Rocky Creek Precinct – Stage Five

Hydraulic Modelling

Technical Memorandum

Prepared for: Kroymans Developments Pty Ltd
Attention: Jarred Doyle
Date: 19th August 2024
Prepared by: Soo Vang
Ref: For Issue

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Stantec

Revision	Description	Author		Quality Check		Independent Review	
01	For Issue	SV		ZM		JD	

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1.0 INTRODUCTION

Background

Stantec previously completed a Flood Impact Assessment for the proposed Pinecrest development located within the Coopers Road Local Area of Mount Peter. This technical memo should be read in conjunction with the *Q194140_R1V1_Flood_Impact_Assessment* report which discussed the interim and ultimate development cases and any associated impacts on the existing flood regime.

Rocky Creek Precinct – Stage Five

To assist in the design of Stage 5 of the Rocky Creek Precinct, additional hydraulic modeling was required for each to assist in:

- The identification of potential issues,
- Optimize stormwater outlet locations,
- Ensure Stages 1 – 5 lots remain free from significant flooding,
- Severe storm assessment

Design Topography

The design DEM (Figure 1) for the Rocky Creek precinct was input into the hydraulic model. The design surface is current for the current Stage 1 - 5 developments. Drainage easements have been input into the model to mimic the ultimate design infrastructure. However, within the model, these structures are exaggerated so that the model grid cells can identify and divert water as intended. these modifications have been made to simulate the cross drainage on Cooper Road and the drainage easement within Stage 5. Future development and Stages within the Rocky Creek precinct may be modified as the development progresses to mitigate potential drainage issues.

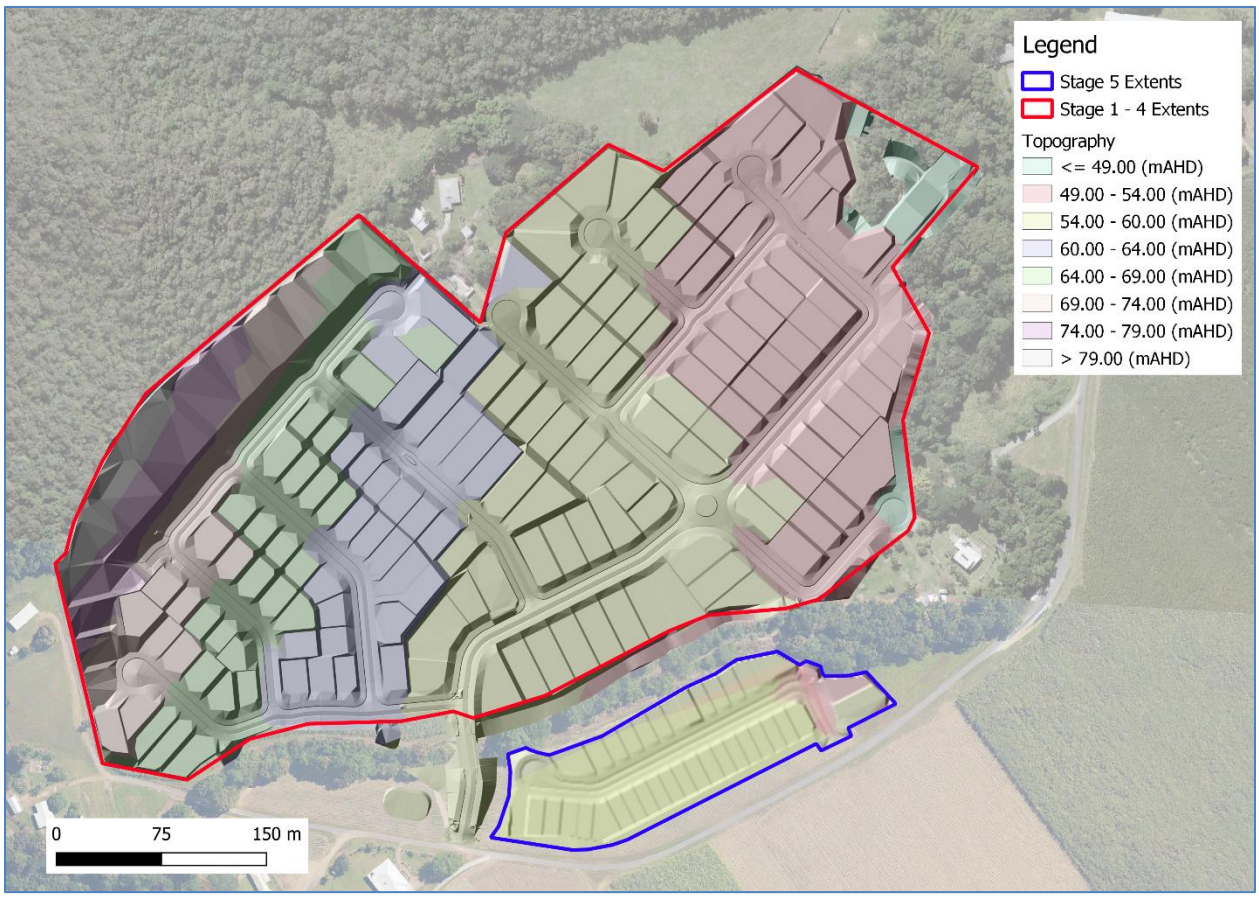


Figure 1 Design DEM

Model Inputs

A complete drainage network (Figure 2) for Stages 1 – 5 of the Rocky Creek Precinct was provided and input into the hydraulic model. A ten percent blockage factor was applied to all pipes in the network. It is expected that minor changes may be required to this network as the development progresses. Stormwater drainage infrastructure and legal points of discharge are also shown in Figure 2.

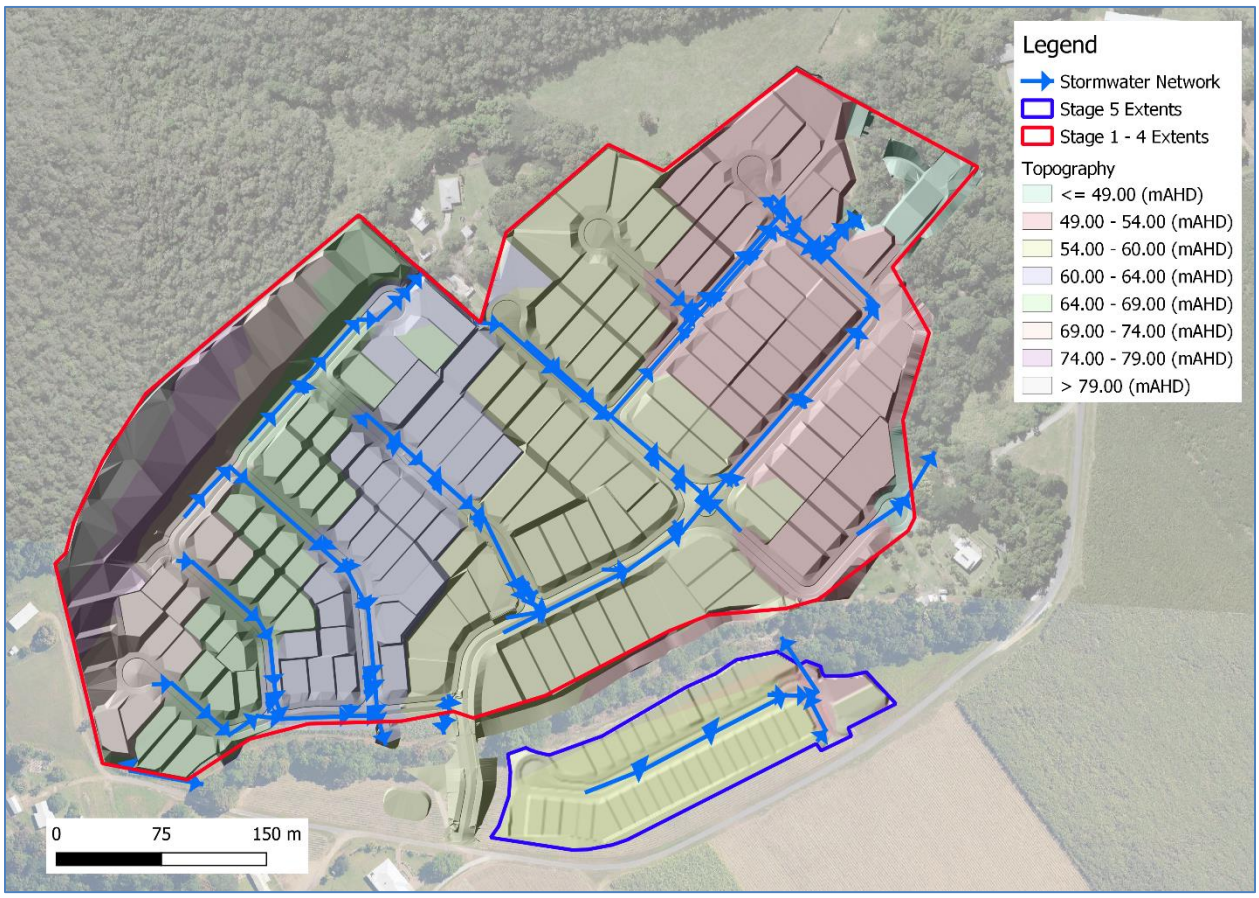


Figure 2 Proposed Pipe Network

The catchment breakdown for the existing topography can be seen in Figure 3. Figure 3 outlines the catchments contributing to the relevant stage. These contributing catchments are highlighted below in green. All minor catchments north of the site have also been identified.

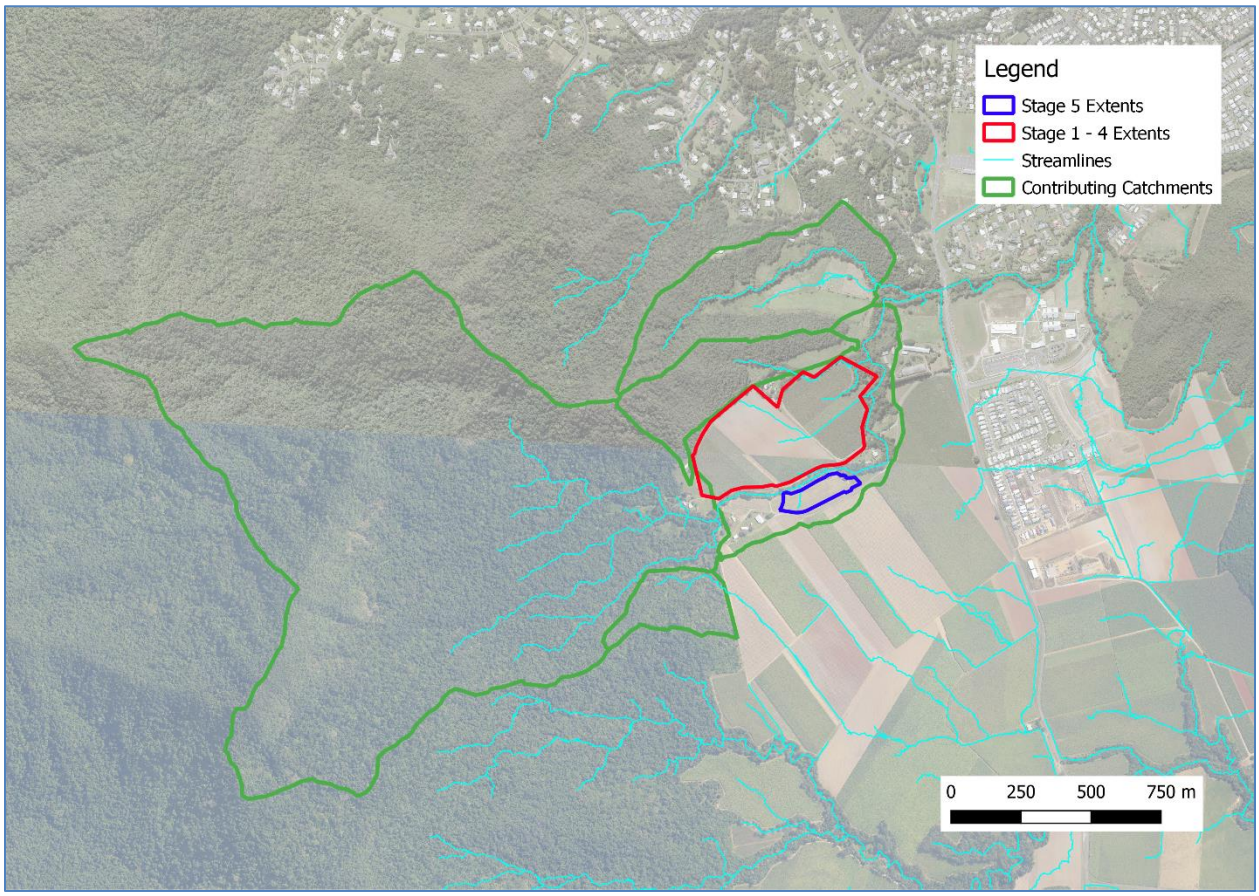


Figure 3 Delineated Catchments

Flows for the Rocky Creek precinct area, Stages 1 – 4 were input into the hydraulic model as a 2D SA PIT layer. This method distributes the flow hydrograph across all pits within a polygon area. The application of hydrographs using this method means that if one inlet reaches capacity excess flows will then be shown on the road and flow to the next downstream inlet. Flows from external catchments were input as SA All inflows which distribute flows evenly across the polygon area. The Stage 5 flows were input via an SA All layer, these flows were distributed on the road to mimic a 'worst case scenario' to assist with the lot level assessment. Inflow locations and type are shown in Figure 4.

