

An aerial photograph of a flooded landscape. A road, possibly a railway track, runs diagonally across the upper half of the image. The surrounding area is a mix of light brown and white, suggesting dry ground or sand. The lower half of the image is dominated by a large, dark green area that appears to be a flooded field or a body of water. A small, dark boat is visible in the lower right quadrant of this green area. The overall texture is grainy and artistic, with some visible brushstrokes or digital effects.

**DELMORE**

**FLOOD  
ASSESSMENT  
REPORT**

Vineway Ltd



**MCKENZIE & CO.**

# DOCUMENT CONTROL RECORD

PROJECT:

Delmore

CLIENT:

Vineway Ltd

PROJECT LOCATION:

53A, 53B & 55 Russell Road and 88, 130 & 132 Upper Ōrewa Road

| Revision | Date       | Originator | Checker | Approver | Description             |
|----------|------------|------------|---------|----------|-------------------------|
| A        | 29/01/25   | HS         |         |          | DRAFT                   |
| B        | 11/02/2025 | HS         | JK      | JK       | Resource consent        |
| C        | 21/07/2025 | HS         | JK      | JK       | Modelling Update        |
| D        | 18/12/2025 | HS         | LV      | JK       | Substantive Application |
| E        | 17/03/2026 | HS         | LV      | JK       | RFI Updates             |
| F        | 16/04/2026 | SL         | LV      | JK       | RFI Updates             |
| G        | 10/05/2026 | SL         | LV      | JK       | RFI Updates             |
| H        | 26/05/2026 | SL         | LV      | JK       | RFI Updates             |

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## 1. INTRODUCTION

McKenzie & Co. Consultants have been engaged by Vineway Ltd to provide a Flood Assessment Report in support of the proposed 109Ha development located at 53A, 53B & 55 Russell Road and 88, 130 & 132 Upper Ōrewa Road, Ōrewa. The development is a residential development for approximately 1213 residential lots.

This report is prepared in support of Vineway Ltd's application for approvals under the Fast-track Approvals Act 2024 by addressing the key flooding matters that relate to this proposal. It is important to note that this report only covers flood hazards, while other infrastructure matters, including earthworks, sediment and erosion control, roading and access, stormwater, wastewater, water supply and utility works, are addressed in separate infrastructure reports.

The primary objective of this flood hazard assessment report is to demonstrate how the proposed system is designed to manage stormwater runoff to minimise flood damage and adverse effects on both the built and natural environments. This report will evaluate the minimum floor levels required for the proposed development, ensuring compliance with the Auckland Unitary Plan (AUP). Additionally, it will assess potential impacts on flood behaviour, specifically examining any effects on water levels and flow velocities both upstream and downstream due to the proposed development activities. The flood assessment report is a critical component of the Stormwater Management Plan for the Delmore development. It will support planning and decision-making by identifying necessary flood mitigation measures and establishing safe floor levels to protect infrastructure and surrounding properties.

To fully comprehend this report, it should be read together with the application, plan drawings, and other supporting documents referred to in this report.

The flood model has been reviewed by Auckland Council, and updates have been made to the model during the initial fast track application

## 2. STANDARDS

Auckland Council Stormwater Code of Practice Version 4,

Auckland Council Modelling Guideline,

Auckland Technical Publication TP108.

## 3. SITE DESCRIPTION

The proposed development site is legally described as Lot 1 DP 336616, Lot 1 DP 497022 & Lot 2 DP 497022, Lot 2 DP 418770, Lot 1 DP 153477 & Lot 2 DP 153477, as illustrated in Figure 1 below. The site is zoned Future Urban Zone (FUZ).

The development is accessed from Grand Drive in the northeast, and Russell Road and Upper Ōrewa Road from the south.

Currently, the site is used for agricultural purposes with livestock roaming across a significant portion of the site. Some bush areas subject to consent notices, and a pine tree stand in the North Eastern portion of the site.

All properties are contained within a single stormwater catchment, which discharges out a single point under the Northern Motorway.

The location of the development is shown below in Figure 1.

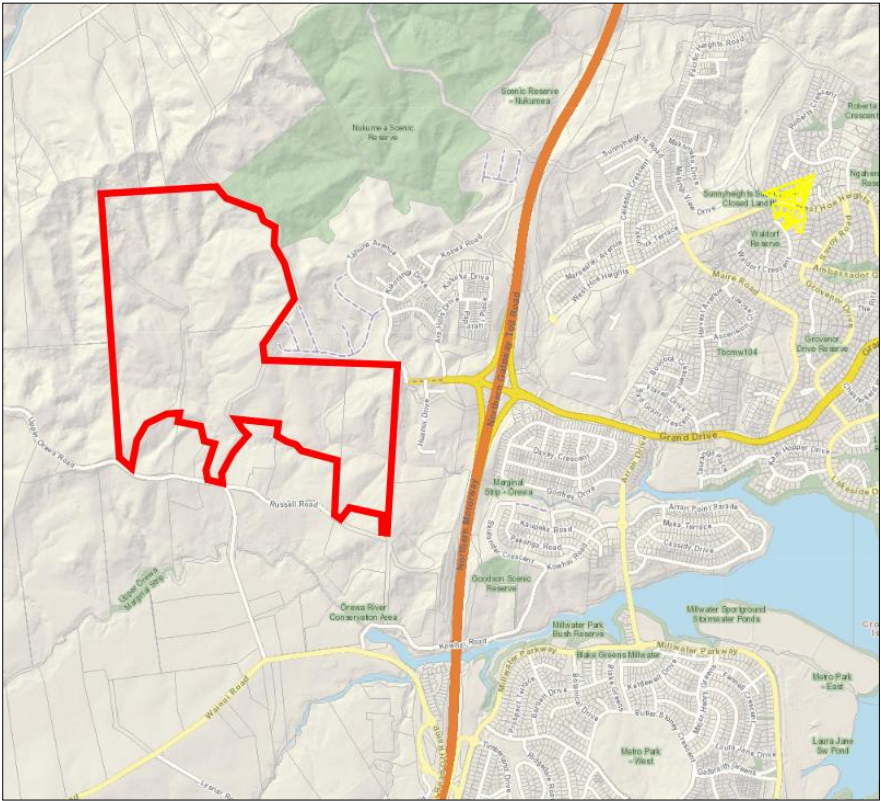
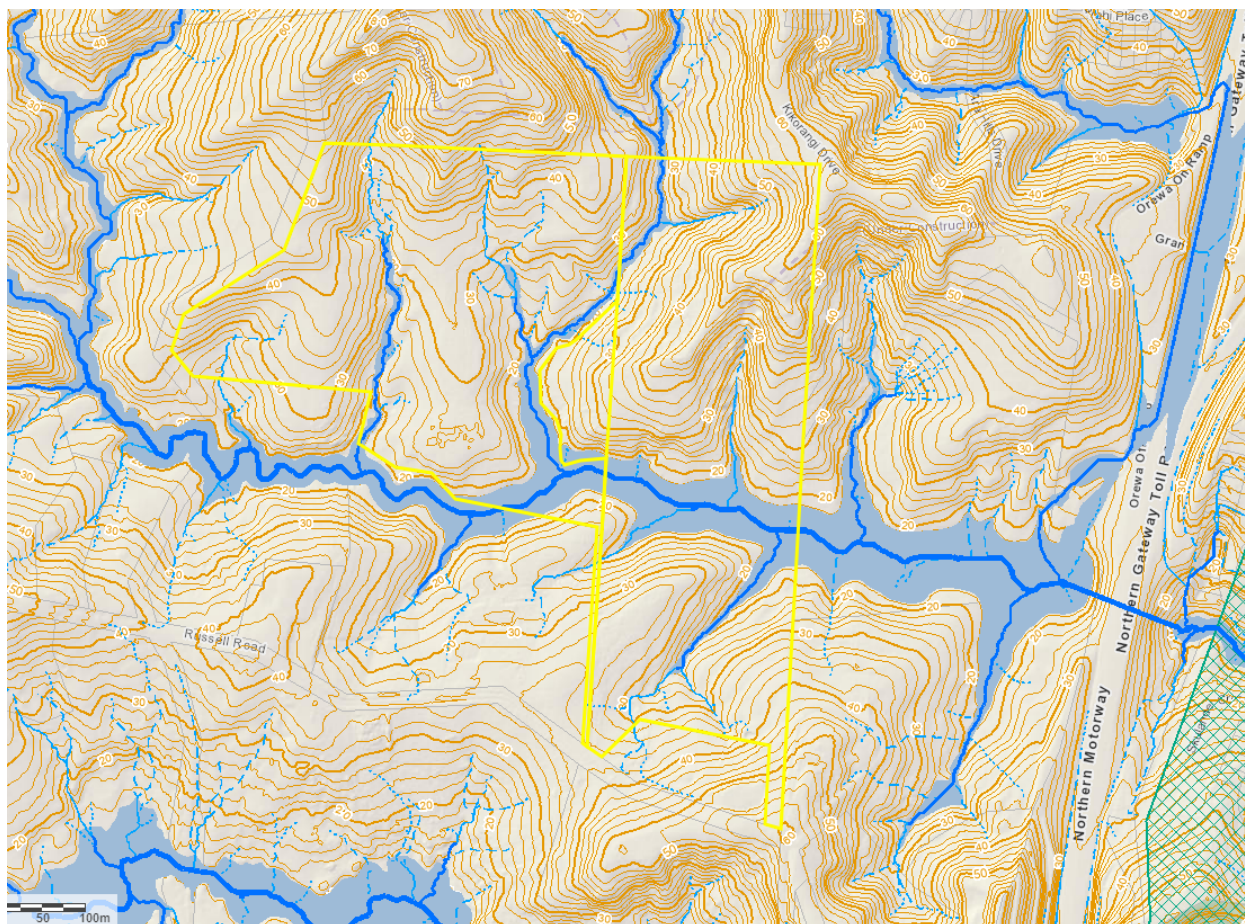


Figure 1 - Site Location – Extent of affected properties

AC Geomaps shows extensive flow paths and flood plains on the site and across the contributing catchment. These are shown in Figure 2 below.



Figure 2 - Site Location with AC Geomaps flow paths and flood plains



*Figure 3 - Development Site with topography, flow paths and flooding (AC Geomaps)*

The outlet of the catchment is to the east where flows exit via a 2100mm diameter culvert under the northern motorway SH1. The culvert discharges into the Southern Stream <sup>1</sup> (refer Ōrewa West ICMP). A catchment plan showing the sub-catchments is appended.

## 4. CATCHMENT DESCRIPTION

The catchment is part of the Ōrewa West Catchment per the 'Auckland Council – Catchment Management Plan Update, Ōrewa West Catchment – January 2014'. The Delmore site is within the Southern Tributary of the Ōrewa West Catchment. The southern tributary discharges via an existing motorway culvert and continues downstream until it reaches the confluence with the Grand Drive catchment before discharging into the coast.

<sup>1</sup> Ōrewa West ICMP 2011

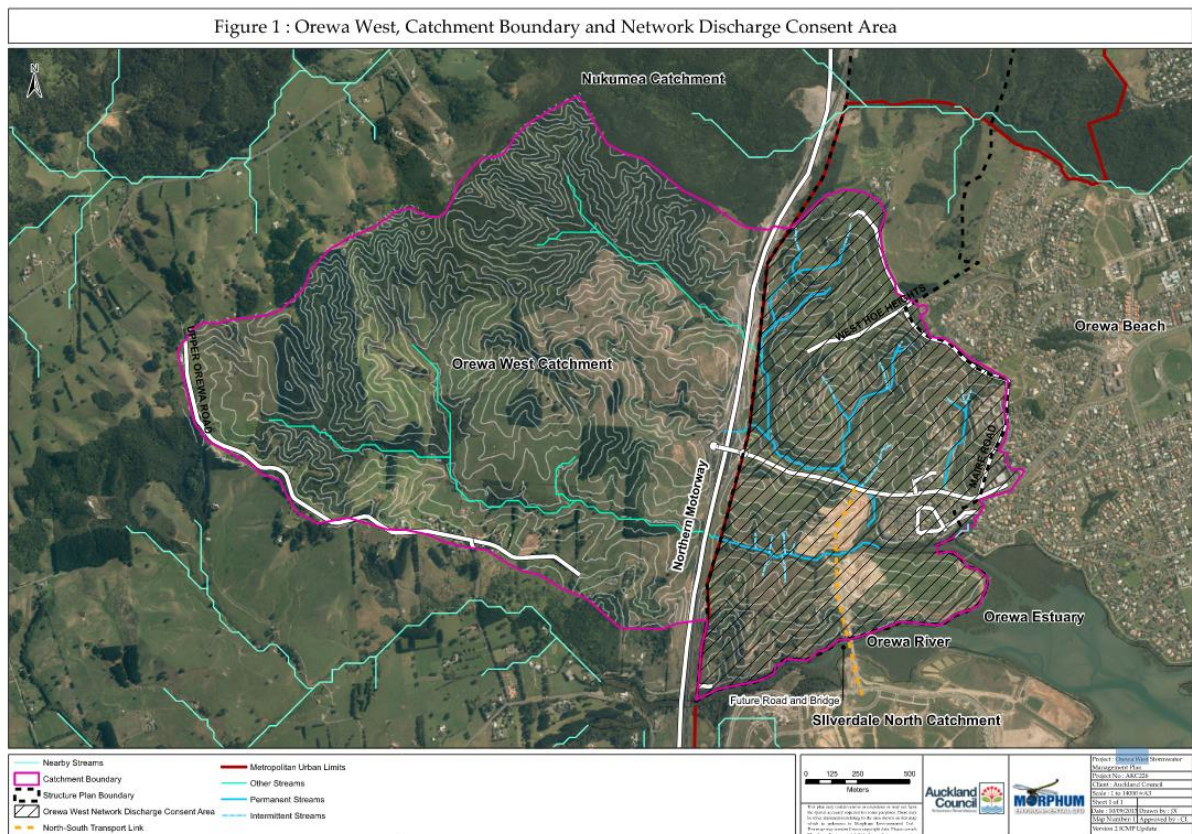


Figure 4 - Ōrewa West Catchment

#### 4.1. Land Use

This property and upstream catchments are within the FUZ and Rural Production Zone defined by AUP. The Maximum Probable Development (MPD) for impervious surfaces in the FUZ has been taken as 60% based on the average lot typology proposed in the Masterplan.

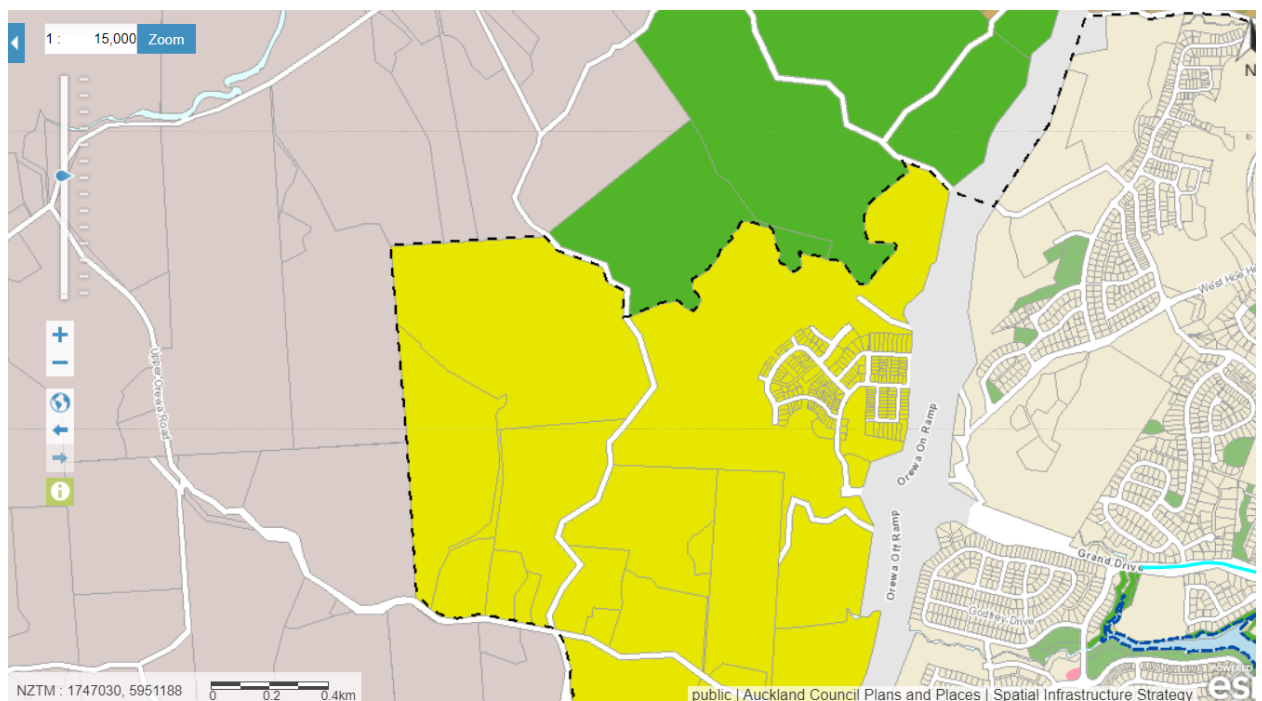


Figure 5 - Land Use

## 5. SITE SURVEY

### 5.1. Culvert and Bridges Structure

A topographical survey has been conducted to determine any hydraulic structures within the ICMP catchment areas.

A visual survey was conducted to assess the condition of the existing motorway culvert. During the survey, no obstructions were observed at the culvert's inlet or outlet. A minor baseflow was noted just above the culvert inlet, and shrubs around the outlet wing wall were present. The culvert is measured at approximately 133m with an inlet invert level of 6.84mRL and outlet invert level of 6.29mRL, which equates to a gradient of approximately 0.4%.



*Figure 6 – Photo of culvert under State Highway 1*

Consultation with NZTA has been undertaken for this culvert, confirming that no upgrades to this culvert are proposed, unless erosion and damage occur during construction, this is proposed to be conditioned in the resource consent. Email correspondence is included in Appendix D.

NZTA has reviewed the levels shown on plan 3725-1-4815, and confirmed that the predicted changes in flood levels are unlikely to materially alter the existing risk profile of the State Highway 1 embankment.



*Figure 7 - Inlet of Culvert under State Highway 1*

Further downstream of the motorway culvert, there are 2 bridges that are within the main flow path of the Delmore contributing catchment. The 2 bridges are the Tauhere Road footbridge and the Arran Drive bridge. The bridges have been included in the model.



*Figure 8 - Downstream bridge piles*



*Figure 9 - Downstream bridge piles*

For the purpose of modelling, all existing culverts have been modelled with zero percent blockage, in line with the condition observed on-site. A 50% and 100% blocked scenario (Scenario 1 and 2) has also been prepared to determine whether there is still sufficient headwater clearance from the motorway due to the increase in impervious areas from the FUZ.

## 6. HYDROLOGICAL MODEL

### 6.1. Method Used

The hydrological model was developed using the TP108 SCS methodology. Sub-catchments were delineated based on the current and proposed topography, and the surface type was based on the current land use for the pre-development model and the proposed land use for the proposed development model.

### 6.2. Hydrological Model Extent

Catchment Delineation is based on the terrain from a combination of Topographical, Drone, Design Surfaces, and Auckland Council DEM 2016 data. The catchment extent is on Drawing 4500, shown below in Figure 10.

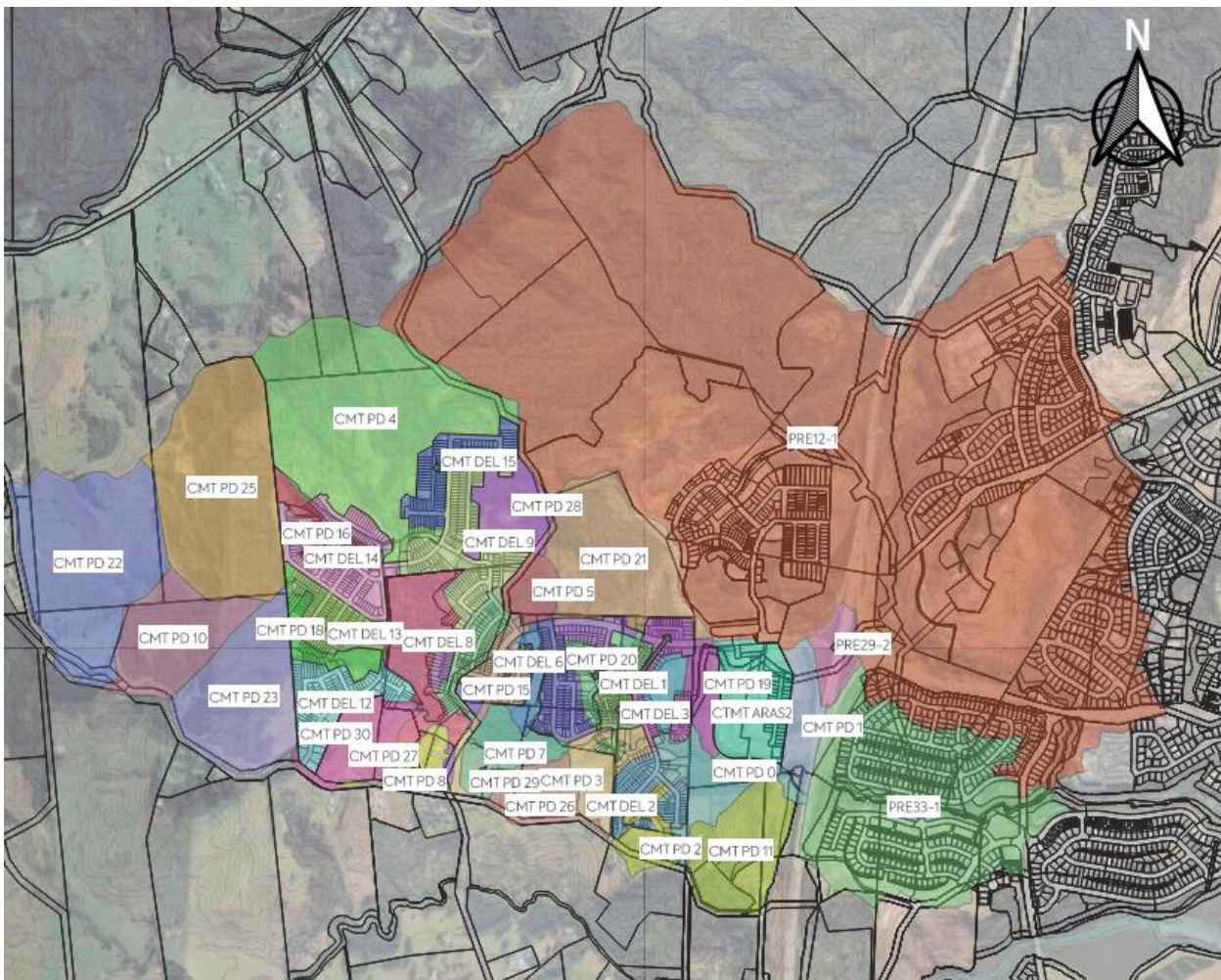


Figure 10 - Catchment extents

### 6.3. Model Set-up

A total of 9 scenarios of the hydrologic model have been developed. The existing scenarios aim to establish a baseline for the flood model with and without climate change. The MPD within the development extent will assess the impact of flooding due to the development. The MPD within the wider FUZ boundaries will

determine that there is capacity in the proposed culverts taking into consideration future upstream development outside of the Delmore Masterplan.

*Table 1 – Hydrologic Model Scenarios*

| Scenario Number | SCENARIO_ID                          | ARI (Year) | CLIMATE CHANGE                                                        | LAND USE (Development Extent) |
|-----------------|--------------------------------------|------------|-----------------------------------------------------------------------|-------------------------------|
| 1               | EXD21CC050AEP                        | 2          | 2.1DC INCREASE IN TEMPERATURE                                         | EXISTING DEVELOPMENT          |
| 2               | EXD21CC010AEP                        | 10         | 2.1DC INCREASE IN TEMPERATURE                                         | EXISTING DEVELOPMENT          |
| 3               | EXD38CC001AEP                        | 100        | 3.8DC INCREASE IN TEMPERATURE                                         | EXISTING DEVELOPMENT          |
| 4               | MPD21CC050AEP                        | 2          | 2.1DC INCREASE IN TEMPERATURE                                         | POST DEVELOPMENT              |
| 5               | MPD21CC010AEP                        | 10         | 2.1DC INCREASE IN TEMPERATURE                                         | POST DEVELOPMENT              |
| 6               | MPD38CC001AEP                        | 100        | 3.8DC INCREASE IN TEMPERATURE                                         | POST DEVELOPMENT              |
| 7               | D_MPD3.8CC001AEP                     | 100        | 3.8DC INCREASE IN TEMPERATURE<br>NZTA CULVERT<br>BLOCKED              | POST DEVELOPMENT              |
| 8               | MPD38CC001AEP_MWAYBLOCKED            | 100        | 3.8DC INCREASE IN TEMPERATURE<br>NZTA CULVERT<br>BLOCKED              | MAXIMUM PROBABLE DEVELOPMENT  |
| 9               | EXD38CC001AEPTWBBASE_MWCBLOCK_EXT    | 100        | 3.8DC INCREASE IN TEMPERATURE<br>NZTA CULVERT<br>BLOCKED              | EXISTING DEVELOPMENT          |
| 10              | MPD38CC_001AEP_CULVS50%BLOCK_9100%BL | 100        | 3.8DC INCREASE IN TEMPERATURE<br>INTERNAL<br>CULVERTS SW CoP<br>CHECK | MAXIMUM PROBABLE DEVELOPMENT  |

## 7. HYDROLOGICAL PARAMETERS

The 24-hour rainfall depth has been obtained from the TP108 rainfall maps. A climate change uplift has been adopted from the Auckland Council Stormwater Code of Practice Version 4.

*Table 2 - Hydrological parameters*

| ARI<br>(Years) | Percent<br>Increase 2.1<br>Climate<br>Change | Percent<br>Increase 3.8<br>Climate<br>Change | Historical<br>Rainfall<br>Depth<br>(mm) | Rainfall<br>Depth with 2.1<br>Climate<br>Change<br>(mm) | Rainfall Depth<br>with 3.8 Climate<br>Change (mm) |
|----------------|----------------------------------------------|----------------------------------------------|-----------------------------------------|---------------------------------------------------------|---------------------------------------------------|
| 2              | 15.1%                                        | 27.4%                                        | 91                                      | 104.7                                                   | 115.9                                             |
| 5              | 16.4%                                        | 29.6%                                        | 127                                     | 147.8                                                   | 164.6                                             |
| 10             | 17.0%                                        | 30.8%                                        | 155                                     | 181.4                                                   | 202.7                                             |
| 20             | 17.2%                                        | 31.2%                                        | 180                                     | 211.0                                                   | 236.2                                             |
| 50             | 17.6%                                        | 31.9%                                        | 210                                     | 247.0                                                   | 277.0                                             |
| 100            | 18.1%                                        | 32.7%                                        | 233                                     | 275.2                                                   | 309.2                                             |

Based on the Geotechnical Report conducted by Riley Consultants, the underlying soil is predominantly clay. Hydrological Soil Type C has been adopted for the analysis, and a Curve Number (CN) of 74 has been adopted. For impervious surfaces, a curve number of 98 is adopted, which is in accordance with the TP108 guidelines. The table below outlines the hydrological parameters adopted.

*Table 3 - Curve Numbers*

| Parameters                                        | Pervious Soil (Type C used)                                           | Impervious Surface                                                    |
|---------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| Curve Number (CN)                                 | 74                                                                    | 98                                                                    |
| Initial Abstraction (Ia)                          | 5                                                                     | 0                                                                     |
| Channelisation Factors (Primarily Grass Channels) | 0.8                                                                   | 0.8                                                                   |
| Time of Concentration (Mins)                      | Varies depending on catchment length and slope. Minimum of 10 minutes | Varies depending on catchment length and slope. Minimum of 10 minutes |

Inflow nodes have been applied at the top of sub-catchment boundaries, and a time of concentration has been calculated for each catchment.

The hydrological data has been calculated using HEC-HMS.

## 8. HYDRAULIC MODEL

### 8.1. Method Used

The hydraulic model will be run in HEC-RAS. It is a 2D model, with minor hydraulic structures represented as 1D nodes. A full 2D model is considered appropriate due to the limited pipe networks in the area, and stormwater is primarily conveyed through a very well-defined overland flow path (OLFP).

The flow run-off calculated in the hydrologic model is applied as a lumped inflow boundary condition in its sub-catchments.

For the hydraulic modelling, 8 scenarios have been prepared for the flood assessment. The standard cell size adopted is a 4x4m grid, with a refinement of 2x2m cells applied in OFLPs and watercourses. This corresponds to cell areas of 16m<sup>2</sup> and 4m<sup>2</sup>, respectively, aligning with the Auckland Modelling Guidelines' Table 3-2, which recommends cell areas of 20m<sup>2</sup> for general areas and 4m<sup>2</sup> for watercourses and OFLPs. The total modelling area is 386.3 ha with 204544 generated cells with an average cell area 9.0m<sup>2</sup>. The model is 2D, with culverts modelled in 1D.

Each sub-catchments peak and temporal flows are calculated by the HEC-HMS SCS method using the normalised hydrograph Auckland Council TP108 over a 24-hour storm duration and applied as an inflow node in RAS. The temporal pattern has been adopted from the Auckland Council Code of Practice Version 4.

The coordinate system for the surface model will be under NZGD2000 – Mount Eden 2000 (EPSG2105) and the Vertical Datum will be on New Zealand Vertical Datum 2016 (NZVD2000)

### 8.2. 1D-2D Linkage

All hydraulic structures identified on the survey have been applied as a 1D element. The meshes are then adjusted to account for any barriers and openings of the structure. The table below outlines the proposed structure in the hydraulic model.

*Table 4 - Structures*

| Location                   | Structure Type | Size / Diameter | Model ID       | Northing (mN) | Easting (mE) |
|----------------------------|----------------|-----------------|----------------|---------------|--------------|
| Northern Gateway Toll Road | Culvert        | 2100mm          | Motorway_Culv  | 832004.0131   | 390984.8906  |
| Tauhere Road               | Footbridge     | -               | TauhereRd_FtBr | 831911.839    | 391318.647   |
| Arran Drive                | Bridge         | -               | ArranDr_Bridge | 831932.0558   | 391652.6631  |

For the proposed scenarios, there will be an additional 9 box culverts and four circular culverts. The dimensions and embedment depth of the culverts are summarised below.

*Table 5 - Culverts*

| Proposed Culvert      | Culvert Parameters |           |                |
|-----------------------|--------------------|-----------|----------------|
|                       | Span (mm)          | Rise (mm) | Embedment (mm) |
| Culvert 1             | 4000               | 2000      | 350            |
| Culvert 2 (circular)  | 1950               |           | 650            |
| Culvert 3             | 5000               | 4000      | 350            |
| Culvert 4             | 5000               | 4000      | 350            |
| Culvert 5             | 4000               | 1000      | 350            |
| Culvert 6             | 4000               | 2000      | 350            |
| Culvert 7             | 6000               | 2000      | 350            |
| Culvert 8             | 2000               | 1000      | 600            |
| Culvert 9 (circular)  | 900                |           | 150            |
| Culvert 10 (circular) | 2100               |           | 700            |
| Culvert 11            | 4000               | 1700      | 350            |
| Culvert 12 (circular) | 1500               | 900       | 400            |

### 8.3. Model Extent

Figure 11 illustrates the extent of the hydraulic model, shown on Drawing 4501. The extent captures the upstream contributing catchment to the Delmore development and the downstream area up to 50m downstream of the Arran Drive bridge. This extent has been adopted as it allows for assessing any upstream and downstream effects from the development.



*Figure 11 – Extent of the hydraulic model*

## 8.4. Tidal Boundary Conditions

A review of the 'Development of an Updated Coastal Marine Area Boundary for the Auckland Region – Prepared for Auckland Council – July 2012' shows in Table A-2 a Mean High-Water Springs-10 (MHWS10) of 1.42mRL based on the Auckland Vertical Datum of 1946. Adjusting this to the New Zealand Vertical Datum 2016 with an offset value of 302mm yields an MHWS of 1.12mRL.

The Auckland Council 'Regionwide Rural Rapid Flood Model Build Report – May 2023' indicates that the MHWS10 for the Ōrewa region (Model Unit I) ranges from 1.42 to 2.30mRL, with an NZVD adjustment of 1.12mRL to 2.00mRL.

A MHWS10 of 2.10mRL (NZVD2016) has been adopted. In the climate change scenario, an uplift of 1m, equivalent to 3.10mRL, has been added to the MHWS.

The MHWS will be applied as a downstream boundary condition approximately 50m downstream of the Arran Drive bridge.

## 8.5. Losses

Manning's roughness coefficient will be applied to the model surface as per the following table. The manning's value will be applied as a land cover polygon in HEC-RAS.

*Table 6 – Mannings Values*

| 2D Surfaces          | Adopted Mannings Value, n |
|----------------------|---------------------------|
| Building Footprints  | 0.5                       |
| Delmore Development  | 0.1                       |
| Roads                | 0.02                      |
| Other Impervious     | 0.035                     |
| External Development | 0.1                       |
| Internal Streams     | 0.1                       |
| External Undeveloped | 0.1                       |
| Downstream Comp      | 0.1                       |
| Grand Drive          | 0.1                       |

For hydraulic structures, the following losses has been used:

*Table 7 – Mannings Numbers*

| Structure Type          | Adopted Mannings Value, n |
|-------------------------|---------------------------|
| Culvert (1D)            | 0.02                      |
| Culvert – Embedded (1D) | 0.06                      |

Refer to Drawings 4515 & 4516 for the land cover plan.

## 9. MODEL SCENARIOS

For the hydraulic models, 18 scenarios have been undertaken. The table below summarises the total number of scenarios that will be prepared along with the scenario identifier.

*Table 8 – Hydraulic Scenarios*

| Scenario Number | SCENARIO_ID                          | ARI (Year) | CLIMATE CHANGE                                               | LAND USE (Development Extent) | Tailwater condition |
|-----------------|--------------------------------------|------------|--------------------------------------------------------------|-------------------------------|---------------------|
| 1               | EXD21CC050AEP                        | 2          | 2.1DC                                                        | EXISTING DEVELOPMENT          | MHWS10 + 1m         |
| 2               | EXD21CC010AEP                        | 10         | 2.1DC                                                        | EXISTING DEVELOPMENT          | MHWS10 + 1m         |
| 3               | EXD38CC001AEP                        | 100        | 3.8DC                                                        | EXISTING DEVELOPMENT          | MHWS10 + 1m         |
| 4               | MPD21CC050AEP                        | 2          | 2.1DC                                                        | POST DEVELOPMENT              | MHWS10 + 1m         |
| 5               | MPD21CC010AEP                        | 10         | 2.1DC INCREASE IN TEMPERATURE                                | POST DEVELOPMENT              | MHWS10 + 1m         |
| 6               | MPD38CC001AEP                        | 100        | 3.8DC INCREASE IN TEMPERATURE                                | POST DEVELOPMENT              | MHWS10 + 1m         |
| 7               | D_MPD3.8CC001AEP                     | 100        | 3.8DC INCREASE IN TEMPERATURE NZTA CULVERT BLOCKED           | POST DEVELOPMENT              | MHWS10 + 1m         |
| 8               | MPD38CC_001AEP_MWAYCULBLOCK          | 100        | 3.8DC INCREASE IN TEMPERATURE NZTA CULVERT BLOCKED           | MAXIMUM PROBABLE DEVELOPMENT  | MHWS10 + 1m         |
| 9               | EXD38CC001AEPTWBBASE_MWCBLOCK_EXT    | 100        | 3.8DC INCREASE IN TEMPERATURE NZTA CULVERT BLOCKED           | EXISTING DEVELOPMENT          | MHWS10 + 1m         |
| 10              | MPD38CC_001AEP_CULVS50%BLOCK_9100%BL | 100        | 3.8DC INCREASE IN TEMPERATURE INTERNAL CULVERTS SW CoP CHECK | MAXIMUM PROBABLE DEVELOPMENT  | MHWS10 + 1m         |

The following table summarises the purpose of the scenarios.

*Table 9 – Scenario purpose*

| Number | Purpose                                                                                              |
|--------|------------------------------------------------------------------------------------------------------|
| 1      | Baseline of current flood risk                                                                       |
| 2      | Baseline of current flood risk                                                                       |
| 3      | Baseline of current flood risk                                                                       |
| 4      | Assessing proposed culvert capacity and minimum floor levels                                         |
| 5      | Assessing proposed culvert capacity and minimum floor levels                                         |
| 6      | Assessing proposed culvert capacity and minimum floor levels                                         |
| 7      | Assessing impact on development when NZTA culvert is fully blocked                                   |
| 8      | Assessing impact on development when NZTA culvert is fully blocked, and full FUZ is fully built out. |
| 9      | Baseline of current flood risk                                                                       |
| 10     | Assessing Stormwater Code of Practice check of culvert capacity and minimum floor levels             |

## 10. VALIDATION METHODOLOGY

Multiple locations will be selected within the model area and compared against the TP108 graphical model to verify the model data against the graphical method. An additional check will be compared against the Auckland Council RFHA model to assess consistency with council output.

Flows and volumes will be compared to determine the difference between them. Any significant differences will be reviewed and assessed as appropriate.

