Flood Study
South Kiama Subdivision
Rezoning
15158 – February 2021

siteplus

planning . engineering . landscape . design . management

FLOOD STUDY

SOUTH KIAMA SUBDIVISION

PREPARED FOR

White Constructions Pty Ltd

PREPARED BY

Site Plus Pty Ltd
(Siteplus)

Head Office: **345 Keira Street WOLLONGONG NSW 2520**
Telephone: (02) 4227 4233
Fax: (02) 4227 4133
E-mail: info@siteplus.com.au

Copyright ©:
This document is and shall remain the property of Site Plus (Siteplus) Pty Ltd. Unauthorised use of this document in any form whatsoever is prohibited.

Site Plus Pty. Ltd.
(Incorporated in NSW)
ACN 104 315 095

Document Tracking

Document Status		Report					
File Location		T:\Projects\15158 South Kiama\15158_SouthKiamaRezoning_FloodStudy_February 2021.doc					
Project No.		15158			Date		February 2021
Rev No	Issue	Author			Approved		
		Name	Signature	Date	Name	Signature	Date
1	Draft	Andrew Craddock			Ken Rootsey		
2	B	Dane Nethery		1.6.18	Andrew Craddock		1.6.18
3	C	Dane Nethery		31.10.18	Andrew Craddock		31.10.18
4	D	Dane Nethery		18.08.20	Andrew Craddock		18.08.20
5	E	Dane Nethery		12.02.21	Andrew Craddock		12.02.21

TABLE OF CONTENTS **Page No.**

EXECUTIVE SUMMARY 3

1. INTRODUCTION 1

1.1. Preliminary 1
1.1.1. Siteplus Engagement 1
1.1.2. Scope of Work 1
1.2. Subject Land 1
1.3. Existing Watercourses 2

2. DATA COLLECTION 4

2.1. Topographic Data 4
2.2. DEM Development 4

3. HYDROLOGICAL MODELLING 7

3.1. Selection of Hydrological Model 7
3.2. Design Rainfall 7
3.3. Design Rainfall Losses 8
3.4. Sub - Catchments 8
3.5. Results of Hydrological Modelling 10
3.5.1. WBNM Model Results 10

4. MODEL DEVELOPMENT 11

4.1. Introduction 11
4.2. Modelling Technique 11
Hydraulic Roughness 12
4.3. Design Rainfall Losses 12
4.4. Hydraulic Structures 12
4.5. Boundary Conditions 17
4.5.1. Rainfall Inflow Region 17
4.5.2. Inflow Boundary Condition 18
4.5.3. 2D Downstream Boundary Condition 21

5. MODEL RESULTS 22

5.1. Structure Blockages 22
5.2. Model Verification 22
5.3. Proposed Model Results 23

6. FLOOD LIABLE LAND 26

6.1. Chapter 29 Development Controls 26
6.2. Floor Levels 26
6.3. Flood Affectation 26
6.4. Evacuation 27
6.5. Management and Design 27

7. CONCLUSION 28

APPENDIX A RMS Work-as-Executed Plans 1
APPENDIX B Flood Mapping 2
APPENDIX C WBNM Text Files 3
APPENDIX D Inflow Hydrograph Details 44
APPENDIX E Table Summary of Results 53

LIST OF FIGURES

Figure 1-1 Study Area 3
Figure 2-1 Existing Catchment Topography 5
Figure 2-2 Proposed Catchment Topography 6
Figure 4-1 Existing Land Use Delineation 9
Figure 4-1 Existing Land Use Delineation 13
Figure 4-2 Proposed Land Use Delineation 14
Figure 4-3 Modelled Hydraulic Structures 19
Figure 4-4 Modelled Hydraulic Structures 20

LIST OF TABLES

Table 3-1 Design Rainfall Parameters 7
Table 3-2 Design Rainfall Losses 8
Table 3-3 Sub-Catchment Summary 8
Table 3-4 Peak Flow Summary 10
Table 4-1 Land Use Table 12
Table 4-2 Modelled Hydraulic Structures within the TUFLOW Model 15
Table 4-3 Blockage Applied to Hydraulic Structures 16
Table 4-4 Downstream Boundary Conditions 21
Table 5-1 Results Summary **Error! Bookmark not defined.**
Table 5-2 1% AEP Model Comparison 22
Table 5-3 1% AEP Cardno Model Verification 23

EXECUTIVE SUMMARY

On behalf of White Constructions Pty Ltd, Site Plus has prepared a flood study for the proposed rezoning of the land on the western side of the Princes Highway between Saddleback Mountain Road and Weir Street, Kiama.

The study site is current grazing agricultural land to the south west of the Kiama Town Centre and is contained on three sides by Saddleback Mountain Road to the north, The Princes Highway to the west and Weir street to the South.

The model also includes Munna Munnora Creek downstream to its outlet to the South Pacific Ocean at Easts Beach Holiday Park, to assess the developments impact on downstream properties.

The northern catchment that drains to the Bonaira Native Gardens has been extended downstream to Reid Street to assess the impact of the development on the downstream properties that lie within the basin upstream of the Railway line.

This report assesses the Hydrological and Hydraulic characteristics of the site and addresses a range of storm events ranging from the 20% Annual Exceedance Probability (AEP) through to the Probable Maximum Flood (PMF) flooding for the site in the pre development case and determines the flood impact of onsite for future development.

A numerical computer model was developed for the entire site and neighboring properties using TUFLOW 2018. The two-dimensional model represents surface flows in 2m grid. Existing culvert data has been attained from Work-as-Executed plans supplied by the Roads and Maritime Services (RMS), previous council approved studies and from Kiama Municipal Council engineering department.

The site is affected by four (4) main water courses which run from west to east across site and are conveyed beneath the Princes Highway. The major hydraulic structure influencing the site is the Highway embankment and the culverts conveying the water courses though it east towards the ocean.

It was found that the blockage factors applied to the culverts under the Princes Highway have a major impact on the upstream flood levels. However, all blockage scenarios modelled indicate that the site can be developed for residential development as majority of the site is not flood affected by all events including the PMF.

It is expected that land areas bound by flooding will have flood free access to either Weir Street or Saddleback Mountain Road as culverts or bridge systems will cater for all floods events up to PMF flood event.

A dam break assessment has been undertaken to demonstrate how upon failure, the two detention basins do not meet the requirements that would mean the dams do not have to be referred to Dam Safety NSW to be assessed as a Declared Dam.

1. INTRODUCTION

1.1. Preliminary

1.1.1. Siteplus Engagement

Site Plus has been commissioned by White Constructions Pty Ltd to prepare a flood study to support the proposed rezoning of grazing land in South Kiama.

1.1.2. Scope of Work

Siteplus determined the following investigations were required to complete a thorough flood study of the site:

- Construct a Hydrological model to determine the flow rates for a range of storms for the 20% AEP up to the PMF.
- Develop a 2D TUFLOW model to calculate the 20%, 10%, 5% and 1% AEP flood extents as well as PMF levels, velocities and hazards for the existing and proposed development scenarios.
- Evaluate the site in terms of Kiama Municipal Council's Floodplain Risk Management requirements and Flood Plain Development Manual; and
- Prepare a report which summarising the findings of the analysis.

1.2. Subject Land

The subject site is bound by the Princes Highway to the west, Saddleback Mountain Road to the North and Weir Street to the South.

Figure 1.1 illustrates the proposed rezoning area in relation to the surrounding Kiama Township, coast line and escapement.

The site currently contains open grazing land with a small extent of forest vegetation on the highway embankment in the south east portion of the site.

The catchments downstream of the Princes Highway contains some residential development within basins created by the existing rail corridor.

1.3. Existing Watercourses

The site is impacted by four main water courses which run west to east across the site.

The northern two water courses are 1st order natural overland flow paths which utilise existing culverts under the Princes Highway to convey flow east into the Muskfield Estate, before being conveyed beneath the rail corridor, ultimately discharging at Kendalls Beach. The two minor catchments are characterised by steep slopes covered with grazing paddocks.

The larger southernmost water course is the 3rd order Munna Munnora Creek which has an extensive catchment which travels west up into the escapement. It is made up of predominately agricultural grazing area with scattered farmhouses and forest on the steepest slopes.

The smaller class 1 southern water course forms a tributary to Munna Munnora creek.



Title:
South Kiama Study Area

Figure: **1.1**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus

2. DATA COLLECTION

2.1. Topographic Data

Topographic Data collated and used for this study includes:

- Work-as-Executed plans form the RMS for the highway surface levels, pipe inverts, and culvert entrance levels.
- Work-as-Executed plans for the Surfleet Place development.
- 1.0m DEM provided by NSW Government Spatial Services.

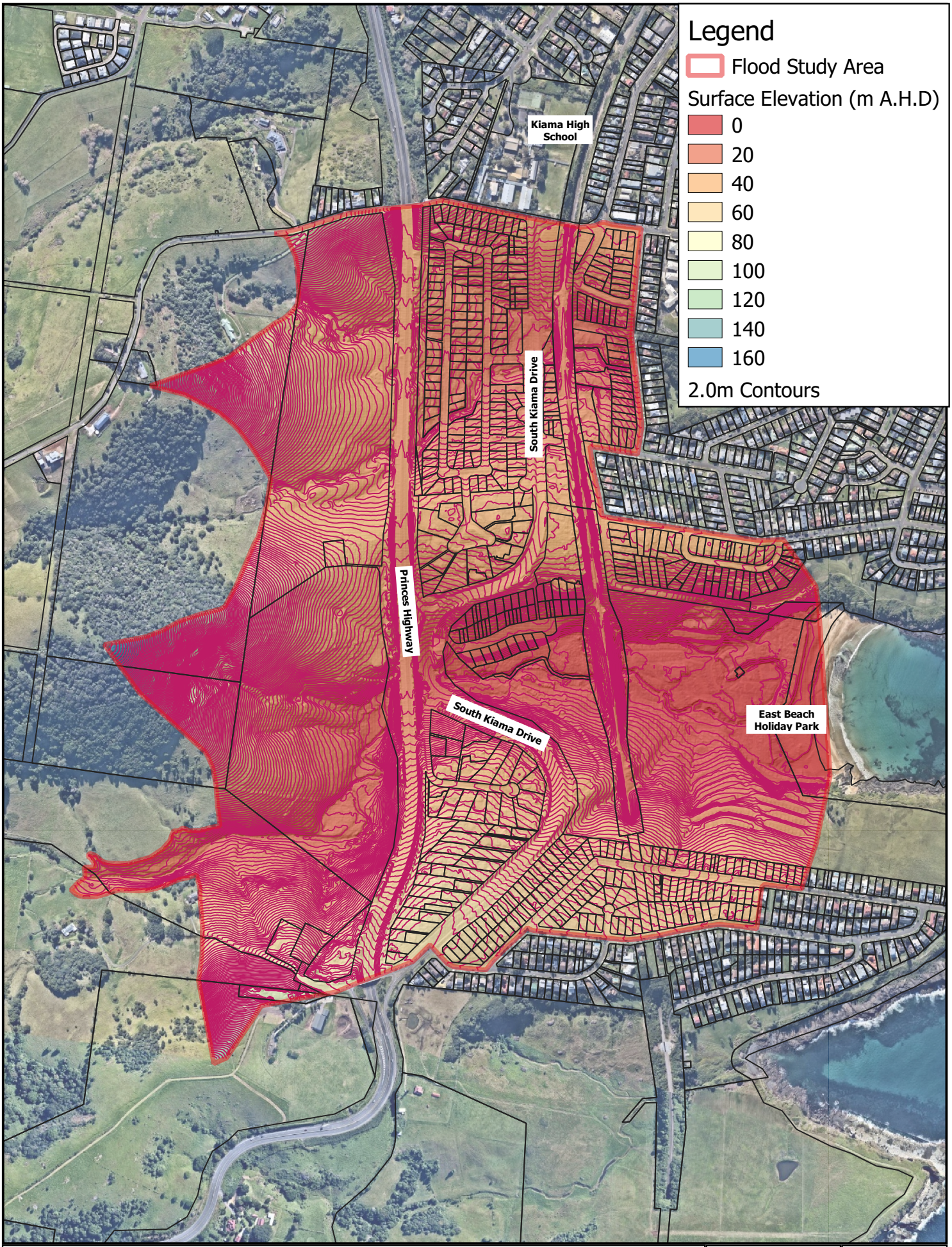
The above sources have been ground proven through onsite delineation.

2.2. DEM Development

The DEM data provided by the NSW Government Spatial Service was fed directly into the TUFLOW model and formed the existing topography. Modification was made to the surface via TUFLOW z shapes to accurately model the land modification as part of the Surfleet Place development that proceeded the DEM data.

Figure 2.1 shows the final DEM used within the model. Within the modelled catchment the elevation ranges from 1m AHD to 160m AHD. The steep water courses and valleys are clearly identifiable within the DEM along with the highway and railway embankment.

A proposed model DEM was developed within Civil 3D to represent the future development. This DEM was output from Civil 3D as a 0.5m DEM to accurately define the overland flow routes defined by kerb and guttering. This was layered on top of the existing DEM. Figure 2.2 shows the final proposed DEM read by TUFLOW and accurately depicts the overland flow routes and creek crossings.



Title:
Digital Elevation Model - Existing Model

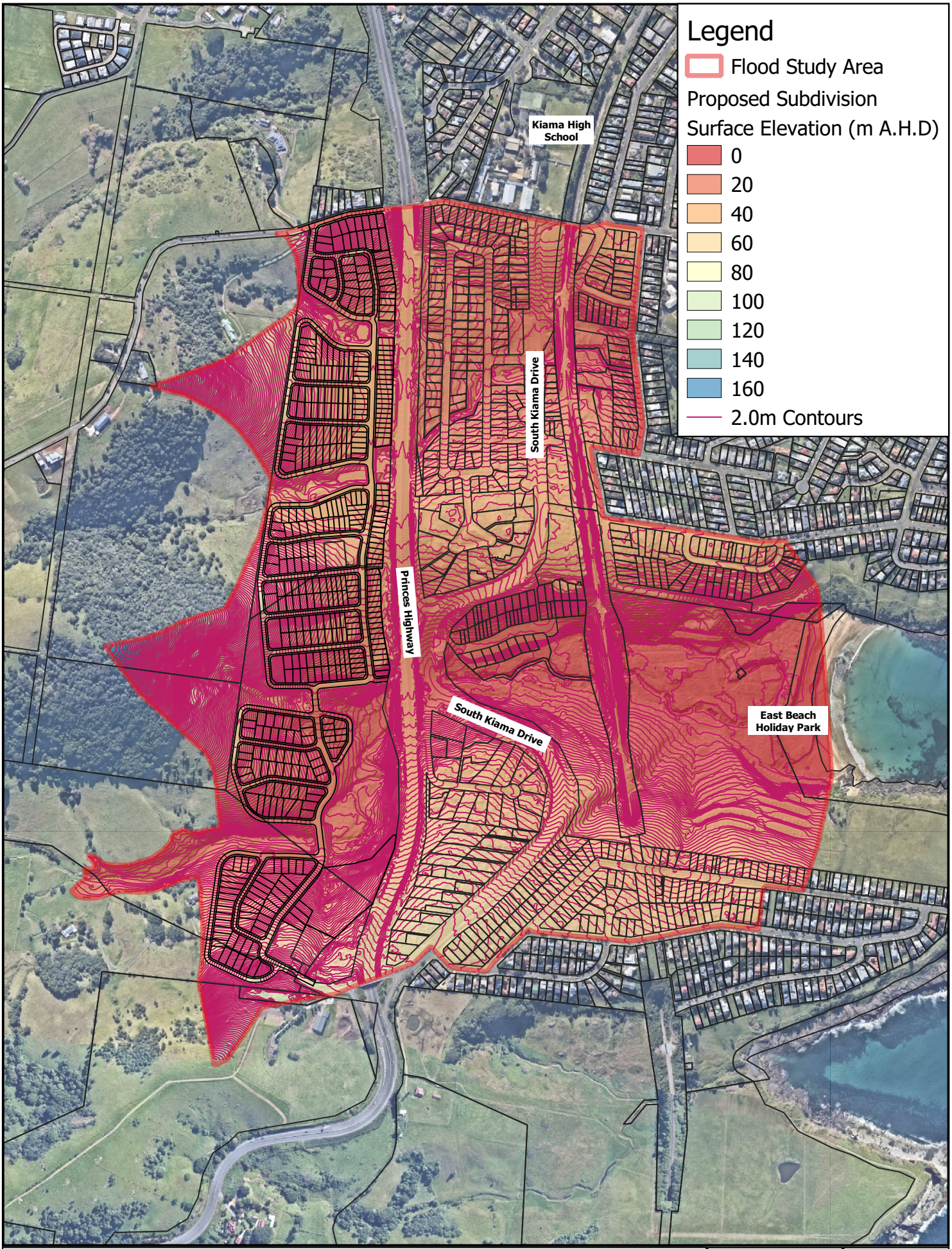
Figure: **2.1**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus



Title:

Digital Elevation Model - Proposed Development Model

Figure: **2.2**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus

3. HYDROLOGICAL MODELLING

3.1. Selection of Hydrological Model

The Watershed Bounded Network Model (WBNM) – 2007 - has been adopted for the hydrological analyses of the catchment upstream of the subject boundary in this study. WBNM has been used extensively in NSW and is accepted by most councils in the region.

The WBNM text files for the three catchments can be found in Appendix A if council would like to develop the model.

3.2. Design Rainfall

WBNM requires Temporal Patterns to determine the design rainfall intensities for a catchment as described in Australian Rainfall and Runoff (AR&R).

AR&R87 rainfalls hyetographs were produced by WBNM using the raw data provided by the BOM website for the catchment area at E: 301,850 and N: 6,159,300.

Table 3-1 Design Rainfall Parameters

Parameter	Location 3
50 year ARI, 1 hour intensity	97.35
50 year ARI, 12 hour intensity	20.36
50 year ARI, 72 hour intensity	6.73
2 year ARI, 1 hour intensity	46.25
2 year ARI, 12 hour intensity	9.81
2 year ARI, 72 hour intensity	2.72
F2 factor	4.27
F50 factor	15.81
Skew	0

ARR16 values and procedures were investigated as part of a concept DRAINS model and it was found, as is case in the whole Illawarra, that flows were reduced by approximately 20% over a range of storms events.

3.3. Design Rainfall Losses

Design Rainfall losses were applied to the WBNM model as follows. These numbers are conservative and assume that there has been some rainfall activity prior to the design burst as is common with catchments in close proximity to the escarpment.

Table 3-2 Design Rainfall Losses

Loss Parameter	Value (mm/hr)
Initial Loss	0.0
Continuing Loss (Pervious)	2.0
Continuing Loss (Impervious)	0.0

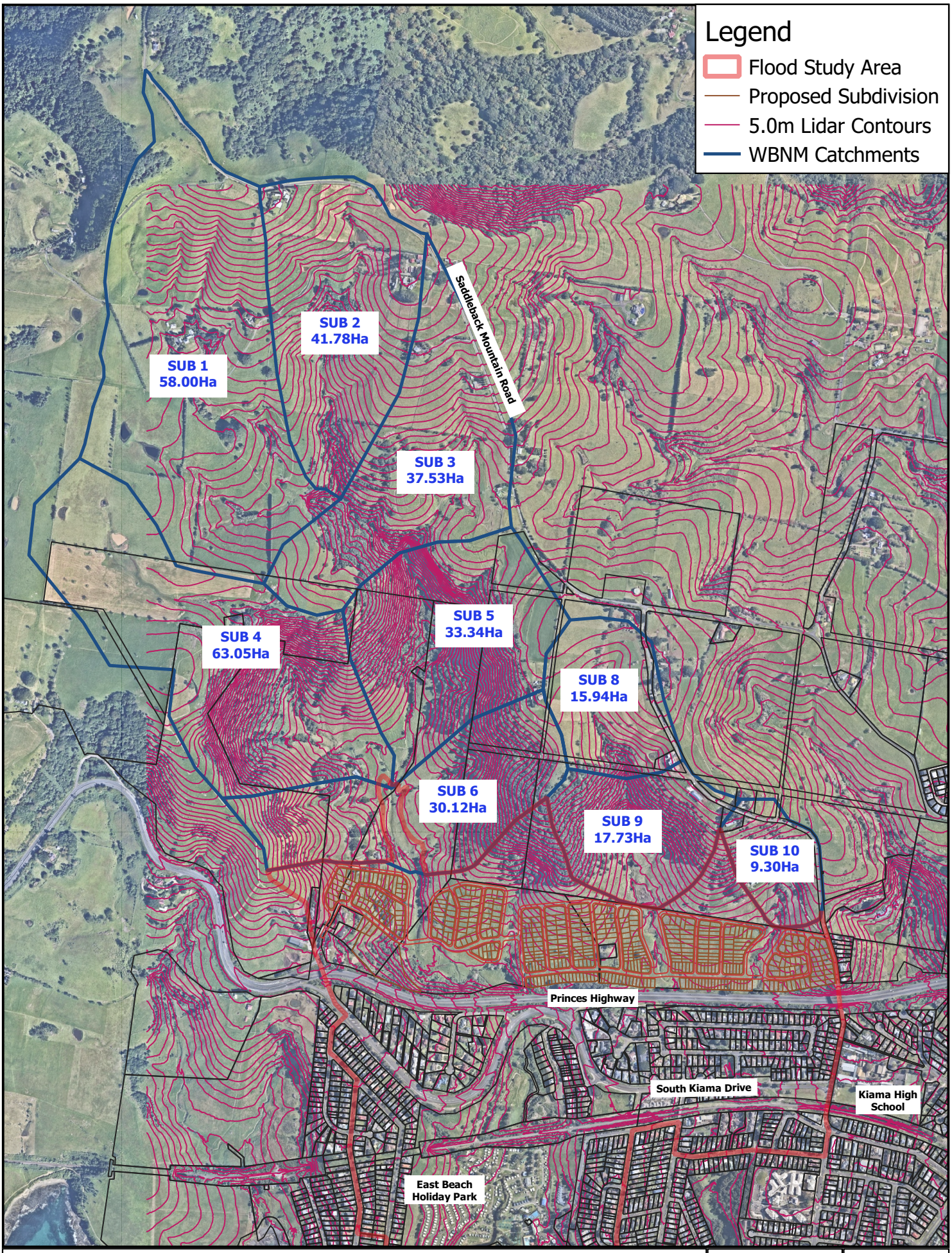
3.4. Sub - Catchments

The subject site was divided into three catchments and as such three different WBNM models were created. The southern catchment consisted of six sub catchments, the middle catchment two sub catchments and the northern catchment just a single sub catchment. The sub catchments are outlined in Table 3-3.

In order to identify the catchment boundaries a 1.0m DEM was accessed via the ELVIS website using data provided by the NSW Government Spatial Service. The survey was used to determine the sub-catchment boundaries and overland flow paths.

Table 3-3 Sub-Catchment Summary

Sub Catchment	Area (Ha)	Impervious %	Catchment Lag Parameter	Stream Lag Factor
Southern Catchment				
SUB1	58.00	0	1.0	
SUB2	41.78	0	1.0	
SUB3	37.53	0	1.0	0.5
SUB4	63.05	0	1.0	0.5
SUB5	33.34	0	1.0	0.5
SUB6	30.12	0	1.0	0.5
Total	286.57	0	1.0	
Middle Catchment				
SUB8	15.94	0	0.8	
SUB9	17.73	0	0.8	0.5
Total	33.67			
Northern Catchment				
SUB10	9.30	0	0.6	



Title:
South Kiama Study - WBNM Sub-catchments

Figure: **3.1**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus

3.5. Results of Hydrological Modelling

3.5.1. WBNM Model Results

A number of durations were modelled ranging from 30min to 270min for a range of events ranging from the 20% AEP event up to and including the PMF Event.

Inflow hydrographs developed by WBNM can be found in Appendix D. A summary of the peak flows for each event and catchment is included.

Table 3-4 Peak Flow Summary

Storm event Time (min)	Southern SUB6 (Upstream 1) Flowrate (m^3/s)	Middle SUB2 (Upstream 3) Flowrate (m^3/s)	Northern SUB1 Flowrate (m^3/s)
20% AEP			
60	46.70	7.96	4.19
90	46.69	8.26	**4.55**
120	**47.19**	**8.33**	4.28
180	30.89	6.71	3.37
10% AEP			
60	54.99	9.32	4.92
90	**55.12**	9.71	**5.33**
120	44.44	**9.77**	4.99
180	45.97	7.83	3.92
5% AEP			
60	65.86	11.12	5.89
90	66.23	11.63	**6.35**
120	**66.47**	**11.67**	5.92
180	55.30	9.30	4.63
1% AEP			
60	89.32	14.75	7.78
90	84.57	**15.32**	**8.27**
120	**89.69**	13.83	6.25
180	71.13	12.28	6.11
PMF			
30	**255.53**	**42.36**	**20.53**
60	250.17	39.16	19.27
120	197.09	28.94	8.48

Due to the storage effects of the Princes Highway and the proposed OSD structure, all hydrographs will be run through the TUFLOW model to determine the critical durations.

4. MODEL DEVELOPMENT

4.1. Introduction

The purpose of the flood modelling is to assess the existing flood characteristics of the catchment, the way flooding is conveyed through the proposed development and the impact the proposed development will have on the flood behaviour within the catchment. This includes the analysis of:

- Surface flows across the catchment.
- Flow within the culverts under the Princes Highway; and
- The impact of differing blockage factors applied to the culverts under the Princes highway.

To simulate these processes a numerical model was developed.

4.2. Modelling Technique

Due to the site being affected by a number of different water courses, Siteplus has adopted a 2D/1D hydrodynamic numerical model as they are currently the most accurate, cost effective and efficient tools to predict flood behaviour.

For this Study TUFLOW was chosen for the modelling for the following reasons:

- Accurately representing overland flow paths.
- Dynamically linking the 1D (culverts) to any point within the 2D model.
- Apply rainfall directly to the modelled area.
- Produce high quality map outs; and
- Is widely accepted by councils as the preferred 2D model.

This study utilises the TUFLOW 2018 release, which is the latest release at the time of the study.

Hydraulic Roughness

Roughness coefficients represent the resistance to flood flows in channels and floodplains. The land use delineation for the model is based on aerial photography and observations during site visits. The land use delineation used in the TUFLOW model is presented in Figures 4.1 and 4.2.

In order to accurately represent the hydraulic characteristics of the study area, a variable depth dependent hydraulic roughness value was applied in the TUFLOW model. For land uses such as roads, forest and Riparian Channels, a higher roughness value was applied at shallow flood depths to account for increased friction losses when sheet flow occurs. The adopted Manning's 'n' roughness coefficients for the land uses within the 2D hydraulic model extent are listed in Table 4.1.

4.3. Design Rainfall Losses

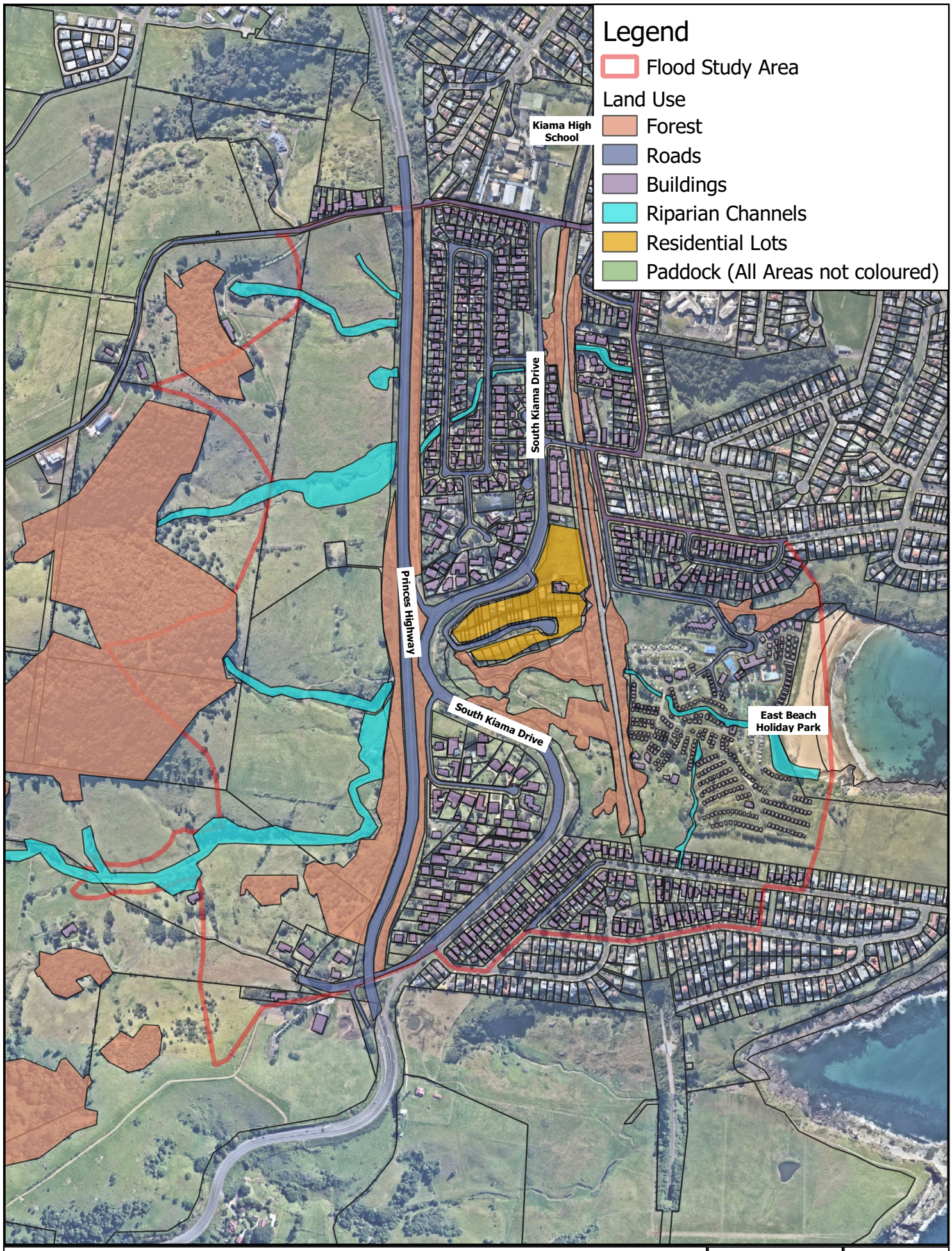
Standard design loss values were applied to the various land uses discretised in the TUFLOW model, based on the imperviousness of the land use. The adopted initial and continuing rainfall losses are presented in Table 4-1.

