Bayview Golf Club

Acid Sulfate Soil Assessment: Stormwater Harvesting and Irrigation Works
Bayview Golf Course, Cabbage Tree Road, Bayview, NSW

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P2108485JR02V01
October 2021

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to complete an Acid Sulfate Soil Assessment in accordance with the scope of services set out in the contract/quotation between Martens & Associates Pty Ltd and Bayview Golf Club (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources including site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc*. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

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Document and Distribution Status

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Revision No.	**Status**	**Release Date**	**Document Location**					
			File Copy	Bayview Golf Club				
1	Draft	08.10.2021	1E, 1P	1P				
1	Final	17.10.2021	1E, 1P	1P				

Distribution Types: F = Fax, H = Hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

Contents

1 Introduction

1.1 Overview and Scope of Work

This report, prepared by Martens and Associates (MA), on behalf of Bayview Golf Club, documents the findings of an acid sulfate soil (ASS) assessment undertaken for proposed stormwater harvesting and irrigation works at Bayview Golf Course, Cabbage Tree Road, Bayview, NSW (the site). The investigation area is shown on Figure 1, Attachment A.

The objectives of the ASS assessment were:

- Preliminary ASS assessment of the site (desktop assessment).
- Field investigations and targeted laboratory testing of soils.
- Determine if an ASS management plan (ASSMP) is required.

1.2 Previous Assessment

In 2017, MA completed an ASS assessment for the site to inform a proposed site development including earthworks (for flood mitigation measures). Laboratory results from this assessment (MA, 2017) have been replicated and considered as part of this current ASS assessment.

1.3 Proposed Development

From the master plan set (Chrisp Consulting (CC), 2021a) and (CC, 2021b) provided by the client, we understand that the proposed development is to collect, divert, store, filter and distribute water into the golf course landscape and will require the installation of service trenching for power, drainage and pressured pipework, which will connect into existing in-ground services and storage ponds. The development primarily includes the following structures:

- Subsoil drainage lines (excavation up to approximately between 0.6 – 1.0 mbgl) connecting to sump pits (requiring excavation up to approximately 1.0 meters below ground level (mBGL)), in all Zones.
- 80 mm irrigation pressure pipe, power and communications conduits (excavation up to approximately 0.6 mbgl), and power control cabinet, in Zone 1.

- Underground 10,500 litre pump tank (excavation up to approximately 3.0 mbgl) and pump pit no.2. (excavation up to approximately 1.5 mbgl), in Zone 1.

- Pump station, with excavation depth of approximately 1.5 – 2.0 mbgl, in Zones 8 and 9.

The most recent proposed development plans are provided in Attachment B.

1.4 Guidelines

This investigation was undertaken in general accordance with the following guidelines:

- Acid Sulfate Soil Management Advisory Committee (1998), *Acid Sulfate Soil Manual*. Referred to as ASSMAC (1998)

- Qld Natural Resources, Mines and Energy (2004) Acid Sulfate Soils Laboratory Methods Guidelines.

2 Site Description

Site details are summarised in Table 1.

Table 1: General site information.

Item	Description / Detail
Site address	Bayview Golf Club 1825 Pittwater Rd, Mona Vale NSW 2103
Legal Identifier	Lot 1 DP 662920 Lot 1 DP 19161 Lot 5 DP 45114 Lot 191 DP 1039481 Lot A DP 339874 Lot 150 DP 1003518 Lot 191 DP 1039481 Lots 1, 2 and 3 DP 986894 Lot 300 DP 1139238
Approximate Area	15.92 Ha (Six Maps, 2021)
Local Government Area	Northern Beaches Council (formerly Pittwater Council).
Site description	The site is developed and vegetated for golf course purposes. Cabbage Tree Road bounds the site to the north, Parkland Road borders the site to the west.
Topography	The NSW Office of Environment and Heritage's (OEH) information system indicates the site topography to comprise as follows: North, north east and north east portion o Terrain disturbed by human activity, with local relief < 2 m. o Disturbed ground landscaped to include berms, cut faces, embankments, mounds, pits and trenches. Slopes levelled to < 3 %. Eastern portion o Flooded valleys infilled with alluvium and surrounded by steep to precipitous Hawkesbury sandstone slopes. o Gently undulating alluvial floodplain with slopes < 3 %. Elevation is < 10 m. South east portion o Gently undulating plains and rolling undulating rises of broad, level to very gently inclined, swales and dunes. o Elevation and local relief is usually < 20 m. o Isolated steep rises with slopes up to 35 % are present. There are depressions and swamps at northern and eastern portion of the site where water gets collected during the rainfall events. The Cahill creek inside the site runs from northern to eastern portion of the site.
Typical slopes, elevation	Slopes are generally low (<2%) and elevation generally ranges from approximately 1 to 2 mAHD.
Expected geology and soils	The published geological map covering this area indicates that the most of the site is underlain by Quaternary deposits (silty to peaty quartz sand, silt, and clay. Ferruginous and humic cementation in places. Common shell layers (*Sydney 1:100 000 Geological Sheet 9130,* 1st edition). The Sydney 1:100,000 Soil Landscape Map 9130 (Soil Conservation Service of NSW) indicates the majority of the site as being part of the Erina erosional landscape, consisting of undulating to rolling rises and low hills. Soils are moderately deep to deep. The eastern corner of the site is mapped as being part of the Deep Creek fluvial landscape, consisting of level to gently undulating alluvial floodplains draining the Hawkesbury Sandstone local relief.

Drainage	The site generally drains somewhat centrally to an inlet which ultimately connects to Winnererremy Bay, Pittwater, located approximately 260 m north east of the site.
Vegetation	Predominantly grass on fairways, edges of fairways have trees (typically Casuarinas and Melaleucas). Mangroves on perimeter of some areas of the inlet which connects to Winnererremy Bay.

3 Preliminary Assessment

3.1 Acid sulfate soil risk map classification

The Pittwater Council ASS risk map classifies the northwest portion of the site as typically Class 5 land, with a band of class 2 in the southeast corner. We note that this area is outside of the proposed development footprint.

The majority of the main golf course and proposed development footprint is classified as Class 2 land, with a band of Class 3 land in the southern-most portion of the site.

Site location relating to ASS risk is presented in Figure 2 Attachment A.

3.2 Geomorphic Setting

The likelihood of ASS occurrence at a site is a function of various geomorphic parameters, in particular those listed in ASSMAC (1998). Each is an indicator that ASS are likely to be present onsite.

Table 2: Geomorphic features indicative of acid sulfate soils.

	Present on site?
Geomorphic Feature	**Area of proposed development footprint**
Holocene sediments	Yes
Soil horizons less than 5 m AHD	Yes
Marine / estuarine sediments or tidal lakes	Yes
Coastal wetland; backwater swamps; waterlogged or scaled areas; inter-dune swales or coastal sand dunes (i.e. deep excavation is required)	Yes
Dominant vegetation is mangroves, reeds, rushes and other swamp or marine tolerant species.	Not currently. Remanent mangroves and acid tolerant species (Casuarinas and Melaleucas).[1]
Geologies containing sulfide bearing material / coal deposits or former marine shales/sediments	Possible[2]
Deep older (Holocene or Pleistocene) estuarine sediments > 10 mBGL (if deep excavation or drainage is proposed)	No

Notes:

[1] May have been present prior to golf course development.

[2] Possibly in fill materials.

3.3 Preliminary Conclusion

As the site is mapped as Class 2 and some of the geomorphic features listed are either present or may formerly have been on-site, indicating that the geomorphic site setting is indicative of potential ASS (PASS) or ASS, an intrusive investigation, with laboratory testing of soils, is required.

4 ASS Assessment Criteria

4.1 Field Screening

Initial screening is undertaken using the field pH (pH_F) and oxidised pH (pH_{Fox}), which were assessed against the ASSMAC (1998) criteria:

- Soils with a $pH_F \leq 4.0$ are indicative of Actual ASS (AASS).
- Soils where $pH_F - pH_{Fox} > 1$ are indicative of potential ASS (PASS).
- Soils with $pH_{Fox} < 3.5$ are indicative of PASS.

In the absence of pH_F, pH_{KCl} has been substituted, which may overestimate the acidity of the soil.

4.2 Action Criteria

Based on the field screening, samples were selected for peroxide oxidation combined acidity and sulfate (sPOCAS) analysis and assessed using Table 4.4 of ASSMAC (1998). The proposed development excavation works have been assessed as generating more than 1000 tonnes of disturbed soil and therefore the analytical results are assessed against the following criteria:

- Sulfur Trail - Oxidisable sulfur (S_{POS}) is > 0.03%; or
- Acid Trail - TPA or TSA is >18 mol H^+/tonne.

If this criteria is exceeded, a detailed management plan and development consent is required.

5 Field Investigations

Three site investigations were undertaken for the assessment, with works detailed below:

- 10 – 11 and 20 - 21 October, 2017 (Completed previously as part of MA 2017 ASS assessment) – Included excavation of 42 boreholes (BH401 to BH442) to a maximum of 15.0 mBGL, and collection of soil samples for laboratory testing.
- 10 September, 2021 – Included excavation of 3 boreholes (BH501 to BH503) to a maximum of 4.0 mBGL, and collection of soil samples for laboratory testing.

Soil sampling depth was completed in general accordance with guidance outlined in the ASSMAC (1998) guidelines which state the minimum sampling depth should be at least one metre below the maximum depth of propped excavation or soil disturbance works. Based on our understanding of the proposed development (outlined in Section 1.3), excavation works are expected to extend to up to a maximum depth of 3.0 mBGL.

Site testing locations are shown in Attachment A.

5.1 Sub-Surface Conditions

Intrusive investigations generally encountered fill and alluvial soils comprising silt, sandy silt, clayey silt, sand, silty sand and clayey sand to investigation depths of 5.2 mBGL. Residual soil (clay and sandy clay) was encountered beneath overlying fill and alluvium to a maximum depth of 5.8 mBGL.

Borehole logs are provided in Attachment C.

