

9 July 2024

Mirvac
 Level 14, 80 Ann Street
 Brisbane QLD 4000

Attention: Jason Augustine

Dear Jason,

RE: EVERLEIGH ROL13 – STORMWATER QUANTITY AND STORMWATER QUALITY ANALYSIS

This letter outlines the water quantity and quality analysis undertaken in support of the Reconfiguration of a Lot (ROL) submission for Precinct 5, 6 & 7 (also referred to as ROL13) of the Everleigh development. The site is located on the corner of Greenbank Road and Teviot Road, Greenbank which is comprised of the following: residential lots, a school and parklands.

The Everleigh development is subject to a whole of site Everleigh Stormwater Masterplan 2024 – ‘Everleigh Stormwater Masterplan Report – Version 3 Rev 2’ (QC4060_005-REP-701-2), also referred to as WOS SWMP 2024, which demonstrates how stormwater quality and quantity is to be managed by multiple infrastructure items working in conjunction. This letter should be read in conjunction with the WOS SWMP 2024.

This letter Confirms the preliminary design of stormwater infrastructure items within the ROL13 footprint meets the stormwater management objectives set with the WOS SWMP 2024. Refer to Figure 1 for the site extent.

**PLANS AND DOCUMENTS
 referred to in the PDA
 DEVELOPMENT APPROVAL**

Approval no: DEV2024/1517

Date: 16 May 2025

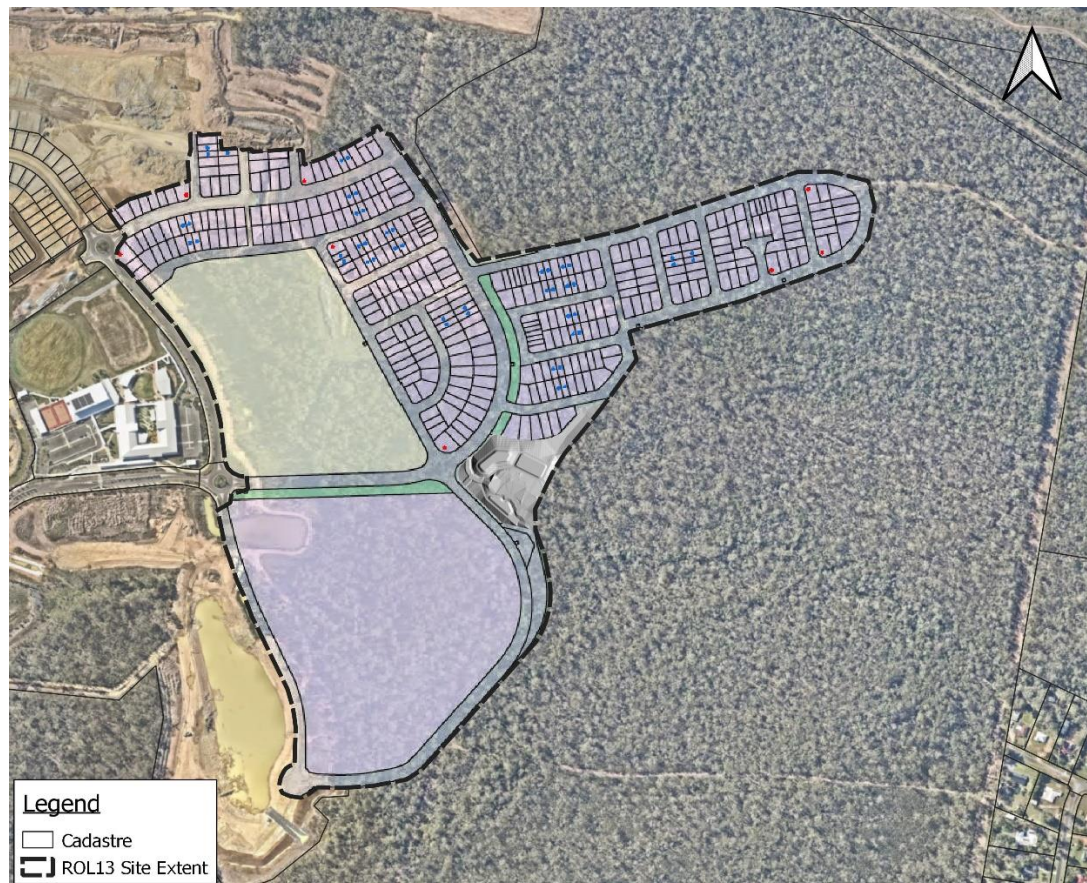


Figure 1: Site Extent

STORMWATER QUANTITY ANALYSIS

Stormwater Quantity Catchment

The WOS SWMP 2023 demonstrates that detention is not required for the ROL13 catchment as shown in Figure 2 which has been extracted from the WOS SWMP. The ROL 13 catchment area outlined in the WOS SWMP has not changed.