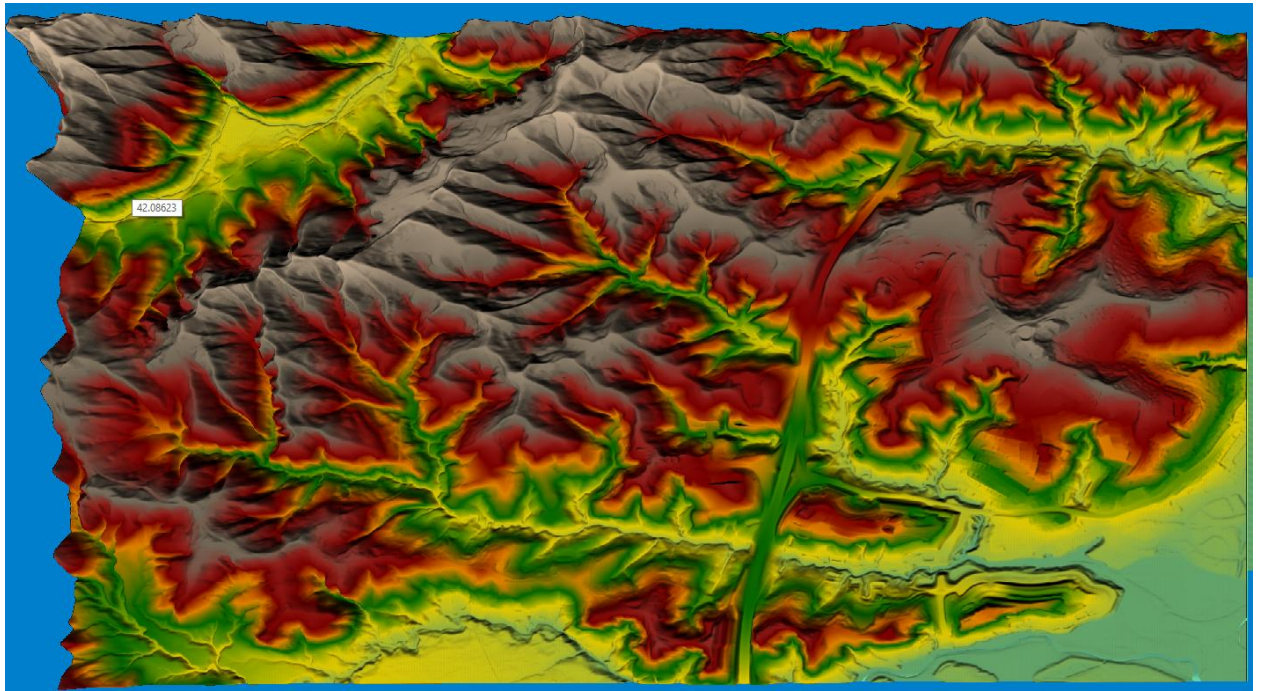
### 10.1. Existing Surface (Pre Development)

A topographical and drone survey for the proposal area was undertaken, and this data has been used for all land within the proposed development site.

LiDAR data 2016 NZVD2016 provided by LINZ Data services, at 0.5m resolution, is used as the existing ground surface model for the wider area around the contributing catchment where topographic data

was not available.

The terrain is shown in Figure 12 below.



*Figure 12 – Existing surface Terrain model*

## **10.2. Design Surface (Post development)**

A detailed design surface was used to prepare a terrain model for the post-development scenario models. Figure 13 below shows these at the development site.



*Figure 13 – Post-Development Surface*

### 10.3. Model Time Steps

An adaptive time step based on a maximum Courant of 4 and a minimum Courant number of 1 was adopted. The base time step is 1 second with a maximum halving of 0.5 seconds and maximum doubling of 4 seconds. The time step was chosen to aid with stability within the model during computation.

### 10.4. Contributing Catchment

Figure 14 below shows the contributing catchment named “15L” of the Ōrewa West ICMP. The size of this catchment is 275ha.

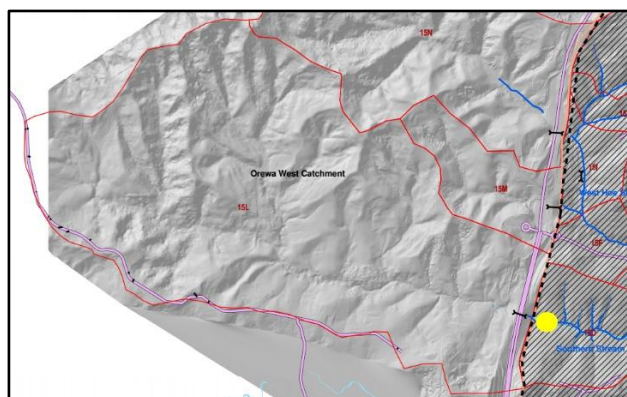


Figure 14 – Ōrewa West ICMP Catchment 15L

Based on the terrain data, an independent catchment analysis has been conducted. The total number of sub-catchments demarcated is 32, which accounts for the cut-off for the future proposed culvert within the Delmore development. Refer to Table 10 for details.

The following table lists each sub-catchment area.

Table 10 – Sub-catchment areas

| SUBCATCHMENT NAME | AREA (ha) | SUBCATCHMENT NAME | AREA (ha) | SUBCATCHMENT NAME | AREA (ha) |
|-------------------|-----------|-------------------|-----------|-------------------|-----------|
| CMT DEL 2         | 3.75      | CMT PD 28         | 6.10      | CMT PD 18         | 2.78      |
| CMT DEL 3         | 2.80      | PRE33-1           | 38.04     | CMT PD 2          | 3.09      |
| CMT DEL 1         | 3.78      | PRE12-1           | 265.42    | CMT PD 3          | 4.21      |
| CMT DEL 6         | 3.69      | CMT PD 25         | 24.49     | CMT PD 29         | 1.70      |
| CMT DEL 8         | 3.36      | CMT PD 22         | 23.87     | CMT PD 8          | 0.50      |
| CMT DEL 10        | 0.86      | CMT PD 10         | 10.79     | CMT PD 30         | 6.09      |
| CMT DEL 15        | 4.70      | CMT PD 23         | 14.72     | CMT PD 4          | 32.88     |
| CMT DEL 9         | 8.23      | CMT PD 27         | 2.44      | CMT PD 21         | 15.83     |
| CMT DEL 12        | 6.10      | CMT PD 1          | 4.34      | CMT PD 16         | 2.21      |
| CMT DEL 14        | 7.61      | CMT PD 26         | 4.77      | CMT PD 15         | 1.86      |
| CMT DEL 13        | 4.24      | CMT PD 0          | 6.55      | CMT PD 20         | 2.55      |
| CMT DEL 4         | 2.33      | CMT PD 11         | 9.89      | CMT PD 17         | 2.17      |
| CMT DEL 16        | 4.24      | PRE29-2           | 3.14      | CMT DEL 17        | 0.57      |
| CMT DEL 11        | 0.62      | CTMT ARAS2        | 8.26      | CMT PD 6          | 8.63      |

|          |      |           |      |          |      |
|----------|------|-----------|------|----------|------|
| CMT PD 7 | 3.42 | CMT PD 19 | 2.74 | CMT PD 5 | 2.86 |
|----------|------|-----------|------|----------|------|

The total sum equivalent to the ICMP boundaries is 266ha. An additional 306ha (consisting of catchments PRE12-1, PRE29-2 and PRE33-1) is applied downstream to determine the full extent of downstream flow.

## 10.5. Inflow Boundary Conditions

Contributing catchments have been delineated as per Catchment Plan drawing 3725-0-4500. Each sub-catchment is assigned a 1D node with the relevant catchment areas and appropriate land cover.

The hydrological inflow is configured to account for actual sub-catchments slope based on equal area terrain method., and each node is positioned at the highest point of its corresponding sub-catchment to ensure the full time of concentration is accurately represented in the model.

For catchments PRE12-1, PRE29-2, and PRE33-1, the time of concentration has been calculated using the equal area method based on the potential flow length and slope. The inflow nodes have been applied at the bottom of the respective sub-catchments. This approach is used because the model has not considered the hydraulic structures within these sub-catchments. The purpose of these inflows is to determine the total downstream flows to assess downstream effects.

Time of concentration calculations are included in Appendix E.

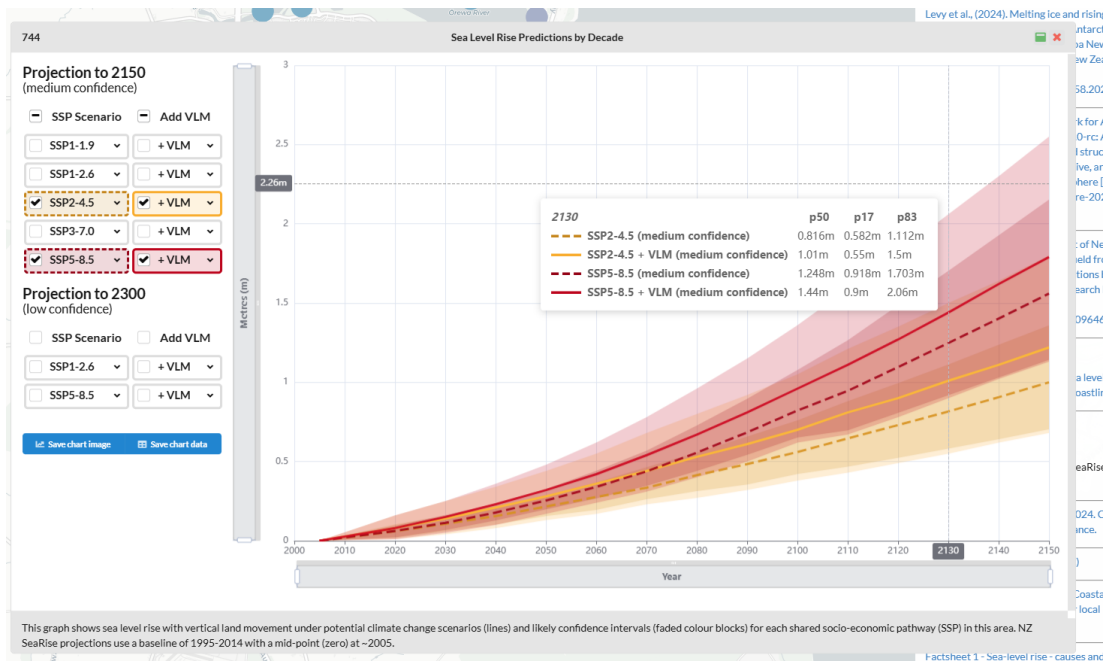
The 24-hour inflow hydrographs for each node have been calculated using HEC-HMS, as discussed in the chapter 6.

For channelisation factor, this was adopted from TP108 table 4.2, which only two values are available 0.6 for pipes, and 0.8 for channels.

## 10.6. Outflow Boundary Conditions

The outflow boundary condition for the flood analysis is located approximately 50m downstream of the Arran Drive bridge.

A review of the 'Development of an Updated Coastal Marine Area Boundary for the Auckland Region – Prepared for Auckland Council – July 2012' shows in Table A-2 a Mean High-Water Springs-10 (MHWS10) of 1.42mRL based on the Auckland Vertical Datum of 1946. Adjusting this to the New Zealand Vertical Datum 2016 with an offset value of 302mm yields an MHWS of 1.12mRL.



The Auckland Council 'Regionwide Rural Rapid Flood Model Build Report – May 2023' indicates that the MHWS10 for the Ōrewa region (Model Unit I) ranges from 1.42 to 2.30mRL, with an NZVD adjustment of 1.12mRL to 2.00mRL.

For modelling, A constant level boundary conditions accounting for sea level rise and vertical land movement based on 50<sup>th</sup> percentile (SSP2-8.5m) of 3.54mRL is applied which consists of SLR and VLM of 1.44m and MHWS of 2.1m.

## 11. RESULTS

### 11.1. Model Mass Error

All model runs reported less than 1% of mass volume error.

### 11.2. Drawing Output

Drawings have been developed to visualise the results of the flood model, outlined in Table 11 below.

*Table 11 – Flood Modelling Results Drawings*

| Drawing Number | Description                                           | Scenario                           |
|----------------|-------------------------------------------------------|------------------------------------|
| 3725-0-4500    | Catchment Plan                                        | N/A                                |
| 3725-0-4502    | 1% AEP Post vs Pre-Development                        | Comparison between Scenarios 3 & 6 |
| 3725-0-4503    | 1% AEP Post-Development Flood Plain                   | 6                                  |
| 3725-0-4504    | 1% AEP Pre-Development Flood Plain                    | 3                                  |
| 3725-0-4505    | 1% AEP Post-Development Flood Plain (FUZ MPD)         | 5                                  |
| 3725-0-4506    | 50% AEP Post-Development Flood Plain                  | 4                                  |
| 3725-0-4507    | 50% AEP Pre-Development Flood Plain                   | 2                                  |
| 3725-0-4508    | 50% AEP Post vs Pre-Development                       | Comparison between Scenario 2 & 4  |
| 3725-0-4512    | 10% AEP Post-Development Flood Plain                  | 5                                  |
| 3725-0-4513    | 10% AEP Pre-Development Flood Plain                   | 2                                  |
| 3725-0-4514    | 10% AEP Post vs Pre-Development                       | Comparison between Scenario 2 & 5  |
| 3725-0-4518    | 1% AEP Post-Development Flood Plain – Rain on Grid    | 9                                  |
| 3725-0-4519    | 1% AEP Pre-Development Flood Plain – Rain on Grid     | 8                                  |
| 3725-0-4521    | 1% AEP Post Development Motorway Culvert Blocked      | 8                                  |
| 3725-0-4522    | 1% AEP Pre Development Motorway Culvert Blocked       | 9                                  |
| 3725-0-4523    | 1% AEP Post Development Internal Culverts SWCoP Check | 10                                 |

### 11.3. Results Discussion

A total of 9 locations have been assessed and shown on Figure 15 below.



Figure 15 - Locations of pre-development and MPD water level comparisons

### 11.4. Results Comparison

Table 12 below shows the depth, velocity, and water surface elevation for each of the 9 locations. Pre-development scenarios with climate change (scenarios 1-3) have been compared with the Delmore post development scenarios (scenarios 4-6) with climate change to assess any increase or decrease in water level and if there any associated increase in risk upstream and downstream due to the modelled changes.

Two scenarios have also been modelled, to assess the effect of the NZTA culver being blocked, on the development, for the post developed scenario, and also for the MPD scenario.

Table 12 - Depth and velocity difference between pre-development and MPD

| ARI 2    |                      |          |       |        |                              |          |       |        |            |          |       |        |
|----------|----------------------|----------|-------|--------|------------------------------|----------|-------|--------|------------|----------|-------|--------|
| Location | S1 - ARI 2, EXISTING |          |       |        | S4 - ARI 2, POST DEVELOPMENT |          |       |        | Difference |          |       |        |
|          | DEPTH                | VELOCITY | WSE   | Hazard | DEPTH                        | VELOCITY | WSE   | Hazard | DEPTH      | VELOCITY | WSE   | Hazard |
| A        | 1.11                 | 1.14     | 6.87  | 1.26   | 1.13                         | 1.17     | 6.89  | 1.32   | 0.02       | 0.03     | 0.02  | 0.06   |
| B        | 3.21                 | 0.70     | 11.32 | 2.25   | 3.39                         | 0.72     | 11.50 | 2.43   | 0.18       | 0.02     | 0.18  | 0.18   |
| C        | 0.97                 | 0.94     | 11.59 | 0.91   | 1.08                         | 0.96     | 11.71 | 1.04   | 0.11       | 0.02     | 0.12  | 0.13   |
| D        | 0.86                 | 0.79     | 14.88 | 0.68   | 0.34                         | 1.10     | 14.36 | 0.37   | -0.52      | 0.31     | -0.52 | -0.30  |
| E        | 0.92                 | 0.10     | 21.45 | 0.09   | 0.29                         | 0.69     | 20.82 | 0.20   | -0.63      | 0.59     | -0.63 | 0.11   |
| F        | 0.95                 | 0.43     | 17.04 | 0.41   | 0.32                         | 0.57     | 17.27 | 0.18   | -0.63      | 0.14     | 0.23  | -0.22  |
| G        | 0.63                 | 0.67     | 24.11 | 0.42   | 0.80                         | 0.53     | 24.28 | 0.42   | 0.17       | -0.14    | 0.17  | 0.00   |
| H        | 0.85                 | 1.01     | 41.27 | 0.86   | 0.09                         | 1.01     | 41.27 | 0.09   | -0.76      | 0.00     | 0.00  | -0.77  |
| I        | 0.25                 | 1.97     | 27.08 | 0.50   | 0.25                         | 1.97     | 27.08 | 0.50   | 0.00       | 0.00     | 0.00  | 0.00   |

**ARI 10**

| Location | S2 - ARI 10, EXISTING |          |       |        | S5 - ARI 10, POST DEVELOPMENT |          |       |        | Difference |          |       |        |
|----------|-----------------------|----------|-------|--------|-------------------------------|----------|-------|--------|------------|----------|-------|--------|
|          | DEPTH                 | VELOCITY | WSE   | Hazard | DEPTH                         | VELOCITY | WSE   | Hazard | DEPTH      | VELOCITY | WSE   | Hazard |
| A        | 1.28                  | 1.31     | 7.04  | 1.68   | 1.31                          | 1.31     | 7.06  | 1.72   | 0.02       | 0.01     | 0.02  | 0.04   |
| B        | 5.75                  | 0.67     | 13.86 | 3.82   | 5.95                          | 0.68     | 14.06 | 4.02   | 0.20       | 0.01     | 0.20  | 0.20   |
| C        | 3.24                  | 1.05     | 13.87 | 3.39   | 3.44                          | 1.06     | 14.07 | 3.65   | 0.20       | 0.01     | 0.20  | 0.26   |
| D        | 1.83                  | 0.88     | 15.85 | 1.61   | 0.88                          | 1.62     | 14.90 | 1.42   | -0.95      | 0.74     | -0.95 | -0.19  |
| E        | 1.00                  | 0.26     | 21.53 | 0.26   | 0.38                          | 1.12     | 20.92 | 0.43   | -0.62      | 0.86     | -0.62 | 0.17   |
| F        | 0.40                  | 0.99     | 17.35 | 0.40   | 0.70                          | 0.81     | 17.64 | 0.56   | 0.29       | -0.18    | 0.29  | 0.17   |
| G        | 0.99                  | 0.97     | 24.46 | 0.95   | 1.21                          | 0.75     | 24.69 | 0.91   | 0.23       | -0.22    | 0.23  | -0.05  |
| H        | 0.12                  | 1.32     | 41.30 | 0.15   | 0.12                          | 1.32     | 41.30 | 0.15   | 0.00       | 0.00     | 0.00  | 0.00   |
| I        | 0.37                  | 2.61     | 27.20 | 0.96   | 0.37                          | 2.60     | 27.19 | 0.95   | 0.00       | 0.00     | 0.00  | 0.00   |

**ARI 100**

| Location | S3 - ARI 100, EXISTING |          |       |        | S6 - ARI 100, POST DEVELOPMENT |          |       |        | Difference |          |       |        |
|----------|------------------------|----------|-------|--------|--------------------------------|----------|-------|--------|------------|----------|-------|--------|
|          | DEPTH                  | VELOCITY | WSE   | Hazard | DEPTH                          | VELOCITY | WSE   | Hazard | DEPTH      | VELOCITY | WSE   | Hazard |
| A        | 1.45                   | 1.41     | 7.21  | 2.05   | 1.44                           | 1.41     | 7.20  | 2.03   | -0.01      | -0.01    | -0.01 | -0.02  |
| B        | 8.91                   | 0.64     | 17.02 | 5.73   | 8.62                           | 0.65     | 16.73 | 5.64   | -0.29      | 0.01     | -0.29 | -0.09  |
| C        | 6.40                   | 0.94     | 17.02 | 6.00   | 6.10                           | 0.95     | 16.73 | 5.79   | -0.29      | 0.01     | -0.29 | -0.20  |
| D        | 3.01                   | 1.36     | 17.03 | 4.08   | 3.02                           | 1.81     | 17.05 | 5.48   | 0.01       | 0.46     | 0.01  | 1.39   |
| E        | 1.09                   | 0.35     | 21.62 | 0.38   | 0.46                           | 1.38     | 21.00 | 0.64   | -0.63      | 1.03     | -0.63 | 0.26   |
| F        | 1.18                   | 1.38     | 18.13 | 1.64   | 1.08                           | 0.95     | 18.02 | 1.02   | -0.11      | -0.43    | -0.11 | -0.61  |
| G        | 1.72                   | 1.10     | 25.20 | 1.90   | 1.75                           | 1.02     | 25.22 | 1.78   | 0.03       | -0.09    | 0.03  | -0.12  |
| H        | 0.18                   | 1.76     | 41.37 | 0.32   | 0.18                           | 1.77     | 41.37 | 0.32   | 0.00       | 0.01     | 0.00  | 0.00   |
| I        | 0.52                   | 3.07     | 27.34 | 1.59   | 0.52                           | 3.07     | 27.35 | 1.59   | 0.00       | 0.00     | 0.00  | 0.01   |

**NZTA blocked culvert scenarios**

| Location | S7 - ARI100, POST, NZTA BLOCKED |          |       |        | S8 - ARI 100, POST, NZTA BLOCKED,MPD |          |       |        |
|----------|---------------------------------|----------|-------|--------|--------------------------------------|----------|-------|--------|
|          | DEPTH                           | VELOCITY | WSE   | Hazard | DEPTH                                | VELOCITY | WSE   | Hazard |
| A        | 0.51                            | 0.31     | 6.27  | 0.16   | 0.51                                 | 0.31     | 6.27  | 0.16   |
| B        | 13.28                           | 0.05     | 21.39 | 0.65   | 13.53                                | 0.08     | 21.64 | 1.08   |
| C        | 10.76                           | 0.24     | 21.39 | 2.54   | 11.01                                | 0.16     | 21.64 | 1.76   |
| D        | 7.36                            | 0.59     | 21.39 | 4.35   | 7.61                                 | 0.51     | 21.64 | 3.90   |
| E        | 0.86                            | 1.38     | 21.39 | 1.18   | 1.11                                 | 1.46     | 21.64 | 1.61   |
| F        | 4.44                            | 0.87     | 21.39 | 3.88   | 4.69                                 | 0.81     | 21.64 | 3.79   |
| G        | 1.75                            | 1.02     | 25.22 | 1.77   | 1.75                                 | 1.02     | 25.22 | 1.78   |
| H        | 0.18                            | 1.75     | 41.37 | 0.32   | 0.18                                 | 1.76     | 41.37 | 0.32   |
| I        | 0.52                            | 3.07     | 27.35 | 1.59   | 0.56                                 | 3.16     | 27.38 | 1.76   |

The 100 year AEP events have been assessed against the PC120 hazard classification provisions, and colour coded against the relevant criteria, with the highest criteria selected.

Very High Hazard

High Hazard

Medium Hazard

Low Hazard

For the purposes of this assessment, references to riparian margins describe vegetated stream corridors and overland flow paths that are not proposed to be occupied, developed, or modified for buildings, access, or infrastructure, and which are intended to continue to function as flood conveyance areas in both the pre- and post-development scenarios.

From the comparison above, the following observations can be made –

#### **Location A**

For smaller flood events, a minor increase in water surface elevation (WSE) of approximately 10–20 mm is predicted. For the 1% AEP (100-year ARI) post-development event, a small decrease in WSE of approximately 10 mm is predicted. Flood depths and velocities remain essentially unchanged.

Flows at this location remain fully contained within the established riparian margins, and the site is located close to the coast where backwater effects dominate. As such, the predicted changes in flood levels are considered negligible. The Flood Hazard Classification in accordance with PC120 remains Very High for both the pre- and post-development scenarios.

#### **Locations B & C**

Locations B and C are located downstream of the development site and adjacent to the Ara Hills Wastewater Treatment Plant. For the smaller flood events (2- and 10-year ARI), increases in WSE of approximately 200 mm are predicted. For the 1% AEP (100-year ARI) event, a decrease in WSE of approximately 290 mm is predicted. Changes in velocities do not result in an increase in flood hazard classification or flood risk when assessed against PC120.

Floodwaters remain contained within established riparian margin areas. The reduction in flood levels during the 100-year ARI event reduces flood risk to the Ara Hills Wastewater Pump Station, which is considered a positive outcome. This is discussed further in Section 12.2.

The Flood Hazard Classification in accordance with PC120 remains Very High for both pre- and post-development scenarios. Overall, the effects associated with these changes in flood depth are considered less than minor.

The Ara Hills Wastewater Pump Station platform level is RL17.21 m (NZVD2016). The post-development 1% AEP (100-year ARI) flood level at this location is approximately RL16.73 m, providing a freeboard of approximately 480 mm. This represents an improvement relative to the pre-development scenario and reduces flood risk to this critical infrastructure.

#### **Locations D & E**

Locations D and E are located immediately upstream of the site. These locations show significant reductions in WSE for the 10-year ARI event due to the removal of the existing culvert arrangement, which comprises a group of five stacked culverts. The replacement culvert provides improved hydraulic efficiency, resulting in reduced upstream water levels.

For the 1% AEP (100-year ARI) event, changes in WSE are negligible at Location D and a decrease is predicted at Location E. An increase in velocity is however noted at Location E, which results in an increase in Depth x Velocity from 0.38 to 0.64. The extent of flooding is contained within a defined channel and does not encroach on any existing dwellings. For this reason, the effects to habitable areas are considered less than

minor.

#### **Location F**

At Location F, an increase in WSE of up to approximately 290 mm is predicted for the 10-year ARI event. This increase occurs entirely within an established riparian margin with no habitable buildings, access routes, services, or critical infrastructure present. The increase does not result in any expansion of the flood extent beyond the existing floodplain, nor does it increase the flood hazard classification under PC120. As such, the increase represents a change in flood level only, rather than an increase in flood risk.

#### **Location G**

For the more frequent flood events, increases in WSE are predicted at Location G due to the removal of headwater effects associated with replacement of the existing culvert. This results in lower flow velocities and an overall reduction in flood hazard.

The stream at this location is located within a deep, bush-clad gully, and floodwaters remain fully contained within the riparian margin. A negligible increase in WSE of approximately 30 mm is predicted for the 1% AEP (100-year ARI) event. The Flood Hazard Classification does not change, and the effects are considered less than minor.

#### **Locations H & I**

No change in WSE is predicted for either the 10-year or 1% AEP (100-year ARI) events at Locations H and I. The Flood Hazard Classification remains unchanged, and no flood effects are identified.

### **11.5. Overall PC120 Assessment**

Overall, the proposed development does not result in any material increase in flood hazard or flood risk when assessed against the provisions of PC120. While localised changes in water surface elevation are predicted for some events, these changes are generally small, are contained within established riparian margins, and do not result in any increase in flood hazard classification or exposure of people, buildings, or critical infrastructure. In several locations, including during the 1% AEP (100-year ARI) event, flood levels are reduced.

Accordingly, the flood effects of the proposal are considered to be no more than less than minor and consistent with the intent of PC120.

Sensitivity testing of 100% blockage of the State Highway 1 culvert demonstrates that, while extreme flood levels occur under this failure scenario, all proposed minimum lot levels and finished floor levels remain above the modelled flood levels.

This assessment is consistent with NZTA's feedback, which confirms that the proposed development does not materially alter the existing risk profile of the motorway embankment and that any residual scour or erosion risk can be appropriately managed through monitoring and consent conditions. The Applicant is actively working with NZTA to determine a mechanism to ensure that Auckland Council is not burdened.

### **11.6. Maximum Probable Development – Future Development Zone**

Scenario with the full Delmore development and the maximum probable development within the Future Urban Zone outside the Delmore development zone have been assessed to determine the minimum floor level and the ultimate pipe capacity. The purpose of this scenario is to ensure that the culvert network have

sufficient capacity to accommodate future development outside the Delmore Masterplan that is within the AUP FUZ zone. The identification of this scenario is MPD38CC001AEPTWBBASE\_PDT which also known as Scenario number 5.

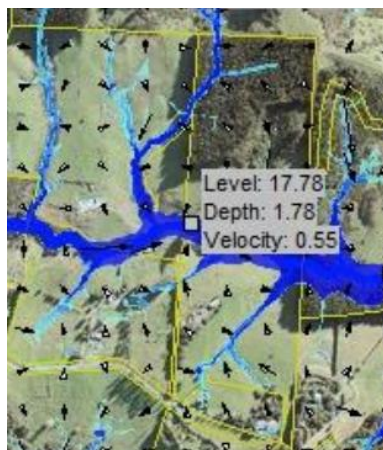
All proposed culverts within the Delmore development are embedded a minimum of 25% of their total height for circular culvert and 350mm for box culverts for ecological requirements except for culverts on a wetland where it matches the invert of the existing wetland (Culvert 9).

Based on the wider FUZ, all minimum ground levels for individual lot platforms are above the 1% AEP MPD flood level by a minimum of 200mm, and minimum proposed floor levels are 300mm above lot platforms. This provides a total freeboard of 500mm for habitable areas.

### 11.7. Auckland Council RFHA Results comparison

Figure 16 below shows the RFM peak elevation and velocity (Source: Healthy Waters). The snippet from the Council RFHA model can be best represented by location E scenario number 5 (MPD38C001AEPTWBBASE\_PDT).

The model prepared by McKenzie & Co reported a flood level of 17.65mRL which is comparable to the Council model. The velocity is reported higher (1.49m/s) which is likely due to the variation in location where the measurements is taken.



*Figure 16 – RFM peak elevation and velocity (Source: Healthy Waters)*

## 12. RISK ASSESSMENT

The slight increases in 100-year ARI flood levels of up to approximately 30 mm upstream are assessed as inconsequential for the following reasons –

- The hazard category for the locations assessed, in accordance with PC120, has not changed
- The post development flood plains are fully contained within the riparian margin,
- There is no increased hazard to houses, roads, people or infrastructure

Slight increases in minor storms are present however as they are contained within the riparian zoned, and do not present an increase in risk, we also have assessed these increases of up to 290mm as less than minor.

A risk assessment against E36 of the Auckland Unitary plan has been completed and is included in the Appendix A. This shows that the overall flood risk from the development is low.

Specific reference is included below.

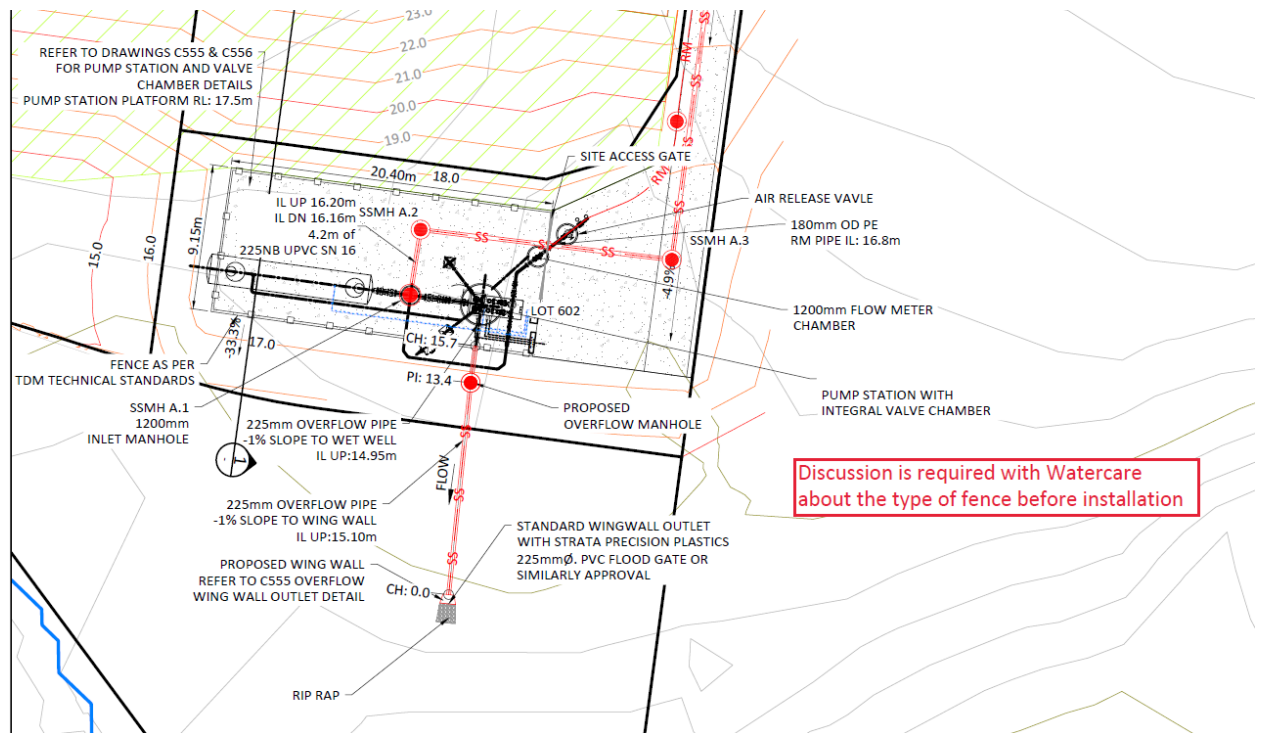
### 12.1. Lots

All lot levels within the development are set above the 100% blocked SH1 culvert level of RL21.80m. This is significantly higher than the calculated post development 1% AEP flood level of 16.73m (3.8 degree climate change).

All building platforms of the residential lots directly upstream of the culvert in the adjacent subdivision are also above the RL21.80m flood level.

### 12.2. Ara Hills Pumpstation

The Ara Hills pumpstation has a platform level of RL17.5m AUK1946. When converted to NZVD2016, the level is RL17.21m NZVD2016. This shows the pumpstation level is slightly above the pre development 1% AEP level of 17.1m, which does not have the required freeboard in accordance with the SWCoP. However it is 480mm above the post development 1% 3.8 degree climate change level of 16.73m, and as such the risk is **decreased** as a result of the development. Refer below for levels, in AUK1946, for the Ara Hills pumpstation.



A blockage assessment of the NZTA culvert was undertaken to assess the flood risk to the pump station, as requested by Healthy Waters. The assessment considered the following scenarios:

- pre-development conditions, representing the existing catchment and development
- post-development conditions, based on the MPD scenario, which includes the Delamore development together with full upstream development

The finished floor level of the pump station is 17.5 m RL.

The modelling results are summarised below:

- Pre-development, blocked culvert: 20.98 m RL
- Post-development, MPD blocked culvert: 21.80 m RL

The modelling indicates that, under both the existing and full development scenarios, the pump station would be inundated in the event of a blockage at the NZTA culvert. It is important to note that the post-development result is based on the full MPD scenario, including full upstream development, rather than the Delamore development in isolation.

As the pump station is inundated under both pre-development and post-development conditions, the Delamore development does not result in any additional inundation risk to the pump station.

### 12.3. Internal Overland Flow Paths

The internal overland flow paths have been assessed in detail in a separate technical memo titled Internal Development Overland Flow Path Analysis by McKenzie and Co Reference 3725 Dated 16 April 2026 and is included within appendix F of this report. This assessment evaluates flood depth, velocity, and depth-velocity (DxV) hazard along the proposed road network under the 1% AEP Design rainfall.

Detailed overland flow path plans showing the depth and DxV outputs from the flood model are included in Appendix A.

The overland flow path assessment demonstrates that the proposed road network complies with the Auckland Transport Technical Design Manual (AT TDM) hydraulic hazard criteria, with all modelled D\*V values remaining below  $0.4 \text{ m}^2/\text{s}$ . While localised flood depths between 200 mm and 400 mm are predicted at key overland flow path discharge points, these areas are confined and associated with exceedance flow conveyance under a 1% AEP event with a fully blocked primary system. The road layout has been optimised to minimise the extent and depth of flooding where practicable.

These flood conditions are temporary, occurring only during short duration storm events with rapid recession of water levels. Alternative access routes remain available, maintaining network connectivity during such events. Given the constraints of the existing topography and downstream network, further mitigation is not practicable without disproportionate intervention. A risk-based approach is therefore adopted, including the provision of appropriate signage to warn users of potential flood hazards. On this basis, the residual flooding effects are considered acceptable within the overall system performance.

### 12.4. NZTA Culvert Inlet Riser

After discussions with Healthy Waters and Auckland Transport during the Fast Track process it has been agreed to install a 2100Ø scruffy dome inlet riser to the existing NZTA culvert. The inlet riser will deal with egress and hazard risks during the 100% blocked NZTA culvert scenario raised by Healthy Waters and Auckland Transport.

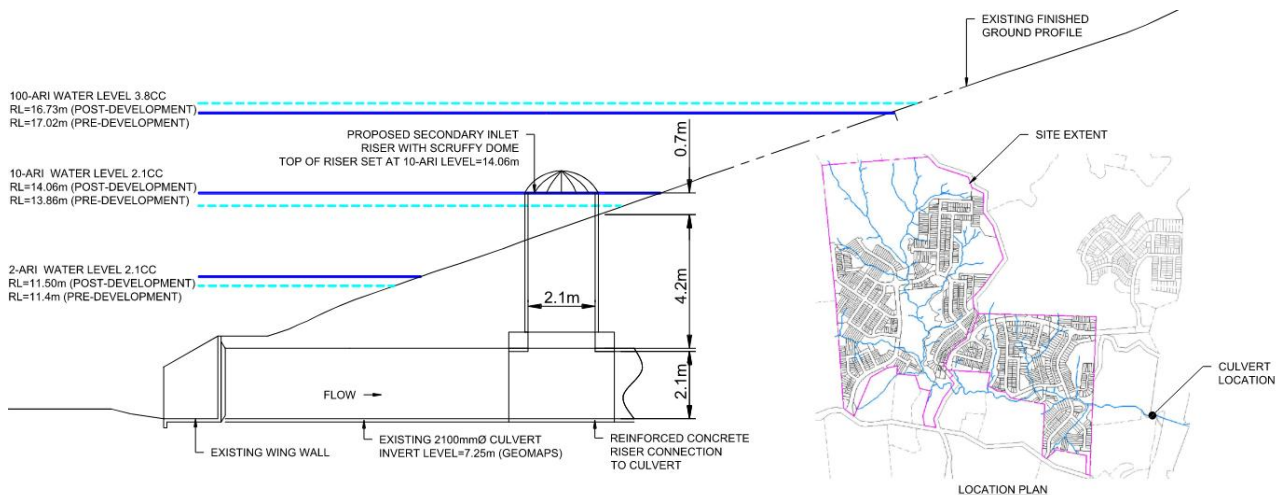


Figure 18: Proposed NZTA Culvert Inlet Riser

## 13.CONCLUSION

The flood assessment for the Delmore development demonstrates that the proposed development has been designed to manage stormwater runoff effectively. The assessment confirms that the minimum floor levels for the proposed lots are above the 1% AEP flood levels (blocked scenario) and overland flow paths are contained within road reserves, existing streams and channels.