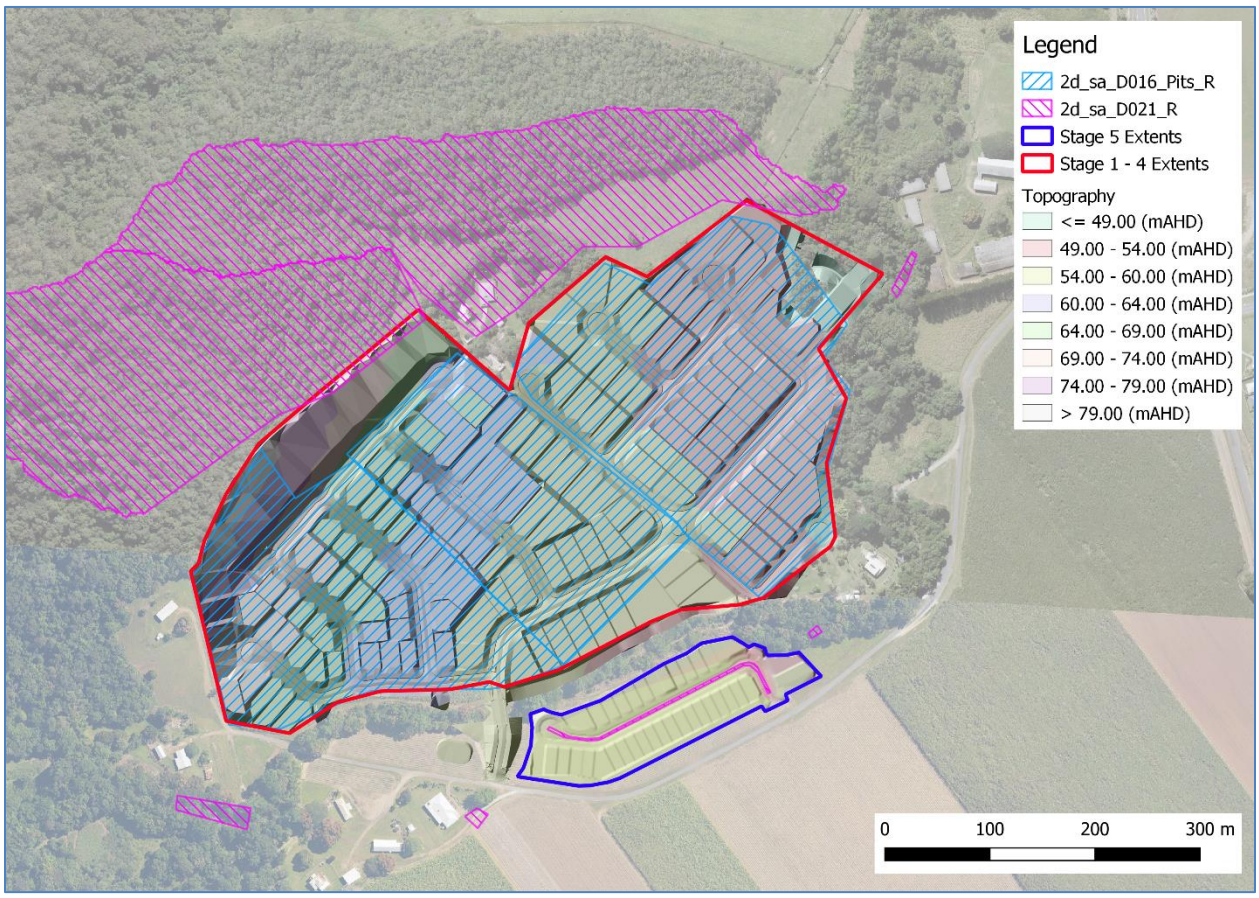


Figure 4 SA Pit Inflow Areas

The proposed Stages 1 – 5 use the ultimate developed case flows from the previously approved master plan. The flow regime, imperviousness and inflows are consistent and compliant with the flooding master plan. Figure 5 shows the inflow locations which align with the original flood modelling master plan.

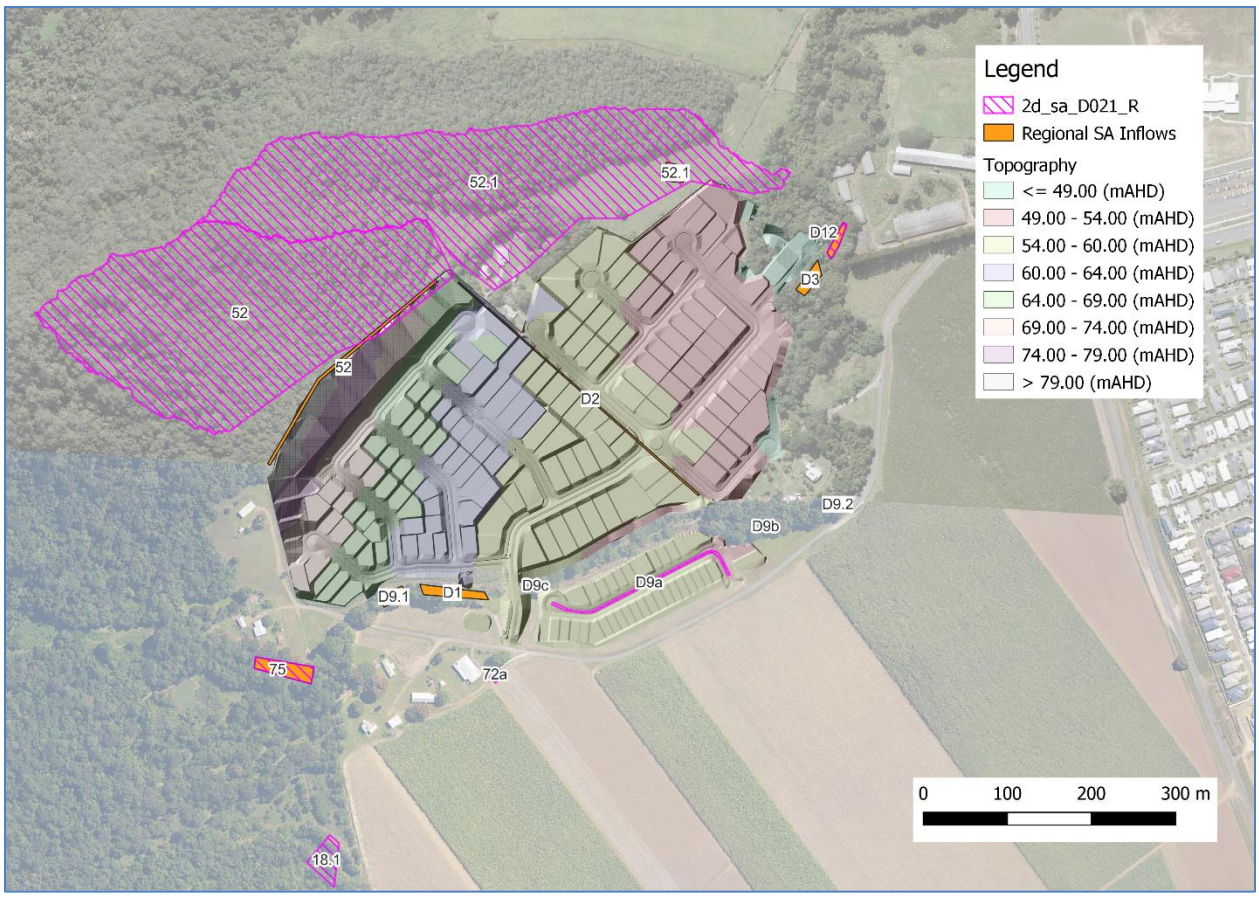


Figure 5 Inflow Locations for Regional Model Compared to Truncated model.

Modelling of the local catchments north of Cooper Road align with the original master plan for Pinecrest. The flows for stages 1 – 5 discharges into Stoney Creek and require no amendments to the cross-drainage structures along Mount Peter Road. The current design (Stage 1 – 5) produce results that closely align with the ultimate master plan modelling (Figure 6), in that any upgrades to Mount Peter Road are only subject to the development that occurs south of Cooper Road (future stages).

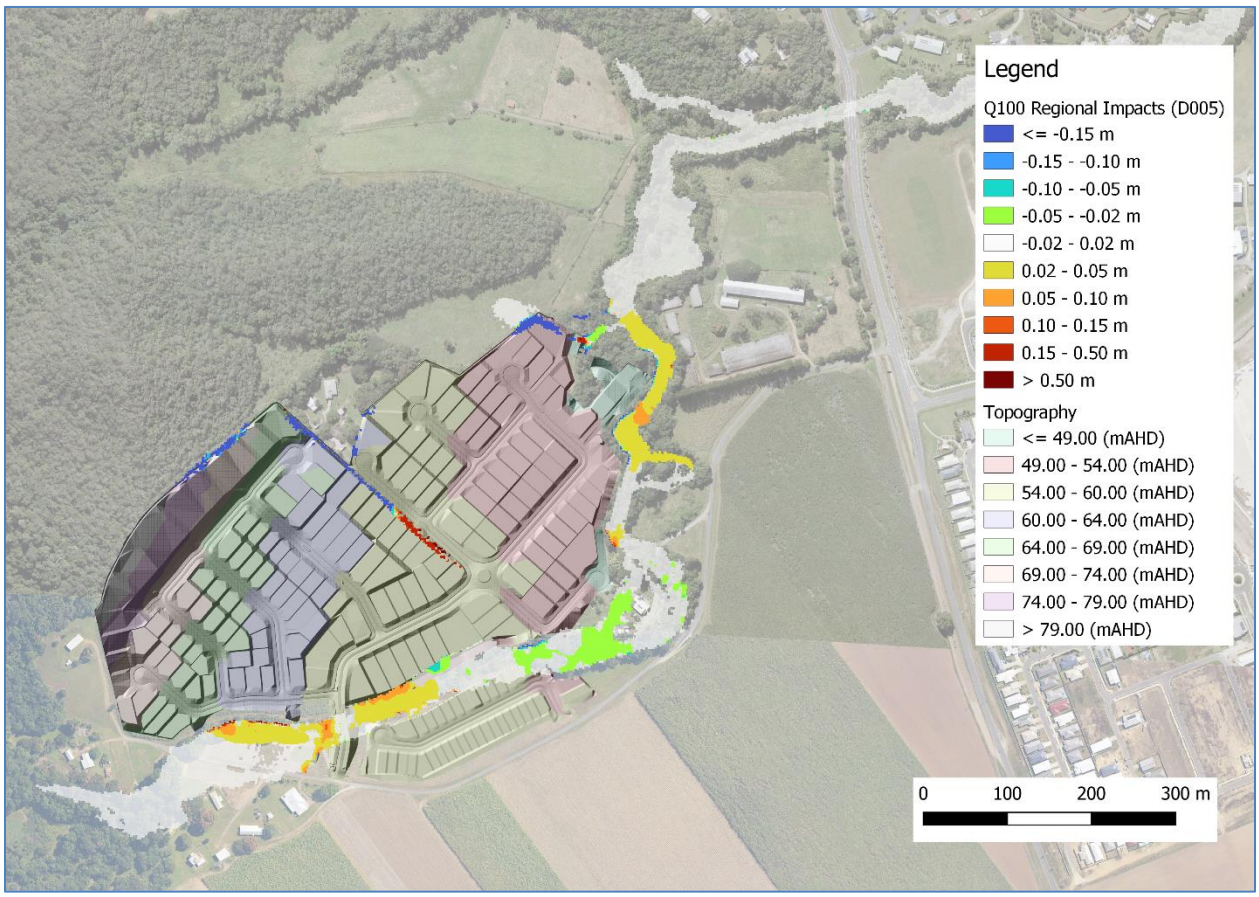


Figure 6 Regional Model Impacts to Stoney Creek.

2.0 RESULTS

1% AEP Event

Modelling has demonstrated that all Lots within Stage 5 of the Rocky Creek Precinct remain free from significant flooding during the 1% AEP event as demonstrated in Figure 7.

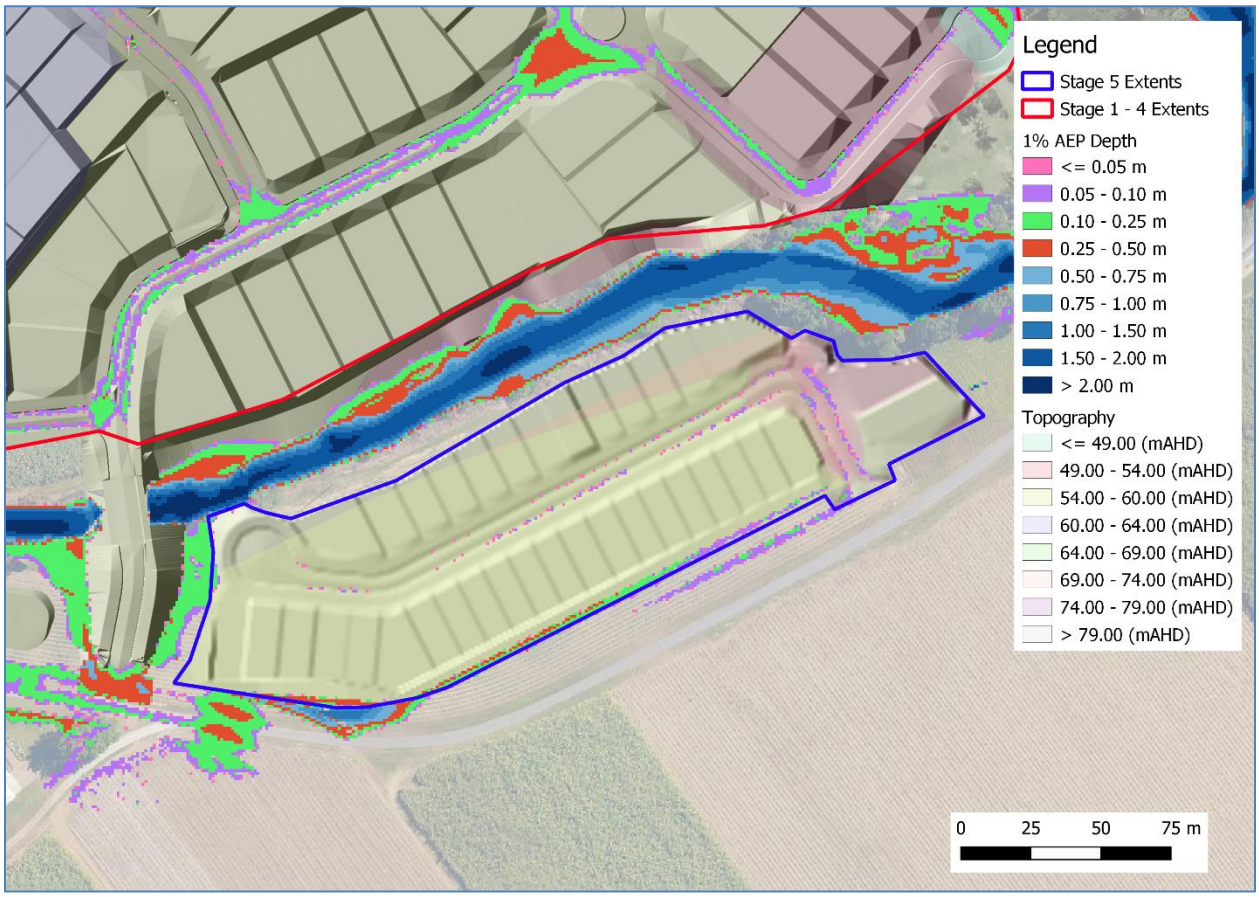


Figure 7 Developed 1% AEP Flood Depths

1% AEP Severe Storm

To assess for impact in a severe storm, the 1% AEP event was run with 100% blockage applied to the pipe network. Figure 8 indicates lots within Stage 5 are flood free during this scenario. It is noted that depths below 50mm are not shown.

