3.10 and 3.11.
DPIE – Department of Primary Industries – Strategy and Policy	**Surface and groundwater protected** • Proposed development design, operation and by-product management should be undertaken to avoid nutrient and sediment build up and minimise erosion, off site surface water movement and groundwater accession. • The proposal should detail how design and operation will be undertaken for by-product management in accordance with best practice to prevent excess build-up of nutrients and salts in the soil profile and increase the risk of leaching. A monitoring program should be developed.	Sections 2 and 3
NSW EPA	**2. Description of the proposal** **General** • Outline cleaner production actions, including: a) Measures to minimize waste (typically through addressing source reduction) b) Proposals for use or recycling by-products c) Proposed disposal methods for solid and liquid waste d) air management systems including all potential sources of air emissions, measures to minimize dust generated, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points e) Water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge	 a), b), c) Sections 2.4 and 3.12. d) Katestone Air Quality Assessment. e) Sections 2 and 3.

Department/Agency	Secretary's Environmental Assessment Requirement	Section
	points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge. f) Soil contamination treatment and prevention systems. • Outline construction works including: a) Actions to address any existing soil contamination b) Any earthworks or site clearing; re-use and disposal of cleared material including details of stockpiling of top soil and spoil on-site and associated erosion and sediment controls c) Construction timetable and staging; hours of construction; proposed construction methods d) Environment protection measures including o Noise mitigation measures o Dust control measures and details of water supply for dust suppression e.g. details of water re-use pond and o Erosion and sediment control measures in accordance with Managing Urban Stormwater Soils and Construction: Volume 1 and Volume 2E Mines and Quarries. o Include a site diagram showing the site layout and location of environmental controls.	f) Sections 2.5 and 3.12 a) Section 2.5 and the Preliminary Site Investigation Report (G&S 2021) b) Sections 2.1 and 3.7 c) Zone Planning EIS 2021 d) • ATP Noise Assessment 2020 • Surface Water Assessment (G&S 2021) and Section 3.7 • Section 3.7 • Drawing 12035.001 and 002
NSW EPA	**Waste and chemicals** Provide details of the quantity and type of both liquid waste and nonliquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the EPA's Waste Classification Guidelines 2014 (as amended from time to time). • Provide details of liquid waste and non-liquid waste management at the facility, including a) The transportation, assessment and handling of waste arriving at or generated at the site b) Any stockpiling of wastes or recovered materials at the site c) Any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on and off site d) The method for disposing of all wastes or recovered materials at the facility e) The emissions arising from the handling, storage, processing and reprocessing of waste at the facility f) The proposed controls for managing the environmental impacts of these activities • Provide details of spoil disposal with particular attention to: a) The quantity of spoil material likely to be generated b) Proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil c) The need to maximise reuse of spoil material in the construction industry d) Identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material e) Designation of transportation routes for transport of spoil	Sections 2.4, 2.5 and 3.12

Department/Agency	Secretary's Environmental Assessment Requirement	Section
	• Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes. • Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.	
NSW EPA	**Water** **Describe management and mitigation measures** A soil and water management plan should be developed which outlines all management and mitigation measures relating to stormwater management and erosion control. The Soil and Water Management Plan should:	
	• Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.	• Section 2.1 and 3.7.
	• Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.	• Sections 2.1 and 3.7
	• Describe wastewater treatment measures that are appropriate to the type and volume of wastewater and are based on a hierarchy of avoiding generation of wastewater; capturing all contaminated water on the site; reusing/ recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.	• Sections 2.3 and 3.12
	• Describe the size and location of the sediment ponds for each stage of the development of the quarry. The sediment basins must meet the design and operational standards of Managing Urban Stormwater Soils and construction: volume 1 and volume 2E. Mines and Quarries. This document requires that at a minimum 90 percentile 5 day rainfall event be used to determine basin sizing for quarries. Detail calculations of sediment basin size. Describe proposed measures for managing sediment basins.	• NA. See Sections 2.1 and 3.7.
	• Outline pollution control measures relating to storage of materials, possibility of accidental spills, appropriate disposal methods and generation of leachate.	• Section 2.4 and 3.12
	• Describe geomorphological impact mitigation measures including: a) Site selection b) Erosion and sediment controls c) Minimising instream works d) Treating existing accelerated erosion and deposition e) Monitoring program	• Sections 2.1 and 3.7
	Soils and contamination **Describe management and mitigation measures**	

Department/Agency	Secretary's Environmental Assessment Requirement	Section
	• Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including: a) Erosion and sediment control measures b) Proposals for site remediation – see Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) c) Proposals for the management of these soils – see Acid Sulfate Soil Manual (Acid Sulfate Soil Advisory Committee 1998) and Acid Sulfate Soils Assessment Guidelines (Acid Sulfate Soil Advisory Committee 1998).	a) Section 2.1 and 3.7. b) Section 2.5 and the Preliminary Site Investigation (G&S 2021) c) Section 2.2 and 3.8
	Waste and chemicals **Describe management and mitigation measures** • Outline measures to minimize the consumption of natural resources • Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste • Outline measures to support any approved regional or industry waste plans	• Sections 2.4 and 3.12
	G. Compilation of mitigation measures • Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under EPA licences or approvals (e.g. outline of an environmental management plan) • The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.	• This SWMP.
Tweed Shire Council	To support any future expansion proposal, the application would need to be supported by the following technical reports prepared by suitably qualified and experienced consultants. o Air Quality Assessment o Surface water and Groundwater Assessment o Traffic Noise Assessment o Construction and Operational Noise Assessment o Acid Sulfate Soil Assessment o Contaminated Land Assessment o Environmental Management Plan: - Air - Construction Noise - Operational Noise - Surface Water	• Katestone Air Quality report (2020) • Surface water and groundwater assessments (G&S 2021) • ATP Noise Assessment 2020 • Acid Sulfate Soil assessment (G&S 2021). • Preliminary Site Investigation (G&S 2021). • This SWMP.

Department/Agency	Secretary's Environmental Assessment Requirement	Section
	- Groundwater - Acid Sulfate Soils	

2 Soil and water management strategies

The various construction and operational activities undertaken to facilitate sand extraction and associated operations for the TSP expansion have the potential (if not properly managed) to result in soil erosion, sedimentation and acidification of potential acid sulfate soils (ASS). Unmanaged soil disturbance also has the potential to impact onsite water quality and ultimately water quality within the receiving environment. These risks and the required mitigation strategies to reduce/remove the potential for adverse environmental impacts are discussed in the following subsections.

2.1 Soil erosion and sedimentation

Slopes at the site are described as level (<1%) to very gently inclined (1-3%)[1], which minimises the potential for erosion across most of the site. However, a number of site activities (including the progressive removal of groundcover, topsoil stripping, stockpiling and dredging) increase the potential for localised erosion.

Site soils are at greatest risk of erosion when topsoil and vegetation is removed in preparation for dredging, thereby exposing subsoils. To minimise erosion risk, these activities will be conducted in a progressive manner to limit the area of exposed soil at any one time.

The topsoil will be progressively stripped from the site ahead of the extraction face and used to form (discontinuous) perimeter bunding to facilitate rehabilitation and landscaping works. Topsoil unable to be reused onsite will be screened, sampled and transported offsite in accordance with the requirements of the NSW EPA's Waste Classification Guidelines 2014.

Temporary seeding or temporary/permanent revegetation would be used to stabilise topsoil used for bunding or rehabilitation, in accordance with this SWMP and the approved rehabilitation and landscaping plans.

Dredging within the extraction lake has the potential to result in erosion/de-stabilisation of lake banks. To minimise bank collapse, an average underwater angle of approximately 1:5 is proposed throughout the extraction lake. The final form of lake banks will vary from gently inclined sandy 'beach' areas and wetlands to steeper banks reinforced with vegetation, floating wetlands and/or placed rock (or similar).

To ensure a stable final form, rehabilitation and landscaping will occur in accordance with an approved rehabilitation and landscaping management plan.

The generation of sediment-laden waters and/or large-scale turbidity within the extraction lake has not been an issue for the current operation due to the following characteristics and operational practices:

- the brackish nature of the lake, leading to rapid precipitation of suspended sediments;
- the progressive nature of dredging, whereby only a relatively small section of the lake profile is subject to dredging at one time;
- the adoption of a stable gradient for lake banks;
- the progressive revegetation of lake banks creating a stable landform; and
- the re-interment of fines within the lake at depth, minimising the creation and/or persistence of sediment plumes.

These conditions and management strategies will continue for the proposed expansion of the extraction lake and dredging operations. The existing condition of the lake will continue for the future operations.

Except in times of high rainfall or flood, the extraction lake remains hydraulically isolated from the surrounding environment, for instance the drainage channels and agricultural drains. This characteristic minimises the potential for onsite

[1] McDonald R. C., Isbell R. F., Speight J. G., Walker J. & Hopkins M. S. Australian Soil and Land Survey Field Handbook. Second Edition 1990, Inkata Press Pty Ltd.

water quality to cause offsite impacts or alternatively, surface water inflows to impact the water quality within the lake. These practices will continue for the expansion proposal, ensuring the generation of turbid waters is avoided wherever and whenever possible.

Based on the site characteristics and the adopted operational strategies, the potential for erosion and sedimentation at the site would be minimised. Further details of these management measures are provided in the Erosion and Sediment Control Plan, in Section 3.7 of this document.

2.2 Disturbance of acid sulfate soils

Sand is to be dredged from the lake to the natural basement of the deposit (approximately 20 m below the existing surface level). Comprehensive testing and analysis of the sand deposit at the current TSP extraction site and within the expansion area indicates that potential acid sulfate soil (PASS) material will be encountered during this process.

TSP adopts a PASS management process which aims to:

- Separate PASS material from the sand product.
- Avoid oxidation of PASS.
- Permanently re-inter PASS in a stable environment, whereby the risk of oxidation and acidification is managed.

Given the high degree of similarity between the material currently being extracted by TSP and that within the proposed expansion area, the existing approved ASS Management approach will also be adopted for operations within the proposed expansion area. This methodology has proven successful over the life of the TSP operations with stable pH levels maintained in the lake and no evidence of the occurrence of acidic reactions in the insitu material surrounding the lake, the reinterred fines or the sands exported from the site.

ASS Management will be divided into two separate methods based on the mode of disturbance, being either dry excavation or wet excavation (dredging). A brief description of these approaches is provided below.

2.2.1 Dry-excavation

Topsoils and overburden (material above the groundwater table) will be progressively removed using dry-excavation methods in advance of the extraction face. These materials will be analysed and, where required, treated through the addition of lime to neutralise any Net Acidity.

Acidic non-ASS soils (ANASS) may also be disturbed during the stripping of topsoil and overburden. These soils do not have the same acid generating potential as ASS or PASS and do not require a high degree of management. Regardless, techniques to manage the disturbance of ANASS material encountered during the stripping of topsoil and overburden are provided in 3.8.2 – ANASS/ASS management during removal of overburden.

2.2.2 Dredging and fines management

The sand resource contains PASS fines which will be separated from the sand through the use of a hydrocyclone located onshore, immediately adjacent to the extraction lake.