An inlet riser must be installed on the existing NZTA culvert downstream of the site to mitigate potential egress and flooding issues in the event the NZTA culvert fully blocks during a 1% AEP event.

Modelling results indicate that the proposed development has resulted in a decrease for the 100% AEP + 3.8-degree climate change, and a minor increase in flood depth upstream of the proposed development for smaller events, however, since it is within the existing channel and away from any habitable area, the risk is considered less than minor.

## 14.LIMITATION

This flood assessment report has been prepared by McKenzie and Co for Vineway Limited to evaluate the flood risks associated with the Delmore development. This report is intended solely for this purpose, and McKenzie and Co accept no responsibility for its use by other parties or for any other purpose.

The results rely on the accuracy of available data and modelling assumptions, including rainfall events, catchment response, and boundary conditions. The assessment does not account for future changes in land use, except for those indicated in the Auckland Unitary Plan. Simplifications in model geometry, such as terrain and drainage structures, may result in localized impacts not being fully represented.

Any use of this report outside its intended purpose is at the sole risk of the user, and McKenzie and Co accept no liability for such use.

# APPENDIX A – Flood Hazard Risk Assessment

## AUP Chapter E36.9 Flood Hazard Risk Assessment Report

Prepared by (company name): McKenzie & Co Ltd

Site Address: 53A&B, 55 Russell Road, Orewa West

Select level of assessed risk from drop

Date: 31/01/2025

Application No:

down list attached to each cell below

### a) The frequency, duration and scale of the flooding hazard;

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>State if the site being developed will be impacted by flooding in more frequent events than 1 % AEP. If assessment is for overland flow, determine trigger event as well as 1% AEP scenario. An assessment of the duration of the flooding hazard for the 1 % AEP event should be made supported with a study of the hydrology of the contributing sub catchments * that is appropriate for the scale of the risk. Describe extent of flooding on site along with discharge rates, depths and velocities at critical points on the developed site.</i></p> | <p>The site is currently subject to flooding. All residential and utility lots will be outside the flooded widths with building floor levels achieving required freeboard. 18 scenarios have been modelled and assessed for the 2, 5, 10, 20, 50 and 100 year events for the pre- and post development, with and without 3.8 degree climate change. No scenarios trigger a flood event within the development site. Flood duration is the same for pre and post development due to the site location being lower in a large contributing catchment. Flows, depths and velocities are shown from drawings 3725-0-4500 onwards. There is negligible flooding risk to upstream and downstream properties in the post- development scenario.</p> <p>In addition to the 1% AEP event, a full MPD analysis based on the future urban zone was assessed. Finished floor levels for the proposed lots have been designed to have 500mm freeboard in this scenario.</p> | <p>LOW</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### b) The type of activity being undertaken and its vulnerability to flooding events;

|                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                   |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Identify the activity or activities incorporated in the proposed development as listed in table E36.4.1. Described the vulnerability (exposure) of the activity or activities to the flood events determined by the investigation into the flooding hazards impacting the site described in E36.9(a). This should include whether the building footprint, any vehicle parking area and means of egress are within the flooding extent.</i></p> | <p>The site is residential only with supporting roads, utility lots, and riparian margins. No buildings, parking or egress routes will be located within the flood extents. Roadways will be located above the flood extents.</p> | <p>LOW</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### c) The consequences of a flooding event in relation to the proposed activity and the people likely to be involved in that activity;

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                         |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Identify the impacts on the proposed activity during a flood event e.g. if the building footprint is fully or partially within the flooded area what level will the flooding reach in respect to the living areas and other components of the dwelling. If egress from the building will be flooded, to what depth and for what period of time. Identify any potential for damage to, or deterioration of, the structural and functional integrity of the building resulting from the intensity and or frequency of flooding.</i></p> | <p>No building foot prints are within the flood plain. Earthworks are proposed to contour the land to direct overland flowpaths away from buildings. Modelling demonstrates no egress issues due to flooding within the site as the road levels are above the 100 year flood plain.</p> | <p>LOW</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### d) The potential effects on public safety and on other property;

|                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                          |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Describe effects on public safety if the activity will include public use. Identify any potential flooding of upstream or downstream properties that may be affected by the proposed activity</i></p> | <p>No adverse effect on public safety will occur due to the development. No increase in flood risk will occur upstream or downstream of the development due to the development activities. Increase in depth due to additional runoff will be contained within the existing channels and no overtopping anticipated.</p> | <p>LOW</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### e) Any exacerbation of an existing flooding hazard risks or creation of a new flooding hazard risk;

|                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                    |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Describe results of investigation into any potential effects on other property if the activity results in diversion of flood flow or overland flow. Identify any new activity that results in an increase to the number of people exposed to an existing flood risk.</i></p> | <p>The proposal does not change any OLFP outside of the site, or the general function of the flood plain. All entry and exit points of OLFPs to the site will remain the same, nor will there be any reduction in capacity to convey the OLFPs. No changes to other neighbouring properties is intended. The proposal will not create any new natural hazards.</p> | <p>LOW</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### h) The design and construction of buildings and structures to mitigate the effects of natural hazards;

|                                                                                                                                                                                                                      |                                                                                                                                                                                                                   |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Describe how the potential flooding effects identified above, determined by investigation and described in detail in a flooding report, will be mitigated by the design and materials of the building.</i></p> | <p>None of the buildings are within the 1% AEP floodplain. General freeboard for habitable floors applied for proposed buildings. OLFPs will be channelled within the road reserve and avoid habitable areas.</p> | <p>LOW</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### j) Site layout and management to avoid or mitigate the adverse effects of natural hazards, including access and exit during a natural hazard event;

|                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Describe how the potential flooding effects identified above, including any effects on upstream and downstream properties, determined by investigation and described in detail in a flooding report, will be mitigated by the design form of any structures and site works. Describe measures proposed to provide safe egress from property</i></p> | <p>Vehicle Access is by the NoR6 collector road and an entry road off Upper Orewa Road. As these roadways are considerably higher in elevation than the floodplain levels access into the development is safe for vehicles. Roads are located above floodplain levels, all dwellings have safe egress.</p> | <p>LOW</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

### l) Any measures and/or plans proposed to mitigate the natural hazard or the effects of the natural hazard.

|                                                                                                                                                                                                                                                                                                |                                                                                                                                                                   |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <p><i>Describe any other measures to mitigate the flooding hazard which can include information about future works planned by Auckland Council in the wider catchment that will reduce the flooding risk. Include any other measures to mitigate effects that are not described above.</i></p> | <p>The modeling shows there is low risk in flooding hazard. All stormwater measures within the Delmore Development have been designed to the 1% MPD scenario.</p> | <p>LOW</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|

## APPENDIX B – Flood Drawings

See Engineering Plans

## APPENDIX C – HEC RAS Results – Refer to drawings

## APPENDIX D – Correspondence

Refer to HW RFI (Attached) for queries

| Request No | HW RFI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicant Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FR-01      | <p>We noticed decreased flood level for 100yrMPD 3-8 CC scenario at the upstream side of the motorway possibly due to increased attenuation at the upstream end. There are increased flood depths upto 0.3m at the upstream side of the motorway for the 10%AEP storm event.</p> <p>We are still concerned with the risk of blockage at the SH1 culvert (2.05m Dia). This culvert is significantly less than other culverts upstream (5x5m or 5x4m) and the downstream Arran Drive Bridge.</p> <p>The consequence of blockage at this culvert will result in significant ponding with a depth of over 14 meters. The culvert invert is about 20m below the Motorway.</p> <p>We consider that a more resilient design is needed at this location</p> | <p>Yes, the observed decrease in flood level during the 1% AEP (100-year MPD 3.8 CC) event is attributed to increased attenuation upstream. While there is an increase in flood depth of up to 0.3 m during the smaller 10% AEP storm event, the resulting water level remains well below the 1% AEP flood level.</p> <p>No significant increase in velocity is observed between the pre- and post-development scenarios. A secondary riser inlet into the culvert under state highway 1 is proposed, in case of the primary inlet being blocked by deleterious material. The general arrangement is shown on drawing 3725-1-4800, as recommended by NZTA. It is proposed that the top of the riser to be set at the 10% AEP flood level.</p> <p>We note that increasing the SH1 culvert size may reduce upstream ponding but will likely result in increased downstream flood depths. This could have potential implications for existing infrastructure, particularly the Tauhere Road footbridge, where the piers are in close proximity to the watercourse. Such changes could increase local scour risk or affect clearance during high-flow events.</p> |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                             |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | <p>with an additional culvert of suitable size and high-level entry with screens. Some debris control structure will also be needed.</p> <p>There will be increase of flood depth downstream from an additional culvert, although we don't envisage flood risk at downstream properties or roads at this stage. This needs to be assessed with additional model runs for this option. Please provide the additional model</p> |                                                                                                                          |
| FR-02 | Refer to attachment                                                                                                                                                                                                                                                                                                                                                                                                           | There was an issue with the DEM in the pre-development scenario where the surveyed surface wasn't included in this area. We have since fixed the DEM, done a remodel, and there is minimal change observed. |
| FR-03 | Refer to the attachment                                                                                                                                                                                                                                                                                                                                                                                                       | Noted, no further action                                                                                                                                                                                    |
| FR-04 | Refer to attachment                                                                                                                                                                                                                                                                                                                                                                                                           | Noted, the pre-development is largely pervious, no further action                                                                                                                                           |

|       |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FR-05 | Refer to attachment | We have remodelled the internal streams with a Manning's of 0.1 to account for future riparian planting. There is no upstream increase noted; however, there is a very small reduction in downstream flooding.                                                                                                                                                                                                                                                                                                         |
| FR-06 | Refer to attachment | Noted, no further action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FR-07 | Refer to attachment | Noted, no further action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FR-08 | Refer to attachment | Noted, no further action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FR-09 | Refer to attachment | Noted, no further action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FR-10 | Refer to attachment | Noted, no further action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FR-11 | Refer to attachment | <p>The rain on grid is too coarse for the internal development and not fit for purpose for assessing the internal flooding within the development site. The model was created to assess the wider catchment for any significant downstream effects due to the development.</p> <p>We have prepared a separate flood risk assessment using 1d hydraulics (12d), which can be found on drawings 4600 series. These show the overland flows are contained within the Road Reserves, and dedicated overland flowpaths.</p> |
| FR-12 | Refer to attachment | As-above, a separate internal analysis has been prepared, refer to drawings 4600 series. (These plans to be provided prior to application for review. They demonstrate that the OLFP's are compliant with TDM)                                                                                                                                                                                                                                                                                                         |
| FR-13 | Refer to attachment | The Mannings on this area would not make a material change to the flood model. Regardless, we have updated the Mannings of the SH reserve to be 0.04                                                                                                                                                                                                                                                                                                                                                                   |
| FR-14 | Refer to attachment | Model and culvert plans has been updated to be consistent. Refer to updated models and drawings. (These plans to be provided prior to application for review, they are now consistent)                                                                                                                                                                                                                                                                                                                                 |
| FR-15 | Refer to attachment | <p>For the hydraulic model, a default Tc of 10 minutes was applied at the centroid.</p> <p>This approach was adopted to enable the 2D model to dynamically determine the actual time to peak based on the complex terrain and flow path characteristics.</p> <p>This method provides a more representative assessment of flow timing than applying fixed Tc values for each subcatchment, especially in areas with variable topography and storage effects.</p>                                                        |

|       |                     |                                                                                                                                                                                                                                                                                                                  |
|-------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FR-16 | Refer to attachment | <p>As-above and consistent with the comment made by HW in FR-10, where the hydrographs measured are consistent with the HW model and both the lumped and ROG model.</p> <p>However, we have updated the hydrological calculation to estimate the time of concentration based on the equal area slope method.</p> |
|-------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## James Kitchen

---

**From:** Pranil Wadan <pranilw@fsconsulting.co.nz>  
**Sent:** Friday, 19 December 2025 9:38 am  
**To:** Peter Mitchell  
**Cc:** Pranil Wadan; carly.hinde@aucklandcouncil.govt.nz; Gerard Thompson; James Kitchen; Andrew Allsopp-Smith; Charlotte MacDonald; Madeleine Wright; Sakti Gounder; Djordje Petkovic  
**Subject:** Re: Delamore - NZTA

Hi Peter,

Thank you for your response. I appreciate you taking the time to provide feedback, especially given how busy you have been.

I am happy to accept the additional condition you suggested regarding monitoring for scour or erosion, including the potential trigger for a relief inlet riser or embankment reinforcement. I can confirm we will include this from our end.

Have a great Christmas break, and thanks again.

Kind Regards



**Pranil Wadan - Director**  
*BE Civil, CPEng, IntPE(NZ), CMEngNZ*  
+64 21 385328  
[www.fsconsulting.co.nz](http://www.fsconsulting.co.nz)

On Fri, 19 Dec 2025 at 00:33, Peter Mitchell <[Peter.Mitchell@asm.nzta.govt.nz](mailto:Peter.Mitchell@asm.nzta.govt.nz)> wrote:

Hi Pranil,

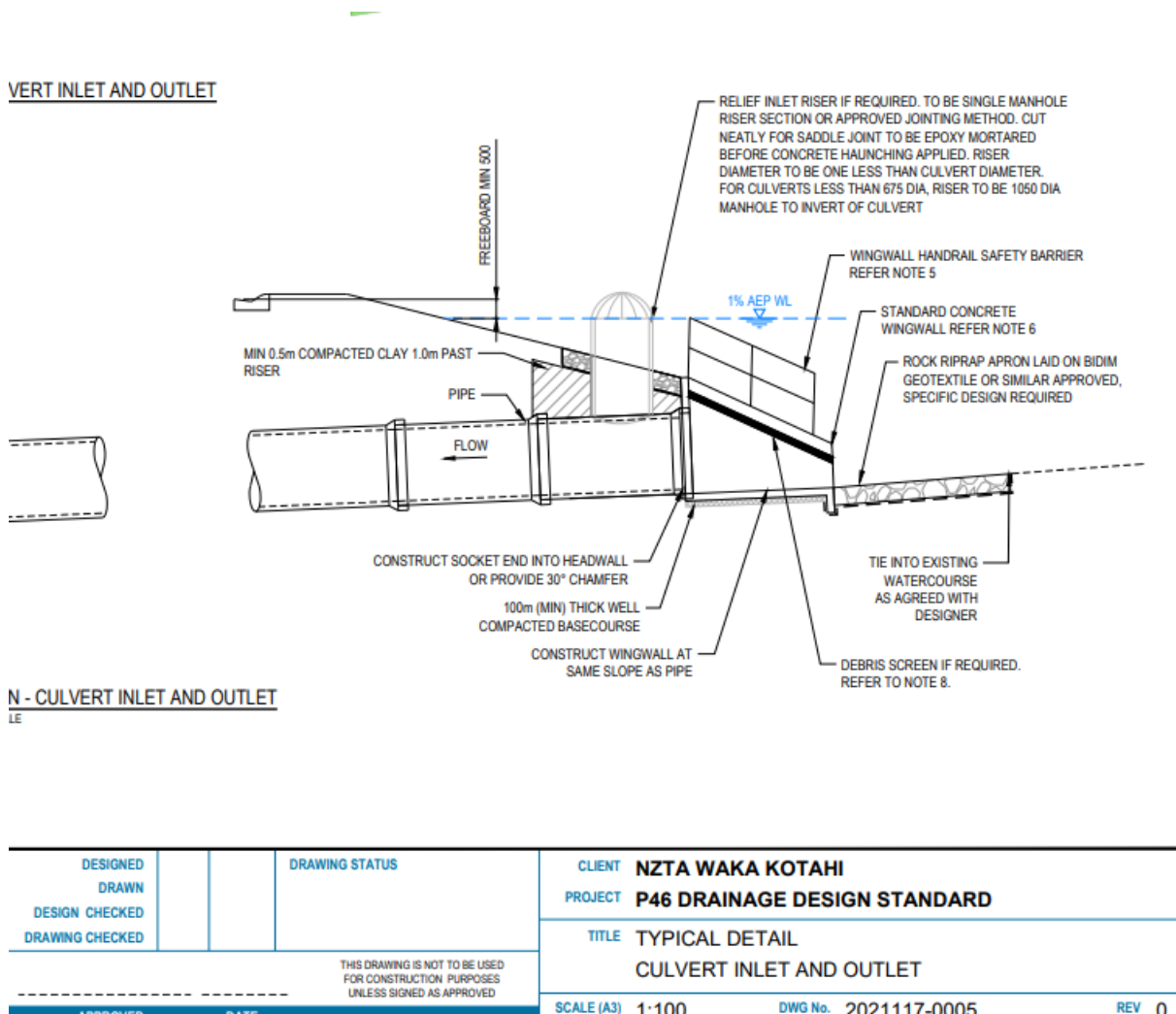
Thank you for following up. Your assessment and summary look good. Nice.

I can confirm that, in general, I am comfortable with what is being proposed for the monitoring and proactive management of the risk of culvert blockage from excessive “slash” and debris, which we have previously experienced where forestry-type land has been cleared for development.

The risk of highway overtopping has never been raised as a concern. Rather, my concern relates to the resilience of the highway embankment due to the increased frequency, velocity, and volume of runoff directed towards the embankment—particularly at the transition from the natural stream to the culvert inlet, and at the ground interface beyond the culvert headwall. Specifically, this relates to

the potential risk of scour and erosion at the transition and inlet where velocities and risk to our system resilience here will be highest.

That said, I am comfortable that the proposed change in water depths is unlikely to materially alter the existing risk profile at our highway system. It may be appropriate, however, for the monitoring regime to include a condition that, should accelerated scour or erosion be observed by mutual monitoring (up to the time that the development is fully built out, and the site is stabilised), that a requirement could be triggered to install a relief inlet riser consistent with NZTA P46 standard design and/or additional embankment interface reinforcement/resilience measures could be proposed by the project. <https://nzta.govt.nz/assets/resources/stormwater-specification/P46-Stormwater-management-and-minor-stream-diversion-design-specification-guidance-document.pdf>



Happy to discuss further.

Regards,

## Peter Mitchell

NZTA Capital Projects Liaison Manager and Stormwater Assets Manager, Asset and Network Performance  
[Auckland System Management](#)

Email: [Peter.Mitchell@asm.nzta.govt.nz](mailto:Peter.Mitchell@asm.nzta.govt.nz)

Mobile: 0272775569

NZ Transport Agency Waka Kotahi

[Facebook](#) | [Twitter](#) | [LinkedIn](#)



Auckland System  
Management Alliance

---

**From:** Pranil Wadan <[pranil.wadan@woods.co.nz](mailto:pranil.wadan@woods.co.nz)>

**Sent:** Wednesday, 17 December 2025 11:18 am

**To:** Peter Mitchell <[Peter.Mitchell@asm.nzta.govt.nz](mailto:Peter.Mitchell@asm.nzta.govt.nz)>; [carly.hinde@aucklandcouncil.govt.nz](mailto:carly.hinde@aucklandcouncil.govt.nz)

**Cc:** Gerard Thompson <[GerardT@barker.co.nz](mailto:GerardT@barker.co.nz)>; James Kitchen <[james@mckenzieandco.co.nz](mailto:james@mckenzieandco.co.nz)>; Andrew Allsopp-Smith <[andrew.as@mylandpartners.com](mailto:andrew.as@mylandpartners.com)>; Charlotte MacDonald <[charlottem@barker.co.nz](mailto:charlottem@barker.co.nz)>; Madeleine Wright <[madeleine.wright@millslane.co.nz](mailto:madeleine.wright@millslane.co.nz)>; Sakti Gounder <[sakti.gounder@woods.co.nz](mailto:sakti.gounder@woods.co.nz)>; Djordje Petkovic <[djordje@mylandpartners.com](mailto:djordje@mylandpartners.com)>; [pranilw@fsconsulting.co.nz](mailto:pranilw@fsconsulting.co.nz)

**Subject:** RE: Delamore - NZTA

Hi Peter,

Hope you're having a good week.

Just wanted to quickly follow up on the email below. Are you able to confirm if you are satisfied with our proposal, or do you have any further questions? Let me know if you'd like to catch up and /or have a quick call to clarify anything.

Also, as a heads-up, I'm moving on from Woods soon, so I won't have this email anymore. Going forward, please send any emails for me to my new address: [pranilw@fsconsulting.co.nz](mailto:pranilw@fsconsulting.co.nz)



**Pranil Wadan**

**General Manager - Water Infrastructure and Planning**

**BE Civil, CPEng, IntPE(NZ), CMEngNZ**

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---

**From:** Pranil Wadan

**Sent:** Monday, 8 December 2025 8:24 pm

**To:** 'Peter Mitchell' <[Peter.Mitchell@asm.nzta.govt.nz](mailto:Peter.Mitchell@asm.nzta.govt.nz)>; 'carly.hinde@aucklandcouncil.govt.nz' <[carly.hinde@aucklandcouncil.govt.nz](mailto:carly.hinde@aucklandcouncil.govt.nz)>

**Cc:** Gerard Thompson <[GerardT@barker.co.nz](mailto:GerardT@barker.co.nz)>; James Kitchen <[james@mckenzieandco.co.nz](mailto:james@mckenzieandco.co.nz)>; Andrew Allsopp-Smith <[andrew.as@mylandpartners.com](mailto:andrew.as@mylandpartners.com)>; Charlotte MacDonald <[charlottem@barker.co.nz](mailto:charlottem@barker.co.nz)>; Madeleine Wright <[madeleine.wright@millslane.co.nz](mailto:madeleine.wright@millslane.co.nz)>; Sakti Gounder <[sakti.gounder@woods.co.nz](mailto:sakti.gounder@woods.co.nz)>; Djordje Petkovic <[djordje@mylandpartners.com](mailto:djordje@mylandpartners.com)>

**Subject:** Delamore - NZTA

Hi Peter,

Thank you again for your time last week to discuss the Delamore project and matters relating to the downstream culvert.

I have summarised our discussion below and highlighted NZTA's key concern:

- NZTA's primary concern is the potential risk of blockage at the downstream culvert. It was acknowledged by all parties that this risk will be significantly reduced as the site transitions from forestry operations to residential development.
- As requested, I have included a plot illustrating the modelled flood levels for the various scenarios. These results are summarised in **Table 1** below.
- It is important to note that the culvert inlet level is 7.25mRL, while the existing motorway is at approximately 27mRL.
- The table shows that even under a full blockage scenario, there remains approximately 5.5m of freeboard to the motorway.
- For the 100-year event, the pre-development flood level is higher than the post-development level. This is due to the proposed culverts providing attenuation in the post-development scenario, reducing downstream flood elevations. These culverts will, however, pass smaller events/ flows forward.

- Overall, the results demonstrate that while there are increases in flood levels are considered negligible to less than minor in the context of the culvert and its relationship to the motorway elevation and increased risk to embankment.

**Table 1 – Culvert Flood Level summary**

|                                | <b>Pre-Development</b> | <b>Post-Development</b> | <b>Difference</b> | <b>Freeboard to Motorway</b> |
|--------------------------------|------------------------|-------------------------|-------------------|------------------------------|
| <b>2yr (3.8°C)</b>             | 11.40mRL               | 11.70mRL                | 300mm             | 15.3m                        |
| <b>5yr (3.8°C)</b>             | 12.60mRL               | 13.20mRL                | 600mm             | 13.8m                        |
| <b>10yr (3.8°C)</b>            | 13.90mRL               | 14.20mRL                | 300mm             | 12.8m                        |
| <b>100yr (3.8°C)</b>           | 17.10mRL               | 16.80mRL                | -300mm            | 10.2m                        |
| <b>100yr – Blocked (3.8°C)</b> | -                      | 21.50mRL                |                   | 5.5m                         |

## Secondary Inlet

- Based on the McKenzie modelling and the significant reduction in blockage risk associated with the change in land use from forestry to residential, our view is that a secondary inlet is not required.
- Rather than providing a secondary inlet, we propose managing this risk through active maintenance and monitoring of the culvert.

The proposed management approach includes:

- A consent condition requiring a management plan to address potential blockage from any residual slash / debris.
- This plan would remain in place until the development is fully built out, and the site is stabilised. Once developed, the blockage risk is expected to be substantially lower; however, we acknowledge some level of temporary risk during construction which will be managed through the management plan.

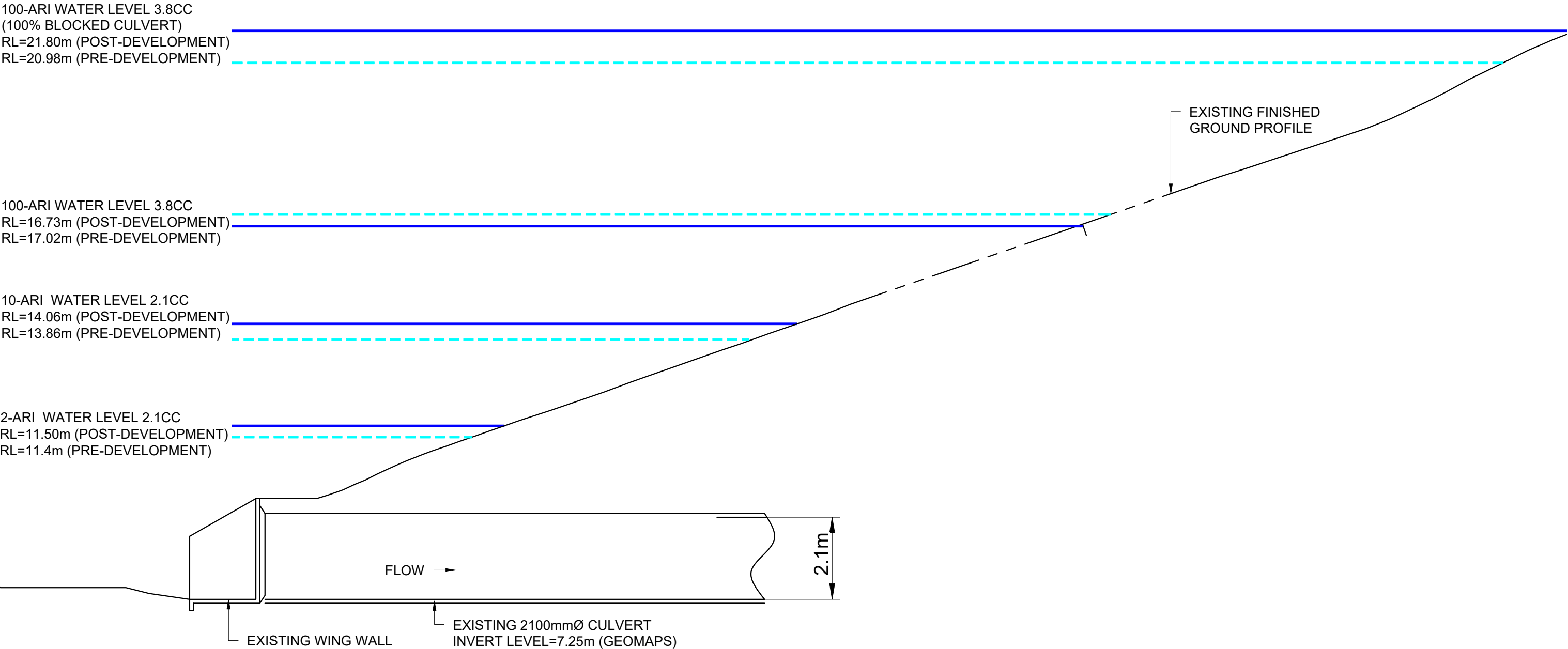
**Could you please confirm whether NZTA would be satisfied with a consent condition requiring a management and monitoring plan - prepared to NZTA's approval - to manage blockage risk until full build-out and site stabilisation?**

LEGEND:

PRE-DEVELOPMENT WATER LEVEL    - - - - -

POST-DEVELOPMENT WATER LEVEL    \_\_\_\_\_

EXISTING MOTORWAY APPROX. LEVEL  
RL=27.00



|     |                      |        |        |        |          |
|-----|----------------------|--------|--------|--------|----------|
| G   | FOR CONSENT          | JK     | LV     | JK     | 16/04/26 |
| F   | UPDATED LABEL        | JDK    |        |        | 19/12/25 |
| E   | UPDATED FLOOD LEVELS | JDK    |        |        | 19/12/25 |
| D   | REMOVED RISER        | JDK    |        |        | 05/12/25 |
| C   | FOR DISCUSSION       | ZW     | JDK    | JDK    | 02/12/25 |
| B   | FOR DISCUSSION       | ZW     | JDK    | JDK    | 01/12/25 |
| A   | FIRST ISSUE          | ZW     |        |        | 20/11/25 |
| REV | DESCRIPTION          | DRN BY | CHK BY | APP BY | DATE     |



MCKENZIE & CO.

CLIENT:

VINEWAY LTD

PROJECT:

DELMORE  
53A, 53B & 55 RUSSELL ROAD  
OREWA  
STAGE 1

TITLE:

STORMWATER  
EXISTING NZTA CULVERT  
UPGRADE PLAN

PURPOSE OF ISSUE:

RESOURCE CONSENT

SCALE:  
1:100m@A3  
DO NOT SCALE

DRAWING NO:  
3725-1-4815

REV:

G

## Lachlan Van der Meij

---

**From:** Dali Suljic <dali.suljic@AucklandCouncil.govt.nz>  
**Sent:** Wednesday, 20 May 2026 1:25 pm  
**To:** Charlotte MacDonald; Lachlan Van der Meij  
**Cc:** Pranil Wadan; Dylan Pope; Hillary Johnston; Carly Hinde  
**Subject:** RE: [#3725] Delmore - Healthy Waters Queries

Thanks Charlotte,

That sounds like a good approach.

Cheers

### Dali Suljic

Phone 09 301 0101 | Mobile 021 0845 5043

**Te Tupuranga me ngā Whanaketanga**

**Healthy Waters and Flood Resilience |**

**Te wāhanga mō ngā Wai Ora me te Manawaroa ā-Waipuke**

Auckland Council | Private Bag 92300 | Auckland 1142

Visit our website [www.aucklandcouncil.govt.nz](http://www.aucklandcouncil.govt.nz)

---

**From:** Charlotte MacDonald <CharlotteM@barker.co.nz>  
**Sent:** Wednesday, 20 May 2026 1:23 pm  
**To:** Dali Suljic <dali.suljic@AucklandCouncil.govt.nz>; Lachlan Van der Meij <Lachlan@mckenzieandco.co.nz>  
**Cc:** Pranil Wadan <pranilw@fsconsulting.co.nz>; Dylan Pope <dylan@dcs.gen.nz>; Hillary Johnston <hillary.johnston@aucklandcouncil.govt.nz>; Carly Hinde <carly.hinde@aucklandcouncil.govt.nz>  
**Subject:** RE: [#3725] Delmore - Healthy Waters Queries

Hi Dali,

I've asked McKenzie & Co to add the location of the NZTA culvert onto the drawing, so that it is clear which culvert this relates to. The following change is proposed to the condition in that regard:

*Prior to section 224(c) certification for Stage 1A-1, Stage 1A-2, Stage 1A-3, Stage 1A-4, and Stage 1B-2, the consent holder must, to the satisfaction of Council, design and install the following on the NZTA culvert **in the location shown on drawing XX**:*

- 1. a relief inlet riser **in accordance with drawing XX**; OR*
- 2. an alternative debris control structure.*

**Advice Note:**

*The consent holder is advised to consult with NZTA prior to undertaking any works on the culvert. All necessary approvals, permits, or other authorisations required by NZTA must be obtained directly from NZTA.*

Let us know if you are happy with that.

Ngā mihi | Kind regards,

---

**CHARLOTTE MACDONALD**

Associate

027 296 5383

CharlotteM@barker.co.nz

[barker.co.nz](http://barker.co.nz)



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---

**From:** Dali Suljic <[dali.suljic@AucklandCouncil.govt.nz](mailto:dali.suljic@AucklandCouncil.govt.nz)>

**Sent:** Wednesday, 20 May 2026 1:18 pm

**To:** Lachlan Van der Meij <[Lachlan@mckenzieandco.co.nz](mailto:Lachlan@mckenzieandco.co.nz)>

**Cc:** Pranil Wadan <[pranilw@fsconsulting.co.nz](mailto:pranilw@fsconsulting.co.nz)>; Dylan Pope <[dylan@dcs.gen.nz](mailto:dylan@dcs.gen.nz)>; Hillary Johnston <[hillary.johnston@aucklandcouncil.govt.nz](mailto:hillary.johnston@aucklandcouncil.govt.nz)>; Carly Hinde <[carly.hinde@aucklandcouncil.govt.nz](mailto:carly.hinde@aucklandcouncil.govt.nz)>; Charlotte MacDonald <[CharlotteM@barker.co.nz](mailto:CharlotteM@barker.co.nz)>

**Subject:** RE: [#3725] Delmore - Healthy Waters Queries

Hi Lachlan,

Confirming below addresses the remaining concerns under Flood Risk Assessment – Habitable Floors. I've suggested to remove the double-up reference to drawing XX as follows:

*Prior to section 224(c) certification for Stage 1A-1, Stage 1A-2, Stage 1A-3, Stage 1A-4, and Stage 1B-2, the consent holder must, to the satisfaction of Council, design and install the following on the NZTA culvert ~~shown on drawing XX~~:*

- 1. a relief inlet riser **in accordance with drawing XX**; OR*
- 2. an alternative debris control structure.*

*Advice Note:*

*The consent holder is advised to consult with NZTA prior to undertaking any works on the culvert. All necessary approvals, permits, or other authorisations required by NZTA must be obtained directly from NZTA.*

Cheers

**Dali Suljic**

Phone 09 301 0101 | Mobile 021 0845 5043

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**Healthy Waters and Flood Resilience |**

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Auckland Council | Private Bag 92300 | Auckland 1142

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**From:** Lachlan Van der Meij <[Lachlan@mckenzieandco.co.nz](mailto:Lachlan@mckenzieandco.co.nz)>

**Sent:** Wednesday, 20 May 2026 11:52 am

**To:** Dali Suljic <[dali.suljic@AucklandCouncil.govt.nz](mailto:dali.suljic@AucklandCouncil.govt.nz)>

**Cc:** Pranil Wadan <[pranilw@fsconsulting.co.nz](mailto:pranilw@fsconsulting.co.nz)>; Dylan Pope <[dylan@dcs.gen.nz](mailto:dylan@dcs.gen.nz)>; Hillary Johnston <[hillary.johnston@aucklandcouncil.govt.nz](mailto:hillary.johnston@aucklandcouncil.govt.nz)>; Carly Hinde <[carly.hinde@aucklandcouncil.govt.nz](mailto:carly.hinde@aucklandcouncil.govt.nz)>; Charlotte MacDonald <[charlottem@barker.co.nz](mailto:charlottem@barker.co.nz)>

**Subject:** RE: [#3725] Delmore - Healthy Waters Queries

Hi Dali,

Thanks for getting back to us promptly.

Understood on the structures / slopes steeper than 1:3 in the drainage reserve.

The Applicant has confirmed they're happy to accept the proposed condition for the NZTA culvert inlet riser.

*Prior to section 224(c) certification for Stage 1A-1, Stage 1A-2, Stage 1A-3, Stage 1A-4, and Stage 1B-2, the consent holder must, to the satisfaction of Council, design and install the following on the NZTA culvert **shown on drawing XX**:*

- 1. a relief inlet riser **in accordance with drawing XX**; OR*
- 2. an alternative debris control structure.*

*Advice Note:*

*The consent holder is advised to consult with NZTA prior to undertaking any works on the culvert. All necessary approvals, permits, or other authorisations required by NZTA must be obtained directly from NZTA.*

Can you please confirm that this closes out the query relating to Flood Risk Assessment – Habitable Floors.

Thanks,  
Locky

**Lachlan Van der Meij** CPeng (Civil)  
**Senior Civil Engineer**

0211184554

Level 1, 55 Corinthian Drive, Albany, Auckland 0632  
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**From:** Dali Suljic <[dali.suljic@AucklandCouncil.govt.nz](mailto:dali.suljic@AucklandCouncil.govt.nz)>  
**Sent:** Tuesday, 19 May 2026 1:37 pm  
**To:** Lachlan Van der Meij <[Lachlan@mckenzieandco.co.nz](mailto:Lachlan@mckenzieandco.co.nz)>  
**Cc:** Pranil Wadan <[pranilw@fsconsulting.co.nz](mailto:pranilw@fsconsulting.co.nz)>; Dylan Pope <[dylan@dcs.gen.nz](mailto:dylan@dcs.gen.nz)>; Hillary Johnston <[hillary.johnston@aucklandcouncil.govt.nz](mailto:hillary.johnston@aucklandcouncil.govt.nz)>; Carly Hinde <[carly.hinde@aucklandcouncil.govt.nz](mailto:carly.hinde@aucklandcouncil.govt.nz)>  
**Subject:** RE: [#3725] Delmore - Healthy Waters Queries

Hi Lachlan,

Thanks for getting in touch. I've CC'd in Hillary, Dylan and Carly to keep the Council team in the loop.

