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Memo

To:	Marcelle Bell	**From:**	Aaron Vendargon
Organisation:	Cardinia Shire Council	**Date:**	3/05/2016
Job Title:	Glismann Road Drainage Scheme		
Subject	Additional Flooding and Water Quality Assessments		

1. INTRODUCTION

This memo outlines the additional flooding and water quality assessments for the Glismann Road Drainage Scheme. It follows on from the latest assessment of the Glismann Road precinct development with no retarding basin in place.

This investigation is primarily focused on managing flood impacts at the following four properties, which are located at the downstream end of the scheme area:

- 111-113 Princes Highway, Beaconsfield;
- 115-117 Princes Highway, Beaconsfield;
- 119-121 Princes Highway, Beaconsfield;
- 123-125 Princes Highway, Beaconsfield; and,

The main purpose of this investigation is to provide advice to manage flood levels at the four properties in question and to size alternative WSUD options for the Glismann Road drainage scheme.

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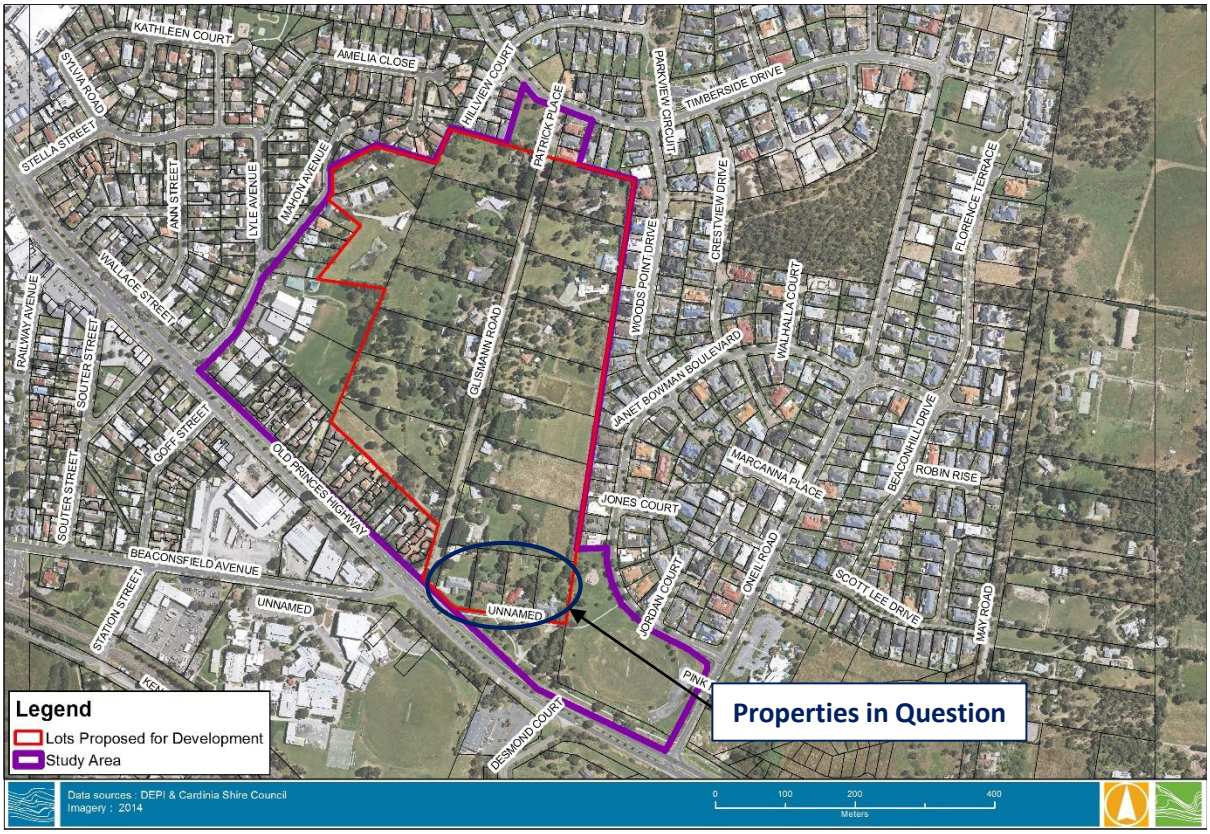

