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GOSFORD CITY COUNCIL

UPPER NARARA CREEK FLOODPLAIN MANAGEMENT STUDY

FINAL

MARCH 1995

Patterson Britton
& Partners Pty Ltd

consulting engineers

To be ammended

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GOSFORD CITY COUNCIL

Upper Narara Creek Floodplain Management Study

FINAL

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Note : This document is preliminary unless it is approved for release by a director of Patterson Britton & Partners ,

level 2
104 Mount Street
North Sydney 2060

PO Box 515
North Sydney 2059
Australia

telephone (02) 9957 1619
facsimile (02) 9957 1291
ACN 003 220 228

Patterson Britton
& Partners Pty Ltd
consulting engineers

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1 INTRODUCTION

Gosford City Council engaged Patterson Britton and Partners, Consulting Engineers in March 1994 to undertake a floodplain management study for Upper Narara Creek (refer **Figure 1**). The study area extends upstream from Deane Street, Narara to the Niagara Park Public School (refer **Figure 2**) although the entire catchment was included in the estimation of flood flows. The main creek line in the study area has been nominated by Council as the Niagara Park Branch.

A Flood and Floodplain Management Study has been undertaken for the area downstream of Deane Street while a Flood Study has been completed for the study area (**Reference 1**).

The Council identified a number of flood mitigation measures for examination in the study and these included (refer **Figure 2**):

1. Deane Street bridge lengthening;
2. Replace existing culverts under Narara Valley Drive (Narara Valley Drive Bridge);
3. Koninderie Parade channel improvements;
4. Formalise flood flow across Narara Valley Drive at Yurunga Avenue;
5. Floodfree access.

Other options considered were:

6. Raising floor levels;
7. Bank stabilisation;
8. Planning controls;
9. Acquisition of affected houses; and
10. Flood evacuation plan.

This report details the findings of the floodplain management study including assessment of existing flooding behaviour and the impact of the mitigation options. It forms the basis for discussion within the Floodplain Management Committee and selection of the preferred management approach for flooding issues within the study area.

2 FLOOD MODEL COMPILATION

Previous flood modelling of the Upper and Lower Narara Creek catchments was undertaken by Kinhill (**Reference 1**), with Deane Street as the model boundary and assuming a fixed relationship between water level and discharge at this boundary. This does not allow examination of the impact of the Deane Street bridge upgrade as a possible flood mitigation option. As such, the upstream and downstream models were combined to form a single model which extended downstream to Brisbane Water.

The MIKE 11 model of the entire system was able to reproduce the design 1% Annual Exceedence Probability flood levels from the Kinhill flood study, both upstream and downstream of Deane Street. However, at Deane Street, the modelled flood levels were lower than those predicted in the Kinhill flood study (refer **Figure 3**).

Further survey was undertaken to more accurately define the channel and floodplain cross-sections around this area. Even with this additional survey, it was not possible to raise the predicted flood levels to the Kinhill flood study values while utilising realistic energy loss estimations. Due to the previous use of a fixed water level and discharge relationship, it is considered that the flood levels at Deane Street were conservative in the Kinhill flood study. The MIKE-11 model of the entire system, established for the subject study, was adopted as the more reliable predictive tool for examination of the floodplain management options. The adopted model cross-section locations and numbers are presented in **Figure 4**.

3 EXISTING FLOODING BEHAVIOUR

3.1 DESIGNATED FLOOD CONDITIONS

The Kinhill flood study (**Reference 1**) estimated the 1% AEP flow conditions in the creek based on the appropriate design rainfall. The flood levels experienced along Koninderie Parade in February 1992 exceeded the estimated 1% AEP levels, even though the rainfall was not as severe as adopted for modelling of the design conditions. It was identified that the main cause of these higher flood levels was blockage of the culverts under Narara Valley Drive during the storm.

Modelling various degrees of blockage at the Narara Valley Drive culverts identified that a blockage of 75% caused creek water levels closely matching the observed levels in the February 1992 flood. It is possible that this degree of blockage could occur again even though management practices have been established which will reduce its likelihood.

The designated flood adopted for the Upper Narara Creek catchment was the 1% AEP rainfall with a 75% blockage of the Narara Valley Drive culverts. These conditions generate flood levels similar to those observed in the February 1992 flood.

3.2 DESIGN FLOOD LEVELS

The estimated flood levels under existing conditions along the main creek line with 75% blockage of the Narara Valley Drive culverts, for 1%, 5%, 20% AEP and PMF storms, are presented in **Figure 5** and in **Appendix A**.

A floor level survey was undertaken within the catchment in order to estimate the extent of inundation which may occur during the design flood severities (refer **Appendix A** for floor levels). The number and location of houses predicted to be inundated in the 1%, 5% and 20% AEP design flood, for the Narara Valley Drive culverts 75% blocked, are presented in **Table 3.1**. The location of houses flooded and the approximate extent of flooding in the 1% AEP flood, with 75% blockage of the Narara Valley Drive culverts, are presented in **Figure 6**.

Table 3.1 PREDICTED EXTENT OF FLOOD INUNDATION OF FLOOR LEVELS

Flood Severity AEP	*Number of Houses Inundated*	*Affected House Locations*
20%	5	19* Koninderie Pde 83*, 85*, 87* Narara Valley Dve 2* Yurunga Ave
5%	8	9#, 17*, 19* Koninderie Pde 65, 83*, 85*, 87* Narara Valley Dve 2* Yurunga Ave
1% **Designated Flood**	15	1, 5, 9#, 11, 13, 17*, 19# Koninderie Pde 63, 65, 83*, 85*, 87* Narara Valley Dve 2*, 4* Yurunga Ave Deane Street Shop

* Floor level inundated due to Tributary B flows.
# Floor level inundated due to Tributary B flows and flooded independently from Koninderie Parade channel

The houses affected by flooding include those inundated by flows overtopping Narara Valley Drive at Tributary B and potentially spreading into eight *(8)* houses as flood waters *(1% AEP)* flow towards the Koninderie Parade channel (refer **Section 5.5**). Two of these houses can also have floor levels inundated by floodwaters from the main Koninderie Parade channel. This flooding can occur independently of flooding in the Koninderie Parade channel.

During the Probable Maximum Flood *(PMF)*, flood levels are predicted to be up to 0.5 m higher than for the 1% AEP flood. This is likely to cause inundation of a further 21 houses above those flooded in the 1% AEP storm. These houses are located generally in the low lying area of Koninderie Parade and Narara Valley Drive. The deepest water above a floor level during the PMF would be about 0.75 m in Koninderie Parade. In the 1% AEP flood, it would be about 0.2 m above the floor level in the same location.

3.3 FLOOD ACCESS

Vehicular access to flood affected areas is important for evacuation purposes and to provide support services in an emergency. Personal safety is also an issue along major pedestrian access routes where it may be possible that people attempt to cross flooded pathways or roads.

Locations at which flood water could flow swiftly across roads or pathways are at the Deane Street and Narara Valley Drive crossings for the main creek line and across Narara Valley Drive opposite Yurunga Avenue. The extent of overtopping at these crossings under existing conditions is presented in **Table 3.2**.

Table 3.2 EXTENT OF OVERTOPPING OF ROAD CROSSINGS DURING FLOODS

Crossing Location	Flood Severity (AEP)								
	20%			5%			1%		
	Water Depth (m)	Peak Velocity (m/s)	Velocity x Depth (m^2/s)	Water Depth (m)	Peak Velocity (m/s)	Velocity x Depth (m^2/s)	Water Depth (m)	Peak Velocity (m/s)	Velocity x Depth (m^2/s)
Deane St	0.7	1.1	0.8	0.9	1.3	1.2	1.1	1.5	1.7
Narara Valley Dve	0	0	0	0.3	1.4	0.4	0.6	2.6	1.6
Yurunga Ave	0.1	0.9	0.1	0.3	1.4	0.4	0.4	1.7	0.7

Both Deane Street and Narara Valley Drive opposite Yurunga Avenue are overtopped even in a 20% AEP storm while the overtopping of the main crossing of Narara Valley Drive does not occur until a 5% AEP storm event. This means that Deane Street and Yurunga Avenue may be overtopped, on average, once every five years, while Narara Valley Drive may be overtopped, on average, once every twenty years.

The product of the overtopping depth and velocity is used as a measure of the relative safety for vehicular and pedestrian access across flow areas. Values of 0.6 and 0.4 are typically adopted as upper limits for safe access by vehicles and pedestrians respectively **(Reference 2 and 3)**. The existing access hazards at Deane Street and Narara Valley Drive crossings are presented in **Figure** 7.

The Deane Street crossing is particularly hazardous because it does not meet these guidelines even in a 20% AEP storm. There is no alternative floodfree vehicular access route for those residents west of the Deane Street crossing and near Hanlan Street south. The crossings of Narara Valley Drive are considered hazardous during storms with a severity above 5% AEP.

Residents in Woorin Close, Willari Avenue and Apara Close have only one vehicular route to Narara Valley Drive which is along the flood affected route of Koninderie Parade and Yurunga Avenue. It is preferable that these residents have floodfree access especially in emergency purposes during severe floods. There is a public reserve between Haggerty Close and Willari Avenue which could provide as an access track via Haggerty Close to Narara Valley Drive. However, the park forms a secondary flood flow path when waters breakout of the main creek channel.

4 FLOODPLAIN MANAGEMENT OPTIONS

4.1 GENERAL DESCRIPTION

A range of structural and non-structural floodplain management options were considered, including those identified by Council *(refer to* **Figure 2** *for locations)*. The options that were considered include:

Structural Options

1. Deane Street bridge lengthening;
2. Narara Valley Drive bridge;
3. Koninderie Parade channel improvements;
4. Formalise flood flow across Narara Valley Drive at Yurunga Avenue;
5. Floodfree access;
6. Raising floor levels;
7. Bank Stabilisation.

Non-Structural Options

8. Planning controls;
9. Acquisition of affected houses;
10. Flood evacuation plan

The above options are discussed in detail below.

OPTION 1 DEANE STREET BRIDGE LENGTHENING

The existing bridge opening under Deane Street is offset slightly to the west of the channel alignment, leading to high energy losses and increased flood levels. The proposal to lengthen the bridge would increase the opening from 8.7 m wide to 10 m wide and align the opening with the creek channel. This would reduce the energy losses and allow more flow under the bridge. The estimated cost of these works would be approximately $85,000 including an allowance for contingencies, design and construction supervision (refer **Appendix C**).

Provision of floodfree access up to a 1% AEP flood at the Deane Street crossing would require raising the road level by 1.1 m to about RL 7.7 m AHD. This would not be financially practical because Deane Street is relatively flat and approximately 400 m of road would have to be raised with additional culverts and channel widening undertaken to accommodate the 1% AEP flood flows without overtopping.

A small improvement which could be undertaken as part of maintenance works associated with this option is the removal of the sediment obstruction on the eastern bank on the upstream side

of the Deane Street bridge. This sediment obstructs flow and its removal would streamline flows under the bridge.

OPTION 2 NARARA VALLEY DRIVE BRIDGE

The existing culverts under Narara Valley Drive are subject to blockage with debris. It is unlikely that measures could be taken to completely alleviate this potential problem with the culverts without causing an impact elsewhere in the catchment, for example, debris traps further upstream could cause increased flood levels in upstream areas.

The existing culvert opening is approximately the same as the channel width and the culvert invert corresponds to the channel bed level leaving little scope for practical improvement to the flow area. In order to overcome the debris blockage problem and reduce overtopping of the road during floods, the most appropriate upgrade option at this site would be a concrete bridge with a higher road level and longer span than at present.

The concrete bridge would span the creek channel and have a deck invert level just above the predicted 1% AEP flood level of 8.5 m AHD. Its overall dimensions would be 22 m long and 9 m wide. The road crest level on the bridge would be about 9.0 m AHD which is about 1.1 m above the existing road level. Roadworks would be required either side of the bridge to regrade the approaches. The estimated cost of these works would be approximately $445,000.

OPTION 3 KONINDERIE PARADE CHANNEL IMPROVEMENTS

In the channel along Koninderie Parade there is considerable accretion of sediments, which reduce the available flow area and cause increased flood levels. The proposed channel improvements would include the clearing of these sediments and a minor widening of the channel along the length of Koninderie Parade. Stabilisation of creek banks further upstream would reduce the future extent of sedimentation in the creek channel, however, in the absence of this stabilisation, it would be necessary for Council to regularly maintain the channel in its improved condition.

The new channel would be formed with a base width of about 5 m and side slopes of 1V:5H and rock protection provided to minimise bank scour in regular flood flows. The upper portions of the banks would be vegetated to stabilise the surface. The estimated cost of the channel improvement works would be approximately $315,000.

OPTION 4 FORMALISE FLOOD FLOW ACROSS NARARA VALLEY DRIVE AT YURUNGA AVENUE

At present there is a 1.8 m diameter pipe which transfers flow from Tributary B under Narara Valley Drive and residences to the creek. This pipe is undersized for larger events and flooding of adjacent residences is caused by the resulting overland flows.

There are a number of options for transferring floodwaters from Tributary B to the creek without causing inundation of residences around Yurunga Avenue. The options considered were:

- Option 4A: two 1.8 m diameter pipes under Narara Valley Drive aligned down Yurunga Ave to the creek; this option minimises the disruption to the existing residences but has a high capital cost *($860,000)* and possible blockage of the pipe inlets could still result in overland flows;

- Option 4B: replace the existing pipe with large culverts along the existing drainage easement; this option has a high capital cost similar to Option 4A and would still be subject to blockage;

- Option 4C: form an overland flow path and purchase two residences *(No. 17 Koninderie Pde and 83 Narara Valley Drive)*; a swale would be formed at grade with brick walls channelling flow to Koninderie Pde; the capital cost would be approximately $313,000 and it is the preferred option;

- Option 4D: relocate the low point in Narara Valley Drive to opposite Yurunga Ave to channel overland flows down Yurunga Ave; this option has a relatively low capital cost *($115,000)* but would exacerbate access problems from Koninderie Pde during floods.

Schematic presentations of Options 4A, 4B and 4C are illustrated in **Figure 8**.

As option 4C was the preferred option, Options 4A, 4B and 4D were not considered further.

OPTION 5 FLOODFREE ACCESS

As identified in **Section 3.2**, there are several locations where road and pedestrian access is impaired during flooding. These locations include the Deane Street and Narara Valley Drive crossings for the main creek line and Narara Valley Drive opposite Yurunga Avenue. Koninderie Parade, running parallel to the main creek line, is also affected by elevated flood levels. As a result of these accessways being flooded, some areas of the catchment become isolated during severe storm events, for example, vehicular access from Willari Ave, Apara Close and Woorin Close during floods would be obstructed by waters flowing out of the channel onto Koninderie Parade.

Options which improve access during floods and which have already been discussed, include:

- provision of floodfree access across the Deane Street bridge (*Option 1*) which would be prohibitively expensive requiring the construction of a new bridge, and the reconstruction of Deane Street and accessways to the residences;

- the upgrading the Narara Valley Drive culverts to a bridge (*Option 2*) which will allow provision of floodfree access;

Additional options to provide floodfree access include:

- Option 5A - One Lane Bridge Over Tributary A at Hanlan Street

  An alternative access route for residents west of the Deane Street crossing would be via a new road bridge across Tributary A to join south and north Hanlan Street. This could be a one lane timber bridge for use only in emergencies. The estimated cost of this 30 m long bridge with associated road works would be approximately $280,000. This bridge would reduce the social trauma associated with the fear of an emergency occurring when floodwaters have blocked all exits from the western area of the catchment.

- Option 5B - Low Key Road Access Between Haggerty Close and Willari Avenue

  It is preferable that an alternative vehicular access is provided from Willari Avenue, Apara Close and Woorin Close to Narara Valley Drive during severe floods. One option is to provide of a low key vehicle access through the public reserve between Willari Avenue and Haggerty Close which would cater for residents in Willari Avenue and Apara Close. It would be necessary to bridge or pipe the small channel towards the northern end of the reserve. The estimated cost of the road and drainage works to provide the low key vehicular access to Haggerty Close would be approximately $50,000, which is a relatively low cost to ease the social trauma and stress associated with flooding in this area.

- Option 5C - Acquisition of Properties to Provide an Accessway

  Alternative access from Woorin Close could be provided with the acquisition of two properties, to direct access to either Apara Close *(then Haggerty Close)* or to Narara Valley Drive. The estimated cost to purchase the two properties would be approximately $286,000 including an allowance for legal and other costs. One of these properties could include No. 9 Woorin Close, which is likely to experience above floor flooding in a 1% AEP flood. Nonetheless, it is a relatively high price for the purpose of access when it is likely that it would not provide a significantly better access route than along Koninderie Parade and then into Willari Avenue.

- Option 5D - Minor Levee to Reduce Secondary Flows

The construction of a levee at the northern end of the reserve near Haggerty Close would reduce the secondary flows which occur in the reserve when the creek banks are overtopped further upstream. This levee would reduce the flood flows through the reserve but would have to be incorporated with other downstream improvements in the main channel to alleviate any potential adverse effects associated with increased flows.

Option 5A was recommended for further consideration for provision of flood free access to the residents generally west of the creek. For localised flood access around Koninderie Parade, Option 5B was preferred to Option 5C because it was less expensive, less disruptive, and did not require acquisition of property. Option 5C was therefore not considered further. Option

5D was recommended for consideration as an option, but would require further assessment at a design level to examine the overall feasibility.

OPTION 6 RAISING FLOOR LEVELS

Raising of floor levels is generally economically feasible for buildings with other than brick, stone or concrete walls. The Liquor Store in Deane Street was the only non brick building which is inundated in existing conditions for a 1% AEP flood *(including 75% blockage of the Narara Valley Drive culverts)*.

None of the proposed improvements would sufficiently reduce flood levels in the vicinity of this building and as such, it may be appropriate to raise its floor level. The Liquor Store floor level would have to be raised about 0.8 m to incorporate a 0.5 m freeboard allowance above the 1% AEP flood level. The estimated cost to raise the floor level of this building would range between $20,000 to $30,000 based on recent work in Sydney and Lake Macquarie.

Raising the floor of the Liquor Store would not be eligible for government funding assistance because it is a commercial operation. Due to its age and condition, it was not considered to be an economically viable option. In the longer term it would be more appropriate to relocate any redevelopment of the site out of the floodway to the higher portions on the northern part of the property.

OPTION 7 BANK STABILISATION

Sedimentation within the creek gradually reduces the waterway area available to convey flood flows and can lead to increased flood levels and the need for more maintenance works. A major source of this sediment is from the erosion of the creek channel banks. Two specific areas were identified in which channel bank stabilisation could reduce the supply of sediment to the creek. These were:

- Option 7A Between Deane Street bridge and Narara Valley Drive culverts, a creek length of approximately 250 metres, or 500 metres of bank to be stabilised, and

- Option 7B Upstream of Koninderie Parade to Niagara Park Primary School, a creek length of approximately 750 metres, or 1500 metres of bank to be stabilised.

In these areas, the creek banks could be regraded to suitable slopes and vegetated to stabilise the surface. In some locations, the channel could be widened to reduce flow velocities and the erosion potential. Bank protection may be required in those areas where the channel dimensions are constrained or excessive velocities exist near structures or on the outside of bends.

Further assessment of the existing channel banks and the flow regime in these areas would be required to determine more specific treatment requirements and therefore the cost of such works. As a preliminary estimate, assuming an average of $500 per metre of bank to stabilise

the banks, Option 7A would cost in the order of $250,000 and Option 7B would cost in the order of $750,000.

OPTION 8 PLANNING CONTROLS

Planning controls are a mechanism of managing development such that the flood hazard does not increase and preferably reduces. Planning controls in terms of appropriate statements in Section 149 Certificates for flood prone properties in the study area have been instigated by Council. Council can also specify appropriate floor levels for redevelopment of properties or additions to existing residences.

With regard to further development especially in the flood prone areas of Narara Valley Drive and the Koninderie Parade area, Council should consider firstly whether redevelopment of existing residences will create an appropriate use for this area given the vehicular access and safety problems which occur during floods. It may be more appropriate to gradually purchase the flood affected properties and return the land to open space.

OPTION 9 ACQUISITION OF AFFECTED HOUSES

Acquisition of residences is an effective means of reducing flood damages and removing buildings from hazardous areas. Acquisition of properties would have to be undertaken with voluntary acceptance by the owner and its implementation schedule would be indeterminate. Preference may be given to the acquisition of properties experiencing the most regular inundation above floor levels either in the existing case or following flood mitigation works.

The value of these properties should be assessed in detail by a qualified valuer. As a preliminary indication, it is estimated that the purchase value of the 14 properties inundated in the 1% AEP flood event, excluding the Liquor Store, would be approximately $1.8 million. Additional costs may be incurred for the removal of each structure from the flooded areas. An estimate of $2.1 million was made for the total cost of this option. Purchase of the eight properties inundated by the 20% AEP flood would cost approximately $1 million.

Voluntary purchase of houses is typically only considered for properties in the most hazardous areas. The subject houses are not in this category and would not be eligible for government funding subsidy. This option was not considered further as without Government subsidy it would not be financially viable.

OPTION 10 FLOOD EVACUATION PLAN

Following the implementation of the proposed flood mitigation works, there may still be residences which experience inundation above floor levels during floods. Also, there may continue to be problems with safe vehicular access during floods.

The response of flood flows to heavy rainfall in the subject catchment is a matter of hours with peak levels occurring three *(3)* to four *(4)* hours after commencement of the storm. This makes it impractical for a flood warning system to provide substantial benefits. It is

appropriate, nonetheless, that a flood evacuation plan be formulated for the catchment, by Council and local residents in conjunction with the local State Emergency Service, Police and other relevant authorities. The plan should consist of, inter alia, the following details:

- a flood awareness program - to explain to local residents the flood behaviour, the hazards and appropriate responses;
- designated contact people - to organise orderly evacuation of residents and possessions;
- defined access routes;
- location of flood shelters;
- clean up program; and
- financial and counselling assistance.

4.2 SUMMARY OF OPTIONS

A list of the structural and non-structural floodplain management options which were considered feasible and beneficial for the reduction in flood hazards and damages is presented in **Table 4.1**.

Table 4.1 FEASIBLE FLOODPLAIN MANAGEMENT OPTIONS

Option	*Estimated Cost ($)*
1. Deane Street bridge lengthening	85,000
2. Narara Valley Drive Bridge	445,000
3. Koninderie Parade channel improvements	315,000
4. Formalise floodflow across Narara Valley Drive at Yurunga Avenue	
4C. Overland flow path requiring purchase of two residences	313,000
5. Floodfree access:	
5A. One lane bridge over Tributary A at Hanlan St	280,000
5B. Low key road access between Haggerty Close and Willari Ave	50,000
5D. Minor levee to reduce secondary flows	50,000
7. Bank Stabilisation	
7A. Between Deane Street bridge and Narara Valley Drive culverts	250,000
7B. Upstream of Koninderie Parade to the primary school	750,000
8. Planning Controls	n/a
10. Flood Evacuation Plan	n/a

The key options in terms reducing the degree of inundation and the resultant flood damages, were considered to be Options 1, 2, 3 and 4. These four options were selected for a more

detailed analysis in **Section 5**, where the impact of the four options on flood behaviour was assessed.

5 IMPACT OF FLOODPLAIN MANAGEMENT OPTIONS ON FLOOD BEHAVIOUR

5.1 GENERAL

From the list of feasible options proposed in **Section 4**, four options were selected for a more detailed assessment of their impact on flood behaviour. The MIKE-11 model established to simulate the existing flooding conditions was used to evaluate changes to the existing flood levels as a result of the implementation of each of the four proposed options. The results of these assessments are discussed below.

5.2 DEANE STREET BRIDGE LENGTHENING

The lengthening of the Deane Street bridge (*Option 1*), resulting in a wider channel under the bridge, would provide a larger waterway area as well as reduce energy losses. The resulting reduction in the peak 1% AEP flood level at the bridge would be about 0.1 m (refer **Figure 9**). The reduction in flood level diminishes in an upstream direction, reducing to negligible values at the Narara Valley Drive crossing. This option would alleviate inundation above floor level in one (1) residence as well as at the Deane Street shop. There would be no change in the number of floor levels inundated during the less severe 5% and 20% AEP floods compared with existing conditions.

The reduction in vehicular access hazard on the Deane Street crossing following upgrading would be significant but would still not provide safe access during a 1% AEP flood (refer **Table 5.1** and **Figure 10**). Safe vehicular access would probably be possible in floods up to a 5% AEP severity while safe pedestrian access would be possible up to a flood between the 5% and 20% AEP severity.

Table 5.1 ACCESS HAZARDS AT DEANE STREET CROSSING (Velocity x Depth)

	Flood Severity (AEP)		
	1%	*5%*	*20%*
Existing Crossing	1.7	1.2	0.8
Upgraded Crossing	1.3	0.6	0.1

5.3 NARARA VALLEY DRIVE BRIDGE

Provision of a bridge at the main creek crossing of Narara Valley Drive (*Option 2*) would reduce peak water levels just upstream of the bridge by up to 0.7 m during a 1% AEP flood (refer **Figure 11**). The main cause of the lower flood levels would be the low potential for blockage at the crossing. Another significant benefit is the provision of floodfree access during a 1% AEP flood although this would have to be combined with works opposite Yurunga Avenue to minimise overtopping flows along Narara Valley Drive.

The reduction in flood level diminishes in an upstream direction to a negligible reduction in flood level opposite Willari Avenue. This improvement would alleviate above floor level inundation in seven *(7)* residences *(out of 8 for existing conditions - excluding Tributary B flooding and Deane Street shop)* in a 1% AEP flood (refer **Figure 12**).

5.4 KONINDERIE PARADE CHANNEL IMPROVEMENTS

For this option (*Option 3*), the majority of the inundation above floor level occurs in the vicinity of Koninderie Parade and hence the channel improvements were located in this area. For a 1% AEP flood, the channel improvements cause a significant reduction in flood levels of up to 0.5 m (refer **Figure 13**). The decrease in level extends from the Narara Valley Drive crossing to upstream of Haggerty Close. The channel works appear to cause a draw down of flood levels which extends upstream of the improvement works.

The channel works alleviate above floor level inundation in three *(3)* residences *(out of 8 for existing conditions - excluding Tributary B flooding and Deane Street shop)* in a 1% AEP flood (refer **Figure 14**). The five (5) residences which would still remain affected are located towards the downstream end of the Koninderie Parade channel and are still potentially affected by backwater flooding due to blockage of the Narara Valley Drive culverts.

5.5 FORMALISE FLOOD FLOW ACROSS NARARA VALLEY DRIVE AT YURUNGA AVENUE

It is understood that in the past, floodwaters from Tributary B have overtopped Narara Valley Drive opposite Yurunga Avenue, and knocked over timber fences on downstream properties and caused flooding above floor levels. Local residents have indicated that floodwaters from Tributary B arrive prior to those in the main channel and this is verified in the model. In the past, residents have experienced inundation from floodwaters overflowing from Tributary B while waters in the Koninderie Parade channel have not overtopped the banks.

Overflows from Tributary B tend to fan out as they flow towards the channel and residents have acknowledged that in the past the following properties have been affected:

- 83, 85, 87 Narara Valley Drive;
- 2,4 Yurunga Avenue;
- 9, 11, 13, 17, 19 Koninderie Parade.

This anecdotal evidence from the residents was checked by examining the likely flow depths of overland flows from Tributary B across Narara Valley Drive.

The estimated peak overflow rates at Narara Valley Drive are:

- 1% AEP - 7.8 m^3/s;
- 5% AEP - 3.8 m^3/s;
- 20% AEP - 0.8 m^3/s.