Please see responses to you queries below:

1. For the purpose of this consent and closing off this item, no further hydraulic modelling will be required. The detailed design of the high-level entry (e.g. size, crest level, etc.) can be resolved at the EPA stage, which may require some further hydraulic design input depending on the final design of the structure. Can you please confirm the Applicant will accept the recommended condition in this

context, or clarify/demonstrate an equivalent outcome can be secured via alternative mechanisms. Healthy Waters preference is also to update the current SMP to capture this decision making and to close the loop on this matter.

- 2a. Although the retaining wall / 1 in 1 slope is located within private land, its main function is to support the maintenance access track. On this basis, although located within private land, the operation and maintenance risk falls onto Healthy Waters and is unlikely to be accepted at EPA in such arrangement
- 2b. This approach is accepted.

Please let me know if you need any further clarifications.

Thanks

**Dali Suljic**

Phone 09 301 0101 | Mobile 021 0845 5043

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**From:** Lachlan Van der Meij <[Lachlan@mckenzieandco.co.nz](mailto:Lachlan@mckenzieandco.co.nz)>

**Sent:** Monday, 18 May 2026 10:28 am

**To:** Dali Suljic <[dali.suljic@AucklandCouncil.govt.nz](mailto:dali.suljic@AucklandCouncil.govt.nz)>

**Cc:** Pranil Wadan <[pranilw@fsconsulting.co.nz](mailto:pranilw@fsconsulting.co.nz)>

**Subject:** [#3725] Delmore - Healthy Waters Queries

Morning Dali,

Let us know if we need to loop in Carly / Hillary or anyone else for this.

We're keen to get some confirmation on two of the outstanding HW comments.

1. **Flood Risk Assessment – Habitable Floors.** Can HW please confirm that if an inlet riser is proposed to the NZTA culvert as per the attached drawing 3725-1-4815 that this comment would be closed out and there would be no additional stormwater modelling required. Pranil is going to contact NZTA this week and get confirmation with them that the principle of this idea is okay with them as well.

|                                                                                                                                                                                                                                             |                                                                                                                                                                                                |                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>Flood Risk Assessment – Habitable Floors</b><br>The flood model and the Flood Risk Assessment are required to be updated to ensure that the assessments are based on the peak flood levels under the existing NZTA culvert full blockage | The models that run the scenarios where NZTA culvert is fully blocked (predevelopment and MPD) have been extended to ensure the peak flood depth is captured. The full extent of the Ara Hills | Th<br>ur<br>pr<br>ap<br>pr |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                           |                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| scenario. In addition, the Flood Risk assessment must reflect the consented landform and finished levels of the Ara Hills development. This is necessary to confirm that flood hazard risk is not increased to the existing consented built environment under the assessed blockage scenario, and to determine whether any additional mitigation measures are required to achieve this outcome, including, but not limited to, the provision of a secondary relief inlet to the existing NZTA culvert. | final consented landform has also been included in these models.<br><br>Flood levels for each scenario have been updated on the cross section drawing 3725-1-4815 and it shows all existing and proposed lots west of the NZTA culvert are above the maximum flood level. | sc<br>ir<br><br>As<br>m<br>cu<br>an<br>Ur<br>ex<br>su<br><br>Tc<br>pr<br>co<br>re<br>alt<br>of<br>pr<br>an |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|

## 2. Operation & Maintenance – Legal Access & Land in Lieu of Reserve – for Drainage Purposes

- a. We are working to remove structures and slopes from the drainage reserves to comply with this comment. We are planning to not propose any retaining or slopes steeper than 1:3 within the proposed drainage reserve, or supporting the proposed public stormwater management device. There are some locations however where the proposed public maintenance access path leading to the proposed stormwater management device is supported by a private retaining wall / 1:1 slope. The supporting structure is within private land and will be maintained privately. Can HW please confirm this is an acceptable approach to address this comment.
- b. There are also some situations where private retaining walls or slopes steeper than 1:3 slopes are proposed up slope of the drainage reserves. It is assumed there is no concern with this approach from HW as the structures are not supporting any of the proposed public HW infrastructure.

| Information Request from Council on the lodged material                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicant Response                                                                                                                                                                                                                                                                                                  | C                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <p><b>Operation and Maintenance – Legal Access</b></p> <p>To resolve concerns regarding legal access to stormwater management devices for operation and maintenance purposes, revised scheme plans are required that locate the devices and all its ancillary elements, including the maintenance access, to be located within the Lieu of Reserve – for Drainage Purposes. In the absence of these changes HWFR may not be able to support acceptance of the stormwater assets for vesting in public ownership.</p> | <p>The following raingardens have been updated to ensure all maintenance can be provided via public access:</p> <ul style="list-style-type: none"> <li>• 03</li> <li>• 05</li> <li>• 11</li> <li>• 23</li> <li>• 25</li> </ul> <p>This will be shown on the scheme plans to be provided to Council on 20 April.</p> | <p>TI<br/>H<br/>sl<br/>Pr<br/>e:<br/>2-<br/>sl<br/>Pr<br/>pl<br/>Si<br/>ve<br/>sh<br/>h:</p> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                     | <p>m<br/>RC<br/>Sh<br/>nc<br/>an<br/>m<br/>st<br/>th<br/>re<br/>Pl:</p>                      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                           |                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <p><b>Land in Lieu of Reserve – for Drainage Purposes</b></p> <p>Revised scheme plans are required to clearly delineate the extent of land proposed to be vested for drainage purposes, demonstrating that the land is limited to that reasonably necessary to accommodate the public stormwater devices and associated access, and excludes disproportionate areas of adjacent stream corridors and riparian batters.</p> <p>In addition, where land is proposed to be vested or transferred to Council, conditions have been recommended that require the Applicant to enter into a sale and purchase agreement with Council for the relevant land no later than the time of application for approval of the survey plans under Section 223 of the RMA. This is necessary to confirm Council’s agreement in principle to the acquisition and to ensure that vesting outcomes are resolved prior to subdivision approval.</p> | <p>Scheme plans have been updated to reduce the area of the proposed drainage reserves to adhere to this request. Where appropriate access to the stream has been maintained along the edge of the devices to ensure that any potential future alteration doesn’t have access issues.</p> | <p>HV<br/>hc<br/>pr<br/>wl</p> <p>HV<br/>th<br/>m:<br/>as<br/>m:<br/>fr<br/>tra<br/>M<br/>Sp</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|

If you’ve got any questions, give us a bell.

Thanks,  
Locky

**Lachlan Van der Meij** CPeng (Civil)  
**Senior Civil Engineer**

0211184554

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## Appendix E – Time of concentration calculations

|             |                                                                             |
|-------------|-----------------------------------------------------------------------------|
| Reference   | 3102                                                                        |
| Client      | Vineway Limited                                                             |
| Project     | Delmore                                                                     |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                          |
| Description | Heterogeneous Time of Concentration - Future Urban Zone Scenario - Combined |

| Revision | Description | Prepared By | Checked By | Approved By |
|----------|-------------|-------------|------------|-------------|
| A        | FIRST ISSUE | HS          |            |             |
|          |             |             |            |             |
|          |             |             |            |             |
|          |             |             |            |             |

| Catchment Label | Catchment Area | Subcatchment 1 | Subcatchment 2 | Equal Area Slope | Catchment Length | Channel Factor | Average Manning (n) | Impervious (Sub C1) | Impervious (Sub C2) | Impervious (Combined) | Soil Type                            | SCS Curve Number | Weighted CN | Ia Method | Ia Weighted (Generic) | Ia Weighted (Waikato) | I <sub>a</sub> weighted (Auckland) | Adopted Ia | Storage S |
|-----------------|----------------|----------------|----------------|------------------|------------------|----------------|---------------------|---------------------|---------------------|-----------------------|--------------------------------------|------------------|-------------|-----------|-----------------------|-----------------------|------------------------------------|------------|-----------|
|                 | ha             | ha             | km2            | m/m              | km               |                |                     | %                   | %                   | %                     |                                      |                  |             |           |                       |                       | mm                                 |            | mm        |
| CMT DEL 1       | 3.87000        | 3.8700         |                | 0.06472          | 0.39884          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 10      | 0.53000        | 0.5300         |                | 0.12919          | 0.19811          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 11      | 0.60000        | 0.6000         |                | 0.11733          | 0.16335          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 12      | 6.09000        | 6.0900         |                | 0.07383          | 0.43844          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 13      | 4.24000        | 4.2400         |                | 0.09815          | 0.54620          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 14      | 7.07000        | 7.0700         |                | 0.07884          | 0.59301          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 15      | 4.70000        | 4.7000         |                | 0.06142          | 0.25904          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 16      | 4.24000        | 4.2400         |                | 0.06415          | 0.54026          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 2       | 3.75000        | 3.7500         |                | 0.04841          | 0.35891          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 3       | 2.80000        | 2.8000         |                | 0.09544          | 0.41876          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 4       | 2.33000        | 2.3300         |                | 0.03635          | 0.41340          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 6       | 3.60000        | 3.6000         |                | 0.05649          | 0.42982          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 8       | 3.20000        | 3.2000         |                | 0.05945          | 0.40152          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT DEL 9       | 7.55000        | 7.5500         |                | 0.09139          | 0.52154          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT PD 0        | 6.46000        | 6.4600         |                | 0.02540          | 0.40751          | 0.8            | 0.06                | 50%                 |                     | 50%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 86.0        | Auckland  | 8.3                   | 2.07                  | 2.50                               | 2.50       | 41        |
| CMT PD 1        | 4.34000        | 4.3400         |                | 0.04833          | 0.57755          | 0.8            | 0.06                | 21%                 |                     | 21%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 79.0        | Auckland  | 13.5                  | 3.37                  | 3.95                               | 3.95       | 67        |
| CMT PD 10       | 10.78000       | 10.7800        |                | 0.04185          | 0.83898          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 11       | 9.89000        | 9.8900         |                | 0.05771          | 0.63199          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT PD 15       | 1.86000        | 1.8600         |                | 0.05355          | 0.43933          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 16       | 1.69000        | 1.6900         |                | 0.06632          | 0.38166          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 17       | 2.17000        | 2.1700         |                | 0.11134          | 0.28501          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 18       | 2.78000        | 2.7800         |                | 0.04155          | 0.60226          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 19       | 2.74000        | 2.7400         |                | 0.06139          | 0.45366          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 2        | 3.09000        | 3.0900         |                | 0.08852          | 0.29499          | 0.8            | 0.06                | 45%                 |                     | 45%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 84.8        | Auckland  | 9.1                   | 2.28                  | 2.75                               | 2.75       | 46        |
| CMT PD 20       | 2.55000        | 2.5500         |                | 0.04046          | 0.46411          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |
| CMT PD 21       | 15.82000       | 15.8200        |                | 0.06510          | 0.71924          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 5.9                   | 1.47                  | 1.75                               | 1.75       | 29        |
| CMT PD 22       | 23.87000       | 23.8700        |                | 0.05340          | 0.73026          | 0.8            | 0.06                | 1%                  |                     | 1%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.2        | Auckland  | 17.6                  | 4.41                  | 4.95                               | 4.95       | 88        |
| CMT PD 23       | 14.72000       | 14.7200        |                | 0.06511          | 0.76769          | 0.8            | 0.06                | 1%                  |                     | 1%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.2        | Auckland  | 17.6                  | 4.41                  | 4.95                               | 4.95       | 88        |
| CMT PD 25       | 24.49000       | 24.4900        |                | 0.03813          | 0.96912          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 17.8                  | 4.46                  | 5.00                               | 5.00       | 89        |

|            |           |          |  |         |         |     |      |     |  |     |                                      |    |      |          |      |      |      |      |    |
|------------|-----------|----------|--|---------|---------|-----|------|-----|--|-----|--------------------------------------|----|------|----------|------|------|------|------|----|
| CMT PD 26  | 4.77000   | 4.7700   |  | 0.04783 | 0.60553 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 27  | 2.44000   | 2.4400   |  | 0.09720 | 0.49009 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 28  | 6.10000   | 6.1000   |  | 0.09668 | 0.43899 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 29  | 1.72000   | 1.7200   |  | 0.12423 | 0.24039 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 3   | 4.21000   | 4.2100   |  | 0.05754 | 0.43543 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 30  | 6.09000   | 6.0900   |  | 0.08040 | 0.62627 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 4   | 33.61000  | 33.6100  |  | 0.03953 | 1.09765 | 0.8 | 0.06 | 50% |  | 50% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 86.0 | Auckland | 8.3  | 2.07 | 2.50 | 2.50 | 41 |
| CMT PD 5   | 2.85000   | 2.8500   |  | 0.14543 | 0.25170 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 6   | 9.83000   | 9.8300   |  | 0.02385 | 0.78206 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 17.8 | 4.46 | 5.00 | 5.00 | 89 |
| CMT PD 7   | 4.00000   | 4.0000   |  | 0.02579 | 0.60685 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT PD 8   | 0.49000   | 0.4900   |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| CMT RG 1   | 0.38000   | 0.3800   |  | 0.01742 | 0.08744 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 17.8 | 4.46 | 5.00 | 5.00 | 89 |
| CTMT ARAS2 | 8.26000   | 8.2600   |  | 0.06134 | 0.70138 | 0.8 | 0.06 | 70% |  | 70% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 90.8 | Auckland | 5.1  | 1.29 | 1.50 | 1.50 | 26 |
| PRE12-1    | 265.36000 | 265.3600 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 50% |  | 50% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 86.0 | Auckland | 8.3  | 2.07 | 2.50 | 2.50 | 41 |
| PRE29-2    | 3.14000   | 3.1400   |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |
| PRE33-1    | 38.04000  | 38.0400  |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 5.9  | 1.47 | 1.75 | 1.75 | 29 |

|             |                                                                              |
|-------------|------------------------------------------------------------------------------|
| Reference   | 3102                                                                         |
| Client      | Vineway Limited                                                              |
| Project     | Delmore                                                                      |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                           |
| Description | Heterogeneous Time of Concentration - Future Urban Zone Scenario - Parameter |

|          |             |             |            |             |
|----------|-------------|-------------|------------|-------------|
| Revision | Description | Prepared By | Checked By | Approved By |
| A        | FIRST ISSUE | HS          |            |             |
|          |             |             |            |             |
|          |             |             |            |             |
|          |             |             |            |             |

| Catchment Label | Catchment Area<br><i>ha</i> | Subcatchment 1<br><i>ha</i> | Subcatchment 2<br><i>km2</i> | Equal Area Slope<br><i>m/m</i> | Catchment Length<br><i>km</i> | Channel Factor | Average Manning<br>(n) | Impervious<br>(Sub C1)<br>% | Impervious<br>(Sub C2)<br>% | Impervious<br>(Combined)<br>% | Soil Type                               | SCS Curve<br>Number | Weighted CN | Ia Method | Adopted Ia | Storage S<br><i>mm</i> |
|-----------------|-----------------------------|-----------------------------|------------------------------|--------------------------------|-------------------------------|----------------|------------------------|-----------------------------|-----------------------------|-------------------------------|-----------------------------------------|---------------------|-------------|-----------|------------|------------------------|
| CMT DEL 1-I     | 0.02516                     | 0.0252                      |                              | 0.06472                        | 0.39884                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 1-P     | 0.01355                     | 0.0135                      |                              | 0.06472                        | 0.39884                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 10-I    | 0.00345                     | 0.0034                      |                              | 0.12919                        | 0.19811                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 10-P    | 0.00186                     | 0.0019                      |                              | 0.12919                        | 0.19811                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 11-I    | 0.00390                     | 0.0039                      |                              | 0.11733                        | 0.16335                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 11-P    | 0.00210                     | 0.0021                      |                              | 0.11733                        | 0.16335                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 12-I    | 0.03959                     | 0.0396                      |                              | 0.07383                        | 0.43844                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 12-P    | 0.02132                     | 0.0213                      |                              | 0.07383                        | 0.43844                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 13-I    | 0.02756                     | 0.0276                      |                              | 0.09815                        | 0.54620                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 13-P    | 0.01484                     | 0.0148                      |                              | 0.09815                        | 0.54620                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 14-I    | 0.04596                     | 0.0460                      |                              | 0.07884                        | 0.59301                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 14-P    | 0.02475                     | 0.0247                      |                              | 0.07884                        | 0.59301                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 15-I    | 0.03055                     | 0.0306                      |                              | 0.06142                        | 0.25904                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 15-P    | 0.01645                     | 0.0165                      |                              | 0.06142                        | 0.25904                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 16-I    | 0.02756                     | 0.0276                      |                              | 0.06415                        | 0.54026                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 16-P    | 0.01484                     | 0.0148                      |                              | 0.06415                        | 0.54026                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 2-I     | 0.02438                     | 0.0244                      |                              | 0.04841                        | 0.35891                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 2-P     | 0.01313                     | 0.0131                      |                              | 0.04841                        | 0.35891                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 3-I     | 0.01820                     | 0.0182                      |                              | 0.09544                        | 0.41876                       | 0.8            | 0.06                   | 100%                        |                             | 100%                          | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 98.0        | Auckland  | 0.00       | 5                      |
| CMT DEL 3-P     | 0.00980                     | 0.0098                      |                              | 0.09544                        | 0.41876                       | 0.8            | 0.06                   | 0%                          |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |

|             |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|-------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT DEL 4-I | 0.01515 | 0.0151 |  | 0.03635 | 0.41340 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT DEL 4-P | 0.00816 | 0.0082 |  | 0.03635 | 0.41340 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT DEL 6-I | 0.02340 | 0.0234 |  | 0.05649 | 0.42982 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT DEL 6-P | 0.01260 | 0.0126 |  | 0.05649 | 0.42982 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT DEL 8-I | 0.02080 | 0.0208 |  | 0.05945 | 0.40152 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT DEL 8-P | 0.01120 | 0.0112 |  | 0.05945 | 0.40152 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT DEL 9-I | 0.04908 | 0.0491 |  | 0.09139 | 0.52154 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT DEL 9-P | 0.02643 | 0.0264 |  | 0.09139 | 0.52154 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 0-I  | 0.03230 | 0.0323 |  | 0.02540 | 0.40751 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 0-P  | 0.03230 | 0.0323 |  | 0.02540 | 0.40751 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 1-I  | 0.00911 | 0.0091 |  | 0.04833 | 0.57755 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 1-P  | 0.03429 | 0.0343 |  | 0.04833 | 0.57755 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 10-I | 0.00001 | 0.0000 |  | 0.04185 | 0.83898 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 10-P | 0.10779 | 0.1078 |  | 0.04185 | 0.83898 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 11-I | 0.06429 | 0.0643 |  | 0.05771 | 0.63199 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 11-P | 0.03462 | 0.0346 |  | 0.05771 | 0.63199 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|             |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|-------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT PD 15-I | 0.00000 | 0.0000 |  | 0.05355 | 0.43933 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 15-P | 0.01860 | 0.0186 |  | 0.05355 | 0.43933 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 16-I | 0.00000 | 0.0000 |  | 0.06632 | 0.38166 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 16-P | 0.01690 | 0.0169 |  | 0.06632 | 0.38166 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 17-I | 0.00000 | 0.0000 |  | 0.11134 | 0.28501 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 17-P | 0.02170 | 0.0217 |  | 0.11134 | 0.28501 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 18-I | 0.00000 | 0.0000 |  | 0.04155 | 0.60226 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 18-P | 0.02780 | 0.0278 |  | 0.04155 | 0.60226 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 19-I | 0.00000 | 0.0000 |  | 0.06139 | 0.45366 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 19-P | 0.02740 | 0.0274 |  | 0.06139 | 0.45366 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 2-I  | 0.01391 | 0.0139 |  | 0.08852 | 0.29499 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 2-P  | 0.01700 | 0.0170 |  | 0.08852 | 0.29499 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 20-I | 0.00000 | 0.0000 |  | 0.04046 | 0.46411 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 20-P | 0.02550 | 0.0255 |  | 0.04046 | 0.46411 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 21-I | 0.10283 | 0.1028 |  | 0.06510 | 0.71924 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 21-P | 0.05537 | 0.0554 |  | 0.06510 | 0.71924 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 22-I | 0.00239 | 0.0024 |  | 0.05340 | 0.73026 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 22-P | 0.23631 | 0.2363 |  | 0.05340 | 0.73026 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 23-I | 0.00147 | 0.0015 |  | 0.06511 | 0.76769 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 23-P | 0.14573 | 0.1457 |  | 0.06511 | 0.76769 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 25-I | 0.00002 | 0.0000 |  | 0.03813 | 0.96912 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 25-P | 0.24488 | 0.2449 |  | 0.03813 | 0.96912 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 26-I | 0.03101 | 0.0310 |  | 0.04783 | 0.60553 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 26-P | 0.01670 | 0.0167 |  | 0.04783 | 0.60553 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 27-I | 0.01586 | 0.0159 |  | 0.09720 | 0.49009 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 27-P | 0.00854 | 0.0085 |  | 0.09720 | 0.49009 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|              |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|--------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT PD 28-I  | 0.03965 | 0.0397 |  | 0.09668 | 0.43899 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 28-P  | 0.02135 | 0.0214 |  | 0.09668 | 0.43899 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 29-I  | 0.01118 | 0.0112 |  | 0.12423 | 0.24039 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 29-P  | 0.00602 | 0.0060 |  | 0.12423 | 0.24039 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 3-I   | 0.02737 | 0.0274 |  | 0.05754 | 0.43543 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 3-P   | 0.01474 | 0.0147 |  | 0.05754 | 0.43543 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 30-I  | 0.03959 | 0.0396 |  | 0.08040 | 0.62627 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 30-P  | 0.02132 | 0.0213 |  | 0.08040 | 0.62627 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 4-I   | 0.16805 | 0.1681 |  | 0.03953 | 1.09765 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 4-P   | 0.16805 | 0.1681 |  | 0.03953 | 1.09765 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 5-I   | 0.01853 | 0.0185 |  | 0.14543 | 0.25170 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 5-P   | 0.00998 | 0.0100 |  | 0.14543 | 0.25170 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 6-I   | 0.00001 | 0.0000 |  | 0.02385 | 0.78206 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 6-P   | 0.09829 | 0.0983 |  | 0.02385 | 0.78206 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 7-I   | 0.02600 | 0.0260 |  | 0.02579 | 0.60685 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 7-P   | 0.01400 | 0.0140 |  | 0.02579 | 0.60685 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 8-I   | 0.00319 | 0.0032 |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 8-P   | 0.00172 | 0.0017 |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT RG 1-I   | 0.00000 | 0.0000 |  | 0.01742 | 0.08744 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT RG 1-P   | 0.00380 | 0.0038 |  | 0.01742 | 0.08744 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CTMT ARAS2-I | 0.05782 | 0.0578 |  | 0.06134 | 0.70138 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CTMT ARAS2-P | 0.02478 | 0.0248 |  | 0.06134 | 0.70138 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE12-1-I    | 1.32680 | 1.3268 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE12-1-P    | 1.32680 | 1.3268 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE29-2-I    | 0.02041 | 0.0204 |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE29-2-P    | 0.01099 | 0.0110 |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE33-1-I    | 0.24726 | 0.2473 |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE33-1-P    | 0.13314 | 0.1331 |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|             |                                                                  |
|-------------|------------------------------------------------------------------|
| Reference   | 3102                                                             |
| Client      | Vineway Limited                                                  |
| Project     | Delmore                                                          |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                               |
| Description | Heterogeneous Time of Concentration - Future Urban Zone Scenario |

|          |             |            |             |
|----------|-------------|------------|-------------|
| Revision | Description | Checked By | Approved By |
| A        | FIRST ISSUE | HS         |             |
|          |             |            |             |
|          |             |            |             |

| Catchment Label | Bransby Williams<br>(Wellington) - Tc | Bransby Williams<br>(Hawkes Bay) - Tc | Bransby Williams<br>(Generic) - Tc | Bransby Williams<br>(Average) - Tc | Ramser Kirpich -<br>Tc | Mannings Kinematic<br>(Building Code E1) - Tc | TP108 - Tc | Average - Tc | Adopted Time of Concentration<br>Method | Time of Concentration | Is there a Minimum Tc<br>Required?      | Specify Minimum Value | Tc Value | Lag Time (2/3 Tc) |
|-----------------|---------------------------------------|---------------------------------------|------------------------------------|------------------------------------|------------------------|-----------------------------------------------|------------|--------------|-----------------------------------------|-----------------------|-----------------------------------------|-----------------------|----------|-------------------|
|                 | Hours                                 | Hours                                 | Hours                              | Hours                              | Hours                  | Hours                                         | Hours      | Hours        | Hours                                   | (Mins)                | Check local/ regional<br>council rules! | Mins                  | (Mins)   | Mins              |
| Use?            | Yes                                   | Yes                                   | Yes                                | Yes                                | Yes                    | Yes                                           | Yes        |              |                                         |                       |                                         |                       |          |                   |
| CMT DEL 1-I     | 0.39                                  | 0.38                                  | 0.38                               | 0.38                               | 0.09                   | 0.50                                          | 0.14       | 0.28         | TP108 - Tc                              | 8.51                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 1-P     | 0.41                                  | 0.40                                  | 0.40                               | 0.41                               | 0.09                   | 0.50                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.16                 | Yes                                     | 10.00                 | 11.16    | 7.44              |
| CMT DEL 10-I    | 0.20                                  | 0.20                                  | 0.20                               | 0.20                               | 0.04                   | 0.34                                          | 0.07       | 0.16         | TP108 - Tc                              | 4.36                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 10-P    | 0.22                                  | 0.21                                  | 0.21                               | 0.21                               | 0.04                   | 0.34                                          | 0.10       | 0.17         | TP108 - Tc                              | 5.72                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 11-I    | 0.17                                  | 0.17                                  | 0.17                               | 0.17                               | 0.04                   | 0.33                                          | 0.07       | 0.15         | TP108 - Tc                              | 3.95                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 11-P    | 0.18                                  | 0.18                                  | 0.18                               | 0.18                               | 0.04                   | 0.33                                          | 0.09       | 0.16         | TP108 - Tc                              | 5.18                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 12-I    | 0.40                                  | 0.39                                  | 0.39                               | 0.39                               | 0.10                   | 0.50                                          | 0.15       | 0.28         | TP108 - Tc                              | 8.71                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 12-P    | 0.42                                  | 0.41                                  | 0.41                               | 0.42                               | 0.10                   | 0.50                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.42                 | Yes                                     | 10.00                 | 11.42    | 7.61              |
| CMT DEL 13-I    | 0.48                                  | 0.47                                  | 0.48                               | 0.48                               | 0.10                   | 0.51                                          | 0.15       | 0.31         | TP108 - Tc                              | 9.25                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 13-P    | 0.51                                  | 0.50                                  | 0.51                               | 0.51                               | 0.10                   | 0.51                                          | 0.20       | 0.33         | TP108 - Tc                              | 12.12                 | Yes                                     | 10.00                 | 12.12    | 8.08              |
| CMT DEL 14-I    | 0.52                                  | 0.51                                  | 0.51                               | 0.51                               | 0.12                   | 0.54                                          | 0.17       | 0.34         | TP108 - Tc                              | 10.43                 | Yes                                     | 10.00                 | 10.43    | 6.95              |
| CMT DEL 14-P    | 0.55                                  | 0.54                                  | 0.54                               | 0.55                               | 0.12                   | 0.54                                          | 0.23       | 0.36         | TP108 - Tc                              | 13.67                 | Yes                                     | 10.00                 | 13.67    | 9.11              |
| CMT DEL 15-I    | 0.25                                  | 0.24                                  | 0.24                               | 0.25                               | 0.07                   | 0.44                                          | 0.11       | 0.21         | TP108 - Tc                              | 6.50                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 15-P    | 0.26                                  | 0.26                                  | 0.26                               | 0.26                               | 0.07                   | 0.44                                          | 0.14       | 0.23         | TP108 - Tc                              | 8.53                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 16-I    | 0.52                                  | 0.51                                  | 0.51                               | 0.51                               | 0.12                   | 0.55                                          | 0.17       | 0.34         | TP108 - Tc                              | 10.43                 | Yes                                     | 10.00                 | 10.43    | 6.95              |
| CMT DEL 16-P    | 0.55                                  | 0.54                                  | 0.54                               | 0.55                               | 0.12                   | 0.55                                          | 0.23       | 0.36         | TP108 - Tc                              | 13.67                 | Yes                                     | 10.00                 | 13.67    | 9.12              |
| CMT DEL 2-I     | 0.37                                  | 0.36                                  | 0.36                               | 0.37                               | 0.10                   | 0.51                                          | 0.14       | 0.28         | TP108 - Tc                              | 8.66                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 2-P     | 0.39                                  | 0.38                                  | 0.39                               | 0.39                               | 0.10                   | 0.51                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.36                 | Yes                                     | 10.00                 | 11.36    | 7.57              |
| CMT DEL 3-I     | 0.39                                  | 0.38                                  | 0.38                               | 0.38                               | 0.08                   | 0.47                                          | 0.13       | 0.27         | TP108 - Tc                              | 7.83                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 3-P     | 0.41                                  | 0.40                                  | 0.41                               | 0.41                               | 0.08                   | 0.47                                          | 0.17       | 0.28         | TP108 - Tc                              | 10.26                 | Yes                                     | 10.00                 | 10.26    | 6.84              |
| CMT DEL 4-I     | 0.47                                  | 0.46                                  | 0.47                               | 0.47                               | 0.12                   | 0.56                                          | 0.17       | 0.33         | TP108 - Tc                              | 10.36                 | Yes                                     | 10.00                 | 10.36    | 6.91              |
| CMT DEL 4-P     | 0.50                                  | 0.49                                  | 0.50                               | 0.50                               | 0.12                   | 0.56                                          | 0.23       | 0.35         | TP108 - Tc                              | 13.59                 | Yes                                     | 10.00                 | 13.59    | 9.06              |
| CMT DEL 6-I     | 0.43                                  | 0.42                                  | 0.42                               | 0.43                               | 0.10                   | 0.52                                          | 0.16       | 0.30         | TP108 - Tc                              | 9.32                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 6-P     | 0.46                                  | 0.45                                  | 0.45                               | 0.45                               | 0.10                   | 0.52                                          | 0.20       | 0.32         | TP108 - Tc                              | 12.21                 | Yes                                     | 10.00                 | 12.21    | 8.14              |
| CMT DEL 8-I     | 0.40                                  | 0.39                                  | 0.40                               | 0.40                               | 0.10                   | 0.51                                          | 0.15       | 0.29         | TP108 - Tc                              | 8.77                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 8-P     | 0.43                                  | 0.42                                  | 0.42                               | 0.42                               | 0.10                   | 0.51                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.50                 | Yes                                     | 10.00                 | 11.50    | 7.67              |
| CMT DEL 9-I     | 0.44                                  | 0.43                                  | 0.43                               | 0.44                               | 0.10                   | 0.51                                          | 0.15       | 0.30         | TP108 - Tc                              | 9.16                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 9-P     | 0.47                                  | 0.46                                  | 0.46                               | 0.46                               | 0.10                   | 0.51                                          | 0.20       | 0.32         | TP108 - Tc                              | 12.01                 | Yes                                     | 10.00                 | 12.01    | 8.01              |
| CMT PD 0-I      | 0.46                                  | 0.45                                  | 0.46                               | 0.46                               | 0.14                   | 0.60                                          | 0.19       | 0.35         | TP108 - Tc                              | 11.43                 | Yes                                     | 10.00                 | 11.43    | 7.62              |
| CMT PD 0-P      | 0.46                                  | 0.45                                  | 0.46                               | 0.46                               | 0.14                   | 0.60                                          | 0.25       | 0.36         | TP108 - Tc                              | 14.99                 | Yes                                     | 10.00                 | 14.99    | 9.99              |
| CMT PD 1-I      | 0.66                                  | 0.64                                  | 0.65                               | 0.65                               | 0.14                   | 0.59                                          | 0.20       | 0.40         | TP108 - Tc                              | 11.87                 | Yes                                     | 10.00                 | 11.87    | 7.91              |
| CMT PD 1-P      | 0.58                                  | 0.56                                  | 0.57                               | 0.57                               | 0.14                   | 0.59                                          | 0.26       | 0.39         | TP108 - Tc                              | 15.56                 | Yes                                     | 10.00                 | 15.56    | 10.37             |
| CMT PD 10-I     | 1.93                                  | 1.88                                  | 1.90                               | 1.90                               | 0.20                   | 0.69                                          | 0.26       | 0.76         | TP108 - Tc                              | 15.85                 | Yes                                     | 10.00                 | 15.85    | 10.57             |
| CMT PD 10-P     | 0.77                                  | 0.75                                  | 0.75                               | 0.76                               | 0.20                   | 0.69                                          | 0.35       | 0.50         | TP108 - Tc                              | 20.78                 | Yes                                     | 10.00                 | 20.78    | 13.85             |
| CMT PD 11-I     | 0.57                                  | 0.56                                  | 0.56                               | 0.56                               | 0.14                   | 0.59                                          | 0.20       | 0.37         | TP108 - Tc                              | 11.94                 | Yes                                     | 10.00                 | 11.94    | 7.96              |
| CMT PD 11-P     | 0.61                                  | 0.59                                  | 0.60                               | 0.60                               | 0.14                   | 0.59                                          | 0.26       | 0.40         | TP108 - Tc                              | 15.65                 | Yes                                     | 10.00                 | 15.65    | 10.44             |
| CMT PD 15-I     | 1.15                                  | 1.12                                  | 1.13                               | 1.13                               | 0.11                   | 0.53                                          | 0.16       | 0.48         | TP108 - Tc                              | 9.61                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 15-P     | 0.46                                  | 0.45                                  | 0.45                               | 0.45                               | 0.11                   | 0.53                                          | 0.21       | 0.33         | TP108 - Tc                              | 12.59                 | Yes                                     | 10.00                 | 12.59    | 8.39              |
| CMT PD 16-I     | 0.96                                  | 0.94                                  | 0.95                               | 0.95                               | 0.09                   | 0.49                                          | 0.14       | 0.42         | TP108 - Tc                              | 8.21                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 16-P     | 0.38                                  | 0.37                                  | 0.38                               | 0.38                               | 0.09                   | 0.49                                          | 0.18       | 0.28         | TP108 - Tc                              | 10.76                 | Yes                                     | 10.00                 | 10.76    | 7.17              |
| CMT PD 17-I     | 0.63                                  | 0.62                                  | 0.62                               | 0.62                               | 0.06                   | 0.40                                          | 0.10       | 0.29         | TP108 - Tc                              | 5.80                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 17-P     | 0.25                                  | 0.25                                  | 0.25                               | 0.25                               | 0.06                   | 0.40                                          | 0.13       | 0.21         | TP108 - Tc                              | 7.60                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 18-I     | 1.59                                  | 1.55                                  | 1.56                               | 1.57                               | 0.15                   | 0.62                                          | 0.21       | 0.64         | TP108 - Tc                              | 12.76                 | Yes                                     | 10.00                 | 12.76    | 8.51              |
| CMT PD 18-P     | 0.63                                  | 0.62                                  | 0.62                               | 0.62                               | 0.15                   | 0.62                                          | 0.28       | 0.42         | TP108 - Tc                              | 16.73                 | Yes                                     | 10.00                 | 16.73    | 11.16             |
| CMT PD 19-I     | 1.11                                  | 1.08                                  | 1.09                               | 1.09                               | 0.11                   | 0.52                                          | 0.16       | 0.47         | TP108 - Tc                              | 9.42                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 19-P     | 0.44                                  | 0.43                                  | 0.43                               | 0.44                               | 0.11                   | 0.52                                          | 0.21       | 0.32         | TP108 - Tc                              | 12.35                 | Yes                                     | 10.00                 | 12.35    | 8.23              |
| CMT PD 2-I      | 0.29                                  | 0.28                                  | 0.28                               | 0.28                               | 0.07                   | 0.42                                          | 0.11       | 0.22         | TP108 - Tc                              | 6.35                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 2-P      | 0.28                                  | 0.27                                  | 0.27                               | 0.28                               | 0.07                   | 0.42                                          | 0.14       | 0.23         | TP108 - Tc                              | 8.33                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 20-I     | 1.24                                  | 1.21                                  | 1.22                               | 1.22                               | 0.13                   | 0.57                                          | 0.18       | 0.53         | TP108 - Tc                              | 10.83                 | Yes                                     | 10.00                 | 10.83    | 7.22              |
| CMT PD 20-P     | 0.49                                  | 0.48                                  | 0.49                               | 0.49                               | 0.13                   | 0.57                                          | 0.24       | 0.36         | TP108 - Tc                              | 14.20                 | Yes                                     | 10.00                 | 14.20    | 9.47              |
| CMT PD 21-I     | 0.61                                  | 0.59                                  | 0.60                               | 0.60                               | 0.15                   | 0.60                                          | 0.21       | 0.39         | TP108 - Tc                              | 12.54                 | Yes                                     | 10.00                 | 12.54    | 8.36              |
| CMT PD 21-P     | 0.64                                  | 0.63                                  | 0.63                               | 0.64                               | 0.15                   | 0.60                                          | 0.27       | 0.41         | TP108 - Tc                              | 16.44                 | Yes                                     | 10.00                 | 16.44    | 10.96             |
| CMT PD 22-I     | 0.93                                  | 0.91                                  | 0.92                               | 0.92                               | 0.16                   | 0.63                                          | 0.22       | 0.48         | TP108 - Tc                              | 13.45                 | Yes                                     | 10.00                 | 13.45    | 8.96              |
| CMT PD 22-P     | 0.59                                  | 0.58                                  | 0.58                               | 0.58                               | 0.16                   | 0.63                                          | 0.29       | 0.42         | TP108 - Tc                              | 17.63                 | Yes                                     | 10.00                 | 17.63    | 11.75             |
| CMT PD 23-I     | 0.99                                  | 0.97                                  | 0.97                               | 0.97                               | 0.15                   | 0.62                                          | 0.22       | 0.49         | TP108 - Tc                              | 13.09                 | Yes                                     | 10.00                 | 13.09    | 8.73              |
| CMT PD 23-P     | 0.62                                  | 0.61                                  | 0.61                               | 0.62                               | 0.15                   | 0.62                                          | 0.29       | 0.42         | TP108 - Tc                              | 17.16                 | Yes                                     | 10.00                 | 17.16    | 11.44             |
| CMT PD 25-I     | 2.09                                  | 2.04                                  | 2.06                               | 2.06                               | 0.23                   | 0.74                                          | 0.30       | 0.83         | TP108 - Tc                              | 17.93                 | Yes                                     | 10.00                 | 17.93    | 11.95             |
| CMT PD 25-P     | 0.83                                  | 0.81                                  | 0.82                               | 0.82                               | 0.23                   | 0.74                                          | 0.39       | 0.55         | TP108 - Tc                              | 23.50                 | Yes                                     | 10.00                 | 23.50    | 15.67             |
| CMT PD 26-I     | 0.61                                  | 0.60                                  | 0.60                               | 0.60                               | 0.15                   | 0.61                                          | 0.20       | 0.39         | TP108 - Tc                              | 12.28                 | Yes                                     | 10.00                 | 12.28    | 8.19              |