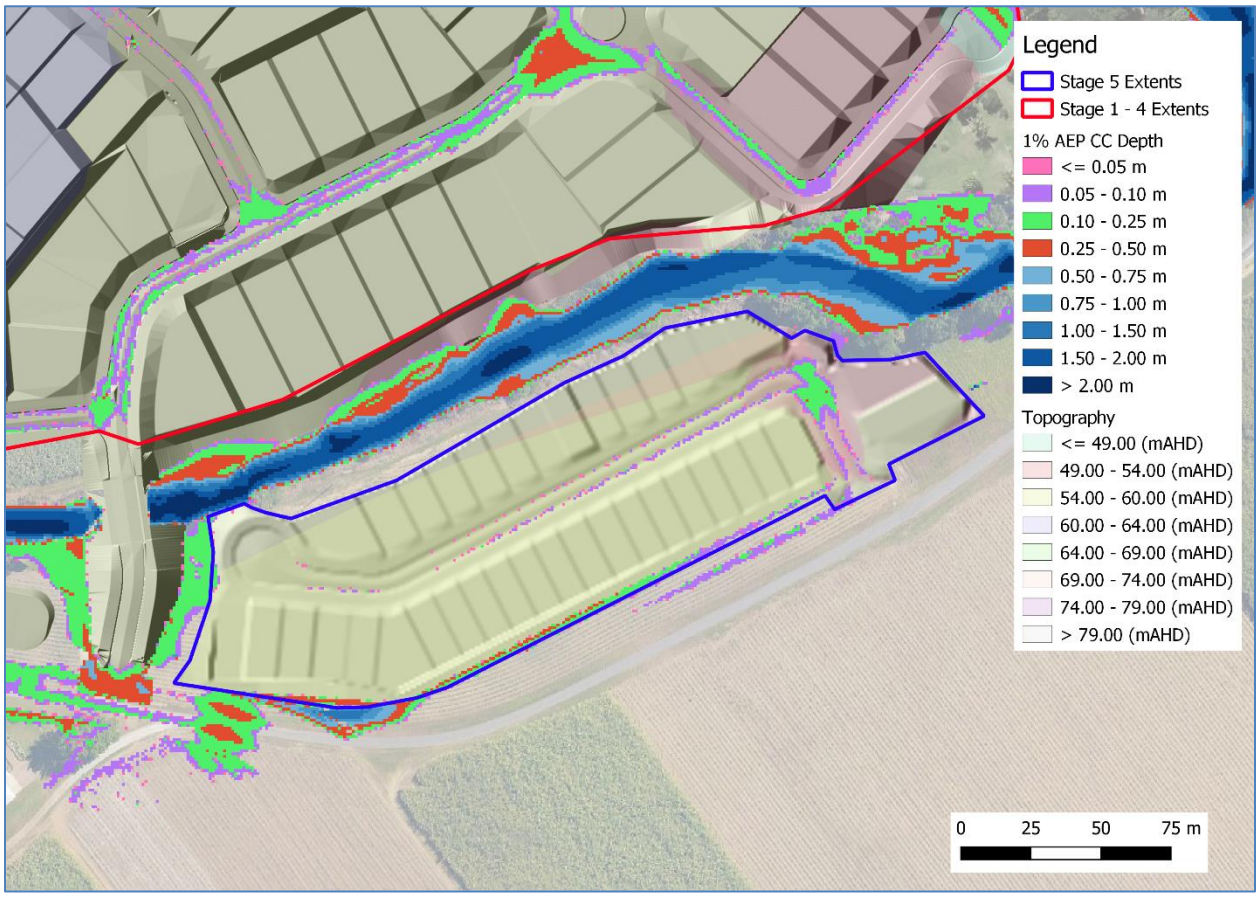


Figure 8 1% AEP Severe Storm

Hazard values recorded during severe storm event indicate that roadways within Stage 5 will remain below a H1 category, as shown in Figure 9.

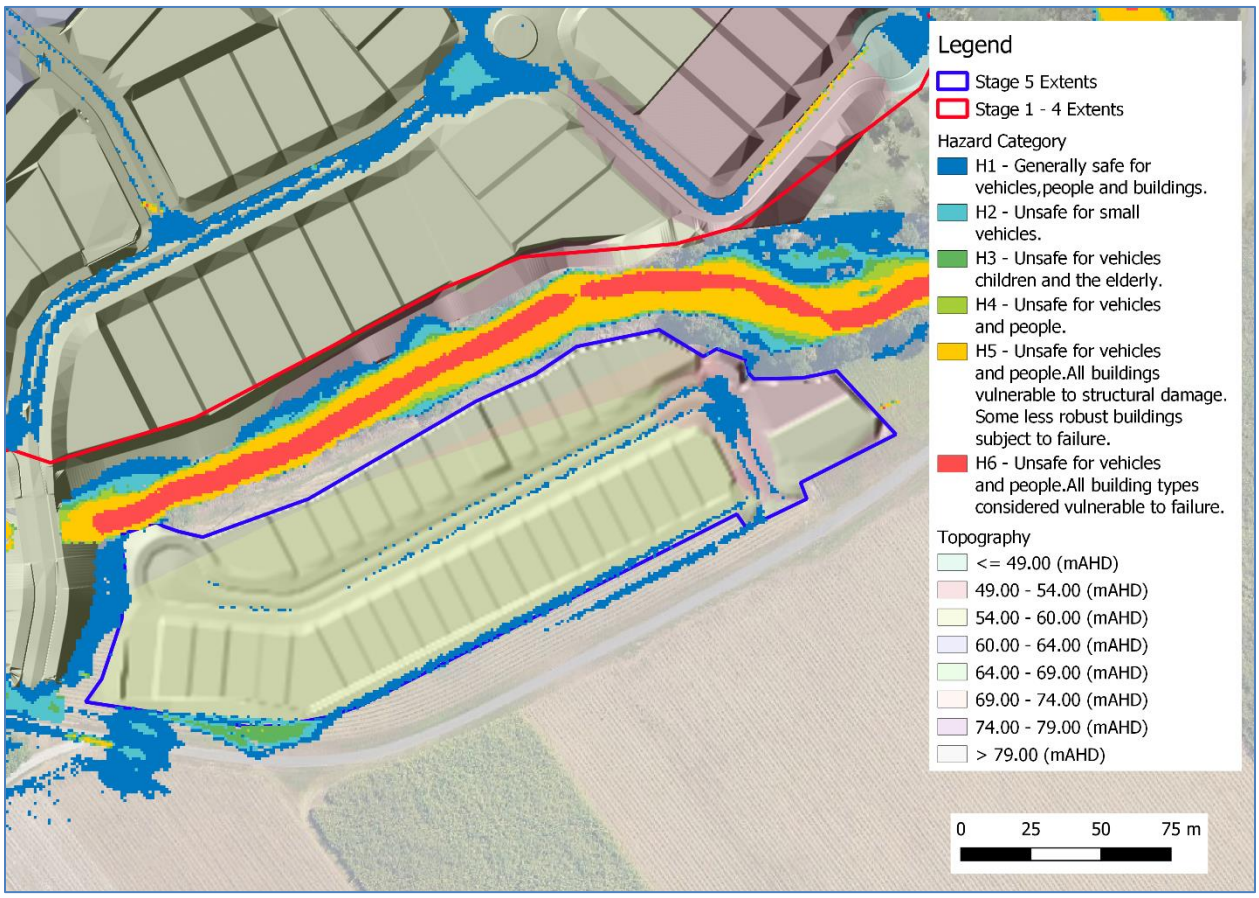


Figure 9 Severe Storm Hazard Values

3.0 CONCLUSION

Modelling of Stage Five of the Rocky Creek precinct indicates that all lots remain free from significant flooding for events up to the 1% AEP event.

Fine scale modelling has been performed to ensure swale drains along the Southern Boundary of Stage 5 function as intended and can cater for the 1% AEP event.

A severe storm assessment has indicated that roads within Stage 5 will remain below a H1 category with no significant changes to flow paths.

4.0 QUALIFICATIONS

This technical memo has been prepared by Stantec for Kroymans Developments Pty Ltd. Specifically, this report provides information relating to flooding within the development area. Our analysis and overall approach has been catered to the specific requirements of Kroymans Developments Pty Ltd, and may not be applicable beyond this scope. For this reason, any other third parties other than Kroymans Developments Pty Ltd are not authorized to utilise this report without further input and advice from Stantec.

Whilst this report accurately assesses catchment hydrologic and hydraulic characteristics based on design storms using industry standard modelling techniques and engineering practices, the actual future observed flows, levels and extent of inundation may vary from those predicted.

All modelling was performed on a design surface DEM that may differ from the final as constructed landforms with no consideration given to how these differences may influence flood behaviour on the site.

This technical memo should be read in conjunction with *Q194140_R1V1_Flood_Impact_Assessment* report which discussed the interim and ultimate development cases and any associated impacts on the existing flood regime from a regional perspective.

APPENDICIES

Appendix A FLOOD MAPPING

U:\304701183\3_Data\2_Analysis\GIS\Figures\ATLAS_MAP\Rocky_Creek_Mapping.qgz

Q5 Peak Water Surface Level

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-01

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q005_Max_Max_h
<= 40.0 mAHD
40.0 - 45.0 mAHD
45.0 - 50.0 mAHD
50.0 - 55.0 mAHD
55.0 - 60.0 mAHD
60.0 - 65.0 mAHD
65.0 - 70.0 mAHD
> 70.0 mAHD

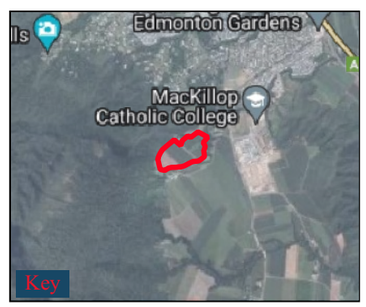
Topography
<= 49.00 (mAHD)
49.00 - 54.00 (mAHD)
54.00 - 60.00 (mAHD)
60.00 - 64.00 (mAHD)
64.00 - 69.00 (mAHD)
69.00 - 74.00 (mAHD)
74.00 - 79.00 (mAHD)
> 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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Q5 Peak Flood Depth

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-02

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q005_Max_Max_d
- <= 0.05 m
- 0.05 - 0.10 m
- 0.10 - 0.25 m
- 0.25 - 0.50 m
- 0.50 - 0.75 m
- 0.75 - 1.00 m
- 1.00 - 1.50 m
- 1.50 - 2.00 m
- > 2.00 m

Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
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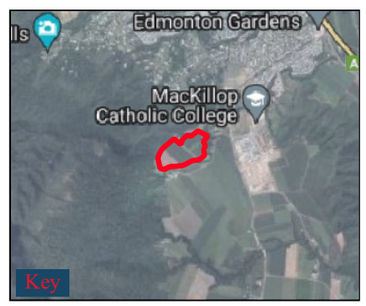
References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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Q5 Peak Flood Velocity

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-03

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q005_Max_Max_V
- <= 0.40 m/s
- 0.40 - 0.50 m/s
- 0.50 - 0.60 m/s
- 0.60 - 0.70 m/s
- 0.70 - 0.80 m/s
- 0.80 - 0.90 m/s
- 0.90 - 1.00 m/s
- 1.00 - 1.20 m/s
- 1.20 - 2.00 m/s
- > 2.00 m/s

Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

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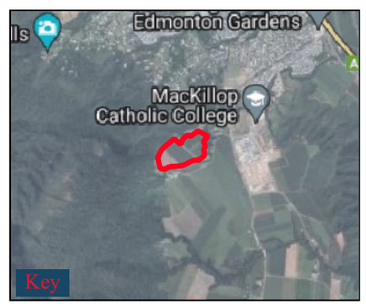

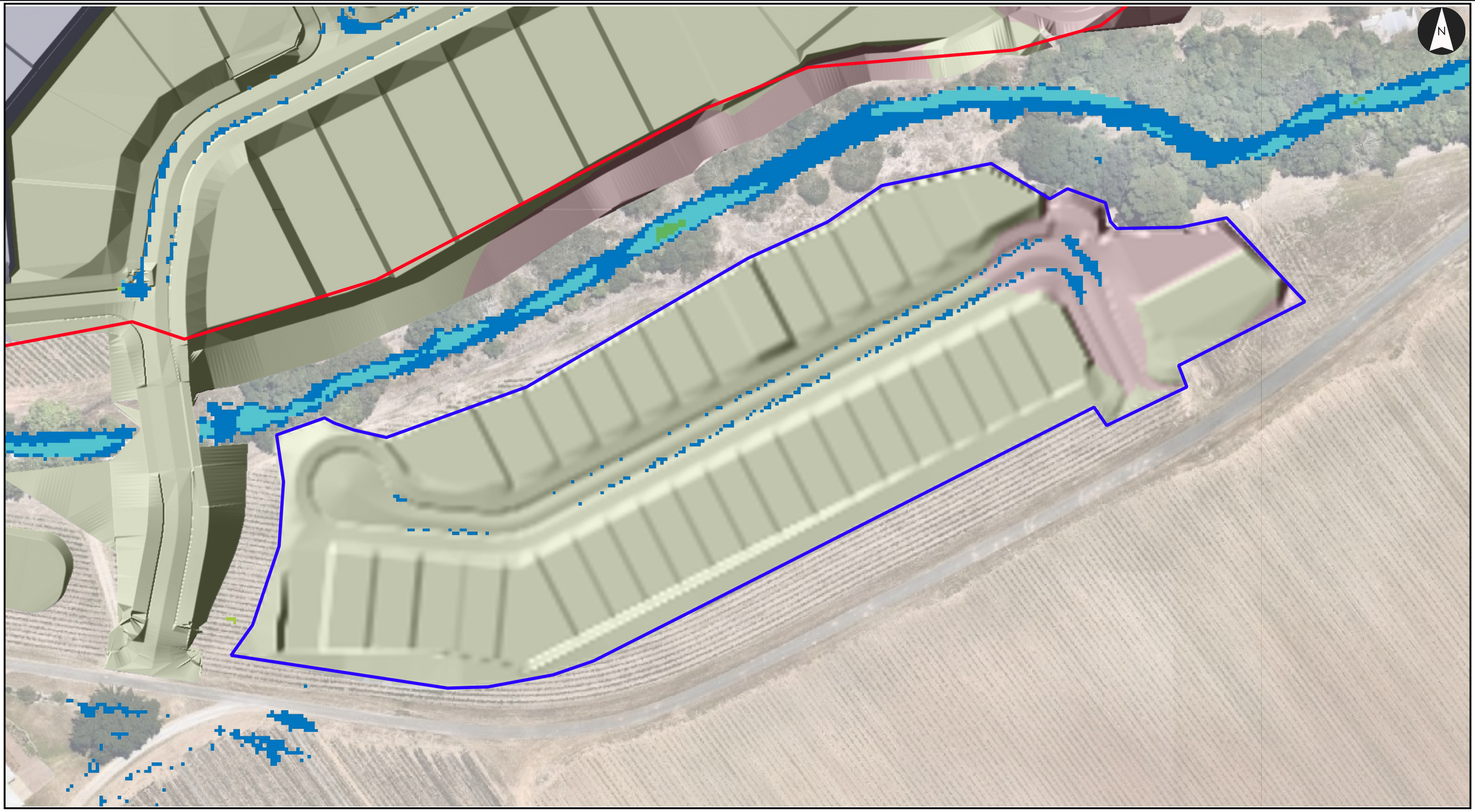

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Q5 Peak Combined Hazard

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-04

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q005_Max_Max_ZAEM1
H1 - Generally safe for vehicles,people and buildings.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles children and the elderly.
H4 - Unsafe for vehicles and people.
H5 - Unsafe for vehicles and people.All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 - Unsafe for vehicles and people.All building types considered vulnerable to failure.

