

FINAL Sandhills Wetland

Detailed Design Report

Client : Planit Consulting (for Byron Shire Council)
Prepared by : Australian Wetlands Consulting Pty Ltd
Project # : 1-191194_4B
Date : November 2023

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Sandhills Wetland

Detailed Design Report

Project control

Project name: **Sandhills Wetland**
Detailed Design Report

Job number: 1-191194_04
Client: Planit Consulting (for Byron Shire Council)
Contact: Rob van Iersel (Planit Consulting)

Prepared by: Australian Wetlands Consulting Pty Ltd

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| | | | | |

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AWC's management system has been certified to ISO 9001

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1 Introduction

The Sandhills reserve is located behind Clarkes beach at the parcel of land identified as Lot 383 DP728202 and Lot 457 DP 1087879 ('the site' herein). Byron Shire Council (BSC) seek to create a wetland system within and around existing drainage features in the eastern portion of the site to achieve a range of environmental objectives including, improving the site's environmental and cultural values, mitigating flood impacts, stormwater treatment, integration with catchment water cycle management objectives, provision of education and recreation opportunities and pedestrian connectivity between key sites in and around the town centre.

The Sandhills site is currently undeveloped with the exception of a pedestrian track connecting Cowper Street to Lawson Steet and underground services (sewer, stormwater and recycled water main).

AWC have been engaged to prepare a detailed design for the wetland which considers additional studies and information that have been undertaken since the development of the wetland concept design (AWC, 2019). The detailed design drawings are provided in Appendix A.

1.1 Design aim and objectives

The aim of this project is to develop a detailed design for a constructed wetland at the site that provides flood storage, improves water quality at the Clarkes beach outlet and enhances local environmental and cultural values.

The objectives for the Sandhills wetland design are:

- Protect and enhance Aboriginal cultural values of the area
- Allow access to water and sewer infrastructure for maintenance and emergency purposes
- Showcase best practice water sensitive urban design
- Improve water quality at the stormwater outlet to Clarkes beach
- Maximise flood storage to mitigate flooding of the sports field and town centre
- Improve visual and environmental amenity of the site
- Ensure acid sulfate soils (actual and potential) are appropriately accounted for and managed
- Protect and enhance environmental values at the site

2 Background

2.1 Background studies

A summary of the studies and monitoring used to inform this detailed design is provided in Table 2-1.

Table 2-1 Background studies

| Study / Information | Description / Relevant findings | Authors | Date |
|---|---|-------------------|---------------|
| Concept Design | A concept design for a constructed stormwater wetland system at the site was developed and, following consultation with Council and Arakwal Aboriginal Lands Council, revised to include three layout options and a preferred option chosen. | AWC | June 2019 |
| Revised Concept Design | | AWC | 2021 |
| Basis of Design report | Summarises the concept design, the information used to prepare the detailed design and information gaps. | AWC | February 2022 |
| Contamination Assessment | The site is considered suitable from a contamination perspective for the proposed wetland development (i.e. recreational use). | ENV solutions | July 2021 |
| Acid Sulfate Management Plan | Laboratory analysis of 6 boreholes within the site indicated the presence of Actual Acid Sulfate Soil (AASS) and Potential Acid Sulfate Soil (PASS). The plan provides management and treatment measures to be employed during excavation at the site. | ENV solutions | August 2021 |
| Biodiversity Development Assessment Report (BDAR) | <p>Outlines the measures taken to avoid, minimise and mitigate impacts to the vegetation and habitats present within the development site during the design, construction and operation of the development.</p> <p>The residual unavoidable impacts of the proposed development were calculated using the Biodiversity Assessment Method Credit Calculator (BAM-C).</p> | Planit Consulting | August 2022 |

3 Detailed Design

Key details of the design are illustrated in the Detailed Design Drawings (Appendix A) which include:

- Layout plan (showing wetland configuration)
- Longitudinal sections
- Cross sections
- Details of inlet and outlet structures

The title of all drawings included are provided in Table 3-1.

Table 3-1 Drawing number and title, Sandhills Wetland Detailed Design

| Drawing No. | Title |
|-------------|--|
| 001 | Cover Sheet & Locality Plan |
| 002 | Site context & Sheet Layout Plan |
| 003 | Site Cut & Fill Plan |
| 101 | Earthworks & Layout Plan 01 |
| 102 | Earthworks & Layout Plan 02 |
| 103 | Earthworks & Layout Plan 03 |
| 201 | Earthworks – Sections Cell 1 |
| 202 | Earthworks – Sections Cell 2 |
| 203 | Earthworks – Sections Cell 3 |
| 301 | Civil Details – Cell 1 inlet |
| 302 | Civil Details – Cell 1 outlets |
| 303 | Civil Details – Cell 2 outlets |
| 304 | Civil Details – Cell 3 outlet |
| 305 | Civil Details – Concrete |
| 401 | Civil and Landscaping Specifications |
| 402 | Civil and Landscaping Specifications |
| 500 | Landscape planting schedules |
| 501 | Landscape materials & planting plan 01 |
| 502 | Landscape materials & planting plan 02 |
| 503 | Landscape materials & planting plan 01 |
| 602 | Landscape Sections |
| 603 | Landscape Sections |

| Drawing No. | Title |
|-------------|-----------------------------------|
| 701 | Landscape Sections |
| 702 | Landscape Details – Seating Nodes |
| 703 | Landscape Details – Hardworks |
| 704 | Landscape Details – Softworks |
| 801 | Landscape Planting Specifications |

3.1 Catchment and hydrology

Local stormwater and seasonal groundwater flows are to be conveyed through the three wetland cells, designed specifically to improve the quality of water flowing through the system, before it is discharged via the existing stormwater outlet to Clarkes Beach.

The total stormwater catchment discharging via the outfall at Clarkes Beach include approximately 37.6 hectares of urban and urban fringe areas. The proposed stormwater treatment wetland consisting of 3 wetland cells or tiers will capture flows from two sub catchments to the north and west of the site including flows from Lighthouse Road, and Massinger Street, with a total combined area of 26.8 ha. The design flow rates utilised in the design are summarised below in Table 3-2. The Design flow rate for the flows from the smallest catchment was determined using the rational method and the flow rates for the larger catchment was established through DRAINS modelling provided by Planit Consulting. (October 2021).

The wetland design approach considered the flows from the contributing catchments and the constraint of the existing outlet feature at Cowper Street. No changes are proposed to the existing outlet or inflows.

Table 3-2 Stormwater catchment sizes and design flowrates used in the design development for the Sandhills wetland.

| | Catchment size (ha) | 10-year ARI flow rate (m ³ /s) | Method |
|---------|---------------------|---|-----------------|
| Cell W1 | 2.04 | 0.55 | Rational method |
| Cell W2 | 24.77 | 3.39 | DRAINS |
| Cell W3 | - | 3.94 | W1 + W2 flows |

3.2 System arrangement

The detailed design consists of three wetland cells (Cell W1, Cell W2 and Cell W3) with a combined footprint of 1.2 ha. Cell W1 receives flows from Lawson St, Cell W2 receives flows from Massinger Street and flows discharging from cell W1. Cell W3 receives flows discharging from cell W2.

Refer to Appendix A for the detailed design drawings.

3.3 Wetland inlet and sedimentation zones

Inlet (or sedimentation) basins within wetland cells are typically included to provide flow buffering and a dedicated place for the deposition and periodic removal of sediment (Water by Design, 2017). These zones are typically sized to capture 90% of the 125 µm particles from the 1-ARI. Inlet ponds can be problematic from a maintenance and aesthetic perspective. Gross pollutants such as bikes and shopping trolleys are frequently dumped in sediment basins and as sediment accumulates, they can become prone to infestation with weeds.

Sediment basins have not been provided within the Sandhills system to reduce maintenance requirements and enhance aesthetics. The flow path from Massinger Street is conveyed via a detention basin on Patterson Street. As the surrounding soils are sandy the majority of the sediment is coarse, heavy and therefore likely to settle out within the detention basin and prior to the wetland. Flows conveyed from the north will enter a vegetated swale prior to being conveyed to wetland cell W1. Coarse sediments and gross pollutants will be deposited within the swale. The removal of accumulated materials in the swale and inlet zones have been considered and are discussed further in the Sandhills Wetland Operation and Maintenance Plan (AWC, 2022).

3.4 Wetland bathymetry

The wetland has been designed to support a range of wetland habitats and wetland vegetation complexes. To achieve this varying water depths have been provided. Cell W1 is the deepest cell with 300mm of standing water during and following rainfall events with an extended detention depth of 300mm. Cell W2 is shallower with an operating water depth of 200mm and an extended detention depth of 200mm. Cell W3 will have just 100mm of standing water and no extended detention depth except when the outlet flow is restricted. Cell W3 is designed to draw down to a low-level following rainfall. This will occur provided that the outlet at Clarkes Beach is not restricted by sand accumulation on the beach front.

Deeper zones have been provided to support aquatic biota in the wetland system. Deep zones (up to 1.5m deep) are provided in cells W2 and W3. These deep zones will provide refugia between rain events for fish, frogs and aquatic invertebrates. Access to open water zones will be restricted by dense planting around the deeper water edge. The deep zones will be lined with an impermeable lining to prohibit interaction with groundwater. Small open water zones have been provided at spillways to facilitate maintenance.

3.5 Inlet and outlet structures

Existing infrastructure will be used at the inlets of cells W1 and W2 to convey flows to the wetlands. The outlet structures of Cells W1 and W2 have been sized to provide a 24-hour detention time ($\pm 10\%$) within the wetland and weirs to convey the 10-year ARI flow safely through the system. Inlet and outlet structures are summarised in Table 3-3. Sizing calculations for the orifices and weirs at the cell outlets are provided in Appendix B. All pipework should be RCP concrete under trafficable weirs and risers PVC to allow for drilling of orifice holes. All outlets are located within concrete pits 600x600x600.

Three weirs have been included in the system. Weirs between cells W1 to W2 and cells W2 to W3 are trafficable and have been sized to convey the 10 year ARI flow across the wetland to the outlet. Cell W3 has a weir and rock lined channel which conveys flows to the existing system outfall pipe. Cell 3 has no extended detention volume or low flow outlet.

Table 3-3 Inlet and outlet details

| | Cell W1 | Cell W2 | Cell W3 |
|-------------------|---|---|-------------------------------|
| Inlet Structure/s | Existing Ø675 RCP pipe from Lawson St and planted constructed swale | Via Cell W1 outlet structures Via existing conduits under Massinger St (2x Ø600mm RCP pipes, 2100 x 600 culvert) | Via Cell W2 outlet structures |
| Low flow outlet | Via orifices and pipe | Via orifices and pipe | None |
| High flow outlet | Trafficable weir | Trafficable weir | Rock weir and channel |

3.6 Flood storage

The combined extended detention volume of the system is 1,030m³ (300m³ in Cell 1 and 730m³ in Cell 2). Cell 3 will also provide attenuation of flood flows. The behaviour of the wetland in flood events has been investigated by BMT WBM and is not covered in detail in this document.

3.7 Ecological function

The design aims to enhance and regenerate existing site vegetation and habitat at the site including wetland forest communities, wet heath and frog habitat. Vegetation layout and design includes species selection that reflects local ecological communities. The frog habitat identified on the site and buffered through inclusion of species that occur in the retained habitat on the site. Key species within the frog habitat include *Baloskion tetraphyllum*, *Rhynchospora brownii* and *Phylidrum lanuginosum* which is already present on the site.

Consideration of planting design around open water intends restricting access to open water for cane toads. Deep zones as described in Section 3.4 play an important role in supporting aquatic biota on the site particularly between rainfall events.

Specific consideration has been given to the groundwater dependent vegetation on the site. Design levels have been set to prevent significant lowering of local groundwater levels. Monitoring has been undertaken to understand the variability of groundwater levels and interaction with site vegetation. The design intent is to ensure that wetland vegetation can be supported by periodic interaction with the groundwater table.

3.8 Access and pathways

The system has been designed to facilitate maintenance access to the inlets, outlets and around the wetland. The pathway network has been developed in response to the Masterplan and following on ground ecological assessment. Some realignment of paths has been undertaken to allow for reduced grades to Massinger Street.

4 Priced BOQ

A detailed priced Bill of Quantities is provided in Appendix C. This estimate includes all aspects of civil works including earthworks, rock work and scour protection, hydraulic components and planting. The total cost estimate is shown in

Table 4-1.

Table 4-1 Revised Cost estimate for the construction of the Sandhills wetland

| Item | Cost |
|--|-----------------------|
| Preliminaries including mobilization, erosion and sediment control, survey set out | \$45,000 |
| Civil works and planting Cell 1 | \$233,491.30 |
| Civil works and planting Cell 2 | \$389,490.60 |
| Civil works and planting Cell 3 | \$619,214.46 |
| Pathways | \$130,637.44 |
| Completion including as constructed survey and drawings | \$25,000 |
| Total | \$1,442,833.80 |
| Contingencies (30%) | \$419,397.70 |
| Sub Total | \$2,063,252.33 |
| GST | \$181,739.90 |
| Total | \$1,999,129.99 |

Costing Assumptions and Exclusions

The cost for removing and treating material cut from the site is not included.

Rates for tree removal are highly variable depending on the technique utilised, pricing includes. Pricing assumes a rate of \$120/tree for both medium and large trees.

5 References

Australian Wetlands Consulting (2019). Sandhills Estate WSUD Final Concept Design Report

Australian Wetlands Consulting (2020). Final Sandhills Estate Revised Scope Wetland.

Australian Wetlands Consulting (2022). Basis of Design report

Env Solutions (2021). Detailed Site Investigation

Env Solutions (2021). Acid Sulphate Soils Management Plan.

Appendix A – Detailed Design

SANDHILLS WETLAND DETAILED DESIGN PACKAGE

REV F - FOR TENDER 25.08.2023 100%



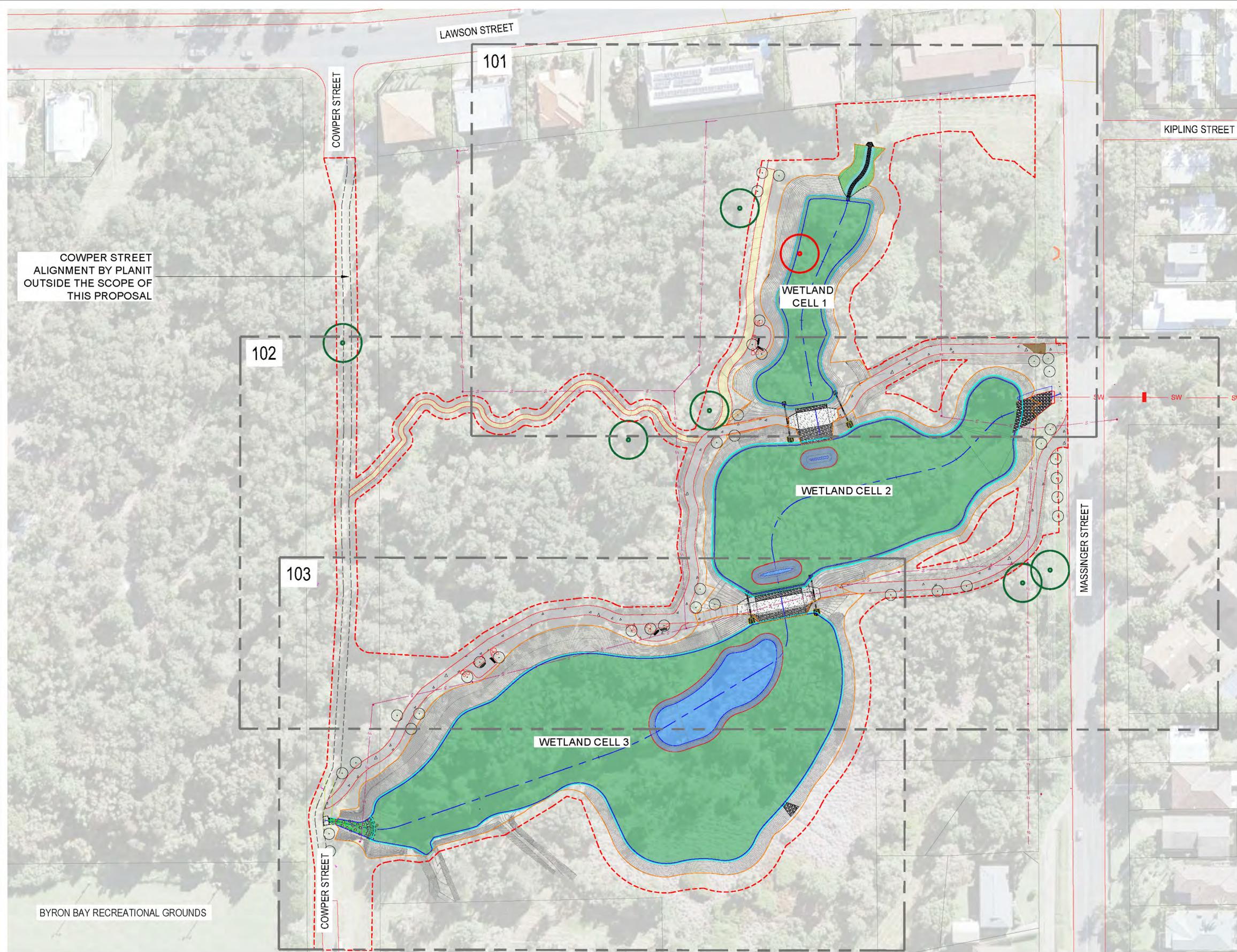
| SHEET NO. | DRAWING NAME | SCALE |
|-----------------|--|-----------|
| 1-191194_DD_001 | COVER SHEET & LOCALITY PLAN | 1:1000@A1 |
| 1-191194_DD_002 | SITE CONTEXT & SHEET LAYOUT PLAN | 1:600@A1 |
| 1-191194_DD_003 | SITE CUT & FILL PLAN | 1:600@A1 |
| 1-191194_DD_004 | SITE EXTENTS | 1:600@A1 |
| 1-191194_DD_101 | EARTHWORKS & LAYOUT PLAN 01 | 1:250@A1 |
| 1-191194_DD_102 | EARTHWORKS & LAYOUT PLAN 02 | 1:250@A1 |
| 1-191194_DD_103 | EARTHWORKS & LAYOUT PLAN 03 | 1:250@A1 |
| 1-191194_DD_201 | EARTHWORKS - SECTIONS CELL 1 | AS SHOWN |
| 1-191194_DD_202 | EARTHWORKS - SECTIONS CELL 2 | AS SHOWN |
| 1-191194_DD_203 | EARTHWORKS - SECTIONS CELL 3 | AS SHOWN |
| 1-191194_DD_301 | CIVIL DETAILS - CELL 1 INLET | AS SHOWN |
| 1-191194_DD_302 | CIVIL DETAILS - CELL 1 OUTLETS | AS SHOWN |
| 1-191164_DD_303 | CIVIL DETAILS - CELL 2 OUTLETS | AS SHOWN |
| 1-191164_DD_304 | CIVIL DETAILS - CELL 3 OUTLET | AS SHOWN |
| 1-191164_DD_305 | CIVIL DETAILS - GENERAL | AS SHOWN |
| 1-191194_DD_401 | CIVIL & LANDSCAPE SPECIFICATION | NA |
| 1-191194_DD_402 | CIVIL & LANDSCAPE SPECIFICATION | NA |
| 1-191194_DD_500 | LANDSCAPE PLANTING SCHEDULES | NA |
| 1-191194_DD_501 | LANDSCAPE MATERIALS & PLANTING PLAN 01 | 1:250@A1 |
| 1-191194_DD_502 | LANDSCAPE MATERIALS & PLANTING PLAN 02 | 1:250@A1 |
| 1-191194_DD_503 | LANDSCAPE MATERIALS & PLANTING PLAN 03 | 1:250@A1 |
| 1-191194_DD_601 | LANDSCAPE SECTIONS | 1:50@A1 |
| 1-191194_DD_602 | LANDSCAPE SECTIONS | 1:50@A1 |
| 1-191194_DD_603 | LANDSCAPE SECTIONS | 1:50@A1 |
| 1-191194_DD_701 | LANDSCAPE DETAILS - SEATING NODES | AS SHOWN |
| 1-191194_DD_702 | LANDSCAPE DETAILS - HARDWORKS | AS SHOWN |
| 1-191194_DD_703 | LANDSCAPE DETAILS - SOFTWORKS | AS SHOWN |
| 1-191194_DD_704 | LANDSCAPE DETAILS - PLANTING MATRIXES | AS SHOWN |
| 1-191194_DD_801 | LANDSCAPE PLANTING SPECIFICATION | NA |

NOTES:
Not for Construction. Do not scale off drawings.

SCALE 1:1000 @ A1 0 5 10 25 50m



01 LOCALITY PLAN
001



COWPER STREET ALIGNMENT BY PLANT OUTSIDE THE SCOPE OF THIS PROPOSAL

LEGEND

-  CONCRETE CYCLEWAY
REFER DETAIL 02_702
-  DECOMPOSED GRANITIC SAND PATH
REFER DETAIL 01_702
-  EXISTING TREE RETAINED
PROTECTED TO MEET AS 4970-2009
-  PROPOSED FEATURE TREE
REFER PLANTING PLANS 501-503
-  EXTENT OF EARTH WORKS
-  OPERATING WATER LEVEL (OWL)
-  FINISHED FLOOR LEVEL (FFL)
-  EXTENT OF WORKS
-  PROPOSED 0.2m CONTOURS
-  SEWER INFRASTRUCTURE
-  SEWER ACCESS HOLE
-  SW PIPE HEADWALL
-  CADESTRAL BOUNDARIES
-  COWPER STREET ALIGNMENT
-  EXISTING TREE REMOVED

BYRON BAY RECREATIONAL GROUNDS



AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
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CLIENT:



Byron Shire Council

DRAWING: **SITE CONTEXT & SHEET LAYOUT PLAN**

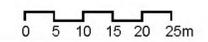
PROJECT: SANDHILLS WETLAND
DETAILED DESIGN PACKAGE

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
| B | DETAILED DESIGN PACKAGE 70% | 28.02.2022 |
| C | DETAILED DESIGN PACKAGE 100% | 02.11.2022 |
| D | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 17.11.2022 |
| E | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 13.12.2022 |
| F | FOR TENDER | 25.08.2023 |



DO NOT SCALE FROM PLANS. TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS ENGINEERS CERTIFICATE BY OTHERS

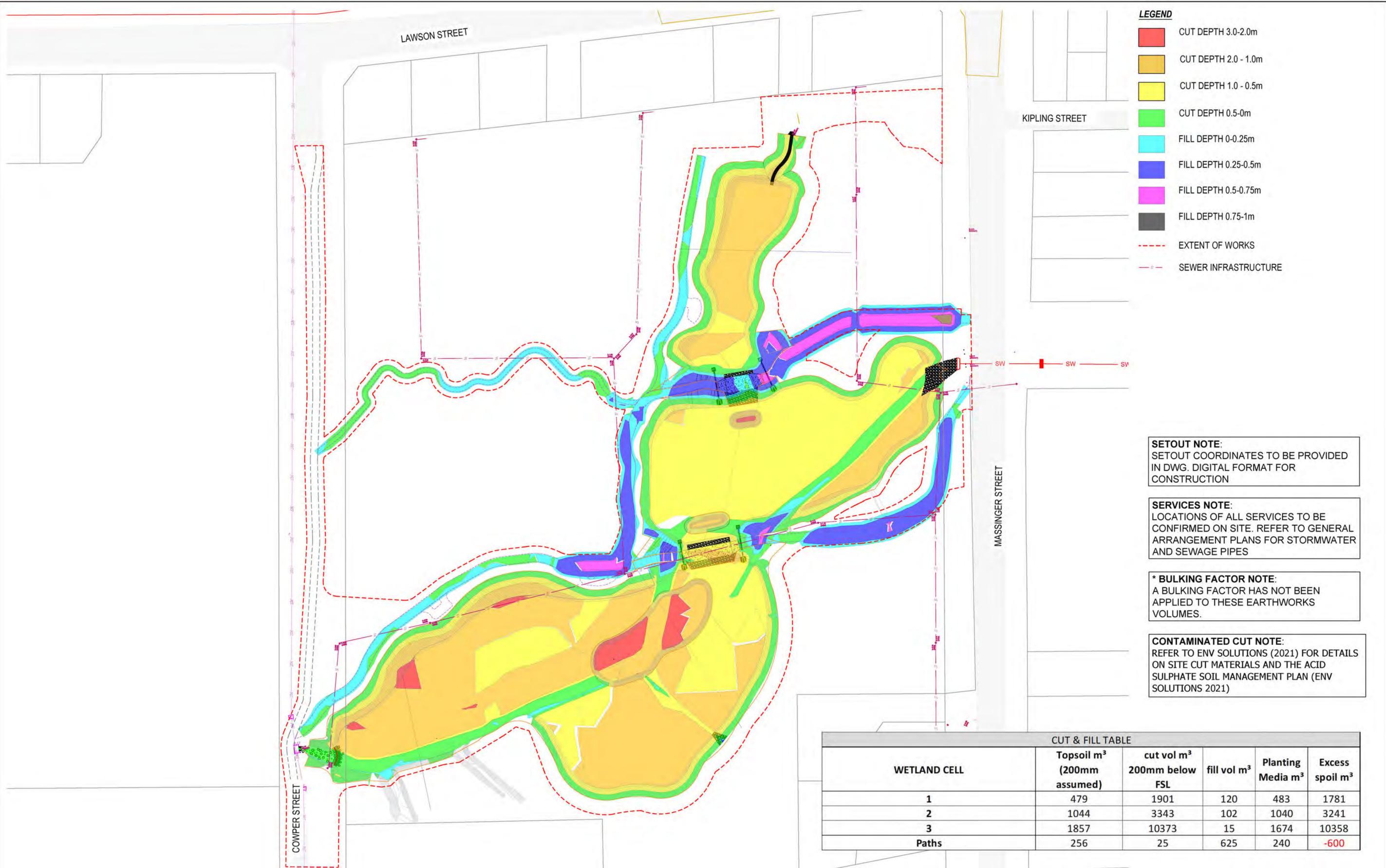
SCALE: 1:600 @ A1



DESIGNED: KC
DRAWN: RSTC
CHECKED: DM

CAD FILE No. **1-91194_SANDHILLS_DD.DWG**
SHEET No. **1-191194_DD_002**

REV. **F**



LEGEND

- CUT DEPTH 3.0-2.0m
- CUT DEPTH 2.0 - 1.0m
- CUT DEPTH 1.0 - 0.5m
- CUT DEPTH 0.5-0m
- FILL DEPTH 0-0.25m
- FILL DEPTH 0.25-0.5m
- FILL DEPTH 0.5-0.75m
- FILL DEPTH 0.75-1m
- EXTENT OF WORKS
- SEWER INFRASTRUCTURE

SETOUT NOTE:
SETOUT COORDINATES TO BE PROVIDED IN DWG. DIGITAL FORMAT FOR CONSTRUCTION

SERVICES NOTE:
LOCATIONS OF ALL SERVICES TO BE CONFIRMED ON SITE. REFER TO GENERAL ARRANGEMENT PLANS FOR STORMWATER AND SEWAGE PIPES

*** BULKING FACTOR NOTE:**
A BULKING FACTOR HAS NOT BEEN APPLIED TO THESE EARTHWORKS VOLUMES.

CONTAMINATED CUT NOTE:
REFER TO ENV SOLUTIONS (2021) FOR DETAILS ON SITE CUT MATERIALS AND THE ACID SULPHATE SOIL MANAGEMENT PLAN (ENV SOLUTIONS 2021)

| CUT & FILL TABLE | | | | | |
|------------------|---|---|-------------------------|-------------------------------|-----------------------------|
| WETLAND CELL | Topsoil m ³ (200mm assumed) | cut vol m ³ 200mm below FSL | fill vol m ³ | Planting Media m ³ | Excess spoil m ³ |
| 1 | 479 | 1901 | 120 | 483 | 1781 |
| 2 | 1044 | 3343 | 102 | 1040 | 3241 |
| 3 | 1857 | 10373 | 15 | 1674 | 10358 |
| Paths | 256 | 25 | 625 | 240 | -600 |

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
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| F | FOR TENDER | 25.08.2023 |



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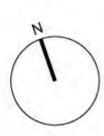
COWPER STREET ALIGNMENT BY PLANT OUTSIDE THE SCOPE OF THIS PROPOSAL

CONTRACTOR SHALL RECTIFY ANY IMPACT TO EXISTING LANDSCAPE ALONG COWPER STREET AND WHERE SHOULDER PLANTING IS NOT SHOWN

- LEGEND**
- - - EXTENT OF WORKS
 - △ CONCRETE CYCLE WAY REFER DETAIL 02_702
 - DECOMPOSED GRANITIC SAND PATH REFER DETAIL 01_702
 - EXISTING TREE REMOVED
 - EXISTING TREE RETAINED PROTECTED TO MEET AS 4970-2009
 - EXTENT OF EARTH WORKS
 - OPERATING WATER LEVEL (OWL)
 - FINISHED FLOOR LEVEL (FFL)
 - PROPOSED 0.2m CONTOURS
 - SEWER INFRASTRUCTURE
 - SEWER ACCESS HOLE
 - S/W PIPE HEADWALL
 - CADESTRAL BOUNDARIES
 - COWPER STREET ALIGNMENT

- P1 MACROPHYTE ZONE 2.6-2.9m AHD 6/m² REFER 01_500 & 05_703
- P2 MACROPHYTE ZONE 2.6-2.9m AHD 6/m² REFER 01_500 & 05_703
- P3 EPHEMERAL ZONE 2.9-3.2m AHD 6/m² REFER 04_500 & 02_703
- P4 DRY BATTER ZONE >3.2m AHD 4/m² REFER 04_500 & 03_703
- P4 DRY BATER ZONE LOW PLANTING NO TREES OR LARGE SHRUBS
- P5 MACROPHYTE ZONE 2.0-2.2m AHD 6/m² REFER 02_500 & 05_703
- P6 MACROPHYTE ZONE 2.0-2.2m AHD 6/m² REFER 02_500 & 05_703
- P7 MACROPHYTE ZONE 1.8-1.9m AHD 6/m² REFER 03_500 & 05_703
- P8 MACROPHYTE ZONE 1.8-1.9m AHD 6/m² REFER 03_500 & 05_703
- P9 FROG MARSH ZONE 1.8-1.9m AHD 6/m² REFER 03_500 & 05_703
- P10 FOREST PLANTING ZONE >1.8m AHD 4/m² REFER 03_500 & 05_703
- P10 FOREST PLANTING ZONE LOW NO TREES OR LARGE SHRUBS
- P11 SHOULDER PLANTING ZONE 4/m² REFER SCHEDULES 04_500 & 03_703
- SHADE FEATURE TREE REFER DETAIL 01_703 & 05_500

