Soil and Water Management Sub Plan

Kingscliff High School Upgrade
SSD-8744305

January 2023

Rev 4

RICHARD CROOKES CONSTRUCTIONS

Document control

Approval and authorisation

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1	Richard Crookes	REV2
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Glossary / Abbreviations

Abbreviations	Expanded text
ASS	Acid Sulphate Soil
CEMP	Construction Environmental Management Plan
CLMP	Contaminated Land Management Plan
CSWMSP	Construction Soil and Water Management Sub-Plan
DP&E	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DSI	Detailed Site Investigation
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESCP	Erosion and Sediment Control Plan
EEC	Endangered Ecological Community
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EWMS	Environmental Work Method Statements
OEH	Office of Environment and Heritage
PASS	Potential Acid Sulphate Soil
PIRMP	Pollution Incident Response Management Plan
POEO Act	*Protection of the Environment Operations Act 1997*
TSC Act	*Threatened Species Conservation Act 1995*

1 Introduction

1.1 Context

The Kingscliff High School Upgrade Project obtained approval SSD-8744305 under Section 4.38 of the Environmental Planning and Assessment Act 1979 by the Minister of Planning and Public Spaces on the 3rd November 2021.

This Construction Soil and Water Management Sub Plan (CSWMSP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Kingscliff High School (KHS) Upgrade (the Project).

This CSWMSP has been prepared to address the requirements of the Kingscliff High School Upgrade Environmental Impact Statement, and all applicable legislation.

1.2 Background and project description

The Kingscliff High School Upgrade Project will include the demolition of existing facilities including carparks, along with the following planned upgrades;

- Construction of a new Visual Arts, Music and Performance Building (Building O) in the north-western portion of the site;
- Refurbishment of a car park to the east of Building O;
- New bike parking facilities in the northern portion of the site;
- An extension to the south of the existing Building A;
- A new hydrant booster, tank and pump room in the north-eastern portion of the site;
- A new Covered Outdoor Learning Area (COLA) to the east of existing Building H;
- Demolition of a footpath and new landscaping works to the north of the current Building F; and
- Alterations and refurbishment of existing buildings C and G.

The Project site is located in the town of Kingscliff, in the Northern Rivers region of New South Wales (NSW), within the Tweed Shire Local Government Area (LGA).

The Environmental Impact Statement (EIS) prepared by SJB Planning on behalf of the NSW Department of Education (DoE) in support of State Significant Development Application (SSD) SSD-8744305, assessed the impacts of construction and operation of the Project on soils and water, within chapter 6.15.

The EIS identified the potential for direct and indirect impacts on water quality but concluded that provided the proposed mitigation and management measures are implemented, no significant long-term impacts would be expected.

This plan is to meet condition B19 of SSD-8744305. A compliance matrix is set out in Table 1.

Table 1: Condition B19 Compliance Table

Condition	Condition Requirements	Document Reference (Page Number)
B19	The Applicant must prepare a Construction Soil and Water Management Sub-Plan (CSWMSP) and the plan must address, but not limited to the following:	
	be prepared by a suitably qualified expert, in consultation with Council	Appendix D
	measures to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving site	17 Appendix A
	describe all erosion and sediment controls to be implemented during construction, including as a minimum, measures in accordance with the publication Managing Urban Stormwater: Soils & Construction (4th edition, Landcom 2004) commonly referred to as the 'Blue Book'	13
	include an Acid Sulfate Soils Management Plan, if required, including measures for the management, handling, treatment and disposal of acid sulfate soils, including monitoring of water quality at acid sulfate soils treatment areas	Appendix C
	provide a plan of how all construction works will be managed in a wet-weather events (i.e. storage of equipment, stabilisation of the Site)	Appendix A
	detail all off-site flows from the site	10-14-15-19
	describe the measures that must be implemented to manage stormwater and flood flows for small and large sized events, including but not limited to 1 in 5-year ARI.	Section 6.3 15+19 Appendix A

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how Richard Crookes Construction proposes to manage and protect soil and water quality during construction phase of the Project.

2.2 Objectives

The key objective of the CSWMSP is to ensure that impacts on soil and water quality during construction are minimised.

To achieve this objective, Richard Crookes Constructions will ensure that:

- Appropriate controls and procedures are implemented and maintained during construction activities to avoid or minimise potential erosion and sedimentation impacts, impacts to water quality and marine environments adjacent to the Project site.
- Safeguards outlined in the EIS prepared of the Project are addressed and assigned responsibility in this Plan.
- Compliance with Condition B19 of the SSD application number SSD-8744305.

2.3 Targets

The following targets have been established for the management of soil and water impacts during the Project:

- Ensure full compliance with the relevant legislative requirements and the EIS.
- Minimise and manage potential soil and water quality impacts from the construction phase of the Project.
- Manage water quality impacts attributable to the project (i.e. maintain waterway health by avoiding the introduction of nutrients, sediment and chemicals outside of that permitted by the environmental protection licence and/or ANZECC guidelines).
- Ensure training on best practice soil and water management is provided to all construction personnel through site inductions.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

All legislation relevant to this CSWMSP is included in the CEMP.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this plan include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
- Department of Environment and Conservation (DEC): Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu" November 1997
- Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004
- Tweed Heads Development Control Plan (DCP) 2008.
- Protection of the Environment Operations (POEO) Act 1997
- Contaminated Land Management Act 1997

4 Existing Environment

The following sections summarise what is known about factors influencing soils and water within and adjacent to the Project site.

The key reference document is the EIS prepared by SJB Planning, dated May 2021.

4.1 Existing Soil Landscape

The site is situated on the Cudgen variant cub soil landscape. This soil landscape is characterized sandy, deep (>100 cm), well-drained Krasnozems. The Cudgen (cub) landscape is characterized low hills and rises formed on top of lamington basalts (eSPADE 2021).

4.2 Geology

The NSW Government soil map index shows the site to be located on Lamington Volcanics - Tertiary basalt, with members of rhyolite, trachyte, tuff, agglomerate & conglomerate (eSPADE 2021).

4.3 Groundwater

The detailed site investigation (DSI) states that there are ten registered groundwater bores located within 1km of the site, with the nearest groundwater bore located approximately 330m south-west of the site and used for irrigation purposes. The depth to groundwater in the bores ranged from 1.8m bgl to 12 m bgl, and yields ranged from 0.25 to 3.4 L/s.

4.4 Acid sulphate soils

Borehole testing undertaken across the site indicated the risk of Potential Acid Sulphate Soils (PASS) with the excavation of soils from a depth of 0.75m below ground level or greater. In accordance with Clause 4.5.5 of the EIS an ASS management plan (ASSMP) has been prepared as a part of a Detailed Site Investigation (DSI) by Douglas Partners (ref: 97611.00) in July 2021 and is to be implemented where the excavation of soils from a depth of 0.75m or greater is required to facilitate the proposal. The ASS management plan is located in Appendix C of this plan.

4.5 Climate and rainfall

The Kingscliff climate is sub-tropical with mean temperatures ranging between a mean minimum of 12°C in July and a mean maximum of 29°C in January. The annual mean rainfall is 1284 mm, with the highest monthly mean rainfall recorded in the month of February (Bureau of Meteorology, 2021).

4.6 Surface Water

The DSI states that the location and regional topography of the site indicates that excess surface water and flows towards Cudgen Creek, located approximately 270m south-east of the proposed development area.

4.7 Flooding

The Drainage and Flood Assessment undertaken by GHD on 13 August 2021 (ref:12540727) found that the proposed development was mostly unaffected by overland flow originating from upstream catchments and surcharge of the existing stormwater network.

4.8 Contamination

The DSI for the site states based on site history information and a site inspection, the potential for contamination at the site is considered to be relatively low and arise primarily from two sources:

- Fill material that may have been imported to the site during filling of a former dam and construction of the high school; and
- Historical agricultural use.

Contaminants of potential concern included:

- Metals/metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
- Total Recoverable Hydrocarbons (TRH);
- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Organochlorine Pesticides and Organophosphate pesticides; and
- Asbestos.

The Douglas Partners Report concluded that there is no contamination based human or environmental health risk at the site and no further investigation was required.

5 Environmental aspects and impacts

The key aspects and potential impacts associated with the management of soil and water during the delivery of works are listed in Table 2.

These potential impacts and opportunities have been considered in the development of this CSWMSP and site-specific procedures for the works.

Table 2: Aspects, Potential Impacts, and Mitigation Measures

Aspects	Potential impacts	Mitigation Measures
Discharge of contaminated water from within site boundary during rainfall.	• Contamination of downstream watercourses • Contamination of soils	Section 6.1, 6.6 and 6.3
Concrete washout	• Contamination of downstream watercourses • Contamination of soils	Bunded area to be provided
Dust from the worksite or from vehicles	• Potential pollution of waterways and air	Section 6.1.2.2
Earthworks/Embankment works/platform excavation works	• Potential spread of contamination into soils /surface or groundwater • Personnel exposure to contaminants • Sediment degrading surrounding environment • Change to flooding characteristics	Section 6.1.3
Flooding of worksites	• Contamination of floodwaters by sewage, fuels and/or chemicals onsite	Section 6.3 and Section 6.4
Leaks or spillages of fuels, oils and grease from construction plant and equipment at compounds.	• Contamination of soil • Contamination of stormwater systems, watercourses, riparian environment • Personnel exposure to contaminants	Section 6.4
Sediment laden runoff during rainfall	• Runoff entering drainage lines causing pollution and impacting aquatic life downstream.	Section 6.1.3
Sediment tracking onto public roads from vehicles leaving site.	• Potential impact on traffic safety • Potential for sediment laden runoff during rainfall • Potential for generation of dust	Section 6.1.2.2
Storage of hazardous substances	• Contamination as a result of a spill • Impact to stormwater systems and watercourses from pollution	Section 6.4
Construction laydown spills	• Contamination as a result of a spill • Impact to stormwater systems and watercourses from pollution	Section 6.4
Inappropriate management (handling, stockpiling, transport, and disposal) of identified contamination or contaminated materials encountered during demolition/construction works.		Section 6

6 Environmental mitigation and management measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS. Specific actions and processes which will be implemented to comply and address the requirements and measures are outlined below and summarised in Table 3.

6.1 Erosion and sediment control

This section outlines the erosion and sediment control measures to be implemented during the construction phase of the Project.

6.1.1 General principals

Erosion and sediment control measures are to be implemented and maintained in accordance with *Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book).

Erosion and sediment control measures on land are to be implemented and maintained to:

- Prevent sediment moving off-site and sediment laden water entering any water course, draining line, or drain inlets.
- Reduce water velocity and capture sediment on-site.
- Minimise the amount of the material transported from site to surrounding pavement surfaces.
- Divert clean water around the site.

6.1.2 Sediment Loss

Calculations on the sediment loss for the proposed earthworks phase of the project indicate the Erosion Hazard is very low. Soil loss has been calculated at 51 t/Ha/year. Soil Loss calculations are provided as Appendix B6.1.3 Erosion and Sediment Control

Sediment control measures (e.g. sediment fencing, silt curtain, mesh or gravel “sausage”) must be installed prior to any construction activities commencing to prevent sediment and any other material (e.g. concrete, grout) moving off-site and entering any water course, drainage line or drain inlets. Dirty water or foreign material must not be released into drainage lines and/or waterways.

Erosion and sedimentation controls are to be checked weekly and maintained as required (including clearing of sediment from behind barriers). Records of inspections and maintenance works undertaken are to be kept on-site and provided on request.**6.1.4 Vehicle Access**

The site access point shall be stabilised, and fencing (e.g. sediment fence or barrier) used to restrict all vehicular movements to that point. Any temporary access points shall be constructed in accordance with Figure 2 Standard Drawing SD 6-14, Appendix A. Stabilised access points with rumble grids or wheel washes to prevent mud tracking on roads will be established. Longer term and/or heavily used haul roads will generally be sealed. Sealed haul roads will be regularly cleaned.

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The calculated value is less than the threshold (150t soil loss/ Hectare / year) whereby the requirement to install a sediment basin is triggered. Therefore, only 2nd and 3rd level erosion and sediment control measures shall be required to be implemented as per the ESCP for the site.

6.1.5 Stockpile management

The following stockpile management measures shall be applied:

- Stockpiles must be located at least 5 m from likely areas of concentrated water flows, and more than 10 m from any waterway.
- Stockpile heights shall not exceed 4 m, and slopes shall not be steeper than 2:1.
- Adequate sediment control measures must be installed prior to stockpiling material.
- Stockpiles that will be in place for more than 20 days, or which are susceptible to wind or water erosion, shall be covered or otherwise protected from erosion, within 10 days of forming each stockpile.

6.1.6 Sediment Basins

Sediment basins are designed to capture and provide settlement time for colloidal suspended particles with treatment. These basins are located to achieve maximum water flows from the disturbed catchments only and require other controls to ensure that clean water from undisturbed catchments is not directed to these basins.

All basins will be constructed in accordance with the principles of Managing Urban Stormwater: Soils and Construction (Landcom 2004).

As a minimum, one basin is to be constructed in accordance with the blue book design capacity based on the 80th percentile 5 day rainfall depth for Tweed Heads (Blue Book Table 6.3a). Rainfall above the basin design rainfall depth of 48.5mm.

Once runoff into the basin has ceased, treatment of the basin with an approved flocculent can commence. Once the flocculent has been added, the basin will be re-tested to check total suspended solids and pH levels.

The sediment basin must have capacity returned rainfall depth marked in the basin within the required number of days (5 days) within runoff into the basin ceasing. Where an initial rainfall event ceases and a second rainfall event commences within 5 days of the first event, the 5 day time limit will re-start.

Basin flocculation takes approximately 3 days to achieve settlement, leaving 2 days to return the basin (pumping or other methods) to capacity in normal conditions, however where extended rainfall periods occur or during higher rainfall periods, some basins may not be able to return to capacity.

RCC intend to treat the sediment basin as soon as practical and safe to access the site. In addition, pre-rainfall actions which will assist in treating basins, these include:

- Adding gypsum to the floor and walls of all basins prior to commissioning the basins.
- Adding gypsum to the inlets of all basins prior to forecast rainfall.
- Pre rainfall controls inspections.

6.1.7 Sediment Controls

- Sediment controls will be installed around stormwater inlet pits and where they will not cause or exacerbate flooding. Traffic management and safety will need to be considered if installing such devices on or near live traffic.
- Turbid construction runoff will be diverted into sediment retention devices such as sediment sumps, sediment fences and other sediment traps where feasible to prevent surface run-off from leaving the site.
- Sediment removed from any trapping device will be relocated where further pollution to downslope lands and waterways cannot occur.
- Mulch bunds will not be used in concentrated flow areas or if they have the potential to result in tannin leachate into waterways.

- All erosion and sediment controls will be inspected at weekly, before a site closure of two days or more, prior to and after rainfall exceeding 20 mm in 24 hours. Maintenance will be carried out as required prior to the next forecast rainfall event. Details of inspection will be maintained via the Site Manager's weekly diary.
- Concrete washout will be confined to designated concrete washout locations or using a Concrete Waste Separation Unit (CWSU), which allows for recycling of concrete waste.
- Clean water diversions to be constructed and stabilised around work areas
- No stockpiles of materials or storage of fuels or chemicals would be located adjacent to the existing culverts.
- Stockpiles will not be placed within 2m of hazards areas including likely areas of high velocity flows such as paved areas and driveways.
- Temporary sediment traps will be retained until after revegetation/rehabilitation.

6.2 Water quality monitoring program

Water quality monitoring will take place for all dewatering works in accordance with the ANZG water quality guidelines. Where practicable any water collected in excavations / site works will be used within the premises (e.g. dust suppression, watering retained vegetation).

For reuse of water onsite, the following criteria must be met:

- pH – 6.5 to 8.5
- No visible oil and grease
- No potential for water to leave the premises
- No surface runoff will be generated from the reuse (reuse includes dust suppression, watering retained vegetation etc.)
- No potential for water to reach any watercourse

If stormwater is collected within the sediment storage basin and can not be beneficially reused onsite, then the following water quality objectives in accordance with the ANZG water quality guidelines for freshwater 95% percentile required prior to discharge:

- pH – 6.5 to 8.5
- Total Suspended Solids (TSS) <50mg/L
- No visible oil and grease
- Aluminium <0.007mg/L

Treatment, validation and discharge is required within 5 days of rainfall causing run-off that exceeds the sediment storage basin zone. (300mm or 10% of volume from base of sediment basin)

6.3 Flooding

The following measures will be implemented to mitigate the impacts of stormwater and flood flows during large rainfall events:

- Stockpiling and storage of materials to occur outside potential flood areas.
- Temporary facilities and hazardous material storage to be above flood levels.
- Maintain overland flow paths.
- Construction equipment (or excess material) would be removed from flood prone areas where significant events are predicted.
- Site sheds and chemical stores will be protected from the anticipated flood events.

- Site inspections will be completed to ensure all erosion and sediment controls are in place prior to the significant event.
- Where applicable, temporary levees or bunds would be strategically placed to contain potential flooding impacts resulting from any temporary works on the floodplain and minimise the risk to surrounding properties which might otherwise be affected.
- In extreme flood events, such as 1 in 100 year ARI, temporary sandbags or diversions will be strategically placed to partially divert excessive floodwater flows away from the site and prevent overloading of stormwater drains and loss of large amounts of soil from site. Internal drainage systems will be inspected, reviewed and bolstered as necessary.

6.4 Wet Weather Event Procedure

RCC will undertake the following monitoring and inspections detailed in Table 3 relating to wet weather events.

Monitoring	Description
Daily Weather Forecast	Daily monitoring of BOM website for weather forecasts including hourly monitoring of the rainfall radars in the lead up and during a wet weather event
Pre rain Inspection	Pre rainfall inspection of the entire site to ensure that all erosion/sedimentation and stabilisation controls are in place and in effective working order. This is to occur prior to a forecast rainfall event where it is a >80% probability of a 10mm or greater rainfall event on the BOM website forecast. The pre rainfall inspection includes the relocation of materials that could cause environmental incidents such as potential pollution incidents onto higher ground and away from flood prone areas.
Inspections during rainfall event	Inspections of the site daily during a prolonged rainfall event to ensure that the all erosion/sedimentation and stabilisation controls functioning effectively and no emergency repairs or maintenance is required. Note that this inspection during rainfall is subject to obtaining safe access to site and should not occur if it will increase the environmental or safety risk, for example mud tracking on public roads.
Post rain inspection	Post rainfall inspection are to occur after a rainfall event >10mm has occurred. These inspections should occur within 24 hours after the rainfall event and should identify any maintenance requirements for the erosion/sedimentation and stabilisation controls. The post rainfall inspections will also identify dewatering requirements onsite including testing and treatment of water captured in construction sediment basins and sumps.

Table 3 Wet Weather Event Procedure

6.5 Acid Sulphate Soils

According to the DSI, PASS is present in the southwestern section of the development are below a depth of 1.5m BGL. Although major excavation of soil below this depth I not expected to be required for the development, if any minor excavation of soil below 1.5m occurs within the southwestern section of the site, neutralisation with lime will be required.

