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21 March 2022

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL
Approval no: DEV2022/1277
Date: 11 November 2022
Queensland Government

Mirvac
Level 17, 123 Eagle Street
Brisbane QLD 4000

Attention: **Jason Augustine**

Dear Jason,

RE: EVERLEIGH PRECINCT 8 – STORMWATER DETENTION AND WATER QUALITY ANALYSIS

This letter outlines the water quantity and quality analysis undertaken in support of the Reconfiguration of a Lot (ROL) submission for Precinct 8, 10 and a small portion of Precinct 11 of the Everleigh development. It is proposed that a combined stormwater detention and treatment basin documented in this letter (refer Attachment A) is constructed within Precinct 8 to provide water quality and quantity requirements to the contributing catchment.

Note that the Everleigh development is subject to a whole of site Everleigh Stormwater Masterplan (Engeny, 2020) (**WOS SWMP**) 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.

This letter:

- Confirms the preliminary design of stormwater infrastructure items within the Precinct 8 footprint meets the stormwater management objectives set with the WOS SWMP.

AMENDED IN RED
By: Gabrielle Shepherd
Date: 7 November 2022
Queensland Government

STORMWATER QUANTITY ANALYSIS

STORMWATER QUANTITY CATCHMENT

Land Use and Catchment Delineation

The XPRAFTS hydrologic model developed by Engeny for the WOS SWMP was utilised for the stormwater quantity analysis detailed below. The contributing catchment reflected in XPRAFTS for the Precinct 8 assessment, and the previously adopted catchment delineation for the WOS SWMP is shown in Figure 1, which presents the slight modifications for the catchment due to the detailed design. The land use adopted for the assessment is provided in Attachment B. The remaining portion of the P8 ROL will discharge south to the D2 detention basin (as outlined under the *ROL06 Stormwater Detention and Water Quality Analysis* (Engeny, 2020) (ROL06 SWMP). This P8 ROL has resulted in reducing the D2 detention basin catchment slightly since the ROL06 SWMP, however, this will only slightly reduce flow received at the D2 detention basin, resulting in further mitigation beyond the required peak flow mitigation targets and therefore not change the outcome for the ROL06 SWMP.

For the purpose of determining whether the stormwater detention infrastructure meets the mitigation requirements, peak flows are reported at two locations; the Site boundary north of the detention basin (Location 1), and downstream at Greenhill Road (Location 2). These locations are indicated on Figure 2.