Table 4-1 Land Use Table

Land Use	Manning's 'n' Depth ≤ 30mm	Manning's 'n' Depth ≤ 100mm	Initial Loss (mm)	Continuing Loss (mm)
Forest	0.10	0.05	30	2.5
Roads	0.02	0.02	0	2.5
Buildings	0.012	0.4	0	2.5
Riparian Channels	0.09	0.09	10	2.5
Lots	0.15	0.15	2	2.5
Paddock	0.1	0.03	20	2.5
Note: Uncoloured or un shaded areas in Figure 3.1 have been modelled as Paddock.				

4.4. Hydraulic Structures

There are five (5) existing culverts beneath the Princes Highway conveying all the stormwater from the site to the downstream catchments. Beyond this there are several culverts conveying flow to the rail corridor. A single culvert then relieves each of the two (2) basins with which both catchments drain to. These existing hydraulic structures are identified in Figure 4.3 and detailed in Table 4-2.



Title:
South Kiama - Existing Land Use

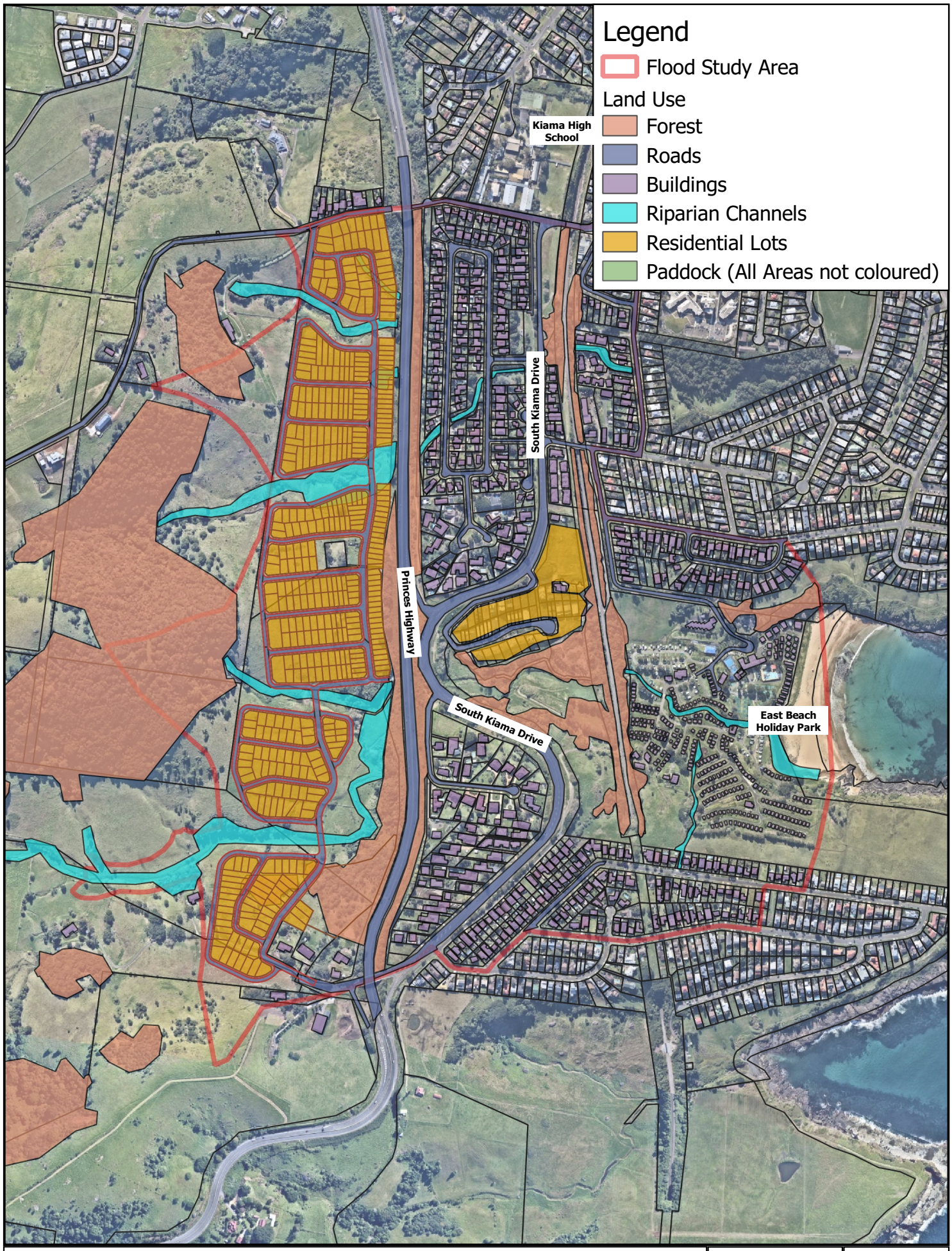
Figure: **4.1**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus



Title:
South Kiama - Proposed Land Use

Figure: **4.2**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus

As part of the road crossing of the watercourses within the site, five (5) culvert crossing are proposed and modelled within TUFLOW. These culverts are designed to convey flows up to an including the 1% AEP event with 500mm freeboard to the road reserve. Proposed culverts are identified in Table 4-2. Table 4-3 outlines the blockage applied to each modelled culvert.

ARR 2019 Book 6 Chapter 6 procedure has been applied to determine the blockage for each culvert. Blockage for the Princes Highway culverts varies between the existing and proposed runs due to mitigation measures outlined below.

Table 4-2 Modelled Hydraulic Structures within the TUFLOW Model

Structure ID	Street or Landmark	Structure Type	Structure Details	Structure Dimensions
Existing				
North 1	Princes Highway	Culvert	1 Circular Culvert	1.65m Diameter
North 2	Princes Highway	Culvert	1 Circular Culvert	0.9m Diameter
Central 1	Princes Highway	Culvert	2 Circular Culverts	2x1.65m Diameter
Central 2	Princes Highway	Culvert	1 Circular Culvert	1.05m Diameter
Road Under	Princes Highway	Road	Steel Arch	5x3.5m Arch opening
Munna 1	South Kiama Drive	Culvert	4 Rectangular Culverts	4x2.37x2.1m Openings
Munna 2	Princes Highway	Culvert	3 Circular Culverts	3x2.85m Diameter
Railway 1	Railway Embankment	Culvert	1 “Horseshoe” Concrete Arch	3.1 3.1m Arch Opening
Railway 2	Railway Embankment	Culvert	1 Circular Culvert	1.50m Diameter
Muskfield Estate 1	Hillview Court	Culvert	1 Circular Culvert	1.50m Diameter
Muskfield Estate 2	Inter-allotment	Culvert	1 Circular Culvert	0.90m Diameter
Muskfield Estate 3	Hillview Court	Culvert	1 Circular Culvert	0.90m Diameter
Muskfield Estate 4	Inter-allotment	Culvert	1 Circular Culvert	0.90m Diameter
Muskfield Estate 5	Hillview Court	Culvert	1 Circular Culvert	1.80m Diameter
Muskfield Estate 6	South Kiama Drive	Culvert	1 Circular Culvert	1.50m Diameter

Structure ID	Street or Landmark	Structure Type	Structure Details	Structure Dimensions
Proposed				
Culvert 1	Road No.1	Culvert	1 Circular Culvert (US Inv. RL.33.360)	1.65m Diameter
Culvert 2	Road No.1	Culvert	1 Circular Culvert (US Inv. RL.32.320)	1.65m Diameter
Culvert 3	Road No.1	Culvert	3 Box Culv. (US Inv. RL.35.280)	3x0.90x1.80m Openings
Culvert 4	Road No.1	Culvert	2 Circular Culverts (US Inv. RL.24.160)	2x1.50m Diameter
Culvert 5	Road No.1	Bridge	12.0m clear span. (US Inv. RL.15.94)	12.0x2.0m Openings
Refer to Figure 3.2 for diagram of structure location and Appendix A for RMS Work as Executed Drawings.				

Table 4-3 Blockage Applied to Hydraulic Structures

Structure ID	Blockage Applied in Each Scenario (%)						
	20% AEP	10% AEP	5% AEP	1% AEP	PMF	Cul. Dia (m)	L_{10} (m)
North 1 - Existing	25	25	50	50	100	1.65	3.0
North 1 - Proposed	10	10	20	20	20		1.5
North 2 - Existing	25	25	50	50	100	0.90	3.0
North 2 - Proposed	0	0	0	0	10		0.5
Central 1 - Existing	25	25	50	50	100	1.65	3.0
Central 1 - Proposed	10	10	20	20	20		1.5
Central 2 - Existing	25	25	50	50	100	1.05	3.0
Central 2 - Proposed	10	10	20	20	20		0.9
Road Under	0	0	0	0	10	5.00	1.5
Munna 1 - Existing	25	25	50	50	100	2.85	3.0
Munna 1 - Proposed	10	20	20	20	20		1.5
Munna 2	0	0	10	10	20	2.37	1.5
Railway 1	10	10	20	20	20	3.10	1.5
Railway 2	25	25	50	50	100	1.50	1.5
Muskfield Est. 1	25	25	50	50	100	1.50	1.5
Muskfield Est. 2	25	25	50	50	100	0.90	1.5
Muskfield Est. 3	0	0	0	0	0	0.90	1.5
Muskfield Est. 4	0	0	0	0	0	0.90	1.5

Muskfield Est. 5	0	0	10	10	20	1.80	1.5
Muskfield Est. 6	25	25	50	50	100	1.50	1.5
Culvert 1	10	10	20	20	20	1.65	1.5
Culvert 2	10	10	20	20	20	1.65	1.5
Culvert 3	10	10	20	20	20	1.80	1.5
Culvert 4	10	10	20	20	20	1.50	1.5
Culvert 5	0	0	0	0	10	12.0	1.5

As part of the Development Application and Construction certificate works at least two protection measures will be proposed upstream of proposed headwalls and existing culverts beneath the Princes Highway to ensure that the likely hood of blockage is greatly reduced. These may include but are not limited to debris deflector walls fitted to headwalls, construction of debris catchpoles spaced accordingly to the downstream culverts size and creation of 'wet' and 'dry' cells at multi cell box culverts. Suitable ramp access will be constructed to each protection measure sized for the appropriate council machine to ensure that the features can be maintained between stormevents.

In order to provide protection to the downstream properties within the existing Muskfield Estate (Northern Catchment) from increases in flood extents due to the proposed development, OSD is required as part of the road crossing at Culvert 2 and Culvert 3. As these are 1st order creeks, in stream OSD is a suitable proposal. OSD will be formed by building up the Road Crossing of the creeks as a berm with minimal modification to the creek alignment.

No other catchments have OSD proposed as it is not required to ensure there are no adverse effects due to flooding on other properties within the modelled catchment.

4.5. Boundary Conditions

The inflow and outflow boundary conditions are required for the TUFLOW model.

The TUFLOW model created for the subject site include three boundary conditions which are:

1. Application of direct rainfall;
2. Inflow hydrographs; and
3. Water level at the downstream boundary.

4.5.1. Rainfall Inflow Region

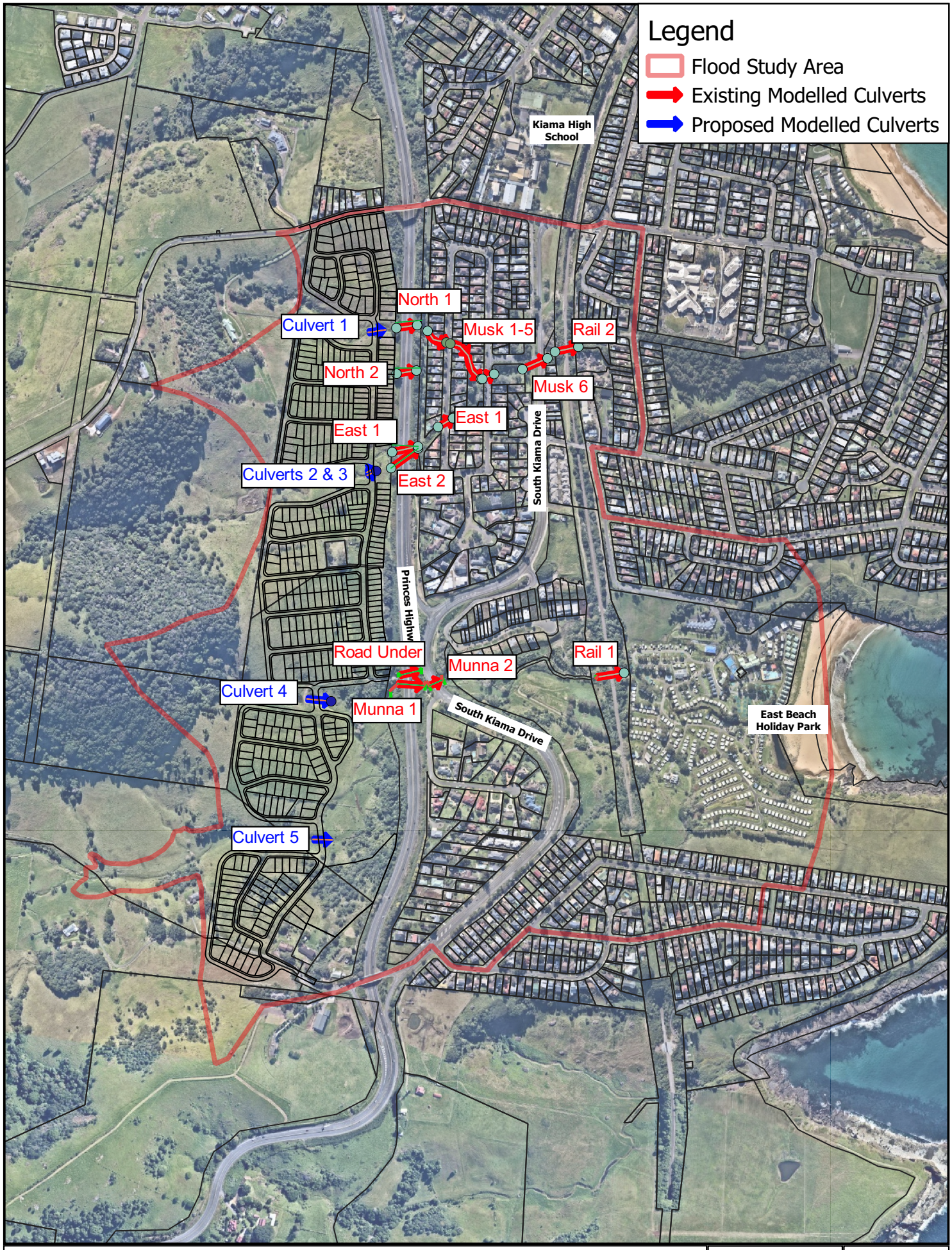
Due to the urban nature of the proposed development a direct rainfall approach has been adopted for the whole modelled catchment. Rainfall hyetographs were extracted from the WBNM model as outlined in section 3 of this report and applied to the entire model.

In order to model an increase in the peak rainfall due to the projected climate change by 2070, the rainfall hyetographs were multiplied by 12%, the appropriate value for the southern rivers of NSW as outlined in the Department of Planning, Industry and Environment (DPIE), Floodplain Risk Management Guideline: Practical Consideration of Climate Change.

4.5.2. Inflow Boundary Condition

To increase the stability of the model and reduce unnecessary run times the upstream catchments were modelled in WBNM and applied as inflow hydrographs at the appropriate locations. The details of these hydrographs are included in Appendix D and the location is shown in Figure 4.4.

As was the case with the Rainfall Inflow Region, hyetographs were multiplied by 12% and re-run within WBNM to obtain the inflow hydrographs to replicate the projected increase in peak rainfall due to the 2070 climate change projections.

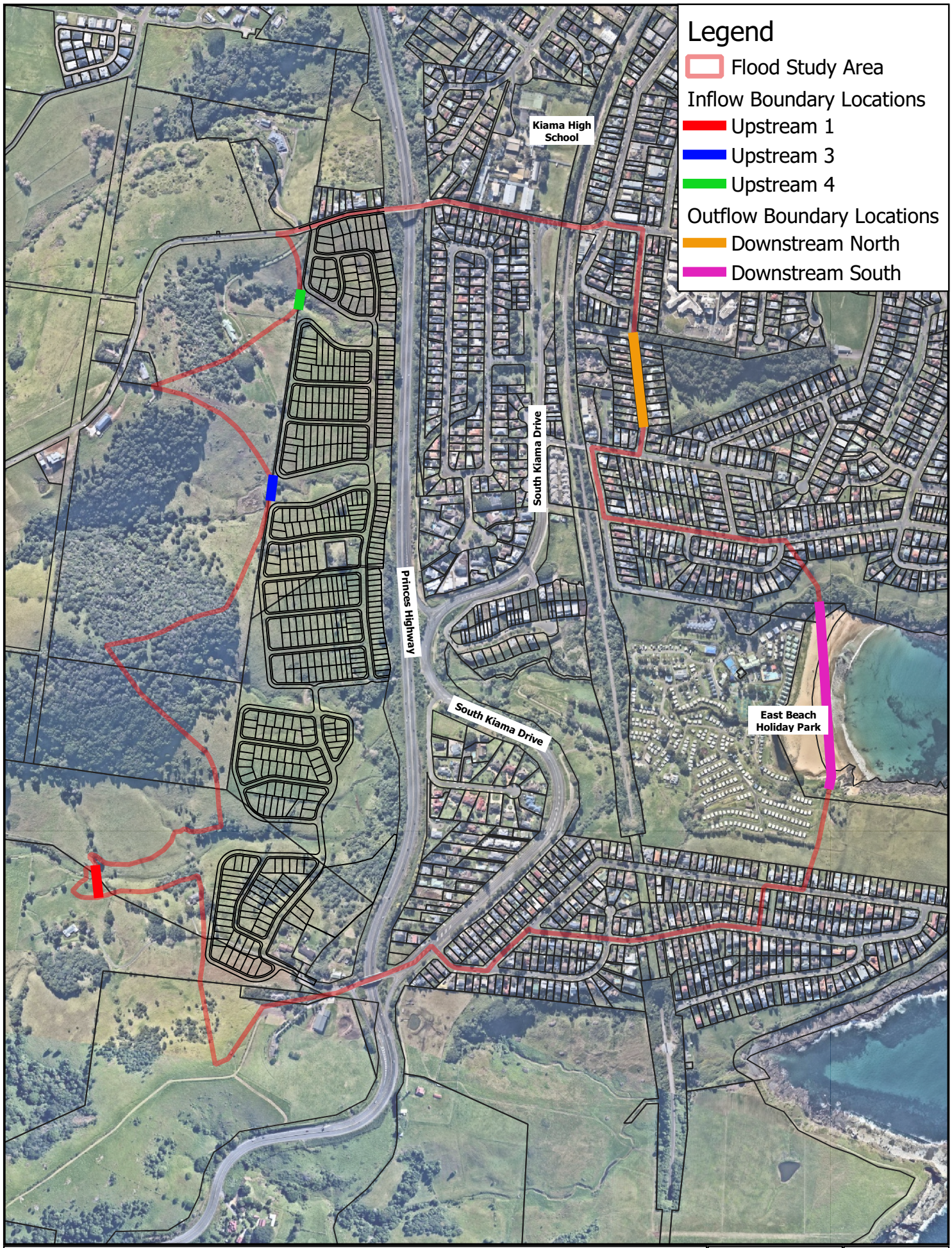


Title:
South Kiama - Modelled Hydraulic Structures

Figure: **4.3**

Rev: **C**

siteplus



Title:
South Kiama - Modelled Boundary Conditions

Figure: **4.4**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus

4.5.3. 2D Downstream Boundary Condition

Two 2D downstream boundary conditions have been applied to the model. The purpose of these boundaries is to set a receiving water level in each catchment representing certain conditions based on the scenario run. This allows for an impact assessment on the downstream developments.

Within the Munna Munnora catchment the downstream boundary condition has been located within Easts Beach to model the interaction between flooding and tide levels. Guidance was sought from the NSW Department of Planning, Industry and Environment (DPIE), Floodplain Risk Management Guideline: Modelling the Interaction of Catchment Flooding and Oceanic Inundation in Coastal Waterways. Table 4-4 below outlines the water level over time for each scenario modelled. 300mm was added initially for the Climate Change sensitivity and as explained later in the report, had little impact on the model due to the drop past the dune.

The northern catchment has been extended significantly past the last basin in the catchment. Beyond this there are no significant trapped low points that will be affected by increased run off from the proposed development. The boundary condition is located behind Reid Street which is acting as a weir across the unnamed creek. The weir level is approximately 1.0m lower than the upstream pipe outlet so doesn't have a significant effect on the outlet water level for the Muskfield Estate basin.

Table 4-4 Downstream Boundary Conditions

Time (hours)	Unblocked	Blockage Applied Scenario					
	All AEP	20% AEP	10% AEP	5% AEP	1% AEP	PMF	Climate Change
Downstream South							
0	0	1.35	1.35	1.45	1.45	1.45	1.75
100	0	1.35	1.35	1.45	1.45	1.45	1.75
Downstream North							
0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0

5. MODEL RESULTS

5.1. Structure Blockages

Referring to the modelled hydraulic structures in Table 3.2, it can be seen that the culvert dimensions vary in both size and configuration.

Several model simulations have been undertaken to identify the flood level range for a combination of blocked, percentage blocked and unblocked culverts scenarios.

A table summarising the peak water levels is shown in Appendix E. It can be seen that conduit blockage had a significant effect on raising the flood levels in the site. As such, any future flood planning level for the site will have to take into account blocked scenario runs.

5.2. Model Verification

At the time of the flood study Kiama Council have not completed a flood study in the downstream catchment and have no known gauging data to calibrate to model with.

Therefore, to verify the model a number of 1D models where created using DRAINS and HEC-RAS of the Southern major water course to determine the validity of the TUFLOW model, the results indicated that the Princes Highway culverts were inlet controlled via the culvert diameter and head of water influencing the culvert.

Table 5-1 1% AEP Model Comparison

Structure ID	Structure Dimensions	TUFLOW Unblocked Level (m AHD)	DRAINS Unblocked Level (m AHD)	HEC-RAS Unblocked Level (m AHD)
South 2	3x2.85m Diameter Pipes	14.68	13.78	15.53

Table 5-2 shows that the TUFLOW model sits between the two one dimensional models. This is an expected result as the HEC-RAS model has been modelled using steady state peak flows with no allowance for storage effects. The DRAINS model simply using an energy head calculation which does not factor in entry losses. As the flood storage in the model for the above structure is approximately 24,134m^3, neglecting this will have a large effect on the model results as shown in Table 5.2 above. Therefore, the TUFLOW model is considered the most accurate.

Table 5-2 1% AEP Cardno Model Verification

Study	Water Level Upstream of Rail Embankment (m AHD)		Flow Through Culverts Beneath Princes Highway (m^3/s)	
	Unblocked Scenario	Blocked Scenario	Unblocked Scenario	50% Blocked Scenario
Cardno Footprint Engineering	10.10	12.10	74	-
SitePlus	10.92	11.48	91.62	88.03

Table 5-3 outlines the surface water levels in the ponding upstream of the railway embankment for both the Cardno/Footprint Engineering Study as well as the SitePlus study. This table identifies that the SitePlus study is more conservative in the water level for the unblocked scenario. The Cardno studied applied a blanket 50% blockage in the blocked run compared to the Siteplus 20% based on ARR19 and therefore results in a less conservative approach.

This variation is acceptable due to the variations in the methods used. The Cardno/Footprint Engineering Study utilises the HEC-RAS program, which utilises a 1D computational method. This relies on a stage storage discharge supplied by the modeller to determine storage within a pond situation which can result in errors. The TUFLOW model is a 2D model which uses a DEM to determine the storage behind the embankment.

Flows into the basin upstream of the Railway Embankment are also higher in the Siteplus model. This may be down to the way in which the Cardno model treated the Basin upstream of the Princes Highway embankment in regards to storage and blockage factors of the culverts beneath the road.

5.3. Proposed Model Results

Based on the levels discussed above, the blockage factor is the major influencing control for flood behaviour within the subject site. However, based on the range of blockage factors modelled it is clear that the site has large portions of flood free areas where development can be supported in terms of flooding.

For the purpose of assessing the proposed site in terms of its effectiveness in safely conveying stormwater in events up to and including the 1% AEP, the worst case of both blocked and unblocked scenarios should be considered. It should be noted that as there is no drainage network included in the model, there is nothing to relieve SAG points leaving the road network more flooded then will be the case when the stormwater network is added at SWC Stage.

As can been seen from the results, all proposed culverts and the bridge adequately convey stormwater without inundation of the road above. All building envelopes within the regular setbacks are above the 1% AEP level plus an adopted freeboard of 500mm inline with Kiama Municipal Council's DCP. The subdivision has been designed so that when 2070 Climate Change Projections are applied to model, a freeboard to all residential lots will be maintained Small patches of stormwater visible on lots are a result of the absence of a stormwater network and will be addressed at the development application stage.

Within the subdivision, in all events up to and including the 1% AEP event, hazard categories of H2 (unsafe for small vehicles) or higher are only located within watercourses with adequate freeboard to private property. This means that the subdivision is suitable for all vehicles and pedestrians in all these events. These hazard categories are categorised according to ARR 2019 figure 6.7.9.

In the PMF event, overtopping of the roads at culvert crossings occur but is managed to a level that is suitable for evacuation by a suitably sized vehicle or by pedestrians at all crossing except at Munna Munnora Creek. That means that if required, emergency evacuation can occur from the subdivision to the North and South if required,

Impact mapping for all events up to and including the 1% AEP event is managed so that there is no significant increase on flooding in any of the downstream catchments. In the PMF there is an increase of approximately 200mm in Munna Munnora Creek between the Princes Highway and Rail Corridor. This increase in such a rare event has no effect on the small number of properties within Surfleet Place as they were already at least 3.0m under water in the existing scenario which would inundate both floors of a two storey building meaning that a dwelling would not be a suitable place of refuge in that event. Hazard Categories remain substantially unchanged along Surfleet Place thus not affecting evacuation routes.

A sensitivity analysis was undertaken utilising the 2070 climate change projection with blockage vs the 1% AEP event with blockage applied. There were major impacts in the southern Munna Munnora catchment of up to 1.0m. Within other catchments the maximum water level increase is 100mm. As such measures will be taken at DA stage to ensure building pads are located above these projected levels.

5.4. Dam Break Assessment

A dam break assessment was undertaken inline with the Dam Safety Guidelines for referral of a dam to Dam Safety. Both OSD basins where breached when the water level reached its

peak in the blocked scenario and an impact assessment undertaken. The flood mapping is shown on sheets 15158.F54-F59.C in Appendix B.

As can be seen in the modelling, the following assessment can be made of the dam breach scenario:

1. The significant impact of the dam breach is concentrated to areas where there is no human habitation. It is limited to the riparian corridors immediately downstream of the OSD basins.
2. There is a small increase in affectation on the Princes Highway external to the traffic lanes that is of a low hazard so as to affect the function of the trafficable lanes or pose risk to a vehicle seeking refuge on the shoulder.
3. In the downstream housing estate, there is a small increase in flood levels to less than 300mm. As such, they will not be considered as Person's at Risk. (PAR).
4. The OSD embankments are both under 5.0m and therefore less than the 15.0m required for automatic referral to Dam Safety.

Due to the Dam Break scenario generating no PAR's and being under the necessary height levels, the two proposed OSD embankments would not require referral to Dam Safety for a Declared Dam Assessment.

6. FLOOD LIABLE LAND

6.1. Chapter 29 Development Controls

Using Chapter 2 Topic 2.5 Flood Prone Land from Kiama Council's DCP, the following standard requirements must be addressed when considering development of the site.

The flood study has been undertaken for rezoning purposes and the headings below outline how with the use of this study can develop the site safely in terms of Flood Risk Management.

The flood study has modelled a range of events from the 20% AEP up to the PMF event and provided depth mapping for both the pre and post developed scenario. Flood velocities, hazard categories and provisional hydraulic categories have been provided for both the 1% AEP and PMF events for the pre and post developed scenario.

Provisional hydraulic categories have been provided based on the following:

- Floodway – Velocity x Depth>0.25m^2/s and Velocity>0.25m/s or Velocity > 1m/s.
- Flood Storage – Anything not floodway with depth greater 0.25m.
- Flood Fringe – All other areas.

This has been based on existing studies within neighbouring catchments in the Illawarra and an approach adopted in many flood studies.

6.2. Floor Levels

The future dwellings and lots after the rezoning is to be above 1% AEP flood level plus freeboard 0.5m freeboard. This level will be set at the development application stage and no lots developable area will be located within the 1% AEP flood extents for the post development scenario. A sensitivity test for has been conducted for the catchment considering 2070 Climate Projections in Plan 15158.F53 in Appendix B. Due to the increase in water levels, freeboard will be maintained from the Projected Level rather than the existing flow rates.

6.3. Flood Affectation

The proposed development will ensure that all adverse flood affects are controlled within the subject site and that no adjoining properties are unduly affected by flooding as a result of the development.

6.4. Evacuation

During both the 1% AEP and PMF flood events safe evacuation is required for all occupants onsite. It is expected that the natural water courses will be bridged or piped in a manner which will allows vehicular access to every proposed lot or proposed dwelling location.

It is expected that an emergency access to the site be provided at both Saddleback Mountain Road and Weir Street with a third possible access via the existing one-way road to South Kiama Drive.