An ASS management plan (ASSMP) has been prepared as a part of the DSI and is to be implemented where the excavation of soils from a depth of 1.5m or greater within the southwestern section is required to facilitate the Project. An excerpt of the ASSMP is provided as Appendix C.

6.6 Spill prevention and response

The following control measures shall be implemented to minimise the risk of pollution caused by accidental leaks or spills:

- No vehicle wash-down shall occur on-site.
- The lowest volume of hydrocarbons (oil, grease, petrol and diesel) practicable will be stored on-site.
- Chemical storage areas will be bunded and chemicals will be stored in accordance with the products Safety Data Sheet (SDS). All fuels, chemicals and hazardous liquids must be stored away from drainage lines, within an impervious bunded area, and not on slopes steeper than 1:10.
- Refuelling and maintenance of vehicles, plant, and equipment shall not be undertaken at any location which drains directly to waters without appropriate temporary bunding being provided. Refuelling operations must not be left unattended.
- An emergency spill kit is to be kept on site at all times and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site.
- Any leaks or spills must be managed and cleaned up in accordance with RCC’s Spill Response Procedure.
- All construction equipment must be inspected by qualified personnel prior to the commencement of work to reduce the risk of hydrocarbon spills or leaks.
- Vehicles and plant must be properly maintained and regularly inspected for fluid leaks.
- Portable toilets must be positioned securely within approved compound areas and emptied on a regular basis using a licensed service provider and human waste disposed of to a local sewerage treatment plant.

6.5 Importation of Soil

Imported soil materials must comprise Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM).

In accordance with SSD-8744305 Condition C22, Richard Crookes must:

- Ensure that only VENM, ENM, or other material that meets the requirements of a relevant order and exemption issued by the EPA, is brought onto the site;
- Keep accurate records of the volume and type of fill to be used;
- Make these records available to the Certifier upon request;

- Ensure the exportation of waste (including fill or soil) from the site is in accordance with the provisions of the Protection of the Environment Operations Act 1997 and the NSW Environment Protection Authority “Waste Classification Guidelines”; and
- Ensure the exportation of waste is transported to a licenced waste facility or an approved site subject to a resource recovery order and exemption.

Soil classification and movement records must be kept by Richard Crookes for no less than seven years.

Table 3: Soil and Water management and mitigation measures

ID	Environmental Aspect	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference
SW1	Sediment laden runoff during rainfall	Erosion and sediment control measures are to be implemented and maintained in accordance with *Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book)	Environmental Consultant	Ongoing	Project Manager or their delegate	Best practice, EIS, Conditions of Consent B19c
SW2	Sediment laden runoff during rainfall	Sediment control measures (e.g. sediment fencing, silt curtain, mesh or gravel “sausage”) must be installed prior to any construction activities commencing.	Sediment fencing, silt curtain etc.	Ongoing	Project Manager or their delegate	Best practice, EIS, Conditions of Consent B19c
SW3	Sediment tracking onto public roads from vehicles leaving site.	A stabilised site access point shall be established prior to construction works commencing. Measures must be in place to ensure that sediment and other materials are not tracked onto roadway by vehicles leaving the site.	Temporary fencing etc.	Pre-construction	Project Manager or their delegate	Best practice, EIS, Conditions of Consent B19b

ID	Environmental Aspect	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference
SW4	Inappropriate management (handling, stockpiling, transport, and disposal) of identified contamination or contaminated materials encountered during demolition / construction works.	Any stockpiles must comply with the requirements outlined in Section 6.1.2.		Ongoing	Project Manager or their delegate	Best practice, EIS
SW5	Leaks or spillages of fuels, oils and grease from construction plant and equipment at compounds.	Any leaks or spills must be managed and cleaned up in accordance with the RCC Spill Response Procedure.		As required	Project Manager or their delegate	Best practice, EIS
SW6		Vehicles and plant must be properly maintained and regularly inspected for fluid leaks.		As required	All staff	Best practice, EIS
SW7	Storage of hazardous substances	The lowest volume of hydrocarbons (oil, grease, petrol and diesel) practicable will be stored on-site.		Ongoing	Project Manager or their delegate	Best practice, EIS
SW9		Chemical storage areas will be bunded and chemicals will be stored in accordance with the products Safety Data Sheet (SDS). All fuels, chemicals and hazardous liquids must be stored away from drainage lines, within an impervious bunded area, and not on slopes steeper than 1:10.		Ongoing	Project Manager or their delegate	Best practice, EIS

ID	Environmental Aspect	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference
SW8	Leaks or spillages of fuels, oils and grease from construction plant and equipment at compounds.	All construction vehicles and equipment must be inspected by qualified personnel prior to the commencement of work to reduce the risk of hydrocarbon spills or leaks.		Ongoing	Project Manager or their delegate	Best practice, EIS,
SW9	Flooding of worksites & Sediment laden runoff during rainfall	Provide a plan of how all construction works will be managed in a wet-weather event (i.e. storage of equipment, stabilisation of the site).		Ongoing	Project Manager or their delegate	Best Practice, Conditions of Consent B19e
SW10	Discharge of contaminated water from within site boundary during rainfall. & Sediment laden runoff during rainfall	Detail all of-site flows from the site		Ongoing	Project Manager or their delegate	Best Practice, Conditions of Consent B19f
SW11	Discharge of contaminated water from within site boundary during rainfall. Sediment laden runoff during rainfall	Describe the measures that must be implemented to manage stormwater and flood flows for small and large sized events, including, but not limited to 1 in 5-year ARI		Ongoing	Project Manager or their delegate	Best Practice, Conditions of Consent B19g
SW12	Acid Sulfate Soils	Adherence to the Acid Sulfate Soils Management Plan - Appendix C				Conditions of Consent B19d

7 Compliance management

7.1 Roles and responsibilities

The Richard Crookes Construction Project Team's organisational structure and overall roles and responsibilities are outlined in the CEMP and Table 3 of this plan.

7.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to soil and water management issues. The induction training will address elements related to soil and water management including the mitigation and management measures outlined in Section 6 of this plan. Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in soil and water management.

7.3 Monitoring and inspection

Routine inspections of erosion and sediment controls will occur weekly and prior to, during and following significant (>25mm) rainfall over a 24-hour period to determine if controls are adequate. Monitoring of surface water will be required if water discharge off site is necessary. Water quality must meet the ANZG Water Quality Guidelines or Section 120 of the POEO Act.

7.4 Weather monitoring

Rainfall at the premises will be measured and recorded in millimetres per 24-hour period at the same time each day from the time that the site office associated with the activities is established.

7.5 Reporting

The contractor shall maintain a documentation and record system in support of this CSWMSP monthly reporting requirements to enable review and auditing of management systems and procedures. Monthly reporting includes information on relevant soil and water data, summary and includes the reporting if any incidents and non-conformance.

Reporting requirements are outlined in the CEMP.

8 Review and improvement

8.1 Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.
- Make comparisons with objectives and targets.

References:

ASSMAC,1998, *NSW Acid Sulfate Soils Manual*.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000.

Bureau Of Meteorology, Gold Coast Seaway Summary Statistics 2021.

Douglas Partners,2021,Detailed Site Investigation, Far North Coast Schools Project Kingscliff High School.

GHD, 2021, *Kingscliff Schools Drainage and Flooding Assessment.*

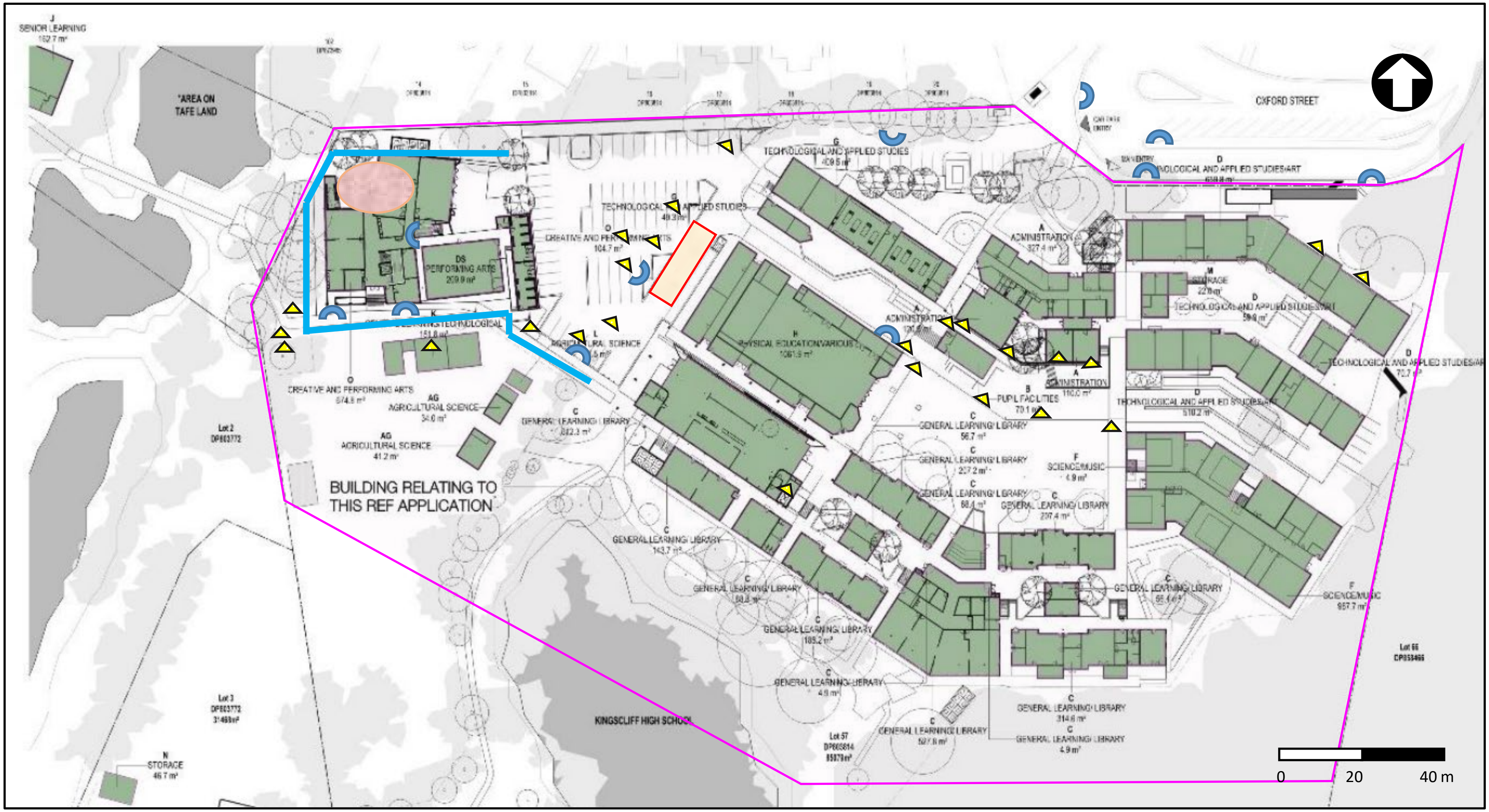
Landcom (2004), Managing Urban Stormwater: Soils and Construction (Blue Book).

Richard Crookes Constructions,2021*, Construction Environmental Management Plan, Kingscliff High School Upgrade.*

SJB Planning, 2021, *Environmental Impact Statement, Kingscliff High School.*

Appendix A –ESCP Drawing

Appendix A –ESCP Drawing



Legend

▬	Sediment Fence
◠	Wire Mesh/Gravel Sediment Filter
🟪	Construction Area
⬭	Stockpile
▭	Stabilized Site Access
▲	Drop Inlet Sediment Trap

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Figure 1 – ESCP Drawing
33 Oxford Street, Kingscliff 2487

Project: Kingscliff High School Upgrade
Client: Richard Crookes Construction
ENV Project Number: 216222

STABILISED SITE ACCESS SD 6-14

CONSTRUCTION NOTES

1. Strip the topsoil, level the site and compact the sub-grade
2. Cover the area with geotextile
3. Construct a 200mm thick pad over the geotextile with Ø40-70mm aggregate
4. Ensure the structure is at least 15m long or to the building alignment and at least 3m wide
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence
6. If required, inclusion of a shaker grid may be included at the construction site end of the stabilised site access

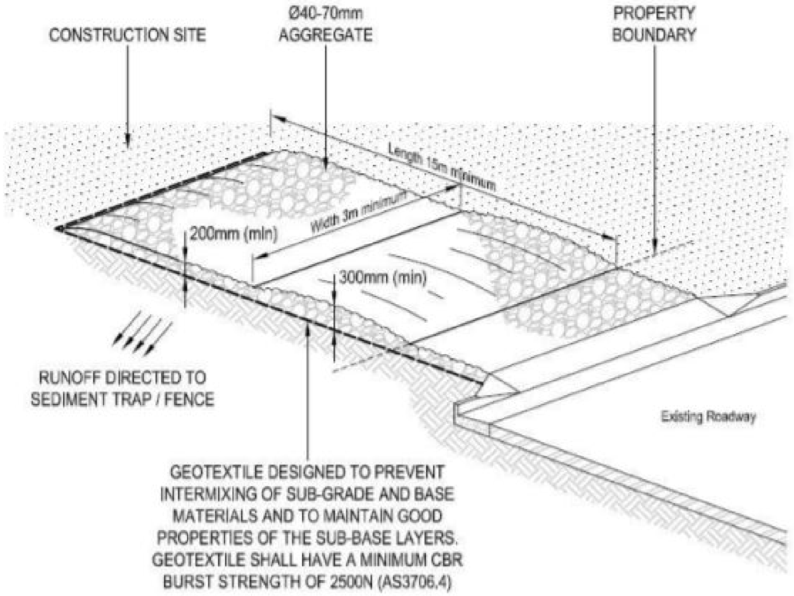

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Figure 2 – Standard Drawing 6-14
33 Oxford Street, Kingscliff 2487

Project: Kingscliff High School Upgrade
Client: Richard Crookes Construction
ENV Project Number: 216222

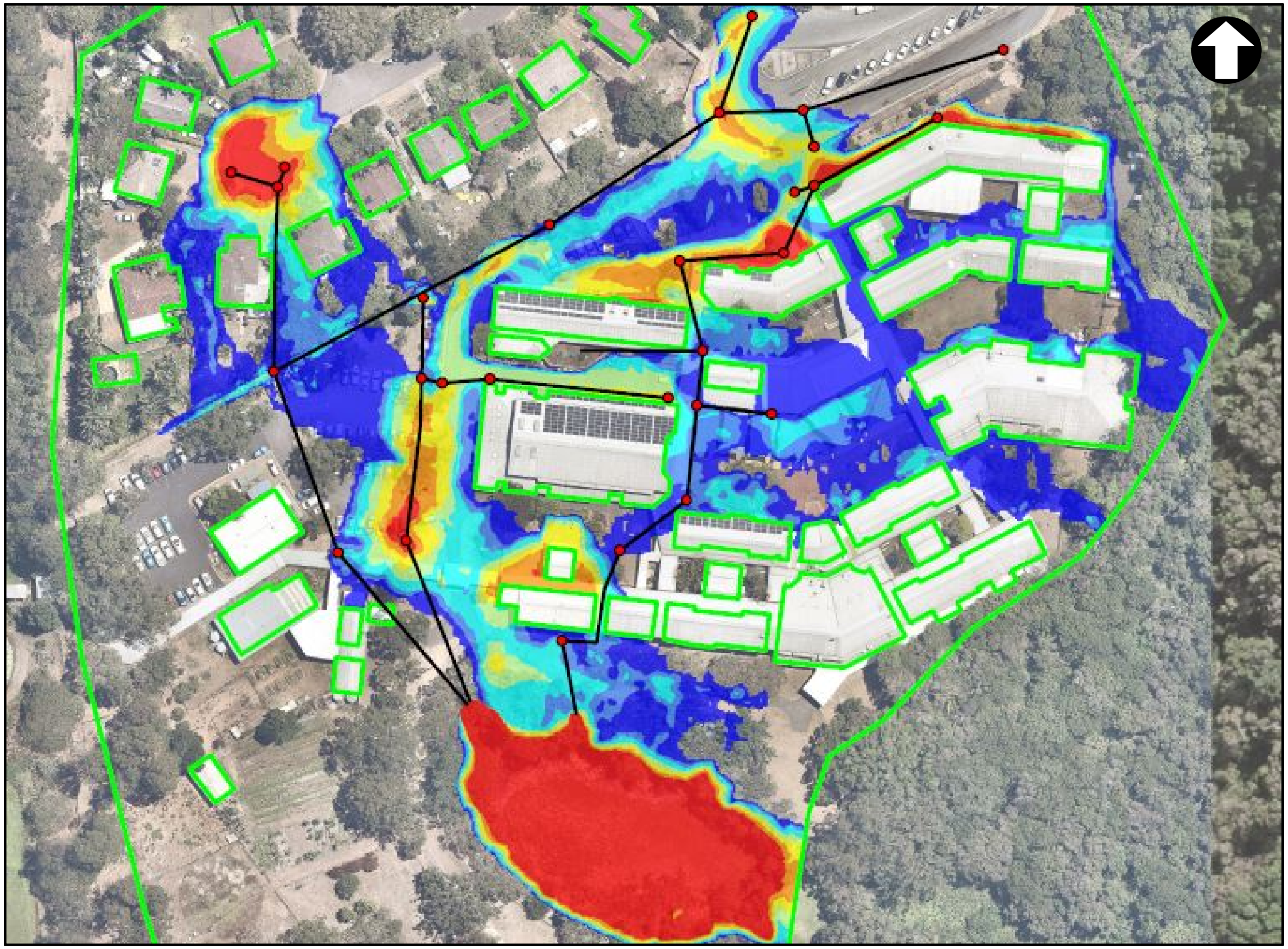

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Figure 3 – Excerpt of GHD Flood Level Map (1 in 100-year ARI)
33 Oxford Street, Kingscliff 2487

Project: Kingscliff High School Upgrade
Client: Richard Crookes Construction
ENV Project Number: 216222

Image Source: GHD (2021). NSW Department of Education SINSW01427-20 - Kingscliff High School Flooding Assessment Phase 2

Appendix B – Soil Loss Calculations

Site area	**Sub-catchment or Name of Structure**						**Notes**
	West						
Total catchment area (ha)	0.52						
Disturbed catchment area (ha)	0.5						

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	F						From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)	25						Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)	25						
% clay (fraction finer than 0.002 mm)	50						
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	F						Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5						See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	85						
x-day, y-percentile rainfall event (mm)	57						
Rainfall R-factor (if known)	8200						Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)							

RUSLE Factors

Rainfall erosivity (*R*-factor)	8200						Auto-filled from above
Soil erodibility (*K*-factor)	0.015						RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	100						
Slope gradient (%)	1.5						
Length/gradient (*LS*-factor)	0.32						
Erosion control practice (*P*-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1	1	1	1	1	1	

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Storage (soil) zone design (no of months)	2						Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.51						See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	51						
Soil Loss Class	1						See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	39						Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	3						See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	151						See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	154						

Appendix C – Acid Sulfate Soils Management Plan
Douglas Partners (2021) Report on Detailed Site Investigation for Contamination Far North Coast Schools Project

Note: the ASSMP is an excerpt of the full document.