|              |      |      |      |      |      |      |      |      |            |       |     |       |       |       |
|--------------|------|------|------|------|------|------|------|------|------------|-------|-----|-------|-------|-------|
| CMT PD 26-P  | 0.65 | 0.64 | 0.64 | 0.64 | 0.15 | 0.61 | 0.27 | 0.42 | TP108 - Tc | 16.10 | Yes | 10.00 | 16.10 | 10.73 |
| CMT PD 27-I  | 0.46 | 0.45 | 0.45 | 0.45 | 0.09 | 0.49 | 0.14 | 0.30 | TP108 - Tc | 8.63  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 27-P  | 0.49 | 0.48 | 0.48 | 0.48 | 0.09 | 0.49 | 0.19 | 0.31 | TP108 - Tc | 11.32 | Yes | 10.00 | 11.32 | 7.55  |
| CMT PD 28-I  | 0.38 | 0.37 | 0.37 | 0.37 | 0.09 | 0.47 | 0.13 | 0.27 | TP108 - Tc | 8.04  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 28-P  | 0.40 | 0.39 | 0.39 | 0.39 | 0.09 | 0.47 | 0.18 | 0.28 | TP108 - Tc | 10.54 | Yes | 10.00 | 10.54 | 7.03  |
| CMT PD 29-I  | 0.22 | 0.22 | 0.22 | 0.22 | 0.05 | 0.37 | 0.08 | 0.18 | TP108 - Tc | 5.01  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 29-P  | 0.24 | 0.23 | 0.23 | 0.23 | 0.05 | 0.37 | 0.11 | 0.19 | TP108 - Tc | 6.57  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 3-I   | 0.43 | 0.42 | 0.42 | 0.42 | 0.11 | 0.52 | 0.16 | 0.30 | TP108 - Tc | 9.35  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 3-P   | 0.46 | 0.45 | 0.45 | 0.45 | 0.11 | 0.52 | 0.20 | 0.32 | TP108 - Tc | 12.25 | Yes | 10.00 | 12.25 | 8.17  |
| CMT PD 30-I  | 0.56 | 0.54 | 0.55 | 0.55 | 0.12 | 0.55 | 0.18 | 0.35 | TP108 - Tc | 10.74 | Yes | 10.00 | 10.74 | 7.16  |
| CMT PD 30-P  | 0.59 | 0.58 | 0.58 | 0.58 | 0.12 | 0.55 | 0.23 | 0.37 | TP108 - Tc | 14.09 | Yes | 10.00 | 14.09 | 9.39  |
| CMT PD 4-I   | 0.97 | 0.95 | 0.96 | 0.96 | 0.25 | 0.77 | 0.32 | 0.57 | TP108 - Tc | 19.26 | Yes | 10.00 | 19.26 | 12.84 |
| CMT PD 4-P   | 0.97 | 0.95 | 0.96 | 0.96 | 0.25 | 0.77 | 0.42 | 0.60 | TP108 - Tc | 25.24 | Yes | 10.00 | 25.24 | 16.83 |
| CMT PD 5-I   | 0.21 | 0.21 | 0.21 | 0.21 | 0.05 | 0.36 | 0.08 | 0.18 | TP108 - Tc | 4.93  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 5-P   | 0.23 | 0.22 | 0.22 | 0.22 | 0.05 | 0.36 | 0.11 | 0.19 | TP108 - Tc | 6.46  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 6-I   | 2.03 | 1.98 | 2.00 | 2.00 | 0.23 | 0.76 | 0.30 | 0.82 | TP108 - Tc | 17.91 | Yes | 10.00 | 17.91 | 11.94 |
| CMT PD 6-P   | 0.81 | 0.79 | 0.79 | 0.80 | 0.23 | 0.76 | 0.39 | 0.54 | TP108 - Tc | 23.48 | Yes | 10.00 | 23.48 | 15.66 |
| CMT PD 7-I   | 0.71 | 0.69 | 0.69 | 0.70 | 0.18 | 0.69 | 0.25 | 0.45 | TP108 - Tc | 14.80 | Yes | 10.00 | 14.80 | 9.87  |
| CMT PD 7-P   | 0.75 | 0.73 | 0.74 | 0.74 | 0.18 | 0.69 | 0.32 | 0.48 | TP108 - Tc | 19.40 | Yes | 10.00 | 19.40 | 12.94 |
| CMT PD 8-I   | 0.09 | 0.09 | 0.09 | 0.09 | 0.02 | 0.25 | 0.04 | 0.10 | TP108 - Tc | 2.46  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 8-P   | 0.10 | 0.10 | 0.10 | 0.10 | 0.02 | 0.25 | 0.05 | 0.11 | TP108 - Tc | 3.23  | Yes | 10.00 | 10.00 | 6.67  |
| CMT RG 1-I   | 0.33 | 0.33 | 0.33 | 0.33 | 0.05 | 0.39 | 0.08 | 0.21 | TP108 - Tc | 4.64  | Yes | 10.00 | 10.00 | 6.67  |
| CMT RG 1-P   | 0.13 | 0.13 | 0.13 | 0.13 | 0.05 | 0.39 | 0.10 | 0.17 | TP108 - Tc | 6.08  | Yes | 10.00 | 10.00 | 6.67  |
| CTMT ARAS2-I | 0.63 | 0.62 | 0.62 | 0.62 | 0.15 | 0.60 | 0.21 | 0.40 | TP108 - Tc | 12.56 | Yes | 10.00 | 12.56 | 8.37  |
| CTMT ARAS2-P | 0.69 | 0.67 | 0.68 | 0.68 | 0.15 | 0.60 | 0.27 | 0.43 | TP108 - Tc | 16.46 | Yes | 10.00 | 16.46 | 10.98 |
| PRE12-1-I    | 2.80 | 2.74 | 2.75 | 2.76 | 0.82 | 1.32 | 0.87 | 1.44 | TP108 - Tc | 52.21 | Yes | 10.00 | 52.21 | 34.81 |
| PRE12-1-P    | 2.80 | 2.74 | 2.75 | 2.76 | 0.82 | 1.32 | 1.14 | 1.51 | TP108 - Tc | 68.45 | Yes | 10.00 | 68.45 | 45.63 |
| PRE29-2-I    | 0.90 | 0.88 | 0.88 | 0.89 | 0.30 | 0.88 | 0.36 | 0.61 | TP108 - Tc | 21.50 | Yes | 10.00 | 21.50 | 14.33 |
| PRE29-2-P    | 0.96 | 0.93 | 0.94 | 0.94 | 0.30 | 0.88 | 0.47 | 0.65 | TP108 - Tc | 28.18 | Yes | 10.00 | 28.18 | 18.79 |
| PRE33-1-I    | 1.47 | 1.43 | 1.44 | 1.45 | 0.43 | 1.00 | 0.50 | 0.84 | TP108 - Tc | 29.92 | Yes | 10.00 | 29.92 | 19.95 |
| PRE33-1-P    | 1.56 | 1.52 | 1.53 | 1.54 | 0.43 | 1.00 | 0.65 | 0.90 | TP108 - Tc | 39.23 | No  |       | 39.23 | 26.15 |

|             |                                                                                 |
|-------------|---------------------------------------------------------------------------------|
| Reference   | 3102                                                                            |
| Client      | Vineway Limited                                                                 |
| Project     | Delmore                                                                         |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                              |
| Description | Heterogeneous Time of Concentration - Masterplan Scenario (Post Dev) - Combined |

|          |             |             |            |             |
|----------|-------------|-------------|------------|-------------|
| Revision | Description | Prepared By | Checked By | Approved By |
| A        | FIRST ISSUE | HS          |            |             |
|          |             |             |            |             |
|          |             |             |            |             |
|          |             |             |            |             |

| Catchment Label | Catchment Area | Subcatchment 1 | Subcatchment 2 | Equal Area Slope | Catchment Length | Channel Factor | Average Manning (n) | Impervious (Sub C1) | Impervious (Sub C2) | Impervious (Combined) | Soil Type                            | SCS Curve Number | Weighted CN | Ia Method | Adopted Ia | Storage S |
|-----------------|----------------|----------------|----------------|------------------|------------------|----------------|---------------------|---------------------|---------------------|-----------------------|--------------------------------------|------------------|-------------|-----------|------------|-----------|
|                 | ha             | ha             | km2            | m/m              | km               |                |                     | %                   | %                   | %                     |                                      |                  |             |           |            | mm        |
| CMT DEL 1       | 3.87000        | 3.8700         |                | 0.06472          | 0.39884          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 10      | 0.53000        | 0.5300         |                | 0.12919          | 0.19811          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 11      | 0.60000        | 0.6000         |                | 0.11733          | 0.16335          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 12      | 6.09000        | 6.0900         |                | 0.07383          | 0.43844          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 13      | 4.24000        | 4.2400         |                | 0.09815          | 0.54620          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 14      | 7.07000        | 7.0700         |                | 0.07884          | 0.59301          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 15      | 4.70000        | 4.7000         |                | 0.06142          | 0.25904          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 16      | 4.24000        | 4.2400         |                | 0.06415          | 0.54026          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 2       | 3.75000        | 3.7500         |                | 0.04841          | 0.35891          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 3       | 2.80000        | 2.8000         |                | 0.09544          | 0.41876          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 4       | 2.33000        | 2.3300         |                | 0.03635          | 0.41340          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 6       | 3.60000        | 3.6000         |                | 0.05649          | 0.42982          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 8       | 3.20000        | 3.2000         |                | 0.05945          | 0.40152          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT DEL 9       | 7.55000        | 7.5500         |                | 0.09139          | 0.52154          | 0.8            | 0.06                | 65%                 |                     | 65%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 89.6        | Auckland  | 1.75       | 29        |
| CMT PD 0        | 6.46000        | 6.4600         |                | 0.02540          | 0.40751          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 1        | 4.34000        | 4.3400         |                | 0.04833          | 0.57755          | 0.8            | 0.06                | 21%                 |                     | 21%                   | Urban Lawns - Type C (Mud/Sandstone) | 74               | 79.0        | Auckland  | 3.95       | 67        |
| CMT PD 10       | 10.78000       | 10.7800        |                | 0.04185          | 0.83898          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 11       | 9.89000        | 9.8900         |                | 0.05771          | 0.63199          | 0.8            | 0.06                | 1%                  |                     | 1%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.3        | Auckland  | 4.93       | 88        |
| CMT PD 15       | 1.86000        | 1.8600         |                | 0.05355          | 0.43933          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 16       | 1.69000        | 1.6900         |                | 0.06632          | 0.38166          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 17       | 2.17000        | 2.1700         |                | 0.11134          | 0.28501          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 18       | 2.78000        | 2.7800         |                | 0.04155          | 0.60226          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 19       | 2.74000        | 2.7400         |                | 0.06139          | 0.45366          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 2        | 3.09000        | 3.0900         |                | 0.08852          | 0.29499          | 0.8            | 0.06                | 6%                  |                     | 6%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 75.4        | Auckland  | 4.70       | 83        |
| CMT PD 20       | 2.55000        | 2.5500         |                | 0.04046          | 0.46411          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 21       | 15.82000       | 15.8200        |                | 0.06510          | 0.71924          | 0.8            | 0.06                | 3%                  |                     | 3%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.7        | Auckland  | 4.85       | 86        |
| CMT PD 22       | 23.87000       | 23.8700        |                | 0.05340          | 0.73026          | 0.8            | 0.06                | 1%                  |                     | 1%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.2        | Auckland  | 4.95       | 88        |
| CMT PD 23       | 14.72000       | 14.7200        |                | 0.06511          | 0.76769          | 0.8            | 0.06                | 1%                  |                     | 1%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.2        | Auckland  | 4.95       | 88        |
| CMT PD 25       | 24.49000       | 24.4900        |                | 0.03813          | 0.96912          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |

|            |           |          |  |         |         |     |      |     |  |     |                                      |    |      |          |      |    |
|------------|-----------|----------|--|---------|---------|-----|------|-----|--|-----|--------------------------------------|----|------|----------|------|----|
| CMT PD 26  | 4.77000   | 4.7700   |  | 0.04783 | 0.60553 | 0.8 | 0.06 | 18% |  | 18% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 78.2 | Auckland | 4.12 | 71 |
| CMT PD 27  | 2.44000   | 2.4400   |  | 0.09720 | 0.49009 | 0.8 | 0.06 | 7%  |  | 7%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 75.7 | Auckland | 4.65 | 82 |
| CMT PD 28  | 6.10000   | 6.1000   |  | 0.09668 | 0.43899 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 29  | 1.72000   | 1.7200   |  | 0.12423 | 0.24039 | 0.8 | 0.06 | 12% |  | 12% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 76.9 | Auckland | 4.40 | 76 |
| CMT PD 3   | 4.21000   | 4.2100   |  | 0.05754 | 0.43543 | 0.8 | 0.06 | 5%  |  | 5%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 75.2 | Auckland | 4.75 | 84 |
| CMT PD 30  | 6.09000   | 6.0900   |  | 0.08040 | 0.62627 | 0.8 | 0.06 | 10% |  | 10% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 76.4 | Auckland | 4.50 | 78 |
| CMT PD 4   | 33.61000  | 33.6100  |  | 0.03953 | 1.09765 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 5   | 2.85000   | 2.8500   |  | 0.14543 | 0.25170 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 6   | 9.83000   | 9.8300   |  | 0.02385 | 0.78206 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 7   | 4.00000   | 4.0000   |  | 0.02579 | 0.60685 | 0.8 | 0.06 | 2%  |  | 2%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.5 | Auckland | 4.90 | 87 |
| CMT PD 8   | 0.49000   | 0.4900   |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT RG 1   | 0.38000   | 0.3800   |  | 0.01742 | 0.08744 | 0.8 | 0.06 | 0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CTMT ARAS2 | 8.26000   | 8.2600   |  | 0.06134 | 0.70138 | 0.8 | 0.06 | 70% |  | 70% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 90.8 | Auckland | 1.50 | 26 |
| PRE12-1    | 265.36000 | 265.3600 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 50% |  | 50% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 86.0 | Auckland | 2.50 | 41 |
| PRE29-2    | 3.14000   | 3.1400   |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 1.75 | 29 |
| PRE33-1    | 38.04000  | 38.0400  |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 65% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 1.75 | 29 |

|             |                                                                                  |
|-------------|----------------------------------------------------------------------------------|
| Reference   | 3102                                                                             |
| Client      | Vineway Limited                                                                  |
| Project     | Delmore                                                                          |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                               |
| Description | Heterogeneous Time of Concentration - Masterplan Scenario (Post Dev) - Parameter |

|          |             |             |            |             |
|----------|-------------|-------------|------------|-------------|
| Revision | Description | Prepared By | Checked By | Approved By |
| A        | FIRST ISSUE | HS          |            |             |
|          |             |             |            |             |
|          |             |             |            |             |
|          |             |             |            |             |

| Catchment Label | Catchment Area | Subcatchment 1 | Subcatchment 2 | Equal Area Slope | Catchment Length | Channel Factor | Average Manning (n) | Impervious (Sub C1) | Impervious (Sub C2) | Impervious (Combined) | Soil Type                            | SCS Curve Number | Weighted CN | Ia Method | Adopted Ia | Storage S |
|-----------------|----------------|----------------|----------------|------------------|------------------|----------------|---------------------|---------------------|---------------------|-----------------------|--------------------------------------|------------------|-------------|-----------|------------|-----------|
|                 | ha             | ha             | km2            | m/m              | km               |                |                     | %                   | %                   | %                     |                                      |                  |             |           |            | mm        |
| CMT DEL 1-I     | 0.02516        | 0.0252         |                | 0.06472          | 0.39884          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 1-P     | 0.01355        | 0.0135         |                | 0.06472          | 0.39884          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 10-I    | 0.00345        | 0.0034         |                | 0.12919          | 0.19811          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 10-P    | 0.00186        | 0.0019         |                | 0.12919          | 0.19811          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 11-I    | 0.00390        | 0.0039         |                | 0.11733          | 0.16335          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 11-P    | 0.00210        | 0.0021         |                | 0.11733          | 0.16335          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 12-I    | 0.03959        | 0.0396         |                | 0.07383          | 0.43844          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 12-P    | 0.02132        | 0.0213         |                | 0.07383          | 0.43844          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 13-I    | 0.02756        | 0.0276         |                | 0.09815          | 0.54620          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 13-P    | 0.01484        | 0.0148         |                | 0.09815          | 0.54620          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 14-I    | 0.04596        | 0.0460         |                | 0.07884          | 0.59301          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 14-P    | 0.02475        | 0.0247         |                | 0.07884          | 0.59301          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 15-I    | 0.03055        | 0.0306         |                | 0.06142          | 0.25904          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 15-P    | 0.01645        | 0.0165         |                | 0.06142          | 0.25904          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 16-I    | 0.02756        | 0.0276         |                | 0.06415          | 0.54026          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 16-P    | 0.01484        | 0.0148         |                | 0.06415          | 0.54026          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 2-I     | 0.02438        | 0.0244         |                | 0.04841          | 0.35891          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 2-P     | 0.01313        | 0.0131         |                | 0.04841          | 0.35891          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 3-I     | 0.01820        | 0.0182         |                | 0.09544          | 0.41876          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 3-P     | 0.00980        | 0.0098         |                | 0.09544          | 0.41876          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 4-I     | 0.01515        | 0.0151         |                | 0.03635          | 0.41340          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 4-P     | 0.00816        | 0.0082         |                | 0.03635          | 0.41340          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 6-I     | 0.02340        | 0.0234         |                | 0.05649          | 0.42982          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 6-P     | 0.01260        | 0.0126         |                | 0.05649          | 0.42982          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 8-I     | 0.02080        | 0.0208         |                | 0.05945          | 0.40152          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 8-P     | 0.01120        | 0.0112         |                | 0.05945          | 0.40152          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 9-I     | 0.04908        | 0.0491         |                | 0.09139          | 0.52154          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 9-P     | 0.02643        | 0.0264         |                | 0.09139          | 0.52154          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 0-I      | 0.00001        | 0.0000         |                | 0.02540          | 0.40751          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |

|             |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|-------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT PD 0-P  | 0.06459 | 0.0646 |  | 0.02540 | 0.40751 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 1-I  | 0.00911 | 0.0091 |  | 0.04833 | 0.57755 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 1-P  | 0.03429 | 0.0343 |  | 0.04833 | 0.57755 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 10-I | 0.00001 | 0.0000 |  | 0.04185 | 0.83898 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 10-P | 0.10779 | 0.1078 |  | 0.04185 | 0.83898 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 11-I | 0.00138 | 0.0014 |  | 0.05771 | 0.63199 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 11-P | 0.09752 | 0.0975 |  | 0.05771 | 0.63199 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 15-I | 0.00000 | 0.0000 |  | 0.05355 | 0.43933 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 15-P | 0.01860 | 0.0186 |  | 0.05355 | 0.43933 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 16-I | 0.00000 | 0.0000 |  | 0.06632 | 0.38166 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 16-P | 0.01690 | 0.0169 |  | 0.06632 | 0.38166 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 17-I | 0.00000 | 0.0000 |  | 0.11134 | 0.28501 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 17-P | 0.02170 | 0.0217 |  | 0.11134 | 0.28501 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 18-I | 0.00000 | 0.0000 |  | 0.04155 | 0.60226 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 18-P | 0.02780 | 0.0278 |  | 0.04155 | 0.60226 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 19-I | 0.00000 | 0.0000 |  | 0.06139 | 0.45366 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 19-P | 0.02740 | 0.0274 |  | 0.06139 | 0.45366 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 2-I  | 0.00185 | 0.0019 |  | 0.08852 | 0.29499 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 2-P  | 0.02905 | 0.0290 |  | 0.08852 | 0.29499 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 20-I | 0.00000 | 0.0000 |  | 0.04046 | 0.46411 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 20-P | 0.02550 | 0.0255 |  | 0.04046 | 0.46411 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 21-I | 0.00475 | 0.0047 |  | 0.06510 | 0.71924 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 21-P | 0.15345 | 0.1535 |  | 0.06510 | 0.71924 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 22-I | 0.00239 | 0.0024 |  | 0.05340 | 0.73026 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 22-P | 0.23631 | 0.2363 |  | 0.05340 | 0.73026 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 23-I | 0.00147 | 0.0015 |  | 0.06511 | 0.76769 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 23-P | 0.14573 | 0.1457 |  | 0.06511 | 0.76769 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 25-I | 0.00002 | 0.0000 |  | 0.03813 | 0.96912 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 25-P | 0.24488 | 0.2449 |  | 0.03813 | 0.96912 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 26-I | 0.00844 | 0.0084 |  | 0.04783 | 0.60553 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 26-P | 0.03926 | 0.0393 |  | 0.04783 | 0.60553 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 27-I | 0.00171 | 0.0017 |  | 0.09720 | 0.49009 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 27-P | 0.02269 | 0.0227 |  | 0.09720 | 0.49009 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 28-I | 0.00001 | 0.0000 |  | 0.09668 | 0.43899 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 28-P | 0.06099 | 0.0610 |  | 0.09668 | 0.43899 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 29-I | 0.00206 | 0.0021 |  | 0.12423 | 0.24039 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 29-P | 0.01514 | 0.0151 |  | 0.12423 | 0.24039 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 3-I  | 0.00211 | 0.0021 |  | 0.05754 | 0.43543 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 3-P  | 0.04000 | 0.0400 |  | 0.05754 | 0.43543 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|              |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|--------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT PD 30-I  | 0.00609 | 0.0061 |  | 0.08040 | 0.62627 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 30-P  | 0.05481 | 0.0548 |  | 0.08040 | 0.62627 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 4-I   | 0.00003 | 0.0000 |  | 0.03953 | 1.09765 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 4-P   | 0.33607 | 0.3361 |  | 0.03953 | 1.09765 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 5-I   | 0.00000 | 0.0000 |  | 0.14543 | 0.25170 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 5-P   | 0.02850 | 0.0285 |  | 0.14543 | 0.25170 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 6-I   | 0.00001 | 0.0000 |  | 0.02385 | 0.78206 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 6-P   | 0.09829 | 0.0983 |  | 0.02385 | 0.78206 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 7-I   | 0.00080 | 0.0008 |  | 0.02579 | 0.60685 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 7-P   | 0.03920 | 0.0392 |  | 0.02579 | 0.60685 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 8-I   | 0.00000 | 0.0000 |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 8-P   | 0.00490 | 0.0049 |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT RG 1-I   | 0.00000 | 0.0000 |  | 0.01742 | 0.08744 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT RG 1-P   | 0.00380 | 0.0038 |  | 0.01742 | 0.08744 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CTMT ARAS2-I | 0.05782 | 0.0578 |  | 0.06134 | 0.70138 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CTMT ARAS2-P | 0.02478 | 0.0248 |  | 0.06134 | 0.70138 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE12-1-I    | 1.32680 | 1.3268 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE12-1-P    | 1.32680 | 1.3268 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE29-2-I    | 0.02041 | 0.0204 |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE29-2-P    | 0.01099 | 0.0110 |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE33-1-I    | 0.24726 | 0.2473 |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE33-1-P    | 0.13314 | 0.1331 |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|             |                                                                      |
|-------------|----------------------------------------------------------------------|
| Reference   | 3102                                                                 |
| Client      | Vineway Limited                                                      |
| Project     | Delmore                                                              |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                   |
| Description | Heterogeneous Time of Concentration - Masterplan Scenario (Post Dev) |

|          |             |            |             |
|----------|-------------|------------|-------------|
| Revision | Description | Checked By | Approved By |
| A        | FIRST ISSUE | HS         |             |
|          |             |            |             |
|          |             |            |             |

| Catchment Label | Bransby Williams<br>(Wellington) - Tc | Bransby Williams<br>(Hawkes Bay) - Tc | Bransby Williams<br>(Generic) -Tc | Bransby Williams<br>(Average) - Tc | Ramser Kirpich -<br>Tc | Mannings Kinematic<br>(Building Code E1) - Tc | TP108 - Tc | Average - Tc | Adopted Time of Concentration<br>Method | Time of Concentration | Is there a Minimum Tc<br>Required?      | Specify Minimum Value | Tc Value | Lag Time (2/3 Tc) |
|-----------------|---------------------------------------|---------------------------------------|-----------------------------------|------------------------------------|------------------------|-----------------------------------------------|------------|--------------|-----------------------------------------|-----------------------|-----------------------------------------|-----------------------|----------|-------------------|
|                 | Hours                                 | Hours                                 | Hours                             | Hours                              | Hours                  | Hours                                         | Hours      | Hours        | Hours                                   | (Mins)                | Check local/ regional<br>council rules! | Mins                  | (Mins)   | Mins              |
| Use?            | Yes                                   | Yes                                   | Yes                               | Yes                                | Yes                    | Yes                                           | Yes        |              |                                         |                       |                                         |                       |          |                   |
| CMT DEL 1-I     | 0.39                                  | 0.38                                  | 0.38                              | 0.38                               | 0.09                   | 0.50                                          | 0.14       | 0.28         | TP108 - Tc                              | 8.51                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 1-P     | 0.41                                  | 0.40                                  | 0.40                              | 0.41                               | 0.09                   | 0.50                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.16                 | Yes                                     | 10.00                 | 11.16    | 7.44              |
| CMT DEL 10-I    | 0.20                                  | 0.20                                  | 0.20                              | 0.20                               | 0.04                   | 0.34                                          | 0.07       | 0.16         | TP108 - Tc                              | 4.36                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 10-P    | 0.22                                  | 0.21                                  | 0.21                              | 0.21                               | 0.04                   | 0.34                                          | 0.10       | 0.17         | TP108 - Tc                              | 5.72                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 11-I    | 0.17                                  | 0.17                                  | 0.17                              | 0.17                               | 0.04                   | 0.33                                          | 0.07       | 0.15         | TP108 - Tc                              | 3.95                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 11-P    | 0.18                                  | 0.18                                  | 0.18                              | 0.18                               | 0.04                   | 0.33                                          | 0.09       | 0.16         | TP108 - Tc                              | 5.18                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 12-I    | 0.40                                  | 0.39                                  | 0.39                              | 0.39                               | 0.10                   | 0.50                                          | 0.15       | 0.28         | TP108 - Tc                              | 8.71                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 12-P    | 0.42                                  | 0.41                                  | 0.41                              | 0.42                               | 0.10                   | 0.50                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.42                 | Yes                                     | 10.00                 | 11.42    | 7.61              |
| CMT DEL 13-I    | 0.48                                  | 0.47                                  | 0.48                              | 0.48                               | 0.10                   | 0.51                                          | 0.15       | 0.31         | TP108 - Tc                              | 9.25                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 13-P    | 0.51                                  | 0.50                                  | 0.51                              | 0.51                               | 0.10                   | 0.51                                          | 0.20       | 0.33         | TP108 - Tc                              | 12.12                 | Yes                                     | 10.00                 | 12.12    | 8.08              |
| CMT DEL 14-I    | 0.52                                  | 0.51                                  | 0.51                              | 0.51                               | 0.12                   | 0.54                                          | 0.17       | 0.34         | TP108 - Tc                              | 10.43                 | Yes                                     | 10.00                 | 10.43    | 6.95              |
| CMT DEL 14-P    | 0.55                                  | 0.54                                  | 0.54                              | 0.55                               | 0.12                   | 0.54                                          | 0.23       | 0.36         | TP108 - Tc                              | 13.67                 | Yes                                     | 10.00                 | 13.67    | 9.11              |
| CMT DEL 15-I    | 0.25                                  | 0.24                                  | 0.24                              | 0.25                               | 0.07                   | 0.44                                          | 0.11       | 0.21         | TP108 - Tc                              | 6.50                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 15-P    | 0.26                                  | 0.26                                  | 0.26                              | 0.26                               | 0.07                   | 0.44                                          | 0.14       | 0.23         | TP108 - Tc                              | 8.53                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 16-I    | 0.52                                  | 0.51                                  | 0.51                              | 0.51                               | 0.12                   | 0.55                                          | 0.17       | 0.34         | TP108 - Tc                              | 10.43                 | Yes                                     | 10.00                 | 10.43    | 6.95              |
| CMT DEL 16-P    | 0.55                                  | 0.54                                  | 0.54                              | 0.55                               | 0.12                   | 0.55                                          | 0.23       | 0.36         | TP108 - Tc                              | 13.67                 | Yes                                     | 10.00                 | 13.67    | 9.12              |
| CMT DEL 2-I     | 0.37                                  | 0.36                                  | 0.36                              | 0.37                               | 0.10                   | 0.51                                          | 0.14       | 0.28         | TP108 - Tc                              | 8.66                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 2-P     | 0.39                                  | 0.38                                  | 0.39                              | 0.39                               | 0.10                   | 0.51                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.36                 | Yes                                     | 10.00                 | 11.36    | 7.57              |
| CMT DEL 3-I     | 0.39                                  | 0.38                                  | 0.38                              | 0.38                               | 0.08                   | 0.47                                          | 0.13       | 0.27         | TP108 - Tc                              | 7.83                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 3-P     | 0.41                                  | 0.40                                  | 0.41                              | 0.41                               | 0.08                   | 0.47                                          | 0.17       | 0.28         | TP108 - Tc                              | 10.26                 | Yes                                     | 10.00                 | 10.26    | 6.84              |
| CMT DEL 4-I     | 0.47                                  | 0.46                                  | 0.47                              | 0.47                               | 0.12                   | 0.56                                          | 0.17       | 0.33         | TP108 - Tc                              | 10.36                 | Yes                                     | 10.00                 | 10.36    | 6.91              |
| CMT DEL 4-P     | 0.50                                  | 0.49                                  | 0.50                              | 0.50                               | 0.12                   | 0.56                                          | 0.23       | 0.35         | TP108 - Tc                              | 13.59                 | Yes                                     | 10.00                 | 13.59    | 9.06              |
| CMT DEL 6-I     | 0.43                                  | 0.42                                  | 0.42                              | 0.43                               | 0.10                   | 0.52                                          | 0.16       | 0.30         | TP108 - Tc                              | 9.32                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 6-P     | 0.46                                  | 0.45                                  | 0.45                              | 0.45                               | 0.10                   | 0.52                                          | 0.20       | 0.32         | TP108 - Tc                              | 12.21                 | Yes                                     | 10.00                 | 12.21    | 8.14              |
| CMT DEL 8-I     | 0.40                                  | 0.39                                  | 0.40                              | 0.40                               | 0.10                   | 0.51                                          | 0.15       | 0.29         | TP108 - Tc                              | 8.77                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 8-P     | 0.43                                  | 0.42                                  | 0.42                              | 0.42                               | 0.10                   | 0.51                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.50                 | Yes                                     | 10.00                 | 11.50    | 7.67              |
| CMT DEL 9-I     | 0.44                                  | 0.43                                  | 0.43                              | 0.44                               | 0.10                   | 0.51                                          | 0.15       | 0.30         | TP108 - Tc                              | 9.16                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 9-P     | 0.47                                  | 0.46                                  | 0.46                              | 0.46                               | 0.10                   | 0.51                                          | 0.20       | 0.32         | TP108 - Tc                              | 12.01                 | Yes                                     | 10.00                 | 12.01    | 8.01              |
| CMT PD 0-I      | 1.09                                  | 1.06                                  | 1.07                              | 1.08                               | 0.14                   | 0.60                                          | 0.19       | 0.50         | TP108 - Tc                              | 11.43                 | Yes                                     | 10.00                 | 11.43    | 7.62              |
| CMT PD 0-P      | 0.43                                  | 0.42                                  | 0.43                              | 0.43                               | 0.14                   | 0.60                                          | 0.25       | 0.35         | TP108 - Tc                              | 14.99                 | Yes                                     | 10.00                 | 14.99    | 9.99              |
| CMT PD 1-I      | 0.66                                  | 0.64                                  | 0.65                              | 0.65                               | 0.14                   | 0.59                                          | 0.20       | 0.40         | TP108 - Tc                              | 11.87                 | Yes                                     | 10.00                 | 11.87    | 7.91              |
| CMT PD 1-P      | 0.58                                  | 0.56                                  | 0.57                              | 0.57                               | 0.14                   | 0.59                                          | 0.26       | 0.39         | TP108 - Tc                              | 15.56                 | Yes                                     | 10.00                 | 15.56    | 10.37             |
| CMT PD 10-I     | 1.93                                  | 1.88                                  | 1.90                              | 1.90                               | 0.20                   | 0.69                                          | 0.26       | 0.76         | TP108 - Tc                              | 15.85                 | Yes                                     | 10.00                 | 15.85    | 10.57             |
| CMT PD 10-P     | 0.77                                  | 0.75                                  | 0.75                              | 0.76                               | 0.20                   | 0.69                                          | 0.35       | 0.50         | TP108 - Tc                              | 20.78                 | Yes                                     | 10.00                 | 20.78    | 13.85             |
| CMT PD 11-I     | 0.84                                  | 0.82                                  | 0.82                              | 0.83                               | 0.14                   | 0.59                                          | 0.20       | 0.44         | TP108 - Tc                              | 11.94                 | Yes                                     | 10.00                 | 11.94    | 7.96              |
| CMT PD 11-P     | 0.55                                  | 0.54                                  | 0.54                              | 0.54                               | 0.14                   | 0.59                                          | 0.26       | 0.38         | TP108 - Tc                              | 15.65                 | Yes                                     | 10.00                 | 15.65    | 10.44             |
| CMT PD 15-I     | 1.15                                  | 1.12                                  | 1.13                              | 1.13                               | 0.11                   | 0.53                                          | 0.16       | 0.48         | TP108 - Tc                              | 9.61                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 15-P     | 0.46                                  | 0.45                                  | 0.45                              | 0.45                               | 0.11                   | 0.53                                          | 0.21       | 0.33         | TP108 - Tc                              | 12.59                 | Yes                                     | 10.00                 | 12.59    | 8.39              |
| CMT PD 16-I     | 0.96                                  | 0.94                                  | 0.95                              | 0.95                               | 0.09                   | 0.49                                          | 0.14       | 0.42         | TP108 - Tc                              | 8.21                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 16-P     | 0.38                                  | 0.37                                  | 0.38                              | 0.38                               | 0.09                   | 0.49                                          | 0.18       | 0.28         | TP108 - Tc                              | 10.76                 | Yes                                     | 10.00                 | 10.76    | 7.17              |
| CMT PD 17-I     | 0.63                                  | 0.62                                  | 0.62                              | 0.62                               | 0.06                   | 0.40                                          | 0.10       | 0.29         | TP108 - Tc                              | 5.80                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 17-P     | 0.25                                  | 0.25                                  | 0.25                              | 0.25                               | 0.06                   | 0.40                                          | 0.13       | 0.21         | TP108 - Tc                              | 7.60                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 18-I     | 1.59                                  | 1.55                                  | 1.56                              | 1.57                               | 0.15                   | 0.62                                          | 0.21       | 0.64         | TP108 - Tc                              | 12.76                 | Yes                                     | 10.00                 | 12.76    | 8.51              |
| CMT PD 18-P     | 0.63                                  | 0.62                                  | 0.62                              | 0.62                               | 0.15                   | 0.62                                          | 0.28       | 0.42         | TP108 - Tc                              | 16.73                 | Yes                                     | 10.00                 | 16.73    | 11.16             |
| CMT PD 19-I     | 1.11                                  | 1.08                                  | 1.09                              | 1.09                               | 0.11                   | 0.52                                          | 0.16       | 0.47         | TP108 - Tc                              | 9.42                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 19-P     | 0.44                                  | 0.43                                  | 0.43                              | 0.44                               | 0.11                   | 0.52                                          | 0.21       | 0.32         | TP108 - Tc                              | 12.35                 | Yes                                     | 10.00                 | 12.35    | 8.23              |
| CMT PD 2-I      | 0.35                                  | 0.34                                  | 0.34                              | 0.34                               | 0.07                   | 0.42                                          | 0.11       | 0.23         | TP108 - Tc                              | 6.35                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 2-P      | 0.26                                  | 0.26                                  | 0.26                              | 0.26                               | 0.07                   | 0.42                                          | 0.14       | 0.22         | TP108 - Tc                              | 8.33                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 20-I     | 1.24                                  | 1.21                                  | 1.22                              | 1.22                               | 0.13                   | 0.57                                          | 0.18       | 0.53         | TP108 - Tc                              | 10.83                 | Yes                                     | 10.00                 | 10.83    | 7.22              |
| CMT PD 20-P     | 0.49                                  | 0.48                                  | 0.49                              | 0.49                               | 0.13                   | 0.57                                          | 0.24       | 0.36         | TP108 - Tc                              | 14.20                 | Yes                                     | 10.00                 | 14.20    | 9.47              |
| CMT PD 21-I     | 0.82                                  | 0.80                                  | 0.81                              | 0.81                               | 0.15                   | 0.60                                          | 0.21       | 0.44         | TP108 - Tc                              | 12.54                 | Yes                                     | 10.00                 | 12.54    | 8.36              |
| CMT PD 21-P     | 0.58                                  | 0.57                                  | 0.57                              | 0.57                               | 0.15                   | 0.60                                          | 0.27       | 0.40         | TP108 - Tc                              | 16.44                 | Yes                                     | 10.00                 | 16.44    | 10.96             |
| CMT PD 22-I     | 0.93                                  | 0.91                                  | 0.92                              | 0.92                               | 0.16                   | 0.63                                          | 0.22       | 0.48         | TP108 - Tc                              | 13.45                 | Yes                                     | 10.00                 | 13.45    | 8.96              |
| CMT PD 22-P     | 0.59                                  | 0.58                                  | 0.58                              | 0.58                               | 0.16                   | 0.63                                          | 0.29       | 0.42         | TP108 - Tc                              | 17.63                 | Yes                                     | 10.00                 | 17.63    | 11.75             |
| CMT PD 23-I     | 0.99                                  | 0.97                                  | 0.97                              | 0.97                               | 0.15                   | 0.62                                          | 0.22       | 0.49         | TP108 - Tc                              | 13.09                 | Yes                                     | 10.00                 | 13.09    | 8.73              |
| CMT PD 23-P     | 0.62                                  | 0.61                                  | 0.61                              | 0.62                               | 0.15                   | 0.62                                          | 0.29       | 0.42         | TP108 - Tc                              | 17.16                 | Yes                                     | 10.00                 | 17.16    | 11.44             |
| CMT PD 25-I     | 2.09                                  | 2.04                                  | 2.06                              | 2.06                               | 0.23                   | 0.74                                          | 0.30       | 0.83         | TP108 - Tc                              | 17.93                 | Yes                                     | 10.00                 | 17.93    | 11.95             |
| CMT PD 25-P     | 0.83                                  | 0.81                                  | 0.82                              | 0.82                               | 0.23                   | 0.74                                          | 0.39       | 0.55         | TP108 - Tc                              | 23.50                 | Yes                                     | 10.00                 | 23.50    | 15.67             |
| CMT PD 26-I     | 0.70                                  | 0.68                                  | 0.68                              | 0.69                               | 0.15                   | 0.61                                          | 0.20       | 0.41         | TP108 - Tc                              | 12.28                 | Yes                                     | 10.00                 | 12.28    | 8.19              |
| CMT PD 26-P     | 0.60                                  | 0.58                                  | 0.59                              | 0.59                               | 0.15                   | 0.61                                          | 0.27       | 0.40         | TP108 - Tc                              | 16.10                 | Yes                                     | 10.00                 | 16.10    | 10.73             |
| CMT PD 27-I     | 0.57                                  | 0.56                                  | 0.56                              | 0.57                               | 0.09                   | 0.49                                          | 0.14       | 0.32         | TP108 - Tc                              | 8.63                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 27-P     | 0.44                                  | 0.43                                  | 0.44                              | 0.44                               | 0.09                   | 0.49                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.32                 | Yes                                     | 10.00                 | 11.32    | 7.55              |
| CMT PD 28-I     | 0.90                                  | 0.88                                  | 0.89                              | 0.89                               | 0.09                   | 0.47                                          | 0.13       | 0.40         | TP108 - Tc                              | 8.04                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 28-P     | 0.36                                  | 0.35                                  | 0.35                              | 0.35                               | 0.09                   | 0.47                                          | 0.18       | 0.27         | TP108 - Tc                              | 10.54                 | Yes                                     | 10.00                 | 10.54    | 7.03              |
| CMT PD 29-I     | 0.26                                  | 0.26                                  | 0.26                              | 0.26                               | 0.05                   | 0.37                                          | 0.08       | 0.19         | TP108 - Tc                              | 5.01                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 29-P     | 0.22                                  | 0.21                                  | 0.21                              | 0.21                               | 0.05                   | 0.37                                          | 0.11       | 0.19         | TP108 - Tc                              | 6.57                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 3-I      | 0.55                                  | 0.54                                  | 0.54                              | 0.55                               | 0.11                   | 0.52                                          | 0.16       | 0.33         | TP108 - Tc                              | 9.35                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 3-P      | 0.41                                  | 0.40                                  | 0.41                              | 0.41                               | 0.11                   | 0.52                                          | 0.20       | 0.31         | TP108 - Tc                              | 12.25                 | Yes                                     | 10.00                 | 12.25    | 8.17              |
| CMT PD 30-I     | 0.67                                  | 0.66                                  | 0.66                              | 0.66                               | 0.12                   | 0.55                                          | 0.18       | 0.38         | TP108 - Tc                              | 10.74                 | Yes                                     | 10.00                 | 10.74    | 7.16              |
| CMT PD 30-P     | 0.54                                  | 0.53                                  | 0.53                              | 0.53                               | 0.12                   | 0.55                                          | 0.23       | 0.36         | TP108 - Tc                              | 14.09                 | Yes                                     | 10.00                 | 14.09    | 9.39              |