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
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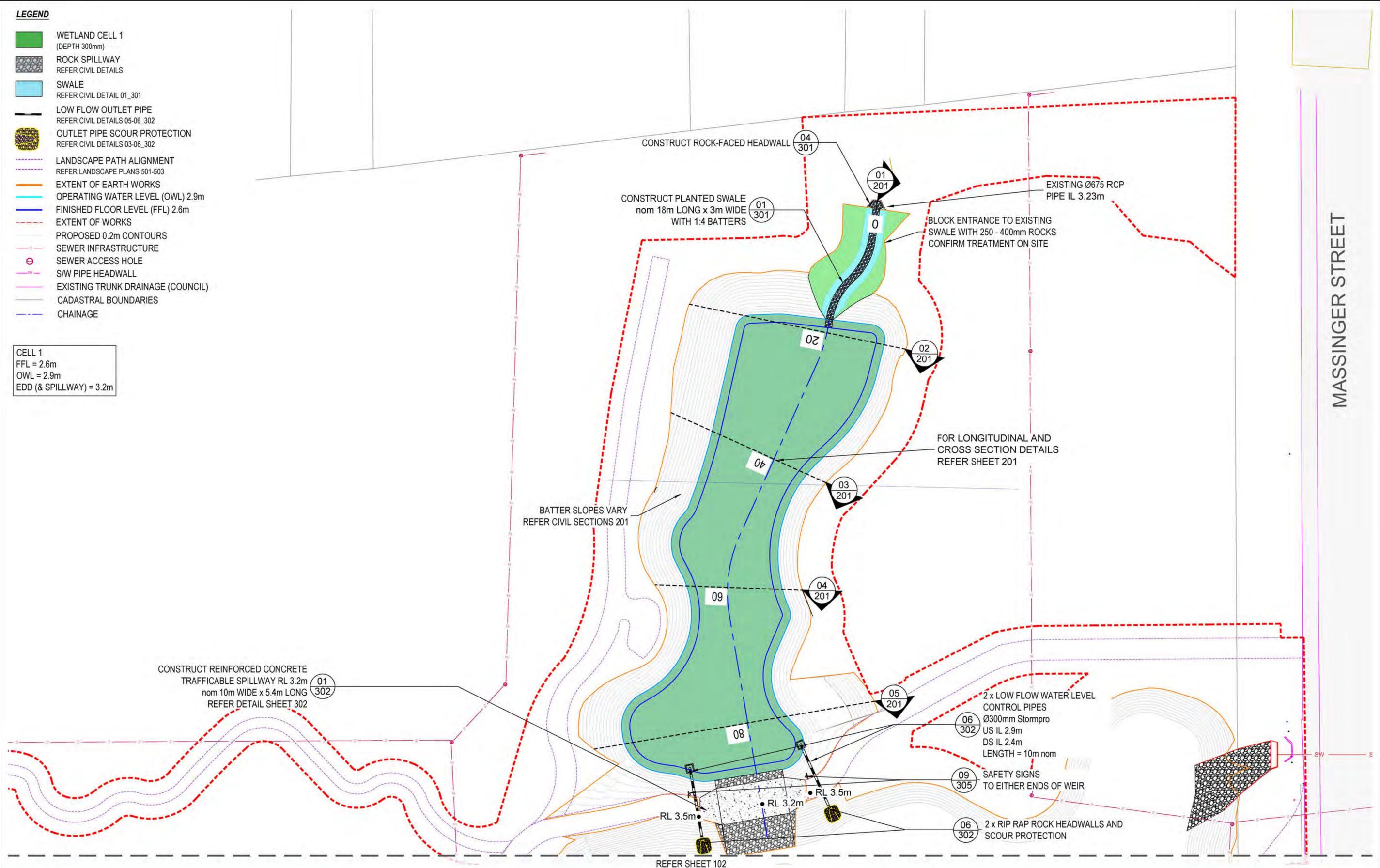


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LEGEND

- WETLAND CELL 1
(DEPTH 300mm)
- ROCK SPILLWAY
REFER CIVIL DETAILS
- SWALE
REFER CIVIL DETAIL 01_301
- LOW FLOW OUTLET PIPE
REFER CIVIL DETAILS 05-06_302
- OUTLET PIPE SCOUR PROTECTION
REFER CIVIL DETAILS 03-06_302
- LANDSCAPE PATH ALIGNMENT
REFER LANDSCAPE PLANS 501-503
- EXTENT OF EARTH WORKS
- OPERATING WATER LEVEL (OWL) 2.9m
- FINISHED FLOOR LEVEL (FFL) 2.6m
- EXTENT OF WORKS
- PROPOSED 0.2m CONTOURS
- SEWER INFRASTRUCTURE
- SEWER ACCESS HOLE
- S/W PIPE HEADWALL
- EXISTING TRUNK DRAINAGE (COUNCIL)
- CADASTRAL BOUNDARIES
- CHAINAGE

CELL 1
FFL = 2.6m
OWL = 2.9m
EDD (& SPILLWAY) = 3.2m



MASSINGER STREET

AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au

CLIENT:

DRAWING: **EARTHWORKS & LAYOUT PLANS 01**

PROJECT: **SANDHILLS WETLAND DETAILED DESIGN PACKAGE**

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
| B | DETAILED DESIGN PACKAGE 70% | 28.02.2022 |
| C | DETAILED DESIGN PACKAGE 100% | 02.11.2022 |
| D | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 17.11.2022 |
| E | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 13.12.2022 |
| F | FOR TENDER | 25.08.2023 |

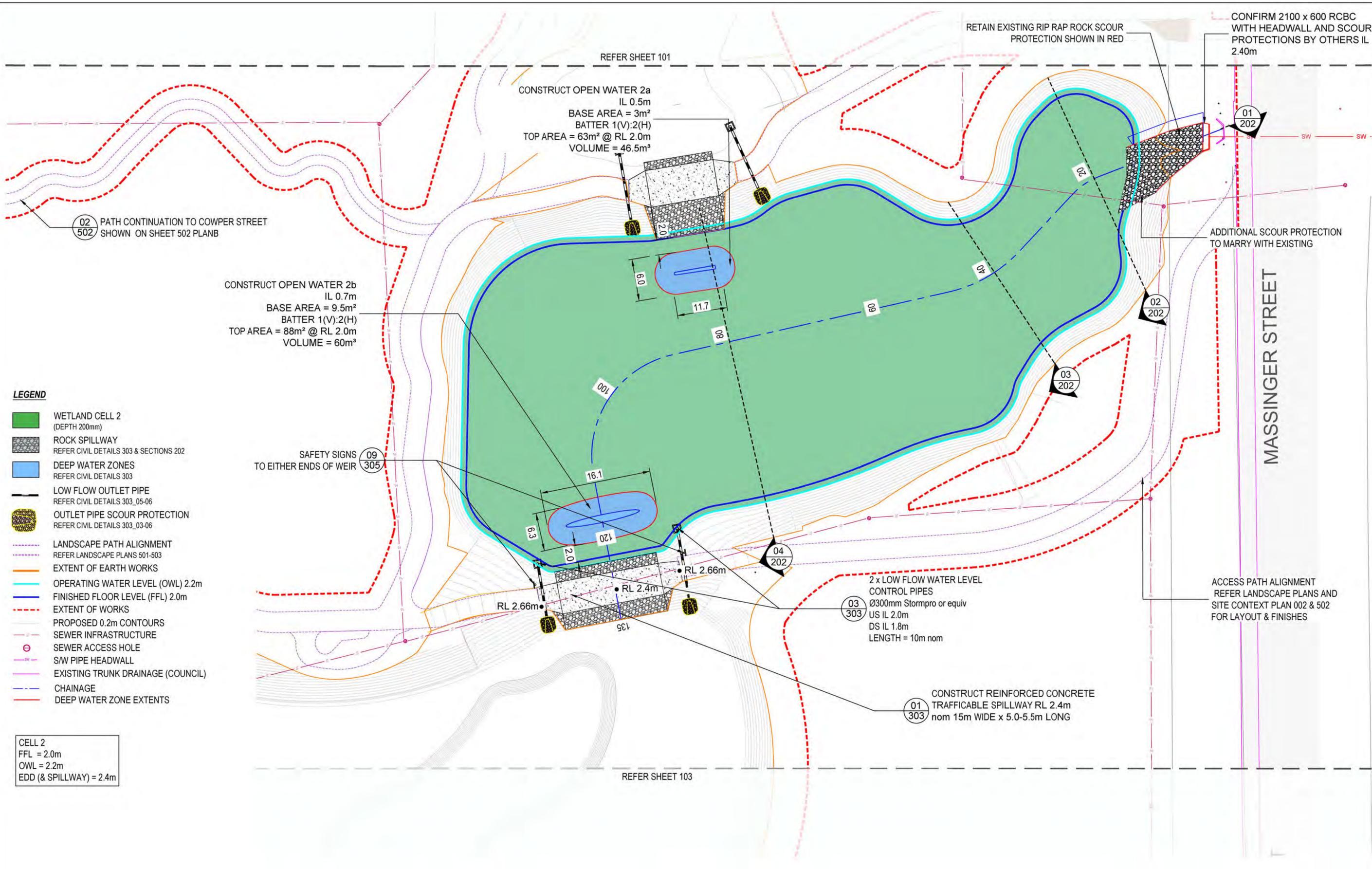
DO NOT SCALE FROM PLANS. TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.

SCALE: 1:250 @ A1

DESIGNED: KC
DRAWN: RS/TC
CHECKED: DM

CAD FILE No. **1-91194_SANDHILLS_DD.DWG**
SHEET No. **1-191194_DD_101**

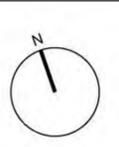
REV. **F**



- LEGEND**
- WETLAND CELL 2 (DEPTH 200mm)
 - ROCK SPILLWAY REFER CIVIL DETAILS 303 & SECTIONS 202
 - DEEP WATER ZONES REFER CIVIL DETAILS 303
 - LOW FLOW OUTLET PIPE REFER CIVIL DETAILS 303_05-06
 - OUTLET PIPE SCOUR PROTECTION REFER CIVIL DETAILS 303_03-06
 - LANDSCAPE PATH ALIGNMENT REFER LANDSCAPE PLANS 501-503
 - EXTENT OF EARTH WORKS
 - OPERATING WATER LEVEL (OWL) 2.2m
 - FINISHED FLOOR LEVEL (FFL) 2.0m
 - EXTENT OF WORKS
 - PROPOSED 0.2m CONTOURS
 - SEWER INFRASTRUCTURE
 - SEWER ACCESS HOLE
 - S/W PIPE HEADWALL
 - EXISTING TRUNK DRAINAGE (COUNCIL)
 - CHAINAGE
 - DEEP WATER ZONE EXTENTS

CELL 2
 FFL = 2.0m
 OWL = 2.2m
 EDD (& SPILLWAY) = 2.4m

| REV. | ISSUE / AMENDMENTS | DATE |
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LEGEND

- WETLAND CELL 3
(DEPTH 100mm)
- ROCK SPILLWAY
REFER CIVIL DETAILS SHEET 303
- DEEPWATER ZONE
REFER SECTIONS 203
- EARTH BUND
REFER CIVIL DETAILS 304
- OUTLET SWALE
REFER CIVIL DETAILS 304
- LOW FLOW OUTLET PIPE
REFER CIVIL DETAILS 303_05-06
- OUTLET PIPE SCOUR PROTECTION
REFER CIVIL DETAILS 303_03-06
- LANDSCAPE PATH ALIGNMENT
REFER LANDSCAPE PLANS 501-503
- EXTENT OF EARTH WORKS
- OPERATING WATER LEVEL (OWL) 2.9m
- FINISHED FLOOR LEVEL (FFL) 2.6m
- EXTENT OF WORKS
- PROPOSED 0.2m CONTOURS
- SEWER INFRASTRUCTURE
- SEWER ACCESS HOLE
- S/W PIPE HEADWALL
- CHAINAGE
- DEEP WATER ZONE EXTENTS
- COWPER STREET ALIGNMENT BY OTHERS

CELL 3
FFL = 1.8m
OWL = 1.9m



AVOID IMPACTING SEWER MAINS WHEN GRADING THIS SLOPE

AVOID IMPACTING SEWER MAINS WHEN GRADING THIS SLOPE
MAKE GOOD CONNECTION TO EXISTING STORMWATER PIT REFER SHEET 304
BALUSTRADE INSTALLED ON TOP TO MEET NON-FALL REQUIREMENTS

CONSTRUCT OPEN WATER 3
IL 0.8m
BASE AREA = 575m²
BATTER 1(V):2(H)
TOP AREA = 805m² @ RL 1.8m
VOLUME = 680m³

CONSTRUCT LOCAL SCOUR PROTECTION DOWN THE PROPOSED BATTER FROM THE EXISTING DRAINAGE SWALE
RIP RAP ROCK D₅₀ = 150mm ON 100mm THICK UNDERLAYER
ROCK D₅₀ = 50mm ON GEOTEXTILE UNDERLAY BIDIM A44 OR EQUIVALENT

REFER SHEET 102

EXISTING SEWER MAIN IL 1.2m
INDICATIVE INLET LEVEL AND LOCATION ONLY
CONTRACTOR TO CONFIRM ON SITE

COWPER STREET



AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au

CLIENT:



Byron Shire Council

DRAWING: **EARTHWORKS & LAYOUT PLANS 03**

PROJECT: SANDHILLS WETLAND
DETAILED DESIGN PACKAGE

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
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| E | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 13.12.2022 |
| F | FOR TENDER | 25.08.2023 |



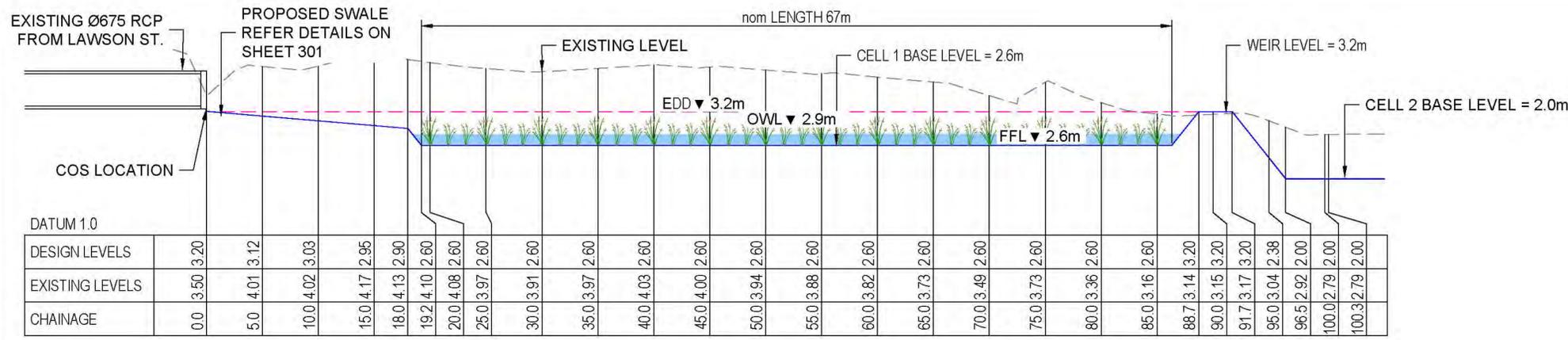
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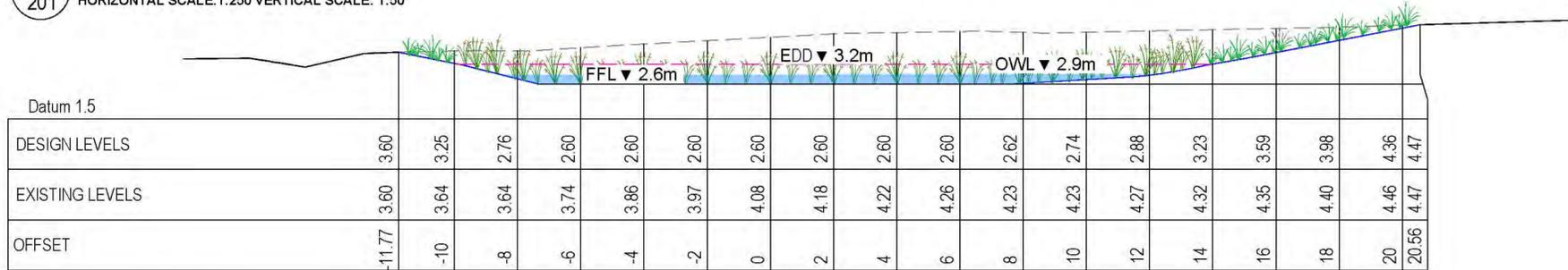
DESIGNED: KC
DRAWN: RS/TC
CHECKED: DM

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SHEET No. **1-191194_DD_103**

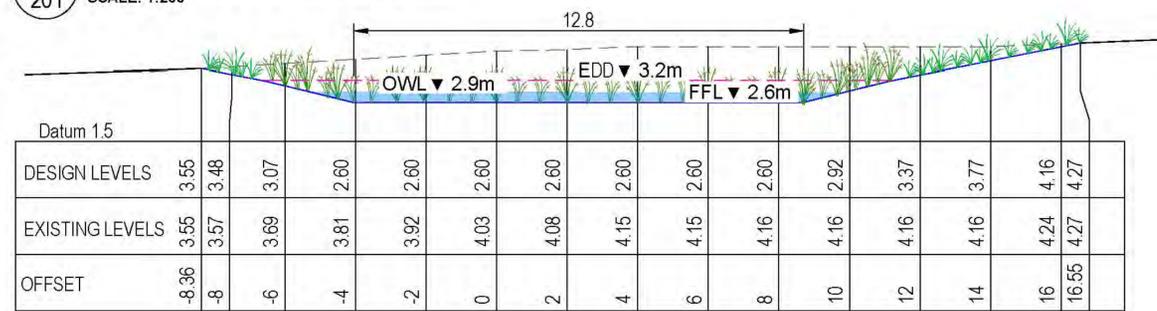
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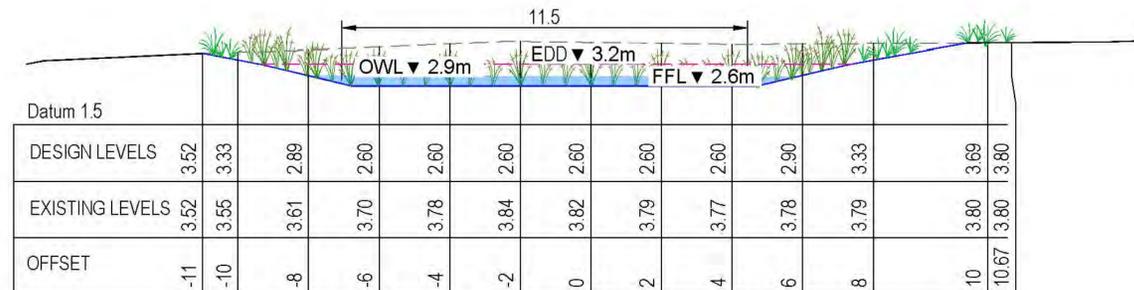
01 LONGITUDINAL SECTION
 201 HORIZONTAL SCALE: 1:250 VERTICAL SCALE: 1:50



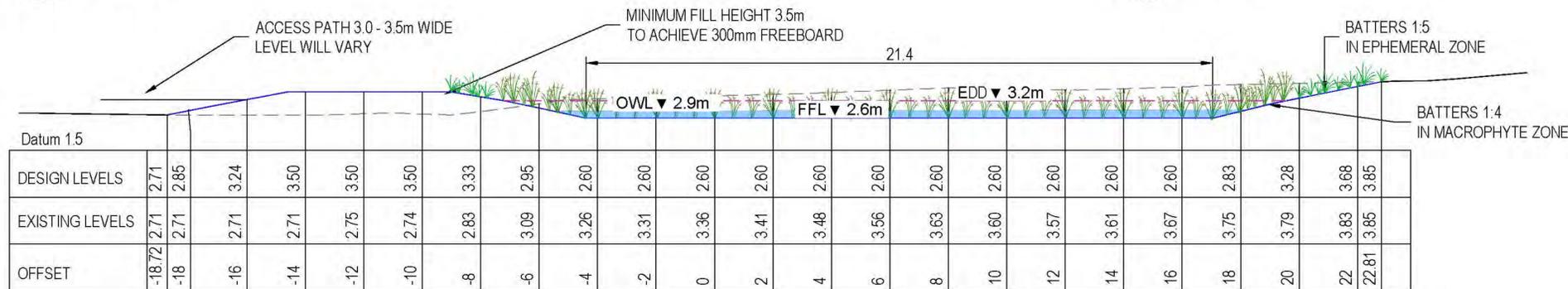
02 CROSS SECTION CHAINAGE 20
 201 SCALE: 1:200



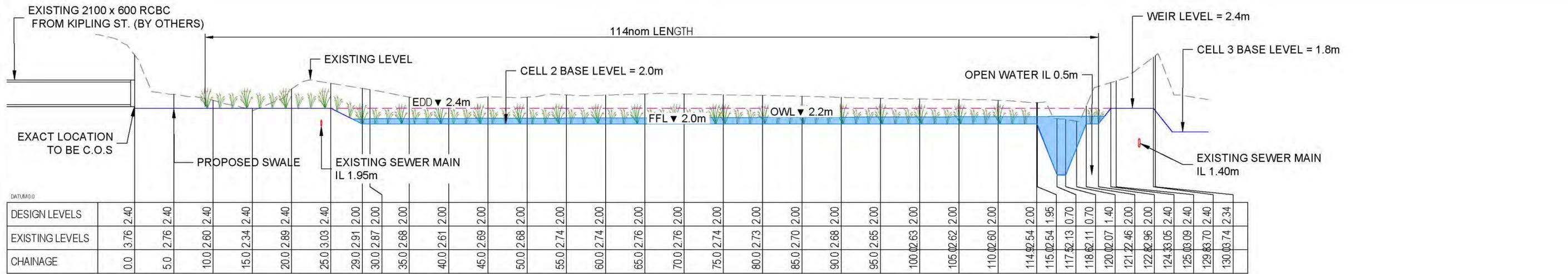
03 CROSS SECTION CHAINAGE 40
 201 SCALE: 1:200



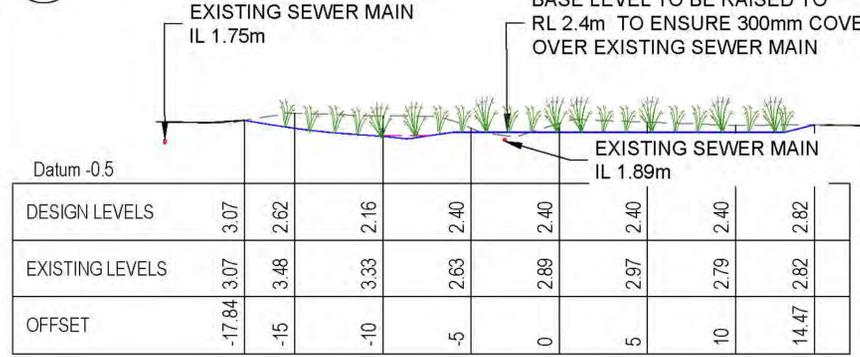
04 CROSS SECTION CHAINAGE 60
 201 SCALE: 1:200



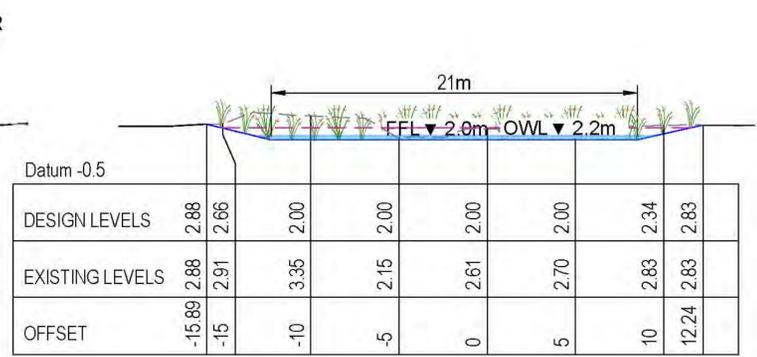
05 CROSS SECTION CHAINAGE 80
 201 SCALE: 1:200



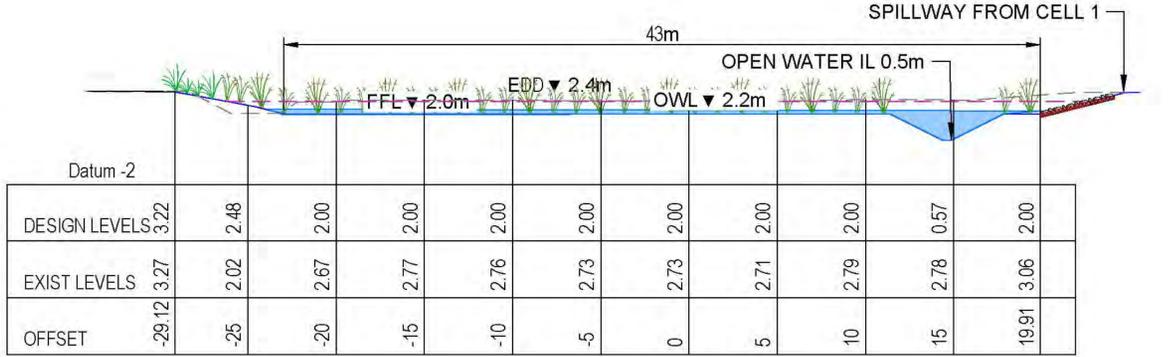
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202 HORIZONTAL SCALE: 1:250 VERTICAL SCALE: 1:50



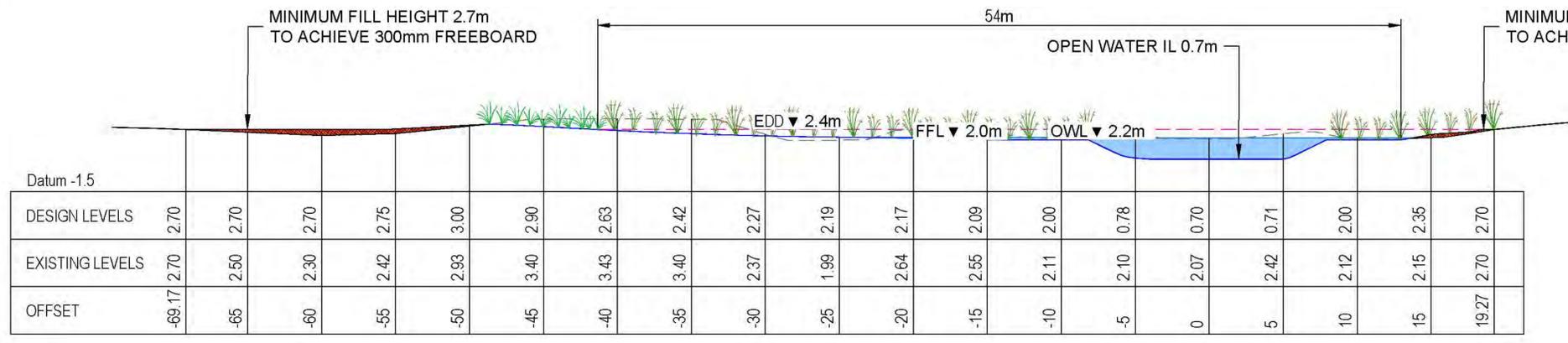
02 CROSS SECTION CHAINAGE 20
202 SCALE: 1:200



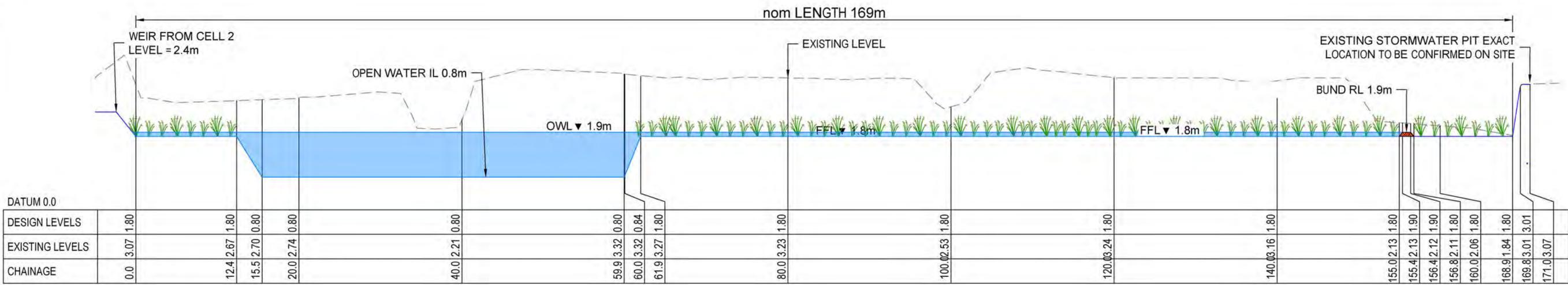
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202 SCALE: 1:200



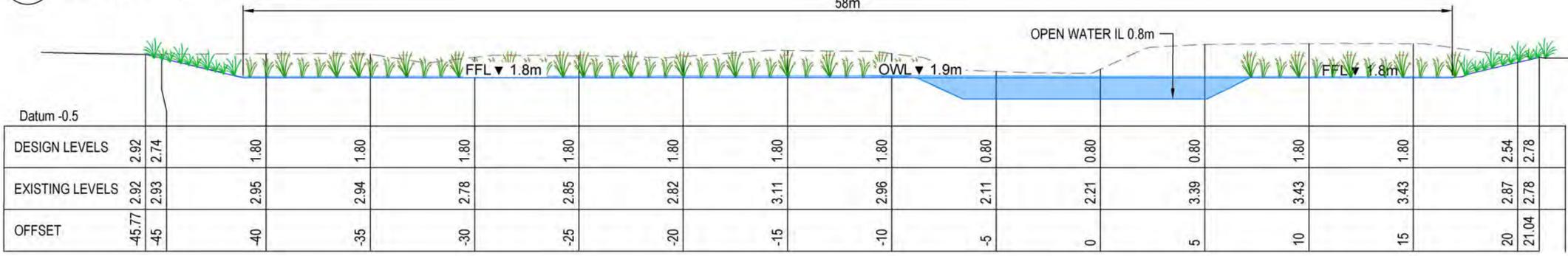
04 CROSS SECTION CHAINAGE 80
202 SCALE: 1:200