Topography
<= 49.00 (mAHD)
49.00 - 54.00 (mAHD)
54.00 - 60.00 (mAHD)
60.00 - 64.00 (mAHD)
64.00 - 69.00 (mAHD)
69.00 - 74.00 (mAHD)
74.00 - 79.00 (mAHD)
> 79.00 (mAHD)

Notes:
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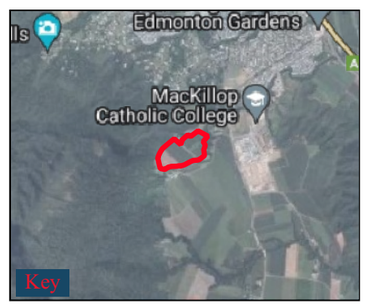
References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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Q100 Peak Water Surface Level

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-05

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q100_Max_Max_h
<= 40.0 mAHD
40.0 - 45.0 mAHD
45.0 - 50.0 mAHD
50.0 - 55.0 mAHD
55.0 - 60.0 mAHD
60.0 - 65.0 mAHD
65.0 - 70.0 mAHD
> 70.0 mAHD

Topography
<= 49.00 (mAHD)
49.00 - 54.00 (mAHD)
54.00 - 60.00 (mAHD)
60.00 - 64.00 (mAHD)
64.00 - 69.00 (mAHD)
69.00 - 74.00 (mAHD)
74.00 - 79.00 (mAHD)
> 79.00 (mAHD)

Notes:
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References:
1. Nearmap

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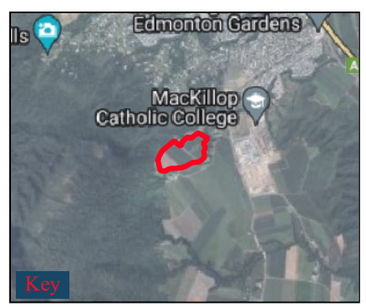
Scale at A3: 1:1000



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Q100 Peak Flood Depth

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-06

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q100_Max_Max_d
- <= 0.05 m
- 0.05 - 0.10 m
- 0.10 - 0.25 m
- 0.25 - 0.50 m
- 0.50 - 0.75 m
- 0.75 - 1.00 m
- 1.00 - 1.50 m
- 1.50 - 2.00 m
- > 2.00 m

Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
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References:
1. Nearmap

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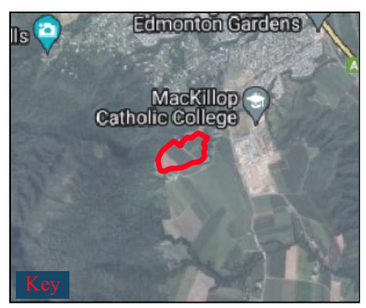
Scale at A3: 1:1000



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Q100 Peak Flood Velocity

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-07

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021_Q100_Max_Max_V
<= 0.40 m/s
0.40 - 0.50 m/s
0.50 - 0.60 m/s
0.60 - 0.70 m/s
0.70 - 0.80 m/s
0.80 - 0.90 m/s
0.90 - 1.00 m/s
1.00 - 1.20 m/s
1.20 - 2.00 m/s
> 2.00 m/s

Topography
<= 49.00 (mAHD)
49.00 - 54.00 (mAHD)
54.00 - 60.00 (mAHD)
60.00 - 64.00 (mAHD)
64.00 - 69.00 (mAHD)
69.00 - 74.00 (mAHD)
74.00 - 79.00 (mAHD)
> 79.00 (mAHD)

Notes:
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References:
1. Nearmap

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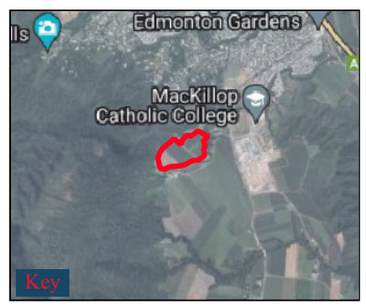

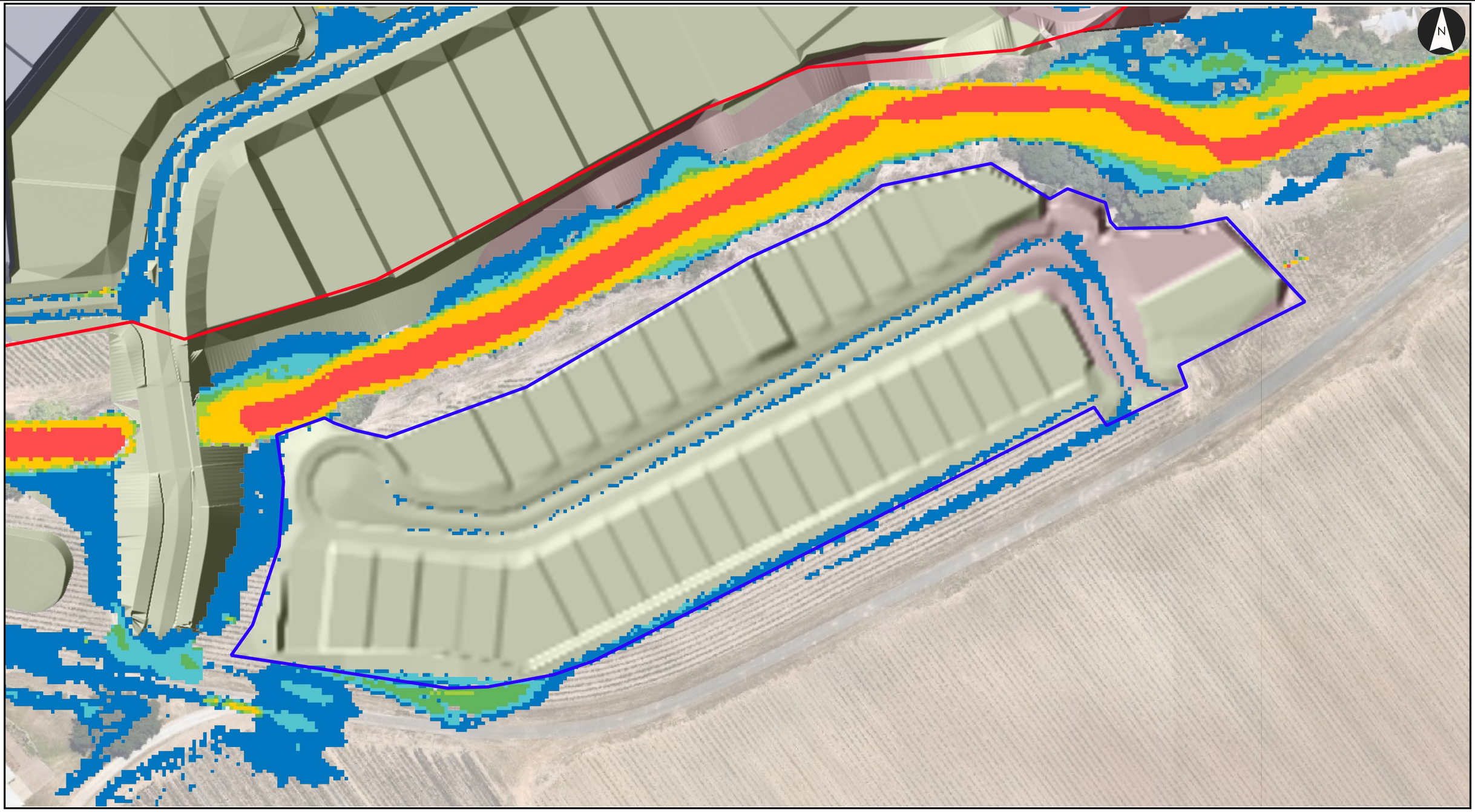

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Q100 Peak Combined Hazard

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-08

Stantec

Legend

- Stage 5 Extents
- Stage 1 - 4 Extents

Mt_Peter_D021_Q100_Max_Max_ZAEM1

- H1 - Generally safe for vehicles,people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people.All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people.All building types considered vulnerable to failure.

Topography

- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

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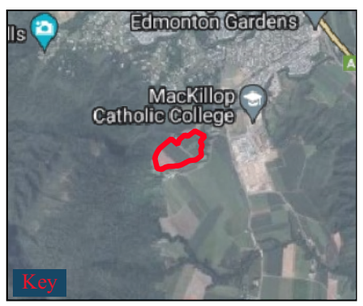
Scale at A3: 1:1000



Q5 Peak Water Surface Level - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-09

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q005_Max_Max_h
<= 40.0 mAHD
40.0 - 45.0 mAHD
45.0 - 50.0 mAHD
50.0 - 55.0 mAHD
55.0 - 60.0 mAHD
60.0 - 65.0 mAHD
65.0 - 70.0 mAHD
> 70.0 mAHD

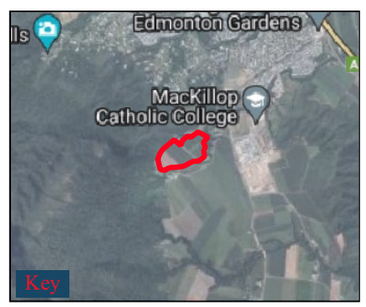
Topography
<= 49.00 (mAHD)
49.00 - 54.00 (mAHD)
54.00 - 60.00 (mAHD)
60.00 - 64.00 (mAHD)
64.00 - 69.00 (mAHD)
69.00 - 74.00 (mAHD)
74.00 - 79.00 (mAHD)
> 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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Q5 Peak Flood Depth - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-010

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q005_Max_Max_d
- <= 0.05 m
- 0.05 - 0.10 m
- 0.10 - 0.25 m
- 0.25 - 0.50 m
- 0.50 - 0.75 m
- 0.75 - 1.00 m
- 1.00 - 1.50 m
- 1.50 - 2.00 m
- > 2.00 m

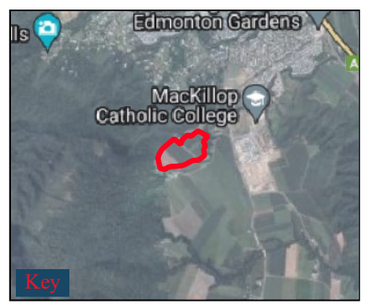
Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

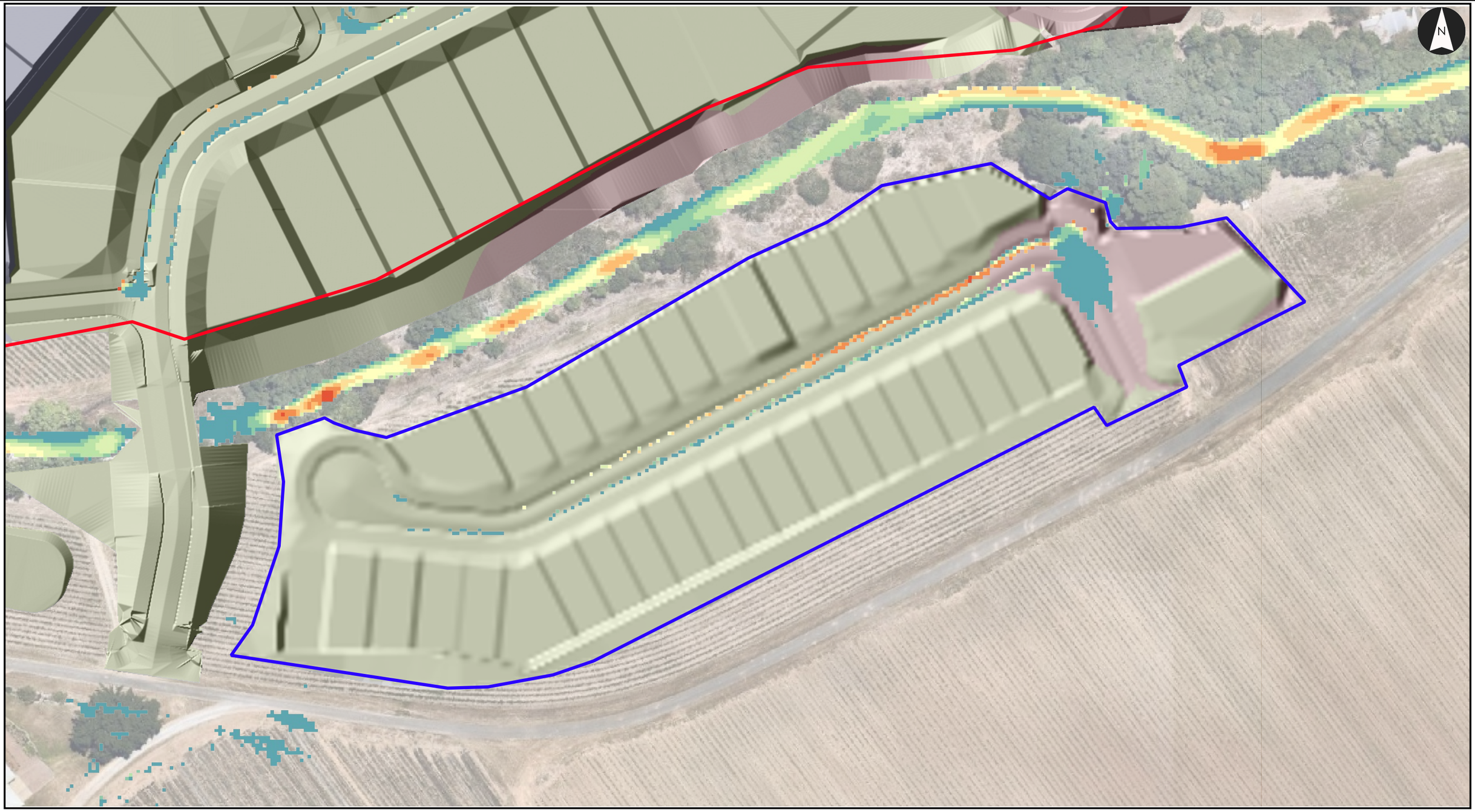
Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000





