May 2026

MNCE Ref: C6527

SITE BASED STORMWATER MANAGEMENT PLAN

189-195 Teviot Road, Greenbank

Commissioned By
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REPORT CONTROL SHEET

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Site:	189-195 Teviot Road, Greenbank
Report Title:	Site Based Stormwater Management Plan
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Rev No.	MUSIC File Name	ICM File Name	Rational Method File Name
A	C6527-260521-MUSIC-S3-REVA	C6558-260331-SWMP	C6527-251201-RM-CALCS-REVA

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1 INTRODUCTION

1.1 Overview and Background

This report has been prepared to support a combined Reconfiguration of a Lot (ROL) and Material Change of Use (MCU) application over Lot 11 on RP210430 at 189–195 Teviot Road, Greenbank. The site is located within the Logan City Council local government area and has a total area of approximately 2ha. Figure 1.1 below provides an aerial locality of the site and adjacent areas.

Figure 1.1: Subject Site bound by Teviot Road to the east (QLD Globe)

The development is proposed to be undertaken in three stages comprising a 1 into 5 lot subdivision including road reserve and park dedication (Stage 1), a subsequent subdivision of three of those lots into 15 lots together with a Material Change of Use for 15 dwelling units (Stage 2), and a Material Change of Use over proposed Lot 16 for a townhouse development comprising 71 units (Stage 3). Refer Appendix A for proposed development layout.

The existing site comprises a single residential dwelling and predominantly vegetated land, falling generally towards the rear of the property at an average grade of approximately 4%, based on the Detail and Level Survey prepared by JW Surveys dated January 2026.

No municipal infrastructure is located within the subject site. However, municipal stormwater and sewer infrastructure are located within a registered services easement within the adjoining property to the rear at 29 Leanne Court, Greenbank (Lot 15 on RP217719). This infrastructure was established as part of recent subdivision works undertaken within the adjoining property to the north at 169–187 Teviot Road, Greenbank (Lot 18 on RP184970).

These subdivision works include the construction of a road reserve extending to the common boundary with the subject site. A municipal water main is also shown within this road reserve on the JW Surveys Detail and Level Survey (refer Appendix B), while available Council mapping identifies municipal stormwater infrastructure within the vicinity of the site. Refer Figure 1.2 below.

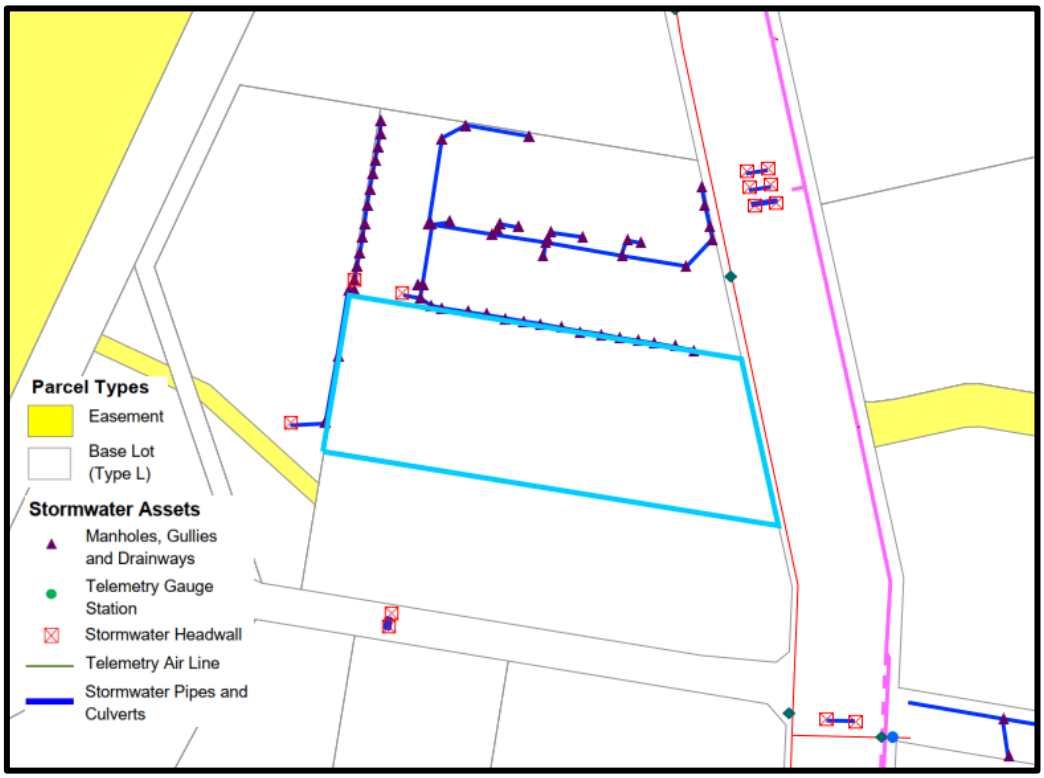


Figure 2.2: Municipal Stormwater Infrastructure Mapping (LCC)

The site is also affected by regional flooding (Upper Oxley Creek) and local overland flow. Refer to the Flood Investigation Report prepared by MNCE for further detail.

1.2 Objectives and Scope

Milanovic Neale Consulting Engineers have been commissioned by Chin-Yuan Chang to undertake an assessment of stormwater quantity and quality impacts associated with the proposed development. Stormwater management strategies are also to be identified for the proposed development as required.

The scope of works undertaken for this project is summarised below:

1. Assessment of the pre and post development stormwater discharge and undertake preliminary design and commentary of any mitigation devices required to control site discharge if required.
2. Assessment of the development against state and local government legislation to identify water quality management measures to be adopted for the proposed development.
3. Undertake pollutant export modelling of anticipated pre and post development pollutant concentrations and loads and conceptual design of water quality improvement devices.

2 DATA

2.1 State and Local Government Policies

The assessment has been undertaken generally in accordance with *Logan City Council Planning Scheme 2015 Version 9.2* and *EDQ PDA Guideline No. 13 – Engineering Standards* applicable to the Greater Flagstone Priority Development Area.

The *State Planning Policy-July 2017, Planning Scheme Policy 5 - Infrastructure and the Infrastructure Code* from Logan City Council's *Planning Scheme 2015 Version 5.1 and Healthy Land and Water (2018) MUSIC Modelling Guidelines* have been used as a guide to establish the required stormwater objectives and requirements for the development.

2.2 Level and Modelling Data

Contour information for the site was obtained from survey data prepared by JW Surveys dated January 2026, which comprise of surface level contours at 0.5m intervals.

As-Constructed information of existing hydraulic infrastructure has been sourced from Logan City Council records in regard to pipe/culvert diameters and invert levels.

Rainfall data was sourced from the Australian Rainfall & Runoff (ARR) Data Hub on 14th January 2026 based on grid cell 27.742 (S), 152.985 (E).

Enveloped LIMB 2020 Intensity Frequency Durations (IFDs) were referenced as this data is said to result in a reduction in local biases across all AEPs, durations and areas, compared to the 2016 IFDs. The Enveloped Dataset represents the maximum of the 2016 and 2020 IFDs.

3 OPPORTUNITIES AND CONSTRAINTS

3.1 Site Opportunity

The site has the opportunity to connect to existing municipal stormwater infrastructure located within a registered services easement within the adjoining property to the west.

3.2 Site Constraints

The size and capacity of the existing municipal stormwater infrastructure within the adjoining easement are currently unknown. Any connection will be subject to confirmation of available capacity and approval from the easement holder.

The site is affected by regional flooding (Upper Oxley Creek) and local overland flow, which may influence the developable area and earthworks requirements.

The proposed development will increase impervious area and runoff, requiring detention measures to ensure peak runoff volumes are maintained at or below existing conditions.

4 WATER QUANTITY MANAGEMENT

This section of the report will provide an assessment of the pre and post development stormwater discharge and undertake preliminary design and commentary of any mitigation devices required to control site discharge.

4.1 Existing Conditions

This section of the report will analyse and comment on the existing site stormwater discharge conditions. The InfoWorks ICM modelling software, utilising the RAFTS routing model, will be used to generate the hydrographs and peak flows from the site for all storm events up to and including the 1% AEP storm event.

4.2 Existing Hydrologic Model

4.2.1 Catchment Definition

The subject site is located within the Greater Flagstone Priority Development Area where conventional Council land use zoning is not defined. For the purpose of estimating existing runoff characteristics a minimum impervious fraction of 10% has been adopted consistent with Rural Residential land use in accordance with QUDM as referenced by Council's Planning Scheme Policy, reflecting surrounding properties of similar size and form.

Refer Table 4.1 below for the catchment summary. Manning's `n` numbers were adopted for specific surface areas and the catchment slope has been determined following review of existing site topography.

Table 4.1: Catchment Data Summary Table

Catchment	Sub Catchment	Area (ha)	Impervious (%)	Slope (%)	Manning's 'n'
Existing	Impervious	2.005	10	4	0.015
	Pervious				0.035

4.2.2 Rainfall Parameters and Losses

As indicated in Section 2.2 above, Rainfall data for the site has been extracted from ARR Data Hub Enveloped LIMB 2020 IFD.

The uniform loss method was adopted to account for rainfall losses throughout the existing catchment. Based on experience and guidance provided in *Australian Rainfall and Runoff, A Guide to Flood Estimation*, initial and continuing loss coefficients adopted for impervious and pervious sub catchments have been tabulated below.

It is noted that an initial loss value equivalent to 70% of the rural loss value (25mm) attributed to the site has been applied.

Table 4.2: Initial and Continuing Loss Parameters

Parameter	Value (mm)
Initial Loss (Pervious)	17.5
Initial Loss (Impervious)	1.0
Continuing Loss (Pervious)	1.1
Continuing Loss (Impervious)	0

Temporal patterns applicable to East Coast North have been adopted in accordance with the *Australian Rainfall and Runoff, A Guide to Flood Estimation*.

4.2.3 Existing Hydrological Results

The following table provides a summary of the peak discharge from the existing site that was estimated by the adopted InfoWorks ICM model utilising the RAFTS Routing Method for all storm events up to and including the 1% AEP storm event.

Table 4.3: Existing Site Peak Discharges

Storm Event	ICM Peak Runoff (m^3/s)
39% AEP	0.218
18% AEP	0.349
10% AEP	0.448
5% AEP	0.545
2% AEP	0.669
1% AEP	0.780

4.2.4 Runoff Comparison

QUDM Section 4.2.3 recommends hydrologic models are calibrated with actual flow data rather than to an alternate runoff routing model. In the absence of such data, Section 4.2.3 continues to state that as an alternative, model results may be compared with the results of a Rational Method peak discharge for catchments less than 500ha.

Based on the methods outlined in *QUDM*, the following parameters were used to estimate the peak runoff from the site. Refer to the Appendix B for detailed rational method calculation summary.

Table 4.4: Rational Method Parameters

Area (ha)	Runoff Coefficient (C10)	Time of Concentration (mins)
2.005	0.74	25

The following table provides a comparison of the results of both the Rational Method and ICM Model results for peak discharges up to and including the 1% AEP storm event.

Table 4.5: Existing Site Peak Discharge Comparison

Storm Event	ICM Peak Runoff (m^3/s)	Rational Method Peak Runoff (m^3/s)	Difference	
			+/-	%
39% AEP	0.218	0.277	0.059	22
18% AEP	0.349	0.382	0.033	9
10% AEP	0.448	0.446	0.002	1
5% AEP	0.545	0.515	0.030	6
2% AEP	0.669	0.654	0.015	2
1% AEP	0.780	0.758	0.022	3

As can be seen above, the RAFTS Routing Method established from the ICM Model generates peak flows that are generally within 9% of what is estimated by the Rational Method. Hence the scenario that has been modelled and applied to the site is considered appropriate.

4.3 Developed Conditions

The proposed development is to be delivered in three stages comprising a 1 into 5 lot subdivision, a 5 into 17 lot subdivision, and a Material Change of Use over Lot 16 for a 71 unit townhouse development.

Developed site stormwater discharge conditions have been assessed for each stage using InfoWorks ICM modelling, utilising the Laurenson Routing Method to generate hydrographs and peak flows for all storm events up to and including the 1% AEP storm event.

4.4 Developed Unmitigated Model

4.4.1 Catchment Definition

Catchment definition for developed conditions has been undertaken for each stage of the proposed development. The site has been modelled as a single lumped catchment with a total catchment area of 2.005 ha. Manning's roughness values have been adopted as 0.015 for impervious surfaces and 0.050 for pervious surfaces.

Impervious area and surface characteristics have been updated to reflect Stage 1, Stage 2 and ultimate development (Stage 3). An average catchment slope has been adopted for each stage, reflecting a combination of roof and ground surfaces based on assumed roof slopes of 9% and ground surface grades of 4%. Refer to Table 4.6 for adopted parameters.

Table 4.6: Catchment Data Summary Table

Development Stage	Description	Impervious (%)	Average Slope (%)
1	Initial subdivision (1 into 5)	16	4
2	Further subdivision (5 into 17)	25	5
3	Ultimate Development (71 Units over Lot 16)	74	6

4.4.2 Rainfall Parameters and Losses

Rainfall Parameters and Losses have been adopted in accordance with Section 4.2.2 of this report.

4.4.3 Developed Hydrological Results

The following table provides a summary of the peak discharge for each stage of the proposed development estimated by the InfoWorks ICM model for all storm events up to and including the 1% AEP storm event. Refer Appendix C for ICM model outputs.

Table 4.7: Developed Site Peak Discharges

Storm Event	ICM Peak Runoff (m^3/s)		
	Stage 1	Stage 2	Stage 3
39% AEP	0.226	0.266	0.535
18% AEP	0.358	0.395	0.647
10% AEP	0.455	0.478	0.716
5% AEP	0.549	0.582	0.837
2% AEP	0.688	0.726	1.021
1% AEP	0.786	0.823	1.147

4.4.4 Runoff Comparison

In accordance with *QUDM*, developed peak discharge estimates have been compared against Rational Method calculations to verify the adopted hydrologic parameters and runoff response for each stage of development.

Based on the methods outlined in *QUDM*, the following parameters were adopted to estimate peak runoff for each development stage. Refer Appendix B for Rational Method calculations.

Table 4.8: Rational Method Parameters

Area (ha)	Development Stage	Runoff Coefficient (C10)	Time of Concentration (mins)
2.005	1	0.75	22
	2	0.77	20
	3	0.87	12

The following tables provide a comparison between Rational Method peak discharge estimates and developed model results for each stage of the proposed development.

Table 4.9: Developed Site Peak Discharge Comparison – Stage 1

Storm Event	ICM Peak Runoff (m^3/s)	Rational Method Peak Runoff (m^3/s)	Difference	
			+/-	%
39% AEP	0.226	0.305	0.079	26
18% AEP	0.358	0.419	0.061	15
10% AEP	0.455	0.488	0.033	7
5% AEP	0.549	0.563	0.014	2
2% AEP	0.688	0.711	0.023	3
1% AEP	0.786	0.821	0.035	4

Table 4.10: Developed Site Peak Discharge Comparison – Stage 2

Storm Event	ICM Peak Runoff (m^3/s)	Rational Method Peak Runoff (m^3/s)	Difference	
			+/-	%
39% AEP	0.266	0.330	0.064	20
18% AEP	0.395	0.454	0.059	13
10% AEP	0.478	0.528	0.050	10
5% AEP	0.582	0.609	0.027	4
2% AEP	0.726	0.766	0.040	5
1% AEP	0.823	0.877	0.054	6

Table 4.11: Developed Site Peak Discharge Comparison – Stage 3

Storm Event	ICM Peak Runoff (m^3/s)	Rational Method Peak Runoff (m^3/s)	Difference	
			+/-	%
39% AEP	0.535	0.481	0.054	11
18% AEP	0.647	0.666	0.019	3
10% AEP	0.716	0.776	0.060	8
5% AEP	0.837	0.903	0.066	7
2% AEP	1.021	1.096	0.075	7
1% AEP	1.147	1.213	0.066	5

As shown above, peak discharge estimates derived from the adopted hydrologic model are generally within 20% of Rational Method calculations across all stages of development and are therefore considered appropriate for the purpose of this assessment.

4.5 Potential Impacts of Development

The following table summarises the percentage increase in peak runoff relative to existing conditions for each stage of the proposed development, based on the peak discharge estimates presented in Tables 4.3 and 4.7 above.

Table 4.12: Peak Runoff Increase Relative to Existing Conditions

Storm Event	% Increase		
	Stage 1	Stage 2	Stage 3
39% AEP	4	22	146
18% AEP	3	13	85
10% AEP	2	7	60
5% AEP	1	7	54
2% AEP	3	9	53
1% AEP	1	6	47

As shown above, Stage 1 and Stage 2 result in relatively minor increases in peak runoff relative to existing conditions. Stage 3 represents the ultimate development condition and results in the greatest increase in runoff due to the proposed 71 unit townhouse development over Lot 16.

Without mitigation measures, increased runoff associated with the proposed development has the potential to adversely impact downstream properties and stormwater infrastructure. Detention measures are therefore required to maintain post-development peak runoff at or below existing conditions.

4.6 Proposed Mitigated Conditions

To maintain post-development peak runoff at or below existing conditions for Stage 1 and Stage 2 works, an above ground detention basin is proposed within the south-western corner of the site. The basin is to be established as part of Stage 1 works and sized to cater for ultimate Stage 2 conditions, capturing runoff up to and including the 1% AEP storm event. Refer to the civil works layout plans for Stage 1 and Stage 2 and associated catchment plans within Appendix A for the proposed drainage arrangement.

The proposed above ground detention basin incorporates the following:

- Minimum detention volume of 165 m³.
- Minimum detention depth of 0.83 m.
- 1 No. 110 mm low flow outlet at basin invert level.
- 1 No. 225 mm mid flow outlet at 0.5 m above basin invert level.

To maintain post-development peak runoff at or below existing conditions for Stage 3 works, an underground detention tank is proposed within the entrance driveway to the MCU development over Lot 16. The detention system is to capture all internal lot runoff up to and including the 1% AEP storm event prior to discharge.

The proposed underground detention system incorporates the following:

- Minimum detention volume of 416 m³.
- Minimum internal tank height of 1.4 m.
- 1 No. 300 mm low flow outlet at tank invert level.
- 2 No. 300 mm mid flow outlets at 0.75 m above tank invert level.

Refer Appendix A for further detail regarding the proposed drainage arrangement.

4.7 Developed Mitigated Model

The proposed detention measures outlined in Section 4.6 have been incorporated into the developed hydrologic model to assess mitigated discharge conditions for each stage of development.

Table 4.13: Mitigated Runoff Comparison

Storm Event	Existing Peak Runoff (m^3/s)	Mitigated Peak Runoff (m^3/s)		
		Stage 1	Stage 2	Stage 3
39% AEP	0.218	0.209	0.212	0.203
18% AEP	0.349	0.290	0.293	0.288
10% AEP	0.448	0.346	0.350	0.418
5% AEP	0.545	0.413	0.447	0.469
2% AEP	0.669	0.578	0.654	0.654
1% AEP	0.780	0.688	0.760	0.729

As shown above, mitigated peak runoff volumes for each stage of development are maintained at or below existing conditions for all storm events up to and including the 1% AEP storm event. The proposed detention measures are therefore considered to satisfy Council's non-worsening stormwater runoff requirements. Refer Appendix C for detailed mitigated model outputs and detention modelling parameters.

5 WATER QUALITY MANAGEMENT

This section of the report provides an assessment of the proposed development against relevant state and local government stormwater quality requirements and outlines the proposed stormwater quality management strategy for the site.

Water quality assessment has been undertaken for the ultimate development condition associated with Stage 3. Pollutant export modelling has been completed to assess anticipated post-development pollutant loads and identify appropriate stormwater quality treatment measures for the development.

5.1 Risk Category

The *State Planning Policy – July 2017* identifies developments as high risk with respect to stormwater quality if any of the following criteria are triggered:

1. Material change of use for urban purposes that involves a land area greater than 2,500m^2 that:
    a. Will result in an impervious area greater than 25 percent of the net developable area; or
    b. Will result in six or more dwellings, or
2. Reconfiguring a Lot for urban purposes that involves a land area greater than 2,500m^2 and will result in 6 or more Lots: or
3. Operational work for urban purposes that involves disturbing more than 2,500m^2 of land;

Based on the above, the ultimate development condition is considered high risk with respect to stormwater quality.

5.2 Water Quality Objectives

5.2.1 Construction Phase

The *Healthy Land and Water (2018) MUSIC Modelling Guidelines* identify that eroded soils and litter are major pollutant sources during construction activity. There is also potential for hydro-modification of streams due to increased run-off coefficients when subsoils are exposed, for longer-term major developments. Water sensitive urban design principles and reducing erosion during construction are fundamental to achieving water quality objectives in relevant waterways.

It is therefore proposed to prepare an erosion and sediment management plan during the operational works phase of the development which will incorporate a range of control measures to be implemented during the construction phase of the project.

5.2.2 Operational Phase

Stormwater quality management design objectives for the operational phase of the development are identified in the following table in accordance with the *Healthy Land and Water (2018) MUSIC Modelling Guidelines.* These objectives provide an emphasis on the reduction of mean annual loadings associated with suspended sediments and nutrients.

Table 5.1: Stormwater Quality Objectives

Region	Minimum Reductions in Mean Annual Loads from Unmitigated Development (%)			
	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Gross Pollutants > 5mm (GP)
South East Queensland	80	60	45	90

5.3 Pollutant Export Modelling

5.3.1 Model Selection

In order to determine on-site pollutant generation, discharge concentrations of target pollutants and the effectiveness of Stormwater Quality Improvement Devices the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been used to model the development proposal.

5.3.2 MUSIC Model Configuration

The following sections identify the modelling parameters used in the configuration of the MUSIC Model adopted for the development. The following figure provides a screenshot of the MUSIC model schematic for reference.

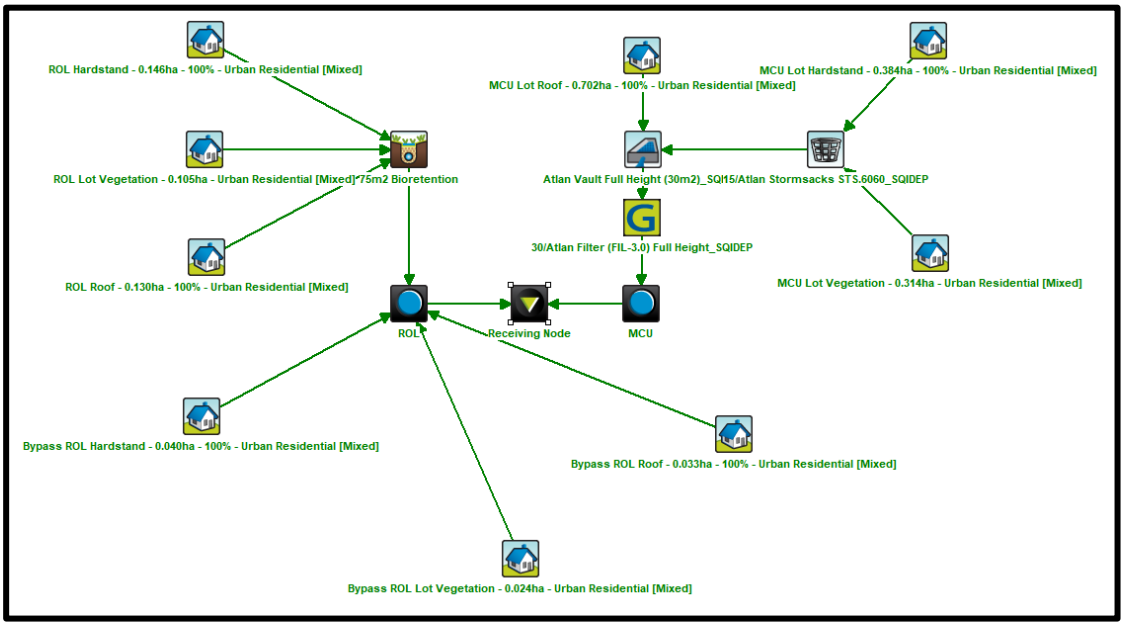


Figure 5.1: MUSIC Model Layout

5.3.2.1 Meteorological and Time Step

Meteorological Data used in the MUSIC model has been identified in accordance with the *Healthy Land and Water (2018) MUSIC Modelling Guidelines*, incorporating the following parameters:

Rainfall Period: 01/01/1990 12:00 AM to 31/12/1999 11:54 PM

Rainfall Station: 40715 SHAILER

A model time step of 6 minutes has also been adopted as recommended in Section 4.1 of the *Healthy Land and Water (2018) MUSIC Modelling Guidelines.*

5.3.2.2 *Catchment Properties*

The MUSIC model for the development adopts a split catchment approach, whereby the site has been broken down into various catchments in accordance with site-specific land uses. The following table provides a summary of the catchment data used in the MUSIC analysis.

Table 5.2: MUSIC Catchment Parameters

Catchment Name	Area (ha)	Fraction Impervious (%)	MUSIC Source Node
ROL Roof	0.130	100	Residential
MCU Lot Roof	0.702	100	Residential
Bypass Lot Roof	0.033	100	Residential
ROL Hardstand	0.146	100	Residential
MCU Lot Hardstand	0.384	100	Residential
Bypass Lot Hardstand	0.040	100	Residential
ROL Lot Vegetation	0.105	0	Residential
MCU Lot Vegetation	0.314	0	Residential
Bypass Lot Vegetation	0.024	0	Residential

5.3.2.3 *Rainfall-Runoff Parameters*

The following table provides a summary of the rainfall-runoff parameters adopted for the source nodes used in the MUSIC analysis which has been extracted from Table 3.9 of the *MUSIC Modelling Guidelines 2018.*

Table 5.3: MUSIC Source Node Base and Storm Flow Concentration Parameters

Land Use	Parameter	Total Suspended Solids (Log_{10} mg/L)		Total Phosphorus (Log_{10} mg/L)		Total Nitrogen (Log_{10} mg/L)	
Roof	Mean	N/A	1.30	N/A	-0.89	N/A	0.26
	Std Deviation	N/A	0.39	N/A	0.31	N/A	0.23
Hardstand	Mean	1.00	2.43	-0.97	-0.30	0.20	0.26
	Std Deviation	0.34	0.39	0.31	0.31	0.20	0.23
Vegetation	Mean	1.00	2.18	-0.97	-0.47	0.20	0.26
	Std Deviation	0.34	0.39	0.31	0.31	0.20	0.23

5.3.2.4 *Pollutant Export Parameters*

The following table provides a summary of the pollutant export parameters for split catchment surface types which have been adopted for the source nodes used in the MUSIC analysis. This information has been extracted from Table 3.8 of the *Healthy Land and Water (2018) MUSIC Modelling Guideline.*

Table 5.4: MUSIC Catchment Parameters

Parameter	Commercial
Rainfall Threshold (mm)	1
Soil Storage Capacity (mm)	500
Initial Storage (%)	10
Field Capacity (mm)	200
Infiltration Capacity Coefficient a	211
Infiltration Capacity Coefficient b	5
Daily Recharge Rate (%)	28
Daily Base-Flow Rate (%)	27
Daily Seepage Rate (%)	0

5.3.3 Developed Unmitigated Conditions

MUSIC Modelling has been performed to determine the pollutant export and corresponding concentrations from the development site under the proposed conditions. The mean annual loads that have been estimated for proposed unmitigated conditions are given in Table 5.6 below, also shown are the mean annual load percentage reductions required to meet current State Planning Policy objectives.