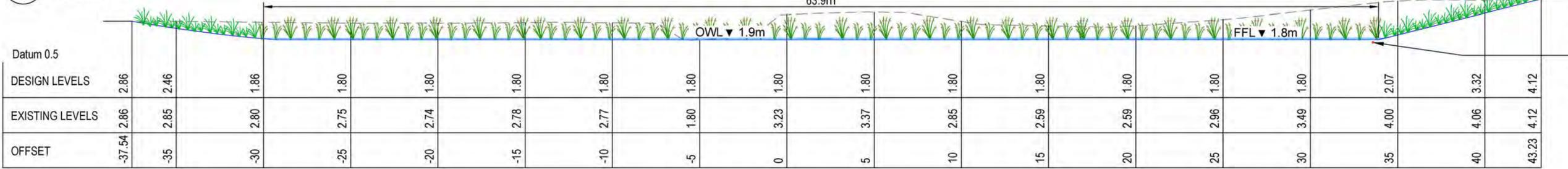
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202 SCALE: 1:200



01 LONGITUDINAL SECTION
203 HORIZONTAL SCALE: 1:250 VERTICAL SCALE: 1:50

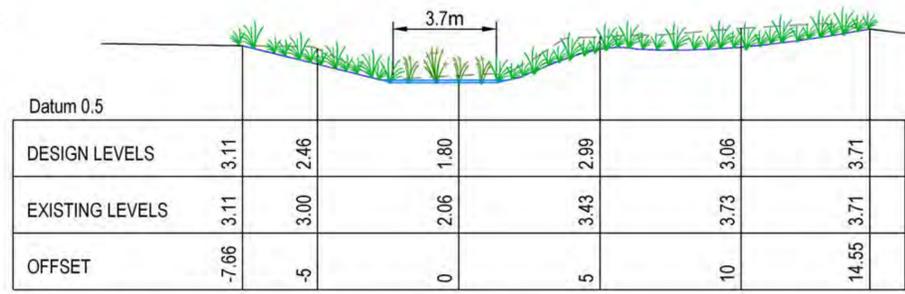
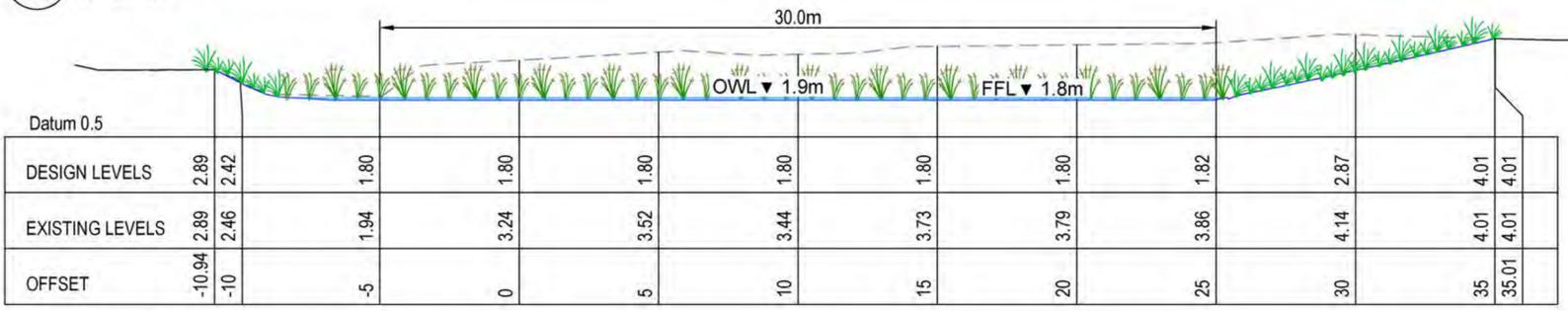


02 CROSS SECTION CHAINAGE 40
203 SCALE: 1:200



EXISTING SEWER MAIN
IL 1.2m
INDICATIVE INLET LEVEL
AND LOCATION ONLY
CONTRACTOR TO
CONFIRM ON SITE

03 CROSS SECTION CHAINAGE 80
203 SCALE: 1:200



04 CROSS SECTION CHAINAGE 120
203 SCALE: 1:200

05 CROSS SECTION CHAINAGE 160
203 SCALE: 1:200 CH 160

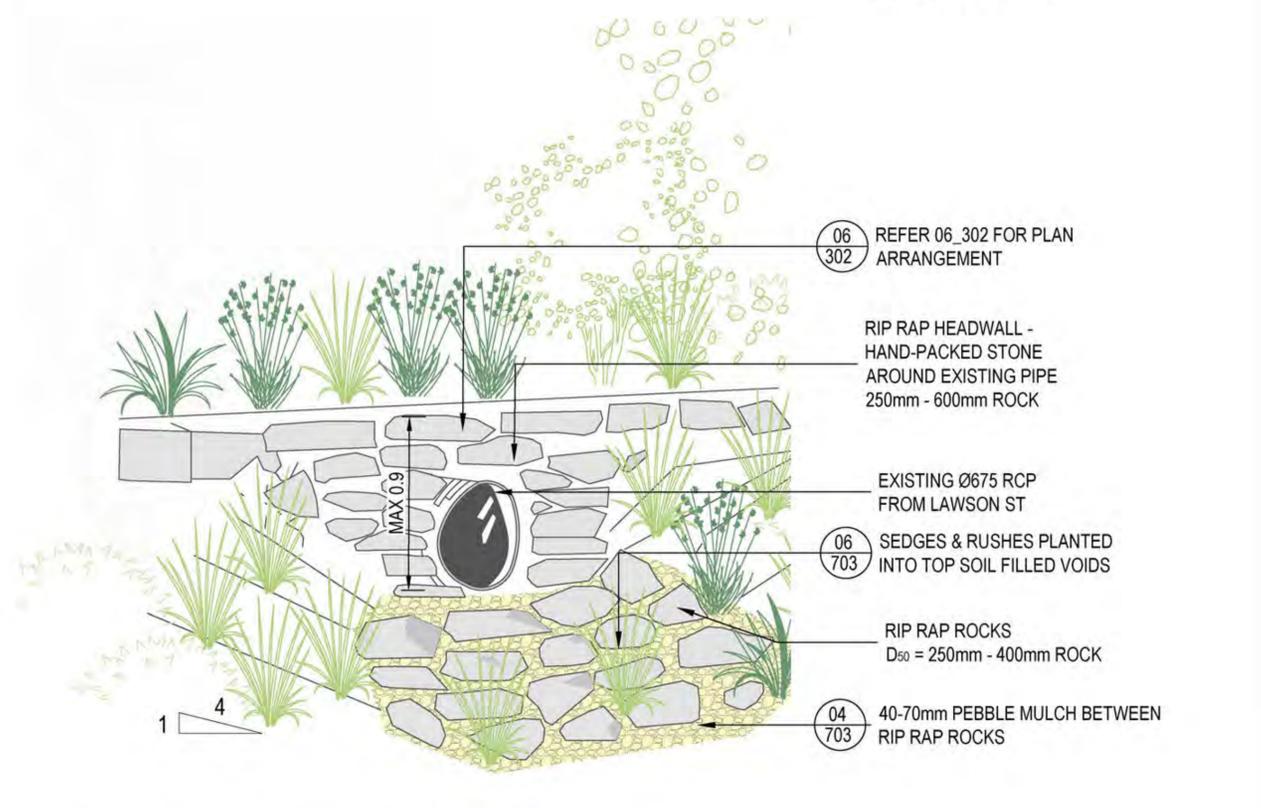
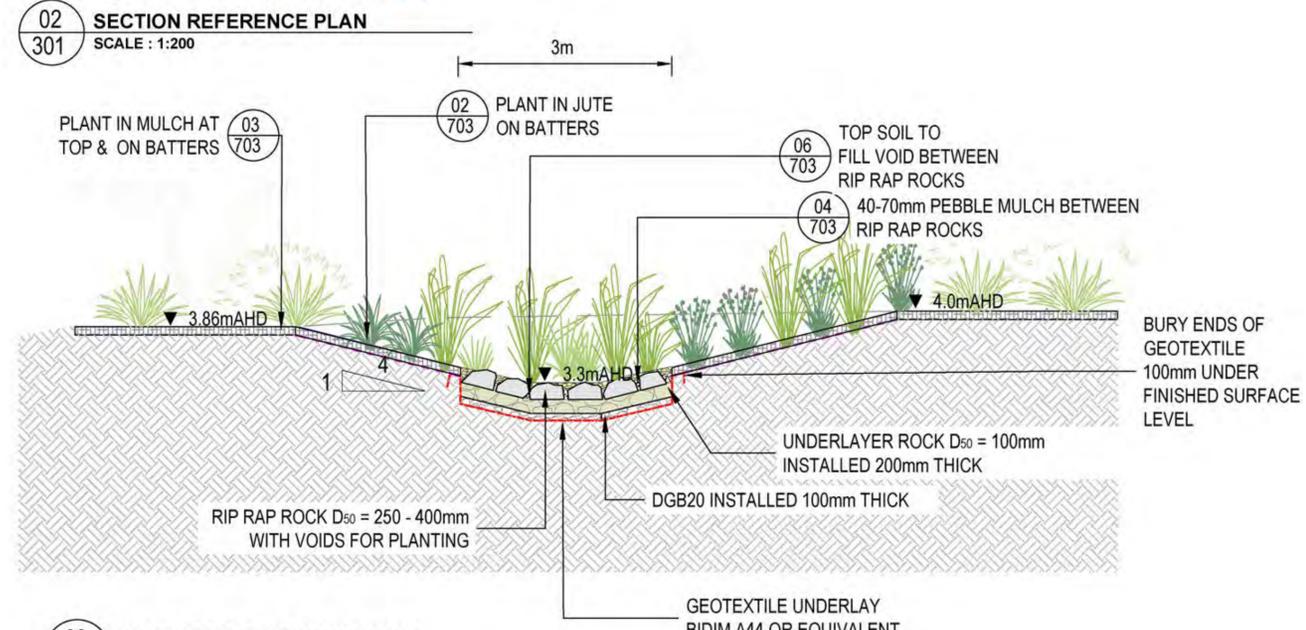
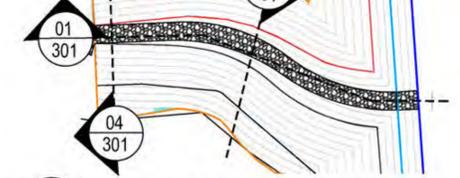
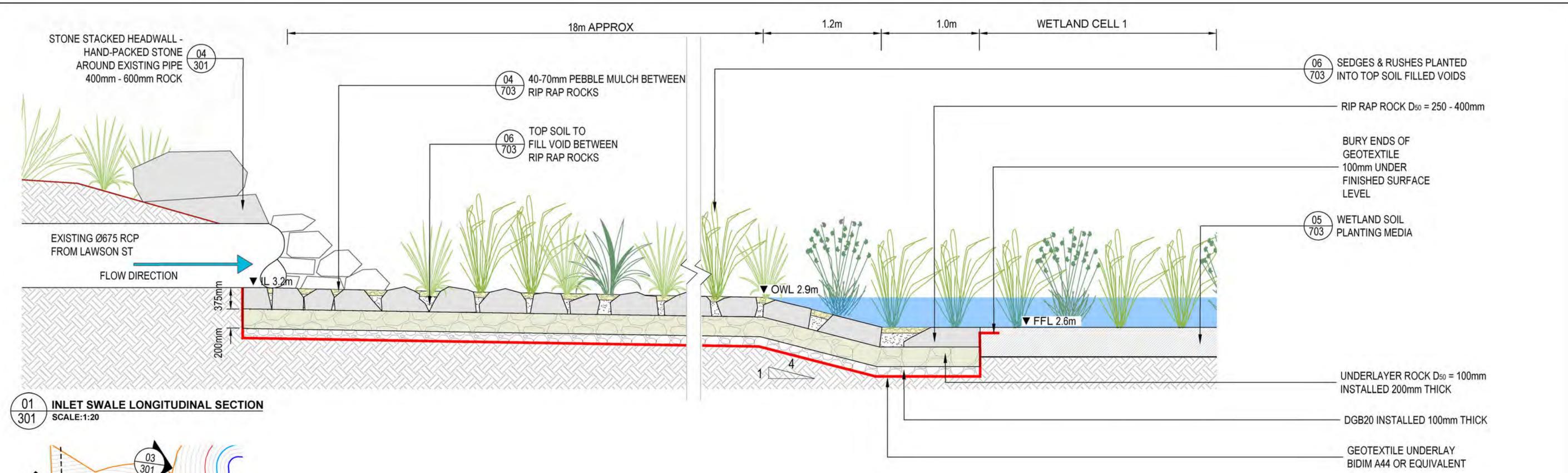


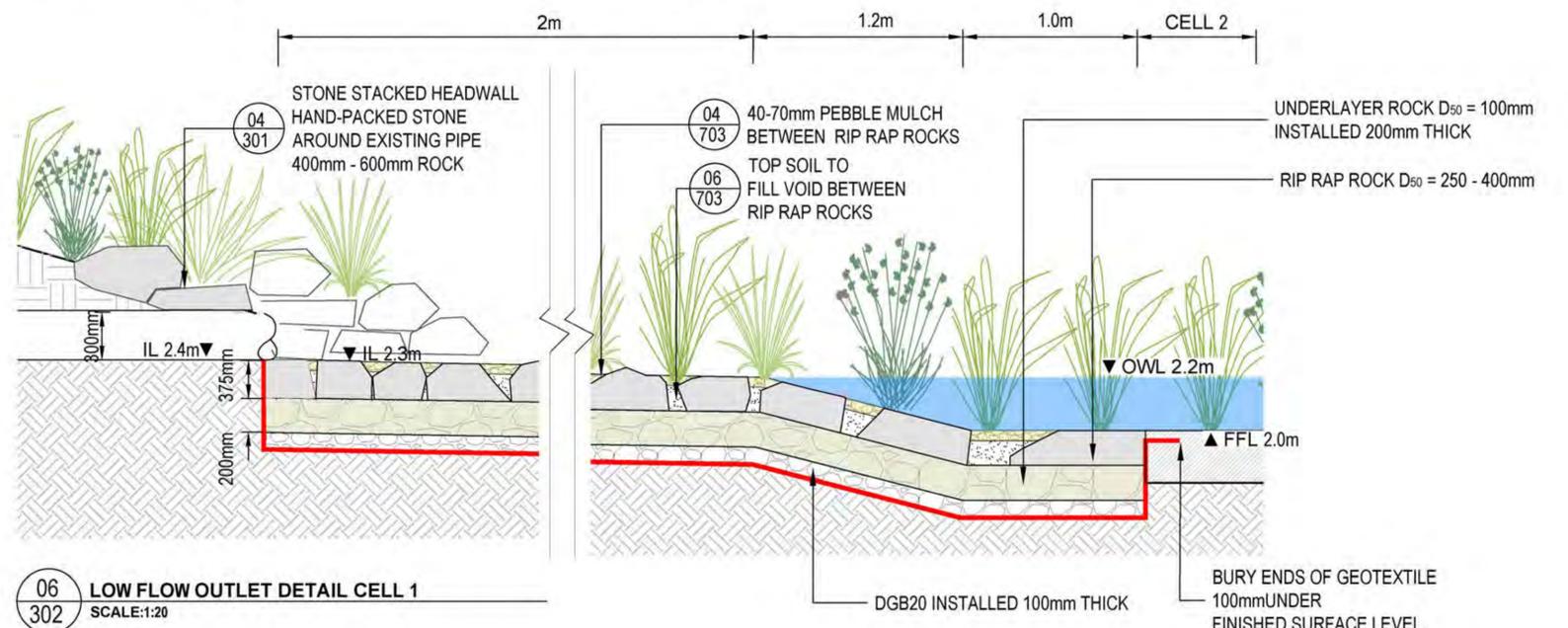
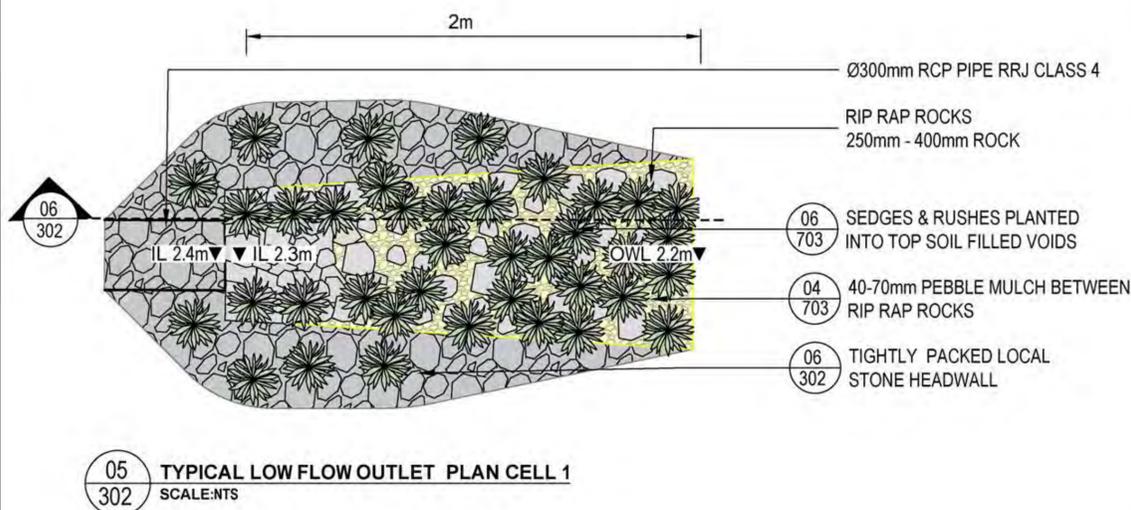
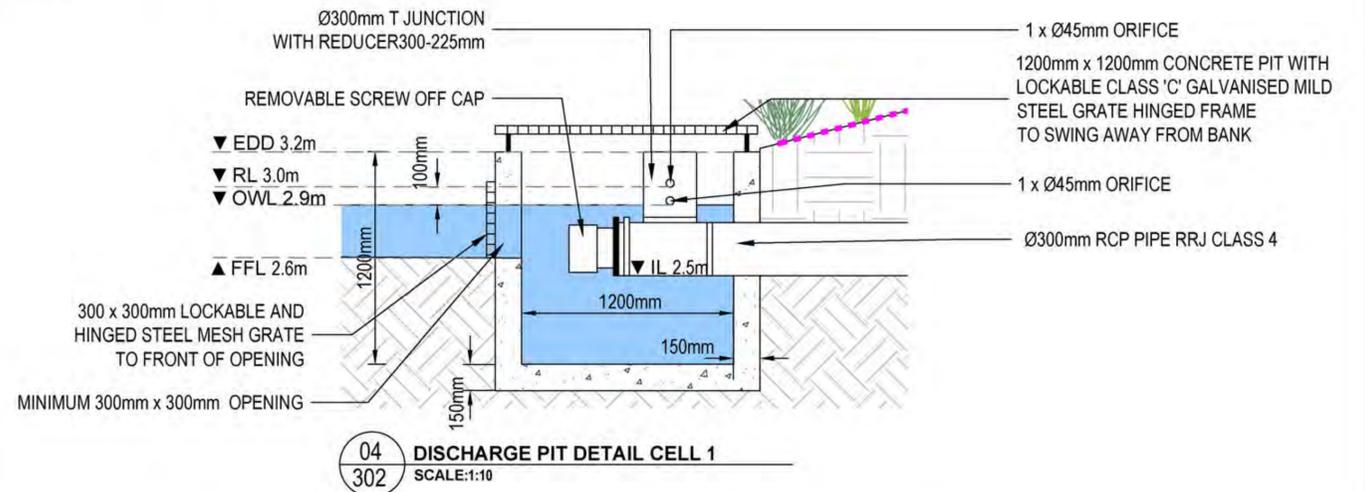
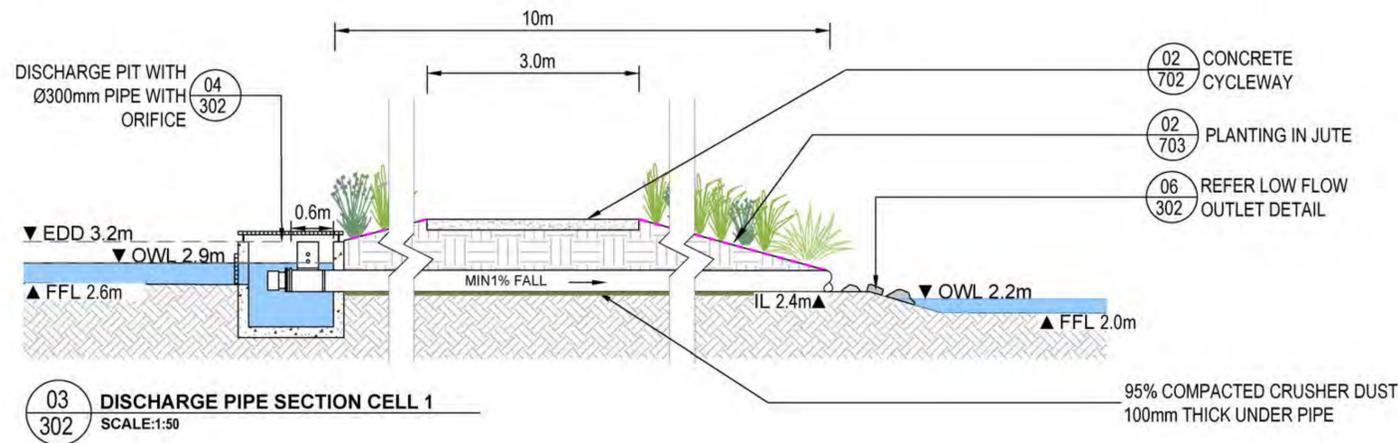
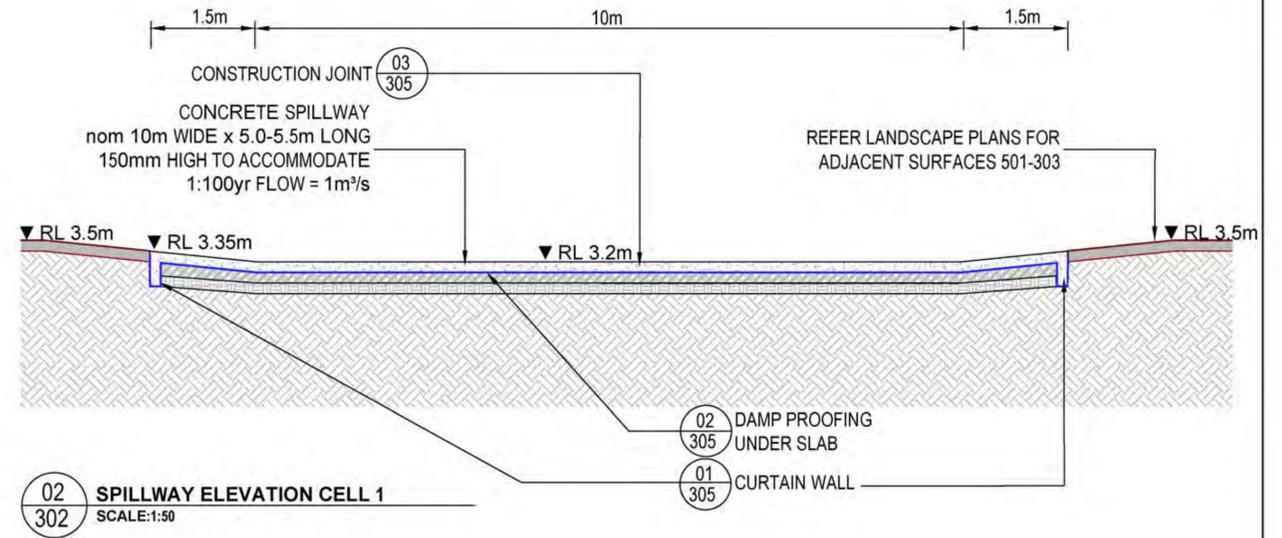
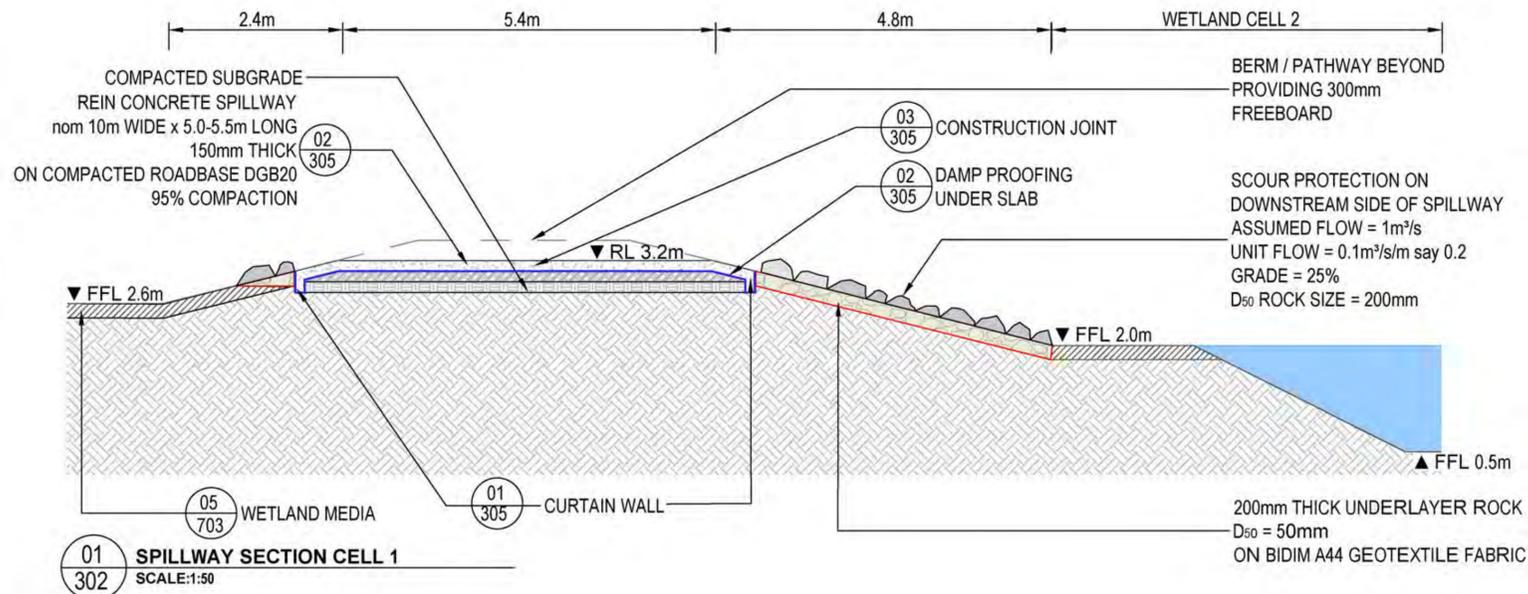
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PROJECT: SANDHILLS WETLAND DETAILED DESIGN PACKAGE