Q5 Peak Flood Velocity - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-011

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q005_Max_Max_V
- <= 0.40 m/s
- 0.40 - 0.50 m/s
- 0.50 - 0.60 m/s
- 0.60 - 0.70 m/s
- 0.70 - 0.80 m/s
- 0.80 - 0.90 m/s
- 0.90 - 1.00 m/s
- 1.00 - 1.20 m/s
- 1.20 - 2.00 m/s
- > 2.00 m/s

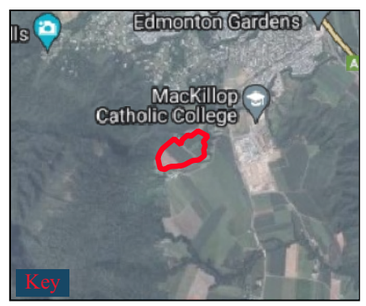
Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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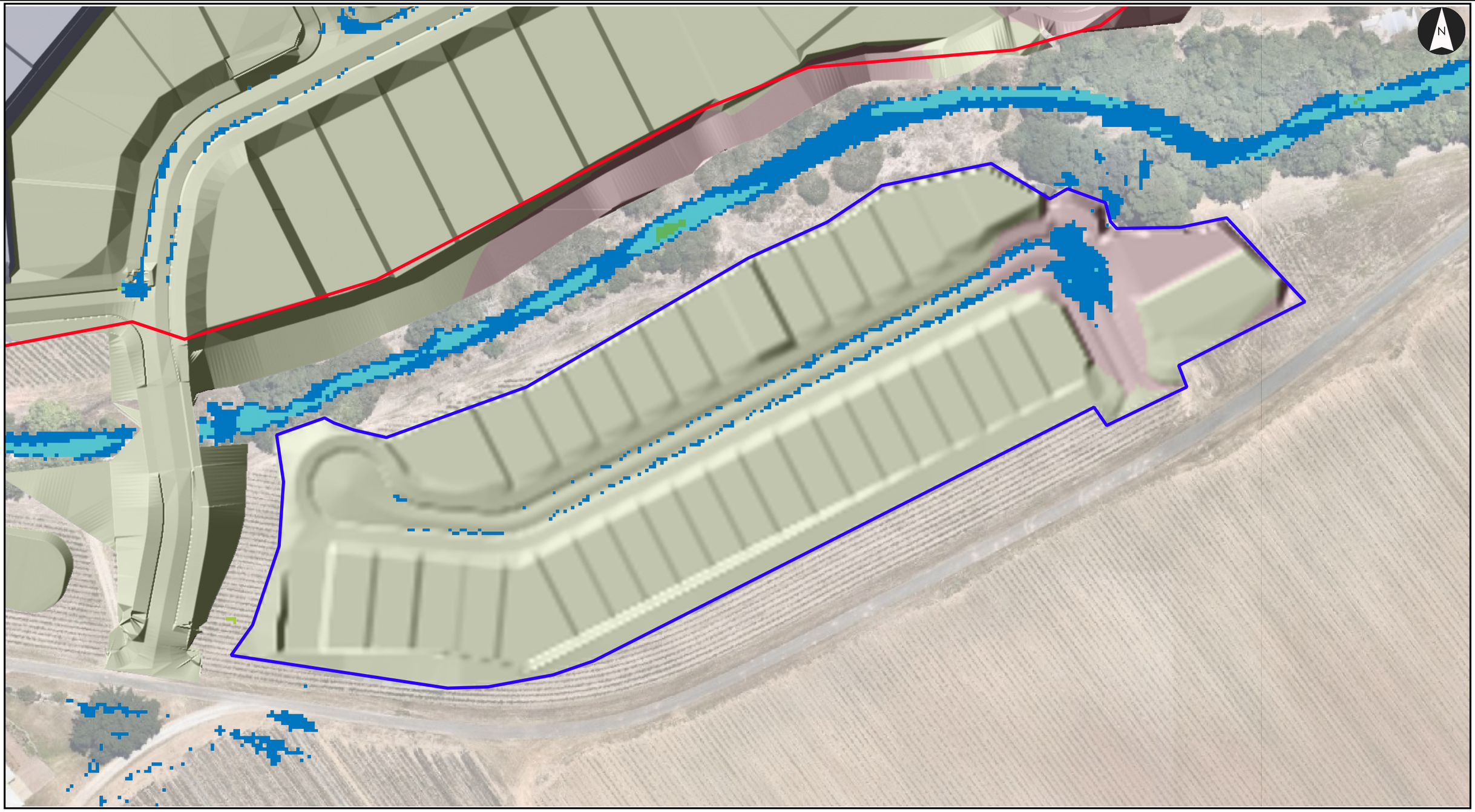

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Q5 Peak Combined Hazard - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-012

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q005_Max_Max_ZAEM1
- H1 - Generally safe for vehicles,people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people.All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people.All building types considered vulnerable to failure.

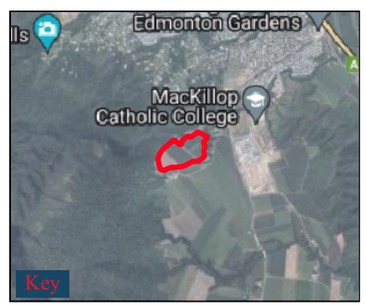
Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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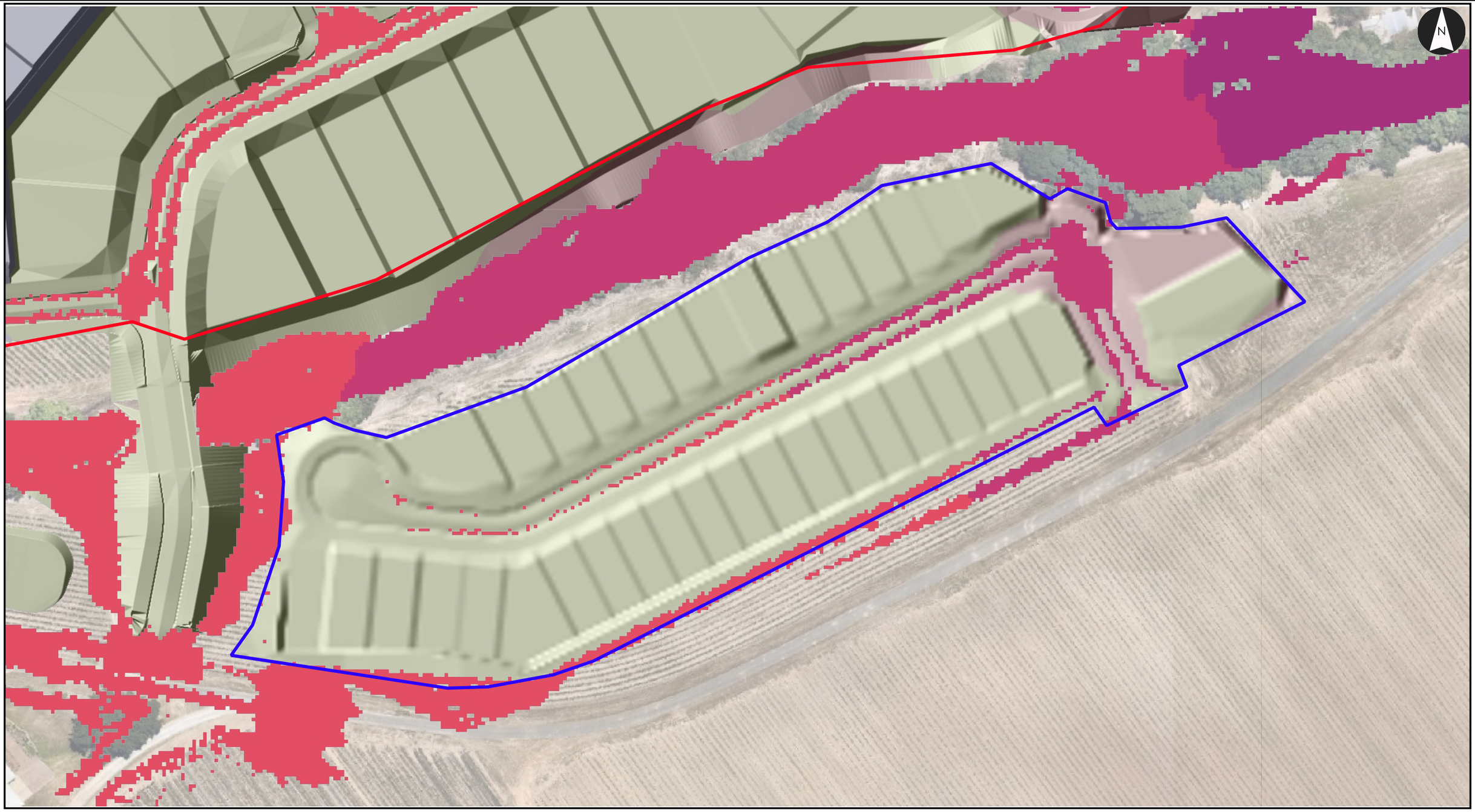


Q100 Peak Water Surface Level - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-013

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q100_Max_Max_h
<= 40.0 mAHD
40.0 - 45.0 mAHD
45.0 - 50.0 mAHD
50.0 - 55.0 mAHD
55.0 - 60.0 mAHD
60.0 - 65.0 mAHD
65.0 - 70.0 mAHD
> 70.0 mAHD

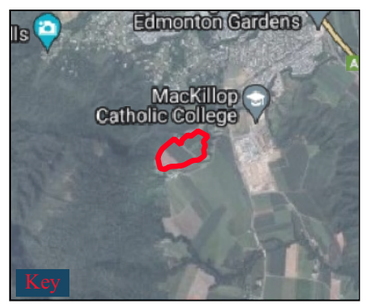
Topography
<= 49.00 (mAHD)
49.00 - 54.00 (mAHD)
54.00 - 60.00 (mAHD)
60.00 - 64.00 (mAHD)
64.00 - 69.00 (mAHD)
69.00 - 74.00 (mAHD)
74.00 - 79.00 (mAHD)
> 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



U:\304701183\3_Data\2_Analysis\GIS\Figures\ATLAS_MAP\Rocky_Creek_Mapping.qgz

Q100 Peak Flood Depth - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-014

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q100_Max_Max_d
- <= 0.05 m
- 0.05 - 0.10 m
- 0.10 - 0.25 m
- 0.25 - 0.50 m
- 0.50 - 0.75 m
- 0.75 - 1.00 m
- 1.00 - 1.50 m
- 1.50 - 2.00 m
- > 2.00 m

Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

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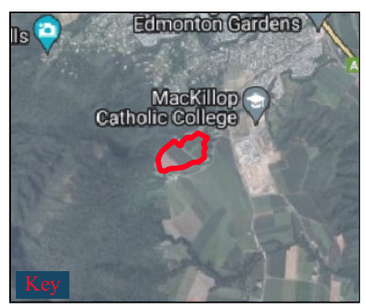
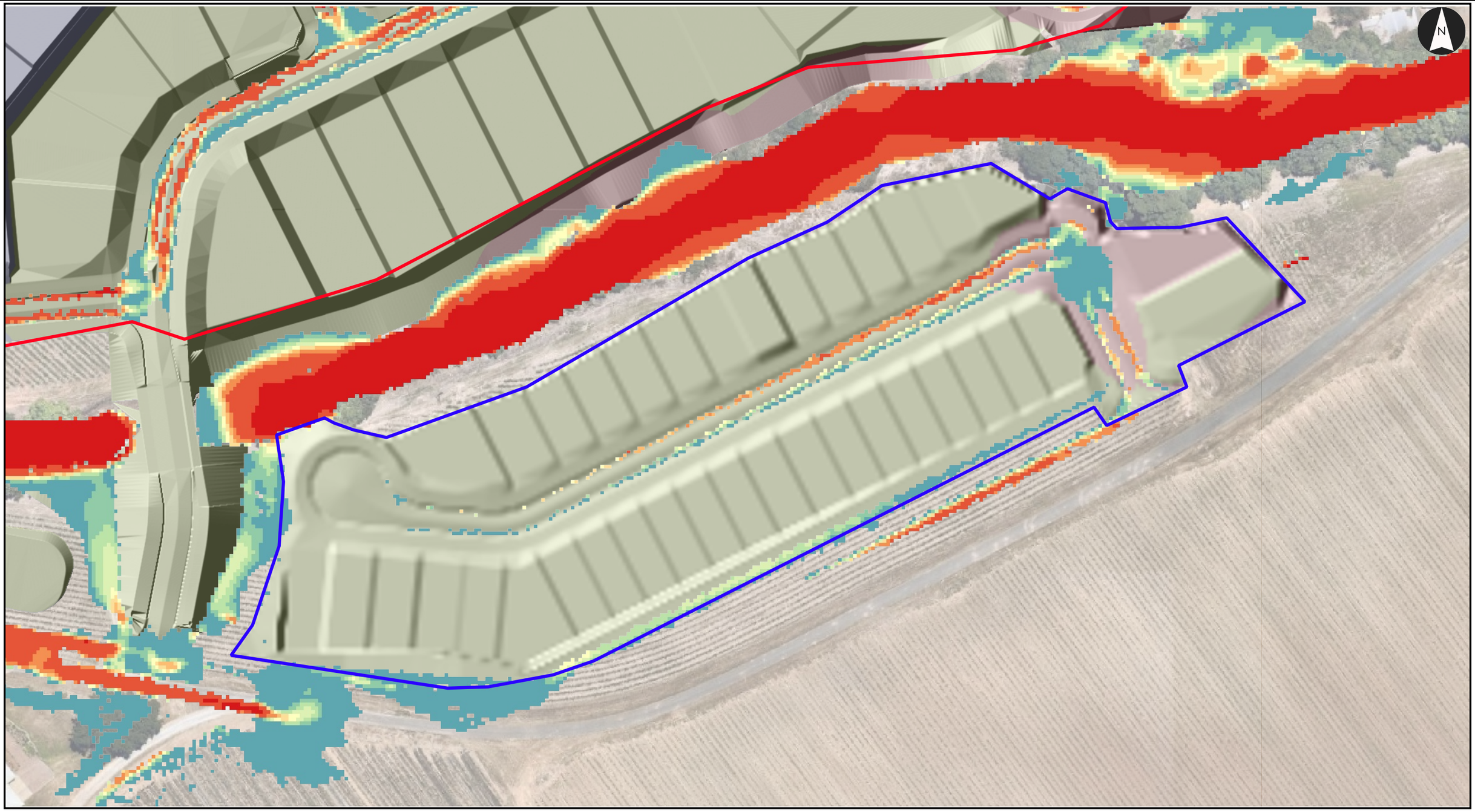
Scale at A3: 1:1000