Emergency evacuation for all lots North of Munna Munnora Creek Culvert Crossing will be via Saddleback Mountain Road whilst all lots to the South will be via Weir Street. As shown in the flood modelling, these routes are provided with a flood free access or flooding of Low Hydraulic hazard (H1 or H2 category in the PMF event).

6.5. Management and Design

The proposed design allows the 1% AEP storm event to safely travel around the site reducing the impact on downstream properties and flood risk within the surrounding area.

7. CONCLUSION

Whites Constructions Pty Ltd is seeking a rezoning the of subject site bound by the Princes Highway to the west, Saddleback Mountain Road to the North and Weir Street to the South for residential development.

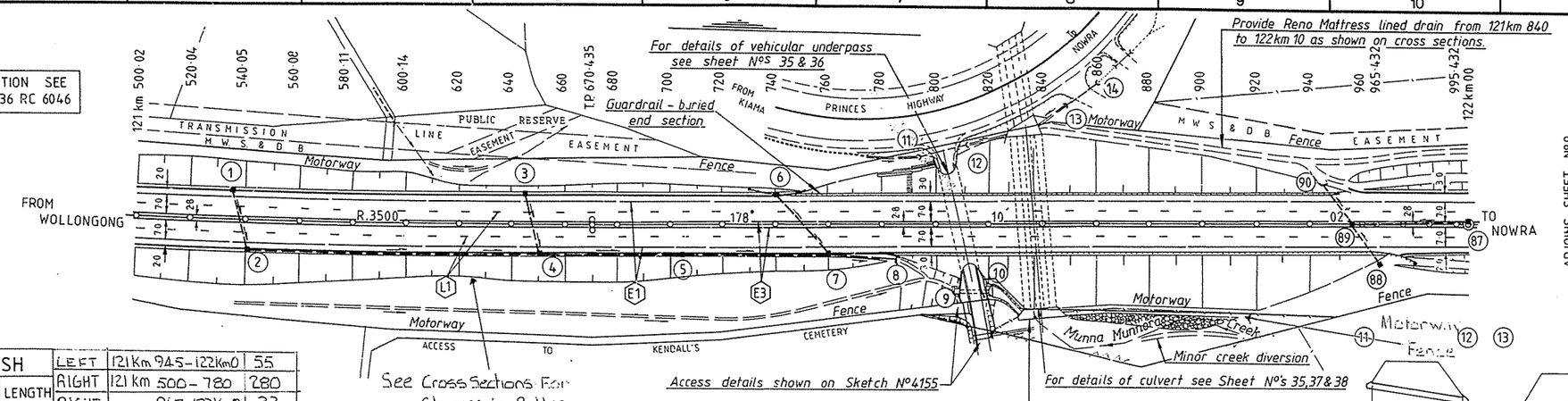
The following conclusions can be made regarding the flood study:

- Large portions of the site are flood free and will not be burden by flooding.
- When applied, the adopted blockage factors allow for a safe development. The proposed development takes these blockage factors into account when sizing culverts and considering emergency routes through the site.
- During the development application stage water course crossings using bridge or culvert structures are considered appropriate for the current site flooding and natural topography.
- No referral is required to Dam Safety NSW due to the safe conveyance of flood water in the dam break scenario generating no PAR.

The flood extents are graphically illustrated in Appendix C.

APPENDIX A
RMS Work-as-Executed Plans

FOR ADJOINING SECTION SEE PLANS REG Nº 0001 236 RC 6046



DRAINAGE & LINEMARKING PLAN

LEGEND

- Gutter type SH
- Gully pit
- Drainage pipe
- Catch drain
- Guardrail
- Batter drain

ADJOINS SHEET Nº 9

GUTTER TYPE SH

	LOCATION	LENGTH
LEFT	121km 500 — 750	250
~~LEFT~~	~~950 — 122km00~~	~~50~~
RIGHT	~~121km 500 — 785~~	~~285~~
RIGHT	~~970 — 122km00~~	~~30~~

GUTTER TYPE SE

LEFT	121km500 — 122km00	500
RIGHT	121km 500 — 122km00	500

GUTTER TYPE SG

LEFT	121km750 — 950	200
~~RIGHT~~	~~121km785 — 970~~	~~185~~
RIGHT	121km780 — 970	190

LEFT	121km 945 - 122km0	55
RIGHT	121 km 500 - 780	280
RIGHT	967-122km0	33

GUARDRAIL

LOCATION		LENGTH
~~LEFT~~	~~121km730 — 952~~	~~222~~
RIGHT	780 — 980	200
LEFT	121km 741 — 952	210

LINED DRAINS

LEFT	121km 774 — 795	21
LEFT	121km 812 — 827	16
LEFT	121km 839 — 850	13
LEFT	121km840 — 122km00	160
RIGHT	121km700 — 807	110
RIGHT	121 km 786 — 796	13
RIGHT	121km 821 — 831	14

PIPE DETAILS

FROM	TO	DIA	CLASS	PIPE INSTAL	JOINT	LENGTH
1	2	375	Z	NT	R	21·96
2	4	375	X	NT	R	109·80
3	4	375	Z	NT	R	21·96
4	5	525	X	NT	R	54·90
5	7	600	X	NT	R	109·80
6	7	375	Z	NT	R	30·50
7	8	675	X	NT	R	25·62
9	10	1200	Y	NT	R	10·98
11	12	450	X	NT	R	17·08
13	14	750	X	NT	R	14·64
88	89	375	X	NT	R	19·52
89	90	900	X	NT	R	19·52

NT denotes — Normal trench

R denotes — Rubber ring joint

W.A.E.

NOTES

DESIGN STORM RECURRENCE INTERVAL

(a) NEW SURFACE DRAINAGE MAXIMUM INTENSITY — 5 YEARS, 192 mm/hr

(b) CROSS DRAINAGE MAXIMUM INTENSITY — 50 YEARS, 295 mm/hr

PIPE FLOW VALUES LESS THAN 0·01 CUMECS ARE NOT SHOWN.

SUBSOIL DRAINS

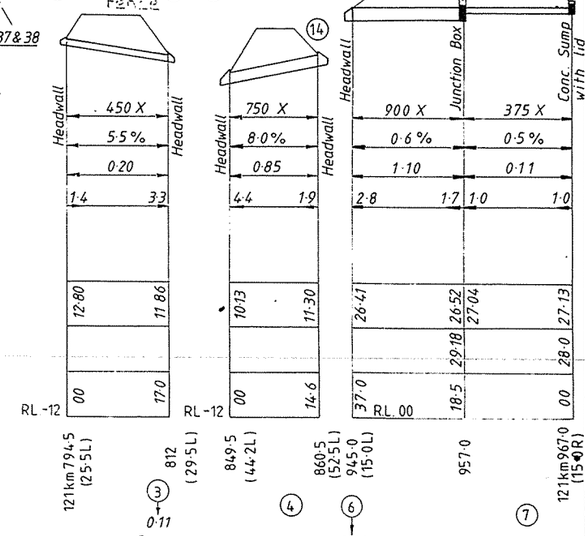
(a) TOTAL LENGTH REQUIRED — 1500 m.

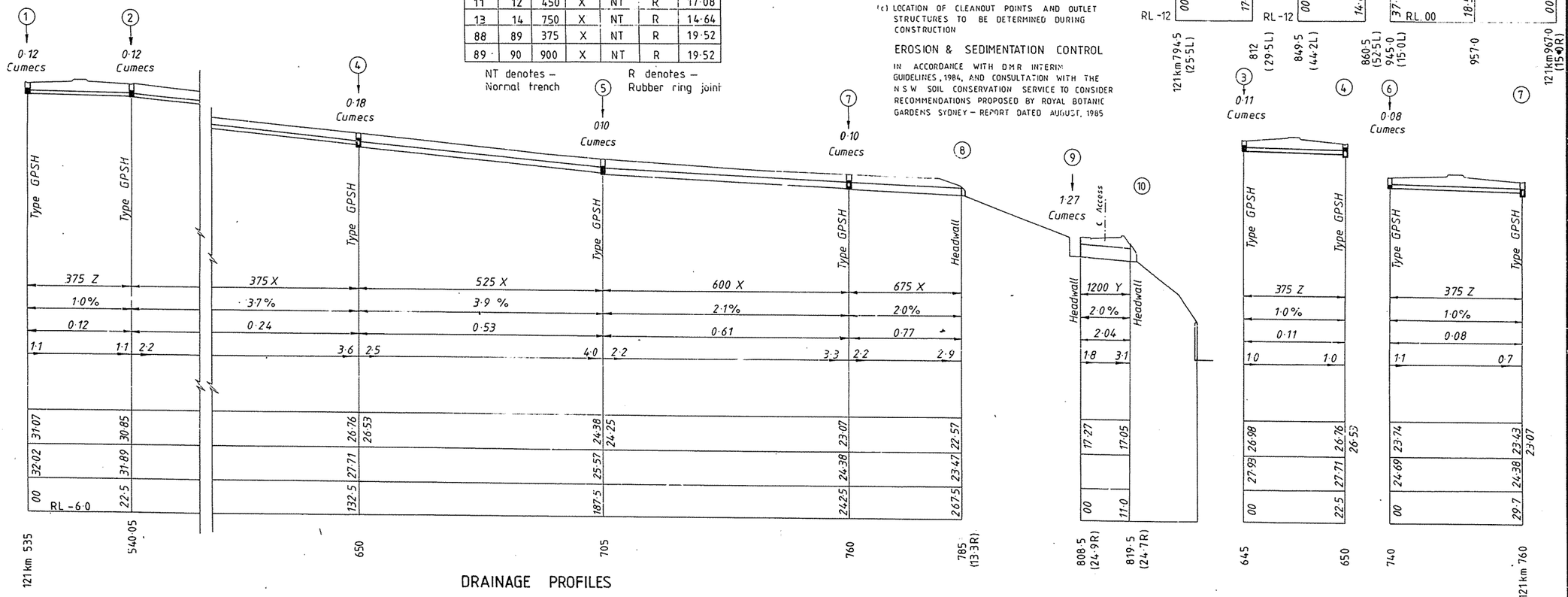
(b) PIPES TO BE LAID AT GRADE OF ROADWAY OR AT MINIMUM 0·5%.

(c) LOCATION OF CLEANOUT POINTS AND OUTLET STRUCTURES TO BE DETERMINED DURING CONSTRUCTION

EROSION & SEDIMENTATION CONTROL

IN ACCORDANCE WITH DMR INTERIM GUIDELINES, 1984, AND CONSULTATION WITH THE N.S.W. SOIL CONSERVATION SERVICE TO CONSIDER RECOMMENDATIONS PROPOSED BY ROYAL BOTANIC GARDENS SYDNEY — REPORT DATED AUGUST, 1985





DRAINAGE PROFILES

SCALES — PLAN 0 5 10 15 20 25 50; PROFILES HORIZ 0 5 10 15 20 25; VERT 0 5 10

DATUM	SURVEYED BY	DESIGNED	CHECKED	PASSED
AHD	B.H.P. ENGINEERING	K. Gibbs 17/7/86		

DEPARTMENT OF MAIN ROADS N.S.W.

STATE HIGHWAY 1 — PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
KIAMA BYPASS
DRAINAGE & LINEMARKING DETAILS — 121km 500 to 122 km 00

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	8

Reg.No. 0001·236·RC·6047

NOTES

DESIGN STORM RECURRENCE INTERVAL

NEW SURFACE DRAINAGE — 5 YEARS
MAXIMUM INTENSITY — 192 mm/hr

PIPE FLOW VALUES LESS THAN 0·01 CUMECS ARE NOT SHOWN.

SUBSOIL DRAINS

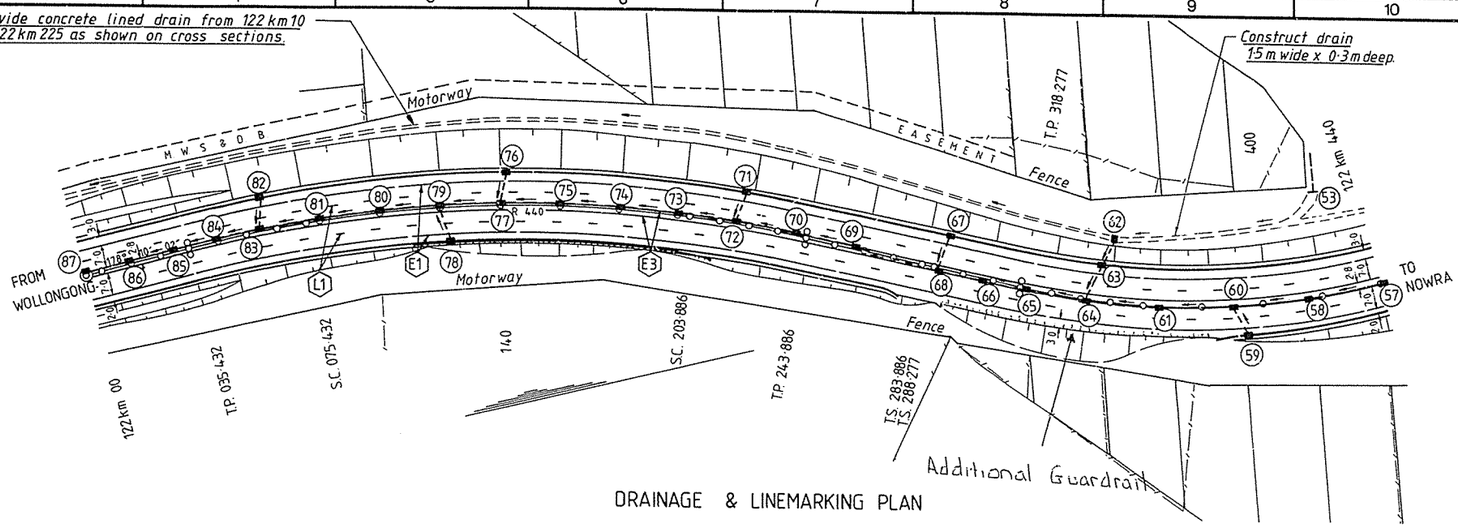
(a) TOTAL LENGTH REQUIRED — 1320 m

(b) PIPES TO BE LAID AT GRADE OF ROADWAY OR AT MINIMUM 0·5%.

(c) LOCATION OF CLEANOUT POINTS AND OUTLET STRUCTURES TO BE DETERMINED DURING CONSTRUCTION

EROSION & SEDIMENTATION CONTROL

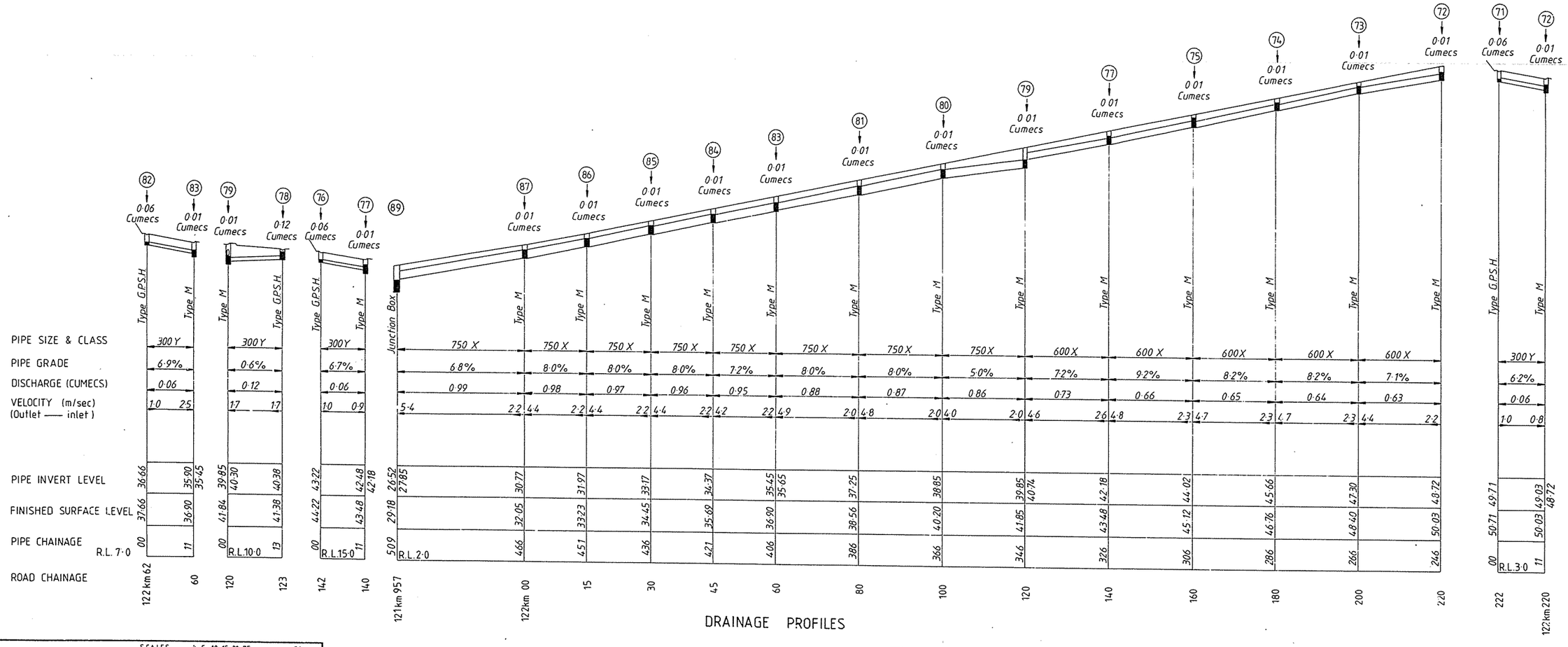
IN ACCORDANCE WITH D.M.R. INTERIM GUIDELINES, 1985, AND CONSULTATION WITH THE N.S.W. SOIL CONSERVATION SERVICE TO CONSIDER RECOMMENDATIONS PROPOSED BY ROYAL BOTANIC GARDENS SYDNEY — REPORT DATED AUGUST, 1985



DRAINAGE & LINEMARKING PLAN

LEGEND

- Gutter type SH
- Gully pit
- Drainage pipe
- Catch drain
- Guardrail



DRAINAGE PROFILES

SCALES
PLAN 0 5 10 15 20 25 50
PROFILES HORIZ 0 5 10 15 20 25
VERT 0 5 10

DATUM	SURVEYED BY	DESIGNED / CHECKED / PASSED
A.H.D.	B.H.P. ENGINEERING	A. Wojciechowski / K. Hyde 21/1/86 /

DEPARTMENT OF MAIN ROADS N.S.W.

STATE HIGHWAY 1 — PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
KIAMA BYPASS
DRAINAGE & LINEMARKING DETAILS — 122 km 00 to 122 km 440

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	9

Reg.No. 0001·236·RC·6047

REDUCTION RATIO

PIPE DETAILS

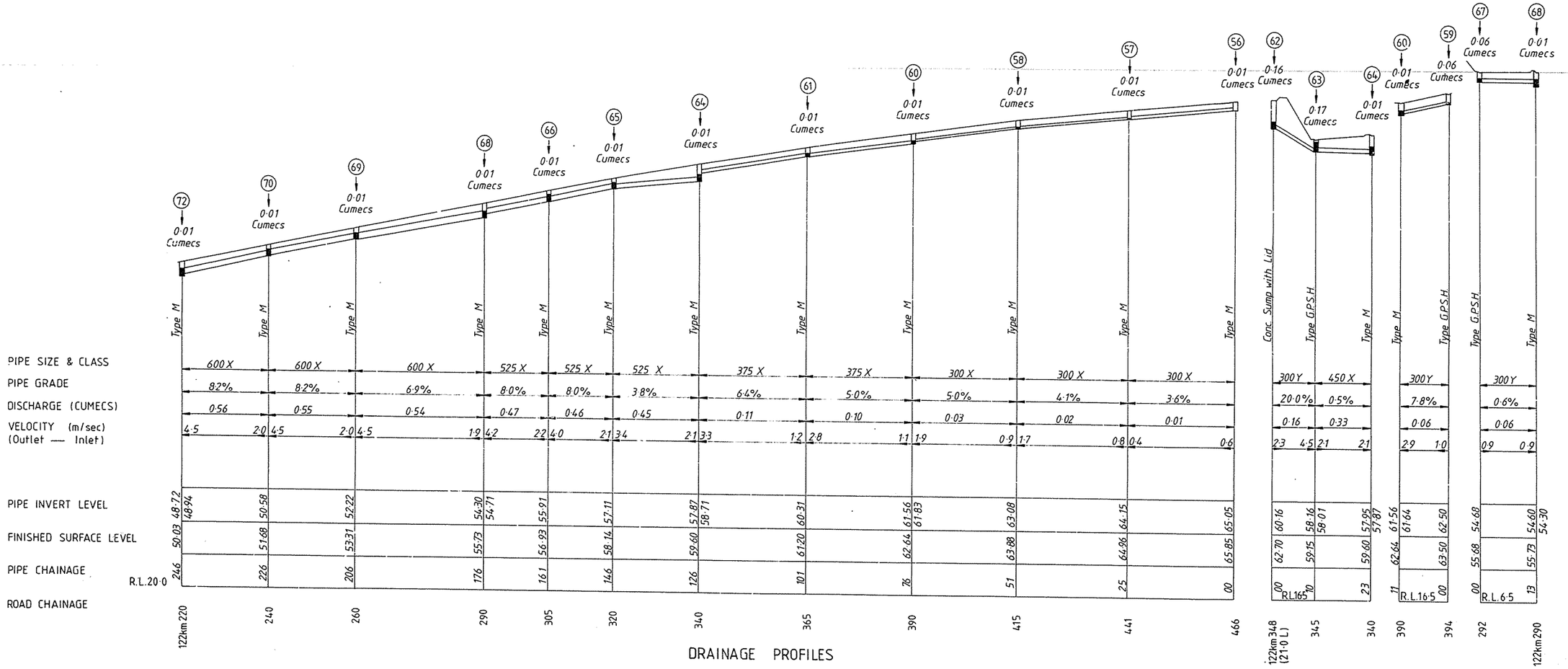
FROM	TO	DIA.	CLASS	PIPE INSTAL.	JOINT	LENGTH	FROM	TO	DIA.	CLASS	PIPE INSTAL.	JOINT	LENGTH
56	57	300	X	N.T.	R	25·62	72	73	600	X	N.T.	R	20·74
57	58	300	X	N.T.	R	26·84	73	74	600	X	N.T.	R	20·74
58	60	300	X	N.T.	R	25·62	74	75	600	X	N.T.	R	20·74
59	60	300	Y	N.T.	R	12·20	75	77	600	X	N.T.	R	20·74
60	61	375	X	N.T.	R	25·62	76	77	300	Y	N.T.	R	12·20
61	64	375	X	N.T.	R	25·62	77	79	600	X	N.T.	R	20·74
62	63	300	Y	N.T.	R	10·98	78	79	300	Y	N.T.	R	13·42
63	64	450	X	N.T.	R	13·42	79	80	750	X	N.T.	R	20·74
64	65	525	X	N.T.	R	20·74	80	81	750	X	N.T.	R	20·74
65	66	525	X	N.T.	R	15·86	81	83	750	X	N.T.	R	20·74
66	68	525	X	N.T.	R	15·86	82	83	300	Y	N.T.	R	12·20
67	68	300	Y	N.T.	R	13·42	83	84	750	X	N.T.	R	15·86
68	69	600	X	N.T.	R	30·50	84	85	750	X	N.T.	R	15·86
69	70	600	X	N.T.	R	20·74	85	86	750	X	N.T.	R	15·86
70	72	600	X	N.T.	R	20·74	86	87	750	X	N.T.	R	15·86
71	72	300	Y	N.T.	R	12·20	87	89	750	X	N.T.	R	43·92

NT denotes normal trench R denotes rubber ring joint.

GUTTER TYPE SH		
LOCATION		LENGTH
LEFT	122km00 — 440	440
RIGHT	122km00 — 278	278
RIGHT	122km383 — 440	57
GUTTER TYPE SE		
LEFT	122km00 — 440	440
RIGHT	122km00 — 440	440

LINED DRAIN		
LOCATION		LENGTH
LEFT	122km00 — 225	225
GUARDRAIL		
RIGHT	122km 110 — 214	104
RIGHT	122km·290 — 382	92

W.A.E.



DRAINAGE PROFILES

SCALES
PROFILES..... HORIZ 0 5 10 15 20 25
VERT 0 5 10

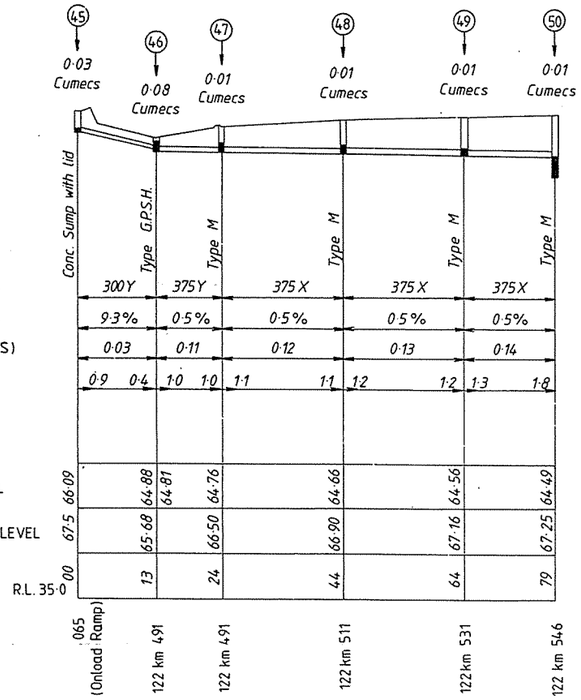
DATUM	SURVEYED BY.....	DESIGNED S. Wojciechowski
A.H.D.	FIELD BOOK.....	CHECKED K. Fuller 23/7/86
	LEVEL BOOK BHP ENGINEERING	PASSED

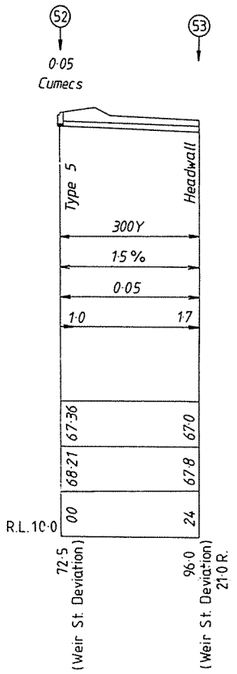
DEPARTMENT OF MAIN ROADS N.S.W.