Figure 1: Precinct 8 Detention Basin Contributing Catchment and Land Use

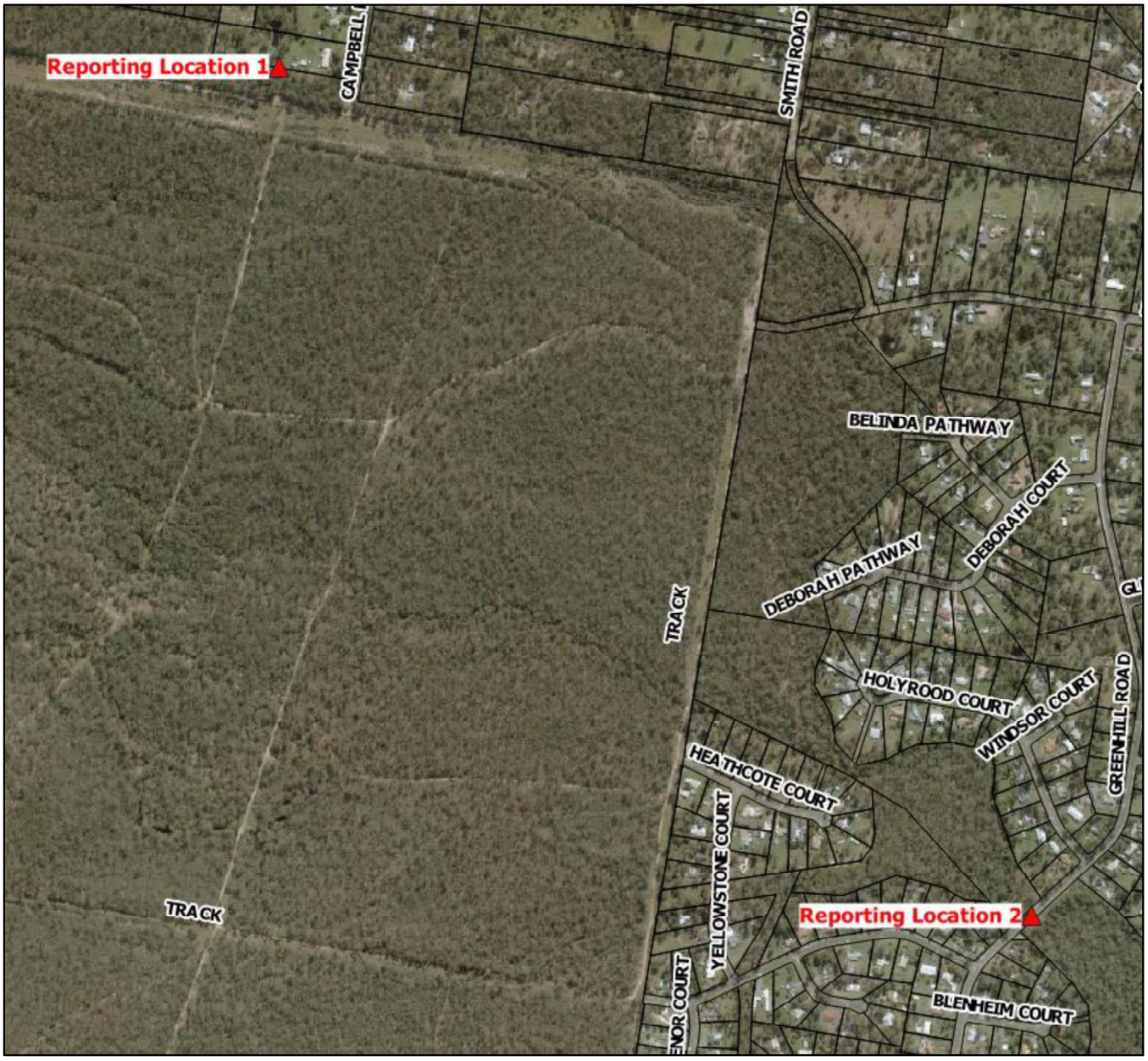


Figure 2: Stormwater Quantity Analysis Reporting Locations

COMPLIANCE WITH WHOLE OF SITE STORMWATER MASTER PLAN

Everleigh Whole of Site Stormwater Master Plan (WOS SWMP)

The WOS SWMP 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. The P8 detention basin is located in the northern portion of the Site and is the subject of this analysis. It is at the approximate location and performs the same function as that of the D4 detention basin in the WOS SMP. A summary of the details provided in the WOS SWMP for the D4 detention basin is provided in the *WOS SWMP Concept Design Parameters* column in Table 1.

Precinct 8 Basin Preliminary Design – Compliance with WOS SWMP

Further refinement of the D4 detention basin design and location following submission of the masterplan has resulted to slight changes to the basin storage curve adopted in the masterplan and it is now referred to as the P8 detention basin. Refer Attachment A for preliminary design of the P8 basin and the associated stormwater quality infrastructure The P8 basin preliminary design parameters are summarised in the *P8 Preliminary Design* column in Table 1. The WOS SWMP model was rerun with the updated P8 basin storage curve (including reduction in storage due to trees to be planted in the basin) to demonstrate that the refined design still meets the objectives of the WOS SMP, refer to Table 2.

The preliminary P8 design at Attachment A complies with the WOS SWMP as demonstrated in Table 2.