Figure 1-1 Study Area and Properties in Question

2. REVIEW OF PROPERTY FLOODING

Floor levels for the four existing properties along Princes Highway were checked and found to be above 1% AEP flood levels under both existing and the developed 'with no retarding basin' conditions. Floor levels and flood levels under both existing and developed conditions are displayed in Table 2-1**Error! Reference source not found.**.

Once development of the precinct area upstream of these properties has occurred, parcel (below floor) flooding on these four existing properties will increase, due to the build-up of floodwaters from increased flow reaching the highway. Flood maps for the existing and developed 'with no retarding basin' conditions are shown in Figure 2-1 and Figure 2-2 below.

Table 2-1 Floor Levels and Flood Levels at Existing Residences

Address	Floor Levels (m AHD)	Flood Levels	
		Existing Conditions (m AHD)	Developed Conditions with no Retarding Basin (m AHD)
111-113 Princes Highway	50.16	49.80	49.95
115-117 Princes Highway	49.95	49.55	49.60
119-121 Princes Highway	50.04	-	49.40
123-125 Princes Highway	49.50	-	49.10

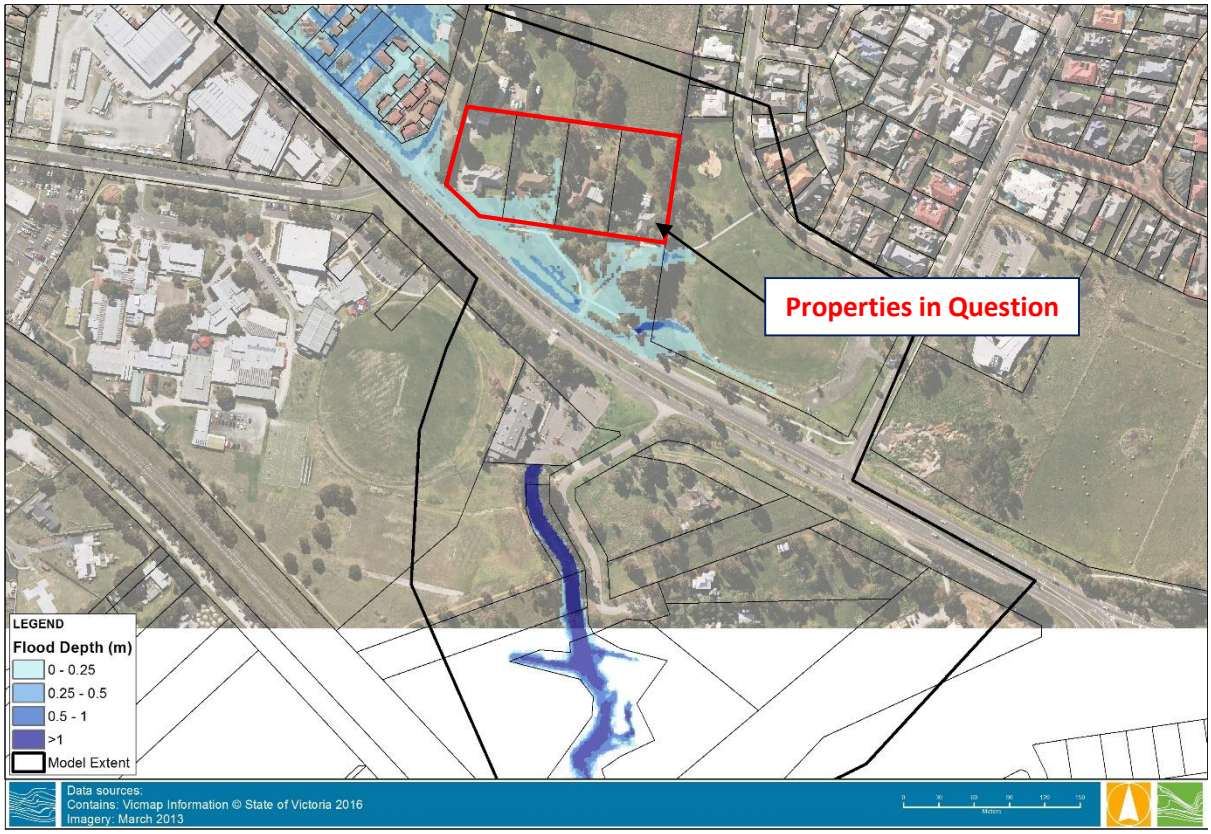

Figure 2-1 Existing Conditions 1% AEP Flood Depths

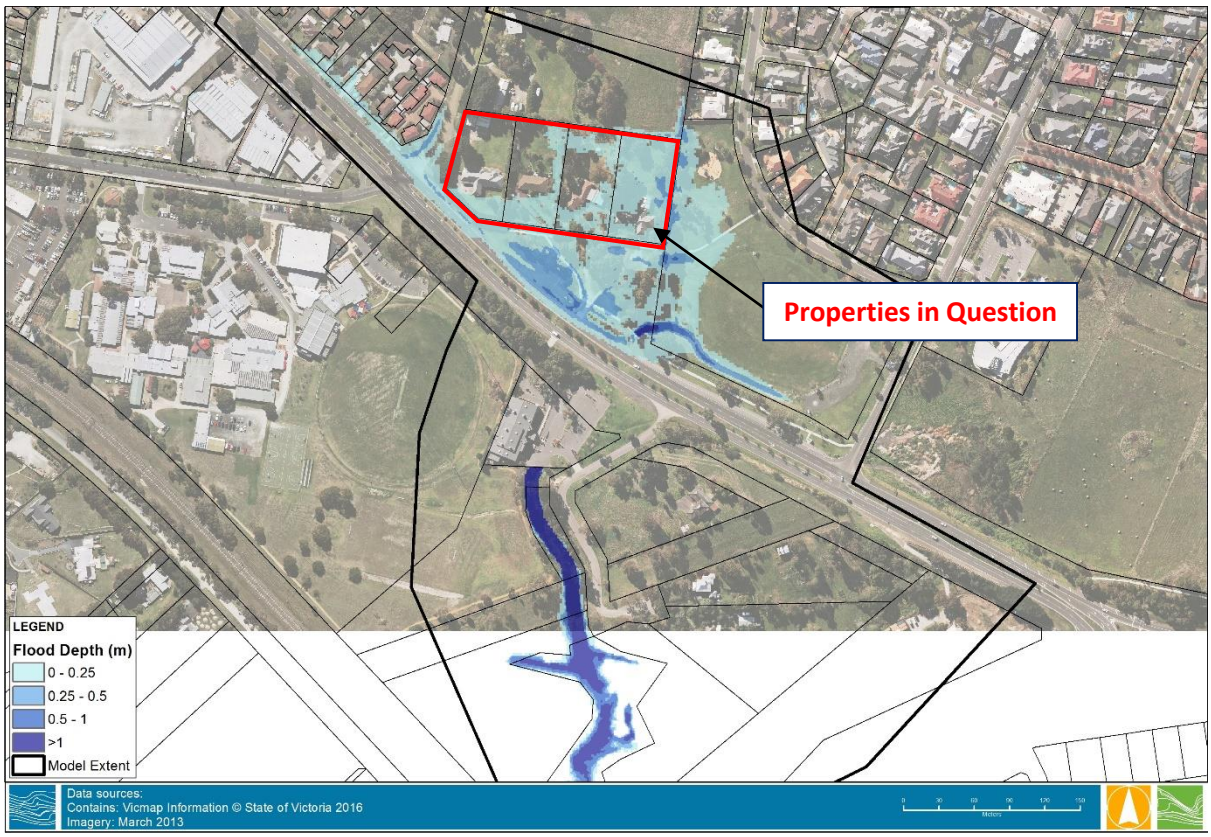

Figure 2-2 Developed Conditions 'with no Retarding Basin' 1% AEP Flood Depths

3. HYDRAULIC MODELLING – LEVEE ALIGNMENTS

Modelling of the 1% AEP flood levels under developed conditions shows that there will be an increase in (below floor) flooding at the properties in question. As an alternative to a retarding basin, a bund/levee to protect these properties was considered.