Based on estimated flow depths and floor levels, the residences likely to experience inundation above floor levels, due to overland flows form Tributary B, would be:

- 20% AEP flood :
  - 2 Yurunga Ave
  - 83, 85 & 87 Narara Valley Drive
  - 19 Koninderie Parade
- 5% AEP flood :
  - as above plus
  - 9 & 17 Koninderie Parade
- 1% AEP flood :
  - as above plus
  - 4 Yurunga Ave

An overland flow path (*Option 4C*) is proposed, which includes a swale at existing ground level with impermeable brick walls either side to channel the overflows. The wall would extend from Yurunga Ave northwards and turn east along the southern boundaries of 17 Koninderie and 83 Narara Valley Drive (refer **Figure 8**). The brick wall would be about 1.2 m high. This option would require purchase of 17 Koninderie Parade and 83 Narara Valley Drive. Vehicular access to 2 Yurunga Ave would be rearranged to Yurunga Ave and the driveway entry to 85 Narara Valley Drive would have to be angled further to the north.

Assuming that the overland flow path was designed to collect and convey the 1% AEP flow rate from Tributary B, this option would alleviate inundation above floor level from overflows in a 1% AEP flood, for the eight (8) residences listed above (refer **Figure 15**). Two of these residences however, would still be subject to flooding from the Koninderie Parade channel.

A narrower overland flow path of 8 m was initially considered and located along the northern boundary of properties 83 Narara Valley Drive and 17 Koninderie Parade. The narrower width would enable the residence on 83 Narara Valley Drive to be retained while 17 Koninderie Parade would be purchased. However, the flow conditions during floods in this narrow channel would be highly hazardous and not appropriate given its proposed location close to residential properties.

For the 1% AEP flood, it is estimated that the flow depth in a 20 m wide overland flow path would be approximately 0.65 m with a velocity of above 0.6 m/s. This represents a low flood hazard rating according to the NSW Floodplain Development Manual.

5.6 COMBINED OPTIONS

5.6.1 Combined Options 3 and 4

The recommended flood mitigation options for the study are likely to be implemented in a staged manner given the limited availability of funding. The most feasible options which are likely to be implemented first are the Koninderie Parade channel improvements (*Option 3*) and the formalisation of flood flows across Narara Valley Drive near Yurunga Avenue (*Option 4C*).

These works would reduce the extent of flooding in Koninderie Parade, Yurunga Avenue and Narara Valley Drive. There would still be the potential for blockage of the Narara Valley Drive culverts, but the likelihood would be lower due to the clearing of the Koninderie Parade channel of vegetation and the streamlining of flow into the culverts.

This combination of options would alleviate above floor inundation in nine (9) residences (*out of fourteen (14) for existing conditions excluding the Deane Street shop*) in a 1% AEP flood. The Deane Street shop would remain inundated above floor level and access hazards would not be significantly deceased. The comparison of the flood profiles for the existing conditions and the combined Options 3 and 4C are shown in **Figure 16**.

5.6.2 Combined Options 1, 2, 3 and 4

The combined implementation of Options 1 to 4 would lower the 1% AEP flood levels sufficiently to alleviate above floor inundation of all properties in the study area, including the shop in Deane Street, as well as decreasing the access hazard, in particular providing flood free access across the Narara Valley Drive bridge crossing in a 1% AEP event.

The Deane Street bridge lengthening provides minor improvement in flooding and it is likely that the combination of the other three options would also alleviate above floor flooding for all residences as well as the Deane Street shop. The flood profile for the combined options is presented in **Figure 17**.

6 FLOODPLAIN MANAGEMENT OPTION JUSTIFICATION

6.1 JUSTIFICATION CRITERIA

The quantitative review of the justification for the flood floodplain management has been based on an assessment of the present worth benefit related to the reduction in flood damages and increases in property values related to the removal of the flood hazard.

The benefit of reduced damages is calculated as the difference between the present worth flood damages for existing conditions and those for the particular option. The present worth damages is estimated by calculating the present worth of the average annual damages over a selected time frame and at a particular discount rate. For this analysis, a 50 year time frame was selected as an indicative life of the improvement works and a discount rate of 7% was adopted.

The average annual damages were estimated by summing the estimated flood damages in one year for the 1%, 5%, 20% AEP and PMF floods. Direct potential flood damages were estimated based on the depth of flooding in relation to floor levels and the type of house or premises. Provision was made when assessing the depth of flooding for variations in water level, as a result of waves and due to the limitations of survey and modelling, with damages assumed to commence when flood levels reach 0.2m below floor level. Allowances were also made for indirect damages such as the cost of clean up. These were assumed to be 25% and 50% of the direct flood damages for residential and commercial properties respectively. Damages to vehicles were included as a separate cost related to depth of flooding above door sill levels. It was assumed that because the flooding in the study area occurred with little warning, it was unlikely that the actual damages could be reduced below the estimated potential damage value.

Recently Council introduced a notification on the Section 149 certificates that properties in the vicinity of the Upper Narara Creek were subject to flooding. This has resulted in a reduction to sale values for these properties. The flood mitigation works would not only reduce flood damages but would restore property values to their levels in the recent past. This benefit has been taken into account in the justification of options.

Other factors such as social trauma and disruption, and access during an emergency are aspects which are difficult to quantify as a financial impact due to flooding. Nonetheless, they are important aspects which should be considered when reviewing the need for flood mitigation works.

The following sections discuss the quantitative financial justification for the proposed mitigation options. As the qualitative issues relating to proposed options may also have a

bearing on the justification of options, these have also been discussed. Details of the flood damages and benefit assessment are contained in **Appendix B**.

6.2 BENEFIT COST RATIOS

The estimated benefits, costs and benefit/cost ratios for the four main mitigation options are presented in **Table 6.1**. Summaries of the details of Options 2, 3 and 4 are presented in **Figures 12, 14 & 15**.

Table 6.1 PRESENT WORTH DAMAGES AND BENEFITS, $

Option	*Total Cost*	*Present Worth Damages Reduction*	*Benefit/ Cost Ratio*	*Increased Property Values**	*Total Benefit*	*Benefit/ Cost Ratio on Total Benefit*
1. Deane Street Bridge Lengthening	85,000	10,000	0.1	15,000	25,000	0.3
2. Narara Valley Drive Bridge	445,000	47,000	0.1	180,000	227,000	0.5
3. Koninderie Parade Channel Improvements	315,000	33,000	0.1	135,000	168,000	0.5
4. Formalise Flood Flow across Narara Valley Drive at Yurunga Ave	313,000	161,000	0.5	90,000	251,000	0.8

* Increased value of each residence no longer flood affected in the 1% AEP flood was $15,000

6.3 DEANE STREET BRIDGE LENGTHENING

As discussed in **Section 5.2**, there is only a marginal reduction in the extent of above floor inundation as a result of the proposed under bridge waterway enlargement (*Option 1*). This is reflected in the relatively low benefit cost ratio of 0.3 for this option. This ratio however, includes only tangible benefits. The intangible benefits associated with this option include

reduced social trauma and disruption, and reduced hazard for pedestrian and vehicular access during floods.

Although the access hazard is reduced by the lengthening of the Deane Street bridge, the over bridge flow will still prohibit safe pedestrian and vehicular access during relatively minor floods. Raising of the Deane Street bridge to provide safe access would require rebuilding of Deane Street and accessways to residences which would be financially prohibitive. As an alternative, emergency access from the areas west of Narara Valley Drive during floods could be provided by a single lane bridge across Tributary B in Hanlan Street (*Option 5A*).

As a result of the low level of the road crest along Deane Street, flows in more severe floods discharge over a long weir formed by the road and, due to the high flow capacity across the weir, only a relatively small backwater effect is created when the capacity of the existing bridge is exceeded. As such, the possible blockage of the under bridge waterway would not have a significant impact on upstream flood levels.

6.4 NARARA VALLEY DRIVE BRIDGE

Provision of a bridge at Narara Valley Drive (*Option 2*) to replace the culverts would have the important beneficial effect of alleviating the potential for blockages and significant backwater inundation of residences in Narara Valley Drive and Koninderie Parade.

This option has a benefit cost ratio of 0.5. This ratio however includes only tangible benefits. The intangible benefits associated with this option include reduced social trauma and disruption as a result of inundation of floor levels, and the provision of floodfree pedestrian and vehicular access during the 1% AEP flood. Taking into account the overall benefits, the benefit cost ratio of this option is considered reasonable.

A summary of the Narara Valley Drive bridge attributes is presented in **Figure 12**.

6.5 KONINDERIE PARADE CHANNEL IMPROVEMENTS

The sediment shoaling and lack of waterway area in the Koninderie Parade channel has a significant impact on raising flood levels in the vicinity of Koninderie Parade. Clearing and widening of the channel (*Option 3*) would substantially reduce the number of residences inundated above floor levels.

This option has a benefit cost ratio of 0.5 and as with the Narara Valley Drive bridge, would markedly reduce the social trauma and disruption associated with floods. Local residents have indicated that they are anxious during heavy rainfall and have difficulty sleeping at those times. It is therefore considered that this option has a reasonable benefit cost ratio.

A summary of the attributes of this option is presented in **Figure 14**.

6.6 FORMALISE FLOOD FLOW ACROSS NARARA VALLEY DRIVE AT YURUNGA AVE

The overland flow path option (*Option 4C*) for the Narara Valley Drive crossing opposite Yurunga Ave would alleviate flooding problems from this source and overcome the potential for blockages of inlet pipes. It is understood that the owners of 17 Koninderie Avenue and 83 Narara Valley Drive are willing to sell their properties. The residences on these properties are the worst affected by flows from Tributary B over Narara Valley Drive.

The option for an overland flow path also provides the opportunity in the future to install pipes or culverts through these properties to cater for the 1% AEP flows and alleviate the access problems associated with flows over Narara Valley Drive opposite Yurunga Avenue.

This option has a benefit cost ratio of 0.8 which does not include an allowance for the substantial reduction in social trauma and disruption which is associated with the regular overtopping of Narara Valley Drive. This option is considered to have a reasonable benefit cost ratio.

A summary of the attributes of this option is presented in **Figure 15**.

6.7 FLOODFREE ACCESS

The benefits of providing floodfree access are primarily intangible and therefore cannot be represented by a benefit cost ratio. Three options were included in the provision of flood free access in the study area, including a one lane bridge over tributary A at Hanlan Street (*Option 5A*), a low key access road between Haggerty Close and Willari Avenue (*Option 5B*) and a minor levee to reduce secondary flows (*Option 5D*). The intangible benefits associated with floodfree access include the following:-

- residents and their possessions may be moved out of potentially isolated and hazardous areas during flood events, which has the potential to reduce damages, stress and trauma, and hazard to life, limb and property; and

- access routes are provided for emergency services to enter flood effected areas, particularly to assist the sick or elderly and to protect potentially flood affected property where possible.

6.8 BANK STABILISATION

The benefits of stabilising the banks of the Niagara Park Branch of Narara Creek include the following:

- stabilisation prevents the loss of sediment from the banks of the channel into the creek where it could reduce the conveyance area of the channel and therefore increase the impact of flooding;

- stabilisation slows the migration of the channel banks, thus protecting property and services adjacent to the creek;

- stabilisation prevents loss of sediment from the catchment into Brisbane Waters during large flood events; and

- ease of maintenance of the channel may be improved by using the stabilised banks as a template for future maintenance clearing.

The above benefits and the intangible benefits associated with reduced levels of flooding are difficult to cost and have not been represented by a benefit cost ratio.

Two options were included for stabilisation of banks, including an area between Deane Street bridge and Narara Valley Drive culverts (Option 7A) and an area upstream of Koninderie Parade to Niagara Park Primary School (Option 7B).

6.9 PLANNING CONTROLS

The benefits of using planning control as a floodplain management tool are primarily intangible and therefore cannot be represented by a benefit cost ratio. Nonetheless, planning controls are a useful mechanism for Council to manage development so as to reduce existing hazards where possible and to minimise future flood hazard.

6.10 FLOOD EVACUATION PLAN

The benefits of implementing a flood evacuation plan are primarily intangible and therefore cannot be represented by a benefit cost ratio. The intangible benefits associated with the implementation of a flood evacuation plan include the following:-

- provides a safe and orderly means of removing people from hazardous situations;

- improves the speed of evacuation, thus reducing hazard, by giving affected residents a designated floodfree route and a destination to evacuate to; and

- brings flood victims together in designated areas where care and treatment can more effectively be provided.

6.11 RECOMMENDED OPTIONS

The recommended floodplain management options for the Upper Narara Creek study area are shown in **Table 6.2**. Included in this table are the relevant costs, the benefit cost ratios and the priority for each recommended option.

Table 6.2 RECOMMENDED FLOODPLAIN MANAGEMENT OPTIONS

Option	*Estimated Cost ($1994)*	*Total Benefit Cost Ratio*	*Priority*
1. Deane Street bridge lengthening	85,000	0.3	Medium
2. Narara Valley Drive Bridge	445,000	0.5	High
3. Koninderie Parade channel improvements	315,000	0.5	High
4. Formalise floodflow across Narara Valley Drive at Yurunga Avenue			
4C. Overland flow path requiring purchase of two residences	313,000	0.8	High
5. Floodfree access:			
5A. One lane bridge over Tributary A at Hanlan St	280,000	n/a	Low
5B. Low key road access between Haggerty Close and Willari Ave	50,000	n/a	Low
5D. Minor levee to reduce secondary flows	50,000	n/a	Medium
7. Bank Stabilisation:			
7A. Between Deane Street bridge and Narara Valley Drive culverts	250,000	n/a	Medium
7B. Upstream of Koninderie Parade to the primary school	750,000	n/a	Medium
8. Planning Controls	n/a	n/a	High
10. Flood Evacuation Plan	20,000	n/a	Low

7 ENVIRONMENTAL IMPACTS

The potential for adverse environmental impacts associated with the proposed floodplain management options are not considered significant from an ecological standpoint. The widening of the opening at the Deane Street culvert would require removal of three trees on the north eastern abutment and two small trees on the south eastern abutment. There are numerous other similar trees in the vicinity and removal of these introduced tree species is unlikely to cause a significant impact on the area. Replacement native trees could be planted alongside the new channel bank.

The construction of a bridge at the main creek crossing of Narara Valley Drive would not require removal of valuable vegetation nor impinge upon significant fauna habitats.

The creek channel along Koninderie Parade has been invaded by many weed species and the clearing of accumulated debris and reformation of the eastern channel banks offers the opportunity to replant the banks with native species indigenous to the area. Young wattle and eucalypt trees have been planted at regular intervals along the grass nature strip on top of the western bank. The clearing of sediment from the channel using an excavator located on the western bank will require removal of some of these young trees. The number to be removed could be minimised by judicious placement of the excavator. Given the young age of the trees, any trees which were removed could be either transplanted or replaced with advanced tree stock. It would be necessary however in any replanting works to be mindful of the need to have access for possible similar future maintenance works.

The construction works associated with the crossings and channel improvements would cause short term disruptions to traffic and construction noise. These adverse effects could be minimised by appropriate control and programming of construction activities.

It is not feasible to sufficiently raise the Deane Street crossing to provide suitable access during a 1% AEP flood. Alternative access could be provided with a bridge to join north and south Hanlan Street across Tributary A. The bridge could be designed so as not to cause any significant changes to normal traffic movements in the area by only allowing use of the bridge in emergencies. It could be designed as a one lane bridge to limit the impact on existing facilities and the creek vegetation. The bridge could span Tributary A with pile supported abutments and be conveniently located adjacent to the recently installed pedestrian access bridge. Installation of the bridge would require removal of a few small trees and weeds. Associated works would include stabilisation of the sandy banks which are likely to be eroded in severe storms and cause sedimentation in downstream sections of the creek.

8 REFERENCES

Reference 1 Upper Narara Creek Flood Study, Kinhill, 1992

Reference 2 AR & R Institution of Engineers Aust, 1987

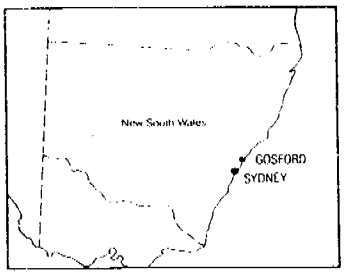
Reference 3 Floodplain Development Manual NSW Government Dec 1986

Reference 4 Rawlinsons 1994 Cost Estimate Manual

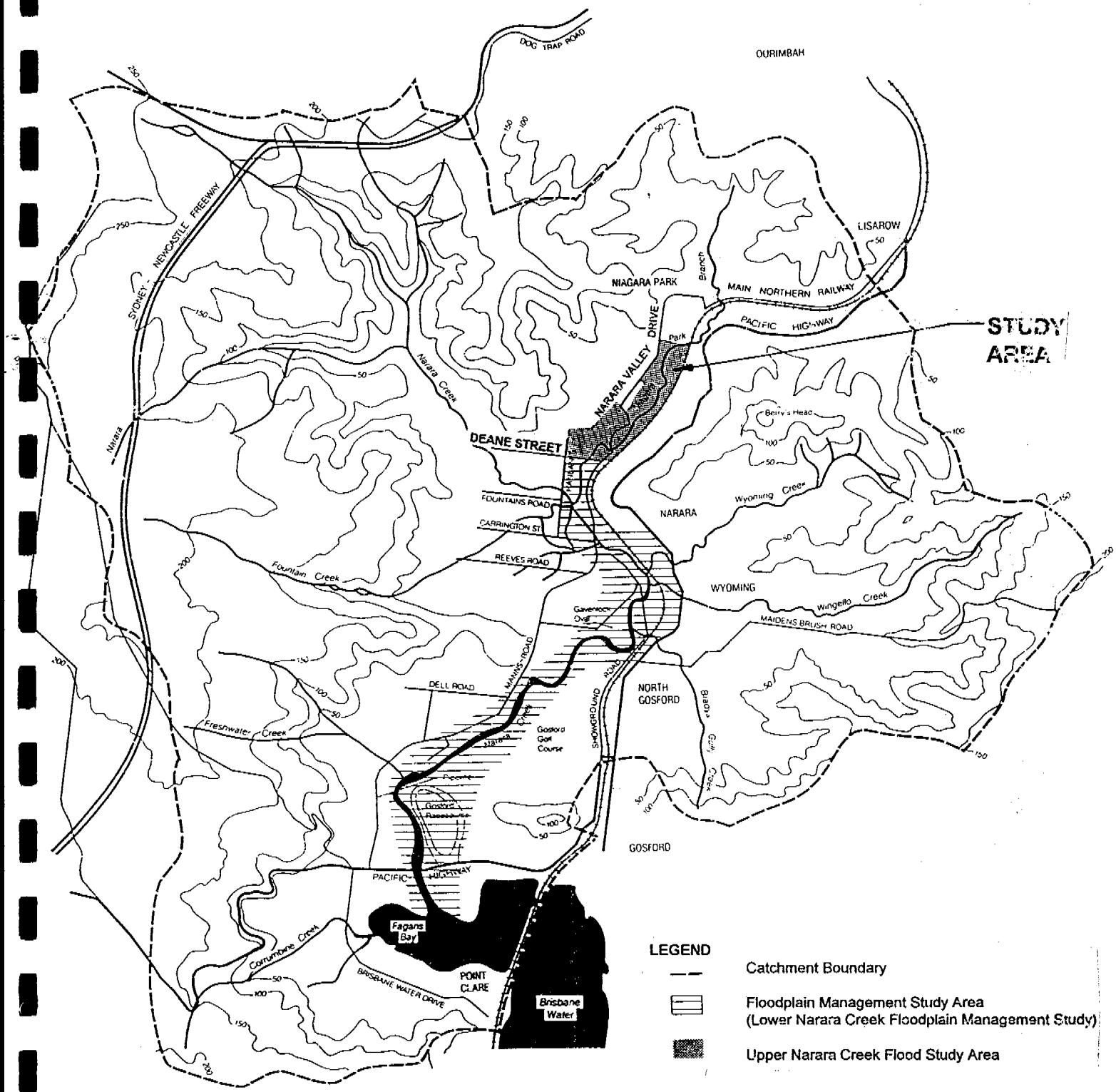
Reference 5 Warragamba Dam IDC Report 1993