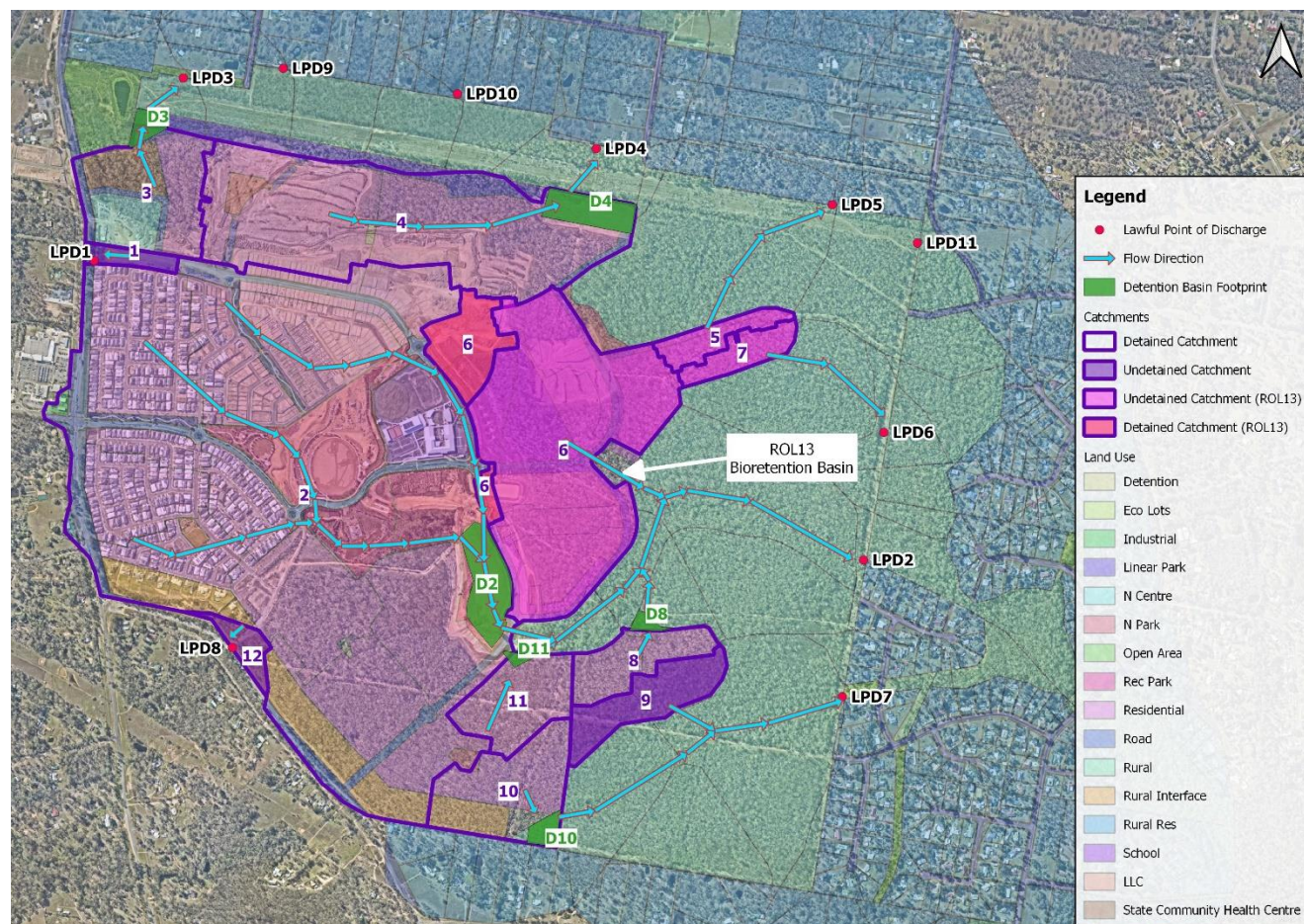


Figure 2: Catchment and Land Use Delineation

Compliance with Whole of Site Stormwater Masterplan

The WOS SWMP 2024 outlines the ultimate stormwater mitigation detention strategy for the Site which includes the specification of numerous detention basins working in conjunction to ensure that ultimate (fully developed) scenario peak flows are mitigated to equal or below pre-development flows. Conceptual design parameters for each of the basins are provided in the WOS SWMP 2024.

Table 1 below provides a summary of the flows received at the ROL13 bioretention basin.

TABLE 1 – PEAK FLOWS AT ROL13 BASIN

Design Flood Event (AEP)	Peak Flow (m ³ /s)
1%	18.19
2%	16.54
5%	14.53
10%	12.75

Design Flood Event (AEP)	Peak Flow (m ³ /s)
18.13%	11.18
39.35%	9.06
63.20%	7.07

STORMWATER QUALITY ANALYSIS

Stormwater Quality Catchments

The catchment reporting to the ROL13 basins and riparian vegetation is referred to as waterway quality catchment 6 in the WOS SWMP (Engeny 2024 – ‘Everleigh Stormwater Masterplan Report – Version 3 Rev 2’) and has an area of 40.8 ha. No changes have been made to the catchment area. Refer Figure 3 for the stormwater quality catchment plan.



Figure 3: Stormwater Quality Catchment

Proposed Stormwater Treatment Train

The stormwater treatment train for ROL13 is proposed to consist of a sediment pond (SB6), a bioretention system (B6) and riparian vegetation (RP6) in the approved WOS SWMP for the development. The overall treatment strategy remains unchanged as all parameters for the proposed treatment devices for this submission are as per the WOS SWMP.

It is proposed that stormwater from the development will enter the proposed Precinct 6 sediment basin via 2 separate inlet pipes. The sediment basin will capture coarse sediment from the upstream catchment prior to discharging to 2 saturated bioretention system cells. High flows will bypass the bioretention basins via a high flow spillway and rock chute to the downstream waterway. Refer to the preliminary design plans enclosed with this memorandum for more details.

Waterway Enhancement

Revegetation and stabilisation of riparian zones is proposed as an alternative treatment measure to bioretention systems where flows discharge to drainage lines within the Environmental area. It is proposed to revegetate 4 m² of riparian habitat for every 1 m² of bioretention filter media required to meet the SPP treatment objectives for the catchment according to the MUSIC model for the development.

We believe this innovative approach to water quality treatment will offer the following additional benefits to council:

- Increase in waterway stability.
- Reduction in maintenance activities due to sedimentation in downstream drains and channels.
- Reduced regular maintenance as this work will replace four WSUD assets all of which would require ongoing maintenance activities.
- Improved natural habitat.
- Improvements to water quality associated with filtration of water through vegetation, shading of the waterway and reduced sediment loads associated with instream erosion.