Table 5.5: MUSIC Unmitigated Mean Annual Loads (kg/yr)

Pollutant	Unmitigated Mean Annual Load (kg/yr)	Reduction required to meet Council Requirements (%)
Total Suspended Solids (TSS)	3510	80
Total Phosphorous (TP)	6.9	60
Total Nitrogen (TN)	32.7	45
Gross Pollutants (GP)	340	90

Refer Appendix A for catchment plan and Appendix D for MUSIC summary report.

5.3.4 Developed Mitigated Conditions

Stormwater quality treatment measures have been incorporated into the proposed development to achieve the applicable stormwater quality objectives for the ultimate development condition.

Runoff generated from Stage 1 and Stage 2 works is proposed to be treated via a bioretention basin incorporated within the proposed above ground detention basin. The following parameters have been adopted for the bioretention system:

- Minimum filter media area of 75 m².
- Filter media depth of 500 mm.
- Extended detention depth of 0.3 m.
- Total Nitrogen (TN) content of filter media assumed as 400 mg/kg.
- Orthophosphate content of filter media assumed as 30 mg/kg.

Runoff generated from Stage 3 works is proposed to be treated via proprietary stormwater quality treatment measures incorporated within the underground detention tank servicing the MCU development over Lot 16. The proposed treatment measures incorporate the following:

- 30No. full height Atlan Filter cartridges fitted within underground detention tank.
- Atlan StormSacks fitted throughout Stage 3 grated inlet pits.

Refer to Appendix A for further detail regarding proposed treatment measures.

The table below demonstrates that the required pollutant reductions have been achieved through implementation of the proposed stormwater treatment measures.

Table 5.6: MUSIC Model Removal Efficiencies

Pollutant	Unmitigated Mean Annual Load (kg/yr)	Mitigated Mean Annual Load (kg/yr)	Reduction required to meet SPP Requirements (%)	Removal Efficiency Achieved (%)
Total Suspended Solids (TSS)	3510	704	80	80
Total Phosphorous (TP)	6.9	1.91	60	72
Total Nitrogen (TN)	32.7	14.3	45	14.3
Gross Pollutants (GP)	340	17.3	90	95

6 INTERPRETATION AND CONCLUSIONS

An assessment of existing and developed stormwater conditions has been undertaken for the proposed development to quantify changes in runoff characteristics and identify appropriate stormwater quantity and quality management measures.

Hydrologic modelling indicates that peak runoff volumes increase progressively across each stage of development as impervious coverage increases, with the ultimate development condition associated with Stage 3 generating the greatest increase in runoff relative to existing conditions.

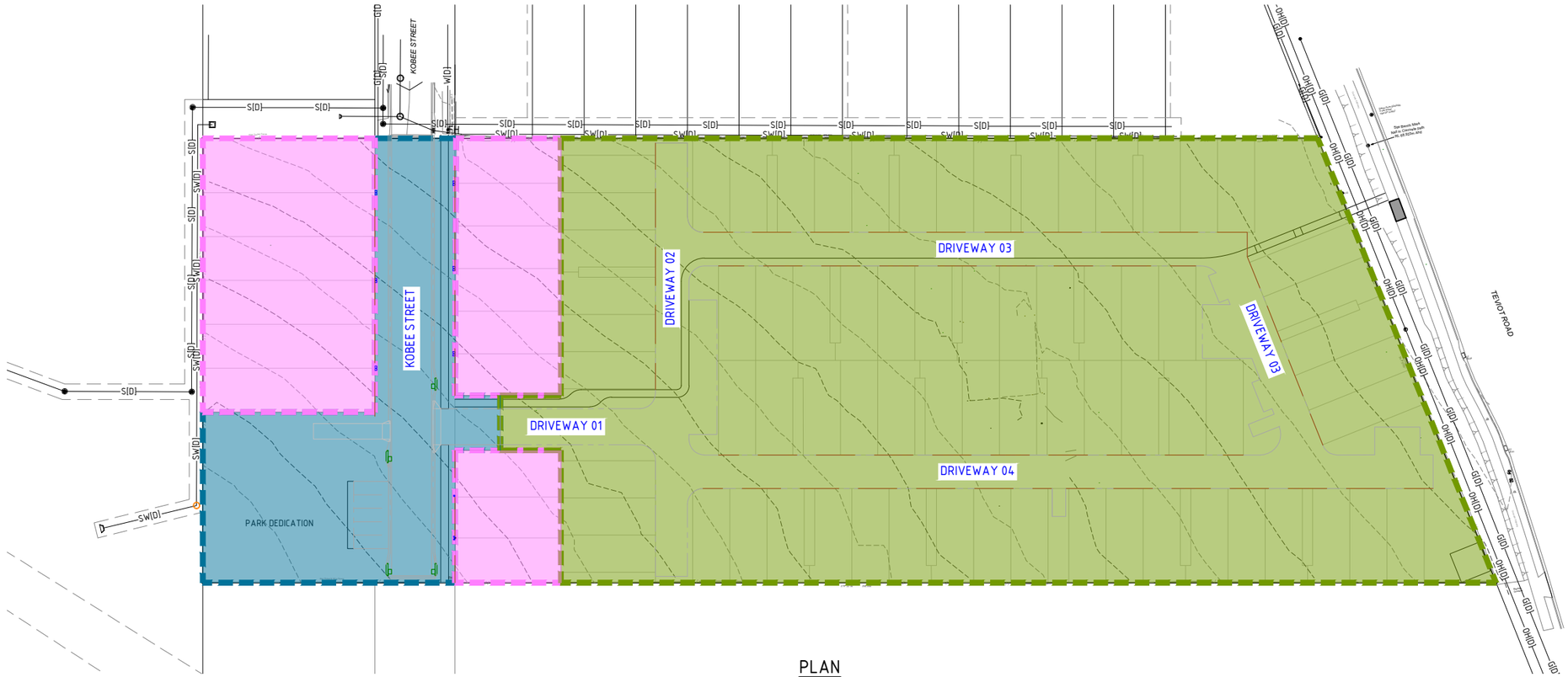
To maintain post-development peak runoff at or below existing conditions, stormwater detention infrastructure is proposed for each stage of development. Stage 1 and Stage 2 works are to be serviced via an above ground detention basin located within the south-western corner of the site, while Stage 3 works are to be serviced via an underground detention system located within the entrance driveway to the MCU development over Lot 16. Modelling demonstrates that mitigated peak runoff volumes are maintained at or below existing conditions for all storm events up to and including the 1% AEP storm event.

Stormwater quality treatment measures have also been incorporated into the proposed development, including a bioretention basin servicing Stage 1 and Stage 2 works and proprietary treatment devices servicing Stage 3 works. MUSIC modelling demonstrates that the proposed treatment measures achieve the applicable stormwater quality objectives.

Based on the above, the proposed stormwater management strategy is considered to satisfy Council's non-worsening stormwater quantity and quality requirements for the proposed development.

APPENDIX A: Proposed Development Layout

NOT FOR CONSTRUCTION



PLAN
SCALE 1:500

LEGEND

- G(D) — EXISTING GAS
- UE(D) — EXISTING ELECTRICAL UNDERGROUND
- OH — EXISTING ELECTRICAL OVERHEAD
- T(D) — EXISTING TELECOMMUNICATION
- SW(D) — EXISTING STORMWATER DRAINAGE
- S(D) — EXISTING SEWERAGE MAIN
- W(D) — EXISTING WATER MAIN
- STAGE 1 WORKS
- STAGE 2 WORKS
- STAGE 3 WORKS

NOTE:
EXISTING SEWER & STORMWATER INFRASTRUCTURE DETAILS WITHIN NEIGHBOURING SERVICE EASEMENT UNKNOWN. ADDITIONAL INVESTIGATIONS/SURVEY REQUIRED TO BE UNDERTAKEN BY OTHERS TO VERIFY DESIGN CONCEPT.

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SCALE 1:500 (A1) 0 10 20 30m
(SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: STAGING WORKS LAYOUT PLAN

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED:	
DRAWING No.: C6527 - ST001	REV.: A	

DO NOT SCALE FROM DRAWING
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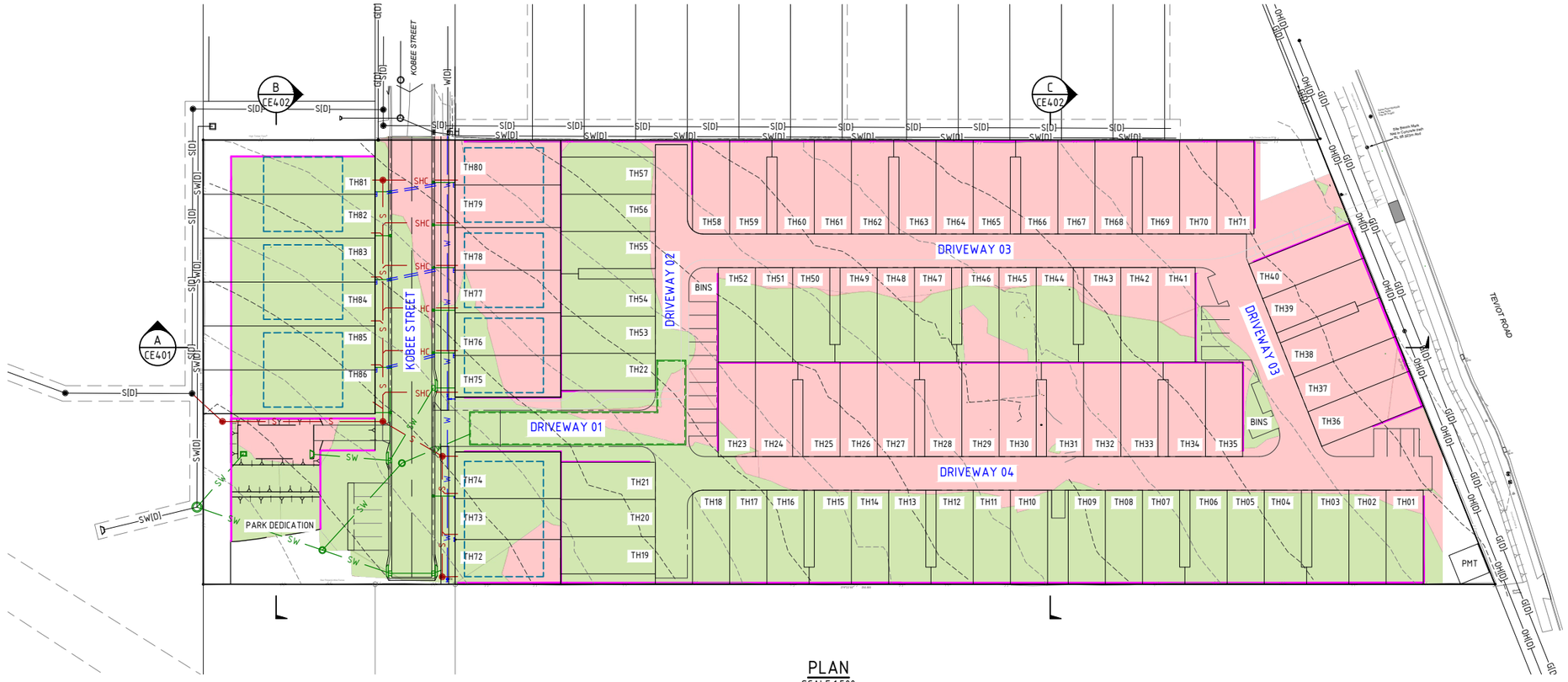
NOT FOR CONSTRUCTION



PLAN
SCALE 1:500

LEGEND

- G[D] — EXISTING GAS
- UE[D] — EXISTING ELECTRICAL UNDERGROUND
- OH — EXISTING ELECTRICAL OVERHEAD
- T[D] — EXISTING TELECOMMUNICATION
- SW[D] — EXISTING STORMWATER DRAINAGE
- S[D] — EXISTING SEWERAGE MAIN
- W[D] — EXISTING WATER MAIN
- PROPOSED TOP OF BATTER
- PROPOSED TOE OF BATTER
- 9.999 — EXISTING CONTOURS
- SW — PROPOSED STORMWATER DRAINAGE
- RW — PROPOSED ROOFWATER DRAINAGE/KERB ADAPTER
- S — PROPOSED SEWERAGE MAIN
- W — PROPOSED WATER MAIN
- PROPOSED RETAINING WALL
- PROPOSED BLE EXTENTS
- WM — PROPOSED WATER METER
- PROPOSED FILL
- PROPOSED CUT

NOTE:
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SCALE 1:500 (A1) 0 10 20 30m
(SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: PRELIMINARY OVERALL CIVIL WORKS LAYOUT PLAN

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED:	
DRAWING No.: C6527 - CE100	REV.: A	

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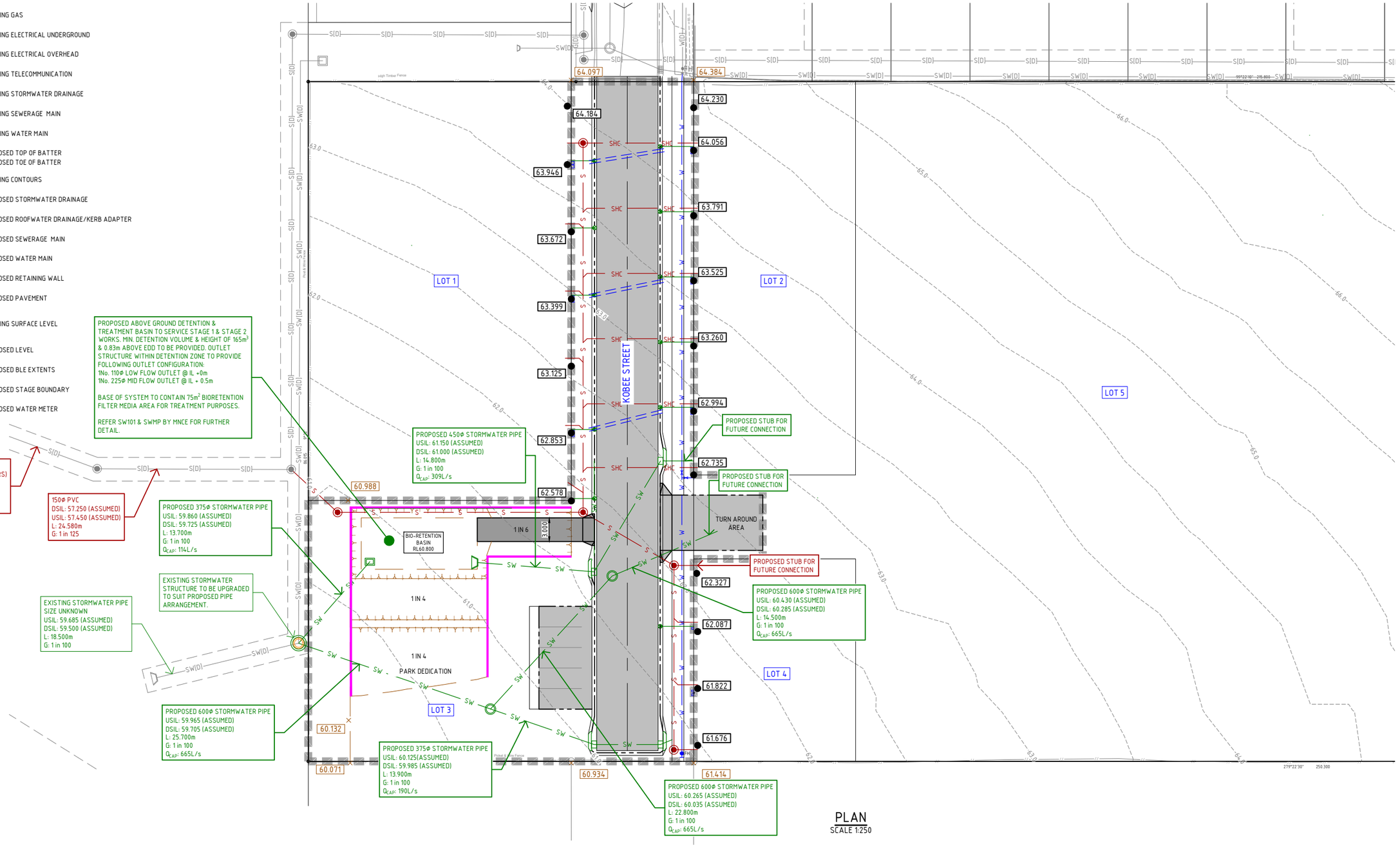
LEGEND

- G[D] — EXISTING GAS
- UE[D] — EXISTING ELECTRICAL UNDERGROUND
- OH — EXISTING ELECTRICAL OVERHEAD
- T[D] — EXISTING TELECOMMUNICATION
- SW[D] — EXISTING STORMWATER DRAINAGE
- S[D] — EXISTING SEWERAGE MAIN
- W[D] — EXISTING WATER MAIN
- PROPOSED TOP OF BATTER / PROPOSED TOE OF BATTER
- 9.999 — EXISTING CONTOURS
- SW — PROPOSED STORMWATER DRAINAGE
- RW — PROPOSED ROOFWATER DRAINAGE/KERB ADAPTER
- S — PROPOSED SEWERAGE MAIN
- W — PROPOSED WATER MAIN
- PROPOSED RETAINING WALL
- PROPOSED PAVEMENT
- × ##.## — EXISTING SURFACE LEVEL
- ● ##.## — PROPOSED LEVEL
- PROPOSED BLE EXTENTS
- PROPOSED STAGE BOUNDARY
- PROPOSED WATER METER



PLAN
SCALE 1:250

NOTE:
EXISTING SEWER & STORMWATER INFRASTRUCTURE DETAILS WITHIN NEIGHBOURING SERVICE EASEMENT UNKNOWN. ADDITIONAL INVESTIGATIONS/SURVEY REQUIRED TO BE UNDERTAKEN BY OTHERS TO VERIFY DESIGN CONCEPT.

NOTE:
SEWER DESIGN CONCEPT BY CIVIL DIMENSIONS CONSULTING ENGINEERS PTY LTD. PLANS AND DOCUMENTS REFFERED TO IN THE PDA DEVELOPMENT APPROVAL No. DEV219/1059 DATED 27/04/2020.

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NOT FOR CONSTRUCTION

SCALE 1:250 (A1) 0 5 10 15m (SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

DO NOT SCALE FROM DRAWING
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MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: PRELIMINARY CIVIL WORKS LAYOUT PLAN - STAGE 1

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED	
DRAWING No.: C6527 - CE101	REV.: A	

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LEGEND

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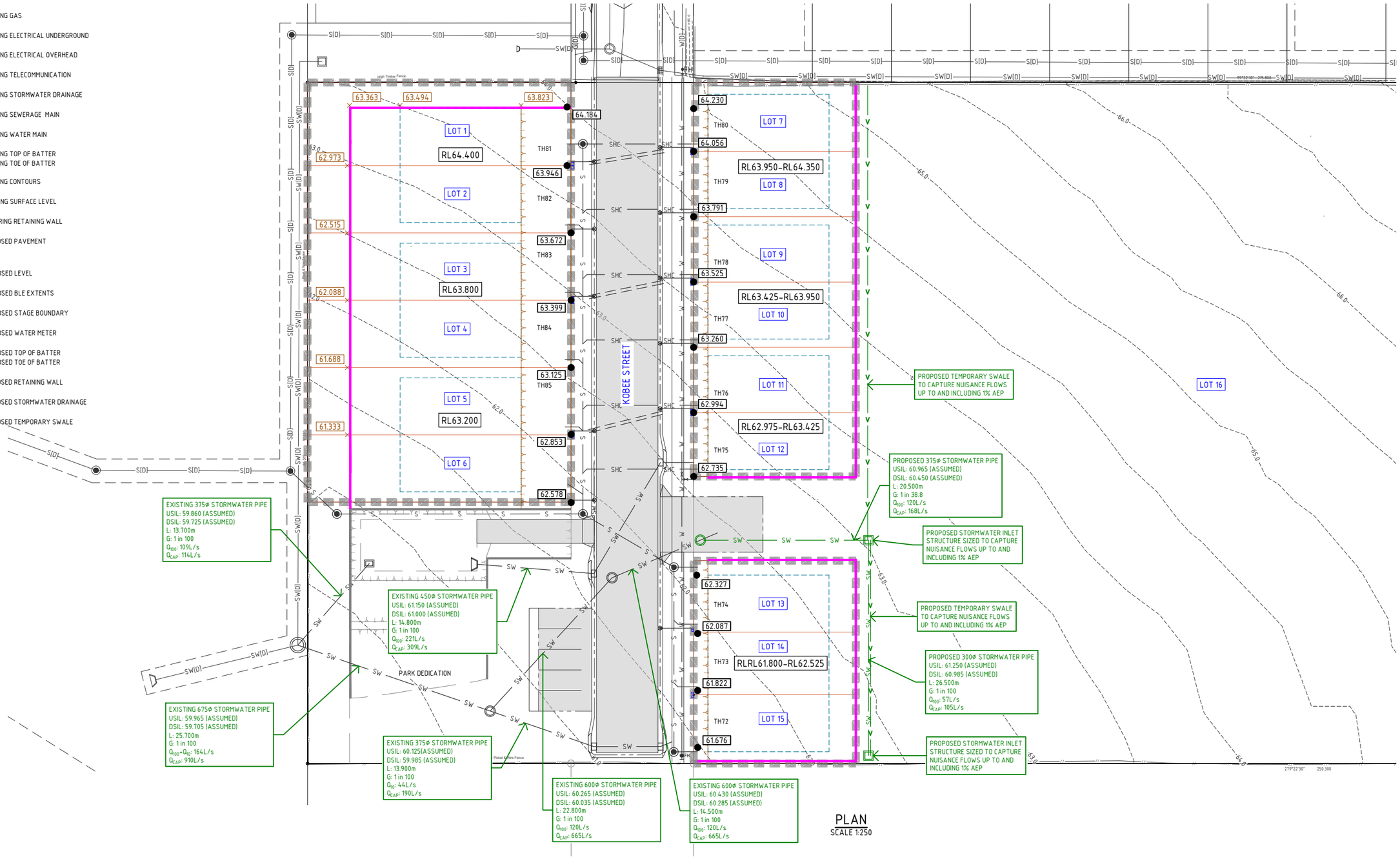
- UE[D] — EXISTING ELECTRICAL UNDERGROUND
- OH — EXISTING ELECTRICAL OVERHEAD
- T[D] — EXISTING TELECOMMUNICATION
- SW[D] — EXISTING STORMWATER DRAINAGE
- S[D] — EXISTING SEWERAGE MAIN
- W[D] — EXISTING WATER MAIN
- EXISTING TOP OF BATTER / EXISTING TOE OF BATTER
- 9.999 — EXISTING CONTOURS
- × ##.## — EXISTING SURFACE LEVEL
- EXISTRING RETAINING WALL
- PROPOSED PAVEMENT
- ● ##.## — PROPOSED LEVEL
- PROPOSED BLE EXTENTS
- PROPOSED STAGE BOUNDARY
- PROPOSED WATER METER
- PROPOSED TOP OF BATTER / PROPOSED TOE OF BATTER
- PROPOSED RETAINING WALL
- SW — PROPOSED STORMWATER DRAINAGE
- > — PROPOSED TEMPORARY SWALE



PLAN
SCALE 1:250

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NOT FOR CONSTRUCTION

SCALE 1:250 (A1) 0 5 10 15m
(SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL STRUCTURAL TRAFFIC PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: PRELIMINARY CIVIL WORKS LAYOUT PLAN - STAGE 2

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED	
DRAWING No.: C6527 - CE201	REV.: A	

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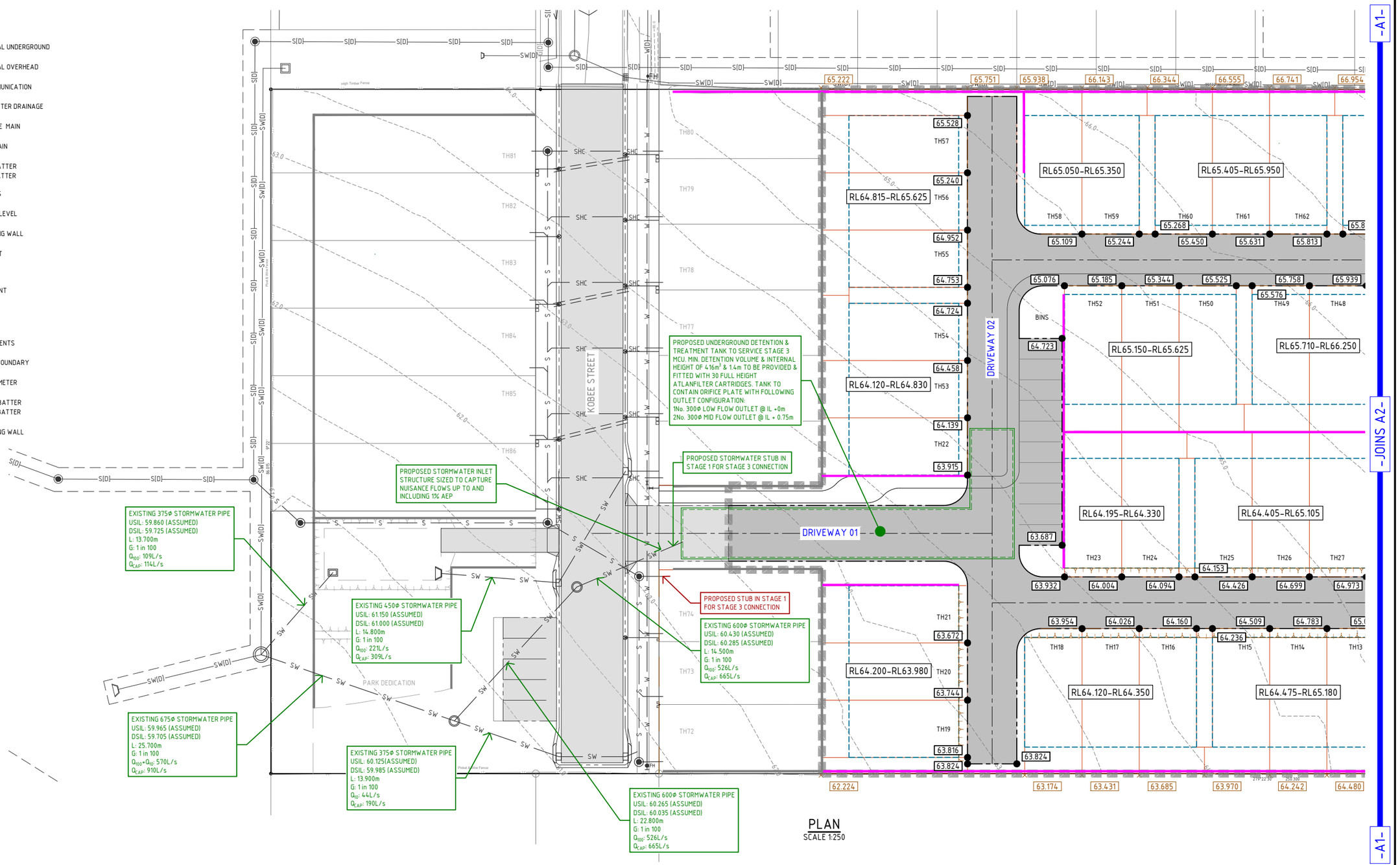
LEGEND

- G[D] — EXISTING GAS
- UE[D] — EXISTING ELECTRICAL UNDERGROUND
- OH — EXISTING ELECTRICAL OVERHEAD
- T[D] — EXISTING TELECOMMUNICATION
- SW[D] — EXISTING STORMWATER DRAINAGE
- S[D] — EXISTING SEWERAGE MAIN
- W[D] — EXISTING WATER MAIN
- EXISTING TOP OF BATTER / EXISTING TOE OF BATTER
- 9.999 — EXISTING CONTOURS
- × ##.## — EXISTING SURFACE LEVEL
- EXISTRING RETAINING WALL
- EXISTING PAVEMENT
- PROPOSED PAVEMENT
- ● ##.## — PROPOSED LEVEL
- PROPOSED BLE EXTENTS
- PROPOSED STAGE BOUNDARY
- WM — PROPOSED WATER METER
- PROPOSED TOP OF BATTER / PROPOSED TOE OF BATTER
- PROPOSED RETAINING WALL



NOTE:
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NOTE:
ALL GRATED INLETS WITHIN STAGE 3 MCU TO BE FITTED WITH ATLAN STORMSACK.