FIGURES

FIGURE 1



LOCALITY PLAN

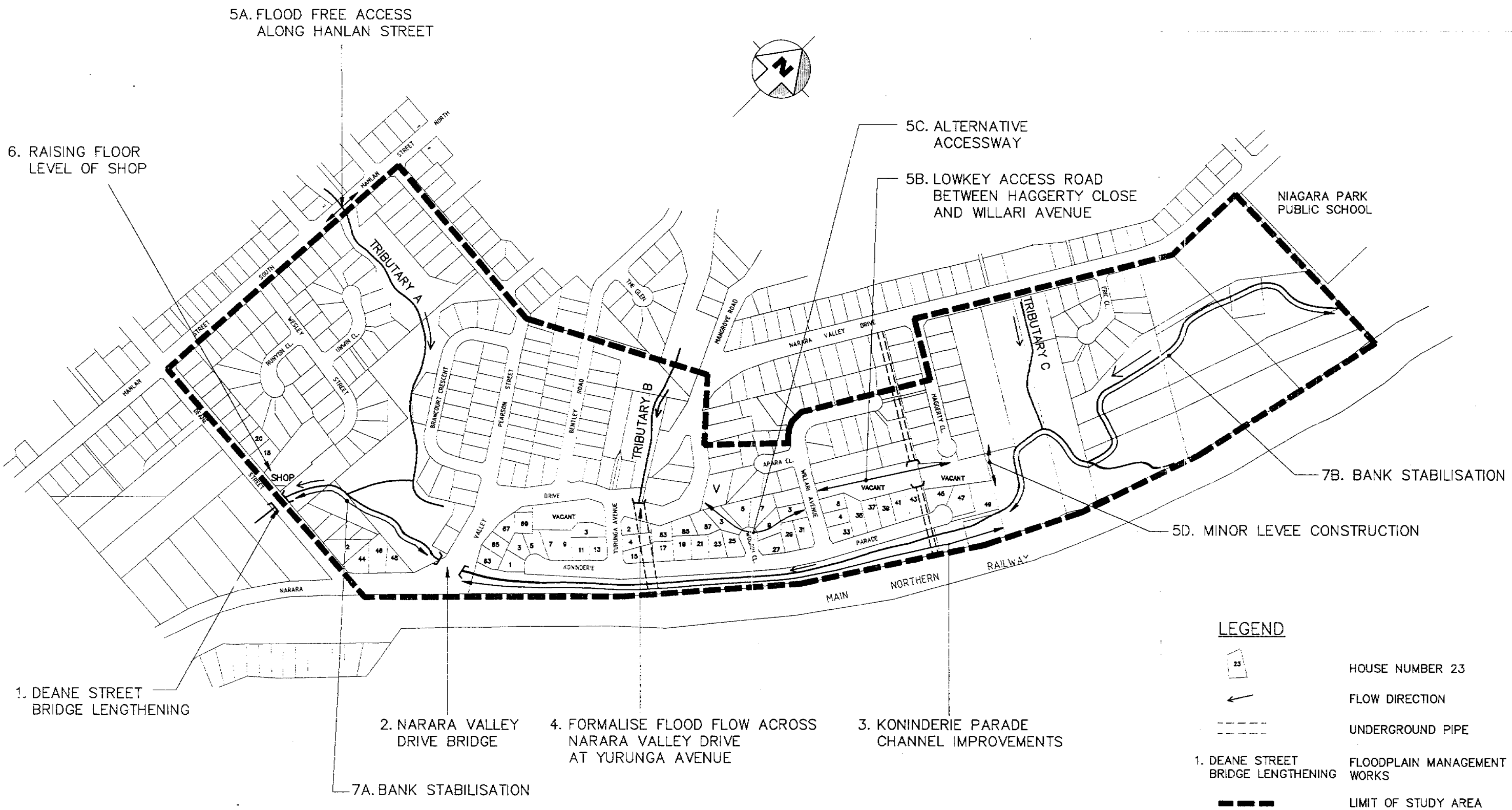


SOURCE: UPPER NARARA CREEK FLOOD STUDY

LOCALITY PLAN

J1792/R1074

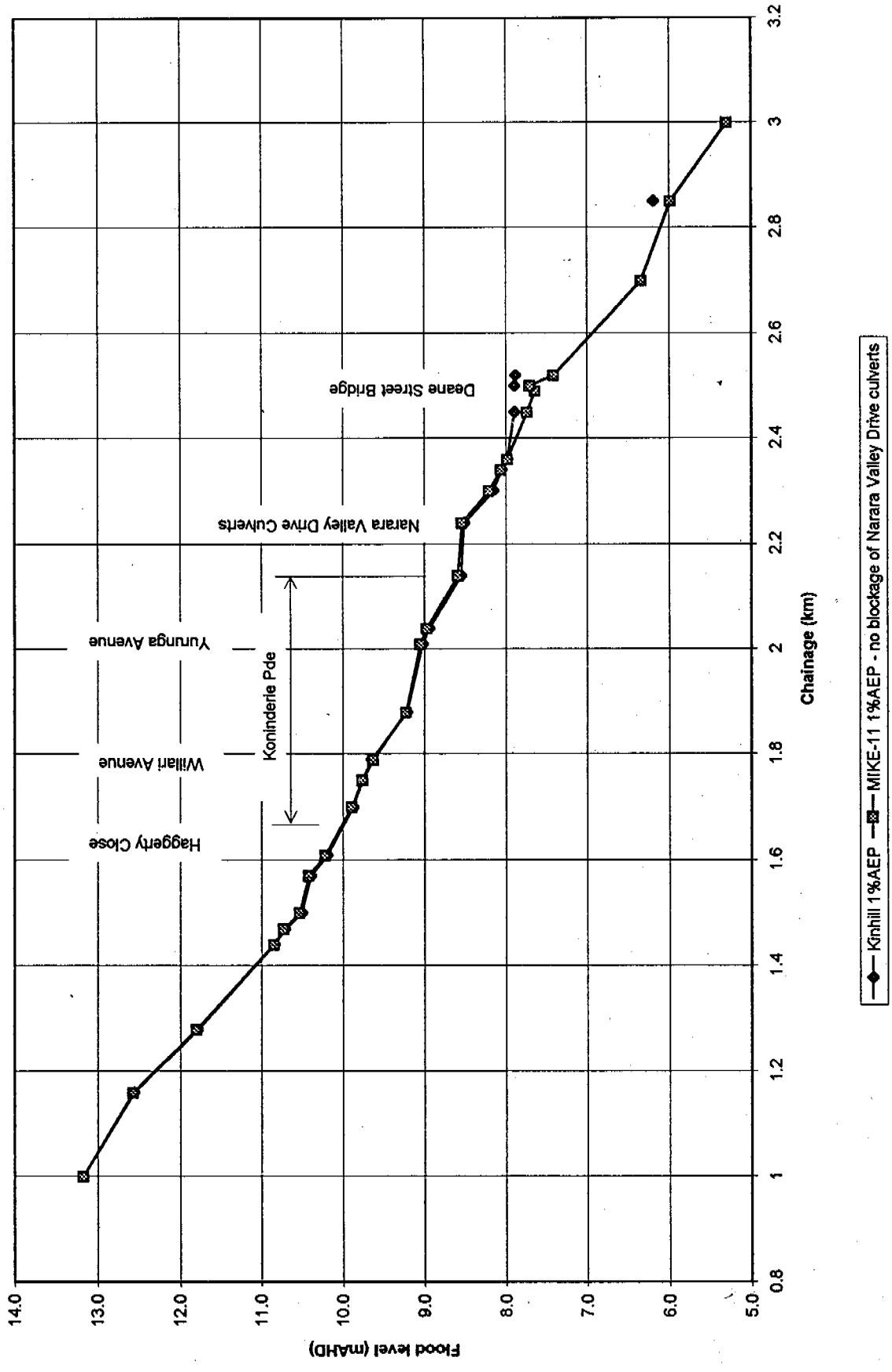
FIGURE 2



UPPER NARARA CREEK STUDY AREA

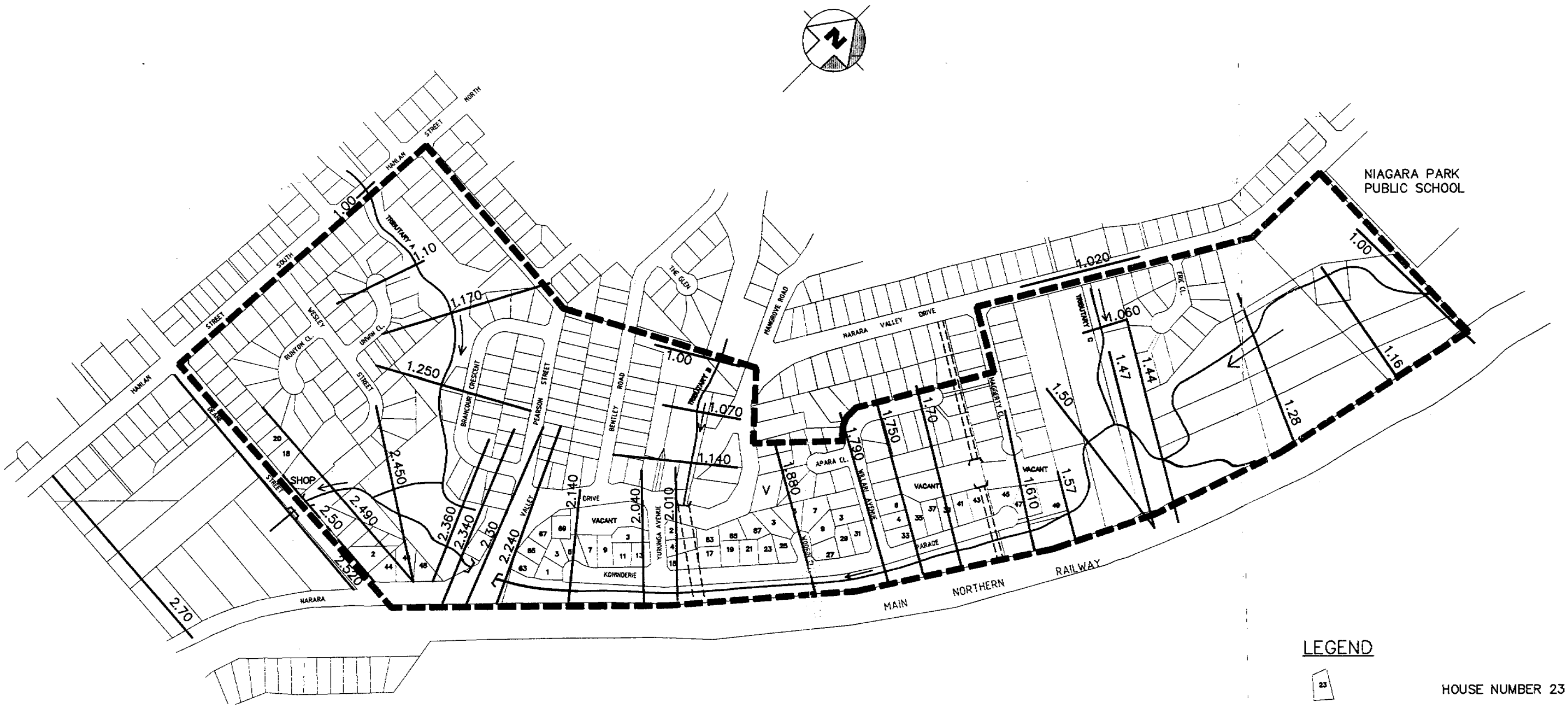
J1792/R1074

FIGURE 3



COMPARISON OF MODEL PREDICTIONS

FIGURE 4



LEGEND

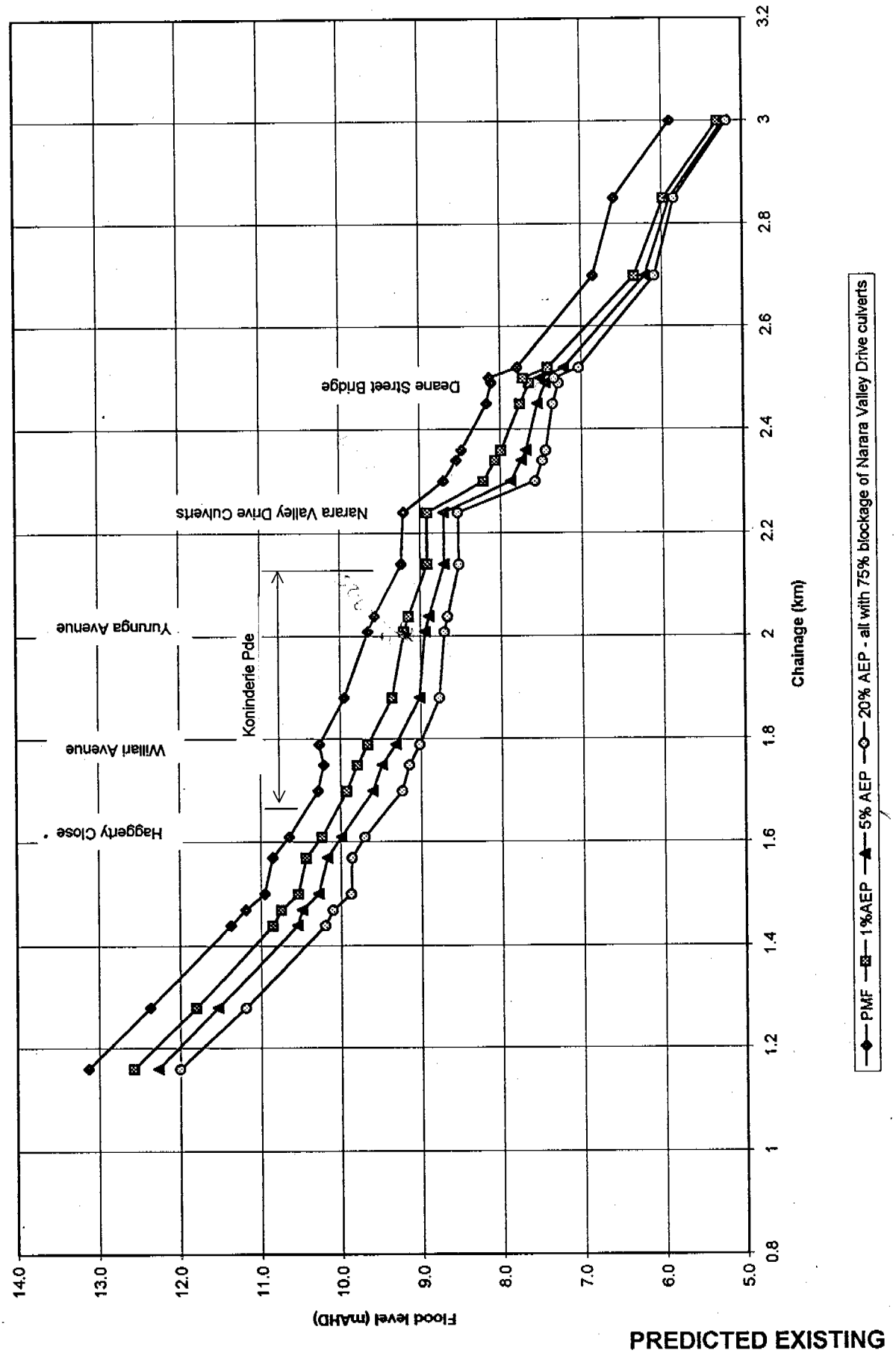
- HOUSE NUMBER 23
- FLOW DIRECTION
- UNDERGROUND PIPE
- 1.57 — MODEL CROSS-SECTION AT CHAINAGE 1.57km
- LIMIT OF STUDY AREA

0 50 100 150 200 250M

J1792/R1074

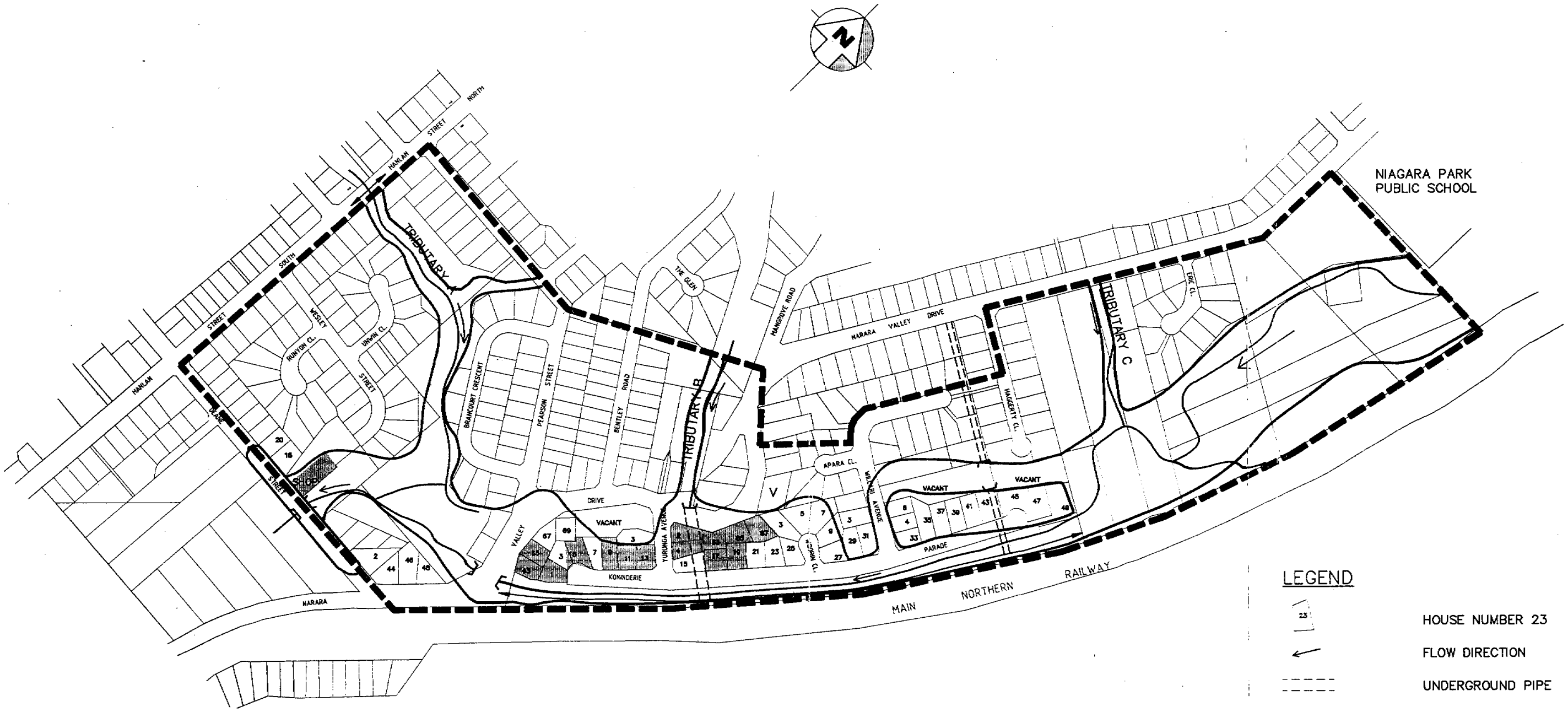
MIKE-11 MODEL LAYOUT

FIGURE 5



PREDICTED EXISTING
PEAK FLOOD LEVELS

FIGURE 6



LEGEND

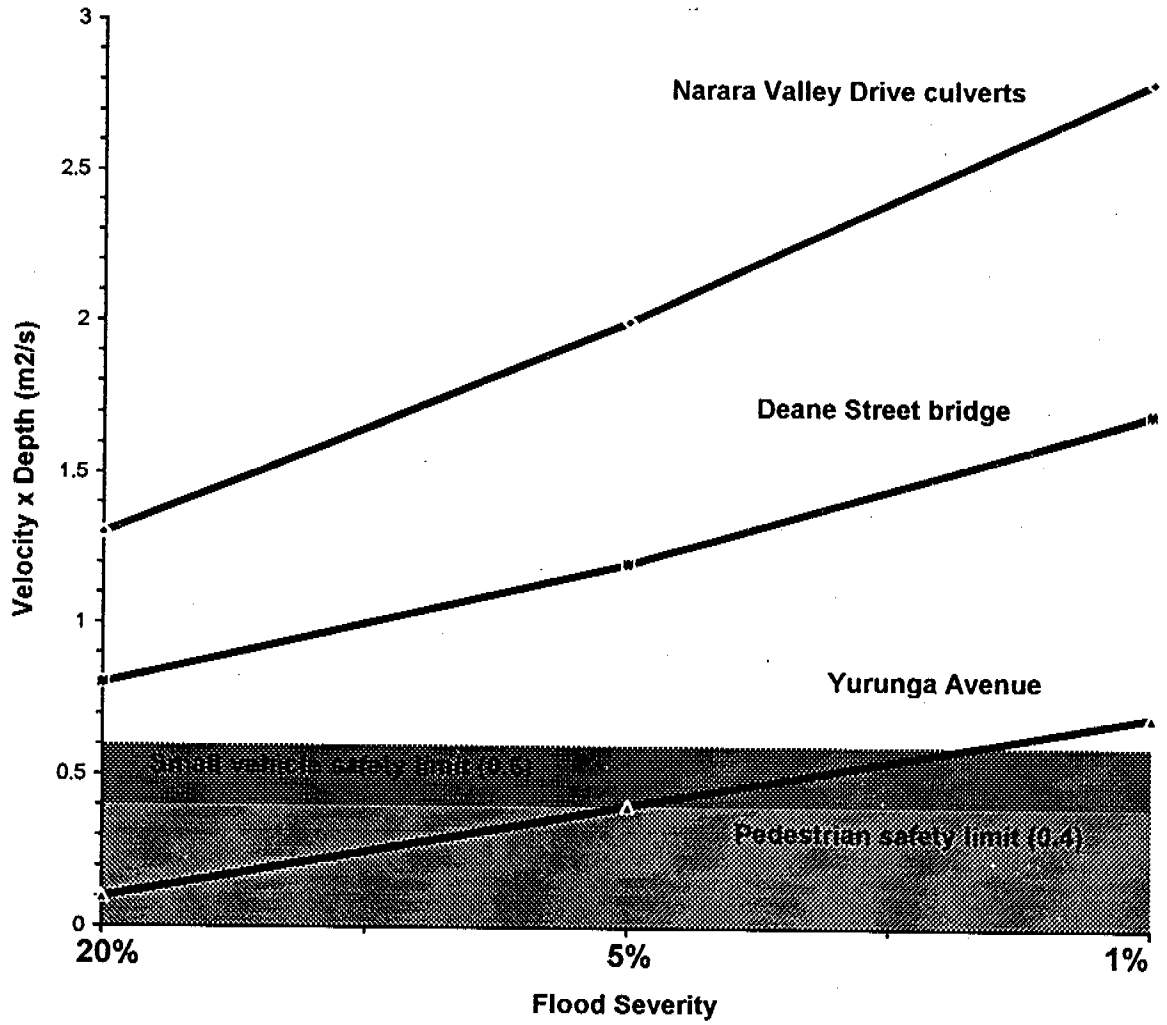
- HOUSE NUMBER 23
- FLOW DIRECTION
- UNDERGROUND PIPE
- ABOVE FLOOR INUNDATION, 1% AEP FLOOD PLUS 75% BLOCKAGE OF NARARA VALLEY DRIVE CULVERTS
- LIMIT OF STUDY AREA
- 1% AEP FLOOD EXTENT WITH 75% BLOCKAGE OF NARARA VALLEY DRIVE CULVERTS

0 50 100 150 200 250M

PREDICTED FLOOR LEVEL INUNDATION - 1% AEP FLOOD

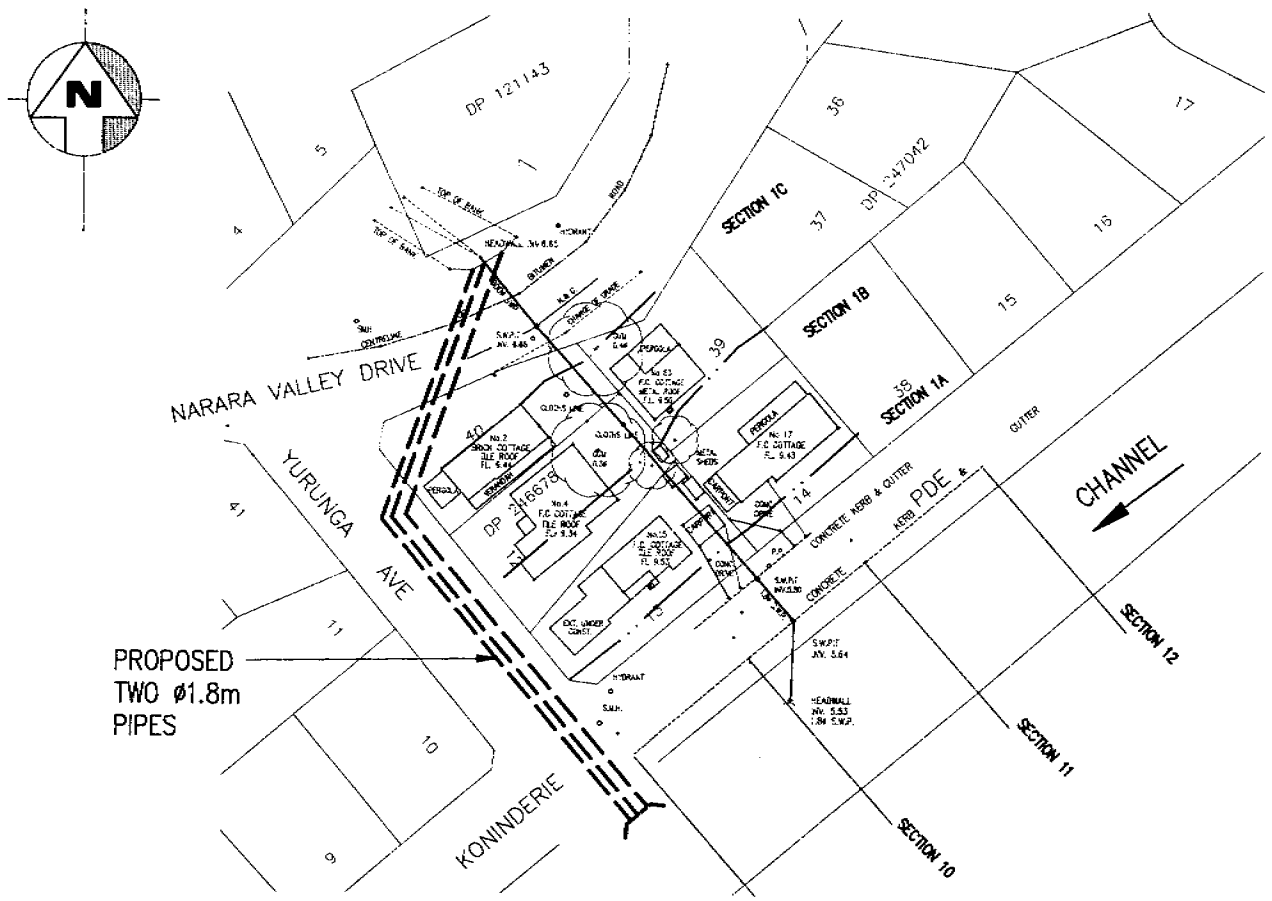
J1792/R1074

FIGURE 7

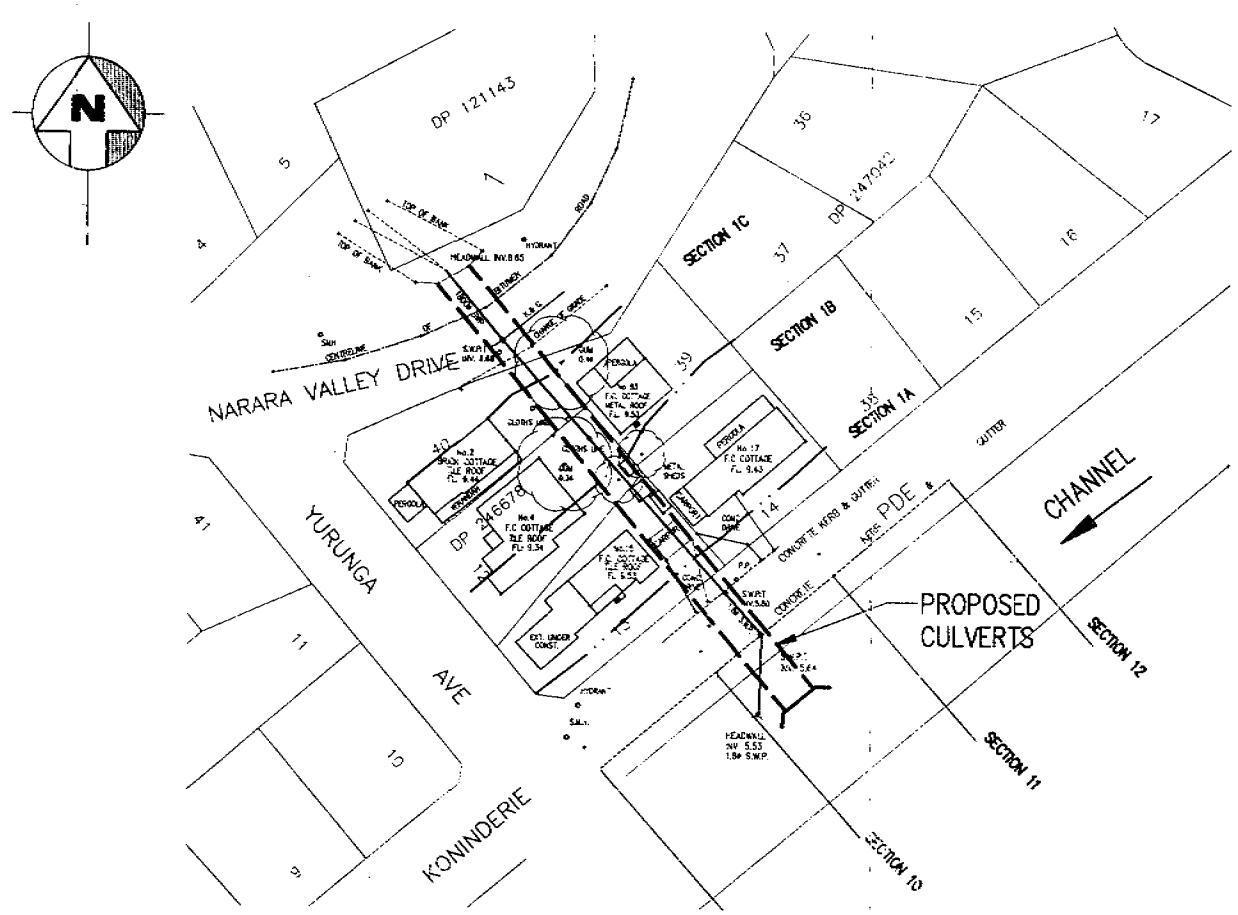


EXISTING FLOOD
ACCESS HAZARD

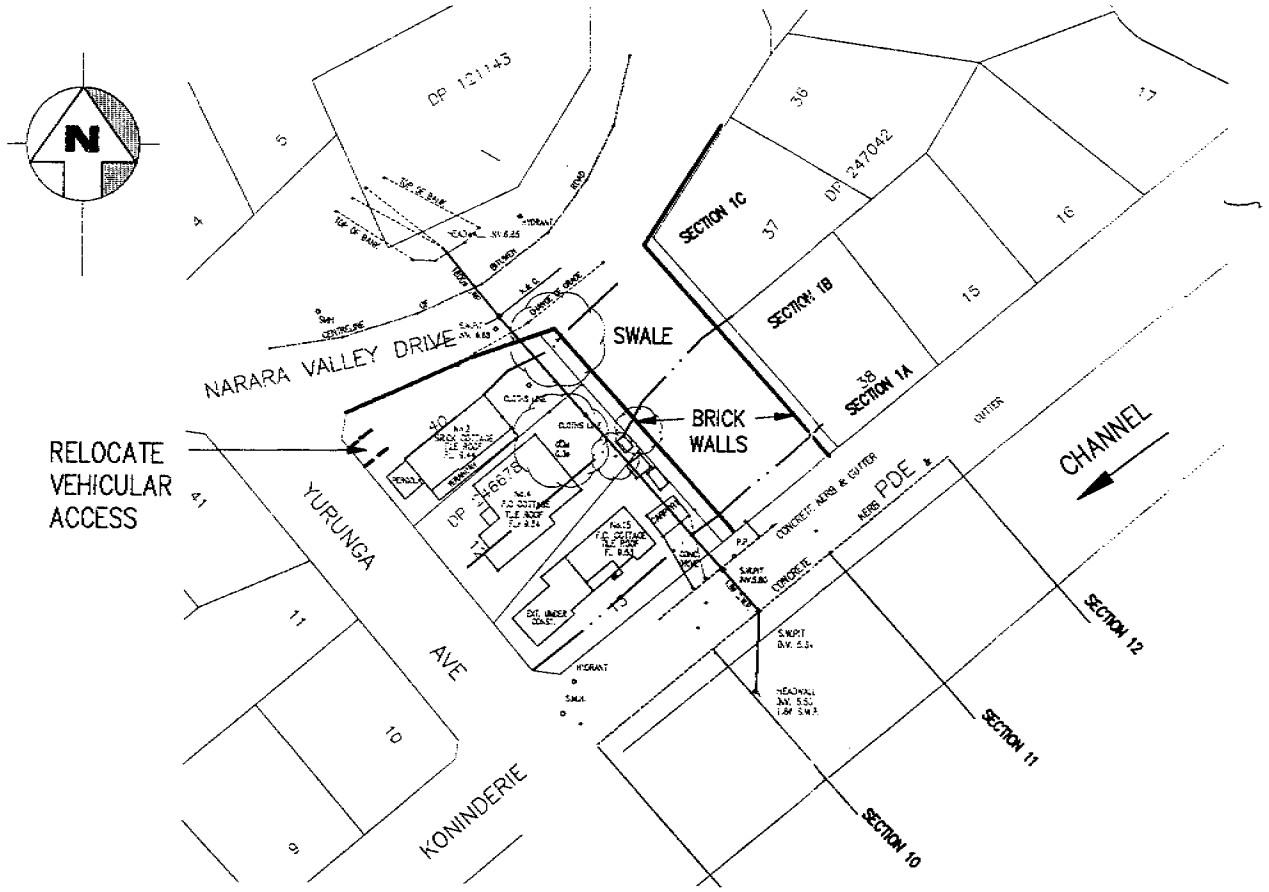
FIGURE 8



OPTION 4A
PIPE FLOW TO CHANNEL



OPTION 4B
REPLACE EXISTING PIPE WITH UNDERGROUND CULVERTS



OPTION 4C
OVERLAND FLOW PATH

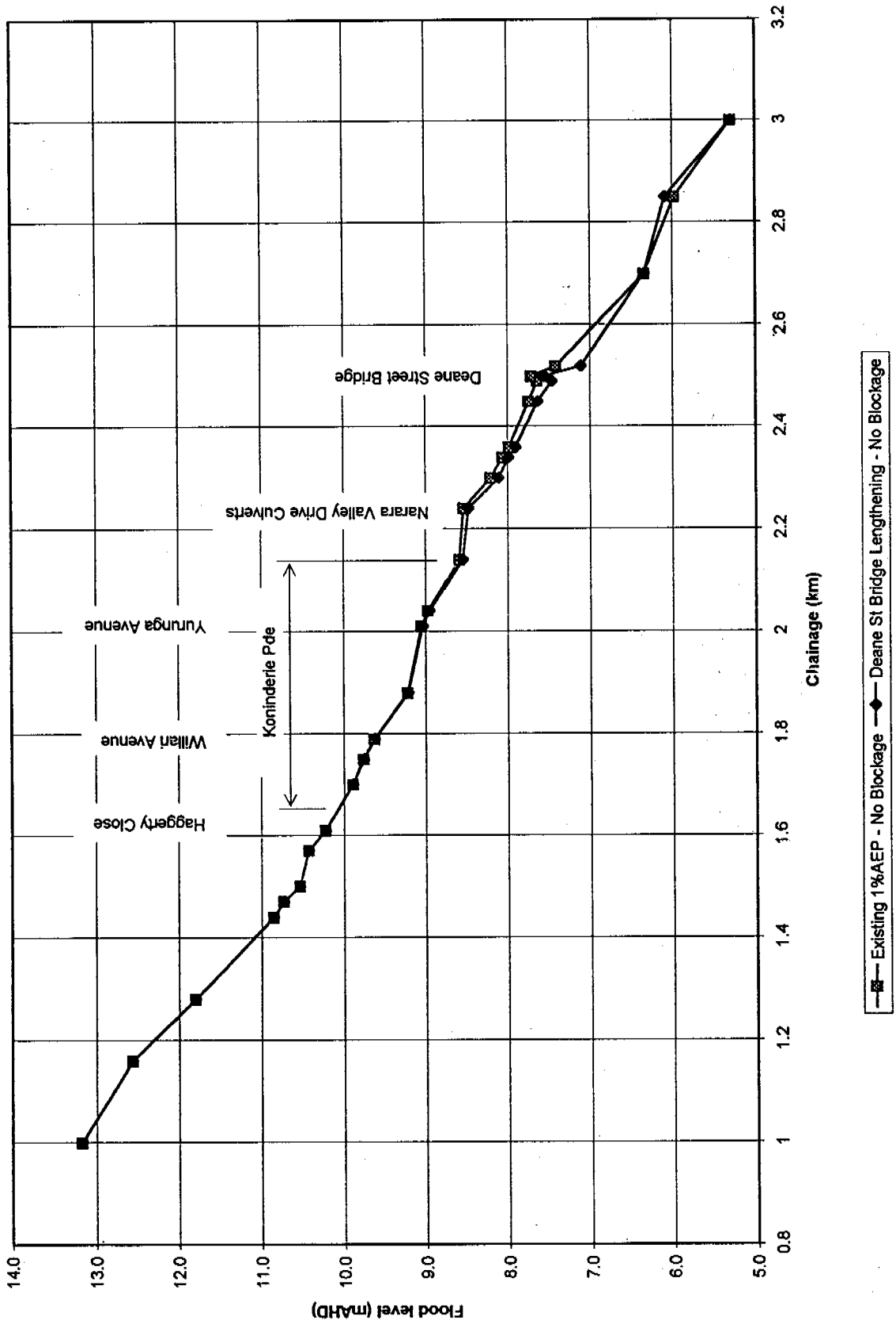
NOTE: OPTION 4D IS RELOCATING THE LOW POINT IN NARARA VALLEY DRIVE TO OPPOSITE YURUNGA AVENUE