Table 1: P8 Preliminary Design

Storm Event	WOS SWMP Concept Design Parameters (Basin D4)	P8 Preliminary Design	Variance with WOS SWMP
Contributing Catchment Area (ha)	47.3	41.5	Change to basin location located outside of Energex easement
Basin Crest	Not specified	46.45 m AHD	N/A
100-year ARI Peak Level (Under Normal Conditions)	Not specified	46.08 m AHD	N/A
Freeboard to top of bund (Under Normal Conditions)	Not specified	370 mm	N/A
100-year ARI Stored Volume (m3) (Under Normal Conditions)	23,233	25,320	Minor change due to refinement of storage curve and contributing catchment through P8 design
100-year ARI Peak Level (all culverts blocked)	Not specified	46.31 m AHD	N/A
Freeboard Under Blockage Sensitivity Conditions	Not specified	140 mm	N/A
Low Flow Outlet	5 / 600 x 600 RCBCs at invert	5 / 450 x 300 RCBC at basin invert at 44.0 m AHD	Minor change due to refinement of storage curve and contributing catchment through P8 design
High Flow Outlet	8 / 1200 x 300 RCBCs at 0.67 m depth	4 / 1200 x 300 RCBC at 45.3 m AHD (1.25 m depth)	Minor change due to refinement of storage curve and contributing catchment through P8 design
Spillway	N/A	5 m wide at 45.9 m AHD (1.85 m depth)	N/A

Table 2: Peak Flow Reporting – WOS SMP Development

	Reporting Location 1 – Site Boundary			Reporting Location 2 – Greenhill Road		
Storm Event	Existing Peak Flow (m^3/s)	Mitigated Peak Flow (m^3/s)	Difference (%)	Existing Peak Flow (m^3/s)	Mitigated Peak Flow (m^3/s)	Difference (%)
100-year ARI	8.13	7.99	-2%	134.60	129.71	-4%
50-year ARI	6.52	6.24	-4%	108.92	105.79	-3%
20-year ARI	4.56	4.52	-1%	86.78	82.01	-6%
10-year ARI	3.63	3.27	-10%	69.30	62.80	-9%
5-year ARI	2.61	2.09	-20%	50.50	45.35	-10%
2-year ARI	1.63	1.52	-7%	33.51	31.51	-6%

STORMWATER QUALITY ANALYSIS

STORMWATER QUALITY CATCHMENTS

The catchment reporting to the Precinct 8 basin is referred to as waterway quality catchment 4 in the WOS SWMP and had an area of 35.0 ha. Minor changes have been made to the catchment area as a result of detailed earthworks and stormwater infrastructure design. The catchment area has increased to 36.7 ha and is outlined in Figure 3.

Figure 3: Stormwater Quality Catchment

PROPOSED STORMWATER TREATMENT TRAIN

The stormwater treatment train for Precinct 8 was proposed to consist of a sediment pond (SB4) and bioretention system (B4) in the approved WOS SWMP for the development. The assets were located within the existing Powerlink easement. The overall treatment strategy remains unchanged; however modifications have been made to the size and parameters of the treatment system to reflect catchment changes and design constraints. The proposed location of the stormwater quality basin has also been relocated outside the Powerlink easement and environmental protection area as outlined in Figure 3.

It is proposed that stormwater from the development will enter the proposed Precinct 8 sediment basin via 3 separate inlet pipes. The sediment basin will capture course sediment from the upstream catchment prior to discharging to 4 saturated bioretention system cells. High flows will bypass the bioretention cells via a high flow bypass channel to the detention basin outlets until the detention basin backflows. Refer to the preliminary design plans enclosed with this memorandum for more 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 the proposed updates to stormwater quality infrastructure for catchment 4 as a result of the catchment and design changes. The table below outlines the water quality treatment updates from the previous WOS SWMP.

Table 3: SB4 and B4 Parameters

Parameter	WOS SWMP Parameters	Proposed Design Parameters	Variance with WOS SWMP
		SB4 Sediment Basin	
Surface Area	1,400 m^2	800 m^2	Size calculated based on 70% capture of 125 micro particle
Extended detention Depth	300 mm	300 mm	N/A
Permanent Pool Volume	2,100m^3	1,200 m^3	Resized based on reduced surface area.
		B4 Bioretention Basin	
Asset Type	Conventional Bioretention Basin	Saturated Bioretention Basin	Improved drought resistance, better vegetation establishment with saturated system
Extended detention depth	300 mm	300 mm	N/A
Surface Area	2,800 m^2	2,400 m^2	Refined through MUSIC model
Filter depth	500 mm	400 mm	Allow for incorporation of level constrained system
TN Content of Filter Media	400 mg/kg	400 mg/kg	N/A
Orthophosphate Content of Filter Media	30 mg/kg	30 mg/kg	N/A

The existing MUSIC model for the WOS SWMP was revised to include the updated water quality catchment 4 area and modified water quality assets parameters as outlined in Table 3. Modelled pollutant load reductions on a whole of site and catchment basis are provided in Table 4.