5.2 Groundwater

Saturated soils were encountered in the southeast portion of the site below depths ranging from 0.35 – 1.7 mBGL. Based on saturated soil depths and the existing 0.25 m contour site plan, a permanent water table is expected beneath the main golf course at a level of the order of 0.1 to 0.5 mAHD.

6 Laboratory Analysis

6.1 Soil Sampling Regime

Initial laboratory analysis of samples taken from BH401 – BH442 included a total of 98 samples submitted to a laboratory for field test analysis (i.e. pH_F and pH_{Fox}) for screening purposes.

Field test results were reviewed and analysed in relation to change in pH; reaction rates; testing locations in consideration of main earthworks excavations; groundwater depth; sample depths and material type.

14 of the 98 samples were selected for laboratory analysis for sPOCAS as per field screening results.

Additional laboratory analysis of samples taken form BH501 – BH503 included 9 soil samples for sPOCAS and one water sample taken from BH501 using a disposable bailer which was submitted for laboratory pH testing

6.2 Soil Analytical Results

sPOCAS laboratory results are summarised in Table 3, with laboratory analytical documentation provided in Attachment D.

Table 3: ASS Analytical Results

Borehole number	Sample Level (mAHD)	Material	pH_F	pH_{Fox}	ΔpH	TPA[1]	TSA[2]	S_{POS}[3]
Criteria			**≤4.0**	**<3.5 or**	**>1 pH unit change**	**>18**	**>18**	**>0.03**
BH403	-0.05	Sand with clay	9.1	8.4	0.7	<5	<5	**0.20**
BH406	1.20	Silt	4.6	4.0	0.6	**370**	**300**	**0.11**
BH407	0.10	Sand	7.1	**2.6**	**4.5**	**52**	**52**	**0.13**
BH412	0.20	Sand	4.8	**2.9**	**1.9**	**140**	**130**	**0.07**
BH413	-0.90	Sand, trace clay	9.4	**2.9**	**6.5**	**65**	**65**	**0.49**
BH423	-0.20	Sand	5.1	**2.1**	**3.0**	**1,100**	**1,100**	**1.8**
BH426	0.10	Sand	5.2	**3.9**	**1.3**	8	<5	<0.01
BH430	-0.15	Sand	5.1	**2.2**	**2.9**	**420**	**410**	**0.68**
BH432	0.95	Sand	5.0	3.6	**1.4**	9	<5	0.03
	-0.15	Sand, trace clay	4.5	**2.0**	**2.5**	**1,500**	**1,500**	**2.3**
BH433	-0.20	Clayey sand	4.6	**2.1**	**2.5**	**1,000**	**1,000**	**1.6**
BH434	0.80	Clay with sand	8.3	5.4	**2.9**	<5	<5	**0.35**
	-0.40	Sand	9.0	8.2	0.8	<5	<5	**0.91**
BH440	0.25	Sand	7.8	**2.8**	**5.0**	**61**	**61**	**0.14**
BH501	1.0	Silty sand	-	-	-	<5	<5	**0.61**
	0	Silty sand	-	-	-	<5	<5	**0.66**
	-1.0	Silty sand	-	-	-	<5	<5	**0.58**
BH502	0	Silty sand	-	-	-	<5	<5	**0.48**
	-0.5	Silty sand	-	-	-	<5	<5	**0.53**
	-1.0	Silty sand	-	-	-	<5	<5	**0.45**
BH503	2.0	Silty sand	-	-	-	<5	<5	**0.75**
	1.5	Silty sand	-	-	-	<5	<5	**0.50**
	1.0	Silty sand	-	-	-	<5	<5	**0.25**

Notes:

1 Titratable Peroxide Acidity (Moles H+/tonne); 2 Titratable Sulfidic Acidity (Moles H+/tonne); 3 Oxidisable sulfur (%); Highlighted/bold values exceed ASSMAC action criteria.

6.3 Water Analytical Results

Laboratory analysis of the water sample taken from BH501 had a pH of 7.2. MA (2017) investigation also included analysis of three groundwater samples (collected using similar methodology) which resulted in similar laboratory pH values of 7.2 – 7.3.

These results are considered to represent near values and not indicative of ASS which would expect pH values of <5.5.

6.4 Discussion and Conclusion

In light of the results of this assessment we make the following conclusions and recommendations:

- Laboratory results indicate that all 23 samples tested (which include samples from MA 2017 investigation) are PASS and 22 of the 23 samples have TPA, TSA or S_{pos} above the ASSMAC (1998) action criteria.
- Laboratory results indicated that little to no acid neutralising capacity remained in the soil profile.
- Suggested liming rates (as outlined in the laboratory documentation) are highly variable ranging from 0.75 to 110 kg / tonne of disturbed soil.
- Tested groundwater has a near neutral pH which suggests actual ASS is not present at groundwater test location. A neutral pH is however typical for PASS.

A management plan (ASSMP) is required to address risks associated with PASS and potential acid generation during site works. The works will fall under a very high treatment category as per Table 4.5 in ASMAC (1998).

Due to the variability of the site, proposed works and excavation depths, and the variability of laboratory testing results, the ASSMP will be divided into distinct 'work areas'. Specific controls and liming rates will be nominated for each work area.

Provided the ASSMP is implemented, acidic soil conditions should not restrict the proposed development.

7 Limitations

The recommendations presented in this report include specific issues to be addressed during the design and construction phases of the project. In the event that any of the recommendations presented in this report are not implemented, the general recommendations may become inapplicable and Martens & Associates Pty Ltd accept no responsibility whatsoever for the performance of the works undertaken where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, sub-surface conditions between and below the completed boreholes or other tests may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact Martens & Associates Pty Ltd.

8 References

Acid Sulfate Soil Management Advisory Committee (1998) *Acid Sulfate Soil Manual*.

Chrisp Consulting (2021), Stormwater harvesting and Irrigation, Bayview Golf Club, Job No. 20056, drawing No. C100, C110 to C124, C130, C140, Revision F, dated 17 March 2021 (CC, 2021a).

Chrisp Consulting (2021), Stormwater harvesting and Irrigation, Bayview Golf Club, titled Pump Station and General Works Details, Job No. 20056, drawing No. C200, Revision B, dated 23 February 2021 (CC, 2021b).

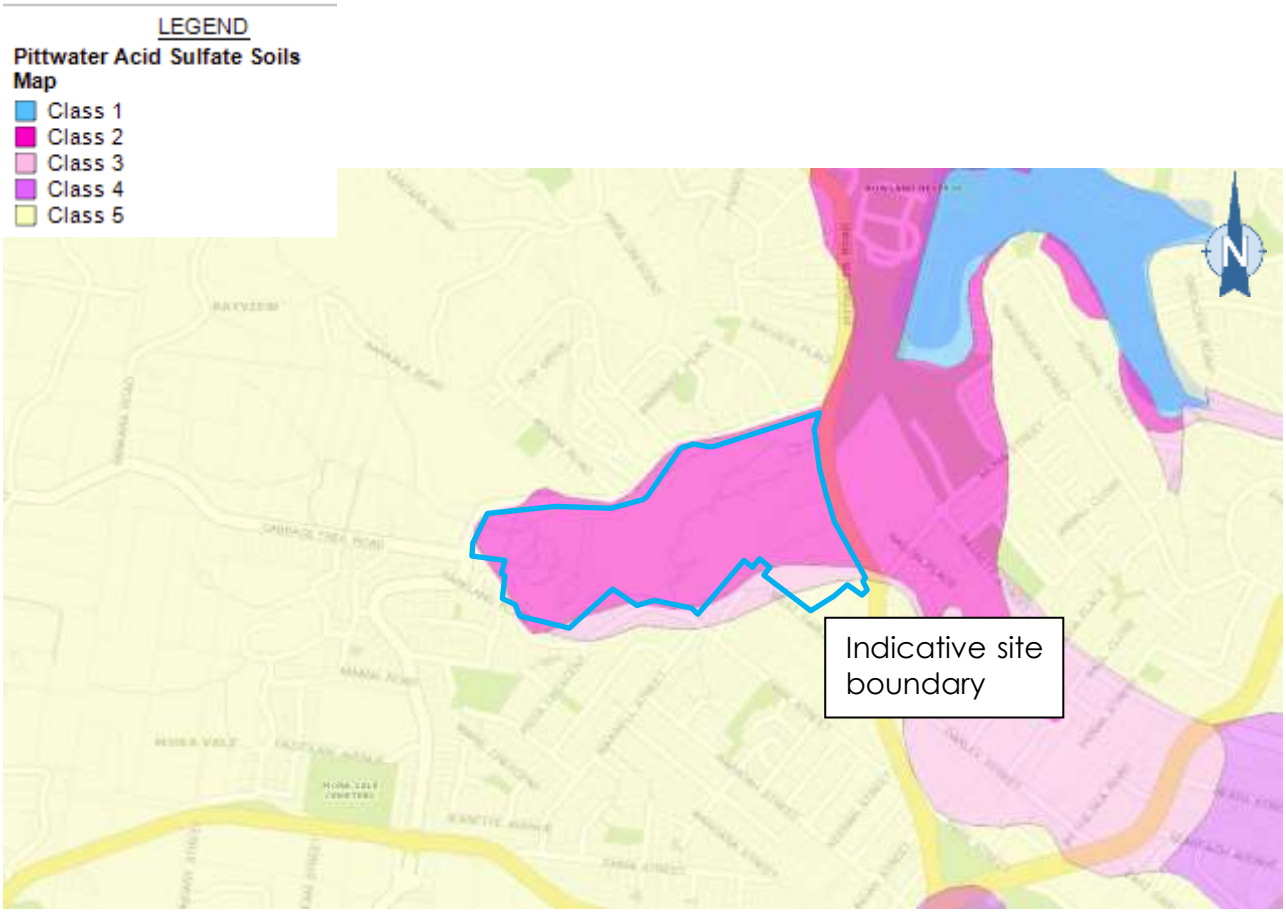
Martens and Associates (2017), *Acid Sulfate Soil Assessment: Proposed Flood Mitigation Earthworks, Bayview Golf Course, Cabbage Tree Road, Bayview, NSW, Report reference no.* P1706099JR04V01, dated 29 November 2017 (MA, 2017).

