SOIL AND WATER ASSESSMENT
PREPARED FOR
ANDY'S EARTHWORKS PTY LTD
100 FAIREY ROAD, SOUTH WINDSOR NSW 2756

Prepared for: Andy's Earthworks Pty Ltd
MacroPlan Dimasi

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Benbow
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Engineering a Sustainable Future for Our Environment

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1. INTRODUCTION

Benbow Environmental has been engaged by Andy's Earthworks Pty Ltd c/o MacroPlan Dimasi to undertake a Soil and Water assessment to support an Environmental Impact Statement (EIS) for the proposed construction materials processing and recycling plant to be located at 100 Fairey Road, South Windsor NSW 2756. The assessment is a qualitative study that addresses the potential impacts to soil and water from the proposed operations in accordance with the Secretary's Environmental Assessment Requirements (SEARs No. 1188).

1.1 SEARS REQUIREMENTS

Water and soil requirements are listed in the Secretary's Environmental Assessment Requirements (SEAR 1188) dated 15/12/2017 as a key issue and the following table provides the details of requirements addressed in this report.

Table 1-1: SEARS

Requirement	Comment
DP&E REQUIREMENTS	
A description of local soils, topography, drainage and landscapes.	See Section 4.1
The details of stormwater, leachate and wastewater management.	See Section 3.5
The details of sediment and erosion controls.	See Section 3.5
A detailed site water balance.	See Section 3.4.1
The details of water usage including water supply and licences.	See Section 3.4
An assessment of impacts to surface and groundwater resources, flooding impacts and impacts to groundwater dependent ecosystems.	See Section 3.6
Measures that would be implemented to ensure that the development is consistent with the Hawkesbury Floodplain Risk Management Study and Plan.	See Section 3.2
An assessment in accordance with ASSMAC Guidelines for the presence and extent of acid sulfate soils (ASS) and potential acid sulfate soils (PASS) on the site.	See Section 4.1.3
Details of the stormwater and wastewater management systems (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	See Section 3.5
A description and appraisal of impact mitigation and monitoring measures.	See Section 5
EPA REQUIRMENTS	
Provide details of the project that are essential for predicting and assessing impacts to waters including: a) the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on http://www.environment.nsw.gov.au/ieo/index.htm, using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000) b) the management of discharges with potential for water impacts c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.	See Section 3.6.1 See Section 3.5 See Section 3.4 See Section 2.6.1
Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts e.g. effluent ponds) and showing potential areas of modification of contours, drainage etc.	See Section 2

Table 1-1: SEARS

Requirement	Comment
Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.	See Section 3.4
Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective.	See section 0 and 2.4
The Water Quality and River Flow Objectives on the website: http://www.environment.nsw.gov.au/ieo/index.htm should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.	See Section 2.3.1
Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).	See Section 3.6.1
Provide site drainage details and surface runoff yield.	See Section 3.5
State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: http://www.environment.nsw.gov.au/ieo/index.htm. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.	See Section 2.3.1
State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 Guidelines for Fresh and Marine Water Quality (http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html) (Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.	See Section 2.3.1 and 3.6
State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries or the NSW Salinity Strategy (DLWC, 2000) (http://www.environment.nsw.gov.au/salinity/government/nswstrategy.htm).	See Section 3.1

Table 1-1: SEARS

Requirement	Comment
Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.	See Section 3.6
Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high-risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include: a) lake or estuary flushing characteristics b) specific human uses (e.g. exact location of drinking water offtake) c) sensitive ecosystems or species conservation values d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment f) historic river flow data where available for the catchment.	See Section 0
No proposal should breach clause 120 of the Protection of the Environment Operations Act 1997 (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).	See Section 3.2
Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.	See Section 3.6.1
Include a rationale, along with relevant calculations, supporting the prediction of the discharges.	See Section 3.6.1
Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).	See Section 0, 3.6.6 and 4.2
Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).	See Section 3.6
Identify any potential impacts on quality or quantity of groundwater describing their source.	See Section 3.6.6
Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.	See Section 3.6.8.1 and 4.1.2
Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.	See Section 4.1.3
Containment of spills and leaks shall be in accordance with EPA's guidelines section 'Bunding and Spill Management' at http://www.epa.nsw.gov.au/mao/bundingspill.htm and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.	See Section 3.5.2

Table 1-1: SEARS

Requirement	Comment
The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered: a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.	See Section 2.3.1
Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment. Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.	See Section 2.6
Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.	See Section 3.1
Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.	See Section 3.1
Reference should be made to Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and Guidelines for Fresh and Marine Water Quality ANZECC 2000)	See Section 3.5
Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.	See Section 3.6.5 and 3.6.7
Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.	See Section 3.6.8.1
Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.	See Section 3.5.4
Outline pollution control measures relating to storage of materials, possibility of accidental spills (e.g. preparation of contingency plans), appropriate disposal methods, and generation of leachate.	See Section 3.6.1
Describe hydrological impact mitigation measures including: a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition) b) minimising runoff c) minimising reductions or modifications to flow regimes d) avoiding modifications to groundwater.	a. See Section 2.1 b. See Section 3.5.4 c. See Section 5 d. See Section 3.6.6

Table 1-1: SEARS

Requirement	Comment
Describe groundwater impact mitigation measures including: a) site selection b) retention of native vegetation and revegetation c) artificial recharge d) providing surface storages with impervious linings e) monitoring program.	See Section 3.6.6
Describe geomorphological impact mitigation measures including: a) site selection b) erosion and sediment controls c) minimising instream works d) treating existing accelerated erosion and deposition e) monitoring program.	See Section 3.6.8.1, 5
Any proposed monitoring should be undertaken in accordance with the Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004).	See Section 3.6.7
Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.	See Section 4.1 and 4.1.4
5. Soils and Contamination - *Assess impacts*	
Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of: a) disturbing any existing contaminated soil b) contamination of soil by operation of the activity c) subsidence or instability d) soil erosion e) disturbing acid sulfate or potential acid sulfate soils.	See Section 4.1.4, 4.2, 3.6.8.1 and 3.6.1,
5. Soils and Contamination - *Describe management and mitigation measures*	
Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including: a) erosion and sediment control measures b) proposals for site remediation – see Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) c) proposals for the management of these soils – see Acid Sulfate Soil Manual (Acid Sulfate Soil Advisory Committee 1998) and Acid Sulfate Soils Assessment Guidelines (Acid Sulfate Soil Advisory Committee 1998).	See Section 3.6.8.1 and 4.1.3

1.2 SCOPE OF WORKS

The assessment is qualitative and the scope of works includes the following:

- Review of relevant plans and documentation relating to the site and proposed development;
- Addressing the key issues for "soil and water" identified in the Secretary's Environmental Assessment Requirements (SEARs) reference: SEAR 1188, dated 15/12/17 including:
  - A description of local soils, topography, drainage and landscapes;
  - The details of stormwater, leachate and wastewater management;
  - The details of sediment and erosion controls;
  - A detailed site water balance;
  - The details of water usage including water supply and licenses;

- An assessment of impacts to surface and groundwater resources, flooding impacts and impacts to groundwater dependent ecosystems;
- Measures that would be implemented to ensure that the development is consistent with the Hawkesbury Floodplain Risk Management Study and Plan;
- Identification of the probability of the occurrence of acid sulfate soils at the site and determination of whether an acid sulfate soil management plan in accordance with ASSMAC guidelines is required; and
- A description and appraisal of impact mitigation and monitoring measures.

The report has been prepared based on the information provided by the client. No soil or water sampling or analysis work was undertaken as part of this assessment. Recommendations for further studies to support the findings of this report are provided where considered necessary.

2. SITE DETAILS AND PROPOSED DEVELOPMENT

This section provides a description of the site, surroundings and proposed development.

2.1 SITE LOCATION

The land is located at 100 Fairey Road, South Windsor NSW 2756, also known as Lot 4, DP264159. The site is located within the Hawkesbury City Council Local Government Area.

Figure 2-1 shows the location within its local setting.

2.2 DESCRIPTION OF THE SITE AND SURROUNDING AREA

The site is located within the Hawkesbury River Catchment and sits on South Creek's floodplain. It covers 22.34 ha, is predominately flat and has been cleared and is covered by grass species. Most large vegetation species have been removed apart from a narrow band of riparian vegetation along South Creek, with some scattered trees populating the site's north-east corner. The site's south-western corner is slightly raised and slopes eastwards down to South Creek. This north flowing tributary of the Hawkesbury River extends the whole length of the site's eastern boundary. A small wetlands exists on the site above the site's development area near the north-western border, and water runs eastwards through the site's north-eastern corner, before joining South Creek (or Wianamatta Creek). The terrain along this northern boundary dips marking the course of the stream bed. Another water course, which is fed by the wetlands immediately south of the site, runs parallel to South Creek (approximately 130 m west) before joining the chain-of-ponds in the site's north-eastern corner.

The site is surrounded by General Industrial IN1 zoned sites to the south-west, west and north-west including Boral Concrete, Snowflake Blast and Powdercoat and V J Glass. Land zoned Primary production RU1 is located to the north, east and south of the site. Further north of the site there is a railway line zoned SP2 Infrastructure and a R2 Low Density Residential area within the suburb of Windsor with a small RE1 Public Recreation area in the centre.

Figure 2-1: Aerial Photograph of Site's Local Setting

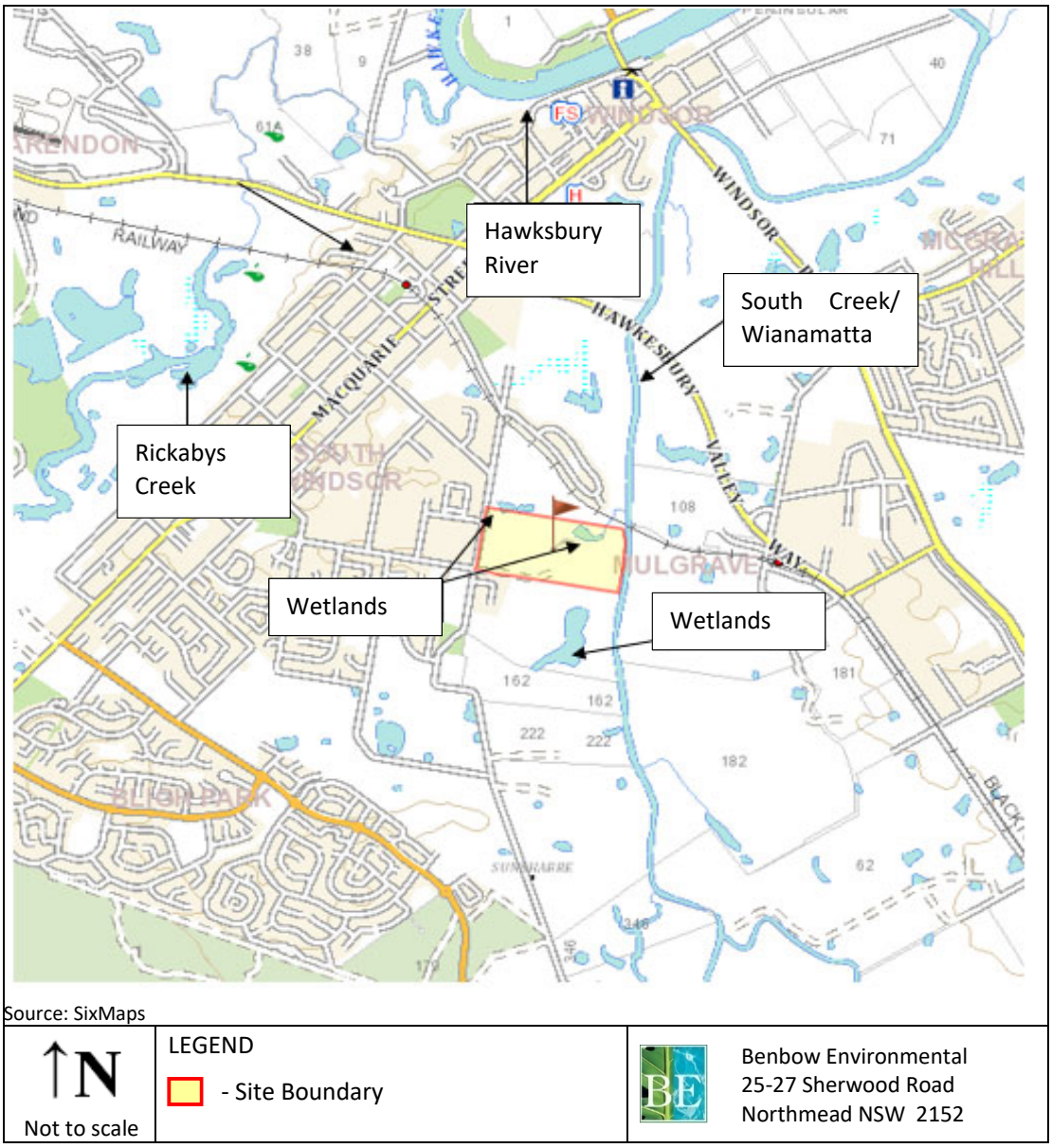
Source: Land and Property Information – SixMaps

N Not to scale	LEGEND: Site boundary	Benbow Environmental 25-27 Sherwood Road Northmead NSW 2152

2.3 NEAREST WATERWAYS

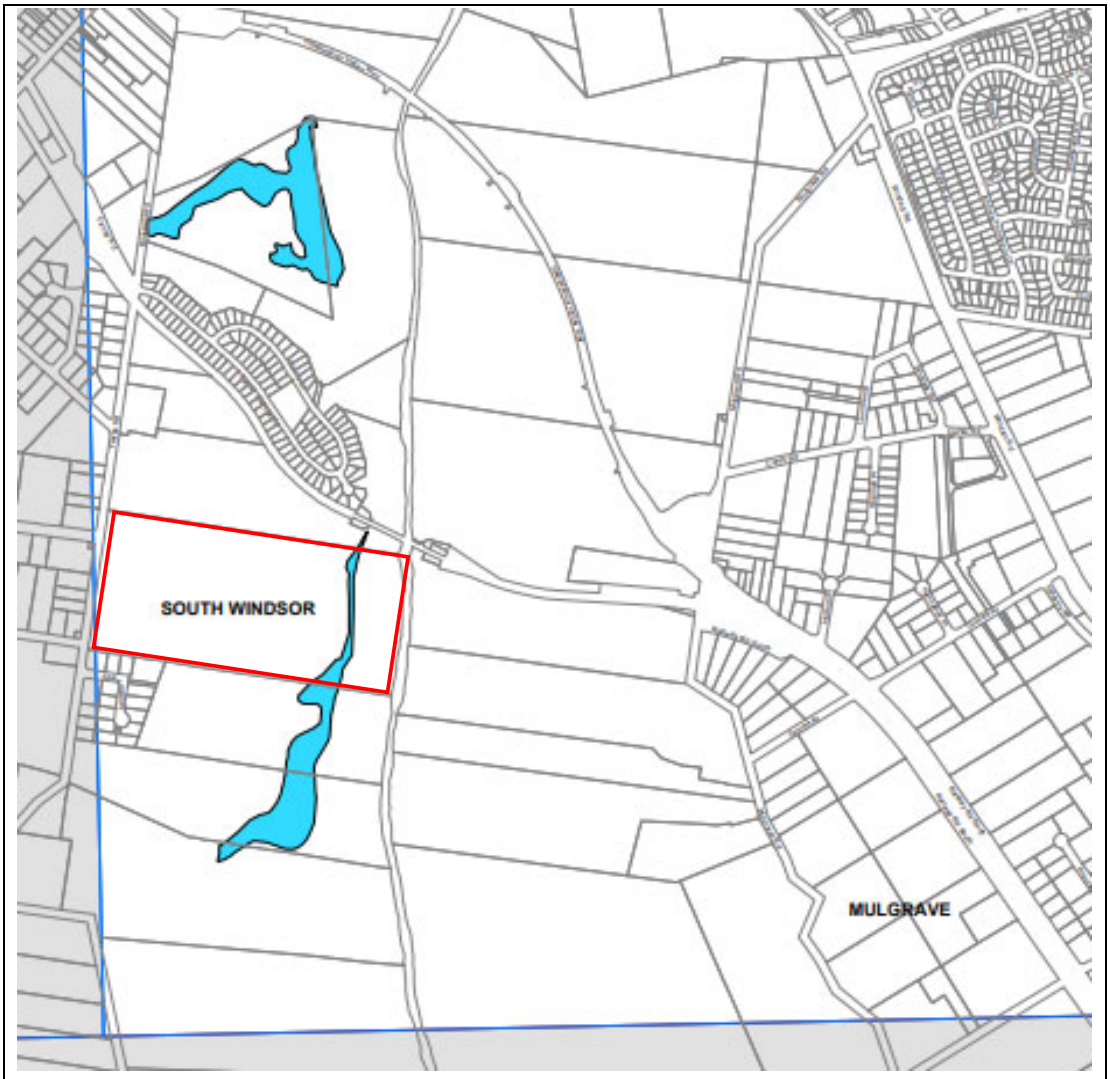
The nearest waterways to the site are shown in Figure 2-2. Small wetlands and associated small tributaries are the only water bodies existing onsite. South Creek, a perennial stream, marks the site's physical eastern boundary. Immediately below the site's southeast corner are larger Wetlands as identified on the Hawkesbury Wetland Map see Figure 2-3.

Figure 2-2: Nearest Rivers and Waterbodies



Source: SixMaps

Figure 2-3: Wetland Map



Source: Hawkesbury LEP 2012 Wetlands Map – Sheet WET_008DB

N Not to scale	LEGEND: - Site Boundary Wetlands	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

2.3.1 Water Quality and River Flow Objectives

Water Quality Objectives (WQOs) and the River Flow Objectives (RFOs) identify the agreed environmental values and long-term goals for NSW's surface waters.

Unfortunately, the NSW Water Quality Objectives website does not provide objectives for the Hawkesbury-Nepean catchment area. Public enquiries for this and other three catchments have been completed or substantially completed by the Healthy Rivers Commission (HRC).

Therefore the NSW Water Quality Objectives are considered to be met if the proposed development complies with the relevant trigger levels set out in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000 Guidelines).

2.4 CATCHMENT MANAGEMENT PLAN

The site is located within the Hawkesbury-Nepean River Catchment.

2.5 RAINFALL

The BoM IFD Design Rainfall Depth (mm) for the site area is provided in table Table 2-1 below, based on the 2016 Rainfall IFD Data System.

Table 2-1: Annual Exceedance Probability (AEP) Depth -33.626354, 150.817142)

Duration	63.20%	50%#	20%*	10%	5%	2%	1%
1 min	1.99	2.27	3.16	3.77	4.39	5.22	5.87
2 min	3.26	3.67	4.97	5.86	6.74	7.96	8.92
3 min	4.54	5.11	6.96	8.24	9.5	11.2	12.6
4 min	5.7	6.45	8.85	10.5	12.2	14.4	16.2
5 min	6.76	7.67	10.6	12.6	14.6	17.4	19.5
10 min	10.8	12.3	17.2	20.6	24	28.6	32.2
15 min	13.4	15.4	21.5	25.8	30.1	35.8	40.3
30 min	18.2	20.7	28.8	34.5	40.1	47.7	53.6
1 hour	23.2	26.2	35.8	42.6	49.3	58.6	65.9
2 hour	28.8	32.2	43.5	51.5	59.6	71	80.1
3 hour	32.8	36.6	49.2	58.3	67.6	80.7	91.3
6 hour	41.7	46.6	62.9	74.9	87.5	105	120
12 hour	54.4	61.2	84.2	102	120	145	165
24 hour	71.4	81.4	116	141	169	205	233
48 hour	91.4	106	155	192	231	278	314
72 hour	103	119	176	220	266	317	357
96 hour	110	128	189	235	285	338	379
120 hour	115	133	196	244	295	349	390
144 hour	118	136	199	247	299	353	395
168 hour	120	138	200	248	299	354	39

2.6 DESCRIPTION OF THE PROPOSAL

The proposed facility will receive, handle and process up to 98,000 tonnes of construction and demolition (C&D) waste per year. This includes virgin excavated natural material (VENM) and excavated natural material (ENM). This material will be crushed and screened within a purpose built building and sorted into individual stream products for reuse.

Separated waste streams will be stored within designated covered storage bays externally. A front end loader will be used to transfer materials to and from the storage bays and the material will then be taken off site by truck to sell to market or to landfill.

2.6.1 Land forming and Excavation Works

The proposed area will be levelled to approximately 18.0 – 17.3 AHD (Australian Height Datum) from the existing range of 18.13-13.8 AHD. Soil required to raise the level would come from elsewhere on the subject site shown in The Concept Bulk Earthwork Depth Cut to Fill Plan provided within the Stormwater and Flood Management Report (Attachment 1). The proposed operational area of the site would be capped with road base material hardstand which would come from a supplier offsite.

Some areas of the site are within 500 m of class 4 acid sulfate soils and due to the extent of the proposed earthworks an acid sulfate soil management plan is recommended. Acid sulfate soils are discussed in further detail in Section 4.1.3.

2.6.2 Proposed Operational Activities

The operation of the proposed facility involves the following activities to be undertaken on site:

- Unloading and loading of materials;
- Material handling and sorting;
- Crushing and screening of C&D waste including VENM, ENM, recycled crushed concrete, brick and excavated rock products within the building; and
- Material storage in external covered storage bays.

The mobile vehicles and machinery used on site will be refuelled by a tanker. All mobile vehicles and machinery will be serviced by contractors who will bring their own chemicals including lubricant and hydraulic oils. Only water will be used in the wheel wash. No chemicals will be stored on site.

2.7 EXISTING SITE CONTAMINATION

The Phase I Environmental Site Assessment undertaken by Benbow Environmental in September 2018 (Ref: 181025_Phase1_Rev4), found no evidence of soil or water contamination.

3. WATER ASSESSMENT

This section provides the water assessment for the proposed development. Attachment 1 provides the Stormwater and Flood Management Report prepared by Sparks and Partners Consulting Engineers. Findings of this report have been considered in this assessment.

3.1 LICENSING REQUIREMENTS

The two key pieces of legislation for the management of water in NSW are the *Water Act 1912* and the *Water Management Act 2000*.