Refer to the ROL13 Rapid Waterway Geomorphic Assessment for further details.

Compliance with Whole of Site Stormwater Master Plan

The WOS SWMP outlines the ultimate stormwater quality strategy for the site which includes the specification of numerous infrastructure items working in conjunction to ensure ultimate (fully developed) scenario stormwater quality requirements are met. This section seeks to verify that the stormwater quality infrastructure for catchment 6 remain the same as the WOS SWMP. Table 2 below outlines the water quality treatment parameters from the WOS SWMP and the proposed design parameters.

TABLE 2 – SB6, B6 AND RP6 PARAMETERS

Parameter	WOS SWMP	Proposed Design
SB6 Sediment Basin		
Surface Area*	950m ²	950m ²
Extended Detention Depth	300mm	300mm
Permanent Pool Volume	770m ³	770m ³
B6 Bioretention Basin		
Asset Type	Saturated System	Saturated System
Extended Detention Depth	300mm	300mm
Surface Area	1080m ²	1080m ²
Filter Depth	700mm	700mm
TN Content of Filter Media	400mg/kg	400mg/kg
Orthophosphate Content of Filter Media	5mg/kg	5mg/kg
RP6 Riparian Vegetation (Modelled as Bioretention)		
Extended Detention Depth	300mm	300mm
Surface Area (Riparian Veg)	3900m ²	3900m ²
Surface Area (Effective Filter Media)	975m ²	975m ²
Filter Depth	500mm	500mm
TN Content of Filter Media	400mg/kg	400mg/kg
Orthophosphate Content of Filter Media	5mg/kg	5mg/kg

Notes:

* As agreed with Council the proposed sediment basin size was calculated based on 70% capture of 125 micro particle.

Modelled pollutant load reductions for ROL13 are provided in Table 3 and Table 4 provides the reductions on a whole of site and catchment basis.

TABLE 3 – WATER QUALITY MODELLING RESULTS – ROL13

Pollutant	Reduction Objectives (%)	WOS Modelled Reduction (%)
Total Suspended Solids	80	86.7
Total Phosphorus	60	77
Total Nitrogen	45	48.4
Gross Pollutants > 5mm	90	100

TABLE 4 – WATER QUALITY MODELLING RESULTS – WOS

Pollutant	Reduction Objectives (%)	WOS Modelled Reduction (%)
Total Suspended Solids	80	80.1
Total Phosphorus	60	68.9
Total Nitrogen	45	45.9
Gross Pollutants > 5mm	90	98.9

The updated MUSIC model indicates that the proposed design water quality and treatment assets is acceptable on a catchment and whole of site basis and is generally in alignment with the WOS SWMP. A preliminary design of the ROL13 treatment system has been enclosed with the memorandum to indicate sufficient space has been allocated for ROL13 water quality and to demonstrate the functionality of the system.

CONCLUSION

An assessment has been undertaken to confirm stormwater quality assets proposed in support of ROL13 submission for the Everleigh development meet quantity and quality requirements. The assessment has indicated the following:

- The proposed sediment basin (SB6), bioretention system (B6) and riparian vegetation (RP6) parameters for ROL13:
 - Meets the requirements of the WOS SWMP.
 - Meets the required stormwater quality targets.

The proposed stormwater infrastructure meets stormwater quality requirements for the ROL13 catchment. The stormwater quantity requirements are achieved as part of the WOS SWMP as it is demonstrated that with the additional detention in other precincts, detention for the ROL13 development is not required.

Regards,



David Sexton

Principal Engineer - Flood, Stormwater & Waterway Management

Enc.

- ROL13 Concept Design (QC4060-007-DWG (EVERLEIGH ROL13))
- Rapid Waterway Geomorphic Assessment (QC4060_007-MEM-001-2-Rapid Waterway Geomorphic Assessment)