NOTES:
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SCALE 1:250 (A1) 0 5 10 15m
(SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

NOT FOR CONSTRUCTION

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REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: PRELIMINARY CIVIL WORKS LAYOUT PLAN - STAGE 3 [SHEET 1 OF 2]

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED:	
DRAWING No.: C6527 - CE301	REV.: A	

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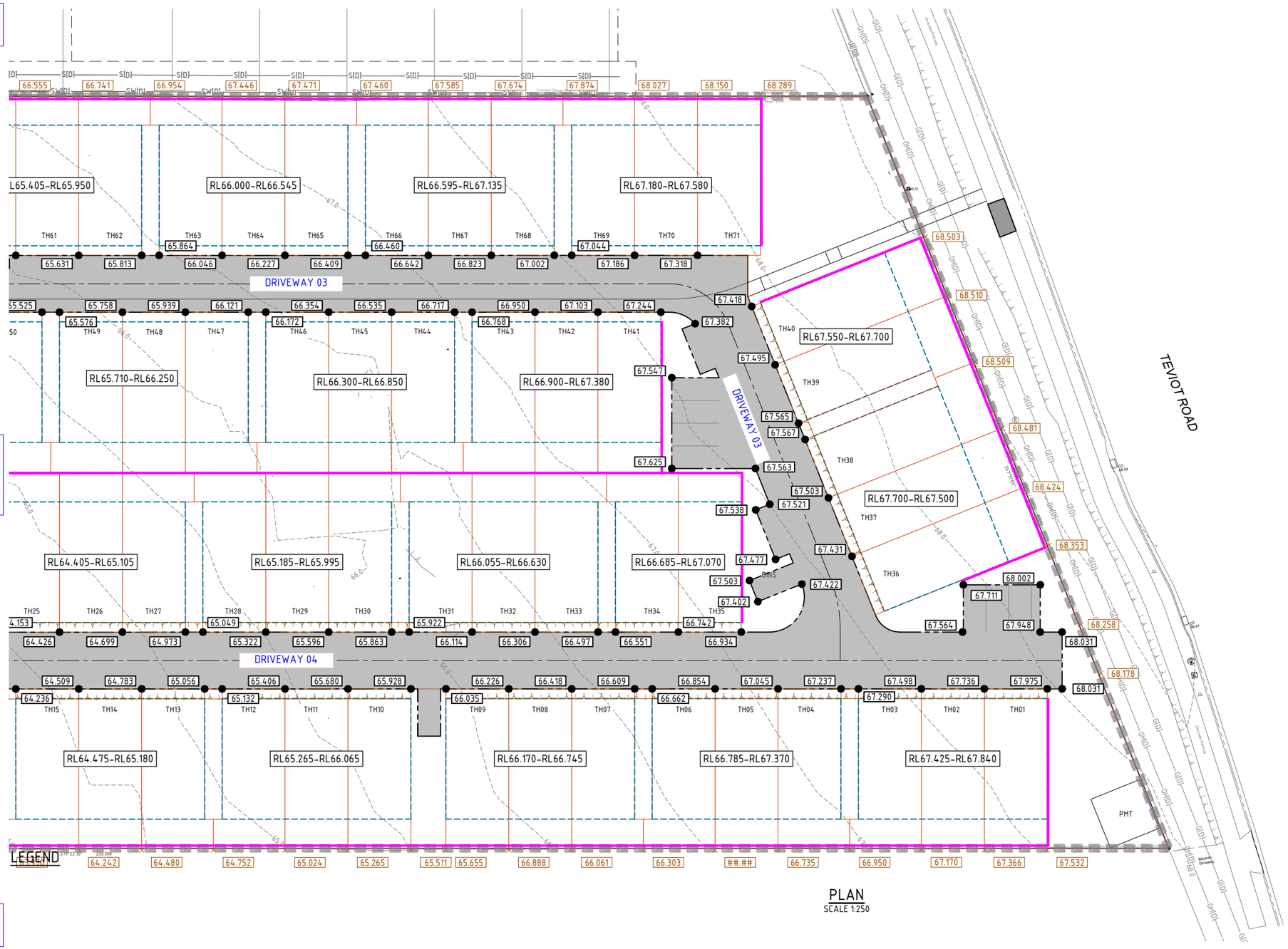
-A2-

-JOINS A1-



LEGEND

- G[D] — EXISTING GAS
- UE[D] — EXISTING ELECTRICAL UNDERGROUND
- OH — EXISTING ELECTRICAL OVERHEAD
- T[D] — EXISTING TELECOMMUNICATION
- SW[D] — EXISTING STORMWATER DRAINAGE
- S[D] — EXISTING SEWERAGE MAIN
- W[D] — EXISTING WATER MAIN
- EXISTING TOP OF BATTER / EXISTING TOE OF BATTER
- 9.999 — EXISTING CONTOURS
- ×##.## — EXISTING SURFACE LEVEL
- EXISTRING RETAINING WALL
- EXISTING PAVEMENT
- PROPOSED PAVEMENT
- ●##.## — PROPOSED LEVEL
- PROPOSED BLE EXTENTS
- PROPOSED STAGE BOUNDARY
- PROPOSED WATER METER
- PROPOSED TOP OF BATTER / PROPOSED TOE OF BATTER
- PROPOSED RETAINING WALL

PLAN
SCALE 1:250

NOTE:
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REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

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A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

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MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

DOCUMENT PRODUCED UNDER AN ISO 9001:2015 CERTIFIED QUALITY MANAGEMENT SYSTEM.

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: PRELIMINARY CIVIL WORKS LAYOUT PLAN - STAGE 3 [SHEET 2 OF 2]

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED	
DRAWING No.: C6527 - CE302		REV.: A

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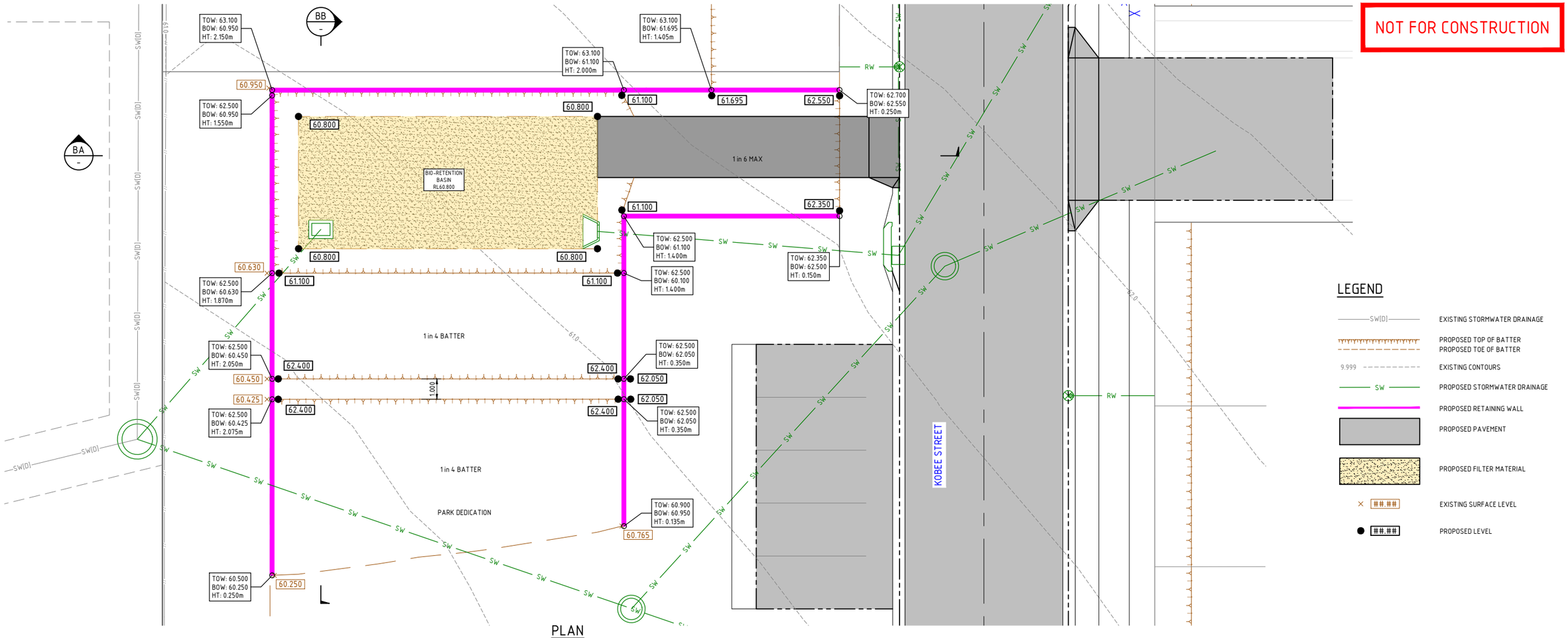
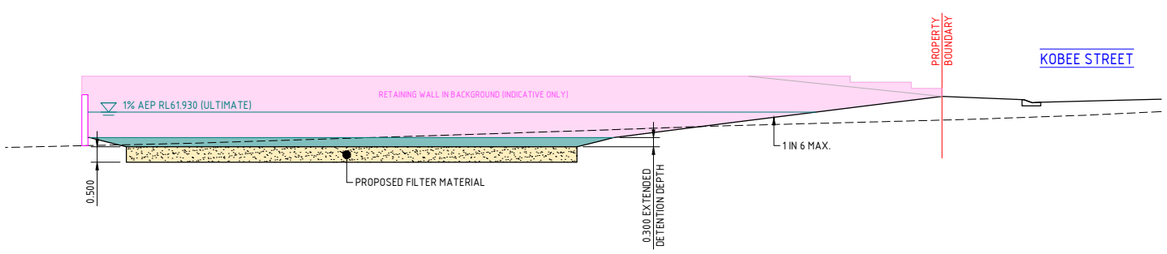


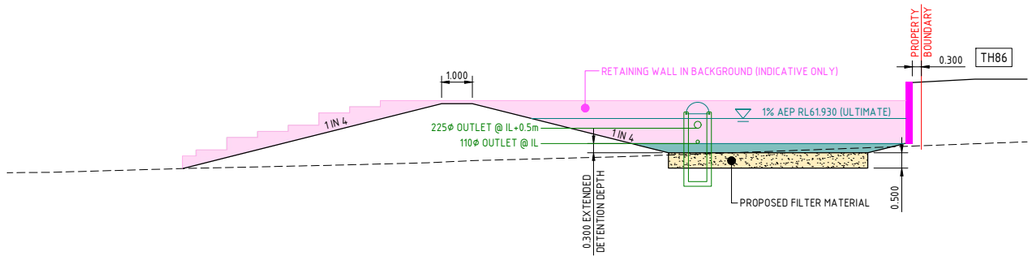
PLAN
SCALE 1:100

LEGEND

- SW(D) — EXISTING STORMWATER DRAINAGE
- PROPOSED TOP OF BATTER / PROPOSED TOE OF BATTER
- 9.999 — EXISTING CONTOURS
- SW — PROPOSED STORMWATER DRAINAGE
- PROPOSED RETAINING WALL
- PROPOSED PAVEMENT
- PROPOSED FILTER MATERIAL
- × ##.## — EXISTING SURFACE LEVEL
- ● ##.## — PROPOSED LEVEL



SECTION BA
SCALE 1:100



SECTION BB
SCALE 1:100

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REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

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A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL STRUCTURAL TRAFFIC PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: COMBINED ABOVE GROUND & BIO-RETENTION BASIN LAYOUT PLAN

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED	
DRAWING No.: C6527 - SW101	REV.: A	

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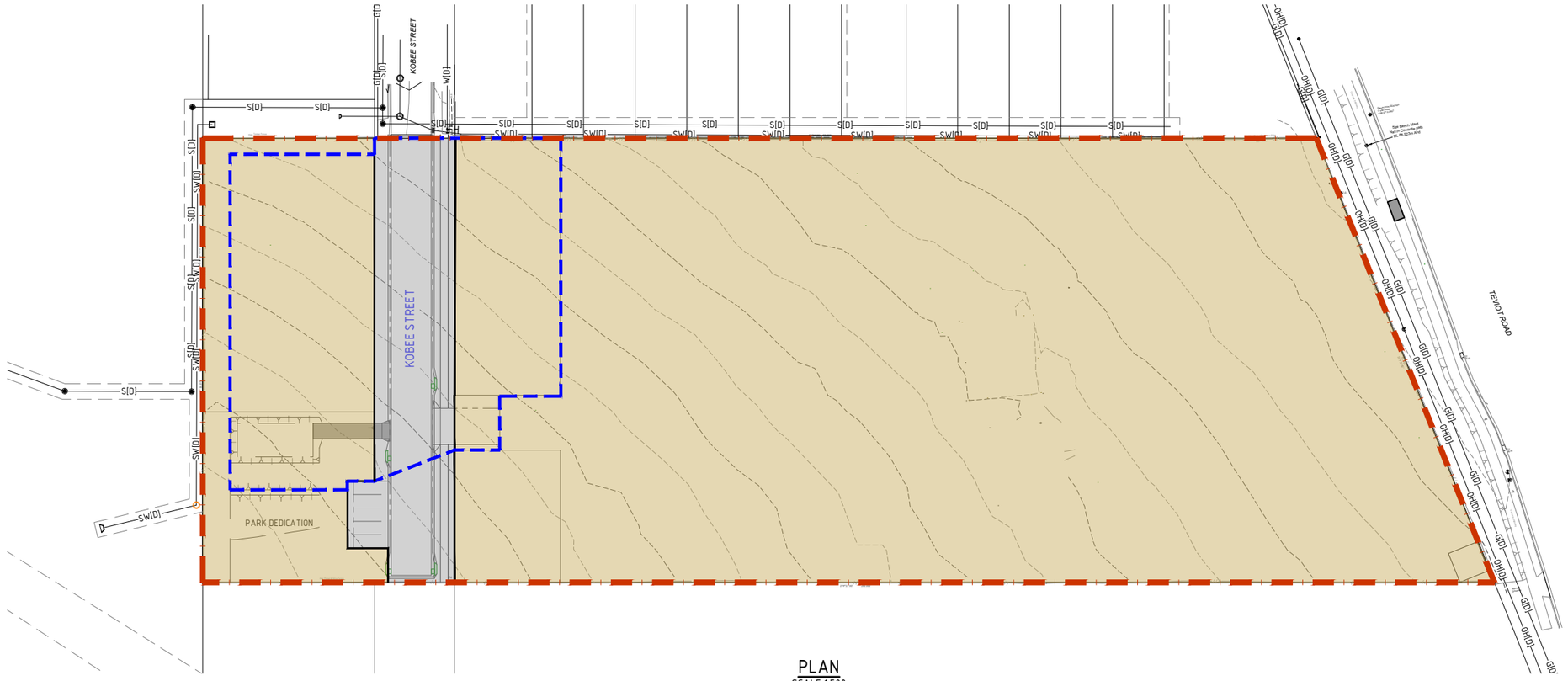

PLAN
SCALE 1:500

LEGEND

- URBANISED STAGE 1
- BALANCE AREA
- OVERALL SITE
- AREA TO BASIN

DEVELOPED CATCHMENT [STAGE 1]	
URBANISED STAGE 1	
A (ha)	0.134
I (%)	100
G (%)	4
BALANCE AREA	
A (ha)	1.871
I (%)	10
G (%)	4
OVERALL SITE	
A (ha)	2.005
I (%)	16
G (%)	4
AREA TO BASIN	
A (ha)	0.381
I (%)	31
G (%)	4

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REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: DEVELOPED CATCHMENT PLAN - STAGE 1

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED	
DRAWING No.: C6527 - SW201	REV.: A	

DO NOT SCALE FROM DRAWING
ALL SCALES ARE AS SHOWN (A1)

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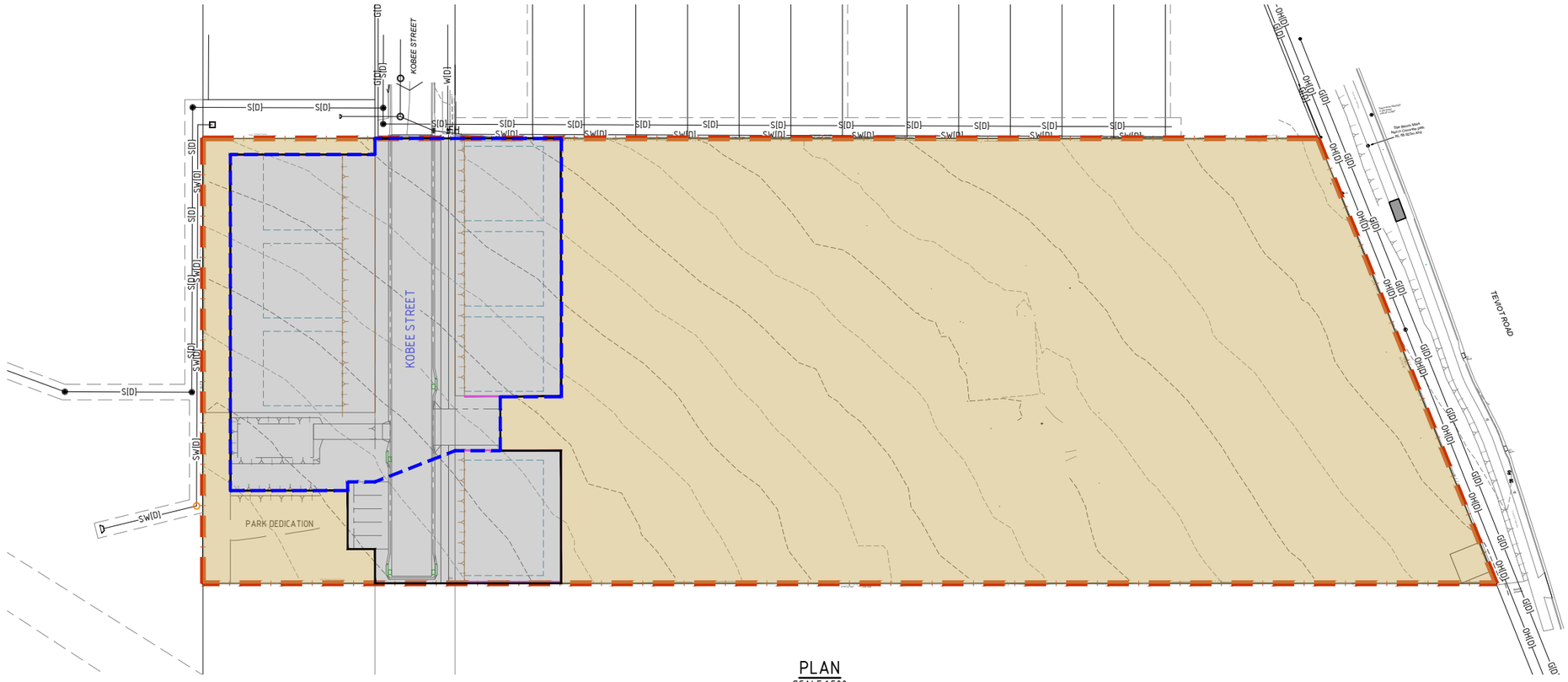

PLAN
SCALE 1:500

LEGEND

- URBANISED STAGE 1 & 2
- BALANCE AREA
- OVERALL SITE
- AREA TO BASIN

DEVELOPED CATCHMENT [STAGE 1]

URBANISED STAGE 1 & 2	
A (ha)	0.474
I (%)	75
G (%)	5
BALANCE AREA	
A (ha)	1.531
I (%)	10
G (%)	4
OVERALL SITE	
A (ha)	2.005
I (%)	16
G (%)	4
AREA TO BASIN	
A (ha)	0.381
I (%)	72
G (%)	6

NOTES:
1. THIS DRAWING TO BE USED FOR DESIGN REVIEW AND ACCESS PERMISSION ONLY. NOT TO BE USED FOR CONSTRUCTION.
2. LEVELS ON SITE TO BE CONFIRMED BY DETAILED SURVEY AND DESIGN REVISED PRIOR TO CONSTRUCTION.
3. APPROPRIATE APPROVALS FROM THE LOCAL AUTHORITIES ARE REQUIRED PRIOR TO CONSTRUCTION.

EXISTING SERVICES NOTE:
THIS DESIGN HAS BEEN PREPARED BASED ON SERVICE AUTHORITY AS CONSTRUCTED INFORMATION OR FIELD SURVEY, IF MADE AVAILABLE TO MNCE AT THE TIME OF DESIGN. THE LOCATION OF UNDERGROUND SERVICES ARE NOTED WITH THEIR RESPECTIVE CLASS IN ACCORDANCE WITH AS5488:2022, THE AUSTRALIAN STANDARDS FOR CLASSIFICATION OF SUBSURFACE UTILITY INFORMATION (SUI). NO POT HOLING HAS BEEN UNDERTAKEN TO VERIFY EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTORS RESPONSIBILITY TO UNDERTAKE FURTHER SURVEY AND POT HOLING AS REQUIRED, TO CONFIRM THE NATURE AND LOCATION OF THESE SERVICES AND VERIFY THE DESIGN.