0 20 40 60m

FORMALISE FLOOD FLOW ACROSS NARARA VALLEY DRIVE AT YURUNGA AVENUE

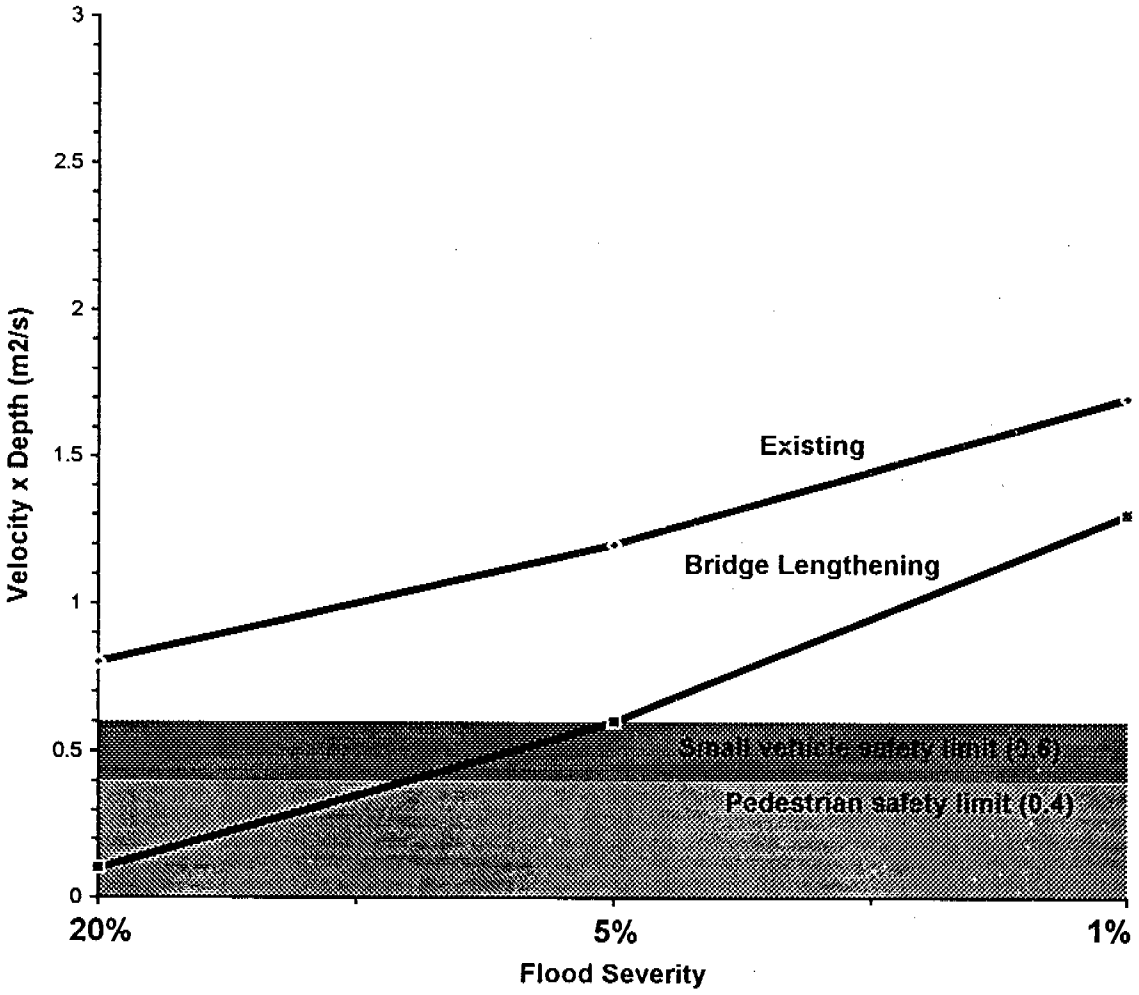
J1792/R1074

FIGURE 9



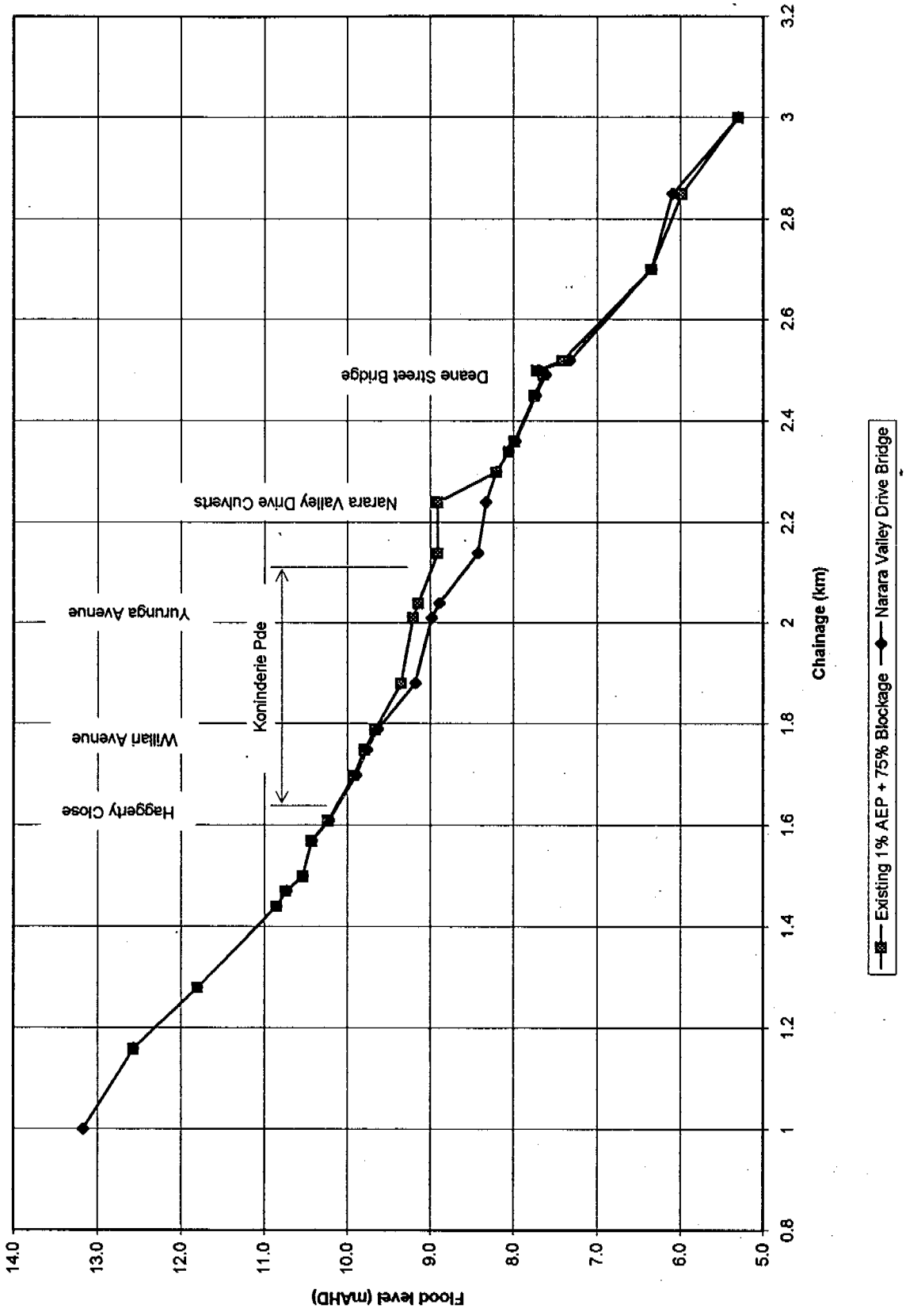
IMPACT ON FLOOD LEVELS DUE TO DEANE STREET BRIDGE LENGTHENING

FIGURE 10

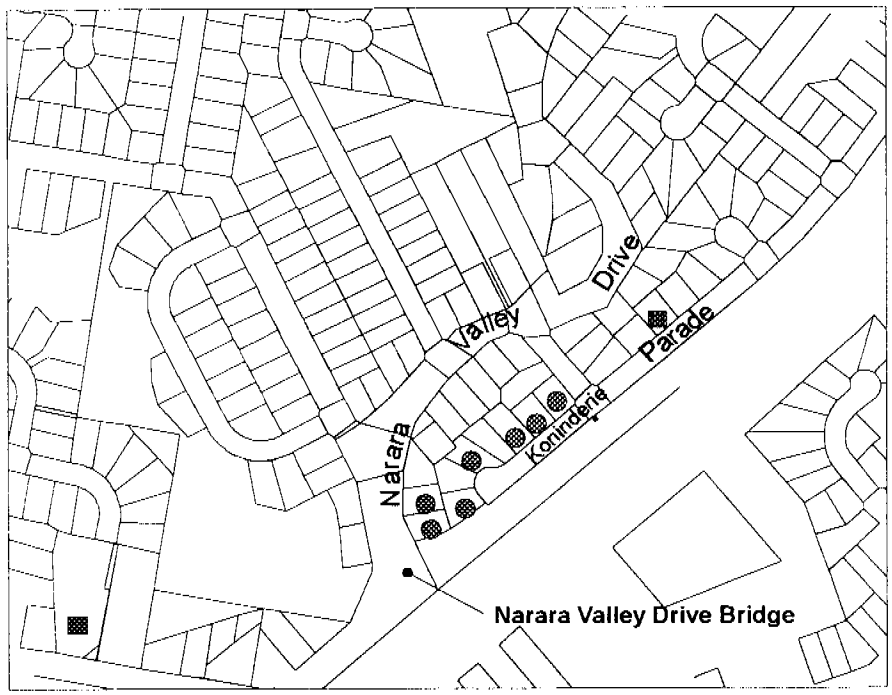


FLOOD ACCESS HAZARD
WITH DEANE ST BRIDGE
LENGTHENED

FIGURE 11

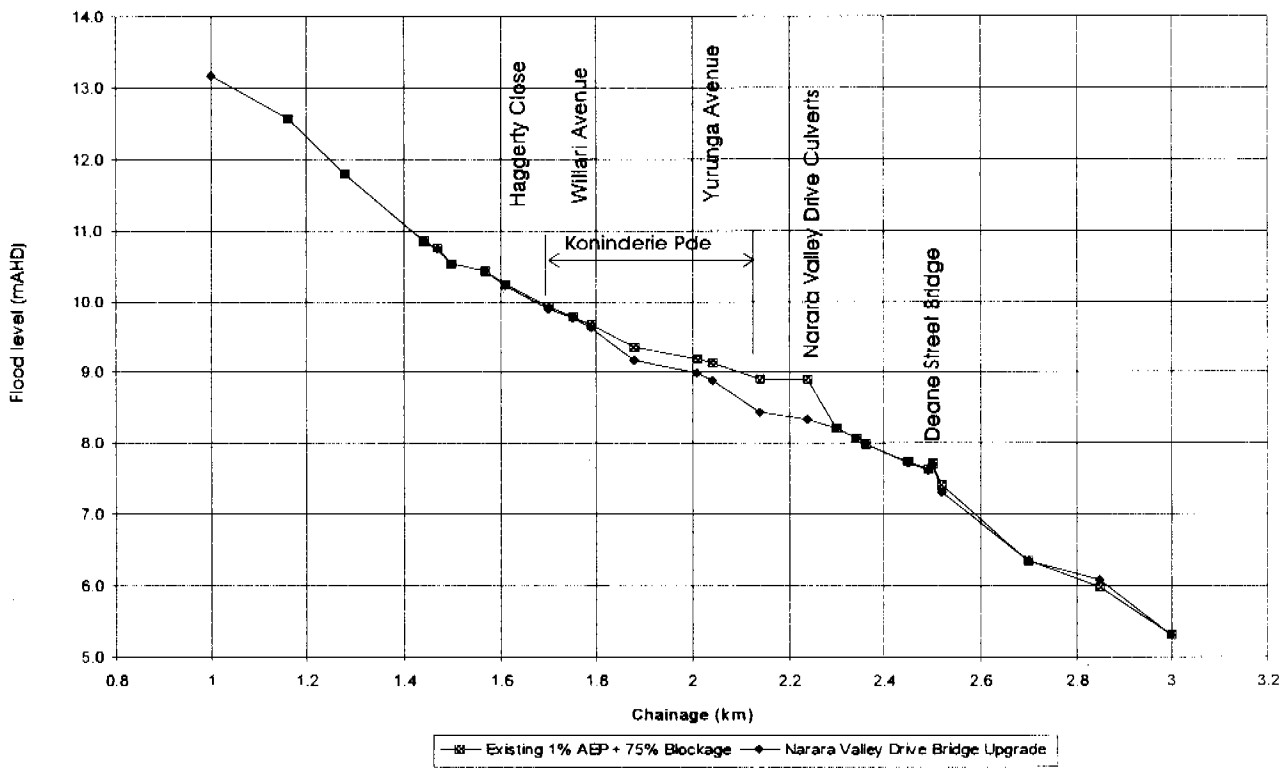


IMPACT ON FLOOD LEVELS DUE TO NARARA VALLEY DRIVE BRIDGE



Floor Inundation
1% AEP Flood Level

Still inundated
No longer inundated
(excludes Tributary B Flooding)



Estimated Cost $445 000
Benefit Cost Ratio 0.5

ADVANTAGES
Reduces blockages
Reduces flooding
Provides flood free access

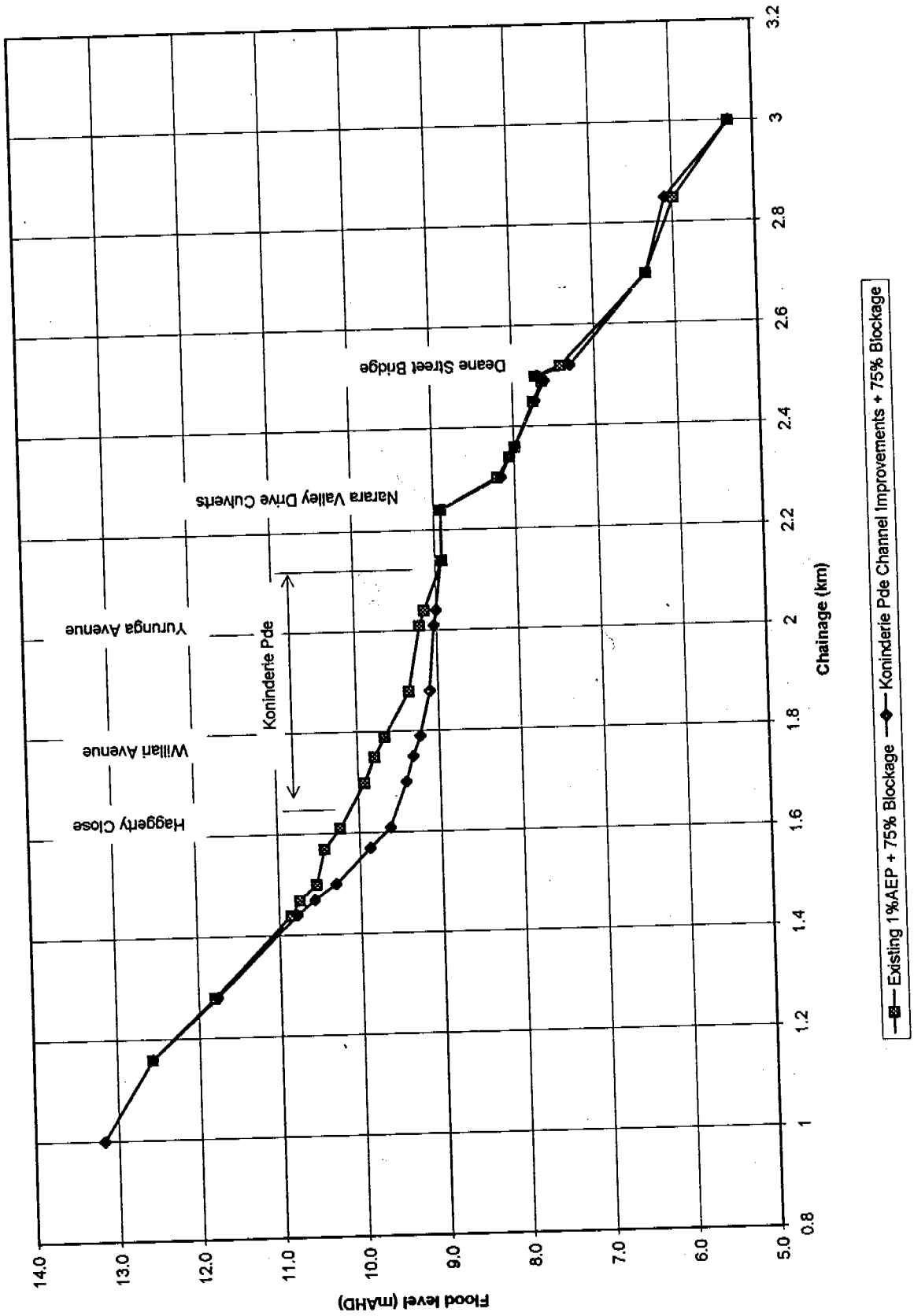
DISADVANTAGES
Increased downstream scour potential

Lawson & Treloar Pty Ltd

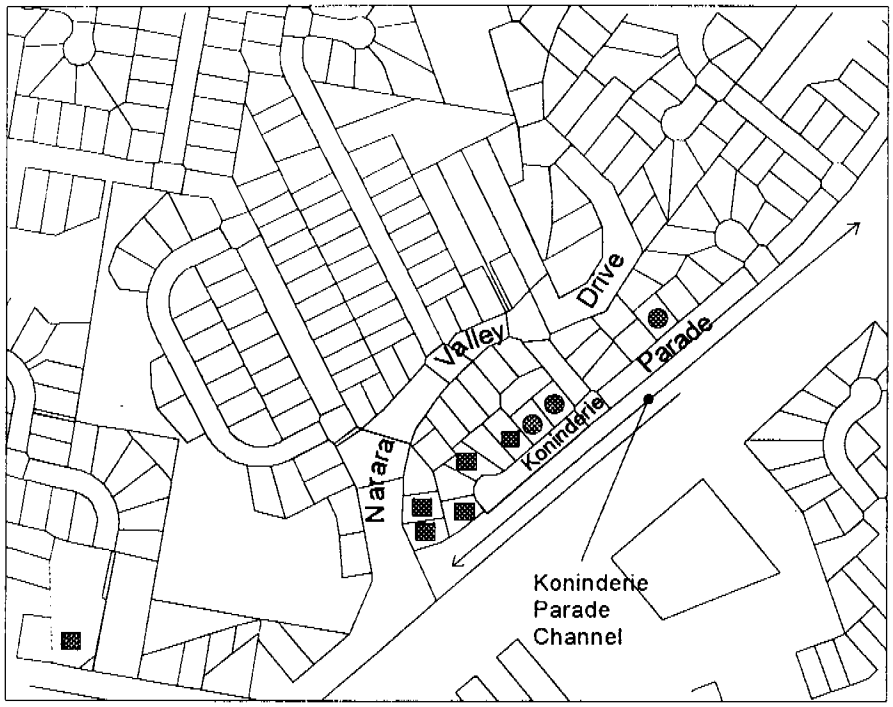
J1792

NARARA VALLEY DRIVE BRIDGE

FIGURE 13

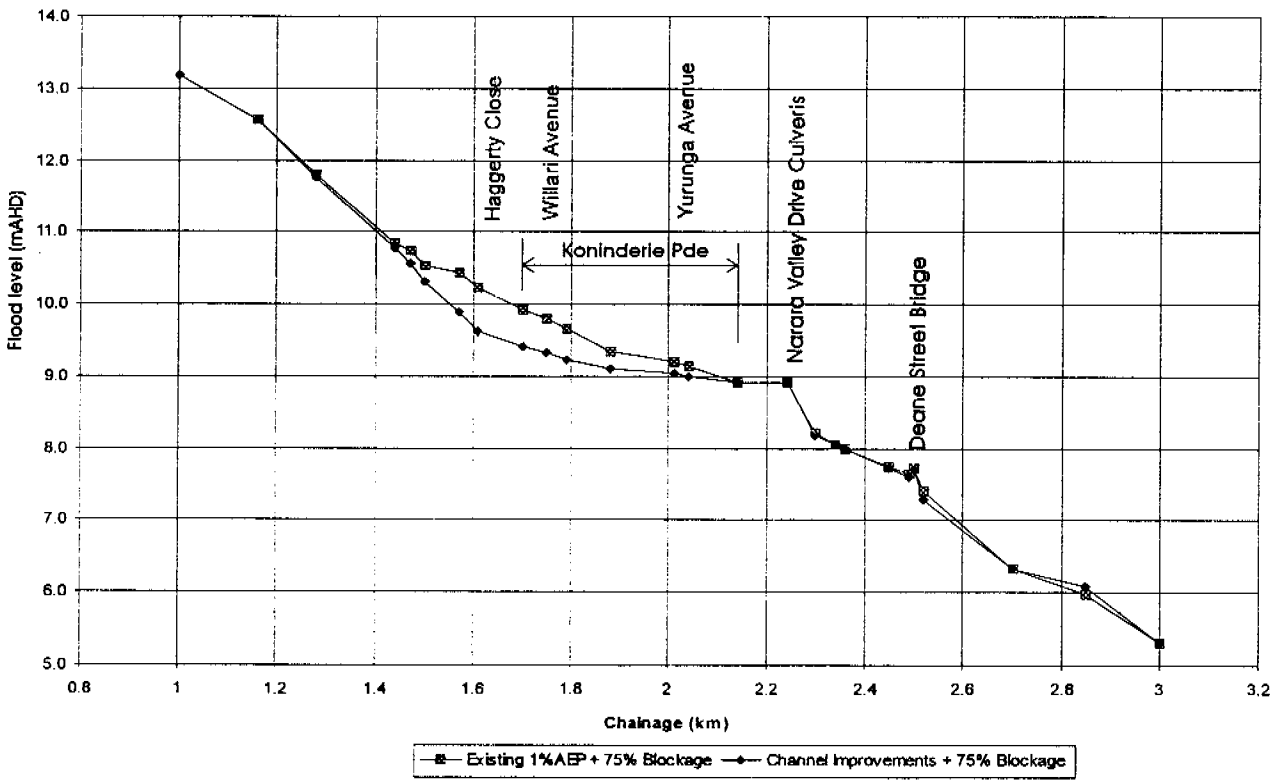


IMPACT ON FLOOD LEVELS DUE TO KONINDERIE PARADE CHANNEL IMPROVEMENTS



Floor Inundation
1% AEP Flood Level

- Still inundated
- No longer inundated (excludes Tributary B Flooding)



Estimated Cost $315 000
Benefit cost Ratio 0.5

ADVANTAGES	Reduces breakout flows Reduces flooding
DISADVANTAGES	Blockages can still occur