3.1.1 Water Act 1912

Licences for water conservation, irrigation, water supply or drainage as well as changing the course of a river can be applied for under the *Water Act 1912*.

The proposed development does not involve works for water conservation, irrigation, water supply or drainage and does not involve works that would change the course of a river, therefore, the *Water Act 1912* does not apply.

3.1.2 Water Management Act 2000

The *Water Management Act 2000* provides requirements for the extraction of water, water use, floodplain and drainage management, the construction of works such as dams and weirs, and undertaking activities on or near water sources in NSW. Approvals for the extraction and use of water, construction of works relating to water use and controlled activities carried out on waterfront land can be obtained under the Act.

Clause 91(2) of the Water Management Act, 2000 (WMA Act) requires an activity approval to carry out a controlled activity in, on or under waterfront land. The following definitions apply:

> ***"controlled activity"*** *means:*
>
> *a) the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or*
> *b) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or*
> *c) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or*
> *d) the carrying out of any other activity that affects the quantity or flow of water in a water source.*
>
> ***"waterfront land"*** *means:*
>
> *a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or*
> *(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or*

(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or

b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters,

where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land.

Waterbodies and a wetland are identified to exist at the site itself and the excavation works involved with the proposed development would be within 40 metres of these waterbodies. Therefore, the proposed modifications require a controlled activity approval.

The proposed development constitutes integrated development as the works require a controlled activity approval under the Water Management Act 2000.

3.1.3 Water Sharing Plans

Two water sharing plans apply to the area where the subject site is located. These are:

- Water Sharing Plan for the Greater Metropolitan Region Unregulated River Sources; and
- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources.

These do not apply to the proposed development.

3.2 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

Clause 120 of the *Protection of the Environment Operations Act 1997* states the following:

120 Prohibition of pollution of waters
(1) A person who pollutes any waters is guilty of an offence.
Note. An offence against subsection (1) committed by a corporation is an offence attracting special executive liability for a director or other person involved in the management of the corporation—see section 169.
(2) In this section:
pollute waters includes cause or permit any waters to be polluted.

The proposed development will not breach the above clause with regard given to the proposed mitigation measures and safeguards to be implemented as described throughout this report.

3.3 SYDNEY REGIONAL ENVIRONMENTAL PLAN NO. 20 – HAWKESBURY NEPEAN RIVER

The site contains environmentally sensitive areas. "Environmentally sensitive areas" are defined under the SREP No. 20 as:

> *"areas where environmental characteristics mean that the potential impacts of land use are greater than elsewhere in the catchment. Environmentally sensitive areas identified by the Hawkesbury-Nepean Environmental Strategy in the Hawkesbury-Nepean catchment are: the river; riparian land; escarpments and other scenic areas; conservation area sub-catchments; national parks and nature reserves; wetlands; other significant floral and faunal habitats and corridors; acid sulphate soils and potential acid sulphate soils."*

The site contains riparian land, wetlands and Class 5 acid sulfate soils and is within 500 m of class 4 acid sulfate soils.

Clause 6 lists the Specific planning policies and recommended strategies of the Sydney Regional Environmental Plan No. 20 – Hawkesbury Nepean River. Relevant strategies for the proposed development are provided Table 3-1 and addressed throughout this report, referenced as follows:

Table 3-1: Specific Planning Policies and Recommended Strategies - SREP No. 20

Policy / Strategies	Comment
(1) Total catchment management (b) Consider the impact of the development concerned on the catchment	See section 3.6.3
(2) Environmentally sensitive areas (d) Protect wetlands (including upland wetlands) from future development and from the impacts of land use within their catchments.	See section 3.6.4
(g) Consideration should be given to the impact of the development concerned on the water table and the formation of acid sulphate soils.	See section 4.1.3
(3) Water quality (a) Quantify, and assess the likely impact of, any predicted increase in pollutant loads on receiving waters	See section 3.6.5
(b) Consider the need to ensure that water quality goals for primary contact recreation and aquatic ecosystem protection are achieved and monitored	See section 3.6.7
(12) Metropolitan strategy (e) Consider the implications of predicted climate change on the location of development and its effect on conservation of natural resources.	See section 3.6.9

3.4 WATER USAGE & SUPPLY

The site will use mains water for the demountable office and amenities and wheel wash. The mains water will be supplied from the existing Evoqua facility connection and be stored within two storage tanks.

A primary and secondary sedimentary detention basin will be located on the eastern side of the site. Water from the sediment detention basins will provide water for landscaped and vegetated areas.

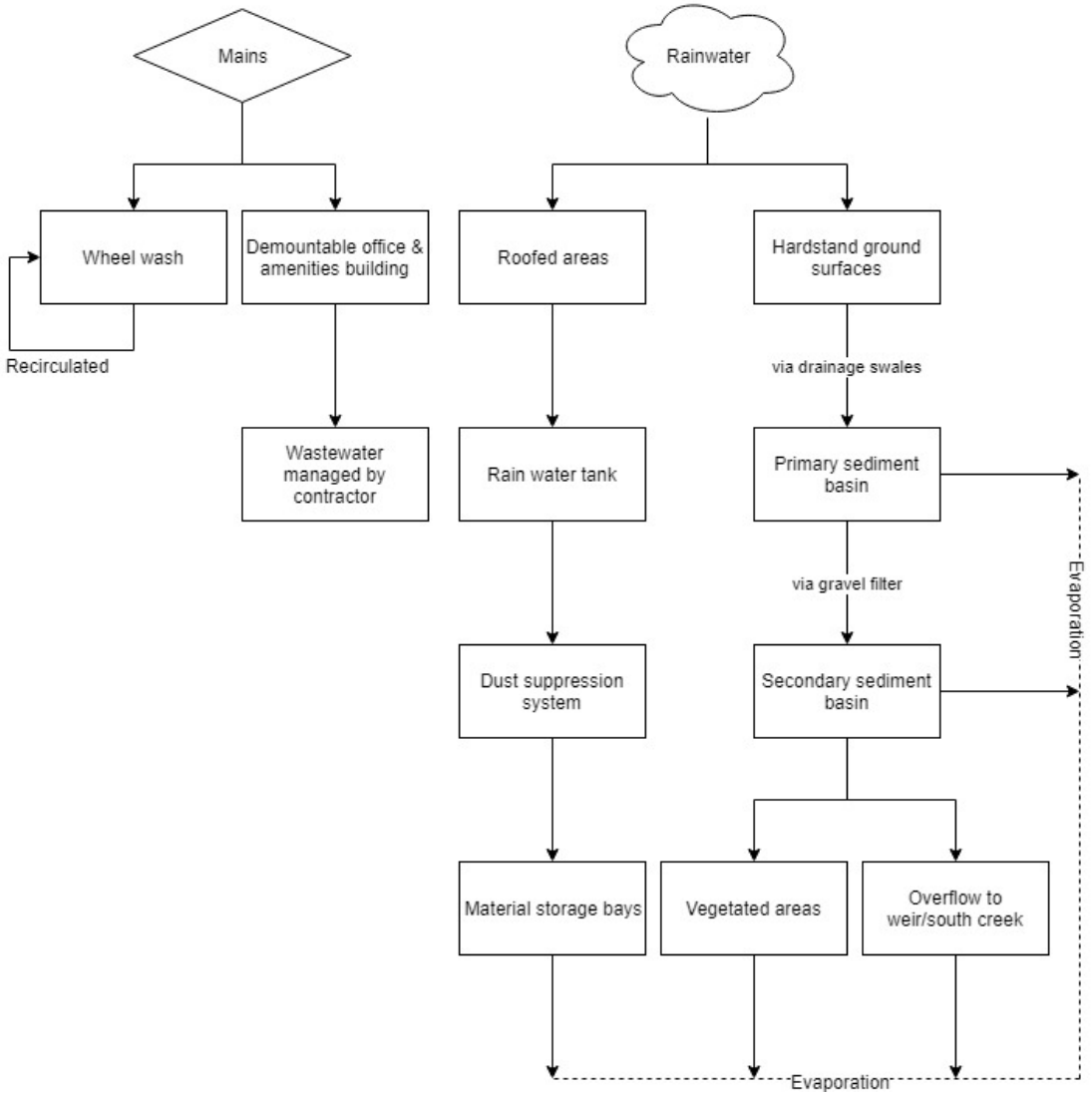
A rainwater tank would capture water from the roofed area of the proposed building. Rainwater would be used for dust suppression purposes.

Wastewater and sewerage from the demountable office and amenities buildings will be managed by a contractor.

3.4.1 Site Water Balance

The following figure shows the site's water balance.

Figure 3-1: Site Water Balance Diagram



3.5 STORMWATER & WASTEWATER MANAGEMENT

This section discusses the management of stormwater and wastewater that would be undertaken as part of the proposed development. Attachment 1 provides the Stormwater and Flood Management report prepared by Sparks and Partners Consulting Engineers. This report details the conceptual design of the stormwater system and presents the results of the MUSIC modelling which was undertaken to confirm the treatment efficiency of the system.

The results demonstrate that with the system in place, the site will achieve a reduction in pollutant export, with the stormwater runoff quality improving.

3.5.1 Stormwater System

The stormwater from the proposed operational area will runoff the hardstand surface into the primary and secondary sediment detention basins shown in the plans in Attachment 1. Grassed drainage channels will direct the water along the northern and southern border of the development area to the sediment detention basins.

Roof water from the proposed building would be captured within a 30kL water tank.

3.5.2 Drainage Swales

Grassed lined drainage swales would convey the collected runoff to sediment basins located on the eastern area of the proposed operational area whilst also filtering any collected course sediments. These grassed drainage swales have been sized to convey the 1:100 year storm flows. The swales would discharge the collected runoff to a primary sedimentation basin which is sized as per the requirements of Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition.

3.5.3 Sediment Basins

The primary basin would remove sediments and Total Suspended Solids (TSS) from the collected runoff and is conceptually sized to treat and hold the 80th percentile 1:10 year ARI storm event. A secondary basin would be provided downstream of the first and is conceptually sized at half the size of the primary basin. Each basin will have a stilling baffle arrangement that maximises the retention time in the basins for any collected runoff to ensure settling of collected sediments and TSS is achieved.

3.5.4 Wastewater

The wastewater generated from the demountable office and amenities buildings will be managed by a contractor.

No other wastewater will be generated from the proposed facility.

3.5.5 Wheel Wash

The wheel wash is a closed loop system that would recirculate water for the washing of truck wheels. The system may need periodic top up with mains water. No wastewater would be generated. No chemicals will be used in the wheel wash. Regular servicing of the system would

be undertaken. Any residual waste generated as part of the regular maintenance would be removed from site by a licenced waste contractor.

3.6 Assessment of Potential Impacts on Water

Assessment of potential impacts of the proposed development to surface and groundwater resources, and flooding is presented in this section.

3.6.1 Surface Water

The operation of the facility would contribute negligible additional quantities to surface water runoff. Some water may be generated from the use of fine mist water sprayers for dust suppression. However, the water from the water sprayers is unlikely to contribute to surface waters as the volume of water would be negligible and the majority would evaporate. Dust suppression would consist of water sprays/water cannon that provide a mist to adequately dampen materials and working areas. This would be a fine mist that would be switched off once stockpiles are damp. Any residual water from dust suppression would be captured within the drainage channels and managed within the sediment basin arrangement.

Surface waters would be generated from a rain event where water would land on the external storage and processing areas. While some of the water may seep through the hardstand and drainage channels the majority of water from external hardstand ground surfaces would flow into the drainage channels and then into the primary detention basin, and then during significant rainfall events the secondary basin.

3.6.2 Potential Pollutants

This section identifies potential pollutants of concern at the site, the relevant source materials, the potential receptors (including wetlands, south creek and downstream tributaries) and the potential exposure pathways.

The primary release mechanism expected on site, is generation of debris and sediment during material handling and sorting procedures, of various materials that potentially contain pollutants. Surface water may provide an avenue for debris and potential pollutants to be transported.

The main potential pollutants of concern include sediments containing high alkalinity (high pH, pH>7) and total suspended solids (TSS). Other lower risk potential pollutants include total recoverable hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene and Xylene (BTEX) and Polycyclic Aromatic Hydrocarbons (PAH) as shown in Table 3-2.

Table 3-2: Conceptual Model of Potential Contaminants and their Source

Known and Potential Primary Sources of Contamination	Primary Release Mechanism	Contaminants of Potential Concern	Potential Environmental Receptors	Exposure Pathways	Risk Level
Concrete	Processing	pH (highly alkaline) Sediments	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff Alkaline surface waters seeping into ground water	Moderate
Bricks/Tiles	Processing	Sediments	Wetlands, streams and native habitats	Surface water runoff	Moderate
Treated Timbers	Debris generated during sorting procedures	Arsenic, Chromium and Copper	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Negligible
Lead Based Paints	Receiving waste containing remnants of materials with Lead Based Paints	Lead	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Negligible
Diesel Fuel and Oils	Leaks/spills from transport vehicles	TRH BTEX PAH	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Low
Plasterboard	Debris generated during sorting procedures	Sulfate Calcium	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Negligible
Metal C&D Waste	Debris generated during sorting procedures and metal ions dissolved in water	Zinc Chromium Cadmium Copper Lead Manganese Iron Aluminium	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Low

Table 3-2: Conceptual Model of Potential Contaminants and their Source

Known and Potential Primary Sources of Contamination	Primary Release Mechanism	Contaminants of Potential Concern	Potential Environmental Receptors	Exposure Pathways	Risk Level
Pesticides/ Herbicides	Soil/sand material containing pesticide/ herbicide contaminated soil/sand	OCP and OPP	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Low
Soil, Organic Matter or Fertilisers	Release of chemicals of concern	Nitrogen Phosphorus Ammonia	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Low
Asphalt Waste	Debris generated during sorting procedures	Hydrocarbons, PAH	Wetlands, streams, groundwater ecosystems and native habitats	Surface water runoff, dissolved pollutants seeping into ground water	Negligible

TRH: Total Recoverable Hydrocarbons
BTEX: Benzene, Toluene, Ethylbenzene and Xylenes
PAH: Polycyclic Aromatic Hydrocarbons
OCP: Organochlorine Pesticide
OPP: Organophosphorus Pesticide

3.6.3 Catchment Impacts

The major impacts to the catchment from the proposed development are associated with the surface water and ground water impacts; these are assessed in the following sections.

3.6.4 Wetland Impacts

The major impacts on the surrounding wetlands would involve the potential pollutants detailed in section 3.6.2 being released from site and contaminating the nearby wetlands which could result in harm to the aquatic ecosystems. The mitigation measures are provided in the following sections.

3.6.5 Surface Water Impacts

3.6.5.1 Construction

The main surface water impact from construction works would be the release of sediments into receiving waters. Erosion and sediment controls are presented in Attachment 1.

The proposed construction works involve the cut and fill of the site area as shown in The Concept Bulk Earthwork Depth Cut to Fill Plan (Attachment 1). During the construction phase erosion and sediment controls will be implemented.

During cut and fill works it is recommended that the areas to be excavated outside the development area are undertaken in stages to minimise the total area disturbed at any one time. This will allow each area to be stabilised and revegetated with pastoral grasses immediately following the excavations works.

In addition there is a low risk of impacts from leakages of oils and fuel from construction work machinery. Refuelling and maintenance would be undertaken by contractors trained in spill prevention procedures.

A construction environmental management plan (CEMP) is recommended to ensure effective management of surface water runoff.

3.6.5.2 Operations

Based on the proposed operations and infrastructure associated with the development, assessment of the potential impacts on surface water is discussed as follows:

- Spillages or releases of dangerous goods, being diesel or lubricating oil entering and contaminating surface waters. No dangerous goods or chemicals would be stored on site. This would greatly reduce to risk of contamination of waters by these substances. Diesel, fuel and lubricating oils would be used within the equipment and machinery on site. The mobile vehicles and machinery used on site will be refuelled by a tanker. All mobile vehicles and machinery will be serviced by contractors who will bring their own chemicals including lubricant and hydraulic oils.

- Product/Waste releases entering and contaminating surface waters.

- Material processed by the facility would be stored externally in designated covered storage areas. This would minimise the potential for the release of pollutants off site. Stormwater would be directed to the primary and secondary sediment basin to remove any sediment via settling. The drainage channels would also be designed to capture sediment. These pollution control devices would be regularly inspected, cleaned and maintained. It is recommend that ongoing testing and monitoring of the water discharge from the sediment basins is undertaken.

The site would contain controls to prevent the contamination of waters. Implementation of an Environmental Management Plan (EMP) would also ensure appropriate management of on-site stormwater.

In addition it is recommended a water monitoring program be put in place to test water in the on-site detention system at the site to ensure no pollutants have been released offsite. This program would be detailed in the EMP.

3.6.6 Groundwater

3.6.6.1 Excavations

The proposed area will be levelled to approximately 18.0 – 17.3 AHD (Australian Height Datum) from the existing range of 18.13-13.8 AHD. Soil required to raise the level would come from elsewhere on the subject site shown in The Concept Bulk Earthwork Depth Cut to Fill Plan (Attachment 1). The proposed development area would be capped with road base material hardstand which would come from a supplier offsite. The excavated area surrounding the development area would be revegetated with pastoral grasses.

Some areas of the site are within 500 m of class 4 acid sulfate soils due to the extent of the earthworks an acid sulfate soil management plan is recommended.

Excavations are expected to have a minimal impact on groundwater.

3.6.6.2 Operations

- There is a risk of contaminants from waste materials entering groundwater through seepage. However the risk is considered to be low due to:
  - The majority of materials brought on site do not pose a contamination risk;
  - The contaminants that may be released would be transported to the sediment basins via surface runoff; and
  - The soil beneath the road base is expected to be weakly pedal orange heavy clays and clayey sand which will reduce water seepage.
- Groundwater monitoring is recommended to ensure potential contamination can be adequately identified. If groundwater contamination is identified a remediation action plan is to be undertaken.
- There is a risk of contaminants from waste material entering the ground water beneath the sediment basins through seepage. It is recommended that that sediment detention basins be sealed with a liner to prevent seepage, this can be achieved with well compacted impervious soil layer(s)/synthetic membranes/bentonite.

- Potential spillages of diesel and lubricating oil could occur during refuelling and equipment maintenance; the risk is considered to be low as these activities will be undertaken by suitably trained contractors.

The site has been designed with safeguards to minimise the potential for the contamination of ground waters. Implementation of an Environmental Management Plan (EMP) would also ensure appropriate management of on-site stormwater.

In addition it is recommended a water monitoring program be put in place to include groundwater and water from the sediment detention basins at the site. This would enable action to be taken should contamination be identified. Details of this program would be provided in the EMP.

3.6.6.3 Groundwater Dependant Ecosystems

GDEs are defined ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants, animals, ecological processes and ecosystem services.

Types of GDEs have been defined which can be split into three categories:

1. Ecosystems that depend on the surface expression of groundwater (lacustrine, palustrine, riverine, estuarine and marine);
2. Ecosystems that depend on the subsurface presence of groundwater (riverine wetlands, terrestrial) and;
3. Ecosystems dependent on the subterranean presence of groundwater (aquifer, cave).

If groundwater sources are altered, polluted or contaminated, surrounding GDEs would be impacted.

Effects on the function of GDEs (Habitat, groundwater level, connectivity)

Potential contamination of groundwater sources can have significant impacts on GDEs. Any changes in stream connectivity between the groundwater sources and the nearby wetlands and South Creek can impact GDE persistence and the spread of contaminated waters. An increase in contaminates such as heavy metals, shifts in levels of nitrogen and phosphorous in the soils and changes to the soils pH and salinity levels (i.e. via sulphate and calcium) will be damaging to surrounding GDEs.

Targeted searches showed there are no threatened floral or faunal species, or populations, sited within or in close proximity to the subject site. The risk of potential contamination through groundwater connectivity to surrounding water bodies is low due to the safeguards and control measures that have been designed into the site.

Potential Safeguard Measures for and GDEs

A number of mitigation and monitoring protocols will be put in place to minimise the potential for contamination of groundwater sources, thus acting as 'safeguard' measures for surrounding GDEs. These protocols will include:

- Install a monitoring bore to test periodically levels of any contaminates.
- Regularly monitoring and ensuring hardstand areas are clean and free of contaminates (i.e. spills and leaks of engine oils and fuels).
- Ensuring hardstand areas are compacted in such manner that this area will simply filter through clean water whilst the sediments are trapped in the top layers of materials.
- Undertaking regular inspections of all areas of the site to ensure safeguards and control measures are maintained in good working order and areas containing vegetation remain healthy.

3.6.7 Water Monitoring Program

This section details the water monitoring program recommended for the proposed development. Monitoring should be undertaken in accordance with the Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004).

3.6.7.1 Surface Water Discharge Monitoring

It is recommended the water from the discharge outlet of the sediment basins be monitored after heavy rain events.

It is recommended water be tested for the pollutants listed in the table below.