SCALE 1:500 (A1) 0 10 20 30m
(SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: DEVELOPED CATCHMENT PLAN - STAGE 2

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED	
DRAWING No.: C6527 - SW202	REV.: A	

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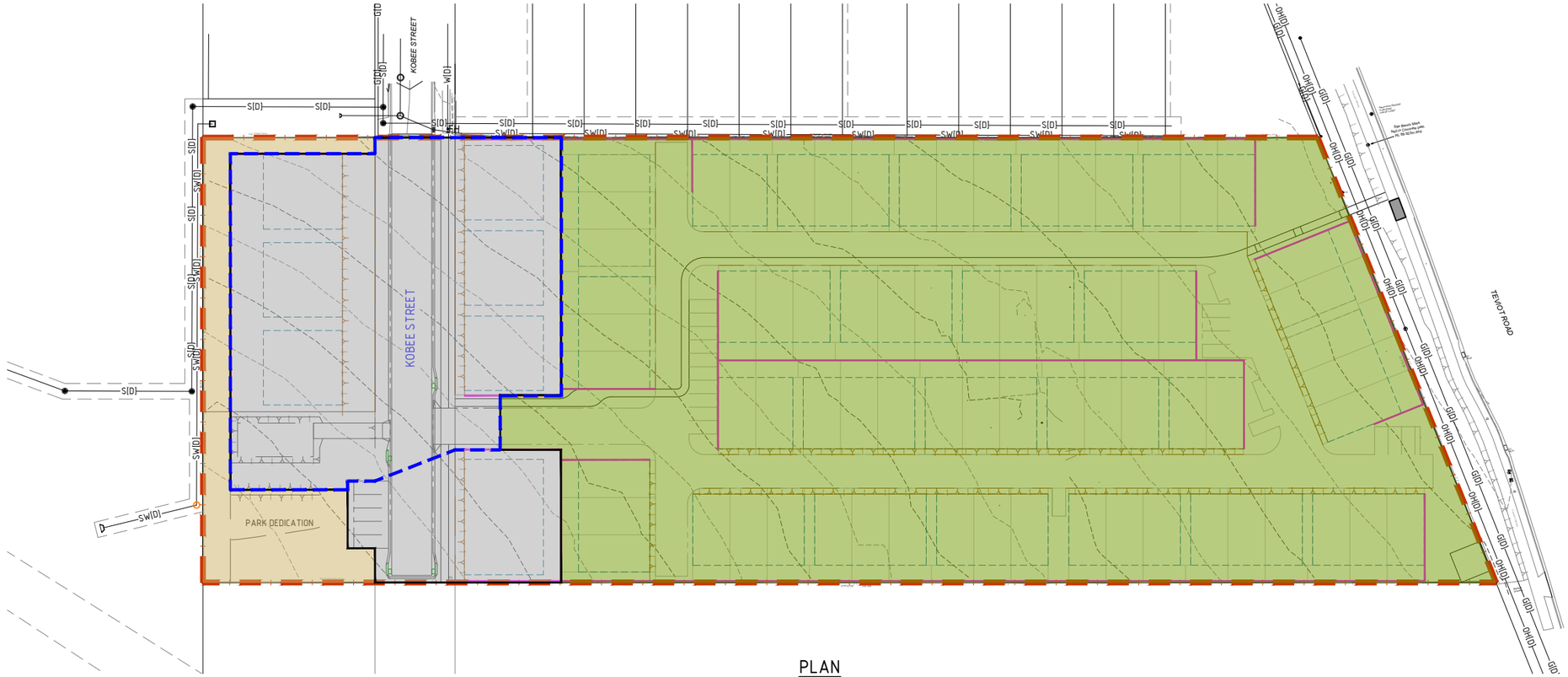

PLAN
SCALE 1:500

LEGEND

- URBANISED STAGE 1 & 2
- URBANISED STAGE 3 AND AREA TO TANK
- BALANCE AREA
- OVERALL SITE
- AREA TO BASIN

DEVELOPED CATCHMENT [STAGE 1]

URBANISED STAGE 1 & 2	
A (ha)	0.474
I (%)	75
G (%)	5
URBANISED STAGE 3 AND AREA TO TANK	
A (ha)	1.431
I (%)	78
G (%)	6
BALANCE AREA	
A (ha)	0.100
I (%)	10
G (%)	4
OVERALL SITE	
A (ha)	2.005
I (%)	74
G (%)	4
AREA TO BASIN	
A (ha)	0.381
I (%)	72
G (%)	6

NOTES:
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SCALE 1:500 (A1) 0 10 20 30m
(SCALE BEFORE REDUCTION)

REAL PROPERTY DESCRIPTION
LOT 17 ON RP210430

REV.	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED
A	PRELIMINARY ISSUE	22.05.26	SM	CFR	

MILANOVIC NEALE CONSULTING ENGINEERS
CIVIL
STRUCTURAL
TRAFFIC
PROJECT MANAGEMENT

CLIENT: CHIN-YUAN CHANG

PROJECT: 189-195 TEVIOT ROAD, GREENBANK

TITLE: DEVELOPED CATCHMENT PLAN - STAGE 1

DRAWN	DESIGNED	DATE
SM	SM	FEB 2026
CHECKED: CFR	APPROVED:	
DRAWING No.: C6527 - SW203	REV.: A	

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APPENDIX B: Rational Method Calculation Summary

RATIONAL METHOD CALCULATIONS - EXISTING SITE

Job Reference	C6527
Site Address	189-195 Teviot Road, Greenbank
Council	LCC LIMB 2020 Enveloped

Number of Sub-Catchments	1	
Minor Storm Event	10% AEP	(As per QUDM Table 7.02.1)
Major Storm Event	1% AEP	(As per QUDM Table 7.02.1)

Subcatchment Summary Table

Number	Catchment Name	Catchment Description	C_{10}	tc
1	Existing Lumped	Rural areas (2-5 dwelling units/ha)	0.74	25

Site C_{10} 0.74

Catchment Calculations (Major and Minor Storm ARI's)

Number	Area	C10	I10	10% AEP	C100	I100	1% AEP
	ha		mm/hr	m ³/s		mm/hr	m³/s
1	2.005	0.74	108	0.446	0.89	153	0.758

Total Runoff	Minor	0.446	m³/s
	Major	0.758	m³/s
Total Area		2.005	ha

Overland Flow Calculations		
Trunk SW Infrastructure		
Pipe Diameter	N/A	m
Number of Pipes		
Grade		m/m
mannings		
Pipe Capacity		m^3/s
Pipe Velocity		m/s
Capacity @ 3m/s		m^3/s
Overland Flow		m^3/s

Runoff Summary		
Freq.	Peak Discharge	
4 EY	0.105	m^3/s
63% AEP	0.210	m^3/s
39% AEP	0.277	m^3/s
15% AEP	0.382	m^3/s
10% AEP	0.446	m^3/s
5% AEP	0.515	m^3/s
2% AEP	0.654	m^3/s
1% AEP	0.758	m^3/s

RATIONAL METHOD CALCULATIONS - DEVELOPED SITE - STAGE 1

Job Reference	C6527
Site Address	189-195 Teviot Road, Greenbank
Council	LCC LIMB 2020 Enveloped

Number of Sub-Catchments	2	
Minor Storm Event	10% AEP	(As per QUDM Table 7.02.1)
Major Storm Event	1% AEP	(As per QUDM Table 7.02.1)

Subcatchment Summary Table

Number	Catchment Name	Catchment Description	C_{10}	tc
1	Stage 1	Significant paved areas	0.88	22
2	Balance	Rural areas (2-5 dwelling units/ha)	0.74	22

Site C_{10} 0.75

Catchment Calculations (Major and Minor Storm ARI's)

Number	Area	C10	I10	10% AEP	C100	I100	1% AEP
	ha		mm/hr	m³/s		mm/hr	m³/s
1	0.134	0.88	117	0.038	1.00	165	0.061
2	1.871	0.74	117	0.450	0.89	165	0.760

Total Runoff	Minor	0.488	m³/s
	Major	0.821	m³/s
Total Area		2.005	ha

Overland Flow Calculations		
Trunk SW Infrastructure		
Pipe Diameter	N/A	m
Number of Pipes		
Grade		m/m
mannings		
Pipe Capacity		m^3/s
Pipe Velocity		m/s
Capacity @ 3m/s		m^3/s
Overland Flow		m^3/s

Runoff Summary		
Freq.	Peak Discharge	
4 EY	0.115	m^3/s
63% AEP	0.231	m^3/s
39% AEP	0.305	m^3/s
15% AEP	0.419	m^3/s
10% AEP	0.488	m^3/s
5% AEP	0.563	m^3/s
2% AEP	0.711	m^3/s
1% AEP	0.821	m^3/s

Job Reference	C6527
Site Address	189-195 Teviot Road, Greenbank
Council	LCC LIMB 2020 Enveloped

Number of Sub-Catchments	2	
Minor Storm Event	10% AEP	(As per QUDM Table 7.02.1)
Major Storm Event	1% AEP	(As per QUDM Table 7.02.1)

Subcatchment Summary Table

Number	Catchment Name	Catchment Description	C_{10}	tc
1	Stage 1 & 2	Significant paved areas	0.88	20
2	Balance	Rural areas (2-5 dwelling units/ha)	0.74	20

Site C_{10} 0.77

Catchment Calculations (Major and Minor Storm ARI's)

Number	Area	C10	I10	10% AEP	C100	I100	1% AEP
	ha		mm/hr	m³/s		mm/hr	m³/s
1	0.474	0.88	123	0.142	1.00	172	0.227
2	1.531	0.74	123	0.386	0.89	172	0.650

Total Runoff	Minor	0.528	m³/s
	Major	0.877	m³/s
Total Area		2.005	ha

Overland Flow Calculations

Trunk SW Infrastructure		
Pipe Diameter	N/A	m
Number of Pipes		
Grade		m/m
mannings		
Pipe Capacity		m^3/s
Pipe Velocity		m/s
Capacity @ 3m/s		m^3/s
Overland Flow		m^3/s

Runoff Summary

Freq.	Peak Discharge	
4 EY	0.125	m^3/s
63% AEP	0.250	m^3/s
39% AEP	0.330	m^3/s
15% AEP	0.454	m^3/s
10% AEP	0.528	m^3/s
5% AEP	0.609	m^3/s
2% AEP	0.766	m^3/s
1% AEP	0.877	m^3/s

RATIONAL METHOD CALCULATIONS - DEVELOPED SITE - STAGE 1 -3

Job Reference	C6527
Site Address	189-195 Teviot Road, Greenbank
Council	LCC LIMB 2020 Enveloped

Number of Sub-Catchments	2	
Minor Storm Event	10% AEP	(As per QUDM Table 7.02.1)
Major Storm Event	1% AEP	(As per QUDM Table 7.02.1)

Subcatchment Summary Table

Number	Catchment Name	Catchment Description	C_{10}	tc
1	Stage 1 -3	Significant paved areas	0.88	12
2	Balance	Rural areas (2-5 dwelling units/ha)	0.74	12

Site C_{10} 0.87

Catchment Calculations (Major and Minor Storm ARI's)

Number	Area	C10	I10	10% AEP	C100	I100	1% AEP
	ha		mm/hr	m³/s		mm/hr	m³/s
1	1.905	0.88	160	0.743	1.00	219	1.159
2	0.100	0.74	160	0.033	0.89	219	0.054

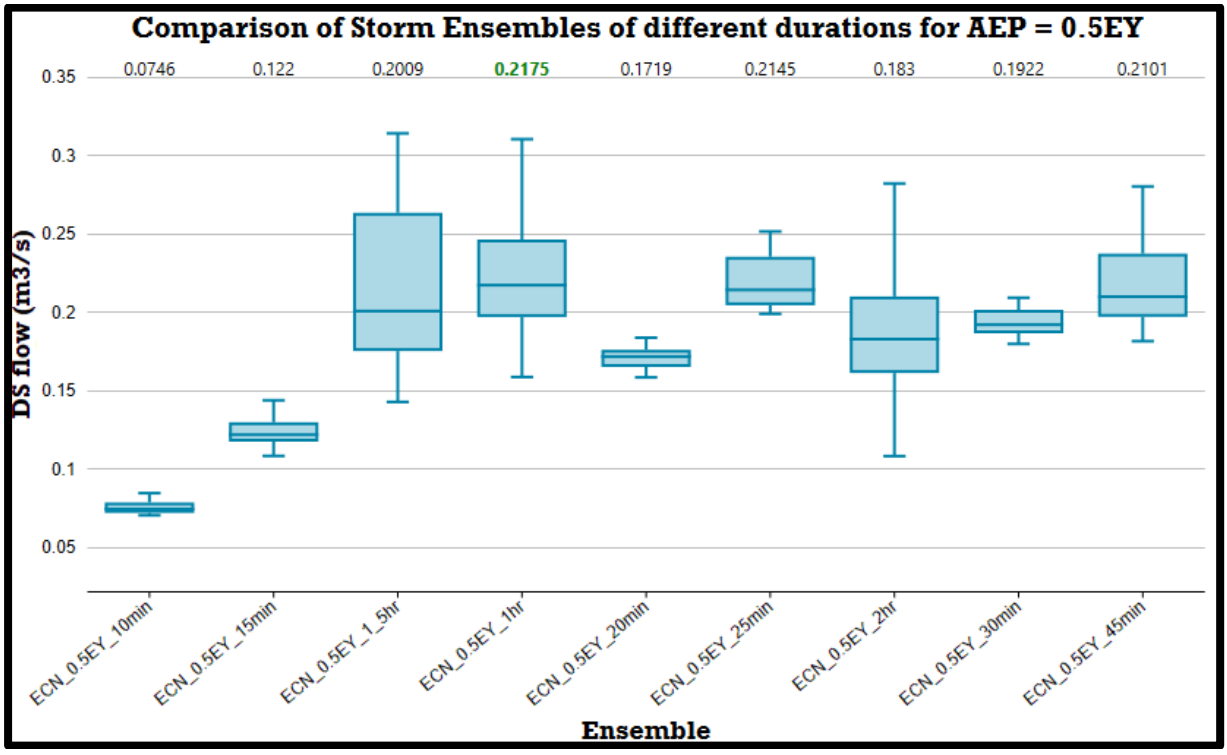
Total Runoff	Minor	0.776	m³/s
	Major	1.213	m³/s
Total Area		2.005	ha

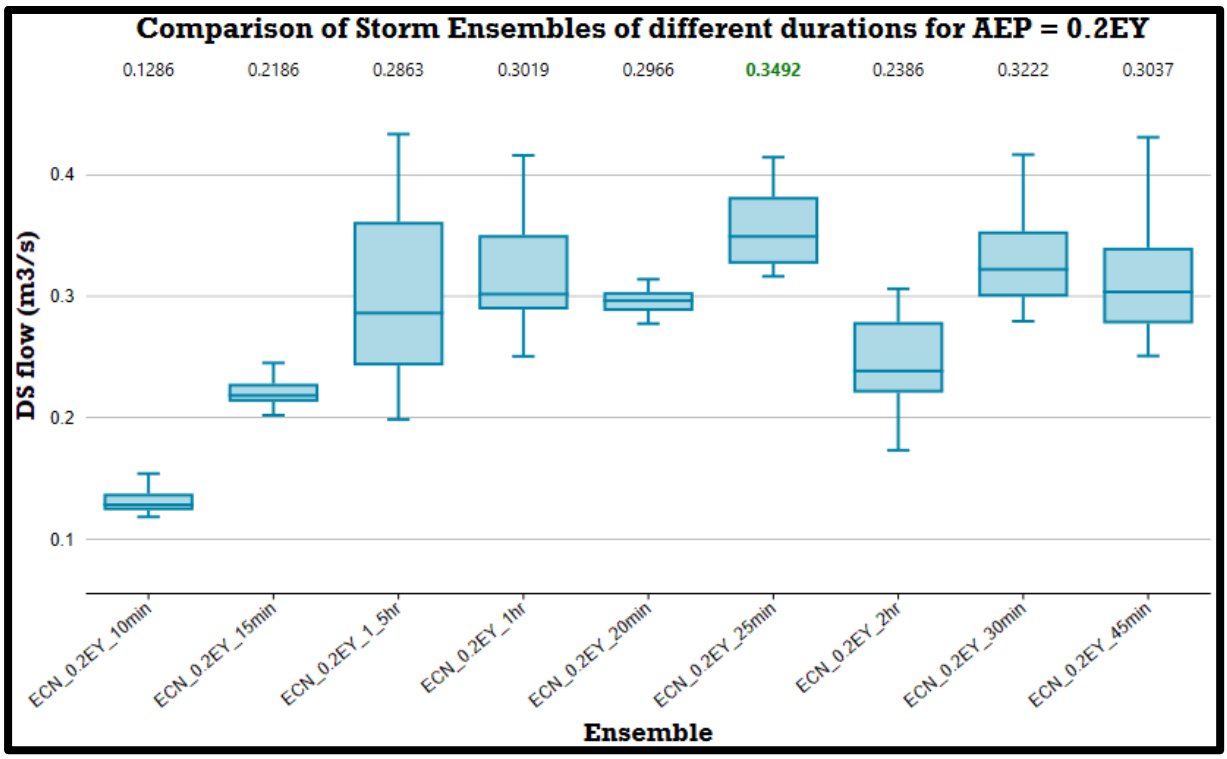
Overland Flow Calculations		
Trunk SW Infrastructure		
Pipe Diameter	N/A	m
Number of Pipes		
Grade		m/m
mannings		
Pipe Capacity		m^3/s
Pipe Velocity		m/s
Capacity @ 3m/s		m^3/s
Overland Flow		m^3/s

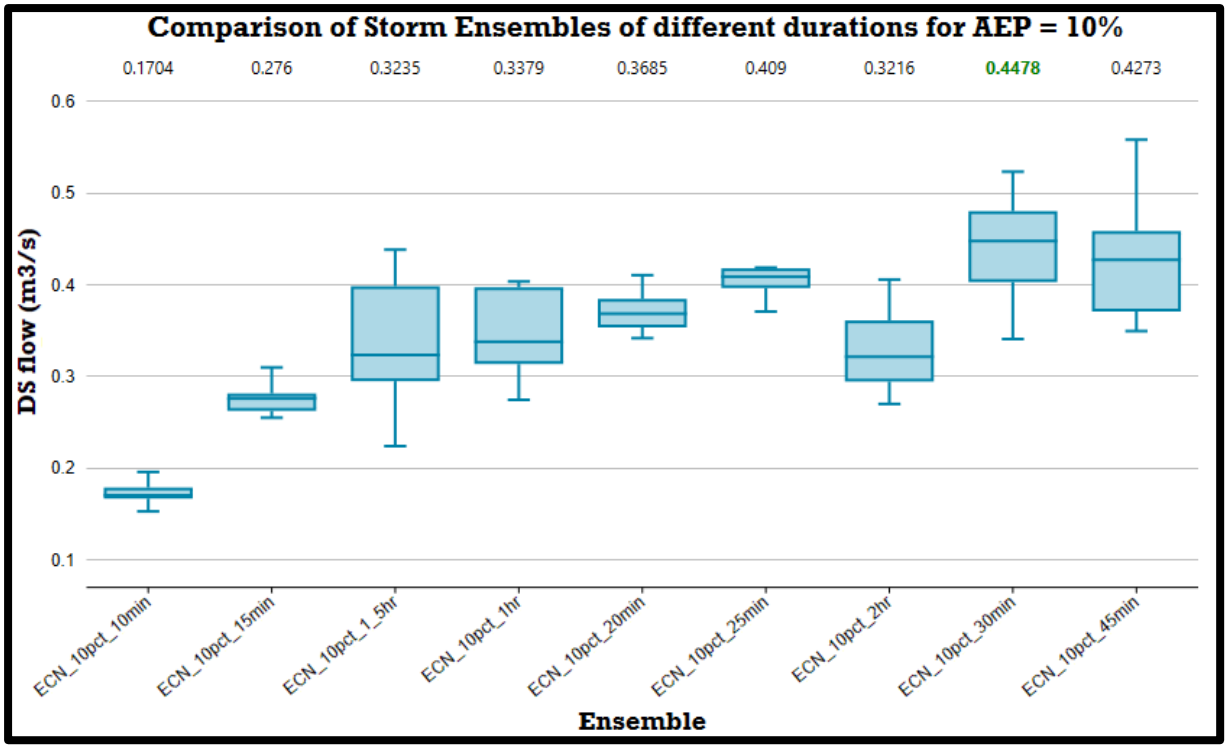
Runoff Summary		
Freq.	Peak Discharge	
4 EY	0.183	m^3/s
63% AEP	0.365	m^3/s
39% AEP	0.481	m^3/s
15% AEP	0.666	m^3/s
10% AEP	0.776	m^3/s
5% AEP	0.903	m^3/s
2% AEP	1.096	m^3/s
1% AEP	1.213	m^3/s

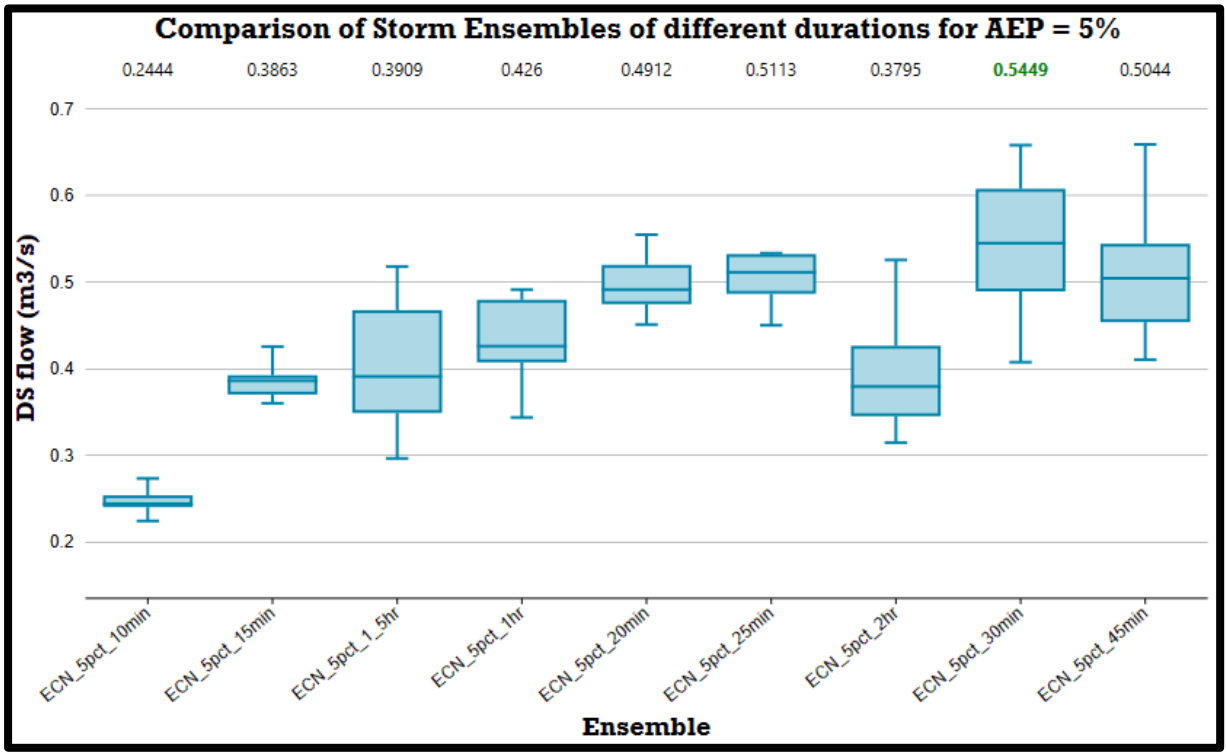
APPENDIX C: ICM Model Inputs, Outputs and Results