Q100 Peak Flood Velocity - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-015

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents

Mt_Peter_D021FB_Q100_Max_Max_V
- <= 0.40 m/s
- 0.40 - 0.50 m/s
- 0.50 - 0.60 m/s
- 0.60 - 0.70 m/s
- 0.70 - 0.80 m/s
- 0.80 - 0.90 m/s
- 0.90 - 1.00 m/s
- 1.00 - 1.20 m/s
- 1.20 - 2.00 m/s
- > 2.00 m/s

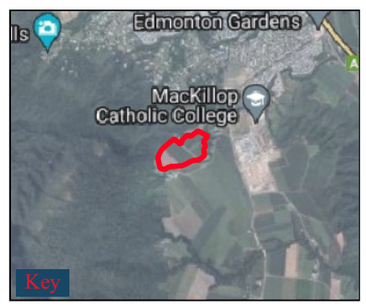
Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



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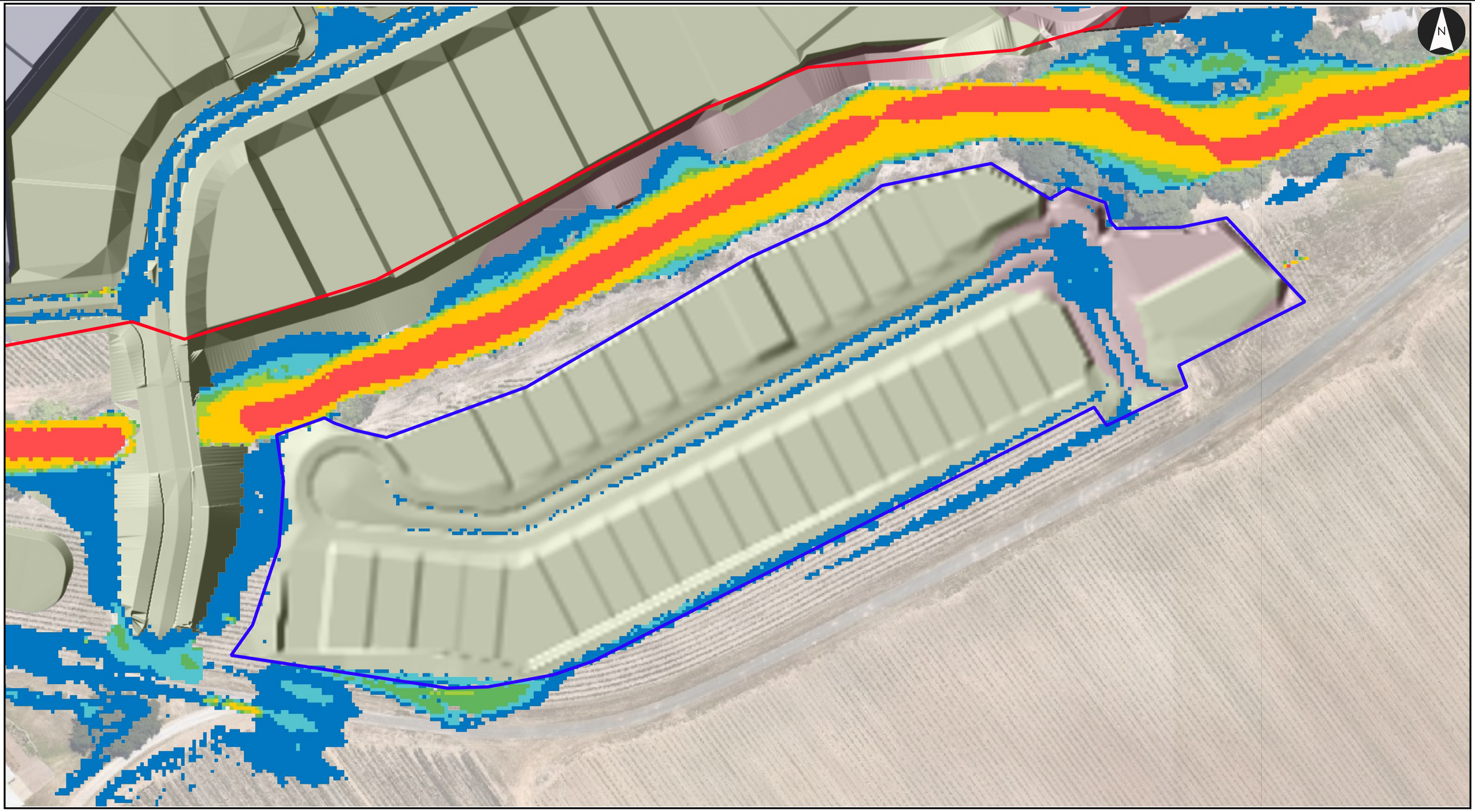

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Q100 Peak Combined Hazard - Fully Blocked

Project: Rocky Creek Stage 1 - 5
Client: Kroymans Developments Pty Ltd
Project Code: 304701183
Drawn By: SV, Checked By: ZM
Date: (2024-08-19)
Figure No: GIS-Q-016

Stantec

Legend

Stage 5 Extents
Stage 1 - 4 Extents
Mt_Peter_D021FB_Q100_Max_Max_ZAEM1
- H1 - Generally safe for vehicles,people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people.All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people.All building types considered vulnerable to failure.

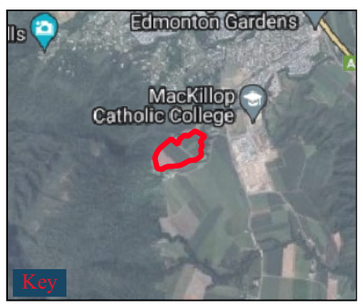
Topography
- <= 49.00 (mAHD)
- 49.00 - 54.00 (mAHD)
- 54.00 - 60.00 (mAHD)
- 60.00 - 64.00 (mAHD)
- 64.00 - 69.00 (mAHD)
- 69.00 - 74.00 (mAHD)
- 74.00 - 79.00 (mAHD)
- > 79.00 (mAHD)

Notes:
1. Map displayed in EPSG:28355

References:
1. Nearmap

10 0 10 20 30 40 m

Scale at A3: 1:1000



Rocky Creek Stage 5

Stormwater Water Management Plan

Prepared for: Kroymans Developments Pty Ltd
Date: 28 November 2024
Prepared by: Soo Vang
Ref: 304701183

Stantec Australia Pty Ltd
Level 3, 52 Merivale Street, South Brisbane QLD 4101
Tel: +61 7 3811 4500 Web: www.stantec.com

Stantec

Revision	Description	Author		Quality Check		Independent Review	
1	DRAFT	Soo Vang	SV	Zac McCosker	ZM	Jarred Doyle	JD

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1.0 INTRODUCTION

1.1 BACKGROUND

Stantec has been engaged by Kroymans Development PTY LTD to prepare a Stormwater Management Plan for the Rocky Creek development stage 5 works.

This management plan has been prepared to align with current design guidelines and addresses the following project objectives;

- Design of Stormwater Quality Improvement Devices (SQID's) to assess the quality of stormwater discharging from the site and compare that to the relevant Water Quality Objectives (WOQ's).

1.2 DESIGN STANDARDS

This management plan has been prepared in accordance with the following design standards;

- FNQROC Regional Development Manual
- Queensland Urban Drainage Manual (QUDM) 2017.
- Water by Design - Music Modelling Guidelines (2010).
- Environment Protection Agency's (EPA) – Guideline – EPA Best Practice Urban Stormwater Management – Erosion and Sediment Control; and
- International Erosion Control Association's (IECA) – Best Practice Erosion & Sediment Control.

It is noted that where design criteria varied, advice in accordance with FNQROC has been adopted.

1.3 DATA

Data which has been sourced or provided to assist in developing used within this report are as follows;

- Rainfall data extracted from the Cairns weather station (31011) for the period of 1990 to 1999
- Aerial imagery sourced from Near map

1.4 PRE-DEVELOPMENT SITE DESCRIPTION

The total subject site has an approximate area of 1.69 ha. As illustrated in **Figure 1**, the site is bounded by Cooper Road and Rocky Creek Road. Based on the latest aerial imagery, the current site consists of open area cane farm.

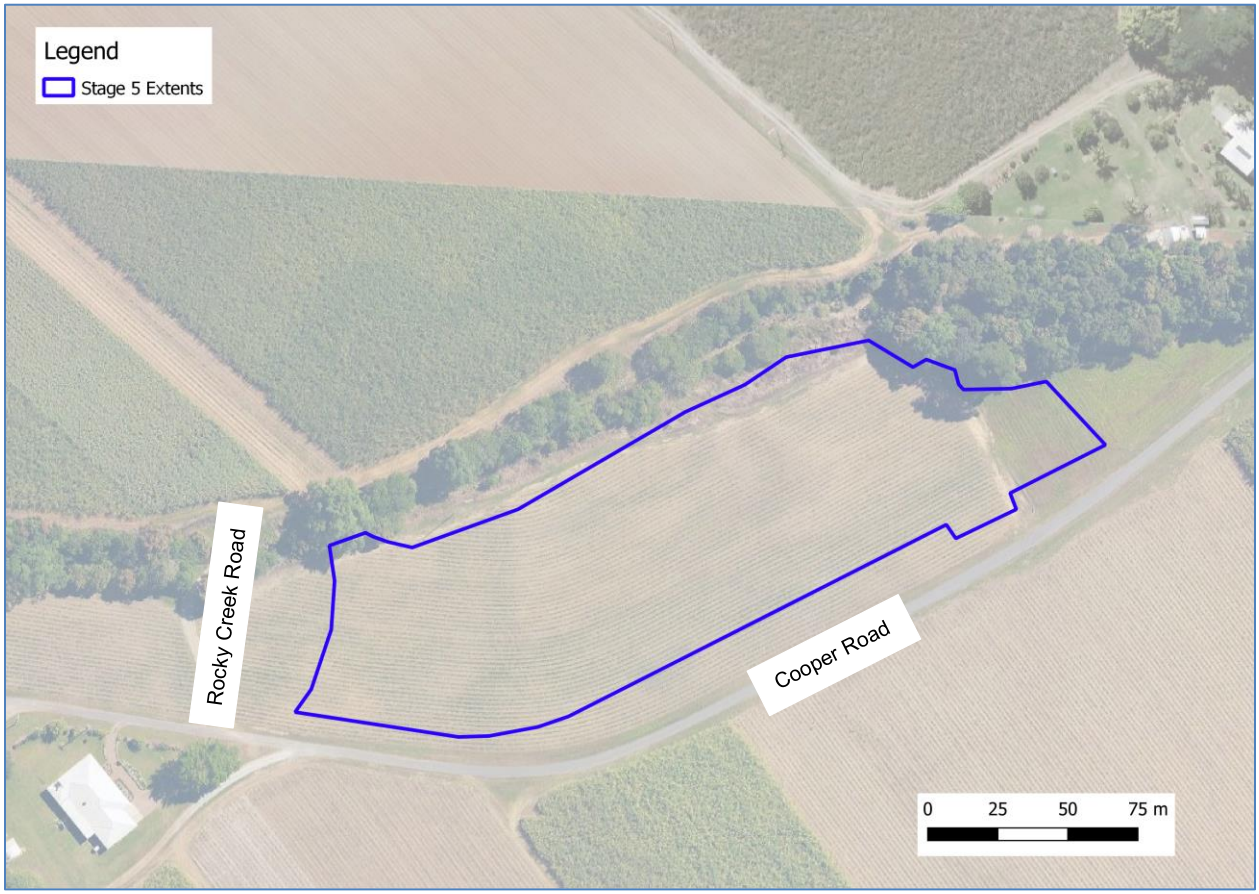

Figure 1 Site location

1.5 PROPOSED DEVELOPMENT WORKS

The proposed housing development site will be subdivided into 36 lots and forms a part of the Rocky Creek Precinct. The development will be a residential area with roads, house and open areas (**Figure 2).**

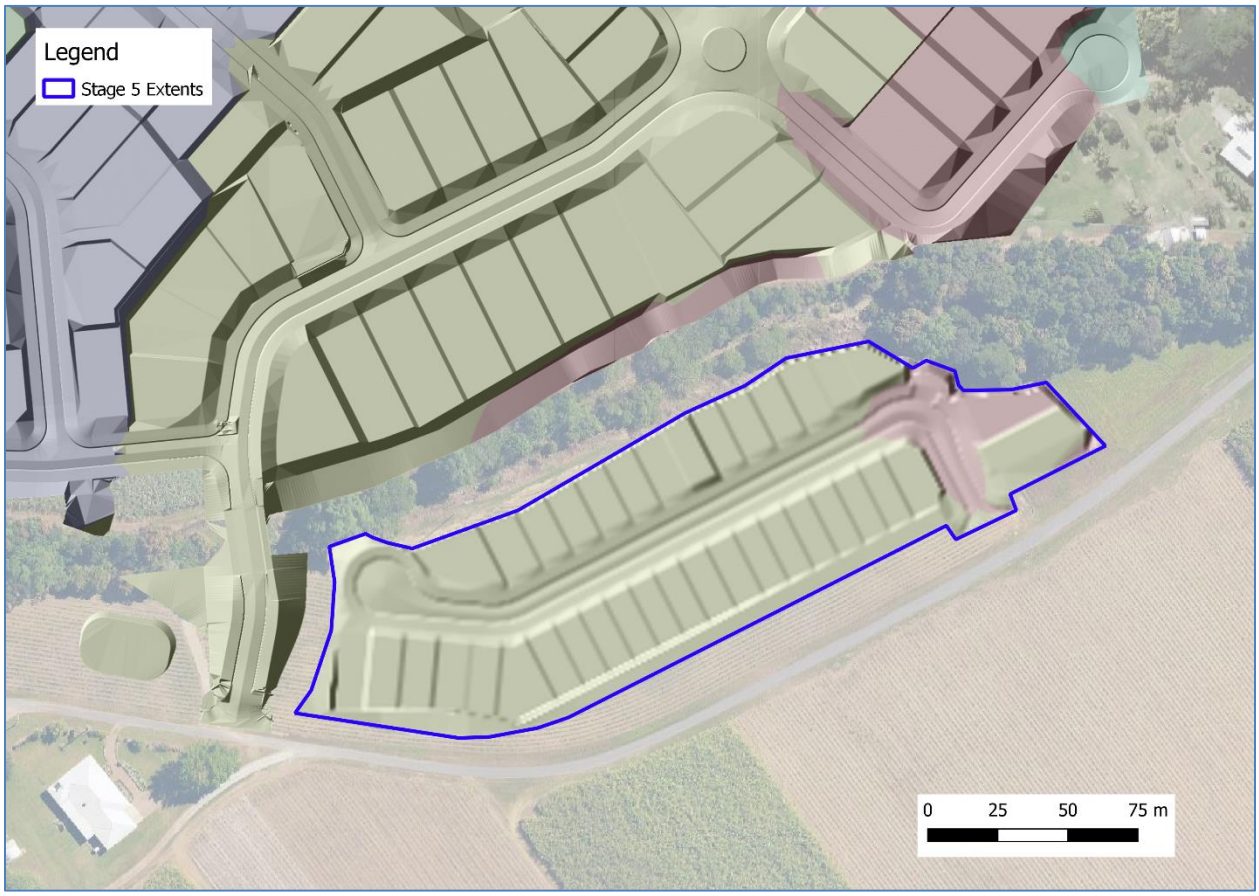

Figure 2 Proposed Development Layout

2.0 STORMWATER QUALITY MANAGEMENT

2.1 STORMWATER QUALITY IMPROVEMENT DEVICE

A Model for Urban Stormwater Improvement Conceptualisation (MUSIC) model has been developed to determine the water quality outcomes based off three proposed treatment trains.