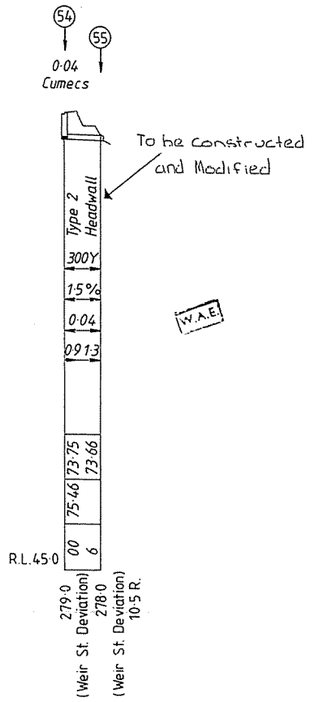
STATE HIGHWAY No1 – PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
KIAMA BYPASS
DRAINAGE PROFILES

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	10

Reg.No. 0001·236·RC·6047







GUARDRAIL

	LOCATION	LENGTH
LEFT	090·38 (WEIR ST.) - ABUT. A (WEIR ST.)	22
LEFT	ABUT. B (WEIR ST.) - 040 (N/B OFFLOAD RAMP)	44
LEFT	080 (S/B ONLOAD RAMP) - 122 km 980·04 (BYPASS)	490
RIGHT	ABUT. B (WEIR ST.) - 187·1 (WEIR ST.)	30
RIGHT	45 (S/B ONLOAD RAMP) - 85 (S/B ONLOAD RAMP)	40

GUTTER TYPE SA

LEFT	ABUT. B (WEIR ST.) - 020 (N/B OFFLOAD RAMP)	25
RIGHT	-5·0 (WEIR ST.) - ABUT. A (WEIR ST.)	113
RIGHT	177·09 (WEIR ST.) - 281·5 (WEIR ST.)	90
LEFT	020 (N/B OFFLOAD RAMP) - 220 (WEIR ST.)	53

GUTTER TYPE SE

LEFT	122 km 440 (BYPASS) - 122 km 833·74 (BYPASS)	394
RIGHT	122 km 440 (BYPASS) - 122 km 833·74 (BYPASS)	394

GUTTER TYPE SF

LEFT	059 (WEIR ST.) - 080·38 (WEIR ST)	23
LEFT	080·38 (WEIR ST.) - 027·76 (S/B ONLOAD RAMP)	12
RIGHT	00 (S/B ONLOAD RAMP) - 027·76 (S/B ONLOAD RAMP)	29
LEFT	122 km 521 (BYPASS) - 122 km 551 (BYPASS)	31
RIGHT	090·84 (S/B ONLOAD RAMP) - 120·84 (S/B ONLOAD RAMP)	31
RIGHT	122 km 565 (BYPASS) - 122 km 595 (BYPASS)	31
LEFT	112 (N/B OFFLOAD RAMP) - 141 (N/B OFFLOAD RAMP)	31

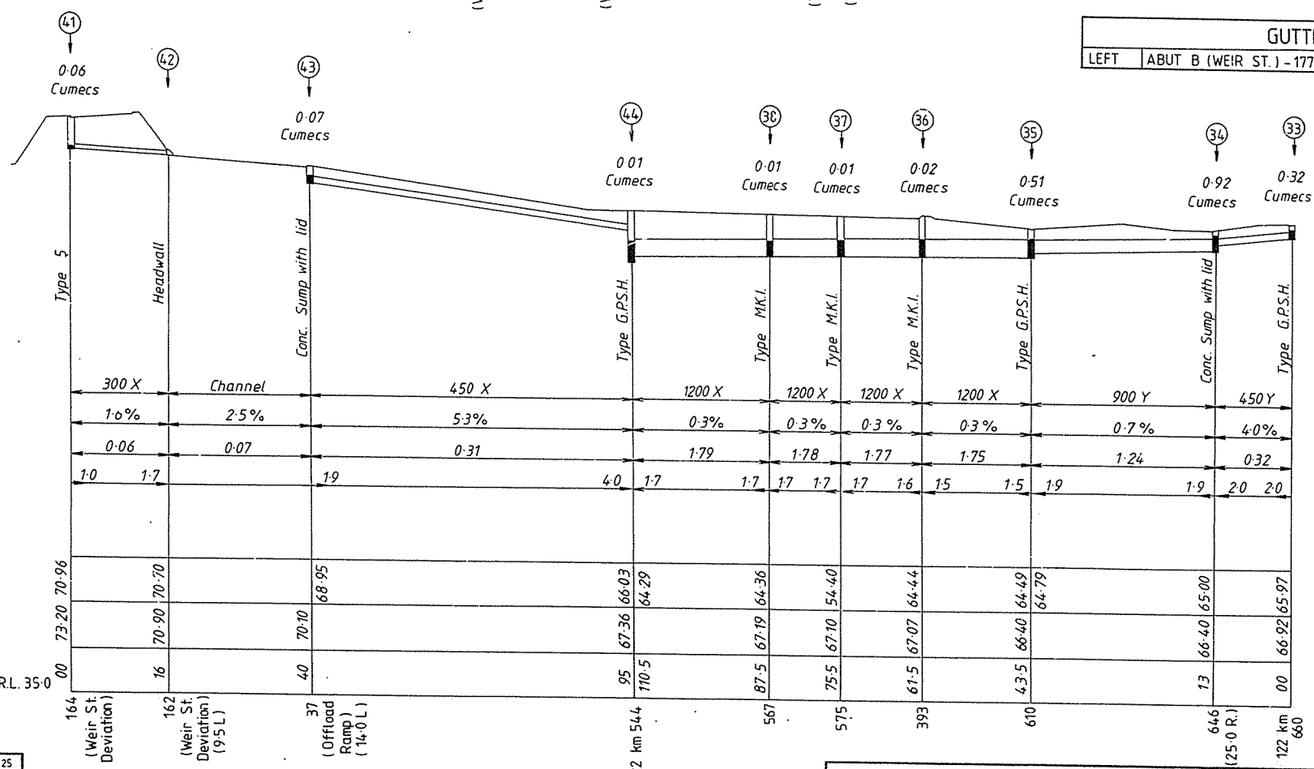
GUTTER TYPE SH

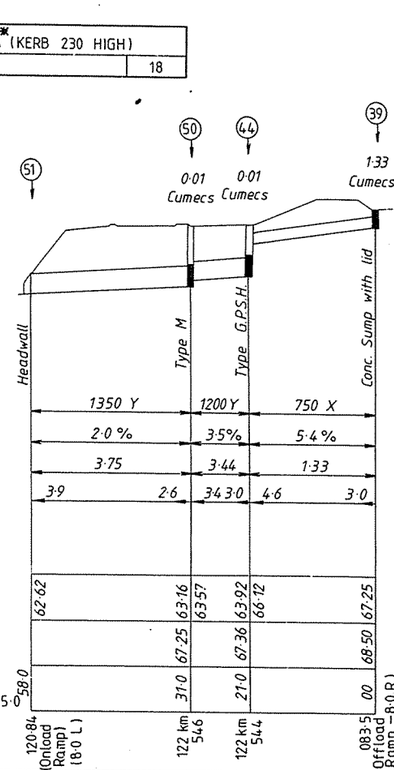
LEFT	122 km 440 (BYPASS) - 122 km 521 (BYPASS)	78
RIGHT	122 km 440 (BYPASS) - 122 km 565 (BYPASS)	129
RIGHT	095 (N/B OFFLOAD RAMP) - 122 km 665 (BYPASS)	108

GUTTER TYPE SA* (KERB 230 HIGH)

LEFT	ABUT B (WEIR ST.) - 177·09 (WEIR ST.)	18







SCALES
PROFILES..... HORIZONTAL..... 0 5 10 15 20 25
VERTICAL..... 0 5 10

DATUM	SURVEYED BY	DESIGNED / CHECKED / PASSED
A.H.D	B.H.P. ENGINEERING	J. Wojciechowski / K. Ryan 24/7/86 /

DEPARTMENT OF MAIN ROADS N.S.W.

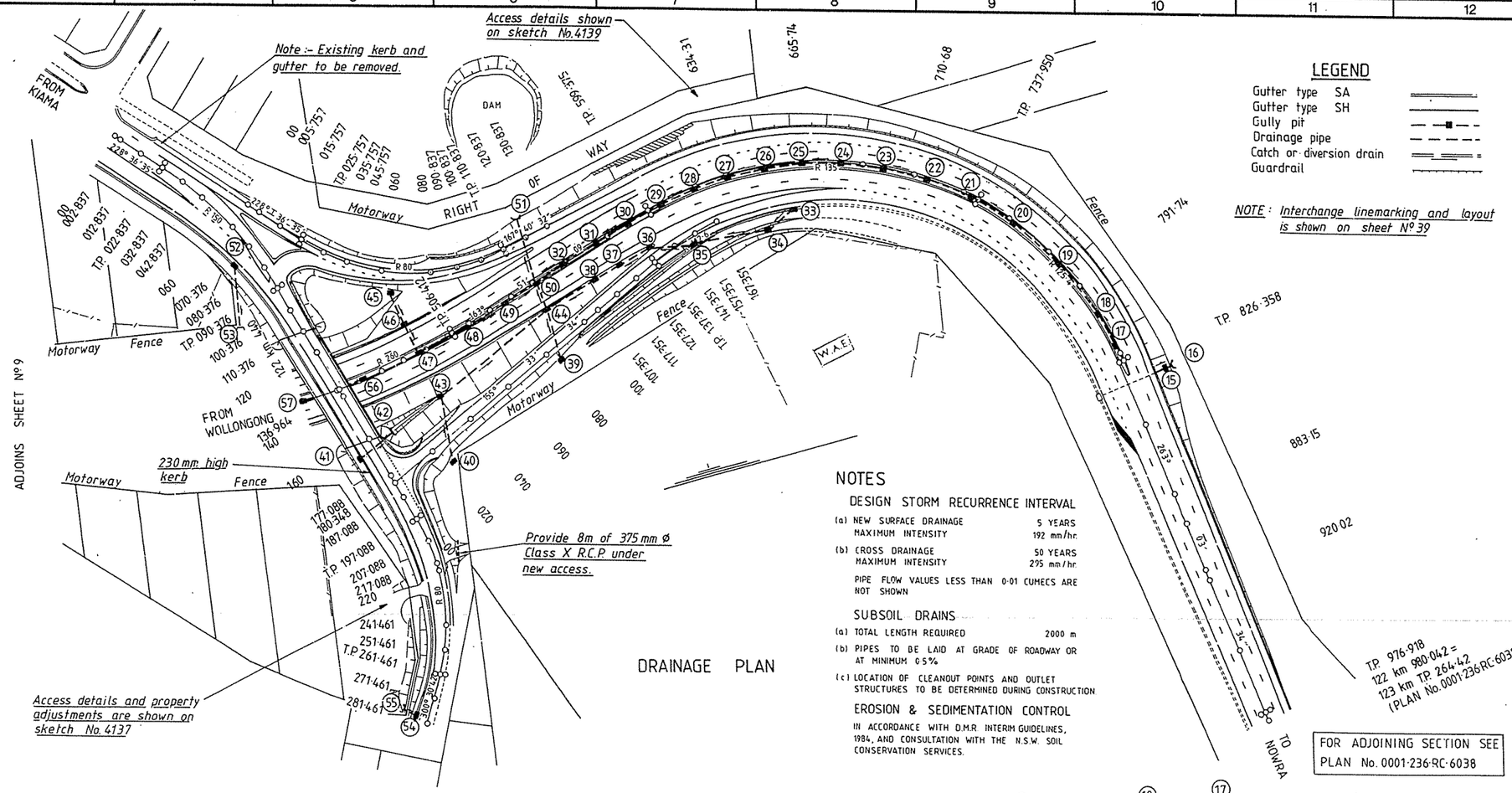
S.H.1 - PRINCES HIGHWAY - MUNICIPALITY OF KIAMA
KIAMA BYPASS
WEIR STREET INTERCHANGE
DRAINAGE PROFILES

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	12

Reg.No. 0001·236·RC·6047

PIPE DETAILS						
FROM	TO	DIA	CLASS	PIPE INSTAL.	JOINT	LENGTH
Existing Pipe	15	450	X	N.T.	R	4·88
15	16	450	X	N.T.	R	2·44
17	18	300	X	N.T.	R	15·86
18	19	300	X	N.T.	R	25·62
19	20	300	X	N.T.	R	25·62
20	21	300	X	N.T.	R	20·74
21	22	300	X	N.T.	R	19·52
22	23	300	X	N.T	R	18·30
23	24	300	X	N.T.	R	17·08
24	25	300	X	N.T.	R	17·08
25	26	300	X	N.T.	R	15·86
26	27	375	X	N.T.	R	15·86
27	28	375	X	N.T.	R	15·86
28	29	375	X	N.T.	R	15·86
29	30	375	X	N.T.	R	15·86
30	31	375	X	N.T.	R	15·86
31	32	375	X	N.T	R	15·86
32	50	375	X	N.T.	R	14·64
33	34	450	Y	N.T.	R	13·42
34	35	900	Y	N.T	R	30·50
35	36	1200	X	N.T.	R	18·30
36	37	1200	X	N.T.	R	14·64
37	38	1200	X	N.T.	R	12·20
38	44	1200	X	N.T.	R	23·18
39	44	750	X	N.T.	R	21·96
40	43	375	X	N.T.	R	26·84
41	42	300	X	N.T.	R	17·08
43	44	450	X	N.T.	R	56·12
44	50	1200	Y	N.T.	R	10·98
45	46	300	Y	N.T.	R	13·42
46	47	375	Y	N.T.	R	10·98
47	48	375	X	N.T.	R	20·74
48	49	375	X	N.T.	R	20·74
49	50	375	X	N.T.	R	15·86
50	51	1350	Y	N.T.	R	28·06
52	53	300	Y	N.T.	R	24·40
54	55	300	Y	N.T.	R	6·10

NT denotes normal trench.
R denotes rubber ring joint.



DRAINAGE PLAN

LEGEND

- Gutter type SA
- Gutter type SH
- Gully pit
- Drainage pipe
- Catch or diversion drain
- Guardrail

NOTE : Interchange linemarking and layout is shown on sheet N° 39

NOTES

DESIGN STORM RECURRENCE INTERVAL

(a) NEW SURFACE DRAINAGE — 5 YEARS
MAXIMUM INTENSITY — 192 mm/hr

(b) CROSS DRAINAGE — 50 YEARS
MAXIMUM INTENSITY — 295 mm/hr

PIPE FLOW VALUES LESS THAN 0·01 CUMECS ARE NOT SHOWN

SUBSOIL DRAINS

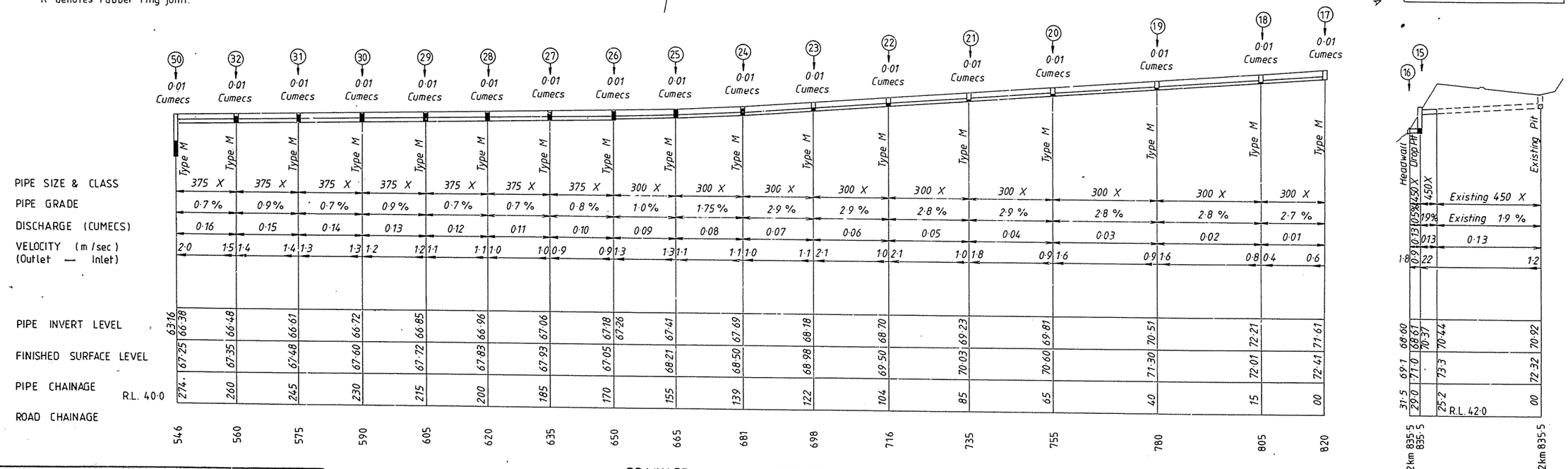
(a) TOTAL LENGTH REQUIRED — 2000 m

(b) PIPES TO BE LAID AT GRADE OF ROADWAY OR AT MINIMUM 0·5%

(c) LOCATION OF CLEANOUT POINTS AND OUTLET STRUCTURES TO BE DETERMINED DURING CONSTRUCTION

EROSION & SEDIMENTATION CONTROL

IN ACCORDANCE WITH D.M.R. INTERIM GUIDELINES, 1984, AND CONSULTATION WITH THE N.S.W. SOIL CONSERVATION SERVICES.



DRAINAGE PROFILES

SCALES
PLAN 0 5 10 15 20 25 50
PROFILES HORIZ. 0 5 10 15 20 25
VERT. 0 5 10

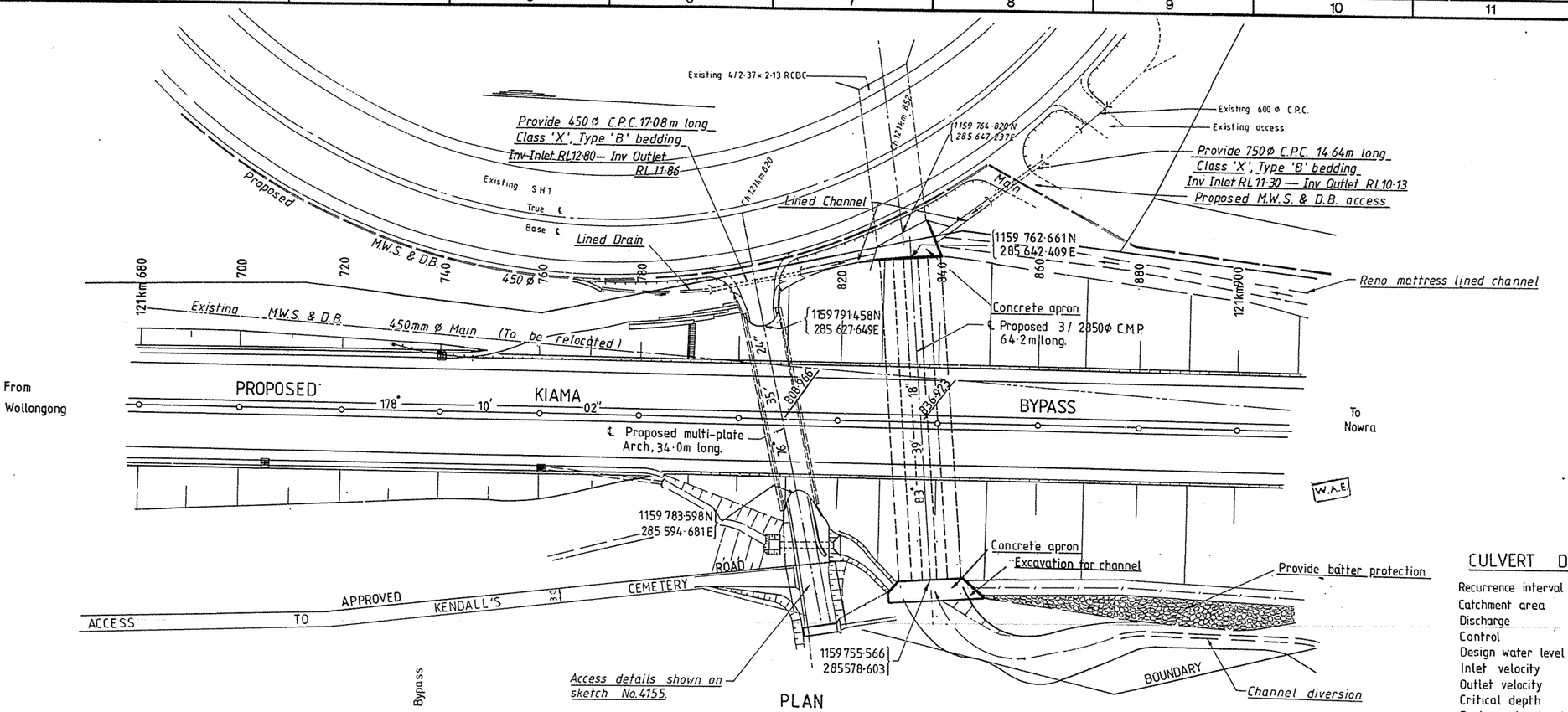
DATUM AHD | SURVEYED BY B.H.P. ENGINEERING | DESIGNED A. Wojciechowski | CHECKED K. Pfeiffer 23/11/88 | PASSED

DEPARTMENT OF MAIN ROADS N.S.W.

S.H.1 – PRINCES HIGHWAY – MUNICIPALITY OF KIAMA
KIAMA BYPASS
WEIR STREET INTERCHANGE
DRAINAGE DETAILS

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	11

Reg.No. 0001·236·RC·6047



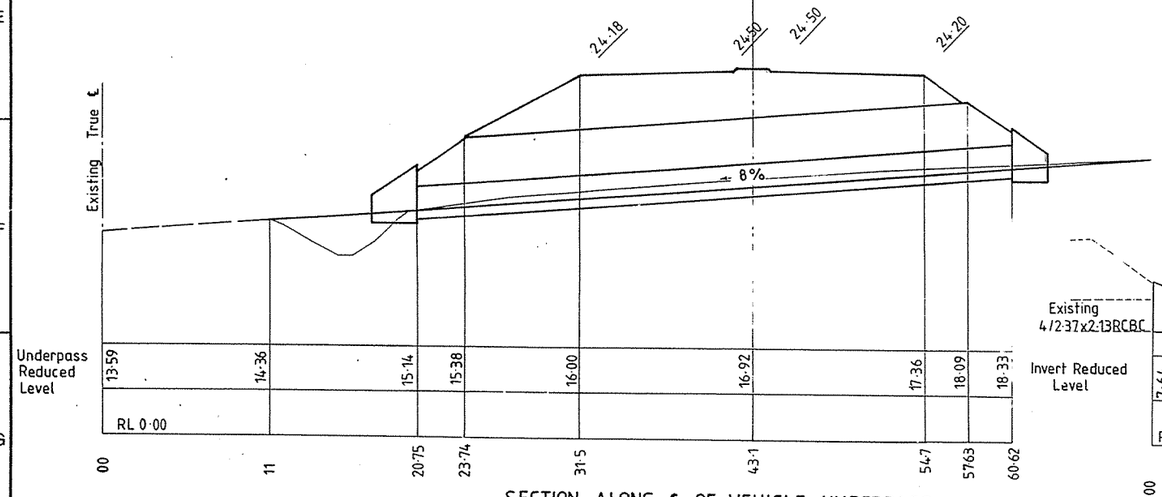
PLAN

Scale 1:500

CULVERT DESIGN DATA

Recurrence interval	50 years
Catchment area	3·02 sq km.*
Discharge	59 m^3/sec.
Control	Inlet
Design water level at inlet.	RL 12·38
Inlet velocity	3·4 m/sec
Outlet velocity	3·4 m/sec
Critical depth	2·7 m
Design water level at outlet	RL 10·26
Froude Number	0·67

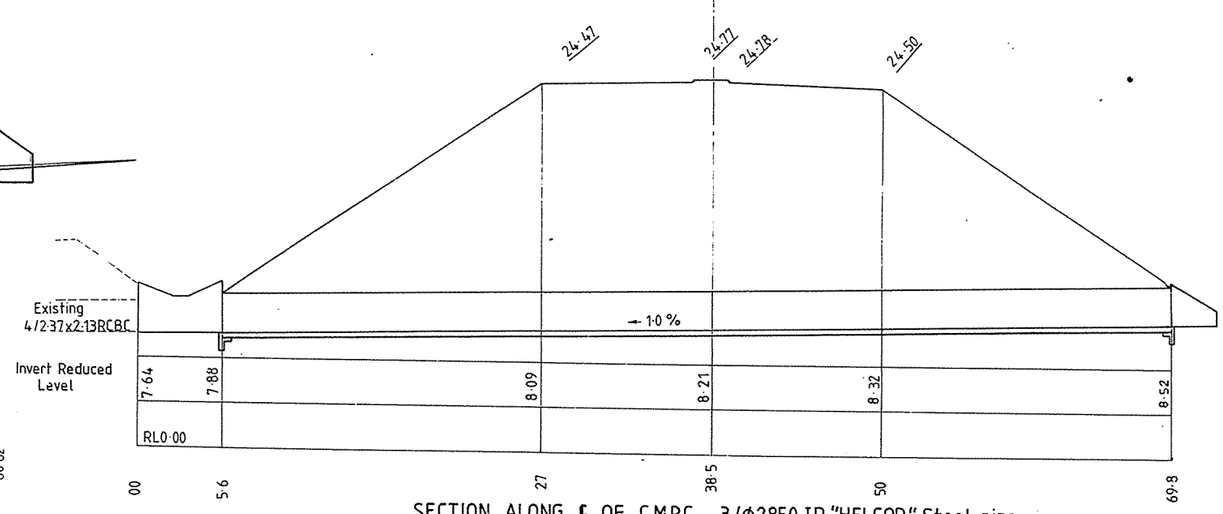
*Adopted from previous Highway calculations



SECTION ALONG ℄ OF VEHICLE UNDERPASS
– 6500 × 3140 × 5 Corrugated Multi-Plate Arch, to AS 2041-2, 1977.

Scale 1:200

NOTE For details see Sheet N°36



SECTION ALONG ℄ OF C.M.P.C., 3/Φ2850 ID "HELCOR" Steel pipe, to AS 1761-2, 1979.

Scale 1:200

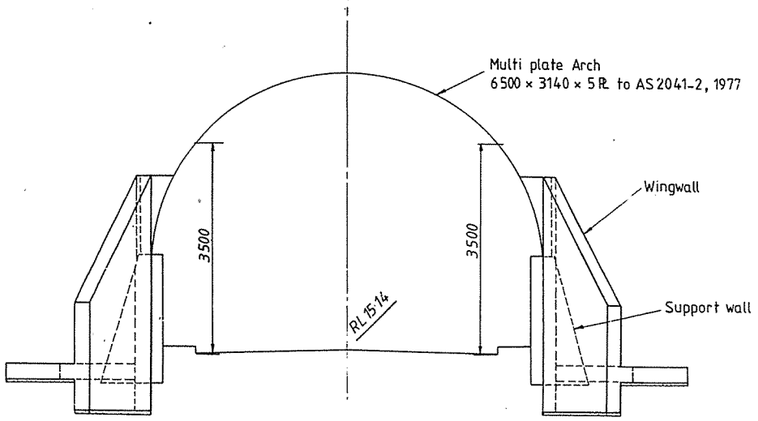
NOTE: For details see Sheet N°'s 37 & 38

DEPARTMENT OF MAIN ROADS N.S.W.

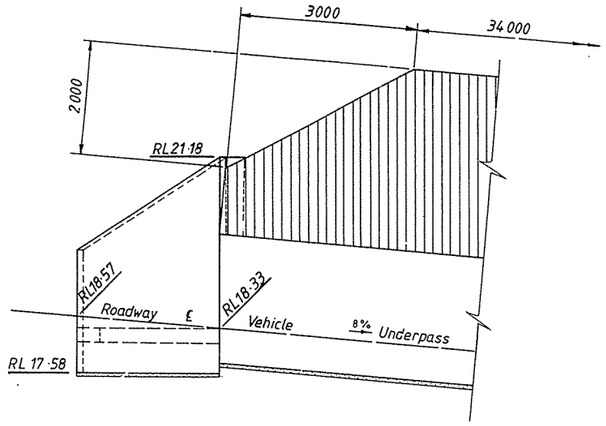
STATE HIGHWAY 1 — PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
PROPOSED VEHICLE UNDERPASS AT 121km 809 AND
PROPOSED C.M.P.C. AT MUNNA MUNNORA CREEK (121 km 835)

FILE No.	No. OF SHEETS	SHEET No.
1/236.1262	51	35

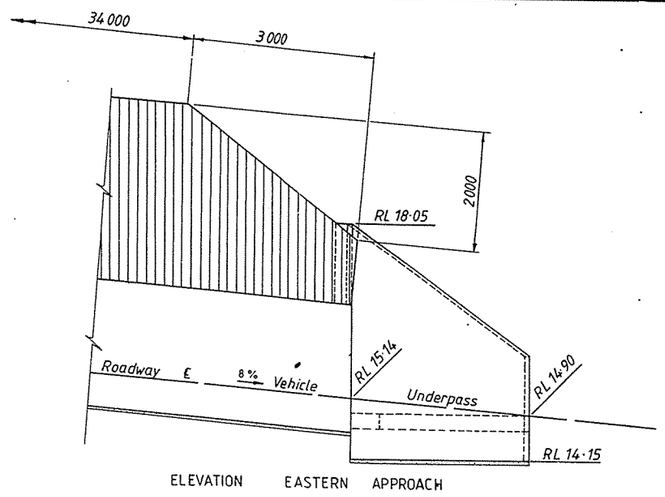
Reg.No. 0001·236·RC·6047



ELEVATION — EASTERN APPROACH

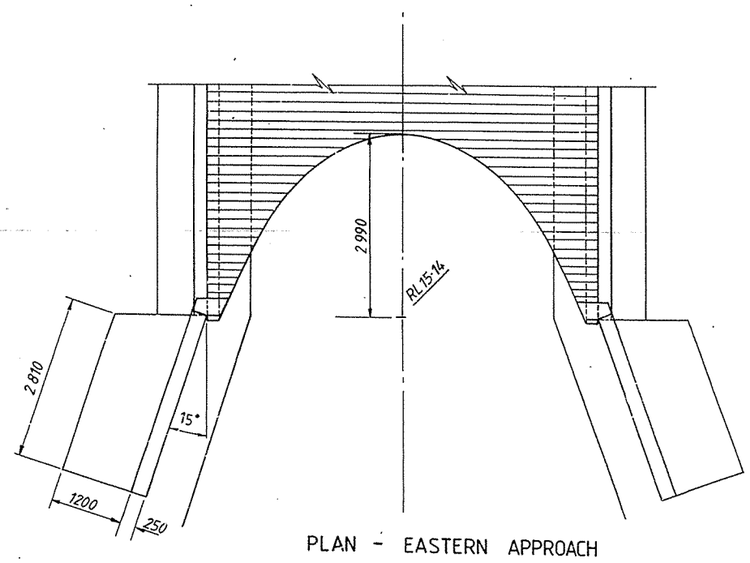


ELEVATION WESTERN APPROACH

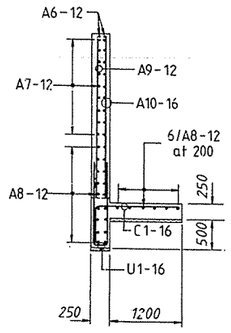


ELEVATION EASTERN APPROACH

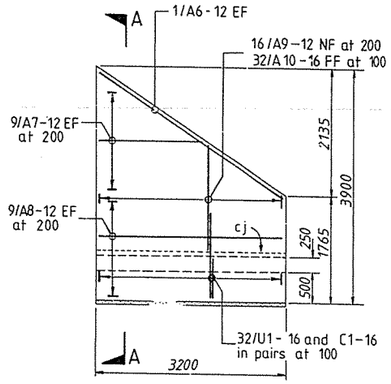
END TREATMENT



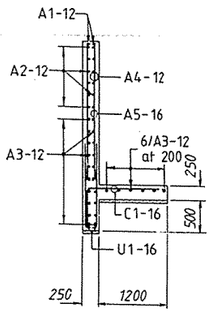
PLAN - EASTERN APPROACH



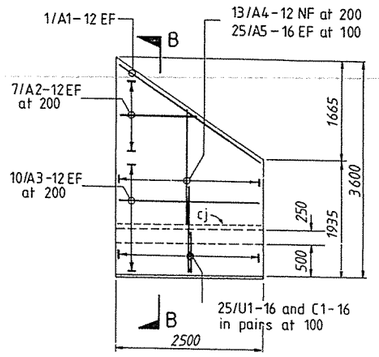
SECTION AA



EASTERN ELEVATION

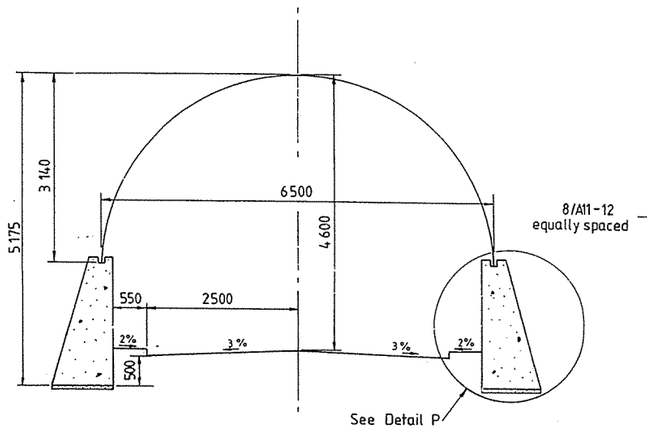


SECTION BB

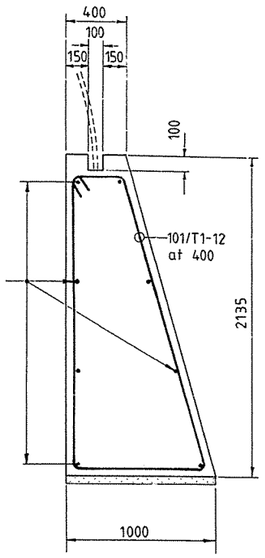


WESTERN ELEVATION

WINGWALL DETAILS



TYPICAL CROSS SECTION



DETAIL P
Scale 1:20

STEEL LIST

CODE	SHAPE	MARK	DIA mm	LENGTH mm	No REQ'D	TOTAL LENGTH m	TOTAL MASS kg
A	Length	A1	12	2880	2	5·8	5
		•A2	12	Av1260	14	17·6	16
		A3	12	2400	26	62·4	55
C	1350, 650	•A4	12	Av1860	13	24·2	21
		•A5	16	Av1860	25	46·5	73
		A6	12	3730	2	7·5	7
T	340, 1935, 890	•A7	12	Av1695	18	30·5	27
		A8	12	3100	24	74·4	66
		•A9	12	Av1960	16	31·4	28
U	1400, 150	•A10	16	Av1930	32	61·8	98
		A11	12	8400	80	672·0	597
		C1	16	1970	57	112·3	177
STANDARD BENDS		T1	12	5245	202	1059·5	941
		U1	16	2890	57	164·7	260

SIZE	D
12	75
16	100

▪ Length includes allowance for 4 laps minimum 435mm long

• VARIABLE BARS

MARK	DIA mm	LENGTH Max mm	LENGTH Min mm	STEPS Size mm	STEPS No	No of Bars in Set	No of Sets
A2	12	2160	360	300	6	7	2
A4	12	2655	1060	133	12	13	1
A5	16	2655	1060	67	24	25	1
A7	12	2895	495	300	8	9	2
A9	12	2960	965	133	15	16	1
A10	16	2965	890	67	31	32	1

NOTES

Dimensions are measured from outside faces of the bar

All bars shall be Grade 410Y to AS 1302.
Welding of Grade 410Y is permitted.