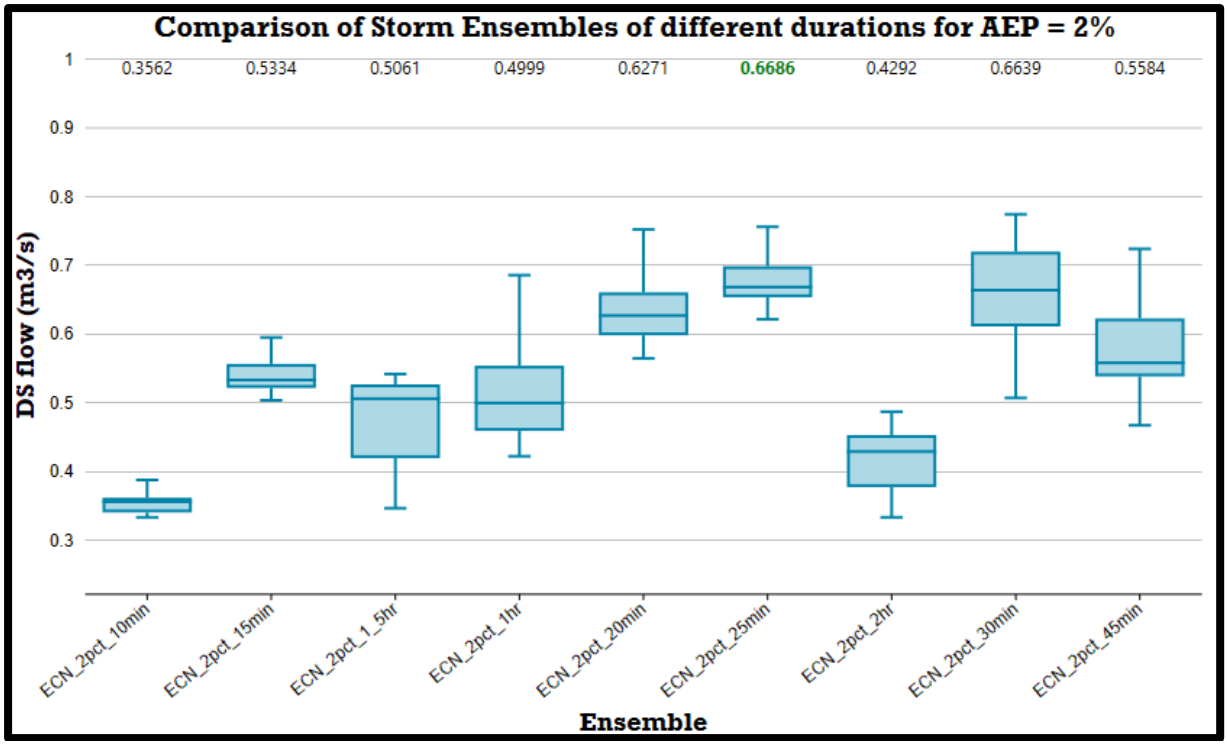
EXISTING CONDITIONS

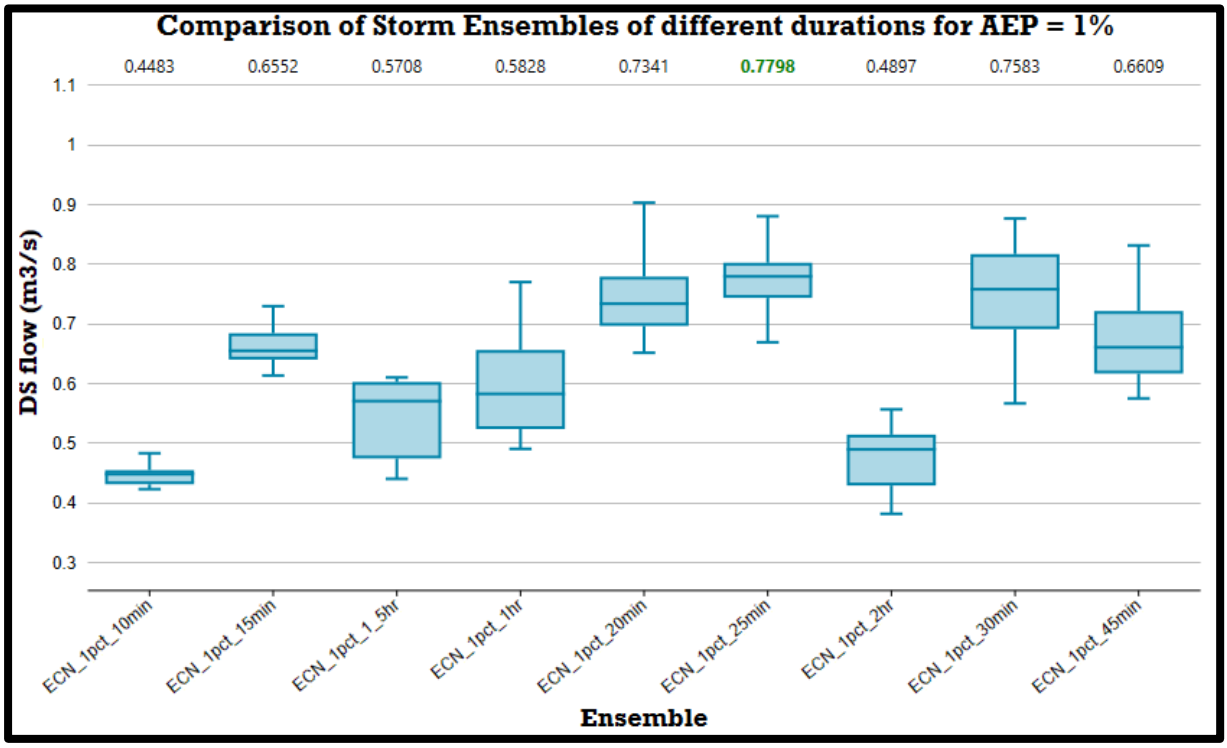




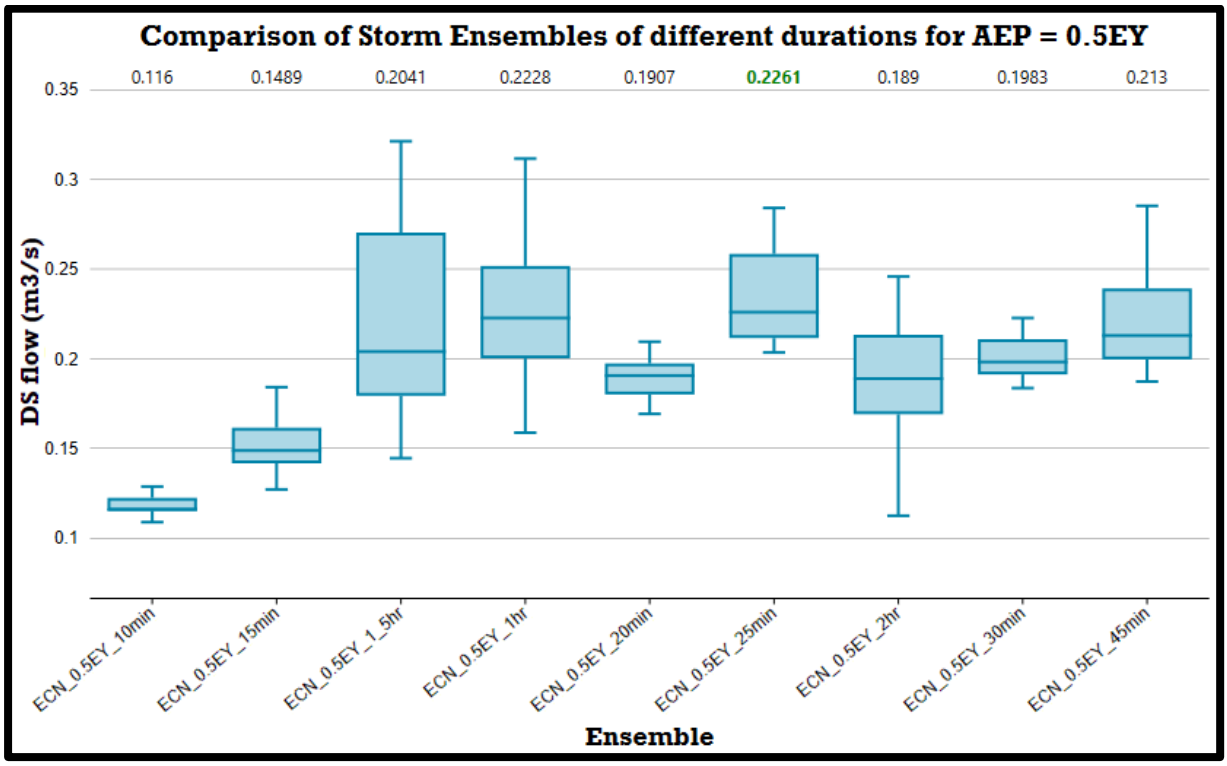

Comparison of Storm Ensembles of different durations for AEP = 10%
0.1704
0.276
0.3235
0.3379
0.3685
0.409
0.3216
0.4478
0.4273
DS flow (m3/s)
0.6
0.5
0.4
0.3
0.2
0.1
ECN_10pct_10min
ECN_10pct_15min
ECN_10pct_1_5hr
ECN_10pct_1hr
ECN_10pct_20min
ECN_10pct_25min
ECN_10pct_2hr
ECN_10pct_30min
ECN_10pct_45min
Ensemble

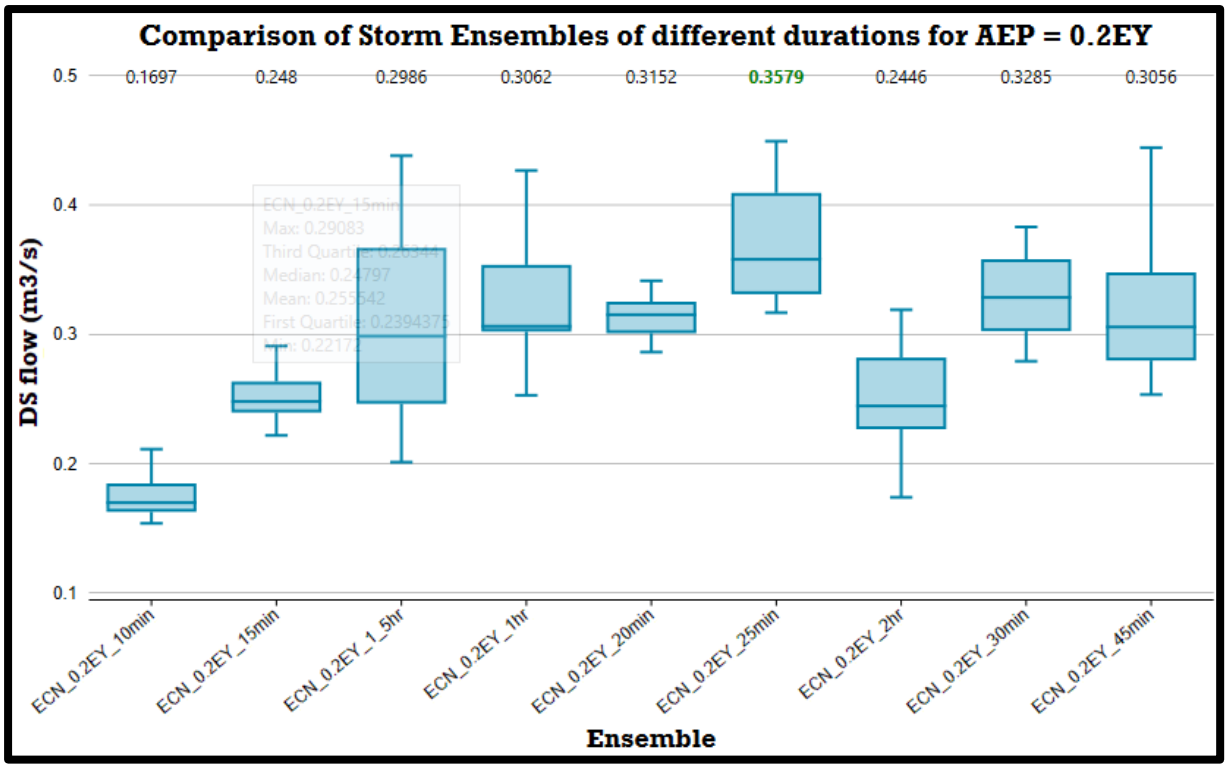

Comparison of Storm Ensembles of different durations for AEP = 5%
0.2444
0.3863
0.3909
0.426
0.4912
0.5113
0.3795
0.5449
0.5044
DS flow (m3/s)
0.7
0.6
0.5
0.4
0.3
0.2
ECN_5pct_10min
ECN_5pct_15min
ECN_5pct_1_5hr
ECN_5pct_1hr
ECN_5pct_20min
ECN_5pct_25min
ECN_5pct_2hr
ECN_5pct_30min
ECN_5pct_45min
Ensemble

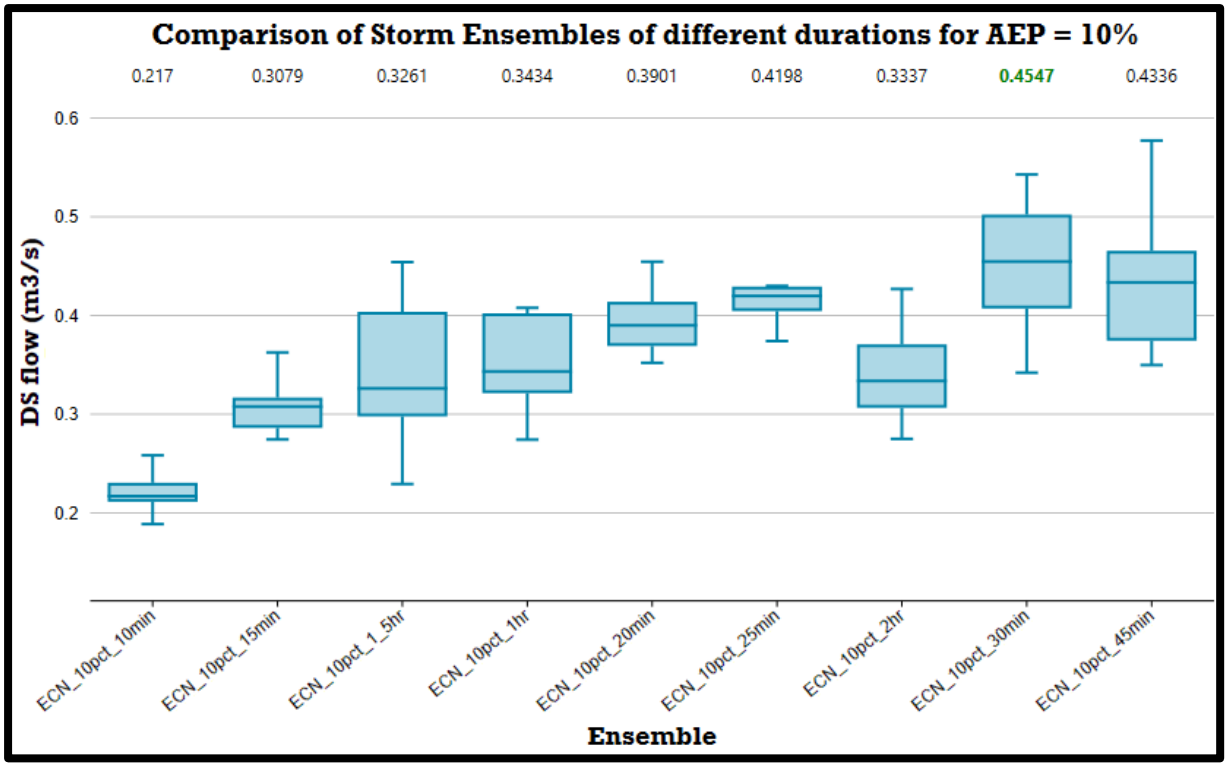

Comparison of Storm Ensembles of different durations for AEP = 2%
0.3562
0.5334
0.5061
0.4999
0.6271
0.6686
0.4292
0.6639
0.5584
DS flow (m3/s)
Ensemble
ECN_2pct_10min
ECN_2pct_15min
ECN_2pct_1_5hr
ECN_2pct_1hr
ECN_2pct_20min
ECN_2pct_25min
ECN_2pct_2hr
ECN_2pct_30min
ECN_2pct_45min

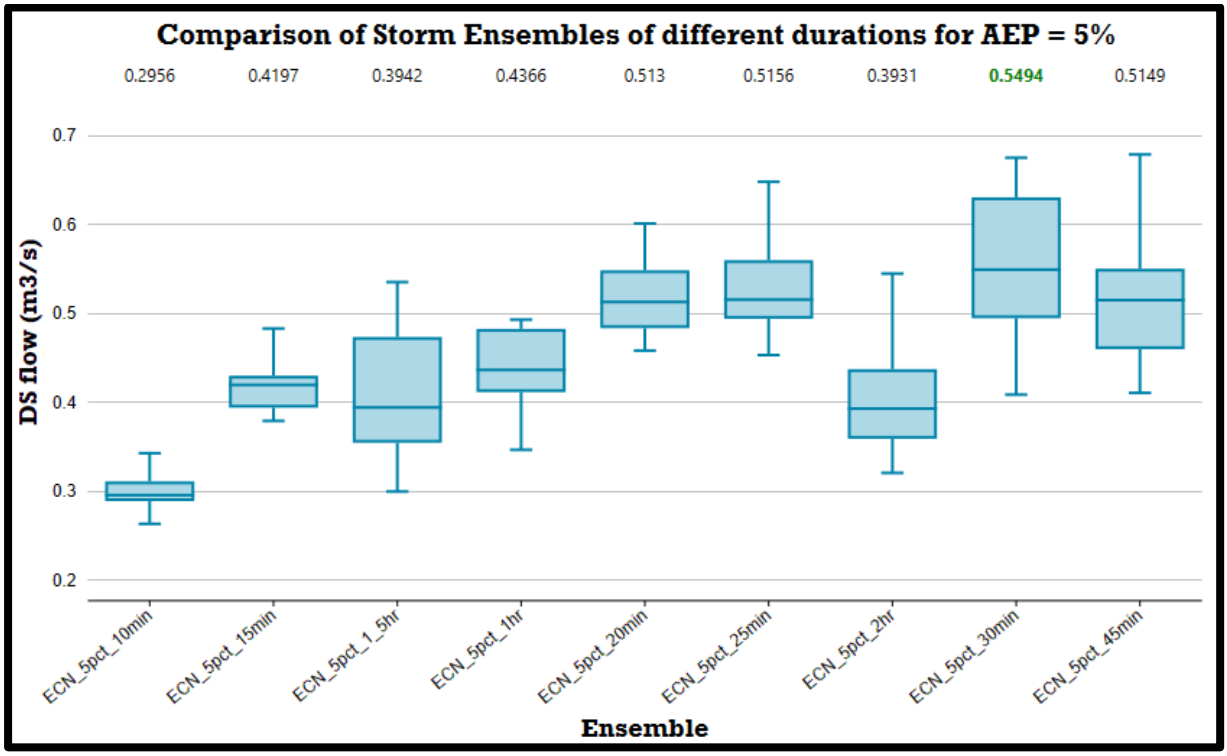

Comparison of Storm Ensembles of different durations for AEP = 1%
0.4483
0.6552
0.5708
0.5828
0.7341
0.7798
0.4897
0.7583
0.6609
DS flow (m3/s)
Ensemble
ECN_1pct_10min
ECN_1pct_15min
ECN_1pct_1_5hr
ECN_1pct_1hr
ECN_1pct_20min
ECN_1pct_25min
ECN_1pct_2hr
ECN_1pct_30min
ECN_1pct_45min

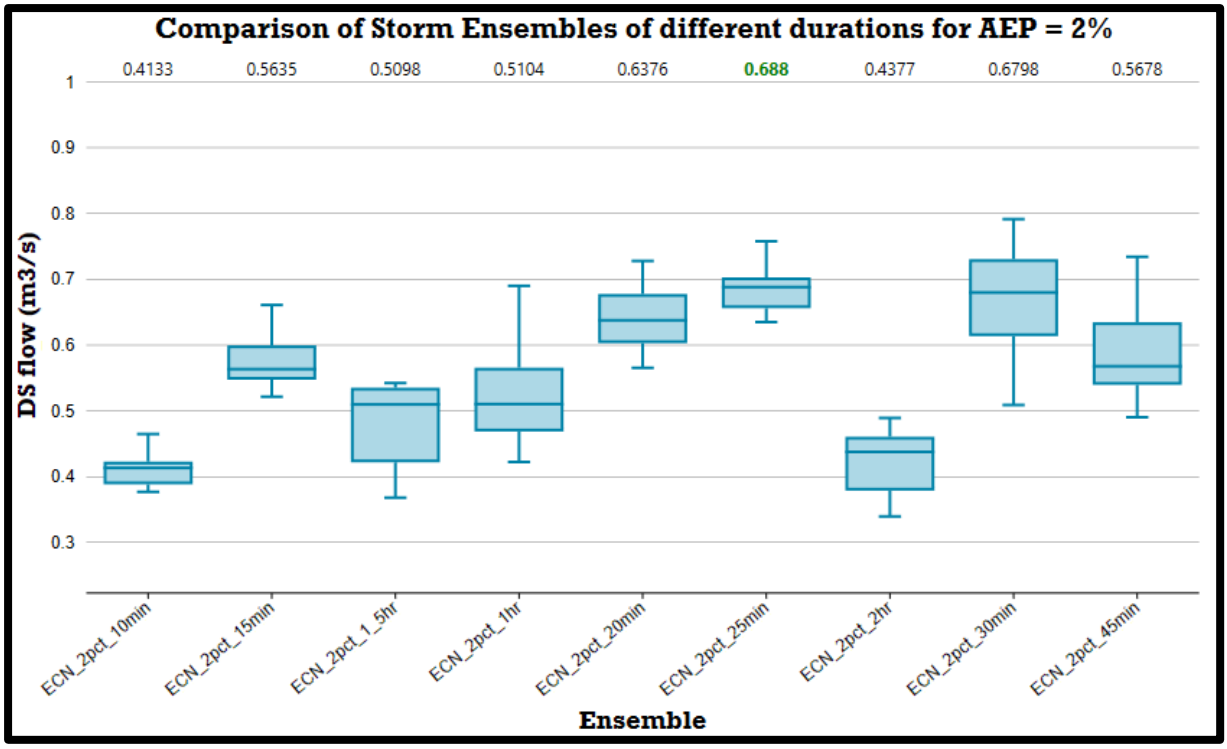
DEVELOPED CONDITIONS – STAGE 1

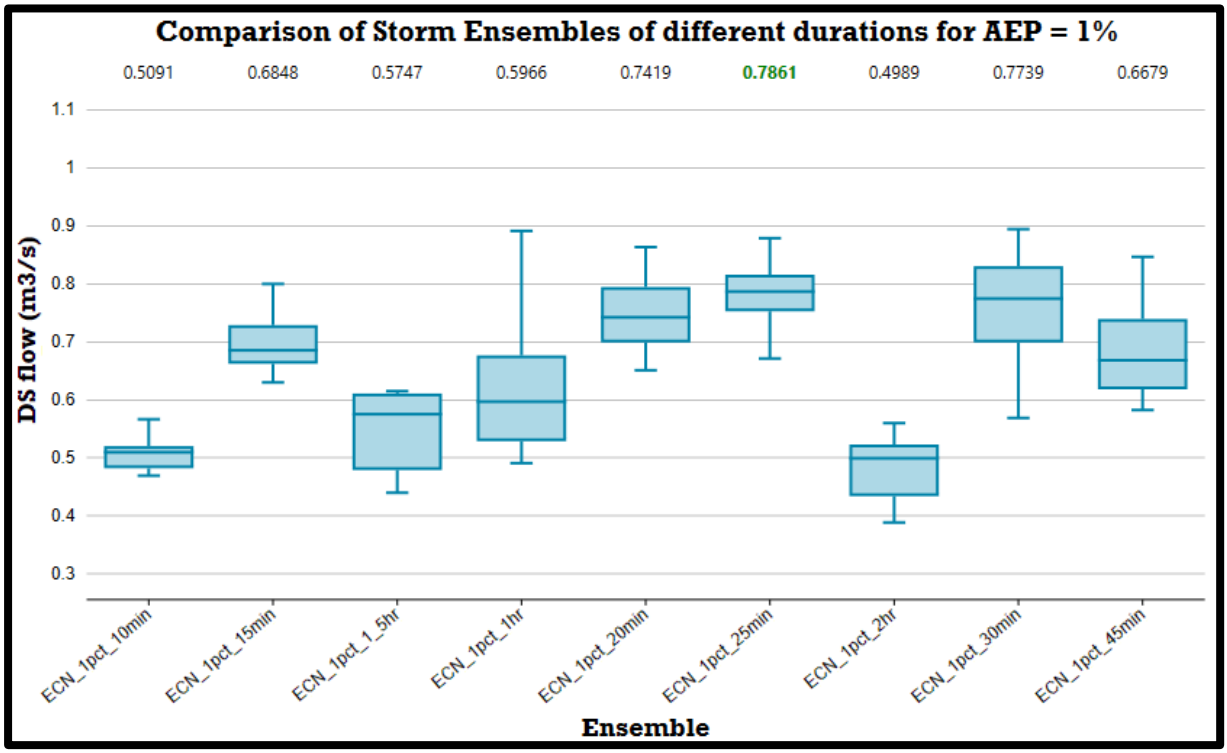




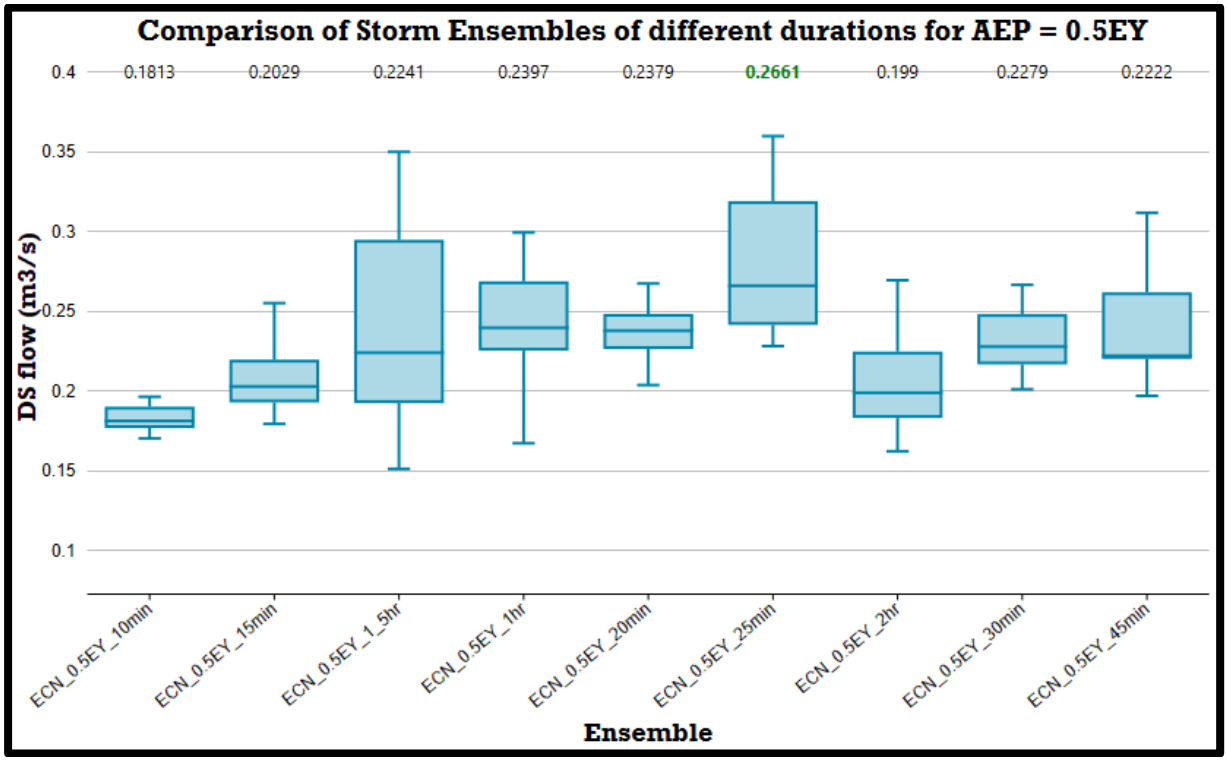

Comparison of Storm Ensembles of different durations for AEP = 10%
0.217
0.3079
0.3261
0.3434
0.3901
0.4198
0.3337
0.4547
0.4336
DS flow (m3/s)
0.6
0.5
0.4
0.3
0.2
ECN_10pct_10min
ECN_10pct_15min
ECN_10pct_1_5hr
ECN_10pct_1hr
ECN_10pct_20min
ECN_10pct_25min
ECN_10pct_2hr
ECN_10pct_30min
ECN_10pct_45min
Ensemble