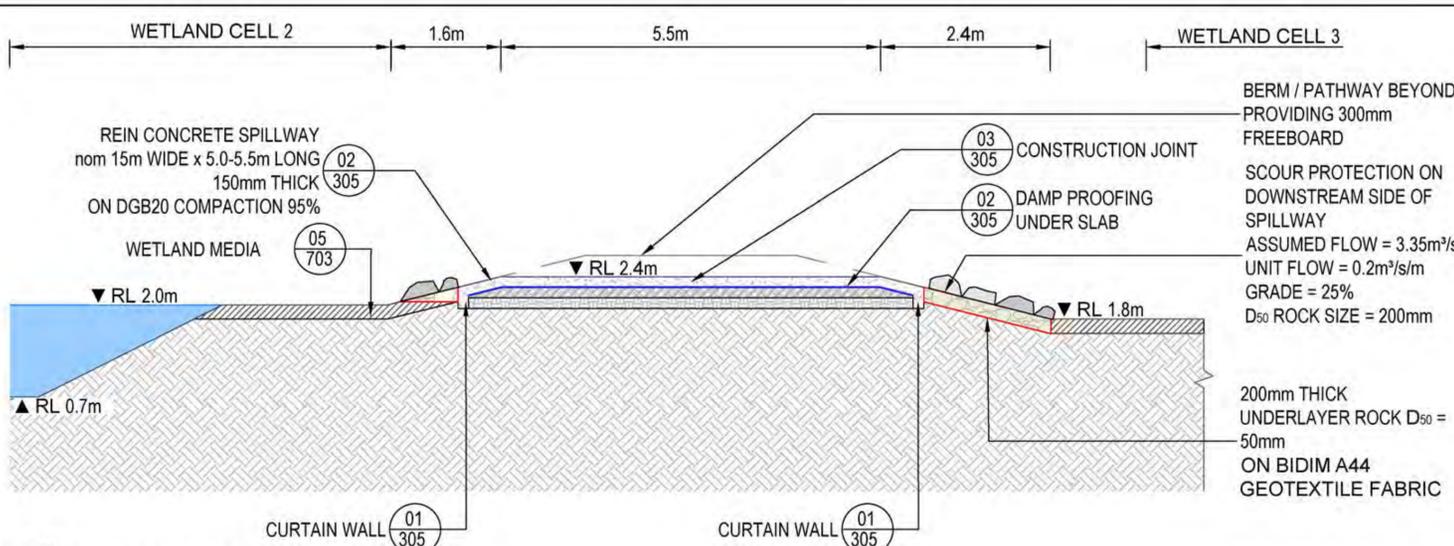
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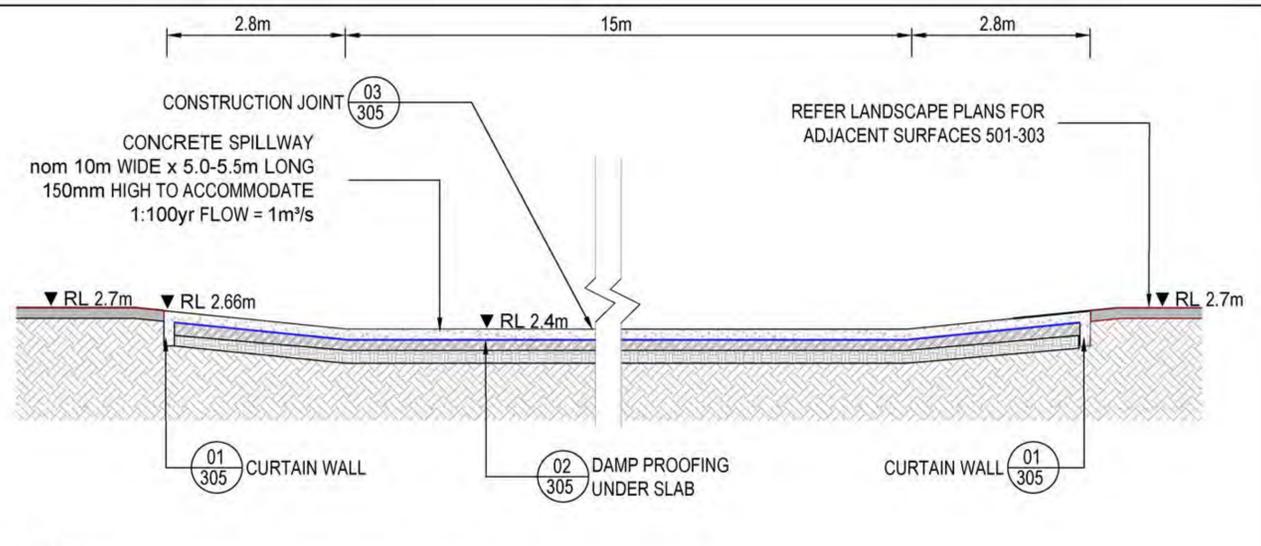
| SCALE AS SHOWN | | REV. F |
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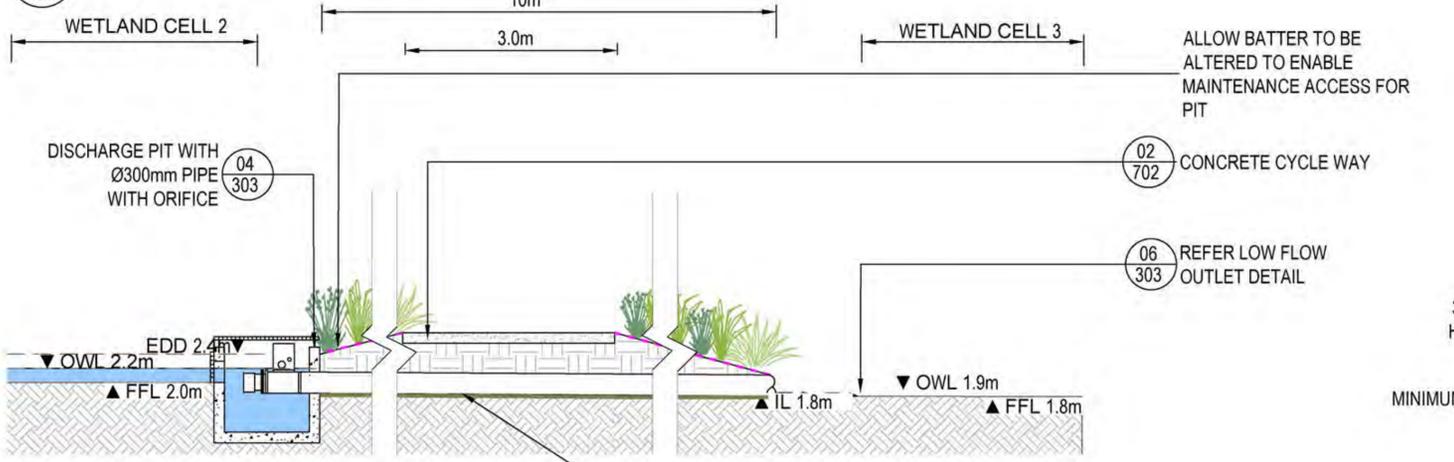




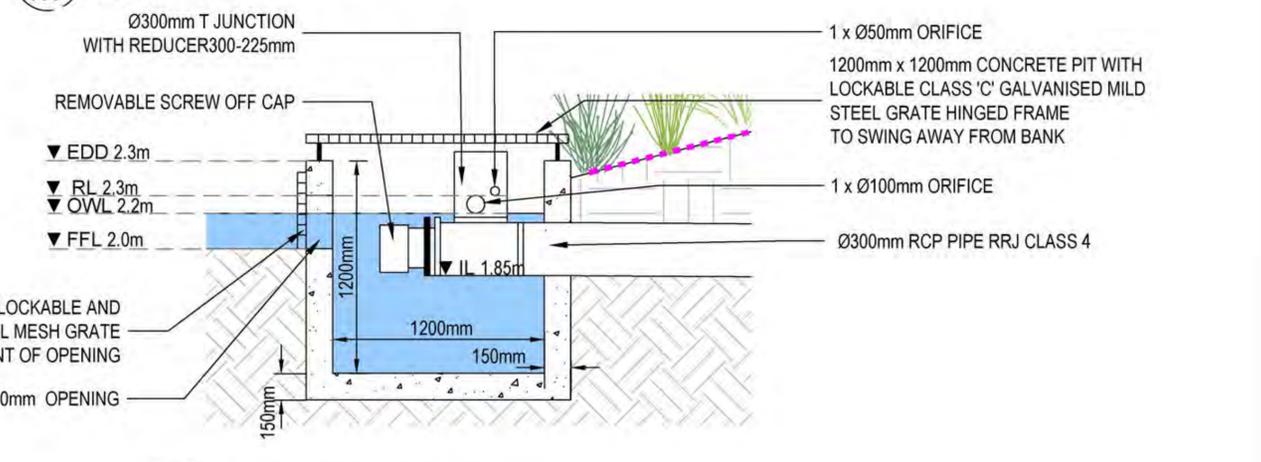
01/303 TYPICAL SPILLWAY SECTION CELL 2
SCALE:1:50



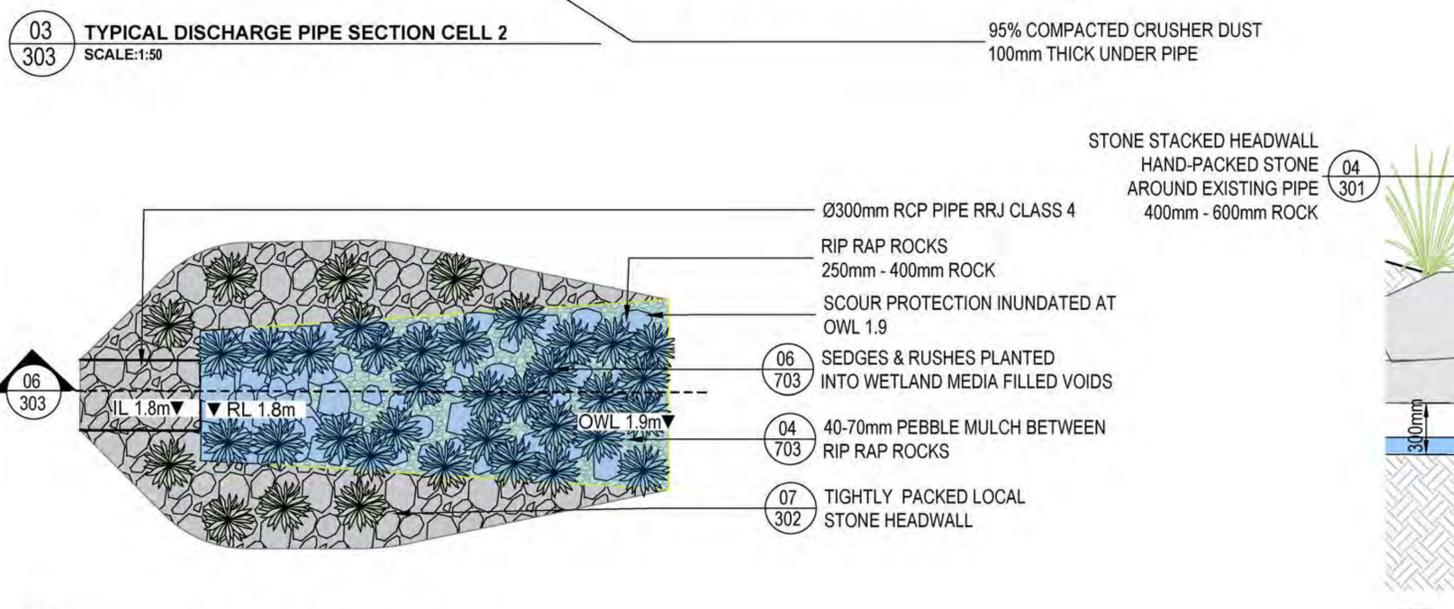
02/303 TYPICAL SPILLWAY ELEVATION CELL 2
SCALE:1:50



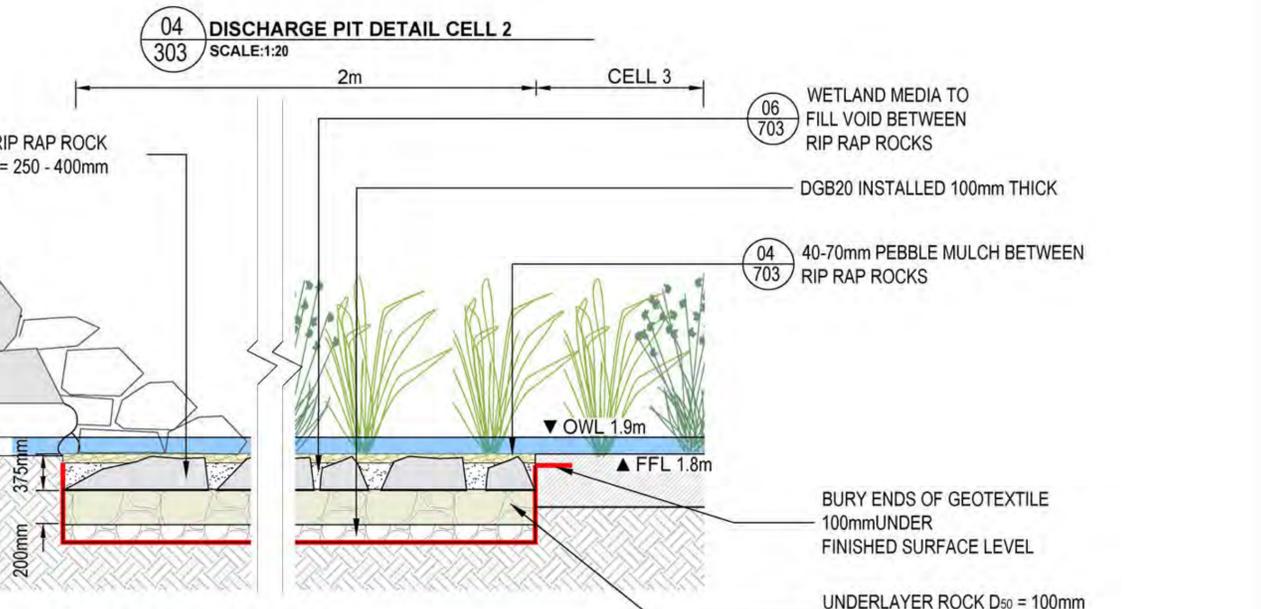
03/303 TYPICAL DISCHARGE PIPE SECTION CELL 2
SCALE:1:50



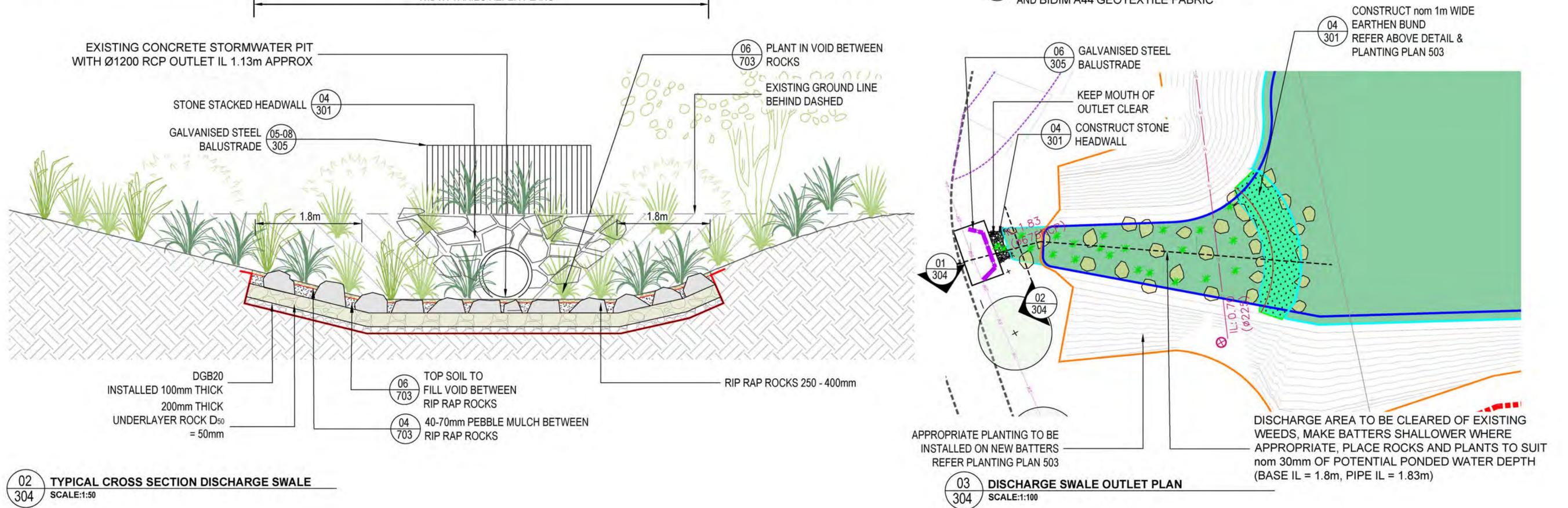
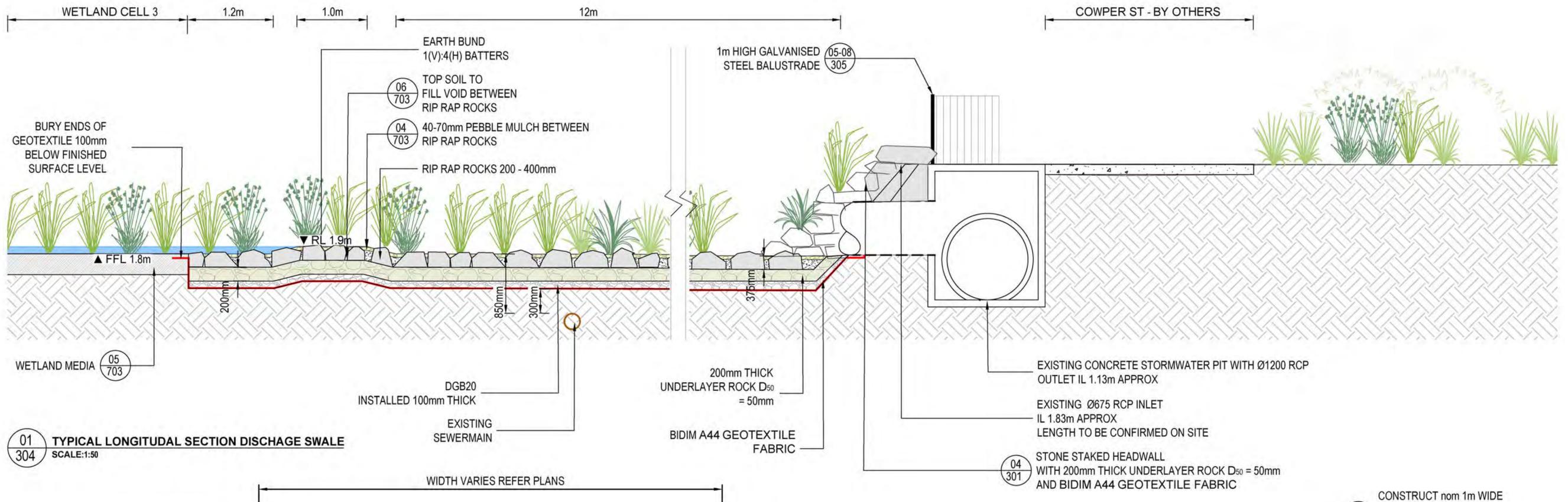
04/303 DISCHARGE PIT DETAIL CELL 2
SCALE:1:20

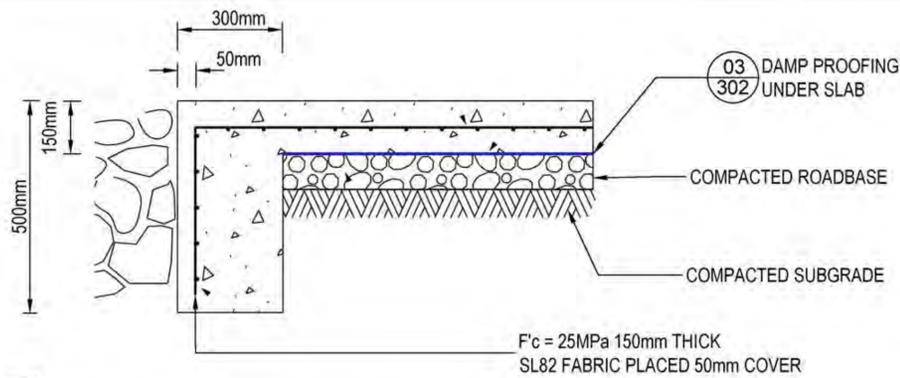


05/303 TYPICAL LOW FLOW OUTLET PLAN CELL 2
SCALE:NTS

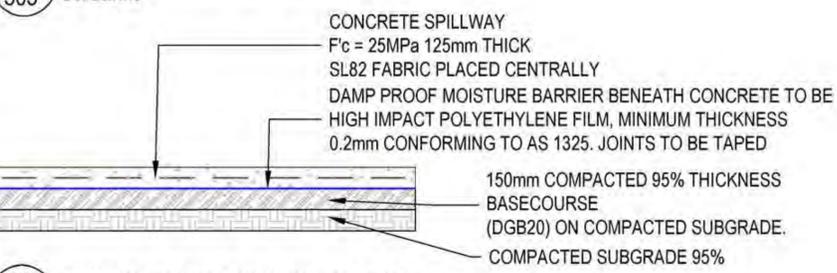


06/303 LOW FLOW OUTLET DETAIL SECTION CELL 2
SCALE:1:20

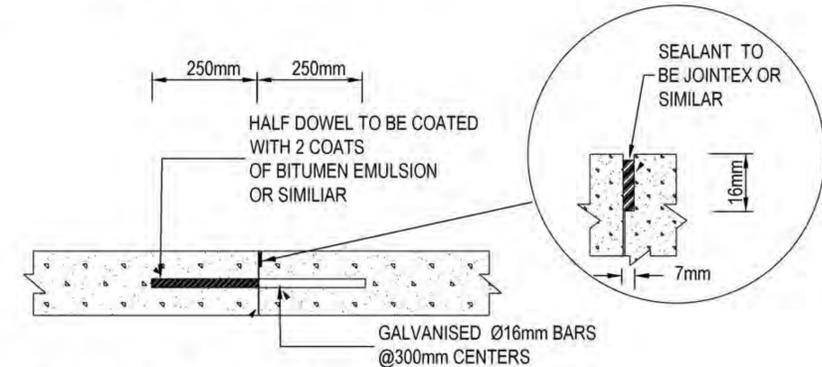




01 CURTAIN WALL DETAIL CELL 1 & 2
305 SCALE:1:10

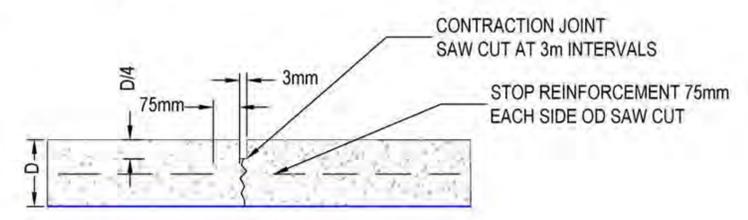


02 CONCRETE SPILLWAY DETAIL CELL 1 & 2
305 SCALE:1:50

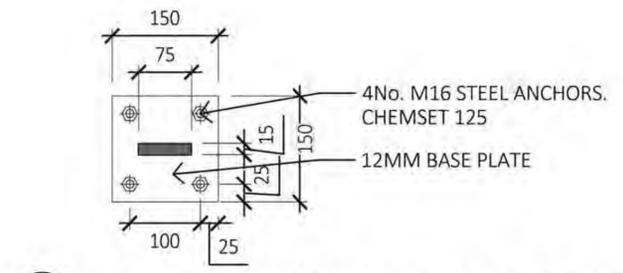


NOTE: DOWELLED JOINTS ARE TO BE PROVIDED AT MAXIMUM OF 12m SPACINGS
EXPANSION JOINTS CAN BE REPLACED WITH CONNELLY OR DANLEY EXPANSION JOINTS OR APPROVED SIMILAR

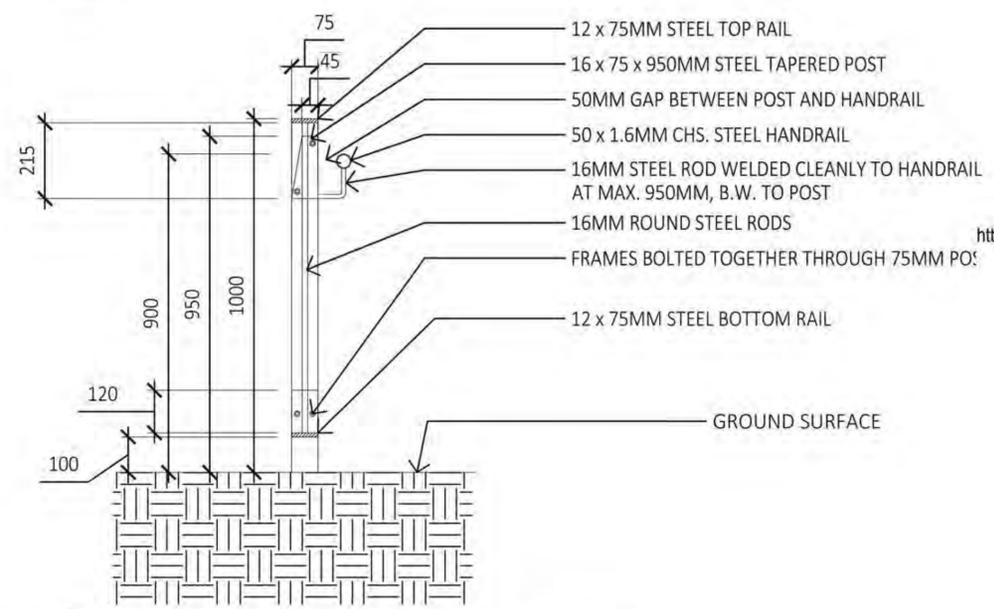
03 CONSTRUCTION JOINT
305 SCALE:1:10



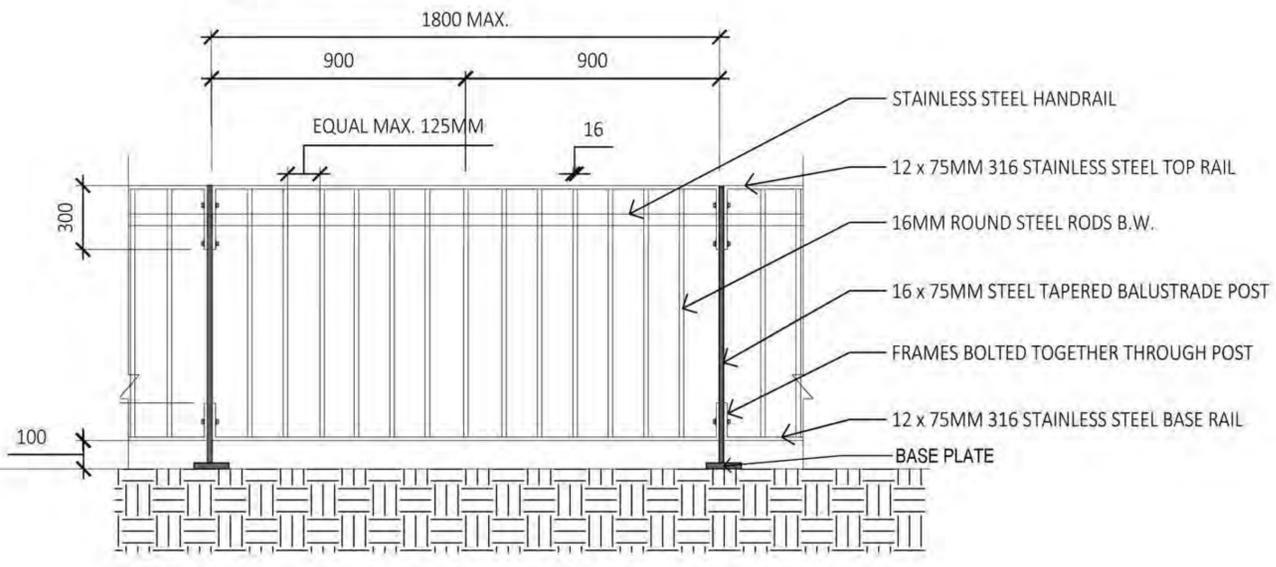
04 CONTRACTION JOINT - SAWN NOT TOOLED
305 SCALE:NTS



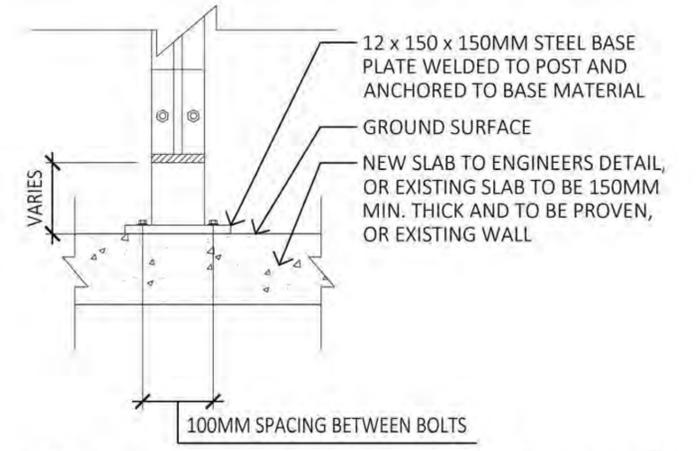
05 HOT DIP GALVANISED STEEL BALUSTRADE BASE PLATE PLAN
305 SCALE:1:5



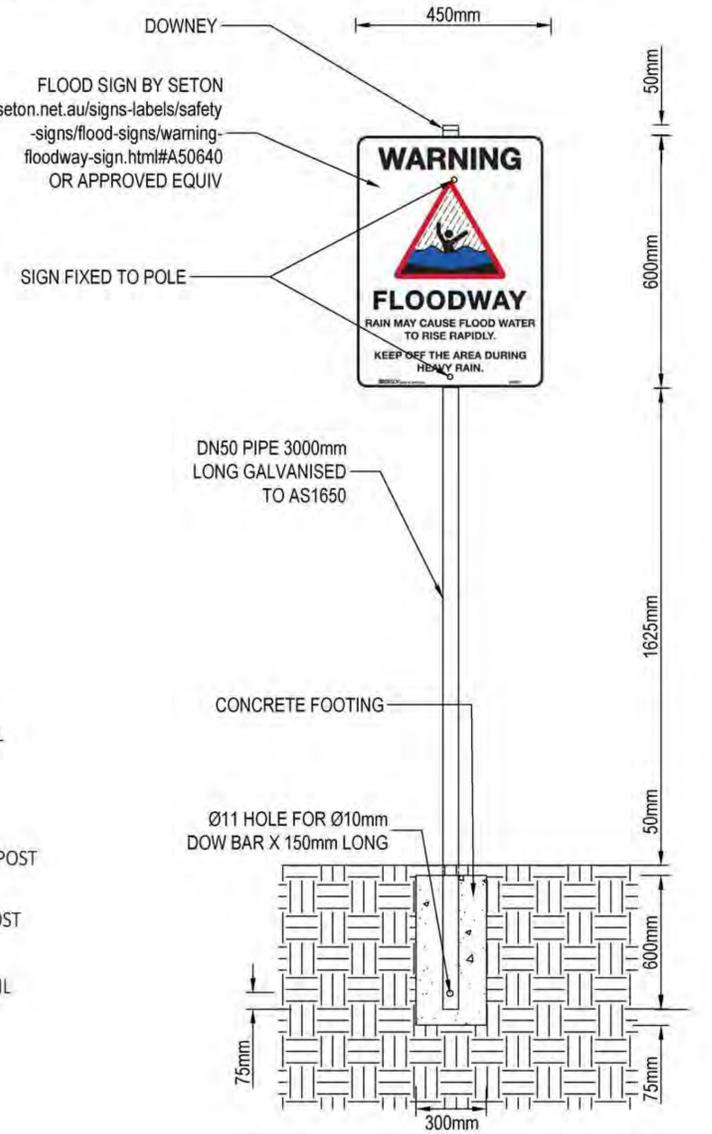
07 HOT DIP GALVANISED STEEL BALUSTRADE SECTION
305 SCALE:1:10



08 HOT DIP GALVANISED STEEL BALUSTRADE ELEVATION
305 SCALE:1:10



06 HOT DIP GALVANISED STEEL BALUSTRADE BASE PLATE ELEVATION
305 SCALE:1:5



09 FLOOD WARNING SIGNAGE DETAIL
305 SCALE:NTS

| REV. | ISSUE / AMENDMENTS | DATE |
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| F | FOR TENDER | 25.08.2023 |

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| SCALE | | REV. |
|----------|-------|---------------------------------------|
| AS SHOWN | | F |
| DESIGNED | KC | CAD FILE No. 1-91194_SANDHILLS_DD.DWG |
| DRAWN | RS/TC | SHEET No. 1-191194_DD_305 |
| CHECKED | DM | |

1 INTRODUCTION AND BACKGROUND

The Sandhills reserve is a vegetated reserve located behind Clarkes beach at the parcel of land identified as Lot 383 DP728202 and Lot 457 DP 1087879 ('the site' herein). Byron Shire Council (BSC) seek to reinstate a wetland system within and around existing drainage features in the eastern portion of the site to achieve a range of environmental objectives including, improving the site's environmental and cultural values, mitigating flood impacts, stormwater treatment, integration with catchment water cycle management objectives, provide education and recreation opportunities and creating pedestrian connectivity between key sites in and around the town centre.