|              |      |      |      |      |      |      |      |      |            |       |     |       |       |       |
|--------------|------|------|------|------|------|------|------|------|------------|-------|-----|-------|-------|-------|
| CMT PD 4-I   | 2.28 | 2.23 | 2.24 | 2.25 | 0.25 | 0.77 | 0.32 | 0.90 | TP108 - Tc | 19.26 | Yes | 10.00 | 19.26 | 12.84 |
| CMT PD 4-P   | 0.91 | 0.89 | 0.89 | 0.89 | 0.25 | 0.77 | 0.42 | 0.58 | TP108 - Tc | 25.24 | Yes | 10.00 | 25.24 | 16.83 |
| CMT PD 5-I   | 0.51 | 0.50 | 0.51 | 0.51 | 0.05 | 0.36 | 0.08 | 0.25 | TP108 - Tc | 4.93  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 5-P   | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.36 | 0.11 | 0.18 | TP108 - Tc | 6.46  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 6-I   | 2.03 | 1.98 | 2.00 | 2.00 | 0.23 | 0.76 | 0.30 | 0.82 | TP108 - Tc | 17.91 | Yes | 10.00 | 17.91 | 11.94 |
| CMT PD 6-P   | 0.81 | 0.79 | 0.79 | 0.80 | 0.23 | 0.76 | 0.39 | 0.54 | TP108 - Tc | 23.48 | Yes | 10.00 | 23.48 | 15.66 |
| CMT PD 7-I   | 1.00 | 0.98 | 0.98 | 0.99 | 0.18 | 0.69 | 0.25 | 0.53 | TP108 - Tc | 14.80 | Yes | 10.00 | 14.80 | 9.87  |
| CMT PD 7-P   | 0.68 | 0.66 | 0.67 | 0.67 | 0.18 | 0.69 | 0.32 | 0.47 | TP108 - Tc | 19.40 | Yes | 10.00 | 19.40 | 12.94 |
| CMT PD 8-I   | 0.23 | 0.22 | 0.22 | 0.22 | 0.02 | 0.25 | 0.04 | 0.13 | TP108 - Tc | 2.46  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 8-P   | 0.09 | 0.09 | 0.09 | 0.09 | 0.02 | 0.25 | 0.05 | 0.10 | TP108 - Tc | 3.23  | Yes | 10.00 | 10.00 | 6.67  |
| CMT RG 1-I   | 0.33 | 0.33 | 0.33 | 0.33 | 0.05 | 0.39 | 0.08 | 0.21 | TP108 - Tc | 4.64  | Yes | 10.00 | 10.00 | 6.67  |
| CMT RG 1-P   | 0.13 | 0.13 | 0.13 | 0.13 | 0.05 | 0.39 | 0.10 | 0.17 | TP108 - Tc | 6.08  | Yes | 10.00 | 10.00 | 6.67  |
| CTMT ARAS2-I | 0.63 | 0.62 | 0.62 | 0.62 | 0.15 | 0.60 | 0.21 | 0.40 | TP108 - Tc | 12.56 | Yes | 10.00 | 12.56 | 8.37  |
| CTMT ARAS2-P | 0.69 | 0.67 | 0.68 | 0.68 | 0.15 | 0.60 | 0.27 | 0.43 | TP108 - Tc | 16.46 | Yes | 10.00 | 16.46 | 10.98 |
| PRE12-1-I    | 2.80 | 2.74 | 2.75 | 2.76 | 0.82 | 1.32 | 0.87 | 1.44 | TP108 - Tc | 52.21 | Yes | 10.00 | 52.21 | 34.81 |
| PRE12-1-P    | 2.80 | 2.74 | 2.75 | 2.76 | 0.82 | 1.32 | 1.14 | 1.51 | TP108 - Tc | 68.45 | Yes | 10.00 | 68.45 | 45.63 |
| PRE29-2-I    | 0.90 | 0.88 | 0.88 | 0.89 | 0.30 | 0.88 | 0.36 | 0.61 | TP108 - Tc | 21.50 | Yes | 10.00 | 21.50 | 14.33 |
| PRE29-2-P    | 0.96 | 0.93 | 0.94 | 0.94 | 0.30 | 0.88 | 0.47 | 0.65 | TP108 - Tc | 28.18 | Yes | 10.00 | 28.18 | 18.79 |
| PRE33-1-I    | 1.47 | 1.43 | 1.44 | 1.45 | 0.43 | 1.00 | 0.50 | 0.84 | TP108 - Tc | 29.92 | Yes | 10.00 | 29.92 | 19.95 |
| PRE33-1-P    | 1.56 | 1.52 | 1.53 | 1.54 | 0.43 | 1.00 | 0.65 | 0.90 | TP108 - Tc | 39.23 | Yes | 10.00 | 39.23 | 26.15 |

|             |                                                                           |
|-------------|---------------------------------------------------------------------------|
| Reference   | 3102                                                                      |
| Client      | Vineway Limited                                                           |
| Project     | Delmore                                                                   |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                        |
| Description | Heterogeneous Time of Concentration - PRE DEVELOPMENT Scenario - COMBINED |

|          |             |             |            |             |
|----------|-------------|-------------|------------|-------------|
| Revision | Description | Prepared By | Checked By | Approved By |
| A        | FIRST ISSUE | HS          |            |             |
|          |             |             |            |             |
|          |             |             |            |             |
|          |             |             |            |             |

| Catchment Label | Catchment Area<br><i>ha</i> | Subcatchment 1<br><i>ha</i> | Subcatchment 2<br><i>km2</i> | Equal Area Slope<br><i>m/m</i> | Catchment Length<br><i>km</i> | Channel Factor | Average Manning<br>(n) | Impervious<br>(Sub C1)<br>% | Impervious<br>(Sub C2)<br>% | Impervious<br>(Combined)<br>% | Soil Type                               | SCS Curve<br>Number | Weighted CN | Ia Method | Adopted Ia | Storage S<br><i>mm</i> |
|-----------------|-----------------------------|-----------------------------|------------------------------|--------------------------------|-------------------------------|----------------|------------------------|-----------------------------|-----------------------------|-------------------------------|-----------------------------------------|---------------------|-------------|-----------|------------|------------------------|
| CMT DEL 1       | 3.87000                     | 3.8700                      |                              | 0.15525                        | 0.21330                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 10      | 0.53000                     | 0.5300                      |                              | 0.11265                        | 0.08270                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 11      | 0.60000                     | 0.6000                      |                              | 0.11733                        | 0.16335                       | 0.8            | 0.06                   | 7.0%                        |                             | 7%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 75.7        | Auckland  | 4.65       | 82                     |
| CMT DEL 12      | 6.09000                     | 6.0900                      |                              | 0.18798                        | 0.23660                       | 0.8            | 0.06                   | 6.0%                        |                             | 6%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 75.4        | Auckland  | 4.70       | 83                     |
| CMT DEL 13      | 4.24000                     | 4.2400                      |                              | 0.21472                        | 0.22136                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 14      | 7.07000                     | 7.0700                      |                              | 0.18252                        | 0.18100                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 15      | 4.70000                     | 4.7000                      |                              | 0.21747                        | 0.12758                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 16      | 4.24000                     | 4.2400                      |                              | 0.12435                        | 0.15783                       | 0.8            | 0.06                   | 4.5%                        |                             | 5%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 75.1        | Auckland  | 4.78       | 84                     |
| CMT DEL 2       | 3.75000                     | 3.7500                      |                              | 0.16252                        | 0.11942                       | 0.8            | 0.06                   | 6.0%                        |                             | 6%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 75.4        | Auckland  | 4.70       | 83                     |
| CMT DEL 3       | 2.80000                     | 2.8000                      |                              | 0.16757                        | 0.13893                       | 0.8            | 0.06                   | 3.0%                        |                             | 3%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.7        | Auckland  | 4.85       | 86                     |
| CMT DEL 4       | 2.33000                     | 2.3300                      |                              | 0.13179                        | 0.13879                       | 0.8            | 0.06                   | 3.0%                        |                             | 3%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.7        | Auckland  | 4.85       | 86                     |
| CMT DEL 6       | 3.60000                     | 3.6000                      |                              | 0.10920                        | 0.22020                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 8       | 3.20000                     | 3.2000                      |                              | 0.09967                        | 0.20564                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT DEL 9       | 7.55000                     | 7.5500                      |                              | 0.23041                        | 0.17002                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 0        | 6.46000                     | 6.4600                      |                              | 0.03157                        | 0.40181                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 1        | 4.34000                     | 4.3400                      |                              | 0.04830                        | 0.57684                       | 0.8            | 0.06                   | 21.0%                       |                             | 21%                           | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 79.0        | Auckland  | 3.95       | 67                     |
| CMT PD 10       | 10.78000                    | 10.7800                     |                              | 0.04182                        | 0.83869                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 11       | 9.89000                     | 9.8900                      |                              | 0.05772                        | 0.63411                       | 0.8            | 0.06                   | 1.4%                        |                             | 1%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.3        | Auckland  | 4.93       | 88                     |
| CMT PD 15       | 1.86000                     | 1.8600                      |                              | 0.05370                        | 0.43302                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 16       | 1.69000                     | 1.6900                      |                              | 0.06374                        | 0.35936                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 17       | 2.17000                     | 2.1700                      |                              | 0.11565                        | 0.30654                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 18       | 2.78000                     | 2.7800                      |                              | 0.04192                        | 0.59976                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 19       | 2.74000                     | 2.7400                      |                              | 0.06170                        | 0.45416                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 2        | 3.09000                     | 3.0900                      |                              | 0.08937                        | 0.29691                       | 0.8            | 0.06                   | 6.0%                        |                             | 6%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 75.4        | Auckland  | 4.70       | 83                     |
| CMT PD 20       | 2.55000                     | 2.5500                      |                              | 0.03540                        | 0.44888                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |
| CMT PD 21       | 15.82000                    | 15.8200                     |                              | 0.06497                        | 0.72036                       | 0.8            | 0.06                   | 3.0%                        |                             | 3%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.7        | Auckland  | 4.85       | 86                     |
| CMT PD 22       | 23.87000                    | 23.8700                     |                              | 0.05337                        | 0.72960                       | 0.8            | 0.06                   | 1.0%                        |                             | 1%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.2        | Auckland  | 4.95       | 88                     |
| CMT PD 23       | 14.72000                    | 14.7200                     |                              | 0.06517                        | 0.76835                       | 0.8            | 0.06                   | 1.0%                        |                             | 1%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.2        | Auckland  | 4.95       | 88                     |
| CMT PD 25       | 24.49000                    | 24.4900                     |                              | 0.03873                        | 0.96821                       | 0.8            | 0.06                   | 0.0%                        |                             | 0%                            | Urban Lawns - Type C<br>(Mud/Sandstone) | 74                  | 74.0        | Auckland  | 5.00       | 89                     |

|            |           |          |  |         |         |     |      |       |  |     |                                      |    |      |          |      |    |
|------------|-----------|----------|--|---------|---------|-----|------|-------|--|-----|--------------------------------------|----|------|----------|------|----|
| CMT PD 26  | 4.77000   | 4.7700   |  | 0.04865 | 0.59558 | 0.8 | 0.06 | 17.7% |  | 18% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 78.2 | Auckland | 4.12 | 71 |
| CMT PD 27  | 2.44000   | 2.4400   |  | 0.09711 | 0.49055 | 0.8 | 0.06 | 7.0%  |  | 7%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 75.7 | Auckland | 4.65 | 82 |
| CMT PD 28  | 6.10000   | 6.1000   |  | 0.09520 | 0.44465 | 0.8 | 0.06 | 0.0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 29  | 1.72000   | 1.7200   |  | 0.12452 | 0.23975 | 0.8 | 0.06 | 12.0% |  | 12% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 76.9 | Auckland | 4.40 | 76 |
| CMT PD 3   | 4.21000   | 4.2100   |  | 0.06118 | 0.42936 | 0.8 | 0.06 | 5.0%  |  | 5%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 75.2 | Auckland | 4.75 | 84 |
| CMT PD 30  | 6.09000   | 6.0900   |  | 0.07770 | 0.59209 | 0.8 | 0.06 | 10.0% |  | 10% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 76.4 | Auckland | 4.50 | 78 |
| CMT PD 4   | 33.61000  | 33.6100  |  | 0.04189 | 1.06261 | 0.8 | 0.06 | 0.0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 5   | 2.85000   | 2.8500   |  | 0.14612 | 0.25162 | 0.8 | 0.06 | 0.0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 6   | 9.83000   | 9.8300   |  | 0.02213 | 0.73994 | 0.8 | 0.06 | 0.0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 7   | 4.00000   | 4.0000   |  | 0.02570 | 0.60831 | 0.8 | 0.06 | 2.0%  |  | 2%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.5 | Auckland | 4.90 | 87 |
| CMT PD 8   | 0.49000   | 0.4900   |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 0.0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT RG 1   | 0.38000   | 0.3800   |  | 0.14165 | 0.05995 | 0.8 | 0.06 | 0.0%  |  | 0%  | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CTMT ARAS2 | 8.26000   | 8.2600   |  | 0.06127 | 0.70279 | 0.8 | 0.06 | 65.0% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 1.75 | 29 |
| PRE12-1    | 265.36000 | 265.3600 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 50.0% |  | 50% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 86.0 | Auckland | 2.50 | 41 |
| PRE29-2    | 3.14000   | 3.1400   |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 65.0% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 1.75 | 29 |
| PRE33-1    | 38.04000  | 38.0400  |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 65.0% |  | 65% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 89.6 | Auckland | 1.75 | 29 |

|             |                                                                   |
|-------------|-------------------------------------------------------------------|
| Reference   | 3102                                                              |
| Client      | Vineway Limited                                                   |
| Project     | Delmore                                                           |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                                |
| Description | Heterogeneous Time of Concentration - PRE DEVELOPMENT - Parameter |

|          |  |             |             |            |             |
|----------|--|-------------|-------------|------------|-------------|
| Revision |  | Description | Prepared By | Checked By | Approved By |
|          |  |             |             |            |             |
|          |  |             |             |            |             |
|          |  |             |             |            |             |
|          |  |             |             |            |             |

| Catchment Label | Catchment Area | Subcatchment 1 | Subcatchment 2 | Equal Area Slope | Catchment Length | Channel Factor | Average Manning (n) | Impervious (Sub C1) | Impervious (Sub C2) | Impervious (Combined) | Soil Type                            | SCS Curve Number | Weighted CN | Ia Method | Adopted Ia | Storage S |
|-----------------|----------------|----------------|----------------|------------------|------------------|----------------|---------------------|---------------------|---------------------|-----------------------|--------------------------------------|------------------|-------------|-----------|------------|-----------|
|                 | ha             | ha             | km2            | m/m              | km               |                |                     | %                   | %                   | %                     |                                      |                  |             |           |            | mm        |
| CMT DEL 1-I     | 0.00000        | 0.0000         |                | 0.15525          | 0.21330          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 1-P     | 0.03870        | 0.0387         |                | 0.15525          | 0.21330          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 10-I    | 0.00000        | 0.0000         |                | 0.11265          | 0.08270          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 10-P    | 0.00530        | 0.0053         |                | 0.11265          | 0.08270          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 11-I    | 0.00042        | 0.0004         |                | 0.11733          | 0.16335          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 11-P    | 0.00558        | 0.0056         |                | 0.11733          | 0.16335          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 12-I    | 0.00365        | 0.0037         |                | 0.18798          | 0.23660          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 12-P    | 0.05725        | 0.0572         |                | 0.18798          | 0.23660          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 13-I    | 0.00000        | 0.0000         |                | 0.21472          | 0.22136          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 13-P    | 0.04240        | 0.0424         |                | 0.21472          | 0.22136          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 14-I    | 0.00001        | 0.0000         |                | 0.18252          | 0.18100          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 14-P    | 0.07069        | 0.0707         |                | 0.18252          | 0.18100          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 15-I    | 0.00000        | 0.0000         |                | 0.21747          | 0.12758          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 15-P    | 0.04700        | 0.0470         |                | 0.21747          | 0.12758          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 16-I    | 0.00191        | 0.0019         |                | 0.12435          | 0.15783          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 16-P    | 0.04049        | 0.0405         |                | 0.12435          | 0.15783          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 2-I     | 0.00225        | 0.0023         |                | 0.16252          | 0.11942          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 2-P     | 0.03525        | 0.0353         |                | 0.16252          | 0.11942          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 3-I     | 0.00084        | 0.0008         |                | 0.16757          | 0.13893          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 3-P     | 0.02716        | 0.0272         |                | 0.16757          | 0.13893          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 4-I     | 0.00070        | 0.0007         |                | 0.13179          | 0.13879          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 4-P     | 0.02260        | 0.0226         |                | 0.13179          | 0.13879          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 6-I     | 0.00000        | 0.0000         |                | 0.10920          | 0.22020          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 6-P     | 0.03600        | 0.0360         |                | 0.10920          | 0.22020          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 8-I     | 0.00000        | 0.0000         |                | 0.09967          | 0.20564          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 8-P     | 0.03200        | 0.0320         |                | 0.09967          | 0.20564          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT DEL 9-I     | 0.00001        | 0.0000         |                | 0.23041          | 0.17002          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |
| CMT DEL 9-P     | 0.07549        | 0.0755         |                | 0.23041          | 0.17002          | 0.8            | 0.06                | 0%                  |                     | 0%                    | Urban Lawns - Type C (Mud/Sandstone) | 74               | 74.0        | Auckland  | 5.00       | 89        |
| CMT PD 0-I      | 0.00001        | 0.0000         |                | 0.03157          | 0.40181          | 0.8            | 0.06                | 100%                |                     | 100%                  | Urban Lawns - Type C (Mud/Sandstone) | 74               | 98.0        | Auckland  | 0.00       | 5         |

|             |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|-------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT PD 0-P  | 0.06459 | 0.0646 |  | 0.03157 | 0.40181 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 1-I  | 0.00911 | 0.0091 |  | 0.04830 | 0.57684 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 1-P  | 0.03429 | 0.0343 |  | 0.04830 | 0.57684 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 10-I | 0.00001 | 0.0000 |  | 0.04182 | 0.83869 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 10-P | 0.10779 | 0.1078 |  | 0.04182 | 0.83869 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 11-I | 0.00138 | 0.0014 |  | 0.05772 | 0.63411 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 11-P | 0.09752 | 0.0975 |  | 0.05772 | 0.63411 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 15-I | 0.00000 | 0.0000 |  | 0.05370 | 0.43302 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 15-P | 0.01860 | 0.0186 |  | 0.05370 | 0.43302 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 16-I | 0.00000 | 0.0000 |  | 0.06374 | 0.35936 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 16-P | 0.01690 | 0.0169 |  | 0.06374 | 0.35936 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 17-I | 0.00000 | 0.0000 |  | 0.11565 | 0.30654 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 17-P | 0.02170 | 0.0217 |  | 0.11565 | 0.30654 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 18-I | 0.00000 | 0.0000 |  | 0.04192 | 0.59976 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 18-P | 0.02780 | 0.0278 |  | 0.04192 | 0.59976 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 19-I | 0.00000 | 0.0000 |  | 0.06170 | 0.45416 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 19-P | 0.02740 | 0.0274 |  | 0.06170 | 0.45416 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 2-I  | 0.00185 | 0.0019 |  | 0.08937 | 0.29691 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 2-P  | 0.02905 | 0.0290 |  | 0.08937 | 0.29691 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 20-I | 0.00000 | 0.0000 |  | 0.03540 | 0.44888 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 20-P | 0.02550 | 0.0255 |  | 0.03540 | 0.44888 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 21-I | 0.00475 | 0.0047 |  | 0.06497 | 0.72036 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 21-P | 0.15345 | 0.1535 |  | 0.06497 | 0.72036 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 22-I | 0.00239 | 0.0024 |  | 0.05337 | 0.72960 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 22-P | 0.23631 | 0.2363 |  | 0.05337 | 0.72960 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 23-I | 0.00147 | 0.0015 |  | 0.06517 | 0.76835 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 23-P | 0.14573 | 0.1457 |  | 0.06517 | 0.76835 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 25-I | 0.00002 | 0.0000 |  | 0.03873 | 0.96821 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 25-P | 0.24488 | 0.2449 |  | 0.03873 | 0.96821 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 26-I | 0.00844 | 0.0084 |  | 0.04865 | 0.59558 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 26-P | 0.03926 | 0.0393 |  | 0.04865 | 0.59558 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 27-I | 0.00171 | 0.0017 |  | 0.09711 | 0.49055 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 27-P | 0.02269 | 0.0227 |  | 0.09711 | 0.49055 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 28-I | 0.00001 | 0.0000 |  | 0.09520 | 0.44465 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 28-P | 0.06099 | 0.0610 |  | 0.09520 | 0.44465 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 29-I | 0.00206 | 0.0021 |  | 0.12452 | 0.23975 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 29-P | 0.01514 | 0.0151 |  | 0.12452 | 0.23975 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 3-I  | 0.00211 | 0.0021 |  | 0.06118 | 0.42936 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 3-P  | 0.04000 | 0.0400 |  | 0.06118 | 0.42936 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|              |         |        |  |         |         |     |      |      |  |      |                                      |    |      |          |      |    |
|--------------|---------|--------|--|---------|---------|-----|------|------|--|------|--------------------------------------|----|------|----------|------|----|
| CMT PD 30-I  | 0.00609 | 0.0061 |  | 0.07770 | 0.59209 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 30-P  | 0.05481 | 0.0548 |  | 0.07770 | 0.59209 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 4-I   | 0.00003 | 0.0000 |  | 0.04189 | 1.06261 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 4-P   | 0.33607 | 0.3361 |  | 0.04189 | 1.06261 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 5-I   | 0.00000 | 0.0000 |  | 0.14612 | 0.25162 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 5-P   | 0.02850 | 0.0285 |  | 0.14612 | 0.25162 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 6-I   | 0.00001 | 0.0000 |  | 0.02213 | 0.73994 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 6-P   | 0.09829 | 0.0983 |  | 0.02213 | 0.73994 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 7-I   | 0.00080 | 0.0008 |  | 0.02570 | 0.60831 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 7-P   | 0.03920 | 0.0392 |  | 0.02570 | 0.60831 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT PD 8-I   | 0.00000 | 0.0000 |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT PD 8-P   | 0.00490 | 0.0049 |  | 0.17761 | 0.09624 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CMT RG 1-I   | 0.00000 | 0.0000 |  | 0.14165 | 0.05995 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CMT RG 1-P   | 0.00380 | 0.0038 |  | 0.14165 | 0.05995 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| CTMT ARAS2-I | 0.05369 | 0.0537 |  | 0.06127 | 0.70279 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| CTMT ARAS2-P | 0.02891 | 0.0289 |  | 0.06127 | 0.70279 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE12-1-I    | 1.32680 | 1.3268 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE12-1-P    | 1.32680 | 1.3268 |  | 0.01503 | 3.20587 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE29-2-I    | 0.02041 | 0.0204 |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE29-2-P    | 0.01099 | 0.0110 |  | 0.00657 | 0.57385 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |
| PRE33-1-I    | 0.24726 | 0.2473 |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 100% |  | 100% | Urban Lawns - Type C (Mud/Sandstone) | 74 | 98.0 | Auckland | 0.00 | 5  |
| PRE33-1-P    | 0.13314 | 0.1331 |  | 0.01677 | 1.44962 | 0.8 | 0.06 | 0%   |  | 0%   | Urban Lawns - Type C (Mud/Sandstone) | 74 | 74.0 | Auckland | 5.00 | 89 |

|             |                                                                |
|-------------|----------------------------------------------------------------|
| Reference   | 3102                                                           |
| Client      | Vineway Limited                                                |
| Project     | Delmore                                                        |
| Address     | 53A, 53 B & 55 Russell Road, Orewa                             |
| Description | Heterogeneous Time of Concentration - PRE DEVELOPMENT - OUTPUT |

|          |             |            |             |
|----------|-------------|------------|-------------|
| Revision | Description | Checked By | Approved By |
| A        | FIRST ISSUE | HS         |             |
|          |             |            |             |
|          |             |            |             |