Two levee alignments were tested in the hydraulic model. Alignment Option 1 crosses the small table drain which lies to the east of the existing properties, while Alignment Option 2 avoids crossing this drain. The two alignment options are show in Figure 3-1.

Drainage of the catchment area upstream of the bund (eastern catchment) was checked. At present, discharges upstream of the bund largely makes its way down to the Old Princes Highway as overland flow, along a small table drain to the east. In the case that no development occurs at these four properties and a levee is constructed, allowance for draining this small local catchment must be included in the levee design.

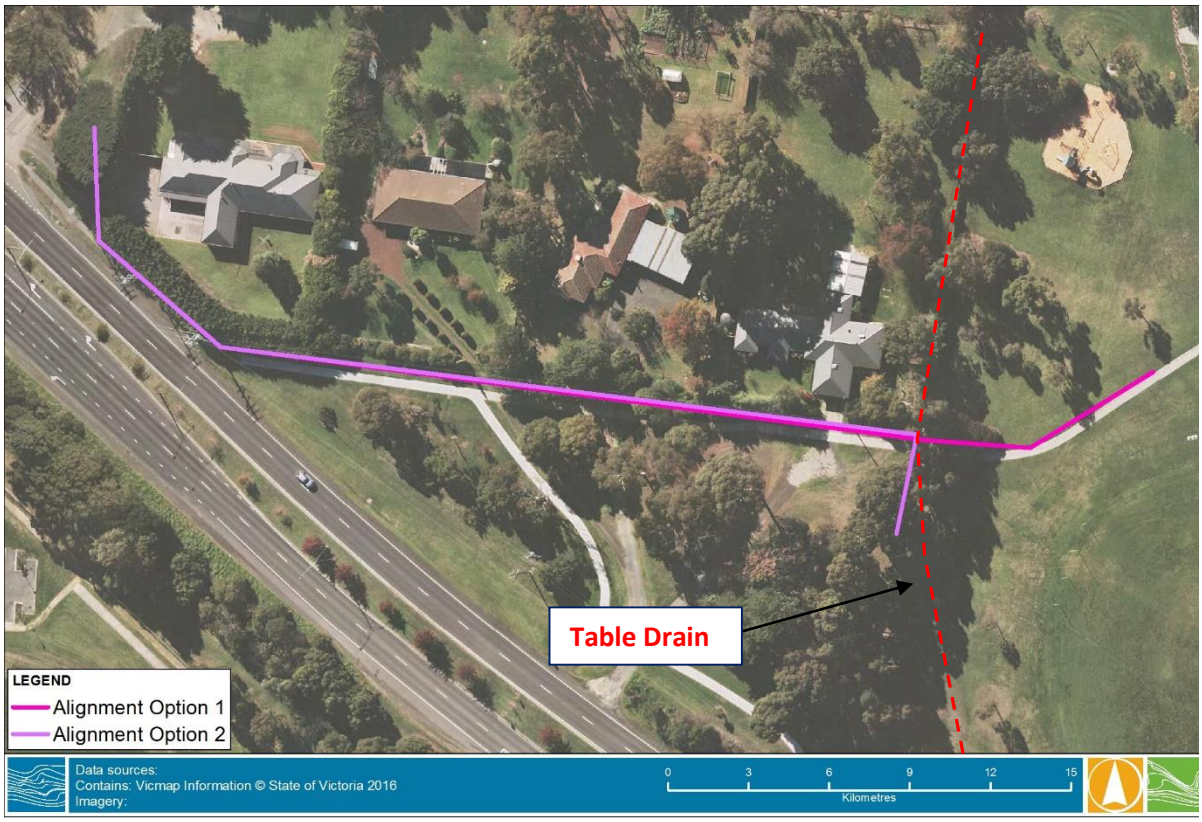

Figure 3-1 Proposed Levee Alignment Options 1 and 2

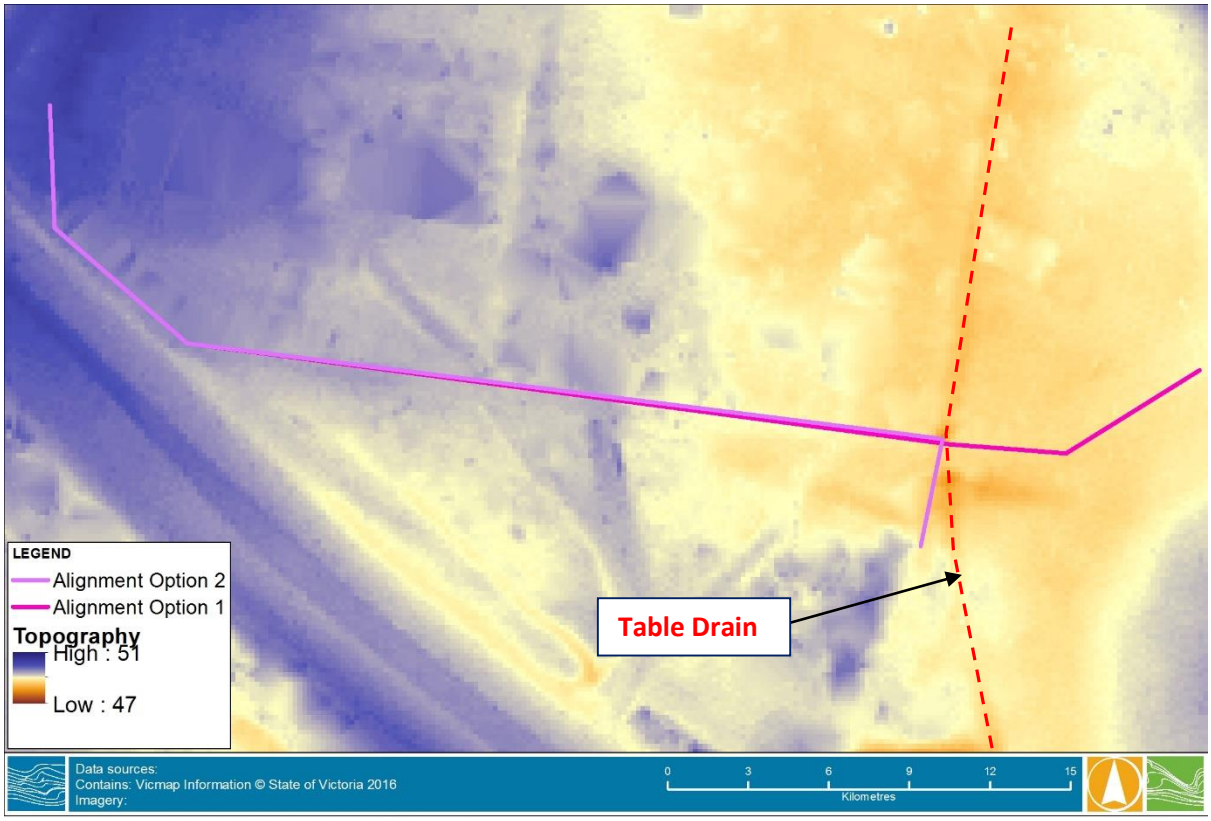

Figure 3-2 LiDAR Topography at the Site

3.1 Levee Alignment 1

Alignment Option 1 protects the four properties in question from flooding in the 1% AEP flood event as shown in Figure 3-3 below. This levee alignment crosses the table drain to the east, meaning that overland flows from the upstream catchment may be held back on these properties until flows can drain away via a drainage structure located in the levee.