Author
CL/RS

Reviewer
DS

Project Manager
CL

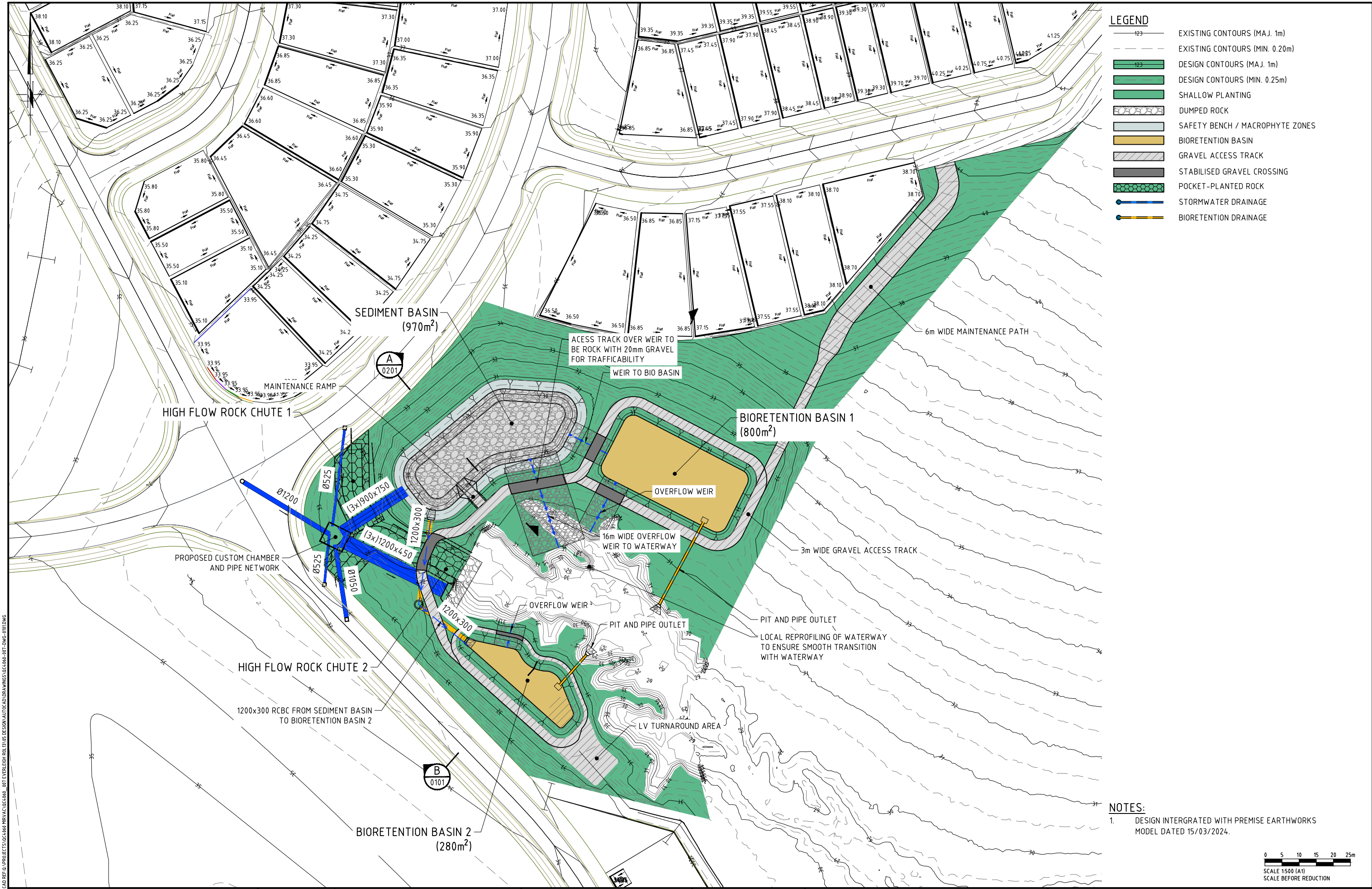
Project Director
DS

QC4060_007-LTR-001-2-Everleigh ROL13 SW Analysis

DISCLAIMER

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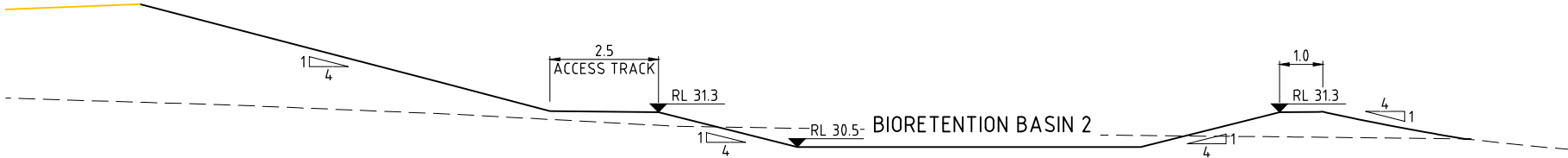


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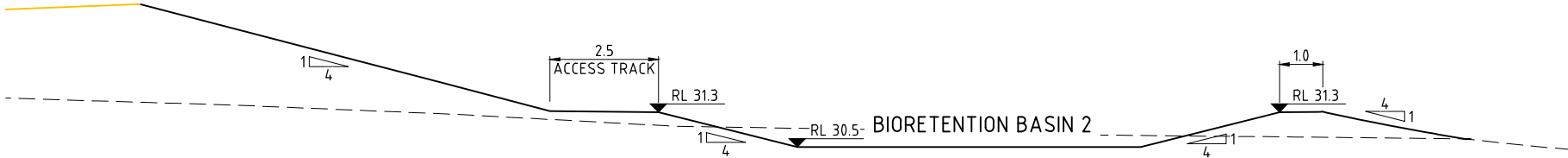
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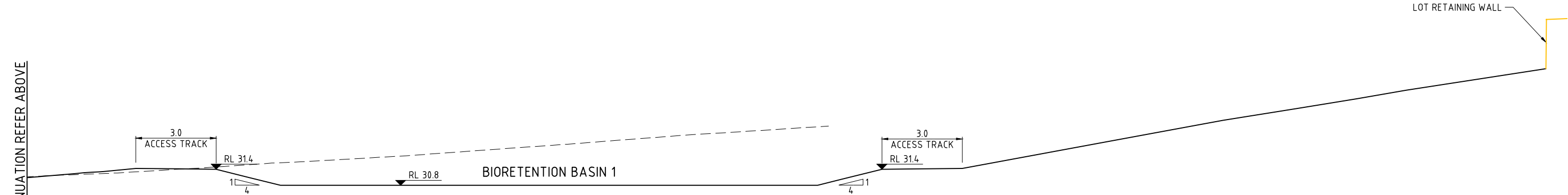
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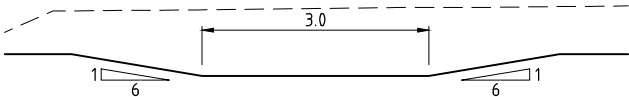
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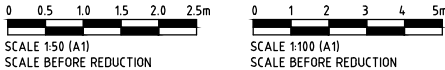
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RAMP TYPICAL SECTION
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LEGEND

- EXISTING SURFACE
- PREMISE EARTHWORKS SURFACE
- DESIGN SURFACE

NOTE:

REFER TO DWG 0101 FOR GENERAL NOTES AND LEGEND.