Minimum lap length shall be 36 diam's.

TOTAL MASS STEEL .... 2·37 Tonnes

GENERAL NOTES

Scale 1:50 unless shown otherwise.

Reduced level are in metres, to A. H. D.

Dimensions are in millimetres.

Minimum 28 day compressive strength of concrete shall be 30 MPa.

Clear cover to reinforcement nearest to the concrete surface shall be 50 mm.

Corners shall be chamfered 20 mm, re-entrant angles filleted 20 mm.

Φ50 weepholes spaced at 1500 centres shall provided in all walls, located 150 mm above top of kerb.

NF denotes near face.
FF denotes far face.
EF denotes each face.

For culvert layout see Sheet No 35

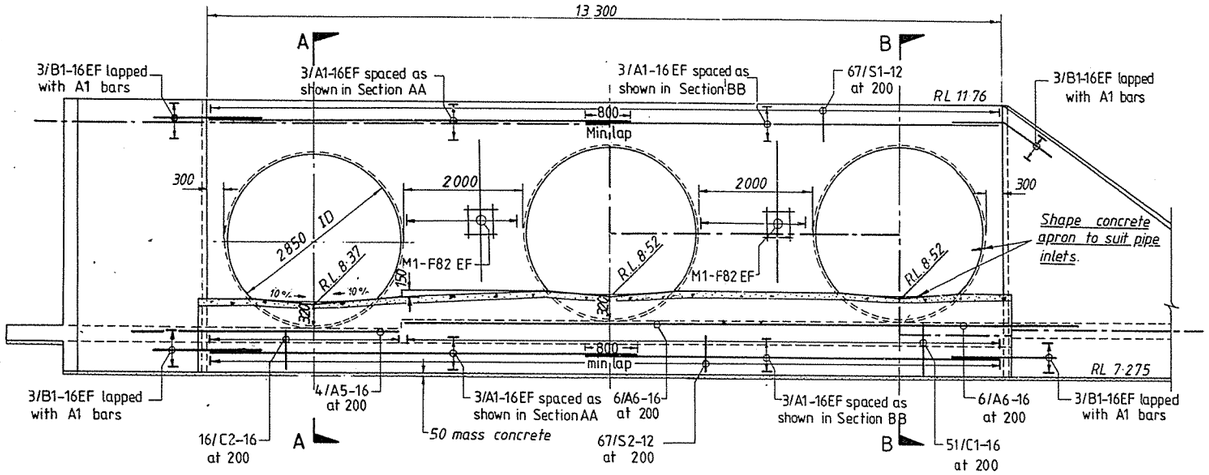
TOTAL	CONCRETE SUPPORT WALLS	120·0 m³
TOTAL	CONCRETE WINGWALLS	12·0 m³
TOTAL	MASS CONCRETE	5·0 m³

DEPARTMENT OF MAIN ROADS N.S.W.

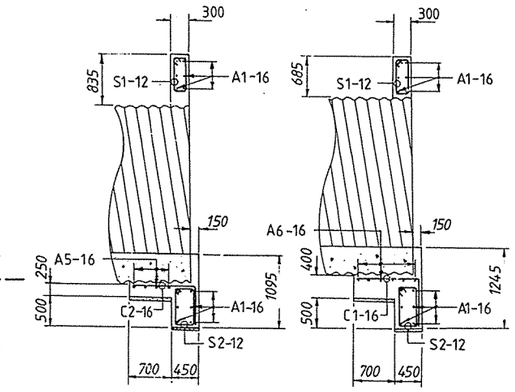
STATE HIGHWAY 1 — PRINCES HIGHWAY
MUNICIPALITY OF KIAMA — KIAMA BYPASS
PROPOSED VEHICLE UNDERPASS AT 121km 809

FILE No.	No. OF SHEETS	SHEET No.
1/236.1262	51	36

Reg.No. 0001·236·RC·6047

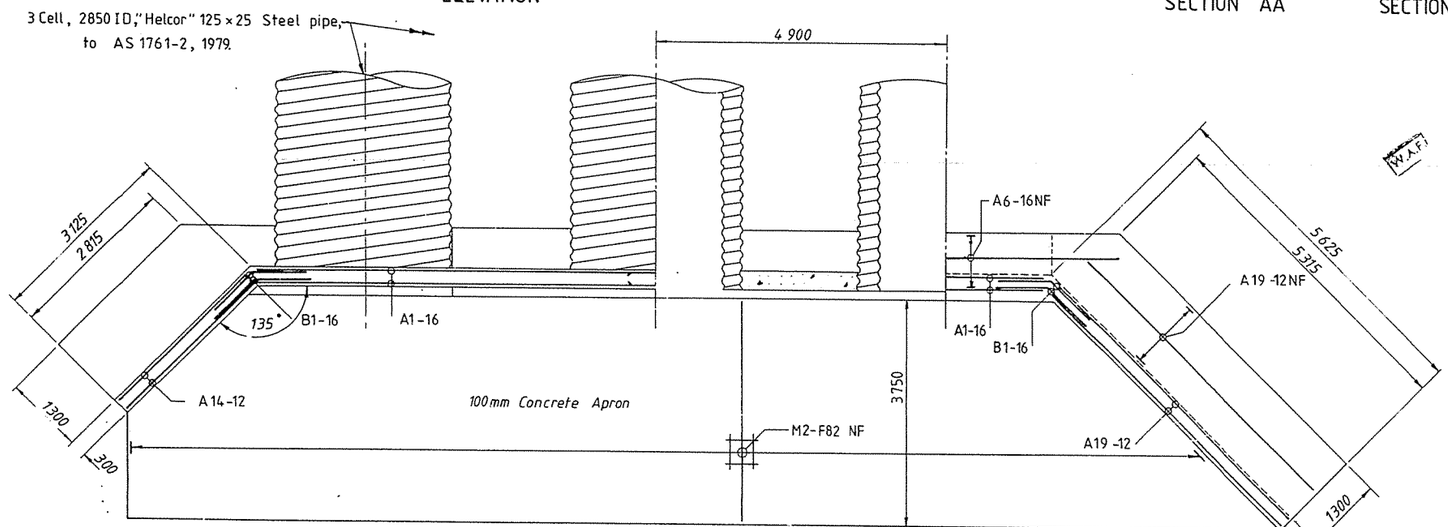


ELEVATION

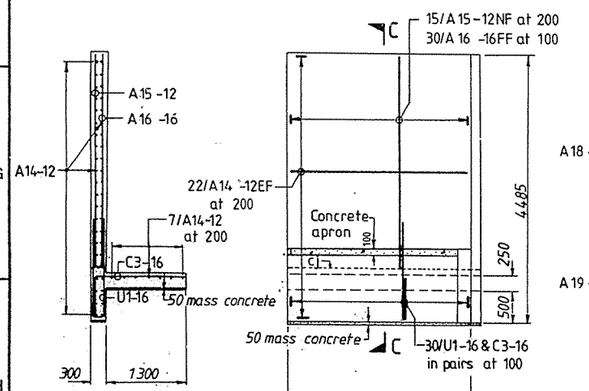


SECTION AA

SECTION BB

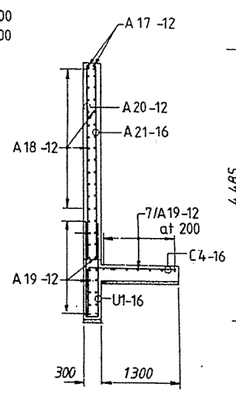


SECTIONAL PLAN

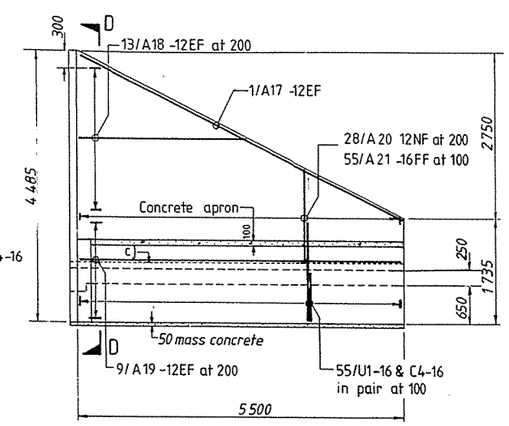


SECTION CC

ELEVATION



SECTION DD



ELEVATION

WINGWALL DETAILS

STEEL LIST

410Y BARS TO AS1302

CODE	SHAPE	MARK	DIA mm	LENGTH mm	N° REQ'D	TOTAL LENGTH m	TOTAL MASS kg
A	L	A1	16	7000	36	252·0	398
		A2	16	7900	12	94·8	150
		A3	16	10000	6	60·0	95
		A4 *	16	4250Av	4	17·0	27
		A5	16	4400	4	17·6	28
B	635 900	A6 Φ	16	5940	12	71·3	113
		A7	12	4200	4	16·8	15
		A8	12	8100	41	332·1	295
		A9 *	12	1760Av	20	35·2	31
		A10 *	12	3080 Av	36	110·9	98
C	L2 L1	A11 *	16	3090 Av	72 *	222·5	351
		A12	12	2320	5	11·6	10
		A13	16	2320	10	23·2	37
		A14	12	2900	51	147·9	131
	MARK L1 L2	A15	12	3585	15	53·8	48
	C1 850 1050	A16	16	3535	30	107·6	170
	C2 650 1050	A17	12	6000	2	12·0	11
	C3 650 1500	A18 *	12	2840Av	26	73·8	66
	C4 800 1500	A19	12	5400	25	135·0	120
S	200(1) 350(2) 535(S1) 650(S2) Stirrup Hook	A20 *	12	1995Av	28	55·9	50
		A21 *	16	1995Av	55	109·7	173
		B1	16	1780	24	42·7	67
		C1	16	1810	102	184·6	292
		C2	16	1660	35	58·1	92
U	1550 200	C3	16	2110	30	63·3	100
		C4	16	2260	137	309·6	489
		S1	12	1610	138	222·2	197
		S2	12	2040	138	281·5	250
		U1	16	3220	137	441·1	697

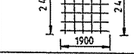
STANDARD BENDS

SIZE	D
12	75
16	100
20	120

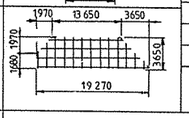
* VARIABLE BARS

MARK	DIA	LENGTH MAX	LENGTH MIN	STEPS SIZE	STEPS N°	N° of Bars in Set	N° of Sets
A4	16	4400	4100	100	3	4	1
A9	12	3050	470	645	4	5	4
A10	12	3805	2360	85	17	18	2
A11	16	3825	2355	42	35	36	2
A18	12	5240	440	400	12	13	2
A20	12	3345	645	100	27	28	1
A21	16	3345	645	50	54	55	1

CODE M1

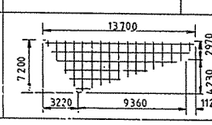


CODE M2



FABRIC

CODE M3



MARK	SIZE	N° REQ'D	AREA m²	TOTAL MASS kg
M1	F82	8	36 5	144
M2	F82	1	61·7	244
M3	F82	1	60·9	240

ΦIncludes min lap 580.

TOTAL STEEL MASS	BARS 410Y	4·60 T
	MESH F82	0·63 T

GENERAL NOTES

Scale 1:50
Reduced levels are in metres to AHD.
Dimensions are in millimetres.
Minimum 28 day compressive strength of concrete shall be 30 MPa.
Clear cover to reinforcement nearest to the concrete surface shall be 50 mm.
Corners shall be chamfered 20 mm, re-entrant angles filleted 20 mm.
Φ50 weepholes spaced at 1500 centres shall be provided in all walls located 150 above top of concrete apron.
NF denotes near face.
FF denotes far face.
EF denotes each face.

Dimensions are measured from outside face of the bar.
All bars shall be grade 410Y to AS 1302
All fabric to AS 1304
Welding of grade 410Y bars is permitted.
Minimum lap length shall be 36 diam. unless shown.
Maximum of TWO layers of fabric at laps.

CONCRETE TOTALS

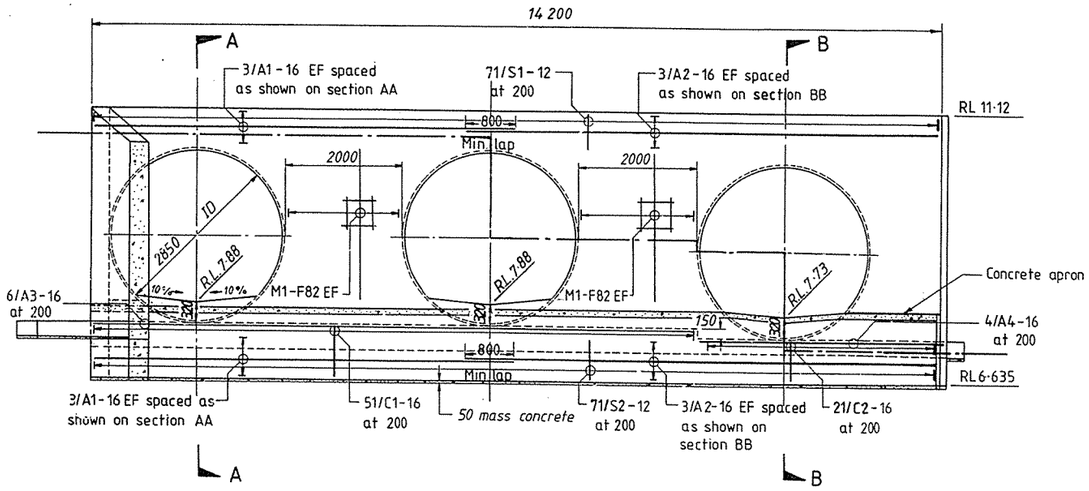
Headwalls including Wingwalls..... 63 m³
Lining in pipes..... 94 m³
Concrete aprons..... 13 m³
Mass concrete..... 3 m³

DEPARTMENT OF MAIN ROADS N.S.W.

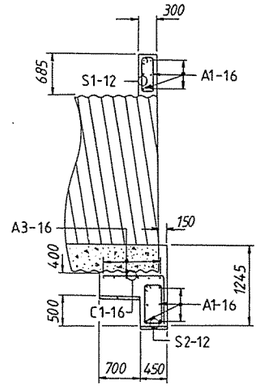
S.H.1. - PRINCES HIGHWAY
MUNICIPALITY OF KIAMA - KIAMA BYPASS
PROPOSED 3 CELL 2850 I.D. C.M.P.C. AT MUNNA MUNNORA CREEK (ch. 121 km 835) - INLET DETAILS

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	37

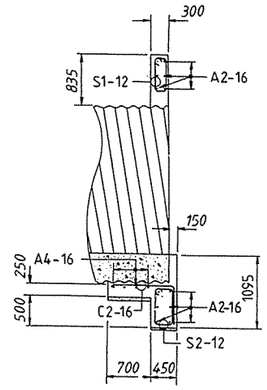
Reg.No. 0001·236·RC·6047



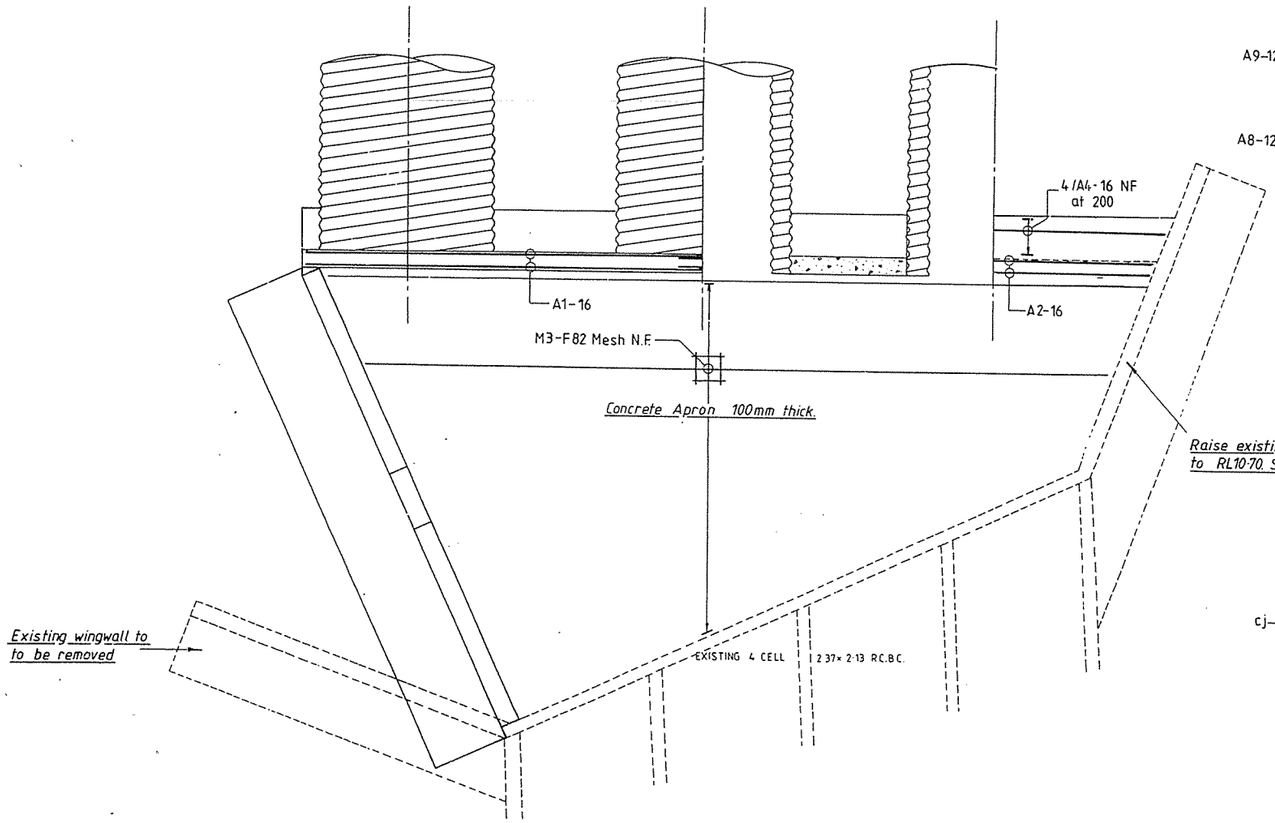
ELEVATION



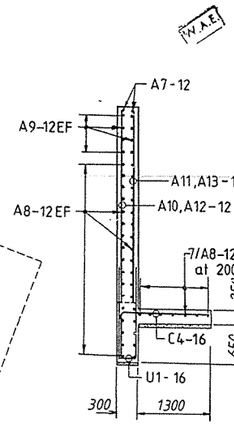
SECTION AA



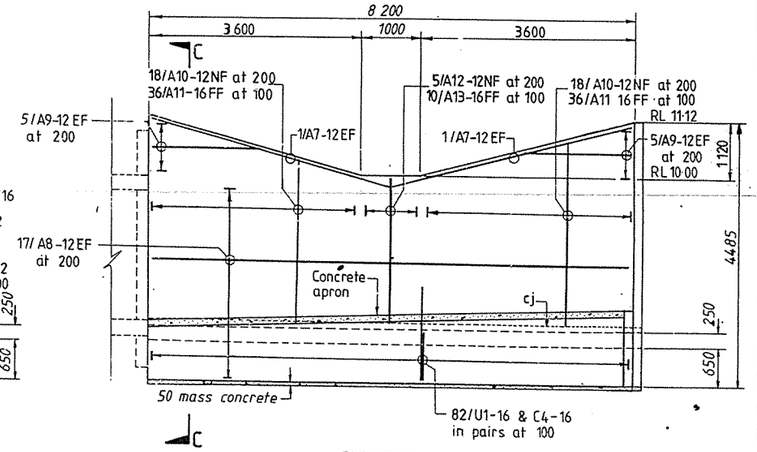
SECTION BB



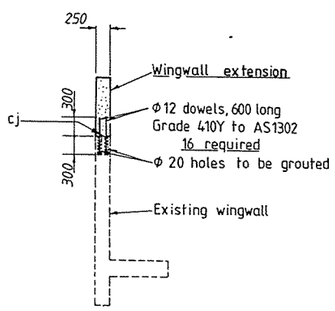
SECTIONAL PLAN



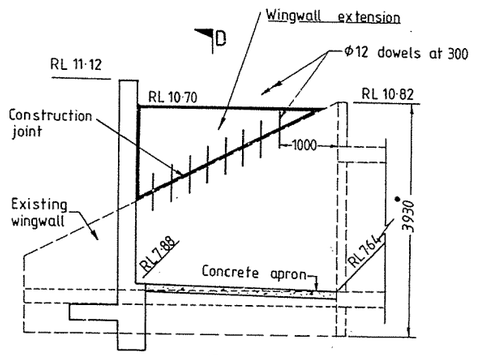
SECTION CC



ELEVATION



SECTION DD



ELEVATION

• Note: Wingwall dimensions from Plan Reg. No. 0001·236·BC·2757

WINGWALL DETAILS

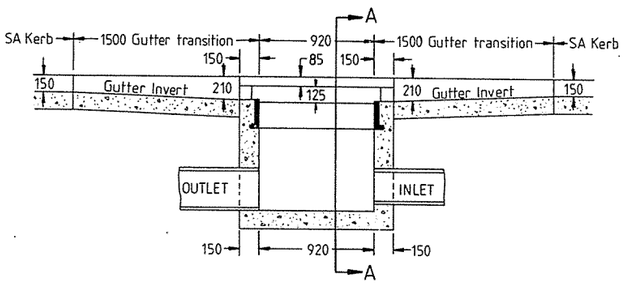
NOTES
Scale 1:50.
Reduced levels are in metres to A.H.D.
Dimensions are in millimetres.
This sheet to be read in conjunction with Sheet Nº

DEPARTMENT OF MAIN ROADS N.S.W.

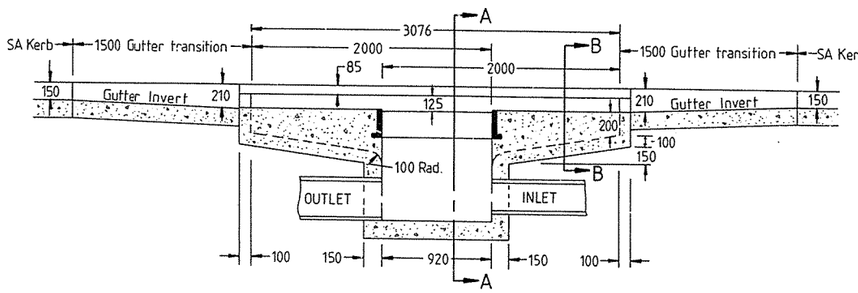
S.H.1. – PRINCES HIGHWAY
MUNICIPALITY OF KIAMA – KIAMA BYPASS
PROPOSED 3 CELL 2850 I.D. C.M.P.C. AT MUNNA MUNNORA CREEK (ch. 121 km 835) – OUTLET DETAILS

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	51	38

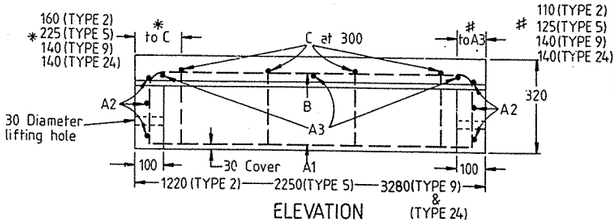
Reg.No. 0001·236·RC·6047



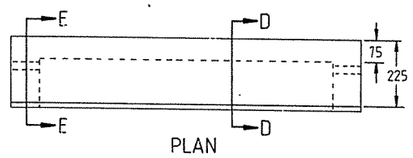
SECTION C-C



SECTION C-C

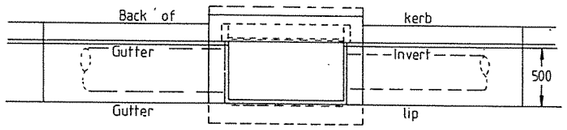


ELEVATION



PLAN

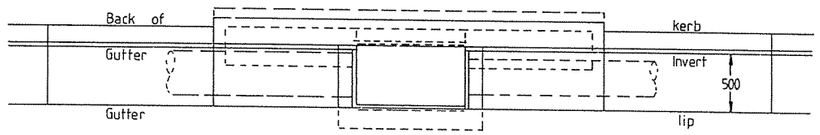
Scale 1 : 10



PLAN

PIT TYPE 2

(Grating removed)

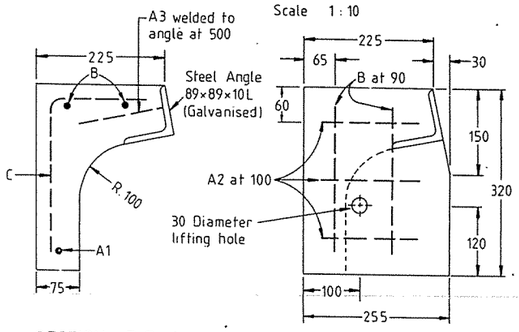


PLAN

PIT TYPE 24

(Grating removed)

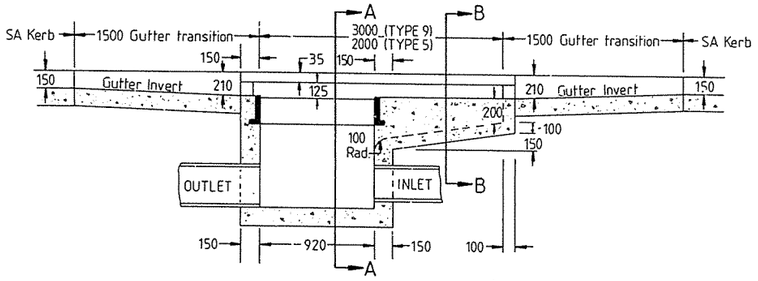
W.A.E.



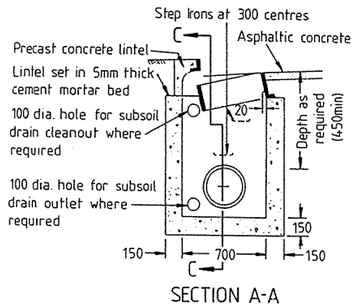
SECTION D-D

SECTION E-E

Scale 1:5

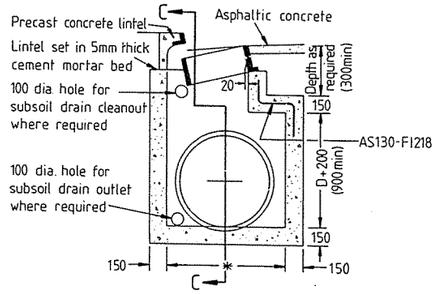


SECTION C-C



SECTION A-A

FOR PIPE DIA. UP TO 600mm



SECTION A-A

FOR PIPE DIA. ABOVE 600mm

AND MULTIPLE PIPES

PIPES ⩾600 ✱ = D + 200

MULTIPLE PIPES ✱ = nD + (n-1) $9\frac{1}{2}$ + 200

where n = number of lines

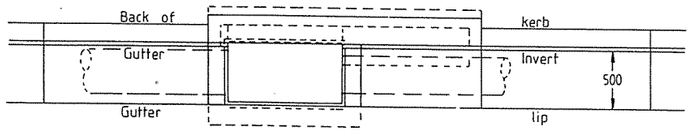
REINFORCEMENT BENDING SCHEDULE

(All plain bars, grade 230R)

Shape	Mark	Dia. mm	L1	Length	No Reqd.	Total Length
	1m LINTEL (TYPE 2)					
A L1	A1	16	1080	1080	1	1080
	A2	10	170	170	6	1020
	A3	10	150	150	3	450
	B	10	1120	1570	2	3140
	C	10	170	410	4	1640
	2m LINTEL (TYPE 5)					
B L1 250 D=40 D=40 250	A1	16	2110	2110	1	2110
	A2	10	170	170	6	1020
	A3	10	150	150	5	750
	B	10	2150	2600	2	5200
	C	10	170	410	7	2870
	3m LINTEL (TYPE 9 & TYPE 24)					
C L1 D=40 260	A1	16	3140	3140	1	3140
	A2	10	170	170	6	1020
	A3	10	150	150	7	1050
	B	10	3180	3630	2	7260
	C	10	170	410	11	4510

NOTES

1. All dimensions are in millimetres.
2. Drawings not to scale.
3. Concrete grade 20MPa at 28 days.
4. Side walls of all pits deeper than 1500mm are to be reinforced with one layer of F82 mesh returned 200mm into base.
5. Pits deeper than 1500mm to be fitted with step irons.
6. All exposed edges to be rounded with 20mm radius.
7. For details of standard double gully pit, grate & frame refer to sheet No 48.