Hydraulic separation using a hydrocyclone is widely used in sand and gravel extraction industries and is one of the most effective mineral separation methods for uniform feeds.[2] The process works by separating the larger particles (i.e. sand) from the finer silt and clay fractions (<2.0 mm) through centrifugal forces within the rotating hydrocyclone. The larger sand particles move to the outside wall of the cyclone and are then discharged to form a sand stockpile. Smaller particles (including the sulfidic fines) stay within suspension and returned to the dredge lake via a dedicated, fines return system.

The return system releases the fines into the water body at a depth of at least three metres below the water surface to minimise the generation of turbid plumes at the surface of the

[2] Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

waterbody. The release location would be selected to ensure a final fines deposition depth of at least eight metres below the water surface. This depth (equating to approximately -7.5m AHD) greatly exceeds the minimum acceptable safety margin for strategic reburial of '*at least one metre below the permanent water table*'[3] which has been consistently found to be at approximately 0.37m AHD[4] over the course of monitoring at the site. Adoption of this final deposition depth also avoids resuspension of fines due to wind, wave, regional flooding or other surface turbulence such as powered boats.

The release location would be monitored to ensure the required depths are achieved and the returns pipe is periodically relocated as required. Annual hydrographic surveys of lake bathymetry would be undertaken to track final fines deposition depths. Vertical profile monitoring of water quality would also occur to confirm suitable oxygen levels at the fines reinterment location(s). This process will achieve long-term placement of fines in a stable, low oxygen environment, preventing ongoing disturbance and minimising opportunities for oxidation.

The extracted sands would be sampled and laboratory analysed in accordance with the guidelines to ensure the relevant performance criteria for sand quality are met. Such monitoring has been undertaken at the site since at least 2006, yielding highly consistent results over time that reflect the efficiency of the hydraulic separation method. No lime treatment of extracted sands has been required owing to the sand resource's high ratio of acid neutralising capacity (ANC) compared to its acid generating potential (AGP).

Given the similarities between the resource at the existing TSP site and within the expansion area, the success of the hydraulic separation and fines reinterment methodology is anticipated to continue for the expansion area.

Detailed techniques to manage the disturbance of ASS material encountered during sand extraction activities are provided in Section 3.8.1 – ASS management during sand extraction.

2.2.3 Water quality management

The existing processing area will be used for the initial phases of the development and then be relocated to the northern perimeter of Lot 2 DP1192506 in accordance with the phasing plan Z19163-104. All processing and stockpiling areas will be graded toward the extraction lake to ensure runoff is captured and managed onsite.

As noted above, regular water quality monitoring occurs within the existing extraction lake and would continue as the lake increases in size as operations move into the expansion area.

The dredging process may result in the release of nutrients or other toxicants contained within pore waters into the dredge lake with resulting water quality issues such as algal blooms. Long term groundwater monitoring of the existing TSP site and recent monitoring within the expansion area has recorded elevated nutrient levels within the site's groundwater environment which are likely related to the historic agricultural uses of the land.

Elevated nutrient levels within the TSP lake have been recorded. However, dilution from rainfall inflows means these levels are substantially lower than those recorded within the groundwater environment and are comparable to (and often less than) those recorded within the nearby Tweed River[5].

2.3 Cyanobacteria management

Long-term cyanobacteria and nutrient monitoring at the site indicated seasonal algal blooms from 2006 to early 2017. The concentration of algal cells within the lake has not reached 'bloom' levels since 2017 and in most instances has been below the National Health and Medical Research Council's Recreational Guideline[6] for primary

[3] Ibid.

[4] Gilbert & Sutherland (2021), Surface Water Assessment, Tweed Sand Plant Expansion, Cudgen, New South Wales.

[5] Coastal Management Program for the Tweed River Estuary: Water Quality Assessment (2017), Hydrosphere Consulting. https://www.yoursaytweed.com.au/21731/widgets/136097/documents/59065.

[6] National Health and Medical Research Council, 2008, Guidelines for Managing Risks in Recreational Water.

contact recreation (<4 mm^3/L). The reduction in algal numbers is likely associated with the gradual increase in lake size (as sand is removed) making the influx of nutrients from the dredging process proportionately smaller. This proportional reduction in nutrient influx limits the algal population that can be sustained, resulting in lower concentrations of algal cells in the waterbody.

TSP's current cyanobacteria management approach has proven effective over time with respect to risk reduction and hazard mitigation. No incidents relating to contact with the lake (by staff, contractors or visitors) have been reported to date. As noted above, the hazard associated with the presence of cyanobacteria in the lake is reducing over time. TSP is committed to achieving stable water quality at the site that is acceptable for a range of end use scenarios. Implementation of the monitoring and management measures in Section 3.11 will aid in achieving this.

2.3.1 Risk reduction strategies

A number of measures have been successfully employed at the site to date to reduce the risks associated with the presence of cyanobacterial blooms. This SWMP recommends continued implementation of these measures, together with new measures to further minimise risks to staff and visitors. This results in the following suite of risk reduction measures:

- Warning signs alerting staff and visitors to the presence of cyanobacteria within the extraction lake shall continue to be maintained at key locations around the extraction lake. Additional signs shall be erected as the extraction lake expands.
- Personal Protective Equipment (PPE) (such as gloves) shall be worn by all staff and visitors who are likely to come into contact with the extraction lake water.
- Any person coming into contact with the extraction lake water should rinse the affected area as soon as possible to remove microscopic cells and toxins.
- Consumption of fish, crustaceans or molluscs from the extraction lake is prohibited.
- Any staff or visitors with a history of allergenic dermal reactions and/or asthma shall be informed of the potential risks during the site induction/sign in process.
- Additional precautions such as avoiding all contact with the extraction lake water and maintaining a distance between themselves and the lake may be necessary for 'at-risk' individuals on a case-by-case basis. Such measures have not been required to date but remain in place as contingencies to be implemented as required.

2.3.2 Hazard mitigation strategies

Owing to their ecological flexibility, certain species of cyanobacteria such as C. raciborskii (which has historically been found in the TSP extraction lake) can be difficult to control or eradicate. A review of the physical and chemical conditions that allow C. raciborskii to proliferate in waterbodies indicates that this species has low light requirements, close to neutral buoyancy and a wide temperature tolerance. These characteristics gives it the capacity to grow in a variety of water bodies.[7] This species is also known to be flexible in its uptake of nitrogen[8] and there is no direct relationship between phosphate availability and blooms.[9]

Since assuming operation of the site in 2007, Hanson has investigated numerous hazard mitigation strategies for their suitability for the TSP lake including:

- Biomanipulation
- Increased water column mixing
- Nutrient load reductions
- Algicides
- pH manipulation

[7] Burford, M and Davis, T 2011, *'Physical and chemical processes promoting dominance of the toxic cyanobacterium Cylindrospermopsis raciborskii'.* Chinese Journal of Oceanology and Limnology, vol 29, pp.883-891.

[8] Burford, M, McNeale, K & McKenzie-Smith, F 2006, '*The role of nitrogen in promoting the toxic cyanophyte Cylindrospermopsis raciborskii in a subtropical water reservoir*'. Freshwater Biology, vol 51, pp.2143-2153.

[9] Padisak, J, 1997, '*Cylindrospermopsis raciborskii, an expanding highly adaptive cyanobacterium: worldwide distribution and review of its ecology*' Arch. Hyrdrobiol. Suppl vol 107, pp.563-593.

- Competing plants
- Rapid changes to the physical conditions of the water body
- Landscaping.

The ecological flexibility of many cyanobacteria species and the size and depth of the TSP lake meant many of these approaches were unlikely to be successful in reducing or eliminating blooms. However, as noted above, algal cell densities have decreased to acceptable levels since 2017 without the need for expensive or disruptive interventions. This improvement is attributed to the proportional reduction in the influx of nutrients due to dredging as the lake size gradually increases. This proportional reduction in nutrient influx limits the size of the algal population, resulting in lower concentrations of algal cells in the waterbody. This effect is expected to continue as the lake expands resulting in ongoing improvements in algal cell densities.

New approaches to cyanobacteria management frequently emerge and it is likely that the current understanding of cyanobacterial management will evolve over time. TSP's current approach to cyanobacteria management has proven effective with respect to risk reduction and hazard mitigation and TSP remains committed to achieving stable water quality at the site including the implementation of novel approaches to cyanobacteria management as they emerge.

This SWMP includes commitments to ongoing cyanobacteria monitoring and adaption of the site's hazard reduction strategies as novel approaches emerge.

2.4 Waste management and minimisation

Similar to the current TSP operations, on-site waste generation in the expansion area will be generally confined to the following four waste streams.

2.4.1 General waste

A general waste stream is generated through the kitchen, office and workshop. General waste is stored on site in a medium-sized waste skip, which is removed by licensed contractors every two months, or more frequently if required.

The volume of general waste generated by the TSP expansion is likely to increase as a result of proposed 24-hour operations, however the total amount is likely to remain insignificant. It is proposed that the current general waste management practices will continue to be adopted for the proposed expansion with an increased frequency of collection if required.

2.4.2 Waste oil

Waste oil is generated from the operation and servicing of plant and equipment used on site. The oil is stored in waste oil drums/sump and is collected every four months (or more frequently if required) by an independent oil recovery unit.

The volume of waste oil generated by the TSP expansion is likely to increase as a result of proposed 24-hour operations, however the total amount is likely to remain insignificant. It is proposed that the current waste oil management practices will continue to be adopted for the proposed expansion with an increased frequency of collection if required.

2.4.3 Wastewater

Wastewater is generated from the onsite toilet facilities. Secondary treatment occurs in an onsite Clearwater 90 Envirocycle treatment system. The treatment system is regularly maintained with inspections/services conducted approximately annually, in accordance with the manufacturer's specifications and with TSC's guidelines.

The volume of wastewater generated by the TSP expansion is likely to increase as a result of proposed 24-hour operations and associated increase in staff numbers.

Wastewater will continue to be managed via the existing Clearwater 90 system until such time as the site workshop and processing facilities are relocated to Lot 2 DP1192506 (estimated at around Year 9 to 13 of the extraction). At that time, an onsite wastewater treatment system will need to be installed at the new location with the required assessments undertaken in accordance with TSC Policies in force at that time.

2.4.4 Hydraulic fluid/oil

Waste hydraulic fluid is generated by plant and dredging equipment. The waste material is stored in the onsite waste drums/sump and collected every four months by Solo Resource Recovery.

2.5 Contaminated lands

The Preliminary Site Investigation (PSI)[10] undertaken throughout the expansion area in response to the SEARs identified a number of potentially contaminating activities/potential contaminants associated with the site. These activities/potential contaminants were typical of land where agricultural activities have historically been undertaken and were limited to small areas of the site as identified on Drawing 12035-416 (Appendix 1).

Should the proposed expansion be approved, a detailed investigation would be undertaken to inform the preparation of a Remediation Action Plan (RAP) for the relevant areas of the site.

In many instances remediation requirements are likely to be straightforward and simply require the removal of identified wastes with selected areas also requiring soil testing. Given that the proposed sand extraction will progress across the lands over a period of 30 years a staged approach to investigation and remediation is considered appropriate. These activities would be undertaken in accordance with an approved RAP and scheduled to occur on a lot-by-lot basis prior to the commencement of extraction within each relevant allotment. This staged approach is supported by SEPP 55, which provides that detailed assessments need not be undertaken immediately following the preliminary investigation but should be undertaken prior to commencement of the new land use.