Appendix C – Acid Sulfate Soils Management Plan
Douglas Partners (2021) Report on Detailed Site Investigation for Contamination Far North Coast Schools Project

Note: the ASSMP is an excerpt of the full document.

13. Acid Sulfate Soil Management Plan (ASSMP)

As detailed above, PASS is present at the site below a depth of approximately 0.75 m bgl. If any excavation of soil from approximately 0.75 m or below occurs the procedures detailed in this ASSMP should be implemented.

The objective of the ASSMP is to reduce the potential on- and off-site environmental impacts associated with the disturbance of PASS identified at the site.

13.1 Management Strategy for On-Site Treatment

13.1.1 Overview

If soil below 0.75 m is excavated it is required to be neutralised with lime. Liming is required to control the oxidation of pyritic material contained within the soil when released from below the water table into aerobic conditions, with the associated generation of acid.

It follows that, where lime neutralisation treatment is to be undertaken, it will require management in a controlled environment, in a bunded and lined pad with perimeter drainage and a sump, in order to enable the collection and separate treatment of any acid leachate formed during the soil drying and liming process. The proposed treatment area is located in the north-western section of the site, as shown in the attached Drawing 2.

It should be noted that saturated soil cannot be neutralised effectively with lime, particularly where it is cohesive. This is because the lime must be well mixed into the soil and this cannot be performed when the soil is overly wet and ‘sticky’. Hence, the excavated soil must be dried back on a lined pad before effective mixing can take place with earthmoving machinery.

All water draining from the soil, once it is removed from the excavation, should be considered as potentially acidic and should be separated in a controlled area, such as the aforementioned bunded and lined pad, and not be allowed to flow back into waterways or stormwater until it has been tested for pH and for any other environmental tests required by the appropriate regulatory authority.

13.1.2 Neutralisation Pads

On-site neutralisation of ASS should be carried out as follows:

- Prepare a liming pad/stockpile site of appropriate area for the volume of soil to be treated. The pad should be prepared on relatively level or gently sloping ground to minimise the risk of any potential instability issues, with a natural (or shaped) fall to the local drainage sump.
- The surface of the pad should be lined with selected approved compacted clay (at least two layers to a combined compacted thickness of 0.5 m) or a geosynthetic liner.
- A guard layer of fine agricultural lime (i.e. aglime) should be applied over the clay subgrade or compacted clay liner, to neutralise downward seepage. The guard layer of lime should be applied at a rate of approximately 5 kg lime per square metre of surface area for every 1 m height of stockpiled soil.
- The excavated soil should then be spread onto the guard layer in layers of 200 mm to 300 mm thickness, leaving a 1 m flat area between the toe of the spread soil and the containment bund or

drain. When spreading the first soil layer, care should be taken not to churn up the lime guard layer.

- Let the soil dry back to facilitate lime mixing (if too wet, then adequate mixing of lime cannot be undertaken).
- Apply aglime to the stockpiled soil over each spread layer and harrow for thorough mixing prior to spreading the next layer. The liming rate required varied considerably between sampling locations, ranging from 2.1 kg/t to 58 kg/t. In general, an overall liming rate of 30 kg/t would be expected to sufficiently neutralise PASS in most locations on-site, however in some locations up to 58 kg/t may be required. The validation testing procedure described in Section 13.1.4 will identify whether the liming rate is sufficient to neutralise PASS.
- Continue the spreading/liming/harrowing cycle until excavation is complete.
- Liming pads should be bunded off, and a circumference drain excavated to collect and localise leachate. The drain and inner bund slopes should be covered with a layer of fine lime applied to neutralise any possible leachate migrating from the stockpiled material.
- When testing indicates that lime neutralisation is complete, then the stockpiled soil may be removed from the liming/neutralisation pad.

Figure 1 below shows a schematic cross section of a treatment pad, extracted from Dear et al (2014)[11].

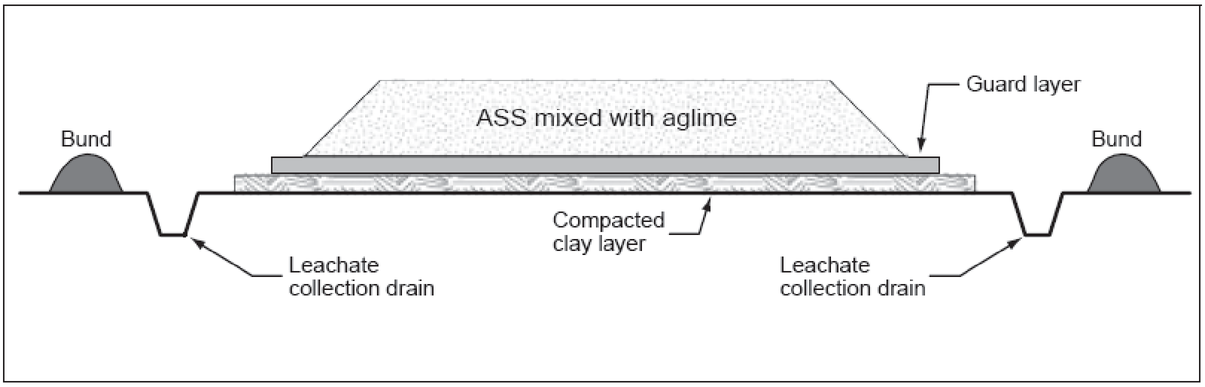

Figure 1: Schematic cross section of treatment pad

Liming of each area of excavation should be pre-planned and appropriate liming pads constructed. Allowances should be made during construction planning to occupy sufficient land to allow for these liming pads. Leachate collection location, lining and construction should be similarly pre-planned.

13.1.3 Neutralising Materials

Aglime should be used as the preferred neutralisation material for the management of ASS as it is usually the cheapest and most readily available product available for soil neutralisation. This material is mildly alkaline (pH of 8.5 to 9), of low solubility, and does not present any handling problems if used correctly. The aglime comprises calcium carbonate typically made from limestone that has been finely ground and sieved to a fine powder.

The aglime purity should preferably be 95% or better, (i.e. NV >95, where NV is the neutralising value, a term used to rate the neutralising power of different forms of materials relative to pure, fine calcium

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[11] Dear SE, Ahern CR, O'Brien LE, Dobos SK, McElnea AE, Moore NG and Watling KM (2014) *Queensland Acid Sulfate Soils Technical Manual: Soil Management Guidelines*, QLD Department of Science, Information, Technology, Innovation and the Arts.

carbonate which is designated NV = 100). Aglime is typically sold at an NV of 95% to 98%. There could be economic justification for using a less pure grade of aglime; however, under these circumstances, the individual lime dosing rates should be increased by a factor of 100/NV.

Due to its low solubility in water, aglime is not suitable for the neutralisation of leachate, which requires a product with a very quick reaction and high solubility. The most suitable neutralising agent for leachate and stockpile drainage water is slaked or quicklime (calcium hydroxide). This is made by treating burnt lime with water (slaking) and comes as a fine white powder. It has a typical NV of about 135. Due to its high alkalinity (pH of about 12.5 to 13), slaked or quicklime should not be allowed to come into contact with the skin or be inhaled.

13.1.4 Validation Testing

Validation testing of the soil and drainage water is required to be conducted after the addition of lime to test whether mixing has been adequate, and to reduce the risk of acidic water being returned to watercourses. Based on an existing plus potential acidity of <0.5%, validation samples of soil should be collected and tested for field pH screening and chromium suite at a minimum frequency of one sample per batch of mixed soil, with a minimum of one sample per 1,000 m^3 of treated soil.

In accordance with Dear et.al. (2014) single non-random grab samples are not recommended for this type of testing. Composite samples should be collected according to either a random or stratified-random protocol. Within each sample for laboratory analysis, a minimum of six subsamples of consistent volume should be collected. The subsamples should extend through the total depth of the treated material but avoid the underlying guard layer. The subsamples should be thoroughly mixed together in a container with a secure lid. Following the compositing of the material, a composite sample should be collected for laboratory analysis.

In addition, the pH of all ponded drainage water around the confines of the treatment bunds should be measured daily.

The soil and water contained within the treatment bunds should not be removed until the target values have been achieved as presented in Table 6 below. Similarly, additional layers of soil should not be added to the bunded stockpile for treatment until the underlying layers have been validated.

Table 6: Target Levels of Neutralised Soil and Water

Test	Target Level
Acid neutralising capacity (ANC)	To exceed existing plus potential acidity of the soil by at least a safety factor of 1.5.
pH_F of soil	6.5 to 8.5
pH_{KCL} of soil	Greater than 6.5
pH of water	6.5 to 8.5

It should be noted that validation testing (i.e. chromium suite tests) will require at least four days turn-around, possibly longer, and hence sufficient time should be allowed in the treatment programme for such verification testing. Only appropriately skilled operatives, such as available through DP, should collect and test verification samples. In addition to normal daily supervision of the soil management process, it is suggested that regular formal inspections be undertaken.

13.2 Management Strategy for Off-Site Disposal

If any PASS is required to be disposed off-site during the development, it must be undertaken in accordance with the NSW EPA *Waste Classification Guidelines – Part 4: Acid Sulfate Soils*, as detailed below.

- PASS must be kept wet at all times during excavation and subsequent handling, transport and storage; and
- PASS must be received at the proposed disposal facility within 16 hours of excavation.

13.2.1 Disposal of PASS Below the Water Table

PASS may be disposed of below the permanent water table provided:

- this occurs within 24 hours of excavation; and
- the PASS must meet the definition of virgin excavated natural material (VENM) under the *Protection of the Environment Operations Act 1997*.

The following requirements must also be met:

- The disposal facility (i.e., landfill) must be licensed by the NSW EPA to dispose of PASS below the water table;
- PASS must be kept wet at all times until burial under the water table;
- PASS must be buried at least 2 m below the lowest historical level of the water table;
- PASS must be disposed of within eight hours of receipt at the landfill; and
- The landfill operator must be provided with documentation for each truckload of material received, indicating that the soil's excavation, transport and handling have been undertaken in accordance with the *Acid Sulfate Soil Manual* (1998)[12].

The landfill operator is required to meet the following requirements:

- The pH of each load of PASS received must be tested prior to placement below the water table in accordance with the test methods specified in the *Acid Sulfate Soil Manual*. These details must be recorded and retained by the landfill operator;
- Soil that has dried out, undergone any oxidation of its sulfidic materials, or which has a pH less than 5.5 must be treated by neutralisation and disposed of at a landfill that can lawfully accept it; and
- The pH of the water into which the PASS is placed must not be less than 6.0 at any time.

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[12] Acid Sulfate Soil Management Advisory Committee, (1998). *Acid Sulfate Soil Manual.* (ASS Manual 1998)

13.2.2 Disposal of PASS Above the Water Table

If PASS cannot be classified as VENM or no facility is available to dispose of the material under the water table, it may be disposed of above the water table provided the following conditions are met:

- The soil must be treated in accordance with the neutralising techniques contained in the *Acid Sulfate Soil Manual 1998*;
- Following treatment, the soil must be chemically assessed in accordance with Step 5 in Part 1 of the *Waste Classification Guidelines,* to determine whether any contaminants are present, and assigned a waste classification; and
- It must be disposed of at a landfill that can lawfully accept that class of waste.

13.3 Training and Induction

Training and induction sessions should be conducted for all contractors and staff involved in the excavation, transport or handling of soils or earthworks on the site. The sessions should be designed to ensure that staff are made aware of relevant issues and are familiar with their responsibilities.

13.4 Record Keeping

Current good management practices should be adopted by the appointed contractor. Complete records of all testing and treatment should be maintained by the contractor, and such records should be made available as required.

13.5 Emergency Response Procedures

Construction activities which may cause potential environmental hazards are summarised in Table 7 below together with recommendations for "Emergency Response Procedures".

Table 7: Emergency Response Procedures

Construction Activity	Potential Environmental Threat	Emergency Response
Excavation of trenches	Flooding of open excavation causing adjacent groundwater levels to rise, leading to potential acid leachate once the excavation is drained	• Inform site foreman and project manager/ environmental officer; • Determine excavation pH; • Correct excavation pH; • Drain pit to tanks/ponds for water quality assessment prior to discharge.

Construction Activity	Potential Environmental Threat	Emergency Response
Stockpiling/Neutralisation	Stockpile washes or slips outside of bunded lime pad	• Inform site foreman and project manager/ environmental officer; • Estimate volume of material breaching bund; • Conduct pH analysis of adjacent watercourses (if any); • Remove breached soil into a bunded limed pad; • Over-excavate contaminated area to 0.2 m depth, apply and mix lime at rate as for guard layers (5 kg lime per m^2 of surface).
Stockpiling/Neutralisation	Breach in stockpile containment bund	• Inform site foreman and project manager/environmental officer; • Close breach in bund; • Conduct pH analysis of adjacent watercourses (if any); • Correct pH in any adjacent watercourse (if required).

For all construction activity incidents which pose an environmental threat, an incident report must be completed to determine how the incident occurred, to implement additional control measures, and to modify work procedures to reduce the likelihood of the incident re-occurring.

Appendix D – Dewatering Management Plan

DEWATERING MANAGEMENT PLAN (DMP)

Kingscliff High School

33 Oxford Street, Kingscliff NSW 2487

SSD-8744305

For:

Richard Crooks Constructions

By:

ENV Solutions

Date:

02/12/2021

ENV Services Pty Ltd

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0	Robert Mark Mitchell	15/11/2021	
1	Robert Mark Mitchell	01/12/2021	
2	Robert Mark Mitchell	02/12/2021	
	Reviewed By:		
1	Stephen Bourne	02/12/2021	
2	Robert Mark Mitchell	02/12/2021	

Scope of Engagement and Limitations:

This report has been prepared by ENV Services PTY LTD (ENV) ABN 98 649 278 977 at the request of Richard Crooks Constructions for the development of a suitable Dewatering Management Plan. No other parties may rely on the contents of this report for any purposes except those stated.

This report has been prepared based on the information provided to us and from other information obtained because of enquiries made by us. ENV accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

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DEWATERING MANAGEMENT PLAN (DMP)

Kingscliff High School

33 Oxford Street, Kingscliff NSW 2487

SSD-8744305

For:

Richard Crooks Constructions

By:

ENV Solutions

Date:

02/12/2021

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0	Robert Mark Mitchell	15/11/2021	
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2	Robert Mark Mitchell	02/12/2021	
	Reviewed By:		
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Table of Contents

List of Tables

1 Introduction

1.1 Background

ENV Services Pty Ltd (ENV) has been engaged by Richie O'Gorman on behalf of Richard Crookes Constructions (Richard Crookes) to prepare a Dewatering Management Plan (DMP) for the Kingscliff High School State Significant Development (SSDA) (Application Number: SSD-8744305).

Hereon referred to as 'the site', the Kingscliff High School is located at 33 Oxford Street Kingscliff NSW 2478 (Lot 57 DP 803814). Reference to the site can be found in Figure 1, Attachment 1.

It works to:

- Satisfy the final SSDA Condition (B36).
- Successfully identify, determine, and describe best practice dewatering & dewatering water treatment methodologies required to successfully excavate two (2) lift over run excavations.

1.2 Proposed Development

Following high level review of site-specific architectural drawings, historic reports and site markups provided Richard Crookes - it is understood that the proposed development includes raising & rebuilding of several existing structures as well as the refurbishment of existing buildings (Building O, Building A, Building H, Building C and Building G).

As part of these refurbishments, it is ENVs understanding that both Building C (Senior School & Library) and Building O (Performing Arts Building) required the installation of lifts where lift overruns are expected to extend beyond the natural standing water level (SWL).

At the time of publication, each lift shaft excavation is expected to measure approximately sixteen (16) square meters. To meet constructability and safety requirements, it is anticipated each excavation would need to be dewatered to approximately two (2) meters below ground level (mbgl) where extracted waters will need to be treated prior to discharge into the receiving environment. It is anticipated each excavation will be dewatered for a period of one (1) week.

1.3 Stakeholder Identification

Table 1 outlines immediate direct (internal) and indirect (external) stakeholders with an interest or concern in construction works associated with the proposed woks outlined in section 1.2.

Table 1: Stakeholder Identification

Stakeholder	Role or Position	Internal/ External
Richard Crooks Constructions	Client	Internal
ENV Services	Consultant	Internal
Tweed Shire Council	Local Authority	External
School Infrastructure NSW	State Authority	External

1.4 Previous Environmental & Geotechnical Investigations

As part of the DMP preparation process ENV conducted an initial desktop review. In addition to stakeholder consultation, the following documentation was reviewed to ensure DMP management structure(s) addressed engineering, environmental, development and other constraints:

- Douglas Partners (July 2021). Report on Detailed Site Investigation for Contamination Far North Coast Schools Project (Document No. R.001.Rev2), Kingscliff High School, 33 Oxford St, Kingscliff NSW.

1.5 Relevant Standards, Guidelines & Literature

This DMP has been developed referencing the following Standards & Guidelines:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality: The Guidelines, Paper No. 4, Volume 1 (Chapters 1 – 7), Australian and New Zealand Environment and Conservation Council (ANZECC) & Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000;

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality: The Guidelines, Paper No. 4, Volume 2 (Chapter 8), Australian and New Zealand Environment and Conservation Council (ANZECC) & Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000;

- Dewatering in the Tweed, A Guideline for the Management of Dewatering Operations, Version 1.0, (October, 2020);

- Tchobanoglous, G. et al, 2003, Wastewater Engineering Treatment and Reuse: Metcalf & Eddy, 4th edn, McGraw-Hill, New York; and,

- Cachman, M. & Preene, M. 2013, Groundwater Lowering in Construction: A Practical Guide to Dewatering, 2nd Edition, CRC Press, New York.

1.6 Dewatering Management Plan Objectives

This DMP has been prepared to satisfy with SSDS (8744305) Condition B36 where the following have been addressed:

- Considers Council's Dewatering in the Tweed Guideline available at https://www.tweed.nsw.gov.au/Documents/Planning/TSC12355_Dewatering_in_the_Tweed_Guideline.pdf;

- Meets the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) available at www.waterquality.gov.au/anzguidelines;

- Includes site plans which indicate the extent of the excavation area and estimated zone of influence of the dewatering activity relative to any adjoining buildings together with an assessment of any impacts likely to occur to any adjoining buildings as a result of the dewatering activities;

- The location to be indicated on the site plan of the area that will be utilised for the positioning of any treatment tank or sedimentation pond on the site including any reserve area to be used for such purpose in the event of the need for additional treatment facilities to be incorporated on the site;

- Details of the proposed method of mechanical aeration to be used in the event that it is necessary to aerate the groundwater to achieve an acceptable Dissolved Oxygen level prior to the offsite discharge of groundwater and where this will be incorporated on the site;

- The provision of written advice from the operator of any on site groundwater treatment system stating that the system to be used will be able to treat the groundwater to the required treatment level prior to discharge. Note. Particular attention is to be given to achieving the required detention times prior to discharge of the groundwater. Advice that the system is simply capable of achieving the necessary treatment will not be acceptable; and

- Considers the Detailed Site Investigation for Contamination for Kingscliff High School, 33 Oxford St, Kingscliff prepared by Douglas Partners dated July 2021 (Project No. 97611.00, Document No. R.001.Revision 2).