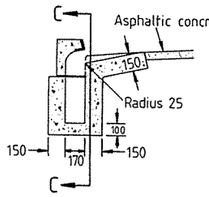
PLAN

PIT TYPE 5&9

(Grating removed)

LEGEND

TYPE 2 = Double grate gully pit with 1 metre lintel.
TYPE 5 = Double grate gully pit with 2 metre lintel.
TYPE 9 = Double grate gully pit with 3 metre lintel.
TYPE 24 = Double grate gully pit to be used in sags.



SECTION B-B

NOTES

1. Clear cover to reinforcement nearest to concrete surface shall be 25mm unless shown otherwise.
2. Exposed surfaces to be off-steel form finish or of high quality steel float finish.
3. Compressive strength of concrete to be a minimum 30MPa at 28 days.
4. All exposed edges to be rounded to 5mm radius.
5. Galvanising to be in accordance with AS 1214/1973 and to be 375 g/sq. metre.

PRECAST CONCRETE LINTELS

. FOR TYPE SA KERB GULLY PITS

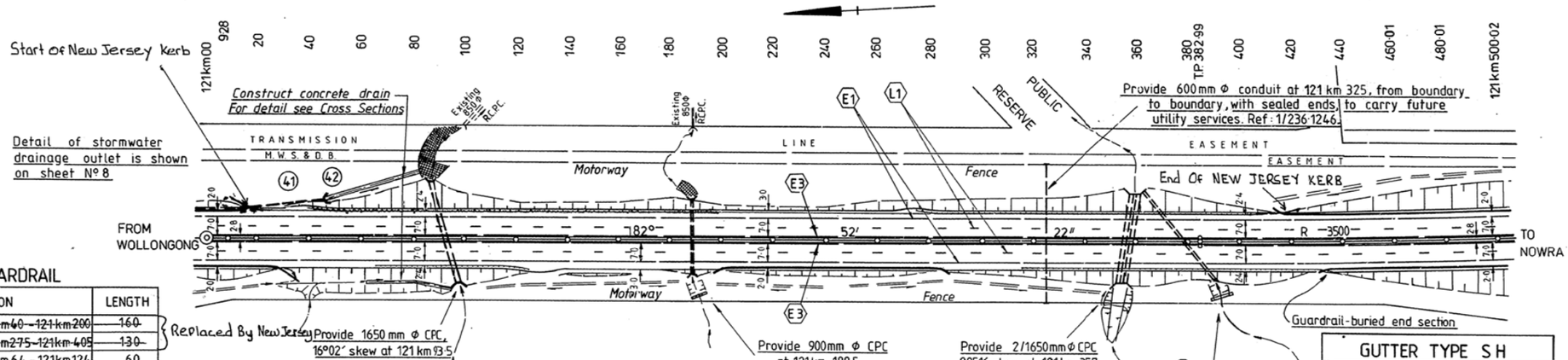
DEPARTMENT OF MAIN ROADS N.S.W.

DRAINAGE STRUCTURES

TYPE 2, 5, 9 & 24 WITH PRECAST LINTELS

FILE No.	No. OF SHEETS.	SHEET No.
1/236·1262	51	46

Reg.No. 0001 236 RC 6047



FOR ADJOINING SECTION SEE PLANS REG Nº 0001 236 RC 6047

LEGEND

- Gutter type SH
- Gully pit
- Drainage pipe
- Lined table drain
- Catch drain
- Guardrail

GUARDRAIL

LOCATION		LENGTH
~~LEFT~~	~~121·km40 – 121·km200~~	~~160~~
~~LEFT~~	~~121·km275–121km·405~~	~~130~~
RIGHT	121km 64 – 121km124	60
RIGHT	121km 316 – 121km ~~436~~426	~~120~~110
Total		~~470~~ 170

Replaced By New Jersey

LINED CATCH / DIVERSION DRAIN

LOCATION		LENGTH
LEFT	120 km455-120 km 83	37·5
RIGHT	120km 00 – 120km 40	40
RIGHT	120km 60 – 120km 100	40

DRAINAGE & LINEMARKING PLAN

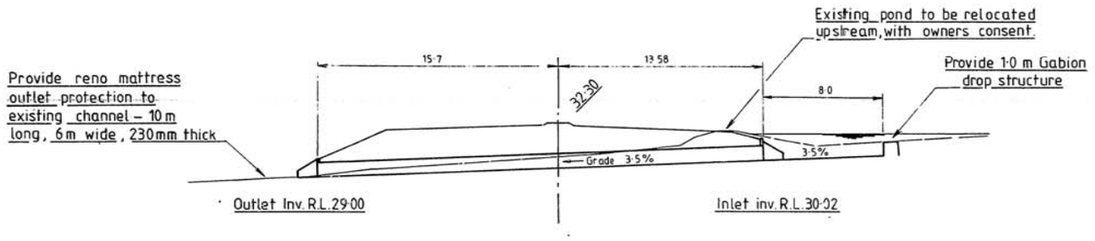
LEFT	121 km 416 – 500	84
RIGHT	121 km 424 – 500	76

GUTTER TYPE SH

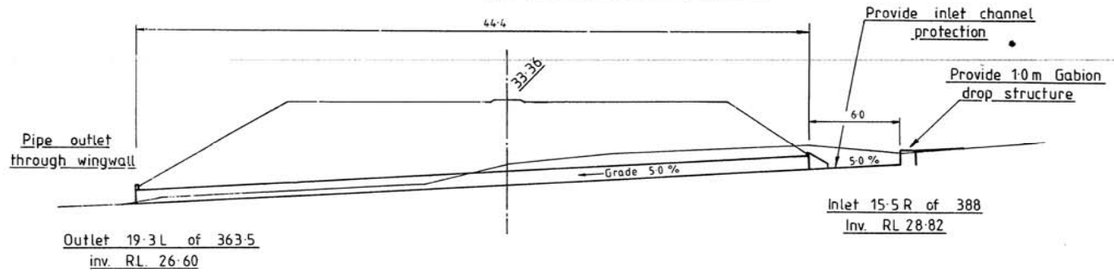
LOCATION		LENGTH
LEFT	121km00 – 121km 15	15
~~LEFT~~	~~121km 416 – 121km 500~~ 415	~~88 84~~
RIGHT	121km 00 –121km 30	30
RIGHT	121km195 –121km287	92
~~RIGHT~~	~~121km 430 – 121km 500~~ 424	~~70 76~~
KERB TYPE NEW JERSEY		
LOCATION		LENGTH
LEFT	121 Km 406 – 121 Km 422	416

GUTTER TYPE SE

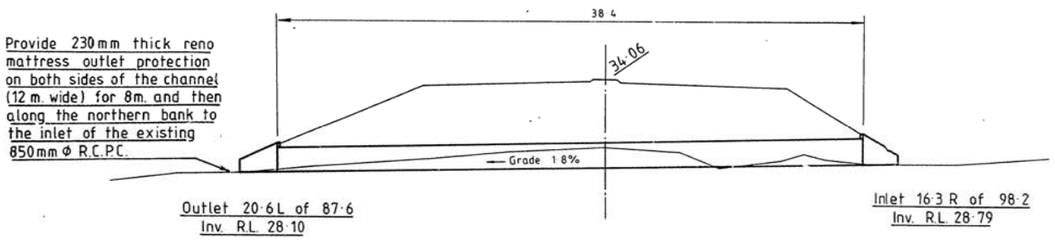
LOCATION		LENGTH
LEFT	121km00 – 121km500	500
RIGHT	121km 00 – 121km500	500
KERB TYPE SG		
LOCATION		LENGTH
RIGHT	121 km 64 – 121 Km 124	60
RIGHT	121 Km 316 – 121 Km 426	110



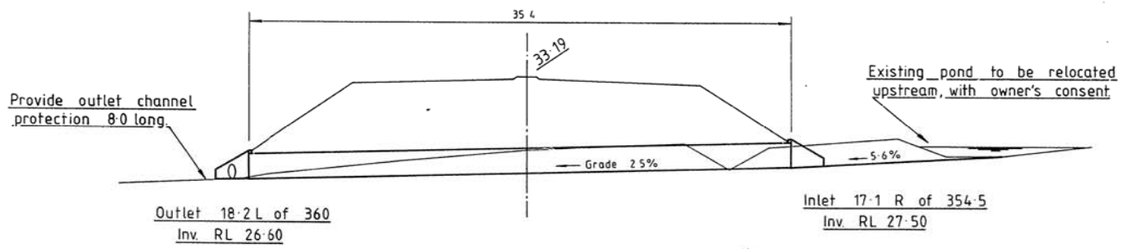
900 mm Φ at 121km 188·5



1050 mm Φ at 121 km 379
39° 09′ Skew



1650 mm Φ at 121 km 93·5
16° 02′ Skew



2/1650 mm Φ at 121 km 357
8° 51′ Skew

CULVERT DESIGN DATA

LOCATION	121 km 93·5	121 km188·5	121 km 357	121 km 379
Recurrence interval (years)	50	50	50	50
Catchment area (ha)	15·9	4·3	38·6	4·3
Discharge (m^3/s) – A.R & R. 1977	7·1	1·6	11·3	1·9
Control	inlet	inlet	inlet	inlet
Design water level at inlet(m)	31·20	31·38	29·60	30·05
Inlet velocity (m/s)	3·3	2·5	2·6	2·2
Outlet velocity (m/s)	4·7	4·3	4·8	5·1
Critical depth (m)	1·1	0·5	0·9	0·5
Froude number	1·5	1·9	1·6	2·4
Length of hydraulic jump (m)	–	–	–	4·9

PIPE DETAILS

LOCATION	SIZE	CLASS	BEDDING	LENGTH
121 km 93·5	1650	Z	B	39·04
188·5	900	X	B	29·28
357	1650	Z	B	70·76
379	1050	Z	B	45·14

▪ Rubber ring joints

SCALES
PLAN 0 10 20 30 40 50
LONG. SECTION 0 2 4 6 8 10

DEPARTMENT OF MAIN ROADS N.S.W.

STATE HIGHWAY 1 – PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
KIAMA TRAFFIC RELIEF ROUTE
DRAINAGE & LINEMARKING DETAILS -121km 00 to 121km 500

FILE No.	No. OF SHEETS	SHEET No.
1/236·12 62	40	31

Reg.No. 0001·236·RC·6046

114 Possible Expressway requirement as advised by the D.M.R..... 15th Sept. 1970. ref: X6/497. 14275.

113 PUBLIC RESERVE

Construct shallow catch drain 6' wide

Earth channel to be deepened to direct storm water into the drainage easement.

Existing Soil heap.

Catch drain

Standard Kerb & gutter constructed

Inv. of 18" ϕ R.C.P. R.L.... 85·38'

87·53

18" ϕ R.C.P.s at grades 1 in 18

Drainage easement 6' wide

Natural

PUBLIC ROAD A

Inv. 79·08

Construct 96' of 60" ϕ R.C.P. line with Std. D.M.R. type h'walls at a grade of 2·1%

R.P. 50' R.L. 85·46

Proposed

G.P.E.K.I.

Inv. of outlet.. 80·31

Kerb

ROAD 'B'

56' WIDE

Construct G.P.E.K.I.

Inv. of inlet 78·98 Inv. of outlet 78·80

Inv. of inlet.. 79·01 Inv. of outlet.. 78·80'

Inv. of inlet.. 76·71 Inv. of outlet.. 76·21'

Inv. of inlet 77·16 Inv. of outlet 76·76

Construct G.P.E.K.I.

Const. G.P.E.K.I. over drainage

12" ϕ R.C.P. at grade 1%

Inv. of pipe inlet.... 78·78

Inv. 73·02

73·22

Inv. of inlet 80·69 Inv. of outlet 79·99

Kerb

& gutter

Tan. Dist..... 78·99'
Sec. Dist..... 34·88'
Arc. Dist..... 119·76'

Crown

offset

Proposed

pegged

1370·41 1420·27 1470·18 1519·89 1569·89 1619·89 1669·89 1719·89 1769·76 1819·76 1869·76 1919·76 1969·76 2019·76 2069·76 2119·76

Const. G.P.E.K.I. over drainage

Inv. 73·02

73·22

R.P. 50' R.L. 82·50

Inv. of inlet.. 80·69 Inv. of outlet.. 79·99

Inv. of inlet.. 77·19 Inv. of outlet.. 76·79

Inv. of inlet.. 76·76 Inv. of outlet.. 76·36

Construct G.P.E.K.I.

Inv. of inlet.. 74·35 Inv. of outlet.. 74·03

Junction Pit

18" ϕ R.C.P.s at grades 1 in 18

Drainage easement 6' wide

Inv. of inlet.. 68·52 Inv. of outlet.. 68·27

Junction Pit

Construct Junction Pit

Inv. of inlet.. 66·91 Inv. of outlet 66·85

Construct std. Junction Pit. Inv. of inlet.. 71·09 Inv. of outlet.. 70·35

Proposed drainage easement

Construct 24" ϕ R.C.P. at grade 1 in 50

Inv. of outlet.. 64·82'

Inv. 64·52

Construct open three sided headwall.

Inv. 63·10'

Inv. of outlet.. 75·46' Inv. of inlet.. 75·71'

Construct Std. Conc. h'wall. Inv. of outlet....

Const. Junction Pit

Const. G.P.E.K.I.

Inv. of outlet 80·20

Inv. of outlet 80·00

Const. G.P.E.K.I. Inv. of outlet 80·10'

59' of 12" ϕ R.C.P. at approx. 1 in 50

Kerb

& gutter

ROAD 'B'

56' WIDE

Inv. 62·09'

Deepen gutter to provide fall to gully pit.

Construct 68' of 72" ϕ R.C.P. line with one Std. D.M.R. type h'wall at a grade of 1·48%

Crossing 3' wide conc. dish

Brick Gos mesh

Future Road Widening Purposes

Future Road Purposes

Reserved

Possessed

Conc. drain crossing 3' wide conc. dish

Conc. Plus Gos mesh

Existing

Proposed

ROAD 'A'

66' WIDE

End of K.&G.

Construct Bituminous surfaced road pavement to H'way.

Bench Mark on conc. H'wall R.L. 63·76

Inv. 57·44

Inv. 56·94

65·15

Batter to bitumen

HIGHWAY to KIAMA

PRINCES from NOWRA

old highway alignment

edge of bitumen

Watercourse

PUBLIC RESERVE

Future Road Widening Purposes

HOUSING COMMISSION PROPERTY

Reflective delineators are to be set along the main outer edge of the bitumen surface (13'6" from the road ℄) at the 4 widened corners and spaced at intervals of not less than 15 feet.

G.P.E.K.I. means standard gully pit with 6' precast lintel. Slotted inlets at an angle of 45° are to be formed in the gutter line where gully pits occur on grades in excess of 4%.

Scale..... 40' = 1".			Designed for 30 Miles per hour. Formation width.... 66' & 56'. Pavement width.... 36' & 30'. Normal Crossfall.. 1 in 32. Boxing Depth..... Subject to pavement test.		Approved on behalf of Kiama Municipal Council. Date....	PROPOSED SUBDIVISION OF MUSKFIELD ESTATE ..... RIVIERA DEVELOPMENT PTY. LTD.	File № / No. of Sheets. / Sheet No. 1.
Datum. Standard	Surveyed ... W.N.M. G.C.S. Drawn..... W.N.M.	Designed... W.N.M. G.C.S.					

97

PUBLIC RESERVE

Earth channel to be deepened to direct storm water into the drainage easement.

Construct Std. conc. headwall Inv. of inlet 108·48'

Earth channel to be deepened to direct storm water into the drainage easement.

Catch drain

Construct Std. conc. headwall Inv. of inlet 83·18'

Construct shallow catch drain 6' wide

Catch drain

ROAD 'B' 56' WIDE

ROAD 'A' 66' WIDE

Pathway 12' wide to be sealed

Pathway to be filled to provide suitable pedestrian access.

Construct Std. Junction Pit. Inv. of inlet..81·09' Inv. of outlet..80·99

Construct Junction pit with grating Surface inlet. 98·00' Outlet. 97·87

Construct Std. Junction Pit. Inv. of inlet 101·02 Inv. of outlet 100·88

Construct Std. Junction Pit. Inv. of inlet..86·44' Inv. of outlet..96·99

Construct G.P.E.K.1. Inv. of inlet....78·98' Inv. of outlet....78·48

Construct G.P.E.K.1. Inv. of inlet....77·45' Inv. of outlet...77·39

Construct G.P.E.K.1. Inv. of inlet 94·48 Inv. of outlet 94·36

Construct G.P.E.K.1. Inv. of inlet.. 78·34 Inv. of outlet..78·20

Construct G.P.E.K.1. Inv. of inlet...75·56 Inv. of outlet..75·43

Construct Std. Junction Pit. Inv. of inlet... 75·38' Inv. of outlet... 74·63'

Construct Std. Junction Pit. Inv. of inlet... 71·03' Inv. of outlet... 70·33'

Construct Std. Junction Pit. Inv. of inlet.. 86·17 Inv. of outlet.. 86·03

Construct Std. Junction Pit. Inv. of inlet... 81·19' Inv. of outlet... 81·02'

Construct Std. Junction Pit. Inv. of inlet.. 68·33' Inv. of outlet.. 68·00'

Construct Std. Conc. Headwall Inv. of outlet..63·37'

Inv. of 30" ϕ R.C.P. R.L. 62·06

Construct bituminous surfaced road pavement to H'way.

construct std. H'wall

Construct std. H'wall Inv. 57·46

Temporary K. & G.

Lay @ ch 37' 18" R.C. ϕ's at

Construct gully pits with G.P.E.K.1

Bench Mark on Conc. H'wall R.L. 63·76

Inv. 56·94

Conc. dish crossing to be shaped to direct water down Road 'B'.

Conc. dish crossing 3' wide 6" conc. plus 60s mesh

Tan. Dist..... 84·97
Sec. Dist..... 39·37
Arc. Dist..... 124·97

Sketch Detail.

Tan. Dist..... 59·88
Sec. Dist..... 21·64
Arc. Dist..... 99·90

Sketch Detail

SADDLEBACK MOUNTAIN ROAD

Future Road Purposes 51

Future Road Widening Purposes 117

Future Road Widening Purposes 118

PUBLIC RESERVE 119

PRIVATE PROPERTIES 116

PRINCES HIGHWAY to Kiama.

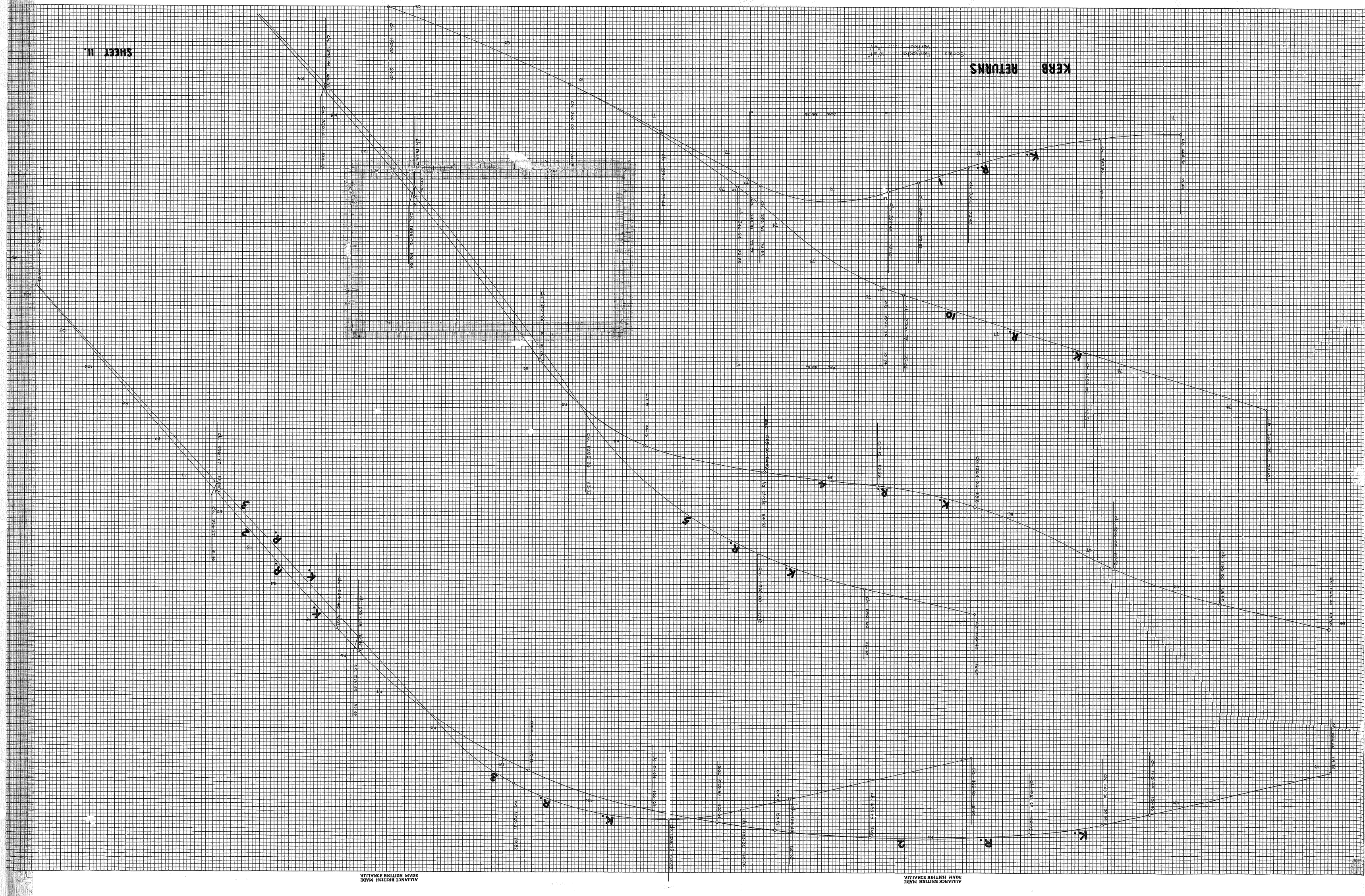
R.P. 50' R.L. 88·95
R.P. 50' R.L. 87·24
R.P. 50' R.L. 104·82
R.P. 50' R.L. 103·71
R.P. 50' R.L. 79·90
R.P. 50' R.L. 86·08
R.P. 50' R.L. 80·21
R.P. 50' R.L. 110·95

G.P.E.K.1. means standard gully pit with 6' precast lintel. Slotted inlets at an angle of 45° are to be formed in the gutter line where gully pits occur on grades in excess of 5%.

PROPOSED SUBDIVISION OF MUSKFIELD ESTATE ..... RIVIERA DEVELOPMENT PTY. LTD.			File Nº	Nº of Sheets	Sheet Nº 2.
					97

97

97


KERB RETURNS
SHEET 11.
ALLIANCE BRITISH MADE SPAM
ALLIANCE BRITISH MADE SPAM

97

SHEET 10.

KERB RETURNS

Scales: Horizontal 0" = 1'
Vertical 1" = 1'

ALLIANCE BRITISH MADE
ALLIANCE BRITISH MADE


BROWN
CALIOPE
ROAD
STREET
THO
STREET
SHOAL
Res.
Kiama
High School
M.P.S.
1396 3
Transmission Line Easement
MAIN
ROAD
R. P. 1437
SADDLEBACK
MOUNTAIN
A
A1
A2
A3
A4
A5
B
B1
B2
C
C1
C2
D
D1
D2
D3
D4
E
E1
E2
E3
E4
PT 98
PT 97
PT 96
PT 95
State
Metal
Quarry
14
PRINCES
HIGHWAY
COAST
Transmission Line Easement
MEASURED BY TREES
NEAR VERTICAL OBSCURED BY TREES
Creek
Munna
Munnora
97

LINED CATCH DRAINS

LOCATION			LENGTH
RIGHT	120km500	– 580	80
RIGHT	120km685	840	155
RIGHT	120km855	– 121km00	145

GUARDRAIL

LOCATION			LENGTH
LEFT	120km500	– 740	240
RIGHT	120km500	– 717	217

GUTTER TYPE SH

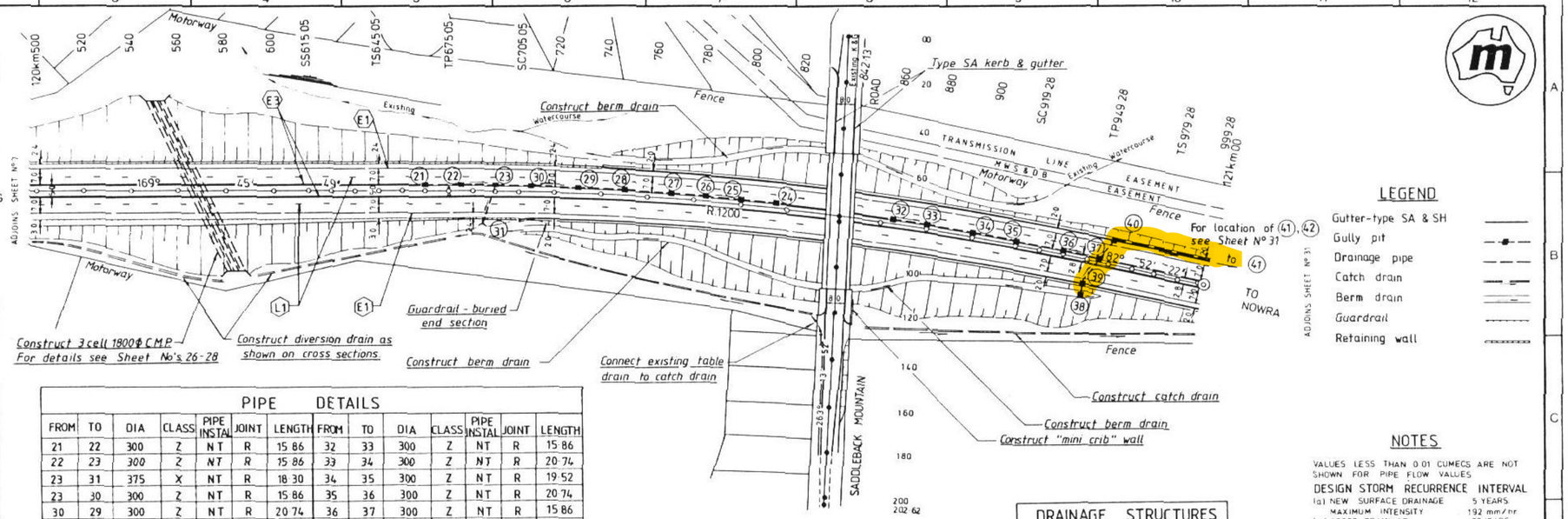
LOCATION			LENGTH
LEFT	120km740	– 121km00	260
RIGHT	120km705	121km00	295

GUTTER TYPE SE

LOCATION			LENGTH
LEFT	120km500	– 121km00	500
RIGHT	120km500	– 121km00	500

GUTTER TYPE SA

LOCATION			LENGTH
LEFT	26 – 51·25	(Abut A)	26
LEFT	108·75	(Abut B) – 125	17
RIGHT	15 – 51·25	(Abut A)	36
RIGHT	108·75	(Abut B) – 123	16



LEGEND

- Gutter-type SA & SH
- Gully pit
- Drainage pipe
- Catch drain
- Berm drain
- Guardrail
- Retaining wall

PIPE DETAILS

FROM	TO	DIA	CLASS	PIPE INSTAL	JOINT	LENGTH	FROM	TO	DIA	CLASS	PIPE INSTAL	JOINT	LENGTH
21	22	300	Z	NT	R	15·86	32	33	300	Z	NT	R	15·86
22	23	300	Z	NT	R	15·86	33	34	300	Z	NT	R	20·74
23	31	375	X	NT	R	18·30	34	35	300	Z	NT	R	19·52
23	30	300	Z	NT	R	15·86	35	36	300	Z	NT	R	20·74
30	29	300	Z	NT	R	20·74	36	37	300	Z	NT	R	15·86
29	28	300	Z	NT	R	20·74	37	39	375	Z	NT	R	12·20
28	27	300	Z	NT	R	20·74	39	38	375	Z	NT	R	6·10
27	26	300	Z	NT	R	15·86	37	40	450	X	NT	R	10·98
26	25	300	Z	NT	R	15·86	40	41	450	Z	NT	R	56·12
25	24	300	Z	NT	R	15·86	41	42	450	X	NT	R	9·76

NT denotes Normal Trench
R denotes Rubber Ring
All bedding 'type B'

DRAINAGE STRUCTURES

N°	LOCATION FROM CONTROL		TYPE
31	120km 690	14·5 R	Headwall
38	120km94928	Berm	GP B
41	121km 15	11·4 L	GPSH
42	121km 45·5	14 L	Headwall