The alignment of the levee is proposed along the existing footpath/access path that runs along the southern boundary of the four properties. This is to minimise the loss in flood storage caused by leveeing off parts of the existing flood extent.

Flood levels grade from 50.1 m AHD at the western end, to 49.0 m AHD at the eastern end of the levee. The average flood depth along the levee is 0.13 m. This levee alignment will have a largely consistent bund height of approximately 0.45 m (when constructed with 300 mm freeboard), or approximately 0.75 m (if constructed with 600 mm freeboard).

Table 3-1 Flood Levels along the Levee - Alignment Option 1

	Western end	Eastern end
Water Level (m AHD)	50.1	49.0

Figure 3-3 Alignment Option 1 and 1% AEP Modelled Flood Depths

3.2 Levee Alignment 2

A second levee alignment (alignment 2) was tested to check the impacts of avoiding crossing the table drain to the east. This alignment will minimise the pooling of water behind the levee at the lowest property (123-125 Princes Highway), however it does cause flooding at this property from the major flows reaching the highway, as shown in Figure 3-4.

The 1% AEP flood levels have been reduced at 123-125 Princes Highway, compared to the 'developed with no flood mitigation works'. The flood level at 123-125 Princes Highway is approximately 900 mm below the floor level.

The option of extending the levee along the eastern and northern boundary of 123-125 Princes Highway was considered but discounted due to the limited space and the practical/visual impacts of surrounding the property with a levee on three sides.

Flood levels grade from 50.1 m AHD at the western end, to 48.8 m AHD at the eastern end of the levee. The average flood depth along the levee is 0.22 m, with a maximum depth of 0.66 m at the eastern end of the levee. This proposed alignment results in a levee with an average height of approximately 0.5 m, if constructed with 300 mm freeboard, or approximately 0.8 m, if constructed with 600 mm freeboard.