Table 3-3: Proposed Sampling List and Relevant Trigger Values

Analytes	ANZECC Trigger Value*	Test Method /Reference	Analytical Limit
Metals			
Arsenic	24 (as III), 13 µg L^{-1} (as V)	ICP-MS	0.001 mg/L
Copper	1.4 µg L^{-1}	ICP-MS	0.001 mg/L
Chromium	1.0 µg L^{-1} (as CrVI)	ICP-MS	0.001 mg/L
Zinc	8 µg L^{-1}	ICP-MS	0.005 mg/L
Lead	3.4 µg L^{-1}	ICP-MS	0.001 mg/L
Aluminium	55 µg L^{-1} (pH>6.5)	ICP-MS	0.01 mg/L
Nickel	11 µg L^{-1}	ICP-MS	0.001 mg/L
Cadmium	0.02 µg L^{-1}	ICP-MS	0.0001 mg/L
Mercury (Inorganic)	0.06 µg L^{-1}	ICP/MS	0.0001 mg/L
Nutrients			
Oxides of Nitrogen	40 µg L^{-1}	APHA 4500	0.002 mg/L
Filterable Reactive Phosphorus	20 µg L^{-1}	APHA 4500	0.01 mg/L
Total Ammonia	900 µg L^{-1} (at pH 8)	APHA 4500	0.01mg/L
Physical			
pH	6.5-8 (Lower-Upper Limit)	APHA 4500 or in situ	0.01 (pH units)
Electrical Conductivity	200-300 µScm^{-1}	APHA 2510 or in situ	1µS/cm
Sulfate	(1)	APHA 4500	1 mg/L
Total Suspended Solids	50 mg/L(2)	APHA 2540	1 mg/L

Table 3-3: Proposed Sampling List and Relevant Trigger Values

Analytes	ANZECC Trigger Value*	Test Method /Reference	Analytical Limit
Polycyclic Aromatic Hydrocarbons			
Napthalene	16 µg L^{-1}	EP075B Sim	1 µg/L
BTEX			
Benzene	950 µg L^{-1}	EP080	1 µg/L
Toluene	(3)	EP080	2 µg/L
Ethylbenzene	(3)	EP080	2 µg/L
O-Xylene	350 µg L^{-1}	EP080	2 µg/L
Total Recoverable Hydrocarbons			
TRH (C6-C40)	(3)	EP071,80	20-100 µg/L
Organochlorine Pesticides			
Chlordane	0.03 µg L^{-1}	EP068A	0.5 µg/L
Endosulfan	0.003 µg L^{-1}	EP068A	0.5 µg/L
Endrin	0.01 µg L^{-1}	EP068A	0.5 µg/L
Heptachlor	0.01 µg L^{-1}	EP068A	0.5 µg/L
Organophosphorus Pesticides			
Azinphos methyl	0.01 µg L^{-1}	EP068B	0.5 µg/L
Chlorpyrifos	0.01 µg L^{-1}	EP068B	0.5 µg/L
Diazinon	0.01 µg L^{-1}	EP068B	0.5 µg/L
Malathion	0.05 µg L^{-1}	EP068B	0.5 µg/L
Parathion	0.004 µg L^{-1}	EP068B	2 µg/L
Herbicides and Fungicides			
2,4-D	280 µg L^{-1}	EP202	10 µg/L
2,4,5-T	36 µg L^{-1}	EP202	10 µg/L

The outlet should be checked after/during any rain event greater than 25 mm/day and sampled if water is being released. If no water is being released, this should be recorded. After the first year, this data will provide an indication of the rain events that will result in release of water. The monitoring program and sampling regime can then be revised.

The EMP will provide an action plan for measures to be implemented if the trigger values are exceeded.

3.6.7.2 Water Monitoring

It is recommended that a ground water monitoring well be installed in the hardstand surface at the site.

It is recommended that periodic water monitoring be undertaken:

- From the ground water monitoring bore; and
- From the sediment detention basins (including water and sediment basins).

These locations are to be monitored for the analytes shown in Table 3-3. If the levels exceed the relevant criteria a remediation action plan is to be undertaken.

It is recommended sampling be undertaken every 3 months for the first year and then frequency and analytes may be revised after the first year of monitoring.

3.6.8 Flooding

The S149 Certificate for the subject site (No. PC0069/19) states the land is subject to riverine flood related development controls.

The proposed development area will be levelled to a finished surface level of RL17.300 along the boundaries of the IN1 zone. This level provides 300 mm freeboard from the 100 year flood level of 17,000.

Attachment 1 provides the Stormwater and Flood Management Report prepared by Sparks and Partners Consulting Engineers.

3.6.8.1 Hawkesbury Floodplain Risk Management Study and Plan

The Hawkesbury Floodplain Risk Management Study and Plan flood risk precincts map shows the site in an area of high-extreme flood risk, Figure 3-2.

The proposed development is consistent with the objectives of the Hawkesbury Floodplain Risk Management Study and Plan.

Chapter 9 (Volume 2) of Hawkesbury Floodplain Risk Management Study and Plan provides guidelines for development on a floodplain.

Rules for general development - Objectives:

a) To ensure the flood risk associated with development, comprising danger to life and damage to property is minimised and not increased beyond the level acceptable to the community;
b) To ensure the proponents of development and the community in general are fully aware of the potential flood hazard and consequent risk associated with the use and development of land within the floodplain;
c) To ensure that proposed development does not exacerbate flooding on other properties;
d) To minimise the risk to life by ensuring the provision of appropriate evacuation measures are available within areas affected by flooding up to a PMF event;
e) Where permitted, to maximise the potential for buildings to be returned to use as quickly and efficiently as practical, after being affected by flooding; and
f) To ensure that the design and siting controls and built form outcomes required to address the flood hazard do not result in unreasonable impacts on the:

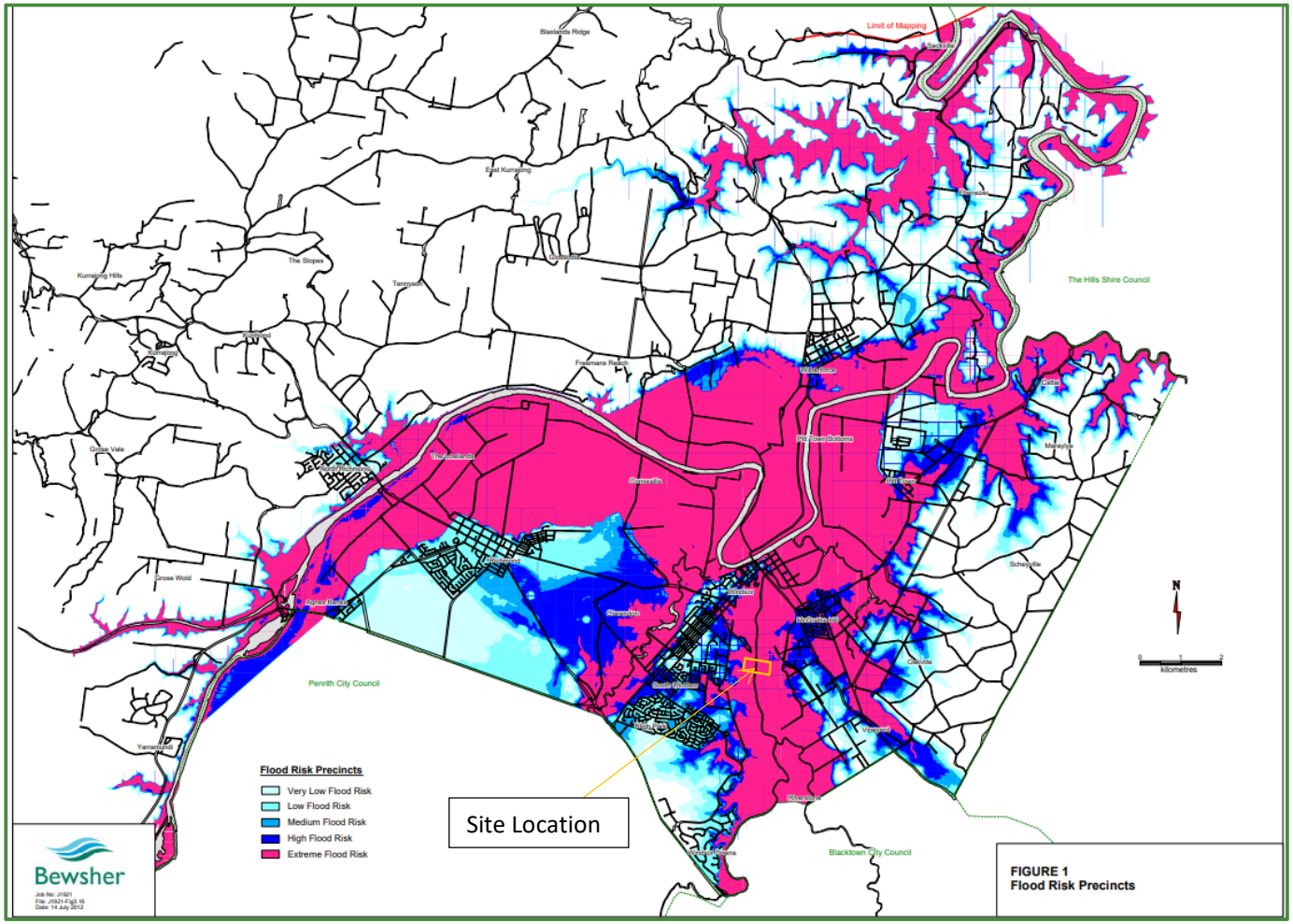
- *Amenity and character of an area;*
- *Streetscape and the relationship of the building to the street; and*
- *The environment and ecology.*

The proposed development will minimise the danger to life and damage to property from flood risks. This is largely achieved by raising process area above the 100 year flood level. It is recommended a flood emergency plan be prepared for construction and operations. This will ensure the proponents are fully aware of the potential flood hazards and will provide appropriate evacuation measures.

The proposed development will not exacerbate flooding on other properties and the soil used to raise the site out of the flood area will come from elsewhere in the site, within the flood risk precinct, increasing the flood capacity of the surrounding site by the volume displaced from the proposed earthworks. A report prepared by Sparks and Partners, Attachment 1, demonstrates that the development will not increase flood impacts elsewhere.

The design and siting controls will not unreasonably impact the amenity of the area, streetscape and the environment and ecology.

Figure 3-2: Flood Risk Precincts



3.6.9 Climate Change

Rising temperature and sea levels are expected to increase the frequency and severity of storm events. This may increase the likelihood of wet weather events leading to stormwater release from the site. Contingency measures for this issue can include increasing the capacity of the sediment detention basins if required.

3.7 EROSION & SEDIMENT CONTROLS

Attachment 1 presents the erosion and sediment controls prepared by Sparks and Partners. A list of general sediment and erosion control requirements are presented in the Concept Cover Sheet, Locality Plan and Drawing Schedule of the attachment. The Concept Sediment and Erosion Control Plan & Details show the concept design details of the stabilised site access, stockpile stabilisation, sediment fence design maintenance and notes. The Concept Sediment Basin Plan & Details Sheet provides the concept design details of the grass swales and sediment detention basin designs.

A Construction Environmental Management Plan (CEMP) and Environmental Management Plan (EMP) are recommended for the construction and operational phases to ensure that erosion and sediment controls are adequately implemented and maintained.

4. SOIL ASSESSMENT

This soil assessment addresses the following:

- A description of local soils, topography, drainage and landscapes; and
- Consideration of any contaminated soil, including acid sulfate soils.

Reference is made to the Phase I Ref: (181025_Phase1_Rev4) throughout this soil assessment.

4.1 EXISTING SOIL CONDITIONS

4.1.1 Local Soils

The 'Penrith 1:100 000 Geological Map Sheet 9030' describes the geological composition of the area as follows:

Tl: Londonderry Clay - Clay, patches of ferruginized, consolidated sand.

Tr: Rickabys Creek Gravel - Conglomerate, matrix suspended.

The Soil and Land Resources of the Hawksbury-Nepean Catchment Map shows that the subject site is located in across two soil landscaping areas classified as Alluvial and Beach

The soil map 'Soil Landscape of Penrith 1:100,000 Sheet 9030' shows that the subject site is located in across two soil landscape areas classified as Fluvial landscapes. 'Berkshire Park' (bp) and 'Freemans Reach' (fr) landscapes are described as follows:

Fluvial landscape 'Berkshire Park' (bp)

> *Landscape: dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system*
>
> *Soils: weakly pedal orange heavy clays and clayey sands, often mottled. Ironstone nodules common. Large (up to 20 cm) silcrete boulders occur in sand/clay matrix. Solods (Dy 3.41), Yellow Podzolic soils (Dy4.11, Dy2.11, Dy2.21, Dy2.22), Red Podzolic Soils (Dr4.11), Chocolate Soils (Dr4.11, Dr4.61), Structured plastic clays (Uf5.23, Gn4.11 and Gn3.11)*
>
> *Limitations: very high wind erosion hazard if cleared. Gully, sheet and rill erosion on dissected areas. Waterlogging, impermeable subsoils, low fertility.*

Fluvial landscape 'Freemans Reach' (fr)

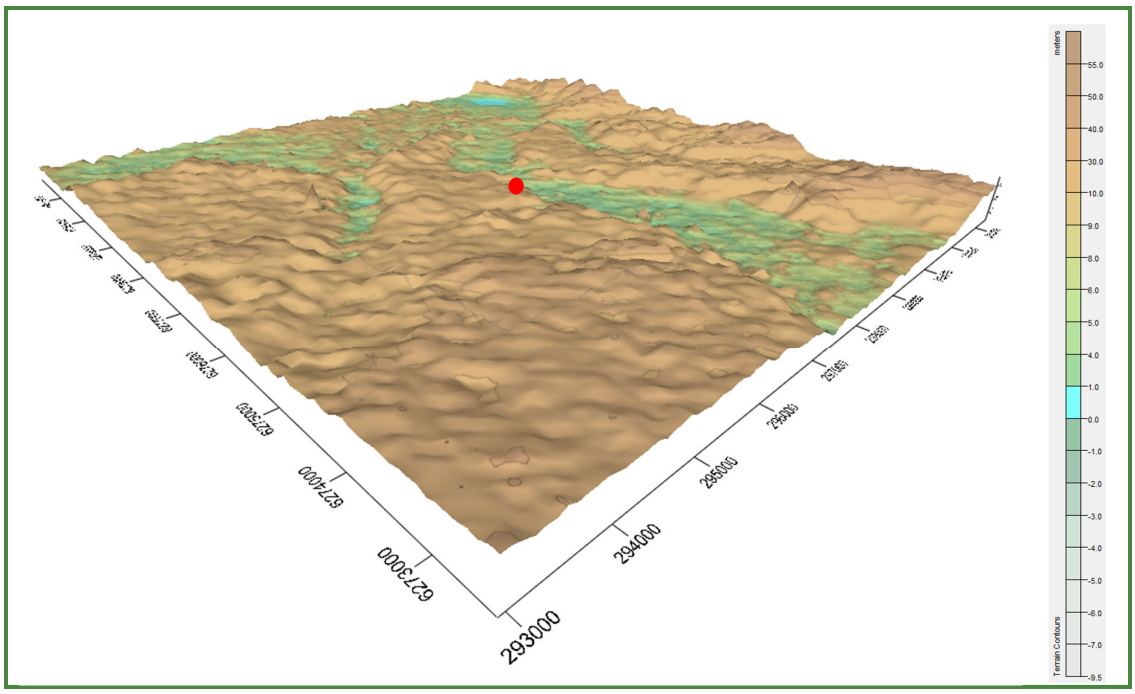
> *Landscape: present active floodplain of the Nepean River. Level with minor (< 10 m) relief to meander scrolls, levees and back swamps.*
>
> *Soils: Deep brown sands and loams, apedal to moderately structured, usually friable. Alluvial Soils (Uc1.21, Uc1.24), Solods (Dy3.41), dark Podzolic soils (Db3.51)*
>
> *Limitations: High streambank erosion hazard, frequent flooding.*

4.1.2 Topography, Drainage and Landscapes

The south-west corner of the site is slightly raised with the site gently sloping downwards towards South Creek along the eastern boundary. Along the northern boundary the terrain also dips down where the stream runs across the site.

A three-dimensional view of the local topography surrounding the site has been provided in Figure 4-1, with the terrain/vertical axis exaggerated by a factor of 10. It should be noted that this figure is an approximation of the actual terrain, based on information that has been digitised from local contour maps.

Figure 4-1: Local Topography with Vertical Exaggeration of 10



Note: ● = Approximate location of site

4.1.3 Acid Sulfate Soil

Information on the SEED (Sharing and Enabling Environmental Data) Map Viewer of Acid Sulfate Soils Risk shows that there is a low probability of occurrence on approximately less than one third of the eastern side of the subject site.

A search from the Australian Soil Resource Information System (ASRIS) of the Atlas of Australian Acid Sulfate Soils database developed by the CSIRO, shows that there is an extremely low to low probability of occurrence of acid sulfate soils (ASS) on the subject site or within close proximity to the site. A map is shown in Figure 4-2 to illustrate these findings.

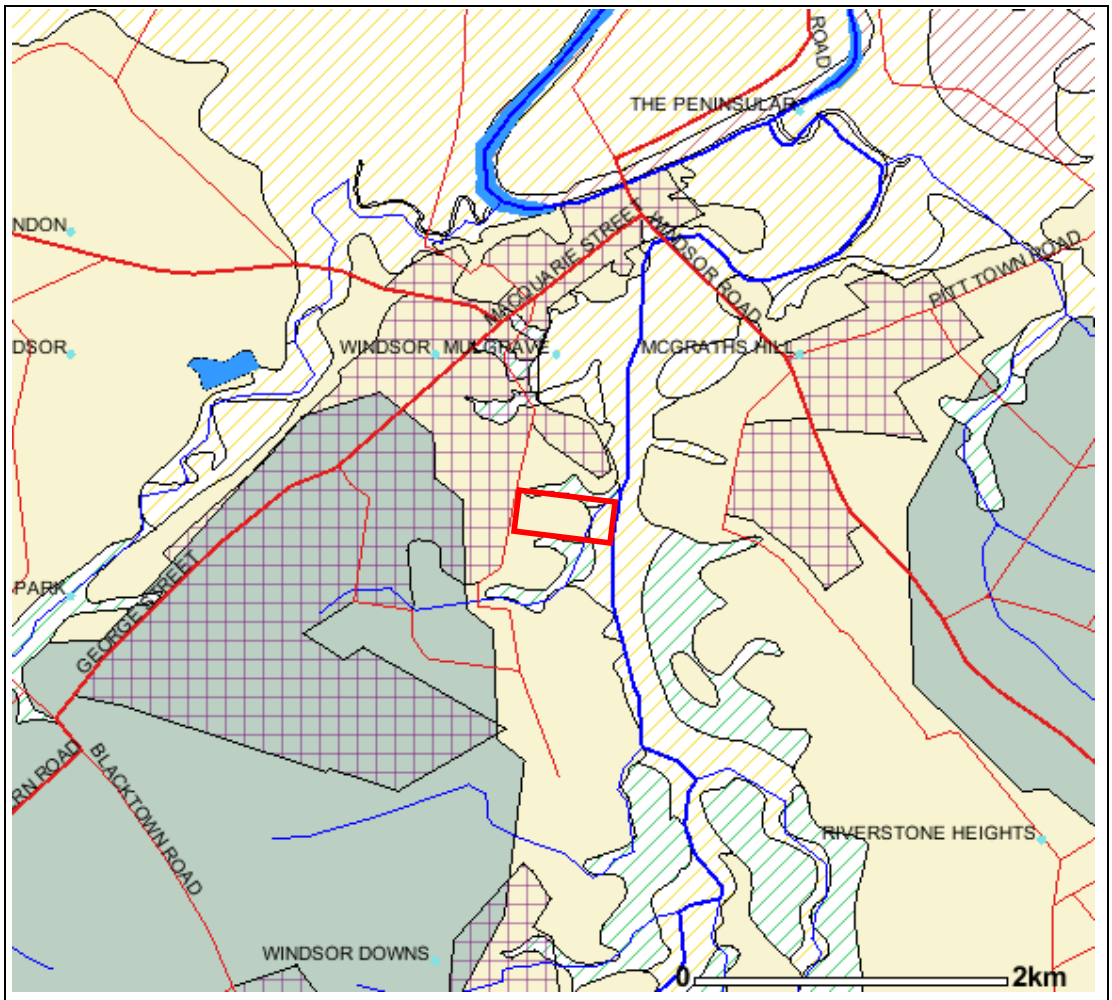
Furthermore, Hawkesbury City Council has further mapping available as part of the Hawkesbury Local Environmental Plan 2012. Under this plan, the subject site is located on land of Class 5 acid sulfate soils, shown in Figure 4-3.

The S10.7 certificate no. PC0069/19 for the property indicates that special provision under Clause 6.1 Acid sulfate soils from the Hawkesbury Local Environmental Plan may apply. In relation to Class 5 land, the following is relevant:

> *6.1 Acid sulfate soils*
>
> *(2) Development consent is required for the carrying out of works described in the Table to this subclause on land shown on the Acid Sulfate Soils Map as being of the class specified for those works.*
>
> *Class of land Works*
>
> *5 Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.*

Some areas of the site are within 500 m of adjacent class 4 land, due to the extent of the earthworks proposed it is recommended an acid sulfate soil management plan be undertaken. A Salinity and Acid Sulfate Assessment prepared by Anderson Environmental is provided in attachment 2.

Figure 4-2: Probability of Acid Sulfate Soil Occurrence at the site.