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MEMORANDUM

Project:	QC4060_007 Everleigh ROL13	Date:	9 July 2024
To:	MIRVAC	From:	Engeny
ATT:	Jason Augustine	CC:	Nick Sommerville
Subject:	ROL13 Rapid Waterway Geomorphic Assessment		

INTRODUCTION

Engeny Australia Pty Ltd (Engeny) has been engaged by Mirvac to undertake a concept design of the water quality treatment devices for Everleigh stage 13 reconfiguration of a lot (ROL13), which are detailed within the Everleigh Stormwater Masterplan Version 3 Revision 2 (also referred to as WOS SWMP 2024). The site is located on the corner of Greenbank Road and Teviot Road, Greenbank and includes precincts 5, 6 & 7 (also referred to as ROL13), which is comprised of the following: residential lots, a school and parklands. The precincts will discharge to a sediment basin and two (2) bioretention basins before ultimately discharging to the downstream waterway.

The downstream waterway is proposed to be enhanced as a part of the water quality masterplan for the site and is depicted in Figure 1 Engeny have prepared this technical memorandum to outline the existing condition of the waterway and determine areas within the waterway that require, or are best suited for, stabilisation and enhancement to contribute to water quality outcomes for the site. Stabilisation and enhancement of the waterway will ultimately reduce sediment and pollutant loads to downstream environs off site.

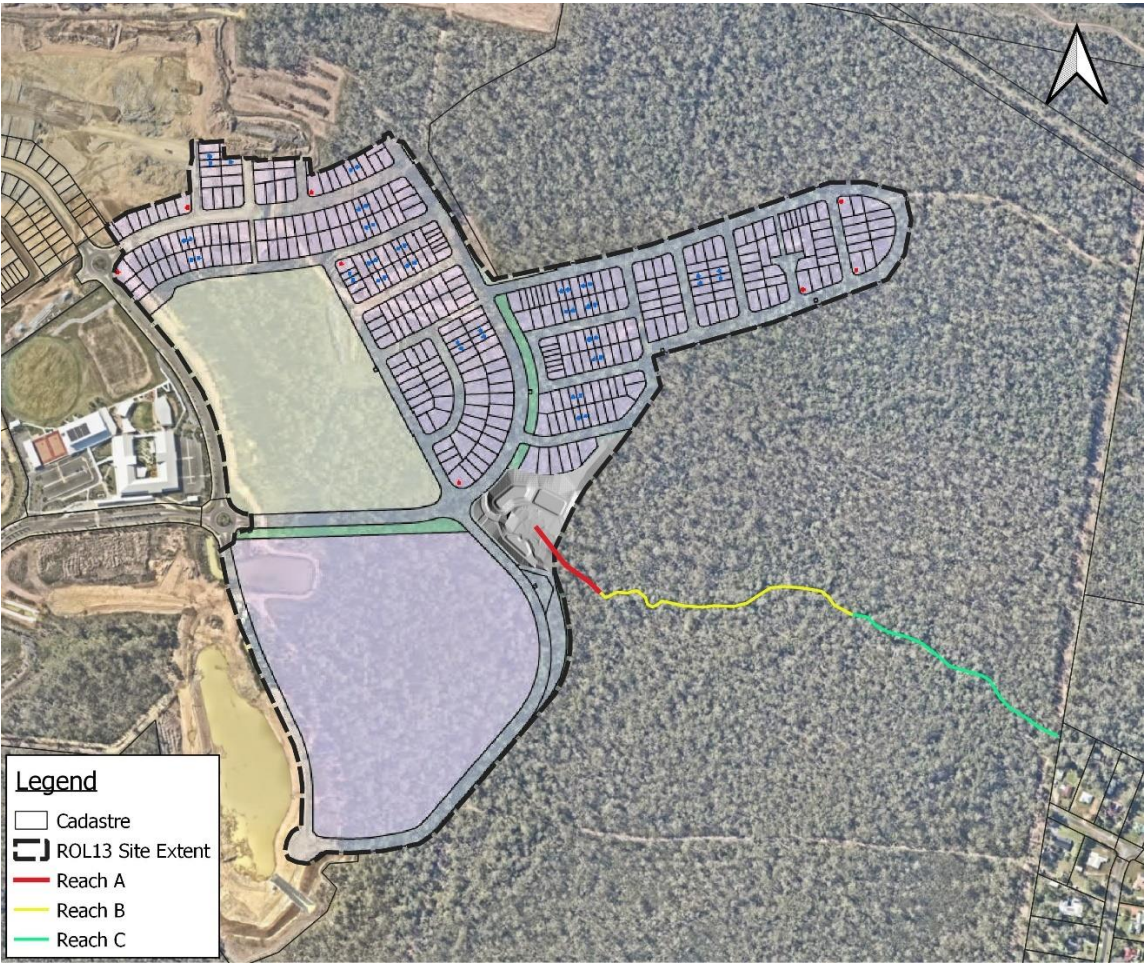


Figure 1: ROL13 Site Extent

SITE ASSESSMENT

A site inspection was undertaken by Carson Ly and David Sexton on the 24th October 2023. The inspection commenced at the downstream end of the waterway, prior to the culvert crossing, and concluded at the downstream boundary of ROL13. The study area for this project is shown in Figure 2 and is a tributary of North Creek that is immediately downstream of the project site. The study area was split into three (3) reporting reaches. Figure 2 the location of the each of the reaches and specifies the geomorphic features observed during the site inspection, as well as instabilities within the waterway, Attachment 1 shows site photos taken at each location. It was observed during the site inspection of the waterway, that the following potential geomorphic risks were evident:

- Generally single Incised low flow channel within wider floodplain.
- Incision generally stabilised where ground covers are present.
- Small headcuts.
- Bank erosion with dispersive soils evident.
- Historical tree clearance (lack of mature trees), likely due to grazing practices.
- Sandy substrate within the channel bed.
- Sinuosity calculation = 1.1 (therefore is considered a straight waterway).

A summary of the site inspection is outlined in Table 1 and should be read in conjunction with Figure 2.