Table 3-2 Flood Levels along the Levee - Alignment Option 2

	Western End	Eastern End
Water Level (m AHD)	50.1	48.8

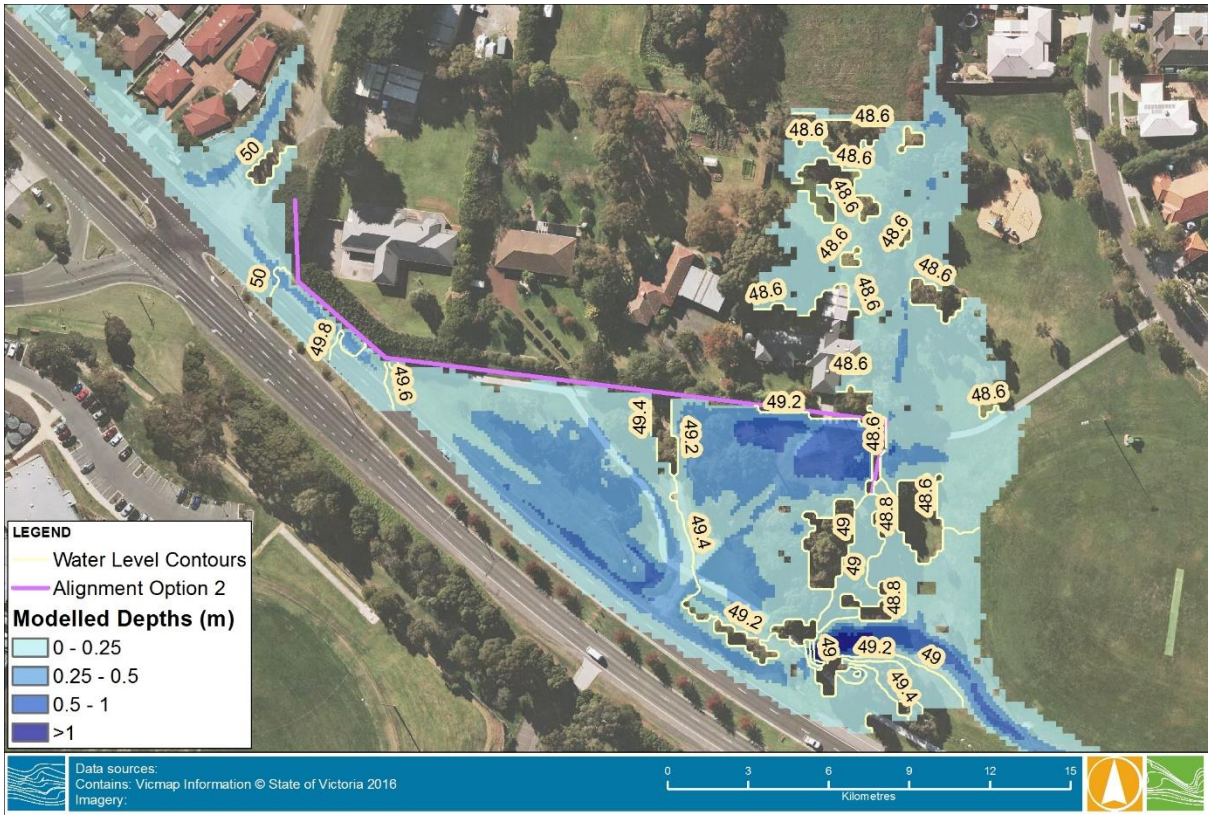

Figure 3-4 Alignment Option 2 and 1% AEP Modelled Flood Depths

3.3 Levee Constructability Considerations

There is limited space between the Highway and the property to the far west (111-113 Princes Highway), in which to construct the levee. There are trees and a few power poles in the road reserve which will need to be considered.

The impact of the levee on access to these existing properties also need to be considered.

4. WATER QUALITY OPTIONS ASSESMENT

A number of WSUD options were assessed to meet water quality treatment targets for two scenarios (100% and 50% scenarios) for the drainage scheme. The treatment targets for the two scenarios is outlined in Table 4-1**Error! Reference source not found.**.

Table 4-1 Water Quality Treatment Targets for the Two Scenarios

Parameter	Percentage Pollutant Reductions	
	100% Scenario	50% Scenario
Total Suspended Solids (kg/yr)	80%	40%
Total Phosphorous (kg/yr)	45%	22.5%
Total Nitrogen (kg/yr)	45%	22.5%
Gross Pollutants (kg/yr)	70%	35%

The scheme originally proposed for a wetland system (within the base of a proposed retarding basin) located in the triangular open space parcel along the highway. This is shown in Figure 4-1 below.

The sizing of this wetland system was undertaken prior to the release of the latest draft Melbourne Water wetland design and MUSIC modelling guidelines. The latest concept WSUD sizing takes into account the requirements outlined in latest guidelines.

Figure 4-1 Plan View of Original Proposed Drainage Scheme WSUD Works

4.1 100% Water Quality Scenario

Two asset options were considered to meet the full treatment targets; a wetland and bioretention asset option. Both options include sediment ponds to provide pre-treatment from the receiving catchments. A summary of the total asset size (including the sediment ponds) for both options is provided in Table 4-2. As shown, the bioretention option requires a significantly smaller area to meet the water quality targets.

Table 4-2 Total Asset Size for the 100% Water Quality Scenario

	Wetland Option	Bioretention Option
Area (m^2)	3,350	895
Assets	Two sediment ponds and a wetland	Two sediment ponds and a bioretention

The breakdown of the sizing requirements for these assets is outlined in Table 4-3. The predicted treatment train performance for these two asset options is outlined in Table 4-4 and Table 4-5. All targets are met under this proposed design, with nitrogen as the limiting factor.