It is proposed that detailed investigations, preparation of the RAP and any subsequent remediation of the identified areas could reasonably form a condition of approval for the proposed expansion.

[10] Gilbert & Sutherland, January 2021. Preliminary Site Investigation, Tweed Sand Plant Expansion, New South Wales.

3 Soil and water management plan

3.1 Objectives

This Soil and Water Management Plan (SWMP) addresses the relevant requirements of the SEARs as reproduced in Section 1.1 of this report. Accordingly, this SWMP establishes responsibilities and procedures for the management of soil and water-related aspects of the TSP operations. It includes an acid sulfate soil management plan, erosion and sediment control plan, surface water monitoring program, groundwater monitoring program and cyanobacteria (blue-green algae) management plan.

The management measures stated in this SWMP were developed to achieve the following objectives:

- Good stewardship of natural resources, consistent with current best practice for extractive industries.
- To minimise potential impacts on adjoining land users and the receiving environment.
- Confirmation of the success of impact control measures by the means of monitoring.
- Compliance with statutory requirements and licence conditions.

This SWMP constitutes an updated version of the site's existing SWMP, which has been implemented at the site since July 2006.

3.2 Implementation

The SWMP requires the Proponent to mitigate the potential environmental impacts associated with the operation of a sand extraction plant at the subject site. The SWMP is to be interpreted and implemented with reference to:

- Department of Housing's 'Managing Urban Stormwater: Soil and Construction Manual',
- Tweed Shire Council's 'Code of Practice for Soil and Water Management on Construction Sites'; and
- 'Soils and Construction Guidelines - Managing Urban Stormwater' 4th Edn., March 2004 (Landcom, New South Wales).
- New South Wales Acid Sulfate Soil Management Advisory Committee (ASSMAC), August 1998. Acid Sulfate Soil Manual (herein the 'ASSMAC Guideline').
- Water Quality Australia, June 2018. National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual.
- Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al 2004).
- McDonald R. C., Isbell R. F., Speight J. G., Walker J. & Hopkins M. S. Australian Soil and Land Survey Field Handbook. Second Edition 1990, Inkata Press Pty Ltd.
- Tweed Shire Council's codes including Code of Practice for Soil and Water Management on Construction Sites.
- ANZECC (2000) Guidelines for Fresh and Marine Water Quality.
- Approved Methods for the Sampling and Analysis of Water Pollutant in NSW 2004.
- The National Health and Medical Research Council's Guidelines for Managing Risks in Recreational Water, Australian Government 2008.

3.3 SWMP structure

The SWMP is based on a series of tables with the person responsible for the implementation of the measures clearly stated. The tables describe the issue, operational policy, performance criteria, the implementation strategy, monitoring, auditing and reporting requirements, failure/incident identification procedures, complaints handling and the necessary corrective actions or contingency plans. The detachable pages within each section detail the provisions of the SWMP.

An objective of the tabular format is to permit approved changes and allow for the SWMP to be a working document. If alteration is required this will only be performed after appropriate consultation with the relevant statutory authorities. The format is presented below for reference purposes.

#.# Title

Person responsible:	The person who has accepted the responsibility of implementing the SWMP provisions detailed on this page

Issue	The issue with which the table deals.
Operational policy	The operational policy or management objective that applies to the element.
Performance criteria	Performance criteria (outcomes) for each element of the operation.
Implementation strategy	The strategies or tasks (to nominated operational design standards) that will be implemented to achieve the performance criteria.
Monitoring program	The monitoring requirements which will measure actual performance (i.e. specified limits to pre-selected indicators of change).
Auditing	The auditing requirements, which will verify implementation of agreed environmental management strategies and compliance with agreed performance criteria.
Reporting/Complaints handling	Content, timing and responsibility for reporting of monitoring results and dealing with complaints received.
Identification of incident or failure	The circumstances under which the agreed performance criteria are unlikely to be met and environmental harm is likely to result.
Corrective action/Contingency measures	The action to be implemented where a performance requirement is not reached or an incident or failure is identified. This section also identifies the company(s) responsible for implementation of the corrective action.

Commitment #

The commitment made by the Proponent(s).

3.4 General commitments

Commitment 1

The Proponent(s) must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of the SWMP relevant to activities they carry out in respect of the development.

Commitment 2

The Proponent(s) undertake to fulfil all commitments made in this SWMP (including any approved amendments). In fulfilling the commitments, the Proponent(s) will conduct all activities on the project site in accordance with relevant current statutory requirements (including any approved amendments).

3.5 Complaints handling procedures

To allow the local community, government or other interested parties to lodge a formal complaint about operations conducted at the site or by associated vehicles or mobile plant, a contact phone number will be advertised at the site's access point. Complaints may also be addressed to TSP/Hanson in writing or referred to a member of the TSP Community Consultative Committee. Alternatively, complaints can also be made to Tweed Shire Council or other relevant statutory authorities. TSP would then be notified of the complaint by the relevant agency.

A Complaints Register will be maintained at the site. Any complaints received (from any source) are to be recorded in a Complaints Register, together with details of:

a) the date and time of the complaint

b) the method by which the complaint was made

c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect

d) the nature of the complaint

e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant,

f) if no action was taken by the licensee, the reasons why no action was taken.

Complaint records will be kept for at least 4 years after the complaint was made.

A copy of the Complaints Register will be made available on the Hanson website and provided at each Community Consultative Committee meeting to ensure Community representatives remain informed about the performance and management of TSP. A summary of complaints received will be reported to DPIE on an annual basis in the site's Annual Report.

3.6 Periodic review and continual improvement

Review of this SWMP will take place regularly throughout the life of the development. The SWMP will be reviewed if monitoring records indicate that it is warranted or in the event of any significant change to operations or soil and water management procedures at TSP. Any modifications to the SWMP will be undertaken in consultation with the relevant authorities.

Hanson are committed to continual improvement of the environmental performance of their operations. Through the effective application of best practice principles, the implementation of strategies outlined in this SWMP and the periodic review and update of the SWMP, TSP will continue to improve the site's environmental performance with progress to be monitored against the performance criteria detailed in this plan.

3.7 Erosion and sediment control plan

Tables 3.7.1 to 3.7.2 constitute the site's Erosion and Sediment Control Plan.

3.7.1 Management of sand extraction

Person Responsible	TSP Management and Dredge Operator

Issue	Sand extraction for commercial sale.
Operational Policy	To provide effective environmental management by controlling and monitoring the sand extraction process.
Performance Criteria	TSP must not transport more than 950,000 tonnes of quarry products from the site in any financial year. No extraction shall occur outside the surveyed limits of extraction.
Implementation Strategy	All activities will be undertaken in accordance with the Development Consent and Environmental Protection License. All plant and equipment used at the site or to monitor the performance of the development will be appropriately maintained and operated. Sand extraction below the water table will be by dredge only. No dry excavation below the water table will be permitted. Extraction of marine clay (the Pleistocene basement below the sand deposit) will not be permitted. The surveyed extent of the approved extraction areas shall be clearly and permanently marked (by a licensed surveyor) with survey posts or equivalent. A minimum buffer of 10 metres shall be maintained between extraction limits and the boundaries of the site. The buffer may be used for activities such as drainage works, batter stabilization works, access, bunds, landscaping, facilities associated with end-use activities and rehabilitation works. The buffer distance should be variable across the site to achieve a stable, natural looking final lake bank design with curved boundaries. Landscaping, including the use of floating wetlands can be utilized to achieve a varied lake bank design.
Monitoring program	The dredging depth will be regulated by the Dredge Operator via use of a depth sounder or similar to ensure that the Pleistocene basement depth is known and that no extraction of marine clay occurs. A hydrographic survey of the bathymetry of the extraction lake shall be completed annually to record and monitor extraction depths. Site Management will ensure through regular observation that no extraction occurs outside the approved extraction limits.

Auditing	Independent environmental auditing must be undertaken in accordance with the requirements of the Conditions of Approval.
Reporting /Complaints handling	The Proponent must provide calendar year annual production data to the DPIE Division of Resources and Geosciences using the standard form for that purpose and include a copy of the form in the Annual Review. Annual hydrographic surveys will be kept on file and made available to statutory authorities upon request. Complaints handling in accordance with Section 3.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval.
Identification of incident or failure	An incident or failure shall be deemed to have occurred if; • Monitoring undertaken by the Dredge Operator indicates extraction has occurred into the marine clay below the sand resource. • Observations by the Site manager indicate extraction has occurred outside the approved extraction limits. • If annual extraction exceeds the limit of 950,000 tonnes per annum.
Corrective Action/Contingency measures	Corrective measures, where required and or practicable, shall be implemented in consultation with DPIE and other relevant statutory authorities depending on the specifics of the incident.

Commitment 3

TSP must not transport more than 950,000 tonnes of quarry products from the site in any financial year.

Commitment 4

No extraction shall occur outside the surveyed limits of extraction or into the marine clay basement below the sand resource.

3.7.2 Sediment and erosion control

Person Responsible	TSP management

Issue	Sediment and Erosion Control
Operational Policy	Soil erosion and the transport of sediments offsite will be prevented as far as practicable.
Performance Criteria	No visible erosion of bunds and lake batters shall be evident at the site. Water quality within the lakes shall comply with the specified water quality criteria.
Implementation Strategy	Erosion and sediment controls shall be installed on an 'as required' basis. Such measures will be installed in accordance with the; • Department of Housing's 'Managing Urban Stormwater: Soil and Construction Manual', • Tweed Shire Council's 'Code of Practice for Soil and Water Management on Construction Sites'; and • 'Soils and Construction Guidelines - Managing Urban Stormwater' 4th Edn., March 2004 (Landcom, New South Wales). All erosion and sediment controls as detailed below shall be routinely inspected and maintained in an operational capacity for the life of the development. <u>Internal roads</u> A vehicular shakedown shall be maintained in good working order at the site entrance/exit point. Dust suppression sprays will be used to manage dust generation from traffic on any unsealed internal roads. Use of the sprays will be optimized to achieve dust suppression whilst avoiding the generation of sediment laden runoff. Any proposed new internal haul roads will be sealed to avoid dust generation from this source. <u>Extraction area/sand processing area</u> Where practicable, all processing areas and areas of disturbed soil will drain towards the on-site lake so that runoff is captured in the extraction lake. Removal of topsoil and vegetation from extraction areas shall occur in a staged manner in order to minimise the area of subsoil exposed at any one time. Topsoil removed from extraction areas may be used to form perimeter bunding around the extraction lake and to facilitate rehabilitation and landscaping works throughout the site. Stockpiles shall be stabilised via temporary seeding or temporary/permanent revegetation in accordance with the approved rehabilitation and landscaping plans.