The Sandhills site is currently undeveloped with the exception of a pedestrian track connecting Cowper Street to Lawson Street and underground services (sewer, stormwater and recycled water main).

AWC have prepared detailed design for the wetland which will consider additional studies and information that have been undertaken since the development of the wetland concept design (AWC, 2019). The detailed design drawings are provided in Appendix A.

1.1 Project Overview

The aim of this project is to develop a stormwater management system including constructed wetland at the site that provide flood storage, improve water quality at the Clarkes beach outlet and enhances local environmental and cultural values.

The objectives for the Sandhills wetland project are:

- Protect and enhance Aboriginal cultural values of the area
- Allow access to water and sewer infrastructure for maintenance and emergency purposes
- Showcase best practice water sensitive urban design
- Improve water quality including at the stormwater outlet to Clarkes beach
- Maximise flood storage to mitigate flooding
- Improve visual and environmental amenity of the site
- Ensure acid sulfate soils (actual and potential) are appropriately accounted for and managed
- Protect and enhance environmental values at the site
- Provide an accessible pedestrian link to the Arakwal Cultural Heritage Centre site
- Provide an accessible open space recreational area that supports passive activation, social connection and community well being
- Support delivery of the key actions from the Belongil Creek Floodplain Risk Management Plan (WBM BMT, 2015), Byron Bay Town Centre Masterplan (Macgregor Coxall, 2015) and Byron Shire Council and Arakwal Memorandum of Understanding.

1.2 Reference Documents

The following table (Table 1_1) details the key documents to be read in combination with this specification document.

| Study / Information | Description / Relevant findings | Authors | Date |
|---|---|-------------------|---------------|
| Concept Design | A concept design for a constructed stormwater wetland system at the site was developed and, following consultation with Council and Arakwal Aboriginal Lands Council, revised to include three layout options and a preferred option chosen. | AWC | June 2019 |
| Revised Concept Design | | AWC | 2021 |
| Detailed Design Report | Summarises the detailed design, the information used to prepare the detailed design and relevant information | AWC | November 2022 |
| Contamination Assessment | The site is considered suitable from a contamination perspective for the proposed wetland development (i.e. recreational use). | ENV solutions | July 2021 |
| Acid Sulfate Management Plan | Laboratory analysis of 6 boreholes within the site indicated the presence of Actual Acid Sulfate Soil (AASS) and Potential Acid Sulfate Soil (PASS). The plan provides management and treatment measures to be employed during excavation at the site. | ENV solutions | August 2021 |
| Biodiversity Development Assessment Report (BDAR) | Outlines the measures taken to avoid, minimise and mitigate impacts to the vegetation and habitats present within the development site during the design, construction, and operation of the development. The residual unavoidable impacts of the proposed development were calculated using the Biodiversity Assessment Method Credit Calculator (BAM-C). | Planit Consulting | August 2022 |

2 GENERAL NOTES

- All works and materials shall be in accordance with Byron Shire Council (BSC) policies then relevant Australian Standards;
- The contractor will prepare a Construction Phase Environmental Management Plan (CEMP) at least two weeks prior to the start up meeting. Any requests for changes will be compiled by the Superintendent and incorporated by the Contractor.
- The contractor may be required to undertake an Aboriginal Cultural Heritage Site Induction (which will be arranged by Byron Shire Council) prior to commencement of any works. During excavation and tree/weed removal works the contractor is required to ensure that its staff are experienced and skilled to ensure compliance with legal obligations to identify and protect Aboriginal Cultural Heritage. Should an Aboriginal Cultural Heritage item or object be identified during works, the contractor will immediately cease work and report it to BSC and, will no recommence work without BSC approval. The contractor will need to accommodate any Aboriginal Cultural Heritage monitors to be present on site to observe components of the works, particularly during excavation or vegetation management works. Aboriginal Cultural Heritage Monitors can arise at the request of a Local Aboriginal Land Council to independently observe works or be contracted directly by BSC (under a separate contract)
- The contractor shall take all necessary measures to protect nearby property owners from dust pollution during all phases of works construction. Finished areas of earthworks shall be kept watered where necessary until a satisfactory grass cover is achieved.
- All construction works are to be joined neatly to existing works.
- Public utilities - Notwithstanding that the positions of public utilities, fittings, pipes, poles, manholes etc may be indicated on the drawings, no responsibility will be accepted by the principal for the accuracy of the representation or the omission thereof.
- Location and level of existing services and structures has been plotted from available records and is indicative only. The contractor shall accurately locate these on site prior to commencing works and shall protect all existing services during construction. Any damage to existing services shall be repaired at the contractors expense;

- Vegetation outside work areas shall not be disturbed unless specifically authorised by the superintendent.
- It is the contractor's responsibility to comply with all relevant legislation.
- It is the responsibility of the contractor to maintain the stability of any temporary works on the site.
- The contractor shall confirm the currency of the set out & levels with the superintendent prior to commencing construction.
- These drawings are to be read in conjunction with the local authority specifications and the project specifications. In the event of a discrepancy refer to the superintendent for clarification.
- All dimensions relevant to setting out and off-site work shall be as indicated on drawings and shall be verified by the contractor before construction and/or fabrication is commenced. The engineers' drawings shall not be scaled, unless specifically noted otherwise.
- During construction, the contractor shall be responsible for maintaining proposed and existing works in a stable condition and ensuring no part shall be over stressed under construction activities. In particular in the zone of influence of sewer network.
- The approval for a substitution shall be sought from the superintendent but is not an authorisation for a variation. Any variation must be approved by the superintendent before work commences.
- Site access must be confirmed and determined in discussion with Byron Shire Council and the contractor shall obtain all necessary and relevant permits.
- The contractor's compound shall be located as approved by superintendent.
- The contractor shall undertake all works in proximity to existing services and infrastructure in accordance with the relevant utility/authority policies and procedures.
- It is the responsibility of the contractor to ensure that any relevant council approvals or work permits relating to the works documented in these drawings have been obtained prior to commencing the related works
- These works are to be adopted by a local authority / adopting authority, all works are to be completed to their satisfaction and accepted on maintenance prior to practical completion being issued.

2.2 As Constructed Information

- As constructed information is to reflect the actual construction and is to be endorsed by a licensed surveyor - the survey points and levels shall be taken at least the same points and levels locations shown on construction drawings and any other relevant points to allow assessment against the proposed design intent;
- The contractor is to supply an 'as constructed' survey plan in 3d dwg and pdf format and in accordance with the local council and authority standards, detailing location and levels of all civil works detailed in these drawings, including but not limited to stormwater, sewer and finished pavement and hardstand areas.
- No more than 2 weeks prior to the 'on maintenance' inspection, the contractor shall undertake a condition report to demonstrate that the stormwater systems are in accordance with the design and specification and acceptable to council and the engineer.

2.3 Groundworks

A Contamination Assessment for the project referred to in the notes and an Acid Sulphate Soil Management Plan has been prepared by Env Solutions (2021).

- All earthworks shall be carried out in accordance with AS3798 and supervision to level 1 shall be supplied by the contractor. The contractor shall employ a qualified geotechnical engineer who is a certified practicing engineer of with a minimum \$10 million professional indemnity insurance, to undertake level 1 supervision of earthworks and whose certification in writing shall include the following:
 - Engineering certification that all general earthworks operations (ie. stripping, proof rolling of subgrade, subgrade treatment, etc) have been carried out in accordance with earthworks specifications and recommendations provided by Env Solutions
 - Engineering certification that fill has been placed and compacted to the required minimum density in accordance with the earthwork's specification
 - Engineering certification that any areas of cut have been compacted to the required minimum density in accordance with the earthwork's specification
 - If required, engineering certification that the controlled fill material is suitable to support a conventional slab on ground floor or pavement system
 - Engineering certification that the areas of cut have been subject to proof roll and compacted under geotechnical supervision to the same standards as fill areas

- The contractor shall employ a qualified geotechnical engineer who is a certified practising engineer with a minimum \$10 million professional indemnity insurance, to undertake geotechnical supervision for duration of earthworks, who shall provide regular site reports detailing:
 - That the stability of all cut-fill batters is adequate
 - That contractors temporary works do not compromise the stability of any temporary or permanent slopes, buildings, or site features
- Notwithstanding the requirement for the builder to obtain geotechnical certification, the builder is to advise the superintendent and seek approval before proceeding with any earthworks or pavement construction that is likely to give rise to a variation claim.
- Unless directed otherwise by the geotechnical engineer on site or by the relevant local authority specification (for works subject to approval adoption by the local authority) filling shall be compacted to appropriate standards as determined by Byron Shire Council.
- Unless directed otherwise in the Geotechnical Report for the project, or by the geotechnical engineer on site, filling and subgrade areas shall be compacted in maximum lifts of 250mm loose thickness.
- Compaction to 95% standard Maximum Dry Density is required for subgrade and base layers
- The contractor must provide a Sediment and Erosion Control Plan and implement sediment and erosion control measures prior to commencing works on site. The contractor must maintain sediment and erosion control mechanisms in working order.
- Topsoil and other organic matter is to be stripped from groundwork areas prior to commencing groundworks and shall be stockpiled on site. Earth stockpiles shall be suitably protected from erosion and weed infestation by covering with weed mat or other means. Topsoil is to be respread to finished surface levels and vegetated to specification prior completion. Excess topsoil is to be removed from site.
- Unless confirmed by the supervising geotechnical engineer, maximum batter slopes should be as Detailed Design Drawings
- Contractor shall allow for addressing site trafficability considering weather conditions likely to prevail during the earthworks period.
- Contractor to consider the implications of disturbed ground conditions when working in close proximity to existing services and shall employ a suitable methodology to address service stability.

3 PRELIMINARY WORKS

3.1 Mobilisation

A pre contract meeting will be held with Byron Shire Council before works commence on the site. The location and establishment and demarcation of works compound, site office, temporary fencing, power supply, traffic management plans, security surveillance etc will be discussed and a draft CEMP including all planned sediment and erosion controls discussed. The works program and key issues such as management of water movement through the site during construction covered.

3.2 Start Up

An inception meeting will be held prior to construction commencing with minutes recorded and circulated by the head contractor. The Landscape Contractor shall attend to ensure timing and communication with the other contractors

- Responsibilities and scope of works are to be delineated
- Once all bulk earthworks and hydraulic structures have been completed a meeting will occur at a nominated hold point with the Principal Contractor to assess site and design details
- Prior to commencement of the construction, landscaping and planting the following details shall be defined:

- Verify existing site and design levels
- Services locations where relevant
- Fencing
- Amenities
- Safety issues and WHS (OHS) requirements
- Sensitive environmental zones
- Sediment and erosion controls
- Any other design features, concerns, problems or other information that may arise

3.3 Erosion and Sediment Control

Appropriate sediment and erosion and sediment control must be clearly documented in the CEMP - Site access, sediment fences, controlled stockpile areas, wheel wash water supply, etc will be detailed by the contractor.

3.4 Site Setout

The contractor must engage surveyor to set out datums and project parameters.

3.5 Clearing and Demolition

Demolition will follow the sequence below in Table 1_1 unless confirmed otherwise with the Superintendent.

| Item | Stage | Tasks |
|------|--------------------------|--|
| 1 | Pre-clearing tree survey | Identify and locate extent of works and trees to be retained and removed |
| 2 | Fauna clearance | Capture and relocate fauna in trees/vegetation to be removed |
| 3 | Tree clearing | Removal of nominated trees - stockpile for re-use within works |
| 4 | Weed removal | Remove weed material and dispose of at an approved waste facility |
| 5 | Rubbish and debris | Remove rubbish and debris from within works area |

Only contractors that are experienced and trained in plant identification and weed removal techniques shall be employed to remove native vegetation and weeds

3.6 Public Access /Safety

Public access to be maintained throughout existing thoroughfares. If not possible provide alternate routes in consultation with the Superintendent.

3.7 Construction Access

Construction access will be via existing public roads however a detailed site access and traffic management plan will be prepared by the Contractor and submitted to the Superintendent at the inception meeting. The plan will be reviewed and the contractor will make any amendments requested by the Superintendent prior to construction commencing.

4 CIVIL AND LANDSCAPING

4.1 Sediment & Erosion Control

Appropriate sediment and erosion control measures must be installed and maintained throughout the construction and establishment phase of the wetland in accordance with the "Blue Book", Managing Urban Stormwater: Soils and Construction.

4.2 Earthworks

Earthworks levels must be in accordance with the Civil Design and Northern Rivers Development Construction Specifications, allowing for a minimum of 300mm lightly compacted topsoil as the finished design level. Local depressions must be minimised so that small puddles do not develop on the wetland cell floors.

4.3 Hydraulic structures

All structures must be constructed in accordance with the design documentation. Any potential changes to the design must be confirmed in writing with BSC before construction starts. Once constructed, the hydraulic structures should be surveyed and reviewed by BSC before finer shaping of the earthworks are undertaken. All concrete pits are to be as per the dimensions shown in the drawings unless approved by the Superintendent including pipework, openings and orifices.

4.4 Pipework

All connections to existing and newly installed structures are to be sealed to the satisfaction of the superintendent. The contractor shall make adequate provision for runoff flows during construction to prevent damage avoid, scour, sedimentation, and erosion. Pipework is to be 250mmPVC or smaller to allow for access, maintenance and water level control of the wetland. Screw on end caps as shown on the drawings are required to allow for maintenance draining of wetlands. Orifice holes are to be drilled in pipework as shown on the drawings to control the flow of water through the wetland cells. The level at which the orifice is drilled is critical to the operation of the wetland. Note: very fine tolerances are required for all hydraulic structures (See Section 4.4)

4.5 Holdpoint

Once all bulk earthworks and hydraulic structures have been completed a meeting will occur at a nominated hold point with the Principal Contractor to assess site and design details

4.6 Tolerances

Hydraulic structures within the wetlands control the movement of stormwater through the system. The construction of these structures must ensure that design levels are achieved. A vertical tolerance of +/-25mm and horizontal tolerance of +/- 200mm applies to all pipework and hydraulic structures including:

- inlet pipes
- inlet zone connections (pit and pipe)
- outlet riser
- outlet pipes (upstream and downstream)
- bypass weirs

A vertical tolerance of +/-50mm applies to earthworks including the wetland cell floors and all earthen embankments and bunds.

4.7 Rockwork

The contractor shall import rock sizes as specified on the drawings or as outlined in this section if not shown on the drawings. Rock and granular materials for vehicular access tracks should be DGB20.

The contractor should provide samples to BSC for approval of the rock mulch for headwalls, rip rap, outlets and swales.

The rock lining for the swale is to consist of

- Rip rap rock D50 250 -400mm
- Pebble mulch 40-70mm between rip rap
- Underlain by 100mm crushed rock
- Underlain by 20mm of fine crushed rock

The hand pack stone headwall swale rock size is to meet the following size requirements (unless otherwise stated on the drawings):

- D50: 250-600mm

All rockwork must be from a locally derived source.

4.6 Soils

Within the wetland macrophyte zones, topsoil should be placed to a minimum depth of 300 mm. Design levels for wetlands are inclusive of topsoil, therefore, when earthworks are occurring, allowance for topsoil is required.

Soils for planting must be of loose, friable consistency and of suitable fertility for plant growth. Soil lumps must be of a maximum 50mm dimension.

Soils for planting must be free from weeds, rocks, debris, and contaminants.

The application of lime may be required where the soil testing identifies a potential soil pH problem (pH < 5) or where acid sulphate soils are detected. The rate of application should be guided by soil test results, and the Acid Sulphate Management Plan (Env Solutions, 2021).

Stockpiled topsoil should be tested and approved by a certified laboratory and wetland designer and may need to be screened to remove any coarse organic matter.

1.1.1 Contamination

In the scenario that fuel, oil, cement or other phytotoxic material is spilt on subsoil or topsoil, excavate the contaminated soil, dispose of to the satisfaction of Byron Shire Council and replace with site soil or imported topsoil.

1.1.2 Installation and Aeration

Spread the media on the prepared surface and grade evenly.

- Fill areas of subsistence to achieve finished levels
- Avoid over compaction
- In areas of high compaction de-compact (rip to 100mm prior to planting)

4.9 Mulch and Jute Mesh

Mulch is to be used as specified to retain moisture in the soil and suppress weeds. Jute mesh is to be installed and used on batters, A sample of the woodchip mulch is to be provided to BSC for approval prior to supply and installation.

- Wood chip mulch is to be used in areas of dry batter and shoulder planting, or as outlined within the construction drawings. Above top of bank. Approx 75mm thick
- It is not to be used in areas of overland flow or within flood prone areas. In these instances, replace with specified jute matting.
- Recycled woodchip mulch from chipped trees on site may be used if agreed with council representative
- Wood chip mulch should be a 15.40 forest blend and if it is to be imported, a sample is to be provided to BSC for approval prior to supply and installation
- Ensure mulch is free of deleterious fungus, pest, disease, soil, weeds and toxins
- 700gsm minimum jute matt should be installed on berms and batters. Overlap adjacent sections of jute by 200mm min and fix using 4mm x 300mm long pins at 6 per m²
- Jute matt must have a minimum of 6 slits per sqm. Purchase of Jute matt with 8 slits is preferable if available

4.10 Seating Nodes

Each seating node is a varying shape. Refer to drawings for location and dimension. Final extents to be determined on site. Adjustment may be made in response to site constraints and agreed with BSC and the site superintendent.

4.11 Pathways

Concrete pathways are to be constructed as shown on the site layout plan (1-191194_DD_02) and as detailed in 1-191194_DD_02/702. Concrete paths are to be white in colour with a broom finish. Concrete paths are to be rated to 32MPa and 150mm thick and laid over compacted subgrade as detailed in 1-191194_DD_02/702.

1.1.1 Deco Granitic Sand

The finished surface material within pathways as shown on site layout plan (1-191194_DD_002) and seating node areas (1-191194_DD_701) is to be decomposed granitic sand.

- Colour to be a consistent golden yellow.
- Size to be fines and sand to 5mm.
- Compact the ground to 95% Standard Maximum Dry Density to AS 1289.5.4.1, prior to installation.
- Deco granitic sand to be rolled and compacted in layers 30mm thick to a depth of 150mm.
- Ensure granitic surface is even with 1% cross fall responding to finished levels of each location.
- Paths shall be retained by Corten steel edging as detailed on sheet 702

| P1 - Macrophyte planting (300mm Deep, Density 6 plants/m ²) | | | | TOTAL | 1043 |
|---|----------------|-------------|-------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| AQUATIC PLANTS (tubestock) | | | | | |
| <i>Baumea articulata</i> | Jointed Rush | 30% | 1877 | | |
| <i>Baumea rubiginosa</i> | Soft Twig Rush | 35% | 2190 | | |
| <i>Bolboschoenus fluviatilis</i> | River bulrush | 10% | 626 | | |
| <i>Eleocharis dulcis</i> | Spike Rush | 25% | 1565 | | |
| | | 100% | 6258 | | |

| P2 - Macrophyte planting (300mm Deep, Density 6 plants/m ²) | | | | TOTAL | 180 |
|---|--------------|-------------|-------------|-------|-----|
| Botanical Name | Common Name | % Prop | Qty | | |
| AQUATIC PLANTS (tubestock) | | | | | |
| <i>Baumea articulata</i> | Jointed Rush | 10% | 108 | | |
| <i>Eleocharis sphacelata</i> | Spike Rush | 20% | 216 | | |
| <i>Lepironia articulata</i> | Grey Sedge | 70% | 756 | | |
| | | 100% | 1080 | | |

| P3 - Shrub & Grass like plantings (Density 4 plants/m ²) | | | | TOTAL | 415 |
|--|----------------|------------|------------|-------|-----|
| Botanical Name | Common Name | % Prop | Qty | | |
| SHRUBS, FERNS and LILLIES (tubestock) | | | | | |
| <i>Banksia robur</i> | Swamp Banksia | 5% | 83 | | |
| <i>Christella dentata</i> | Binung | 10% | 166 | | |
| <i>Crinum pedunculatum</i> | Swamp Lily | 5% | 83 | | |
| <i>Dianella caerulea</i> | Blue Flax-lily | 5% | 83 | | |
| <i>Melastoma affine</i> | Blue Tongue | 5% | 83 | | |
| | | 30% | 498 | | |

| NATIVE GRASSES & SEDGES (tubestock) | | | | | |
|-------------------------------------|---------------------|------------|-------------|--|--|
| <i>Bolboschoenus fluviatilis</i> | River bulrush | 5% | 83 | | |
| <i>Carex appressa</i> | Tall Sedge | 10% | 166 | | |
| <i>Ficinia nodosa</i> | Knobby Club Rush | 10% | 166 | | |
| <i>Gahnia sieberiana</i> | Red-fruit Saw-sedge | 5% | 83 | | |
| <i>Juncus usitatus</i> | Salt Marsh Rush | 5% | 83 | | |
| <i>Leersia hexandra</i> | Cutgrass | 5% | 83 | | |
| <i>Lomandra confertifolia</i> | Mat Rush | 5% | 83 | | |
| <i>Lomandra longifolia</i> | Spiny-head Mat-rush | 10% | 166 | | |
| <i>Philydrum lanuginosum</i> | Frogsmouth | 5% | 83 | | |
| <i>Themeda australis</i> | Kangaroo Grass | 5% | 83 | | |
| | | 65% | 1079 | | |

| GROUNDCOVERS (150mm pot size) | | | | | |
|----------------------------------|----------------|-------------|-------------|--|--|
| <i>Tetragonia tetragonioides</i> | Native Spinach | 5% | 83 | | |
| | | 5% | 83 | | |
| | | 100% | 1660 | | |

| P4 - Terrestrial Planting Zone Dry Batter (Density 4 plants/m ²) | | | | TOTAL | 2626 |
|--|------------------------|-----------|------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| TREES (forestry tubestock) | | | | | |
| <i>Banksia integrifolia</i> | Coastal Banksia | 1% | 105 | | |
| <i>Casuarina glauca</i> | Swamp Sheoak | 0.50% | 53 | | |
| <i>Cryptocarya foetida</i> | Stinking Cryptocarya | 0.50% | 53 | | |
| <i>Ficus coronata</i> | Sandpaper Fig | 1% | 105 | | |
| <i>Lophostemon suaveolens</i> | Swamp Box | 1% | 105 | | |
| <i>Melaleuca quinquenervia</i> | Broad-leaved Paperbark | 1% | 105 | | |
| | | 5% | 525 | | |

| SHRUBS (tubestock) | | | | | |
|---------------------------------|--------------------|------------|-------------|--|--|
| <i>Astromyrtus dulcis</i> | Midgen Berry | 2% | 210 | | |
| <i>Banksia robur</i> | Swamp Banksia | 5% | 525 | | |
| <i>Callistemon pachyphyllus</i> | Wallum Bottlebrush | 5% | 525 | | |
| <i>Christella dentata</i> | Binung | 2% | 210 | | |
| <i>Crinum pedunculatum</i> | Swamp Lily | 2% | 210 | | |
| <i>Dianella caerulea</i> | Blue Flax-lily | 5% | 525 | | |
| <i>Melastoma affine</i> | Blue Tongue | 3% | 315 | | |
| | | 24% | 2521 | | |

| NATIVE GRASSES & SEDGES (tubestock) | | | | | |
|-------------------------------------|---------------------|------------|-------------|--|--|
| <i>Carex appressa</i> | Tall Sedge | 2% | 210 | | |
| <i>Ficinia nodosa</i> | Knobby Club Rush | 2% | 210 | | |
| <i>Gahnia sieberiana</i> | Red-fruit Saw-sedge | 5% | 525 | | |
| <i>Imperata cylindrica</i> | Cogon Grass | 10% | 1050 | | |
| <i>Juncus kraussii</i> | Salt Marsh Rush | 2% | 210 | | |
| <i>Leersia hexandra</i> | Cutgrass | 10% | 1050 | | |
| <i>Lomandra confertifolia</i> | Mat Rush | 10% | 1050 | | |
| <i>Lomandra longifolia</i> | Spiny-head Mat-rush | 5% | 525 | | |
| <i>Themeda australis</i> | Kangaroo Grass | 10% | 1050 | | |
| | | 56% | 5882 | | |

| GROUNDCOVERS (150mm pot size) | | | | | |
|----------------------------------|-----------------|-------------|--------------|--|--|
| <i>Hibbertia scandens</i> | Snake Vine | 5% | 525 | | |
| <i>Carpobrotus glaucescens</i> | Native Pig Face | 5% | 525 | | |
| <i>Tetragonia tetragonioides</i> | Native Spinach | 5% | 525 | | |
| | | 15% | 1576 | | |
| | | 100% | 10504 | | |

| P5 - Macrophyte planting (200mm Deep, Density 6 plants/m ²) | | | | TOTAL | 573 |
|---|--------------|-------------|-------------|-------|-----|
| Botanical Name | Common Name | % Prop | Qty | | |
| AQUATIC PLANTS (tubestock) | | | | | |
| <i>Baumea articulata</i> | Jointed Rush | 10% | 344 | | |
| <i>Eleocharis sphacelata</i> | Spike Rush | 20% | 688 | | |
| <i>Lepironia articulata</i> | Grey Sedge | 70% | 2407 | | |
| | | 100% | 3438 | | |

| P6 - Macrophyte planting (200mm Deep, Density 6 plants/m ²) | | | | TOTAL | 3126 |
|---|------------------|-------------|--------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| AQUATIC PLANTS (tubestock) | | | | | |
| <i>Baumea articulata</i> | Jointed Rush | 25% | 4689 | | |
| <i>Baumea rubiginosa</i> | Soft Twig Rush | 25% | 4689 | | |
| <i>Baloskion tetraphyllum</i> | Tassel Cord Rush | 10% | 1876 | | |
| <i>Eleocharis dulcis</i> | Spike Rush | 20% | 3751 | | |
| <i>Lepironia articulata</i> | Grey Sedge | 20% | 3751 | | |
| | | 100% | 18756 | | |

| P7 - Macrophyte plantings (100mm Deep, Density 6 plants/m ²) | | | | TOTAL | 258 |
|--|----------------|-------------|-------------|-------|-----|
| Botanical Name | Common Name | % Prop | Qty | | |
| AQUATIC PLANTS (tubestock) | | | | | |
| <i>Baumea articulata</i> | Jointed Rush | 25% | 387 | | |
| <i>Baumea rubiginosa</i> | Soft Twig Rush | 25% | 387 | | |
| <i>Bolboschoenus fluviatilis</i> | River bulrush | 25% | 387 | | |
| <i>Eleocharis dulcis</i> | Spike Rush | 25% | 387 | | |
| | | 100% | 1548 | | |

| P8 - Shallow Macrophyte Plantings (100mm Deep, Density 6 plants/m ²) | | | | TOTAL | 1578 |
|--|------------------|-------------|-------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| AQUATIC & GRASS LIKE PLANTS (tubestock) | | | | | |
| <i>Baumea rubiginosa</i> | Soft Twig Rush | 20% | 1894 | | |
| <i>Baloskion tetraphyllum</i> | Tassel Cord Rush | 20% | 1894 | | |
| <i>Eleocharis dulcis</i> | Spike Rush | 20% | 1894 | | |
| <i>Juncus uttatus</i> | Marsh Rush | 20% | 1894 | | |
| <i>Rhynchospora brownii</i> | Beak Rush | 20% | 1894 | | |
| | | 100% | 9468 | | |

| P9 - Frog Marsh Plantings (100mm Deep, Density 6 plants/m ²) | | | | TOTAL | 2620 |
|--|------------------|-------------|--------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| NATIVE GRASSES & SEDGES (tubestock) | | | | | |
| <i>Baloskion tetraphyllum</i> | Tassel Cord Rush | 20% | 3144 | | |
| <i>Blechnum indicum</i> | Swamp Water Fern | 20% | 3144 | | |
| <i>Baumea rubiginosa</i> | Soft Twig Rush | 20% | 3144 | | |
| <i>Rhynchospora brownii</i> | Beak Rush | 30% | 4716 | | |
| <i>Philydrum lanuginosum</i> | Frogsmouth | 10% | 1572 | | |
| | | 100% | 15720 | | |

| P10 - Wetland Forest Plantings (100mm Deep, Density 4 plants/m ²) | | | | TOTAL | 4759 |
|---|------------------------|-----------|------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| TREES (45L) | | | | | |
| <i>Lophostemon suaveolens</i> | Swamp Box | 2.5% | 476 | | |
| <i>Melaleuca quinquenervia</i> | Broad-leaved Paperbark | 2.5% | 476 | | |
| | | 5% | 952 | | |

| SHRUBS, FERNS and LILLIES (tubestock) | | | | | |
|---------------------------------------|------------------|--------------|-------------|--|--|
| <i>Banksia robur</i> | Swamp Banksia | 3% | 571 | | |
| <i>Blechnum indicum</i> | Swamp Water Fern | 3% | 571 | | |
| <i>Christella dentata</i> | Binung | 2% | 381 | | |
| <i>Crinum pedunculatum</i> | Swamp Lily | 2.5% | 476 | | |
| <i>Melastoma affine</i> | Blue Tongue | 2% | 381 | | |
| | | 12.5% | 2380 | | |

| NATIVE GRASSES & SEDGES (tubestock) | | | | | |
|--|---------------------|--------------|--------------|--|--|
| <i>Baumea articulata</i> | Jointed Rush | 10% | 1904 | | |
| <i>Carex appressa</i> | Tall Sedge | 15% | 2855 | | |
| <i>Ficinia nodosa</i> | Knobby Club Rush | 14.5% | 2760 | | |
| <i>Gahnia sieberiana</i> | Red-fruit Saw-sedge | 13% | 2475 | | |
| <i>Juncus kraussii</i> | Salt Marsh Rush | 12% | 2284 | | |
| <i>Lomandra confertifolia</i> | Mat Rush | 9% | 1713 | | |
| <i>Philydrum lanuginosum</i> | Frogsmouth | 9% | 1713 | | |
| | | 82.5% | 15705 | | |
| 1 tree / 5m2, 1 shrub / 2m2, grasses & sedges @ 4/m2 | | 100% | 19036 | | |

| P10 - Wetland Forest Plantings (100mm Deep, Density 4 plants/m ²) | | | | TOTAL | 4759 |
|---|------------------------|-----------|------------|-------|------|
| Botanical Name | Common Name | % Prop | Qty | | |
| TREES (forestry tubestock) | | | | | |
| <i>Lophostemon suaveolens</i> | Swamp Box | 2.5% | 476 | | |
| <i>Melaleuca quinquenervia</i> | Broad-leaved Paperbark | 2.5% | 476 | | |
| | | 5% | 952 | | |

| SHRUBS, FERNS and LILLIES (tubestock) | | | | | |
|---------------------------------------|------------------|--------------|-------------|--|--|
| <i>Banksia robur</i> | Swamp Banksia | 3% | 571 | | |
| <i>Blechnum indicum</i> | Swamp Water Fern | 3% | 571 | | |
| <i>Christella dentata</i> | Binung | 2% | 381 | | |
| <i>Crinum pedunculatum</i> | Swamp Lily | 2.5% | 476 | | |
| <i>Melastoma affine</i> | Blue Tongue | 2% | 381 | | |
| | | 12.5% | 2380 | | |

| NATIVE GRASSES & SEDGES (tubestock) | | | | | |
|--|---------------------|--------------|--------------|--|--|
| <i>Baumea articulata</i> | Jointed Rush | 10% | 1904 | | |
| <i>Carex appressa</i> | Tall Sedge | 15% | 2855 | | |
| <i>Ficinia nodosa</i> | Knobby Club Rush | 14.5% | 2760 | | |
| <i>Gahnia sieberiana</i> | Red-fruit Saw-sedge | 13% | 2475 | | |
| <i>Juncus kraussii</i> | Salt Marsh Rush | 12% | 2284 | | |
| <i>Lomandra confertifolia</i> | Mat Rush | 9% | 1713 | | |
| <i>Philydrum lanuginosum</i> | Frogsmouth | 9% | 1713 | | |
| | | 82.5% | 15705 | | |
| 1 tree / 5m2, 1 shrub / 2m2, grasses & sedges @ 4/m2 | | 100% | 19036 | | |

| FEATURE TREES 100L | | | | CODE | 2681 |
|--------------------------------|------------------------|----|--|------|-----------|
| Botanical Name | Common Name | | | | Qty |
| <i>Banksia integrifolia</i> | Coastal Banksia | Bi | | | 11 |
| <i>Cryptocarya foetida</i> | Stinking Cryptocarya | Cf | | | 4 |
| <i>Ficus coronata</i> | Sandpaper Fig | Fc | | | 4 |
| <i>Lophostemon suaveolens</i> | Swamp Box | Ls | | | 5 |
| <i>Melaleuca quinquenervia</i> | Broad-leaved Paperbark | Mq | | | 9 |
| | | | | | 33 |