2 Site Characteristics

2.1 Site Description

The site is located at 33 Oxford Street, Kingscliff, NSW 2487, and is referred to by the Tweed Shire Council as Lot 57 DP 803814 and has an approximate area of 8.498 ha. A figure of the site location is shown in Figure 1, Attachment 1.

The site is approximately rectangular in shape and contains buildings, pavements, asphalt, grassed areas and a bushland area. The north-western and centre-north sections of the site contained asphaltic-concrete surfaced car parks. The site is located south of the Oxford Street cul-de-sac and is bound by Cudgen Creek to the south. The school buildings and proposed development area are located in the northern portion of the site, with the remainder (southern) areas of the site comprising a sports field and bushland.

2.2 Surrounding Environment

The Councils Land Environment Plan (LEP) (2014) presents the site as located in an area zone R2 – Low Density Residential area. Surrounding land use is described in Table 2.

Table 2: Surrounding Land Use

Direction	Environment
North	Low Density Residential Area
East	Bushland - open space (Deferred Matter)
South	Cudgen Creek
West	NSW TAFE

2.3 Topography & Drainage

The site is located towards the south-western toe of a hillside, and slopes downwards to the south towards Cudgen Creek. On-site elevations range from approximately 10 m to 2 m relative to Australian Height Datum (AHD).

The Detailed Site Investigation (Douglas Partners July 2021) and topology mapping indicate that the major surface water receptor of surface water flows and excess groundwater will be the Cudgen Creek, located approximately 270 m south-east of the proposed development area.

2.4 Geology & Soils

The site is located within a geological unit characterised by undifferentiated alluvial deposits of sand, silt and clay. Table 3 presents a summary of the encountered subsurface profile.

Table 3: Subsurface Condition Summary

Material Description	Depth (m)	
	From	To
FILL: fill is encountered with an average depth of approximately 0.4 m. The fill was generally comprised of sand, gravelly sand, silty sand or clayey sand.	0.05 m	0.9 m
ALLUVIAL: natural sandy and natural clay soil was encountered beneath the fill, underlain by clayey/silty sand.	0.4 m	2 m
POSSIBLE RESIDUAL SOIL: likely to be Clayey/silty sand	> 2 m	-

2.5 Acid Sulfate Soils

Referencing Council Local Environmental Plan (LEP) Acid Sulfate Soils Planning Maps, the land has been identified as having Class 1, Class 2, Class 3, and Class 5 ASS. A more detailed review of the building envelope outlines most of the envelope fall within Class 3 and Class 5 ASS maps.

As part of the Douglas Partners Detailed Site Investigation (DSI), Potential Acid Sulfate Soils (PASS) were identified from approximately 0.75 mbgl. Prescribed liming rates varied across the site (2.1 kg/ tonne to 58.0 kg/tonne). However, all soils excavated below 0.75 mbgl will require liming prior to validation and legal disposal.

Table 6 of the Douglas Partners DSI outlines all water will need to be treated and meet a pH of 6.5 – 8.5 prior to discharge (where this should be measured daily). Furthermore, this DMP recommend minimising drawdown depth and duration to the lowest possible extent to mitigate potential PASS oxidation.

2.6 Saturated Hydraulic Conductivity

Hydraulic conductivity (ksat) is a quantitative measure of a saturated soils ability to transmit water when subject to a hydraulic gradient. A key factor (input) in determining estimate extraction volumes during both the draw-down dewatering phase and groundwater maintenance phase (steady-state dewatering).

Utilising data obtained from the sites underlain geology (see section 2.4) in-ground ksat values are described in Table 4.

Table 4: Permeability (ksat)

Geology	Permeability (m /s) - Upper	Permeability (m /s) - Lower
Silty Sands	**1 x 10^{-4}**	1 x 10^{-6}
Clayey Sands	1 x 10^{-5}	**1 x 10^{-8}**

Permeability figures have been cross referenced using values recommended by Engineers Australia (2006) and Cachman & Preene's: Practical Guidelines Towards Lowering Groundwater in Construction (2013).

Due to the limitations associated with the homogenous nature of inground conditions, and other assumptions regarding inground geology, changes in permeability (ksat) are highly volatile. Therefore, natural variations in the permeability between each different sub-surface material are likely to occur due to the variations in silt or clay content, and variations in grain size of the sand as well as the positioning and interrelation of the secondary porosity features such as, joints / fractures or defects.

Any changes in underlain geology may result in changes in saturated hydraulic conductivity and therefore groundwater extraction flow rate. On this basis, calculations (discussed in following sections) have been used as an approximation for both the draw-down dewatering phase and groundwater maintenance phase (steady-state dewatering)

2.7 Groundwater

2.7.1 Groundwater Well Drilling & Construction

Two (2) boreholes (MW3 and MW4) were drilled on 1st of October 2021 to depths of 2.4 m and 3.0 m, respectively, at the locations shown on the Sampling Location Plan (Figure 2, Attachment 1). A trailer mounted drill rig and solid flight augers were used at each location.

At each of the borehole locations, groundwater wells were installed once the target depth, or auger refusal, had been reached. The wells were constructed by placing 50 mm diameter slotted PN18 PVC casing and solid casing into the borehole; and installing a gravel pack, with bentonite seals to the ground surface. Drilling logs describing the soil profiles encountered and construction details for the wells are provided in Attachment 2.

The soils at each location were logged in general accordance with the Unified Soil Classification System (USCS), with reference to any odours or other field indicators of potential contamination (See Attachment 2).

After well construction, each newly installed well was developed using a steel bailer and surging techniques, to ensure that as many fines were removed from the gravel pack surrounding the screened interval as possible.

2.7.2 Groundwater Sampling

To aid in deriving suitable Water Quality Objectives (WQOs), as recommended by the Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZG 2018), on the 1st of October 2021, the following activities were completed at each of the groundwater monitoring well:

- Depth to groundwater and total well depth was measured using an interface probe (IP), relative to the top of the PVC casing.
- Physiochemical samples were tested using a Horiba U-52 multi meter probe.
- Samples for laboratory analysis were collected from each of the wells. The analytical suite including pH, Electrical Conductivity (us/cm), Total Suspended Solids (TSS), Total Recoverable Hydrocarbons (TRH), BETX, Polycyclic Aromatic Hydrocarbons (PAH) Metals

(As, Cd, Cr, Cu, Pb, Hg, Ni and Zn). A copy of the laboratory Chain of Custody (COC) and Results are presented as Attachment 3.

2.7.3 Standing Water Level (SWL)

Once installed, groundwater monitoring wells (MW) were dipped using a surface interface probe where groundwater was measured at 0.627 mbgl (MW3) and 0.432 mbgl (MW4) respectively.

Furthermore, given the sites proximity to the Cudgen Creek and the Pacific Ocean, fluctuations in SWL are anticipated. It is also safe to assume that fluctuations in SWL may also occur following periods of high rainfall (or in the wetter months of the year).

2.7.4 Groundwater Quality

In summary, physiochemical analysis show groundwater to be slightly acidic (MW3 pH = 6.40, MW4 pH = 6.40). The Electrical Conductivity (EC) value of 190 µS/cm in both MW3 and MW4 are indicative freshwater environment (i.e., low in salinity). It is worth noting that groundwater samples were extremely turbid at the time of sampling (MW3 TSS = 5,000, MW4 TSS = 7,300). As a result, it is likely this may have had an impact on total metals concentrations outlined below.

In examining toxicants of potential concern, groundwaters quality appeared to be hydrocarbon free where TRH, BETX and PAH were all below Limit of Reporting (LOR).

Table 5 provided as summary of metals concentrations from MW3 and MW4. In summary, Copper (Total), Lead (Total) and Zinc (Total) were shown to exceed both Marine and Freshwater Default Guideline Values (DGV) for an 80th percentile level of protection. Furthermore, Chromium (Total) was shown exceed Marine DGVs for a 80th percentile level of protection.

Table 5: Groundwater Metals Concentrations (all values expressed as µg/L).

Analyte	MW3	MW4	80% Level of Protection	
			Marine	Freshwater
Arsenic (Total)	8	4	-	140
Cadmium (Total)	0.4	0.4	36	0.8
Chromium (Total)	**170**	20	**85**	40
Copper (Total)	**44**	**38**	**8**	**2.5**
Lead (Total)	**16**	**100**	**12**	**9.4**
Mercury (Total)	< 0.05	0.62	1.4	5.4
Nickel (Total)	9	11	560	17
Zinc (Total)	**74**	**230**	**21**	**31**

2.8 Receiving Environment

The receiving environment can generally be described as a as a 2,500 square meter dam located approximately 35 meters south of the existing KHS buildings (Figure 3, Attachment 1). Onsite inspections of the system point to the dam acting as a discharge point for the KHS school's stormwater system and is therefore man made. This then appears to grade west through a series of ponds and then discharge into the Cudgen Creek and then Pacific Ocean.

2.8.1 Receiving Environment Sampling

To aid in deriving suitable Water Quality Objectives (WQOs), as recommended by the Australian & New Zealand Guidelines for Fresh & Marine Water Quality (ANZG 2018), on the 1st of October 2021, receiving environment pphysiochemical samples were tested using a Horiba U-52 multi meter probe where results where field logs are presented as Attachment 2.

In addition, a laboratory analysis was collected and analysed for pH, Electrical Conductivity (us/cm), Total Suspended Solids (TSS), Total Recoverable Hydrocarbons (TRH), BETX, Polycyclic Aromatic Hydrocarbons (PAH) Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn). A copy of the laboratory Chain of Custody (COC) and Results are presented as Attachment 3.

2.8.2 Receiving Environment Water Quality

Receiving environment waters can generally be described as slightly acidic (pH = 6.3). The Electrical Conductivity (EC) value of 110 µS/cm is indicative of a freshwater environment (i.e., low in salinity). Wates were also clear at the time of sampling (TSS = 10 mg/L).

In examining toxicants of potential concern, groundwaters quality appeared to be hydrocarbon free where TRH, BETX and PAH were all below Limit of Reporting (LOR). Furthermore, all metals with the exclusion of Zinc (9 µg/L) were below LOR.

2.8.3 Receiving Environment Ecosystem Classification

In assessing the system, it is practical to assume that physiochemical variables such as Dissolved Oxygen (DO), pH and oxidative state of nutrients and metals would vary would fluctuate based on rainfall and thermal stratification impacts.

As a result, for the purpose of deriving a suitable WQOs, receiving waters could be generally described as being a lowland river that has been significantly degraded by human activity and has lower ecological value than slightly or moderately disturbed waters (i.e., 80th percentile - highly disturbed ecosystem).

3 Water Quality Objectives (WQO)

Based on the above, prior to and during discharge, all extracted groundwater will need to meet WQOs specified in Table 6.

Furthermore, the following guidelines & standards have been considered:

- Australian & New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018): Default Guideline Values (DGV's) for physiochemical (PC) stressors and toxicants.
- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000. Particularly PC stressors outlined in Volume 1, Table 3.3.2 – 3.3.3.
- Dewatering in the Tweed: A Guideline for the Management of Dewatering Operations (October 2020).

Table 6: Water Quality Objectives (WQO's)

Analyte	Units	Water Quality Objective (WQO)
pH[1]	pH	6.5 – 8.0
Total Suspended Solids (TSS)[1]	mg/L	< 50
Turbidity [1,2]	NTU	< 20
Dissolved Oxygen (% Saturation) [1,2]	% Saturation	90 - 110
Chromium (Dissolved) [2,3]	µg/L	40
Copper (Dissolved) [2,3]	µg/L	2.5
Lead (Dissolved) [2,3]	µg/L	9.4
Zinc (Dissolved) [2,3]	µg/L	31

Table notes:

1. Derived from ANZECC/ ARMCANZ (2000) Estuaries – (Table 3.3.2)
2. Derived from Dewatering in the Tweed – A Guideline for the Management of Dewatering Operations.
3. Derived from ANZG (2018) – Freshwater 80th Percentile (DGV)

4 Dewatering Management Plan

4.1 Dewatering Process

Outlined in earlier sections of this DMP, the SWL has been measured at approximately 0.627 mbgl (MW3) and 0.432 mbgl (MW4) where groundwater in each excavation will need to be extracted (draw-down dewatering) & maintained (steady-state dewatering) at approximately two (2) mbgl for approximately one (1) week.

To manage groundwater, deep well dewatering techniques are likely to be implemented initially where well point methodologies should be considered (only if required). All extracted groundwater will need to be treated prior to discharge offsite (into the receiving environment) and will need to meet criteria specified in Table 6.

4.2 Deep Well Dewatering

4.2.1 Proposed Methodology

Generally sited just outside the are of proposed excavation, as a rule of thumb, deep wells are installed 1.5 – 2 times the depth of the primary excavation (i.e., 3 – 4 mbgl). Conventional methods include auguring or drilling a well using a 20-tonne excavator and installing a liner. Liners generally consist of plastic or steel pipe, of which a section is slotted or perforated to form a well screen to allow water to enter; other sections consist of unperforated pipe (the well casing). The space between the wall of the liner and the well (annulus) is then backfilled using filter media (suitable drainage gravel) – known as a filter pack. Well diameters vary and are dependent on the contractor however conventional methods include a 600 mm well with a 450 mm liner (and 150 mm annulus).

Once installed, high-head submersible pumps (on float operation) will transfer collected water through a HDPE header (or equivalent) to the inlet of the water treatment plant for the dewatering duration.

4.2.2 Deep Well Draw-down Estimates (Per Lift Shaft).

Draw-down refers to the initial static body of water to be removed via deep well dewatering.

Where:

- Length of Excavation (m) = 4
- Width of Excavation (m) = 4
- Drawdown Depth (m) = 2
- Current SWL depth (mbgl) = 0.5
- Voids Ratio (n) = 0.3

Initial deep well drawdown estimates are expected to be approximately 7.2 m^3 or 7.2 KL.

4.2.2.1 Steady-State Estimates (Per Lift Shaft).

Assuming hydraulic conductivities specified in Table 4, flow rates into the excavation are estimated to be less than 1 l/s. Over a period of one (1) week, extraction volumes are estimated to be less than 432 m^3 (432 kL)

These number have been estimated Utalising Sichardt's equation where empirical methods are used to establish cone of depression and relative pumping rates. Outputs are presented in Attachment 4.

4.2.3 Total Extraction Volumes

Working to a one (1) week program per lift shaft, combining draw-down and steady-state estimates – estimate extraction volumes are expected to be less than 878.4 m^3. See Table 7 below.

Table 7: Total Extraction Estimates

	Building C Lift Shaft – Upper Estimate	Building O Lift Shaft – Upper Estimate
Draw-Down (kL)	7.2	7.2
Steady – State (kL)	432.0	432.0
Total (kL)	**439.2**	**439.2**

As stated in earlier sections of this report, estimates assume a homogenous in-ground condition in the sand, however changes in the subsurface can change conditions (particularly in the fractured siltstone). As a result, permeability reductions are likely, which mean a likely reduce total extraction volume (unless a confined aquifer is found within the fractured rock).

4.2.4 Radius of Cone Depression

Otherwise referred to as the zone of influence, the cone of depression is a theoretical concept used to visualise how a well is affecting the surrounding aquifer. When pumping starts, water storage will be released by the aquifer (dependant on permeability). As time passes the zone of influence will continue to increase, but at a diminishing rate until either an aquifer boundary is reached, or an equilibrium point is reached.

Referencing permeability values presented in Table 4, Sichardt's equation notes the Dewatering Radius of Influence (R_0) is expected to be up to 45 meters (over 71 hours). Detailed outputs are presented in Attachment 4.

4.3 Groundwater Treatment Process

Discussed in earlier sections of this DMP, extracted groundwater will require treatment prior to release into the receiving environment. Treated groundwater will need to meet WQO's presented in Table 6.

To achieve this, a Dewatering Water Treatment Plant (WTP) will need to be established onsite & commissioned by suitably qualified engineer or scientist. At a minimum ENV would recommend processes that include:

- Solid’s removal capability.
- pH correction control/ aeration capability

A process flow diagram (PFD) of such a process is presented in Attachment 5. Furthermore, it is noted that additional treatment units or processes may be required.

As a contingency, all dewatering water treatment plant should be sized to suit a minimum 10 litres per second. A map of equipment placement is presented in Figure 4, Attachment 1.

However, should flow rates exceed estimates (i.ee, greater than 10 l/s) or fail to meet WQO’s specified in Table 6, additional plant may be required. Details of each step are presented in greater detail below.

4.4 Coagulant Assisted Tilt Separation (Solids Removal)

Assisted utilising an appropriately selected flocculant, coagulant and/or polymer, the tilt separation process primarily works to removed suspended solids prior to discharge. Although sediment loads should be managed upfront (i.e., socking, or backfilling spears), the system should be suitably sized to handle flow rates specified in the earlier sections of this report.

As recommended by the NSW Blue Book - flocculant, coagulant and/or polymer dose rates should be determined & managed by an appropriately qualified person (i.e., chemical engineer/ industrial chemist or equivalent). A material safety data sheet (MSDS) for a typical aluminium based coagulant is presented in Attachment 6.

4.5 pH Correction & Metals Removal

An automated pH dosing system is recommended where operational setpoints should be refined as part of the commissioning process to ensure the likelihood of pH over/ under shoot risk is mitigated.

pH correction will be required to raise baseline groundwater pH to meet WQO’s specified in Table 6 and will aid in metals precipitation.

Dose rates should be determined by an appropriately qualified person. A material safety data sheet (MSDS) for a typical pH correction chemical (Caustic Soda) is available for viewing in Attachment 6.

4.6 Aeration

Should dissolved oxygen be measured below WQO’s specified in Table 6, a mechanical aeration process should be incorporated into the process at either the front or back end. Here, closed loop blower (or compressor) and vessel system should be established and monitored to ensure DO objectives are achieved.

5 Validation & Monitoring

The purpose of the validation and monitoring process is to provide a framework for dewatering contractors to collect, interpret, act and report on the performance of the dewatering process. Ultimately to ensure treatment measures are satisfactory and meet WQOs outlined in Table 6. the DMP promotes a combination of collection techniques including analytical field sampling and telemetric data collection (i.e., real time).

5.1 Analytical Field Sampling Frequency

Prior to discharge, a sample will need to be collected from the outlet of the WTP and validated (utilising NATA certified laboratory) against WQO's presented in Table 6.