KONINDERIE PARADE CHANNEL IMPROVEMENT

Floor Inundation
1% AEP Flood Level

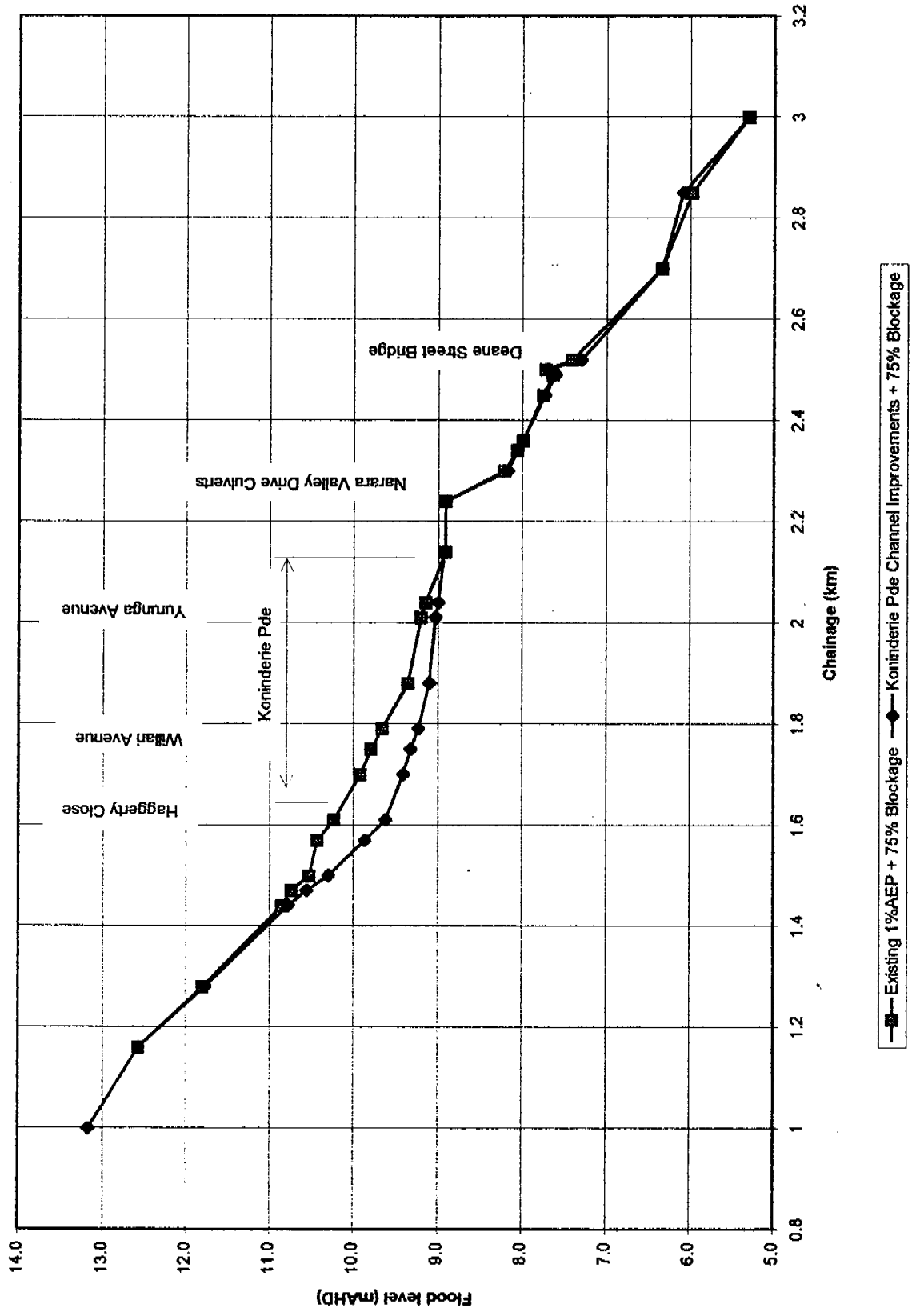
● No Longer Inundated

Estimated Cost	$313 000
Benefit Cost Ratio	0.8

ADVANTAGES	Reduces flooding
DISADVANTAGES	Requires purchase of two properties

FORMALISE FLOOD FLOW ACROSS NARARA VALLEY DRIVE AT YURUNGA AVENUE

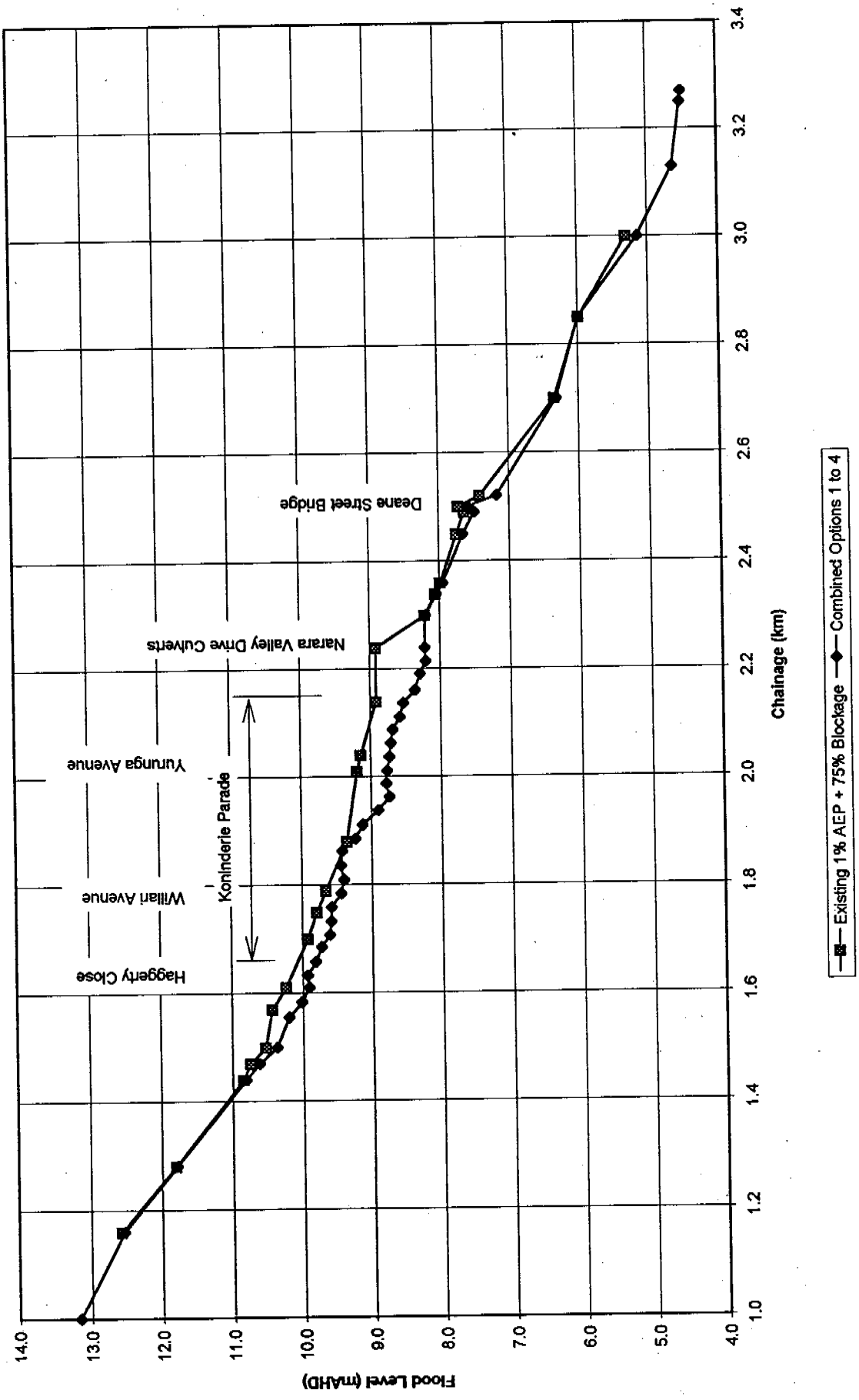
FIGURE 16



Note: Impact of Option 4 (formalise flood flow across Narara Valley Drive at Yurunga Avenue) is restricted to flood levels within Tributary B.

IMPACT ON FLOOD LEVELS DUE TO COMBINED OPTIONS THREE AND FOUR

FIGURE 17



IMPACT ON FLOOD LEVELS DUE TO COMBINED OPTIONS ONE TO FOUR

APPENDIX A
FLOOD MODEL RESULTS

APPENDIX A1
EXISTING FLOOD BEHAVIOUR AND IMPACT OF FLOODPLAIN MANAGEMENT OPTIONS

UPPER NARARA FLOODING MIKE 11 MODEL RESULTS

LEGEND	
Exis	- Existing with unblocked culverts at Narara Valley Drive
Block	- Existing with culverts 75% blocked at Narara Valley Drive
Chan	- Koninderie Parade channel improvements with unblocked culverts at Narara Valley Drive
Comb	- Koninderie Parade channel improvements with culverts 75% blocked at Narara Valley Drive
Dean	- Deane Street bridge lengthening
NVD	- Replace culverts at Narara Valley Drive with a concrete bridge
Allopt	- All options combined

FLOOD LEVELS

Photo No	Lot	DP	No.	Street	Floor Level	PMF Exis	1% Exis	5% Exis	20% Exis	PMF Block	1% Block	5% Block	20% Block	PMF Chan	1% Chan	5% Chan	20% Chan	PMF Comb	1% Comb	5% Comb	20% Comb	PMF Dean	1% Dean	5% Dean	20% Dean	PMF NVD	1% NVD	5% NVD	20% NVD	1% Allopt
1.25						12.37	11.80	11.53	11.19	12.37	11.80	11.53	11.19	12.34	11.77	11.47	11.11	12.34	11.77	11.47	11.12	12.37	11.80	11.53	11.19	12.37	11.80	11.53	11.19	11.79
45	3	787877	3	Eric Cl	13.11	12.37	11.80	11.53	11.19	12.37	11.80	11.53	11.19	12.34	11.77	11.47	11.11	12.34	11.77	11.47	11.12	12.37	11.80	11.53	11.19	12.37	11.80	11.53	11.19	11.79
46	4	787877	5	Eric Cl	13.25	12.17	11.60	11.33	10.99	12.17	11.61	11.33	10.99	12.13	11.57	11.26	10.87	12.13	11.57	11.26	10.88	12.17	11.60	11.33	10.98	12.17	11.60	11.33	10.98	11.59
47	5	787877	7	Eric Cl	13.08	12.00	11.45	11.16	10.82	12.00	11.45	11.17	10.82	11.96	11.40	11.09	10.68	11.96	11.40	11.09	10.69	12.00	11.45	11.16	10.82	12.00	11.45	11.16	10.82	11.44
48	6	787877	9	Eric Cl	12.63	11.88	11.33	11.04	10.69	11.88	11.33	11.05	10.70	11.83	11.28	10.96	10.53	11.83	11.28	10.96	10.55	11.88	11.33	11.04	10.69	11.88	11.33	11.04	10.69	11.31
49	7	787877	11	Eric Cl	12.57	11.72	11.18	10.88	10.54	11.72	11.18	10.89	10.54	11.66	11.12	10.79	10.35	11.66	11.13	10.80	10.37	11.72	11.18	10.88	10.54	11.72	11.18	10.88	10.54	11.16
50	8	787877	13	Eric Cl	12.88	11.55	11.02	10.72	10.37	11.55	11.02	10.72	10.37	11.48	10.95	10.62	10.15	11.48	10.96	10.62	10.17	11.55	11.02	10.71	10.37	11.55	11.02	10.71	10.37	10.99
51	9	787877	12	Eric Cl	12.84	11.45	10.93	10.61	10.26	11.45	10.93	10.62	10.27	11.38	10.85	10.51	10.03	11.38	10.86	10.52	10.05	11.45	10.93	10.61	10.26	11.45	10.93	10.61	10.26	10.89
1.44						11.37	10.85	10.54	10.19	11.37	10.85	10.54	10.20	11.29	10.77	10.43	9.83	11.29	10.78	10.44	9.98	11.37	10.85	10.54	10.19	11.37	10.85	10.54	10.19	10.81
1.47						11.19	10.73	10.47	10.07	11.19	10.74	10.48	10.10	11.01	10.55	10.20	9.86	11.01	10.56	10.22	9.72	11.19	10.73	10.47	10.07	11.19	10.73	10.47	10.07	10.62
1.02						11.98	12.64	12.49	12.31	11.98	12.64	12.48	12.29	11.98	12.64	12.50	12.34	11.98	12.65	12.50	12.32	11.98	12.64	12.49	12.31	11.98	11.07	12.49	12.31	12.70
55	13	787877	4	Eric Cl	12.96	11.98	12.64	12.49	12.31	11.98	12.64	12.48	12.29	11.98	12.64	12.50	12.34	11.98	12.65	12.50	12.32	11.98	12.64	12.49	12.31	11.98	11.07	12.49	12.31	12.70
54	12	787877	6	Eric Cl	12.97	11.98	12.64	12.49	12.31	11.98	12.64	12.48	12.29	11.98	12.64	12.50	12.34	11.98	12.65	12.50	12.32	11.98	12.64	12.49	12.31	11.98	11.07	12.49	12.31	12.70
53	11	787877	8	Eric Cl	13.19	10.95	11.86	11.78	11.70	10.95	11.86	11.78	11.70	10.76	11.85	11.77	11.71	10.76	11.85	11.77	11.71	10.95	11.86	11.78	11.70	10.95	10.53	11.78	11.70	11.82
1.06						10.95	11.86	11.78	11.70	10.95	11.86	11.78	11.70	10.76	11.85	11.77	11.71	10.76	11.85	11.77	11.71	10.95	11.86	11.78	11.70	10.95	10.53	11.78	11.70	11.92
52	10	787877	10	Eric Cl	12.59	10.95	11.86	11.78	11.70	10.95	11.86	11.78	11.70	10.76	11.85	11.77	11.71	10.76	11.85	11.77	11.71	10.95	11.86	11.78	11.70	10.95	10.53	11.78	11.70	11.92
1.14						10.95	11.07	10.85	10.64	10.95	11.07	10.64	10.65	10.76	11.07	10.60	10.55	10.76	11.07	10.81	10.58	10.95	11.07	10.85	10.64	10.95	10.53	10.85	10.64	11.14
1.5	UN-NAGARA					10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.37
1.5	UN-BKOUT					10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.16	10.26	9.85	10.37
64A	1	599284	Pre-school	Narara Valley Dv	12.61	10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.37
64B	1	599284	Church hall	Narara Valley Dv	12.88	10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.37
1.57						10.85	10.42	10.15	9.62	10.85	10.43	10.17	9.66	10.47	9.82	9.43	9.07	10.46	9.87	9.51	9.19	10.85	10.42	10.14	9.82	10.85	10.42	10.14	9.82	10.19
56	5	255337	9	Haggerty Cl	12.43	10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.53
57	6	255337	11	Haggerty Cl	12.11	10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.53
58	7	255337	13	Haggerty Cl	11.73	10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.53
59	8	255337	15	Haggerty Cl	11.01	10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.53	10.26	9.85	10.53
105	11	259388	49	Koninderie Pd	11.14	10.81	10.38	10.11	9.79	10.81	10.39	10.13	9.82	10.41	9.76	9.38	9.03	10.41	9.82	9.46	9.15	10.81	10.38	10.11	9.79	10.80	10.38	10.11	9.79	10.38
1.51	UN-NAGARA					10.64	10.22	9.96	9.67	10.64	10.23	9.99	9.70	10.20	9.57	9.19	8.86	10.19	9.62	9.28	8.99	10.64	10.22	9.96	9.67	10.64	10.22	9.96	9.67	9.91
1.51	UN-BKOUT					10.91	10.40	9.78	9.11	10.91	10.41	9.83	9.22	10.71	9.77	8.96	8.96	10.71	9.80	9.10	8.97	10.91	10.40	9.79	9.10	10.91	10.16	9.79	9.11	10.01
104	10	259388	47	Koninderie Pd	11.26	10.64	10.22	9.96	9.67	10.64	10.23	9.99	9.70	10.20	9.57	9.19	8.86	10.19	9.62	9.28	8.99	10.64	10.22	9.96	9.67	10.64	10.22	9.96	9.67	10.22
103	9	259388	45	Koninderie Pd	10.85	10.64	10.22	9.96	9.67	10.64	10.23	9.99	9.70	10.20	9.57	9.19	8.86	10.19	9.62	9.28	8.99	10.64	10.22	9.96	9.67	10.64	10.22	9.96	9.67	10.22
60	8	259388	16	Haggerty Cl	11.00	10.83	10.33	9.72	9.11	10.83	10.34	9.77	9.22	10.63	9.64	8.97	8.91	10.63	9.70	9.10	8.95	10.83	10.34	9.71	9.10	10.83	10.33	9.72	9.11	10.33
61	7	259388	14	Haggerty Cl	11.83	10.84	10.34	9.73	9.11	10.84	10.35	9.77	9.22	10.63	9.65	8.97	8.91	10.64	9.71	9.10	8.95	10.84	10.34	9.72	9.10	10.84	10.34	9.72	9.11	10.34
62	6	259388	12	Haggerty Cl	12.25	10.82	10.32	9.71	9.11	10.82	10.33	9.76	9.22	10.61	9.62	8.96	8.90	10.62	9.69	9.10	8.94	10.82	10.33	9.70	9.10	10.82	10.33	9.71	9.11	10.32
63	12	261387	10	Haggerty Cl	12.47	10.91	10.40	9.79	9.11	10.91	10.41	9.83	9.22	10.71	9.77	8.96	8.96	10.71	9.80	9.10	8.97	10.91	10.40	9.79	9.10	10.91	10.16	9.79	9.11	10.40
102	34	246678	43	Koninderie Pd	10.84	10.83	10.33	9.72	9.11	10.83	10.34	9.77	9.22	10.63	9.64	8.97	8.91	10.63	9.70	9.10	8.95	10.83	10.34	9.72	9.10	10.83	10.34	9.72	9.11	10.33
111	18	262329	20	Willari Av	11.38	10.75	10.27	9.65	9.11	10.75	10.27	9.71	9.22	10.54	9.51	8.95	8.86	10.55	9.60	9.10	8.92	10.75	10.27	9.64	9.10	10.75	10.27	9.64	9.11	10.27
110	17	262329	22	Willari Av	11.30	10.73	10.25	9.64	9.11	10.74	10.26	9.70	9.22	10.52	9.48	8.95	8.85	10.53	9.58	9.10	8.92	10.73	10.26	9.63	9.10	10.73	10.25	9.63	9.11	10.25
101	33	246678	41	Koninderie Pd	10.73	10.74	10.26	9.64	9.11	10.74	10.26	9.70	9.22	10.53	9.49	8.95	8.85	10.54	9.59	9.10	8.92	10.74	10.26	9.63	9.10	10.74	10.26	9.63	9.11	10.26

FLOOD LEVELS

Photo No	Lot	DP	No.	Street	Floor Level	PMF Exis	1% Exis	5% Exis	20% Exis	PMF Block	1% Block	5% Block	20% Block	PMF Chan	1% Chan	5% Chan	20% Chan	PMF Comb	1% Comb	5% Comb	20% Comb	PMF Dean	1% Dean	5% Dean	20% Dean	PMF NVD	1% NVD	5% NVD	20% NVD	1% Allopt
112	19	262329	18	Willari Av	11.60	10.68	10.21	9.59	9.11	10.68	10.22	9.66	9.22	10.47	9.40	8.93	8.62	10.48	9.52	9.10	8.90	10.68	10.21	9.58	9.10	10.68	10.21	9.58	9.11	10.21
17	UN-NIAGARA					10.28	9.83	9.53	9.10	10.28	9.82	9.60	9.20	9.99	9.28	8.89	8.53	9.99	9.41	9.09	8.64	10.28	9.89	9.51	9.09	10.28	9.89	9.52	9.10	9.61
17	UN-SKOUT					10.62	10.16	9.54	9.11	10.62	10.17	9.62	9.22	10.40	9.29	8.92	8.77	10.42	9.44	9.10	8.86	10.62	10.16	9.52	9.09	10.62	9.63	9.53	9.11	9.65
100	32	246678	39	Koninderle Pd	11.01	10.69	10.22	9.60	9.11	10.69	10.23	9.67	9.22	10.48	9.41	8.94	8.82	10.49	9.53	9.10	8.90	10.69	10.22	9.59	9.10	10.69	10.22	9.59	9.11	10.22
99	31	246678	37	Koninderle Pd	10.40	10.62	10.16	9.54	9.11	10.62	10.16	9.62	9.22	10.40	9.29	8.92	8.78	10.42	9.44	9.10	8.88	10.62	10.16	9.52	9.09	10.62	10.16	9.53	9.11	10.16
113	5	251193	16	Willari Av	11.55	10.60	10.15	9.52	9.10	10.60	10.15	9.60	9.21	10.39	9.28	8.92	8.78	10.40	9.43	9.10	8.88	10.60	10.15	9.51	9.09	10.60	10.15	9.51	9.10	10.15
98	30	246678	35	Koninderle Pd	10.29	10.54	10.09	9.45	9.07	10.54	10.09	9.54	9.18	10.31	9.24	8.92	8.79	10.34	9.38	9.08	8.86	10.54	10.10	9.44	9.06	10.54	10.10	9.44	9.07	10.09
114	4	251193	14	Willari Av	11.35	10.53	10.08	9.44	9.06	10.53	10.07	9.52	9.17	10.30	9.23	8.91	8.79	10.32	9.37	9.08	8.86	10.53	10.08	9.42	9.05	10.53	10.08	9.43	9.07	10.08
115	3	251193	12	Willari Av	11.25	10.45	10.02	9.35	9.03	10.45	10.00	9.44	9.12	10.21	9.17	8.91	8.80	10.24	9.32	9.06	8.88	10.45	10.02	9.34	9.02	10.45	10.02	9.34	9.03	10.02
1.75	UN-NIAGARA					10.26	9.76	9.40	8.99	10.21	9.79	9.46	9.14	9.90	9.17	8.77	8.37	9.90	9.32	9.02	8.77	10.20	9.76	9.38	8.97	10.20	9.76	9.39	8.99	9.56
1.75	UN-SKOUT					10.36	9.94	9.25	8.99	10.36	9.91	9.34	9.07	10.09	9.10	8.90	8.62	10.14	9.25	9.03	8.88	10.36	9.94	9.23	8.98	10.36	9.92	9.24	8.99	9.64
116	2	251193	10	Willari Av	11.26	10.36	9.94	9.25	8.99	10.36	9.91	9.34	9.07	10.09	9.10	8.90	8.62	10.14	9.25	9.03	8.88	10.36	9.94	9.23	8.98	10.36	9.92	9.24	8.99	9.94
117	1	251193	8	Willari Av	10.80	10.36	9.94	9.25	8.99	10.36	9.91	9.34	9.07	10.09	9.10	8.90	8.62	10.14	9.25	9.03	8.88	10.36	9.94	9.23	8.98	10.36	9.92	9.24	8.99	9.94
118	27	246678	6	Willari Av	10.05	10.22	9.72	9.34	8.94	10.23	9.75	9.43	9.10	9.87	9.14	8.75	8.36	9.88	9.30	9.01	8.76	10.22	9.72	9.33	8.92	10.21	9.72	9.33	8.94	9.72
119	28	246678	4	Willari Av	10.04	10.22	9.72	9.34	8.93	10.23	9.75	9.43	9.09	9.87	9.13	8.74	8.35	9.88	9.29	9.01	8.76	10.22	9.72	9.32	8.91	10.22	9.72	9.32	8.93	9.72
97	29	246678	33	Koninderle Pd	10.03	10.39	9.96	9.28	9.00	10.39	9.94	9.38	9.09	10.13	9.13	8.90	8.62	10.17	9.27	9.04	8.88	10.39	9.96	9.27	8.99	10.39	9.96	9.27	9.00	9.96
1.76	UN-NIAGARA					10.26	9.83	9.22	8.83	10.26	9.86	9.31	9.01	9.81	9.06	8.70	8.31	9.83	9.23	8.97	8.74	10.26	9.83	9.20	8.81	10.25	9.63	9.20	8.83	9.44
1.76	UN-SKOUT					10.26	9.83	9.22	8.83	10.26	9.86	9.31	9.01	9.81	9.06	8.70	8.31	9.83	9.23	8.97	8.74	10.26	9.83	9.20	8.81	10.25	9.63	9.20	8.83	9.44
96	24	246678	31	Koninderle Pd	9.92	10.23	9.70	9.32	8.82	10.23	9.74	9.41	9.08	9.86	9.12	8.74	8.35	9.87	9.28	9.00	8.76	10.23	9.71	9.30	8.90	10.22	9.70	9.31	8.92	9.70
95	23	246678	29	Koninderle Pd	9.92	10.19	9.54	9.13	8.74	10.19	9.59	9.25	8.95	9.76	9.03	8.66	8.28	9.79	9.21	8.95	8.72	10.18	9.54	9.11	8.72	10.18	9.53	9.12	8.75	9.54
106	25	246678	3	Willari Av	10.01	10.26	9.63	9.22	8.83	10.26	9.86	9.31	9.01	9.81	9.06	8.70	8.31	9.83	9.23	8.97	8.74	10.26	9.63	9.20	8.81	10.25	9.63	9.20	8.83	9.63
109	13	251193	9	Willari Av	11.05	10.18	9.53	9.13	8.74	10.19	9.59	9.24	8.95	9.75	9.03	8.66	8.28	9.79	9.20	8.95	8.72	10.18	9.54	9.11	8.72	10.17	9.53	9.11	8.74	9.53
107	14	251193	4	Apara Cl	11.34	10.13	9.46	9.06	8.68	10.14	9.53	9.19	8.91	9.71	9.00	8.63	8.25	9.76	9.18	8.93	8.71	10.12	9.46	9.04	8.65	10.11	9.45	9.05	8.68	9.46
94	22	246678	27	Koninderle Pd	9.92	10.12	9.46	9.06	8.68	10.14	9.53	9.19	8.91	9.71	9.00	8.63	8.25	9.76	9.18	8.93	8.71	10.12	9.46	9.04	8.65	10.11	9.45	9.04	8.68	9.46
92	20	246678	7	Woorin Cl	10.04	10.05	9.37	8.97	8.60	10.07	9.46	9.12	8.86	9.66	8.96	8.60	8.21	9.71	9.15	8.91	8.70	10.05	9.37	8.95	8.56	10.04	9.34	8.96	8.60	9.37
93	21	246678	9	Woorin Cl	9.65	10.04	9.35	8.96	8.58	10.06	9.45	9.11	8.85	9.65	8.95	8.59	8.20	9.70	9.15	8.91	8.69	10.04	9.35	8.93	8.55	10.03	9.33	8.94	8.59	9.35
108	15	251193	6	Apara Cl	11.34	10.04	9.35	8.96	8.58	10.05	9.45	9.11	8.85	9.65	8.95	8.59	8.20	9.70	9.15	8.91	8.69	10.04	9.35	8.93	8.55	10.02	9.33	8.94	8.58	9.35
1.88						9.93	9.22	8.83	8.46	9.95	9.35	9.01	8.77	9.57	8.89	8.54	8.15	9.64	9.10	8.68	8.67	9.90	9.21	8.80	8.42	9.91	9.18	8.81	8.46	9.23
91	19	246678	5	Woorin Cl	9.70	10.03	9.34	8.95	8.57	10.05	9.44	9.11	8.85	9.64	8.95	8.59	8.20	9.70	9.14	8.91	8.69	10.03	9.34	8.92	8.54	10.02	9.32	8.93	8.58	9.34
90	18	246678	3	Woorin Cl	9.97	9.93	9.21	8.83	8.46	9.95	9.34	9.01	8.77	9.57	8.89	8.54	8.15	9.63	9.10	8.88	8.67	9.92	9.21	8.80	8.42	9.90	9.17	8.81	8.46	9.21
74	A	408411	95	Narara Valley Dv	12.44	9.92	9.21	8.83	8.46	9.94	9.34	9.01	8.77	9.56	8.89	8.54	8.15	9.63	9.10	8.88	8.67	9.92	9.21	8.79	8.41	9.90	9.17	8.81	8.46	9.21
73	2	207275	93	Narara Valley Dv	11.89	9.92	9.21	8.83	8.46	9.94	9.34	9.01	8.77	9.56	8.89	8.54	8.15	9.63	9.10	8.88	8.67	9.92	9.21	8.79	8.41	9.90	9.17	8.81	8.46	9.21
89	17	246678	25	Koninderle Pd	9.48	9.87	9.18	8.80	8.42	9.89	9.31	9.00	8.76	9.52	8.87	8.52	8.12	9.60	9.09	8.87	8.66	9.86	9.18	8.76	8.37	9.84	9.14	8.77	8.42	9.18
88	16	246678	23	Koninderle Pd	9.35	9.88	9.18	8.80	8.43	9.90	9.32	9.00	8.76	9.53	8.87	8.52	8.12	9.60	9.09	8.87	8.66	9.87	9.18	8.77	8.38	9.85	9.15	8.78	8.43	9.18
87	15	246678	21	Koninderle Pd	9.30	9.82	9.15	8.77	8.40	9.85	9.30	8.99	8.75	9.49	8.85	8.50	8.10	9.57	9.08	8.86	8.65	9.82	9.15	8.73	8.34	9.79	9.11	8.75	8.40	9.15
72	36	247042	87	Narara Valley Dv	9.57	9.79	9.14	8.75	8.37	9.82	9.28	8.98	8.74	9.47	8.84	8.49	8.09	9.55	9.07	8.85	8.65	9.79	9.13	8.71	8.32	9.76	9.09	8.73	8.38	9.14
86	38	247042	19	Koninderle Pd	9.07	9.78	9.13	8.75	8.37	9.81	9.27	8.98	8.74	9.46	8.84	8.48	8.08	9.54	9.07	8.85	8.65	9.77	9.13	8.70	8.31	9.74	9.09	8.72	8.37	9.13
85	14	246678	17	Koninderle Pd	9.42	9.74	9.10	8.72	8.34	9.77	9.26	8.97	8.73	9.43	8.82	8.46	8.06	9.52	9.06	8.84	8.64	9.73	9.10	8.68	8.28	9.69	9.06	8.70	8.35	9.10
71	37	247042	85	Narara Valley Dv	9.64	9.73	9.10	8.72	8.34	9.77	9.25	8.97	8.73	9.42	8.82	8.46	8.06	9.51	9.06	8.84	8.64	9.72	9.10	8.67	8.28	9.69	9.06	8.69	8.34	9.10
84	13	246678	15	Koninderle Pd	9.52	9.69	9.08	8.70	8.31	9.73	9.24	8.96	8.72	9.39	8.80	8.45	8.04	9.49	9.05	8.83	8.63	9.68	9.08	8.65	8.25	9.64	9.03	8.67	8.32	9.08
70	39	247042	83	Narara Valley Dv	9.51	9.68	9.08	8.69	8.31	9.73	9.23	8.96	8.72	9.39	8.80	8.44	8.04	9.48	9.05	8.83	8.63	9.68	9.08	8.65	8.25	9.64	9.03	8.67	8.31	9.08
75	12	246678	4	Yurunga Av	9.41	9.63	9.04	8.66	8.27	9.67	9.21	8.94	8.70	9.35	8.78	8.42	8.01	9.45	9.04	8.82	8.62	9.62	9.04	8.61	8.20	9.57	9.00	8.63	8.28	9.04
69	40	247042	2	Yurunga Av	9.45	9.62	9.04	8.66	8.27	9.67	9.21	8.94	8.70	9.34	8.77	8.42	8.01	9.44	9.04	8.82	8.62	9.62	9.04	8.61	8.20	9.57	8.99	8.63	8.28	9.04
2.01						9.66	9.06	8.65	8.26	9.65	9.20	8.94	8.70	9.33	8.77	8.41	8.00	9.43	9.03	8.82	8.62	9.59	9.03	8.59	8.18	9.56	8.98	8.62	8.26	8.77
1.90						9.97	9.92	9.60	9.66	9.97	9.92	9.60	9.66	9.97	9.92	9.60	9.66	9.97	9.92	9.60	9.66	9.97	9.92	9.60	9.66	9.97	9.84	9.60	9.66	9.92
1.97						9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.89	9.76	9.63	9.87
41	2	596517	72	Narara Valley Dv	10.55	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.86
42	3	596517	74	Narara Valley Dv	10.28	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.86