| Catchment Label | Bransby Williams<br>(Wellington) - Tc | Bransby Williams<br>(Hawkes Bay) - Tc | Bransby Williams<br>(Generic) -Tc | Bransby Williams<br>(Average) - Tc | Ramser Kirpich -<br>Tc | Mannings Kinematic<br>(Building Code E1) - Tc | TP108 - Tc | Average - Tc | Adopted Time of Concentration<br>Method | Time of Concentration | Is there a Minimum Tc<br>Required?      | Specify Minimum Value | Tc Value | Lag Time (2/3 Tc) |
|-----------------|---------------------------------------|---------------------------------------|-----------------------------------|------------------------------------|------------------------|-----------------------------------------------|------------|--------------|-----------------------------------------|-----------------------|-----------------------------------------|-----------------------|----------|-------------------|
|                 | Hours                                 | Hours                                 | Hours                             | Hours                              | Hours                  | Hours                                         | Hours      | Hours        | Hours                                   | (Mins)                | Check local/ regional<br>council rules! | Mins                  | (Mins)   | Mins              |
| Use?            | Yes                                   | Yes                                   | Yes                               | Yes                                | Yes                    | Yes                                           | Yes        |              |                                         |                       |                                         |                       |          |                   |
| CMT DEL 1-I     | 0.42                                  | 0.41                                  | 0.41                              | 0.41                               | 0.04                   | 0.34                                          | 0.07       | 0.22         | TP108 - Tc                              | 4.33                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 1-P     | 0.17                                  | 0.16                                  | 0.16                              | 0.16                               | 0.04                   | 0.34                                          | 0.09       | 0.16         | TP108 - Tc                              | 5.68                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 10-I    | 0.21                                  | 0.21                                  | 0.21                              | 0.21                               | 0.02                   | 0.26                                          | 0.04       | 0.13         | TP108 - Tc                              | 2.55                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 10-P    | 0.08                                  | 0.08                                  | 0.08                              | 0.08                               | 0.02                   | 0.26                                          | 0.06       | 0.11         | TP108 - Tc                              | 3.35                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 11-I    | 0.21                                  | 0.21                                  | 0.21                              | 0.21                               | 0.04                   | 0.33                                          | 0.07       | 0.16         | TP108 - Tc                              | 3.95                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 11-P    | 0.16                                  | 0.16                                  | 0.16                              | 0.16                               | 0.04                   | 0.33                                          | 0.09       | 0.15         | TP108 - Tc                              | 5.18                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 12-I    | 0.22                                  | 0.22                                  | 0.22                              | 0.22                               | 0.04                   | 0.34                                          | 0.07       | 0.17         | TP108 - Tc                              | 4.38                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 12-P    | 0.17                                  | 0.17                                  | 0.17                              | 0.17                               | 0.04                   | 0.34                                          | 0.10       | 0.16         | TP108 - Tc                              | 5.74                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 13-I    | 0.40                                  | 0.39                                  | 0.40                              | 0.40                               | 0.04                   | 0.32                                          | 0.07       | 0.21         | TP108 - Tc                              | 4.03                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 13-P    | 0.16                                  | 0.16                                  | 0.16                              | 0.16                               | 0.04                   | 0.32                                          | 0.09       | 0.15         | TP108 - Tc                              | 5.28                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 14-I    | 0.32                                  | 0.32                                  | 0.32                              | 0.32                               | 0.03                   | 0.31                                          | 0.06       | 0.18         | TP108 - Tc                              | 3.70                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 14-P    | 0.13                                  | 0.13                                  | 0.13                              | 0.13                               | 0.03                   | 0.31                                          | 0.08       | 0.14         | TP108 - Tc                              | 4.85                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 15-I    | 0.23                                  | 0.22                                  | 0.23                              | 0.23                               | 0.02                   | 0.27                                          | 0.05       | 0.14         | TP108 - Tc                              | 2.79                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 15-P    | 0.09                                  | 0.09                                  | 0.09                              | 0.09                               | 0.02                   | 0.27                                          | 0.06       | 0.11         | TP108 - Tc                              | 3.66                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 16-I    | 0.17                                  | 0.17                                  | 0.17                              | 0.17                               | 0.04                   | 0.32                                          | 0.06       | 0.15         | TP108 - Tc                              | 3.80                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 16-P    | 0.13                                  | 0.13                                  | 0.13                              | 0.13                               | 0.04                   | 0.32                                          | 0.08       | 0.14         | TP108 - Tc                              | 4.98                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 2-I     | 0.12                                  | 0.12                                  | 0.12                              | 0.12                               | 0.03                   | 0.28                                          | 0.05       | 0.12         | TP108 - Tc                              | 2.91                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 2-P     | 0.09                                  | 0.09                                  | 0.09                              | 0.09                               | 0.03                   | 0.28                                          | 0.06       | 0.11         | TP108 - Tc                              | 3.82                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 3-I     | 0.16                                  | 0.15                                  | 0.15                              | 0.15                               | 0.03                   | 0.29                                          | 0.05       | 0.13         | TP108 - Tc                              | 3.19                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 3-P     | 0.11                                  | 0.11                                  | 0.11                              | 0.11                               | 0.03                   | 0.29                                          | 0.07       | 0.12         | TP108 - Tc                              | 4.18                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 4-I     | 0.17                                  | 0.16                                  | 0.16                              | 0.16                               | 0.03                   | 0.30                                          | 0.06       | 0.14         | TP108 - Tc                              | 3.43                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 4-P     | 0.12                                  | 0.12                                  | 0.12                              | 0.12                               | 0.03                   | 0.30                                          | 0.07       | 0.13         | TP108 - Tc                              | 4.49                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 6-I     | 0.47                                  | 0.46                                  | 0.46                              | 0.46                               | 0.05                   | 0.37                                          | 0.08       | 0.24         | TP108 - Tc                              | 4.92                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 6-P     | 0.19                                  | 0.18                                  | 0.18                              | 0.18                               | 0.05                   | 0.37                                          | 0.11       | 0.18         | TP108 - Tc                              | 6.45                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 8-I     | 0.45                                  | 0.44                                  | 0.44                              | 0.44                               | 0.05                   | 0.37                                          | 0.08       | 0.23         | TP108 - Tc                              | 4.83                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 8-P     | 0.18                                  | 0.17                                  | 0.18                              | 0.18                               | 0.05                   | 0.37                                          | 0.11       | 0.17         | TP108 - Tc                              | 6.33                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 9-I     | 0.29                                  | 0.28                                  | 0.28                              | 0.28                               | 0.03                   | 0.29                                          | 0.06       | 0.16         | TP108 - Tc                              | 3.31                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT DEL 9-P     | 0.11                                  | 0.11                                  | 0.11                              | 0.11                               | 0.03                   | 0.29                                          | 0.07       | 0.13         | TP108 - Tc                              | 4.34                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 0-I      | 1.03                                  | 1.01                                  | 1.01                              | 1.01                               | 0.12                   | 0.57                                          | 0.18       | 0.47         | TP108 - Tc                              | 10.61                 | Yes                                     | 10.00                 | 10.61    | 7.07              |
| CMT PD 0-P      | 0.41                                  | 0.40                                  | 0.40                              | 0.40                               | 0.12                   | 0.57                                          | 0.23       | 0.33         | TP108 - Tc                              | 13.91                 | Yes                                     | 10.00                 | 13.91    | 9.27              |
| CMT PD 1-I      | 0.66                                  | 0.64                                  | 0.65                              | 0.65                               | 0.14                   | 0.59                                          | 0.20       | 0.39         | TP108 - Tc                              | 11.86                 | Yes                                     | 10.00                 | 11.86    | 7.91              |
| CMT PD 1-P      | 0.58                                  | 0.56                                  | 0.57                              | 0.57                               | 0.14                   | 0.59                                          | 0.26       | 0.39         | TP108 - Tc                              | 15.55                 | Yes                                     | 10.00                 | 15.55    | 10.36             |
| CMT PD 10-I     | 1.93                                  | 1.88                                  | 1.90                              | 1.90                               | 0.20                   | 0.69                                          | 0.26       | 0.76         | TP108 - Tc                              | 15.85                 | Yes                                     | 10.00                 | 15.85    | 10.57             |
| CMT PD 10-P     | 0.77                                  | 0.75                                  | 0.75                              | 0.76                               | 0.20                   | 0.69                                          | 0.35       | 0.50         | TP108 - Tc                              | 20.78                 | Yes                                     | 10.00                 | 20.78    | 13.85             |
| CMT PD 11-I     | 0.84                                  | 0.82                                  | 0.83                              | 0.83                               | 0.14                   | 0.59                                          | 0.20       | 0.44         | TP108 - Tc                              | 11.97                 | Yes                                     | 10.00                 | 11.97    | 7.98              |
| CMT PD 11-P     | 0.55                                  | 0.54                                  | 0.54                              | 0.54                               | 0.14                   | 0.59                                          | 0.26       | 0.38         | TP108 - Tc                              | 15.69                 | Yes                                     | 10.00                 | 15.69    | 10.46             |
| CMT PD 15-I     | 1.13                                  | 1.10                                  | 1.11                              | 1.11                               | 0.11                   | 0.53                                          | 0.16       | 0.48         | TP108 - Tc                              | 9.51                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 15-P     | 0.45                                  | 0.44                                  | 0.44                              | 0.44                               | 0.11                   | 0.53                                          | 0.21       | 0.32         | TP108 - Tc                              | 12.46                 | Yes                                     | 10.00                 | 12.46    | 8.31              |
| CMT PD 16-I     | 0.91                                  | 0.89                                  | 0.90                              | 0.90                               | 0.09                   | 0.48                                          | 0.13       | 0.40         | TP108 - Tc                              | 7.98                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 16-P     | 0.36                                  | 0.36                                  | 0.36                              | 0.36                               | 0.09                   | 0.48                                          | 0.17       | 0.28         | TP108 - Tc                              | 10.47                 | Yes                                     | 10.00                 | 10.47    | 6.98              |
| CMT PD 17-I     | 0.67                                  | 0.66                                  | 0.66                              | 0.67                               | 0.06                   | 0.41                                          | 0.10       | 0.31         | TP108 - Tc                              | 6.01                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 17-P     | 0.27                                  | 0.26                                  | 0.26                              | 0.27                               | 0.06                   | 0.41                                          | 0.13       | 0.22         | TP108 - Tc                              | 7.88                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 18-I     | 1.58                                  | 1.54                                  | 1.55                              | 1.56                               | 0.15                   | 0.62                                          | 0.21       | 0.64         | TP108 - Tc                              | 12.70                 | Yes                                     | 10.00                 | 12.70    | 8.46              |
| CMT PD 18-P     | 0.63                                  | 0.61                                  | 0.62                              | 0.62                               | 0.15                   | 0.62                                          | 0.28       | 0.42         | TP108 - Tc                              | 16.64                 | Yes                                     | 10.00                 | 16.64    | 11.10             |
| CMT PD 19-I     | 1.11                                  | 1.08                                  | 1.09                              | 1.09                               | 0.11                   | 0.52                                          | 0.16       | 0.47         | TP108 - Tc                              | 9.41                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 19-P     | 0.44                                  | 0.43                                  | 0.43                              | 0.44                               | 0.11                   | 0.52                                          | 0.21       | 0.32         | TP108 - Tc                              | 12.34                 | Yes                                     | 10.00                 | 12.34    | 8.22              |
| CMT PD 2-I      | 0.35                                  | 0.34                                  | 0.34                              | 0.35                               | 0.07                   | 0.42                                          | 0.11       | 0.24         | TP108 - Tc                              | 6.36                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 2-P      | 0.27                                  | 0.26                                  | 0.26                              | 0.26                               | 0.07                   | 0.42                                          | 0.14       | 0.22         | TP108 - Tc                              | 8.34                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 20-I     | 1.23                                  | 1.20                                  | 1.21                              | 1.22                               | 0.13                   | 0.58                                          | 0.18       | 0.53         | TP108 - Tc                              | 11.03                 | Yes                                     | 10.00                 | 11.03    | 7.35              |
| CMT PD 20-P     | 0.49                                  | 0.48                                  | 0.48                              | 0.48                               | 0.13                   | 0.58                                          | 0.24       | 0.36         | TP108 - Tc                              | 14.46                 | Yes                                     | 10.00                 | 14.46    | 9.64              |
| CMT PD 21-I     | 0.82                                  | 0.81                                  | 0.81                              | 0.81                               | 0.15                   | 0.60                                          | 0.21       | 0.44         | TP108 - Tc                              | 12.56                 | Yes                                     | 10.00                 | 12.56    | 8.38              |
| CMT PD 21-P     | 0.58                                  | 0.57                                  | 0.57                              | 0.58                               | 0.15                   | 0.60                                          | 0.27       | 0.40         | TP108 - Tc                              | 16.47                 | Yes                                     | 10.00                 | 16.47    | 10.98             |
| CMT PD 22-I     | 0.93                                  | 0.91                                  | 0.92                              | 0.92                               | 0.16                   | 0.63                                          | 0.22       | 0.48         | TP108 - Tc                              | 13.44                 | Yes                                     | 10.00                 | 13.44    | 8.96              |
| CMT PD 22-P     | 0.59                                  | 0.57                                  | 0.58                              | 0.58                               | 0.16                   | 0.63                                          | 0.29       | 0.42         | TP108 - Tc                              | 17.62                 | Yes                                     | 10.00                 | 17.62    | 11.74             |
| CMT PD 23-I     | 0.99                                  | 0.97                                  | 0.97                              | 0.98                               | 0.16                   | 0.62                                          | 0.22       | 0.49         | TP108 - Tc                              | 13.10                 | Yes                                     | 10.00                 | 13.10    | 8.73              |
| CMT PD 23-P     | 0.62                                  | 0.61                                  | 0.61                              | 0.62                               | 0.16                   | 0.62                                          | 0.29       | 0.42         | TP108 - Tc                              | 17.17                 | Yes                                     | 10.00                 | 17.17    | 11.45             |
| CMT PD 25-I     | 2.08                                  | 2.03                                  | 2.05                              | 2.05                               | 0.23                   | 0.74                                          | 0.30       | 0.83         | TP108 - Tc                              | 17.83                 | Yes                                     | 10.00                 | 17.83    | 11.89             |
| CMT PD 25-P     | 0.83                                  | 0.81                                  | 0.82                              | 0.82                               | 0.23                   | 0.74                                          | 0.39       | 0.54         | TP108 - Tc                              | 23.38                 | Yes                                     | 10.00                 | 23.38    | 15.59             |
| CMT PD 26-I     | 0.68                                  | 0.67                                  | 0.67                              | 0.67                               | 0.14                   | 0.60                                          | 0.20       | 0.40         | TP108 - Tc                              | 12.09                 | Yes                                     | 10.00                 | 12.09    | 8.06              |
| CMT PD 26-P     | 0.58                                  | 0.57                                  | 0.58                              | 0.58                               | 0.14                   | 0.60                                          | 0.26       | 0.40         | TP108 - Tc                              | 15.84                 | Yes                                     | 10.00                 | 15.84    | 10.56             |
| CMT PD 27-I     | 0.57                                  | 0.56                                  | 0.56                              | 0.57                               | 0.09                   | 0.49                                          | 0.14       | 0.32         | TP108 - Tc                              | 8.64                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 27-P     | 0.44                                  | 0.43                                  | 0.44                              | 0.44                               | 0.09                   | 0.49                                          | 0.19       | 0.30         | TP108 - Tc                              | 11.33                 | Yes                                     | 10.00                 | 11.33    | 7.55              |
| CMT PD 28-I     | 0.92                                  | 0.90                                  | 0.90                              | 0.91                               | 0.09                   | 0.48                                          | 0.14       | 0.40         | TP108 - Tc                              | 8.15                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 28-P     | 0.37                                  | 0.36                                  | 0.36                              | 0.36                               | 0.09                   | 0.48                                          | 0.18       | 0.28         | TP108 - Tc                              | 10.68                 | Yes                                     | 10.00                 | 10.68    | 7.12              |
| CMT PD 29-I     | 0.26                                  | 0.26                                  | 0.26                              | 0.26                               | 0.05                   | 0.37                                          | 0.08       | 0.19         | TP108 - Tc                              | 5.00                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 29-P     | 0.21                                  | 0.21                                  | 0.21                              | 0.21                               | 0.05                   | 0.37                                          | 0.11       | 0.18         | TP108 - Tc                              | 6.55                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 3-I      | 0.54                                  | 0.53                                  | 0.53                              | 0.53                               | 0.10                   | 0.51                                          | 0.15       | 0.33         | TP108 - Tc                              | 9.09                  | Yes                                     | 10.00                 | 10.00    | 6.67              |
| CMT PD 3-P      | 0.40                                  | 0.39                                  | 0.40                              | 0.40                               | 0.10                   | 0.51                                          | 0.20       | 0.30         | TP108 - Tc                              | 11.92                 | Yes                                     | 10.00                 | 11.92    | 7.94              |
| CMT PD 30-I     | 0.64                                  | 0.62                                  | 0.63                              | 0.63                               | 0.12                   | 0.55                                          | 0.17       | 0.37         | TP108 - Tc                              | 10.46                 | Yes                                     | 10.00                 | 10.46    | 6.97              |
| CMT PD 30-P     | 0.51                                  | 0.50                                  | 0.50                              | 0.51                               | 0.12                   | 0.55                                          | 0.23       | 0.35         | TP108 - Tc                              | 13.71                 | Yes                                     | 10.00                 | 13.71    | 9.14              |

|              |      |      |      |      |      |      |      |      |            |       |     |       |       |       |
|--------------|------|------|------|------|------|------|------|------|------------|-------|-----|-------|-------|-------|
| CMT PD 4-I   | 2.18 | 2.13 | 2.14 | 2.15 | 0.24 | 0.75 | 0.31 | 0.86 | TP108 - Tc | 18.52 | Yes | 10.00 | 18.52 | 12.35 |
| CMT PD 4-P   | 0.87 | 0.85 | 0.85 | 0.86 | 0.24 | 0.75 | 0.40 | 0.56 | TP108 - Tc | 24.28 | Yes | 10.00 | 24.28 | 16.19 |
| CMT PD 5-I   | 0.51 | 0.50 | 0.51 | 0.51 | 0.05 | 0.36 | 0.08 | 0.25 | TP108 - Tc | 4.92  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 5-P   | 0.20 | 0.20 | 0.20 | 0.20 | 0.05 | 0.36 | 0.11 | 0.18 | TP108 - Tc | 6.45  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 6-I   | 1.95 | 1.91 | 1.92 | 1.92 | 0.23 | 0.75 | 0.29 | 0.80 | TP108 - Tc | 17.66 | Yes | 10.00 | 17.66 | 11.78 |
| CMT PD 6-P   | 0.78 | 0.76 | 0.76 | 0.77 | 0.23 | 0.75 | 0.39 | 0.53 | TP108 - Tc | 23.16 | Yes | 10.00 | 23.16 | 15.44 |
| CMT PD 7-I   | 1.00 | 0.98 | 0.99 | 0.99 | 0.19 | 0.69 | 0.25 | 0.53 | TP108 - Tc | 14.84 | Yes | 10.00 | 14.84 | 9.89  |
| CMT PD 7-P   | 0.68 | 0.66 | 0.67 | 0.67 | 0.19 | 0.69 | 0.32 | 0.47 | TP108 - Tc | 19.45 | Yes | 10.00 | 19.45 | 12.97 |
| CMT PD 8-I   | 0.23 | 0.22 | 0.22 | 0.22 | 0.02 | 0.25 | 0.04 | 0.13 | TP108 - Tc | 2.46  | Yes | 10.00 | 10.00 | 6.67  |
| CMT PD 8-P   | 0.09 | 0.09 | 0.09 | 0.09 | 0.02 | 0.25 | 0.05 | 0.10 | TP108 - Tc | 3.23  | Yes | 10.00 | 10.00 | 6.67  |
| CMT RG 1-I   | 0.15 | 0.15 | 0.15 | 0.15 | 0.02 | 0.23 | 0.03 | 0.11 | TP108 - Tc | 1.93  | Yes | 10.00 | 10.00 | 6.67  |
| CMT RG 1-P   | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.23 | 0.04 | 0.09 | TP108 - Tc | 2.53  | Yes | 10.00 | 10.00 | 6.67  |
| CTMT ARAS2-I | 0.64 | 0.62 | 0.63 | 0.63 | 0.15 | 0.61 | 0.21 | 0.40 | TP108 - Tc | 12.58 | Yes | 10.00 | 12.58 | 8.39  |
| CTMT ARAS2-P | 0.68 | 0.66 | 0.67 | 0.67 | 0.15 | 0.61 | 0.27 | 0.42 | TP108 - Tc | 16.49 | Yes | 10.00 | 16.49 | 10.99 |
| PRE12-1-I    | 2.80 | 2.74 | 2.75 | 2.76 | 0.82 | 1.32 | 0.87 | 1.44 | TP108 - Tc | 52.21 | Yes | 10.00 | 52.21 | 34.81 |
| PRE12-1-P    | 2.80 | 2.74 | 2.75 | 2.76 | 0.82 | 1.32 | 1.14 | 1.51 | TP108 - Tc | 68.45 | Yes | 10.00 | 68.45 | 45.63 |
| PRE29-2-I    | 0.90 | 0.88 | 0.88 | 0.89 | 0.30 | 0.88 | 0.36 | 0.61 | TP108 - Tc | 21.50 | Yes | 10.00 | 21.50 | 14.33 |
| PRE29-2-P    | 0.96 | 0.93 | 0.94 | 0.94 | 0.30 | 0.88 | 0.47 | 0.65 | TP108 - Tc | 28.18 | Yes | 10.00 | 28.18 | 18.79 |
| PRE33-1-I    | 1.47 | 1.43 | 1.44 | 1.45 | 0.43 | 1.00 | 0.50 | 0.84 | TP108 - Tc | 29.92 | Yes | 10.00 | 29.92 | 19.95 |
| PRE33-1-P    | 1.56 | 1.52 | 1.53 | 1.54 | 0.43 | 1.00 | 0.65 | 0.90 | TP108 - Tc | 39.23 | No  |       | 39.23 | 26.15 |

## Appendix F – Internal Overland Flow Path Analysis

# Technical Memo – Internal Development

## Overland Flow Path Analysis

|           |                                            |      |      |
|-----------|--------------------------------------------|------|------|
| To:       | Vineway Limited                            |      |      |
| From:     | McKenzie & Co – Haka Subagio (MCCL)        |      |      |
| Cc:       | Project Team                               |      |      |
| Date:     | Thursday, 16 April 2026                    |      |      |
| Job:      | Delmore 53A, 53B & 55 Russell Road, Orewa  | Ref: | 3725 |
| Location: | 53A, 53B & 55 Russell Road, Orewa, Delmore |      |      |

Re: Civil Engineering – Infrastructure – 100% Detailed Design

### 1. Purpose

This memorandum presents the overland flow path analysis for the proposed road reserve within the Delmore Development. The assessment evaluates flood depth, velocity, and depth-velocity (DxV) hazard along the proposed road network under the 1% AEP Design rainfall.

The external overland flow path assessment is addressed separately in the flood assessment report and is excluded from this memorandum

### 2. Overview

The analysis was undertaken using TUFLOW with a rain-on-grid rainfall methodology. Hydrological data, boundary conditions, and topographic inputs were ported from the HEC-RAS model used for the Delmore flood assessment, which has been provided to Healthy Waters for council review.

Tuflow was adopted to allow 2m x 2m grid resolution within the road reserve with 250mm sub-grid sampling, providing increased model resolution to understand the hydraulic performance. Outside of Road reserve, a grid size of 4x4m was adopted.

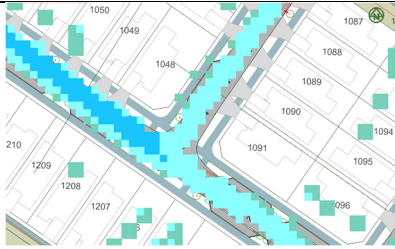
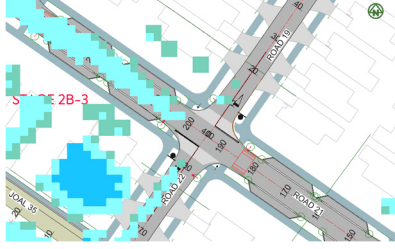
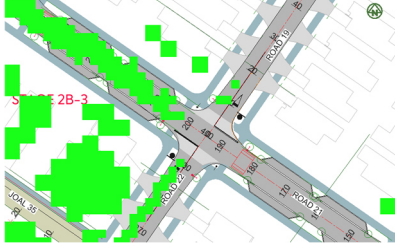
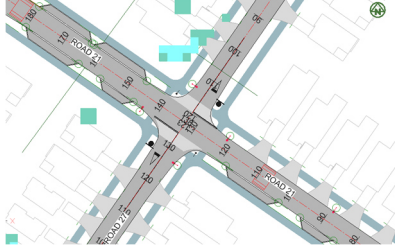
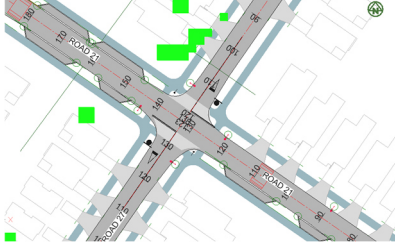
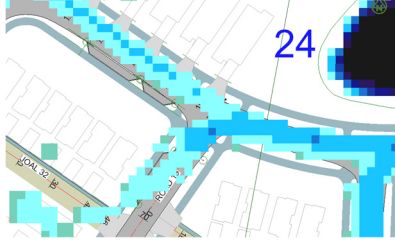
### 3. Assessment Criteria

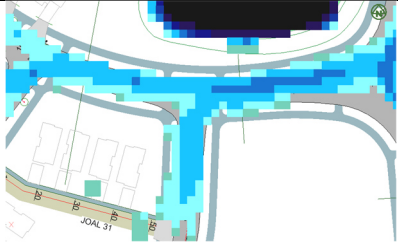
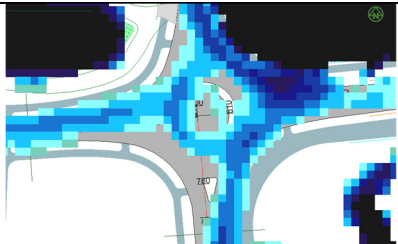
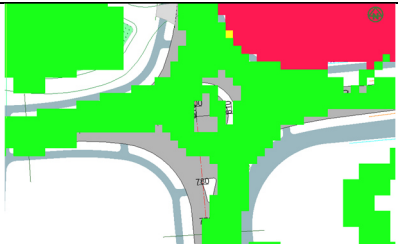
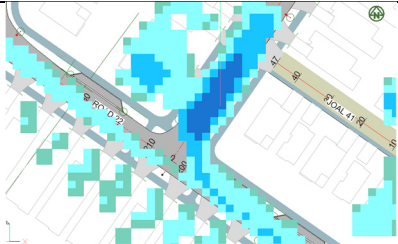
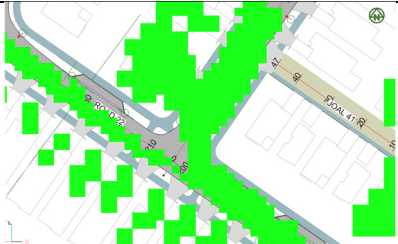
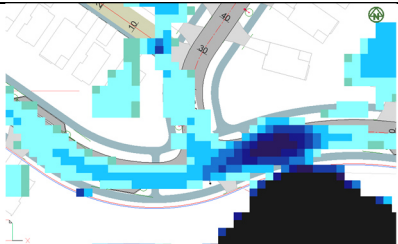
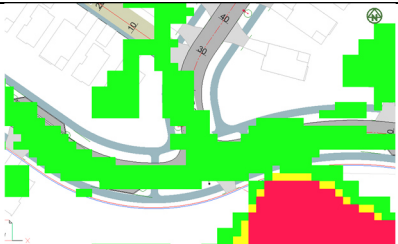
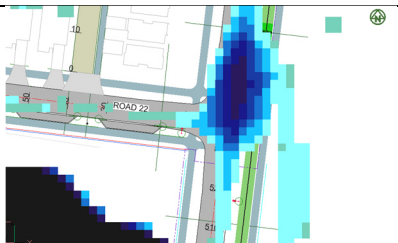
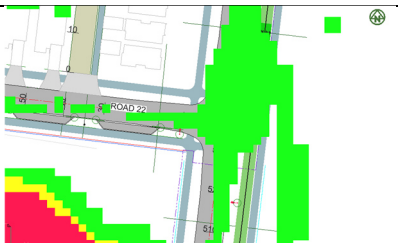
The hydraulic performance criteria have been assessed against Auckland Transport Design Manual (ATTDM) Road Drainage Chapter particularly under table 3:

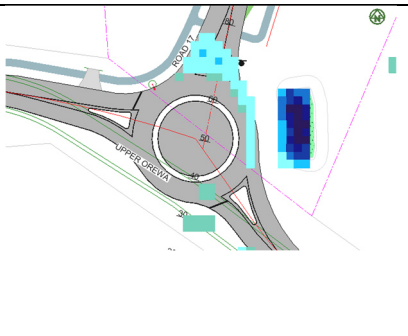
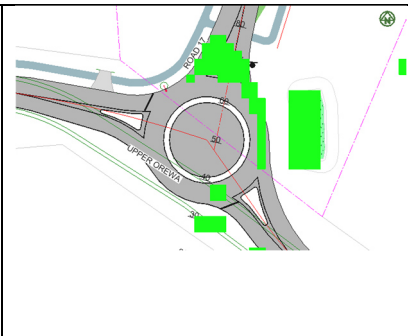
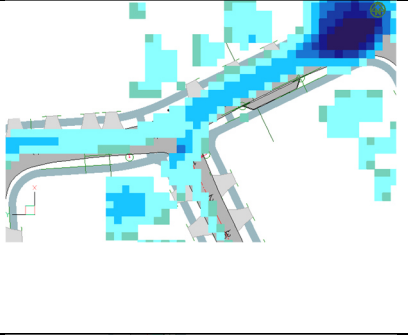
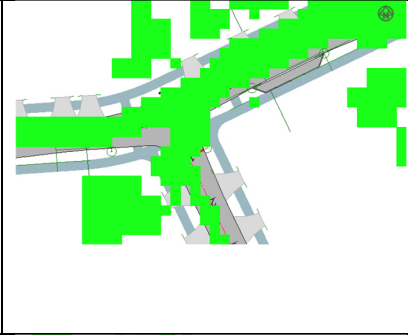
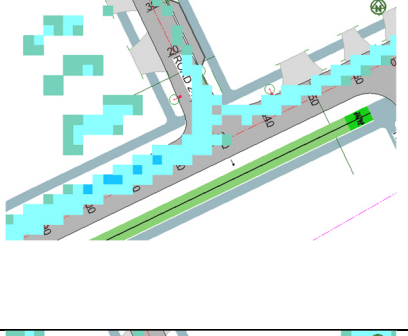
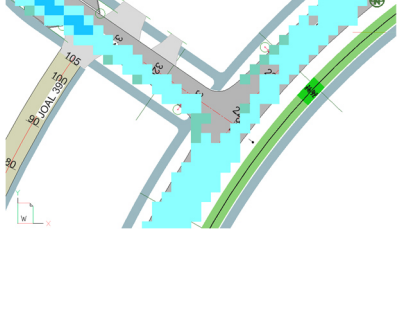
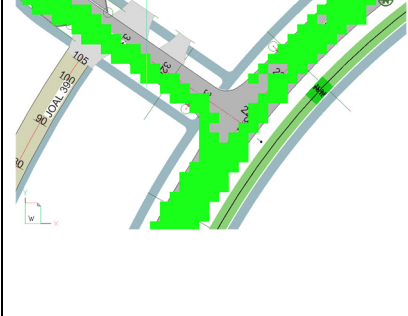
- Pedestrian Safety to be less than 0.4m<sup>2</sup>/s where the location is classified as obvious danger (pram crossings, intersections), and less than 0.6m<sup>2</sup>/s for everywhere else
- Maximum water levels of 300mm above roadways surface for areas subject to transverse flow.

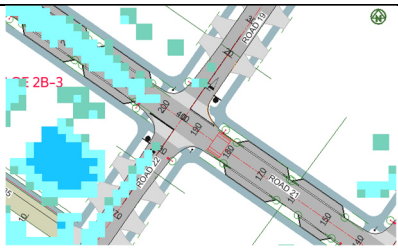
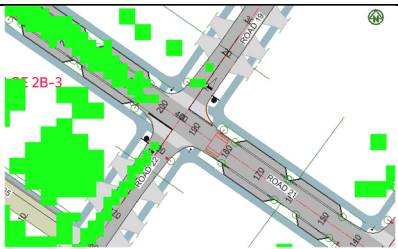
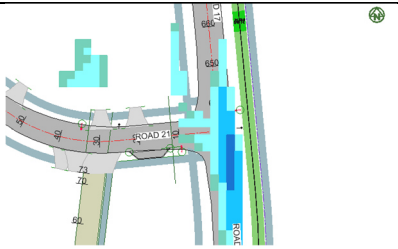
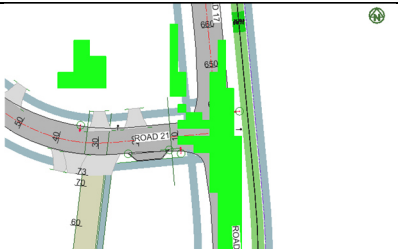
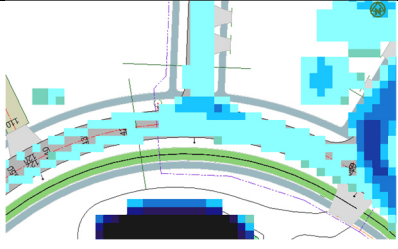
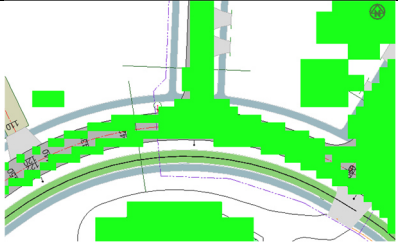
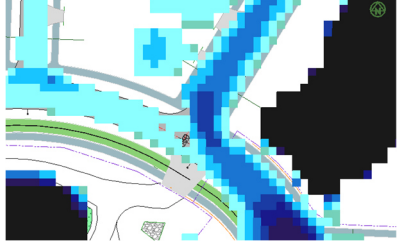
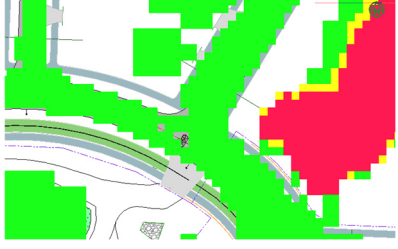
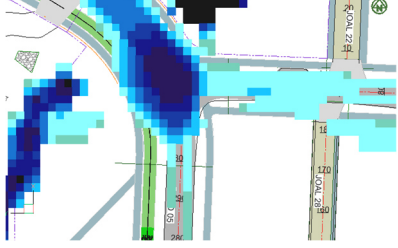
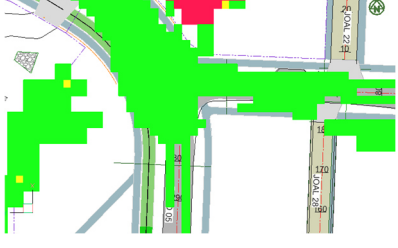
#### 4. Results

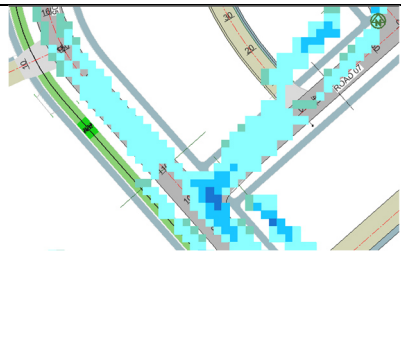
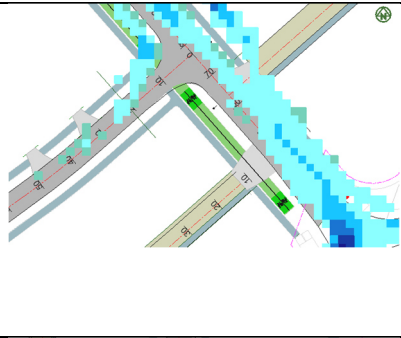
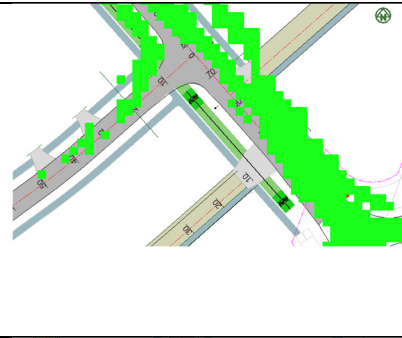
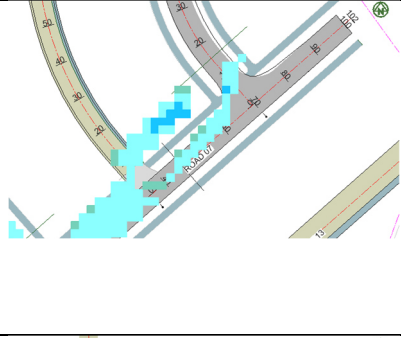
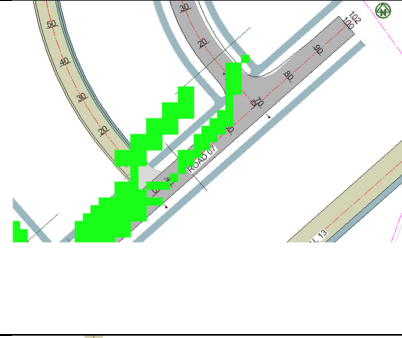
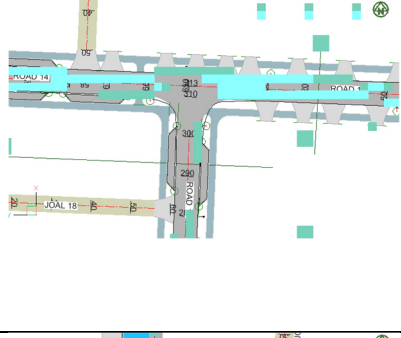
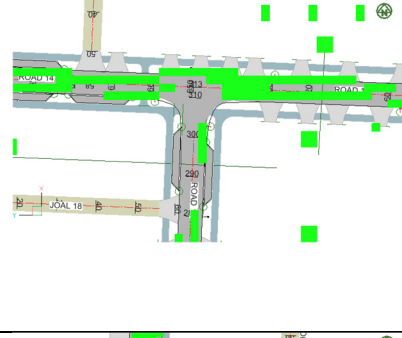
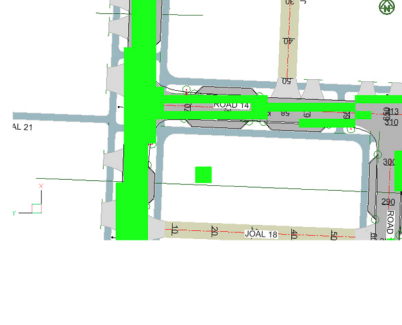
The site is located on the property of 53A, 53B & 55 Russell Road, Orewa with legal description (LOT 1 DP 497022, LOT 2 DP 497022, LOT 1 DP 336616.) as shown on Figure 1 below. The property is located in Auckland Council (AC).

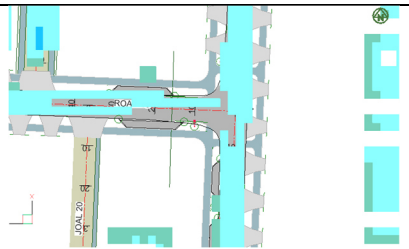
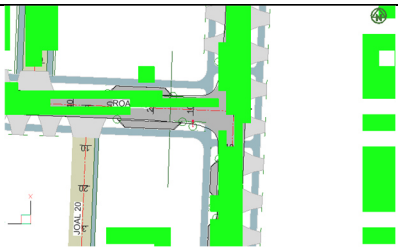
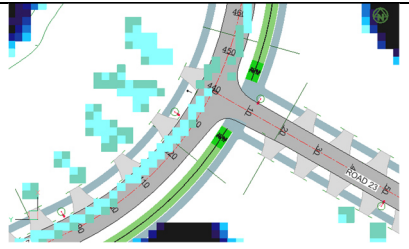
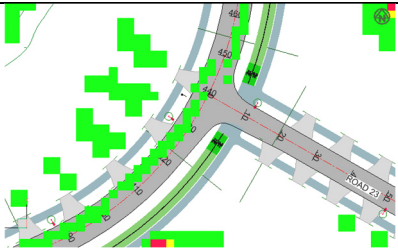
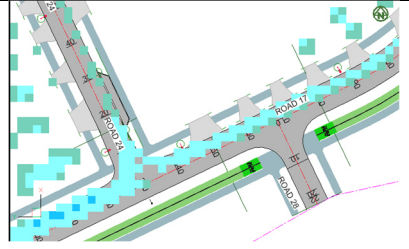
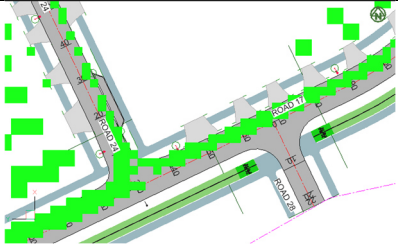
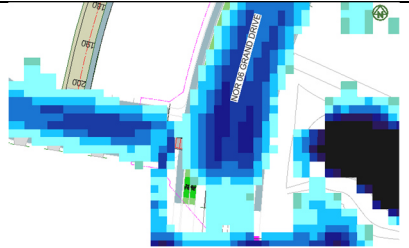
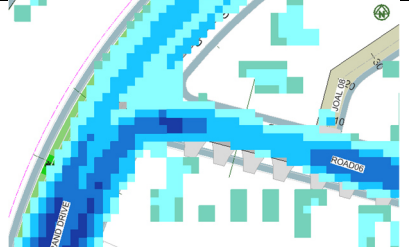
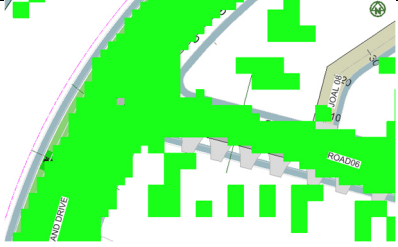
| Location |                             | Depth Map                                                                           | Hazard Map                                                                           | Comments                                                                                               |
|----------|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Stage 2  |                             |                                                                                     |                                                                                      |                                                                                                        |
| 1        | Road 21 / Road 18           |    |    | Flood Depth within this area ranges within 0mm to 150mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |
| 2        | Road 21 / Road 19 / Road 22 |   |   | Flood Depth within this area ranges within 0mm to 150mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |
| 3        | Road 21 / Road 27           |  |  | Flood Depth within this area ranges within 0mm to 100mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |
| 4        | Road 19 / Road 18           |  |  | Flood Depth within this area ranges within 0mm to 200mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |

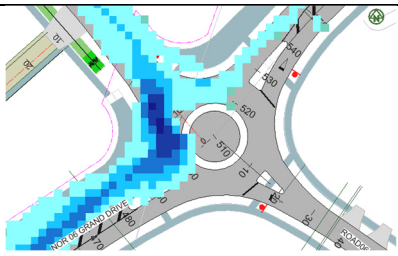
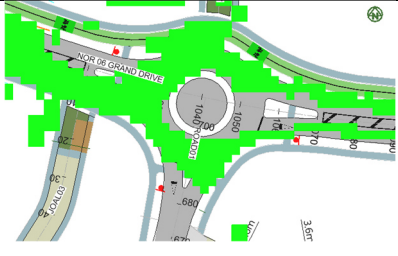
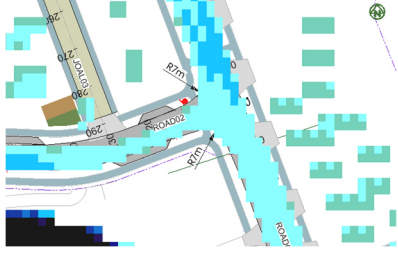
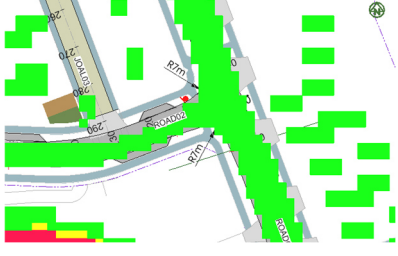
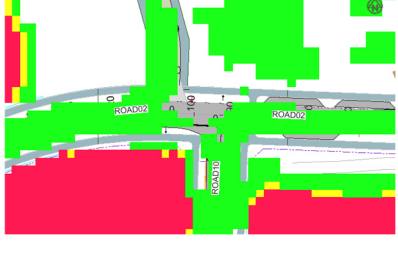
|   |                             |                                                                                     |                                                                                      |                                                                                                                        |
|---|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 5 | Road 18 / Road 20           |    |    | <p>Flood Depth within this area ranges within 0mm to 200mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p>            |
| 6 | Road 05 / Road 17 / Road 18 |    |    | <p>Flood Depth within the carriageway area ranges within 0mm to 300mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 7 | Road 22 / Road 27           |   |   | <p>Flood Depth within this area ranges within 0mm to 200mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p>            |
| 8 | Road 22 / Road 26           |  |  | <p>Flood Depth within this area ranges within 0mm to 400mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p>            |
| 9 | Road 22 / Road 17           |  |  | <p>Flood Depth within this area ranges within 0mm to 350mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p>            |