Source: ASRIS 2018

↑N
Not to scale

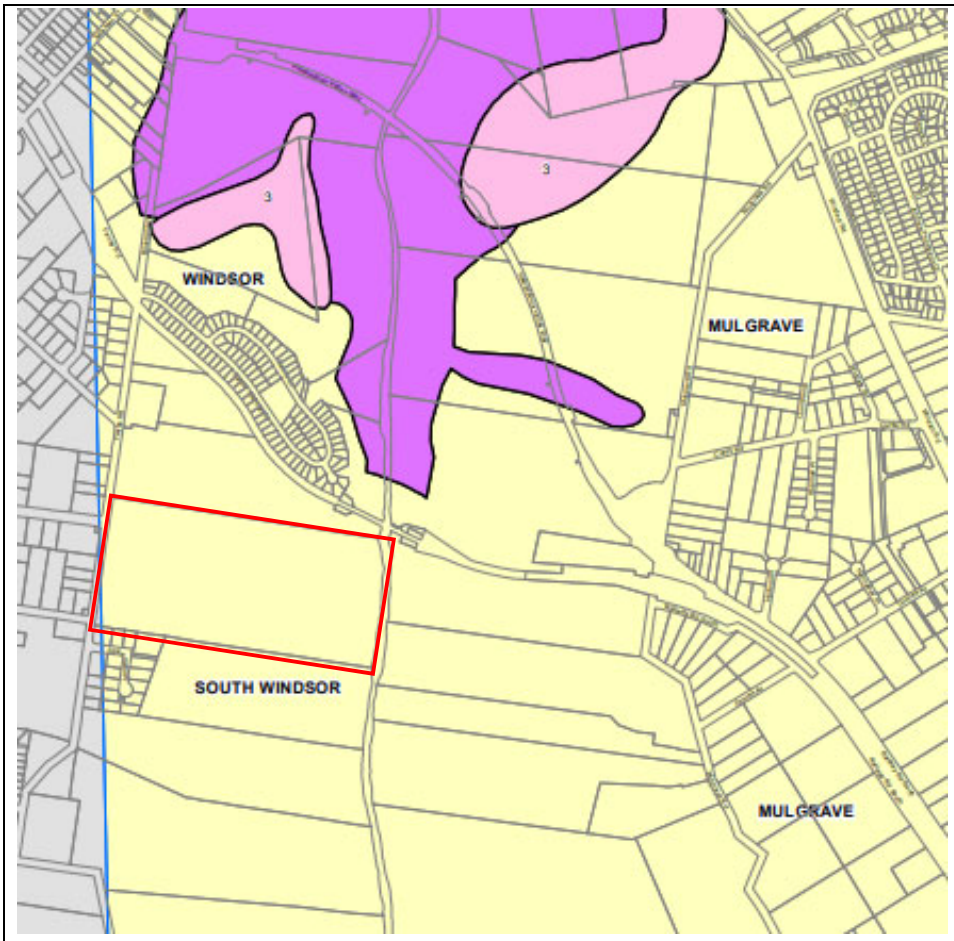
LEGEND:

Approximate site location

- A1 High Probability/High Confidence
- A2 High Probability/Moderate Confidence
- A3 High Probability/Low Confidence
- A4 High Probability/Very Low Confidence
- A- High Probability/Confidence Unknown
- B1 Low Probability/High Confidence
- B2 Low Probability/Moderate Confidence
- B3 Low Probability/Low Confidence
- B4 Low Probability/Very Low Confidence
- B- Low Probability/Confidence Unknown
- C1 Extremely Low Probability/High Confidence
- C2 Extremely Low Probability/Moderate Confidence
- C3 Extremely Low Probability/Low Confidence
- C4 Extremely Low Probability/Very Low Confidence
- C- Extremely Low Probability/Confidence Unknown

Benbow Environmental
25-27 Sherwood St
Northmead NSW 2152

Figure 4-3: Acid Sulfate Soil Map from Hawkesbury LEP 2012



Source: Hawkesbury LEP 2012 Acid Sulfate soils Map – Sheet ASS_008DB

↑N Not to scale	LEGEND: Approximate site location **Acid Sulfate Soils** 1 Class 1 2 Class 2 3 Class 3 4 Class 4 5 Class 5	Benbow Environmental 25-27 Sherwood St Northmead NSW 2152

4.1.4 Existing Contaminated Soil

The conclusions of the Phase I environmental site assessment is reproduced as follows:

- A group of old chemical storage containers, water tanks and IBCs on site but they are all clean which represents a low risk of contamination.
- A couple of mounds of fill are on site but no likely contaminants were found.
- A small amount of spilt fertiliser was found near the shipping containers.
- Old fuses were found in a metal box on the site but there were no signs of leakages.
- Some run-off from the adjacent concrete batching plant gets onto site along the southern boundary.

The site environmental assessment and detailed search into the site's history has not found evidence of contaminating activities to have occurred at the site.

Further investigation of the site, in regards to a Phase II Assessment, is not considered warranted.

However, the following recommendations are made:

- The spilled fertiliser near the shipping containers should be cleaned up.
- Waste scattered around the site of the development should be removed appropriately.
- Run-off from the concrete batching plant onto the site should be prevented.

Some areas of the site are within 500 m of adjacent class 4 land, due to the extent of the earthworks proposed it is recommended an acid sulfate soil management plan be undertaken. A salinity and acid sulfate soil assessment prepared by Anderson Environmental is provided in Attachment 2.

4.2 Potential Impacts on Soil

Construction

An impact to soil during the construction phase is soil erosion; this is addressed in Section 3.6.9.

There are no likely impacts to soil based on the construction activities proposed.

An acid sulfate soil management plan should be implemented during construction.

Operation

The potential sources of contamination are the use of fuel and oils and waste as well as any contamination of surface waters migrating into the soil. Potential contaminants are shown in Table 3-2.

- Potential spillages of diesel and lubricating oil could occur during refuelling and equipment maintenance; the risk would be minimised through procedures and training in appropriate methods and signage showing how to avoid spills and the use of appropriately trained contractors.

- Good housekeeping practices are important to prevent contamination. These include regular cleaning of all hardstand areas, inspection of the integrity of equipment and inspection, cleaning and maintenance of stormwater/surface water system.

5. SAFEGUARDS AND MITIGATION MEASURES

A summary of the soil and water environmental safeguards are provided as follows:

- Installation of primary and secondary sediment detention basins and associated stormwater safeguards and infrastructure;
- Construction erosion and sediment controls implemented and maintained;
- Sediment detention basins designed to prevent seepage by provision of a sealed liner;
- Water quality testing of surface and groundwater;
- Maintenance of all stormwater infrastructure including drainage swales and sediment detention basins;
- Preparation of a flood emergency response plan;
- Staff trained in spill response and emergency procedures, including flood emergency response and maintenance and EMP procedures;
- Implementation of a Construction Environmental Management Plan that includes an Acid Sulfate Soil Management Plan; and
- Implementation of an Environmental Management Plan that includes a Regular workplace inspection to maintain a high standard of housekeeping;

5.1 MONITORING REGIME

The water quality of the discharge water and water within the sediment detention basins will be monitored.

A ground water monitoring bore will be installed in the hardstand area for monitoring. Groundwater monitoring should be undertaken prior to the commencement of operations to establish baseline conditions.

It is recommended the onsite detention basins and groundwater be monitored every 3 months for the first year and to be revised thereafter. The secondary sediment basin discharge outlet will also be monitored after major rain events when discharge is likely.

A water monitoring program would be detailed within the site's EMP and would include sampling methods, equipment and frequency, water quality indicators and laboratory requirements and test methods. The monitoring regime may be revised after the first year of operations.

6. CONCLUDING REMARKS

Benbow Environmental has been engaged by Andy's Earthworks Pty Ltd c/o MacroPlan Dimasi to undertake a Soil and Water assessment to support an Environmental Impact Statement (EIS) for the proposed construction materials processing and recycling plant to be located at 100 Fairey Road, South Windsor NSW 2756. The assessment is a qualitative study that addresses the potential impacts to soil and water from the proposed operations in accordance with the Secretary's Environmental Assessment Requirements (SEARs No. 1188).

With the control measures and monitoring procedures recommended in this report, the potential soil and water impacts of the proposed development are considered low.

This concludes the report.

Damien Thomas	Emma Hansma	R T Benbow
Graduate Environmental Scientist	Senior Engineer	Principal Consultant

7. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Andy's Earthworks Pty Ltd, as per our agreement for providing environmental services. Only Andy's Earthworks Pty Ltd is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Andy's Earthworks Pty Ltd for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

8. REFERENCES

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ATTACHMENTS

Attachment 1: Sparks & Partners - Stormwater & Flood Management Report

SPARKS
+PARTNERS
CONSULTING ENGINEERS
HYDRAULIC I CIVIL I FIRE

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PARRAMATTA NSW 2150

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admin@sparksandpartners.com.au

sparksandpartners.com.au

ABN 95 161 152 969

STORMWATER & FLOOD MANAGEMENT REPORT

BULK RESOURCE FACILITY

100 Fairey Rd, South Windsor

Date:	2 October 2019
Revision:	3
Issue:	1
Ref. No.:	17208_Stormwater Mgmt. Report

Prepared for: **Andy's Earthworks Pty Ltd**
C/o
Macroplan Pty Ltd

Disclaimer

Document Control

Revision	Date	Description	Prepared	Reviewed	Approved
1	12.11.18	Issued for DA	MW	MW	MW
2	14.11.18	Issued for DA	MW	MW	MW
3	02.10.19	Issued for DA	MW	MW	MW

Prepared by	Morgan Walter	Revision	3
Approved by	Morgan Walter	Revision	3

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

Sparks & Partners have been engaged by Andy's Earthworks Pty Ltd to provide civil engineering services to support the proposed Development Application for a bulk resource facility at 100 Fairey Rd, South Windsor. The engineering services include the design and documentation of the stormwater drainage infrastructure and finished pavement levels for the proposed development and assessment of flood management.

The site falls within the Local Government Area (LGA) of Hawkesbury City Council, with the development being assessed against the relevant section of their Local Environment Plan (LEP) and Development Control Plan (DCP). The development proposal provides measures that manage stormwater runoff and provide flood storage mitigation in accordance with Councils relevant controls and guidelines.

2. INTRODUCTION

2.1 Existing Site

The site is located at 100 Fairey Rd, South Windsor, is rectangular in shape, oriented in an east to west direction and is approximately 223,190m² in area. The site is bounded by Fairey Rd on the western boundary, South Creek on the eastern boundary, an existing industrial development/resource facility on the southern boundary and vacant rural land on the northern boundary. The site topography is that is falls from the west to the east with a difference in height ranging from RL5.330 in the north-east corner to RL17.970 in the south-west corner. The site is generally vacant, being cleared of any large vegetation and being covered with small grasses, an existing building is located in the south east portion that is used by an existing water testing business. The site has two (2) land use zones being IN1 and RU1. The IN1 zone is located in the south west, with an approximate area of 67,190m ², with the RU2 zine located on the north and eastern portions of the site. The site is subject to flooding with Council advising that the 1:100year flood level is RL17.000m AHD. A detailed survey of the site has been prepared and is included in Appendix A for reference.

2.2 Proposed Development

The proposed development consists of a bulk resource supply facility which will be located in the area zoned IN1 and will involves the processing and storage of bulk materials for use in the construction industry, such as road base, sands, aggregates etc. The development will occupy approximately 62,300m² of the IN1 zone, and consist of a central processing builing surrounded by cleared open space. The Development will involve the raising of the site to be located above the 1:100year flood level, which will result in cut to fill earthworks being undertaken in both the IN1 and RU1 zones. Detailed concept engineering plans have been prepared and are located an Appendix B for reference and are to be read in conjunction with this report.

3. STORMWATER MANAGEMENT

3.1 General

The objective of stormwater management for the development is to convey flows in safe and economical manner, whilst maintaining water quality at an acceptable level as per the requirements of Section 8. Stormwater Drainage of the Hawkesbury City Council DCP (HCCDCP). The proposed site grading and drainage consists of providing a central high point with the site which allows for sheet flows to run to the boundaries of the development, with the flows then conveyed via grassed swales to sediment basins located in the east

3.2 Stormwater Quality

Grassed lined drainage swales convey the collected runoff to sediment basins located to east whilst also filtering any collected course sediments. These grassed drainage swales are preliminary sized to convey the 1:100year storm flows. The swales discharge the collected runoff to a primary sedimentation basin which is sized as per the requirements of *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition*. This primary basin is sized to further remove sediments and Total Suspended Solids (TSS) from the collected runoff and is conceptually sized to treat and hold the 80th percentile 1:10year ARI storm event. A secondary basin is provided downstream of the first and is conceptually sized at half the size of the primary basin. Each basin has a stilling baffle arrangement that maximises the retention time in the basins for any collected runoff to ensure settling of collected sediments and TSS is achieved.

To further confirm the treatment efficiency of the proposed grassed swales and sedimentation basins MUSIC modelling has been undertaken to compare the existing and post development runoff quality. The modelling has been based on local rainfall data and a comparison of the existing site runoff quality and the proposed development runoff quality as per the requirements of section 8.24 Runoff Water Quality of the HCCDCP.

The existing site and proposed development catchments have been modelled using the generic input values for agriculture and quarry land uses respectively, which best reflects the expected pollutant generation loads. The results of the MUSIC modelling are presented below and demonstrate that the site will achieve a reduction in pollutant export, with the stormwater runoff quality improving.

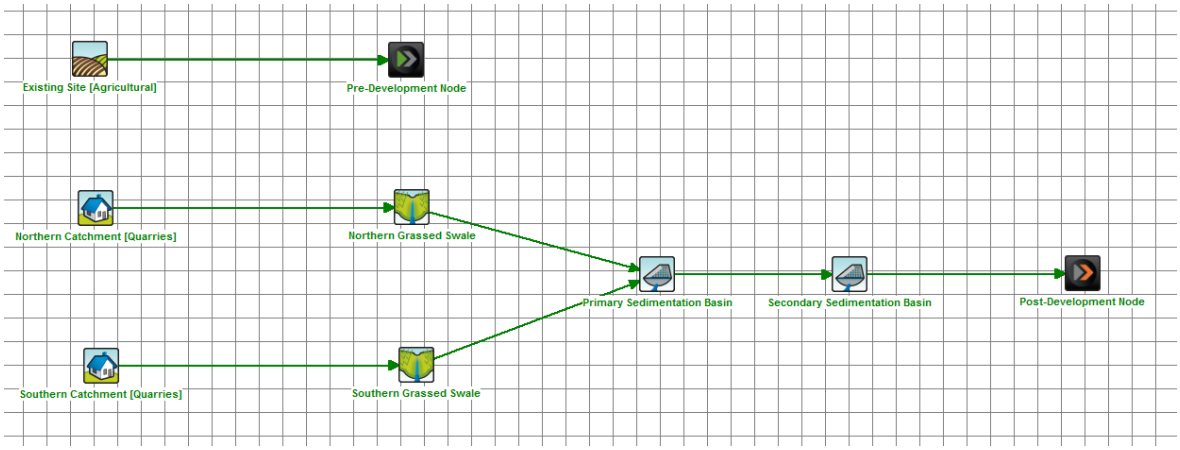


Figure 1 - MUSIC Model

	Existing Source Load	Post Developed Source Load	Post Developed Residual Load	Reduction Achieved	% Reduction Achieved	Compliance with HCC Requirement
Total Suspended Solids (kg/yr)	1,450	7,610	198	1,252	86.3	Yes
Total Phosphorus (kg/yr)	4.02	4.22	0.73	3.29	81.8	Yes
Total Nitrogen (kg/yr)	29.5	21.1	9.56	19.94	67.59	Yes
Gross Pollutants (kg/yr)	0	0	0	0	0	Yes

Table 1 - MUSIC Model Pre to Post Development Water Quality Results

3.3 Stormwater Quantity Discharge

An assessment to pre to post stormwater discharge for the development has been undertaken to establish if On-Site Detention (OSD) is required as per the methodology outlined in section 8.21.2 Design of Systems of the HCCDCP. The calculations have been undertaken using the DRAINS software package and local rainfall Intensity Frequency Duration (IFD) data obtained from the Bureau of Meteorology (BOM). The analysis was based on the site being pervious for the pre and post development with the post developed scenario having the buildings included as impervious area. The main changes between the pre and post development are those of surface roughness, flow path lengths, the 4% increase in impervious area and the introduction of the two sediment basins that trap and hold water, slowing down the rate of discharge from the development. A summary of the input values to determine the peak flows are provided in Table 1 below.

Scenario	Site Area (m²)	% Pervious	Flow Path Length (m)	Flow Path Slope (%)	Manning's 'n'
Pre-Development	62,334	100	355	1.2	0.035
Post Developed	62,334	96	390	0.7	0.025

Table 2 - Pre & Post Development Catchment Characteristics

The sediment basins were modelled in each storm event with an assumed capacity available for use as temporary storage. The table below details the percentage capacity available at the start of each storm event.

Storm Event (ARI)	Available Basin Capacity for Detention Storage (%)
1	100
2	90
5	80
10	70
20	50
50	20
100	10

Table 3 - Available Basin Capacity for Detention Storage

Based on the above the following peak stormwater discharge flow rates were determined for the pre and post development scenarios with the comparison results detailed in Table 4 below.

Storm Event (ARI)	Pre-developed peak discharge (m³/sec)	Post developed peak Site Runoff (m³/sec)
1	0	0
2	0	0
5	0.581	0
10	0.766	0
20	1.010	0.193
50	1.670	1.390
100	1.970	1.550

Table 4 - Pre & Post Development Peak Stormwater Discharge

Based on the above results the sediment basins are acting as an OSD system thereby reducing the peak runoff for the post development drainage scenario and ensuring there is no increase in stormwater runoff from the development.

4. FLOODING MANAGEMENT

4.1 General

The site has been identified as being located within a flood zone, with the 100year flood level provided by Council being RL17.000. Council have advices that the proposed development is to be located above this flood level.

The proposed finished levels of the development have been set at a minimum finished surface level of RL17.300 along the boundaries of the IN1 zone. This level provides 300mm freeboard from the 100year flood level of 17.000.

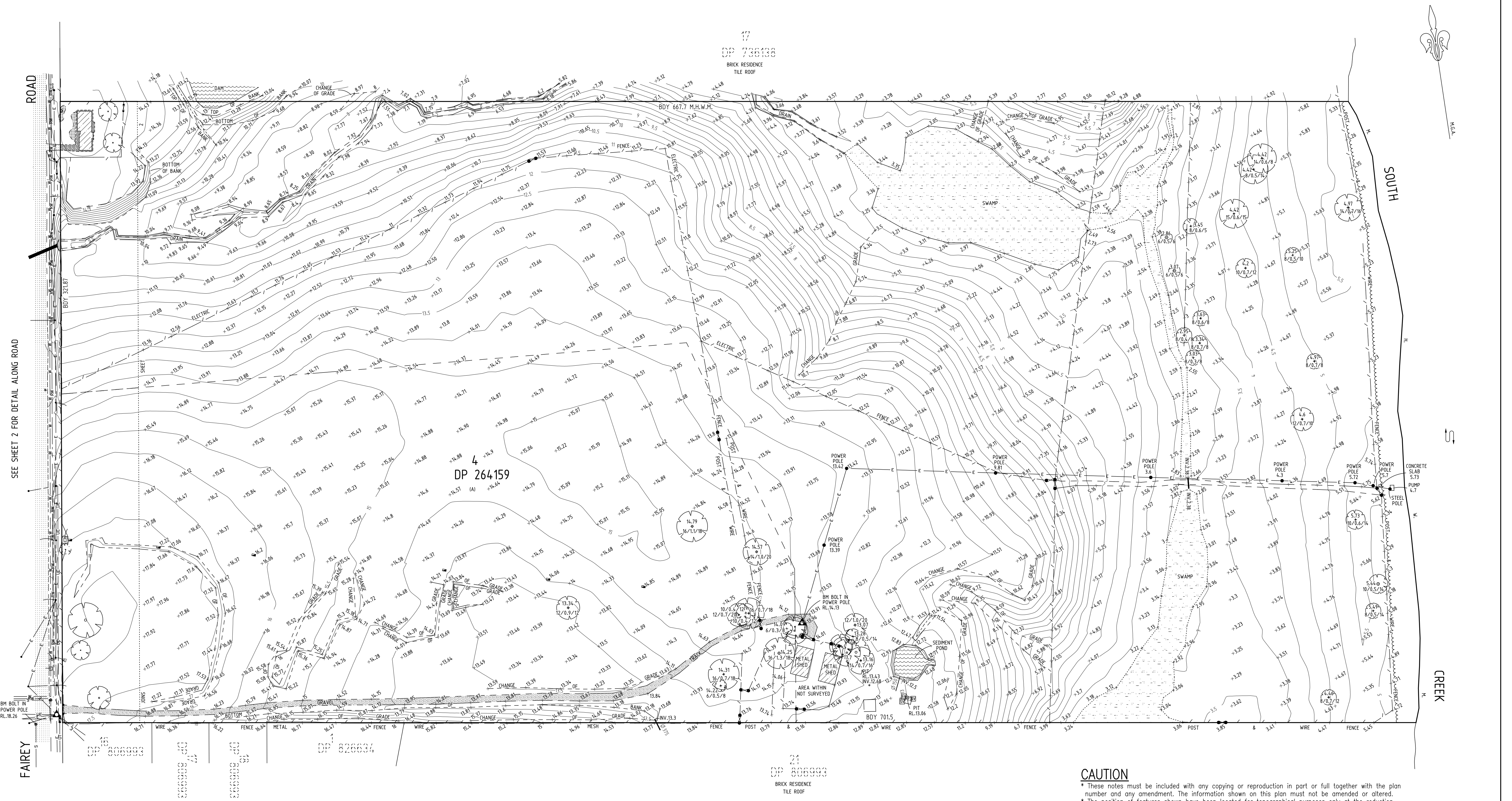
By raising the site to be located above the 100yr flood level filling is required, which result in a loss of flood storage from the flood plain. To address this loss, it is proposed that bulk earthworks are undertaken on the site that result in a neutral cut to fill and no net loss of flood storage. The proposed earthworks involve the cutting of material from the eastern and northern portions of the site located in the RU1 zone and placing this in the IN1 zone. 3D modelling has been undertaken to assess the loss of flood storage volume and the resultant extent of bulk earthworks cut works. The resultant loss of floodplain storage from the fill works is approximately 124,350m³, with the total cut works being approximately 130,630m³. This slight excess of cut ensures the no loss of flood plain storage occurs and that the proposed development will have no detrimental effects on any properties in the flood plain and will not alter the existing flooding regime. refer to the concept engineering plans for details of the cut to fill works.

5. CONCLUSION

Based on the preparation of the concept engineering plans, MUSIC and DRAINS modeling results it is demonstrated that the proposed development meets the requirements of the Hawkesbury City Council DCP for stormwater runoff water quality and quantity. There is a reduction in sediment and pollutant export from the site and no net increase in stormwater runoff peak discharges when comparing the existing to the post developed scenarios. The proposed development is sited above 1:100year flood level and achieves a slight increase in flood storage through bulk earthwork cut to fill works.