	To minimize bank slippage bank profiles shall be designed and stabilised in accordance with specifications from a geotechnical engineer and the approved landscaping plans. If bank erosion is observed, the area shall be regraded to achieve a maximum gradient of 1:5 and the area stabilized in accordance with geotechnical advice and/or the landscaping plans. Lake perimeters shall be progressively rehabilitated in accordance with the approved rehabilitation and landscaping management plans to ensure a stable final form. Fines will be released into the lake at a depth of at least 3 metres below the water surface and achieve a final deposition of depth of 8 metres or greater thereby minimizing the creation and/or persistence of sediment plumes. <u>Release of surface waters</u> The site will comply with the conditions of its Environmental Protection Licence at all times. Surface waters in the lake will be hydraulically isolated from the external drainage lines except during times of high rainfall (as identified by the site water balance[11] and stormwater/flooding assessments[12]). In the event that a release of surface waters is required (outside the conditions described above), the EPA shall be notified prior to the release. Release water quality objectives shall be negotiated with EPA at the time of notification. All dredging and processing activities shall cease not less than 24 hours prior to the commencement of overflow or other release of waters from the dredge lake. No dredging or processing shall occur when waters are overflowing or otherwise being released from the dredge lake. Flood storage capacity at the site must be maintained at no less than the pre-existing flood storage capacity throughout all stages of the development.
Monitoring program	TSP management shall undertake visual inspections of areas at risk of erosion on fortnightly and following rainfall events (defined as >25mm in 24hours) to ensure erosion and sedimentation controls are installed (if necessary) and maintained, and to verify the integrity and stability of the lake batters. Lake turbidity shall be routinely monitored insitu in accordance with Section 3.9.1 of this SWMP.
Auditing	Independent environmental auditing must be undertaken in accordance with the requirements of the Conditions of Approval.
Reporting/Complaints handling	Complaints handling in accordance with Section 3.5 of this SWMP.

[11] Gilbert & Sutherland, 2021. Surface Water Assessment, Tweed Sand Plant Expansion, Cudgen, New South Wales.

[12] Burchills Engineering Solutions, 2020. Tweed Sand Plant, Flood & Stormwater Assessment.

	Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Details of the site's flood storage capacity must be reported in the Annual Review along with any relevant items with respect to erosion and sediment control.
Identification of incident or failure	Visual evidence of onsite erosion including lake banks/batters. Failure to temporarily stabilise stockpiled topsoil Ongoing exceedances of the sites surface water quality criteria.
Corrective action/Contingency measures	Regrade/reform areas of the site where erosion has occurred to create a stable landform. Apply seed, hydromulch or other revegetation measure to stockpiles to facilitate rapid stabilisation. Ensure lake remains hydraulically isolated from external drainage lines (under normal operating conditions) and if necessary conduct remediation works such as removal of sediment or flocculation of affected waters.

Commitment 5

Appropriate sediment and erosion control measures will be used to minimise sedimentation, erosion and the transportation of materials (across and offsite).

3.8 Acid sulfate soil management plan

Tables 3.8.1 to 3.8.2 constitute the site's Acid Sulfate Soil Management Plan.

3.8.1 ASS management during sand extraction

Person Responsible	TSP Management

Issue	Acid sulfate soil management during sand extraction and processing operations.
Operational Policy	To minimise opportunities for oxidation of PASS materials (and subsequent acid generation) associated with the sand extraction and processing operations.
Performance Criteria	No PASS material shall be removed from the site unless adequately neutralized in accordance with the provisions of this SWMP. Fines material shall be discharged into the dredge lake at a depth of greater than 3 metres below the surface water level and shall achieve a final deposition depth of at least 8 metres below the water surface level. No oxidation of PASS materials or acid generation will result from the extraction and processing of sand on-site. pH of the extraction lake shall be maintained between 6.5 and 8.5.
Implementation Strategy	No dewatering of the extraction lake will occur without an equivalent volume of 'top-up' water being returned to the lake. Surface waters in the lake will be hydraulically isolated from the external drainage lines except during times of high rainfall (as identified by the site water balance[13] and stormwater/flooding assessments[14]). All materials dredged from the lake shall be hydraulically separated through a cyclone (or equivalent hydraulic separation device) to remove pyritic fines from the sand. The hydraulically separated fines will be strategically reburied (re-interred) within the extraction lake as soon as possible to prevent oxidation. All fines material shall be discharged into the lake at a depth of no less than 3.0m below the water surface. All fines shall achieve a final deposition depth of at least 8.0m below the water surface level. Adequate drainage will be maintained around the cyclone/wash plant to ensure that any leachate from the sand stockpiles drains towards the on-site lake. Fines shall be returned to the lake via a pipeline, the velocity will be sufficient to ensure that no precipitation of pyritic fines occurs during the movement of these waters toward the on-site lake. Extracted sands shall be sampled in accordance with the procedures outlined below to determine any requirements for lime treatment. Sands requiring lime shall be treated to neutralise any existing and potential acidity. In calculating the amount of lime or neutralising agent to be added, a mixing factor for safety of 1.5 will be used.

[13] Gilbert & Sutherland, 2021. Surface Water Assessment, Tweed Sand Plant Expansion, Cudgen, New South Wales.

[14] Burchills Engineering Solutions, 2020. Tweed Sand Plant, Flood & Stormwater Assessment.

Monitoring program	A hydrographic survey of the bathymetry of the extraction lake shall be completed annually to monitor the final deposition depth of fines material. The extracted sand (following hydraulic separation) will be tested according to the following procedure: **Frequency:** Take a minimum of 10 samples over a quarterly period for **Analysis:** Samples to be analysed via the CRS/TAA method. **Sample size:** Samples shall be approximately 0.3kg. **Soil characterisation:** Soil characterisation on each sample should be performed by the laboratory and/or a suitably qualified and experienced person and include: • field description (McDonald *et al*, 1990), • field texture, colour, pH. **Sampling:** Soil samples to be collected in sealed geological sampling bags that exclude air. These should be chilled or frozen during transportation to the laboratory for analysis. **Handling and storage**: Sent to laboratory or dried within 24 hours.
Auditing	Independent environmental auditing must be undertaken in accordance with the requirements of the Conditions of Approval.
Reporting/Complaint handling	Complaints handling in accordance with Section 3.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Results to be reported in the Annual.
Identification of incident or failure	Failure to meet the release and final deposition depths for fines re-interment. Failure to collect the required samples. Failure to undertake lime treatment when required. Acidification of site waters.
Corrective action/Contingency measures	Conduct necessary modifications to fines return system to ensure designated release and deposition depths are achieved. Implement additional procedures and training to ensure samples are collected in accordance with this SWMP. Implement additional procedures and training to ensure lime treatment is undertaken when required in accordance with this SWMP. Investigate remedial options for water quality in consultation with a suitably qualified environmental consultant.

Commitment 6

Appropriate procedures for the processing of sands will be undertaken throughout the life of operations at the site to mitigate risks associated with PASS.

3.8.2 ANASS and/or ASS management during removal of overburden

Person responsible	TSP management

Issue	Acidic non-acid sulfate soil (ANASS) and/or Acid sulfate soil (ASS) identification and treatment during removal of overburden.
Operational policy	Identify ANASS and ASS within overburden materials.
Performance criteria	All ANASS and ASS within overburden materials are appropriately identified and treated (where required).
Implementation strategy	Overburden materials to be progressively removed as dredging advances. The ANASS/ASS characteristics of the overburden and any need for lime treatment are to be determined through sampling in accordance with the monitoring program below. Sands requiring lime shall be treated to neutralise any existing and potential acidity. In calculating the amount of lime or neutralising agent to be added, a mixing factor for safety of 1.5 will be used.
Monitoring program	All overburden materials will be sampled prior to removal according to the following protocol; **Frequency –** In accordance with the ASSMAC guidelines sampling frequency shall be 2 boreholes per hectare (or equivalent per cubic metre rate) over the excavation area with holes constructed to the depth where groundwater is encountered. If a reduced sampling frequency can be justified, this rate may be reduced upon receipt of written consent from the relevant statutory authorities. **Analysis –** Samples shall be collected at intervals of 0.5m down the soil profile, screened for acid sulfate soil potential and undergo Chromium Reducible Sulfur (CRS) and Total Actual Acidity (TAA) analyses at an appropriate laboratory. **Sample size -** Soil samples approximately 0.3kg each to be collected from each soil horizon with a soil profile description. **Sampling -** Soil samples to be collected in sealed containers or geological sampling bags that exclude air. **Handling and storage -** Sent to laboratory or dried within 24 hours.
Auditing	Independent environmental auditing must be undertaken in accordance with the requirements of the Conditions of Approval.
Reporting/Complaints handling	Complaints handling in accordance with Section 3.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Results to be reported in the Annual Review.

Identification of incident or failure	Failure to collect the required samples. Failure to undertake lime treatment when required. Acidification of site waters.
Corrective action/Contingency measures	Implement additional procedures and training to ensure samples are collected in accordance with this SWMP. Implement additional procedures and training to ensure lime treatment is undertaken when required in accordance with this SWMP. Investigate remedial options for water quality in consultation with a suitably qualified environmental consultant.

Commitment 7

Appropriate procedures for the identification and management of PASS or AASS in the site's overburden will be undertaken throughout the life of operations at the site.

3.9 Surface water monitoring program

Person Responsible	TSP Management

Issue	Water quality in the extraction lake(s)
Operational Policy	To maintain baseline surface water quality in the extraction lake and/or compliance with the site's water quality objectives.
Performance Criteria	TSP management will aim to meet the water quality objectives identified in Table 3.9.1 below for surface water in the extraction lake.

Table 3.9.1 Water quality objectives – surface water

Pollutant	Unit of measure	Water quality objective
pH	pH units	6.5 - 8.5
Dissolved Oxygen	% saturation	>90
Turbidity	NTU	5 - 20
Dissolved Iron	mg/L	<0.13
Dissolved Aluminium	mg/L	<0.055
Arsenic	mg/L	<0.024
Total Nitrogen	mg/L	<0.78
Total Phosphorus	mg/L	<0.05

Notes:

1. The values of water quality indicators will vary naturally and not all of this variation is ecologically important.[15].
2. The site-specific criteria are based on the ANZECC Guidelines (where available and relevant to site conditions). Where ANZECC Guidelines do not specify a trigger value, or where the trigger value is not appropriate for site conditions the 80th percentile of the baseline data set has been adopted[16].
3. The probability of a single observation exceeding the 80th percentile is 20%. The probability of a Type 1 error (or the risk of triggering a false alarm) is 20%.

[15] Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, 2000, Section 3.1, Page 21.

[16] Gilbert & Sutherland (2021). Surface Water Assessment, Tweed Sand Plant Expansion, Cudgen, New South Wales.