DRAINAGE & LINEMARKING PLAN

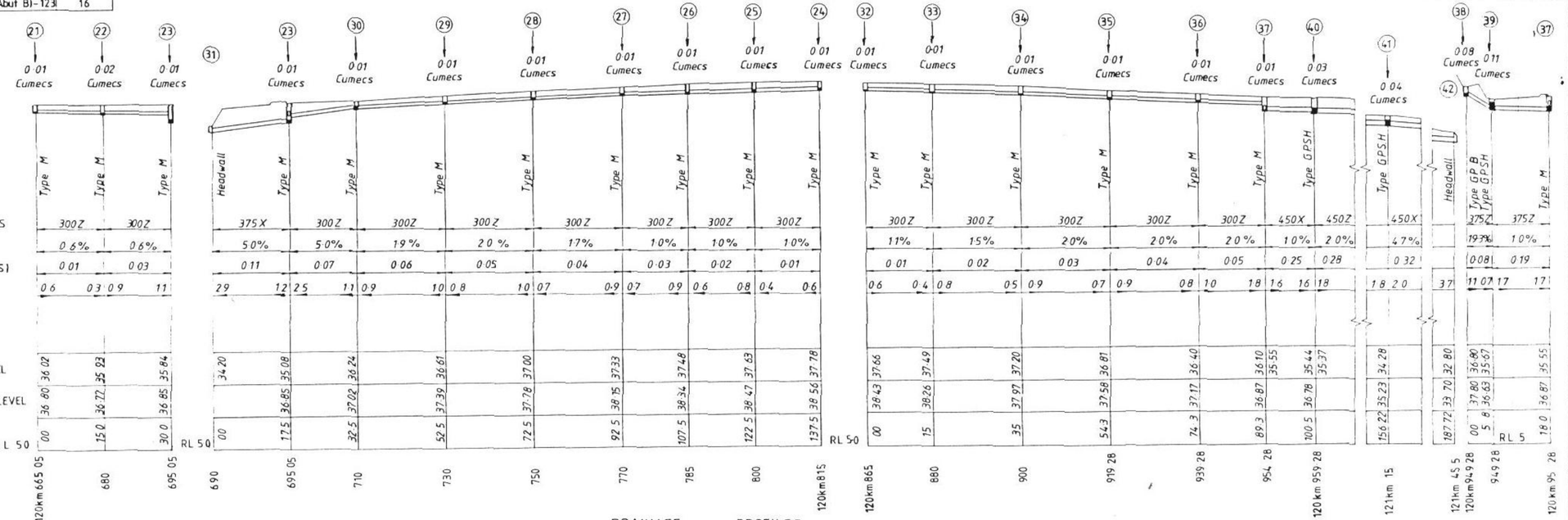
NOTES

VALUES LESS THAN 0·01 CUMECS ARE NOT SHOWN FOR PIPE FLOW VALUES

DESIGN STORM RECURRENCE INTERVAL
(a) NEW SURFACE DRAINAGE ... 5 YEARS
MAXIMUM INTENSITY ... 192 mm/hr
(b) CROSS DRAINAGE ... 50 YEARS
MAXIMUM INTENSITY ... 295 mm/hr

SUBSOIL DRAINS
(a) TOTAL LENGTH REQUIRED SECTION 120km500 TO 121km00 – 1500m
(b) PIPES TO BE LAID AT GRADE OF ROADWAY OR AT MINIMUM 0·5%
(c) LOCATION OF CLEANOUT POINTS AND OUTLET STRUCTURES TO BE DETERMINED DURING CONSTRUCTION

EROSION & SEDIMENTATION CONTROL
IN ACCORDANCE WITH INTERIM GUIDELINES-1984



DRAINAGE PROFILES

PLAN SCALES 0 5 10 15 20 25 50
PROFILES HORIZ 1:500
VERT 1:100

DATUM A H D | SURVEYED BY D. Tanner | FIELD BOOK 0001 236 FB 5554 | LEVEL BOOK 0001 236 LB 5799
DESIGNED K. Riggar 1/3/05 | CHECKED A. Wyatt 5/5/05 | PASSED

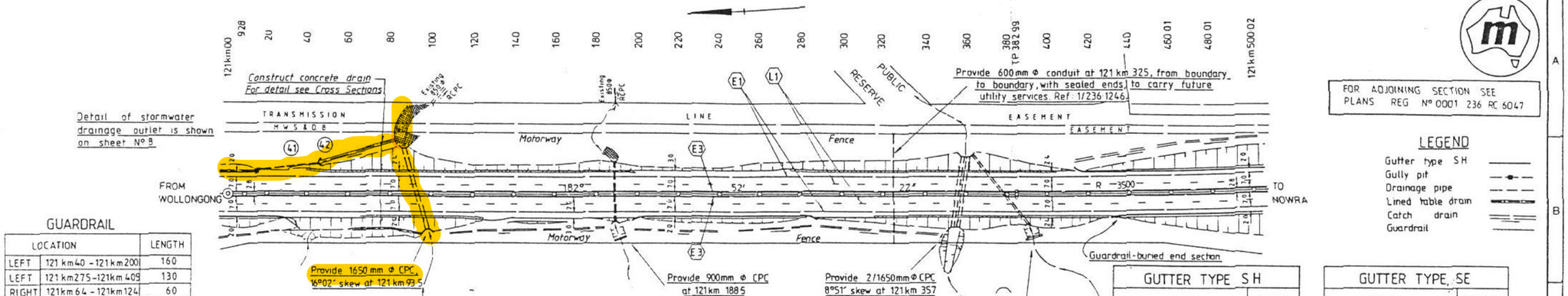
DEPARTMENT OF MAIN ROADS N.S.W.

STATE HIGHWAY 1 – PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
KIAMA TRAFFIC RELIEF ROUTE
DRAINAGE & LINEMARKING DETAILS – 120km500 to 121km00

FILE No.	No. OF SHEETS	SHEET No.
1/236·1262	40	8

Reg.No. 0001·236·RC·6046

S.D. 1128



FOR ADJOINING SECTION SEE PLANS REG No 0001 236 RC 6047

LEGEND

- Gutter type SH
- Gully pit
- Drainage pipe
- Lined table drain
- Catch drain
- Guardrail

GUARDRAIL

LOCATION		LENGTH
LEFT	121 km40 – 121 km200	160
LEFT	121 km275 – 121 km405	130
RIGHT	121km64 – 121km124	60
RIGHT	121km316 – 121km436	120
Total		470

LINED CATCH / DIVERSION DRAIN

LOCATION		LENGTH
LEFT	120km455 – 120 km 83	37·5
RIGHT	120km 00 – 120km 40	40
RIGHT	120km 60 – 120km 100	40

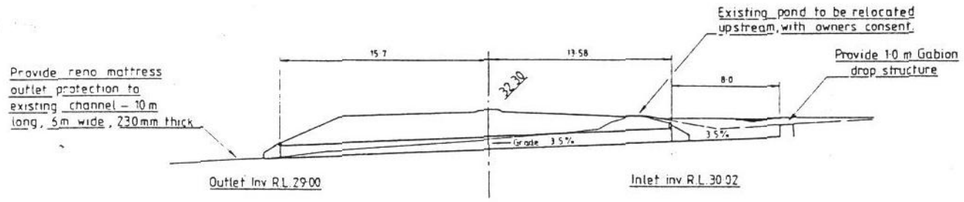
DRAINAGE & LINEMARKING PLAN

GUTTER TYPE SH

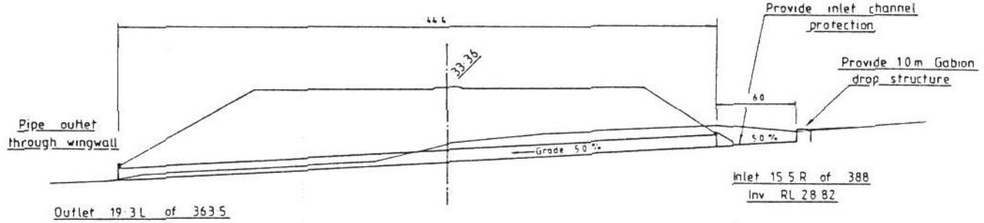
LOCATION		LENGTH
LEFT	121km00 – 121km 15	15
LEFT	121km412 – 121km 500	88
RIGHT	121km 00 – 121km 30	30
RIGHT	121km195 – 121km287	92
RIGHT	121km430 – 121km500	70

GUTTER TYPE SE

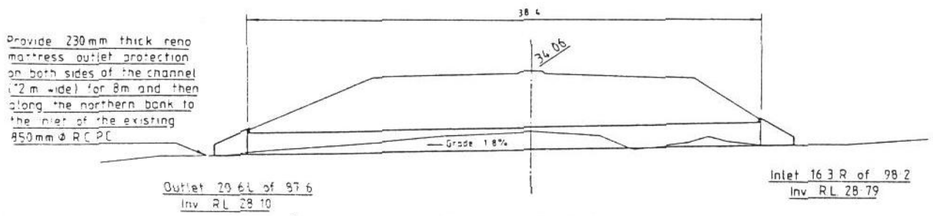
LOCATION		LENGTH
LEFT	121km00 – 121km500	500
RIGHT	121km00 – 121km500	500



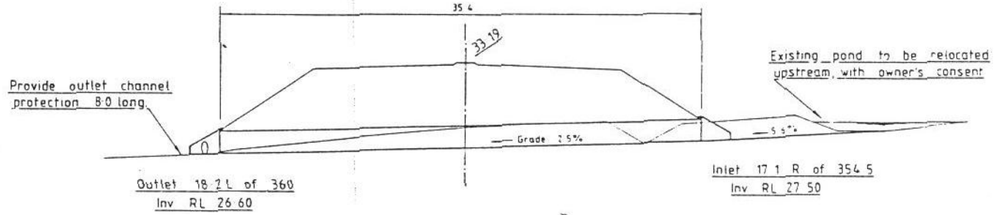
900 mm ø at 121km 188·5



1050 mm ø at 121 km 379
39° 09′ Skew



1650 mm ø at 121 km 93·5
16° 02′ Skew



2/1650 mm ø at 121km 357
8° 51′ Skew

CULVERT DESIGN DATA

LOCATION	121 km 93·5	121 km188·5	121 km 357	121 km 379
Recurrence interval (years)	50	50	50	50
Catchment area (ha)	15·9	4·3	38·6	4·3
Discharge (m^3/s) – AR&R 1977	7·1	1·6	11·3	1·9
Control	inlet	inlet	inlet	inlet
Design water level at inlet(m)	31·20	31·38	29·60	30·05
Inlet velocity (m/s)	3·3	2·5	2·6	2·2
Outlet velocity (m/s)	4·7	4·3	4·8	5·1
Critical depth (m)	1·1	0·5	0·9	0·5
Froude number	1·5	1·9	1·6	2·4
Length of hydraulic jump (m)	–	–	–	4·9

PIPE DETAILS

LOCATION	SIZE	CLASS	BEDDING	LENGTH
121 km 93·5	1650	Z	B	39·04
188·5	900	X	B	29·28
357	1650	Z	B	70·76
379	1050	Z	B	45·14

* Rubber ring joints

SCALES

PLAN 0 10 20 30 40 50

LONG SECTION 0 2 4 6 8 10

DEPARTMENT OF MAIN ROADS N.S.W.

STATE HIGHWAY 1 – PRINCES HIGHWAY
MUNICIPALITY OF KIAMA
KIAMA TRAFFIC RELIEF ROUTE
DRAINAGE & LINEMARKING DETAILS -121km 00 to 121km 500

FILE No.	No. OF SHEETS	SHEET No.
1/236 1262	40	31

Reg.No. 0001·236·RC·6046

APPENDIX B
Flood Mapping



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Unblocked - 20% AEP Event

Fig: **15158.F01**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Unblocked - 10% AEP Event

Fig: **15158.F02**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Unblocked - 5% AEP Event

Fig: **15158.F03**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Unblocked - 1% AEP Event

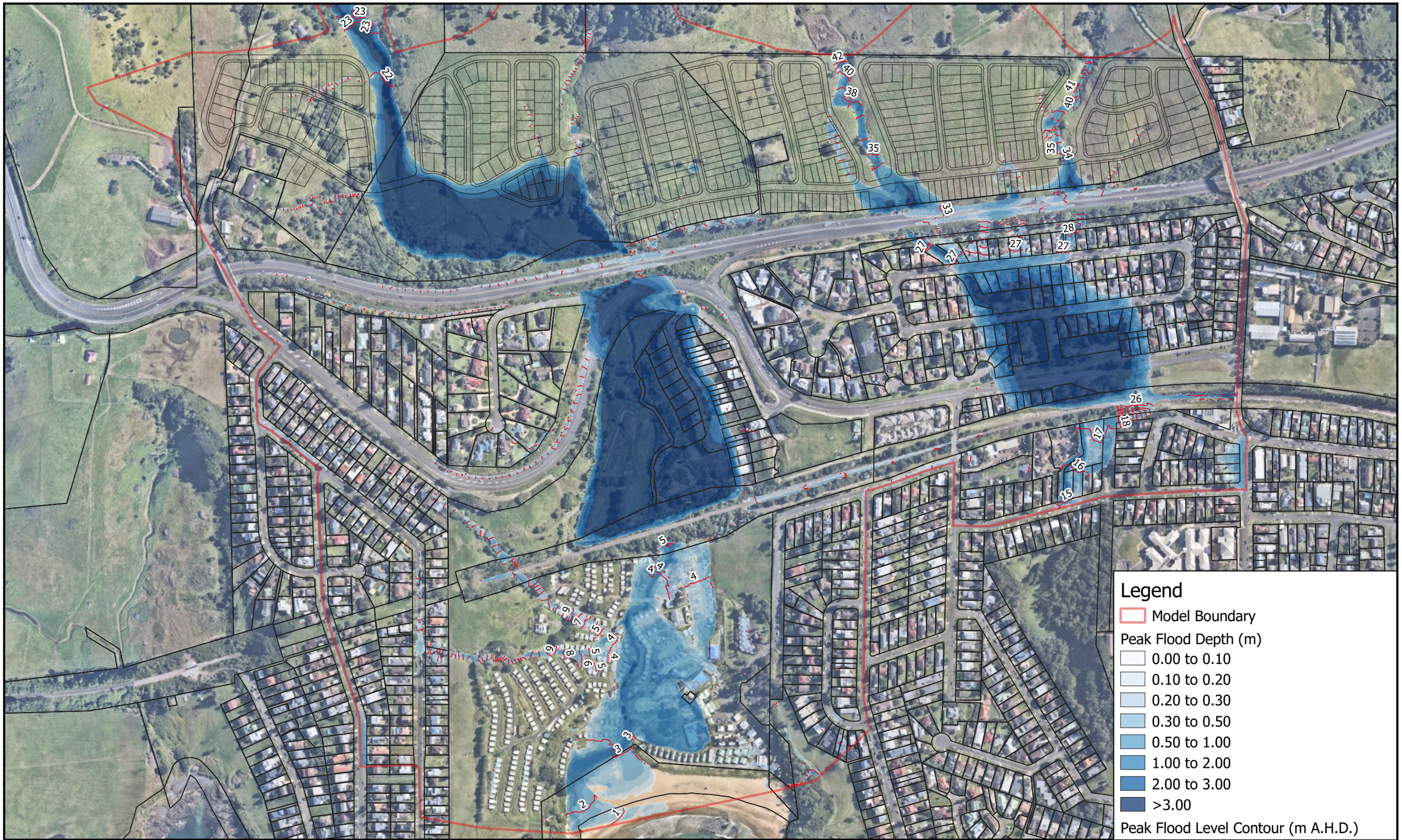
Scale: 1:5500 @ A3

Fig: **15158.F04**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Unblocked - PMF Event

Fig: **15158.F05**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Blockage Applied - 20% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F06**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Blockage Applied - 10% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F07

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Blockage Applied - 5% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F08**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Blockage Applied - 1% AEP Event

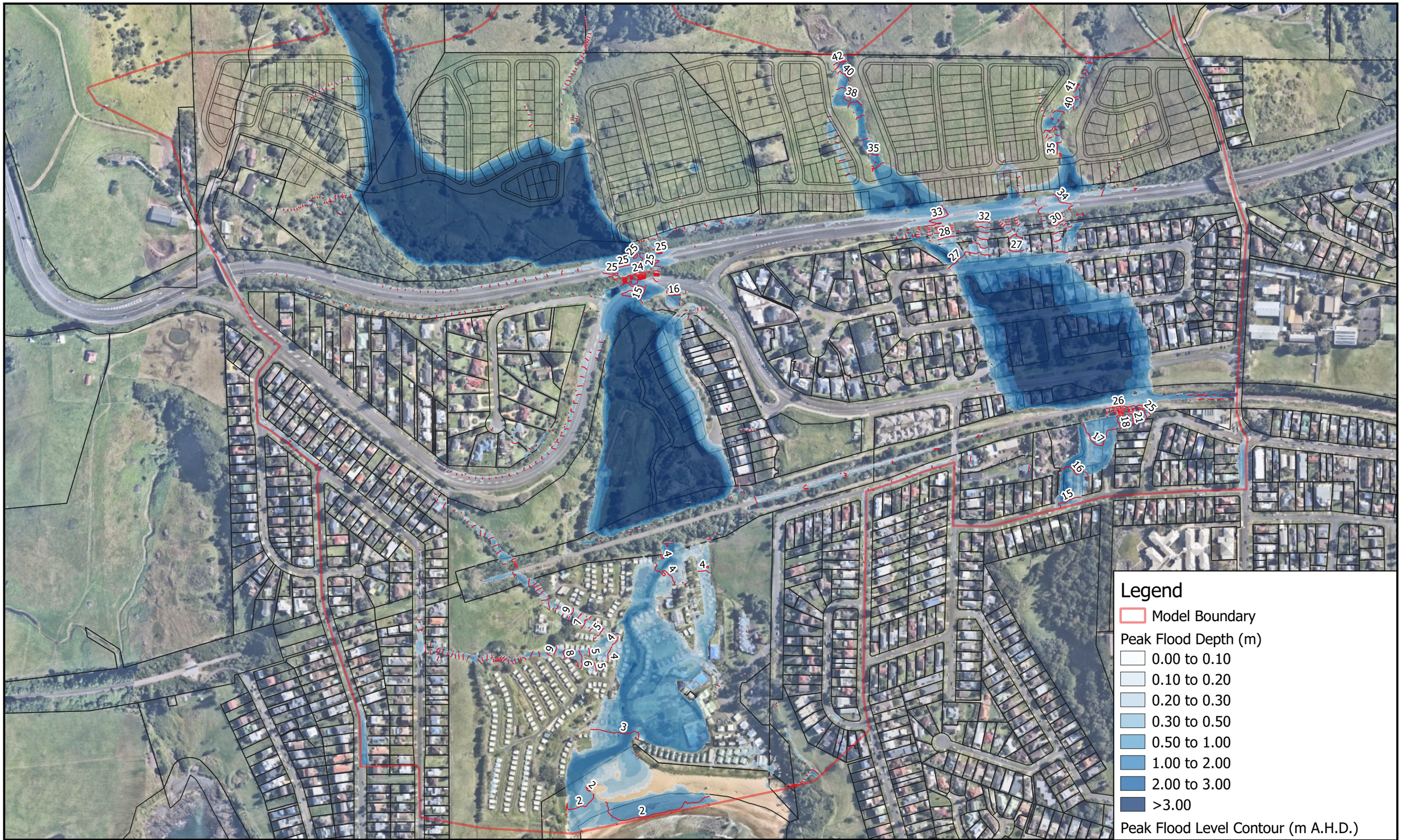
Scale: 1:5500 @ A3

Fig: **15158.F09**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Existing Scenario
Blockage Applied - PMF Event

Fig: **15158.F10**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Unblocked - 20% AEP Event

Fig: **15158.F11**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Unblocked - 10% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F12**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Unblocked - 5% AEP Event

Fig: **15158.F13**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Unblocked - 1% AEP Event

Fig: **15158.F14**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Unblocked - PMF Event

Fig: **15158.F15**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Blockage Applied - 20% AEP Event

Fig: **15158.F16**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Blockage Applied - 10% AEP Event

Fig: **15158.F17**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Blockage Applied - 5% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F18**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

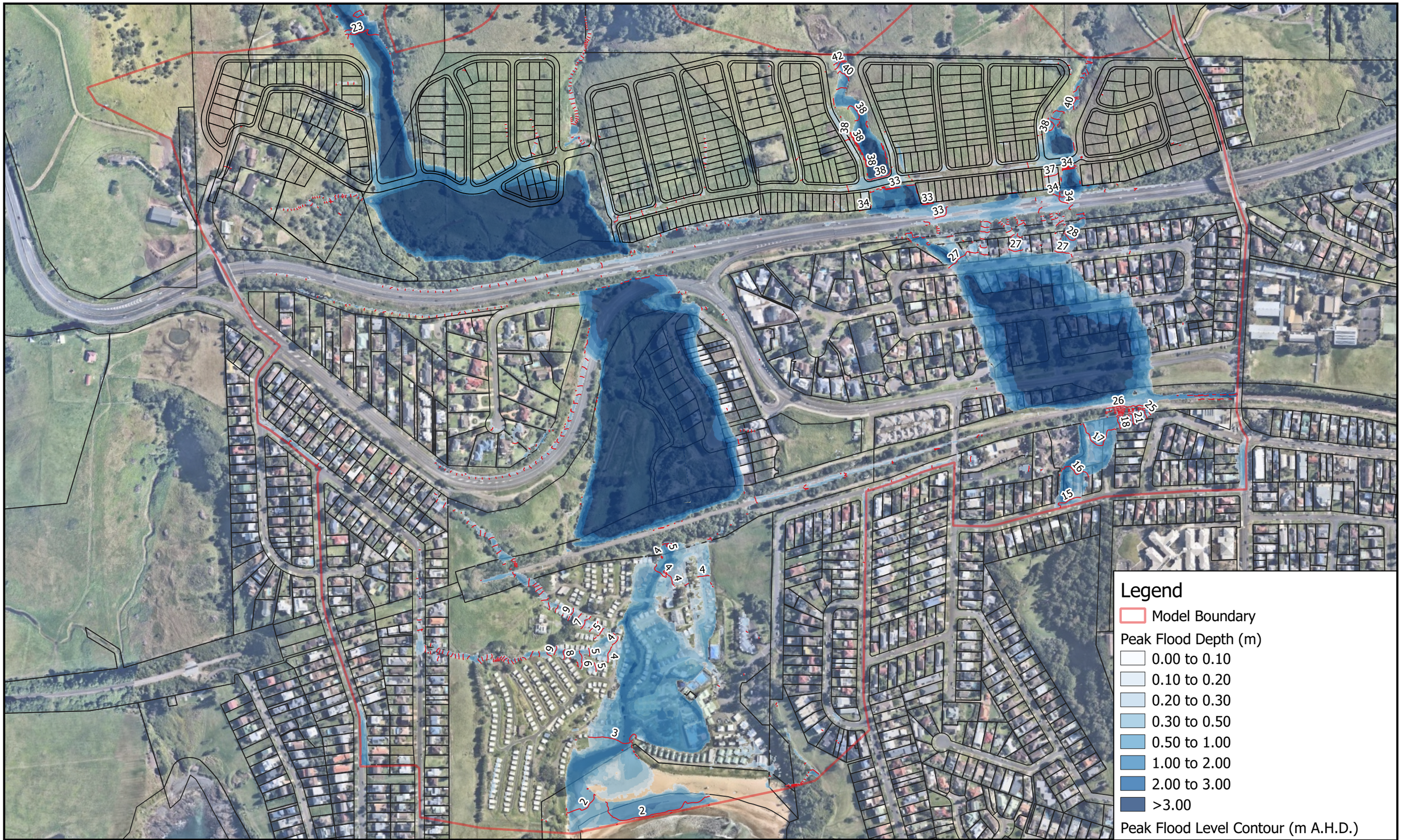
South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Blockage Applied - 1% AEP Event

Fig: **15158.F19**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Blockage Applied - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F20**

Rev: **C**

Date: **10.02.2021**

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Existing Scenario
Unblocked - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F21

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Existing Scenario
Unblocked - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F22

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Existing Scenario
Blockage Applied - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F23

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Existing Scenario
Blockage Applied - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F24

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Proposed Development Scenario
Unblocked - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F25

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Proposed Development Scenario
Unblocked - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F26

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Velocity (m/s)

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- > 4

Title:

South Kiama Rezoning
Flood Velocity Mapping - Proposed Development Scenario
Blockage Applied - 1% AEP Event

N

75 0 75 150 225 300 m

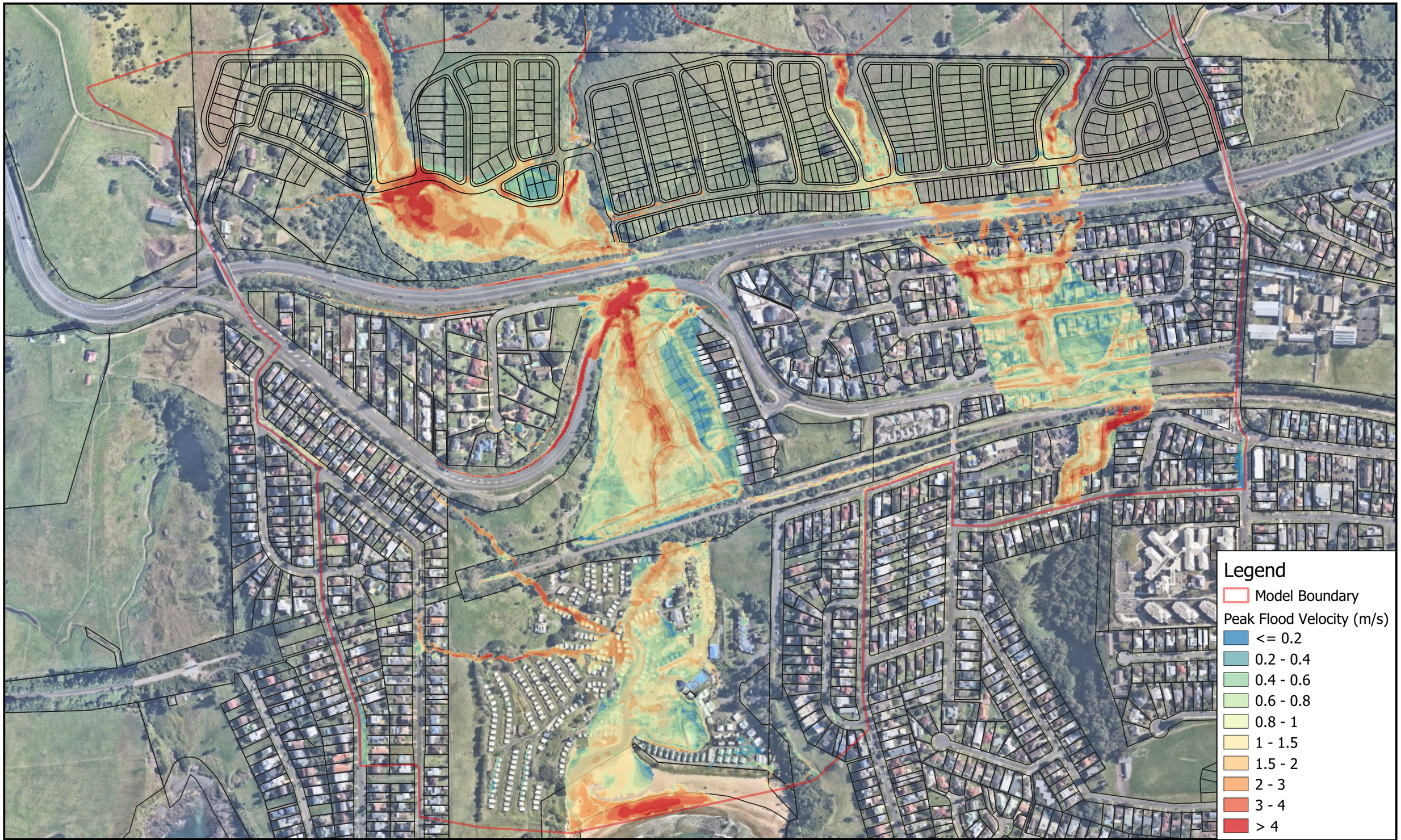
Scale: 1:5500 @ A3

Fig: 15158.F27

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Velocity Mapping - Proposed Development Scenario
Blockage Applied - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F28**

Rev: **C**

Date: **10.02.2021**

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

- H1: No vunerability constraints
- H2: Unsafe for small vehicles
- H3: Unsafe for all vehicles, children & elderly
- H4: Unsafe for all people and all vehicles
- H5: Building require special design & construction
- H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Existing Scenario
Unblocked - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F29

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

- H1: No vunerability constraints
- H2: Unsafe for small vehicles
- H3: Unsafe for all vehicles, children & elderly
- H4: Unsafe for all people and all vehicles
- H5: Building require special design & construction
- H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Existing Scenario
Unblocked - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F30

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Existing Scenario
Blockage Applied - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F31

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Existing Scenario
Blockage Applied - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F32

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Unblocked - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F33

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

- H1: No vunerability constraints
- H2: Unsafe for small vehicles
- H3: Unsafe for all vehicles, children & elderly
- H4: Unsafe for all people and all vehicles
- H5: Building require special design & construction
- H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Unblocked - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F34

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Blockage Applied - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F35

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Blockage Applied - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F36

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Categorisation

Floodway

Flood Storage

Flood Fringe

Title:

South Kiama Rezoning
Hydraulic Categorisation - Existing Scenario
1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F37

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Categorisation

Floodway

Flood Storage

Flood Fringe

Title:

South Kiama Rezoning
Hydraulic Categorisation - Existing Scenario
PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F38

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Categorisation

Floodway

Flood Storage

Flood Fringe

Title:

South Kiama Rezoning
Hydraulic Categorisation - Proposed Development Scenario
1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F39

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Hydraulic Categorisation

Floodway

Flood Storage

Flood Fringe

Title:

South Kiama Rezoning
Hydraulic Categorisation - Proposed Development Scenario
PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F40

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Unblocked - 20% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F41

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Unblocked - 10% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F42

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Unblocked - 5% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F43

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Unblocked - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F44