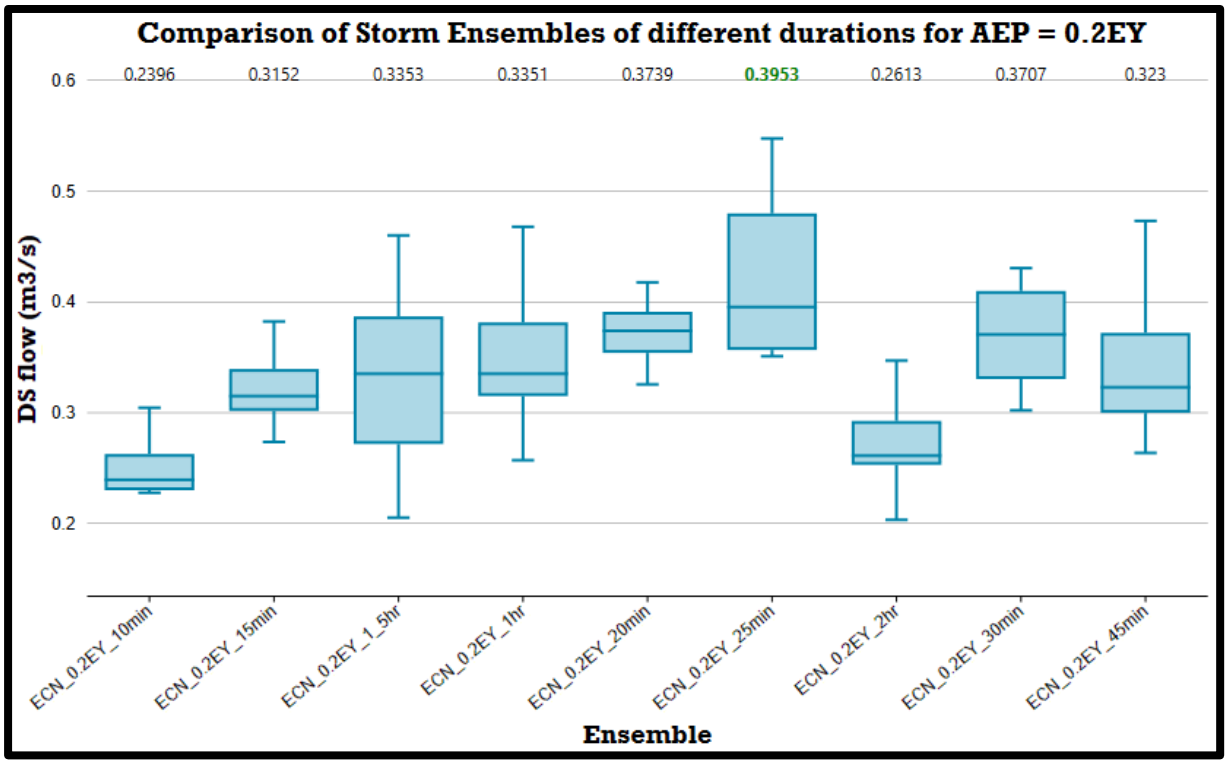

Comparison of Storm Ensembles of different durations for AEP = 5%
0.2956
0.4197
0.3942
0.4366
0.513
0.5156
0.3931
0.5494
0.5149
DS flow (m3/s)
0.7
0.6
0.5
0.4
0.3
0.2
ECN_5pct_10min
ECN_5pct_15min
ECN_5pct_1_5hr
ECN_5pct_1hr
ECN_5pct_20min
ECN_5pct_25min
ECN_5pct_2hr
ECN_5pct_30min
ECN_5pct_45min
Ensemble

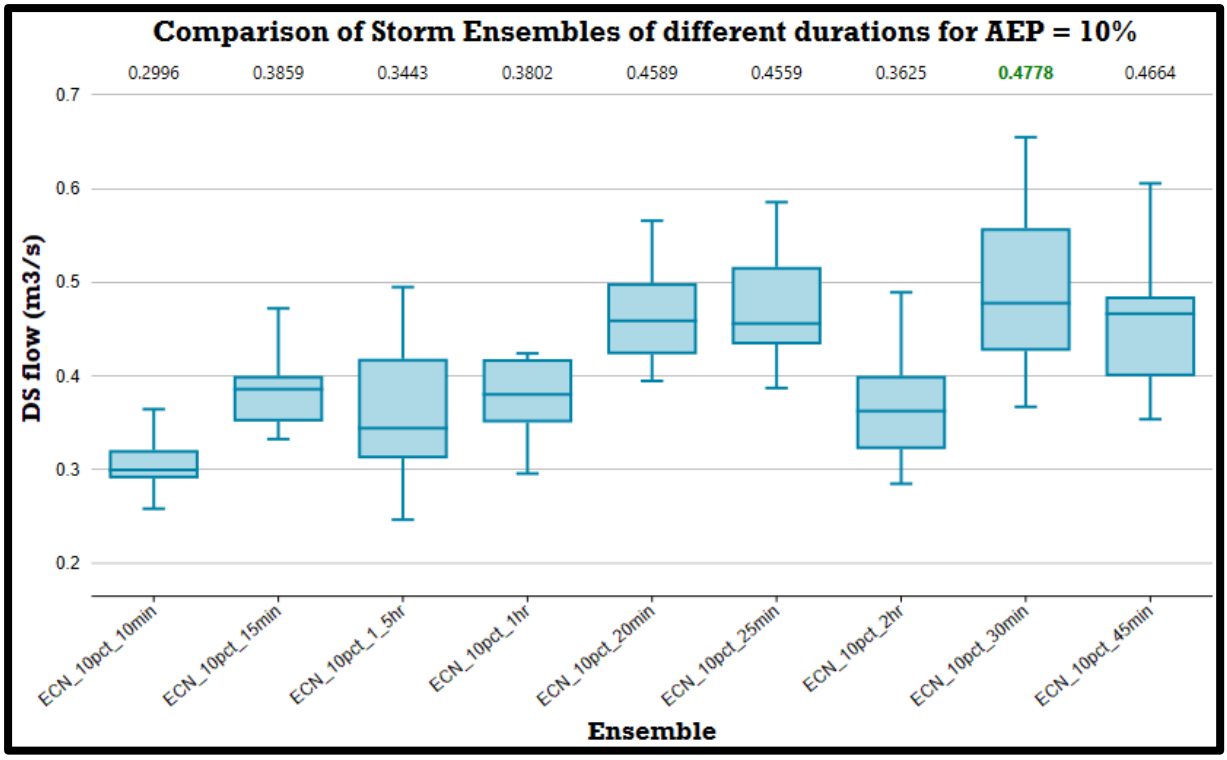

Comparison of Storm Ensembles of different durations for AEP = 2%
0.4133
0.5635
0.5098
0.5104
0.6376
0.688
0.4377
0.6798
0.5678
DS flow (m3/s)
Ensemble
ECN_2pct_10min
ECN_2pct_15min
ECN_2pct_1_5hr
ECN_2pct_1hr
ECN_2pct_20min
ECN_2pct_25min
ECN_2pct_2hr
ECN_2pct_30min
ECN_2pct_45min

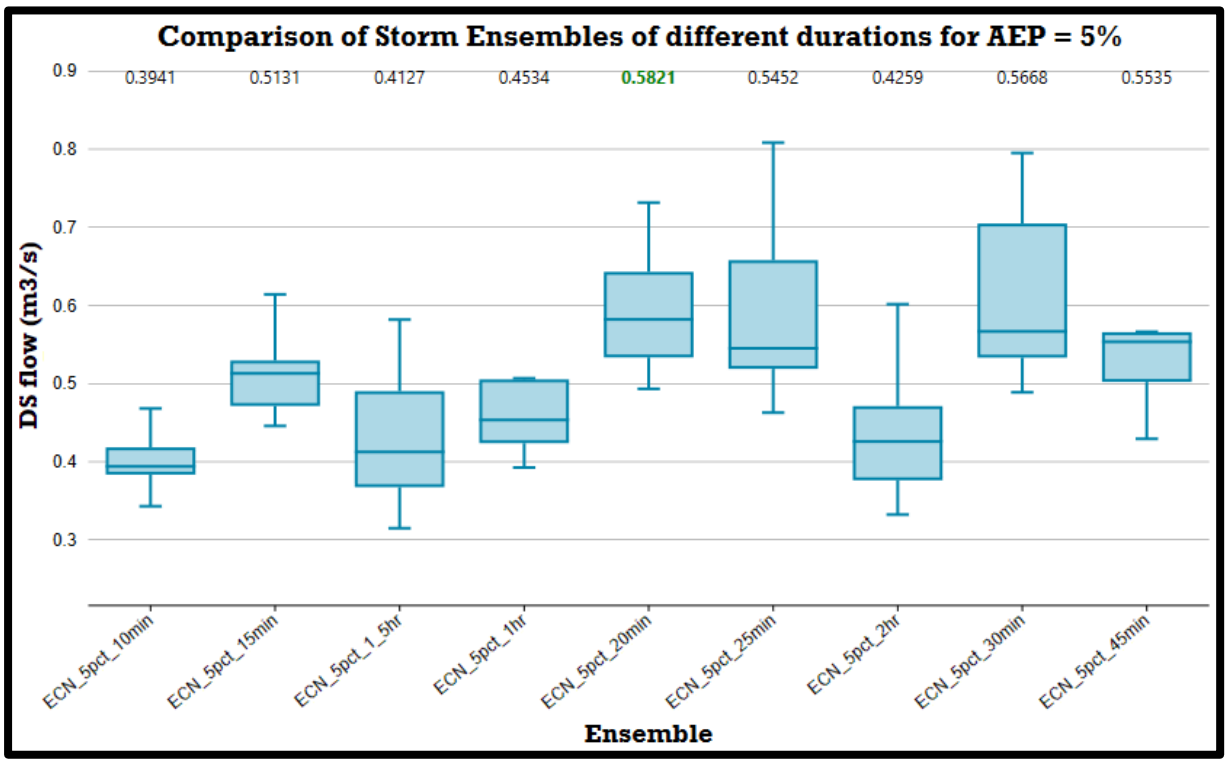

Comparison of Storm Ensembles of different durations for AEP = 1%
0.5091
0.6848
0.5747
0.5966
0.7419
0.7861
0.4989
0.7739
0.6679
DS flow (m3/s)
Ensemble
ECN_1pct_10min
ECN_1pct_15min
ECN_1pct_1_5hr
ECN_1pct_1hr
ECN_1pct_20min
ECN_1pct_25min
ECN_1pct_2hr
ECN_1pct_30min
ECN_1pct_45min

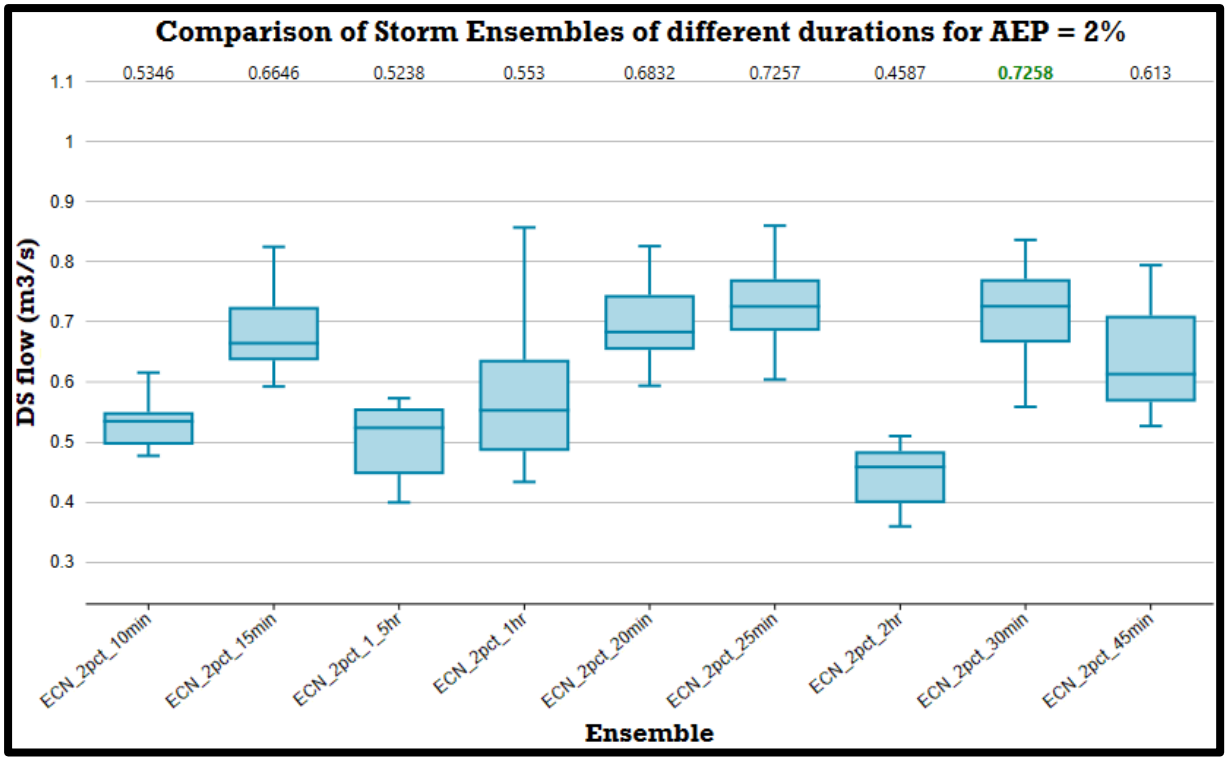
DEVELOPED CONDITIONS – STAGE 2

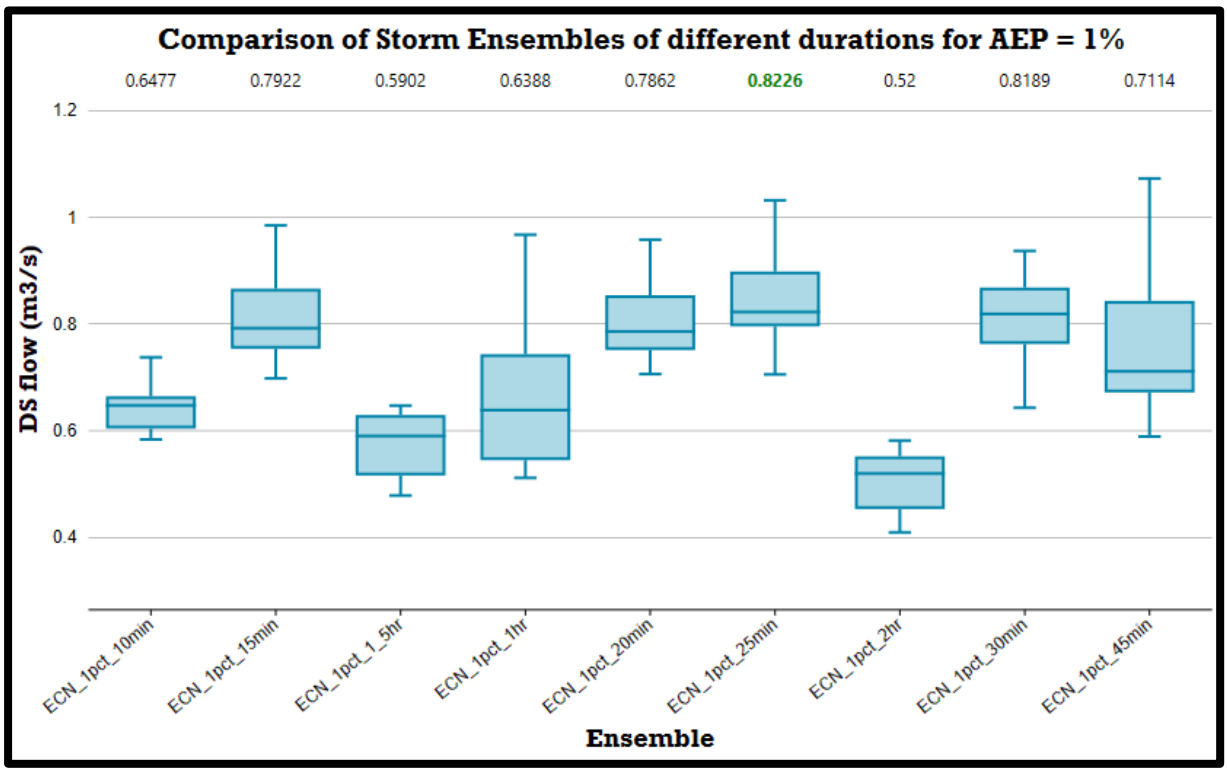




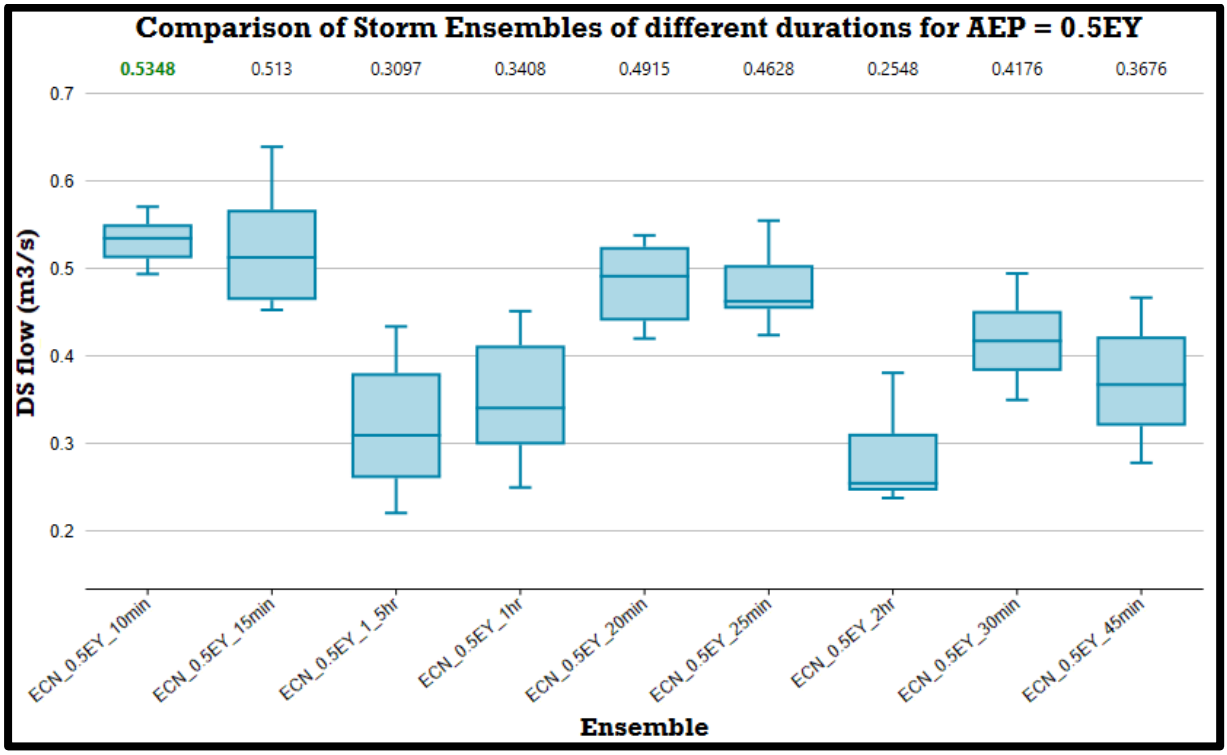

Comparison of Storm Ensembles of different durations for AEP = 10%
0.2996
0.3859
0.3443
0.3802
0.4589
0.4559
0.3625
0.4778
0.4664
0.7
0.6
0.5
0.4
0.3
0.2
DS flow (m3/s)
ECN_10pct_10min
ECN_10pct_15min
ECN_10pct_1_5hr
ECN_10pct_1hr
ECN_10pct_20min
ECN_10pct_25min
ECN_10pct_2hr
ECN_10pct_30min
ECN_10pct_45min
Ensemble

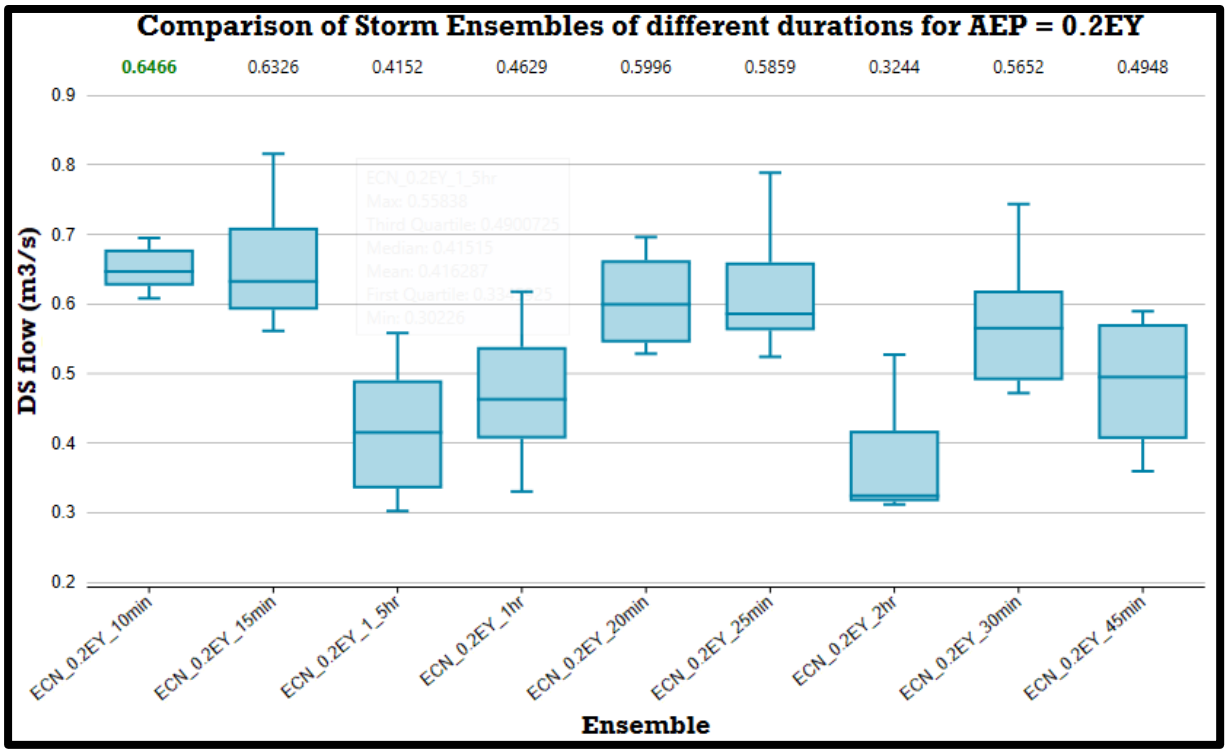

Comparison of Storm Ensembles of different durations for AEP = 5%
0.3941
0.5131
0.4127
0.4534
0.5821
0.5452
0.4259
0.5668
0.5535
0.9
0.8
0.7
0.6
0.5
0.4
0.3
DS flow (m3/s)
ECN_5pct_10min
ECN_5pct_15min
ECN_5pct_1_5hr
ECN_5pct_1hr
ECN_5pct_20min
ECN_5pct_25min
ECN_5pct_2hr
ECN_5pct_30min
ECN_5pct_45min
Ensemble

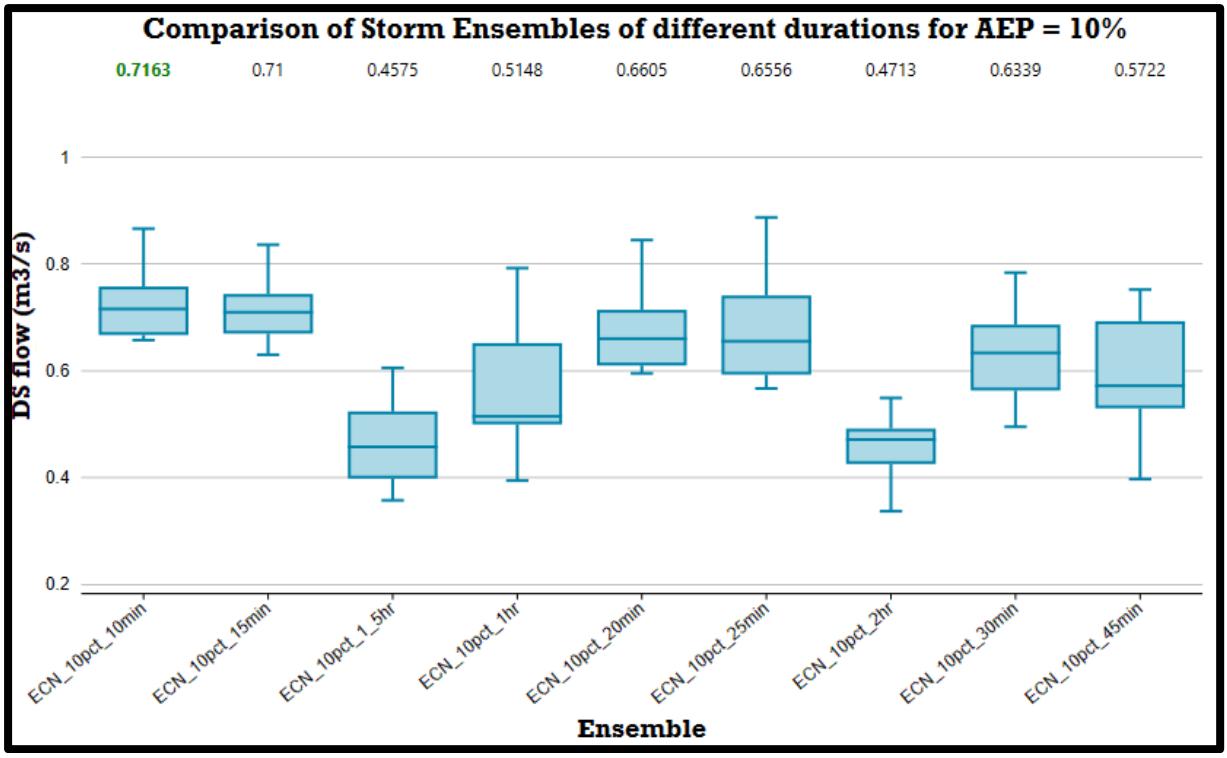

Comparison of Storm Ensembles of different durations for AEP = 2%
0.5346
0.6646
0.5238
0.553
0.6832
0.7257
0.4587
0.7258
0.613
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
DS flow (m3/s)
ECN_2pct_10min
ECN_2pct_15min
ECN_2pct_1_5hr
ECN_2pct_1hr
ECN_2pct_20min
ECN_2pct_25min
ECN_2pct_2hr
ECN_2pct_30min
ECN_2pct_45min
Ensemble