Implementation Strategy	Baseline surface water quality or compliance with the site's water quality objectives will be maintained with the long-term aim of achieving water quality suitable for recreational purposes at the cessation of extraction at the site. Offsite impacts from site operations will be avoided or otherwise minimised wherever possible. Surface waters in the lake will be hydraulically isolated from the external drainage lines except during times of high rainfall (as identified by the site water balance[17] and stormwater/flooding assessments[18]). Nutrient and turbidity management Potential nutrient sources (such as fertilizer) shall be prevented from entering the extraction lake to minimise the occurrence and severity of algal blooms. Any effluent generated on-site will be treated prior to disposal using an appropriately designed, operated and maintained treatment system. Soil disturbance shall be minimized wherever possible and managed in accordance with Section 3.7 of this SWMP. Bank stability shall be monitored and managed in accordance with Section 3.7 of this SWMP. Where sediment problems are identified, settling in the dredge pond shall be aided by dosing with a flocculant such as gypsum or other appropriate methodology. pH management within the extraction lake No dewatering of the extraction lake will occur without an equivalent volume of 'top-up' water being returned to the lake. All materials dredged from the lake shall be hydraulically separated through a cyclone (or equivalent hydraulic separation device) to remove pyritic fines from the sand. The hydraulically separated fines will be strategically reburied (re-interred) within the extraction lake as soon as possible to prevent oxidation. All fines material shall be discharged into the lake at a depth of no less than 3.0m below the water surface. All fines shall achieve a final deposition depth of at least 8.0m below the water surface level. Adequate drainage will be maintained around the cyclone/wash plant to ensure that any seepage from the sand stockpiles drains towards the on-site lake. Fines shall be returned to the lake via a pipeline, the velocity within the pipeline will be sufficient to ensure that no precipitation of pyritic fines occurs during the movement of these waters toward the on-site lake.

[17] Gilbert & Sutherland, 2021. Surface Water Assessment, Tweed Sand Plant Expansion, Cudgen, New South Wales.

[18] Burchills Engineering Solutions, 2020. Tweed Sand Plant, Flood & Stormwater Assessment.

Monitoring program	Insitu monitoring equipment shall be calibrated in accordance with the manufacturer's instructions. Surface water quality monitoring Compliance monitoring shall be undertaken on a biannual basis at the surface water monitoring locations shown on Drawing 12035.003. Biannual monitoring shall be undertaken for the parameters listed in Table 4.13.1.1 above. Sample collection shall be undertaken by a suitably qualified environmental consultant with analysis of samples undertaken at a NATA accredited laboratory. Biannual vertical profile monitoring shall be undertaken at central locations within the extraction lake(s). Locations to be determined as lake expansion occurs. Sampling shall occur at one-metre intervals for the full depth of the lake (at VP1) with samples analysed for in situ parameters only (pH, temperature, REDOX potential, electrical conductivity and dissolved oxygen). Sample collection shall be undertaken by a suitably qualified environmental consultant. Compliance monitoring shall continue for a period of three (3) years following completion of extraction or until stable water quality has been achieved. Operational monitoring Weekly in situ monitoring for pH, electrical conductivity, temperature, dissolved oxygen, salinity, REDOX potential will be undertaken by TSP Management using appropriate equipment calibrated in accordance with the Manufacturer's specifications. Daily rainfall totals will be recorded by TSP Management.
Auditing	Independent environmental auditing must be undertaken in accordance with the Conditions of Approval.
Reporting/Complaints handling	Biannual compliance monitoring shall be undertaken. A report summarising the results of monitoring and comparing them to the WQOs shall be prepared following each round of biannual monitoring and forwarded to the relevant authorities for comment. Complaints handling to be undertaken in accordance with Section 3.5 of this SWMP. Exceedances of the WQO's recorded during biannual compliance monitoring to be notified to DPE in accordance with the Conditions of Approval. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Biannual compliance monitoring results to be reported in the Annual Review.

Identification of incident or failure	Sustained deterioration of surface water quality (outside the effects of drought or flood) verified through appropriate statistical analysis.
Corrective Action/Contingency measures	If the test results for any parameter fail to meet the water quality objectives an investigation into possible causes will be conducted and reported in the biannual report. The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in surface water quality (verified through statistical analysis or similar) is present. If a trend exists for declining surface water quality, the likely cause(s) of the decline shall be investigated. Specific remedial actions for poor water quality (e.g. turbid waters, low pH) shall be determined in consultation with a suitable qualified environmental consultant but may include; • The addition of a lime based ameliorant or saline water at a calculated rate to raise pH to acceptable levels. • The addition of a chemical flocculent to reduce turbidity to acceptable levels.

Commitment 8

Baseline surface water quality or compliance with the site's water quality objectives will be maintained with the long-term aim of achieving water quality suitable for recreational purposes at the cessation of extraction at the site.

3.10 Groundwater monitoring program

Person Responsible	TSP Management

Issue	Long term groundwater quality and levels will be monitored and analysed against the specified water quality objectives.
Operational Policy	Groundwater quality at the site shall be monitored and managed to achieve compliance with the site's water quality objectives.
Performance Criteria	TSP management will aim to meet the water quality objectives identified in Table 3.10.1 and 3.10.2 below for water in the shallow and deep groundwater bores as shown on Drawing 12035.003.

Table 3.10.1 – WQO's for shallow bores

Pollutant	Unit of measure	Water quality objective – shallow bores
pH	pH units	6.5 - 8.5
Dissolved Iron	mg/L	<17.3
Dissolved Aluminium	mg/L	<0.055
Arsenic	mg/L	<0.024
Total Nitrogen	mg/L	<1.8
Total Phosphorus	mg/L	<0.58

Table 3.10.2 – WQO's for deep bores

Pollutant	Unit of measure	Water quality objective – shallow bores
pH	pH units	6.5 - 8.5
Dissolved Iron	mg/L	<1.9
Dissolved Aluminium	mg/L	<0.055
Arsenic	mg/L	<0.024
Total Nitrogen	mg/L	<19.48
Total Phosphorus	mg/L	<0.67

Notes:

1. The values of water quality indicators will vary naturally and not all of this variation is ecologically important.[19].
2. The site-specific criteria are based on the ANZECC Guidelines (where available and relevant to site conditions). Where ANZECC Guidelines do not specify a trigger value, or where the trigger value is not appropriate for

[19] Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, 2000, Section 3.1, Page 21.

	site conditions the 80th percentile of the baseline data set has been adopted.[20] 3. The probability of a single observation exceeding the 80th percentile is 20%. The probability of a Type 1 error (or the risk of triggering a false alarm) is 20%.
Implementation Strategy	Baseline groundwater quality will be maintained and impacts from site operations will be minimised wherever possible. All groundwater-related site activities will be undertaken in accordance with the groundwater licences issued for the site and this SWMP. To minimise adverse impacts to groundwater quality and quantity on and off-site, no dewatering of the extraction lake will occur without an equivalent volume of 'top-up' water being returned to the lake. All sand extraction below the groundwater table shall be undertaken via dredge to minimize impacts on groundwater both on and off-site.
Monitoring program	Insitu monitoring equipment shall be calibrated in accordance with the manufacturer's instructions. <u>Compliance monitoring</u> Compliance monitoring shall be undertaken on a biannual basis at the shallow and deep groundwater monitoring locations shown on Drawing 12035.003. Biannual monitoring shall be undertaken for the parameters listed in Table 3.10.1 above. Sample collection shall be undertaken by a suitably qualified environmental consultant with analysis of samples undertaken at a NATA accredited laboratory. Groundwater movement (flow) and levels will be assessed through preparation of potentiometric surfaces based on monthly groundwater level data collected as part of TSP's operational monitoring program. These drawings will be prepared on an annual basis and be used to assess changes in groundwater movement over time including the potential for site activities to affect vegetation and groundwater supply to neighbouring properties. Compliance monitoring shall continue for a period of three (3) years following completion of extraction or until stable water quality has been achieved. <u>Operational monitoring</u> Monthly in situ monitoring for groundwater level, pH, electrical conductivity, temperature, dissolved oxygen, salinity, REDOX potential will be undertaken by TSP Management. Daily rainfall totals will be recorded by TSP Management.
Auditing	Independent environmental auditing must be undertaken in accordance with the Conditions of Approval.

[20] Gilbert & Sutherland (2021). Groundwater Assessment, Tweed Sand Plant Expansion, Cudgen, New South Wales.

Reporting/Complaints handling	Biannual compliance monitoring shall be undertaken. A report summarising the results of monitoring and comparing them to the WQOs shall be prepared following each round of biannual monitoring and forwarded to the relevant authorities for comment. Complaints handling to be undertaken in accordance with Section 3.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Biannual compliance monitoring results to be reported in the Annual Review.
Identification of incident or failure	Sustained deterioration of groundwater quality (outside the effects of drought or flood) verified through statistical analysis. Significant variations in groundwater level outside drought or flood conditions and outside the predictions of the numerical groundwater model that are confirmed to be due to on-site activities. Offsite vegetation dieback caused by variations in the groundwater table caused by TSP operations. Formation of a cone of depression or a groundwater mound that extends beyond the predictions of the numerical groundwater model.
Corrective Action/Contingency measures	If the test results for any parameter fail to meet the water quality objectives an investigation into possible causes will be conducted and reported in the biannual report. The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in groundwater quality (verified through statistical analysis or similar) is present. If a trend exists for declining groundwater quality, the likely cause(s) of the decline shall be identified.

Commitment 9

Long term groundwater quality and levels will be monitored and analysed against the specified water quality objectives.

3.11 Cyanobacteria management plan

Table 3.11.1to 3.11.3 outlines the site's cyanobacteria (blue-green algae) management plan.

3.11.1Cyanobacteria monitoring program

Person responsible	TSP Management

Issue	Cyanobacterial (blue-green algae) monitoring
Operational policy	Cyanobacteria populations within the extraction lake shall be monitored on a regular basis to assess and record any changes in species composition and numbers with the long-term aim of achieving water quality suitable for recreational purposes at the cessation of extraction at the site.
Performance criteria	The following 'alert levels' have been modified from the NHMRC Guidelines (Table 6.2). The alert levels are based on an assessment of biovolume and toxin testing and have been modified to reflect the historic conditions within the extraction lake and the current risk profile.

Alert level	Description
Surveillance (Green mode)	The total cell concentration of potentially toxigenic cyanobacteria does not exceed 500 cells/mL and total biovolume of all potentially toxigenic cyanobacteria does not exceed 0.5 mm^3/L.
Alert (Amber mode)	Biovolume equivalent of 0.5 to < 1.8 mm^3/L of potentially toxic cyanobacteria.
Action (Red mode)	Biovolume equivalent of ≥ 1.8 mm^3/L of potentially toxic cyanobacteria or ≥ 10 mm^3/L total biovolume of all cyanobacterial material.

Notes: *Test for toxin(s) most relevant to cyanobacteria present. Drinking water guideline value for cylindrospermopsin is as recommended for that of microcystin in water supplies. It would be a safe inference that the same could apply to recreational guidelines. As the current NHMRC trigger value for microcystin is >10 µg/L, in the absence of other thresholds this value should therefore also apply to cylindrospermopsin and other toxins.