Once discharge has commenced, an additional sample will be collected and validated every seven (7) days (or as required under the guidance of a suitably qualified person) for the duration of dewatering works onsite as part of the continual discharge monitoring program. Standard turn-around-time (TAT) for sample analysis should be a maximum three (3) days for all sample analytes.

5.1.1 Analytical Sampling Methodology

At the frequency outlined above, laboratory samples will be collected from the discharge point. The samples will:

- Represent a waste or element of the environment from which it is taken;
- Not be contaminated during collection, where analyte concentrations will not change between the time of collection and analysis.
- Be collected by an appropriately qualified person.
- Include sampling utilising correct sampling methodologies.
- Include representative sample(s); and,
- Be labelled, preserved, stored, and transported appropriately for analysis.

Samples will be analysed by a National Association of Testing Authority (NATA) laboratory and will be inclusive of analytes outlined in Table 6.

5.1.2 Field Monitoring

To ensure management of the treatment processes, twice weekly field monitoring will be included as part of the ongoing monitoring process. Monitoring will cover aspects of all treatment steps, these include but are not limited to:

- Visual inspection of treatment process.
- pH assessment.
- Turbidity (NTU) assessment; and,
- Flow (m/s OR m^3/ hour) assessment. Flow measurements are taken from a calibrated flow meter included in the dewatering water treatment plant.

Observations will be recorded and stored onsite where a ‘service report’ will be provided and presented to the principal contractor outlining physiochemical changes across the process, high level plant function/ performance summary and flow (rate & totalised volume).

5.1.3 Telemetric Date Collection

In addition to service monitoring, data will be collected using an online PLC system (such as HOBO Link ™). As part of this system, physiochemical and physical parameters such as; pH, turbidity and flow rate will be measured in real time where analysis will be provided to a dewatering treatment expert.

Should physiochemical or physical parameters fall ‘out of spec’, the dewatering subcontractor will be notified via SMS or an alternative method (i.e., Email) where action will be required as outlined in the following section.

6 Action & Analysis

The following section aims to provide dewatering water treatment operators with the ability to effectively assess treatment performance following receipt of monitoring data and make accurate decisions to ensure risk treatment processes are upheld. Analysis and action processes are detailed in the sections below.

6.1 pH Correction/ Metals Precipitation

Daily Check:

- Telemetric OR physiochemical check out of specification.

Action:

- Check and re calibrate pH probe.
- Check chemical (base) dosing pump to ensure its functionality.
- Check chemical drum to ensure chemical volume is sufficient.

IF pH probe still out of specified range:

- Replace pH probe with critical spare.
- Notify relevant stakeholders of change.
- Dewatering Manager to note in daily dewatering management plan report.

Analytical Check:

- Analytical pH results outside of specified WQO’s.

Action:

- Shut down or put into recycle.
- Re-calibrate pH probes.
- Check proportional bands (or equivalent pH control process).
- Implement changes and monitor.
- Notify relevant stakeholders (internal & external).
- Dewatering Manager to note in daily dewatering management plan report.
- Re-sample and validated once pH corrections have occurred.
- Re assess risk and treatment methodology (if pH challenges persist).
- Additional treatment units or methodologies may need to be employed.

6.2 Dissolved Oxygen (DO) – Physiochemical Only

Daily Check:

- Dissolved Oxygen (DO) physiochemical check outside of specified limit.

Action:

- Check Dissolved Oxygen probe on Horiba U-52 meter (or equivalent).
- Re measure DO in fresh sample collected from discharge of treatment train (post Air-and Post media Polishing Unit).
- Assess result.

IF DO still out of specified range:

- Review DO treatment methodology.
- Implement DO treatment methodology change.
- Dewatering Manager to note in daily dewatering management plan report.
- Re – evaluated the following day, and if required.
- Re assess risk and treatment methodology.
- Implement aeration solution and validate methodology.

6.3 Turbidity (NTU) & Total Suspended Solids (TSS)

Daily Check & Analytical Check:

- Turbidity (NTU) physiochemical check outside of specified limits.
- Turbidity (NTU) analytical check out of specification.
- Turbidity (NTU) telemetric result out of specification.

Action:

- Check and Turbidity probe (PLC Unit and Horiba U-52 meter).
- Re measure Turbidity in fresh sample collected from discharge of treatment train.
- Assess result.
- Check chemical dosing pump(s) to ensure its functionality.
- Check chemical drum to ensure chemical volume is sufficient.
- Check sediment level in treatment tank.

IF NTU still out of specified range;

- Review NTU treatment methodology.
- Conduct assisted flocculation checks (i.e., Jar Test) to re define and optimize dose rates.
- Implement NTU treatment methodology change.
- Dewatering Manager to note in daily dewatering management plan report.
- Additional treatment units or methodologies may need to be employed.

dewatering report will be supplied, summarising the results of monitoring within two weeks of cessation of discharges.

During the dewatering process, a daily report will need to be completed by the onsite Dewatering Management. The report will note any exceedance in discharge criteria, as well as any other comments relating to the dewatering process.

Any complaints shall be noted in the site logbook and corrective action taken (where appropriate and practicable) to prevent recurrence. Complaints and complaints management are the responsibility of the principal contractor where their policy will be adopted as best practice.

8 Attachments

Attachment Reference	Attachment Title
Attachment 1	Figure 1: Site location Figure 2: ENV Monitoring Well Locations Figure 3: Discharge Location Figure 4: DMP Water Treatment Location
Attachment 2	ENV Drill Logs & Field Logs
Attachment 3	ENV Water Quality Results
Attachment 4	Dewatering Calculations
Attachment 5	Process Flow Diagram
Attachment 6	MSDS

9 Attachment 1

Figure 1 – Site Location Plan

Kingscliff High School
33 Oxford Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216186

Image source: Sixmaps

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Figure 2 –Sampling Location
Kingscliff High School
33 Oxford Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216186

Image source: Sixmaps

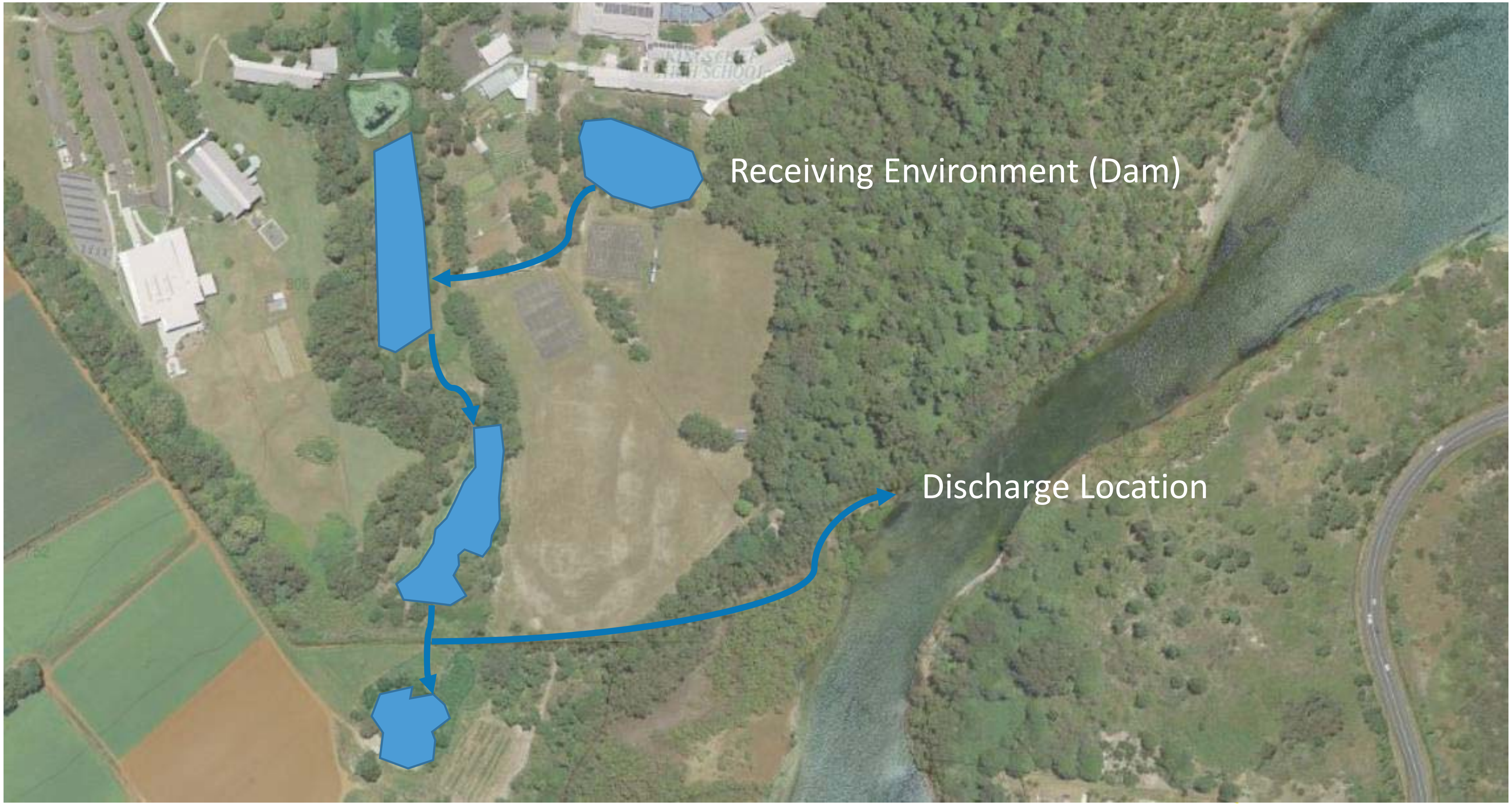
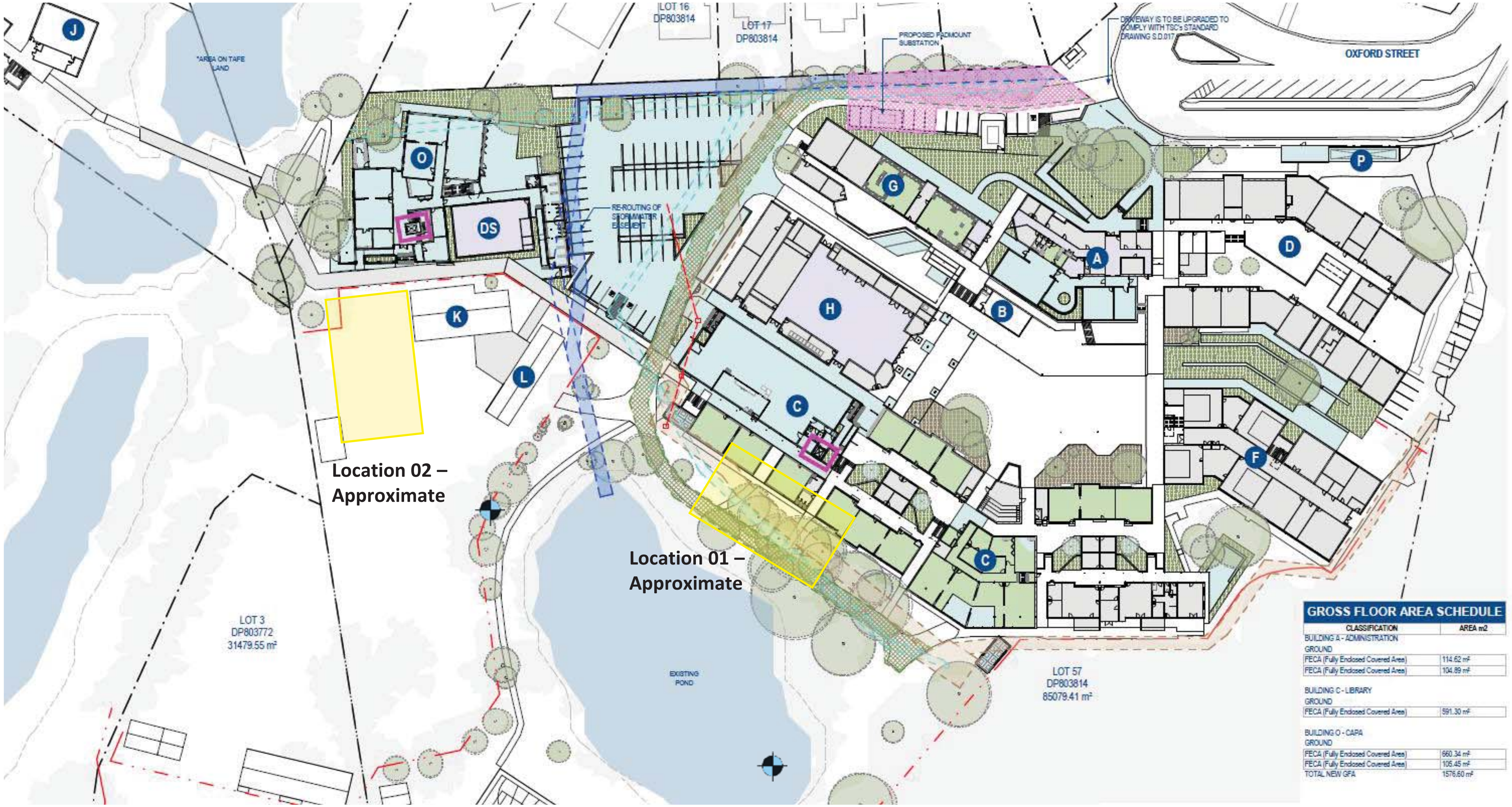


Figure 3 – Receiving Environment & Discharge Location
Kingscliff High School
33 Oxford Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216186

Image source: Sixmaps



GROSS FLOOR AREA SCHEDULE

CLASSIFICATION	AREA m2
BUILDING A - ADMINISTRATION	
GROUND	
FECA (Fully Enclosed Covered Area)	114.62 m²
FECA (Fully Enclosed Covered Area)	104.89 m²
BUILDING C - LIBRARY	
GROUND	
FECA (Fully Enclosed Covered Area)	591.30 m²
BUILDING O - CAPA	
GROUND	
FECA (Fully Enclosed Covered Area)	660.34 m²
FECA (Fully Enclosed Covered Area)	105.45 m²
TOTAL NEW GFA	1576.60 m²

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Figure 3 – Water Treatment Plant Approximate Location
Kingscliff High School
33 Oxford Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216186

Image source: Richard Crookes Constructions

10 Attachment 2

GROUNDWATER LOG MW3

PROJECT NUMBER 216187
PROJECT NAME Kingscliff High School
CLIENT Richard Crookes
ADDRESS 33 Oxford Street, Kingscliff NSW 2487
LICENCE NO.

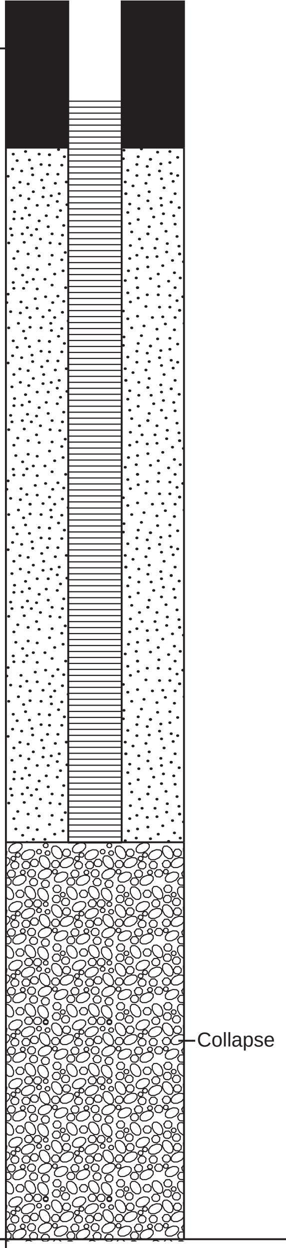
DRILLING DATE 1/10/2021
TOTAL DEPTH 2.5
DIAMETER 50 mm
CASING uPVC
SCREEN uPVC Factory Slotted

COORDINATES
COORD SYS
COMPLETION
SURFACE ELEVATION 5.703 mAHD
WELL TOC

COMMENTS

LOGGED BY JS
CHECKED BY

Depth (m)	Graphic Log	Moisture	Material Description	Well Diagram
	▨	D	TOPSOIL: Brown	
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4		W	SAND: Grey	
2.6 2.8			Termination Depth at: 2.5 m	



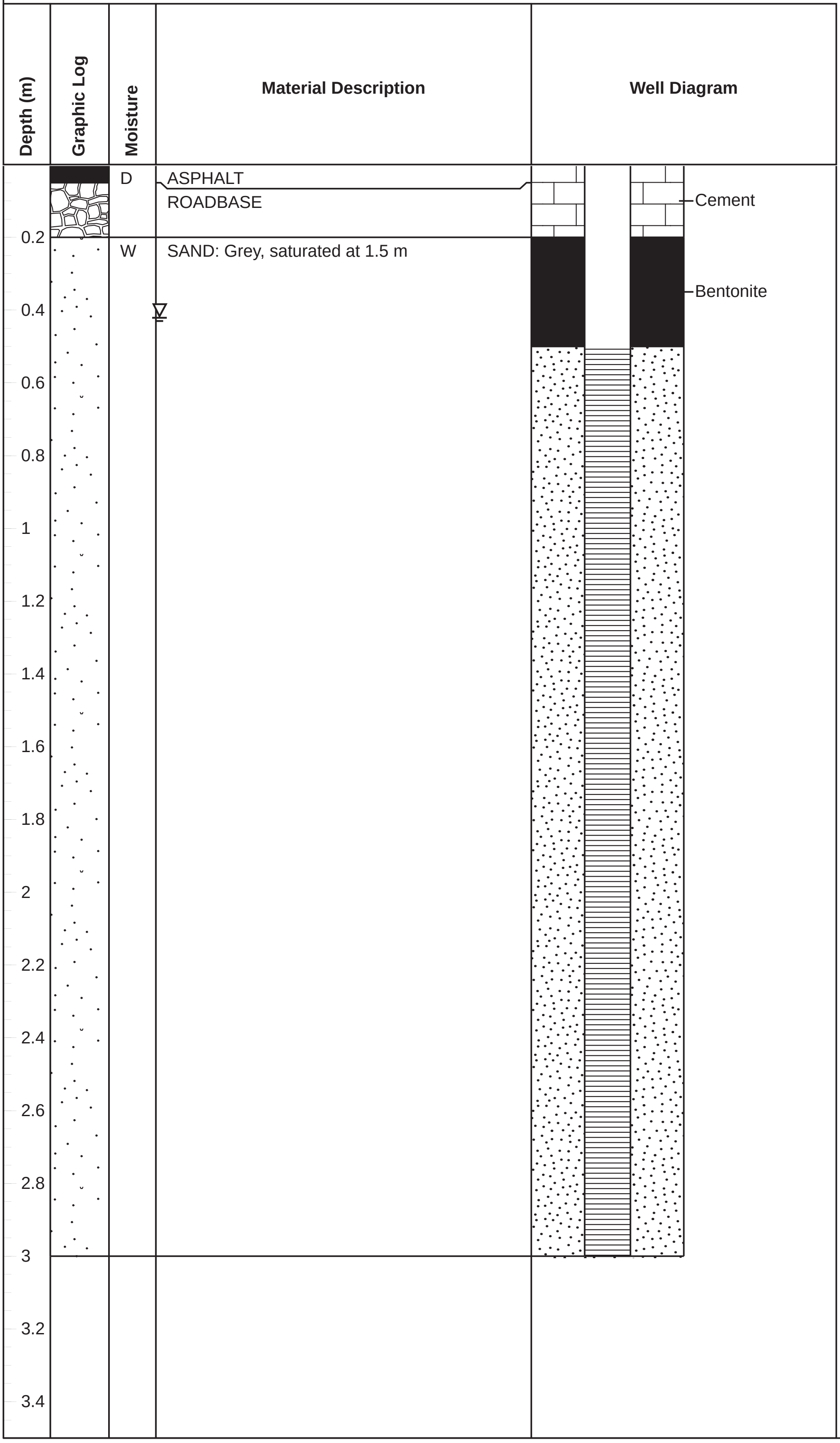
produced by ESlog.ESdat.net on 05 Oct 2021