Table 4: Water Quality Modelling Results

Pollutant	Reduction Objectives (%)	WOS Modelled Reduction (%)
Total Suspended Solids	80	80.8
Total Phosphorus	60	69.2
Total Nitrogen	45	45.2
Gross Pollutants > 5mm	90	98.8

The updated MUSIC model indicates that the proposed changes to the area of water quality catchment 4 and treatment assets is acceptable on a catchment and whole of site basis and is generally in alignment with the WOS SMMP. A preliminary design of the Precinct 8 treatment system has been enclosed with the memorandum to indicate sufficient space has been allocated for catchment 4 water quality and to demonstrate the functionality of the system.

BASEFLOW

It has been evidenced within the industry for some bioretention systems exposure to continuous baseflow can lead to excessive algal biofilms on the filter media which can clog the surface preventing infiltration. Engeny has completed the following consideration for the bio-retention system B4.

Field observations in the vicinity of the proposed basin have not identified any form of baseflow at the site in the predeveloped condition. This observation indicates for the current natural catchment conditions, where a delayed baseflow can occur from the upper storage within the vegetation zone, does not occur at the site of the bio-retention basin.

While studies have shown lack of consistent response of baseflow to urbanization in different settings due to complex interaction of various hydrologic behaviour, many have reported large decreases in baseflow and groundwater recharge because of increased impervious surfaces in urbanized catchments and efficient flush of water (piped flows) (Price, 2011; Hamel et al, 2013).

In large catchments, it is reported that the combined effects of remnant natural landscape features and human activities such as car washing can change the expected effects of human development on storm runoff (Burns et al., 2005). The suburban landscape features such as lawns, parks, open space results in groundwater recharge rates like that under pre-urban development conditions. Hence, for less dense or carefully mediated urban development, land use activities associated with moderate runoff impact or episodic disturbance is anticipated to result in no detectible downstream baseflow response change (Konrad & Booth, 2002; Burns et al., 2005; Price, 2011).

Based on the literature above it is difficult to clearly determine if baseflow will be an issue within the B4 bioretention basin, however it is less likely given the high density and lack of permeable area within the newly developed urban contributing catchment. Thus, no modifications or changes to the design is considered necessary.

To provide an allowance for small risk of baseflow it is proposed to install a 100mm PVC pipe between the sediment basin and high flow bypass channel. This pipe will be installed at a 1% grade at a level of RL44.2 within the sediment basin allowing for 5L/s of baseflow to bypass the bioretention systems via the high flow bypass system. The pipe will be capped at each end as it is only intended to be used if baseflow become an issue.

A sensitivity was run to determine impacts if 5L/s of baseflow bypassed the system. The results of this model run are shown in Table 5, which indicates that the water quality objectives can still be achieved with this low flow bypass system is installed.

Table 5: Water Quality Modelling Results

Pollutant	Reduction Objectives (%)	WOS Modelled Reduction (%)
Total Suspended Solids	80	80.8
Total Phosphorus	60	69.2
Total Nitrogen	45	45.0
Gross Pollutants > 5mm	90	98.8

CONCLUSION

An assessment has been undertaken to confirm stormwater quantity and quality assets proposed in support of Precinct 8 submission for the Everleigh development meet quantity and quality requirements. The assessment has indicated the following:

- The preliminary P8 design:
  - meets the requirements of the WOS SWMP.
  - meets the required peak flow mitigation and freeboard targets for the full contributing catchment at the required peak flow reporting locations.
- The proposed sediment basin (SB4) and bioretention system (B4) parameters for Precinct 8 have been refined and:
  - Meet the requirements of the WOS SWMP.
  - Meet the required stormwater quality targets for the full contributing catchment in isolation.

The proposed stormwater infrastructure meets stormwater quality and quantity requirements.