Implementation strategy	TSP Management shall employ a suitably qualified environmental consultant to undertake the required monitoring within the extraction lake.
Monitoring	Monthly monitoring Monitoring of the extraction lake shall be undertaken on a monthly basis at representative locations within the extraction lake(s). At each location a composite sample shall be taken for analysis of: • Algal cell count, biovolume and predominant genera • Polymerase Chain Reaction (PCR) genetic toxin testing • Total nitrogen • Nitrogen-oxidised • Ammonia • Total Phosphorus • Orthophosphorus

	Following completion of extraction monitoring for the parameters detailed above shall continue quarterly for a period of three (3) years or until stable water quality has been achieved. Annual vertical profile monitoring Vertical profile monitoring would be conducted on an annual basis and will involve the collection of samples at three depths: the water surface; eight metres deep and the maximum depth of the lake (approximately 16 to 18 metres) for analysis of: • Cell count/biovolume of cyanobacteria • Toxin analysis (CYN and deoxy CYN) • PCR genetic testing for PKS-CYN gene • Nutrients (total nitrogen, total phosphorus, orthophosphorus, oxidised nitrogen and ammonia) • Metals and cations (ICP suite of 16 elements) • Conductivity • Temperature • Oxidation-Reduction Potential (ORP) Annual vertical profile monitoring shall continue for a period of three (3) years following completion of extraction or until stable water quality has been achieved.
Auditing	Independent environmental auditing will be undertaken in accordance with the Conditions of Approval.
Reporting	Cyanobacteria monitoring results shall be provided electronically to site management following each monitoring event. Monthly and annual cell counts to be compared against the adapted NHRMC Framework to allow 'alert' levels to be assigned. Complaints handling to be undertaken in accordance with Section 4.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval and the following; Public health authorities will be notified when cyanobacterial biovolumes or toxin levels are within the 'Action' Red level. Correspondence shall be forwarded to Tweed Shire Council's Environmental Health division and the NSW Department of Planning including details of cyanobacterial biovolumes, toxicity levels (if toxicity is present) and the health and safety precautions implemented to protect Plant staff. Monitoring results to be reported in the Annual Review.
Identification of incident or failure	Failure to undertake monitoring in accordance with the program outlined above.
Corrective action	Immediately arrange for a suitably qualified consultant to undertake the required monitoring.

Commitment 10

Cyanobacteria populations within the extraction lake shall be monitored in accordance with the SWMP to assess and record any changes in species composition and numbers.

3.11.2 Risk reduction measures

Person responsible	TSP Management

Issue	Human health risks associated with exposure to algal blooms and associated toxins throughout the operational life of the extractive industry.
Operational policy	TSP Management shall conduct all works in a manner that minimises risks to staff and visitors.
Performance criteria	All staff and visitors shall be informed of the risks associated with cyanobacterial blooms and associated toxins. Management shall implement risk reduction measures to avoid exposure to cyanobacterial blooms and minimise risks to health.
Implementation strategy	Warning signs shall be placed around the lake in prominent areas to warn staff and visitors of the presence of algal blooms. Person Protective Equipment (PPE) shall be worn by all staff and visitors who are likely to come into contact with the lake water. Any person coming into contact with the water should rinse the affected area as soon as possible to remove microscopic cells and toxins. Consumption of fish, crustaceans or mollusc from the lake is prohibited. Any staff or visitors with a history of allergenic dermal reactions and/or asthma should be informed of the potential risks during the site induction/sign in procedures. Additional precautions such as avoiding all contact with the lake water and maintaining a distance between themselves and the lake may be necessary on a case-by-case basis.
Monitoring	TSP management shall inspect warning signs on a regular basis to ensure they remain in place and are well maintained. TSP management shall monitor any breaches of PPE rules and respond appropriately. TSP management shall regularly review induction procedures to ensure current information is available regarding the health risks associated with cyanobacteria cells and toxins. Monitoring of the presence and severity of algal blooms shall be undertaken in accordance with Section 4.15.1.
Auditing	Independent environmental auditing will be undertaken in accordance with the Conditions of Approval.
Reporting	Cyanobacteria monitoring results shall be provided electronically to site management following each monitoring event. Complaints handling to be undertaken in accordance with Section 4.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Monitoring results to be reported in the Annual Review.

Identification of incident or failure	Failure to maintain warning signs around the extraction lake. Failure to ensure all staff and visitors wear appropriate PPE. Failure to prevent (wherever possible) the consumption of fish, crustaceans or molluscs from the lake. Failure to inform staff and visitors with a history of allergic reactions or asthma about the dangers of cyanobacterial blooms and associated toxins.
Corrective action	Immediately arrange for replacement/additional signage to be placed around the lake at key locations Re-educate staff and visitors about the importance of PPE. Re-educate staff and visitors about the risks associated with consumption of species from the lake Ensure staff and visitors are informed of the risks associated with exposure to cyanobacterial cells and toxins.

Commitment 11

TSP Management shall conduct all works in a manner that minimises risks to staff and visitors associated with the potential presence of cyanobacteria.

3.11.3Hazard mitigation measures

Person responsible	TSP Management

Issue	Reduction in the prevalence and severity of algal blooms within the extraction lake.
Operational policy	Wherever possible, TSP Management shall implement practical measures to reduce the prevalence and severity of algal blooms within the extraction lake with the long-tern aim of achieving water quality suitable for recreational purposes at the cessation of sand extraction at the site.
Performance criteria	Ongoing consideration and research into hazard reduction measures. Periodic implementation of trial programs to reduce algal cell numbers over time.
Implementation strategy	TSP management shall stay informed of developments and innovations in cyanobacterial management where applicable to the site. Where possible, TSP Management shall implement trial programs in consultation with the nominated Environmental Consultant at the site to reduce the prevalence and severity of algal blooms. Such trial programs may include; <u>The introduction of (native) competing plants</u> The introduction of (native) plants into the extraction lake (particularly floating kinds) may prove beneficial through nutrient uptake and blocking UV light penetration through the water column. <u>Lake riparian area rehabilitation and landscaping</u> Rehabilitation works on riparian areas of the lake where works are complete may prove beneficial for algal management. Regrading of lake batters to encourage the growth of reed banks would create habitat for fish and bird species that may consume the algal cells. Further riparian vegetation would also provide some shading of the lake edges thereby reducing light penetration. Lake riparian rehabilitation shall be undertaken in accordance with the short, medium and long term strategies in the Rehabilitation and Landscaping Management Plan. <u>Biomanipulation</u> Dosing of water bodies with specific micro nutrients to rebalance algal populations and outcompete problematic cyanobacteria. Products such as Diatomix may be suitable and could be implemented on a trial basis following cost and feasibility studies at the site.
Monitoring	Trial programs shall be monitored to assess their success in reducing the prevalence and severity of algal blooms. Dedicated monitoring programs shall be implemented at the time of commencement of the trial programs to monitor the success or otherwise of the trial.
Auditing	Independent environmental auditing will be undertaken in accordance with the Conditions of Approval.
Reporting	Cyanobacteria monitoring results shall be provided electronically to site management following each monitoring event.

	Complaints handling to be undertaken in accordance with Section 4.5 of this SWMP. Incident notification, reporting and response to be undertaken in accordance with the Conditions of Approval. Monitoring results to be reported in the Annual Review.
Identification of incident or failure	Failure to report the results of cyanobacterial management investigations (desktop or otherwise) or trial program results in the Annual Report.
Corrective action	Ensure each Annual Report captures the cyanobacterial investigations and research results from each annual return period.

Commitment 12

Wherever possible, TSP Management shall implement practical measures to reduce the prevalence and severity of algal blooms within the extraction lake.

3.12 Waste management

Person responsible	TSP Management

Issue	Waste minimisation and management.
Operational policy	• To ensure all waste generated onsite is stored, re-used, recycled removed and disposed of in an appropriate manner. • To adhere to the waste management hierarchy. • To minimise potential environmental and social impacts from waste and waste handling. • To minimise the amount of waste produced as a result of operations on site. • To keep site neat and tidy.
Performance criteria	• No green waste material removed from site. • Adherence to the waste management hierarchy with waste removed from site only for disposal to landfill or a recycling facility when it cannot be re-used on site. • Ensure facilities are available onsite for the segregation of wastes into streams to allow for recycling. Storage facilities to be clearly labelled, covered and regularly maintained. • Storage of waste shall occur within the boundaries of the site in appropriate waste disposal bins to council specifications. • All waste is to be collected and transported by an appropriately licensed contractor and disposed of to an appropriately licensed facility.
Implementation strategy	**General strategies:** Reduction, reuse or recycling practices should be used wherever practicable. The following actions will apply in order to achieve this outcome: • All waste is to be stored within site boundaries in covered receptacles that meet TSC specifications. • No waste generated outside of the site is to be received at the site for storage or disposal. • An appropriate number of covered waste receptacles will be located on site with the provision of dedicated areas or additional receptacles for the storage of re-usable and recyclable materials. • Waste containers will be emptied as required (based on volumes generated) by an appropriately licensed contractor. • All waste is to be removed from site only by an appropriately licensed contractor and taken to a facility with the correct permits for handling and processing the waste form. • The site should be left clean and tidy at the end of each work day with no waste left loose or exposed. • Any spillage is to be collected immediately and disposed of at an appropriately licensed facility.

	Specific strategies: In respect of **topsoil/overburden materials**, the following action will apply: • Stripped topsoil/overburden to be re-used on site to facilitate rehabilitation and landscaping works. • Excess topsoil would be screened, sampled and transported offsite in accordance with the requirements of the NSW EPA's Waste Classification Guidelines 2014. For **green waste**, the following actions will apply: • Clearing of onsite vegetation shall be limited to only what is required as shown on the relevant plans. • Green waste produced onsite (including wooden fencing) will be mulched and re-spread across the site following the completion of earthworks, or stockpiled and used to facilitate landscaping works. Specific **putrescible waste** management measures are: • There will be clearly labelled bins on site for putrescible waste that will be emptied as required based on the volumes generated. • All putrescible waste will be removed by an appropriately licensed contractor and taken to a facility for composting or disposal. For **non-putrescible waste**, the following actions will apply: • Clearly labelled bins will be available onsite to segregate waste into recyclable or non-recyclable material. • Reuse any material onsite where possible (e.g. construction materials). • Minimise volume of waste going to landfill. • Bins will be regularly collected by a suitably licenced contractor to avoid stockpiling or overflow. For **on-site wastewater**, the following actions will apply: • Appropriate onsite waste water treatment facilities will be designed, installed and maintained in accordance with relevant TSC requirements. **Special waste** will be managed according to the following: • Onsite generation of special waste shall be avoided wherever possible. • If onsite repairs to plant or equipment are undertaken, any generated special wastes will be appropriately stored until collection by an appropriately licensed contractor **Hazardous waste** will be managed in accordance with the following: • Any storage of oils or hazardous liquid/materials shall be in containers that meet Australian standard and stored away from hazard areas and sensitive receiving environments such as waterways. • Compliance with relevant legislation regarding removal, containment and emission control of hazardous waste will be achieved, including the submission of records to PCA prior to removal. • Any spills are to be cleaned up immediately with wastes disposed of to an appropriately licensed facility.