Figure 2: Project Study Area

Table 1: Reach Assessment Site Inspection

Reach	Observations
A – Upstream Reach	<p>Reach A is approximately 100m long and is located immediately downstream of the proposed development. Location 1 is considered the most upstream point of the defined waterway. The reach consisted of a small incised ephemeral low flow channel within the greater floodplain. Surrounding vegetation consisted of small trees, long grass and lomandra. However, vegetation was sparse in a number of areas and the batters of the upstream portion of the reach had limited vegetation cover. Location 2 shows the confluence of the reach with the main waterway, which presents as a more defined channel. It was evident that the batters were eroding in this area.</p>
B – Mid Reach	<p>Reach B is approximately 370m long and commences at location 2. The waterway appeared to be much more defined through Reach B and consisted of deepening to the channel where natural ponds have been formed and are holding water. Throughout the entirety of the reach, several features and instabilities were observed. At Location 4 scour to the bank was located at a bend with dispersive soils being evident. The channel was approximately 3m deep in this area. Several small trees were found at the top of both sides of the banks however, there are limited ground covers to assist the trees in establishing and stabilising the embankment. The combination of dispersive soils and limited ground covers has resulted in the widening of the channel, and the ongoing erosion of the embankment.</p> <p>Further downstream, dispersive soils continued to be evident, with limited vegetation on the banks of the waterway. The lack of vegetation and presence of exposed dispersive soils has resulted in the significant scour and erosion of the banks where the roots of trees had been exposed (locations 7, 8 & 9).</p> <p>A head cut was observed at location 10. The head cut is partially stabilised by lomandra and long grass. Several ponds were also found in the vicinity of location 10 which appeared to be hydrating vegetation.</p>
C – Downstream Reach	<p>Reach C is approximately 340m long and commences downstream of the first head cut. Similar to the mid reach the downstream reach consisted of small trees located at the top of batter with limited ground covers to stabilise the embankment. At Location 11 the primary channel had eroded and blocked the channel resulting in a secondary channel forming through deposition on the inside bench. The confluence of the primary and secondary channel occurs approximately 20-30m downstream of where the split occurred. The main channel continued at a consistent depth of approx. 1m from location 10 to location 12 where the incised low flow channel deepened to 1.5-2.0m. Two (2) additional head cuts were observed at location 14 and location 16 which were partially stabilised by native grasses.</p>

EROSION RISK ASSESSMENT

Vegetative Assessment

A high levels vegetative assessment was conducted as part of the geomorphic risk assessment. Several areas of erosion were identified which can be attributed to lack of vegetation within the bed and bank of the waterway. Several instances of bank slumping and headcuts were observed during the site inspection. Areas of instability generally correlated with areas where vegetation was lacking, suggesting the waterway stability would be improved, from additional vegetation. Figure 3 specifies the areas in which would benefit the most.

Identified Risks

Lack of Vegetation – Areas of the waterway experiencing erosion generally alignment with areas lacking in riparian vegetation. Vegetation enhances stability of the waterway by binding soils and creating a low velocity boundary layer that protects soils at the surface. Enhancement of riparian vegetation improves water quality through bank and bed stabilisation which reduces sediment transport and mobilisation of associated nutrients, filtration through vegetation removes nutrients while slowing flows.

Ponds - The site inspection noted the presence of small ponds that are currently hydrating the surrounding landscape and enhancing vegetation. Increased riparian densities around the fringes of these ponds will enhance stability and habitat value reducing the risk of erosion occurring around and within these ponds.

Head Cuts - Head cuts have been identified in Locations 10, 14 and 16, as noted in Figure 2. There is potential for these head cuts to continue to migrate further upstream, deepening and widening the waterway. This could result in significant sediment transport to downstream environs and loss of native vegetation adjoining the waterway which provides habitat.

Erosion - There is significant bank and batter erosion present throughout the study area, most noticeable in Locations 2 and 11. Bank erosion is a common cause of sediment within waterways, impacting water quality and resulting in blockages within the waterway.

Dispersive Soils - Dispersive soils were noted throughout Reach B. If exposed these soils are highly erodible and structurally unstable. Further bank and batter erosion, and resulting reduced water quality, will continue if these soils remain exposed.

JUSTIFICATION

As identified during the site inspection the study area displayed a range of erosion features that have been naturally occurring over time. At present, there is minimal vegetation to provide bank stability, water filtration, and habitat for fauna. As stated in the approved WOS SWMP 2024, the proposed development will not result in additional flows or an increase in velocity through the eroded sections of the waterway, therefore, it is unlikely that the existing erosion features will accelerate due to the developed area. However, as erosion features and headcuts have developed it is possible that they will continue to naturally deepen without intervention which may ultimately impact the proposed development as it progresses upstream. In order to provide stabilisation of the naturally eroding waterway and provide water quality treatment of the development, it is proposed a minimal disturbance planting method be undertaken.

As per the approved WOS SWMP 2024 the revegetation and stabilisation of riparian zones is proposed as an alternative treatment measure to bioretention systems where flows discharge to drainage lines within the Environmental area. It is proposed to revegetate 4 m² of riparian habitat for every 1 m² of bioretention filter media required to meet the SPP treatment objectives for the catchment according to the MUSIC model for the development.

As part of the revegetation, it is proposed to undertake minor profiling as required for successful vegetation establishment along the relevant sections of waterway. Detailed plans for the riparian revegetation are to be included as part of the stormwater management plans for the relevant development stages.

In addition, Engeny believe this innovative approach to water quality treatment will offer the following additional benefits to council:

- Increase in waterway stability.
- Reduction in maintenance activities due to sedimentation in downstream drains and channels.
- Reduced regular maintenance as this work will replace four WSUD assets all of which would require ongoing maintenance activities.
- Improved natural habitat.
- Improvements to water quality associated with filtration of water through vegetation, shading of the waterway and reduced sediment loads associated with instream erosion.