GROUNDWATER LOG MW4

PROJECT NUMBER 216187	**DRILLING DATE** 01/10/2021	**COORDINATES**
PROJECT NAME Kingscliff High School	**TOTAL DEPTH** 3	**COORD SYS**
CLIENT Richard Crookes	**DIAMETER** 50 mm	**COMPLETION**
ADDRESS 33 Oxford Street, Kingscliff NSW 2487	**CASING** uPVC	**SURFACE ELEVATION** 4.39 mAHD
LICENCE NO.	**SCREEN** uPVC Factory Slotted	**WELL TOC**

COMMENTS

LOGGED BY JS
CHECKED BY



Disclaimer This bore log is intended for environmental not geotechnical purposes.

produced by ESlog.ESdat.net on 05 Oct 2021

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ENV SOLUTIONS – Groundwater Monitoring Log

Client:		**Job Nº:**	
Project:		**Well Nº:**	mw3
Location:		**Depth (m):**	6 1.6

WELL DEVELOPMENT	**WELL FINISH:**	☑ Gatic Cover ☐ Monument ☐ PVC Pipe	4·39m AHD		
	Stage 1	**Stage 2**		**Stage 1**	**Stage 2**
Method:			**SWL - Before: (m)**		
Date:			**Time - Before: (hrs)**		
Undertaken By:			**SWL - After: (m)**		
Water Volume Removed: (L)			**Time - After: (hrs)**		
Comments:					

WELL PURGING DETAILS			
Method:		**SWL - Before: (mBGL)**	0.627
Date:		**Time - Before: (hrs)**	11:45
Undertaken By:		**SWL - After: (m)**	DRY
Well Atmos. (PID): (ppm)		**Time - After: (hrs)**	11:48
Total Volume Removed: (L)	16		

PURGING MEASUREMENTS

Time (hrs)	Volume Removed (L)	DTW (m)	Temp. (°C)	pH	EC (mS/cm)	Eh (mV)	DO (ppm)
		~~21.54~~	21.54	6.1	0.226	74	2.0
		DAM	↓				
			20.9	6.0	0.13	130	7.8
Stabilisation Range:		- 0.1 m	+/- 3 °C	+/- 0.05	+/- 10mV	+/- 10%	+/- 0.2

Comments:

WELL SAMPLING DETAILS			
Method:		**SWL - Before: (m)**	0·627
Date:		**Time - Before: (hrs)**	
Undertaken By:		**Water Temperature (°C)**	
pH: (pH Units)		**EC: (mS/cm)**	
Eh: (mV)		**DO: (ppm)**	
Colour / Odour / Comments:			
Casing Diameter (mm)		**Analysis Required:**	
Depth to LNAPL (mm)		**TRH / BTEXN / PAH / 8 Metals**	
LNAPL Thickness (mm)		**MNA**	
Primary Sample ID		**Nutrients**	
QC Sample ID		**PFAS**	
Hydrocarbon Sheen Observed?	Yes / No	**Other:**	
Were Samples Filtered?	Yes / No		

DAM

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ENV SOLUTIONS – Groundwater Monitoring Log

Client:		**Job N°:**	218186
Project:		**Well N°:**	MW4
Location:		**Depth (m):**	2.256

WELL DEVELOPMENT | **WELL FINISH:** ☑ Gatic Cover ☐ Monument ☐ PVC Pipe 5·703 m AHD

	Stage 1	Stage 2		Stage 1	Stage 2
Method:			**SWL - Before: (m)**		
Date:			**Time - Before: (hrs)**		
Undertaken By:			**SWL - After: (m)**		
Water Volume Removed: (L)			**Time - After: (hrs)**		

Comments:

WELL PURGING DETAILS

Method:	BAILER	**SWL - Before: (mBGL)**	0.432
Date:	1-10-21	**Time - Before: (hrs)**	11:00
Undertaken By:	JS	**SWL - After: (m)**	DRY
Well Atmos. (PID): (ppm)		**Time - After: (hrs)**	11:02
Total Volume Removed: (L)			

PURGING MEASUREMENTS

Time (hrs)	Volume Removed (L)	DTW (m)	Temp. (°C)	pH	EC (mS/cm)	Eh (mV) ORP	DO (ppm)
	1		22.02	7.17	0.314	31	3.38
	10		"	6.37	0.242	47	3.71
Stabilisation Range:		- 0.1 m	+/- 3 °C	+/- 0.05	+/- 10mV	+/- 10%	+/- 0.2

Comments:

WELL SAMPLING DETAILS

Method:		**SWL - Before: (m)**	0.45
Date:		**Time - Before: (hrs)**	11:05
Undertaken By:		**Water Temperature (°C)**	
pH: (pH Units)		**EC: (mS/cm)**	
Eh: (mV)		**DO: (ppm)**	

Colour / Odour / Comments:

Casing Diameter (mm)		**Analysis Required:**	
Depth to LNAPL (mm)		**TRH / BTEXN / PAH / 8 Metals**	
LNAPL Thickness (mm)		**MNA**	
Primary Sample ID		**Nutrients**	
QC Sample ID		**PFAS**	
Hydrocarbon Sheen Observed?	Yes / No	**Other:**	
Were Samples Filtered?	Yes / No		

11 Attachment 3

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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Darwin Office - Envirolab Services
Unit 7, 17 Willes Rd, Berrimah, NT 0820

Client: Richard Crooks
Contact Person: Sinead Hastie
Project Mgr: Stephen Bourne
Sampler: Joshua Stainlay & Ben Peteirse
Address: 313 River St. Ballina, NSW 2478
Phone: 1300 861 325 Mob: 0491 065 725
Email: stephen.bourne@envsolutions.com.au

Client Project Name/Number/Site etc (ie report title): 216186 - Kingscliff High School
PO No.:
Envirolab Quote No. :
Date results required:
Or choose: standard TAT
Additional report format: esdat
Lab Comments:

Sample information					Tests Required	Comments
Envirolab Sample ID	Client Sample ID or Information	Depth	Date sampled	Type of sample	Combo 3	Provide as much information about the sample as you can
1	MW3		1/10/2021		x	
2	MW4		1/10/2021	vials x 2, Amber x 1, small amber x2, metals (unfiltered)	x	
3	DAM		1/10/2021		x	

Envirolab Services
12 Ashley St
Chatswood NSW
Ph: (02) 9910 6200
Job No: 279813
Date Received: 7/10/2021
Time Received: 815
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	ENV Solutions	Received by (Company):	ELS	*Lab Use Only*	
Print Name:	Joshua Stainlay	Print Name:	RG	Job number: 279813	Cooling: Ice / Ice-pack / None
Date & Time:	5/10/2021	Date & Time:	7/10/2021 815	Temperature: ID	Security seal: Intact / Broken / None
Signature:	JStainlay	Signature:		TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Ming To

Subject: FW: job number 216186 and 216187

Ref: 279813-A.
TAT: Standard
Due: 25/10/2021
MT.

279813-A

From: Josh Stainlay <josh.stainlay@envsolutions.com.au>
Sent: Monday, 18 October 2021 3:16 PM
To: SydneyMailbox <Sydney@envirolab.com.au>
Cc: Stephen Bourne <stephen.bourne@envsolutions.com.au>; Ben Pieterse <ben@envsolutions.com.au>
Subject: job number 216186 and 216187

Hey Sally/Greta,
I sent in water samples the week before last from these 2 job numbers and forgot to add to the COC that samples would need to be run for TSS, EC and pH. There should be 4 samples (3 on 216186 and 1 on 216187).
Would you be able to do that for me? thankyou ① – ③

Regards

Josh Stainlay
Environmental Scientist | **ENV Solutions**
313 River St Ballina | T: 1300 861 325
PO Box 248 Ballina NSW 2478 | M: 0402 300 324
josh.stainlay@envsolutions.com.au | www.envsolutions.com.au

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ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

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The Bundjalung are the traditional owners of the land on which I live and work. I respectfully acknowledge their unique cultural and spiritual relationship to the land, waters and seas and their significant contribution to our society.

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ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 279813

Client Details

Client	ENV Solutions Pty Ltd
Attention	Stephen Bourne
Address	313 River St, Ballina, NSW, 2478

Sample Details

Your Reference	**216186 - Kingscliff High School**
Number of Samples	3 Water
Date samples received	07/10/2021
Date completed instructions received	07/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	14/10/2021
Date of Issue	14/10/2021

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Dragana Tomas, Senior Chemist
Hannah Nguyen, Metals Supervisor
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water				
Our Reference		279813-1	279813-2	279813-3
Your Reference	UNITS	MW3	MW4	DAM
Date Sampled		1/10/2021	1/10/2021	1/10/2021
Type of sample		Water	Water	Water
Date extracted	-	11/10/2021	11/10/2021	11/10/2021
Date analysed	-	12/10/2021	12/10/2021	12/10/2021
TRH C_6 - C_9	µg/L	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10
Benzene	µg/L	<1	<1	<1
Toluene	µg/L	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2
o-xylene	µg/L	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1
Surrogate Dibromofluoromethane	%	108	110	109
Surrogate toluene-d8	%	95	96	96
Surrogate 4-BFB	%	87	87	87

svTRH (C10-C40) in Water				
Our Reference		279813-1	279813-2	279813-3
Your Reference	UNITS	MW3	MW4	DAM
Date Sampled		1/10/2021	1/10/2021	1/10/2021
Type of sample		Water	Water	Water
Date extracted	-	08/10/2021	08/10/2021	08/10/2021
Date analysed	-	09/10/2021	09/10/2021	09/10/2021
TRH C_{10} - C_{14}	µg/L	<100	<50	<50
TRH C_{15} - C_{28}	µg/L	<200	<100	<100
TRH C_{29} - C_{36}	µg/L	<200	<100	<100
Total +ve TRH (C10-C36)	µg/L	<100	<50	<50
TRH >C_{10} - C_{16}	µg/L	<100	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<100	<50	<50
TRH >C_{16} - C_{34}	µg/L	<200	<100	<100
TRH >C_{34} - C_{40}	µg/L	<200	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<100	<50	<50
Surrogate o-Terphenyl	%	#	72	64

PAHs in Water				
Our Reference		279813-1	279813-2	279813-3
Your Reference	UNITS	MW3	MW4	DAM
Date Sampled		1/10/2021	1/10/2021	1/10/2021
Type of sample		Water	Water	Water
Date extracted	-	08/10/2021	08/10/2021	08/10/2021
Date analysed	-	08/10/2021	08/10/2021	08/10/2021
Naphthalene	µg/L	<1	<1	<1
Acenaphthylene	µg/L	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1
Fluorene	µg/L	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1
Anthracene	µg/L	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1
Pyrene	µg/L	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1
Chrysene	µg/L	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	71	89	81

HM in water - total				
Our Reference		279813-1	279813-2	279813-3
Your Reference	UNITS	MW3	MW4	DAM
Date Sampled		1/10/2021	1/10/2021	1/10/2021
Type of sample		Water	Water	Water
Date prepared	-	08/10/2021	08/10/2021	08/10/2021
Date analysed	-	08/10/2021	08/10/2021	08/10/2021
Arsenic-Total	µg/L	8	4	<1
Cadmium-Total	µg/L	0.4	0.4	<0.1
Chromium-Total	µg/L	170	20	<1
Copper-Total	µg/L	44	38	<1
Lead-Total	µg/L	16	100	<1
Mercury-Total	µg/L	<0.05	0.62	<0.05
Nickel-Total	µg/L	9	11	<1
Zinc-Total	µg/L	74	230	9

Method ID	Methodology Summary
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			11/10/2021	[NT]	[NT]	[NT]	[NT]	11/10/2021	[NT]
Date analysed	-			12/10/2021	[NT]	[NT]	[NT]	[NT]	12/10/2021	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	98	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	98	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	102	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	106	[NT]	[NT]	[NT]	[NT]	107	[NT]
Surrogate toluene-d8	%		Org-023	94	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate 4-BFB	%		Org-023	85	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Date analysed	-			09/10/2021	[NT]	[NT]	[NT]	[NT]	09/10/2021	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	102	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	102	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
Surrogate o-Terphenyl	%		Org-020	80	[NT]	[NT]	[NT]	[NT]	71	[NT]

QUALITY CONTROL: PAHs in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Date analysed	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Naphthalene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Acenaphthylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Fluorene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	68	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	96	[NT]	[NT]	[NT]	[NT]	88	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	279813-2
Date prepared	-			08/10/2021	1	08/10/2021	08/10/2021		08/10/2021	08/10/2021
Date analysed	-			08/10/2021	1	08/10/2021	08/10/2021		08/10/2021	08/10/2021
Arsenic-Total	µg/L	1	Metals-022	<1	1	8	7	13	100	#
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	1	0.4	0.3	29	97	102
Chromium-Total	µg/L	1	Metals-022	<1	1	170	150	12	99	119
Copper-Total	µg/L	1	Metals-022	<1	1	44	40	10	98	#
Lead-Total	µg/L	1	Metals-022	<1	1	16	14	13	96	#
Mercury-Total	µg/L	0.05	Metals-021	<0.05	1	<0.05	[NT]		100	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	1	9	8	12	97	111
Zinc-Total	µg/L	1	Metals-022	<1	1	74	69	7	99	##

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

TRH Water(C10-C40) NEPM -
 # Percent recovery for the surrogate/matrix spike is not possible to report due to interference from analytes (other than those being tested) in sample #1.
 # The PQL has been raised due to interferences from analytes (other than those being tested) in sample #1.

8 HM in water - total
 - # Low spike recovery was obtained for this sample. The sample was re-digested and re-spiked and the low recovery was confirmed. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.
 - ## Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

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ph 02 9910 6200   fax 02 9910 6201
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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 279813-A

Client Details

Client	ENV Solutions Pty Ltd
Attention	Joshua Stainlay
Address	313 River St, Ballina, NSW, 2478

Sample Details

Your Reference	**216186 - Kingscliff High School**
Number of Samples	additional analysis
Date samples received	07/10/2021
Date completed instructions received	18/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	25/10/2021
Date of Issue	21/10/2021

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics				
Our Reference		279813-A-1	279813-A-2	279813-A-3
Your Reference	UNITS	MW3	MW4	DAM
Date Sampled		1/10/2021	1/10/2021	1/10/2021
Type of sample		Water	Water	Water
Date prepared	-	20/10/2021	20/10/2021	20/10/2021
Date analysed	-	20/10/2021	20/10/2021	20/10/2021
pH	pH Units	6.4	6.4	6.3
Electrical Conductivity	µS/cm	190	190	110
Total Suspended Solids	mg/L	5,000	7,300	10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			20/10/2021	2	20/10/2021	20/10/2021		20/10/2021	[NT]
Date analysed	-			20/10/2021	2	20/10/2021	20/10/2021		20/10/2021	[NT]
pH	pH Units		Inorg-001	[NT]	2	6.4	[NT]		100	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	2	190	[NT]		103	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	2	7300	7400	1	96	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

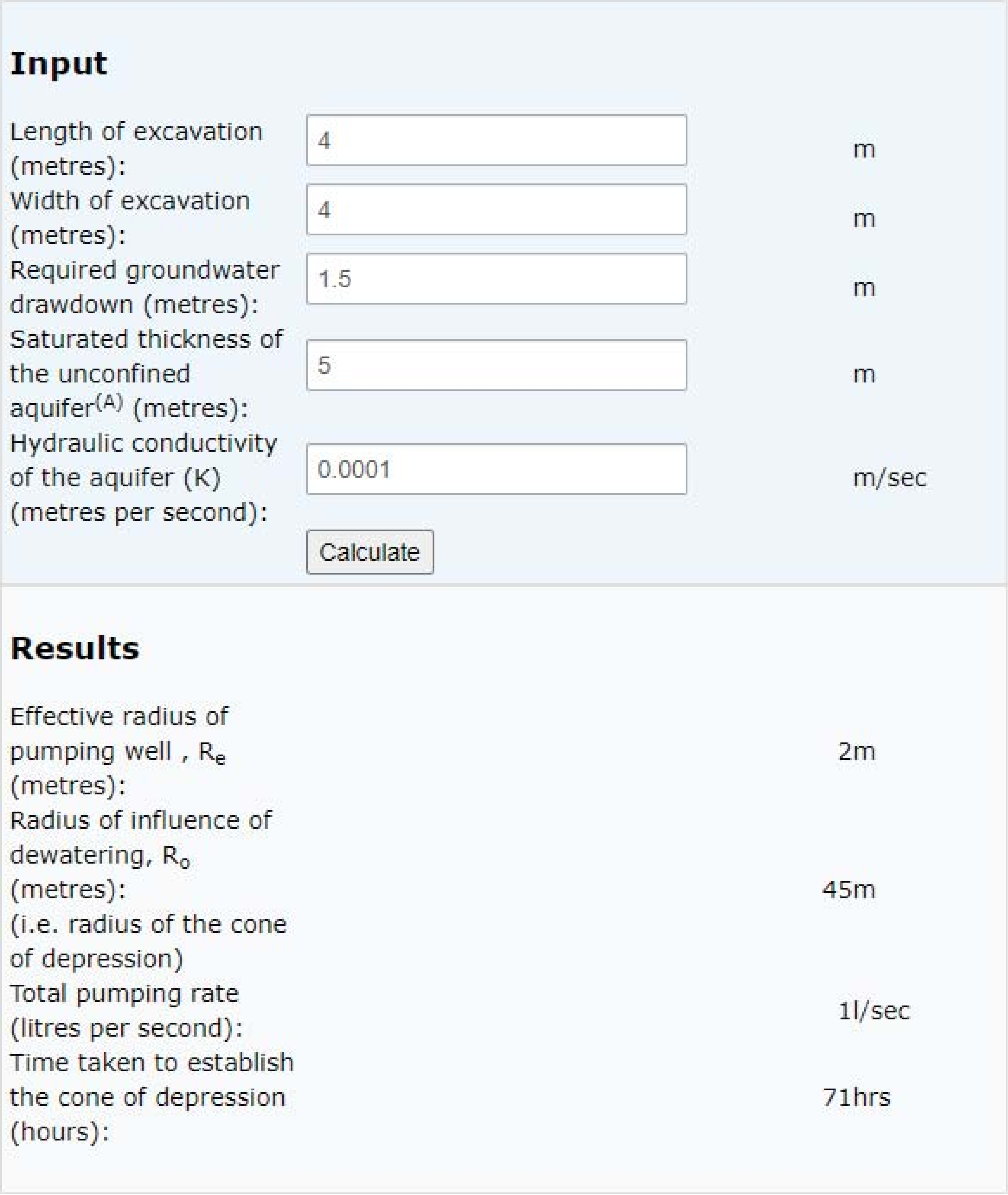
Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