Northern Beaches Council (2015) *Development Control Plan, Amendment 19.*

NSW Department of Mineral Resources (1983), *Sydney 1:100,000 Geological Sheet 9130.*

Qld Natural Resources, Mines and Energy (2004) *Acid Sulfate Soils Laboratory Methods Guidelines*.

9 Attachment A – Site Plans



Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	WX	**Pittwater Council – Acid Sulfate Soils Map**	Drawing No: **FIGURE 2**
Approved:	BM		
Date:	22.09.2021		
Scale:	Not to Scale		File No: P2108485JR01V01

NOTE:
- APPROXIMATE WORKS AREAS DERIVED FROM ZONE MAP AREAS & GENERAL WORKS (SHEET C110) OF PLANSET PROVIDED BY CHRISP CONSULTING (REVISION F DATED 17/03/2021 FOR DEVELOPMENT APPLICATION).

KEY

- BORE HOLE
- EXCAVATION > 1.0m
- APPROXIMATE INVESTIGATION AREA AND APPROXIMATE WORKS AREA
- WORK ZONES 1-10

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	29/09/20201	RK	WX	GT	GT

SCALE
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A1 (A3) 1:2,000 (1:4,000)

GRID	DATUM	PROJECT MANAGER
GDA 94	mAHD	GT

CLIENT
BAYVIEW GOLF CLUB

PROJECT NAME/PLANSET TITLE
STORMWATER HARVESTING & IRRIGATION
ACID SULFATE SOILS ASSESSMENT
CABBAGE TREE ROAD, BAYVIEW, NSW

martens & Associates Pty Ltd
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DRAWING TITLE
TESTING LOCATION PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2108485	PS01	R01	PS01-J100	A

DRAWING ID: P2108485-PS01-R01-J100

PRINTED: 29.09.2021 - USER: RIKKI.HURDOZHA
A1 / A3 LANDSCAPE (A1LC_v02.0.01)

10 Attachment B – Proposed Plans

STORMWATER HARVESTING AND IRRIGATION
BAYVIEW GOLF CLUB
CIVIL WORKS

DRAWING LIST	
DRAWING No.	DRAWING TITLE
C100	TITLE PAGE & LOCALITY PLAN
C110	ZONE MAP AREAS & GENERAL WORKS
C111	ZONE 1 DETAIL PLAN
C112	ZONE 2 DETAIL PLAN
C113	ZONE 3 DETAIL PLAN
C114	ZONE 4 DETAIL PLAN
C115	ZONE 5 DETAIL PLAN
C116	ZONE 6 DETAIL PLAN
C117	ZONE 7 DETAIL PLAN
C118	ZONE 8 DETAIL PLAN - SHEET 1 OF 2
C119	ZONE 8 DETAIL PLAN - SHEET 2 OF 2
C120	ZONE 9 DETAIL PLAN - SHEET 1 OF 3
C121	ZONE 9 DETAIL PLAN - SHEET 2 OF 3
C122	ZONE 9 DETAIL PLAN - SHEET 3 OF 3
C123	ZONE 10 DETAIL PLAN - SHEET 1 OF 2
C124	ZONE 10 DETAIL PLAN - SHEET 2 OF 2
C130	TYPICAL SEDIMENT & EROSION CONTROL PLAN & DETAILS
C140	COUNCIL STORMWATER ASSET PLAN
C200	PUMP STATION AND GENERAL WORKS DETAILS

LOCALITY PLAN
NTS

DIAL BEFORE YOU DIG

DIAL BEFORE YOU DIG www.1100.com.au

IMPORTANT: THE CONTRACTOR IS TO MAINTAIN A CURRENT SET OF "DIAL BEFORE YOU DIG" DRAWINGS ON SITE AT ALL TIMES.

ISSUE FOR DEVELOPMENT APPLICATION

REV	DATE	REVISION DESCRIPTION
A	13.10.2020	ISSUE FOR REVIEW AND COMMENT
B	15.10.2020	ISSUE FOR PRE-DA COMMENTS
C	12.01.2021	ISSUE FOR REVIEW AND COMMENT
D	23.02.2021	ISSUE FOR REVIEW
E	09.03.2021	DRAWING C140 ADDED
F	17.03.2021	ISSUED FOR DEVELOPMENT APPLICATION

TITLE	NAME
DRAWN	DI
DESIGNED	CP
DRG CHECK	CP
DESIGN CHECK	AL
APPROVED	CP

BAYVIEW GOLF CLUB

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A.B.N. 11 164 806 044

STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

TITLE PAGE & LOCALITY PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
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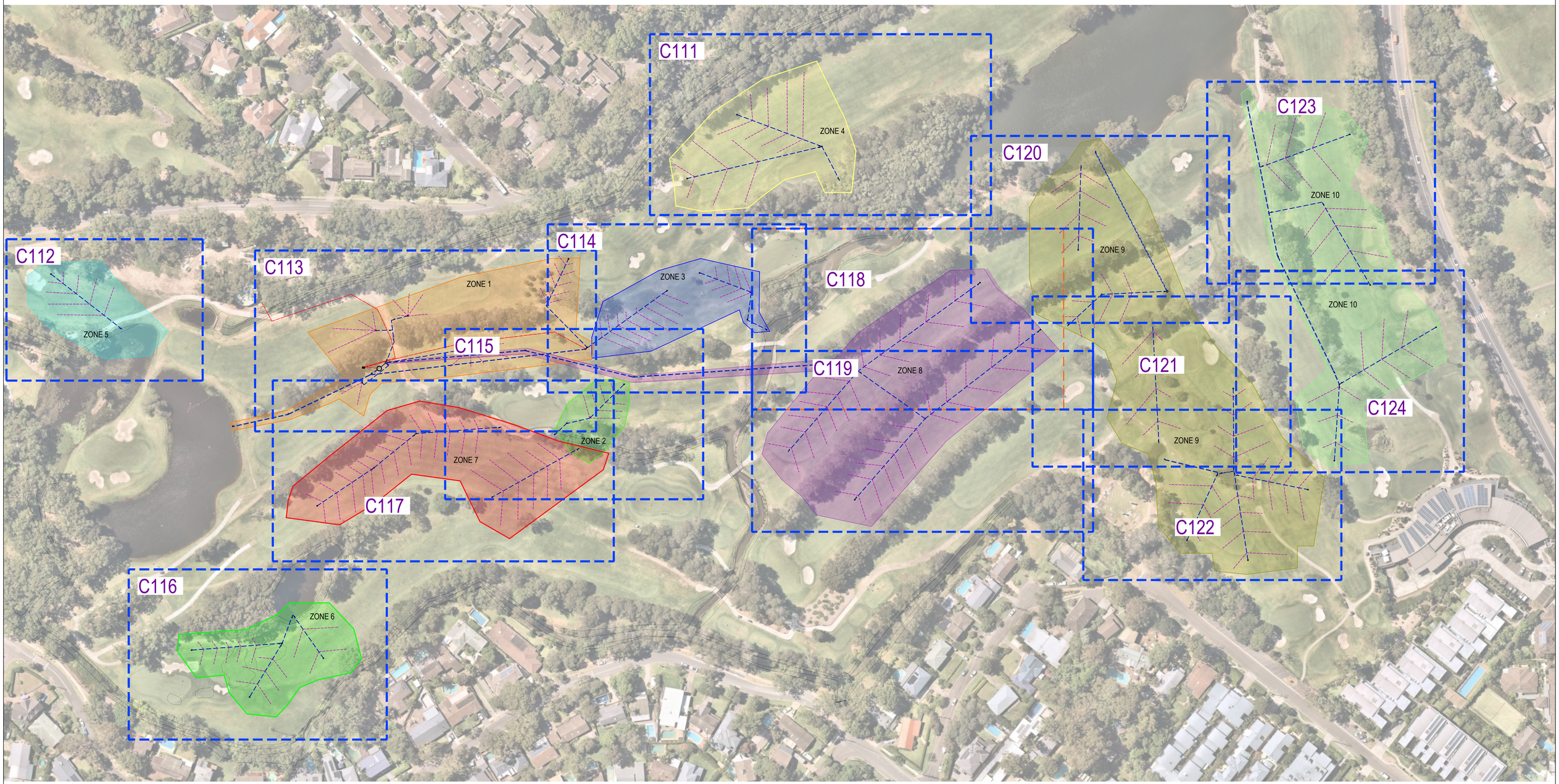

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E	09.03.2021	UPDATED AERIAL
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TITLE	NAME
DRAWN	DI
DESIGNED	CP
DRG CHECK	CP
DESIGN CHECK	AL
APPROVED	CP

BAYVIEW GOLF CLUB

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STORMWATER HARVESTING AND IRRIGATION

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ZONE MAP AREAS & GENERAL WORKS