The MUSIC modelling undertaken as part of this stormwater quality assessment was developed with reference to Water by Design's *'MUSIC Modelling Guidelines (Version 2018)'.*

2.2 OBJECTIVE / TARGET

The development of land has the potential to lead to an increase in pollutant loads and nutrients discharging into receiving waterways. The objective for this SWMP is to present three water treatment trains to determine if any are deemed practical and feasible for the site.

2.3 METEOROLOGICAL INFORMATION

Meteorological information used for all modelling applications was based on information derived from the Bureau of Meteorology (BOM). Rainfall data for the site was obtained for the Cairns Station (31011) for the timeframe 1990 - 1999 and applied to the model using a 6min time step.

2.4 WATER QUALITY OBJECTIVES

In accordance with FNQROC, the following WQO's objectives are applicable for load reduction targets for the post development site;

- 80% reduction in Total Suspended Solids (TSS)
- 60% reduction in Total Phosphorous (TP)
- 40% reduction in Total Nitrogen (TN)
- 90% reduction in Gross Pollutants

2.5 CATCHMENT DETAILS

The post-development stormwater quality catchment will consider the entirety of the stage 5 site (Figure 2).

Below (Table 1) is a breakdown of the site charecteristics along with the associated run-off parameters and pollutant exports.

Table 1 Post Development Site MUSIC Catchment Areas

Catchment ID	Ground (ha)	Ground Imperviousness	Road (ha)	Road Imperviousness	Roof (ha)	Roof Imperviousness
Catchment	0.668	10%	0.228	100%	0.776	100%

Rainfall runoff parameters were based on recommended MUSIC rainfall-runoff parameters of the Water by Design guidelines. Table 2 summarizes the characteristics adopted for the developed site conditions.

Table 2 Adopted Rainfall Runoff Parameters

Parameter	Open Area	Sealed Road	Residential
Rainfall Threshold (mm)	1	1	1
Soil Storage Capacity (mm)	120	500	500
Initial Storage (% capacity)	10	10	10
Field Capacity (mm)	80	200	200
Infiltration Capacity Co-efficient a	200	211	211
Infiltration Capacity Co-efficient b	1	5	5
Initial Depth (mm)	50	50	50
Daily Recharge Rate (%)	25	28	28
Daily Baseflow Rate (%)	3	27	27
Daily Deep Seepage Rate (%)	0	0	0

Pollutant export parameters for the storm flows and base flows of the catchment were based on Pollutant export parameters for split catchment land use (log10 values) of the Water by Design guidelines. Table 3 summarises the parameters used for the MUSIC modelling.

Table 3 Pollutant Export Parameters

FLOW TYPE	SURFACE TYPE	TSS LOG^{10} VALUES		TP LOG^{10} VALUES		TN LOG^{10} VALUES	
		MEAN	ST. DEV	MEAN	ST. DEV	MEAN	ST. DEV
Urban Residential							
Baseflow Parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Roads	1	0.34	-0.97	0.31	0.2	0.2
	Ground Level	1	0.34	-0.97	0.31	0.2	0.2
Stormflow Parameters	Roof	1.3	0.39	-0.89	0.31	0.26	0.23
	Roads	2.43	0.39	-0.3	0.31	0.26	0.23
	Ground Level	2.18	0.39	-0.47	0.31	0.26	0.23

2.6 STORMWATER QUALITY IMPROVEMENT DEVICES

There are three proposed Stormwater Quality Improvement Devices (SQIDs) for the stage 5 site. Below is the breakdown of each treatment device and their respective layouts.

2.6.1 Proposed Option 1 (HUME GPT)

Proposed option 1 includes a single HUMEGARD GPT. The HUMEGARD treatment train and parameters are shown below in Figure 3 and Table 4.

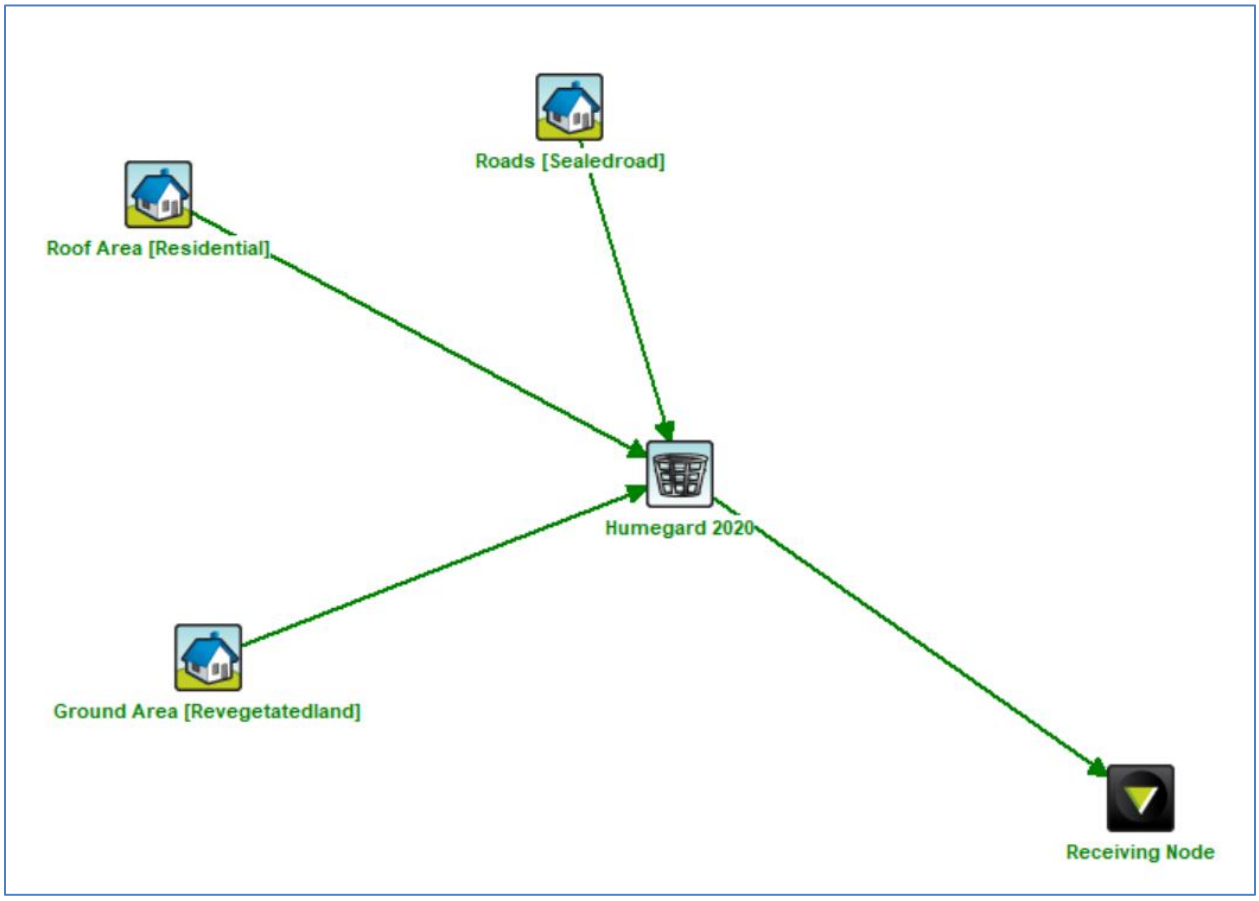

Figure 3 Proposed Stormwater Treatment Train (HUMEGARD)

Table 4 Summary of HUMEGARD Properties

Parameter	**Value**			
Low Flow By-pass (m^3/s)	0			
High Flow By-pass (m^3/s)	100			
Gross Pollutant (kg/ML)	Input	Output	Inflow (m^3/s)	% Capture
	0	0	0	100
	5	3	1	100
Total Phosphorus (mg/L)	Input	Output	Inflow (m^3/s)	% Capture
	0	0	0	100
	5	3	1	100
Total Suspended Solids (mg/L)	Input	Output	Inflow (m^3/s)	% Capture
	0	0	0	100
	500	255	1	100
Total Nitrogen (mg/L)	Input	Output	Inflow (m^3/s)	% Capture
	0	0	0	100
	5	3.7	1	100

2.6.2 Proposed Option 2 (HUMEGARD and Swale)

Proposed option 2 includes a HUMEGARD GPT and a swale in the northeastern boundary. The swale treatment train and parameters are shown below in Figure 4 and Table 5.

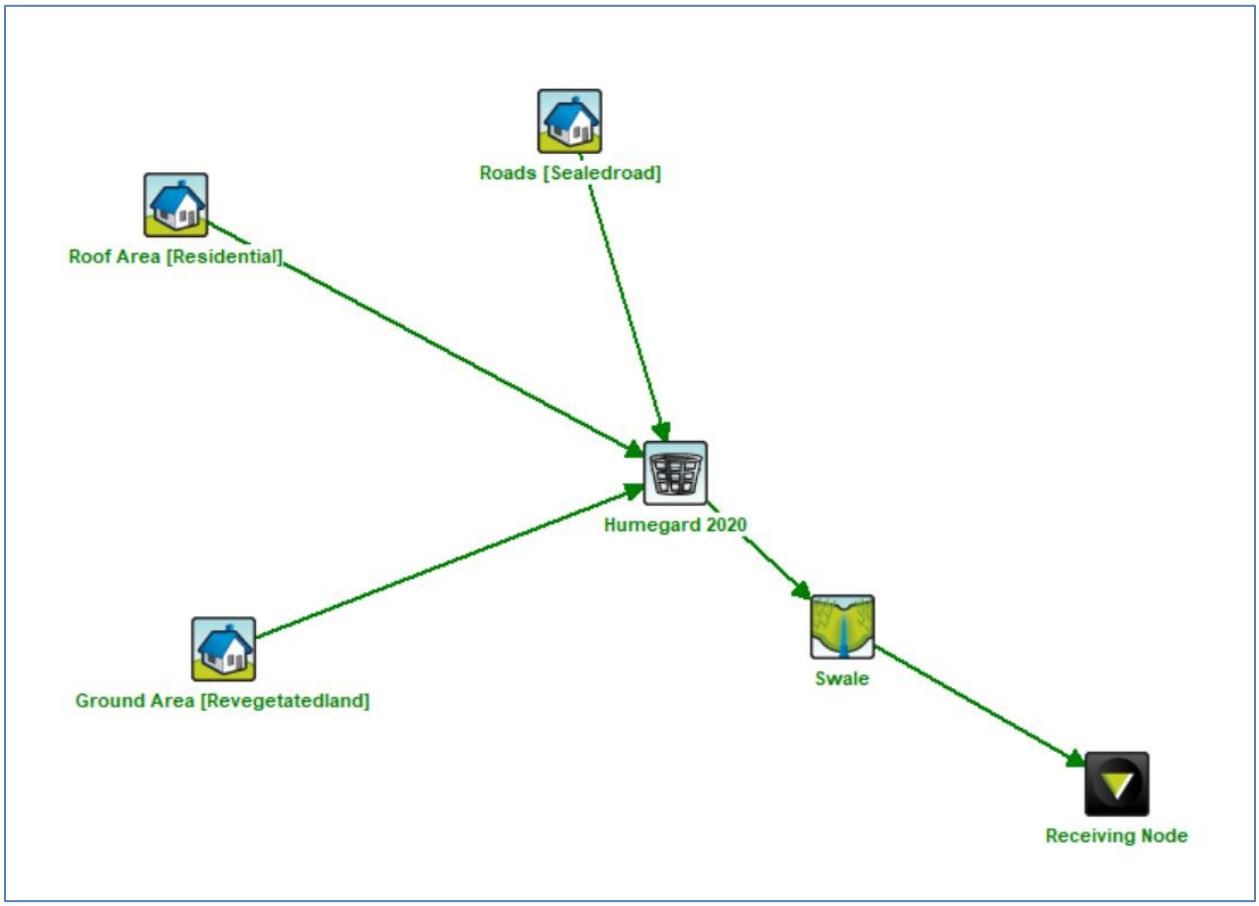

Figure 4 Proposed Stormwater Treatment Train (HUMEGARD + Swale)

Table 5 Summary of SWALE Properties

Parameter	Value
Low Flow By-pass (m^3/s)	0.002
Length (m)	12
Bed Slope (%)	1
Base Width (m)	3
Top Width (m)	5
Depth (m)	0.40
Vegetation Height (m)	0.30
Exfiltration Rate (mm/hr)	400

2.6.3 Proposed Option 3 (HIMEGARD and Bio-Swale)

Proposed option 3 includes a HUMEGARD GPT and a Bio-swale in the northeastern boundary. The Bio-swale treatment train and parameters are shown below in Figure 5 and Table 6.