David Sexton

Principal, RPEQ No. 20884

Enc. Attachment A - Concept Design Drawings (M43000_013 Sk004/05)

Attachment B - Adopted Land Use

ATTACHMENT A - CONCEPT DESIGN DRAWINGS (M43000_013 SK004/05)

All bioretention basins to be approximately 800m²

BIORETENTION BASIN 1 (800m2)

BIORETENTION BASIN 2 (800m2)

BIORETENTION BASIN 3 (800m2)

BIORETENTION BASIN 4 (1000m2)

OVERFLOW SPILLWAY WITH CONCRETE SILL

LOW FLOW RCBC

HIGH FLOW RCBC

DETENTION BASIN FLOOR TO BE PLANTED (BY OTHERS)

SEWER PUMP STATION (BY OTHERS)

3.0m WIDE CONCRETE ACCESS RAMP TO SEDIMENT BASIN & EMBANKMENT

DETENTION BASIN STORAGE
RL 46.15
28600m3

main bypass spillway weir to be suitable material for maintenance vehicle to traverse

low-flow bypass pipe to be included from the sediment basin to basin outlet which can be opened or closed as necessary by the asset owner.

INFLOW CULVERTS BY OTHERS

SEDIMENT BASIN (900m2)

SEDIMENT BASIN OVERFLOW POINTS INTO BIORETENTION BASINS ROCK PROTECTION AND CONCRETE SILL REQUIRED.

INFLOW CULVERTS BY OTHERS

2.5m FOOTPATH WITH 1.5m PLANTED VERGE EITHER SIDE

LIMIT OF FOOTPATH DESIGNED BY ENGENY, REFER LANDSCAPE ARCHITECT PLANS FOR FOOTPATH TIE IN

LEGEND

- EXISTING CONTOURS (MAJ. 1m)
- EXISTING CONTOURS (MIN. 0.25m)
- DESIGN CONTOURS (MAJ. 1m)
- DESIGN CONTOURS (MIN. 0.25m)
- DETENTION BASIN EARTHWORKS
- STABILISED GRAVEL ACCESS TRACK
- BIORETENTION BASIN EXTENTS
- CONCRETE ACCESS TRACK
- CONCRETE FOOTPATH
- GRADED ROCK

LEGEND CONTINUED

- HIGH FLOW BYPASS CHANNEL
- BIORETENTION BASIN INFLOW POINTS
- FULL SUPPLY LEVEL (RL 46.15)
- SEDIMENT BASIN NWSL (RL 44.3)

TREE LEGEND

- TREE TO BE REMOVED
- TREE TBC FOLLOWING DETAILED DESIGN
- TREE TO REMAIN

AMENDED IN RED

By: Gabrielle Shepherd

Date: 7 November 2022

Queensland Government

NOTES:

1. DESIGN BASED ON GROUND SURVEY DATED 11/07/2019
2. DESIGN INTERGRATED WITH PREMISE EARTHWORKS MODEL DATED 21/02/2022
3. EXISTING SERVICE DEPTHS TBC
4. FINAL FOOTPATH ALIGNMENT TBC FOLLOWING COORDINATION WITH LANDSCAPE ARCHITECT.

0 5 10 15 20 25m

SCALE 1:500 (A1)
SCALE BEFORE REDUCTION

ENGENY WATER MANAGEMENT
Ph. 07 3221 7174
Level 2
500 Queen St
Brisbane QLD
www.engeny.com.au

NOT FOR CONSTRUCTION

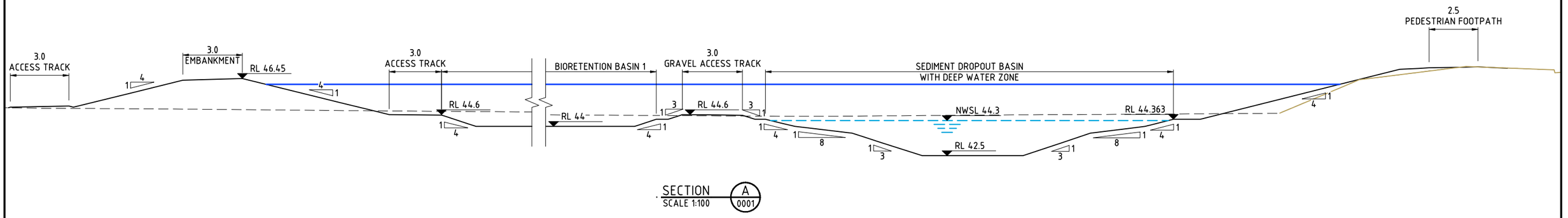
DATE	21.03.22
DRAWN BY	NWN
JOB No.	M43000-019