JOB NUMBER:	SCALE @ A1	SHEET No	REV
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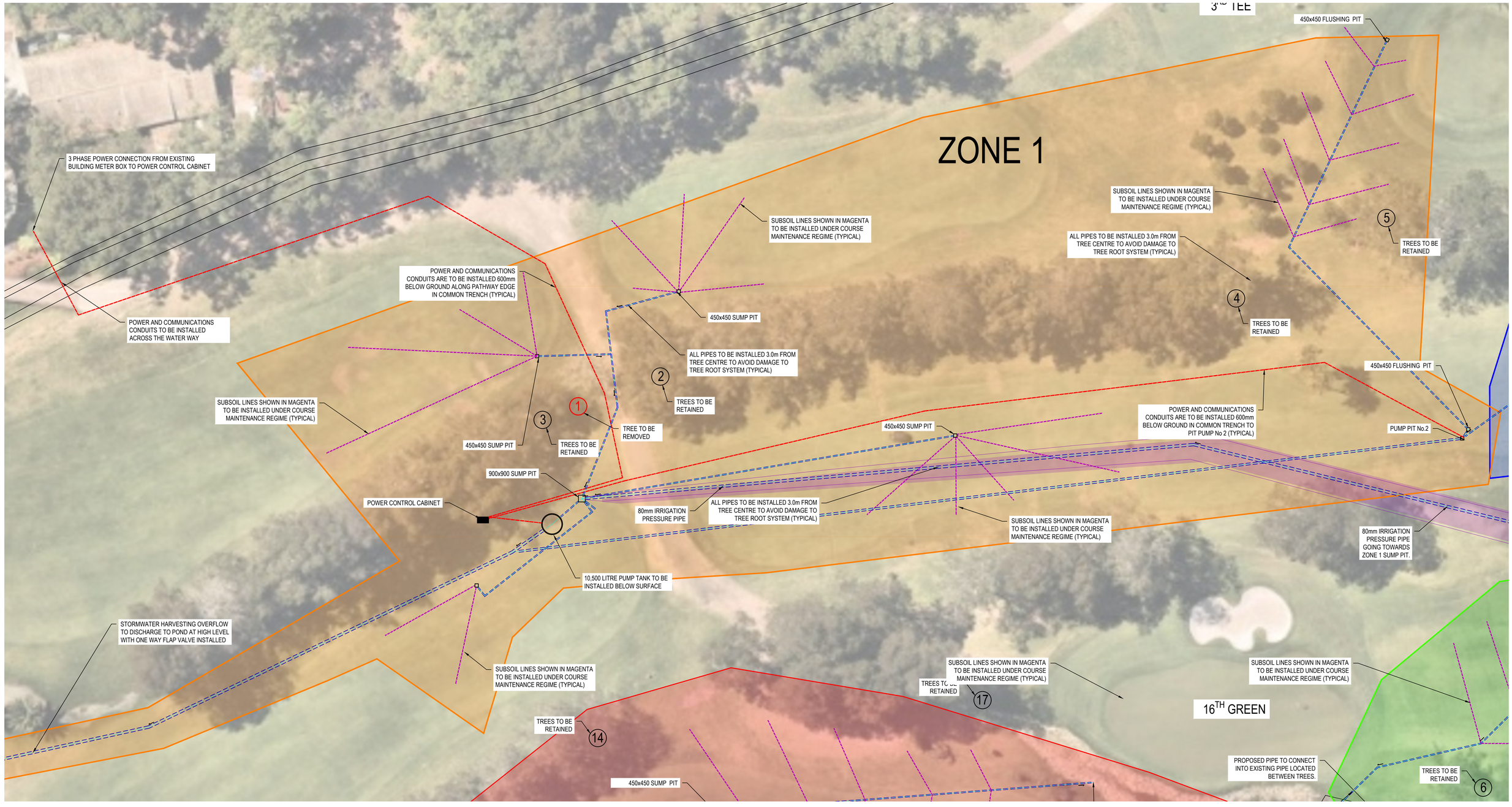

UTILITIES LEGEND

- MAINS POWER
- STORMWATER HARVESTING COLLECTION PIPE
- SUBSOIL DRAINAGE PIPE (COMPLETED UNDER COURSE MAINTENANCE AS REQUIRED)

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NOTES:

1. ALL INSTALLED PIPES AND CONDUITS MUST BE INSTALLED 3.0M FROM THE CENTRE OF ANY TREE. UNLESS OTHERWISE NOTED WHERE PIPES MUST BE INSTALLED CLOSER, HAND EXCAVATION SHALL ONLY BE PERMITTED TO INVESTIGATE THE LOCATION OF TREE ROOTS AND AVOID DAMAGE
2. ALL SUBSOIL LINES SHALL BE INSTALLED UNDER COURSE MAINTENANCE AS REQUIRED TO DRAIN SATURATED LANDS AND DO NOT FORM PART OF THESE APPROVALS

SCALE 1:250 @ A1
SCALE 1:500 @ A3

0 2.5 5 10 15 20 25 metres

REV	DATE	REVISION DESCRIPTION
A	13.10.2020	ISSUE FOR REVIEW AND COMMENT
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STORMWATER HARVESTING AND IRRIGATION

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ZONE 1 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
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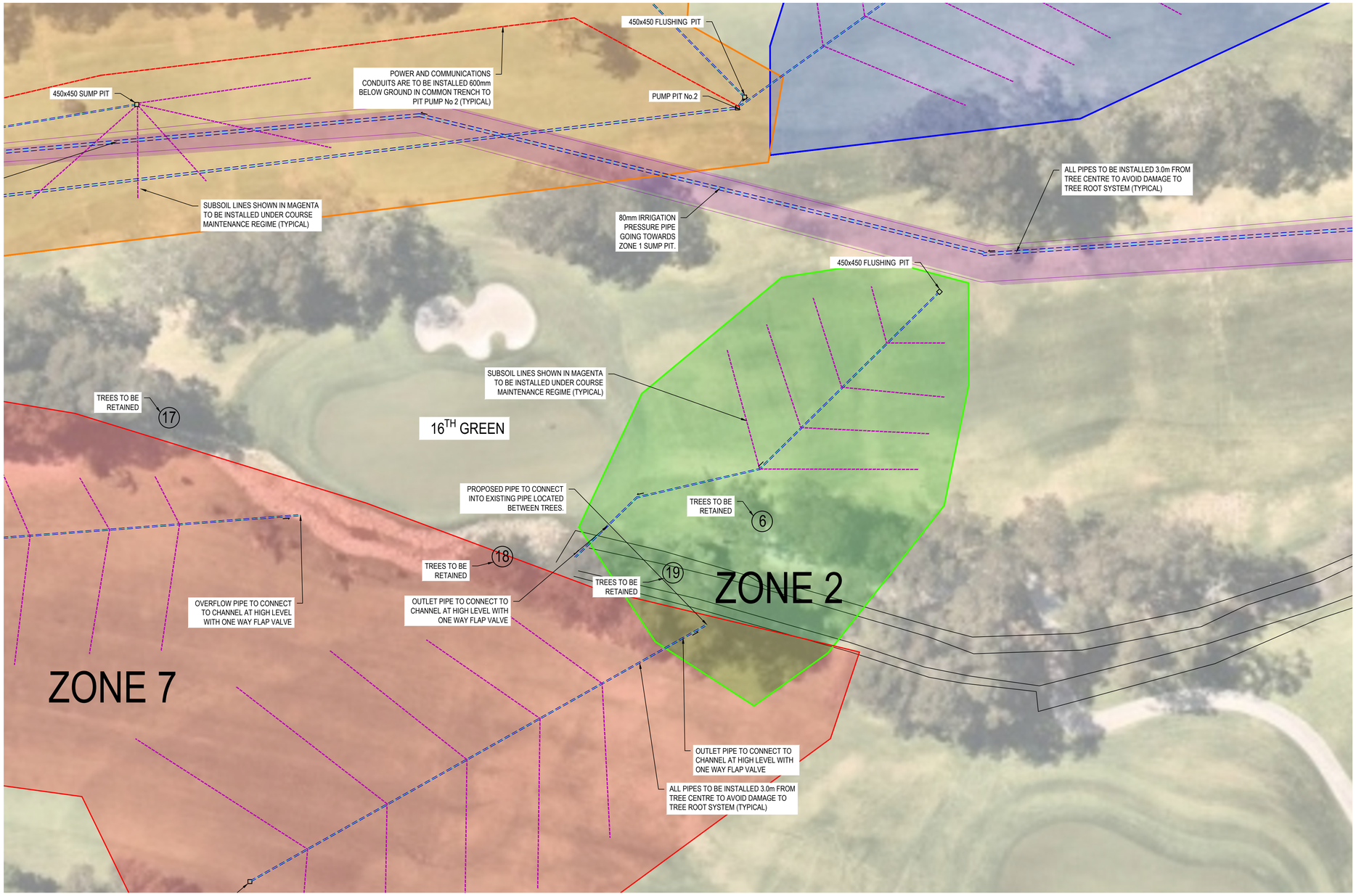

UTILITIES LEGEND

- MAINS POWER
- STORMWATER HARVESTING COLLECTION PIPE
- SUBSOIL DRAINAGE PIPE (COMPLETED UNDER COURSE MAINTENANCE AS REQUIRED)

THIS TEXT TO BE PRINTED IN COLOUR

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SCALE 1:250 @ A1
SCALE 1:500 @ A3

0 2.5 5 10 15 20 25 metres

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A	13.10.2020	ISSUE FOR REVIEW AND COMMENT
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DESIGNED	CP
DRG CHECK	CP
DESIGN CHECK	AL
APPROVED	CP