Monitoring	Waste management practices will be reported in the Annual Review.
Auditing	Independent environmental auditing will be undertaken in accordance with the Conditions of Approval.
Reporting	• Records of waste removal invoices and plant and equipment servicing shall be kept up to date and shall be made available to the relevant statutory authorities upon request. • Any incidents involving waste handling onsite or spills shall be reported to the TSP Manager immediately. • When there is potential or actual environmental harm as a result of waste management, the TSP Manager is to notify appropriate authorities and corrective actions implemented as directed. • When there is potential or actual environmental harm as a result of waste management, TSC is to be contacted immediately on Council's Environmental Health Services line (02) 6670 2400 or the TSC after hours emergency contact number 1800 818 326. • Any staff training or inductions on waste management are to be recorded.
Identification of incident or failure	**General incident or failure:** • Monitoring indicates ongoing, repetitive, incorrect waste management or complaints. • Large quantities of waste going to landfill when it has the potential to be re-used or recycled. • Insufficient waste storage capacity or frequency of waste removal from site. • Waste generated outside of site being received at the site for storage or disposal without the correct permit. **Identification of incident or failure in respect to a specific waste stream:** In respect to identification of incident or failure relating to **topsoil/overburden material**: • Removal of topsoil/overburden from site without first exhausting all opportunities for onsite reuse. • Removal of topsoil/overburden from site without following the specifications of the NSW EPA's Waste Classification Guidelines 2014. Failure or incident in handling of **green waste:** • Removal of green waste from site. • Failure to take opportunities to reuse green waste onsite. Identification of failure or incident in handling **putrescible waste**: • Putrescible waste being found outside of the appropriate receptacles – i.e. being found on site not in bins. • Putrescible waste collected infrequently leading to rotting in bins, attracting wildlife and/or causing foul odour.

	Identification of failure or incident in handling **non-putrescible waste**: • Non-putrescible waste being found outside of the appropriate bins – i.e. being found on site not in bins or not being segregated onsite. • Insufficient capacity of receptacles causing overflow of waste. • Inappropriate offsite disposal of waste. Evidence of failure or incident of **onsite wastewater effluent:** • Inappropriate management/disposal of wastewater. Identification of **special waste** related incident or failure: • Inappropriate storage, removal or disposal. Failure or incident relating to **hazardous waste**: • Hazardous waste not being correctly or safely stored as per the relevant Australian Standard. • Hazardous waste spills not being removed, treated and reported appropriately.
Corrective action	**General Corrective Actions:** The process for any general waste related incident will be: • Investigate cause and undertake any required reporting. • Undertake remediation. • Implement re-training where necessary The site manager or designated representative will direct clean-up operations as required. Directions will be based on the processes as follows: • Source of waste is to be identified. • Appropriate clean-up actions to be undertaken. • Waste to be disposed of by licenced contractor. • To avoid a reoccurrence, increase onsite waste storage capacity where necessary, increasing the frequency of waste collection and re-train staff. • Implementation of appropriate procedures in accordance with the NSW EPA Wase Classification Guidelines.

Commitment 13
Site management will adhere to the waste management hierarchy and maximise reuse and/or recycling on site of any materials to minimise the need for disposal off site.

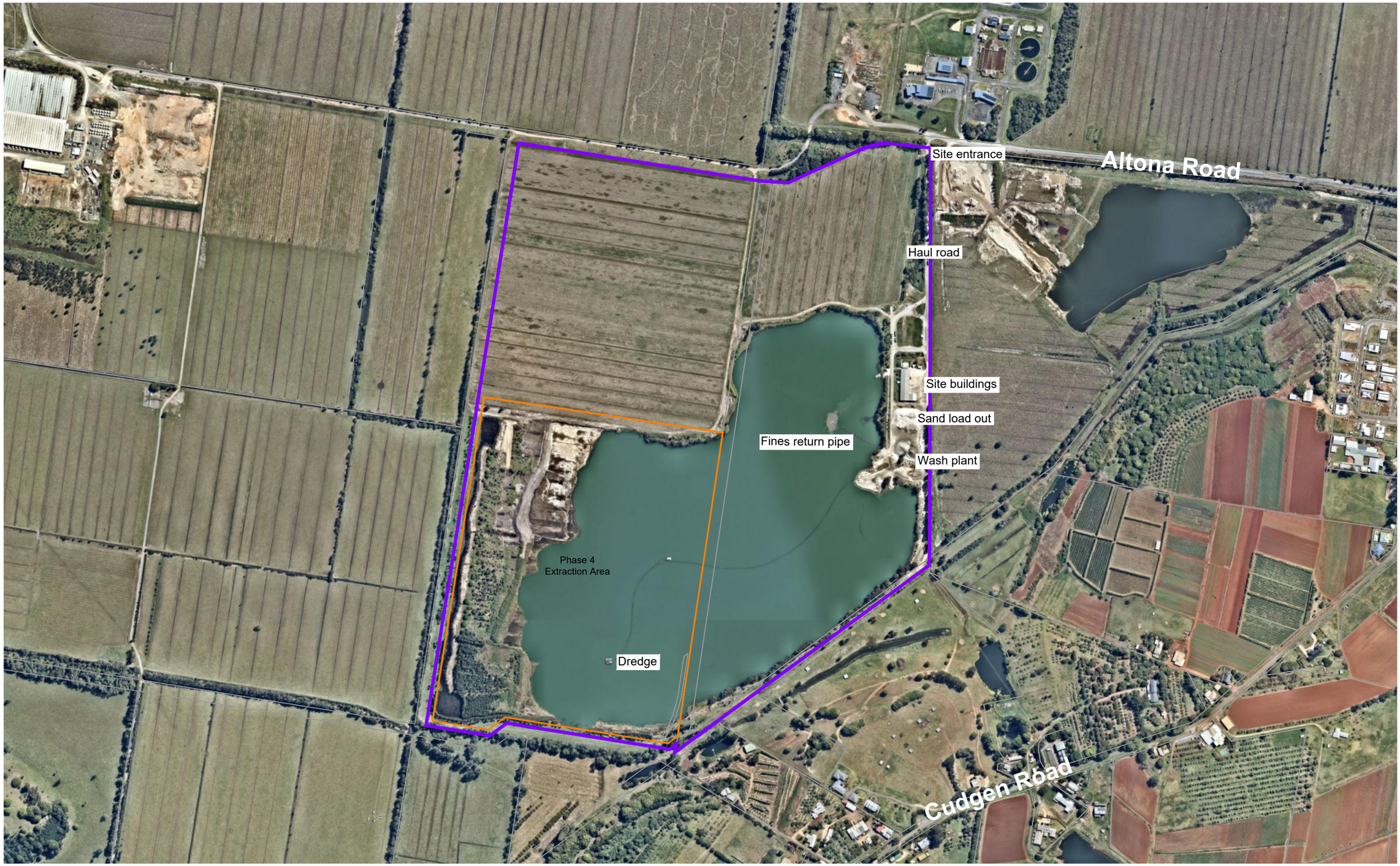
4 Limitations of reporting

Gilbert & Sutherland Pty Ltd has made every effort to ensure that the information provided in this report is accurate. The interpretation of scientific data, however, involves professional judgment and as such is open to error.

In recognizing the potential for errors in scientific interpretation, Gilbert & Sutherland Pty Ltd does not guarantee that the information is totally accurate or complete and clients are advised not to rely solely on this information when making commercial decisions. Any representation, statement, opinion or advice, expressed or implied is made in good faith and on the basis that the authors, Gilbert & Sutherland Pty Ltd, their agents or employees are not liable (whether by reason of lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement or advice referred to above.

Furthermore, this information should not be relied upon by any persons other than the client, for whom it has been compiled. This information reflects the specific brief and the budget of the client concerned, who enjoys an individual tolerance of risk.

5 Appendix 1 – Drawings



ORIENTATION

SCALE
50 100 150 200 250 300
metres

ROBINA

PO Box 4115 Robina QLD4230 07 5578 9944
Email robina@access.gs **www.access.gs**

LEGEND

- Site Boundary
- Phase 4 Extraction Area (indicative only)

SOURCES

Image: Nearmap 2020. Image date: 14/09/2020

PROJECT	CLIENT	DRAWING
TWEED SAND PLANT EXPANSION	HANSON CONSTRUCTION MATERIALS	EXISTING TWEED SAND PLANT OPERATION

SCALE	DATE	DRAWN	CHECKED	PROJECT	DRAWING	REVISION
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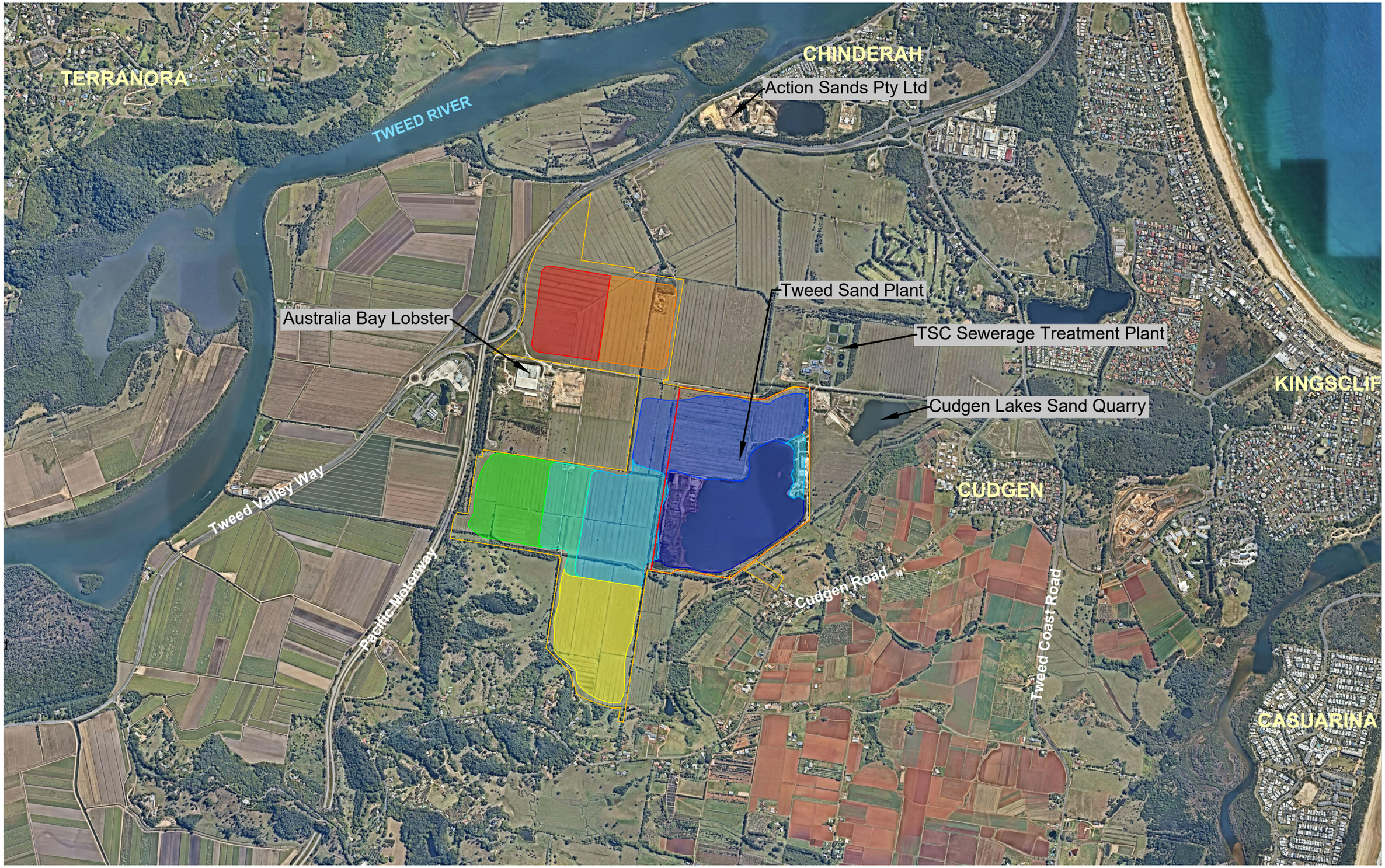
GILBERT SUTHERLAND