APPENDIX A. EXISTING SITE SURVEY

A1



LEGEND

- DENOTES SEWER MANHOLE
- DENOTES TELSTRA PIT
- E — DENOTES OVERHEAD ELECTRICITY LINE
- RW — DENOTES APPROXIMATE UNDERGROUND RECYCLED WATER LINE
- T — DENOTES OVERHEAD TELSTRA LINE
- S — DENOTES APPROXIMATE UNDERGROUND SEWER LINE
- UE — DENOTES APPROXIMATE UNDERGROUND ELECTRICITY LINE
- W — DENOTES APPROXIMATE UNDERGROUND WATER LINE
- DENOTES GATE

(A) DENOTES "INI" ZONED LAND AS DIGITISED FROM HLEP MAPPING

1:1000

20 10 0 20 40 60 80 100

ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN

CAUTION

* These notes must be included with any copying or reproduction in part or full together with the plan number and any amendment. The information shown on this plan must not be amended or altered.
* The position of features shown have been located for topographical purposes only at the reduction ratio shown. Boundary dimensions have been taken from the Title diagram.
* This survey plan is for planning and design purposes only and is not to be used for construction. If any construction is to be undertaken close to or relative to any boundary, or accurate position of features is needed a specific setout or boundary survey is required.
* Contours shown are indicative of the surface and should not be interpolated to determine accurate levels.
* The terms and conditions of Restrictions, Positive Covenants and/or the location and type of any appurtenant easements, if any, appearing on the Certificate of Title have not been investigated.
* Unless otherwise shown individual trees have not been located. Trees shown are indicative of their size. The tree spreads are shown central about the trunk and may not be a true indication of their drip line.
* Only visible services of water, gas, drainage, electricity, telecommunications and sewer have been located.
* The position of underground services shown has been taken from service authority diagrams and are indicative only unless otherwise stated.
* Prior to any demolition, excavation or construction, service authorities MUST be contacted for the possible location of further services and the precise location of all services.

DIAL 1100 BEFORE YOU DIG

Date		REVISION
	F	
	E	
	D	
	C	
	B	
	A	

0 10 20 30 40 50 MILLIMETRES AT A1 100 110 120 130 140 150

DESIGN BY
SURVEY BY G.DOUGLAS
CALCS BY
DRAWN BY G.DOUGLAS
CHECKED BY A.EDWARDS

REDUCTION RATIO AT A1 1:1000
CONTOUR INTERVAL 0.5m
ORIGIN OF LEVELS PM 56492 RL.15.656
DATUM A.H.D.

McKINLAY MORGAN & ASSOCIATES Pty Ltd.
ACN 169 615 801 ABN 90 169 615 801
CONSULTING SURVEYORS - PROJECT MANAGERS
333 George Street, Windsor NSW 2756
PO Box 217 Windsor NSW 2756
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www.mckinlaymorgan.com.au

DATE OF SURVEY 26/7/2017 & 28/7/2017 & 20–21/11/2017
FILE No. 94026
COUNCIL REF

CLIENT NAME EVOQUA WATER TECHNOLOGIES
LOCALITY SOUTH WINDSOR LGA HAWKESBURY
PLAN No. 94026:D:3 C.FILE: 94026D3.DWG

PLAN SHOWING LEVELS & CONTOURS OVER LOT 4 DP 264159 FAIREY ROAD, SOUTH WINDSOR

SHEET No. 1 OF 2 SHEETS

APPENDIX B. CONCEPT ENGINEERING PLANS

100 FAIREY RD, SOUTH WINDSOR
CIVIL WORKS

SITE WORKS - GENERAL

1. ALL WORKS ARE TO BE UNDERTAKEN IN ACCORDANCE WITH LOCAL COUNCIL, AUSTRALIAN AND AUTHORITY STANDARDS.
2. ALL TRENCHING WORKS ARE TO BE RESTORED TO ORIGINAL CONDITION.
3. THE INTEGRITY OF ALL EXISTING AND NEW SERVICES IS TO BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
4. ALL PLANS ARE TO BE READ IN CONJUNCTION WITH APPROVED ARCHITECTS, STRUCTURAL ENGINEERS AND OTHER CONSULTANT'S PLANS. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER FOR CLARIFICATION.

SEDIMENT AND EROSION CONTROL

1. THE CONTRACTOR SHALL INSTIGATE ALL SEDIMENT AND EROSION CONTROL MEASURES IN ACCORDANCE WITH THE HILLS SHIRE COUNCIL REQUIREMENTS AND THE "BLUE BOOK" (MANAGING URBAN STORMWATER SOILS AND CONSTRUCTION, PRODUCED BY THE DEPARTMENT OF HOUSING). THESE MEASURES ARE TO BE REGULARLY INSPECTED AND MAINTAINED.
2. THE SEDIMENT & EROSION CONTROL PLAN PRESENTS CONCEPTS ONLY, THE CONTRACTOR SHALL AT ALL TIMES BE RESPONSIBLE FOR THE ESTABLISHMENT & MANAGEMENT OF A DETAILED SCHEME MEETING COUNCIL'S DESIGN, AND ALL OTHER REGULATORY AUTHORITY REQUIREMENTS.
3. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE SHALL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:
   a. INSTALL ALL TEMPORARY SEDIMENT FENCES AND BARRIER FENCES. WHERE FENCES ARE ADJACENT TO EACH OTHER THE SEDIMENT FENCE CAN BE INCORPORATED INTO THE BARRIER FENCE.
   b. CONSTRUCT TEMPORARY STABILISED SITE ACCESS. INCLUDING SHAKE DOWN AND WASH PAD.
   c. INSTALL SEDIMENT CONTROL MEASURES AS OUTLINED ON THESE SEDIMENT AND CONTROL PLANS (ONCE APPROVED)
4. THE CONTRACTOR SHALL UNDERTAKE SITE DEVELOPMENT WORKS SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF MINIMUM WORKABLE SIZE.
5. AT ALL TIMES AND IN PARTICULAR DURING WINDY AND DRY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL. TACIFIERS MAY BE USED TO CONTROL DUST DURING EXTENDED PERIODS OF DRY WEATHER.
6. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) SHALL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.
7. WATER SHALL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS THE CATCHMENT AREA HAS BEEN STABILISED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED OUT.
8. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES SHALL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE STABILISED / REHABILITATED.
9. THE CONTRACTOR SHALL ALLOW FOR THE ESTABLISHMENT OF ANY OTHER EROSION PROTECTION MEASURES. (IF APPLICABLE).
10. THE CONTRACTOR SHALL REGULARLY INSPECT (MINIMUM TWICE PER WEEK) ALL EROSION AND SEDIMENT CONTROL MEASURES TO ENSURE THEY ARE OPERATING EFFECTIVELY. REPAIRS AND/OR MAINTENANCE SHALL BE UNDERTAKEN REGULARLY AND AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.
11. ACCEPTABLE RECEPTORS SHALL BE USED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER. WASTE FROM THESE RECEPTORS SHALL BE DISPOSED OF IN ACCORDANCE WITH REGULATORY AUTHORITY REQUIREMENTS. PAY ALL FEES AND PROVIDE EVIDENCE OF SAFE DISPOSAL.

SITE WORKS - ACCESS AND SAFETY

1. ALL WORKS ARE TO BE UNDERTAKEN IN A SAFE MANNER IN ACCORDANCE WITH ALL STATUTORY AND INDUSTRIAL RELATION REQUIREMENTS.
2. ACCESS TO ADJACENT BUILDINGS AND PROPERTIES SHALL BE MAINTAINED AT ALL TIMES.
3. WHERE NECESSARY SAFE PASSAGE SHALL BE PROVIDED FOR VEHICLES AND PEDESTRIANS THROUGH OR ADJACENT TO THE SITE.

STORMWATER

1. ALL WORKS ARE TO BE UNDERTAKEN IN ACCORDANCE WITH THE FOLLOWING AUSTRALIAN STANDARDS AS2032, AS3500 AND AS3725 AS A MINIMUM.
2. ALL PIPES LESS THAN OR EQUAL TO Ø300mm IN SIZE ARE TO BE SOLVENT WELD-JOINTED UPVC CLASS SN6 U.N.O.
3. ALL PIPES Ø375mm OR GREATER IN SIZE ARE TO BE MIN. CLASS 2 REINFORCED CONCRETE PIPE (RCP) WITH SPIGGOT AND SOCKETED JOINT OR VANTAGE PIPE PLUS (VPIPE+) FIBRE REINFORCED CONCRETE (FRC) WITH VANTAGE PIPE PLUS JOINT U.N.O.
4. ALL PIPES ARE TO BE LAID AT MIN. 1.0% GRADE U.N.O.
5. PIPE BEDDING IS TO BE HS2 UNDER ROADS AND TRAFFICKED AREAS AND SHALL BE H2 IN LANDSCAPED AND PEDESTRIAN TRAFFICKED AREAS U.N.O.
6. ALL PIPE BENDS AND JUNCTIONS ARE TO BE MADE WITH EITHER PURPOSE MADE FITTINGS OR STORMWATER DRAINAGE PITS.
7. MINIMUM COVER FROM THE OBVERT OF THE STORMWATER PIPE OF 300mm IS TO BE PROVIDED IN LANDSCAPED AREAS AND 600mm IN VEHICULAR TRAFFICKED AREAS U.N.O.
8. WHERE MINIMUM COVER CANNOT BE ACHIEVED CONCRETE ENCASEMENT OF THE AFFECTED PIPE IS MAY BE UNDERTAKEN WITH 20MPa CONCRETE WITH A MIN. COVER OF 150mm TO ALL SIDES OF THE PIPE. THE CONTRACTOR SHALL CONFIRM THIS REQUIREMENT WITH THE ENGINEER OR SUPERINTENDENT.
9. LAID PIPELINES ARE TO HAVE THE FOLLOWING CONSTRUCTED TOLERANCES:
   a. HORIZONTAL-1:300 ANGULAR DEVIATION FROM REQUIRED ALIGNMENT;
   b. VERTICAL-1:300 ANGULAR DEVIATION FROM REQUIRED ALIGNMENT.
10. ALL DRAINAGE PITS ARE TO BE CAST IN-SITU, PRECAST DRAINAGE PITS MAY BE USED WITH APPROVAL FROM THE ENGINEER. THE CONTRACTOR SHALL SUBMIT A PRECAST PIT INSTALLATION WORK METHOD STATEMENT FOR ASSESSMENT BY THE ENGINEER FOR APPROVAL.
11. DRAINAGE PIT COVERS ARE TO BE EITHER GALVANISED STEEL OR CAST IRON CLASS 'B' IN LANDSCAPED AND PEDESTRIAN TRAFFICKED AREAS AND CLASS 'D' IN ALL VEHICULAR TRAFFICKED AREAS U.N.O.
12. DRAINAGE PIT COVERS ARE TO BE 'HEELSAFE' TYPE IN ALL PEDESTRIAN TRAFFICKED AREAS U.N.O.
13. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED PRIOR TO COMMENCING WORKS ON SITE.
14. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
15. DOWN PIPES CONNECTED DIRECT TO PIPES TO BE CONNECTED AT 45° TO THE FLOW DIRECTION WITH A CLEANING EYE PROVIDED AT GROUND LEVEL.

FINISHED LEVELS

1. LEVELS BASED ON SURVEY PREPARED BY McKINLAY MORGAN & ASSOCIATES PTY. LTD.. THE CONTRACTOR SHALL VERIFY LEVELS PRIOR TO CONSTRUCTION COMMENCEMENT, ANY DISCREPANCIES SHALL BE NOTIFIED TO THE ENGINEER OR SUPERINTENDENT FOR CLARIFICATION.
2. FINISHED LEVELS SHOWN ARE CONCEPTUAL ONLY AND SUBJECT TO DETAILED DESIGN PRIOR TO CONSTRUCTION CERTIFICATE APPLICATION. FINAL FINISHED LEVELS TO BE +/- 0.5m FROM LEVELS SHOWN.
3. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
4. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:4H.

DRAWING SCHEDULE

LOCALITY PLAN
NOT TO SCALE - COURTESY OF SIX MAPS

DA APPROVAL

1. DO NOT SCALE OFF THIS DRAWING. USE DIMENSIONS & ARCHITECTURAL DRAWINGS ONLY
2. DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATION.
3. LEVELS ARE INDICATIVE ONLY AND ARE TO BE CHECKED PRIOR TO COMMENCEMENT OF ANY WORKS.
4. AUTHORITIES MAINS AND/OR EXISTING SERVICES ARE TO BE LOCATED AND CHECKED PRIOR TO COMMENCEMENT OF ANY WORKS
5. COMPLETION OF THE QUALITY RECORD IS EVIDENCE THAT THE DESIGN AND DRAWING HAVE BEEN VERIFIED.

VERIFICATION
COMPLETION OF THE DRAWING STATUS IS EVIDENCE THAT THE DESIGN HAS BEEN VERIFIED AS CONFORMING TO THE REQUIREMENTS OF THE PROJECT QUALITY PLAN

DRAWING STATUS	INITIAL	DATE
PRELIMINARY		
FOR INFORMATION ONLY		
FOR CLIENT APPROVAL		
FOR TENDER		
FOR CONSTRUCTION		

CHECKED MW — DATE 13.05.19
APPROVED — DATE
PAGE B1 — PLOT DATE October 2, 2019
SCALE NOT TO SCALE

NORTH POINT

DATE	No	AMENDMENT	INIT	REV
12.11.18		ISSUED FOR DA APPROVAL	MW	1
31.01.19		ISSUED FOR DA APPROVAL	MW	2
02.10.19		DRAWING LIST REVISED	MW	3

CLIENT: AD+E

PROJECT: 100 FAIREY RD, SOUTH WINDSOR

PLANNER: MACRO PLAN

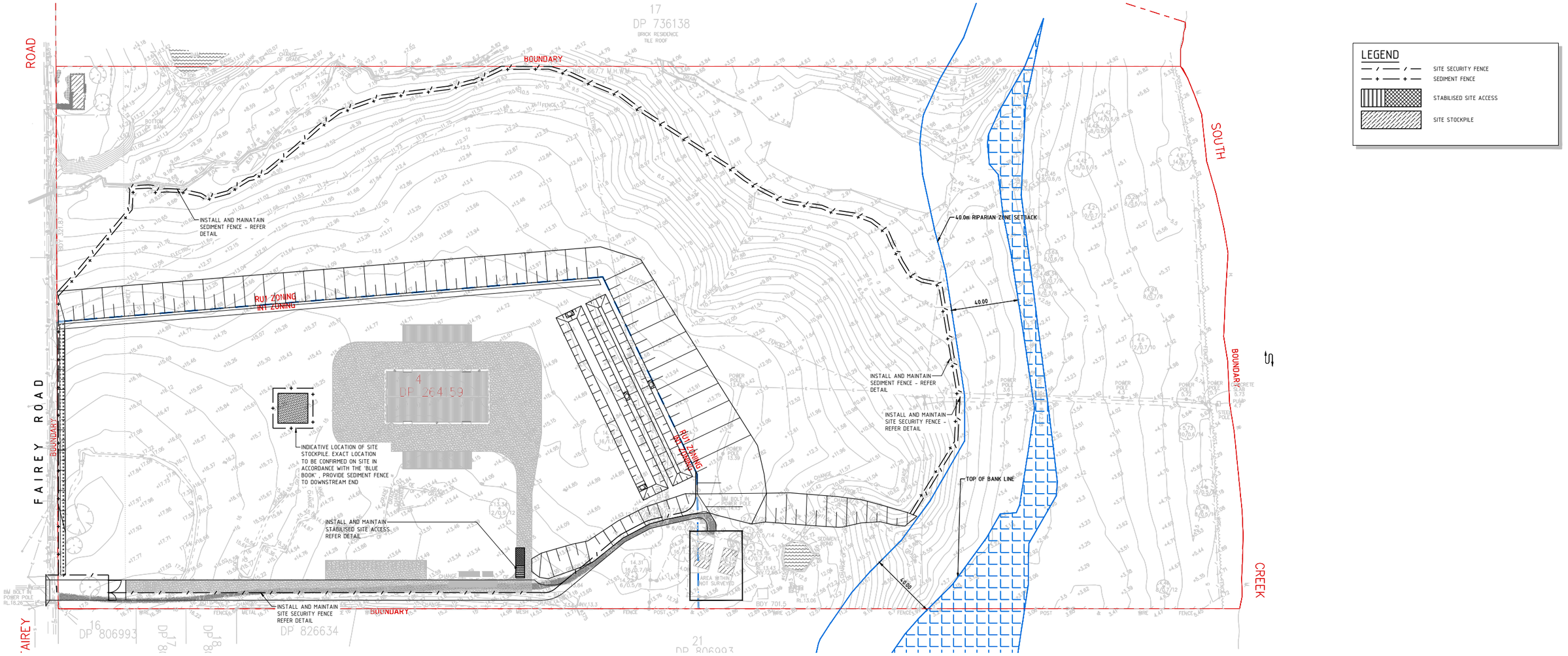
DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY
COVER SHEET, LOCALITY PLAN AND DRAWING SCHEDULE

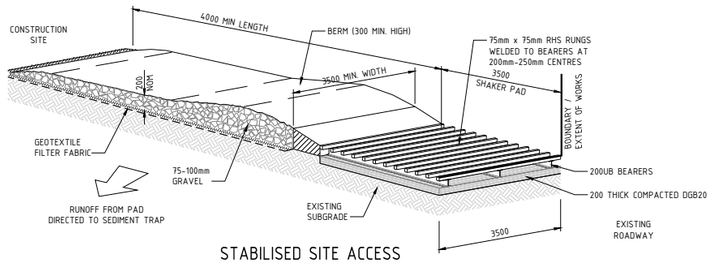
SPARKS +PARTNERS
CONSULTING ENGINEERS
HYDRAULIC | CIVIL | FIRE
Level 1, 91 George Street | Parramatta | NSW 2150
P 02 9891 5033 | F 02 9891 3898 | E admin@sparksandpartners.com.au

AHSCA

DATE	DESIGNED	DRAWN	JOB No	DWG No	No IN SET	REV
OCT 2018	MW	LC	17208	DA1.01	--- OF	3

SCALE N.T.S.



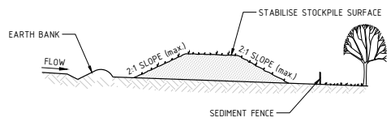


STABILISED SITE ACCESS

NOT TO SCALE

MAINTENANCE

1. THE TEMPORARY ACCESS SHALL BE MAINTAINED IN A CONDITION THAT PREVENTS TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS OF WAY.
2. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL GRAVEL AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT,
3. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS OF WAY MUST BE REMOVED IMMEDIATELY.
4. INSTALL BARRIER ON EITHER SIDE OF SHAKER PAD
5. TO ENSURE VEHICLES ARE GUIDED ON TO THE PAD.
6. INVERT OF SHAKER PAD TO BE DRAINED VIA AGRICULTURAL PIPE WRAPPED IN GEOTEXTILE FABRIC.

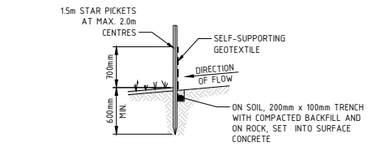


STOCKPILE

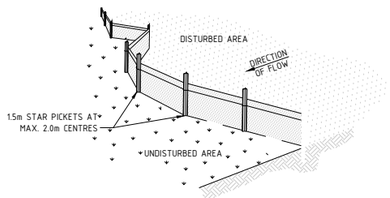
NOT TO SCALE

NOTES:

1. PLACE STOCKPILES MORE THAN 2 (PREFERABLY 5) METRES FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2 METRES IN HEIGHT. 4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES 1 TO 2 METRES DOWNSLOPE.



SECTION DETAIL



SEDIMENT FENCE

NOT TO SCALE

NOTES:

1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN IN THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50L/s IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 200mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. DRIVE 1.5m LONG STAR PICKETS INTO GROUND AT 2.0m INTERVALS (MAX) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.

DA APPROVAL

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VERIFICATION
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DRAWING STATUS	INITIAL	DATE
PRELIMINARY		
FOR INFORMATION ONLY		
FOR CLIENT APPROVAL		
FOR TENDER		
FOR CONSTRUCTION		

CHECKED	DATE
MW	13.05.19
APPROVED	DATE
PAGE	PLOT DATE
B1	October 2, 2019

NORTH POINT

SCALE
0 5 10 15 20 25 30 35 40
METERS

DATE	No	AMENDMENT	INIT	REV
12.11.18		ISSUED FOR DA APPROVAL	MW	1
15.11.18		ISSUED FOR DA APPROVAL	MW	2
02.10.19		RIPARIAN ZONE ADDED	MW	3

DATE	No	AMENDMENT	INIT	REV

CLIENT: AD+E

PROJECT: 100 FAIREY RD, SOUTH WINDSOR

PLANNER: MACRO PLAN

DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY SEDIMENT AND EROSION CONTROL PLAN & DETAILS

SPARKS +PARTNERS
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DATE	DESIGNED
OCT 2018	MW
SCALE	DRAWN
1:500	LC
JOB No	DWG No	No IN SET	REV
17208	DA2.01	--- OF	3

LEGEND

17.50	BULK EARTHWORKS SURFACE MAJOR CONTOUR LINE
8.00	BULK EARTHWORKS SURFACE MINOR CONTOUR LINE
21.10	EXISTING SURFACE CONTOUR LINE

ROAD

SOUTH

CREEK

FAIREY

17
DP 736138
BRICK RESIDENCE
TILE ROOF

4
DP 264159

16
DP 806993

DP 826634

21
DP 806993
BRICK RESIDENCE
TILE ROOF

BATTER 1 IN 3

BATTER 1 IN 4

17.500

18.000

8.000

8.500

9.000

9.500

10.000

10.500

11.000

14.000

7.000

6.500

6.000

5.500

5.000

4.500

4.000

BOTTOM OF BANK

TOP OF BANK

CHANGE OF GRADE

BDY 66

BDY 701.5

AREA WITHIN NOT SURVEYED

SEDIMENT POND

BM BOLT IN POWER POLE RL18.20

PIT RL13.06

DA APPROVAL

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DRAWING STATUS	INITIAL	DATE
PRELIMINARY		
FOR INFORMATION ONLY		
FOR CLIENT APPROVAL		
FOR TENDER		
FOR CONSTRUCTION		

CHECKED MW | DATE 13.05.19
APPROVED | DATE
PAGE B1 | PLOT DATE October 2, 2019

NORTH POINT

SCALE 0 10 20 30 40 50 60 70 80 METERS

DATE	No	AMENDMENT	INIT	REV
10.10.18		ISSUE FOR INFORMATION	MW	1
12.11.18		ISSUE FOR DA APPROVAL	MW	2
15.11.18		ISSUE FOR DA APPROVAL	MW	3
02.10.19		BE EXTENT REVISED AS CLOUDED	MW	4

CLIENT: AD+E

PROJECT: 100 FAIREY RD, SOUTH WINDSOR

PLANNER: MACRO PLAN

DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY BULK EARTHWORK CONTOUR PLAN

SPARKS +PARTNERS
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DATE	DESIGNED	SCALE	DRAWN	JOB No	DWG No	No IN SET	REV
OCT 2018	MW	1:1000	LC	17208	DA3.01	--- OF	4

LEGEND

CUT:		FILL:	
-5.0 TO -2.5m		0.0 TO 0.1m	
-2.5 TO -1.5m		0.1 TO 0.25m	
-1.5 TO -1.0m		0.25 TO 0.5m	
-1.0 TO -0.75m		0.5 TO 0.75m	
-0.75 TO -0.5m		0.75 TO 1.0m	
-0.5 TO -0.25m		1.0 TO 1.5m	
-0.25 TO -0.1m		1.5 TO 2.5m	
-0.1 TO 0.0m		2.5 TO 5.0m	

NOTES

1. CUT TO FILL DEPTHS SHOWN ARE BASED ON LEVEL SHOWN ON SURVEY PREPARED BY McKINLAY MORGAN & ASSOCIATES SURVEYORS, REF: 94026D3, DATED 05/10/2018
2. VOLUMES DETAILED BELOW DO NOT TAKE INTO ACCOUNT BULKING & COMPACTION OF THE MATERIAL, DETAILED EXCAVATION FOR ALL SERVICES TRENCHING & FOUNDATIONS, AND BACKFILL FOR RETAINING WALL CONSTRUCTION. CONTRACTOR TO CONFIRM VOLUMES BASED ON WORKS METHODOLOGY EMPLOYED.