ISSUE FOR DEVELOPMENT APPLICATION

BAYVIEW GOLF CLUB

CHRISP CONSULTING
15 Jersey Street, Turramurra
New South Wales, Australia 2074
Telephone: 0408 696 526
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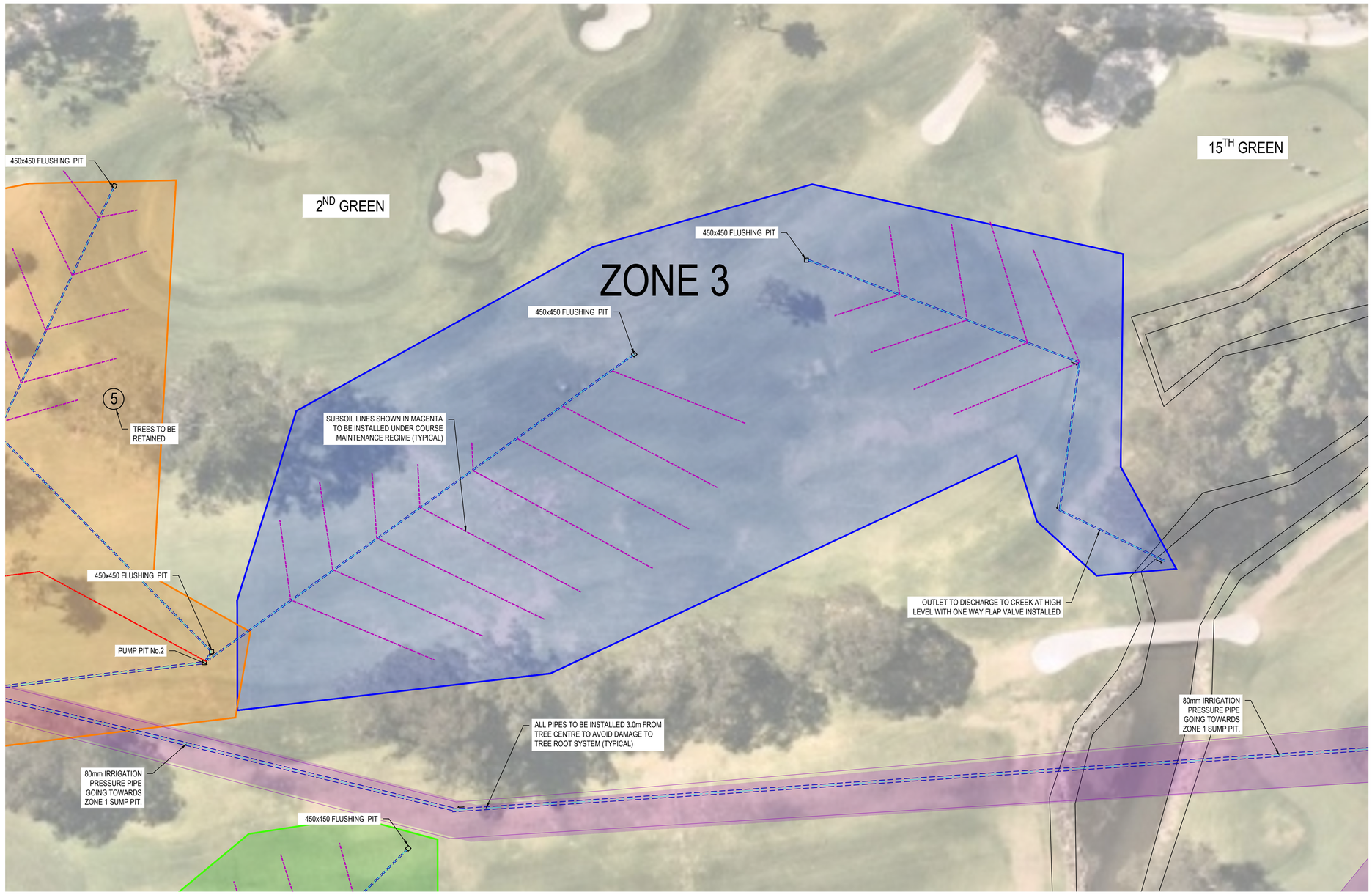
STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

ZONE 2 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C112	F



UTILITIES LEGEND

- MAINS POWER
- STORMWATER HARVESTING COLLECTION PIPE
- SUBSOIL DRAINAGE PIPE (COMPLETED UNDER COURSE MAINTENANCE AS REQUIRED)

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STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

ZONE 3 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C113	F

UTILITIES LEGEND

- MAINS POWER
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SCALE 1:500 @ A3

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ZONE 4 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C114	D

UTILITIES LEGEND

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ZONE 5 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C115	D

UTILITIES LEGEND

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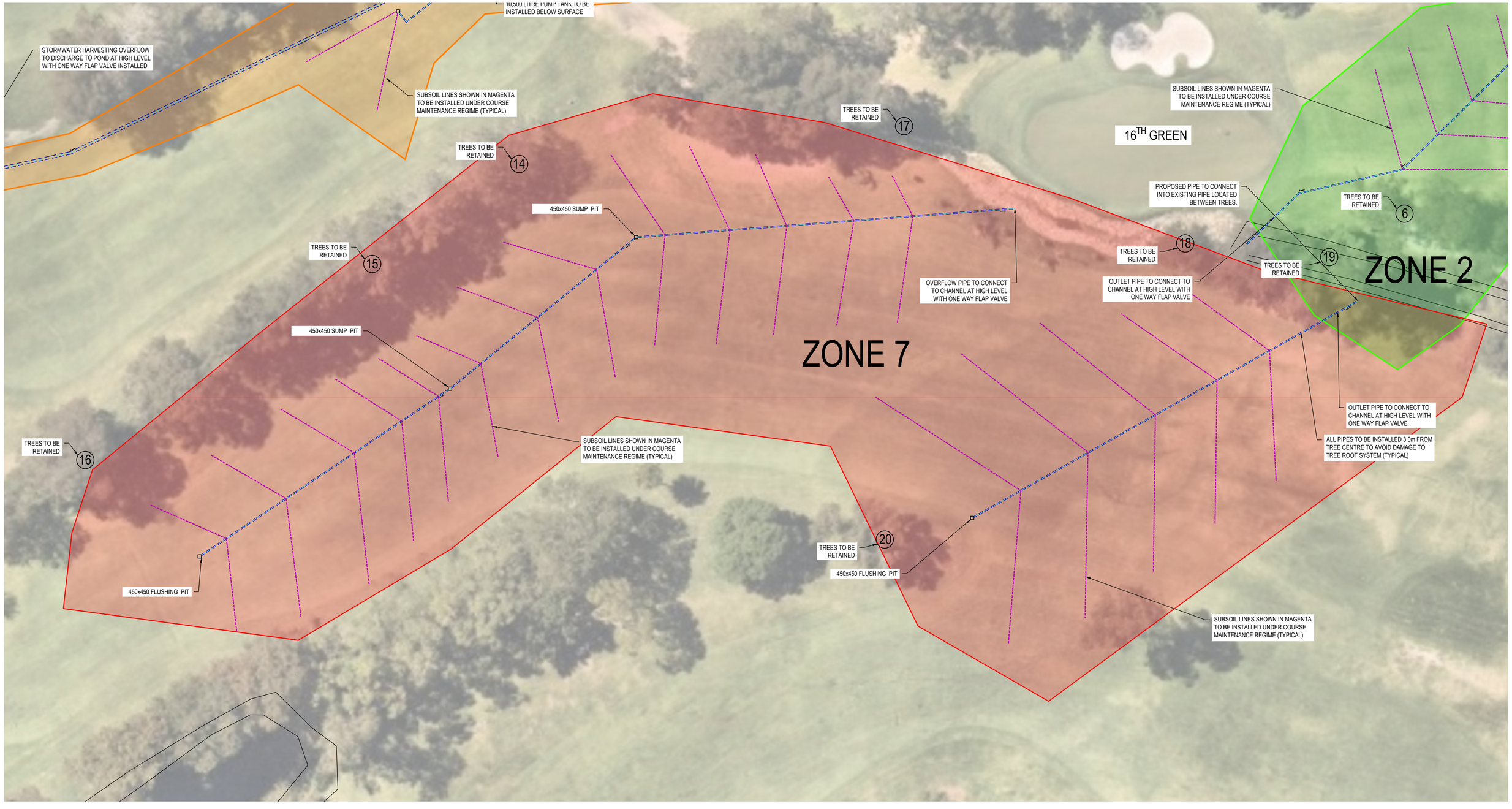
ZONE 6 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C116	D



UTILITIES LEGEND

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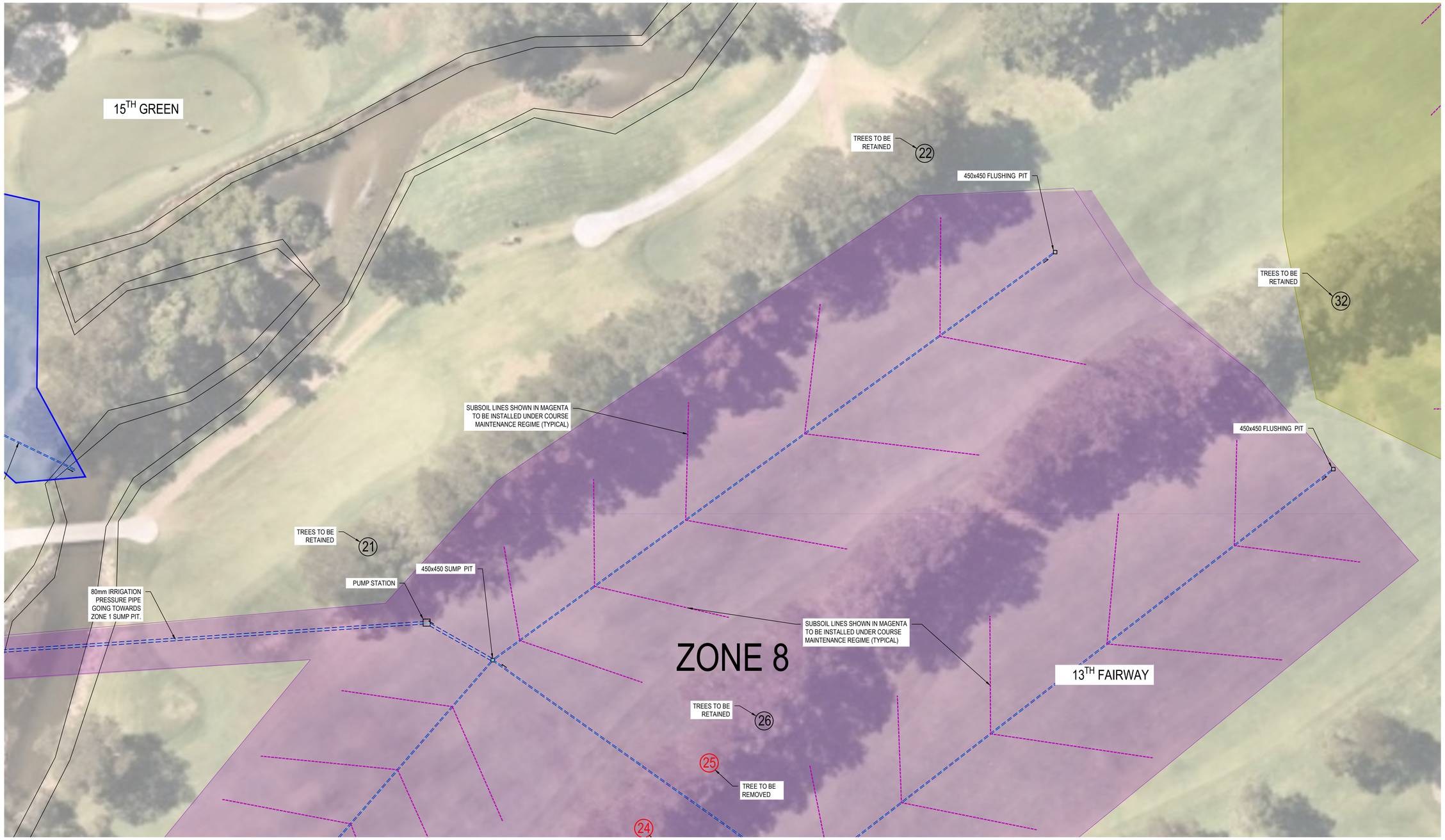
BAYVIEW GOLF CLUB