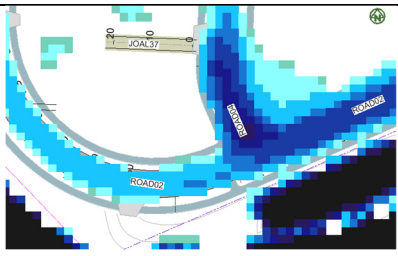
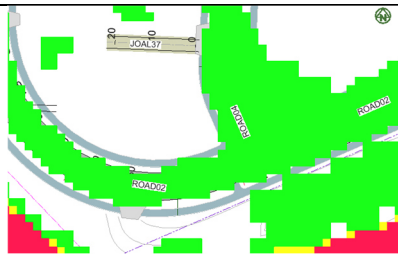
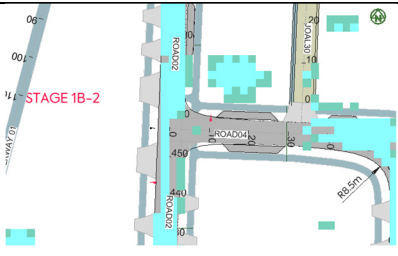
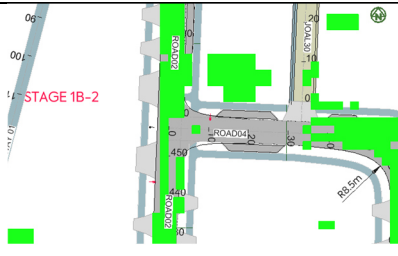
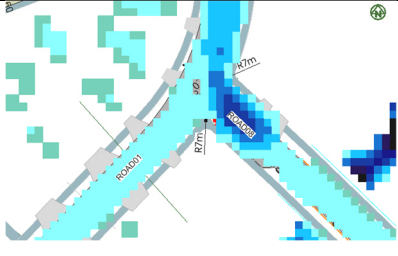
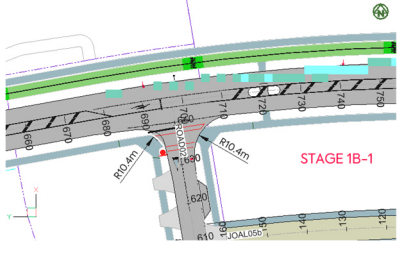
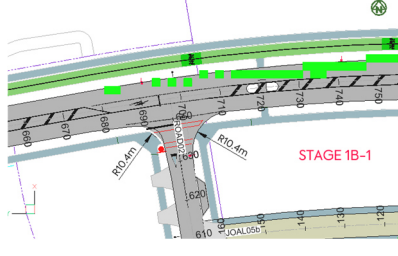
|    |                       |                                                                                     |                                                                                      |                                                                                                             |
|----|-----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 10 | Road 17 / Upper Orewa |    |    | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 11 | Road 24 / Road 25     |    |    | <p>Flood Depth within this area ranges within 0mm to 400mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 12 | Road 24 / 17          |   |   | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 13 | Road 25 / Road 17     |  |  | <p>Flood Depth within this area ranges within 0mm to 100mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 14 | Road 24 / Road 17     |  |  | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |

|    |                   |                                                                                     |                                                                                      |                                                                                                             |
|----|-------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 15 | Road 21 / Road 19 |    |    | <p>Flood Depth within this area ranges within 0mm to 100mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 16 | Road 21 / Road 17 |    |    | <p>Flood Depth within this area ranges within 0mm to 200mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 17 | Road 05 / Road 14 |   |   | <p>Flood Depth within this area ranges within 0mm to 200mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 18 | Road 05 / Road 13 |  |  | <p>Flood Depth within this area ranges within 0mm to 400mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 19 | Road 05 / Road 15 |  |  | <p>Flood Depth within this area ranges within 0mm to 400mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |

|    |                   |                                                                                     |                                                                                      |                                                                                                             |
|----|-------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 20 | Road 05 / Road 07 |    |    | <p>Flood Depth within this area ranges within 0mm to 200mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 21 | Road 05 / Road 12 |    |    | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 22 | Road 07 / Road 15 |   |   | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 23 | Road 13 / Road 14 |  |  | <p>Flood Depth within this area ranges within 0mm to 100mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 24 | Road 14 / Road 14 |  |  | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |

|         |                              |                                                                                     |                                                                                      |                                                                                                             |
|---------|------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 25      | Road 14 / Road 16            |    |    | <p>Flood Depth within this area ranges within 0mm to 100mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 26      | Road 23 / Road 17            |    |    | <p>Flood Depth within this area ranges within 0mm to 100mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 27      | Road 17 / Road 28            |   |   | <p>Flood Depth within this area ranges within 0mm to 100mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| Stage 1 |                              |                                                                                     |                                                                                      |                                                                                                             |
| 28      | Road 12 / Nor 06 Grand Drive |  |  | <p>Flood Depth within this area ranges within 0mm to 300mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 29      | Road 06 / Nor 06 Grand Drive |  |  | <p>Flood Depth within this area ranges within 0mm to 250mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |

|    |                                        |                                                                                     |                                                                                      |                                                                                                             |
|----|----------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 30 | Road 06 / Nor 06 Grand Drive / Road 05 |    |    | <p>Flood Depth within this area ranges within 0mm to 300mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 31 | Road 03 / Nor 6 Grand Drive            |    |    | <p>Flood Depth within this area ranges within 0mm to 250mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 32 | Road 01 / Nor 6 Grand Drive            |   |   | <p>Flood Depth within this area ranges within 0mm to 250mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 33 | Road 02 / Road 01                      |  |  | <p>Flood Depth within this area ranges within 0mm to 150mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |
| 34 | Road 02 / Road 10                      |  |  | <p>Flood Depth within this area ranges within 0mm to 350mm.</p> <p>DxV are less than 0.4m<sup>2</sup>/s</p> |

|    |                             |                                                                                     |                                                                                      |                                                                                                        |
|----|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 35 | Road 04 / Road 02           |    |    | Flood Depth within this area ranges within 0mm to 350mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |
| 36 | Road 04 / Road 02           |    |    | Flood Depth within this area ranges within 0mm to 100mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |
| 37 | Road 01 / Road 08           |   |   | Flood Depth within this area ranges within 0mm to 250mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |
| 38 | Road 02 / Nor 6 Grand Drive |  |  | Flood Depth within this area ranges within 0mm to 100mm.<br><br>DxV are less than 0.4m <sup>2</sup> /s |

The analysis of the above critical intersections has shown that all intersections comply with the Auckland Transport Technical Design Manual (AT TDM).

The predicted flood hazard at the identified discharge points 6, 8, 9, 11, 18, 19, 28, 30, 34 and 35 are characterised by depths between 300 mm and 400 mm, with D\*V values remaining below 0.4. While the resulting depths exceed Auckland Transport's preferred general thresholds for nuisance flooding, the associated hazard rating indicates that the flow conditions are low risk in terms of pedestrian and vehicle stability.

It's noted that the maximum flood depth between 300–400mm are confined to overland flow path discharge points and the roadway design has been optimised to reduce the extent of these isolated

flood areas. As per the Stormwater Code of Practice, the primary network is considered to be 100% blocked.

The exceedance is expected to be temporary in nature, with durations limited to between 5 and 23.5 minutes (refer to Attachment A), with rapid recession of floodwater following peak flows. The frequency and duration of inundation are therefore limited, reducing the overall level of risk to users.

It is also noted that alternative access routes remain available during such events, ensuring network connectivity is maintained and that users are not solely reliant on the affected locations.

Given the constraints of the existing topography and downstream network, further mitigation to fully eliminate ponding at these points is not practicable without disproportionate intervention. As such, a risk management approach is adopted. This will include the provision of appropriate signage to warn users of potential flood hazards during storm events, the inclusion of high flow catch pits allowing informed decision-making and reinforcing safe use of the network. As the risk hazard is considered low, and the DxV values are compliant with the AT TDM, the details of the mitigation measures will be confirmed during the Engineering Plan Approval process, once the construction level design detail has been completed.

On this basis, the residual flooding effects are considered acceptable within the context of the wider system performance.

## 5. Conclusion

The overland flow path assessment demonstrates that the proposed road network achieves compliance with the Auckland Transport Technical Design Manual (AT TDM) in terms of hydraulic hazard, with all modelled D\*V values remaining below  $0.4 \text{ m}^2/\text{s}$  across the assessed network. This confirms that flood conditions do not pose a stability risk to pedestrians or vehicles.

While localised exceedances of the 300 mm depth guideline are predicted at key overland flow path discharge points, these are confined, shallow ponding areas associated with the conveyance of exceedance flows under a 1% AEP event with a fully blocked primary system. The road layout has been optimised to minimise both the extent and depth of flooding where practicable.

These flood conditions are temporary in nature, occurring only during short duration storm events with rapid recession of water levels. The limited duration and frequency of inundation reduces the overall risk to users. In addition, alternative access routes are available throughout the network, ensuring that connectivity is maintained during such events.

Given the constraints of the existing topography and downstream receiving environment, further mitigation to eliminate these localised effects is not practicable without disproportionate intervention. A risk-based approach is therefore adopted, including the provision of appropriate signage to warn users of potential flood hazards during storm events, with final details to be confirmed at Engineering Plan Approval stage.

On this basis, the residual flooding effects are considered acceptable, and the proposed road network is deemed to achieve an appropriate level of service and safety under the design storm event.

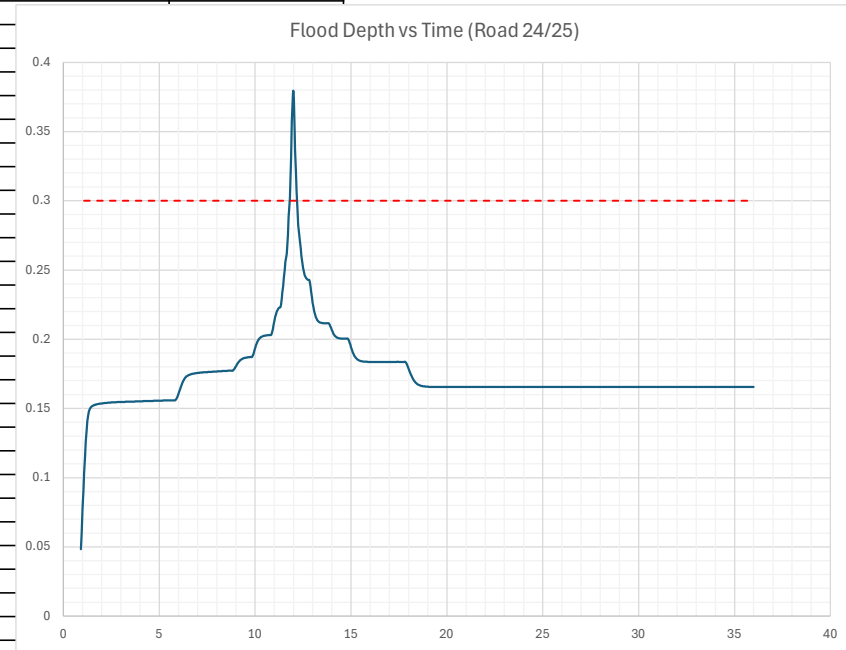
## **Attachment A – Depth Exceedance Analysis**

Road 24 &amp; 25 - Depth vs Time

| Time (hr) | Depth (m) | Threshold (m) | Rising Cross X (hr) | Falling Cross X (hr) |
|-----------|-----------|---------------|---------------------|----------------------|
| 0.00      |           |               |                     |                      |
| 0.08      |           |               |                     |                      |
| 0.17      |           |               |                     |                      |
| 0.25      |           |               |                     |                      |
| 0.33333   |           |               |                     |                      |
| 0.42      |           |               |                     |                      |
| 0.50      |           |               |                     |                      |
| 0.58      |           |               |                     |                      |
| 0.67      |           |               |                     |                      |
| 0.75      |           |               |                     |                      |
| 0.83      |           |               |                     |                      |
| 0.92      | 0.04829   |               |                     |                      |
| 1.00      | 0.0774    |               |                     |                      |
| 1.08      | 0.10357   | 0.3           |                     |                      |
| 1.17      | 0.12567   | 0.3           |                     |                      |
| 1.25      | 0.14092   | 0.3           |                     |                      |
| 1.33      | 0.14793   | 0.3           |                     |                      |
| 1.42      | 0.15054   | 0.3           |                     |                      |
| 1.50      | 0.15172   | 0.3           |                     |                      |
| 1.58      | 0.15229   | 0.3           |                     |                      |
| 1.67      | 0.15272   | 0.3           |                     |                      |
| 1.75      | 0.15302   | 0.3           |                     |                      |
| 1.83      | 0.15328   | 0.3           |                     |                      |
| 1.92      | 0.1535    | 0.3           |                     |                      |
| 2.00      | 0.15363   | 0.3           |                     |                      |
| 2.08      | 0.15378   | 0.3           |                     |                      |
| 2.17      | 0.15392   | 0.3           |                     |                      |
| 2.25      | 0.15403   | 0.3           |                     |                      |
| 2.33      | 0.15416   | 0.3           |                     |                      |
| 2.42      | 0.15423   | 0.3           |                     |                      |
| 2.50      | 0.15434   | 0.3           |                     |                      |
| 2.58      | 0.15442   | 0.3           |                     |                      |
| 2.67      | 0.15447   | 0.3           |                     |                      |
| 2.75      | 0.15454   | 0.3           |                     |                      |
| 2.83      | 0.15458   | 0.3           |                     |                      |
| 2.92      | 0.15464   | 0.3           |                     |                      |
| 3.00      | 0.15464   | 0.3           |                     |                      |
| 3.08      | 0.15471   | 0.3           |                     |                      |
| 3.17      | 0.15475   | 0.3           |                     |                      |
| 3.25      | 0.15479   | 0.3           |                     |                      |
| 3.33      | 0.15487   | 0.3           |                     |                      |
| 3.42      | 0.15489   | 0.3           |                     |                      |
| 3.50      | 0.15491   | 0.3           |                     |                      |
| 3.58      | 0.15493   | 0.3           |                     |                      |
| 3.67      | 0.15496   | 0.3           |                     |                      |
| 3.75      | 0.15503   | 0.3           |                     |                      |
| 3.83      | 0.15505   | 0.3           |                     |                      |
| 3.92      | 0.15511   | 0.3           |                     |                      |
| 4.00      | 0.15517   | 0.3           |                     |                      |
| 4.08      | 0.15519   | 0.3           |                     |                      |
| 4.17      | 0.15526   | 0.3           |                     |                      |
| 4.25      | 0.15528   | 0.3           |                     |                      |
| 4.33      | 0.15533   | 0.3           |                     |                      |
| 4.42      | 0.15534   | 0.3           |                     |                      |
| 4.50      | 0.15538   | 0.3           |                     |                      |
| 4.58      | 0.15543   | 0.3           |                     |                      |
| 4.67      | 0.15548   | 0.3           |                     |                      |
| 4.75      | 0.15551   | 0.3           |                     |                      |
| 4.83      | 0.15555   | 0.3           |                     |                      |
| 4.92      | 0.1556    | 0.3           |                     |                      |
| 5.00      | 0.15562   | 0.3           |                     |                      |

**Summary**

Rising X intercept (hr): 11.7970  
Falling X intercept (hr): 12.1887  
Duration above 0.3m (hr): 0.3916  
Duration in Minutes 23.5

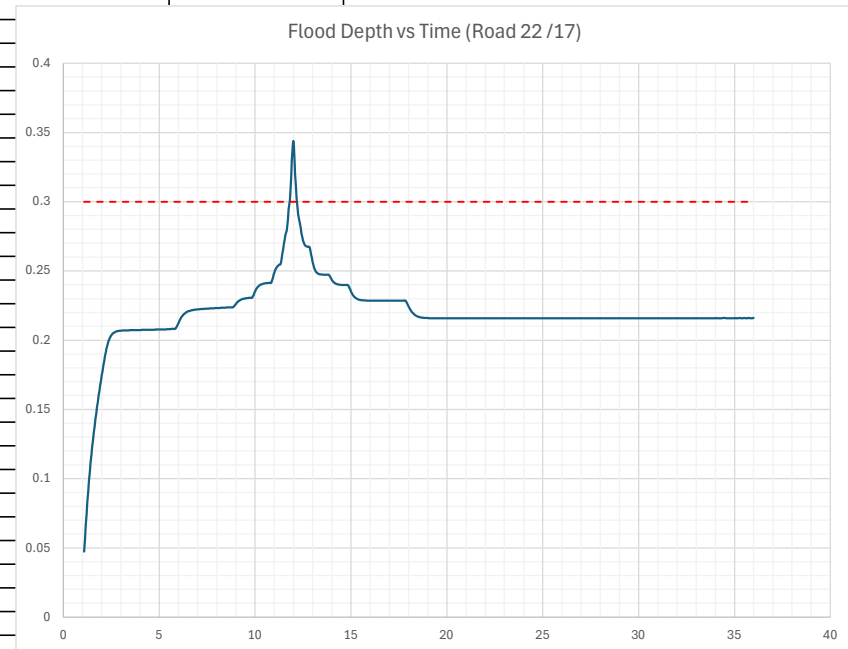


Road 22 &amp; 27- Depth vs Time

| Time (hr) | Depth (m) | Threshold (m) | Rising Cross X (hr) | Falling Cross X (hr) |
|-----------|-----------|---------------|---------------------|----------------------|
| 0         |           |               |                     |                      |
| 0.08333   |           |               |                     |                      |
| 0.16667   |           |               |                     |                      |
| 0.25      |           |               |                     |                      |
| 0.33333   |           |               |                     |                      |
| 0.41667   |           |               |                     |                      |
| 0.5       |           |               |                     |                      |
| 0.58333   |           |               |                     |                      |
| 0.66667   |           |               |                     |                      |
| 0.75      |           |               |                     |                      |
| 0.83333   |           |               |                     |                      |
| 0.91667   |           |               |                     |                      |
| 1         |           |               |                     |                      |
| 1.08333   | 0.04732   | 0.3           |                     |                      |
| 1.16667   | 0.06605   | 0.3           |                     |                      |
| 1.25      | 0.08315   | 0.3           |                     |                      |
| 1.33333   | 0.09826   | 0.3           |                     |                      |
| 1.41667   | 0.11137   | 0.3           |                     |                      |
| 1.5       | 0.12283   | 0.3           |                     |                      |
| 1.58333   | 0.13306   | 0.3           |                     |                      |
| 1.66667   | 0.14244   | 0.3           |                     |                      |
| 1.75      | 0.1513    | 0.3           |                     |                      |
| 1.83333   | 0.15957   | 0.3           |                     |                      |
| 1.91667   | 0.16736   | 0.3           |                     |                      |
| 2         | 0.17466   | 0.3           |                     |                      |
| 2.08333   | 0.18166   | 0.3           |                     |                      |
| 2.16667   | 0.18837   | 0.3           |                     |                      |
| 2.25      | 0.1941    | 0.3           |                     |                      |
| 2.33333   | 0.1985    | 0.3           |                     |                      |
| 2.41667   | 0.20159   | 0.3           |                     |                      |
| 2.5       | 0.20362   | 0.3           |                     |                      |
| 2.58333   | 0.2049    | 0.3           |                     |                      |
| 2.66667   | 0.20575   | 0.3           |                     |                      |
| 2.75      | 0.20624   | 0.3           |                     |                      |
| 2.83333   | 0.20655   | 0.3           |                     |                      |
| 2.91667   | 0.20677   | 0.3           |                     |                      |
| 3         | 0.20689   | 0.3           |                     |                      |
| 3.08333   | 0.20694   | 0.3           |                     |                      |
| 3.16667   | 0.20705   | 0.3           |                     |                      |
| 3.25      | 0.20709   | 0.3           |                     |                      |
| 3.33333   | 0.20712   | 0.3           |                     |                      |
| 3.41667   | 0.20714   | 0.3           |                     |                      |
| 3.5       | 0.20719   | 0.3           |                     |                      |
| 3.58333   | 0.20723   | 0.3           |                     |                      |
| 3.66667   | 0.20723   | 0.3           |                     |                      |
| 3.75      | 0.20726   | 0.3           |                     |                      |
| 3.83333   | 0.2073    | 0.3           |                     |                      |
| 3.91667   | 0.20734   | 0.3           |                     |                      |
| 4         | 0.20735   | 0.3           |                     |                      |
| 4.08333   | 0.20738   | 0.3           |                     |                      |
| 4.16667   | 0.2074    | 0.3           |                     |                      |
| 4.25      | 0.20745   | 0.3           |                     |                      |
| 4.33333   | 0.20746   | 0.3           |                     |                      |
| 4.41667   | 0.20751   | 0.3           |                     |                      |
| 4.5       | 0.20753   | 0.3           |                     |                      |
| 4.58333   | 0.20755   | 0.3           |                     |                      |
| 4.66667   | 0.20757   | 0.3           |                     |                      |
| 4.75      | 0.20761   | 0.3           |                     |                      |
| 4.83333   | 0.20764   | 0.3           |                     |                      |
| 4.91667   | 0.20768   | 0.3           |                     |                      |
| 5         | 0.20774   | 0.3           |                     |                      |

**Summary**

Rising X intercept (hr): 11.7954  
Falling X intercept (hr): 12.1832  
Duration above 0.3m (hr): 0.3878  
Duration in Minutes 23.3

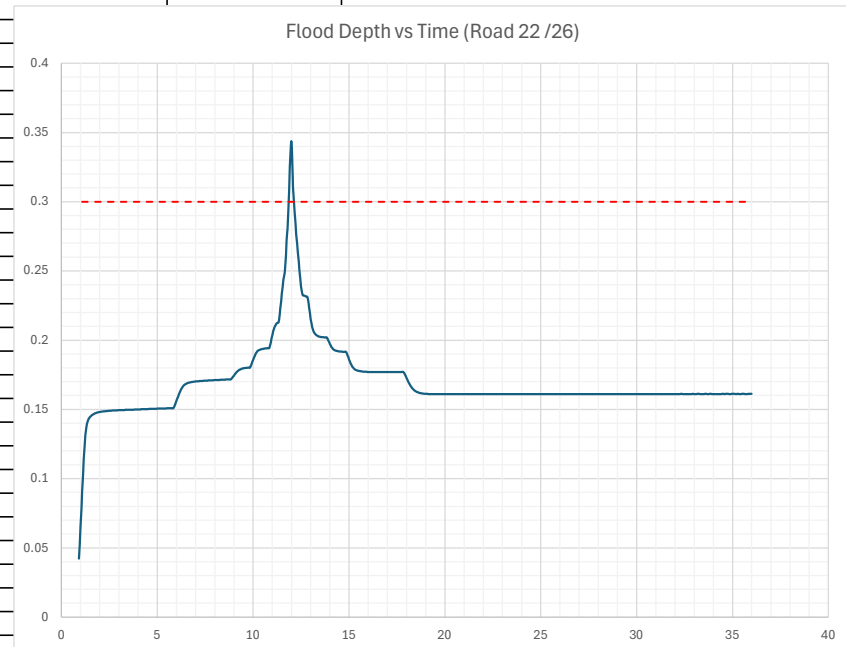


Road 22 &amp; 26- Depth vs Time

| Time (hr) | Depth (m) | Threshold (m) | Rising Cross X (hr) | Falling Cross X (hr) |
|-----------|-----------|---------------|---------------------|----------------------|
| 0         |           |               |                     |                      |
| 0.08333   |           |               |                     |                      |
| 0.16667   |           |               |                     |                      |
| 0.25      |           |               |                     |                      |
| 0.33333   |           |               |                     |                      |
| 0.41667   |           |               |                     |                      |
| 0.5       |           |               |                     |                      |
| 0.58333   |           |               |                     |                      |
| 0.66667   |           |               |                     |                      |
| 0.75      |           |               |                     |                      |
| 0.83333   |           |               |                     |                      |
| 0.91667   | 0.04215   |               |                     |                      |
| 1         | 0.06557   |               |                     |                      |
| 1.08333   | 0.09063   | 0.3           |                     |                      |
| 1.16667   | 0.11401   | 0.3           |                     |                      |
| 1.25      | 0.1313    | 0.3           |                     |                      |
| 1.33333   | 0.1395    | 0.3           |                     |                      |
| 1.41667   | 0.14298   | 0.3           |                     |                      |
| 1.5       | 0.14462   | 0.3           |                     |                      |
| 1.58333   | 0.14567   | 0.3           |                     |                      |
| 1.66667   | 0.14648   | 0.3           |                     |                      |
| 1.75      | 0.14709   | 0.3           |                     |                      |
| 1.83333   | 0.14756   | 0.3           |                     |                      |
| 1.91667   | 0.14791   | 0.3           |                     |                      |
| 2         | 0.14814   | 0.3           |                     |                      |
| 2.08333   | 0.14838   | 0.3           |                     |                      |
| 2.16667   | 0.14851   | 0.3           |                     |                      |
| 2.25      | 0.14867   | 0.3           |                     |                      |
| 2.33333   | 0.14876   | 0.3           |                     |                      |
| 2.41667   | 0.14887   | 0.3           |                     |                      |
| 2.5       | 0.14899   | 0.3           |                     |                      |
| 2.58333   | 0.14908   | 0.3           |                     |                      |
| 2.66667   | 0.14919   | 0.3           |                     |                      |
| 2.75      | 0.14923   | 0.3           |                     |                      |
| 2.83333   | 0.14929   | 0.3           |                     |                      |
| 2.91667   | 0.14937   | 0.3           |                     |                      |
| 3         | 0.1494    | 0.3           |                     |                      |
| 3.08333   | 0.14948   | 0.3           |                     |                      |
| 3.16667   | 0.14953   | 0.3           |                     |                      |
| 3.25      | 0.14955   | 0.3           |                     |                      |
| 3.33333   | 0.14961   | 0.3           |                     |                      |
| 3.41667   | 0.14964   | 0.3           |                     |                      |
| 3.5       | 0.14966   | 0.3           |                     |                      |
| 3.58333   | 0.14969   | 0.3           |                     |                      |
| 3.66667   | 0.14976   | 0.3           |                     |                      |
| 3.75      | 0.14982   | 0.3           |                     |                      |
| 3.83333   | 0.14984   | 0.3           |                     |                      |
| 3.91667   | 0.14991   | 0.3           |                     |                      |
| 4         | 0.14996   | 0.3           |                     |                      |
| 4.08333   | 0.15001   | 0.3           |                     |                      |
| 4.16667   | 0.15006   | 0.3           |                     |                      |
| 4.25      | 0.15009   | 0.3           |                     |                      |
| 4.33333   | 0.15015   | 0.3           |                     |                      |
| 4.41667   | 0.1502    | 0.3           |                     |                      |
| 4.5       | 0.15026   | 0.3           |                     |                      |
| 4.58333   | 0.15033   | 0.3           |                     |                      |
| 4.66667   | 0.15034   | 0.3           |                     |                      |
| 4.75      | 0.15037   | 0.3           |                     |                      |
| 4.83333   | 0.15042   | 0.3           |                     |                      |
| 4.91667   | 0.15048   | 0.3           |                     |                      |
| 5         | 0.15053   | 0.3           |                     |                      |

**Summary**

Rising X intercept (hr): 11.8549  
 Falling X intercept (hr): 12.1320  
 Duration above 0.3m (hr): 0.2771  
 Duration in Minutes: 16.6

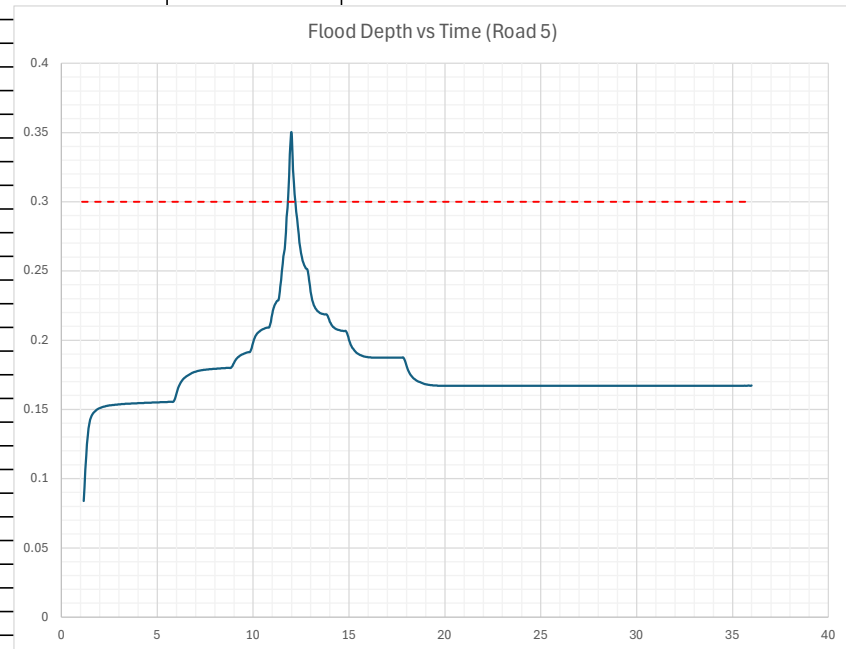


# Road 5 Depth vs Time

| Time (hr) | Depth (m) | Threshold (m) | Rising Cross X (hr) | Falling Cross X (hr) |
|-----------|-----------|---------------|---------------------|----------------------|
| 0         |           |               |                     |                      |
| 0.08333   |           |               |                     |                      |
| 0.16667   |           |               |                     |                      |
| 0.25      |           |               |                     |                      |
| 0.33333   |           |               |                     |                      |
| 0.41667   |           |               |                     |                      |
| 0.5       |           |               |                     |                      |
| 0.58333   |           |               |                     |                      |
| 0.66667   |           |               |                     |                      |
| 0.75      |           |               |                     |                      |
| 0.83333   |           |               |                     |                      |
| 0.91667   |           |               |                     |                      |
| 1         |           |               |                     |                      |
| 1.08333   |           | 0.3           |                     |                      |
| 1.16667   | 0.08394   | 0.3           |                     |                      |
| 1.25      | 0.10655   | 0.3           |                     |                      |
| 1.33333   | 0.12469   | 0.3           |                     |                      |
| 1.41667   | 0.13626   | 0.3           |                     |                      |
| 1.5       | 0.14248   | 0.3           |                     |                      |
| 1.58333   | 0.14565   | 0.3           |                     |                      |
| 1.66667   | 0.14746   | 0.3           |                     |                      |
| 1.75      | 0.14866   | 0.3           |                     |                      |
| 1.83333   | 0.14963   | 0.3           |                     |                      |
| 1.91667   | 0.15037   | 0.3           |                     |                      |
| 2         | 0.15094   | 0.3           |                     |                      |
| 2.08333   | 0.1514    | 0.3           |                     |                      |
| 2.16667   | 0.15181   | 0.3           |                     |                      |
| 2.25      | 0.15213   | 0.3           |                     |                      |
| 2.33333   | 0.1524    | 0.3           |                     |                      |
| 2.41667   | 0.15263   | 0.3           |                     |                      |
| 2.5       | 0.15285   | 0.3           |                     |                      |
| 2.58333   | 0.153     | 0.3           |                     |                      |
| 2.66667   | 0.15316   | 0.3           |                     |                      |
| 2.75      | 0.15329   | 0.3           |                     |                      |
| 2.83333   | 0.15341   | 0.3           |                     |                      |
| 2.91667   | 0.15353   | 0.3           |                     |                      |
| 3         | 0.15366   | 0.3           |                     |                      |
| 3.08333   | 0.15373   | 0.3           |                     |                      |
| 3.16667   | 0.15385   | 0.3           |                     |                      |
| 3.25      | 0.15391   | 0.3           |                     |                      |
| 3.33333   | 0.15399   | 0.3           |                     |                      |
| 3.41667   | 0.15411   | 0.3           |                     |                      |
| 3.5       | 0.15412   | 0.3           |                     |                      |
| 3.58333   | 0.15416   | 0.3           |                     |                      |
| 3.66667   | 0.15425   | 0.3           |                     |                      |
| 3.75      | 0.15432   | 0.3           |                     |                      |
| 3.83333   | 0.15436   | 0.3           |                     |                      |
| 3.91667   | 0.15442   | 0.3           |                     |                      |
| 4         | 0.15448   | 0.3           |                     |                      |
| 4.08333   | 0.15454   | 0.3           |                     |                      |
| 4.16667   | 0.15459   | 0.3           |                     |                      |
| 4.25      | 0.15464   | 0.3           |                     |                      |
| 4.33333   | 0.15468   | 0.3           |                     |                      |
| 4.41667   | 0.15474   | 0.3           |                     |                      |
| 4.5       | 0.15478   | 0.3           |                     |                      |
| 4.58333   | 0.15483   | 0.3           |                     |                      |
| 4.66667   | 0.1549    | 0.3           |                     |                      |
| 4.75      | 0.15492   | 0.3           |                     |                      |
| 4.83333   | 0.15498   | 0.3           |                     |                      |
| 4.91667   | 0.15505   | 0.3           |                     |                      |
| 5         | 0.15507   | 0.3           |                     |                      |

## Summary

|                           |         |
|---------------------------|---------|
| Rising X intercept (hr):  | 11.8119 |
| Falling X intercept (hr): | 12.2027 |
| Duration above 0.3m (hr): | 0.3908  |
| Duration in Minutes       | 23.4    |



| Time (hr) | Depth (m) | Threshold (m) | Rising Cross X (hr) | Falling Cross X (hr) |
|-----------|-----------|---------------|---------------------|----------------------|
| 0         |           |               |                     |                      |
| 0.08333   |           |               |                     |                      |
| 0.16667   |           |               |                     |                      |
| 0.25      |           |               |                     |                      |
| 0.33333   |           |               |                     |                      |
| 0.41667   |           |               |                     |                      |
| 0.5       |           |               |                     |                      |
| 0.58333   |           |               |                     |                      |
| 0.66667   |           |               |                     |                      |
| 0.75      |           |               |                     |                      |
| 0.83333   |           |               |                     |                      |
| 0.91667   |           |               |                     |                      |
| 1         |           |               |                     |                      |
| 1.08333   |           | 0.3           |                     |                      |
| 1.16667   |           | 0.3           |                     |                      |
| 1.25      | 0.04154   | 0.3           |                     |                      |
| 1.33333   | 0.04467   | 0.3           |                     |                      |
| 1.41667   | 0.04673   | 0.3           |                     |                      |
| 1.5       | 0.04876   | 0.3           |                     |                      |
| 1.58333   | 0.05024   | 0.3           |                     |                      |
| 1.66667   | 0.05118   | 0.3           |                     |                      |
| 1.75      | 0.05181   | 0.3           |                     |                      |
| 1.83333   | 0.05236   | 0.3           |                     |                      |
| 1.91667   | 0.05273   | 0.3           |                     |                      |
| 2         | 0.05306   | 0.3           |                     |                      |
| 2.08333   | 0.0534    | 0.3           |                     |                      |
| 2.16667   | 0.0536    | 0.3           |                     |                      |
| 2.25      | 0.05379   | 0.3           |                     |                      |
| 2.33333   | 0.05396   | 0.3           |                     |                      |
| 2.41667   | 0.0541    | 0.3           |                     |                      |
| 2.5       | 0.05421   | 0.3           |                     |                      |
| 2.58333   | 0.05435   | 0.3           |                     |                      |
| 2.66667   | 0.05446   | 0.3           |                     |                      |
| 2.75      | 0.05459   | 0.3           |                     |                      |
| 2.83333   | 0.05468   | 0.3           |                     |                      |
| 2.91667   | 0.05477   | 0.3           |                     |                      |
| 3         | 0.05486   | 0.3           |                     |                      |
| 3.08333   | 0.05493   | 0.3           |                     |                      |
| 3.16667   | 0.05499   | 0.3           |                     |                      |
| 3.25      | 0.05508   | 0.3           |                     |                      |
| 3.33333   | 0.05517   | 0.3           |                     |                      |
| 3.41667   | 0.05524   | 0.3           |                     |                      |
| 3.5       | 0.05534   | 0.3           |                     |                      |
| 3.58333   | 0.0554    | 0.3           |                     |                      |
| 3.66667   | 0.05548   | 0.3           |                     |                      |
| 3.75      | 0.05552   | 0.3           |                     |                      |
| 3.83333   | 0.05558   | 0.3           |                     |                      |
| 3.91667   | 0.05565   | 0.3           |                     |                      |
| 4         | 0.0557    | 0.3           |                     |                      |
| 4.08333   | 0.05576   | 0.3           |                     |                      |
| 4.16667   | 0.05584   | 0.3           |                     |                      |
| 4.25      | 0.05593   | 0.3           |                     |                      |
| 4.33333   | 0.056     | 0.3           |                     |                      |
| 4.41667   | 0.05603   | 0.3           |                     |                      |
| 4.5       | 0.0561    | 0.3           |                     |                      |
| 4.58333   | 0.05615   | 0.3           |                     |                      |
| 4.66667   | 0.05621   | 0.3           |                     |                      |
| 4.75      | 0.05627   | 0.3           |                     |                      |
| 4.83333   | 0.05635   | 0.3           |                     |                      |
| 4.91667   | 0.05642   | 0.3           |                     |                      |
| 5         | 0.05647   | 0.3           |                     |                      |

### Summary

|                           |         |
|---------------------------|---------|
| Rising X intercept (hr):  | 11.9649 |
| Falling X intercept (hr): | 12.0445 |
| Duration above 0.3m (hr): | 0.0797  |
| Duration in Minutes       | 4.8     |