   FLOOD FILL VOLUME - 124,350m³
   SITE BE FILL VOLUME - 2181m³
   PAVEMENT THICKNESS VOLUME - 35,540m³

   TOTAL CUT VOLUME - 126,531m³
   TOTAL FILL VOLUME - 126,531m³

   TOTAL IMPORT - 0m³
   (EXCLUDES TRENCHING FOR OTHER SERVICES)
3. REFER DRAWING SK06 FOR TYPICAL BULK EARTHWORK SCHEMATIC DIAGRAM

DA APPROVAL

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PAGE B1 | PLOT DATE October 2, 2019

NORTH POINT

SCALE 0 10 20 30 40 50 60 70 80 METERS

DATE	No	AMENDMENT	INIT	REV
10.10.18		ISSUE FOR INFORMATION	MW	1
12.11.18		ISSUE FOR DA APPROVAL	MW	2
15.11.18		ISSUE FOR DA APPROVAL	MW	3
02.10.19		BE EXTENT REVISED AS CLOUDED	MW	4

CLIENT: AD+E

PROJECT: 100 FAIREY RD, SOUTH WINDSOR

PLANNER: MACRO PLAN

DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY BULK EARTHWORK DEPTH CUT TO FILL PLAN

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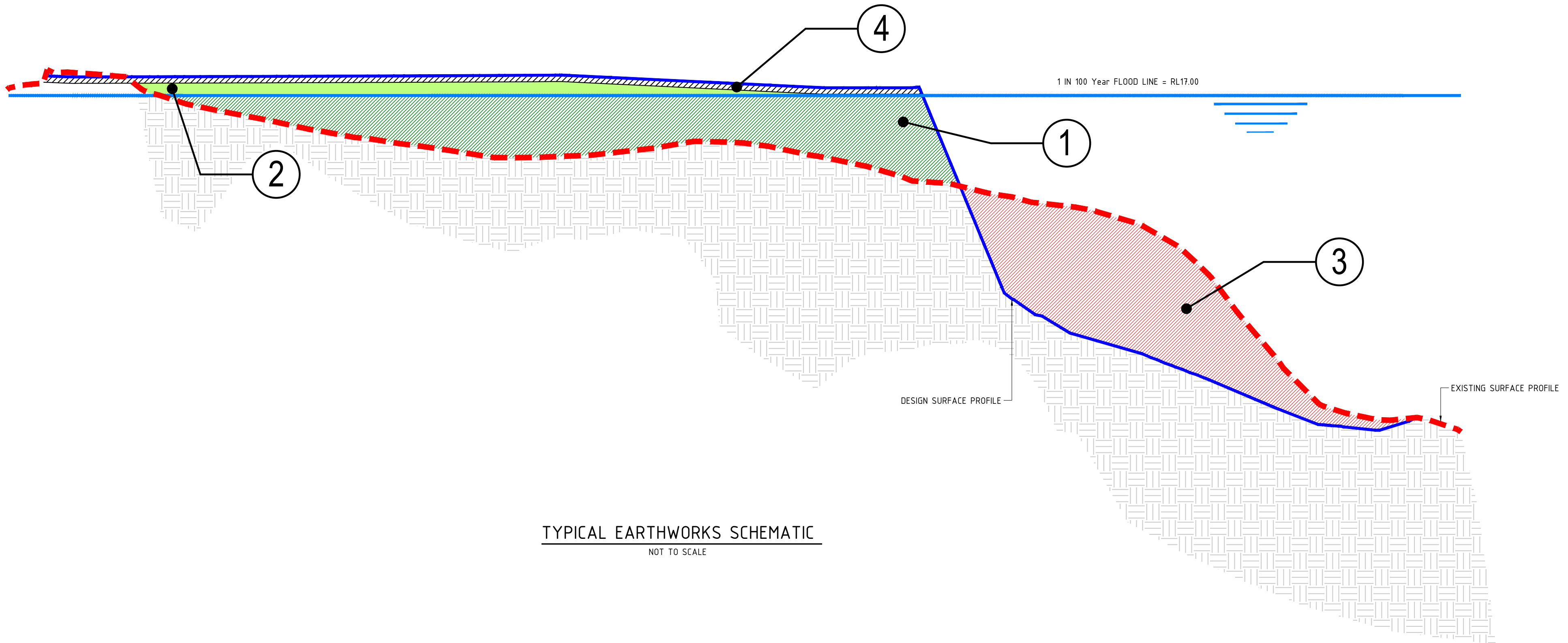
AHSCA

DATE OCT 2018 | DESIGNED MW | DRAWN LC | SCALE 1:1000 | JOB No 17208 | DWG No DA3.05 | No IN SET --- OF | REV 4

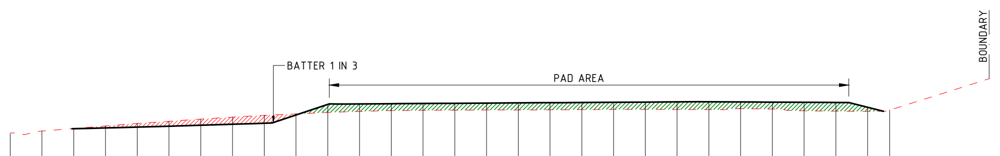


TYPICAL EARTHWORKS SCHEMATIC

NOT TO SCALE

LEGEND

Legend	Ref
FLOOD FILL VOLUME	1
SITE BE FILL VOLUME	2
TOTAL CUT VOLUME	3 = 1 + 2
PAVEMENT THICKNESS (500mm)	4



DATUM R.L. -4.000

CHAINAGE	DESIGN SURFACE LEVEL	EXISTING SURFACE LEVEL
0.000		8.218
10.000		8.793
20.000	9.516	9.555
30.000	9.776	10.382
40.000	10.049	11.180
50.000	10.320	11.856
60.000	10.631	12.535
70.000	10.942	13.172
80.000	11.250	13.725
90.000	13.844	14.192
100.000	17.166	14.644
110.000	17.339	14.953
120.000	17.402	15.215
130.000	17.466	15.303
140.000	17.529	15.354
150.000	17.591	15.408
160.000	17.654	15.414
170.000	17.716	15.477
180.000	17.778	15.509
190.000	17.840	15.586
200.000	17.901	15.602
210.000	17.961	15.578
220.000	17.985	15.533
230.000	17.941	15.810
240.000	17.899	15.718
250.000	17.842	15.164
260.000	17.786	15.049
270.000	16.286	14.981
276.957		15.389

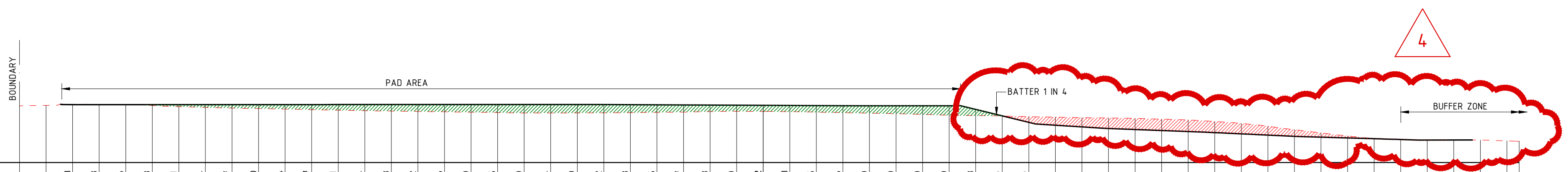
BULK EARTHWORKS SECTION (A / DA3.05)

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

LEGEND

CUT AREA

FILL AREA



DATUM R.L. -4.000

CHAINAGE	DESIGN SURFACE LEVEL	EXISTING SURFACE LEVEL
0.000		17.237
10.000		17.446
20.000	17.743	17.896
30.000	17.723	17.859
40.000	17.726	17.779
50.000	17.728	17.420
60.000	17.731	16.983
70.000	17.734	16.663
80.000	17.737	16.453
90.000	17.740	16.258
100.000	17.744	16.066
110.000	17.747	15.851
120.000	17.751	15.652
130.000	17.754	15.466
140.000	17.758	15.330
150.000	17.762	15.172
160.000	17.766	15.043
170.000	17.770	14.898
180.000	17.775	14.737
190.000	17.780	14.591
200.000	17.784	14.591
210.000	17.789	14.617
220.000	17.772	14.658
230.000	17.723	14.721
240.000	17.675	14.833
250.000	17.627	14.942
260.000	17.578	15.110
270.000	17.530	15.215
280.000	17.482	15.194
290.000	17.433	15.105
300.000	17.385	14.938
310.000	17.336	14.723
320.000	17.300	14.540
330.000	17.300	14.330
340.000	17.300	14.072
350.000	17.300	13.746
360.000	15.933	13.627
370.000	13.515	13.484
380.000	11.096	13.235
390.000	9.958	13.068
400.000	9.385	12.832
410.000	8.789	12.721
420.000	8.431	12.570
430.000	8.074	12.292
440.000	7.705	11.988
450.000	7.244	11.422
460.000	6.806	10.681
470.000	6.330	9.625
480.000	5.855	8.320
490.000	5.535	7.146
500.000	5.237	5.981
510.000	4.939	4.993
520.000	4.641	4.661
530.000	4.480	4.452
540.000		4.413
550.000		4.443
560.000		4.142
564.625		3.941

BULK EARTHWORKS SECTION (B / DA3.05)

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

DA APPROVAL

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VERIFICATION

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DRAWING STATUS	INITIAL	DATE
PRELIMINARY		
FOR INFORMATION ONLY		
FOR CLIENT APPROVAL		
FOR TENDER		
FOR CONSTRUCTION		

CHECKED: MW | DATE: 13.05.19

APPROVED: | DATE:

PAGE: B1 | PLOT DATE: October 2, 2019

NORTH POINT

SCALE 0 10 20 30 40 50 60 70 80 METERS

DATE	No	AMENDMENT	INIT	REV
10.10.18		ISSUE FOR INFORMATION	MW	1
12.11.18		ISSUED FOR DA APPROVAL	MW	2
15.11.18		ISSUE FOR DA APPROVAL	MW	3
02.10.19		ISSUE FOR DA APPROVAL	MW	4

DATE	No	AMENDMENT	INIT	REV

CLIENT: AD+E

PROJECT: 100 FAIREY RD, SOUTH WINDSOR

SPARKS + PARTNERS
CONSULTING ENGINEERS
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PLANNER: MACRO PLAN

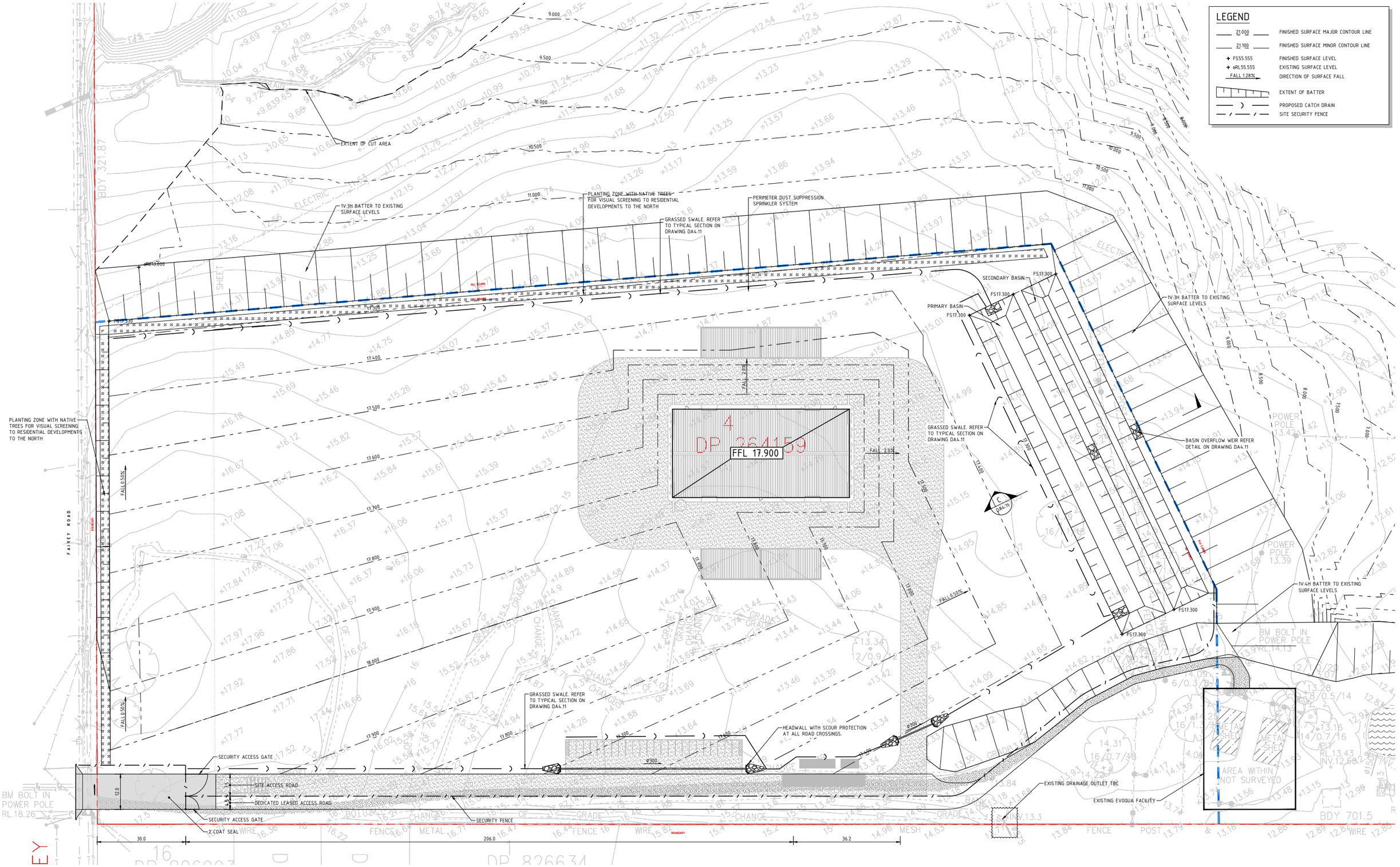
DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY BULK EARTHWORK SECTIONS

DATE: OCT 2018 | DESIGNED: MW | SCALE: 1:1000 | DRAWN: LC

ISO 9001 : 2000 QUALITY ASSURED COMPANY

AHSCA The Association of Hydraulic Services Consultants Australia (NSW) Inc. CORPORATE MEMBER

JOB No: 17208 | DWG No: DA3.11 | No IN SET: ---- OF | REV: 4



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FOR INFORMATION ONLY		
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FOR TENDER		
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CHECKED MW DATE 13.05.19
APPROVED DATE
PAGE SIZE B1 PLOT DATE October 2, 2019

NORTH POINT

SCALE 0 5 10 15 20 25 30 35 40 METERS

DATE	No	AMENDMENT	INIT	REV
26.09.17		FOR INNFORMATION	SF	1
26.10.17		ISSUED FOR COORDINATION	DL	2
12.11.18		ISSUED FOR DA APPROVAL	MW	3
15.11.18		ISSUED FOR DA APPROVAL	MW	4
31.01.19		ISSUED FOR DA APPROVAL	MW	5
02.10.19		REVISED TO INCLUDE BUILDING	MW	6

CLIENT: AD+E

PROJECT: 100 FAIREY RD, SOUTH WINDSOR

PLANNER: MACRO PLAN

DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY SITEWORKS AND GRADING PLAN

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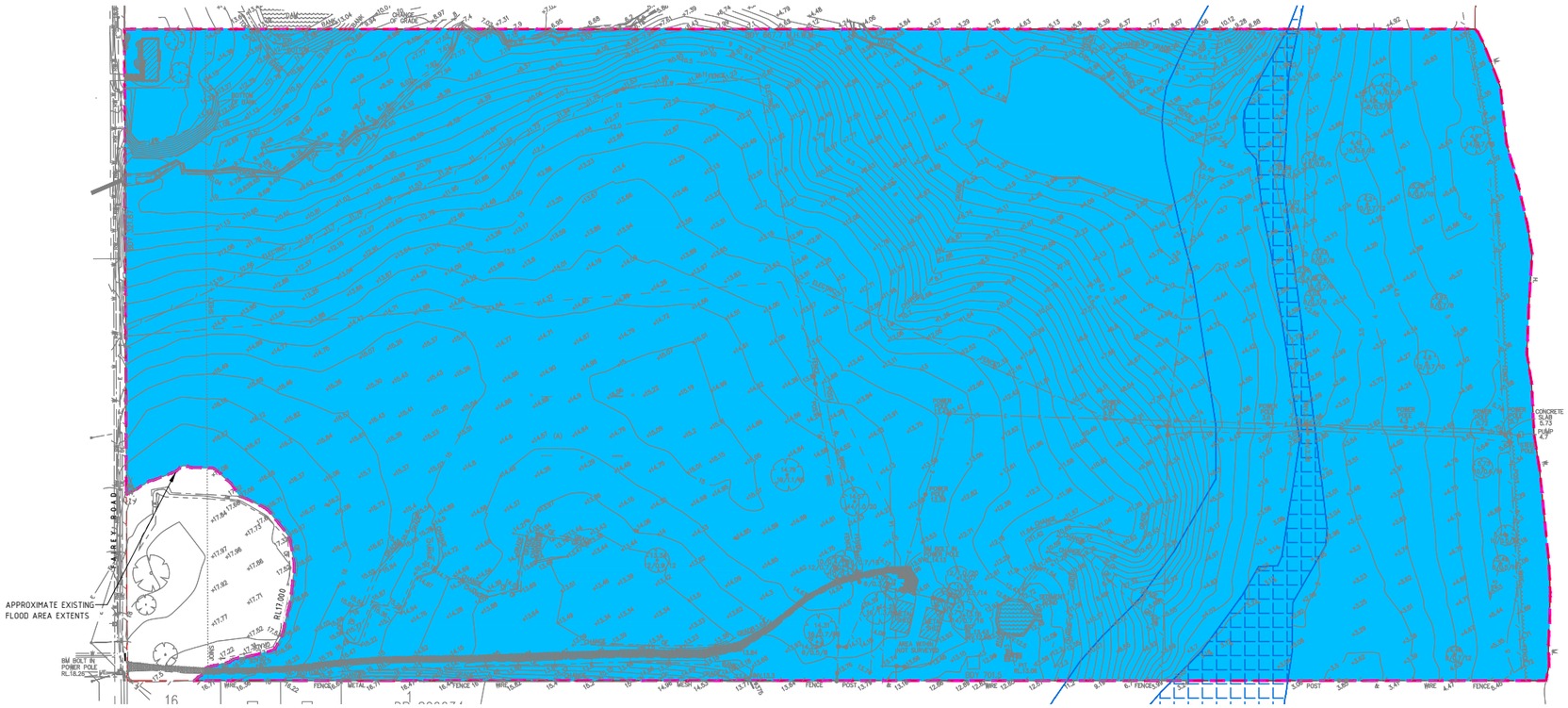
AHSCA CORPORATE MEMBER

DATE OCT 2018 | DESIGNED MW | SCALE 1:500 @ B1 | DRAWN LC
JOB No 17208 | DWG No DA4.01 | No IN SET --- OF | REV 6



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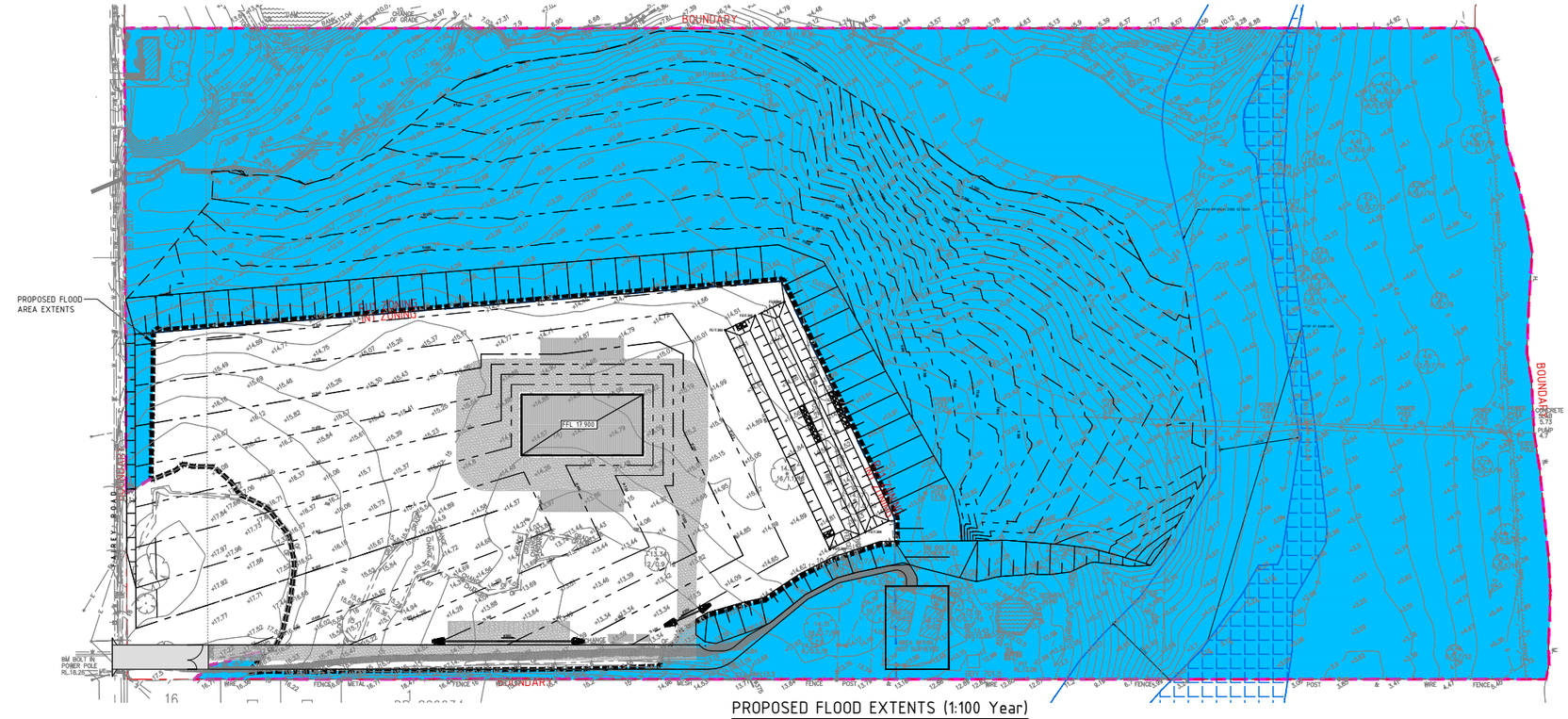

PROPOSED FLOOD EXTENTS (1:100 Year)

DA APPROVAL

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5. COMPLETION OF THE QUALITY RECORD IS EVIDENCE THAT THE DESIGN AND DRAWING HAVE BEEN VERIFIED.