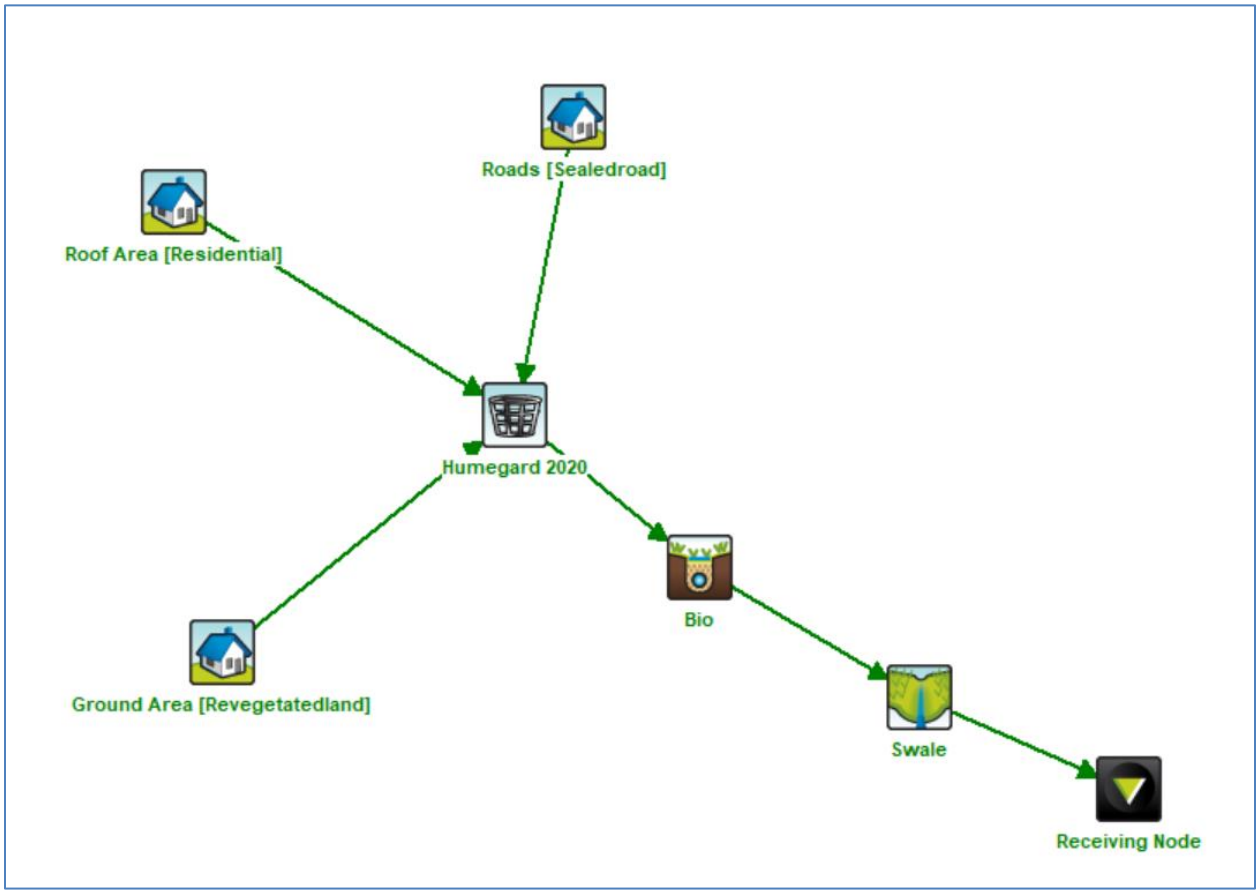

Figure 5 Proposed Stormwater Treatment Train (HUMEGARD + Bio-Swale)

Table 6 Summary of Bio-Swale Properties

Parameter	Value
Low Flow By-pass (m^3/s)	0
High Flow By-pass (m^3/s)	100
Extended Detention Depth (m)	0.4
Surface Area (m^2)	60
Filter Area (m^2)	50
Saturated Hydraulic Conductivity (mm/hr)	200

Parameter	Value
Filter Depth (m)	0.5
TN Content of Filter Media (mg/kg)	400
Orthophosphate Content of Filter Media (mg/kg)	30
Exfiltration Rate (mm/hr)	0
Overflow Weir Width (m)	2.0
Is base Lined?	Yes
Vegetated with Effective Nutrient Removal Plants?	Yes

2.7 POST DEVELOPMENT MODELLING RESULTS

The proposed stormwater quality improvement device (SQID) has simulated the reduction in pollutant loads discharged to the downstream receiving waterway. Table 7 illustrates the effectiveness of the proposed SQID for the proposed site treatment trains.

Table 7 MUSIC Treatment Train Effectiveness (HUMEGARD)

% Reduction	Sources	Residual Load	% Reduction	Target Reduction (%)
TSS (kg/yr)	3160	1610	49	80
TP (kg/yr)	7.58	4.55	40	60
TN (kg/yr)	46.1	34.1	26	40
Gross Pollutants (kg/yr)	364	36.4	90	90

Table 8 MUSIC Treatment Train Effectiveness (Swale)

% Reduction	Sources	Residual Load	% Reduction	Target Reduction (%)
TSS (kg/yr)	3160	1190	62.4	80
TP (kg/yr)	7.58	4.13	45.5	60
TN (kg/yr)	46.1	33.9	26.5	40
Gross Pollutants (kg/yr)	364	7.16	98	90

Table 9 MUSIC Treatment Train Effectiveness (Bio-Swale)

% Reduction	Sources	Residual Load	% Reduction	Target Reduction (%)
TSS (kg/yr)	3160	822	74	80
TP (kg/yr)	7.58	3.02	60.2	60
TN (kg/yr)	46.1	29.3	36.5	40
Gross Pollutants (kg/yr)	364	0.00	100.00	90

A review of the resultant mitigated mean annual loads in the table above shows that a combination the GPT and other treatments devices (swales and bio-swales provides) increase treatment effectiveness of the stormwater runoff from the catchments for TSS, TP, TN and Gross Pollutants.

These results indicate that insufficient treatment measures have been provided. To improve the treatment effectiveness, other treatment devices or avenues should be explored. However given the limited space available, alternative options should be discussed with Council.

3.0 OPERATIONAL PHASE – STORMWATER MANAGEMENT

3.1 OBJECTIVE / TARGET

To implement the principles of environmentally sustainable development (ESD) by controlling the levels of contaminants (sediments and nutrients) entering downstream local water courses or road stormwater drainage systems.

3.2 COMPLIANCE CRITERIA

To comply with Council's Stormwater Quality Management Guidelines, as outlined in Section 2.4 of this report, and other relevant Council bylaws and health and safety requirements.

Treatment devices will be designed to treat runoff generated by the 3 month ARI storm event in accordance with Council's requirements.

3.3 MANAGEMENT MEASURES

In consideration of the constraints of the proposed development and the space available, the following stormwater treatment measures are proposed to achieve the best practice stormwater management of the expected pollutant export loads from the subject site.

The primary stormwater management measures to be installed to maintain the quality of runoff discharging from the proposed development are vegetated bio-swale systems.

3.4 CONSTRUCTION AND ESTABLISHMENT

The construction and establishment of the vegetated stormwater treatment devices, including bio-retention systems, should be undertaken with reference to the *'Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (Version 1.1, April 2010)'*, prepared by Water by Design.

3.5 MONITORING SCHEDULE

A monitoring program should be established for the vegetated stormwater treatment devices as outlined in the *'Maintaining Vegetated Stormwater Assets (February 2012)'* document, prepared by Water by Design. Table 10 outlines a number of the monitoring activities that may need to be considered as part of the monitoring programs established for these devices.

Table 10 Monitoring Program for Vegetated Bio-retention Systems

Time Frame (after construction)	Monitoring Activity	Frequency
0 – 6 Months	Erosion / scour of invert & batters	After major storm events
	Weed inundation / litter & debris accumulation	3 monthly
	Inappropriate access, excessive wear & damage to invert & batters	3 monthly
	Build-up of sediments and / or clogging of filter media	3 monthly
	Condition of vegetation such as vegetation health & density	3 monthly
	Condition of inlet & outlet structures	After major storm events
> 6 Months	Erosion / scour of invert & batters	3 monthly
	Weed inundation / litter & debris accumulation	3 monthly
	Inappropriate access, excessive wear & damage to invert & batters	3 monthly
	Build-up of sediments and / or clogging of filter media	3 monthly
	Condition of vegetation such as vegetation health & density	3 monthly
	Condition of inlet & outlet structures	After major storm events & / or 3 monthly

The Developer will be responsible for all monitoring activities associated with the operation of the vegetated bio-retention systems.

3.6 MAINTENANCE SCHEDULE

The on-going performance of the treatment devices will be dependent on the maintenance conducted. Maintenance programs should be established for the vegetated stormwater treatment devices as outlined in the 'Maintaining Vegetated Stormwater Assets (February 2012)' document, prepared by Water by Design.

The maintenance program shown in Table 11 outlines a number of the maintenance activities that may need to be considered as part of the maintenance programs established for the devices.

Table 11 Maintenance Program for Vegetated Bio-retention Systems

Time Frame (after construction)	Monitoring Activity	Frequency
0 – 6 Months	Repairs to basin profile	As required by results of monitoring
	Watering, re-vegetating	As required by results of monitoring
	Removal of litter, debris, weeds & excessive sediment build up	Monthly, or as required by results of monitoring
	Mowing / pruning of basin vegetation to maintain optimal vegetation height	As required by results of monitoring
	Tilling of filter media area if evidence of clogging	As required by results of monitoring
> 6 Months	Repairs to basin profile	As required by results of monitoring
	Removal of litter, debris, weeds & excessive sediment build up	3 monthly, or as required by results of monitoring
	Mowing / pruning of basin vegetation to maintain optimal vegetation height	As required by results of monitoring
	Tilling of filter media area if evidence of clogging	As required by results of monitoring

The Developer will be responsible for all maintenance activities associated with the operation of the vegetated bio-retention systems.

Lime dosing (or similar) of the bio-retention filter media may be required periodically to 'neutralise' acidity levels within the soil resulting from slightly acidic precipitation and / or runoff. In order to determine the requirement for dosing, pH levels within the soil should be monitored twice a year.

Full bio-retention system filter media soil replacement shall occur when pollutant levels within the soil reach levels toxic to the plants within the filter media or when the system fails to drain adequately after tilling of the filter media surface. Monitoring carried out during the 3 monthly inspections shall be used to monitor pollutant levels.

3.7 REPORTING

The Developer shall be notified of any system failure, incidences of non-compliance and corrective actions implemented during the maintenance period, with Council to be notified of any significant failures that have the potential to cause environmental harm during the maintenance period.

3.8 CORRECTIVE ACTION

When the nominated compliance criterion is not met, then an investigation into the cause and source of the pollutants is to be carried out and the appropriate remedial action taken based on the outcomes of this investigation.

4.0 EROSION AND SEDIMENT CONTROL

The construction phase of development may result in an increase in sediment transfer and pollutant loads discharging from the subject site. In order to protect downstream waterways and existing stormwater infrastructure during the construction phase of development, the site control and monitoring procedures are recommended to be implemented by the contractor throughout the entire construction phase of development.

The performance criteria for the erosion and sediment control strategy to be implemented into the construction phase of the project, is outlined in the *'State Planning Policy July 2017'* prepared by the Department of Infrastructure, Local Government and Planning (DILGP) and the *'Urban Stormwater Quality Planning Guidelines 2010'* prepared by the Department of Environment Resource Management. These criteria as outlined in Part G Appendix 2 of the State Planning Policy are summarised in Table 12, Table 13, Table 14 below, and a summary of discharge criteria based on both documents mentioned above is provided in Table 15 below.

Table 12 Construction Phase – Stormwater Management Design Objectives

Issue	Desired Outcomes
Drainage Control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works. 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins.
Erosion Control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised using methods which will achieve effective shot-term stabilisation.

Issue	Desired Outcomes
Sediment Control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 metres^2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5-8.5).
Litter, Hydrocarbons and Other Contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway Stability and Flood Flow Management	1. Where measures are required to meet post-construction waterway stability objectives (specified in table B, Appendix 2 (State Planning Policy, 2017)), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

Table 13 Construction Phase – Stormwater Management Design Objectives for Temporary Drainage Works

Temporary Drainage Works	Anticipated Operation Design Life and Minimum Design Storm Event		
	< 12 Months	12 - 24 Months	> 24 Months
Drainage Structure	1 in 2-year ARI 39% AEP	1 in 5-year ARI 18% AEP	1 in 10-year ARI 10% AEP
Where located immediately up-slope of an occupied property that would be adversely affected by the failure or overtopping of the structure.		1 in 10-year ARI 10% AEP	
Culvert Crossing		1 in 1-year ARI 63% AEP	

Table 14 Part 3 – Construction Phase – Stormwater Management Design Objectives for Emergency Spillways on Temporary Sediment Basins

Drainage Works	Anticipated Operation Design Life and Minimum Design Storm Event		
	< 3 Months	3 - 12 Months	> 12 Months
Emergency Spillway on Temporary Sediment Basins	1 in 10-year ARI 10% AEP	1 in 20-year ARI 5% AEP	1 in 50-year ARI 2% AEP

Based on the above information, the release criteria for controlled runoff events or pumped discharges from the construction site is to be as shown below in Table 15.

Table 15 Discharge Performance Criteria

Parameter	Release Criteria
Waste	No release of waste or litter
Coarse Sediment	No release of coarse sediment
Turbidity	Discharge turbidity (NTU) value shall be less than 50 NTU and/or no greater than 10% above receiving waters immediately downstream of discharge.
Hydrocarbons, Tannins & Paint	No visible trace
Suspended Solids	Discharges shall be < 50 mg/L TSS, or equivalent turbidity as determined by laboratory analysis by correlating turbidity with the suspended solids limit.
pH	6.5 - 8.5, except where and to the extent that, the natural receiving waters lie outside this range.

5.0 CONCLUSION

Stantec was engaged by Kroymans Development Pty Ltd to prepare a Stormwater Management Plan for the proposed stage 5 of the Rock Creek Precinct. The proposed development was assessed against relevant local and state guidelines to assess site stormwater quality outcomes.

Stantec has tested three options for water sensitive urban design (WSUD) to manage the quality of stormwater runoff from the proposed development by the integration of treatment devices.

Of the three water treatment trains tested, none achieved SPP reductions. Option 3 resulted in the best in the best outcomes, with option 1 the worst.

Due to site constraints, there are limited opportunities to introduce water treatment devices at this location. The current options that have been tested should be discussed with Council and the most feasible solution agreed upon.

6.0 QUALIFICATIONS

The analysis and overall approach has been catered to the specific requirements of this assessment, and may not be applicable beyond this scope. For this reason, any other third parties are not authorised to utilise this report without further input and advice from Stantec Australia Pty Ltd. Whilst this report accurately assesses the stormwater quality requirements for the site using industry standard modelling techniques and engineering practices, the actual future observed water quality outcomes may vary from those predicted.

Appendix A CONCEPT LAYOUT