FLOOD LEVELS

Photo No	Lot	DP	No.	Street	Floor Level	PMF Exis	1% Exis	5% Exis	20% Exis	PMF Block	1% Block	5% Block	20% Block	PMF Chan	1% Chan	5% Chan	20% Chan	PMF Comb	1% Comb	5% Comb	20% Comb	PMF Dean	1% Dean	5% Dean	20% Dean	PMF NVD	1% NVD	5% NVD	20% NVD	1% Allopt
44	2	24289	82	Narara Valley Dv	12.23	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.90	9.86	9.76	9.63	9.86
1.14						9.89	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.85	9.75	9.62	9.84
43	5	24289	80	Narara Valley Dv	11.63	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.85	9.75	9.62	9.84
40	1	584143	70	Narara Valley Dv	10.81	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.85	9.75	9.62	9.84
39	41	238748	68	Narara Valley Dv	11.84	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.85	9.75	9.62	9.84
38	40	238748	66	Narara Valley Dv	12.13	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.85	9.75	9.62	9.84
2.04						9.51	8.97	8.57	8.18	9.57	9.14	8.89	8.66	9.26	8.72	8.37	7.96	9.37	9.00	8.60	8.50	8.85	8.51	8.10	9.44	8.89	8.53	8.19	8.73
83	10	246678	13	Koninderie Pd	9.16	9.63	9.04	8.66	8.28	9.68	9.21	8.94	8.70	9.35	8.78	8.42	8.01	9.45	9.04	8.62	8.62	9.62	9.05	8.61	8.21	9.58	9.00	8.63	8.28	9.04
76	11	246678	3	Yurunga Av	9.49	9.09	8.55	8.15	7.75	9.22	8.91	8.71	8.52	9.05	8.55	8.20	7.75	9.21	8.91	8.73	8.56	9.07	8.52	8.03	7.54	8.90	8.39	8.07	7.76	8.55
82	9	246678	11	Koninderie Pd	9.11	9.51	8.96	8.57	8.19	9.57	9.14	8.89	8.66	9.26	8.72	8.37	7.96	9.38	9.00	8.60	8.61	9.51	8.95	8.51	8.10	9.45	8.89	8.54	8.19	8.96
81	8	246678	9	Koninderie Pd	8.81	9.37	8.82	8.44	8.06	9.45	9.06	8.83	8.61	9.19	8.67	8.33	7.91	9.32	8.97	8.78	8.59	9.36	8.81	8.36	7.95	9.28	8.73	8.40	8.07	8.82
80	7	246678	7	Koninderie Pd	9.26	9.30	8.75	8.37	7.99	9.39	9.02	8.79	8.59	9.16	8.64	8.30	7.89	9.29	8.96	8.76	8.58	9.29	8.74	8.29	7.87	9.19	8.65	8.32	8.00	8.75
37	16	238748	64	Narara Valley Dv	12.02	9.11	8.59	8.19	7.82	9.23	8.91	8.70	8.52	9.06	8.57	8.24	7.82	9.22	8.92	8.74	8.56	9.10	8.55	8.09	7.67	8.97	8.43	8.13	7.83	3.00
2.74						9.11	8.59	8.19	7.82	9.23	8.91	8.70	8.52	9.06	8.57	8.24	7.82	9.22	8.92	8.74	8.56	9.10	8.55	8.09	7.67	8.97	8.43	8.13	7.83	8.55
79	6	246678	5	Koninderie Pd	8.90	9.18	8.64	8.25	7.88	9.29	8.95	8.74	8.54	9.10	8.60	8.26	7.85	9.24	8.93	8.75	8.57	9.17	8.62	8.17	7.74	9.05	8.51	8.20	7.89	8.55
78	5	246678	3	Koninderie Pd	9.07	9.11	8.57	8.18	7.81	9.23	8.91	8.71	8.52	9.06	8.57	8.24	7.81	9.22	8.92	8.74	8.56	9.10	8.54	8.08	7.65	8.96	8.43	8.12	7.82	8.43
36	15	238748	62	Narara Valley Dv	11.53	9.10	8.56	8.17	7.78	9.23	8.91	8.71	8.52	9.06	8.56	8.22	7.78	9.21	8.92	8.73	8.56	9.08	8.53	8.05	7.60	8.93	8.41	8.10	7.79	8.41
77	4	246678	1	Koninderie Pd	8.90	9.08	8.55	8.15	7.74	9.22	8.91	8.71	8.52	9.05	8.55	8.20	7.75	9.21	8.91	8.73	8.56	9.07	8.52	8.02	7.53	8.90	8.38	8.07	7.75	8.38
68	100	792456	69	Narara Valley Dv	9.64	9.08	8.55	8.14	7.73	9.22	8.91	8.71	8.52	9.05	8.55	8.19	7.74	9.21	8.91	8.73	8.56	9.07	8.51	8.02	7.52	8.89	8.38	8.06	7.74	8.38
67	3	246678	67	Narara Valley Dv	9.18	9.07	8.54	8.13	7.70	9.21	8.91	8.71	8.52	9.05	8.54	8.18	7.71	9.21	8.91	8.73	8.55	9.05	8.50	7.99	7.47	8.86	8.36	8.04	7.71	8.36
65	1	246678	63	Narara Valley Dv	8.79	9.07	8.54	8.12	7.69	9.21	8.91	8.71	8.52	9.05	8.54	8.17	7.70	9.21	8.91	8.73	8.55	9.05	8.50	7.98	7.45	8.86	8.35	8.03	7.70	8.35
66	2	246678	65	Narara Valley Dv	8.71	9.06	8.54	8.12	7.69	9.21	8.91	8.71	8.52	9.05	8.54	8.17	7.70	9.21	8.91	8.73	8.55	9.05	8.50	7.98	7.45	8.85	8.35	8.03	7.70	8.35
35	1	229277	60	Narara Valley Dv	10.80	9.06	8.53	8.11	7.67	9.21	8.91	8.71	8.53	9.04	8.53	8.16	7.68	9.21	8.91	8.73	8.55	9.04	8.49	7.96	7.41	8.84	8.34	8.01	7.68	8.34
2.24						9.06	8.54	8.10	7.65	9.20	8.91	8.71	8.53	9.04	8.53	8.16	7.66	9.21	8.91	8.73	8.55	9.04	8.49	7.94	7.39	8.82	8.31	8.00	7.66	8.32
34	2	229277	58	Narara Valley Dv	11.48	8.90	8.38	8.00	7.62	8.99	8.60	8.35	8.11	8.88	8.37	8.03	7.62	8.98	8.59	8.36	8.12	8.67	8.32	7.84	7.35	8.77	8.28	7.94	7.61	8.21
2.3						8.70	8.21	7.87	7.59	8.71	8.21	7.87	7.57	8.67	8.17	7.68	7.57	8.67	8.17	7.67	7.56	8.65	8.11	7.69	7.31	8.70	8.06	7.67	7.54	8.20
32	8	242245	1	Brancourt Cr	11.14	8.59	8.08	7.76	7.51	8.59	8.09	7.77	7.50	8.58	8.09	7.79	7.51	8.59	8.09	7.79	7.50	8.56	8.02	7.61	7.24	8.59	8.09	7.76	7.47	8.09
33	7	242245	6	Pearson St	12.53	8.55	8.04	7.73	7.49	8.55	8.06	7.74	7.48	8.56	8.06	7.77	7.49	8.56	8.06	7.76	7.48	8.53	7.99	7.58	7.22	8.55	8.06	7.73	7.44	8.01
2.36						8.49	7.98	7.67	7.45	8.49	7.99	7.68	7.44	8.49	7.99	7.70	7.44	8.49	7.99	7.70	7.43	8.46	7.90	7.49	7.15	8.48	7.73	7.67	7.40	7.95
24	22	242245	22	Brancourt Cr	9.30	8.49	7.98	7.68	7.45	8.49	8.00	7.69	7.44	8.50	8.00	7.71	7.45	8.50	8.00	7.71	7.44	8.47	7.92	7.51	7.17	8.49	8.00	7.68	7.40	7.95
31	9	242245	3	Brancourt Cr	10.31	8.48	7.97	7.67	7.45	8.48	7.98	7.68	7.44	8.48	7.99	7.70	7.44	8.49	7.99	7.70	7.43	8.46	7.90	7.49	7.15	8.48	7.98	7.67	7.40	7.90
23	7	255485	48	Narara Valley Dv	8.78	8.45	7.95	7.66	7.44	8.45	7.96	7.67	7.43	8.46	7.97	7.69	7.43	8.46	7.97	7.69	7.42	8.43	7.88	7.48	7.14	8.45	7.96	7.65	7.39	7.85
6	43	245497	20	Wesley St	11.40	8.26	7.81	7.58	7.39	8.26	7.82	7.58	7.38	8.26	7.81	7.59	7.37	8.26	7.81	7.59	7.36	8.20	7.71	7.36	7.01	8.25	7.81	7.57	7.33	7.75
7	42	245497	22	Wesley St	11.20	8.21	7.77	7.55	7.37	8.21	7.77	7.56	7.36	8.23	7.79	7.58	7.36	8.23	7.79	7.58	7.35	8.16	7.69	7.34	6.99	8.22	7.79	7.55	7.32	7.70
2.45						8.17	7.74	7.53	7.36	8.17	7.75	7.54	7.35	8.16	7.73	7.55	7.34	8.16	7.73	7.54	7.33	8.06	7.63	7.30	6.94	8.15	7.70	7.52	7.30	7.66
8	41	245497	24	Wesley St	10.94	8.17	7.73	7.53	7.35	8.17	7.74	7.53	7.35	8.19	7.76	7.56	7.35	8.19	7.76	7.56	7.34	8.12	7.65	7.32	6.96	8.18	7.76	7.53	7.31	7.67
22	6	255485	46	Narara Valley Dv	8.41	8.16	7.73	7.53	7.35	8.17	7.74	7.53	7.34	8.37	7.90	7.65	7.40	8.37	7.90	7.64	7.40	8.32	7.80	7.42	7.08	8.36	7.89	7.61	7.36	7.67
9	40	245497	13	Wesley St	11.69	8.16	7.72	7.52	7.35	8.17	7.73	7.53	7.34	8.16	7.73	7.54	7.34	8.16	7.73	7.54	7.33	8.08	7.62	7.30	6.93	8.15	7.73	7.52	7.29	7.65
10	39	245497	11	Wesley St	11.56	8.16	7.72	7.52	7.35	8.16	7.73	7.53	7.34	8.15	7.72	7.54	7.33	8.16	7.72	7.53	7.32	8.07	7.61	7.29	6.93	8.15	7.72	7.51	7.29	7.64
11	34	245497	6	Runyon Cl	11.28	8.15	7.70	7.50	7.33	8.15	7.71	7.51	7.33	8.14	7.70	7.51	7.32	8.15	7.70	7.51	7.31	8.06	7.59	7.26	6.90	8.14	7.70	7.49	7.28	7.60
12	33	245497	8	Runyon Cl	10.18	8.14	7.67	7.48	7.32	8.14	7.68	7.48	7.31	8.13	7.68	7.50	7.30	8.14	7.68	7.49	7.30	8.05	7.57	7.25	6.89	8.13	7.69	7.49	7.27	7.57
13	32	245497	10	Runyon Cl	9.15	8.12	7.64	7.45	7.29	8.12	7.65	7.45	7.29	8.11	7.63	7.46	7.27	8.12	7.63	7.45	7.26	8.03	7.54	7.23	6.86	8.12	7.67	7.47	7.26	7.52
14	31	245497	12	Runyon Cl	11.18	8.12	7.65	7.46	7.30	8.13	7.66	7.46	7.29	8.12	7.65	7.47	7.28	8.12	7.65	7.46	7.27	8.03	7.55	7.23	6.86	8.12	7.68	7.47	7.26	7.51
2.49						8.11	7.64	7.44	7.28	8.11	7.64	7.44	7.28	8.10	7.61	7.44	7.28	8.10	7.61	7.43	7.25	7.97	7.46	7.15	6.77	8.09	7.70	7.41	7.21	7.49
21	5	255485	44	Narara Valley Dv	8.51	8.13	7.67	7.48	7.32	8.13	7.68	7.48	7.31	8.12	7.66	7.48	7.30	8.12	7.66	7.48	7.29	8.18	7.69	7.35	6.99	8.23	7.80	7.56	7.32	7.52
20	3	625827	2	Deane St	8.46	8.13	7.68	7.49	7.32	8.14	7.69	7.49	7.32	8.12	7.67	7.49	7.30	8.13	7.67	7.49	7.29	8.09	7.63	7.31	6.95	8.16	7.74	7.53	7.30	7.53
19	1	786893	Shop	Deane St	7.62	8.13	7.66	7.47	7.31	8.13	7.67	7.47	7.30	8.11	7.65	7.47	7.28	8.12	7.65	7.47	7.27	8.00	7.50	7.19	6.82	8.11	7.65	7.44	7.24	7.51
18	24	245497	18	Deane St	8.30	8.13	7.67	7.48	7.32	8.13	7.68	7.48	7.31	8.12	7.66	7.48	7.29	8.12	7.66	7.48	7.28	7.99	7.49	7.18	6.81	8.10	7.64	7.44	7.23	7.52

FLOOD LEVELS

Photo No	Lot	DP	No.	Street	Floor Level	PMF Exis	1% Exis	5% Exis	20% Exis	PMF Block	1% Block	5% Block	20% Block	PMF Chan	1% Chan	5% Chan	20% Chan	PMF Comb	1% Comb	5% Comb	20% Comb	PMF Dean	1% Dean	5% Dean	20% Dean	PMF NVD	1% NVD	5% NVD	20% NVD	1% Allopt
17	23	244428	20	Deane St	8.97	8.13	7.68	7.49	7.32	8.14	7.69	7.49	7.32	8.12	7.67	7.49	7.30	8.12	7.67	7.49	7.29	7.99	7.48	7.17	6.80	8.10	7.63	7.43	7.23	7.53
16	22	244428	22	Deane St	9.58	8.13	7.66	7.47	7.31	8.13	7.67	7.48	7.30	8.11	7.65	7.47	7.29	8.12	7.65	7.47	7.28	7.99	7.50	7.18	6.81	8.11	7.64	7.44	7.23	7.51
15	21	244428	24	Deane St	10.49	8.13	7.67	7.48	7.32	8.13	7.68	7.48	7.31	8.12	7.66	7.48	7.29	8.12	7.66	7.48	7.28	7.99	7.49	7.18	6.80	8.10	7.64	7.43	7.23	7.52
2.50						8.14	7.71	7.51	7.34	8.14	7.72	7.51	7.33	8.13	7.70	7.52	7.32	8.14	7.70	7.51	7.31	8.01	7.55	7.23	6.83	8.12	7.32	7.49	7.28	7.59
TRIBUTARY A																														
1.00						17.16	16.91	16.61	16.73	17.16	16.91	16.61	16.73	17.16	16.91	16.61	16.73	17.16	16.91	16.61	16.73	17.16	16.91	16.61	16.73	17.16	10.14	16.91	16.73	16.91
1	81	563294	82	Hanlan St	20.02	15.90	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.90	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.69
120	2	714993	84	Hanlan St	23.72	15.90	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.90	15.69	15.62	15.56	15.89	15.69	15.62	15.56	15.69
1.1						13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	8.61	13.34	13.32	13.37
127	54	245497	15	Unwin Cl	15.39	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	8.61	13.34	13.32	13.37
126	53	245497	13	Unwin Cl	14.66	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	8.61	13.34	13.32	13.37
125	52	245497	11	Unwin Cl	14.02	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	13.37	13.34	13.32	13.48	8.61	13.34	13.32	13.37
1.17						10.24	10.15	10.11	10.08	10.24	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.23	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.24	7.98	10.11	10.08	10.25
28	18	242245	12	Brancourt Cr	14.22	10.20	10.11	10.07	10.05	10.20	10.10	10.07	10.05	10.20	10.10	10.07	10.05	10.20	10.10	10.07	10.05	10.20	10.11	10.07	10.05	10.20	10.10	10.07	10.05	10.21
27	19	242245	10	Brancourt Cr	13.65	10.06	9.97	9.93	9.90	10.06	9.96	9.93	9.90	10.06	9.96	9.93	9.90	10.06	9.96	9.93	9.90	10.06	9.97	9.93	9.90	10.06	9.96	9.93	9.90	10.07
2	51	245497	9	Unwin Cl	13.17	10.33	10.24	10.20	10.18	10.33	10.23	10.20	10.18	10.33	10.23	10.20	10.18	10.33	10.23	10.20	10.18	10.33	10.24	10.20	10.18	10.33	10.23	10.20	10.18	10.34
124	50	245497	7	Unwin Cl	13.81	10.24	10.15	10.11	10.08	10.24	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.23	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.24	7.98	10.11	10.08	10.25
123	49	245497	5	Unwin Cl	13.59	10.24	10.15	10.11	10.08	10.24	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.23	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.24	7.98	10.11	10.08	10.25
26	20	242245	8	Brancourt Cr	11.61	8.80	8.71	8.63	8.60	8.80	8.67	8.63	8.60	8.80	8.67	8.63	8.60	8.80	8.67	8.63	8.60	8.80	8.68	8.64	8.61	8.80	8.67	8.63	8.60	8.82
122	48	245497	3	Unwin Cl	13.29	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
1.25						8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
121	47	245497	1	Unwin Cl	12.49	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
3	46	245497	14	Wesley St	12.48	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
4	45	245497	16	Wesley St	12.11	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
25	27	242245	6	Brancourt Cr	11.81	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
29	11	242245	7	Brancourt Cr	12.81	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
30	10	242245	5	Brancourt Cr	11.66	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
5	44	245497	18	Wesley St	11.53	8.74	8.66	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	8.76
2.35						8.48	7.96	7.67	7.45	8.48	7.99	7.68	7.44	8.48	7.99	7.70	7.44	8.49	7.99	7.70	7.43	8.46	7.90	7.49	7.15	8.48	7.73	7.67	7.40	7.95