VERIFICATION
COMPLETION OF THE DRAWING STATUS IS EVIDENCE THAT THE DESIGN HAS BEEN VERIFIED AS CONFORMING TO THE REQUIREMENTS OF THE PROJECT QUALITY PLAN

DRAWING STATUS	INITIAL	DATE
PRELIMINARY		
FOR INFORMATION ONLY		
FOR CLIENT APPROVAL		
FOR TENDER		
FOR CONSTRUCTION		

CHECKED MW | DATE 13.05.19
APPROVED | DATE
PAGE B1 | PLOT DATE October 2, 2019
NORTH POINT
SCALE SCALE AS SHOWN ON PLAN

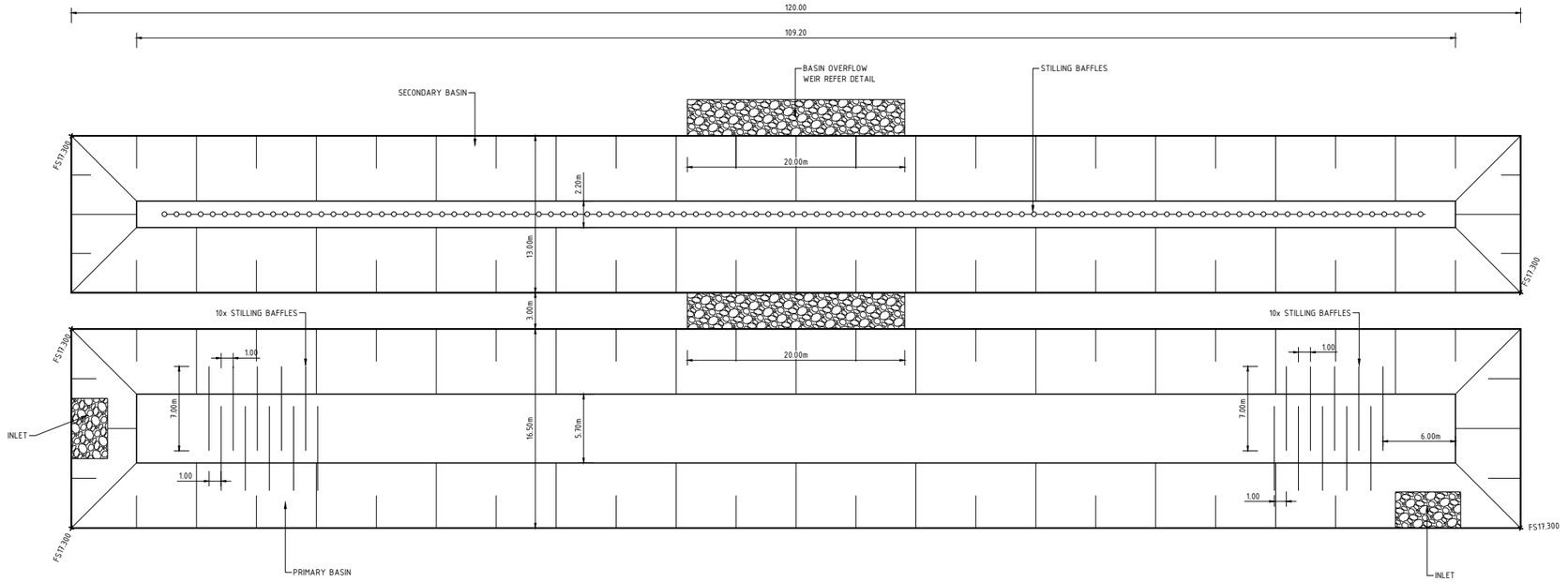
DATE	No	AMENDMENT	INIT	REV
12.11.18		ISSUED FOR DA APPROVAL	MW	1
15.11.18		ISSUED FOR DA APPROVAL	MW	2
02.10.19		ARCHITECTURAL PLAN ADDED	MW	3

CLIENT: AD+E
PLANNER: MACRO PLAN
PROJECT: 100 FAIREY RD, SOUTH WINDSOR
DRAWING TITLE: DA - RESOURCE RECOVERY FACILITY EXISTING AND PROPOSED FLOODING PLAN

SPARKS +PARTNERS
CONSULTING ENGINEERS
HYDRAULIC | CIVIL | FIRE
Level 1, 91 George Street | Parramatta | NSW 2150
P 02 9891 5033 | F 02 9891 3898 | E admin@sparksandpartners.com.au

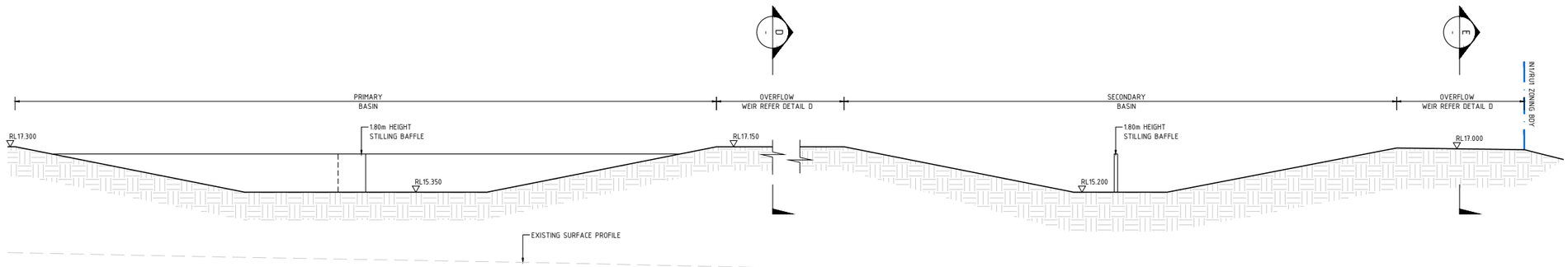
AHSCA CORPORATE MEMBER

DATE OCT 2018 | DESIGNED MW | DRAWN LC | SCALE 1:1200
JOB No 17208 | DWG No DA4.05 | No IN SET --- OF | REV 3



SEDIMENT BASIN PLAN

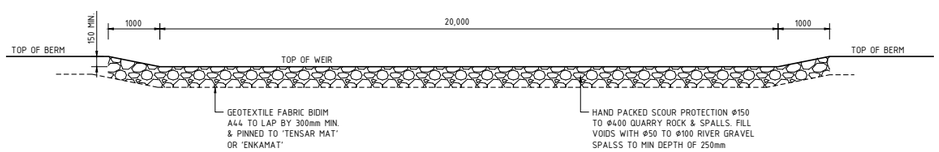
SCALE 1:200



TYPICAL SECTION THROUGH BASINS

C

SCALE HOR 1:50, VERT 1:100



TYPICAL SECTION THROUGH OVERFLOW WEIR

D E

HORIZONTAL SCALE 1:50
VERTICAL SCALE 1:50

GRASS SWALE

NOT TO SCALE

DA APPROVAL

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DRAWING STATUS	INITIAL	DATE
PRELIMINARY		
FOR INFORMATION ONLY		
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FOR TENDER		
FOR CONSTRUCTION		

CHECKED MW DATE 13.05.19
APPROVED DATE
PAGE B1 PLOT DATE October 2, 2019

NORTH POINT

SCALE SCALE AS SHOWN ON PLAN

DATE	No	AMENDMENT	INIT	REV
12.11.18		ISSUED FOR DA APPROVAL	MW	1
02.10.19		WEIR DETAILS REVISED	MW	2

CLIENT AD+E

PROJECT 100 FAIREY RD, SOUTH WINDSOR

PLANNER MACRO PLAN

DRAWING TITLE DA - RESOURCE RECOVERY FACILITY SEDIMENT BASIN PLAN & DETAILS SHEET

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AHSCA CORPORATE MEMBER

DATE OCT 2018 DESIGNED MW
SCALE AS SHOWN DRAWN LC
JOB No 17208 DWG No DA4.11 No IN SET --- OF REV 2

Attachment 2: Anderson Environmental – Salinity and Acid Sulfate Soil Assessment

SALINITY AND ACID SULFATE ASSESSMENT FOR A PROPOSED DEVELOPMENT AT

100 FAIREY ROAD

SOUTH WINDSOR

HAWKESBURY CITY COUNCIL

LOCAL GOVERNMENT AREA

Job number: 2289

Anderson Environmental Pty Ltd 87 164 830 728
Ph: 1300 302 507 Fax: (02) 8580 4731
Office: 35B, 1 Maitland Place Baulkham Hills 2153
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www.andenviro.com.au

Version 1

Version	Date drafted	Drafted by
1	22/08/2018	Jason Anderson
Version	**Date reviewed**	**Reviewed by**
1	28/08/2018	Jason Anderson
Approved by		**Date**
Jason Anderson (Director)		28/08/2018

EXECUTIVE SUMMARY

Introduction

Anderson Environmental was contracted to conduct a soil salinity assessment and acid sulfate soils assessment for a proposed development at Lot 4 DP264159 - 100 Fairey Road, South Windsor, in the Hawkesbury City Council Local Government Area (LGA), hereafter referred to as the subject site.

The subject site is proposed to be developed as a Concrete Recycling Facility. Andy's Earthworks Pty Ltd is seeking development consent to establish a construction materials crushing and recycling plant.

The Project is proposed to be located over the south-western portion of the large mixed rural/industrial allotment of which only a small portion is currently used by Evoqua as a research facility. This facility is located approximately half way along the site's southern boundary. The development of the construction materials crushing and recycling plant will operate within the IN1 zoned portion of the site, whilst the Evoqua operations will be maintained in situ. The project is to be located on the south-west quarter of the site.

The subject site is composed of a mixture of cleared mainly exotic grasslands and an occasional overstorey eucalypt.

Methodology

Salinity

Assessment followed the guidelines found in "*Site Investigations for Urban Salinity*" by the Department of Land and Water Conservation (2002). The subject site was assessed visually to determine signs of potential soil salinity; bare soil patches, stressed vegetation, salt encrustations etc.
Soil was also collected for field and laboratory analysis from six locations across the subject site. This locations were selected to give a good representation of the subject site in relation to the proposed development.

Collected samples were analysed by Envirolab Sydney for salinity analysis.

Acid Sulfate

The assessment followed;

- *"Acid Sulfate Soils Assessment Guidelines"* Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.
- *Acid Sulfate Soils Planning Guidelines.* Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.
- *Acid Sulfate Soils Laboratory Methods Guidelines*. Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.

Soil was also collected for field and laboratory analysis from six locations across the subject site. This locations were selected to give a good representation of the subject site in relation to the proposed development.

Collected samples were analysed by Envirolab Sydney for salinity and acid sulfate analysis.

Results

No visible signs of soil salinity were apparent during the field survey. The site was well vegetated with mainly exotic paddock grasses and there were no significant areas of exposed soil which could not be explained by other causes.

Laboratory testing confirmed that salinity levels were well below the thresholds listed in the guidelines for saline soils.

Laboratory analysis for Acid Sulfate indicate that the soils are below the required thresholds.

Conclusion

This assessment determined that soil salinity and acid sulfate are not limiting factors for the proposed development on the subject site. Any excavation is understood to be limited and based on the proposal it appears that most of the soil will be capped by a hard surface thus largely limiting any significant soil profile disturbance.

Table of Contents

1. Introduction

1.1 Background

Anderson Environmental was engaged to conduct a Salinity Assessment (SA) and Acid Sulfate Assessment (ASA) for a proposal at 100 Fairey Road, South Windsor, Hawkesbury Shire Council Local Government Area, hereafter referred to as the subject site.

The subject site is proposed to be developed as a Concrete Recycling Facility. Andy's Earthworks Pty Ltd is seeking development consent to establish a construction materials crushing and recycling plant.

The Project is proposed to be located over the south-western portion of the large mixed rural/industrial allotment of which only a small portion is currently used by Evoqua as a research facility. This facility is located approximately half way along the site's southern boundary. The development of the construction materials crushing and recycling plant will operate within the IN1 zoned portion of the site, whilst the Evoqua operations will be maintained in situ. The project is to be located on the south-west quarter of the site.

The subject site is composed of a mixture of cleared mainly exotic grasslands and an occasional overstorey eucalypt. The subject site is proposed to be developed as a concrete recycling facility utilising the south-western quarter of the subject site.

1.2 Subject Site

The subject site and its local context is shown in **Figure 1.1** below.

The subject site is composed of mainly pasture improved grassland for cattle grazing. There is a wetland on the north-eastern quarter of the site. The site drains to the east where it adjoins South Creek. South Creek is part of the Hawkesbury-Nepean catchment, located on the Cumberland Plain, Greater Western Sydney, New South Wales.

Note: All figures in this report are to be considered indicative. Distances specified are to be assessed on the ground by qualified surveyors prior to the conduction of any works.

Figure 1.1: Subject site showing local context – Source: Six Maps

1.3 Soils

The Blacktown soil group comprises the soils on the subject site as described from the Soil Landscapes of Penrith 1:100000 Sheet (Bannerman, S.M., and Hazelton, P.A., 1990), see **Table 1.2**.

Table 1.2: Soil mapping

Bt = Blacktown (670km^2)	
Landscape	Gently undulating rises on Wianamatta Group shales. Local relief to 30m, slopes usually <5%. Broad rounded crests and ridges with gently inclined slopes. Cleared eucalypt woodland and tall open forest (dry sclerophyll forest)
Soils	Shallow to moderately deep (<100cm) hardsetting mottled texture contrast soils, red and brown podzolic soils (Dr3.21, Dr3.31, Db2.11, Db2.21) on crests grading to yellow podzolic soils (Dr2.11, Dy3.11) on lower slopes and in drainage lines
Limitations	Moderately reactive highly plastic subsoil, low fertility soil, poor soil drainage

This mapping appears accurate for the subject site based on observations made during field work.

1.4 Salinity Information

The assessment of the subject site followed the document "*Site Investigations for Urban Salinity*" by the Department of Land and Water Conservation (2002). A saline soil is defined as a soil which contains sufficient soluble salt to adversely affect plant growth and/or land use. A soil is often considered saline if it has an ECe of 4 dS/m (deciSiemens per metre). More sensitive plants may show effects at 1-2 dS/m. This is however also influenced by the pH and

the relative amounts of the various cations (positively charged ions) in the soil such as sodium, calcium, potassium and magnesium.

1.5 Acid Sulfate Soils Information

The assessment of the site followed the document "Acid Sulfate Soils Assessment Guidelines" (August 1998).

Acid sulfate soils is the common name given to naturally occurring soils and sediments that contain iron sulfide (pyrite). As sea levels slowly rose (between 6,000 and 10,000 years ago), substantial deposits of pyritic sediments formed in estuarine mud, where tidal seawater (containing sulfur) met and mixed with freshwater outflows (containing iron). Acid sulfate soils are defined as either:

- **Actual** acid sulfate soils - where the soils have already been exposed to oxygen and have a pH < 4, or
- **Potential** acid sulfate soils - where the soils have not been exposed but have the potential to generate sulfuric acid if exposed.

Left undisturbed, acid sulfate soils do not pose any harm as they are in an anerobic condition. However, if they are disturbed and exposed to oxygen (air) through activities such as excavation or the lowering of the water table, sulfuric acid may be produced in large quantities. A tonne of acid sulfate soils has the capacity to generate 1.6 tonnes of pure sulfuric acid. Depending on the particular sediment's ability to buffer acid generation, sulfuric acid can continue to be generated for many hundreds of years if not treated correctly.

Impacts of acid sulfate soils

Sulfuric acid can have detrimental effects on the natural or built environment by:

- Corroding and weakening concrete, iron, steel and certain aluminium alloys.
- Dissolving certain essential elements from the soil, making it toxic and adverse to plant growth.
- Affecting biodiversity and ecological integrity by degrading habitat, soil and water quality, potentially resulting in the death or disease of fish and other organisms.

Where are acid sulfate soils found?

Acid sulfate soils are typically found in low lying areas near the coast, such as mangrove and salt marsh areas, tidal areas, at the bottom of coastal lakes, estuaries and under sand dunes. They usually occur below 5 metres AHD and beneath the water table but occasionally have been found above the water table.

Acid sulfate soil classes and impact triggers

Acid sulfate soils have been classified based on the likelihood of the acid sulfate soils being present in particular areas and at certain depths. There are five classifications:

Class 1

Acid sulfate soils in a Class 1 area are likely to be found on and below the natural ground surface. Any works will trigger the requirement for assessment and may require management.

Class 2

Acid sulfate soils in a Class 2 area are likely to be found below the natural ground surface. Any works beneath the natural ground surface, or works which are likely to lower the water table, will trigger the requirement for assessment and may require management.

Class 3

Acid sulfate soils in a Class 3 area are likely to be found beyond 1 metre below the natural ground surface. Any works that extend beyond 1 metre below the natural ground surface, or works which are likely to lower water table beyond 1 metre below the natural ground surface, will trigger the requirement for assessment and may require management.

Class 4

Acid sulfate soils in a Class 4 area are likely to be found beyond 2 metres below the natural ground surface. Any works that extend beyond 2 metres below the natural ground surface, or works which are likely to lower the water table beyond 2 metres below the natural ground surface, will trigger the requirement for assessment and may require management.

Class 5

Acid sulfate soils are not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres on adjacent class 1,2,3 or 4 land. Works in a Class 5 area that are likely to lower the water table below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land will trigger the requirement for assessment and may require management.