MIRVAC

EVERLEIGH P8
GENERAL ARRANGMENT PLAN

Original Size A1 | Drg No. M43000-019-SKE-0001 | Rev. A

LAST MODIFIED:12/1/2022 11:37 AM
CAD REF:K:\PROJECTS\M43000_MIRVAC\M43000_019 P8 PRELIMINARY DESIGN\05 DESIGN\AUTOCAD\SKETCHES\M43000-019-SKE-4001.DWG



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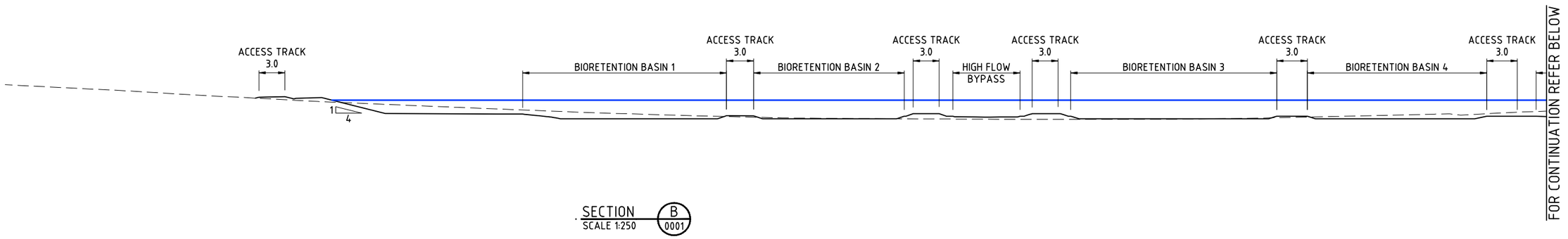

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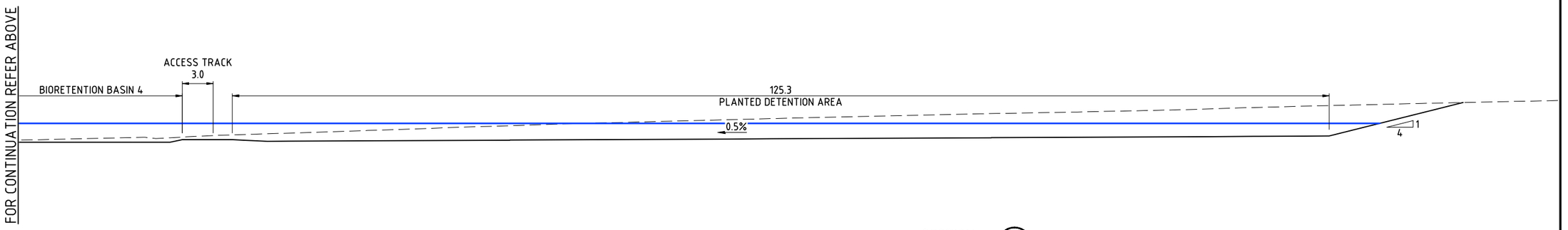

SECTION B
SCALE 1:250 0001

NOTES:

1. DESIGN BASED ON GROUND SURVEY DATED 11/07/2019
2. DESIGN INTERGRATED WITH PREMISE EARTHWORKS MODEL DATED 21/02/2022
3. EXISTING SERVICE DEPTHS TBC
4. FINAL FOOTPATH ALIGNMENT TBC FOLLOWING COORDINATION WITH LANDSCAPE ARCHITECT.

LEGEND

- EXISTING SURFACE
- BULK EARTHWORKS SURFACE (BY OTHERS)
- DESIGN SURFACE
- DETENTION STORAGE SURFACE (RL 46.15)

0 1 2 3 4 5m
SCALE 1:100 (A1)
SCALE BEFORE REDUCTION

0 2.5 5.0 7.5 10.0 12.5m
SCALE 1:250 (A1)
SCALE BEFORE REDUCTION

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EVERLEIGH P8
BULK EARTHWORKS SECTIONS

Original Size A1
Drg No. M43000-019-SKE-0002
Rev. A

ATTACHMENT B – ADOPTED LANDUSE