ZONE 7 DETAIL PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C117	D



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SCALE 1:500 @ A3

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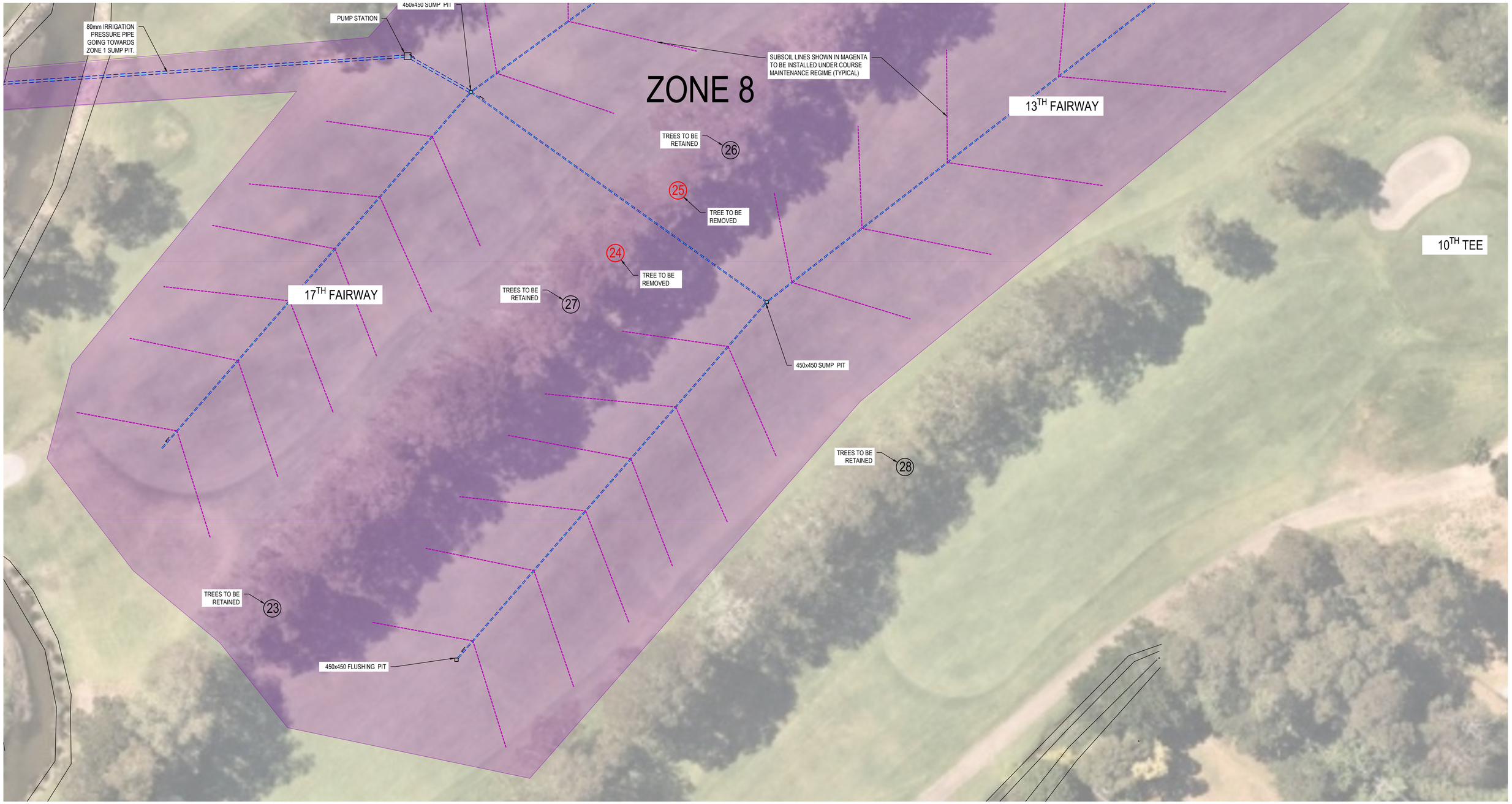
ZONE 8 DETAIL PLAN - SHEET 1 OF 2

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C118	D



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SCALE 1:500 @ A3

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STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

ZONE 8 DETAIL PLAN - SHEET 2 OF 2

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C119	D

UTILITIES LEGEND

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ZONE 9 DETAIL PLAN - SHEET 1 OF 3

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C120	D

UTILITIES LEGEND

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STORMWATER HARVESTING AND IRRIGATION

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ZONE 9 DETAIL PLAN - SHEET 2 OF 3

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C121	D

UTILITIES LEGEND

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STORMWATER HARVESTING AND IRRIGATION

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ZONE 9 DETAIL PLAN - SHEET 3 OF 3

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C122	D

UTILITIES LEGEND

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ZONE 10 DETAIL PLAN - SHEET 1 OF 2

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C123	D

UTILITIES LEGEND

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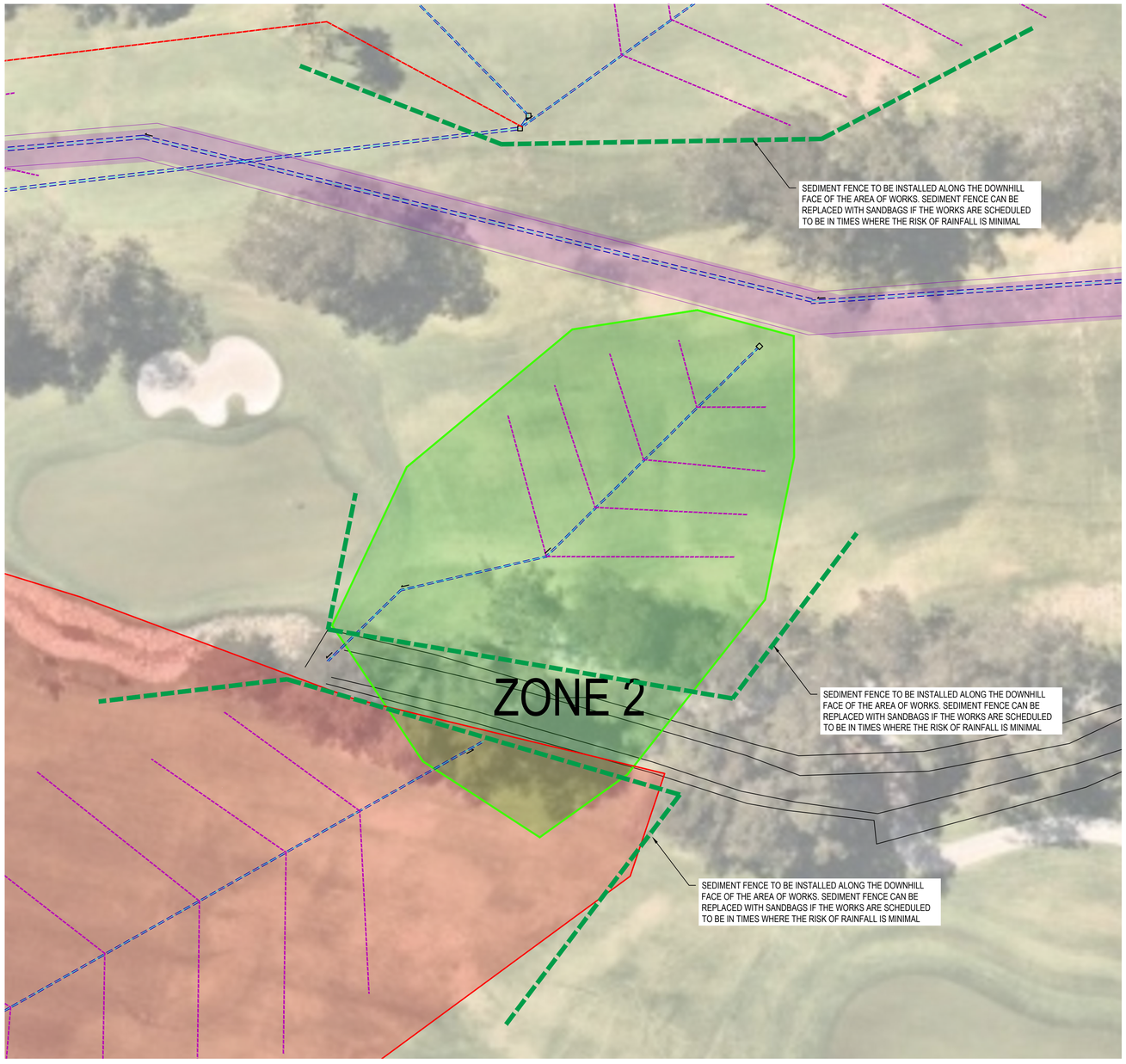
ZONE 10 DETAIL PLAN - SHEET 2 OF 2