Note: *Australian Height Datum, and 'work' is defined as any works that disturb more than one (1) tonne of soil, or lower the water table.*

Table 1.3 – Classification of Acid Sulfate Soils

Field pH of water	*Water analysis Cl^{1-}:SO_4^{2-} (by mass)*	*Field soils or water indicators*	*Typical soil reaction to 30% H_2O_2*	*Preliminary Assessment*
6-8	approx 7 but may be between 5-9	nil	nil reaction and no drop in pH	no sulfidic material present
		ASS indicators	mild to strong effervescence and drop in pH	sulfide present but probably has not been oxidised at any time
<5	approx 7 but may be between 5-9	nil	nil reaction and no drop in pH	no sulfidic material present and low pH can be attributed to other causes
		ASS indicators	mild effervescence and drop in pH	sulfide has probably not been oxidised at any time and low pH can be attributed to other causes
6-8	2 - 5	unclear indicators	mild effervescence and drop in pH	presence of sulfidic material is uncertain; must be verified by chemical analysis or visual observation of crystals
	<2	indicators of actual or potential ASS	mild to strong effervescence and drop in pH	presence of sulfidic material plus the presence of a buffering agent
< 5	2 - 5	unclear indicators	mild effervescence and drop in pH	presence of sulfidic material is uncertain; must be verified by chemical analysis or visual observation of crystals
< 5	<2	indicators of actual or potential ASS	mild to strong effervescence and drop in pH	presence of sulfidic material with little buffering agent

Source: Acid Sulfate Soils Manual

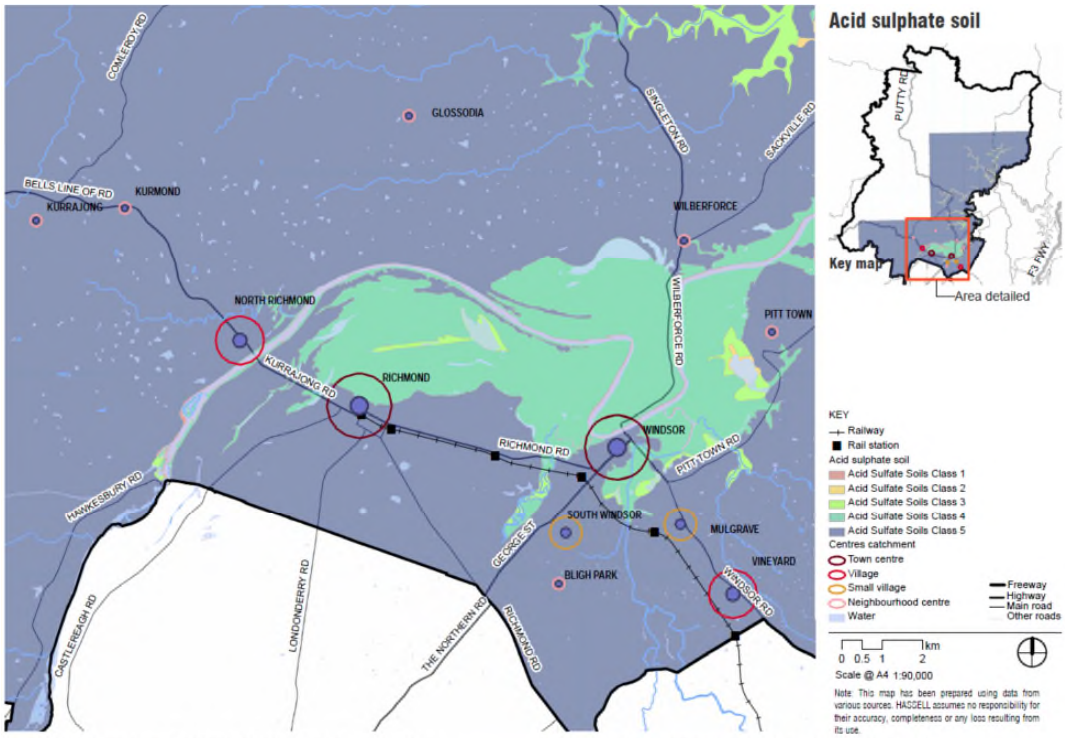

Figure 4.4: Hawkesbury Residential Strategy Acid Sulphate Soils (Source: Hawkesbury City Council GIS, October 2009)

Figure 1.2: Subject site Acid Sulfate Class Mapping (Class 5 for the Subject Site)

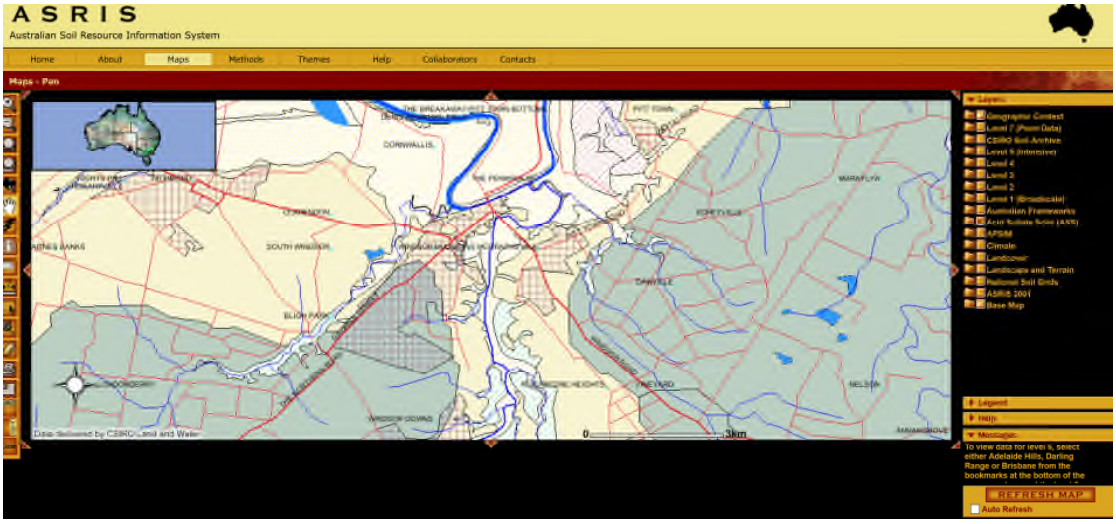

Figure 1.3: Subject site Acid Sulfate ASRIS Mapping

2. Methodology

2.1 Site Assessment

The site was assessed according to the broad guidelines provided in the *Site Investigations for Urban Salinity* guideline and the Acid Sulfate Soils Assessment Guidelines (1998).

The first step is an overview of the site and its conditions followed by soil sampling and analysis.

The site was assessed on foot to determine any obvious signs of potential salinity at ground level. After this soil sampling was undertaken at strategic judgemental locations to cover the development area and site.

2.2 Soil Assessment

The soil assessment was carried out using a vehicle mounted 100mm hydraulic auger and a hand-held 50mm motorized core sampler. A core sample was extracted from each sampling location and examined to catalogue its stratigraphic profile. Records were made on a borehole log in the field, with the following parameters recorded:

- Soil colour;
- Soil type (sandy loam, loamy clay etc.);
- Percentage of coarse fragments;
- Presence of water table;
- Local relief (decimal degrees); and
- Any evidence of shrink/swell reactivity.

A total of six samples were collected across the subject site. Sample locations are shown below in **Figure 2.1**. Samples were collected at a depth of 200mm.

Soils were analysed by Envirolab which is a NATA accredited laboratory.

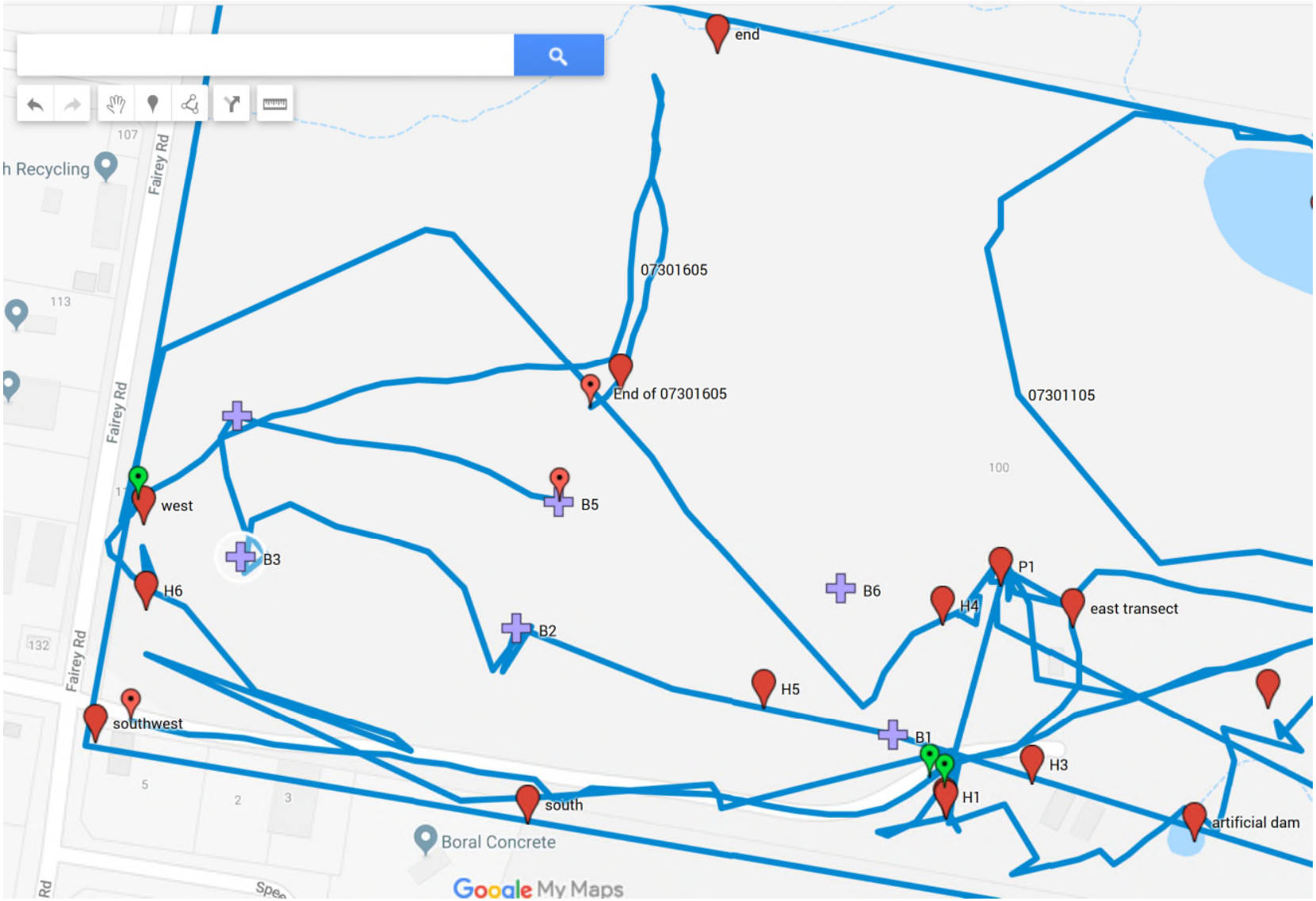

Figure 2.1: Soil sampling locations B1-B6 = Boreholes 1-6

3. Results

3.1 Site Assessment Results

The soils were broadly similar across the subject site, with shallow clay loams overlying clays followed by heavy clays. Sampling depth was to 80cm with all boreholes being similar.

3.2 Laboratory testing

Collected samples were analysed by Envirolab Sydney which is a NATA registered Laboratory. The results indicate that the soils are not saline and are well within the guidelines for acid sulfate potential.

4. Conclusion

This site assessment for salinity indicates that the site contains low salinity (within acceptable levels). Soil pH is typical of soils in this local area and the likelihood of aggressive corrosion to concrete and steel is low according to AS:2159:2009.

The results of both the field surveys, field soil structural and textural assessment and chemical analysis indicates that the soil is not saline and does not represent a significant salinity risk. The soil properties are also not likely to be aggressive in relation to concrete or steel. As such these factors are not a limitation to the proposed development.

The assessment for Acid Sulfate Soils indicates that the soils are within the acceptable parameters. As such the development does not place the environment as risk as a result of any reduction of acid sulfate material.

5. References

Ahern C R, Stone, Y, and Blunden B (1998). *Acid Sulfate Soils Assessment Guidelines* Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.

Bannerman, S.M., and Hazelton, P.A. (1990). Soil Landscapes of the Penrith 1:100 000 Sheet. Soil Conservation Service of NSW. Sydney.

McDonald, R.C Isbell, R.F., Speight, J.C., Walker, J and Hoplins, M.S. (1990). Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press Melbourne.

Site Investigations for Urban Salinity by the Department of Land and Water Conservation (2002)

6. Appendix 1: Disclaimer and Limitation of Liability

The use of this report is for the client only and is based on an assessment of the site at the point in time of assessment. The material in this report reflects the judgement of Anderson Environmental Pty Ltd in light of background information and site conditions at the time of assessment and we take no responsibility for any database inaccuracies or other inaccuracies in background and or other information. The report is not to be reproduced or released to any other party, in whole or in part, without the express written consent of Anderson Environmental Pty Ltd. This report is Copyright protected and is not to be reproduced in part or whole or used by a third party without the express written permission of Anderson Environmental Pty Ltd. If you are not the client who commissioned this report or a local government authority for which approval is being sought as part of the formal DA process and are in possession of this report you are in breach of the law and we reserve the right to recover damages from any individuals, companies or other parties as a result of such breaches. Any use, which a third party makes of this report, or any reliance or discussions based on it, is the responsibility of such Third Parties and as outlined above is in breach of the law. Anderson Environmental and its staff accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions taken based on this report and reserves the right to recover damages from the third party from breaches as outlined above.

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7. Appendix 2: Soil Analysis Results

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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 197314

Client Details	
Client	Anderson Environmental Pty Ltd
Attention	Jason Anderson
Address	PO Box 7451, Baulkham Hills, NSW, 2153

Sample Details	
Your Reference	**2289**
Number of Samples	6 Soil
Date samples received	30/07/2018
Date completed instructions received	30/07/2018

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	07/08/2018
Date of Issue	06/08/2018
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***	

Results Approved By
Nick Sarlamis, Inorganics Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By
Jacinta Hurst, Laboratory Manager

Envirolab Reference: 197314
Revision No: R00

8.

Misc Inorg - Soil						
Our Reference		197314-1	197314-2	197314-3	197314-4	197314-5
Your Reference	UNITS	S1	S2	S3	S4	S5
Depth		20cm	20cm	15cm	20cm	20cm
Date Sampled		30/07/2018	30/07/2018	30/07/2018	30/07/2018	30/07/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/08/2018	01/08/2018	01/08/2018	01/08/2018	01/08/2018
Date analysed	-	01/08/2018	01/08/2018	01/08/2018	01/08/2018	01/08/2018
pH 1:5 soil:water	pH Units	5.8	6.2	7.9	6.4	5.7
Electrical Conductivity 1:5 soil:water	µS/cm	48	35	78	29	110
Estimated Salinity*	mg/kg	160	120	260	99	370

Misc Inorg - Soil		
Our Reference		197314-6
Your Reference	UNITS	S6
Depth		20cm
Date Sampled		30/07/2018
Type of sample		Soil
Date prepared	-	01/08/2018
Date analysed	-	01/08/2018
pH 1:5 soil:water	pH Units	5.8
Electrical Conductivity 1:5 soil:water	µS/cm	73
Estimated Salinity*	mg/kg	250

sPOCAS + %S w/w						
Our Reference		197314-1	197314-2	197314-3	197314-4	197314-5
Your Reference	UNITS	S1	S2	S3	S4	S5
Depth		20cm	20cm	15cm	20cm	20cm
Date Sampled		30/07/2018	30/07/2018	30/07/2018	30/07/2018	30/07/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/08/2018	01/08/2018	01/08/2018	01/08/2018	01/08/2018
Date analysed	-	01/08/2018	01/08/2018	01/08/2018	01/08/2018	01/08/2018
pH $_{kcl}$	pH units	4.6	4.7	5.6	5.0	4.3
TAA pH 6.5	moles H$^+$ /t	16	16	<5	9	26
s-TAA pH 6.5	%w/w S	0.03	0.03	<0.01	0.01	0.04
pH $_{Ox}$	pH units	3.7	4.1	3.7	3.3	4.0
TPA pH 6.5	moles H$^+$ /t	<5	15	<5	<5	52
s-TPA pH 6.5	%w/w S	<0.01	0.02	<0.01	<0.01	0.08
TSA pH 6.5	moles H$^+$ /t	<5	<5	<5	<5	26
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	0.04
ANC$_E$	% $CaCO_3$	<0.05	<0.05	<0.05	<0.05	<0.05
a-ANC$_E$	moles H$^+$ /t	<5	<5	<5	<5	<5
s-ANC$_E$	%w/w S	<0.05	<0.05	<0.05	<0.05	<0.05
S$_{KCl}$	%w/w S	<0.005	<0.005	0.005	<0.005	0.006
S$_P$	%w/w	0.02	0.01	0.02	0.01	0.01
S$_{POS}$	%w/w	0.02	0.009	0.01	0.009	0.006
a-S$_{POS}$	moles H$^+$ /t	9	5	9	6	<5
Ca$_{KCl}$	%w/w	0.04	0.05	0.08	0.05	0.02
Ca$_P$	%w/w	0.04	0.06	0.08	0.05	0.02
Ca$_A$	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
Mg$_{KCl}$	%w/w	0.021	0.019	0.045	0.017	0.039
Mg$_P$	%w/w	0.023	0.029	0.055	0.024	0.050
Mg$_A$	%w/w	<0.005	0.010	0.010	0.008	0.011
S$_{HCl}$	%w/w S	<0.005	<0.005	<0.005	<0.005	0.012
S$_{NAS}$	%w/w S	<0.005	<0.005	<0.005	<0.005	0.006
a-S$_{NAS}$	moles H$^+$ /t	<5	<5	<5	<5	<5
s-S$_{NAS}$	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H$^+$ /t	25	22	10	15	33
s-Net Acidity	%w/w S	0.04	0.04	0.02	0.02	0.05
Liming rate	kg $CaCO_3$ /t	1.9	1.6	0.75	1.1	2.5
s-Net Acidity without -ANCE	%w/w S	0.041	0.035	0.016	0.023	0.053
a-Net Acidity without ANCE	moles H$^+$ /t	25	22	10	15	33
Liming rate without ANCE	kg $CaCO_3$ /t	1.9	1.6	0.75	1.1	2.5

sPOCAS + %S w/w		
Our Reference		197314-6
Your Reference	UNITS	S6
Depth		20cm
Date Sampled		30/07/2018
Type of sample		Soil
Date prepared	-	01/08/2018
Date analysed	-	01/08/2018
pH $_{kcl}$	pH units	4.9
TAA pH 6.5	moles H$^+$ /t	6
s-TAA pH 6.5	%w/w S	0.01
pH $_{Ox}$	pH units	3.5
TPA pH 6.5	moles H$^+$ /t	<5
s-TPA pH 6.5	%w/w S	<0.01
TSA pH 6.5	moles H$^+$ /t	<5
s-TSA pH 6.5	%w/w S	<0.01
ANC_E	% $CaCO_3$	<0.05
a-ANC_E	moles H$^+$ /t	<5
s-ANC_E	%w/w S	<0.05
S_{KCl}	%w/w S	<0.005
S_P	%w/w	0.01
S_{POS}	%w/w	0.009
a-S_{POS}	moles H$^+$ /t	6
Ca_{KCl}	%w/w	0.06
Ca_P	%w/w	0.07
Ca_A	%w/w	0.005
Mg_{KCl}	%w/w	0.020
Mg_P	%w/w	0.029
Mg_A	%w/w	0.008
S_{HCl}	%w/w S	<0.005
S_{NAS}	%w/w S	<0.005
a-S_{NAS}	moles H$^+$ /t	<5
s-S_{NAS}	%w/w S	<0.01
Fineness Factor	-	1.5
a-Net Acidity	moles H$^+$ /t	12
s-Net Acidity	%w/w S	0.02
Liming rate	kg $CaCO_3$ /t	0.90
s-Net Acidity without -ANCE	%w/w S	0.019
a-Net Acidity without ANCE	moles H$^+$ /t	12
Liming rate without ANCE	kg $CaCO_3$ /t	0.90

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-034	Soil samples are extracted and measured using a conductivity cell and dedicated meter.
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			01/08/2018	1	01/08/2018	01/08/2018		01/08/2018	[NT]
Date analysed	-			01/08/2018	1	01/08/2018	01/08/2018		01/08/2018	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	5.8	5.8	0	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	48	48	0	103	[NT]
Estimated Salinity*	mg/kg	5	Inorg-034	<5	1	160	160	0	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			01/08/2018	1	01/08/2018	01/08/2018		01/08/2018	[NT]
Date analysed	-			01/08/2018	1	01/08/2018	01/08/2018		01/08/2018	[NT]
pH $_{kcl}$	pH units		Inorg-064	[NT]	1	4.6	4.6	0	91	[NT]
TAA pH 6.5	moles H$^+$/t	5	Inorg-064	<5	1	16	16	0	95	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	1	0.03	0.03	0	[NT]	[NT]
pH $_{Ox}$	pH units		Inorg-064	[NT]	1	3.7	4.0	8	95	[NT]
TPA pH 6.5	moles H$^+$/t	5	Inorg-064	<5	1	<5	<5	0	101	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
TSA pH 6.5	moles H$^+$/t	5	Inorg-064	<5	1	<5	<5	0	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
ANC$_E$	% $CaCO_3$	0.05	Inorg-064	<0.05	1	<0.05	<0.05	0	[NT]	[NT]
a-ANC$_E$	moles H$^+$/t	5	Inorg-064	<5	1	<5	<5	0	[NT]	[NT]
s-ANC$_E$	%w/w S	0.05	Inorg-064	<0.05	1	<0.05	<0.05	0	[NT]	[NT]
S$_{KCl}$	%w/w S	0.005	Inorg-064	<0.005	1	<0.005	0.005	0	[NT]	[NT]
S$_P$	%w/w	0.005	Inorg-064	<0.005	1	0.02	0.02	0	[NT]	[NT]
S$_{POS}$	%w/w	0.005	Inorg-064	<0.005	1	0.02	0.01	67	[NT]	[NT]
a-S$_{POS}$	moles H$^+$/t	5	Inorg-064	<5	1	9	9	0	[NT]	[NT]
Ca$_{KCl}$	%w/w	0.005	Inorg-064	<0.005	1	0.04	0.04	0	[NT]	[NT]
Ca$_P$	%w/w	0.005	Inorg-064	<0.005	1	0.04	0.04	0	[NT]	[NT]
Ca$_A$	%w/w	0.005	Inorg-064	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
Mg$_{KCl}$	%w/w	0.005	Inorg-064	<0.005	1	0.021	0.021	0	[NT]	[NT]
Mg$_P$	%w/w	0.005	Inorg-064	<0.005	1	0.023	0.027	16	[NT]	[NT]
Mg$_A$	%w/w	0.005	Inorg-064	<0.005	1	<0.005	0.006	18	[NT]	[NT]
S$_{HCl}$	%w/w S	0.005	Inorg-064	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
S$_{NAS}$	%w/w S	0.005	Inorg-064	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-S$_{NAS}$	moles H$^+$/t	5	Inorg-064	<5	1	<5	<5	0	[NT]	[NT]
s-S$_{NAS}$	%w/w S	0.01	Inorg-064	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	<1.5	1	1.5	1.5	0	[NT]	[NT]
a-Net Acidity	moles H$^+$/t	5	Inorg-064	<5	1	25	25	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	<0.01	1	0.04	0.04	0	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	1	1.9	1.9	0	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	<0.01	1	0.041	0.040	2	[NT]	[NT]
a-Net Acidity without ANCE	moles H$^+$/t	5	Inorg-064	<5	1	25	25	0	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	1	1.9	1.9	0	[NT]	[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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-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.