12 Attachment 4

Qmax Estimate



Input

Length of excavation (metres):	4	m
Width of excavation (metres):	4	m
Required groundwater drawdown (metres):	1.5	m
Saturated thickness of the unconfined aquifer(A) (metres):	5	m
Hydraulic conductivity of the aquifer (K) (metres per second):	0.0001	m/sec

Results

Effective radius of pumping well , R_e (metres):	2m
Radius of influence of dewatering, R_o (metres): (i.e. radius of the cone of depression)	45m
Total pumping rate (litres per second):	1l/sec
Time taken to establish the cone of depression (hours):	71hrs

Calculation methods

Dewatering of a rectangular excavation with dimensions **a** metres wide and **b** metres long can be approximated as pumping from a large-diameter bore with an equivalent radius of $\mathbf{r_e}$ metres, where:

$$r_e = \sqrt{\frac{ab}{\pi}}$$

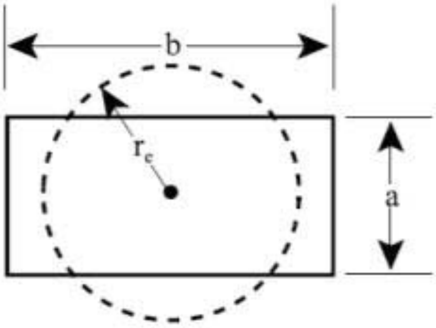


Figure E1 Equation No 1

The radius of influence of this large-diameter bore (i.e radius of the cone of depression of the watertable) can be approximated using Sichardt's equation:

$$\boxed{R_o = 3000(H - h)\sqrt{K}}$$

$$R_o = 3000 \text{ x } s \text{ x}$$

Figure E2 Equation No 2

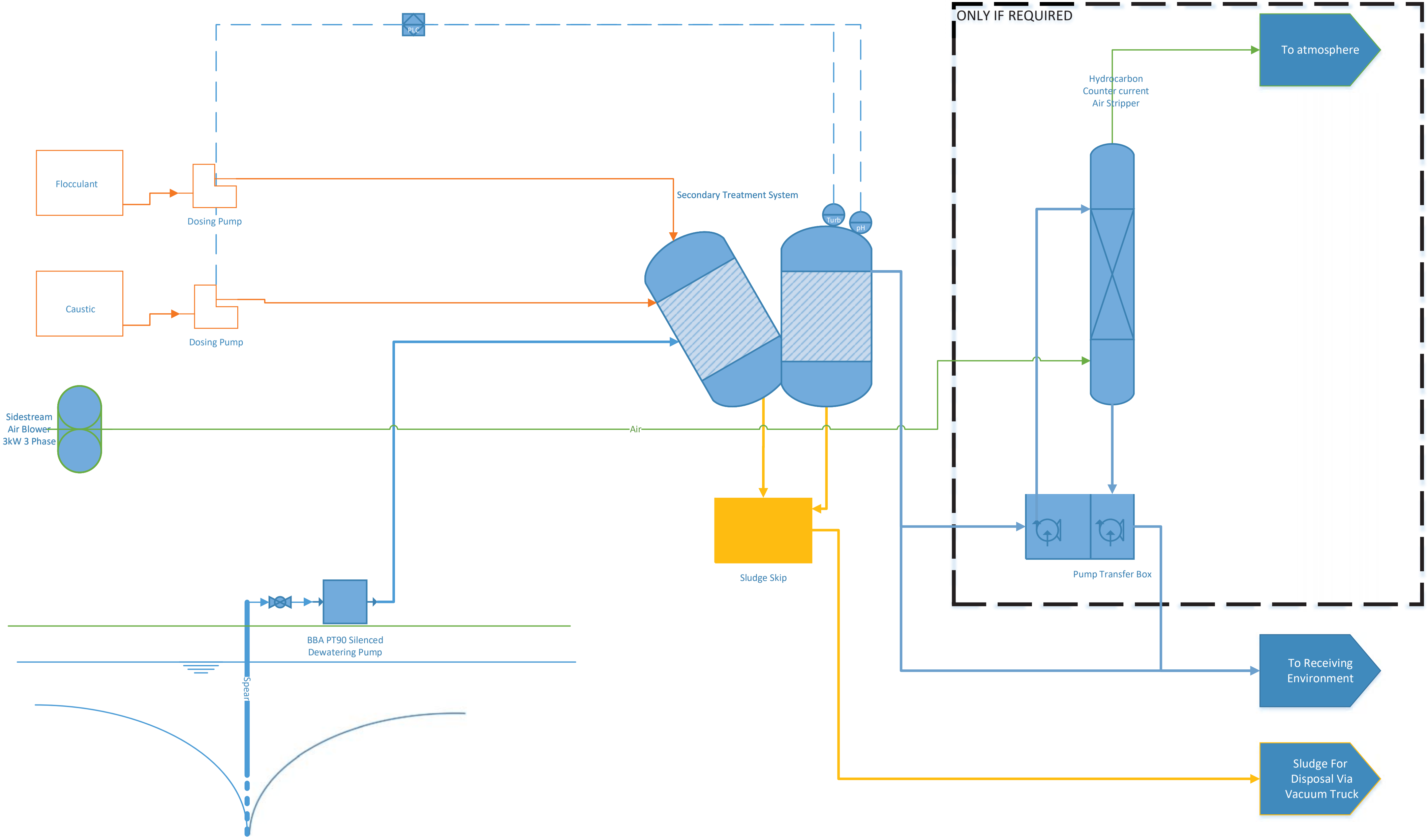
Where: R_o = radius of influence of an equivalent pumping bore (m)
s = maximum groundwater draw down (m)
K = hydraulic conductivity of aquifer matrix (units of m/s)

$$H^2 - h^2 = \frac{nq}{\pi k}(\ln R_o - \ln r_e)$$

Figure E3 Equation No 3

Where: H = saturated thickness of the aquifer undisturbed by pumping (m)
h = saturated thickness of the aquifer at maximum drawdown (m)
k = hydraulic conductivity of aquifer matrix (units of m/s)
R_o = radius of influence of an equivalent pumping bore (m)
r_e = effective radius of an equivalent pumping bore (m)
q = pumping rate of individual dewatering well points (m^3/s)
n = number of well points used to dewater the excavation

13 Attachment 5



REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APP.
A	ISSUED FOR INFORMATION	16/06/16	JKF	JKF	RM	RM

Client:

ENV Solutions Pty Ltd
PO BOX 248
Ballina NSW 2478
admin@envsolutions.com.au

Project:
Dewatering System Overview

Drawing Title:
Process Flow Diagram

Size: A3 Job No: ENV Drawing No: 0001 Revision: A

14 Attachment 6

SAFETY DATA SHEET

HYDRO 790

Infosafe No.: MTHO9
ISSUED Date : 29/08/2016
ISSUED by: Hydro-Chem Pty Ltd

1. IDENTIFICATION

GHS Product Identifier
HYDRO 790

Product Code
790

Product Type
pH CONTROL AGENT

Company Name
Hydro-Chem Pty Ltd

Address
23B Industrial Drive Braeside
VIC 3195 AUSTRALIA

Telephone/Fax Number
Tel: (03) 9553 1011

Emergency phone number
1300 558 788

Emergency Contact Name
Tony Ventura

Recommended use of the chemical and restrictions on use
Normally use at the rate of 10 - 100 ml HYDRO 790 per 1000 Litres of water.
Consult your HydroChem technical representative for specific recommendation.

Other Names

Name	Product Code
Sodium Hydroxide Solution 50%	
Sodium Hydroxide Liquid 50%	
Caustic Soda Solution	
Lye Solution	

Additional Information
Product Description : An alkaline solution used for pH adjustment of waste water recirculating systems.

2. HAZARD IDENTIFICATION

GHS classification of the substance/mixture
Classified as Hazardous according to the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) including Work, Health and Safety Regulations, Australia.
Classified as Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. (7th edition)
Corrosive to Metals: Category 1
Eye Damage/Irritation: Category 1

Skin Corrosion/Irritation: Category 1B

Signal Word (s)
DANGER

Hazard Statement (s)
H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.

Pictogram (s)
Corrosion

Precautionary statement – Prevention
P234 Keep only in original container.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P264 Wash contaminated skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statement – Response
P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/physician.
P363 Wash contaminated clothing before reuse.
P390 Absorb spillage to prevent material damage.

Precautionary statement – Storage
P405 Store locked up.
P406 Store in corrosive resistant/ container with a resistant inner liner.

Precautionary statement – Disposal
P501 Dispose of contents/container to / in accordance with local regulations..

3. COMPOSITION/INFORMATION ON INGREDIENTS

Information on Composition
All ingredients in this product are listed on the Australian Inventory of Chemical Substances (AICS).

Ingredients

Name	CAS	Proportion
Sodium hydroxide	1310-73-2	10-60 %

4. FIRST-AID MEASURES

Inhalation
Remove source of contamination or move victim to fresh air. Restore breathing and administer oxygen if required. Keep victim warm, quiet and in a reclining position. Seek medical advice immediately.

Ingestion
Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Rinse mouth thoroughly with water. Do not induce vomiting. If victim can swallow, have him/her drink 240 to 300 ml of water to dilute material in stomach. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. Seek medical attention immediately.

Skin
As quickly as possible, flush contaminated area with lukewarm, gently running water for at least 30 minutes, by the clock.
Under running water, remove contaminated clothing. If irritation persists, repeat flushing. Seek medical attention immediately.

Eye contact
Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 30 minutes, by the clock, holding the eyelids(s) open. Take care not to rinse contaminated water into the non-affected eye. If irritation persists, repeat flushing. Seek medical attention immediately.

First Aid Facilities
Safety showers and eye wash facilities should be made available wherever this product is in regular use.

Advice to Doctor
Treat symptomatically as for strong alkalis.

5. FIRE-FIGHTING MEASURES

Fire Fighting Measures
Fire-fighters must wear full protective clothing including self contained breathing apparatus. Remove from the vicinity containers not involved in the fire.must wear full protective clothing including self contained breathing apparatus. Remove from the vicinity containers not involved in the fire.

Suitable Extinguishing Media
Extinguishing Media : Use extinguishing media suitable to surrounding fire conditions.

Specific Hazards Arising From The Chemical
FIRE HAZARD COMMENTS: Sodium hydroxide and its solutions will not burn or support combustion.
However, reaction of sodium hydroxide with a number of commonly encountered materials can generate sufficient heat to ignite nearby combustible material.

Hazchem Code
2R

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures
Evacuate unprotected personnel from danger area. Wear appropriate protective clothing. Slippery when spilt. Avoid accidents, clean up immediately. Contain using sand and earth - prevent runoff into drains and waterways. Use absorbent (soil or sand, sawdust, inert material, vermiculite). Collect and seal in properly labelled drums for disposal. Neutralise remaining product with dilute acid, adjusting pH to 6-10. Wash area down with excess water.

7. HANDLING AND STORAGE

Handling and storage
Store away from incompatible materials such as aluminium, zinc, tin, magnesium and alloys of these metals. Also incompatible with acids, chlorinated compounds, bromine compounds and nitrated hydrocarbons. Post warning signs when appropriate. Keep storage areas secure and segregated from populated work areas. Take necessary maintenance precautions to avoid leaks.

Additional information on precautions for use
Leather is attacked by caustic.
Always use good occupational work practices.

Other Information
Exothermic reaction on dilution with water. Extremely slippery when wet.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure limit values
TLV, 2.0 mg/m3 -Ceiling Value
As published by the National Health & Medical Research Council.
Ceiling Value - Is the concentration that should not be exceeded even instantaneously.
TLV is the time weighted average concentration of the work atmosphere over a normal 8-hour work day and a 40-hour work week. Nearly all workers may be repeatedly exposed to this level, day after day, without adverse effect.
These TLVs are issued as guidelines for good practice. All atmospheric contamination should be kept to as low a level as is practically possible.
These TLVs should not be used as fine lines between safe and dangerous concentrations.

Appropriate Engineering Controls
Maintain concentration below recommended exposure limit.
ENGINEERING CONTROLS Engineer control methods to reduce hazardous exposures are preferred. General methods include mechanical ventilation, (dilution and general exhaust), process or personnel enclosure, control of process conditions and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may be also required. Use a corrosion-resistant ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Use local exhaust ventilation, and process enclosure if necessary, to control airborne spray/mists. Supply sufficient air to make up for air removed by exhaust systems.

Personal Protective Equipment
RESPIRATORY PROTECTION If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protective equipment including approved respiratory protection.
Have appropriate equipment available for use in emergencies such as spills or fire. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.
RESPIRATORY PROTECT. GUIDELINES - RECOMMENDATIONS FOR SODIUM HYDROXIDE
CONCENTRATIONS IN AIR: UP TO 50 mg/m3: Powered air-purifying respirator with dust and mist filter(s); or SAR operated in a continuous flow mode.
UP TO 100 mg/m3: Full-facepiece SCBA; or full-facepiece SAR; or full-facepiece respirator with high-efficiency particulate filter(s).
UP TO 250 mg/m3: Positive pressure, full-facepiece SAR. EMERGENCY OR PLANNED
ENTRY IN UNKNOWN CONCENTRATION OR IDLH CONDITIONS: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA. ESCAPE: Full-facepiece respirator with high-efficiency particulate filter(s); or escape-type SCBA.
NOTE: Substance causes eye irritation or damage; eye protection needed.
ABBREVIATIONS: SAR = supplied-air respirator; SCBA = self-contained breathing apparatus. IDLH = Immediately Dangerous to Life or Health. NOTE:
In these recommendations the IDLH concentration is defined as the maximum concentration which would not cause any escape impairing symptoms or irreversible health effects to a person exposed for 30 minutes if the respirator failed.
EYE/FACE PROTECTION Splash proof chemical safety goggles. A face shield may also be necessary.
SKIN PROTECTION Impervious gloves, coveralls, boots and/or other resistant protective clothing. Have a safety shower/eye-wash fountain readily available in the immediate work area.
RESIST. FOR PROTECTIVE CLOTHING SODIUM HYDROXIDE: GOOD: Chlorinated polyethylene (CPE), natural rubber, neoprene, nitrile/ polyvinyl chloride
(PVC), nitrile, polyethylene (PE), PVC, polyurethane, styrene-butadiene rubber (SBR) , Viton/chlorobutyl rubber, Silvershield, SBR/ neoprene, FAIR/POOR: Butyl rubber SODIUM HYDROXIDE SOLUTIONS, LESS THAN 30%: GOOD:PE, neoprene/natural rubber SODIUM HYDROXIDE SOLUTIONS, 30-70%: VERY GOOD: Natural rubber, neoprene, nitrile/PVC, nitrile, PVC, Viton, Saranex GOOD: Butyl rubber, CPE, Viton/neoprene, butyl rubber/neoprene, Teflon, natural rubber/neoprene/nitrile-butadiene rubber, SBR, neoprene/natural rubber , neoprene/PVC FAIR/POOR: Polyvinyl alcohol, nonwoven PE NOTE: Resistance of specific materials can vary from product to product. Evaluate resistance under conditions of use and maintain clothing carefully.
PERSONAL PROTECTION COMMENTS Remove contaminated clothing promptly. Keep contaminated clothing in closed containers. Discard or launder before reusing. Inform laundry personnel of contaminant's hazards.

Hygiene Measures
Launder contaminated clothing before re-use.
Wash hands before eating, drinking, smoking and using the toilet.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form
Liquid

Appearance
Water, clear white to slightly coloured strongly alkaline liquid.
Hygroscopic. Miscible with water. Exothermic reaction on dilution with water.

Odour
Mild

Boiling Point
140°C (approx)

Solubility in Water
Soluble

Specific Gravity
1.48 - 1.52 @ 20ºC

pH
> 13

Vapour Pressure
Not Allocated

Flash Point
Not applicable.

Flammability
Non flammable.
May react with aluminium, tin, zinc to produce flammable hydrogen gas (possible explosion hazard).

Flammable Limits - Lower
Not Allocated

Other Information
Solubility in water - Soluble.
Freezing point - 12°c (approx)

10. STABILITY AND REACTIVITY

Chemical Stability
Stable.

Hazardous Decomposition Products
None known.

Possibility of hazardous reactions
The substance is a strong base and reacts violently with acids. Attacks aluminium, zinc and tin forming combustible gas (hydrogen). Reacts with ammonium salts generating ammonia gas. Reacts with organohalogen compounds to form spontaneously combustible compounds. Reacts explosively with nitro and chloro organic compounds. Absorbs water and carbon dioxide from the air. Exothermic reaction on dilution with water.

Hazardous Polymerization
Does not occur.

11. TOXICOLOGICAL INFORMATION

Toxicology Information
KNOWN TOXICOLOGICAL DATA:
Hydro 790: Oral (rat) LDLO = 500 mg/kg.

Intraperitoneal (mouse) LD50 = 40 mg/kg.
Oral (rabbit) LDLO = 500 mg/kg [10% solution].

Ingestion
Can kill if swallowed.
There are no reported cases of industrial workers ingesting sodium hydroxide or its solutions. Should ingestion occur, severe pain; burning of the mouth, throat and oesophagus; vomiting; diarrhoea; collapse and possible death may result.

Inhalation
Effects of inhaling sodium hydroxide mists have not been clearly established. Most references indicate that irritation of the nose, throat and lungs would occur due to the corrosive nature of sodium hydroxide.
However, there are no actual reports of industrial workers exposed to sodium hydroxide experiencing these symptoms.

Skin
Extremely corrosive. Capable of causing severe burns with deep ulceration.
Can penetrate to deeper layers of skin. Corrosion will continue until removed. Severity depends on concentration and duration of exposure.
Burns are not immediately painful; onset of pain may be minutes to hours.

Eye
Extremely corrosive. Can penetrate deeply causing irritation or severe burns depending on the concentration and duration of exposure. In severe cases, ulceration and permanent blindness may occur.