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C124	D

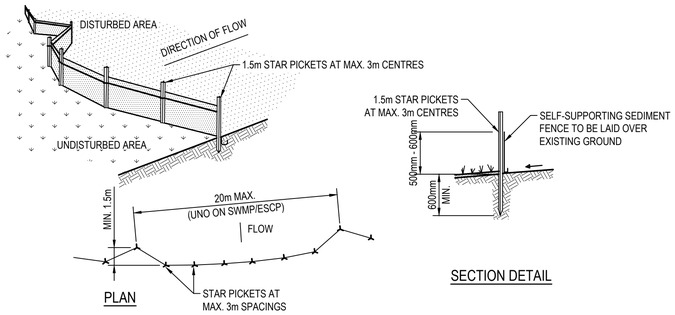


SEDIMENT & EROSION CONTROL LEGEND

SEDIMENT FENCE

SAND BAG SEDIMENT TRAP

1. ALL STRIPPED TOPSOIL AND EARTHWORKS IS TO BE RELOCATED ON SITE AT THE DISCRETION OF THE CLIENT AND ARBORIST. FOR MATERIAL WHICH CANNOT BE RE-USED ON SITE, IT IS TO BE TAKEN OFF SITE AT THE COMPLETION OF EVERY SHIFT

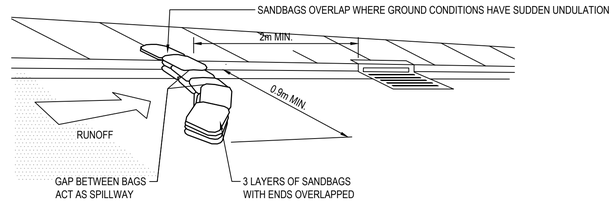


CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCE AS CLOSE AS POSSIBLE TO PARALLEL TO THE CONTOURS OF THE SITE.
2. DRIVE 1.5m LONG STAR PICKETS INTO GROUND, 3m APART.
3. FIX SELF-SUPPORTING SEDIMENT FENCE TO UPSLOPE SIDE OF POSTS WITH WIRE TIES OR AS RECOMMENDED BY SEDIEMNT FENCE MANUFACTURER.
4. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.

SEDIMENT CONTROL FENCE

N.T.S.



SANDBAG SEDIMENT TRAP

N.T.S.

DIAL BEFORE YOU DIG

DIAL BEFORE YOU DIG www.1100.com.au

IMPORTANT: THE CONTRACTOR IS TO MAINTAIN A CURRENT SET OF "DIAL BEFORE YOU DIG" DRAWINGS ON SITE AT ALL TIMES.

ISSUE FOR DEVELOPMENT APPLICATION

THIS TEXT TO BE PRINTED IN COLOUR

SCALE 1:250 @ A1
SCALE 1:500 @ A3

0 2.5 5 10 15 20 25 metres

REV	DATE	REVISION DESCRIPTION
A	23.02.2021	ISSUE FOR REVIEW
B	09.03.2021	UPDATED AERIAL
C	17.03.2021	ISSUED FOR DEVELOPMENT APPLICATION

TITLE	NAME
DRAWN	DI
DESIGNED	CP
DRG CHECK	CP
DESIGN CHECK	AL
APPROVED	CP

BAYVIEW GOLF CLUB

CHRISP CONSULTING
15 Jersey Street, Turramurra
New South Wales, Australia 2074
Telephone: 0408 696 526
www.chrispconsulting.com.au
A.B.N. 11 164 806 044

N

STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

TYPICAL SEDIMENT & EROSION CONTROL PLAN & DETAILS

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	1:250	C130	C

NOTE:
ALL COUNCIL STORMWATER INFRASTRUCTURE IN THE AREA IS SHOWN ON THIS DRAWING. NO IMPACT FROM PROPOSED WORKS IS EXPECTED

LEGEND:
- STORMWATER CONDUIT

THIS TEXT TO BE PRINTED IN COLOUR

ISSUE FOR DEVELOPMENT APPLICATION

REV	DATE	REVISION DESCRIPTION
A	09.03.2021	ISSUED FOR REVIEW
B	17.03.2021	ISSUED FOR DEVELOPMENT APPLICATION

TITLE	NAME
DRAWN	DI
DESIGNED	CP
DRG CHECK	CP
DESIGN CHECK	AL
APPROVED	CP

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STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

COUNCIL STORMWATER ASSET PLAN

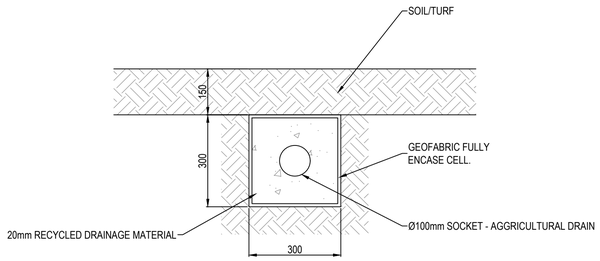
JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	NTS	C140	B

SITEWORKS NOTES

1. CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORK.
2. ALL WORK IS TO BE UNDERTAKEN IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS, **COUNCIL SPECIFICATIONS** AND THE DIRECTIONS OF THE PRINCIPAL'S REPRESENTATIVE.
3. WHERE NEW WORKS ABUT EXISTING THE CONTRACTOR SHALL ENSURE THAT A SMOOTH EVEN PROFILE, FREE FROM ABRUPT CHANGES IS OBTAINED.
4. CARE IS TO BE TAKEN WHEN EXCAVATING NEAR EXISTING SERVICES OR TREES. NO MECHANICAL EXCAVATIONS ARE TO BE UNDERTAKEN OVER COMMUNICATIONS OR ELECTRICAL SERVICES. HAND EXCAVATE IN THESE AREAS.
5. ALL TRENCH BACKFILL MATERIAL SHALL BE COMPACTED TO THE SAME DENSITY AS THE ADJACENT MATERIAL.
6. CONTRACTOR TO OBTAIN ALL AUTHORITY APPROVALS.
7. ALL BATTERS TO BE GRASSED LINED WITH MINIMUM 100 TOPSOIL AND APPROVED GRASS SEED OR TURF.
8. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY DIVERSION DRAINS AND MOUNDS TO ENSURE THAT AT ALL TIMES EXPOSED SURFACES ARE FREE DRAINING AND WHERE NECESSARY EXCAVATE SUMPS AND PROVIDE PUMPING EQUIPMENT TO DRAIN EXPOSED AREAS.
9. ON COMPLETION OF WORKS ALL DISTURBED AREAS MUST BE RESTORED TO ORIGINAL INCLUDING, BUT NOT LIMITED TO, KERBS, FOOTPATHS, CONCRETE AREAS, GRASS AND LANDSCAPED AREAS.

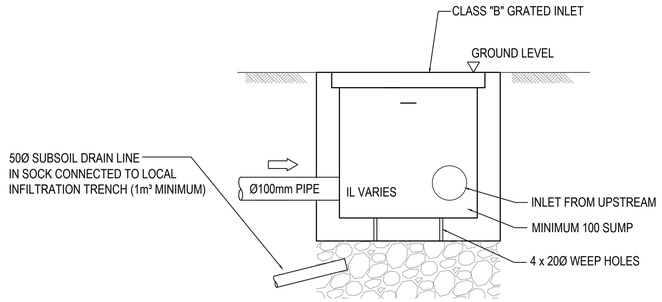
STORMWATER NOTES

1. MINIMUM GRADE TO STORMWATER LINES TO BE 1%. (U.N.O.)
2. CONTRACTOR TO SUPPLY AND INSTALL ALL FITTINGS AND SPECIALS INCLUDING VARIOUS PIPE ADAPTORS TO ENSURE PROPER CONNECTION BETWEEN DISSIMILAR PIPEWORK.
3. ALL CONNECTIONS TO EXISTING DRAINAGE PITS SHALL BE MADE IN A TRADESMAN-LIKE MANNER AND THE INTERNAL WALL OF THE PIT AT THE POINT OF ENTRY SHALL BE CEMENT RENDERED TO ENSURE A SMOOTH FINISH.
4. WHERE SUBSOIL DRAINAGE LINES PASS UNDER CONCRETE AND VEHICULAR PAVEMENTS UNSLOTTED UPVC SEWER GRADE PIPE SHALL BE USED.



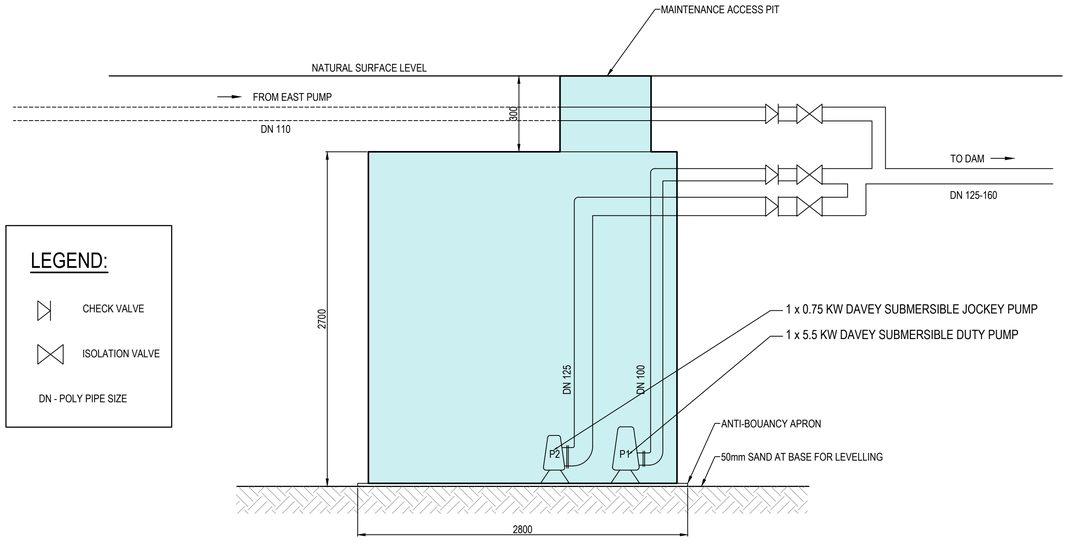
TYPICAL 100mm SUBSOIL LINE SYSTEM

SCALE 1:10



TYPICAL STORMWATER COLLECTION PIT

N.T.S.