ORIENTATION

SCALE
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metres

ROBINA
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LEGEND
- Site boundary - existing
- Site boundary - expansion area

INDICTIVE EXPANSION AREA PHASES
- Phases 1-4 (approved)
- Phase 5
- Phase 6
- Phase 7
- Phase 8
- Phase 9
- Phase 10
- Phase 11

SOURCES
Image: Nearmap 2020. Image date: 14/09/2020

PROJECT	CLIENT	DRAWING
TWEED SAND PLANT EXPANSION	HANSON CONSTRUCTION MATERIALS	PROPOSED TWEED SAND PLANT EXPANSION

SCALE	DATE	DRAWN	CHECKED	PROJECT	DRAWING	REVISION
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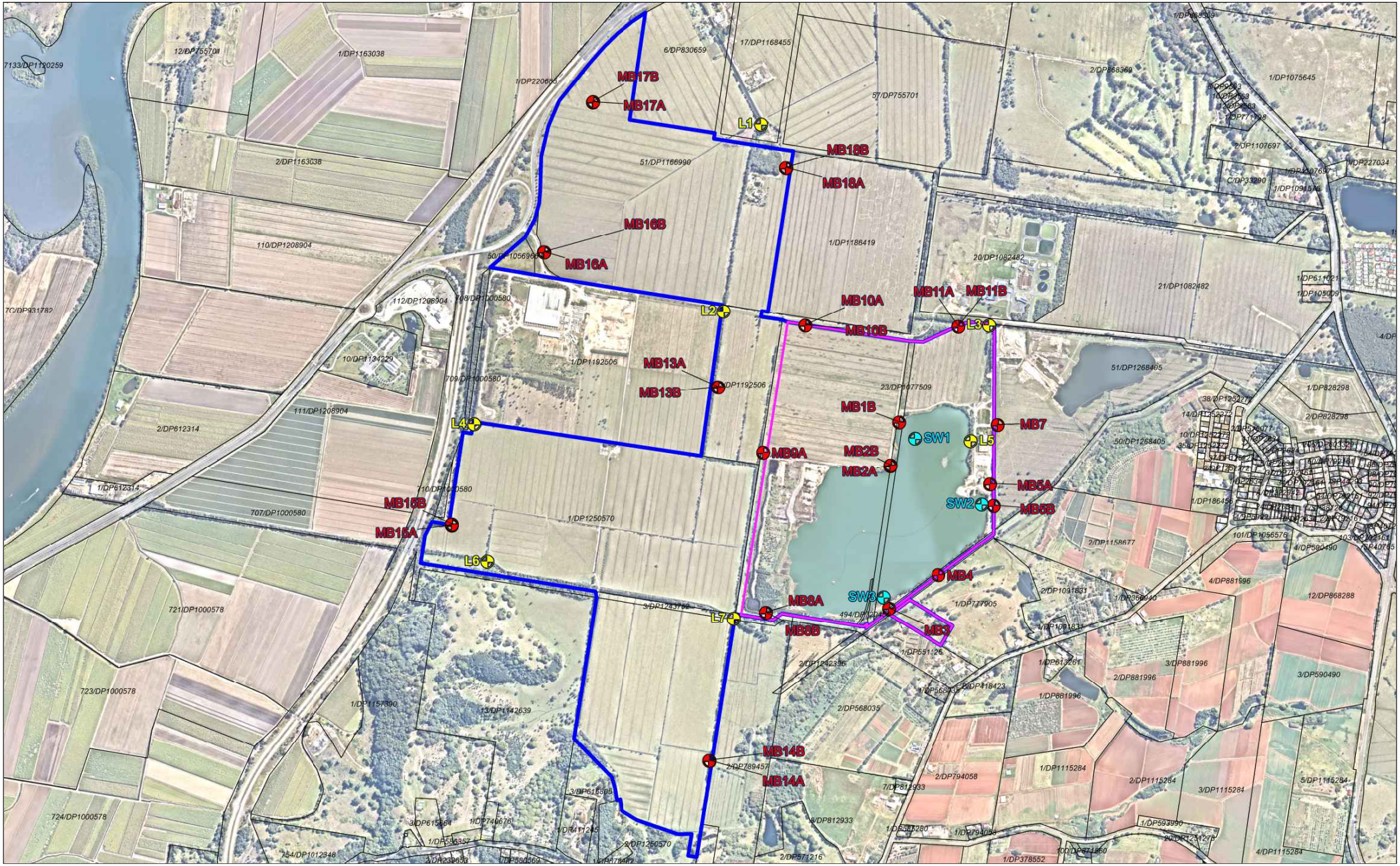
GILBER SUTHERLAN



ORIENTATION

SCALE

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metres

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LEGEND

- Cadastral boundaries
- Site Boundary - Existing
- Site boundary - Expansion Area
- Groundwater monitoring bores
- Surface water monitoring locations
- Surface water loggers

SOURCES

Image: Nearmap image dated 14 September 2020.

Cadastral: NSW Six Maps, sourced 23/11/2020.

PROJECT
TWEED SAND PLANT EXPANSION

CLIENT
HANSON CONSTRUCTION MATERIALS

DRAWING
MONITORING LOCATIONS

SCALE	DATE	DRAWN	CHECKED	PROJECT	DRAWING	REVISION
1:12 500@A3	19/01/2021	AJF	CMA	12035	003	-

GILBERT SUTHERLAND

PROJECT TITLE

HANSON TWEED SAND PLANT

PHASE 5-11

DRAWING TITLE

CONCEPT DEVELOPMENT PHASING

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	PASHING ARRANGEMENT CHANGES - REQ. PLANNER	25.01.2021	ZP	LN	LN	LN

ISSUE: PRELIMINARY	CLIENT: HANSON CONSTRUCTION MATERIALS PTY LTD
BASE PROVIDED BY: SIXMAPS DCDB	MANAGER: LANCE NEWLEY

ZONE PLANNING GROUP

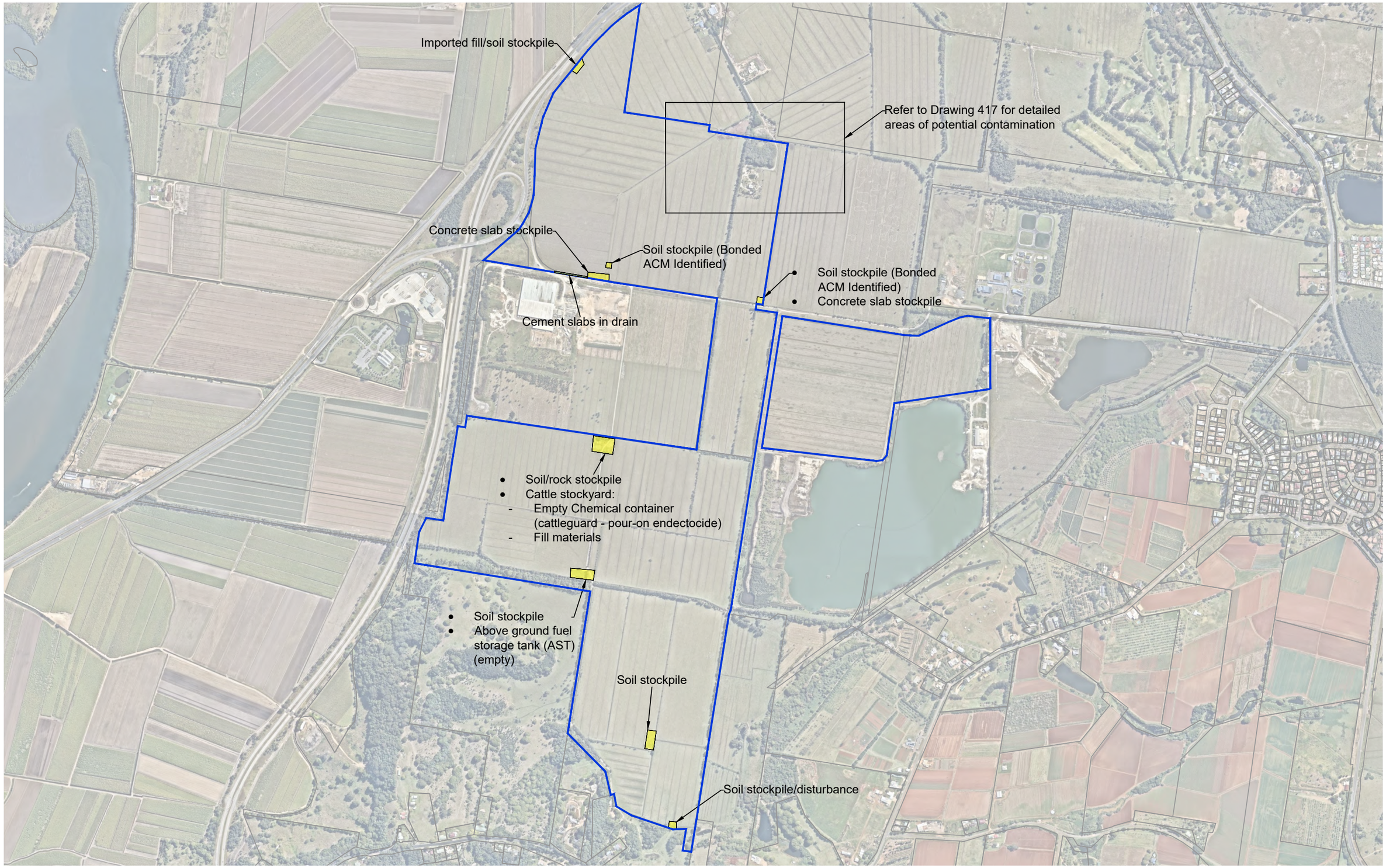
GOLD COAST
1638 Tweed Street, Burleigh Heads QLD 4220
PO Box 3805, Burleigh Town QLD 4220

GLADSTONE
2/172 Goondoon St, Gladstone, QLD 4680
PO Box 5332, Gladstone QLD 4680

zonelandscape.com.au | 07 55622303

JOB / DRAWING NO:
Z19163- 104

SHEET NO.
SHEET 01 OF 01



ORIENTATION

SCALE 1:12 500

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metres

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LEGEND

- Assessment Boundary
- Lot Boundaries
- Potentially Contaminated Area

SOURCES

Image: Nearmap 2020. Image date: 14/09/2020

PROJECT	CLIENT	DRAWING
TWEED SAND PLANT EXPANSION	HANSON CONSTRUCTION MATERIALS	LOCATION OF POTENTIALLY CONTAMINATED AREAS

SCALE	DATE	DRAWN	CHECKED	PROJECT	DRAWING	REVISION
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GILBERT SUTHERLAND