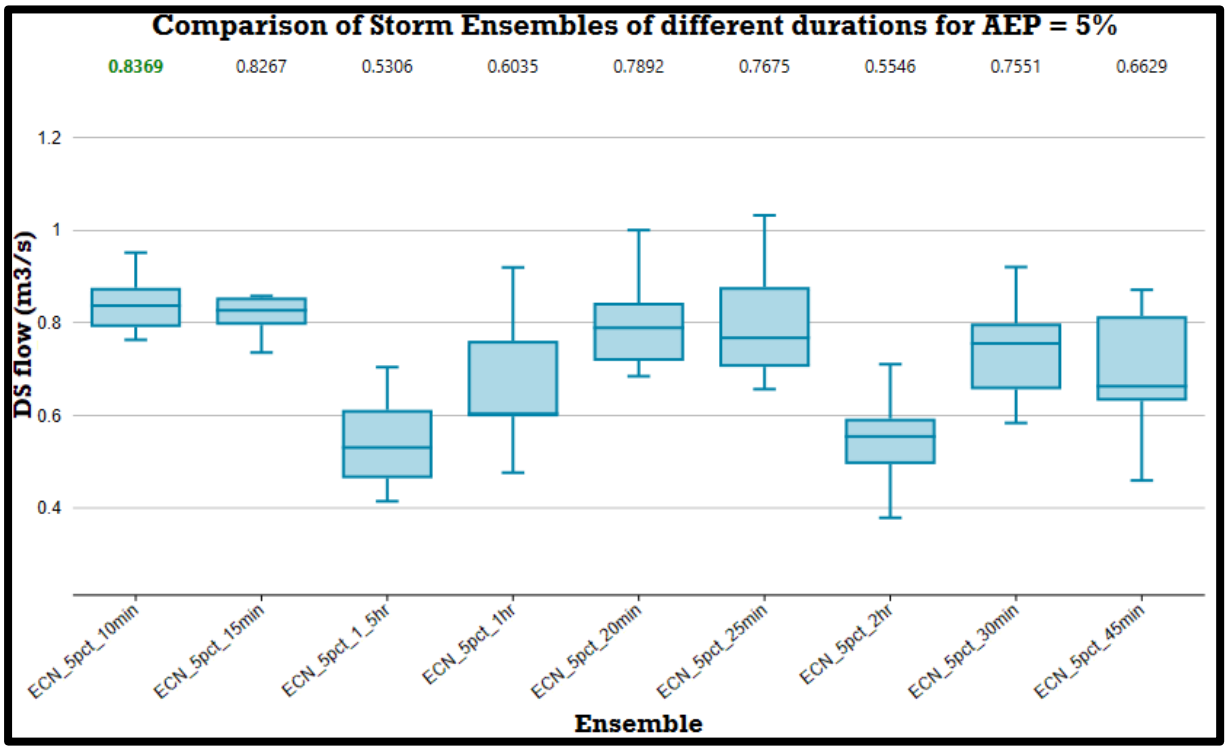

Comparison of Storm Ensembles of different durations for AEP = 1%
0.6477
0.7922
0.5902
0.6388
0.7862
0.8226
0.52
0.8189
0.7114
1.2
1
0.8
0.6
0.4
DS flow (m3/s)
ECN_1pct_10min
ECN_1pct_15min
ECN_1pct_1_5hr
ECN_1pct_1hr
ECN_1pct_20min
ECN_1pct_25min
ECN_1pct_2hr
ECN_1pct_30min
ECN_1pct_45min
Ensemble

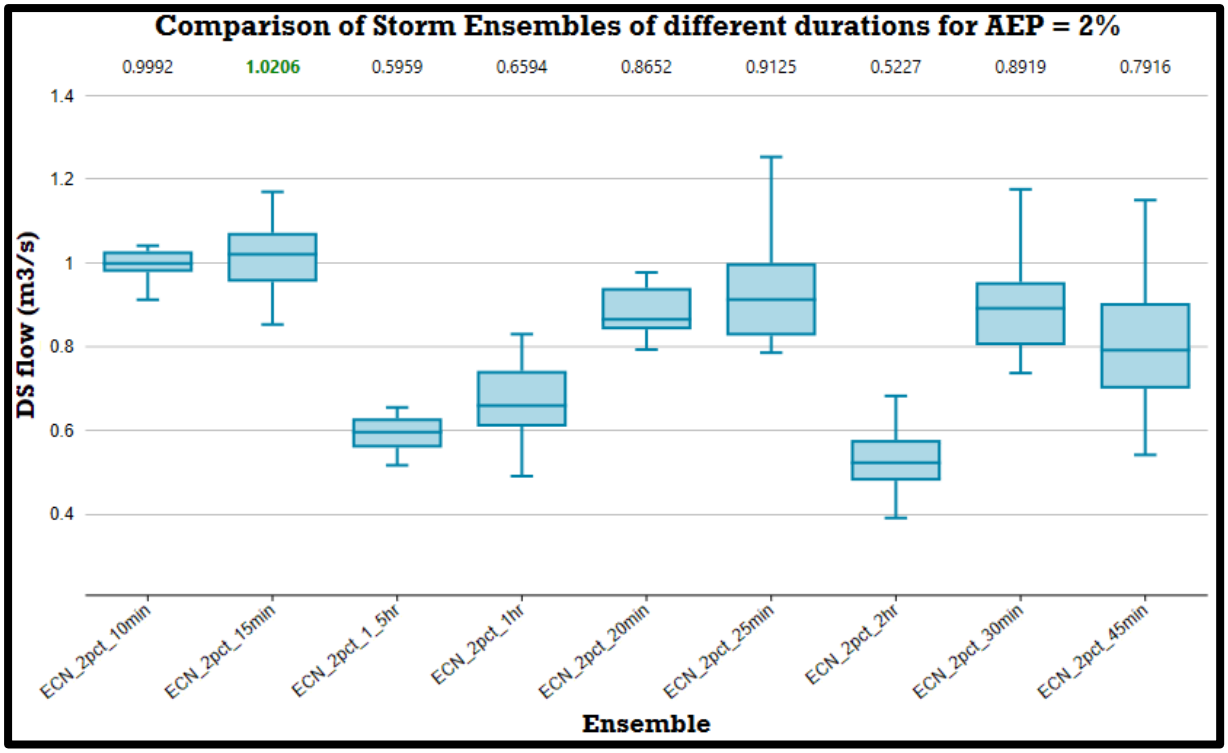
DEVELOPED CONDITIONS – STAGE 3

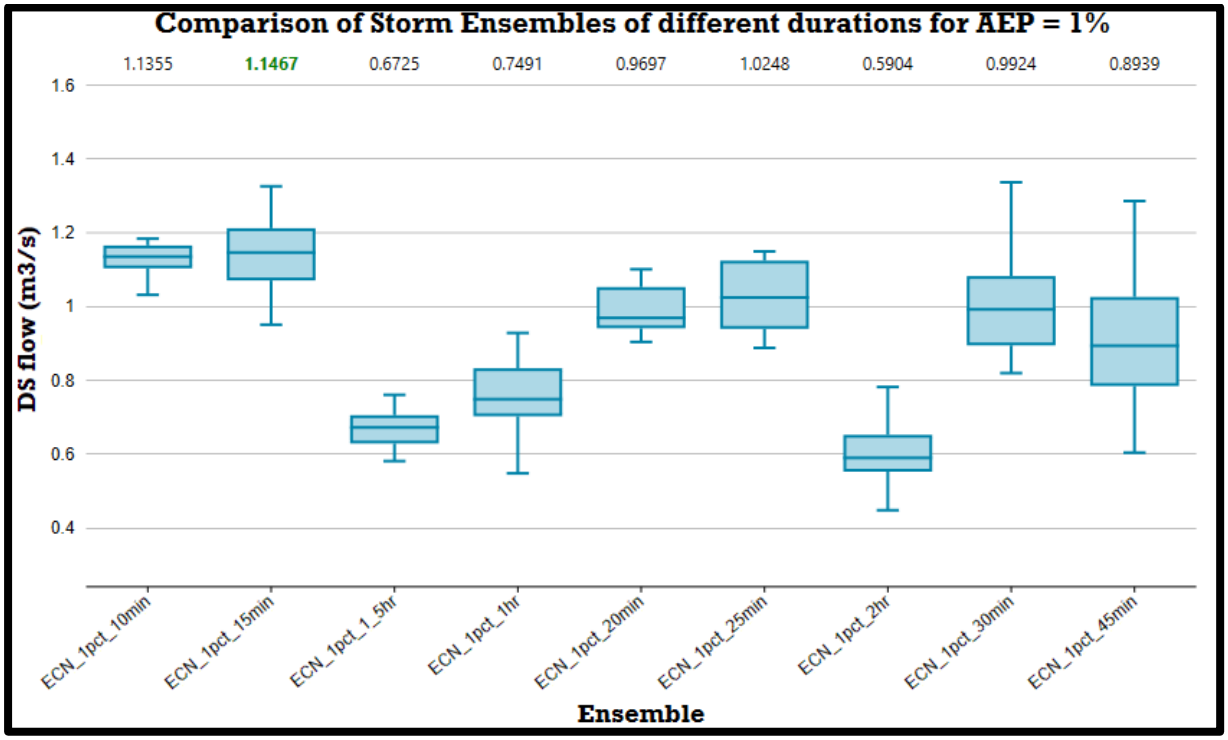




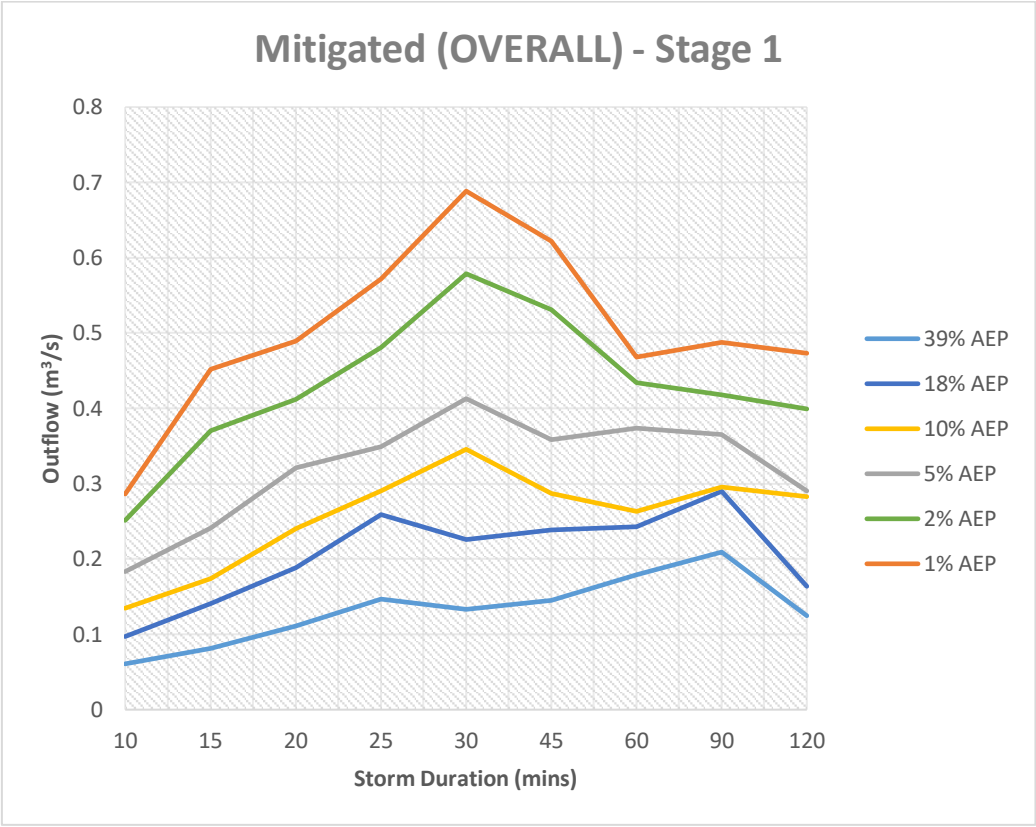

Comparison of Storm Ensembles of different durations for AEP = 10%
0.7163
0.71
0.4575
0.5148
0.6605
0.6556
0.4713
0.6339
0.5722
DS flow (m3/s)
1
0.8
0.6
0.4
0.2
ECN_10pct_10min
ECN_10pct_15min
ECN_10pct_1_5hr
ECN_10pct_1hr
ECN_10pct_20min
ECN_10pct_25min
ECN_10pct_2hr
ECN_10pct_30min
ECN_10pct_45min
Ensemble

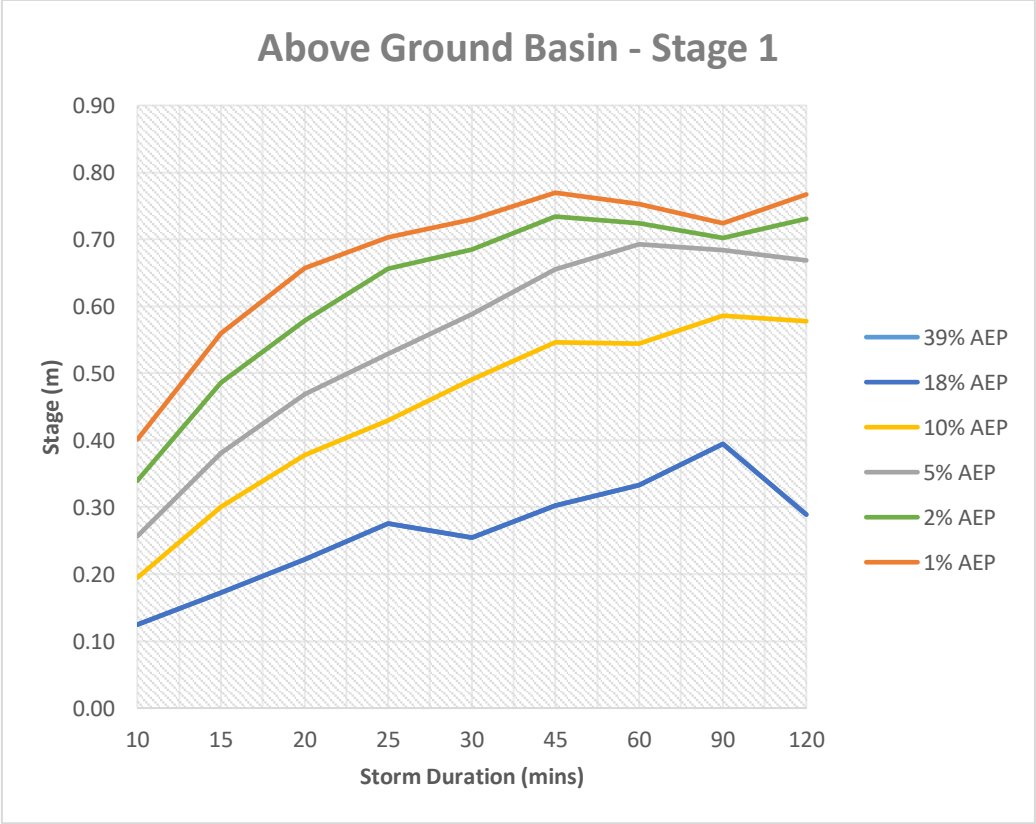

Comparison of Storm Ensembles of different durations for AEP = 5%
0.8369
0.8267
0.5306
0.6035
0.7892
0.7675
0.5546
0.7551
0.6629
DS flow (m3/s)
1.2
1
0.8
0.6
0.4
ECN_5pct_10min
ECN_5pct_15min
ECN_5pct_1_5hr
ECN_5pct_1hr
ECN_5pct_20min
ECN_5pct_25min
ECN_5pct_2hr
ECN_5pct_30min
ECN_5pct_45min
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 2%
0.9992
1.0206
0.5959
0.6594
0.8652
0.9125
0.5227
0.8919
0.7916
DS flow (m3/s)
1.4
1.2
1
0.8
0.6
0.4
ECN_2pct_10min
ECN_2pct_15min
ECN_2pct_1_5hr
ECN_2pct_1hr
ECN_2pct_20min
ECN_2pct_25min
ECN_2pct_2hr
ECN_2pct_30min
ECN_2pct_45min
Ensemble

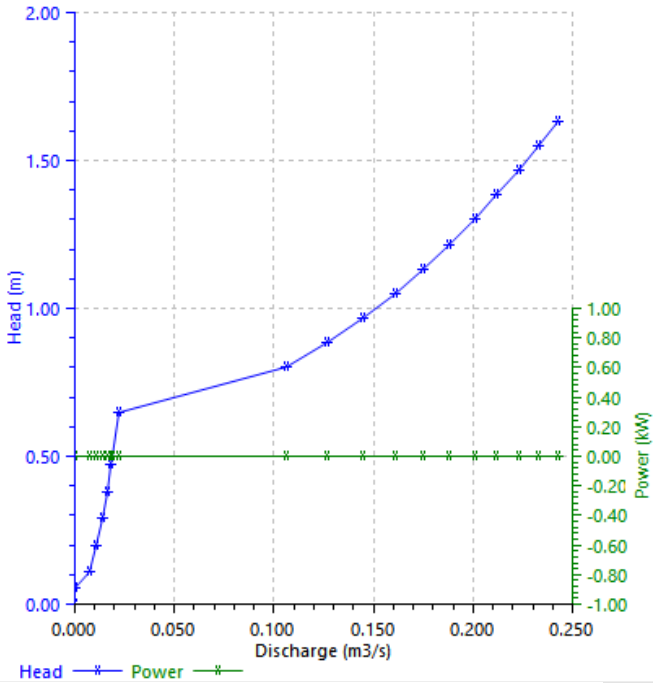

Comparison of Storm Ensembles of different durations for AEP = 1%
1.1355
1.1467
0.6725
0.7491
0.9697
1.0248
0.5904
0.9924
0.8939
DS flow (m3/s)
1.6
1.4
1.2
1
0.8
0.6
0.4
ECN_1pct_10min
ECN_1pct_15min
ECN_1pct_1_5hr
ECN_1pct_1hr
ECN_1pct_20min
ECN_1pct_25min
ECN_1pct_2hr
ECN_1pct_30min
ECN_1pct_45min
Ensemble

MITIGATED CONDITIONS – STAGE 1

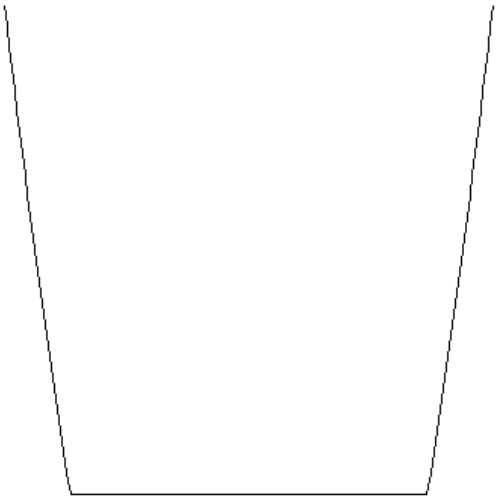




Head (m)	Discharge (m3/s)	Power (kW)
0.0000	0.0000	
0.0550	0.0000	
0.1100	0.0070	
0.2000	0.0110	
0.2900	0.0140	
0.3800	0.0160	
0.4700	0.0180	
0.5000	0.0190	
0.6500	0.0220	
0.8000	0.1060	
0.8830	0.1270	
0.9670	0.1450	
1.0500	0.1610	
1.1330	0.1750	
1.2170	0.1880	
1.3000	0.2010	
1.3830	0.2120	
1.4670	0.2230	
1.5500	0.2330	
1.6330	0.2430	



Level (m AD)	Area (m2)
0.500	149.73
0.550	156.39
0.600	162.20
0.650	167.97
0.700	173.73
0.750	179.48
0.800	185.23
0.850	190.98
0.900	196.74
0.950	202.49
1.000	208.24
1.050	213.99
1.100	219.75
1.150	225.50
1.200	231.25
1.250	237.00
1.300	242.74
1.350	248.49
1.400	254.24
1.450	259.98
1.500	265.73
1.550	271.47
1.600	277.21
1.650	282.95



Detention Tank Design

Orifice Details

Low Flow		*Mid Flow*				High Flow Conditions	Weir		Number	
Size (m)	0.11	Size (m)	0.225	Number	1	Length (m)			Height (m)	
Number	1	Height (m	0.5							

Basin Level	S.A.	Ave S.A.	Thickness	Volume	Cumulative Volume
(m)	(m^2)	(m^2)	(m)	(m^3)	(m^3)
0.000	0.000	0.000	0.000	0.000	0.000
0.055	120.000	60.000	0.055	3.300	3.300
0.110	120.000	120.000	0.055	6.600	9.900
0.200	120.000	120.000	0.090	10.800	20.700
0.290	120.000	120.000	0.090	10.800	31.500
0.380	120.000	120.000	0.090	10.800	42.300
0.470	120.000	120.000	0.090	10.800	53.100
0.500	120.000	120.000	0.030	3.600	56.700
0.613	120.000	120.000	0.113	13.500	70.200
0.696	120.000	120.000	0.083	10.000	80.200
0.779	120.000	120.000	0.083	10.000	90.200
0.863	120.000	120.000	0.083	10.000	100.200
0.946	120.000	120.000	0.083	10.000	110.200
1.029	120.000	120.000	0.083	10.000	120.200
1.113	120.000	120.000	0.083	10.000	130.200
1.196	120.000	120.000	0.083	10.000	140.200
1.279	120.000	120.000	0.083	10.000	150.200
1.363	120.000	120.000	0.083	10.000	160.200
1.446	120.000	120.000	0.083	10.000	170.200
1.529	120.000	120.000	0.083	10.000	180.200

Low Flow Details

Basin Level	Head	$Q_{orifice}$
(m)	(m)	(m^3/s)
0.000	0.000	0.000
0.055	0.000	0.000
0.110	0.055	0.007
0.200	0.145	0.011
0.290	0.235	0.014
0.380	0.325	0.016
0.470	0.415	0.018
0.500	0.445	0.019
0.613	0.558	0.021
0.696	0.641	0.023
0.779	0.724	0.024
0.863	0.808	0.025
0.946	0.891	0.027
1.029	0.974	0.028
1.113	1.058	0.029
1.196	1.141	0.030
1.279	1.224	0.031
1.363	1.308	0.032
1.446	1.391	0.033
1.529	1.474	0.034

Mid Flow Details

Basin Level	Head	$Q_{orifice}$
(m)	(m)	(m^3/s)
0.000	0.000	0.000
0.055	0.000	0.000
0.110	0.000	0.000
0.200	0.000	0.000
0.290	0.000	0.000
0.380	0.000	0.000
0.470	0.000	0.000
0.500	0.000	0.000
0.613	0.000	0.000
0.696	0.083	0.034
0.779	0.167	0.048
0.863	0.250	0.059
0.946	0.333	0.068
1.029	0.417	0.076
1.113	0.500	0.083
1.196	0.583	0.090
1.279	0.667	0.096
1.363	0.750	0.102
1.446	0.833	0.108
1.529	0.917	0.113

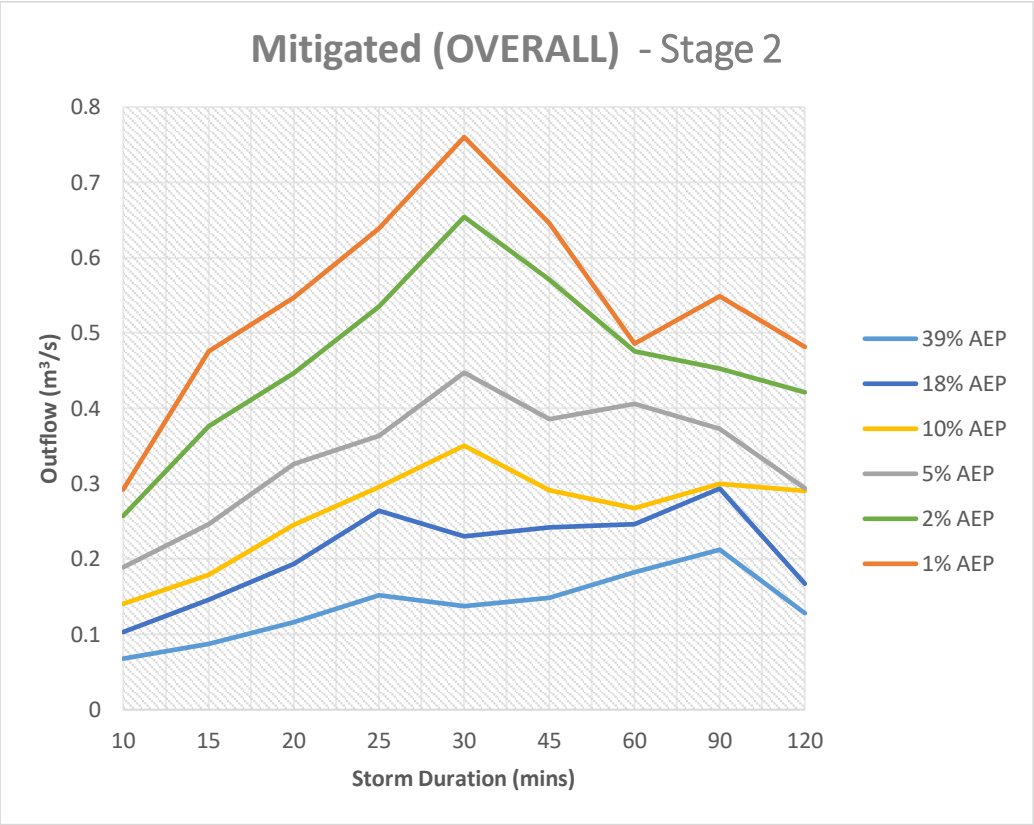
High Flow Details

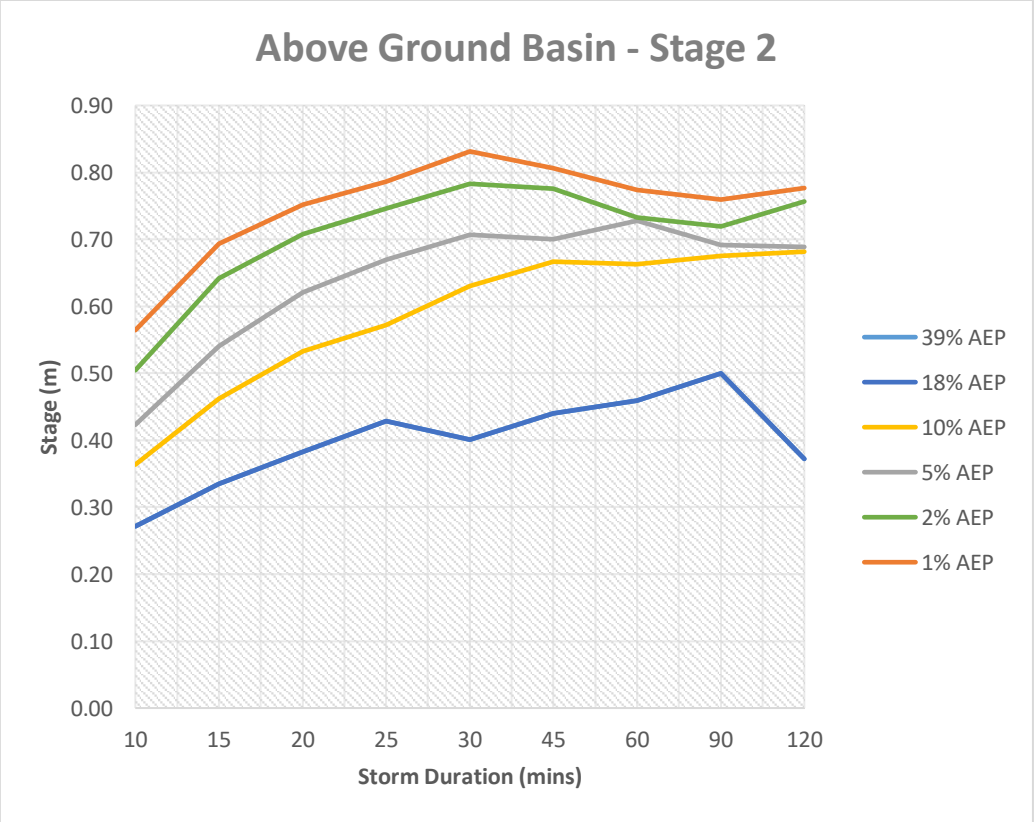
Basin Leve	Head	Qweir
(m)	(m)	(m^3/s)
0.000	0.000	0.000
0.055	0.000	0.000
0.110	0.055	0.000
0.200	0.145	0.000
0.290	0.235	0.000
0.380	0.325	0.000
0.470	0.415	0.000
0.500	0.445	0.000
0.613	0.558	0.000
0.696	0.641	0.000
0.779	0.724	0.000
0.863	0.808	0.000
0.946	0.891	0.000
1.029	0.974	0.000
1.113	1.058	0.000
1.196	1.141	0.000
1.279	1.224	0.000
1.363	1.308	0.000
1.446	1.391	0.000
1.529	1.474	0.000