APPENDIX A2
HOUSE FLOOR LEVELS AND FREEBOARD TO FLOOD LEVELS

UPPER NARARA CREEK FLOOD FREEBOARD DEPTHS

Note: Negative number means the flood level is below the floor level

Note: Legend is presented in Appendix A1

CALCULATED DEPTHS

Photo No	Lot	DP	No.	Street	Floor Level	PMF Exis	1% Exis	5% Exis	20% Exis	PMF Block	1% Block	5% Block	20% Block	PMF Chan	1% Chan	5% Chan	20% Chan	PMF Comb	1% Comb	5% Comb	20% Comb	PMF Dean	1% Dean	5% Dean	20% Dean	PMF NVD	1% NVD	5% NVD	20% NVD	1% Allopt
1.28						12.37	11.80	11.53	11.19	12.37	11.80	11.53	11.19	12.34	11.77	11.47	11.11	12.34	11.77	11.47	11.12	12.37	11.80	11.53	11.19	12.37	11.80	11.53	11.19	11.80
45	3	787877	3	Eric Cl	13.11	-0.74	-1.31	-1.58	-1.92	-0.74	-1.31	-1.58	-1.92	-0.77	-1.34	-1.64	-2.00	-0.77	-1.34	-1.64	-1.99	-0.74	-1.31	-1.58	-1.92	-0.74	-1.31	-1.58	-1.92	-1.32
46	4	787877	5	Eric Cl	13.25	-1.08	-1.65	-1.92	-2.26	-1.08	-1.65	-1.92	-2.26	-1.12	-1.68	-1.99	-2.38	-1.12	-1.68	-1.99	-2.37	-1.08	-1.65	-1.92	-2.27	-1.08	-1.65	-1.92	-2.27	-1.66
47	5	787877	7	Eric Cl	13.08	-1.08	-1.63	-1.92	-2.26	-1.08	-1.63	-1.91	-2.26	-1.12	-1.68	-1.99	-2.41	-1.12	-1.68	-1.99	-2.39	-1.08	-1.63	-1.92	-2.26	-1.08	-1.63	-1.92	-2.26	-1.64
48	6	787877	9	Eric Cl	12.63	-0.75	-1.30	-1.59	-1.94	-0.75	-1.30	-1.58	-1.93	-0.80	-1.35	-1.67	-2.10	-0.80	-1.35	-1.67	-2.08	-0.75	-1.30	-1.59	-1.94	-0.75	-1.30	-1.59	-1.94	-1.32
49	7	787877	11	Eric Cl	12.57	-0.85	-1.39	-1.69	-2.03	-0.85	-1.39	-1.68	-2.03	-0.91	-1.45	-1.78	-2.23	-0.91	-1.45	-1.77	-2.20	-0.85	-1.39	-1.69	-2.04	-0.85	-1.39	-1.69	-2.03	-1.41
50	8	787877	13	Eric Cl	12.88	-1.33	-1.86	-2.17	-2.52	-1.33	-1.86	-2.16	-2.51	-1.40	-1.93	-2.26	-2.74	-1.40	-1.92	-2.26	-2.71	-1.33	-1.86	-2.17	-2.52	-1.33	-1.86	-2.17	-2.52	-1.89
51	9	787877	12	Eric Cl	12.84	-1.40	-1.92	-2.23	-2.58	-1.40	-1.91	-2.22	-2.57	-1.46	-1.99	-2.33	-2.81	-1.46	-1.99	-2.32	-2.79	-1.40	-1.92	-2.23	-2.58	-1.40	-1.92	-2.23	-2.58	-1.95
1.44						11.37	10.85	10.54	10.19	11.37	10.85	10.54	10.20	11.29	10.77	10.43	9.93	11.29	10.78	10.44	9.96	11.37	10.85	10.54	10.19	11.37	10.85	10.54	10.19	10.85
1.47						11.19	10.73	10.47	10.07	11.19	10.74	10.48	10.10	11.01	10.55	10.20	9.68	11.01	10.56	10.22	9.72	11.19	10.73	10.47	10.07	11.19	10.73	10.47	10.07	10.73
1.02						11.99	12.64	12.49	12.31	11.99	12.64	12.48	12.29	11.98	12.64	12.50	12.34	11.99	12.65	12.50	12.32	11.98	12.64	12.49	12.31	11.98	11.07	12.49	12.31	11.07
55	13	787877	4	Eric Cl	12.96	-0.98	-0.32	-0.47	-0.65	-0.98	-0.32	-0.48	-0.67	-0.98	-0.32	-0.46	-0.62	-0.98	-0.31	-0.46	-0.64	-0.98	-0.32	-0.47	-0.65	-0.98	-1.89	-0.47	-0.65	-0.26
54	12	787877	6	Eric Cl	12.97	-0.99	-0.33	-0.48	-0.66	-0.99	-0.33	-0.49	-0.68	-0.99	-0.33	-0.47	-0.63	-0.99	-0.32	-0.47	-0.65	-0.99	-0.33	-0.48	-0.66	-0.99	-1.90	-0.48	-0.66	-0.27
53	11	787877	8	Eric Cl	13.19	-2.24	-1.33	-1.41	-1.49	-2.24	-1.33	-1.41	-1.49	-2.43	-1.34	-1.42	-1.48	-2.43	-1.34	-1.42	-1.48	-2.24	-1.33	-1.41	-1.49	-2.24	-2.66	-1.41	-1.49	-1.37
1.06						10.95	11.86	11.78	11.70	10.96	11.86	11.78	11.70	10.76	11.85	11.77	11.71	10.76	11.85	11.77	11.71	10.95	11.86	11.78	11.70	10.95	10.53	11.78	11.70	10.53
52	10	787877	10	Eric Cl	12.59	-1.64	-0.73	-0.81	-0.89	-1.64	-0.73	-0.81	-0.89	-1.83	-0.74	-0.82	-0.88	-1.83	-0.74	-0.82	-0.88	-1.64	-0.73	-0.81	-0.89	-1.64	-2.06	-0.81	-0.89	-0.67
1.11						10.95	11.07	10.85	10.64	10.95	11.07	10.84	10.65	10.76	11.07	10.80	10.56	10.76	11.07	10.81	10.56	10.95	11.07	10.85	10.64	10.95	10.53	10.85	10.64	10.53
1.6	UN-NIAGARA					10.96	10.59	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.78	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.85	10.53	10.26	9.85	10.53
1.5	UN-BKOUT					10.95	10.53	10.26	9.85	10.95	10.53	10.28	9.87	10.76	10.28	9.91	9.44	10.76	10.30	9.93	9.48	10.95	10.53	10.26	9.85	10.95	10.16	10.26	9.85	10.16
64A	1	599284	Pre-school	Narara Valley Dv	12.61	-1.66	-2.08	-2.35	-2.76	-1.66	-2.08	-2.33	-2.74	-1.85	-2.33	-2.70	-3.17	-1.85	-2.31	-2.68	-3.13	-1.66	-2.08	-2.35	-2.76	-1.66	-2.08	-2.35	-2.76	-2.24
64B	1	599284	Church hall	Narara Valley Dv	12.88	-1.93	-2.35	-2.62	-3.03	-1.93	-2.35	-2.60	-3.01	-2.12	-2.60	-2.97	-3.44	-2.12	-2.58	-2.95	-3.40	-1.93	-2.35	-2.62	-3.03	-1.93	-2.35	-2.62	-3.03	-2.51
1.57						10.65	10.42	10.15	9.82	10.85	10.43	10.17	9.86	10.47	8.62	9.43	9.07	10.48	9.87	9.61	9.19	10.65	10.42	10.14	9.82	10.85	10.42	10.14	9.82	10.42
56	5	255337	9	Haggerty Cl	12.43	-1.48	-1.90	-2.17	-2.58	-1.48	-1.90	-2.15	-2.56	-1.67	-2.15	-2.52	-2.99	-1.67	-2.13	-2.50	-2.95	-1.48	-1.90	-2.17	-2.58	-1.48	-1.90	-2.17	-2.58	-1.90
57	6	255337	11	Haggerty Cl	12.11	-1.16	-1.58	-1.85	-2.26	-1.16	-1.58	-1.83	-2.24	-1.35	-1.83	-2.20	-2.67	-1.35	-1.81	-2.18	-2.63	-1.16	-1.58	-1.85	-2.26	-1.16	-1.58	-1.85	-2.26	-1.58
58	7	255337	13	Haggerty Cl	11.73	-0.78	-1.20	-1.47	-1.88	-0.78	-1.20	-1.45	-1.86	-0.97	-1.45	-1.82	-2.29	-0.97	-1.43	-1.80	-2.25	-0.78	-1.20	-1.47	-1.88	-0.78	-1.20	-1.47	-1.88	-1.20
59	8	255337	15	Haggerty Cl	11.01	-0.06	-0.48	-0.75	-1.16	-0.06	-0.48	-0.73	-1.14	-0.25	-0.73	-1.10	-1.57	-0.25	-0.71	-1.08	-1.53	-0.06	-0.48	-0.75	-1.16	-0.06	-0.48	-0.75	-1.16	-0.48
105	11	259388	49	Koninderie Pd	11.14	-0.33	-0.77	-1.03	-1.35	-0.33	-0.75	-1.01	-1.32	-0.73	-1.38	-1.76	-2.11	-0.73	-1.32	-1.68	-1.99	-0.34	-0.77	-1.04	-1.35	-0.34	-0.77	-1.03	-1.35	-0.77
1.61	UN-NIAGARA					10.64	10.22	9.96	9.67	10.64	10.23	9.99	9.70	10.20	9.57	9.19	8.86	10.19	9.62	9.28	8.99	10.64	10.22	9.96	9.67	10.64	10.22	9.96	9.67	10.22
1.51	UN-BKOUT					10.91	10.40	9.79	9.11	10.91	10.41	9.83	9.22	10.71	9.77	8.96	8.96	10.71	9.80	9.10	8.97	10.91	10.40	9.79	9.10	10.91	10.16	9.79	9.11	10.16
104	10	259388	47	Koninderie Pd	11.26	-0.62	-1.04	-1.30	-1.59	-0.62	-1.03	-1.27	-1.56	-1.06	-1.69	-2.07	-2.40	-1.07	-1.64	-1.98	-2.27	-0.62	-1.04	-1.30	-1.59	-0.62	-1.04	-1.30	-1.59	-1.04
103	9	259388	45	Koninderie Pd	10.85	-0.21	-0.63	-0.89	-1.18	-0.21	-0.62	-0.86	-1.15	-0.65	-1.28	-1.66	-1.99	-0.66	-1.23	-1.57	-1.86	-0.21	-0.63	-0.89	-1.18	-0.21	-0.63	-0.89	-1.18	-0.63
60	8	259388	16	Haggerty Cl	11.00	-0.17	-0.67	-1.28	-1.89	-0.17	-0.66	-1.23	-1.78	-0.38	-1.36	-2.04	-2.09	-0.37	-1.30	-1.90	-2.05	-0.17	-0.66	-1.29	-1.90	-0.17	-0.67	-1.28	-1.89	-0.67
61	7	259388	14	Haggerty Cl	11.83	-0.99	-1.49	-2.10	-2.72	-0.99	-1.48	-2.06	-2.61	-1.20	-2.19	-2.86	-2.92	-1.19	-2.12	-2.73	-2.88	-0.99	-1.49	-2.11	-2.73	-0.99	-1.49	-2.11	-2.72	-1.49
62	6	259388	12	Haggerty Cl	12.25	-1.43	-1.93	-2.54	-3.14	-1.43	-1.92	-2.49	-3.03	-1.64	-2.63	-3.29	-3.35	-1.63	-2.56	-3.15	-3.31	-1.43	-1.92	-2.55	-3.15	-1.43	-1.93	-2.54	-3.14	-1.93
63	12	261387	10	Haggerty Cl	12.47	-1.56	-2.07	-2.68	-3.36	-1.56	-2.06	-2.64	-3.25	-1.76	-2.70	-3.49	-3.51	-1.76	-2.67	-3.37	-3.50	-1.56	-2.07	-2.68	-3.37	-1.56	-2.31	-2.68	-3.36	-2.07
102	34	246678	43	Koninderie Pd	10.84	-0.01	-0.51	-1.12	-1.73	-0.01	-0.50	-1.07	-1.62	-0.21	-1.20	-1.87	-1.93	-0.21	-1.14	-1.74	-1.89	-0.01	-0.50	-1.13	-1.74	-0.01	-0.50	-1.12	-1.73	-0.51
111	18	262329	20	Willari Av	11.38	-0.63	-1.12	-1.73	-2.27	-0.63	-1.11	-1.67	-2.16	-0.84	-1.88	-2.43	-2.52	-0.83	-1.78	-2.28	-2.46	-0.63	-1.11	-1.74	-2.28	-0.63	-1.11	-1.74	-2.27	-1.12
110	17	262329	22	Willari Av	11.30	-0.57	-1.05	-1.66	-2.19	-0.57	-1.04	-1.60	-2.08	-0.78	-1.82	-2.36	-2.45	-0.77	-1.72	-2.20	-2.38	-0.57	-1.05	-1.67	-2.20	-0.57	-1.05	-1.67	-2.19	-1.05
101	33	246678	41	Koninderie Pd	10.73	0.01	-0.47	-1.09	-1.62	0.01	-0.47	-1.03	-1.51	-0.20	-1.24	-1.78	-1.88	-0.19	-1.14	-1.63	-1.81	0.01	-0.47	-1.10	-1.63	0.01	-0.47	-1.10	-1.62	-0.47
112	19	262329	18	Willari Av	11.60	-0.92	-1.39	-2.01	-2.49	-0.92	-1.38	-1.94	-2.38	-1.13	-2.20	-2.67	-2.79	-1.12	-2.08	-2.50	-2.70	-0.92	-1.39	-2.02	-2.51	-0.92	-1.39	-2.02	-2.49	-1.39
1.7	UN-NIAGARA					10.28	9.89	9.53	9.16	10.28	9.92	9.60	9.23	9.99	9.28	8.89	8.53	9.99	9.41	9.09	8.64	10.28	9.89	9.53	9.09	10.28	9.89	9.62	9.10	9.89
1.7	UN-BKOUT					10.62	10.16	9.54	9.11	10.62	10.17	9.62	9.22	10.40	9.29	8.92	8.77	10.42	9.44	9.10	8.88	10.62	10.16	9.52	9.09	10.62	9.63	9.53	9.11	9.63

CALCULATED DEPTHS

Photo	Lot	DP	No.	Street	Floor	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	1%
No					Level	Exis	Exis	Exis	Exis	Block	Block	Block	Block	Chan	Chan	Chan	Chan	Comb	Comb	Comb	Comb	Dean	Dean	Dean	Dean	NVD	NVD	NVD	NVD	Allopt
100	32	246678	39	Koninderie Pd	11.01	-0.32	-0.79	-1.41	-1.90	-0.32	-0.79	-1.34	-1.79	-0.53	-1.60	-2.07	-2.19	-0.52	-1.48	-1.91	-2.11	-0.32	-0.79	-1.42	-1.92	-0.32	-0.79	-1.42	-1.90	-0.79
99	31	246678	37	Koninderie Pd	10.40	0.22	-0.24	-0.86	-1.29	0.22	-0.24	-0.78	-1.18	0.00	-1.11	-1.48	-1.63	0.02	-0.96	-1.30	-1.52	0.22	-0.24	-0.88	-1.31	0.22	-0.24	-0.87	-1.29	-0.24
113	5	251193	16	Willari Av	11.55	-0.95	-1.41	-2.03	-2.45	-0.95	-1.40	-1.95	-2.34	-1.16	-2.27	-2.63	-2.77	-1.15	-2.12	-2.45	-2.67	-0.95	-1.40	-2.04	-2.46	-0.95	-1.40	-2.04	-2.45	-1.41
98	30	246678	35	Koninderie Pd	10.29	0.25	-0.20	-0.84	-1.22	0.25	-0.20	-0.75	-1.11	0.02	-1.05	-1.38	-1.50	0.05	-0.91	-1.21	-1.41	0.25	-0.19	-0.85	-1.23	0.25	-0.19	-0.85	-1.22	-0.20
114	4	251193	14	Willari Av	11.35	-0.82	-1.27	-1.91	-2.29	-0.82	-1.28	-1.83	-2.18	-1.05	-2.12	-2.44	-2.56	-1.03	-1.98	-2.28	-2.47	-0.82	-1.27	-1.93	-2.30	-0.82	-1.27	-1.92	-2.29	-1.27
115	3	251193	12	Willari Av	11.25	-0.80	-1.23	-1.90	-2.22	-0.80	-1.25	-1.81	-2.13	-1.04	-2.08	-2.34	-2.45	-1.01	-1.93	-2.20	-2.37	-0.80	-1.23	-1.91	-2.23	-0.80	-1.23	-1.91	-2.22	-1.23
1.75	UN-NIAGARA					10.20	9.76	9.40	8.99	10.21	9.79	9.48	9.14	9.90	9.17	8.77	8.47	9.90	9.32	9.02	8.77	10.20	9.76	9.39	8.99	10.20	9.76	9.39	8.99	9.76
1.75	UN-BKOUT					10.36	9.94	9.25	8.99	10.36	9.91	9.34	9.07	10.09	9.10	8.90	8.82	10.14	9.25	9.03	8.88	10.36	9.94	9.23	8.99	10.36	9.92	9.24	8.99	9.92
116	2	251193	10	Willari Av	11.26	-0.90	-1.32	-2.01	-2.27	-0.90	-1.35	-1.92	-2.19	-1.17	-2.16	-2.36	-2.44	-1.12	-2.01	-2.23	-2.38	-0.90	-1.32	-2.03	-2.28	-0.90	-1.34	-2.02	-2.27	-1.32
117	1	251193	8	Willari Av	10.80	-0.44	-0.86	-1.55	-1.81	-0.44	-0.89	-1.46	-1.73	-0.71	-1.70	-1.90	-1.98	-0.66	-1.55	-1.77	-1.92	-0.44	-0.86	-1.57	-1.82	-0.44	-0.88	-1.56	-1.81	-0.86
118	27	246678	6	Willari Av	10.05	0.17	-0.33	-0.71	-1.11	0.18	-0.30	-0.62	-0.95	-0.18	-0.92	-1.31	-1.70	-0.17	-0.76	-1.04	-1.29	0.17	-0.33	-0.72	-1.13	0.16	-0.33	-0.72	-1.11	-0.33
119	28	246678	4	Willari Av	10.04	0.18	-0.32	-0.70	-1.11	0.19	-0.29	-0.61	-0.95	-0.17	-0.91	-1.30	-1.69	-0.16	-0.75	-1.04	-1.28	0.18	-0.32	-0.72	-1.13	0.18	-0.32	-0.72	-1.11	-0.32
97	29	246678	33	Koninderie Pd	10.03	0.36	-0.07	-0.75	-1.03	0.36	-0.09	-0.65	-0.94	0.10	-0.90	-1.13	-1.22	0.14	-0.76	-0.99	-1.15	0.36	-0.07	-0.76	-1.04	0.36	-0.07	-0.76	-1.03	-0.07
1.79	UN-NIAGARA					10.26	9.63	9.22	8.83	10.26	9.86	9.31	9.01	9.81	9.06	8.70	8.31	9.83	9.23	8.97	8.74	10.26	9.63	9.20	8.81	10.25	9.63	9.20	8.83	9.63
1.79	UN-BKOUT					10.26	9.63	9.22	8.83	10.26	9.86	9.31	9.01	9.81	9.06	8.70	8.31	9.83	9.23	8.97	8.74	10.26	9.63	9.20	8.81	10.25	9.87	9.20	8.83	9.87
96	24	246678	31	Koninderie Pd	9.92	0.31	-0.22	-0.60	-1.00	0.31	-0.19	-0.51	-0.84	-0.06	-0.80	-1.18	-1.57	-0.05	-0.64	-0.92	-1.16	0.31	-0.21	-0.62	-1.02	0.30	-0.22	-0.61	-1.00	-0.22
95	23	246678	29	Koninderie Pd	9.92	0.27	-0.38	-0.79	-1.18	0.27	-0.33	-0.67	-0.97	-0.16	-0.89	-1.26	-1.64	-0.13	-0.72	-0.97	-1.20	0.26	-0.38	-0.81	-1.20	0.26	-0.39	-0.80	-1.17	-0.38
106	25	246678	3	Willari Av	10.01	0.25	-0.38	-0.79	-1.18	0.25	-0.35	-0.70	-1.00	-0.20	-0.95	-1.31	-1.70	-0.18	-0.78	-1.04	-1.27	0.25	-0.38	-0.81	-1.20	0.24	-0.38	-0.81	-1.18	-0.38
109	13	251193	9	Willari Av	11.05	-0.87	-1.52	-1.92	-2.31	-0.86	-1.46	-1.81	-2.10	-1.30	-2.02	-2.39	-2.78	-1.26	-1.85	-2.10	-2.33	-0.87	-1.52	-1.95	-2.33	-0.88	-1.52	-1.94	-2.31	-1.52
107	14	251193	4	Apara Cl	11.34	-1.21	-1.88	-2.28	-2.66	-1.20	-1.81	-2.15	-2.43	-1.63	-2.34	-2.71	-3.09	-1.59	-2.16	-2.41	-2.63	-1.22	-1.88	-2.30	-2.69	-1.23	-1.89	-2.29	-2.66	-1.88
94	22	246678	27	Koninderie Pd	9.92	0.20	-0.46	-0.86	-1.24	0.22	-0.39	-0.73	-1.01	-0.21	-0.92	-1.29	-1.67	-0.16	-0.74	-0.99	-1.21	0.20	-0.46	-0.89	-1.27	0.19	-0.48	-0.88	-1.24	-0.46
92	20	246678	7	Woorin Cl	10.04	0.01	-0.67	-1.07	-1.45	0.03	-0.58	-0.92	-1.18	-0.38	-1.08	-1.44	-1.83	-0.33	-0.89	-1.13	-1.35	0.01	-0.67	-1.10	-1.48	0.00	-0.70	-1.08	-1.44	-0.67
93	21	246678	9	Woorin Cl	9.65	0.39	-0.30	-0.69	-1.07	0.41	-0.20	-0.54	-0.80	0.00	-0.70	-1.06	-1.45	0.05	-0.50	-0.74	-0.96	0.39	-0.30	-0.72	-1.10	0.38	-0.32	-0.71	-1.07	-0.30
108	15	251193	6	Apara Cl	11.34	-1.30	-1.99	-2.38	-2.76	-1.29	-1.89	-2.23	-2.49	-1.69	-2.39	-2.75	-3.14	-1.64	-2.19	-2.43	-2.65	-1.31	-1.99	-2.41	-2.80	-1.32	-2.02	-2.40	-2.76	-1.99
1.68						9.93	9.22	8.83	8.46	9.95	9.36	9.01	8.77	9.67	8.89	8.54	8.15	9.64	9.10	8.88	8.67	9.93	9.21	8.80	8.42	9.91	9.16	8.81	8.46	9.18
91	19	246678	5	Woorin Cl	9.70	0.33	-0.36	-0.75	-1.13	0.35	-0.26	-0.59	-0.85	-0.06	-0.75	-1.11	-1.50	0.00	-0.56	-0.79	-1.01	0.33	-0.36	-0.78	-1.16	0.32	-0.38	-0.77	-1.13	-0.36
90	18	246678	3	Woorin Cl	9.97	-0.04	-0.76	-1.14	-1.51	-0.02	-0.63	-0.96	-1.20	-0.40	-1.08	-1.43	-1.82	-0.34	-0.87	-1.09	-1.30	-0.05	-0.76	-1.18	-1.56	-0.07	-0.80	-1.16	-1.51	-0.76
74	A	408411	95	Narara Valley Dv	12.44	-2.52	-3.23	-3.61	-3.99	-2.50	-3.10	-3.43	-3.67	-2.88	-3.55	-3.90	-4.30	-2.81	-3.34	-3.56	-3.77	-2.52	-3.24	-3.65	-4.03	-2.54	-3.27	-3.63	-3.98	-3.23
73	2	207275	93	Narara Valley Dv	11.89	-1.97	-2.68	-3.06	-3.44	-1.95	-2.55	-2.88	-3.12	-2.33	-3.00	-3.35	-3.75	-2.26	-2.79	-3.01	-3.22	-1.97	-2.69	-3.10	-3.48	-1.99	-2.72	-3.08	-3.43	-2.68
89	17	246678	25	Koninderie Pd	9.48	0.39	-0.30	-0.68	-1.06	0.41	-0.17	-0.48	-0.72	0.04	-0.61	-0.97	-1.36	0.12	-0.39	-0.61	-0.82	0.38	-0.31	-0.72	-1.11	0.36	-0.34	-0.71	-1.06	-0.30
88	16	246678	23	Koninderie Pd	9.35	0.53	-0.17	-0.55	-0.92	0.55	-0.03	-0.35	-0.59	0.18	-0.48	-0.83	-1.23	0.25	-0.26	-0.48	-0.69	0.52	-0.17	-0.58	-0.97	0.50	-0.21	-0.57	-0.92	-0.17
87	15	246678	21	Koninderie Pd	9.30	0.52	-0.15	-0.53	-0.91	0.55	-0.01	-0.31	-0.55	0.19	-0.45	-0.80	-1.20	0.27	-0.22	-0.44	-0.65	0.52	-0.15	-0.57	-0.96	0.49	-0.19	-0.55	-0.90	-0.15
72	36	247042	87	Narara Valley Dv	9.57	0.22	-0.44	-0.82	-1.20	0.25	-0.29	-0.59	-0.83	-0.10	-0.73	-1.08	-1.48	-0.02	-0.50	-0.72	-0.92	0.22	-0.44	-0.86	-1.25	0.19	-0.48	-0.84	-1.19	-0.44
86	38	247042	19	Koninderie Pd	9.07	0.71	0.06	-0.33	-0.70	0.74	0.20	-0.09	-0.33	0.39	-0.23	-0.59	-0.99	0.47	0.00	-0.22	-0.42	0.70	0.06	-0.37	-0.76	0.67	0.02	-0.35	-0.70	0.06
85	14	246678	17	Koninderie Pd	9.42	0.32	-0.32	-0.70	-1.08	0.35	-0.16	-0.45	-0.69	0.01	-0.60	-0.96	-1.36	0.10	-0.36	-0.58	-0.78	0.31	-0.32	-0.74	-1.14	0.27	-0.36	-0.72	-1.08	-0.32
71	37	247042	85	Narara Valley Dv	9.64	0.09	-0.54	-0.92	-1.31	0.13	-0.39	-0.68	-0.92	-0.22	-0.83	-1.18	-1.58	-0.13	-0.58	-0.80	-1.00	0.08	-0.54	-0.97	-1.37	0.05	-0.58	-0.95	-1.30	-0.54
84	13	246678	15	Koninderie Pd	9.52	0.17	-0.44	-0.82	-1.21	0.21	-0.29	-0.56	-0.80	-0.13	-0.72	-1.07	-1.48	-0.03	-0.47	-0.69	-0.89	0.16	-0.44	-0.87	-1.27	0.12	-0.49	-0.85	-1.20	-0.44
70	39	247042	83	Narara Valley Dv	9.51	0.17	-0.44	-0.82	-1.20	0.22	-0.28	-0.56	-0.79	-0.12	-0.71	-1.07	-1.47	-0.03	-0.46	-0.68	-0.88	0.17	-0.44	-0.86	-1.27	0.13	-0.48	-0.84	-1.20	-0.44
75	12	246678	4	Yurunga Av	9.41	0.22	-0.37	-0.75	-1.14	0.26	-0.20	-0.47	-0.71	-0.06	-0.64	-0.99	-1.40	0.04	-0.37	-0.59	-0.79	0.21	-0.37	-0.80	-1.21	0.16	-0.41	-0.78	-1.13	-0.37
69	40	247042	2	Yurunga Av	9.45	0.17	-0.41	-0.79	-1.18	0.22	-0.24	-0.51	-0.75	-0.11	-0.68	-1.03	-1.44	-0.01	-0.41	-0.63	-0.83	0.17	-0.41	-0.84	-1.25	0.12	-0.46	-0.82	-1.17	-0.41
2.01						9.60	9.05	8.65	8.26	9.65	9.20	8.84	8.70	9.33	8.77	8.41	8.06	9.43	9.03	8.82	8.62	9.59	9.03	8.59	8.18	9.85	8.95	8.62	8.26	8.96
1.00						9.97	9.92	9.80	9.66	9.97	9.92	9.80	9.66	9.97	9.92	9.80	9.66	9.97	9.92	9.80	9.66	9.97	9.92	9.80	9.66	9.97	9.84	9.80	9.66	9.84
1.07						9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.87	9.76	9.63	9.92	9.85	9.76	9.63	9.85
41	2	596517	72	Narara Valley Dv	10.55	-0.65	-0.69	-0.79	-0.92	-0.65	-0.69	-0.79	-0.92	-0.65	-0.69	-0.79	-0.92	-0.65	-0.69	-0.79	-0.92	-0.65	-0.69	-0.79	-0.92	-0.65	-0.69	-0.79	-0.92	-0.69
42	3	596517	74	Narara Valley Dv	10.28	-0.38	-0.42	-0.52	-0.65	-0.38	-0.42	-0.52	-0.65	-0.38	-0.42	-0.52	-0.65	-0.38	-0.42	-0.52	-0.65	-0.38	-0.42	-0.52	-0.65	-0.38	-0.42	-0.52	-0.65	-0.42
44	2	24289	82	Narara Valley Dv	12.23	-2.33	-2.37	-2.47	-2.60	-2.33	-2.37	-2.47	-2.60	-2.33	-2.37	-2.47	-2.60	-2.33	-2.37	-2.47	-2.60	-2.33	-2.37	-2.47	-2.60	-2.33	-2.37	-2.47	-2.60	-2.37
1.14						9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.84	9.75	9.62	9.88	9.85	9.75	9.62	9.85