*Plant in locations shown on plans 501-503

*Minimum 5m spacing between feature trees

04 PLANTING SCHEDULE P3, P4 & P11
500

LEGEND

-  **P1** MACROPHYTE ZONE
2.6-2.9m AHD 6/m² REFER 01_500 & 05_703
-  **P2** MACROPHYTE ZONE
2.6-2.9m AHD 6/m² REFER 01_500 & 05_703
-  **P3** EPHEMERAL ZONE
2.9-3.2m AHD 6/m² REFER 04_500 & 02_703
-  **P4** DRY BATTER ZONE
>3.2m AHD 4/m² REFER 04_500 & 03_703
-  **P4** DRY BATTER ZONE LOW PLANTING
NO TREES OR LARGE SHRUBS
-  **P11** SHOULDER PLANTING ZONE
4/m² REFER 04_500 & 03_703
-  SHADE FEATURE TREE
REFER DETAIL 01_703 & 05_500
-  **BI** *Banksia integrifolia*
-  **CF** *Cryptocarya foetida*
-  **FC** *Ficus coronata*
-  **LS** *Lophostemon suaveolens*
-  **MQ** *Melaleuca quinquenervia*
-  CONCRETE CYCLEWAY
REFER DETAIL 02_702
-  DECOMPOSED GRANITIC SAND PATH
REFER DETAIL 01_702
-  EXISTING TREE RETAINED
PROTECTED TO MEET AS 4970-2009
-  EXISTING TREE REMOVED
-  EXTENT OF EARTH WORKS
-  OPERATING WATER LEVEL (OWL) 2.9m
-  FINISHED FLOOR LEVEL (FFL) 2.6m
-  EXTENT OF WORKS
-  PROPOSED 0.1m CONTOURS
-  SEWER INFRASTRUCTURE
-  SEWER MAN HOLE

CELL 1
FFL = 2.6m AHD
OWL = 2.9m AHD
EDD (& SPILLWAY) = 3.2m AHD



REFER SHEET 502

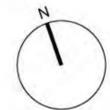
MASSINGER STREET

AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au



DRAWING: **LANDSCAPE MATERIALS & PLANTING 01**
PROJECT: SANDHILLS WETLAND DETAILED DESIGN PACKAGE

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
| B | DETAILED DESIGN PACKAGE 70% | 28.02.2022 |
| C | DETAILED DESIGN PACKAGE 100% | 02.11.2022 |
| D | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 17.11.2022 |
| E | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 13.12.2022 |
| F | FOR TENDER | 25.08.2023 |



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SCALE: 1:250 @ A1
DESIGNED: KC
DRAWN: RST/C
CHECKED: DM

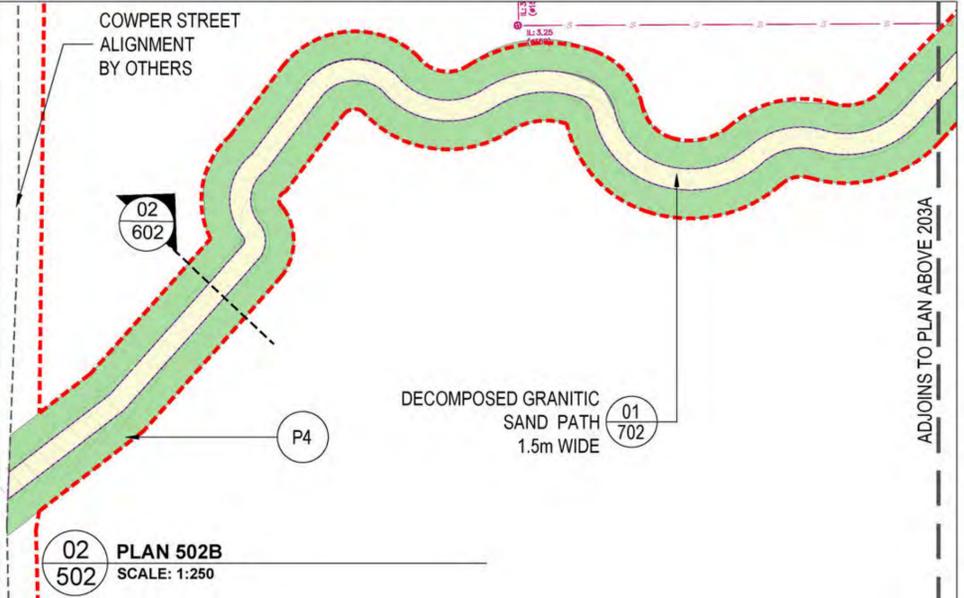
CAD FILE No. **1-91194_SANDHILLS_DD.DWG**
SHEET No. **1-191194_DD_501**



- LEGEND**
- P5 MACROPHYTE ZONE
2.0-2.2m AHD 6/m² REFER 02_500 & 05_703
 - P6 MACROPHYTE ZONE
2.0-2.2m AHD 6/m² REFER 02_500 & 05_703
 - P3 EPHEMERAL ZONE
2.2-2.4m AHD 6/m² REFER 04_500 & 02_703
 - P4 DRY BATTER ZONE
>2.4m AHD 4/m² REFER 04_500 & 03_703
 - P4 DRY BATER ZONE LOW PLANTING
NO TREES OR LARGE SHRUBS
 - P11 SHOULDER PLANTING ZONE
4/m² REFER 04_500 & 03_703
 - SHADE FEATURE TREE
REFER DETAIL 01_703 & 05_500
 - BI *Banksia integrifolia*
 - CF *Cryptocarya foetida*
 - FC *Ficus coronata*
 - LS *Lophostemon suaveolens*
 - MQ *Melaleuca quinquenervia*
 - CONCRETE CYCLEWAY
REFER DETAIL 02_702
 - DECOMPOSED GRANITIC SAND PATH
REFER DETAIL 01_702
 - EXISTING TREE RETAINED
PROTECTED TO MEET AS 4970-2009
 - EXTENT OF EARTH WORKS
 - OPERATING WATER LEVEL (OWL) 2.2m
 - FINISHED FLOOR LEVEL (FFL) 2.0m
 - EXTENT OF WORKS
 - PROPOSED 0.1m CONTOURS
 - SEWER INFRASTRUCTURE
 - SEWER MAN HOLE

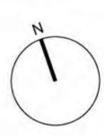
01 PLAN 502A
SCALE: 1:250

CELL 2
FFL = 2.0m
OWL = 2.2m
EDD (& SPILLWAY) = 2.4m



02 PLAN 502B
SCALE: 1:250

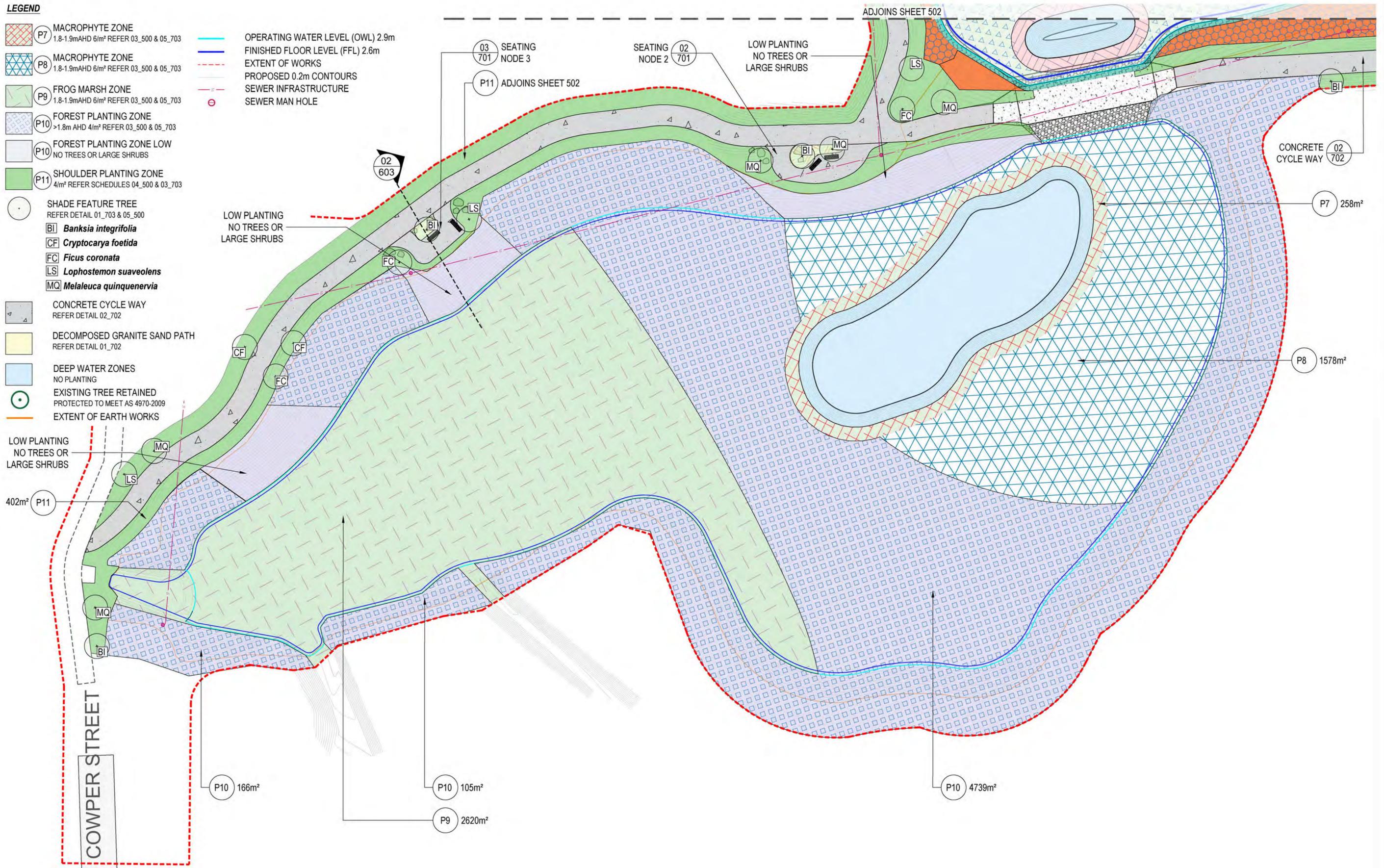
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LEGEND

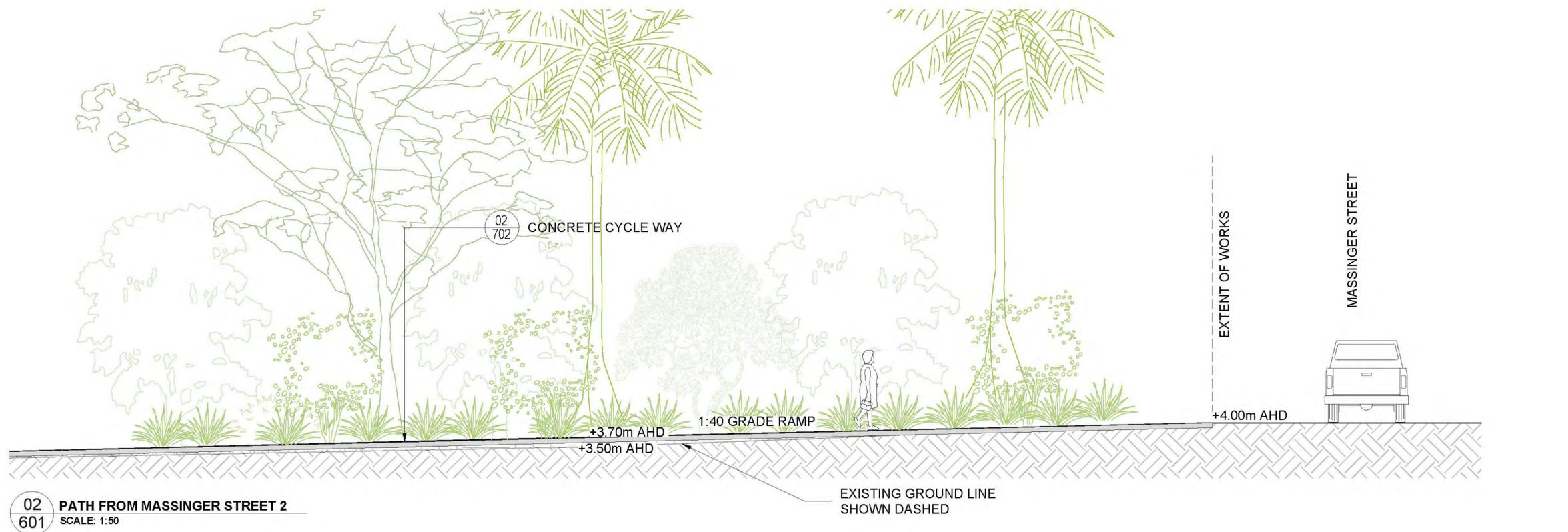
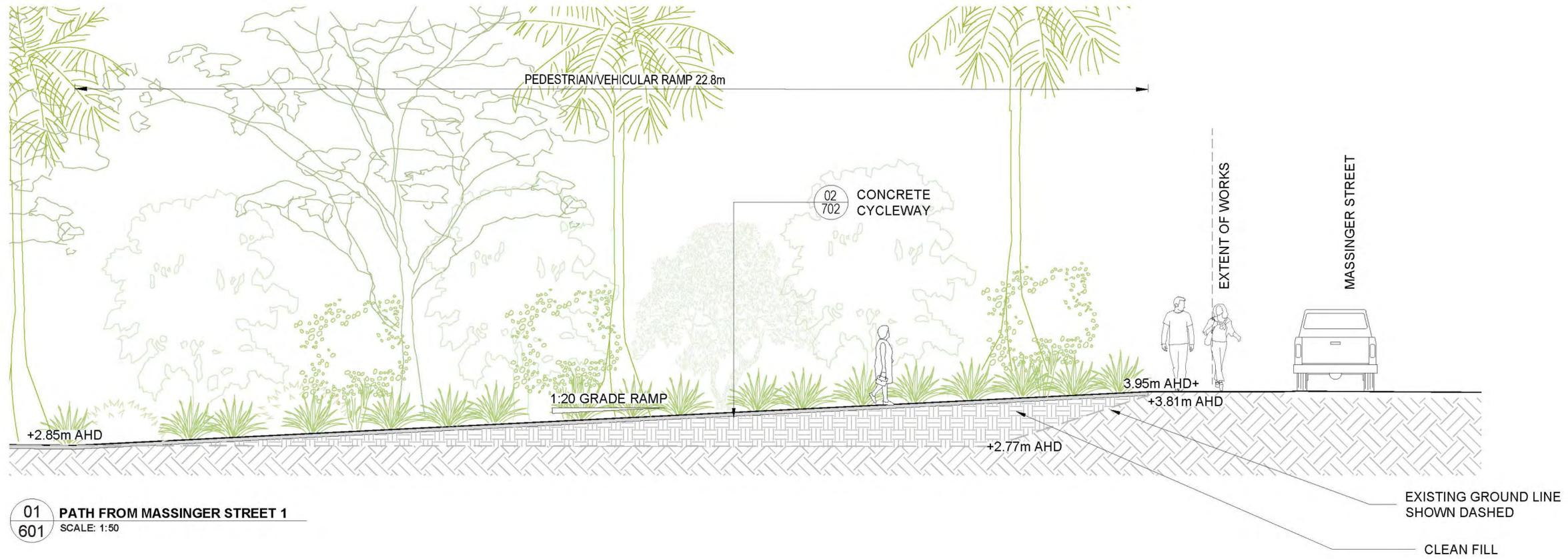
-  P7 MACROPHYTE ZONE
1.8-1.9m AHD 6/m² REFER 03_500 & 05_703
-  P8 MACROPHYTE ZONE
1.8-1.9m AHD 6/m² REFER 03_500 & 05_703
-  P9 FROG MARSH ZONE
1.8-1.9m AHD 6/m² REFER 03_500 & 05_703
-  P10 FOREST PLANTING ZONE
>1.8m AHD 4/m² REFER 03_500 & 05_703
-  P10 FOREST PLANTING ZONE LOW
NO TREES OR LARGE SHRUBS
-  P11 SHOULDER PLANTING ZONE
4/m² REFER SCHEDULES 04_500 & 03_703
-  SHADE FEATURE TREE
REFER DETAIL 01_703 & 05_500
-  BI *Banksia integrifolia*
-  CF *Cryptocarya foetida*
-  FC *Ficus coronata*
-  LS *Lophostemon suaveolens*
-  MQ *Melaleuca quinquenervia*
-  CONCRETE CYCLE WAY
REFER DETAIL 02_702
-  DECOMPOSED GRANITE SAND PATH
REFER DETAIL 01_702
-  DEEP WATER ZONES
NO PLANTING
-  EXISTING TREE RETAINED
PROTECTED TO MEET AS 4970-2009
-  EXTENT OF EARTH WORKS
-  OPERATING WATER LEVEL (OWL) 2.9m
-  FINISHED FLOOR LEVEL (FFL) 2.6m
-  EXTENT OF WORKS
-  PROPOSED 0.2m CONTOURS
-  SEWER INFRASTRUCTURE
-  SEWER MAN HOLE



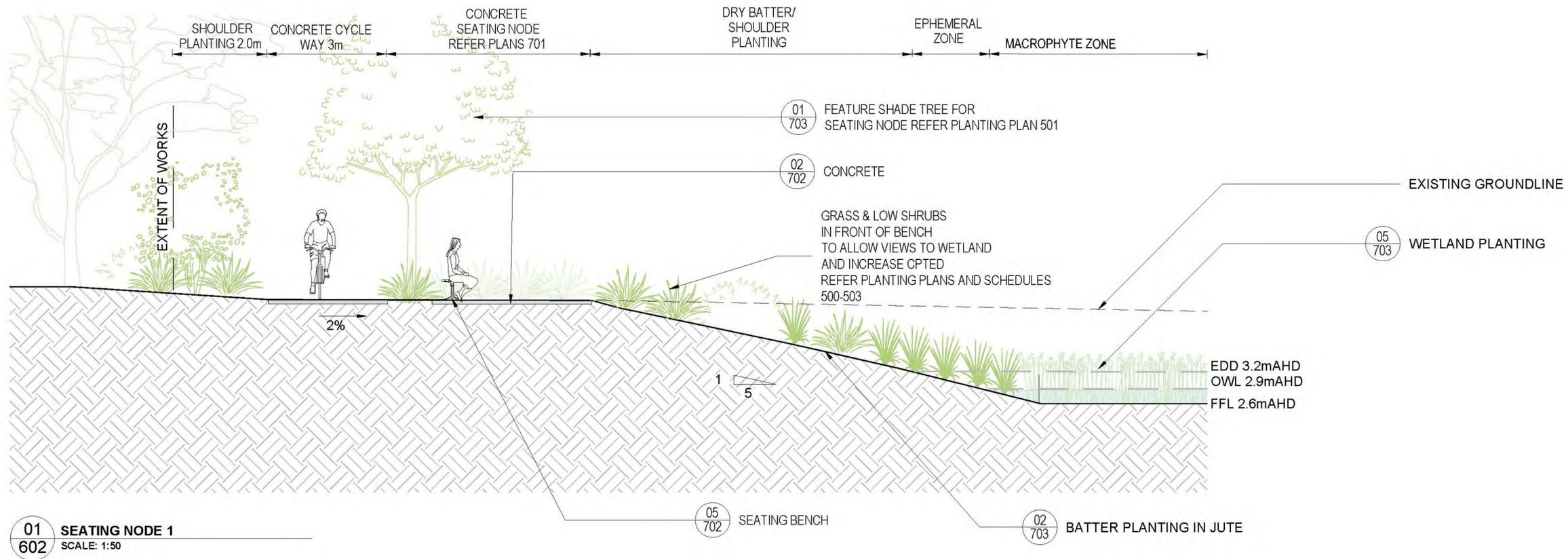
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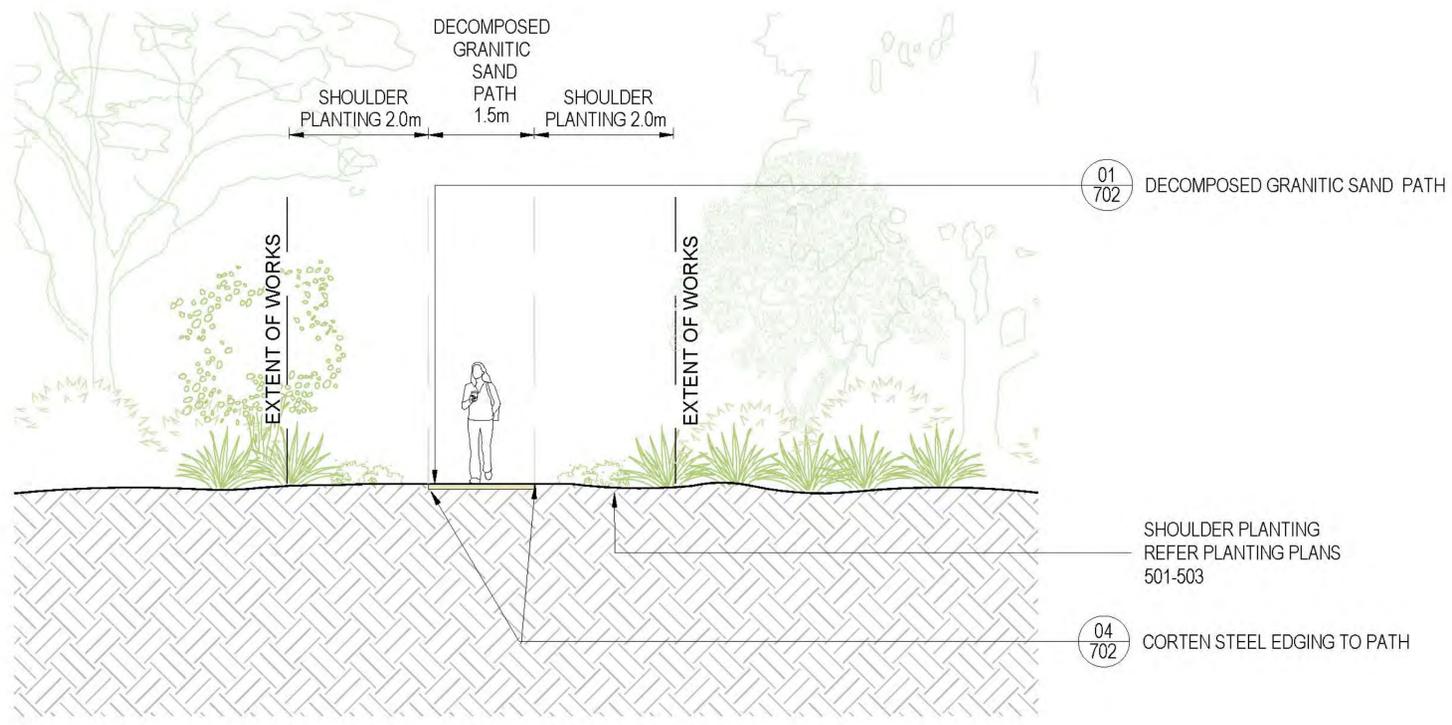
DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.