Therefore, with the correct restoration and vegetation, the erosion features identified in the site inspection can be stabilised and future erosion reduced.

WATERWAY STABILITY RECOMMENDATIONS

Reaches A and B of the waterway downstream to the project site have experienced a large amount of erosion. The stability recommendations have been divided across several sections throughout both reaches and the locations of such treatment is specified in Figure 3 and typical details of the treatment are specified in Attachment B.

Reaches A and B show signs of bank scour and erosion, which can be associated with ongoing flow events, dispersive soils and limited vegetation. Despite the visual incision present within the downstream reach of the study area, major stabilisation works are not recommended due to inaccessibility of the waterway and impacts to EPBC protected vegetation.

In lieu of major works, it is proposed to retain the natural formation of reaches A and B, by stabilising the area through planting and monitoring for further erosion. The following points outline the proposed strategy from the downstream reaches:

- Incorporate a 10m riparian buffer to the waterway in key locations to stabilise the eroding banks.
 - 4 groundcovers per 1m² – Tubestock Planting.
 - Combination of trees and shrubs at an approximate density of 1 plant per 10 m² (Densities may vary depending on existing canopy cover) – Tubestock and 100mm pots with consideration for deep stem planting on edges of eroded banks.
- Retain existing vegetation, where possible, and enhance native riparian vegetation within the proposed buffer. Consideration should be given to establishment of vegetation within the channel to stabilise the bed.
- Identify strategic locations for the placement of coir logs with vegetation planted either side. These locations will primarily be within the low flow channel. Coir logs are to be anchored to their position by wooden stakes. The coir mesh logs will assist in reducing velocities and promoting deposition within the low flow channel. As the lomandra plants take hold they will reinforce the stability of the surrounding banks and anchor the coir logs in their position.

The stabilisation strategy relies on the establishment of vegetation to provide long term stability of the waterway. A watering/ maintenance program will be required in the first 12 months following completion of landscaping to ensure optimum vegetation establishment.

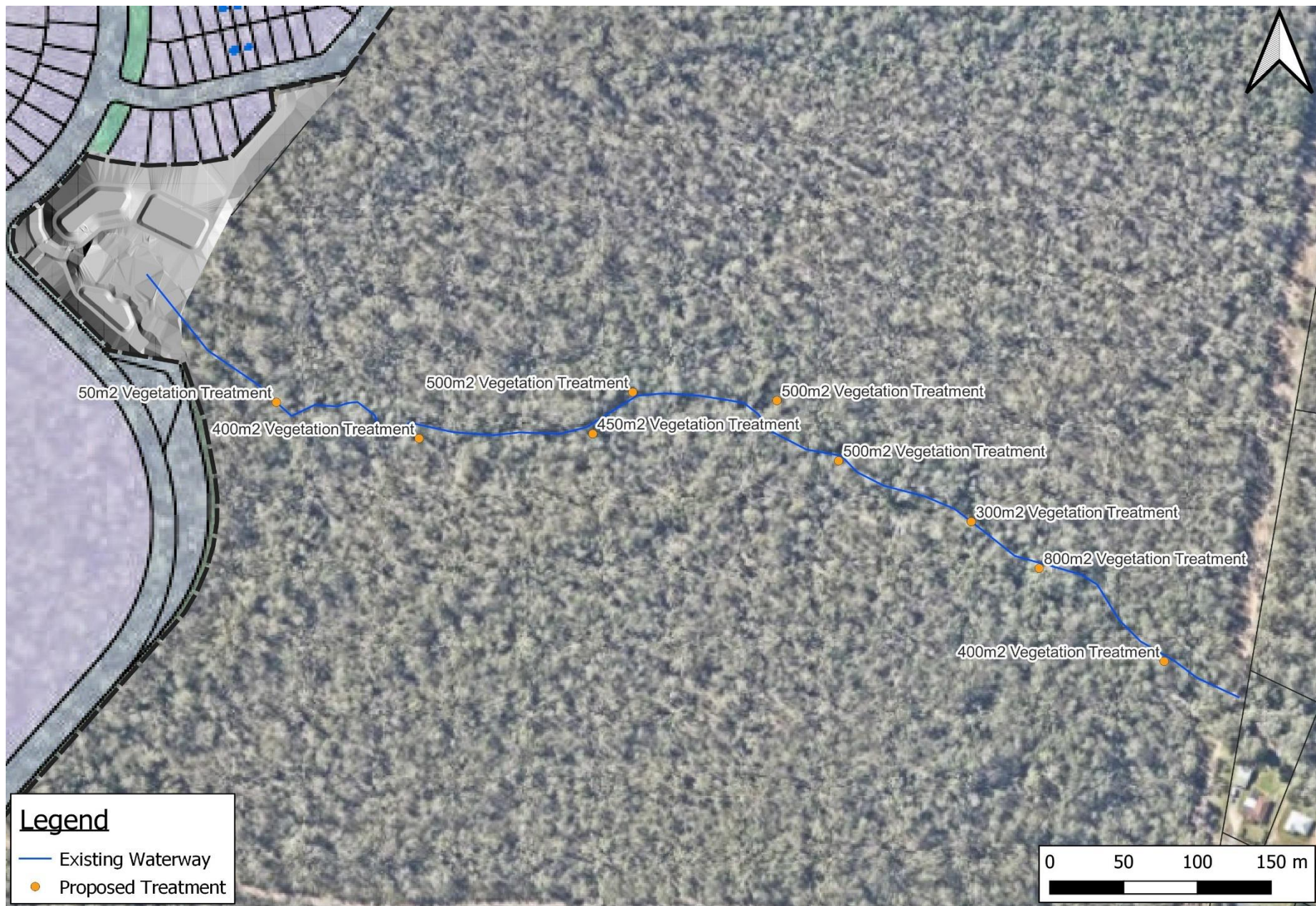


Figure 3: Proposed Treatment Locations

SUMMARY, CONCLUSION & RECOMMENDATION

The above visual and quantitative assessment of the study area has assisted in informing the stability of the proposed waterway configuration. While the reach is generally stable, it is evident that there are some areas of naturally occurring erosion. In order to achieve the stormwater quality treatment target objectives of the Everleigh Stormwater Masterplan and also assist with stabilising the existing waterway, the following items summarise the findings and recommendations:

- The geomorphology investigation undertaken noted a number of stabilisation issues that require addressing. These included upstream migrating headcuts, isolated bank erosion, and localised areas of dispersive subsoils.
- Stabilisation recommendations include: – Coir logs are to be utilised to reduce velocities and prevent further incision of the low flow channel where scour has taken place.
- A 10m densely vegetated riparian buffer will be provided on the outside of the banks and bed where evidence of erosion and dispersive soils is present.

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ATTACHMENT 1: SITE INSPECTION PHOTOS





Location 1 – Proposed Basin Location



Location 2 – Confluence Location



Location 3 – Significant Deposition



Location 4 – Scour and Dispersive Soils



Location 5 – Limited Vegetation



Location 6 – Dry Wetland off Channel



Location 7 – Waterway Widened with Exposed Banks



Location 8 – Bank Erosion Evident



Location 9 – Bank Erosion to Outside Bend



Location 10 – Headcut Location 1



Location 11 – Bank Erosion and Split Waterway



Location 12 – Incised Low Flow Channel Deepens



Location 13 – Instream Pond



Location 14 – Headcut Location 2



Location 15 – Bank Erosion and Split Waterway

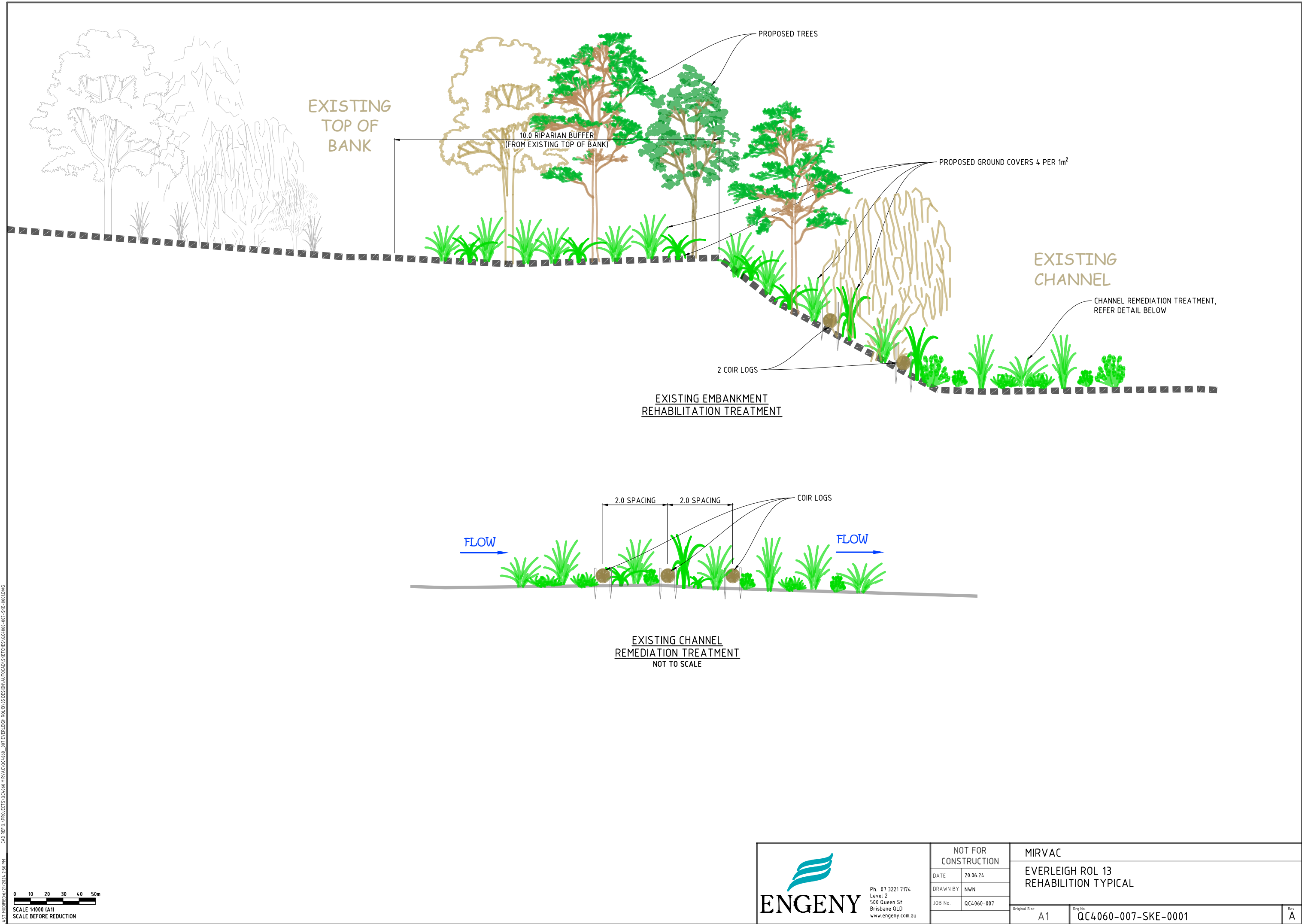


Location 16 – Headcut Location 3


ATTACHMENT 2: TYPICAL TREATMENT SECTIONS



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