PUMP STATION

SCALE 1:25

LEGEND:

- CHECK VALVE
- ISOLATION VALVE
- DN - POLY PIPE SIZE

ISSUE FOR DEVELOPMENT APPLICATION

REV	DATE	REVISION DESCRIPTION
A	12.01.2021	ISSUE FOR REVIEW AND COMMENT
B	23.02.2021	ISSUE FOR REVIEW

TITLE	NAME
DRAWN	DI
DESIGNED	CP
DRG CHECK	CP
DESIGN CHECK	AL
APPROVED	CP

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STORMWATER HARVESTING AND IRRIGATION

CLIENT
BAYVIEW GOLF CLUB

PUMP STATION AND GENERAL WORKS DETAILS

JOB NUMBER:	SCALE @ A1	SHEET No	REV
20056	AS SHOWN	C200	B

THIS TEXT TO BE PRINTED IN COLOUR

11 Attachment C – Borehole Logs

CLIENT	Bayview Golf Club		COMMENCED	10/09/2021	COMPLETED	10/09/2021	**REF BH501**
PROJECT	Geotechnical & Acid Sulfate Soil Assessment		LOGGED	DS	CHECKED		Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Man-Made Fill	VEGETATION	Grass	PROJECT NO. P2108485
EQUIPMENT		4WD ute-mounted hydraulic dril rig	LONGITUDE	151.2946	RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	LATITUDE	-33.6692	ASPECT		SLOPE

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Inflow	0.5	0.60				ML	Sandy SILT; low liquid limit; dark brown.	M		ALLUVIUM
				0.80					dark grey from 0.4 m.			
			1.0		1.0/S/1 D 1.00 m			SP	Silty SAND; fine to medium grained; pale grey; trace shell.			
				1.30					brown from 1.3 m.			
			2.0		2.0/S/1 D 2.00 m					W		
			3.0		3.0/S/1 D 3.00 m							
				4.00	3.9/S/1 D 3.90 m							
			4.0						Hole Terminated at 4.00 m			4.00: Target depth reached.

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

martens
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MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - BOREHOLE

CLIENT	Bayview Golf Club		COMMENCED	10/09/2021	COMPLETED	10/09/2021	**REF BH502**
PROJECT	Geotechnical & Acid Sulfate Soil Assessment		LOGGED	DS	CHECKED		Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Man-Made Fill	VEGETATION	Grass	PROJECT NO. P2108485
EQUIPMENT		4WD ute-mounted hydraulic dril rig	LONGITUDE	151.2958	RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.00 m depth	LATITUDE	-33.6691	ASPECT		SLOPE

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Inflow	0.5	0.40	0.5/S/1 D 0.50 m			ML	Sandy SILT; low liquid limit; dark brown.	M		ALLUVIUM
				0.70				SM	dark grey from 0.4 m. Silty SAND; fine to medium grained; pale brown; trace shell.			
			1.0		1.0/S/1 D 1.00 m							
			1.5	1.50					brown from 1.5 m.	W		
			2.0		2.0/S/1 D 2.00 m							
			2.5		2.5/S/1 D 2.50 m							
			3.0	3.00	2.9/S/1 D 2.90 m				Hole Terminated at 3.00 m			3.00: Target depth reached.
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
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mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - BOREHOLE

CLIENT	Bayview Golf Club		COMMENCED	10/09/2021	COMPLETED	10/09/2021	**REF BH503**
PROJECT	Geotechnical & Acid Sulfate Soil Assessment		LOGGED	DS	CHECKED		Sheet 1 OF 1
SITE	Bayview Golf Course, Bayview, NSW		GEOLOGY	Man-Made Fill	VEGETATION	Grass	PROJECT NO. P2108485
EQUIPMENT		4WD ute-mounted hydraulic dril rig	LONGITUDE	151.2972	RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø75 mm x 3.10 m depth	LATITUDE	-33.6694	ASPECT		SLOPE

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Inflow	0.5	0.60	0.5/S/1 D 0.50 m			ML	SILT; low liquid limit; dark brown; with sand.	M		ALLUVIUM
			1.0		1.0/S/1 D 1.00 m			SM	Silty SAND; fine to medium grained; brown, pale brown; trace shell.			
			1.5	1.50					brown from 1.5 m.	W		
			2.0		2.0/S/1 D 2.00 m							
			2.5		2.5/S/1 D 2.50 m							
			3.0	3.10	2.9/S/1 D 2.90 m							
									Hole Terminated at 3.10 m			3.10: Target depth reached.
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - BOREHOLE

12 Attachment D – Laboratory Analytical Documentation

Envirolab Services Pty Ltd
ABN 37 112 535 645
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 277758

Client Details

Client	Martens & Associates Pty Ltd
Attention	Dean Shi
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2108485 - Bayview Golf Club**
Number of Samples	10 Soil
Date samples received	10/09/2021
Date completed instructions received	10/09/2021

Analysis Details

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

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

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

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

Report Details

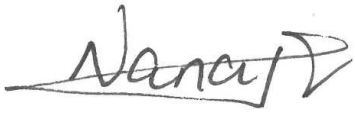
Date results requested by	17/09/2021
Date of Issue	20/09/2021

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
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS + %S w/w						
Our Reference		277758-1	277758-2	277758-3	277758-4	277758-5
Your Reference	UNITS	BH501/2.0	BH501/3.0	BH501/4.0	BH502/2.0	BH502/2.5
Date Sampled		10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
pH $_{kcl}$	pH units	9.4	9.4	9.3	9.4	9.5
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	8.1	8.0	7.9	7.9	7.9
TPA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	13	13	13	13	13
a-ANC_E	moles H^+ /t	2,500	2,500	2,500	2,500	2,500
s-ANC_E	%w/w S	4.0	4.0	4.0	4.0	4.0
S_{KCl}	%w/w S	0.08	0.06	0.06	0.04	0.06
S_P	%w/w	0.68	0.72	0.63	0.53	0.58
S_{POS}	%w/w	0.61	0.66	0.58	0.48	0.53
a-S_{POS}	moles H^+ /t	380	410	360	300	330
Ca_{KCl}	%w/w	0.25	0.23	0.22	0.18	0.20
Ca_P	%w/w	5.5	6.0	5.2	5.8	5.4
Ca_A	%w/w	5.3	5.7	5.0	5.6	5.2
Mg_{KCl}	%w/w	0.021	0.020	0.020	0.015	0.017
Mg_P	%w/w	0.40	0.43	0.36	0.36	0.41
Mg_A	%w/w	0.38	0.41	0.34	0.34	0.39
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
a-S_{NAS}	moles H^+ /t	[NT]	[NT]	[NT]	[NT]	[NT]
s-S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5	<5
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without -ANCE	%w/w S	0.61	0.66	0.58	0.48	0.53
a-Net Acidity without ANCE	moles H^+ /t	380	410	360	300	330
Liming rate without ANCE	kg $CaCO_3$ /t	29	31	27	23	25

sPOCAS + %S w/w					
Our Reference		277758-6	277758-7	277758-8	277758-9
Your Reference	UNITS	BH502/3.0	BH503/2.0	BH503/2.5	BH503/3.0
Date Sampled		10/09/2021	10/09/2021	10/09/2021	10/09/2021
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021
pH $_{kcl}$	pH units	9.4	9.4	9.5	9.5
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	8.0	7.9	7.8	8.0
TPA pH 6.5	moles H^+ /t	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+ /t	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	13	13	13	13
a-ANC_E	moles H^+ /t	2,500	2,500	2,500	2,500
s-ANC_E	%w/w S	4.0	4.0	4.0	4.0
S_{KCl}	%w/w S	0.05	0.06	0.06	0.22
S_P	%w/w	0.51	0.81	0.55	0.47
S_{POS}	%w/w	0.45	0.75	0.50	0.25
a-S_{POS}	moles H^+ /t	280	470	310	150
Ca_{KCl}	%w/w	0.20	0.22	0.19	0.18
Ca_P	%w/w	5.4	6.0	5.4	5.1
Ca_A	%w/w	5.2	5.7	5.2	4.9
Mg_{KCl}	%w/w	0.016	0.018	0.015	0.015
Mg_P	%w/w	0.37	0.38	0.38	0.33
Mg_A	%w/w	0.35	0.36	0.36	0.32
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]
a-S_{NAS}	moles H^+ /t	[NT]	[NT]	[NT]	[NT]
s-S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without -ANCE	%w/w S	0.45	0.75	0.50	0.25
a-Net Acidity without ANCE	moles H^+ /t	280	470	310	150
Liming rate without ANCE	kg $CaCO_3$ /t	21	35	23	12

Miscellaneous Inorganics		
Our Reference		277758-10
Your Reference	UNITS	WS01
Date Sampled		10/09/2021
Type of sample		Soil
Date prepared	-	10/09/2021
Date analysed	-	10/09/2021
pH	pH Units	7.2

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-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on National acid sulfate soils sampling and identification methods manual June 2018. Ideally samples should be received in the laboratory at <4oC. Please refer to SRA for sample temperature on receipt.

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			14/09/2021	[NT]	[NT]	[NT]	[NT]	14/09/2021	[NT]
Date analysed	-			14/09/2021	[NT]	[NT]	[NT]	[NT]	14/09/2021	[NT]
pH $_{kcl}$	pH units		Inorg-064	[NT]	[NT]	[NT]	[NT]	[NT]	96	[NT]
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pH $_{Ox}$	pH units		Inorg-064	[NT]	[NT]	[NT]	[NT]	[NT]	95	[NT]
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	100	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-ANC_E	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{POS}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-S_{POS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ca_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ca_A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mg_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mg_A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-S_{NAS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	<1.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Date analysed	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

SPOCAS
s-ANCE,a-ANCE:
the existance of shells in the samples for this report, may exaggerate the ance results.