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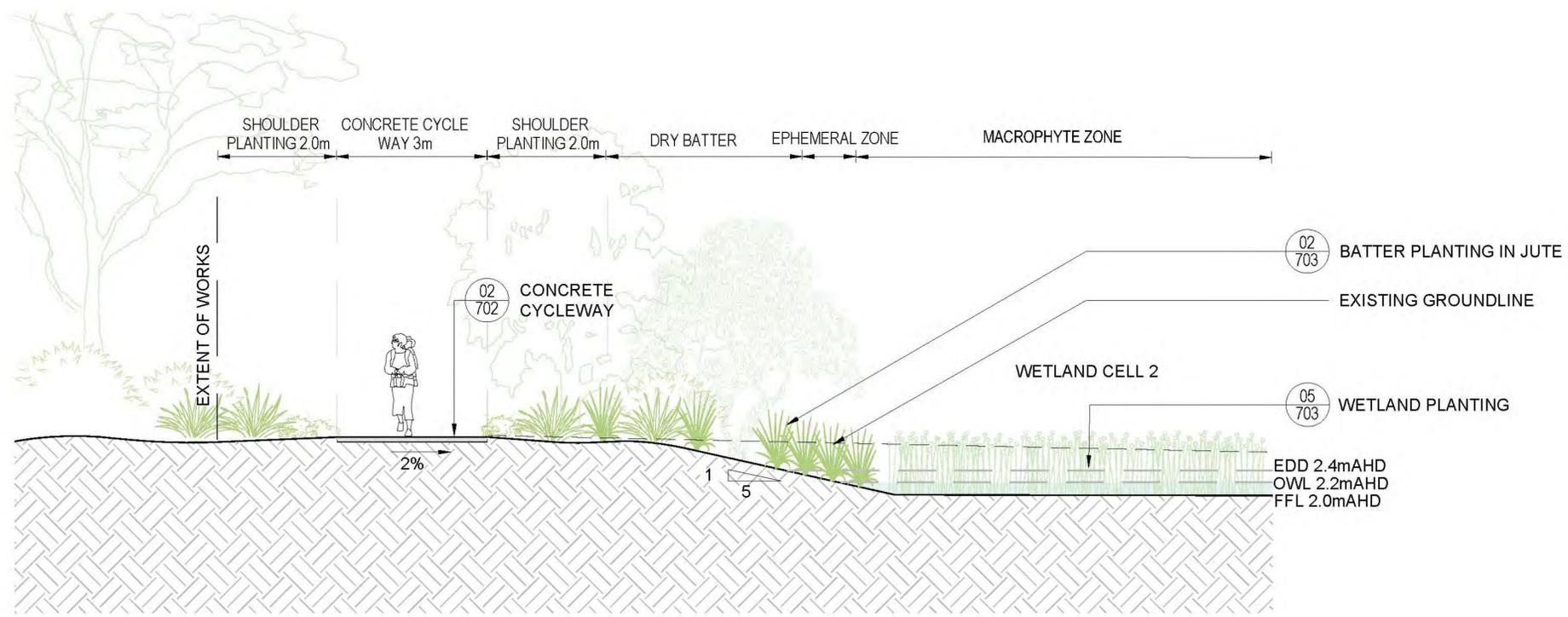
01 SEATING NODE 1
602 SCALE: 1:50



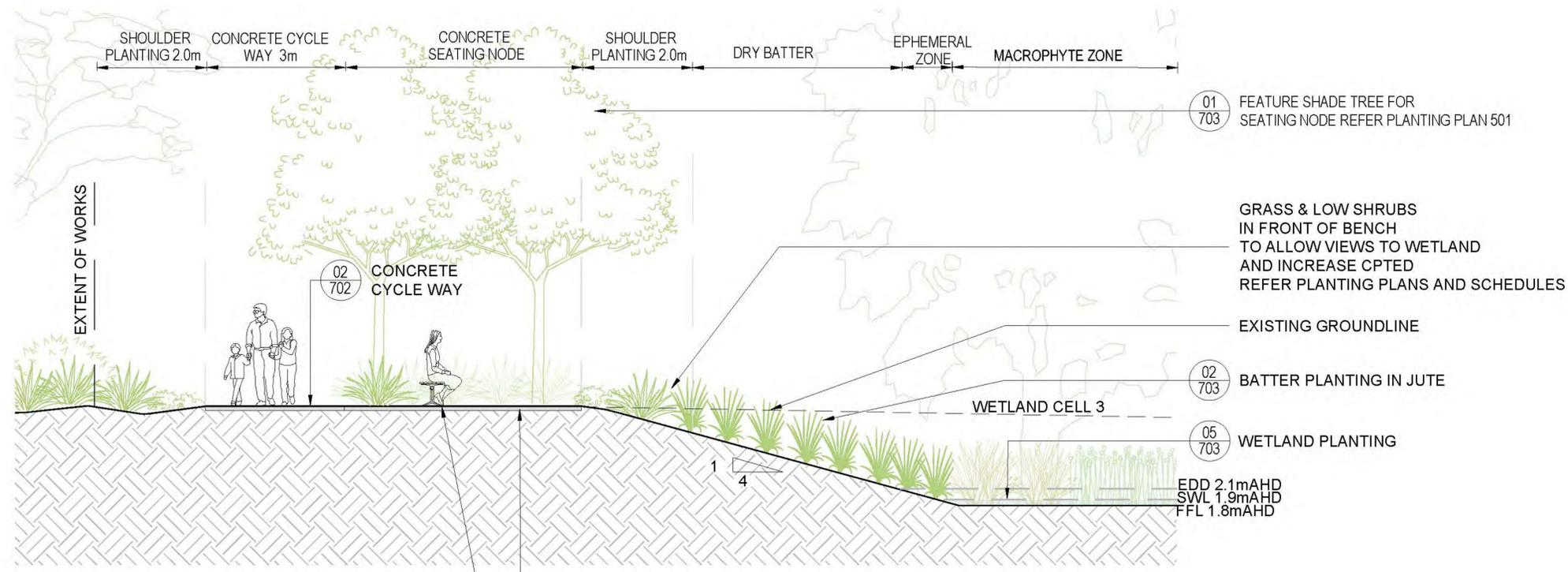
02 DECOMPOSED GRANITIC SAND PEDESTRIAN PATH
602 SCALE: 1:50

| REV. | ISSUE / AMENDMENTS | DATE |
|------|---|------------|
| A | PRE -DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
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01
603 CONCRETE PATH WETLAND CELL 2
SCALE: 1:50



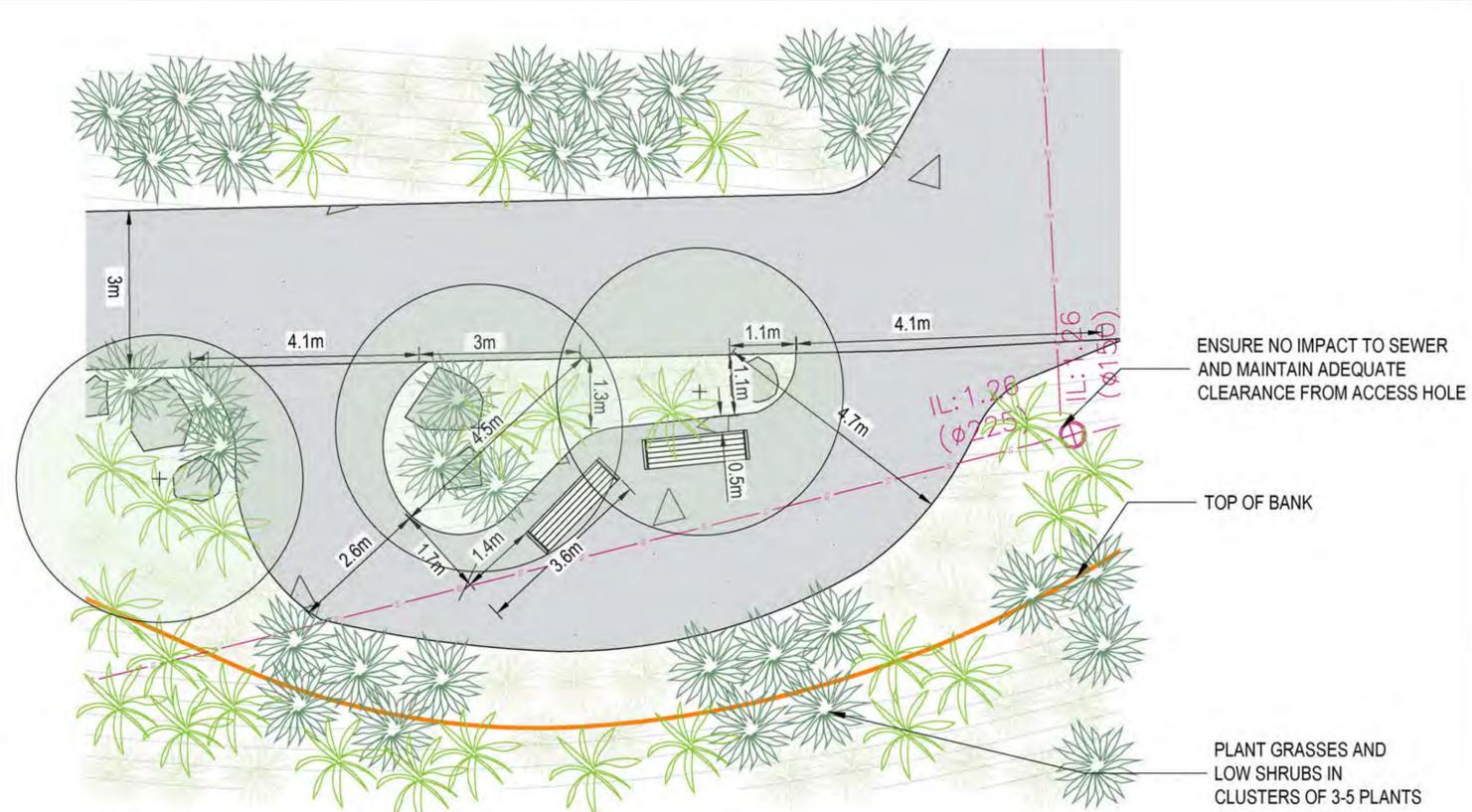
02
603 SECTION SEATING NODE 3 WETLAND CELL 3
SCALE: 1:50

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
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| F | FOR TENDER | 25.08.2023 |

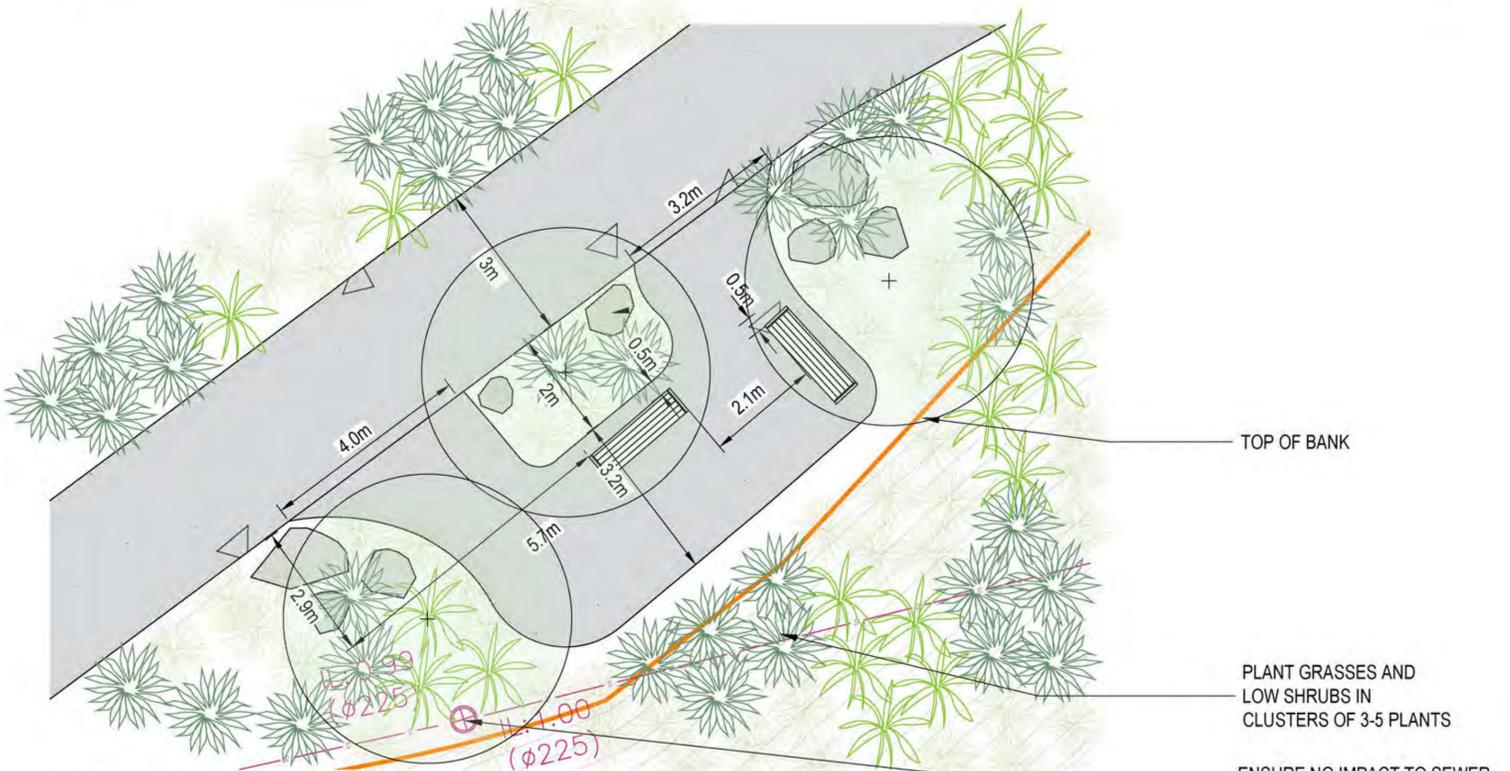
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01 SEATING NODE 1 DETAIL PLAN
701 SCALE:1:75



02 SEATING NODE 2 DETAIL PLAN
701 SCALE:1:75



03 SEATING NODE 3 DETAIL PLAN
701 SCALE:1:75

PLANTING PLAN NOTE:
REFER SHEETS 501 - 503 FOR PLANTING ZONES.
ONLY LOW GROWING SPECIES TO 1.2m HIGH SHALL BE PLANTED IN FRONT OF THE SEATING NODE BENCHES

CORTEN STEEL EDGING NOTE:
CORTEN STEEL EDGING TO BE INSTALLED TO THE SIDE OF ALL DECOMPOSED GRANITIC SAND PATHS
REFER PLANS 501-503 AND DETAILS 702_03/04

SETOUT NOTE:
FINAL SETOUT TO THE PROJECT SURVEYOR THROUGH GPS COORDINATES
ANY DISCREPANCIES IN MEASUREMENTS SHALL REPORTED TO THE PROJECT LANDSCAPE ARCHITECT BEFORE INSTALLATION

LEGEND

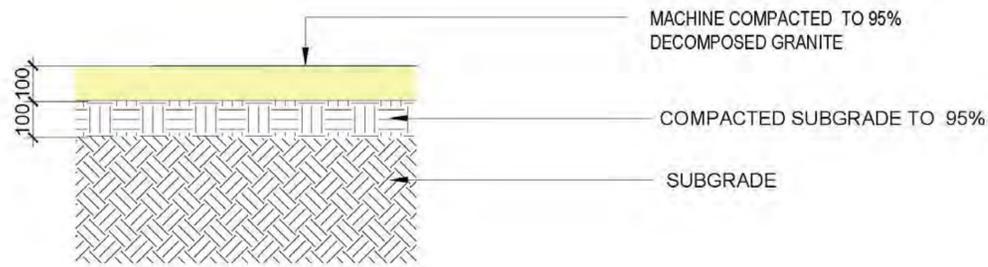
- PROSED FEATURE SHADE TREE
REFER DETAIL 01_703
- GRASS + LOW SHRUB PLANTING
REFER PLANTING SCHEDULES SHEET 500
- FEATURE ROCKS
REFER DETAIL 03_702
- SEATING BENCH
REFER DETAIL 05_702
- CONCRETE CYCLE WAY/SEATING NODE
REFER DETAIL 02_702
- DECOMPOSED GRANITIC SAND PATH
REFER DETAIL 01_702
- CORTEN STEEL EDGING
REFER DETAIL 04_702
- EXTENT OF EARTH WORKS (TOP OF BANK)
- PROPOSED 0.2m CONTOURS
- SEWER INFRASTRUCTURE
- SEWER ACCESS HOLE

| REV. | ISSUE / AMENDMENTS | DATE |
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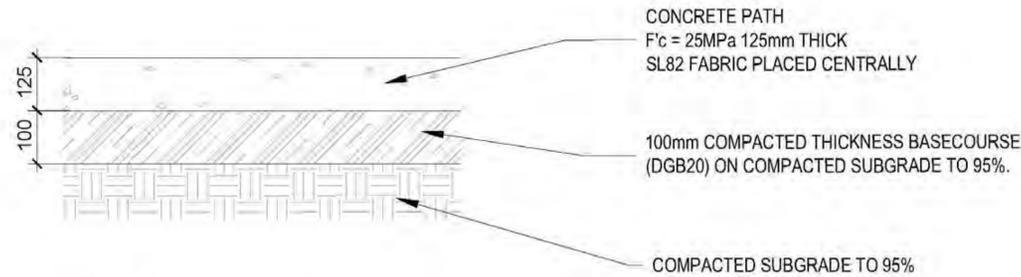
| | | | |
|-------------------|----------------|---|------------------|
| SCALE AS SHOWN | DESIGNED KC | CAD FILE No. 1-91194_SANDHILLS_DD.DWG | REV. F |
| | DRAWN RST/C | SHEET No. 1-191194_DD_701 | |
| | CHECKED DM | | |



NOTES:

1. COLOUR TO BE CONSISTENT GOLDEN YELLOW
2. SIZE - FINES AND SAND TO 5mm
3. DECOMPOSED GRANITIC SAND TO BE ROLLED AND COMPACTED IN LAYERS 30mm THICK TO A DEPTH OF 100mm.
4. ENSURE SURFACE EVEN WITH 1:100 CROSS FALL RESPONDING TO FINISHED LEVELS OF LOCATION.
5. MIX STABILIZER A01 BINDER AT RATE OF 3% DRY WEIGHT
6. ALL DECO PATHS TO HAVE STEEL EDGING REFER DETAIL 04_702

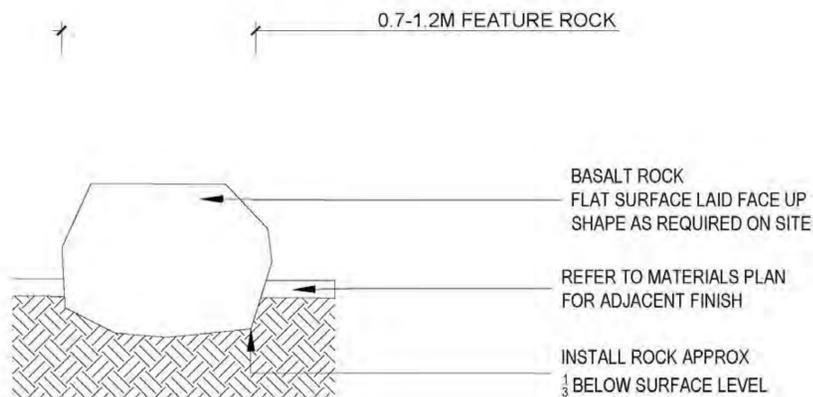
01 DECOMPOSED GRANITIC SAND PATH
702 SCALE: 1:10



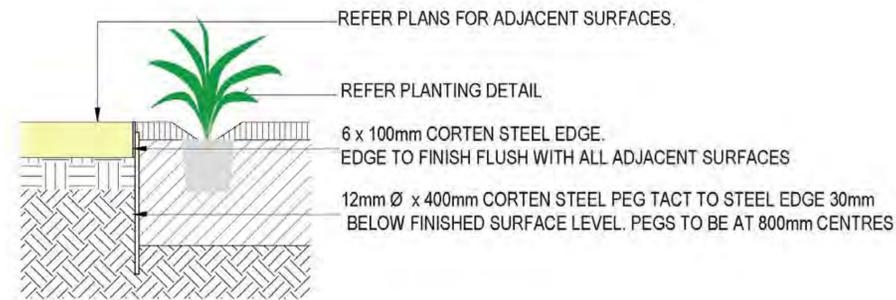
NOTES:

1. COLOUR: WHITE
2. BROOM FINISH
3. CONTRACTION JOINTS SHALL BE INSTALLED EVERY 3m TO PREVENT CRACKING.
4. EXPANSION JOINTS TO BE INSTALLED AT EVERY 12m.
5. ENSURE SURFACE EVEN WITH 1:100 CROSS FALL RESPONDING TO FINISHED LEVELS OF LOCATION.

02 CONCRETE CYCLE WAY
702 SCALE: 1:10



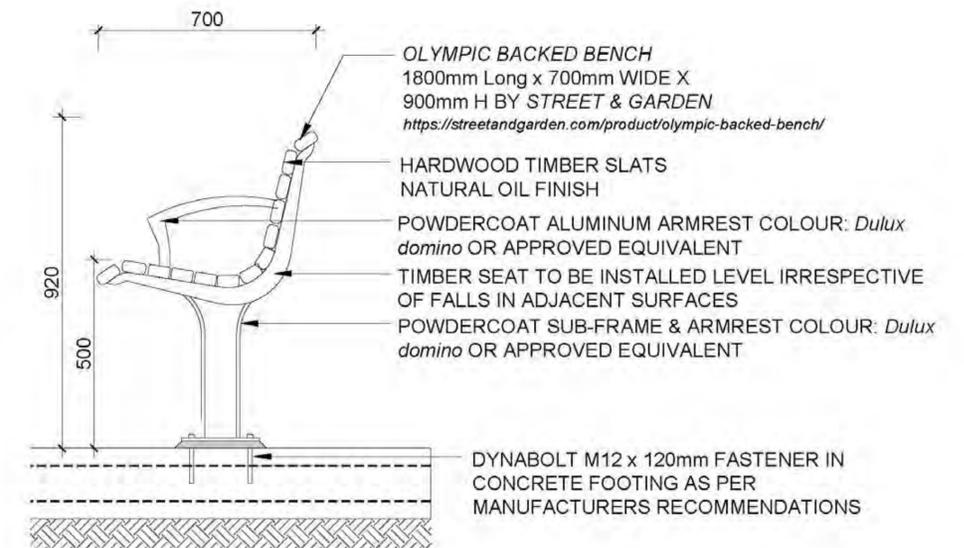
03 FEATURE ROCKS
702 SCALE: 1:10



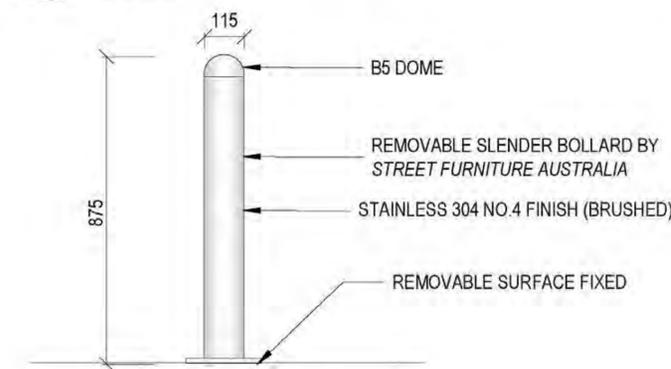
04 CORTEN STEEL EDGE DETAIL
702 SCALE: 1:10



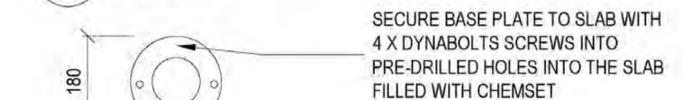
05 TIMBER SEATING BENCH RENDER
702 SCALE: NTS



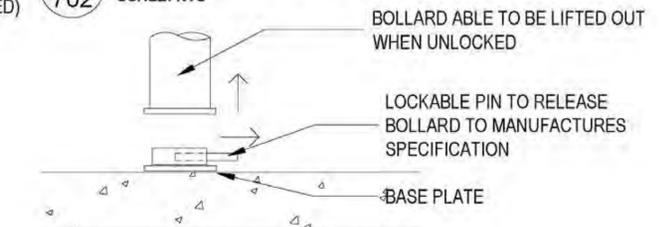
06 TIMBER SEATING BENCH DETAIL
702 SECTION: 1:10



06 REMOVABLE BOLLARD
702 SCALE: NTS



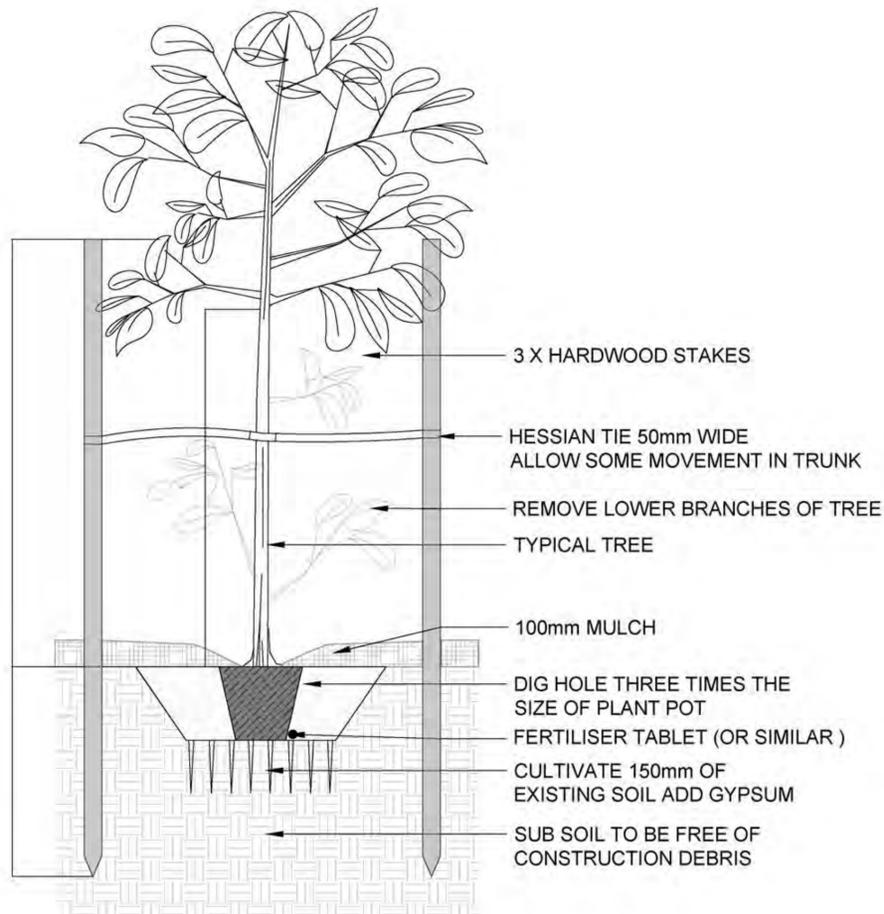
07 BOLLARD BASE PLATE PLAN
702 SCALE: NTS



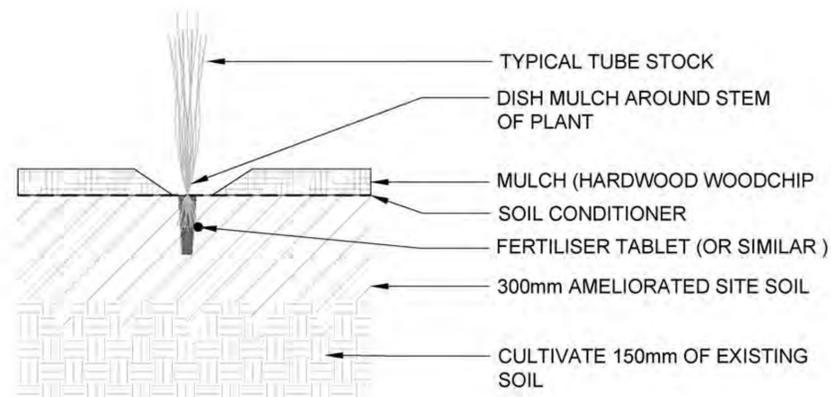
08 REMOVABLE SURFACE FIXED
702 SCALE: NTS

| REV. | ISSUE / AMENDMENTS | DATE |
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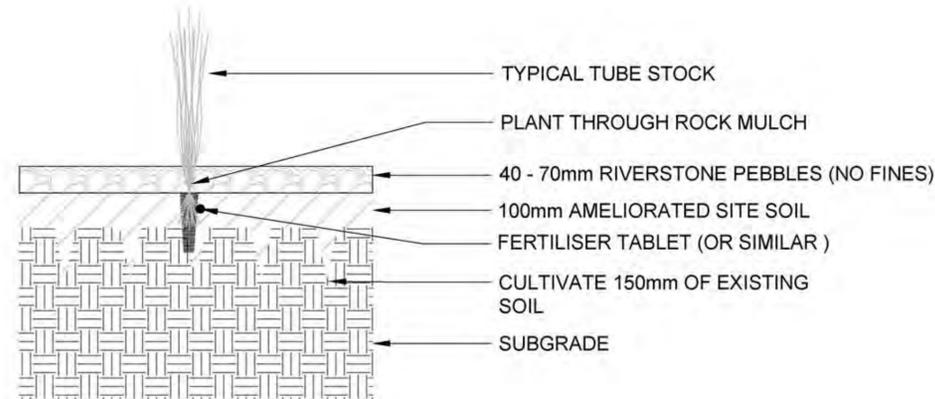
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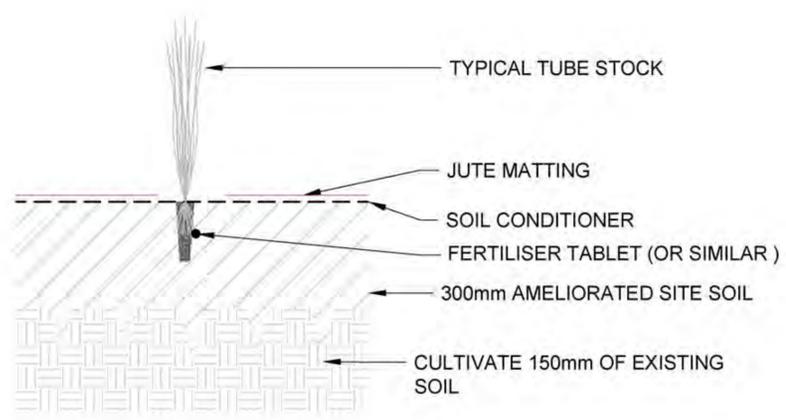
01 FEATURE TREE PLANTING
SCALE: 1:10



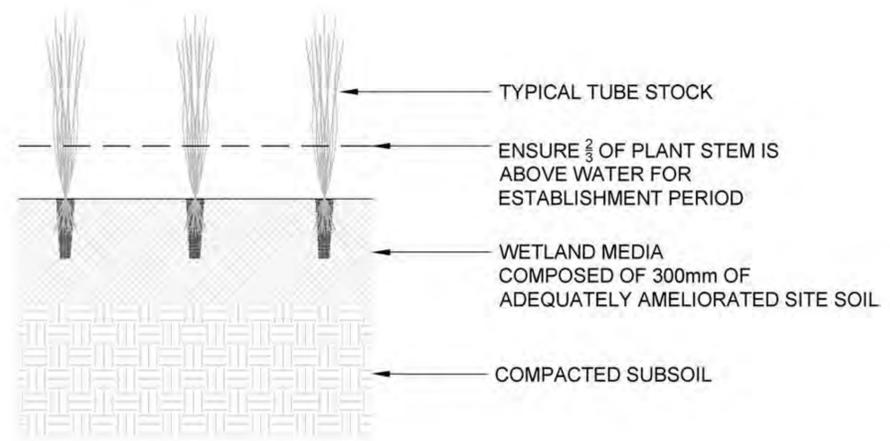
03 PLANTING IN MULCH
SCALE: 1:10



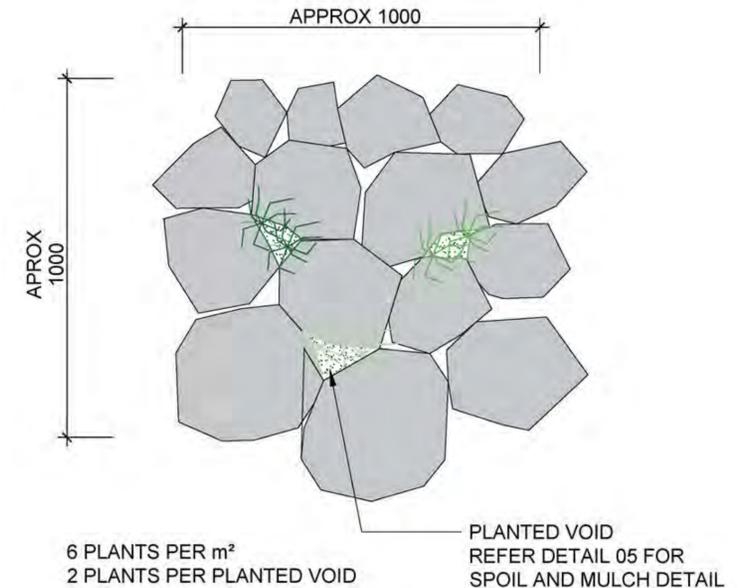
04 PLANTING IN ROCK MULCH
SCALE: 1:10



02 PLANTING IN JUTE
SCALE: 1:10



05 PLANTING IN WETLAND
SCALE: 1:10



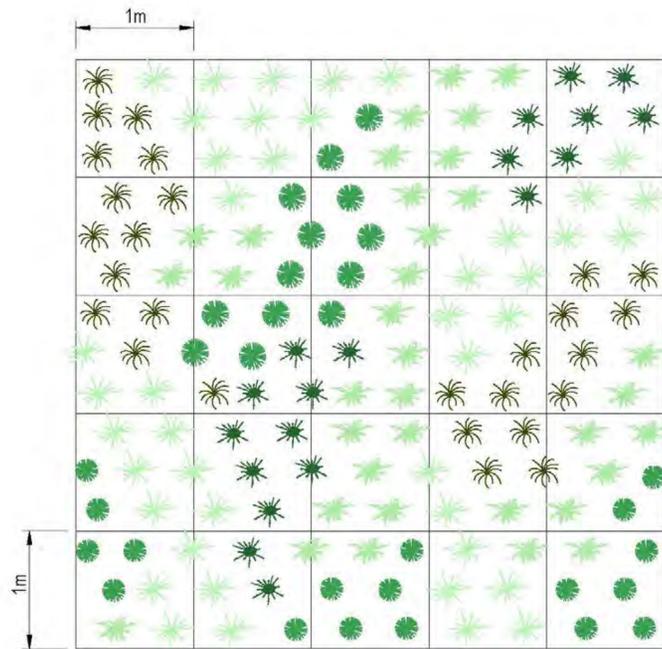
06 PLANTING IN ROCK VOIDS
SCALE: 1:10

PLANTING NOTE:
ALL PLANTING ON BATTERS IS TO BE JUTTED
ALL PLANTING ABOVE THE TOP OF BATTERS IS TO BE MULCHED

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
| B | DETAILED DESIGN PACKAGE 70% | 28.02.2022 |
| C | DETAILED DESIGN PACKAGE 100% | 02.11.2022 |
| D | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 17.11.2022 |
| E | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 13.12.2022 |
| F | FOR TENDER | 25.08.2023 |

DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.

| SCALE | | REV. |
|----------|-------|---|
| AS SHOWN | | F |
| DESIGNED | KC | CAD FILE No. 1-91194_SANDHILLS_DD.DWG |
| DRAWN | RS/TC | SHEET No. 1-191194_DD_703 |
| CHECKED | DM | |

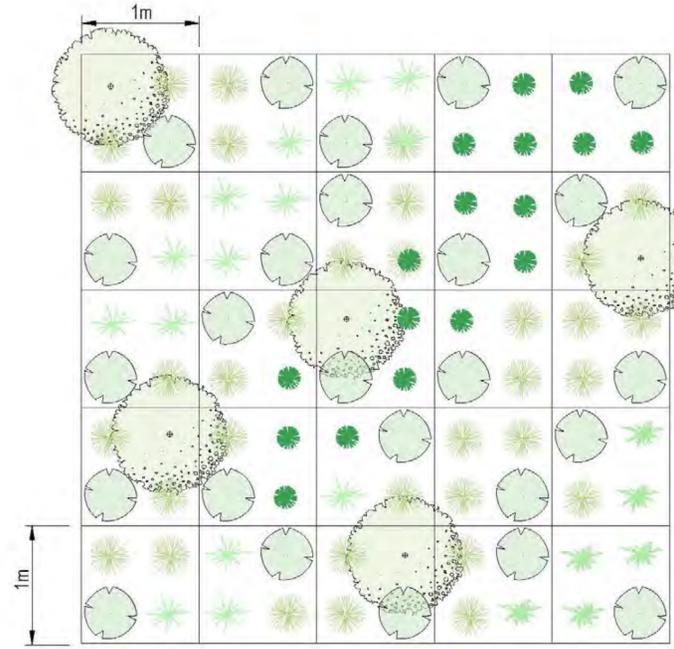


LEGEND

6 X PLANTS/1m²

DENSITY 6 PLANTS/m²
GROUP SPECIES in APPROXIMATELY 10 - 20 PLANTS

01 PLANTING MATRIX ZONES P1, P2, P5, P6, P7, P8, P9
704 SCALE: 1:30

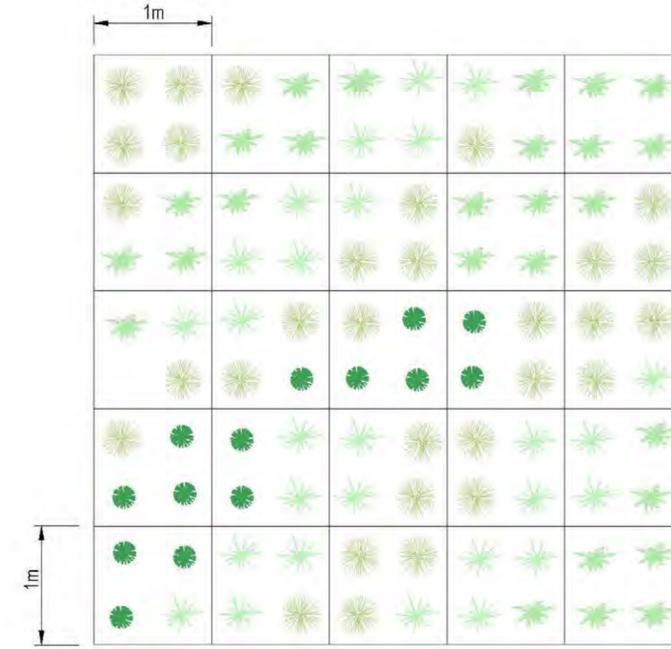


LEGEND

- 1 X TREE/5m² (APPROXIMATELY)
- 1 X SHRUB/1m² (APPROXIMATELY)
- 3 X GRASS/GROUNDCOVER/1m² (APPROXIMATELY)

DENSITY 4 PLANTS/m²
GROUP SPECIES in APPROXIMATELY 10 - 20 PLANTS

02 PLANTING MATRIX ZONES P4 & P10
704 SCALE: 1:30



LEGEND

4 X PLANTS /1m²

DENSITY 4 PLANTS/m²
GROUP SPECIES APPROXIMATELY 10 - 20 PLANTS

03 PLANTING MATRIX ZONE P3 & P11
704 SCALE: 1:30

| REV. | ISSUE / AMENDMENTS | DATE |
|------|--|------------|
| A | PRE-DETAILED DESIGN PACKAGE COUNCIL REVIEW | 17.11.2021 |
| B | DETAILED DESIGN PACKAGE 70% | 28.02.2022 |
| C | DETAILED DESIGN PACKAGE 100% | 02.11.2022 |
| D | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 17.11.2022 |
| E | DETAILED DESIGN PACKAGE AMENDMENTS 100% | 13.12.2022 |
| F | FOR TENDER | 25.08.2023 |

DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.

SCALE
AS SHOWN

| | |
|----------|-------|
| DESIGNED | KC |
| DRAWN | RS/TC |
| CHECKED | DM |

| REV. | FILE |
|----------|---|
| F | CAD FILE No. 1-91194_SANDHILLS_DD.DWG |
| | SHEET No. 1-191194_DD_704 |

1 Planting specification

- The planting is to be carried out by qualified and experienced contractors and all plants are to be sourced from local provenance.
- All plants material is to be in accordance with the species, variety, height and container size specified.

1.1 Planting

Specification as per drawing details and reiterated below.

- The contractor is to supply all plants and turf shown on the drawings (refer to design drawings) and as required to make good all disturbed surfaces
 - The contractor is responsible for undertaking planting of all plants shown on the planting plan as well as replacing all other surfaces that have been damaged due to construction works with 'like for like'
- All plants to be used are required to have a normal growth habit and must be sound, healthy and vigorous and free from pests and infections
- All turf must be provided by the Contractor to make good all disturbed turf areas
- Plants must be grown in the containers of the size stated in the planting schedule and must have sufficient roots to hold earth together intact after removal from containers without being rootbound
- Plants/turf must have large healthy root systems with no evidence of root curl, restriction or damage
- Plants that meet the measurements specified but do not possess a normal balanced height and spread will be rejected
- Plants must be hardened off, not soft or forced, and suitable for planting in the natural climate conditions existing at the site

1.2 Plant Supply

- The contractor is to supply all plants in required species in the available numbers with sufficient time prior to undertaking planting
- The contractor should liaise with the Superintendent to replace any plants that fail or are damaged at any stage of the work under the contract
- Provenance: Plants supplied will be of local provenance, and from the appropriate vegetation community, and as close to site as practical, preferably within a 20 km radius of the site
 - Certificate of provenance: Supply confirmation of provenance of the species as seed is collected/sown, so acceptability of sourced material can be confirmed

1.3 Plant Schedule

- Refer to the planting plans for details

1.4 Execution

- The plants are to be planted by suitably landscape specialists with knowledge of planting methods and be able to identify species to allow for the landscaping plan to be properly implemented

1.5 Planting Set out

- The Contractor must install plants to the extent as shown on drawings
- The zones to be planted are to be marked out on site prior to planting and the set out is to be approved by the Superintendent prior to any planting commencing
- The Contractor is to confirm extent of areas to be planted on site after completion of civil works. Refer to drawings for locations, species, quantities and container sizes.

1.6 Planting conditions

- Planting should be carried out when weather and soil conditions are favourable to plant establishment
 - Do not plant in unsuitable weather conditions including such as extreme heat, cold, frost, wind or rain
- The plants must be planted using appropriate horticultural techniques and in accordance with the drawings

1.7 Storage

- All delivered plants are to be maintained by the Contractor
 - The storage of plants is to be approved by the superintendent, to suit the plant delivery program
 - Where possible plant immediately after delivery
- Protect plants at all times from sun or drying winds
- Plants that cannot be planted immediately on delivery must be kept in the shade, well protected and adequately watered
- Plants must be handled in such a manner to avoid any damage

1.8 Placing

- Planting holes should be at least twice the size of the plant root ball
- The hole should be heavily watered immediately prior to planting and should have ample loose soil to ensure that root soil contact is complete and that no air gaps exist
- A slight depression should be made around the plant to assist in the trapping and infiltration of water
- Install plant stock to the areas indicated at the densities shown, in random pattern, insuring complete coverage

1.9 Fertilising and additives

- Appropriate fertiliser may be added to the plantings at the discretion of the contractor to ensure successful establishment.

1.10 Plant Establishment

- The Contractor is to maintain all plants for an establishment/maintenance period of 6 months from the date that all plants have been installed
- Records of all watering and maintenance carried out during the establishment period are to be maintained by the Contractor and supplied to the Superintendent
- Irrigate plantings throughout the establishment period unless the site receives adequate rainfall
- Plants should be irrigated as required to maintain growth rates free of stress
- Less frequent heavy watering is preferable to light watering
- The soil moisture content needs to be assessed daily and watering regime adjusted accordingly

1.11 Replacement

- Replace damaged or failed plants with plants of the same type and size
- Plant replacement will be at the cost of the contractor during the establishment/maintenance period.

1.12 Soil

Within the wetland macrophyte zones, topsoil should be placed to a minimum depth of 300 mm. Design levels for wetlands are inclusive of topsoil, therefore, when earthworks are occurring, allowance for topsoil is required.

Soils for planting must be of loose, friable consistency and of suitable fertility for plant growth. Soil lumps must be of a maximum 50mm dimension.

Soils for planting must be free from weeds, rocks, debris, and contaminants.

The application of lime may be required where the soil testing identifies a potential soil pH problem (pH < 5) or where acid sulphate soils are detected. The rate of application should be guided by soil test results, and the Acid Sulphate Management Plan (Env Solutions, 2021).

Stockpiled topsoil should be tested and approved by a certified laboratory and wetland designer and may need to be screened to remove any coarse organic matter.

1.1.1 Contamination

In the scenario that fuel, oil, cement or other phytotoxic material is spilt on subsoil or topsoil, excavate the contaminated soil, dispose of to the satisfaction of Byron Shire Council and replace with site soil or imported topsoil.

1.1.2 Installation and Aeration

Spread the media on the prepared surface and grade evenly.

- Fill areas of subsistence to achieve finished levels
- Avoid over compaction
- In areas of high compaction de-compact (rip to 100mm prior to planting)

Appendix B – Outlet Calculations

Cell 1 orifices

The Hydraulic Retention Time (HRT) is calculated as:

Extended detention volume/ total outflow

The outflow from the orifices is calculated using the orifice equation:

$$Q = C_d * A * \sqrt{2 * g * H} * B$$

where, C_d is coefficient of discharge, g is acceleration due to gravity in m/s^2 , B is the blockage factor and H is the distance between the water level and the center of the orifice.

| | | | | | | |
|---------------------------------|-------------------------------------|--|----------------|----------------|-----------------------------|-----------------|
| | Blockage factor | 0.5 | | | | |
| | Orifice invert level (above SWL) | 0 | 0.1 | 0.2 | | |
| | Orifice centre position (above SWL) | 0.0225 | 0.1225 | 0.2225 | | |
| | Orifice diameter (mm) | 45 | 45 | 45 | | |
| | Discharge coefficient (Cd) | 0.6 | 0.6 | 0.6 | | |
| | number of orifices | 2 | 2 | 0 | | |
| | Total Orifice area (m2) | 0.00318 | 0.0031808 6 | 0 | | |
| Extended Detention depth | Extended Detention volume | Out Flow at given Ext. Det. Depth (l/s) | | | Total Out Flow (l/s) | HRT (hr) |
| 0 | 0 | | | | 0.0000 | |
| 0.1 | 100 | 1.17550 | | | 1.1755 | 26.58 |
| 0.2 | 200 | 1.77898 | 1.17550 | | 2.9545 | 21.15 |
| 0.3 | 300 | 2.22435 | 1.77898 | 0.00000 | 4.0033 | 23.42 |

Cell 1 Minimum Weir Size

The weir dimensions required to convey the design flow are calculated using the weir equation:

$$Q = \frac{2}{5} C_w Z H^{2.5}$$

Where:

Q = discharge over side-sloped portion of weir, (m^3/s)

Z = side slope (Z horizontal to 1 vertical) of the weir crest

H = distance between water surface and the crest, (m)

C_w = weir coefficient, 1.67

| | | |
|--|-------|----------------------------|
| Adopted blockage factor | 0.90 | (10% blocked) |
| 'Design flow' (10 year ARI) | 0.55 | m ³ /s |
| side slope (z) | 10 | (horizontal) : 1(vertical) |
| C _w | 1.67 | |
| Spillway Weir Crest Level | 3.2 | m AHD |
| Embankment level | 3.5 | m AHD |
| Max. water level above spillway (for 'Design Flow') | 0.15 | m |
| Freeboard to top of embankment | 0.15 | m |
| Therefore, L = | 5.63 | m |
| total side slope length = | 6 | 3 m each side |
| total length = | 11.63 | m |

Cell 2 orifices

| | | | | | |
|---------------------------------|--|--|----------------|-------------------------|---------------------------------|
| | Blockage factor | 0.5 | | | |
| | Orifice invert level (height above OWL) | 0 | 0.1 | | |
| | Orifice centre position (height above OWL) | 0.05 | 0.125 | | |
| | Orifice diameter (mm) | 100 | 50 | | |
| | number of orifices | 2 | 2 | | |
| | Total Orifice area (m ²) | 0.01571 | 0.00392699 | | 0.0196 |
| Extended Detention depth | Extended Detention volume | Flow at given Ext. Det. Depth (l/s) | | Total Flow (l/s) | Not. Detention Time (hr) |
| 0 | 0 | | | 0 | |
| 0.1 | 364.96 | 4.66265 | | 4.66 | 24.46 |
| 0.2 | 729.92 | 8.07594 | 1.42764 | 9.50 | 24.00 |

Cell 2 Outlet Weir

| | | |
|---|-------|----------------------------|
| Adopted blockage factor | 0.95 | |
| 'Design Operational Flow' (1-Year Event) | 10 | ARI |
| 'Design flow' (10 year ARI) | 3.94 | m ³ /s |
| side slope (z) | 10 | (horizontal) : 1(vertical) |
| C_w | 1.66 | |
| Spillway Weir Crest Level | 2.4 | m AHD |
| Embankment level | 2.7 | m AHD |
| Max. water level above spillway (for 'Design Flow') | 0.3 | m |
| Freeboard to top of embankment | 0 | m |
| Therefore, L = | 13.94 | m |
| Side slope length = | 6.00 | m (3 m each side) |
| total length = | 19.94 | m |

Appendix C – Bill of Quantities

| Sandhills Wetland 1 - Construction | | | | | | |
|------------------------------------|---------------------------------------|--|----------------|-------|--------------|----------------------------|
| | | | | | | Sub- Total \$ 233,491.30 |
| Clearing and Earthworks | | | | | | |
| NO. | Action | Description | Unit | Qty | Rate | Total |
| 2.1 | Water Management | Divert flows around wetland and dewater proposed wetland | Each | | \$ 15,000.00 | \$ - |
| 2.2 | Access track | Undertake subgrade works and construct maintenance access track | m ² | 450 | \$ 5.00 | \$ 2,250.00 |
| 2.3 | Tree Removal - Medium | Cut & remove existing medium size tree from site including stump grinding to 300mm below surface and backfilling | Each | 116 | \$ 120.00 | \$ 13,920.00 |
| 2.4 | Tree Removal - Large | Cut & remove existing large size tree from site including stump grinding to 300mm below surface and backfilling | Each | 31 | \$ 120.00 | \$ 3,720.00 |
| 2.5 | Remove topsoil and stockpile | Remove topsoil (assumed 200mm thick) and stockpile on site for use as planting media within the wetland. Test and treat for ASS | m ³ | 479 | \$ 15.00 | \$ 7,185.00 |
| 2.6 | Excavate basin | Excavate basin W1 to 200mm below finished level and batter slopes | m ³ | 1,901 | \$ 15.00 | \$ 28,515.00 |
| 2.7 | Cut to Fill | Using suitable spoil extracted compact Fill as required to achieve design levels | m ³ | 120 | \$ 15.00 | \$ 1,800.00 |
| 2.8 | Removal of excess fill | Disposal of excess to Council Requirements - possibly neighbouring sports fields | m ³ | 1,781 | \$ 8.00 | \$ 14,248.00 |
| 2.9 | Set wetland floors and compaction | Set wetland floors to required design levels prior to placement of topsoil | m ² | 1,004 | \$ 5.00 | \$ 5,017.50 |
| | | | | | | Sub- Total \$ 76,655.50 |
| Construction | | | | | | |
| 3.1 | Install planting media | Spread stockpiled topsoil to 200mm thickness of soft friable soil for planting across the wetland macrophyte, ephemeral and batters | m ³ | 483 | \$ 8.00 | \$ 3,864.00 |
| 3.2 | Supply and install outlet pipe | Supply and install 2 RCP outlet pipes for maintenance draining | m | 20 | \$ 350.00 | \$ 7,000.00 |
| 3.3 | Inlet Structure | Supply and install drainage structures including excavation with lockable GMS grate hinged to frame | Each | 2 | \$ 1,500.00 | \$ 3,000.00 |
| 3.4 | Valve pit | Supply and install upturned pipe in pit with orifices drilled to detail | Each | 2 | \$ 200.00 | \$ 400.00 |
| 3.5 | Outlet headwalls - Rocks not concrete | Supply and install riprap headwall and rock scour protection | Each | 2 | \$ 2,500.00 | \$ 5,000.00 |
| 3.6 | Supply and install weir | Supply and install rock weir tops and geofabric underlay | m ² | 61 | \$ 150.00 | \$ 9,120.00 |
| 3.7 | Supply and install concrete spillway | Supply and install reinforced concrete overflow weir nom 10m long x 5.5m wide x 150mm thick 30MPa SL82 Fabric battering up to proposed walkway | m ² | 79 | \$ 82.00 | \$ 6,510.80 |
| | | | | | | Sub-Total \$ 34,894.80 |
| Planting | | | | | | |
| 4.1 | Batter planting | Supply and install of tube stock at 4/m ² | m ² | 1,336 | \$ 10.00 | \$ 13,360.00 |
| | Shoulder Planting | Supply and install of tube stock at 4/m ² | m ² | 992 | \$ 10.00 | \$ 9,920.00 |
| 4.3 | Ephemeral planting | Supply and install of tube stock at 6/m ² | m ² | 268 | \$ 15.00 | \$ 4,020.00 |
| 4.2 | Mulching | Supply and install native woodchip mulch on batters (above OWL = 2.9m) | m ² | 2,328 | \$ 7.00 | \$ 16,296.00 |
| 4.4 | Macrophyte Planting | Supply and install of tube stock plants at 6/m ² | m ² | 1,223 | \$ 15.00 | \$ 18,345.00 |
| 4.5 | Planting maintenance | Allowance for establishment period 3 mth and maintenance for 12mth | mth | 15 | \$ 4,000.00 | \$ 60,000.00 |
| | | | | | | Sub- Total \$ 121,941.00 |
| Total Cost | | | | | | Total \$ 233,491.30 |

Sandhills Wetland, Byron Shire Council

| Sandhills Wetland 2 - Construction | | | | | | |
|------------------------------------|---|--|----------------|-------|--------------|---------------------------------|
| | | | | | | Sub- Total \$ 389,490.60 |
| Clearing and Earthworks | | | | | | |
| NO. | Action | Description | Unit | Qty | Rate | Total |
| 2.1 | Water Management | Divert flows around wetland and dewater proposed wetland | Each | 1 | \$ 15,000.00 | \$ 15,000.00 |
| 2.2 | Access track | Undertake subgrade works and construct maintenance access track | m ² | 600 | \$ 5.00 | \$ 3,000.00 |
| 2.3 | Tree Removal - Medium | Cut & remove existing medium size tree from site including stump grinding to 300mm below surface and backfilling and mulching | Each | 465 | \$ 120.00 | \$ 55,800.00 |
| 2.4 | Tree Removal - Large | Cut & remove existing large size tree from site including stump grinding to 300mm below surface and backfilling and mulching | Each | 56 | \$ 120.00 | \$ 6,720.00 |
| 2.5 | Remove topsoil and stockpile | Remove topsoil (assumed 200mm thick) and stockpile on site for use as planting media within the wetland. Test and treat for ASS | m ³ | 1,044 | \$ 15.00 | \$ 15,663.00 |
| 2.6 | Excavate basin | Excavate basin W2 to 200mm below finished level incl side batters | m ³ | 3,237 | \$ 15.00 | \$ 48,552.00 |
| | Excavate open Water sections | Excavate open water sections | m ³ | 106 | \$ 15.00 | \$ 1,584.00 |
| 2.7 | Cut to Fill | Using suitable spoil extracted compact Fill as required to achieve design levels | m ³ | 102 | \$ 15.00 | \$ 1,530.00 |
| 2.8 | Removal of excess fill | Disposal of excess to Council Requirements - possibly neighbouring sports fields | m ³ | 3,240 | \$ 8.00 | \$ 25,923.20 |
| 2.9 | Set wetland floors and compaction | Set wetland floors to required design levels prior to placement of topsoil | m ² | 3,499 | \$ 5.00 | \$ 17,495.00 |
| 2.10 | Set open water base and batters for proposed clay lining | Set open water base to required design level, plus extra depth for clay lining | m ² | 186 | \$ 5.00 | \$ 931.50 |
| | | | | | | Sub- Total \$ 192,198.70 |
| Construction | | | | | | |
| 3.1 | Install clay liner to open water areas | Clay liner or approved equivalent - 2 separate areas | m ² | 186 | \$ 10.00 | \$ 1,863.00 |
| 3.2 | Install planting media | Spread stockpiled topsoil to 200mm thickness of soft friable soil for planting across the wetland macrophyte, ephemeral and batters | m ³ | 1,329 | \$ 8.00 | \$ 10,628.80 |
| 3.3 | Supply and install outlet pipe | Supply and install 2 outlet RCP pipe for maintenance draining | m | 16 | \$ 350.00 | \$ 5,600.00 |
| 3.4 | Outlet structure | Supply and install drainage structures including excavation with lockable GMS grate hinged to frame | Each | 2 | \$ 1,500.00 | \$ 3,000.00 |
| 3.5 | Valve pit | Supply and install upturned pipe in pit with orifices drilled to detail | Each | 2 | \$ 200.00 | \$ 400.00 |
| 3.6 | Outlet headwalls - Rocks not concrete | Supply and install riprap headwall and rock scour protection | Each | 2 | \$ 2,500.00 | \$ 5,000.00 |
| 3.7 | Supply and install weir | Supply and install rock weir tops and geofabric underlay | m ² | 65 | \$ 150.00 | \$ 9,675.00 |
| 3.8 | Supply and install trafficable concrete spillway | Supply and install reinforced concrete overflow weir nom 20m long x 5.4m wide x 150mm thick 30MPa SL82 Fabric battering up to proposed walkway | m ² | 134 | \$ 82.00 | \$ 11,020.80 |
| 3.9 | Rock Scour Protection - lining (for 2100x600 RCBC if req) | Supply and Install Non-woven Geotextile Filter Fabric as specified in Notes 3m width with 1m overlap for Scour protection | lin.m | 11 | \$ 15.00 | \$ 165.00 |
| 3.10 | Rock Scour Protection - underlay | Supply and install Underlay Rock with D50 = 50mm min 100mm thick | m ³ | 2.3 | \$ 85.00 | \$ 192.10 |
| 3.11 | Rock Scour Protection - Rocks | Supply and install 200mm Rock to base of Swale and batters | m ³ | 4.5 | \$ 85.00 | \$ 384.20 |
| | | | | | | Sub-Total \$ 47,928.90 |
| Planting | | | | | | |
| 4.1 | Batter planting | Supply and install of tube stock at 6/m ² | m ² | 1,289 | \$ 15.00 | \$ 19,335.00 |
| 4.2 | Batter Mulching | Supply and install native woodchip mulch on batters | m ² | 1,289 | \$ 7.00 | \$ 9,023.00 |
| 4.3 | Ephemeral planting | Supply and install of tube stock at 6/m ² | m ² | 147 | \$ 15.00 | \$ 2,205.00 |
| 4.4 | Macrophyte Planting | Supply and install of tube stock plants at 6/m ² | m ² | 3,920 | \$ 15.00 | \$ 58,800.00 |
| 4.5 | Planting maintenance | Allowance for establishment period 3 mth and maintenance for 12mth | mth | 15 | \$ 4,000.00 | \$ 60,000.00 |
| | | | | | | Sub- Total \$ 149,363.00 |
| Total Cost | | | | | | Total \$ 389,490.60 |

Sandhills Wetland, Byron Shire Council

| Sandhills Wetland 3 - Construction | | | | | | | |
|------------------------------------|---|---|----------------|-------|--------------|----------------------|-------------------|
| | | | | | | Sub- Total \$ | 619,214.46 |
| Clearing and Earthworks | | | | | | | |
| NO. | Action | Description | Unit | Qty | Rate | Total | |
| 2.1 | Water Management | Divert flows around wetland and dewater proposed wetland | Each | - | \$ 15,000.00 | \$ | 15,000.00 |
| 2.2 | Access track | Undertake subgrade works and construct maintenance access track | m ² | 585 | \$ 5.00 | \$ | 2,925.00 |
| 2.3 | Tree Removal - Medium | Cut & remove existing medium size tree from site including stump grinding to 300mm below surface and backfilling | Each | 382 | \$ 120.00 | \$ | 45,840.00 |
| 2.4 | Tree Removal - Large | Cut & remove existing large size tree from site including stump grinding to 300mm below surface and backfilling | Each | 59 | \$ 120.00 | \$ | 7,080.00 |
| 2.5 | Remove topsoil and stockpile | Remove topsoil (assumed 200mm thick) and stockpile on site for use as planting media within the wetland. Test and treat for ASS | m ³ | 1,857 | \$ 15.00 | \$ | 27,852.00 |
| 2.6 | Excavate basin | Excavate basin W3 to 200mm below finished level | m ³ | 9,687 | \$ 15.00 | \$ | 145,305.00 |
| | Excavate open water section | Excavate to open Water Base level (0.8m) | m ³ | 686 | \$ 16.00 | \$ | 10,976.00 |
| 2.7 | Cut to Fill | Using suitable spoil extracted compact Fill as required to achieve design levels | m ³ | 15 | \$ 15.00 | \$ | 225.00 |
| 2.8 | Removal of excess fill | Disposal of excess to Council Requirements - possibly neighbouring sports fields | m ³ | 9,672 | \$ 8.00 | \$ | 77,376.00 |
| 2.9 | Set wetland floors and compaction | Set wetland floors to required design levels prior to placement of topsoil | m ² | 6,423 | \$ 5.00 | \$ | 32,115.00 |
| 2.10 | Set open water 1 base and batters for proposed clay lining | Set open water base to required design level, plus extra depth for clay lining | m ² | 575 | \$ 5.00 | \$ | 2,875.00 |
| | | | | | | Sub- Total \$ | 364,694.00 |
| Construction | | | | | | | |
| 3.1 | Install clay liner to open water areas | clay liner or approved equivalent | m ² | 832 | \$ 10.00 | \$ | 8,320.00 |
| 3.2 | Install planting media | Spread stockpiled topsoil to 200mm thickness of soft friable soil for planting across the wetland macrophyte, ephemeral and batters | m ³ | 1,674 | \$ 8.00 | \$ | 13,395.20 |
| 3.3 | install diversion berm | Supply, install, compact stockpiled spoil to form proposed Earthen Bund nom 7m long x 0.1m high x 1.2m wide at base | m ³ | 0.8 | \$ 15.00 | \$ | 11.55 |
| 3.5 | install planting media | Spread stockpiled topsoil to 100mm thickness of soft friable soil for planting over Earthen Bund | m ³ | 0.8 | \$ 15.00 | \$ | 12.71 |
| 3.8 | Outlet headwall 675 | Supply and install Stone Headwall for existing 675mm dia pipe | Each | 1 | \$ 750.00 | \$ | 750.00 |
| 3.9 | Rock lined weir - lining (for swale from lots to the south) | Supply and Install Non-woven Geotextile Filter Fabric as specified in Notes 3m width with 1m overlap for Scour protection | lin.m | 5 | \$ 15.00 | \$ | 75.00 |
| 3.10 | Rock lined weir - underlay | Supply and install Underlay Rock with D50 = 50mm min 100mm thick | m ³ | 1.2 | \$ 85.00 | \$ | 103.28 |
| 3.11 | Rock lined weir - Rocks | Supply and install 200mm Rock to base of Swale and batters | m ³ | 2.4 | \$ 85.00 | \$ | 206.55 |
| | | | | | | Sub-Total \$ | 22,489.46 |
| Planting | | | | | | | |
| 4.1 | Forest Zone planting | Supply and install of tube stock at 6/m ² | m ² | 4,853 | \$ 15.00 | \$ | 72,795.00 |
| 4.2 | Mulching | Supply and install native woodchip mulch on batters | m ² | 4,853 | \$ 7.00 | \$ | 33,971.00 |
| 4.3 | Frog Marsh Zone | Supply and install of tube stock at 6/m ² | m ² | 2,517 | \$ 15.00 | \$ | 37,755.00 |
| 4.4 | Macrophyte Planting | Supply and install of tube stock plants at 6/m ² | m ² | 1,834 | \$ 15.00 | \$ | 27,510.00 |
| 4.5 | Planting maintenance | Allowance for establishment period 3 mth and maintenance for 12mth | mth | 15 | \$ 4,000.00 | \$ | 60,000.00 |
| | | | | | | Sub- Total \$ | 232,031.00 |
| Total Cost | | | | | | Total \$ | 619,214.46 |



Leading environmental solutions...

Bangalow

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