Chronic Effects
HEALTH EFFECTS There have been no documented effects due to long-term exposure to sodium hydroxide.
CARCINOGENICITY Sodium hydroxide has been implicated as a cause of cancer of the oesophagus in individuals who have ingested it. The cancer may develop 12 to 42 years after the ingestion incident. Similar cancers have been observed at the sites of severe thermal burns. These cancers may be due to tissue destruction and scar formation rather than the sodium hydroxide itself. Not classed as a carcinogen by Worksafe Aust.
TERATOGENICITY AND EMBRYOTOXICITY Insufficient information.
TOXICOLOGICAL SYNERGISTIC MATERIALS Insufficient information.
MUTAGENICITY Insufficient information.
POTENTIAL FOR ACCUMULATION None.

12. ECOLOGICAL INFORMATION

Environmental Protection
Harmful to aquatic life. TLm 96: 100-10 ppm.
Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Waste Disposal
Refer to State Land Waste Management Authority or a licensed disposal contractor for disposal.
Empty containers must be decontaminated, rinse with water before landfill disposal.

14. TRANSPORT INFORMATION

U.N. Number
1824

UN proper shipping name
SODIUM HYDROXIDE SOLUTION

Transport hazard class(es)
8

Packing Group
II

Hazchem Code
2R

Storage and Transport
UN No. 1824 (II)
Keep containers closed at all times. Store away from acids. Do not use aluminium or galvanized containers or use die-cast zinc or aluminium bungs.
Steel bungs should be used. Containers made of nickel alloys are preferred.
Steel containers are acceptable if temperatures are not elevated. Storage tanks should be above ground and surrounded is capable of holding the entire contents. Limit quantity of material in storage. Restrict access to storage area. Post warning signs where appropriate. Keep storage areas separate from populated work areas. Inspect periodically for deficiencies such as damage or leaks.
Class 8 Corrosives shall not be loaded in the same vehicle with:

- Class 1 Explosives
- Class 4.3 Dangerous when wet substances
- Class 5.1 Oxidizing agents
- Class 5.2 Organic peroxides
- Class 6 * when a cyanide
- Class 7 Radioactive materials
- Class 8 * when an acid.
- Foodstuffs or foodstuff empties.

Observe the requirements of the Australian Code for the transport of dangerous goods by road and rail.

IERG Number
37

15. REGULATORY INFORMATION

Poisons Schedule
S6

Packaging & Labelling
Labelling requirements of the Standard for Uniform Scheduling of Drugs and Poisons do not apply to a poison that is packed and sold solely for industrial, laboratory or manufacturing purposes; however is labelled in accordance with the National Occupational Health and Safety Commission's 'National Code of Practice for the Labelling of Workplace Substances'.
Pack Sizes : 15 L, 200 L or 1000 L.

16. OTHER INFORMATION

Contact Person/Point

Normal Working Hours - Ph: (03) 9553 1011 Fax: (03) 9553 1387
Ask for the Facilities Manager, Sales Manager or Services Manager.
After Hours - Ph : 1300 558 788

Further information/advice is available to those persons responsible for the design of safe work practices on their written request to HydroChem.

This SDS summarises to the best of our knowledge at the date of issue, the health and safety hazard information of the selected substance and how to safely handle the selected substance in the workplace. Each user should read this SDS and consider the information in the context of how the product will be handled and used in the workplace, including in conjunction with other products.

Hydro-Chem Pty Ltd responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

If clarification or further information is required, the user should contact Hydro-Chem Pty Ltd using the contact details provided.

Empirical Formula & Structural Formula
H-Na-O in water

Other Information
ABBREVIATIONS:
- ACGIH - American Conference of Government Industrial Hygienists
- OSHA - Occupational Safety and Health Information
- TLV - Threshold Limit Value
- NOHSC - National Occupational Health & Safety Committee

END OF SDS

SAFETY DATA SHEET

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name:	**LIQUID ALUMINIUM CHLOROHYDRATE**
Other Names:	Aluminium Chloride Hydroxide, Aluminium Chlorohydrate, Aluminium Hydroxychloride, Aluminium Chlorohydroxide.
Manufacturers Product Code:	MegaPac 23™.
Recommended use of the chemical and restrictions on use:	Flocculent for the treatment of municipal water supplies, waste water and industrial effluents; removal of phosphate in sewage treatment; paper manufacture; chemical manufacture.
Supplier:	Omega Chemicals
ABN:	32 982 143 022 / A.C.N 005 032 744 T/A
Street Address:	55 FITZGERALD ROAD, LAVERTON NORTH VIC 3026
Telephone Number:	+61 3 8368 8000
Facsimile:	+61 3 8368 8020
Emergency Telephone:	1300 131 001 (24 Hours) Poisons Information Centre Australia: 131 126

2. HAZARD IDENTIFICATION

Hazard Classification:	Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS. Classified as hazardous according to Safe Work Australia; HAZARDOUS SUBSTANCE.
GHS Classification:	No available data
Signal Word (s):	No available data
Hazard Statement(s):	H320 Causes eye irritation H316 Causes mild skin irritation
Precautionary Statement(s):	
Prevention Statement(s):	P102 Keep out of reach of children P103 Read Label before use P104 Read Safety Data Sheet before use P234 Keep only in original container P264 Wash hand thoroughly after handling. P280 Wear protective gloves/protective clothing/eye protection/face protection

Response Statement(s): P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P337+P313 If eye irritation persists: Get medical advice/attention.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.
P362 Take off contaminated clothing and wash before use.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P301+P330+P331 IF SWALLOWED: Rinse mouth. Do not induce vomiting.
P313 Get medical advice/attention
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P262 Do not get in eyes, skin or on clothing.

Storage Statement(s): P405 Store locked up.
P406 Store in corrosive resistant/compatible container.
P403+P235 Store in well-ventilated place. Keep cool.

Disposal Statement(s): Dispose of contents/container according to jurisdictional regulations.

Poison Schedule (SUSMP): None Allocated

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients:	**CAS Number**	**Proportion:**	**Hazard Codes**
Aluminium Chlorohydrate	12042-91-0	50%	H320, H316
Water	7732-18-5	Balance to 100%	

4. FIRST - AID MEASURES

For advice, contact Poisons Information Centre on 131 126 or a Doctor.

Ingestion: Immediately rinse mouth with water. Give plenty of water to drink. **DO NOT** induce vomiting. If vomiting occurs give further water. Never give anything by mouth if victim is rapidly losing consciousness. **Seek immediate medical attention.**

Eyes: Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. **Seek medical assistance.**

Skin: Remove all contaminated clothing without delay. Wash skin gently and thoroughly with copious amounts of water. If irritation occurs, seek medical attention.

Inhalation: Remove the source of contamination or move the victim to fresh air; avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. Seek medical attention.

Advice to Doctor: Treat symptomatically.

Additional Information

Aggravated medical conditions caused by exposure: No information available on medical conditions which are aggravated by exposure to this product. Repeated skin exposure may lead to dermatitis. Repeated ingestion of this product may cause phosphate deficiency which can weaken bones.

5. FIRE FIGHTING MEASURES

Extinguishing Media: In case of fire, use an appropriate extinguishing media (water fog or if unavailable fine water spray, foam, carbon dioxide, dry chemical powder) that is the most suitable for surrounding fire conditions. Keep containers cool with water spray. If safe to do so, remove containers from path of fire. Suppress (knock-down) gases, vapours and mists with a water spray jet.

Hazchem Code: N/A.

Specific Hazards arising from the substance or mixture:

Hazards from Combustion: Product is non-flammable and stable under normal conditions of use and storage. Under fire conditions this product may emit toxic and/or irritating vapours and gases including hydrogen chloride gas.

Flammability Conditions: Product is a non-flammable liquid.

Special Protective Precautions and Equipment for Fire Fighters: Fire fighters should wear a self-contained breathing apparatus and full protective clothing along with protective equipment. Prevent fire extinguishing water from contaminating surface water or the ground water system.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures/Protective Equipment/Personal Precautions: Evacuate all unnecessary personnel. Work upwind. Increase ventilation. Use water spray to disperse vapours. Personnel involved in the clean-up should wear full protective clothing; self-contained breathing apparatus may be needed for prolonged periods of exposure. Avoid walking through spilled product as it may be slippery. Cover drains. Collect, bind and pump off spills.

Environmental Precautions:	Do not allow product to enter drains, sewers, waterways or soil. If contamination of drains has occurred, advise the local emergency services.
Methods and Materials for Containment and Clean Up:	Contain spilled product using absorbent (soil or sand). Prevent run off into drains, sewers waterways or soil. Collect and seal in properly labelled drums ready for appropriate disposal. Dilute remaining product with water, then carefully neutralize with lime. For large spills notify local emergency services.

7. HANDLING AND STORAGE

Precautions for Safe Handling:	Irritant liquid. Ensure an eye bath and safety shower are available and ready for use. Use only in a well-ventilated area. Prevent the build-up of mists in the work atmosphere. Avoid inhalation of mists, and skin or eye contact. Wear appropriate protective equipment to prevent inhalation, skin and eye contact when mixing and using. Ensure a high level of personal hygiene is maintained when using this product, that is, always wash hands before eating, drinking, smoking or using the toilet. Keep containers sealed when not in use.
Container Type:	Packaging must comply with requirements of Hazardous Substances (Packaging) Regulations 2001. Store in original packaging as approved by manufacturer. Store and transport in corrosion resistant containers such as stainless steel, rubber lined steel, PVC, fibreglass or polyethylene.
Conditions for Safe Storage, including any Incompatibles:	Store in a cool, dry, well-ventilated area out of direct sunlight. Do not store with incompatible products such as chlorite, hypochlorite, sulphite, oxidizing agents and cyanides; Avoid contact with unalloyed steels, galvanized or aluminium surfaces. Do not store with any foodstuffs.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters:

National Exposure Standards:	Aluminium Chlorohydrate: No specific exposure standard. Aluminium soluble salts (as Aluminium): AU OEL: 2 mg/m^3.
Biological Limit Values:	No data available
Appropriate Engineering: Controls:	Select suitable materials for the construction of storage tanks, containers, pipe valves and fittings. Ensure adequate ventilation. Natural ventilation should be adequate under normal use conditions. Keep containers closed when not in use in a well-ventilated area.

Individual Protection Measures, such as Personal Protective Equipment (PPE):	**Respirator:**	If engineering controls are not effective in controlling airborne exposure then an approved respirator with a replaceable mist filter should be used.
	Eyes:	Chemical splash goggles or safety glasses with side shields and a full-face shield as appropriate should be used.
	Hands:	Wear elbow-length gloves of impervious material, PVC or rubber should be suitable.
	Clothing:	Protective overalls, splash apron and rubber boots.

After using this product always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Core Information

Appearance:	Colourless to slightly cloudy liquid.
Formula:	$Al_2(OH)_5Cl$.
Odour:	Odourless.
pH:	2.5 – 3.5.
Vapour Pressure:	No data available.
Vapour Density:	No data available.
Boiling Point:	>100°C.
Freezing Point:	ca. -5°C.
Solubility (in Water):	Miscible.
Specific Gravity:	1.33 – 1.34 (at 20°C).
Flash Point:	N/A.
Flammability Limits (as Percent Volume in Air):	**Lower Explosive Limit** N/A. **Upper Explosive Limit** N/A.
Ignition Temperature:	No data available.

Additional Information

Specific Heat Value:	No data available.
Particle Size:	No data available.
Volatile Organic Compounds Content (VOC):	No data available.
Viscosity:	No data available.
Percent Volatile:	No data available.
Octanol/Water Partition Coefficient:	No data available.
Saturated Vapour Concentration:	No data available.
Additional Characteristics:	Insoluble in alcohol.
Flame Propagation/Burning Rate of Solid Materials:	No data available.
Properties that may Initiate or Contribute to the Intensity of a Fire:	No data available.
Potential for Dust Explosion:	N/A.
Reactions that Release Flammable Gases or Vapours:	Thermal decomposition will produce hydrogen chloride gas.
Fast or Intensely Burning Characteristics:	No data available.
Non-Flammables that Could Contribute Unusual Hazards to a Fire:	No data available.
Release of Invisible Flammable Vapours and Gases:	No data available.
Decomposition Temperature:	No data available.
Evaporation Rate:	No data available.

10. STABILITY AND REACTIVITY

Reactivity:	
Chemical Stability:	Stable under normal conditions of storage and handling. This product can hydrolyse and form a precipitate of aluminium hydroxide in very dilute aqueous solutions. The solubility is dependent on the pH.

Possibility of hazardous Reactions: Strong aqueous solutions of the product will readily react with sodium hydroxide and other alkali to form a thick slippery paste or gel. When involved in a fire, the product will undergo thermal decomposition to produce hydrogen chloride gas.

Conditions to Avoid: Heat-sensitive, avoid exposure to extreme heat and high temperatures. Avoid sources of ignition.

Incompatible Materials: Avoid contact with unalloyed steels, galvanized or aluminium surfaces. Do not expose to chlorite, hypochlorite, sulphite, sodium hydroxide, alkalis, oxidizing agents and cyanides. Keep away from all foodstuffs.

Hazardous Decomposition Products: Hydrogen chloride gas.

11. TOXICOLOGICAL INFORMATION

Toxicity Data

LD50: 13000 mg/kg (rat, oral).

Acute (short term)

Ingestion: May be harmful if swallowed. May cause abdominal pain, nausea, vomiting, bleeding stomach, incoordination, muscle spasm and kidney damage.

Eye: Can cause moderate to severe irritation and inflammation to the eyes.

Skin: Can cause irritation and stinging to open cuts and wounds.

Inhalation: This product has a very low vapour pressure at ambient temperature and therefore cannot normally be inhaled. Inhalation of mists from the product can cause sore throat, coughing and irritation of nose. High concentration of mists may cause congestion and restriction of airways.

Chronic (long term)

Skin: Repeated or prolonged exposure may cause dermatitis.

Ingestion: Repeated ingestion of this product may cause phosphate deficiency which can weaken bones.

12. ECOLOGICAL INFORMATION

Ecotoxicity: No data available.

Persistence and Degradability: No data available.

Mobility: No data available.

Additional Information

Environmental Fate (Exposure): No data available.

Bio accumulative Potential: No data available.

Other Adverse Effects: Discharge into the environment must be avoided. Avoid contaminating waterways, drains and sewers. This product is an inorganic compound. A metal hydroxide precipitate is formed during hydrolyses in the pH range 5 to 7; due to this reaction the pH of the water decreases. If phosphates are present then metal phosphate complexes may form.

13. DISPOSAL CONSIDERATIONS

Disposal Methods: Dispose of in accordance with all local, state and federal regulations. Refer to appropriate State Waste Disposal Authority. Observe local regulations. After dilution and careful neutralisation, approved liquid waste land fill site may be suitable.

Special Precautions for Landfill or Incineration: No data available.

14. TRANSPORT INFORMATION

UN Number: None allocated.

UN Proper Shipping Name: Aluminium Chloride Hydroxide.

Dangerous Goods Class: None allocated.

Subsidiary Risk: None allocated.

Packaging Group: None allocated.

Special Precautions for User: Irritant.

Hazchem Code: N/A.

APPROVED FOR AIR CARGO by IATA.

15. REGULATORY INFORMATION

Poisons Schedule: N/A.

EPG: N/A.

AICS Name: Aluminium Chloride Hydroxide.

Additional information: No data available.

16. OTHER INFORMATION

Revision Details

Reason for Revision:

Version 1	5 year review. Updated to a new format. Additional information added.
Version 2	Alignment to GHS requirements.
Version 3	Reclassified as Hazardous.

Literature References

Chemical Rubber Company:	Handbook of Chemistry and Physics, 85th Edition.
Safe Work Australia:	Hazardous Chemicals Information System (HCIS) Exposure Standards and GHS Classifications Data-Base, 25 June 2016.
National Transport Commission:	Australian Code for the Transport of Dangerous Goods by Road and Rail, Volume 7.

Abbreviations

CAS Number:	Chemical Abstract Service Registry Number.
GHS	Globally Harmonized System of Classification and Labelling of Chemicals.
EPG:	Emergency Procedure Guide.
LD50:	Lethal Dose 50%: The lowest concentration at which approximately 50% of test animals will die when given the specified dose by mouth.
ADG Code:	Australian Code for the Transport of Dangerous Goods by Road and Rail, Volume 7.
AICS Name:	Australian Inventory of Chemical Substances Name.
OEL:	Occupational Exposure Level.
N/A:	Not Applicable.

Disclaimer

This Safety Data Sheet is offered solely for information, consideration and investigation to determine the suitability of various health and safety precautions as may be required under the user's specific conditions and processes. All such conditions and processes are beyond the control of Omega Chemicals.

The information contained herein is based on data available to Omega Chemicals from both our own technical sources and recognised published references and is believed to be both accurate and reliable. Omega Chemicals however provides no warranties, either expressed or implied, and assumes no responsibility for the accuracy or completeness of this information.

Omega Chemicals reserves the right to revise this Safety Data Sheet as information becomes available. The user has the responsibility, by making contact with this company or otherwise to make certain the Safety Data Sheet is the latest issue.

DOCUMENT END

Appendix E – Consultant Qualification

ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Ben Pieterse

Environmental Scientist

Qualifications

Bachelor of Environmental Science. Southern Cross University, 2019.

National Acid Sulfate Soils Guidance - Identification and Assessment Course. Southern Cross University, 2021.

Conduct Backhoe/Loader Operations. Lawrence Davis Industry Training, 2021.

Asbestos Awareness Training. Alert Force, 2020.

Construction Induction. Workplace Health and Safety QLD, 2019.

Certificate II Information Technology. TAFE NSW, 2008

Key areas of Experience:

- Desktop and field- based site assessment
- Technical report writing
- Contaminated land investigation and remediation
- Resource recovery and waste management
- Project management
- Stakeholder engagement
- Environmental management
- On-site wastewater assessment

Career Summary

A multi-skilled and accomplished Environmental Scientist, Ben is approaching three years of environmental consulting experience in the northern NSW region. A member of the Australasian Land and Groundwater Association (ALGA) Association of NSW – Ben’s expertise is crucial in identifying environmental issues and delivering the correct solution.

Ben’s recent experience includes; Leading the preparation of Construction Environmental Management Plans, Management of works contracts and subcontractor engagement, Routinely applying resource recovery options for materials generated by local Councils and private enterprise, leading the successful assessment and of a local Council site, routinely applying resource recovery options for materials generated by local Councils and private enterprise.

Environmental Project Highlight

2021 - Detailed site investigation and acid sulfate soil assessment associated with the development of a constructed wetland at Byron Bay, NSW.
Client: Byron Shire Council

- Consultation with stakeholders to establish target project outcomes.
- Develop project budget, contract procurement and engagement and coordination of subcontractors.
- Lead site investigation program (borehole drilling and soil sampling program).
- Preparation of Detailed Site Investigation Report and Acid Sulfate Soils Management Plan.
- Ongoing consultation with client on project outcomes and requirements for management of excavation spoil.