Stage Storage Discharge Table

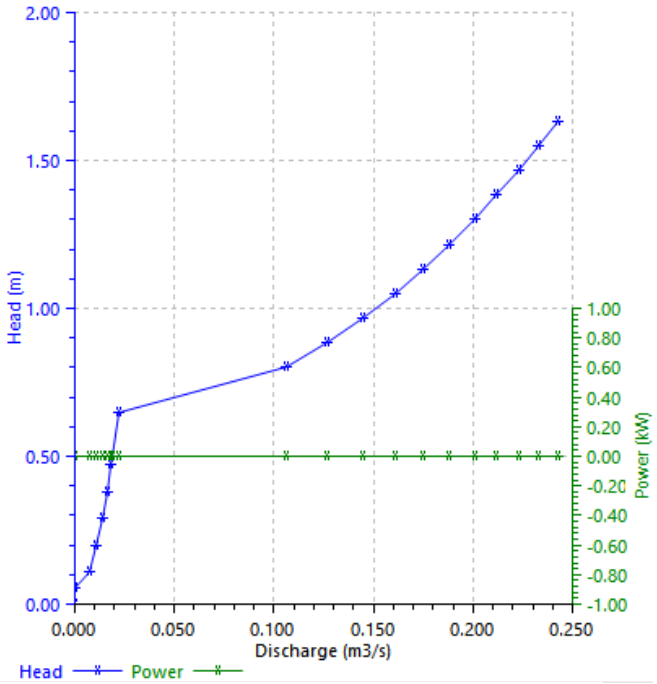
Basin Level	Volume	Outflow
(m)	(m^3)	(m^3)
0.000	0.000	0.000
0.055	3.300	0.000
0.110	9.900	0.007
0.200	20.700	0.011
0.290	31.500	0.014
0.380	42.300	0.016
0.470	53.100	0.018
0.500	56.700	0.019
0.613	70.200	0.021
0.696	80.200	0.057
0.779	90.200	0.072
0.863	100.200	0.084
0.946	110.200	0.095
1.029	120.200	0.104
1.113	130.200	0.112
1.196	140.200	0.120
1.279	150.200	0.128
1.363	160.200	0.134
1.446	170.200	0.141
1.529	180.200	0.147

MITIGATED CONDITIONS – STAGE 2

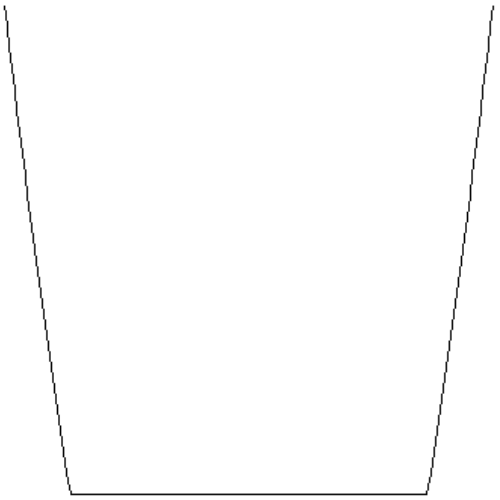




Head (m)	Discharge (m3/s)	Power (kW)
0.0000	0.0000	
0.0550	0.0000	
0.1100	0.0070	
0.2000	0.0110	
0.2900	0.0140	
0.3800	0.0160	
0.4700	0.0180	
0.5000	0.0190	
0.6500	0.0220	
0.8000	0.1060	
0.8830	0.1270	
0.9670	0.1450	
1.0500	0.1610	
1.1330	0.1750	
1.2170	0.1880	
1.3000	0.2010	
1.3830	0.2120	
1.4670	0.2230	
1.5500	0.2330	
1.6330	0.2430	



Level (m AD)	Area (m2)
0.500	149.73
0.550	156.39
0.600	162.20
0.650	167.97
0.700	173.73
0.750	179.48
0.800	185.23
0.850	190.98
0.900	196.74
0.950	202.49
1.000	208.24
1.050	213.99
1.100	219.75
1.150	225.50
1.200	231.25
1.250	237.00
1.300	242.74
1.350	248.49
1.400	254.24
1.450	259.98
1.500	265.73
1.550	271.47
1.600	277.21
1.650	282.95



Detention Tank Design

Orifice Details

Low Flow		*Mid Flow*				High Flow Conditions	Weir		Number	
Size (m)	0.11	Size (m)	0.225	Number	1	Length (m)			Height (m)	
Number	1	Height (m	0.5							

Basin Level	S.A.	Ave S.A.	Thickness	Volume	Cumulative Volume
(m)	(m^2)	(m^2)	(m)	(m^3)	(m^3)
0.000	0.000	0.000	0.000	0.000	0.000
0.055	120.000	60.000	0.055	3.300	3.300
0.110	120.000	120.000	0.055	6.600	9.900
0.200	120.000	120.000	0.090	10.800	20.700
0.290	120.000	120.000	0.090	10.800	31.500
0.380	120.000	120.000	0.090	10.800	42.300
0.470	120.000	120.000	0.090	10.800	53.100
0.500	120.000	120.000	0.030	3.600	56.700
0.613	120.000	120.000	0.113	13.500	70.200
0.696	120.000	120.000	0.083	10.000	80.200
0.779	120.000	120.000	0.083	10.000	90.200
0.863	120.000	120.000	0.083	10.000	100.200
0.946	120.000	120.000	0.083	10.000	110.200
1.029	120.000	120.000	0.083	10.000	120.200
1.113	120.000	120.000	0.083	10.000	130.200
1.196	120.000	120.000	0.083	10.000	140.200
1.279	120.000	120.000	0.083	10.000	150.200
1.363	120.000	120.000	0.083	10.000	160.200
1.446	120.000	120.000	0.083	10.000	170.200
1.529	120.000	120.000	0.083	10.000	180.200

Low Flow Details

Basin Level	Head	$Q_{orifice}$
(m)	(m)	(m^3/s)
0.000	0.000	0.000
0.055	0.000	0.000
0.110	0.055	0.007
0.200	0.145	0.011
0.290	0.235	0.014
0.380	0.325	0.016
0.470	0.415	0.018
0.500	0.445	0.019
0.613	0.558	0.021
0.696	0.641	0.023
0.779	0.724	0.024
0.863	0.808	0.025
0.946	0.891	0.027
1.029	0.974	0.028
1.113	1.058	0.029
1.196	1.141	0.030
1.279	1.224	0.031
1.363	1.308	0.032
1.446	1.391	0.033
1.529	1.474	0.034

Mid Flow Details

Basin Level	Head	$Q_{orifice}$
(m)	(m)	(m^3/s)
0.000	0.000	0.000
0.055	0.000	0.000
0.110	0.000	0.000
0.200	0.000	0.000
0.290	0.000	0.000
0.380	0.000	0.000
0.470	0.000	0.000
0.500	0.000	0.000
0.613	0.000	0.000
0.696	0.083	0.034
0.779	0.167	0.048
0.863	0.250	0.059
0.946	0.333	0.068
1.029	0.417	0.076
1.113	0.500	0.083
1.196	0.583	0.090
1.279	0.667	0.096
1.363	0.750	0.102
1.446	0.833	0.108
1.529	0.917	0.113

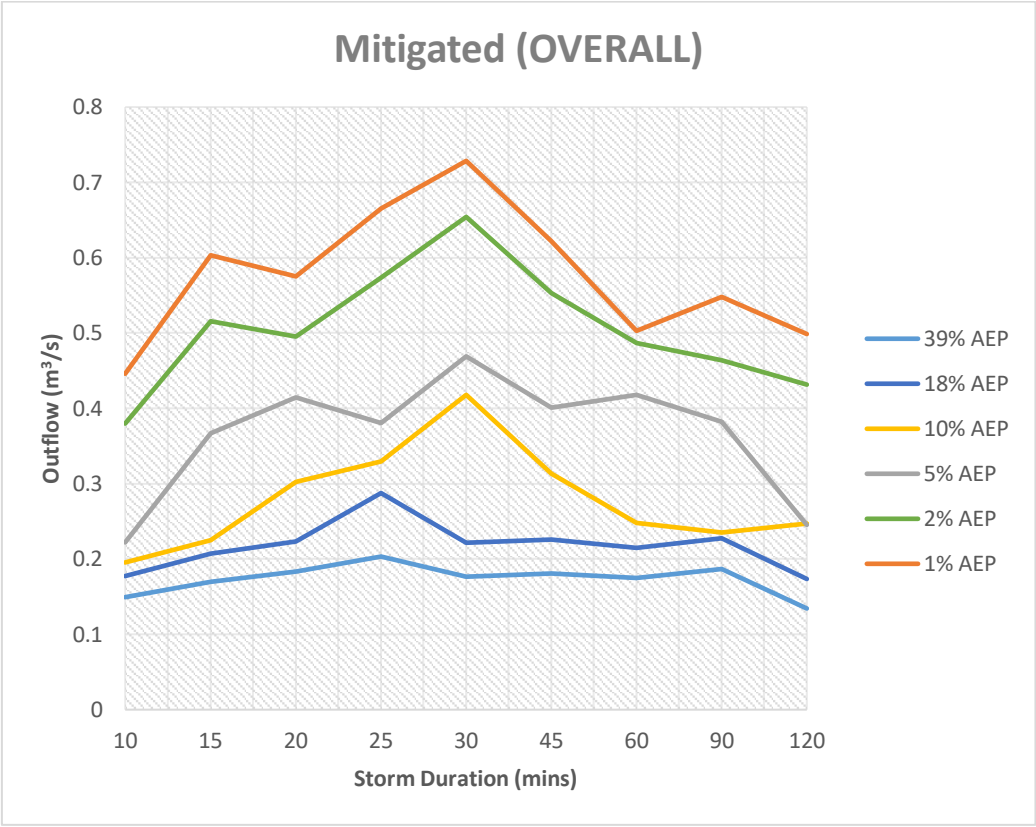
High Flow Details

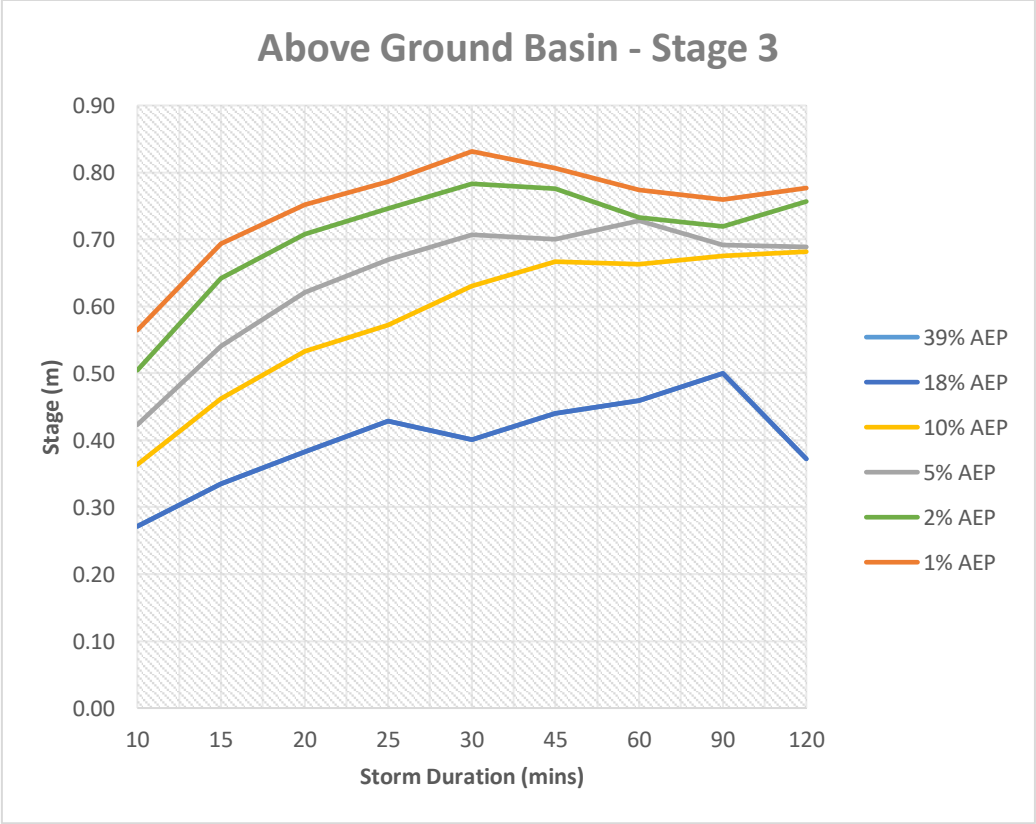
Basin Leve	Head	Qweir
(m)	(m)	(m^3/s)
0.000	0.000	0.000
0.055	0.000	0.000
0.110	0.055	0.000
0.200	0.145	0.000
0.290	0.235	0.000
0.380	0.325	0.000
0.470	0.415	0.000
0.500	0.445	0.000
0.613	0.558	0.000
0.696	0.641	0.000
0.779	0.724	0.000
0.863	0.808	0.000
0.946	0.891	0.000
1.029	0.974	0.000
1.113	1.058	0.000
1.196	1.141	0.000
1.279	1.224	0.000
1.363	1.308	0.000
1.446	1.391	0.000
1.529	1.474	0.000

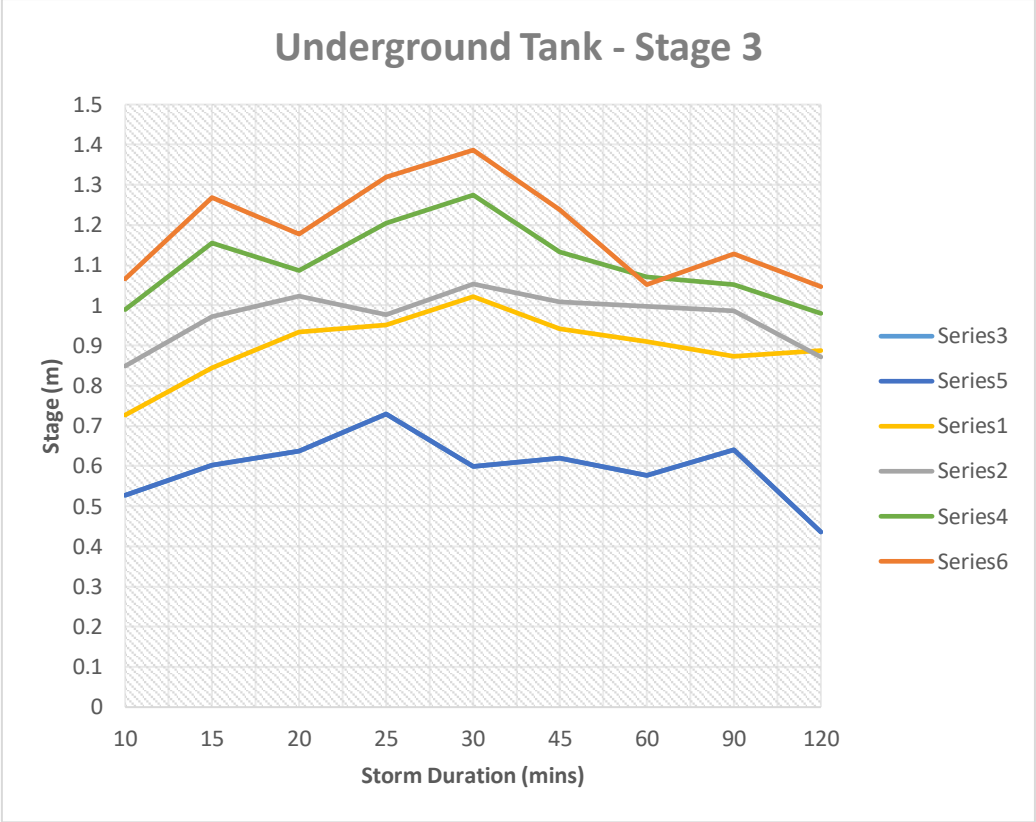
Stage Storage Discharge Table

Basin Level	Volume	Outflow
(m)	(m^3)	(m^3)
0.000	0.000	0.000
0.055	3.300	0.000
0.110	9.900	0.007
0.200	20.700	0.011
0.290	31.500	0.014
0.380	42.300	0.016
0.470	53.100	0.018
0.500	56.700	0.019
0.613	70.200	0.021
0.696	80.200	0.057
0.779	90.200	0.072
0.863	100.200	0.084
0.946	110.200	0.095
1.029	120.200	0.104
1.113	130.200	0.112
1.196	140.200	0.120
1.279	150.200	0.128
1.363	160.200	0.134
1.446	170.200	0.141
1.529	180.200	0.147

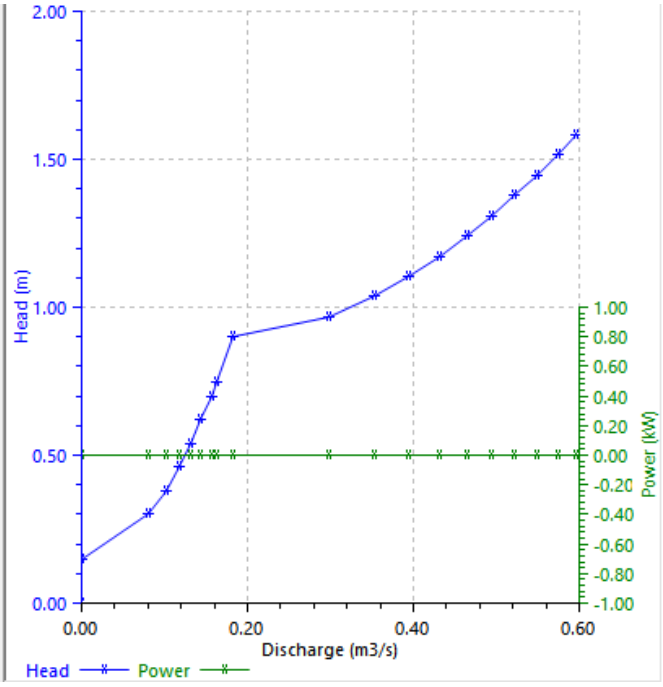
MITIGATED CONDITIONS – STAGE 3



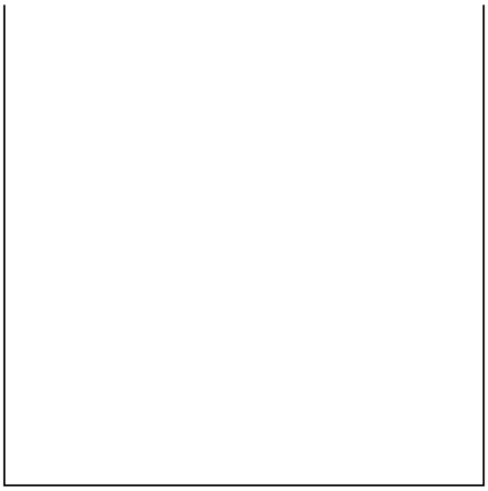




Head (m)	Discharge (m3/s)	Power (kW)
0.0000	0.0000	
0.1500	0.0000	
0.3000	0.0810	
0.3800	0.1010	
0.4600	0.1170	
0.5400	0.1310	
0.6200	0.1440	
0.7000	0.1560	
0.7500	0.1620	
0.9000	0.1820	
0.9680	0.2990	
1.0360	0.3520	
1.1050	0.3950	
1.1730	0.4310	
1.2410	0.4640	
1.3090	0.4940	
1.3770	0.5220	
1.4450	0.5490	
1.5140	0.5740	
1.5820	0.5970	



Level (m AD)	Area (m2)
0.500	300.00
2.000	300.00



Detention Tank Design

Orifice Details

Low Flow		*Mid Flow*			High Flow Conditions	Weir		Number	
Size (m)	0.3	Size (m)	0.3	Number 2	Length (m)			Height (m)	
		Height (m	0.75						

Basin Level	S.A.	Ave S.A.	Thickness	Volume	Cumulative Volume
(m)	*(m^2)*	*(m^2)*	*(m)*	*(m^3)*	*(m^3)*
0.000	0.000	0.000	0.000	0.000	0.000
0.150	120.000	60.000	0.150	9.000	9.000
0.300	120.000	120.000	0.150	18.000	27.000
0.380	120.000	120.000	0.080	9.600	36.600
0.460	120.000	120.000	0.080	9.600	46.200
0.540	120.000	120.000	0.080	9.600	55.800
0.620	120.000	120.000	0.080	9.600	65.400
0.700	120.000	120.000	0.080	9.600	75.000
0.750	120.000	120.000	0.050	6.000	81.000
0.900	120.000	120.000	0.150	18.000	99.000
0.968	120.000	120.000	0.068	8.182	107.182
1.036	120.000	120.000	0.068	8.182	115.364
1.105	120.000	120.000	0.068	8.182	123.545
1.173	120.000	120.000	0.068	8.182	131.727
1.241	120.000	120.000	0.068	8.182	139.909
1.309	120.000	120.000	0.068	8.182	148.091
1.377	120.000	120.000	0.068	8.182	156.273
1.445	120.000	120.000	0.068	8.182	164.455
1.514	120.000	120.000	0.068	8.182	172.636
1.582	120.000	120.000	0.068	8.182	180.818

Low Flow Details

Basin Level	Head	$Q_{Orifice}$
(m)	*(m)*	*(m^3/s)*
0.000	0.000	0.000
0.150	0.000	0.000
0.300	0.150	0.081
0.380	0.230	0.101
0.460	0.310	0.117
0.540	0.390	0.131
0.620	0.470	0.144
0.700	0.550	0.156
0.750	0.600	0.162
0.900	0.750	0.182
0.968	0.818	0.190
1.036	0.886	0.197
1.105	0.955	0.205
1.173	1.023	0.212
1.241	1.091	0.219
1.309	1.159	0.226
1.377	1.227	0.232
1.445	1.295	0.239
1.514	1.364	0.245
1.582	1.432	0.251

Mid Flow Details

Basin Level	Head	$Q_{Orifice}$
(m)	*(m)*	*(m^3/s)*
0.000	0.000	0.000
0.150	0.000	0.000
0.300	0.000	0.000
0.380	0.000	0.000
0.460	0.000	0.000
0.540	0.000	0.000
0.620	0.000	0.000
0.700	0.000	0.000
0.750	0.000	0.000
0.900	0.000	0.000
0.968	0.068	0.110
1.036	0.136	0.155
1.105	0.205	0.190
1.173	0.273	0.219
1.241	0.341	0.245
1.309	0.409	0.268
1.377	0.477	0.290
1.445	0.545	0.310
1.514	0.614	0.329
1.582	0.682	0.346

High Flow Details

Basin Leve	Head	Qweir
(m)	*(m)*	*(m^3/s)*
0.000	0.000	0.000
0.150	0.000	0.000
0.300	0.150	0.000
0.380	0.230	0.000
0.460	0.310	0.000
0.540	0.390	0.000
0.620	0.470	0.000
0.700	0.550	0.000
0.750	0.600	0.000
0.900	0.750	0.000
0.968	0.818	0.000
1.036	0.886	0.000
1.105	0.955	0.000
1.173	1.023	0.000
1.241	1.091	0.000
1.309	1.159	0.000
1.377	1.227	0.000
1.445	1.295	0.000
1.514	1.364	0.000
1.582	1.432	0.000

Stage Storage Discharge Table

Basin Level	Volume	Outflow
(m)	*(m^3)*	*(m^3)*
0.000	0.000	0.000
0.150	9.000	0.000
0.300	27.000	0.081
0.380	36.600	0.101
0.460	46.200	0.117
0.540	55.800	0.131
0.620	65.400	0.144
0.700	75.000	0.156
0.750	81.000	0.162
0.900	99.000	0.182
0.968	107.182	0.299
1.036	115.364	0.352
1.105	123.545	0.395
1.173	131.727	0.431
1.241	139.909	0.464
1.309	148.091	0.494
1.377	156.273	0.522
1.445	164.455	0.549
1.514	172.636	0.574
1.582	180.818	0.597

APPENDIX D: MUSIC Model Summary

Receiving Node

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Treatment Train Effectiveness

	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	Gross Pollutants (kg/yr)
Sources	15.8	3.51E3	6.91	32.7	340
Residual Load	15.7	704	1.91	14.3	17.3
% Reduction	1.0	79.9	72.4	56.1	94.9