Table 4-3 WSUD Asset Concept Sizing – 100% Water Quality Scenario

Component	Sediment Pond 1	Sediment Pond 2	Bioretention	Wetland
Area (m^2)	600	250	45	2,500
Filter area (m^2)	-	-	27	-
Extended detention depth (m)	0.35	0.35	0.35	0.35
Permanent pool depth/filter depth (m)	1	1	0.5	Varies (average depth = 0.5)
Permanent pool volume (m^3)	240	100	-	1,000

Table 4-4 MUSIC Modelling Results – Wetland Option for Full Treatment

Parameters	Total source loads	Residual load after treatment	Load removed in proposed WSUD assets	Development source loads	% Removal of development source loads
Total Suspended Solids (kg/yr)	48,200	20,500	27,700	20,000	>100
Total Phosphorous (kg/yr)	101	58	43	43	>100
Total Nitrogen (kg/yr)	758	622	136	303	45
Gross Pollutants (kg/yr)	9,750	0	9,750	3,980	>100

Table 4-5 MUSIC Modelling Results – Bioretention Option for Full Treatment

Parameters	Total source loads	Residual load after treatment	Load removed in proposed WSUD assets	Development source loads	% Removal of development source loads
Total Suspended Solids (kg/yr)	48,200	21,200	27,000	20,000	>100
Total Phosphorous (kg/yr)	101	61	40	43	93
Total Nitrogen (kg/yr)	758	620	138	303	46
Gross Pollutants (kg/yr)	9,750	0	9,750	3,980	>100

4.2 50% Water Quality Scenario

An alternative option looking at providing half the water quality treatment on site was assessed, with the balance to be provided through a water quality offset rate payment.

The modelling for this option showed that only a single sediment pond, that receives inflows from the major catchment to the west, is required. This is the western sediment pond as shown in Figure 4-1 above. Further treatment in the form of a bioretention or wetland is not required.

A summary of the total asset size for this options is provided in Table 4-6.

The breakdown of the sizing requirements for this asset is outlined in Table 4-7, and the predicted treatment train performance is outlined in Table 4-8.

Table 4-6 Total Asset Size for the 50% Water Quality Scenario

Area (m^2)	600
Assets	Single sediment pond

Table 4-7 WSUD Asset Concept Sizing – 50% Water Quality Scenario

Component	Sediment Pond 1
Area (m^2)	600
Filter area (m^2)	-
Extended detention depth (m)	0.35
Permanent pool depth (m)	1
Permanent pool volume (m^3)	240

Table 4-8 MUSIC Modelling Results – Option for Half Treatment

Parameters	Total source loads	Residual load after treatment	Load removed in proposed WSUD assets	Development source loads	% Removal of development source loads
Total Suspended Solids (kg/yr)	48,200	29,200	19,000	20,000	95
Total Phosphorous (kg/yr)	101	75	26	43	61
Total Nitrogen (kg/yr)	758	685	73	303	24
Gross Pollutants (kg/yr)	9,750	2,310	7,440	3,980	>100

5. RECOMMENDED FUTURE FLOOR LEVEL

This Section provides advice on proposed floor levels, should the existing four properties be developed in the future. Survey of the highway and the LiDAR data was used to assess the level at which water starts to overtop the highway.

It was found that water would start to pass over the highway at 49.44 m AHD. It is therefore recommended that future floor levels are set with a designated freeboard above this level to minimise the risk of above floor flooding. Out of the four existing properties, only 123-125 Princes Highway (which has a floor level of 49.5 m AHD) has some minimal risk of flooding in large events, when water builds up behind the highway.

6. CONCLUSION

The additional flooding and water quality assessments undertaken for the Glismann Road Drainage Scheme shows that:

- Floor levels for the four existing properties along the highway are above the 1% AEP flood level for the developed 'with no retarding basin' option;
- As an alternative to a retarding basin, a levee was considered to protect the four properties from increased below floor flooding. Two levee alignments were considered, both of which provide at least 600 mm freeboard protection to the future 1% AEP flood levels;
- A levee alignment (Alignment 1) which crosses the table drain to the east will provide the greatest protection to the property at the eastern end (123-125 Princes Highway). This alignment will need include a structure to drain the local catchment upstream of the levee; and
- There are options to provide either full or partial (50%) water quality treatment within the triangular open space parcel upstream of the highway.

Regards

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Water Technology Pty Ltd