CALCULATED DEPTHS

Photo	Lot	DP	No.	Street	Floor	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	PMF	1%	5%	20%	1%
No					Level	Exis	Exis	Exis	Exis	Block	Block	Block	Block	Chan	Chan	Chan	Chan	Comb	Comb	Comb	Comb	Dean	Dean	Dean	Dean	NVD	NVD	NVD	NVD	Allopt
43	5	24289	80	Narara Valley Dv	11.63	-1.75	-1.79	-1.88	-2.01	-1.75	-1.79	-1.88	-2.01	-1.75	-1.79	-1.88	-2.01	-1.75	-1.79	-1.88	-2.01	-1.75	-1.79	-1.88	-2.01	-1.75	-1.78	-1.88	-2.01	-1.79
40	1	584143	70	Narara Valley Dv	10.81	-0.93	-0.97	-1.06	-1.19	-0.93	-0.97	-1.06	-1.19	-0.93	-0.97	-1.06	-1.19	-0.93	-0.97	-1.06	-1.19	-0.93	-0.97	-1.06	-1.19	-0.93	-0.96	-1.06	-1.19	-0.97
39	41	238748	68	Narara Valley Dv	11.84	-1.96	-2.00	-2.09	-2.22	-1.96	-2.00	-2.09	-2.22	-1.96	-2.00	-2.09	-2.22	-1.96	-2.00	-2.09	-2.22	-1.96	-2.00	-2.09	-2.22	-1.96	-1.99	-2.09	-2.22	-2.00
38	40	238748	66	Narara Valley Dv	12.13	-2.25	-2.29	-2.38	-2.51	-2.25	-2.29	-2.38	-2.51	-2.25	-2.29	-2.38	-2.51	-2.25	-2.29	-2.38	-2.51	-2.25	-2.29	-2.38	-2.51	-2.25	-2.28	-2.38	-2.51	-2.29
2.04						9.51	8.97	8.67	8.18	9.67	9.14	8.89	8.66	9.26	8.72	8.37	7.98	9.37	9.00	8.80	8.60	9.50	8.95	8.51	8.10	9.44	8.89	8.53	8.19	8.89
83	10	246678	13	Koninderie Pd	9.16	0.47	-0.12	-0.50	-0.89	0.52	0.05	-0.22	-0.46	0.19	-0.38	-0.74	-1.15	0.29	-0.12	-0.34	-0.54	0.46	-0.12	-0.55	-0.95	0.42	-0.16	-0.53	-0.88	-0.12
78	11	246678	3	Yurunga Av	9.49	-0.40	-0.94	-1.34	-1.75	-0.27	-0.58	-0.78	-0.97	-0.44	-0.94	-1.29	-1.74	-0.28	-0.58	-0.76	-0.93	-0.42	-0.97	-1.46	-1.95	-0.59	-1.10	-1.42	-1.73	-0.94
82	9	246678	11	Koninderie Pd	9.11	0.40	-0.15	-0.54	-0.92	0.46	0.03	-0.22	-0.45	0.15	-0.39	-0.74	-1.15	0.27	-0.11	-0.31	-0.50	0.40	-0.16	-0.60	-1.01	0.34	-0.22	-0.57	-0.92	-0.15
81	8	246678	9	Koninderie Pd	8.81	0.56	0.01	-0.37	-0.75	0.64	0.25	0.02	-0.20	0.38	-0.14	-0.48	-0.90	0.51	0.16	-0.04	-0.22	0.55	0.00	-0.45	-0.86	0.47	-0.08	-0.42	-0.75	0.01
80	7	246678	7	Koninderie Pd	9.26	0.04	-0.51	-0.90	-1.27	0.13	-0.24	-0.47	-0.67	-0.11	-0.62	-0.96	-1.37	0.03	-0.31	-0.50	-0.68	0.03	-0.53	-0.97	-1.39	-0.07	-0.61	-0.94	-1.26	-0.51
37	16	238748	64	Narara Valley Dv	12.02	-2.91	-3.43	-3.83	-4.20	-2.79	-3.11	-3.32	-3.50	-2.96	-3.45	-3.78	-4.20	-2.80	-3.10	-3.28	-3.46	-2.92	-3.47	-3.93	-4.35	-3.05	-3.59	-3.89	-4.19	-9.02
2.14						9.11	8.59	8.19	7.82	9.23	8.91	8.70	8.52	9.06	8.57	8.24	7.82	9.22	8.92	8.74	8.56	9.10	8.55	8.09	7.67	8.97	8.43	8.13	7.83	8.43
79	6	246678	5	Koninderie Pd	8.90	0.28	-0.26	-0.65	-1.02	0.39	0.05	-0.16	-0.36	0.20	-0.30	-0.64	-1.05	0.34	0.03	-0.15	-0.33	0.27	-0.28	-0.74	-1.16	0.15	-0.39	-0.70	-1.01	-0.35
78	5	246678	3	Koninderie Pd	9.07	0.04	-0.50	-0.89	-1.26	0.16	-0.16	-0.37	-0.55	-0.01	-0.50	-0.84	-1.26	0.15	-0.15	-0.33	-0.51	0.03	-0.53	-0.99	-1.42	-0.11	-0.64	-0.95	-1.25	-0.64
38	15	238748	62	Narara Valley Dv	11.53	-2.43	-2.97	-3.37	-3.75	-2.30	-2.62	-2.82	-3.01	-2.47	-2.97	-3.31	-3.75	-2.32	-2.62	-2.80	-2.97	-2.45	-3.00	-3.48	-3.93	-2.60	-3.12	-3.43	-3.74	-3.12
77	4	246678	1	Koninderie Pd	8.90	0.18	-0.35	-0.76	-1.16	0.32	0.01	-0.19	-0.38	0.15	-0.35	-0.70	-1.15	0.31	0.01	-0.17	-0.34	0.17	-0.38	-0.88	-1.37	0.00	-0.52	-0.83	-1.15	-0.52
68	100	792456	69	Narara Valley Dv	9.64	-0.56	-1.09	-1.50	-1.91	-0.42	-0.73	-0.93	-1.12	-0.59	-1.09	-1.45	-1.90	-0.43	-0.73	-0.91	-1.08	-0.58	-1.13	-1.63	-2.12	-0.75	-1.26	-1.58	-1.90	-1.26
67	3	246678	67	Narara Valley Dv	9.18	-0.11	-0.64	-1.06	-1.48	0.03	-0.27	-0.47	-0.66	-0.13	-0.64	-1.01	-1.47	0.03	-0.27	-0.45	-0.63	-0.13	-0.68	-1.19	-1.71	-0.32	-0.82	-1.14	-1.47	-0.82
65	1	246678	63	Narara Valley Dv	8.79	0.28	-0.25	-0.67	-1.10	0.42	0.12	-0.08	-0.27	0.26	-0.25	-0.62	-1.09	0.42	0.12	-0.06	-0.24	0.26	-0.29	-0.81	-1.34	0.07	-0.44	-0.76	-1.09	-0.44
66	2	246678	65	Narara Valley Dv	8.71	0.35	-0.18	-0.59	-1.02	0.50	0.20	0.00	-0.19	0.34	-0.18	-0.54	-1.01	0.50	0.20	0.02	-0.16	0.34	-0.21	-0.73	-1.27	0.14	-0.36	-0.68	-1.01	-0.36
35	1	229277	60	Narara Valley Dv	10.80	-1.74	-2.27	-2.69	-3.13	-1.59	-1.89	-2.09	-2.28	-1.76	-2.27	-2.64	-3.12	-1.59	-1.89	-2.07	-2.25	-1.76	-2.31	-2.84	-3.39	-1.96	-2.46	-2.79	-3.12	-2.46
2.24						9.05	8.54	8.10	7.68	9.20	8.91	8.71	8.53	9.04	8.53	8.15	7.66	9.21	8.91	8.73	8.55	9.03	8.48	7.94	7.36	8.82	8.21	8.00	7.66	8.21
34	2	229277	58	Narara Valley Dv	11.48	-2.58	-3.10	-3.48	-3.86	-2.49	-2.88	-3.13	-3.37	-2.60	-3.11	-3.45	-3.86	-2.50	-2.89	-3.12	-3.36	-2.62	-3.16	-3.65	-4.13	-2.71	-3.20	-3.54	-3.87	-3.27
2.3						8.70	8.21	7.87	7.59	8.71	8.21	7.87	7.57	8.67	8.12	7.86	7.57	8.67	8.17	7.87	7.56	8.65	8.11	7.69	7.31	8.70	8.06	7.87	7.54	8.06
32	8	242245	1	Brancourt Cr	11.14	-2.55	-3.06	-3.38	-3.63	-2.55	-3.05	-3.37	-3.64	-2.56	-3.05	-3.35	-3.63	-2.55	-3.05	-3.35	-3.64	-2.58	-3.12	-3.54	-3.90	-2.55	-3.05	-3.38	-3.68	-3.05
33	7	242245	6	Pearson St	12.53	-3.98	-4.49	-4.80	-5.04	-3.98	-4.47	-4.79	-5.05	-3.98	-4.47	-4.77	-5.04	-3.97	-4.47	-4.77	-5.05	-4.00	-4.54	-4.95	-5.31	-3.98	-4.47	-4.80	-5.09	-4.52
2.36						8.48	7.98	7.67	7.45	8.48	7.99	7.66	7.44	8.48	7.99	7.70	7.44	8.49	7.99	7.70	7.43	8.46	7.90	7.49	7.15	8.46	7.73	7.67	7.40	7.73
24	22	242245	22	Brancourt Cr	9.30	-0.81	-1.32	-1.62	-1.85	-0.81	-1.30	-1.61	-1.86	-0.81	-1.30	-1.59	-1.85	-0.80	-1.30	-1.59	-1.86	-0.83	-1.38	-1.79	-2.13	-0.81	-1.31	-1.62	-1.90	-1.35
31	9	242245	3	Brancourt Cr	10.31	-1.83	-2.34	-2.64	-2.86	-1.83	-2.33	-2.63	-2.87	-1.83	-2.32	-2.61	-2.87	-1.82	-2.32	-2.61	-2.88	-1.86	-2.41	-2.82	-3.16	-1.84	-2.33	-2.65	-2.91	-2.41
23	7	255485	48	Narara Valley Dv	8.78	-0.33	-0.83	-1.12	-1.34	-0.33	-0.82	-1.11	-1.35	-0.32	-0.81	-1.09	-1.35	-0.32	-0.81	-1.10	-1.36	-0.35	-0.90	-1.30	-1.64	-0.33	-0.82	-1.13	-1.39	-0.93
6	43	245497	20	Wesley St	11.40	-3.14	-3.59	-3.82	-4.02	-3.14	-3.58	-3.82	-4.02	-3.14	-3.59	-3.81	-4.03	-3.14	-3.59	-3.81	-4.04	-3.20	-3.69	-4.04	-4.39	-3.15	-3.59	-3.84	-4.07	-3.65
7	42	245497	22	Wesley St	11.20	-2.99	-3.44	-3.65	-3.83	-2.99	-3.43	-3.64	-3.84	-2.97	-3.41	-3.62	-3.84	-2.97	-3.41	-3.63	-3.85	-3.04	-3.51	-3.86	-4.21	-2.98	-3.41	-3.65	-3.88	-3.50
2.45						8.17	7.74	7.53	7.36	8.17	7.75	7.54	7.35	8.16	7.73	7.55	7.34	8.16	7.73	7.54	7.33	8.06	7.63	7.30	6.94	8.15	7.70	7.52	7.30	7.70
8	41	245497	24	Wesley St	10.94	-2.78	-3.21	-3.41	-3.59	-2.77	-3.20	-3.41	-3.59	-2.75	-3.18	-3.38	-3.59	-2.75	-3.18	-3.38	-3.60	-2.82	-3.29	-3.62	-3.98	-2.76	-3.18	-3.41	-3.63	-3.27
22	6	255485	46	Narara Valley Dv	8.41	-0.25	-0.68	-0.88	-1.06	-0.24	-0.68	-0.88	-1.07	-0.04	-0.51	-0.77	-1.01	-0.04	-0.51	-0.77	-1.01	-0.09	-0.61	-0.99	-1.33	-0.05	-0.52	-0.80	-1.05	-0.74
9	40	245497	13	Wesley St	11.69	-3.53	-3.97	-4.17	-4.34	-3.53	-3.96	-4.16	-4.35	-3.53	-3.96	-4.15	-4.35	-3.53	-3.96	-4.15	-4.36	-3.61	-4.07	-4.39	-4.76	-3.54	-3.96	-4.17	-4.40	-4.04
10	39	245497	11	Wesley St	11.56	-3.40	-3.84	-4.04	-4.21	-3.40	-3.83	-4.03	-4.22	-3.41	-3.84	-4.03	-4.23	-3.40	-3.84	-4.03	-4.24	-3.49	-3.95	-4.27	-4.63	-3.41	-3.84	-4.05	-4.27	-3.92
11	34	245497	6	Runyon Cl	11.28	-3.13	-3.58	-3.78	-3.95	-3.13	-3.57	-3.77	-3.95	-3.14	-3.58	-3.77	-3.96	-3.13	-3.58	-3.77	-3.97	-3.23	-3.70	-4.02	-4.38	-3.14	-3.58	-3.79	-4.00	-3.68
12	33	245497	8	Runyon Cl	10.18	-2.04	-2.51	-2.70	-2.87	-2.04	-2.50	-2.70	-2.87	-2.05	-2.50	-2.68	-2.88	-2.04	-2.50	-2.69	-2.89	-2.13	-2.61	-2.93	-3.30	-2.05	-2.49	-2.70	-2.91	-2.61
13	32	245497	10	Runyon Cl	9.15	-1.03	-1.51	-1.70	-1.86	-1.03	-1.50	-1.70	-1.86	-1.04	-1.52	-1.69	-1.88	-1.04	-1.52	-1.70	-1.89	-1.12	-1.61	-1.92	-2.29	-1.03	-1.48	-1.68	-1.89	-1.63
14	31	245497	12	Runyon Cl	11.18	-3.06	-3.53	-3.72	-3.88	-3.05	-3.52	-3.72	-3.89	-3.07	-3.54	-3.71	-3.90	-3.06	-3.54	-3.72	-3.91	-3.15	-3.63	-3.95	-4.32	-3.06	-3.50	-3.71	-3.92	-3.67
2.49						8.11	7.64	7.44	7.28	8.11	7.64	7.44	7.28	8.10	7.61	7.44	7.26	8.10	7.61	7.43	7.25	7.97	7.46	7.16	6.77	8.09	7.70	7.41	7.21	7.70
21	5	255485	44	Narara Valley Dv	8.51	-0.38	-0.84	-1.03	-1.19	-0.38	-0.83	-1.03	-1.20	-0.39	-0.85	-1.03	-1.22	-0.39	-0.85	-1.03	-1.23	-0.33	-0.82	-1.16	-1.52	-0.28	-0.72	-0.95	-1.19	-0.99
20	3	625827	2	Deane St	8.46	-0.33	-0.78	-0.97	-1.14	-0.33	-0.77	-0.97	-1.14	-0.34	-0.79	-0.97	-1.16	-0.34	-0.79	-0.97	-1.17	-0.37	-0.83	-1.15	-1.51	-0.30	-0.72	-0.94	-1.16	-0.93
																											7.65			7.51
18	24	245497	18	Deane St	8.30	-0.17	-0.63	-0.82	-0.98	-0.17	-0.62	-0.82	-0.99	-0.18	-0.64	-0.82	-1.01	-0.18	-0.64	-0.82	-1.02	-0.31	-0.81	-1.12	-1.50	-0.20	-0.66	-0.87	-1.07	-0.78
17	23	244428	20	Deane St	8.97	-0.84	-1.29	-1.49	-1.65	-0.84	-1.28	-1.48	-1.66	-0.85	-1.30	-1.48	-1.67	-0.85	-1.30	-1.48	-1.68	-0.98	-1.49	-1.80	-2.17	-0.87	-1.34	-1.54	-1.74	-1.44

CALCULATED DEPTHS

Photo No	Lot	DP	No.	Street	Floor Level	PMF Exis	1% Exis	5% Exis	20% Exis	PMF Block	1% Block	5% Block	20% Block	PMF Chan	1% Chan	5% Chan	20% Chan	PMF Comb	1% Comb	5% Comb	20% Comb	PMF Dean	1% Dean	5% Dean	20% Dean	PMF NVD	1% NVD	5% NVD	20% NVD	1% Allopt
16	22	244428	22	Deane St	9.58	-1.45	-1.92	-2.11	-2.27	-1.45	-1.91	-2.10	-2.28	-1.47	-1.93	-2.11	-2.29	-1.46	-1.93	-2.11	-2.30	-1.59	-2.09	-2.40	-2.77	-1.48	-1.94	-2.14	-2.35	-2.07
15	21	244428	24	Deane St	10.49	-2.36	-2.82	-3.01	-3.17	-2.36	-2.81	-3.01	-3.18	-2.37	-2.83	-3.01	-3.20	-2.37	-2.83	-3.01	-3.21	-2.50	-3.00	-3.32	-3.69	-2.39	-2.86	-3.06	-3.26	-2.97
2.50						8.14	7.71	7.51	7.34	8.14	7.72	7.51	7.33	8.13	7.70	7.52	7.32	8.14	7.70	7.51	7.31	8.01	7.55	7.23	6.83	8.12	7.32	7.49	7.28	7.52
TRIBUTARY A																														
1.00						17.16	16.91	16.81	16.73	17.16	16.91	16.81	16.73	17.16	16.91	16.81	16.73	17.16	16.91	16.81	16.73	17.16	16.91	16.81	16.73	17.16	10.14	16.81	16.73	10.14
1	81	563294	82	Hanlan St	20.02	-4.13	-4.33	-4.40	-4.46	-4.13	-4.33	-4.40	-4.46	-4.13	-4.33	-4.40	-4.46	-4.13	-4.33	-4.40	-4.46	-4.13	-4.33	-4.40	-4.46	-4.13	-4.33	-4.40	-4.46	-4.33
120	2	714993	84	Hanlan St	23.72	-7.83	-8.03	-8.10	-8.16	-7.83	-8.03	-8.10	-8.16	-7.83	-8.03	-8.10	-8.16	-7.83	-8.03	-8.10	-8.16	-7.83	-8.03	-8.10	-8.16	-7.83	-8.03	-8.10	-8.16	-8.03
1.1						13.46	13.37	13.34	13.32	13.46	13.37	13.34	13.32	13.46	13.37	13.34	13.32	13.46	13.37	13.34	13.32	13.46	13.37	13.34	13.32	13.46	8.61	13.34	13.32	8.61
127	54	245497	15	Unwin Cl	15.39	-1.91	-2.02	-2.05	-2.07	-1.91	-2.02	-2.05	-2.07	-1.91	-2.02	-2.05	-2.07	-1.91	-2.02	-2.05	-2.07	-1.91	-2.02	-2.05	-2.07	-1.91	-6.78	-2.05	-2.07	-2.02
126	53	245497	13	Unwin Cl	14.66	-1.18	-1.29	-1.32	-1.34	-1.18	-1.29	-1.32	-1.34	-1.18	-1.29	-1.32	-1.34	-1.18	-1.29	-1.32	-1.34	-1.18	-1.29	-1.32	-1.34	-1.18	-6.05	-1.32	-1.34	-1.29
125	52	245497	11	Unwin Cl	14.02	-0.54	-0.65	-0.68	-0.70	-0.54	-0.65	-0.68	-0.70	-0.54	-0.65	-0.68	-0.70	-0.54	-0.65	-0.68	-0.70	-0.54	-0.65	-0.68	-0.70	-0.54	-5.41	-0.68	-0.70	-0.66
1.17						10.24	10.15	10.11	10.08	10.24	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.23	10.14	10.11	10.08	10.24	10.14	10.11	10.08	10.24	7.98	10.11	10.08	7.98
28	18	242245	12	Brancourt Cr	14.22	-4.02	-4.11	-4.15	-4.18	-4.02	-4.12	-4.15	-4.18	-4.02	-4.12	-4.15	-4.18	-4.02	-4.12	-4.15	-4.18	-4.02	-4.12	-4.15	-4.18	-4.02	-4.12	-4.15	-4.18	-4.01
27	19	242245	10	Brancourt Cr	13.65	-3.59	-3.68	-3.72	-3.75	-3.59	-3.69	-3.72	-3.75	-3.59	-3.69	-3.72	-3.75	-3.59	-3.69	-3.72	-3.75	-3.59	-3.69	-3.72	-3.75	-3.59	-3.69	-3.72	-3.75	-3.58
2	51	245497	9	Unwin Cl	13.17	-2.84	-2.93	-2.97	-2.99	-2.84	-2.94	-2.97	-2.99	-2.84	-2.94	-2.97	-2.99	-2.84	-2.94	-2.97	-2.99	-2.84	-2.94	-2.97	-2.99	-2.84	-2.94	-2.97	-2.99	-2.83
124	50	245497	7	Unwin Cl	13.81	-3.57	-3.66	-3.70	-3.73	-3.57	-3.67	-3.70	-3.73	-3.57	-3.67	-3.70	-3.73	-3.58	-3.67	-3.70	-3.73	-3.57	-3.67	-3.70	-3.73	-3.57	-5.83	-3.70	-3.73	-3.56
123	49	245497	5	Unwin Cl	13.59	-3.35	-3.44	-3.48	-3.51	-3.35	-3.45	-3.48	-3.51	-3.35	-3.45	-3.48	-3.51	-3.36	-3.45	-3.48	-3.51	-3.35	-3.45	-3.48	-3.51	-3.35	-5.61	-3.48	-3.51	-3.34
26	20	242245	8	Brancourt Cr	11.61	-2.81	-2.90	-2.98	-3.01	-2.81	-2.94	-2.98	-3.01	-2.81	-2.94	-2.98	-3.01	-2.81	-2.95	-2.98	-3.01	-2.81	-2.93	-2.97	-3.01	-2.81	-2.94	-2.98	-3.01	-2.79
122	48	245497	3	Unwin Cl	13.29	-4.55	-4.63	-4.72	-4.75	-4.55	-4.68	-4.72	-4.75	-4.55	-4.68	-4.72	-4.75	-4.55	-4.69	-4.72	-4.75	-4.55	-4.67	-4.71	-4.74	-4.55	-5.31	-4.72	-4.75	-4.53
1.29						8.74	8.66	8.57	8.51	8.74	8.61	8.57	8.54	8.74	8.61	8.57	8.54	8.74	8.60	8.57	8.54	8.74	8.62	8.58	8.55	8.74	7.98	8.57	8.54	7.98
121	47	245497	1	Unwin Cl	12.49	-3.75	-3.83	-3.92	-3.95	-3.75	-3.88	-3.92	-3.95	-3.75	-3.88	-3.92	-3.95	-3.75	-3.89	-3.92	-3.95	-3.75	-3.87	-3.91	-3.94	-3.75	-4.51	-3.92	-3.95	-3.73
3	46	245497	14	Wesley St	12.48	-3.74	-3.82	-3.91	-3.94	-3.74	-3.87	-3.91	-3.94	-3.74	-3.87	-3.91	-3.94	-3.74	-3.88	-3.91	-3.94	-3.74	-3.86	-3.90	-3.93	-3.74	-4.50	-3.91	-3.94	-3.72
4	45	245497	16	Wesley St	12.11	-3.37	-3.45	-3.54	-3.57	-3.37	-3.50	-3.54	-3.57	-3.37	-3.50	-3.54	-3.57	-3.37	-3.51	-3.54	-3.57	-3.37	-3.49	-3.53	-3.56	-3.37	-4.13	-3.54	-3.57	-3.35
25	27	242245	6	Brancourt Cr	11.91	-3.07	-3.15	-3.24	-3.27	-3.07	-3.20	-3.24	-3.27	-3.07	-3.20	-3.24	-3.27	-3.07	-3.21	-3.24	-3.27	-3.07	-3.19	-3.23	-3.26	-3.07	-3.83	-3.24	-3.27	-3.05
29	11	242245	7	Brancourt Cr	12.81	-4.07	-4.15	-4.24	-4.27	-4.07	-4.20	-4.24	-4.27	-4.07	-4.20	-4.24	-4.27	-4.07	-4.21	-4.24	-4.27	-4.07	-4.19	-4.23	-4.26	-4.07	-4.83	-4.24	-4.27	-4.05
30	10	242245	5	Brancourt Cr	11.66	-2.92	-3.00	-3.09	-3.12	-2.92	-3.05	-3.09	-3.12	-2.92	-3.05	-3.09	-3.12	-2.92	-3.06	-3.09	-3.12	-2.92	-3.04	-3.08	-3.11	-2.92	-3.68	-3.09	-3.12	-2.90
5	44	245497	18	Wesley St	11.53	-2.79	-2.87	-2.96	-2.99	-2.79	-2.92	-2.96	-2.99	-2.79	-2.92	-2.96	-2.99	-2.79	-2.93	-2.96	-2.99	-2.79	-2.91	-2.95	-2.98	-2.79	-3.55	-2.96	-2.99	-2.77
2.36						8.48	7.98	7.67	7.45	8.48	7.99	7.68	7.44	8.48	7.99	7.70	7.44	8.49	7.99	7.70	7.43	8.46	7.90	7.49	7.15	8.48	7.73	7.87	7.40	7.73
19	1	786893	Shop	Deane St	7.62	0.51	0.04	-0.15	-0.31	0.51	0.05	-0.15	-0.32	0.49	0.03	-0.15	-0.34	0.50	0.03	-0.15	-0.35	0.38	-0.12	-0.43	-0.80	0.49	0.03	-0.18	-0.38	-0.11

APPENDIX B
FLOOD DAMAGE ASSESSMENTS

APPENDIX B1
STAGE DAMAGE FLOOD DATA

APPENDIX B1 STAGE DAMAGE FLOOD DATA

Depth Category		Residential Damage				Commercial Damage
From (m)	To (m)	Direct Damage	Indirect Damage (25% of direct)	External Damage (Vehicle)	Total Damage	
-0.20	0.00	$2,150	$538	$0	$2,688	$10,000
0.00	0.09	$3,310	$828	$0	$4,138	$20,000
0.09	0.10	$8,275	$2,069	$0	$10,344	$30,000
0.10	0.20	$10,290	$2,573	$0	$12,863	$40,000
0.20	0.30	$12,000	$3,000	$1,000	$16,000	$50,000
0.30	0.40	$13,520	$3,380	$1,000	$17,900	$60,000
0.40	0.50	$14,620	$3,655	$2,000	$20,275	$70,000
0.50	0.60	$15,670	$3,918	$2,000	$21,588	
0.60	0.70	$16,550	$4,138	$2,000	$22,688	
0.70	0.80	$17,380	$4,345	$2,000	$23,725	
0.80	0.90	$18,070	$4,518	$5,000	$27,588	
0.90	1.00	$18,480	$4,620	$5,000	$28,100	

APPENDIX B2
FLOOD DAMAGE ESTIMATES

APPENDIX B2 FLOOD DAMAGE ESTIMATES $

Condition/Option	Type of Property	Flood Severity PMF	1%	5%	20%	Average Annual Damages	Present Worth Damages*
Existing with no blockage at Narara Valley Drive culverts	residential	512,325	27,088	-	-		
	shop	70,000	20,000	10,000	-		
	total	582,325	47,088	10,000	-	3,883	53,600
Existing with Narara Valley Drive culverts 75% blocked	residential	571,425	93,088	19,025	5,375		
	shop	70,000	20,000	10,000	-		
	total	641,425	113,088	29,025	5,375	6,864	94,700
Existing Narara Valley Drive crossing, opposite Yurunga Avenue *(Tributary B)*	residential	238,200	148,140	97,000	20,690		
	shop	-	-	-	-		
	total	238,200	148,140	97,000	20,690	11,660	161,000
Narara Valley Drive Bridge	residential	460,413	17,575	-	-		
	shop	60,000	20,000	10,000	-		
	total	520,413	37,575	10,000	-	3,477	48,000
Koninderie Parade Channel improvements with Narara Valley Drive culverts 75% blocked	residential	297,594	62,200	14,888	2,688		
	shop	70,000	20,000	10,000	-		
	total	367,594	82,200	24,888	2,688	4,442	61,300
Deane Street Bridge Lengthening**	residential	17,900	-	-	-		
	shop	50,000	10,000	-	-		
	total	67,900	10,000	-	-	440	6,070
All options combined	residential		-	-	-		
	shop		-	-	-		
	total	n/c	-	-	-	n/c	n/c

*Note: 7% discount rate and 50 year life.
** For those houses/shops affected by the Deane Street bridge lengthening, the existing Present Worth Damages is $16,285.
N/c - Not calculated

APPENDIX B3
OPTION BENEFIT COST RATIOS

APPENDIX B3 OPTION BENEFIT COST RATIOS

Option	Reduction in Flood Damages ($)	Increased House Value* ($)	Total Benefit ($)	Total Cost ($)	Benefit Cost Ratio
Deane St Bridge Lengthening	10,200	15,000	25,000	85,000	0.3
Narara Valley Drive Bridge	46,700	180,000	226,700	445,000	0.5
Koninderie Parade Channel Improvements	33,400	135,000	198,400	315,000	0.5
Formalise floodflow across Narara Valley Drive at Yurunga Avenue	161,000	90,000	251,000	313,000	0.8

*Increased value of each residence no longer flood affected in the 1% AEP flood was $15,000

APPENDIX C
COST ESTIMATES

APPENDIX C COST ESTIMATES

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1. Deane Street Bridge Lengthening

- rebuild timber bridge to lengthen by 2 m;
- 10 m long x 8 m wide - 80 m^2
- 80 m^2 @ $ 1,000/m^2

		$ 80,000
	+ SID	$ 5,000
		$ 85,000

2. Narara Valley Drive Bridge

- remove existing culverts & disposal	$ 51,000		
- bridge works			
9 m wide x 22 m long			
198 m^2 @ $1,500/$m^2$	$297,000		
- roadworks and approaches	$ 21,000		$ 369,000
		+ SID	$ 76,000
			$ 445,000

3. Koninderie Parade Channel Improvements

- rock stabilised channel		
570 m @ $500/m		$ 285,000
	+ SID	$ 30,000
		$ 315,000

4. Formalise floodflow across Narara Valley Drive at Yurunga Avenue

a) Two 1.8 m dia Pipes Down Yurunga Ave

- 260 m @ $2,350/m	$611,000		
- other works: roadworks, headwalls etc.	$ 77,000		$ 688,000
		+ SID	$ 172,000
			$ 860,000

b) Culverts along Drainage Easement

- similar cost to (b)	$ 860,000

c) Overland Flow Path

- purchase two houses	$260,000		
- remove two houses	$ 5,000		
- brick walls 1130 x long x 1.2 m high 150 m^2 @ $99/$m^2$	$ 15,444		
- landscaping	$ 2,000		$ 282,444
		+ SID	$ 28,200
		say,	$ 313,000

5. Floodfree Access

a) One lane bridge over Tributary A at Hanlan Street

- timber bridge (4m W x 30m L)	$215,000		
- approaches	$ 15,000		$ 230,000
		+ SID	$ 46,000
		say,	$ 280,000

b) Low key road access between Haggerty Close and Willari Avenue

- construct 400m access road	$ 40,000		
- surface stabilisation	$ 5,000		$ 45,000
		+ SID	$ 5,000
		say,	$ 50,000

c) Purchase of Two Properties to Provide an Accessway

- purchase two houses	$260,000		
- remove two houses	$ 5,000		
- landscaping	$ 2,000		$ 267,000
		+ SID	$ 53,000
		say,	$ 320,000

d) Minor levee

	nom.	$ 50,000

6. Bank Stabilisation

a) Between Deane Street bridge and Narara Valley Drive culverts
- stabilise 500m of bank @ $500/m $250,000

b) Upstream of Koninderie Parade to the primary school
- stabilise 1,500m of bank @ $500/m $750,000

6. Acquisition of Affected Houses

- purchase 14 houses	$1,820,000	
- remove 14 houses	$ 40,000	
- landscaping	$ 15,000	$1,875,000
	+ SID	$ 188,000
	say,	$2,100,000

End of Report