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Unblocked - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F45

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Blockage Applied - 20% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F46

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Blockage Applied - 10% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F47

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Blockage Applied - 5% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F48

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Blockage Applied - 1% AEP Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F49

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Blockage Applied - PMF Event

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F50

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Blockage Applied - 1% AEP Event 2070 Climate Projections

Fig: **15158.F51**

Rev: **C**

Date: **10.02.2021**

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Blockage Applied - 1% AEP Event 2070 Climate Projections

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F52

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Title:

South Kiama Rezoning
Flood Impact Mapping - Sensitivity Analysis
Climate Change Projection

Fig: 15158.F53

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Culvert 1 Failure Assessment

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F54**

Rev: **C**

Date: **10.02.2021**

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Culvert 1 Failure Assessment

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F55

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Culvert 1 Failure Assessment

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F56

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Culvert 2&3 Failure Assessment

Fig: **15158.F57**

Rev: **C**

Date: **10.02.2021**

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

- H1: No vunerability constraints
- H2: Unsafe for small vehicles
- H3: Unsafe for all vehicles, children & elderly
- H4: Unsafe for all people and all vehicles
- H5: Building require special design & construction
- H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Culvert 2&3 Failure Assessment

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F58

Rev: C

Date: 10.02.2021

siteplus

Legend

Model Boundary

Peak Flood Level Difference (m)

-0.5

-0.3

-0.05

No Impact

+0.05

+0.3

+0.5

Cell Variation

Was Wet now Dry

Was Dry Now Wet

Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Culvert 2&3 Failure Assessment

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F59

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Proposed Development Scenario
Sensitivity Analysis - Blockage + 10%

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: **15158.F60**

Rev: **C**

Date: **10.02.2021**

siteplus

Legend

Model Boundary

Hydraulic Hazard Categorisation

H1: No vunerability constraints

H2: Unsafe for small vehicles

H3: Unsafe for all vehicles, children & elderly

H4: Unsafe for all people and all vehicles

H5: Building require special design & construction

H6: Not suitable for any type of development

Title:

South Kiama Rezoning
Hydraulic Hazard Mapping - Proposed Development Scenario
Sensitivity Analysis - Blockage + 10%

N

75 0 75 150 225 300 m

Scale: 1:5500 @ A3

Fig: 15158.F61

Rev: C

Date: 10.02.2021

siteplus



Title:

South Kiama Rezoning
Flood Impact Mapping - Proposed Development Scenario
Sensitivity Analysis - Blockage + 10%

N

75 0 75 150 225 300 m

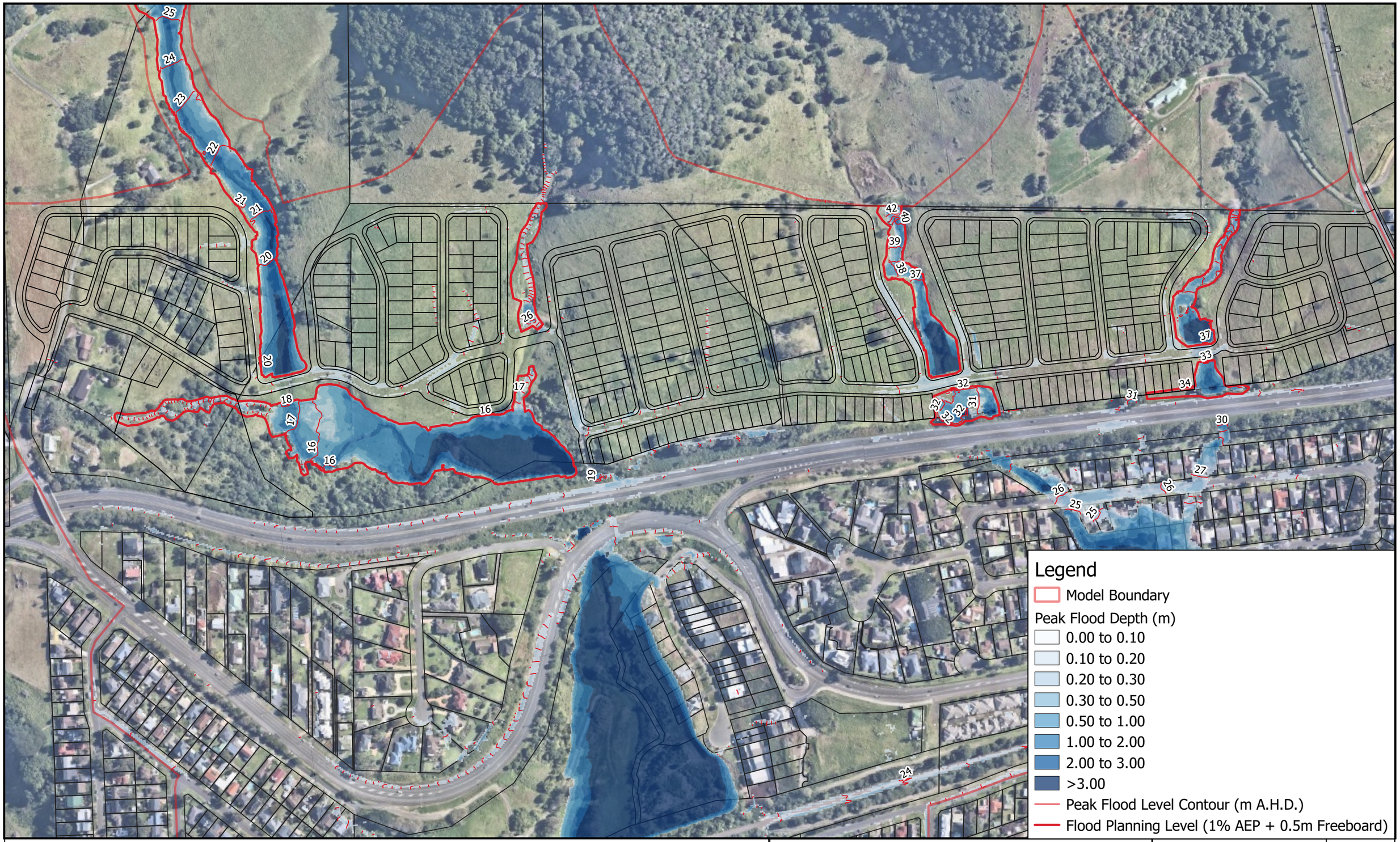
Scale: 1:5500 @ A3

Fig: **15158.F62**

Rev: **C**

Date: **10.02.2021**

siteplus



Title:

South Kiama Rezoning
Flood Depth Mapping - Maximum Flood Extents + Climate Change
Flood Planning Level Envelope

Fig: 15158.F63

Rev: C

Date: 10.02.2021

siteplus

APPENDIX C
WBNM Text Files

Southern Catchment

```
#####START_PREAMBLE_BLOCK##########|##########|##########|##########|
RUNFILE 15158_WBNM_Southern
Runs 5 year ARI & PMF design storms from duration 30 to 270 minutes.

Set sum_multistorms flag to TRUE in the Global.ini or Project.ini files
for a summary table of results.
Calculation time steps are set for each storm to be <= the time period
in the ARR design temporal patterns. If your time step is too long, WBNM
warns you and adjusts it down to the required value.
#####END_PREAMBLE_BLOCK##########|##########|##########|##########|


#####START_STATUS_BLOCK##########|##########|##########|##########|
T:\Projects\15158 South Kiama\WBNM\15158_WBNM_B
last edited  27/ 7/2020
by  Default user name of Your Organisation
2003_V104   Unchecked_Edited_Model
#####END_STATUS_BLOCK##########|##########|##########|##########|


#####START_DISPLAY_BLOCK##########|##########|##########|##########|
  299936.00  6159534.00   302772.00  6157285.00
      none
  299936.00  6159534.00   302772.00  6157285.00   302772.00  6159555.00
#####END_DISPLAY_BLOCK##########|##########|##########|##########|


#####START_TOPOLOGY_BLOCK##########|##########|##########|##########|
       7
SUB1        300651.00  6158118.00   301232.00  6158361.00 SUB3
SUB2        300402.00  6158626.00   301111.00  6158420.00 SUB3
SUB3        300853.00  6158924.00   301313.00  6158605.00 SUB4
SUB4        301548.00  6158335.00   301861.00  6158756.00 SUB6
SUB5        301360.00  6158993.00   301861.00  6158756.00 SUB6
SUB6        301946.00  6158882.00   302091.00  6158870.00 SUB7
SUB7        302304.00  6159006.00   302503.00  6159095.00 SINK
#####END_TOPOLOGY_BLOCK##########|##########|##########|##########|


#####START_SURFACES_BLOCK##########|##########|##########|##########|
      0.77
-99.90000150
SUB1            58.00       0.00       1.00       0.10
SUB2            41.78       0.00       1.00       0.10
SUB3            37.53       0.00       1.00       0.10
SUB4            63.05       0.00       1.00       0.10
SUB5            33.34       0.00       1.00       0.10
SUB6            30.12       0.00       1.00       0.10
SUB7            22.75       0.00       1.00       0.10
#####END_SURFACES_BLOCK##########|##########|##########|##########|


#####START_FLOWPATHS_BLOCK#########|##########|##########|##########|
        5
SUB3
#####ROUTING
      0.50
SUB4
#####ROUTING
      0.50
SUB5
#####ROUTING
      0.50
SUB6
#####ROUTING
      0.50
SUB7
#####ROUTING
      0.50
#####END_FLOWPATHS_BLOCK##########|##########|##########|##########|


#####START_LOCAL_STRUCTURES_BLOCK##|##########|##########|##########|
        0
```

```
#####END_LOCAL_STRUCTURES_BLOCK####|###########|###########|###########|


#####START_OUTLET_STRUCTURES_BLOCK#|###########|###########|###########|
         0
#####END_OUTLET_STRUCTURES_BLOCK###|###########|###########|###########|


#####START_STORM_BLOCK############|###########|###########|###########|
        35
#####START_STORM#1
1% AEP 30mn
       5.00
       5.00
#####START_DESIGN_RAIN
        100        30        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63 Test IFD rainfall coeffs
NEWDESGAUGEX
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00       2.00       0.00
SUB2               0.00       2.00       0.00
SUB3               0.00       2.00       0.00
SUB4               0.00       2.00       0.00
SUB5               0.00       2.00       0.00
SUB6               0.00       2.00       0.00
SUB7               0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#1
#####START_STORM#2
1% AEP 45mn
       5.00
       5.00
#####START_DESIGN_RAIN
        100        45        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00       2.00       0.00
SUB2               0.00       2.00       0.00
SUB3               0.00       2.00       0.00
SUB4               0.00       2.00       0.00
SUB5               0.00       2.00       0.00
SUB6               0.00       2.00       0.00
SUB7               0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#2
#####START_STORM#3
1% AEP 60mn
       5.00
       5.00
#####START_DESIGN_RAIN
        100        60        1.00
IFD_COEFFS_IN_THIS_FILE
```

```
        1
KIAMA               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#3
#####START_STORM#4
1% AEP 90mn
     15.00
     15.00
#####START_DESIGN_RAIN
       100       90        1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#4
#####START_STORM#5
1% AEP 120mn
     15.00
     15.00
#####START_DESIGN_RAIN
       100       120       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
```

```
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#5
#####START_STORM#6
1% AEP 180mn
      15.00
      15.00
#####START_DESIGN_RAIN
       100      180         1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00        2.00        0.00
SUB2               0.00        2.00        0.00
SUB3               0.00        2.00        0.00
SUB4               0.00        2.00        0.00
SUB5               0.00        2.00        0.00
SUB6               0.00        2.00        0.00
SUB7               0.00        2.00        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#6
#####START_STORM#7
1% AEP 270mn
      15.00
      15.00
#####START_DESIGN_RAIN
       100       270         1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00        2.00        0.00
SUB2               0.00        2.00        0.00
SUB3               0.00        2.00        0.00
SUB4               0.00        2.00        0.00
SUB5               0.00        2.00        0.00
SUB6               0.00        2.00        0.00
SUB7               0.00        2.00        0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#7
#####START_STORM#8
PMF 2HR
      15.00
      15.00
#####START_DESIGN_RAIN
      9999       120         1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
```

```
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB2            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
SUB4            0.00      2.00      0.00
SUB5            0.00      2.00      0.00
SUB6            0.00      2.00      0.00
SUB7            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#8
#####START_STORM#9
PMF 3HR
      15.00
      15.00
#####START_DESIGN_RAIN
     9999       180       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB2            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
SUB4            0.00      2.00      0.00
SUB5            0.00      2.00      0.00
SUB6            0.00      2.00      0.00
SUB7            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#9
#####START_STORM#10
PMF 270mn
      15.00
      15.00
#####START_DESIGN_RAIN
     9999       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB2            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
SUB4            0.00      2.00      0.00
SUB5            0.00      2.00      0.00
SUB6            0.00      2.00      0.00
SUB7            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#10
```

```
#####START_STORM#11
PMF 30min
      5.00
      5.00
#####START_DESIGN_RAIN
      9999        30       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#11
#####START_STORM#12
PMF 60min
      5.00
      5.00
#####START_DESIGN_RAIN
      9999        60       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#12
#####START_STORM#13
1% AEP 25min
      5.00
      5.00
#####START_DESIGN_RAIN
       100        25       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2             20.0        2.50       0.50
SUB3             20.0        2.50       0.50
```

```
SUB4              20.0       2.50       0.50
SUB5              20.0       2.50       0.50
SUB6              20.0       2.50       0.50
SUB7              20.0       2.50       0.50
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#13
#####START_STORM#14
1% AEP 20min
       5.00
       5.00
#####START_DESIGN_RAIN
        100        20       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             10.00       2.00       0.00
SUB2              20.0       2.50       0.50
SUB3              20.0       2.50       0.50
SUB4              20.0       2.50       0.50
SUB5              20.0       2.50       0.50
SUB6              20.0       2.50       0.50
SUB7              20.0       2.50       0.50
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#14
#####START_STORM#15
20% AEP 30mn
       5.00
       5.00
#####START_DESIGN_RAIN
         5         30       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#15
#####START_STORM#16
20% AEP 45mn
       5.00
       5.00
#####START_DESIGN_RAIN
```

```
  5       45        1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#16
#####START_STORM#17
20% AEP 60mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       60        1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#17
#####START_STORM#18
20% AEP 90mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       90       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
```

```
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#18
#####START_STORM#19
20% AEP 120mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       120       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama             1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#19
#####START_STORM#20
20% AEP 180mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       180       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama             1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#20
#####START_STORM#21
20% AEP 270mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama             1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
```

#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
SUB2 20.0 2.50 0.50
SUB3 20.0 2.50 0.50
SUB4 20.0 2.50 0.50
SUB5 20.0 2.50 0.50
SUB6 20.0 2.50 0.50
SUB7 20.0 2.50 0.50
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#21
#####START_STORM#22
10% AEP 30mn
5.00
5.00
#####START_DESIGN_RAIN
10 30 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
SUB2 0.00 2.00 0.00
SUB3 0.00 2.00 0.00
SUB4 0.00 2.00 0.00
SUB5 0.00 2.00 0.00
SUB6 0.00 2.00 0.00
SUB7 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#22
#####START_STORM#23
10% AEP 45mn
5.00
5.00
#####START_DESIGN_RAIN
10 45 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
SUB2 0.00 2.00 0.00
SUB3 0.00 2.00 0.00
SUB4 0.00 2.00 0.00
SUB5 0.00 2.00 0.00
SUB6 0.00 2.00 0.00
SUB7 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0

```
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#23
#####START_STORM#24
10% AEP 60mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10        60       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#24
#####START_STORM#25
10% AEP 90mn
      5.00
      5.00
#####START_DESIGN_RAIN
 10               90       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#25
#####START_STORM#26
10% AEP 120mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10       120       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
```

```
SUB2            20.0      2.50      0.50
SUB3            20.0      2.50      0.50
SUB4            20.0      2.50      0.50
SUB5            20.0      2.50      0.50
SUB6            20.0      2.50      0.50
SUB7            20.0      2.50      0.50
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#26
#####START_STORM#28
10% AEP 270mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10       270      1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama            1KIAMA       301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB2            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
SUB4            0.00      2.00      0.00
SUB5            0.00      2.00      0.00
SUB6            0.00      2.00      0.00
SUB7            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#28
#####START_STORM#29
5% AEP 30mn
      5.00
      5.00
#####START_DESIGN_RAIN
       20       30       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama            1KIAMA       301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB2            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
SUB4            0.00      2.00      0.00
SUB5            0.00      2.00      0.00
SUB6            0.00      2.00      0.00
SUB7            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#29
#####START_STORM#30
5% AEP 45mn
      5.00
```

```
      5.00
#####START_DESIGN_RAIN
       20        45       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
SUB2             0.00       2.00       0.00
SUB3             0.00       2.00       0.00
SUB4             0.00       2.00       0.00
SUB5             0.00       2.00       0.00
SUB6             0.00       2.00       0.00
SUB7             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#30
#####START_STORM#31
5% AEP 60mn
      5.00
      5.00
#####START_DESIGN_RAIN
    20            60       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
SUB2             0.00       2.00       0.00
SUB3             0.00       2.00       0.00
SUB4             0.00       2.00       0.00
SUB5             0.00       2.00       0.00
SUB6             0.00       2.00       0.00
SUB7             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#31
#####START_STORM#32
5% AEP 90mn
      5.00
      5.00
#####START_DESIGN_RAIN
       20        90       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
SUB2             0.00       2.00       0.00
SUB3             0.00       2.00       0.00
SUB4             0.00       2.00       0.00
SUB5             0.00       2.00       0.00
SUB6             0.00       2.00       0.00
```

```
SUB7            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#32
#####START_STORM#33
5% AEP 120mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20        120        1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB2            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
SUB4            0.00       2.00       0.00
SUB5            0.00       2.00       0.00
SUB6            0.00       2.00       0.00
SUB7            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#33
#####START_STORM#34
5% AEP 180mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20        180        1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama               1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB2            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
SUB4            0.00       2.00       0.00
SUB5            0.00       2.00       0.00
SUB6            0.00       2.00       0.00
SUB7            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#34
#####START_STORM#35
5% AEP 270mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20        270        1.00
IFD_COEFFS_IN_THIS_FILE
         1
```

```
Kiama               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#35
#####START_STORM#35
10% AEP 180mn
       5.00
       5.00
#####START_DESIGN_RAIN
        10        180       -1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27       15.81        0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB2              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
SUB4              0.00       2.00       0.00
SUB5              0.00       2.00       0.00
SUB6              0.00       2.00       0.00
SUB7              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#35
#####END_STORM_BLOCK##########################################################################
```

Middle Catchment

```
#####START_PREAMBLE_BLOCK##########|##########|##########|##########|
RUNFILE 15158_WBNM_Southern
Runs 5 year ARI & PMF design storms from duration 30 to 270 minutes.

Set sum_multistorms flag to TRUE in the Global.ini or Project.ini files
for a summary table of results.
Calculation time steps are set for each storm to be <= the time period
in the ARR design temporal patterns. If your time step is too long, WBNM
warns you and adjusts it down to the required value.
#####END_PREAMBLE_BLOCK##########|##########|##########|##########|


#####START_STATUS_BLOCK##########|##########|##########|##########|
T:\Projects\15158 South Kiama\WBNM\15158_WBNM_Middle
last edited  27/ 7/2020
by  Default user name of Your Organisation
2003_V104   Unchecked_Edited_Model
#####END_STATUS_BLOCK##########|##########|##########|##########|


#####START_DISPLAY_BLOCK##########|##########|##########|##########|
  301336.88  6159836.00   302236.38  6159225.00
      none
  299936.00  6159534.00   302772.00  6157285.00   302772.00  6159555.00
#####END_DISPLAY_BLOCK##########|##########|##########|##########|


#####START_TOPOLOGY_BLOCK##########|##########|##########|##########|
       2
SUB1          301584.50  6159457.00 301835.4060  6159481.00 SUB3
SUB3          302003.22  6159514.00   302233.72  6159561.00 SINK
#####END_TOPOLOGY_BLOCK##########|##########|##########|##########|


#####START_SURFACES_BLOCK##########|##########|##########|##########|
      0.77
-99.90000150
SUB1            15.94       0.00       1.00       0.00
SUB3            17.53       0.00       1.00       0.00
#####END_SURFACES_BLOCK##########|##########|##########|##########|


#####START_FLOWPATHS_BLOCK#########|##########|##########|##########|
        1
SUB3
#####ROUTING
      0.50
#####END_FLOWPATHS_BLOCK##########|##########|##########|##########|


#####START_LOCAL_STRUCTURES_BLOCK##|##########|##########|##########|
        0
#####END_LOCAL_STRUCTURES_BLOCK####|##########|##########|##########|


#####START_OUTLET_STRUCTURES_BLOCK#|##########|##########|##########|
        0
#####END_OUTLET_STRUCTURES_BLOCK###|##########|##########|##########|


#####START_STORM_BLOCK#############|##########|##########|##########|
       35
#####START_STORM#1
1% AEP 30mn
      5.00
      5.00
#####START_DESIGN_RAIN
       100        30        1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA         301850.00  6159300.00       50.00       46.25       9.81       2.72       97.35       20.36       6.73
4.27       15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
NEWDESGAUGEX
#####START_CALC_RAINGAUGE_WEIGHTS
```

```
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#1
#####START_STORM#2
1% AEP 45mn
      5.00
      5.00
#####START_DESIGN_RAIN
       100       45       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA             1KIAMA       301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#2
#####START_STORM#3
1% AEP 60mn
      5.00
      5.00
#####START_DESIGN_RAIN
       100       60       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA             1KIAMA       301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#3
#####START_STORM#4
1% AEP 90mn
      15.00
      15.00
#####START_DESIGN_RAIN
       100       90       1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA             1KIAMA       301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
```

```
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#4
#####START_STORM#5
1% AEP 120mn
      15.00
      15.00
#####START_DESIGN_RAIN
        100        120        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#5
#####START_STORM#6
1% AEP 180mn
      15.00
      15.00
#####START_DESIGN_RAIN
        100       180        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#6
#####START_STORM#7
1% AEP 270mn
      15.00
      15.00
#####START_DESIGN_RAIN
        100       270        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
```

```
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#7
#####START_STORM#8
PMF 2HR
      15.00
      15.00
#####START_DESIGN_RAIN
     9999        120        1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
SUB3             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#8
#####START_STORM#9
PMF 3HR
      15.00
      15.00
#####START_DESIGN_RAIN
     9999        180        1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
SUB3             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#9
#####START_STORM#10
PMF 270mn
      15.00
      15.00
#####START_DESIGN_RAIN
     9999        270        1.00
IFD_COEFFS_IN_THIS_FILE
        1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
SUB3             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
```

0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#10
#####START_STORM#11
PMF 30min
5.00
5.00
#####START_DESIGN_RAIN
9999 30 1.00
IFD_COEFFS_IN_THIS_FILE
1
KIAMA 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
SUB3 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#11
#####START_STORM#12
PMF 60min
5.00
5.00
#####START_DESIGN_RAIN
9999 60 1.00
IFD_COEFFS_IN_THIS_FILE
1
KIAMA 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
SUB3 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#12
#####START_STORM#13
1% AEP 25min
5.00
5.00
#####START_DESIGN_RAIN
100 25 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
SUB3 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#13

```
#####START_STORM#14
1% AEP 20min
      5.00
      5.00
#####START_DESIGN_RAIN
       100        20       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#14
#####START_STORM#15
20% AEP 30mn
      5.00
      5.00
#####START_DESIGN_RAIN
         5        30       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#15
#####START_STORM#16
20% AEP 45mn
      5.00
      5.00
#####START_DESIGN_RAIN
   5       45        1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#16
#####START_STORM#17
20% AEP 60mn
      5.00
```

```
      5.00
#####START_DESIGN_RAIN
        5       60        1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#17
#####START_STORM#18
20% AEP 90mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5        90        1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#18
#####START_STORM#19
20% AEP 120mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       120        1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#19
#####START_STORM#20
20% AEP 180mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       180        1.00
```

```
IFD_COEFFS_IN_THIS_FILE
        1
Kiama               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#20
#####START_STORM#21
20% AEP 270mn
      5.00
      5.00
#####START_DESIGN_RAIN
        5       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#21
#####START_STORM#22
10% AEP 30mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10        30       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama               1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#22
#####START_STORM#23
10% AEP 45mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10        45       1.00
IFD_COEFFS_IN_THIS_FILE
        1
```

```
Kiama           1KIAMA      301850.00  6159300.00    50.00    46.25     9.81     2.72    97.35    20.36     6.73
4.27    15.81     0.00   1100.00       25     0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00     2.00     0.00
SUB3            0.00     2.00     0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
       0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
       0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#23
#####START_STORM#24
10% AEP 60mn
     5.00
     5.00
#####START_DESIGN_RAIN
       10       60     1.00
IFD_COEFFS_IN_THIS_FILE
       1
Kiama           1KIAMA      301850.00  6159300.00    50.00    46.25     9.81     2.72    97.35    20.36     6.73
4.27    15.81     0.00   1100.00       25     0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00     2.00     0.00
SUB3            0.00     2.00     0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
       0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
       0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#24
#####START_STORM#25
10% AEP 90mn
     5.00
     5.00
#####START_DESIGN_RAIN
 10             90     1.00
IFD_COEFFS_IN_THIS_FILE
       1
Kiama           1KIAMA      301850.00  6159300.00    50.00    46.25     9.81     2.72    97.35    20.36     6.73
4.27    15.81     0.00   1100.00       25     0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00     2.00     0.00
SUB3            0.00     2.00     0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
       0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
       0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#25
#####START_STORM#26
10% AEP 120mn
     5.00
     5.00
#####START_DESIGN_RAIN
       10      120     1.00
IFD_COEFFS_IN_THIS_FILE
       1
Kiama           1KIAMA      301850.00  6159300.00    50.00    46.25     9.81     2.72    97.35    20.36     6.73
4.27    15.81     0.00   1100.00       25     0.63
#####END_DESIGN_RAIN
```

```
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#26
#####START_STORM#28
10% AEP 270mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama            1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#28
#####START_STORM#29
5% AEP 30mn
      5.00
      5.00
#####START_DESIGN_RAIN
       20       30       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama            1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
SUB3            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#29
#####START_STORM#30
5% AEP 45mn
      5.00
      5.00
#####START_DESIGN_RAIN
       20       45       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama            1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
```

```
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#30
#####START_STORM#31
5% AEP 60mn
       5.00
       5.00
#####START_DESIGN_RAIN
    20           60       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#31
#####START_STORM#32
5% AEP 90mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20         90       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#32
#####START_STORM#33
5% AEP 120mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20        120       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
SUB3            0.00       2.00       0.00
#####END_LOSS_RATES
```

```
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#33
#####START_STORM#34
5% AEP 180mn
      5.00
      5.00
#####START_DESIGN_RAIN
        20       180       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama             1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATESS
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#34
#####START_STORM#35
5% AEP 270mn
      5.00
      5.00
#####START_DESIGN_RAIN
        20       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama             1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#35
#####START_STORM#35
10% AEP 180mn
      5.00
      5.00
#####START_DESIGN_RAIN
        10       180      -1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama             1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
SUB3              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
```

#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#35
#####END_STORM_BLOCK##

Northern Catchment

```
#####START_PREAMBLE_BLOCK##########|##########|##########|##########|
RUNFILE 15158_WBNM_Northern
Runs 5year ARI & PMF design storms from duration 30 to 270 minmutes.

Set sum_multistorms flag to TRUE in the Global.ini or Project.ini files
for a summary table of results.
Calculation time steps are set for each storm to be <= the time period
in the ARR design temporal patterns. If your time step is too long, WBNM
warns you and adjusts it down to the required value.
#####END_PREAMBLE_BLOCK##########|##########|##########|##########|


#####START_STATUS_BLOCK##########|##########|##########|##########|
T:\Projects\15158 South Kiama\WBNM\15158_WBNM_Northern
last edited  27/ 7/2020
by  Default user name of Your Organisation
2003_V104   Unchecked_Edited_Model
#####END_STATUS_BLOCK##########|##########|##########|##########|


#####START_DISPLAY_BLOCK##########|##########|##########|##########|
 301898.2810  6160092.00  302293.844  6159778.00
       none
   299936.00  6159534.00   302772.00  6157285.00   302772.00  6159555.00
#####END_DISPLAY_BLOCK##########|##########|##########|##########|


#####START_TOPOLOGY_BLOCK##########|##########|##########|##########|
         1
SUB1          302105.22  6159948.00  302293.844  6159956.00 SINK
#####END_TOPOLOGY_BLOCK##########|##########|##########|##########|


#####START_SURFACES_BLOCK##########|##########|##########|##########|
       0.77
-99.90000150
SUB1             15.94       0.00       1.00       0.00
#####END_SURFACES_BLOCK##########|##########|##########|##########|


#####START_FLOWPATHS_BLOCK#########|##########|##########|##########|
         1
SUB1
#####ROUTING
       0.50
#####END_FLOWPATHS_BLOCK##########|##########|##########|##########|


#####START_LOCAL_STRUCTURES_BLOCK##|##########|##########|##########|
         0
#####END_LOCAL_STRUCTURES_BLOCK####|##########|##########|##########|


#####START_OUTLET_STRUCTURES_BLOCK#|##########|##########|##########|
         0
#####END_OUTLET_STRUCTURES_BLOCK###|##########|##########|##########|


#####START_STORM_BLOCK#############|##########|##########|##########|
        35
#####START_STORM#1
1% AEP 30mn
       5.00
       5.00
#####START_DESIGN_RAIN
        100        30        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA               1KIAMA         301850.00  6159300.00       50.00       46.25        9.81        2.72       97.35       20.36        6.73
4.27       15.81        0.00     1100.00          25        0.63 Test IFD rainfall coeffs
NEWDESGAUGEX
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
```

```
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#1
#####START_STORM#2
1% AEP 45mn
       5.00
       5.00
#####START_DESIGN_RAIN
        100        45       1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#2
#####START_STORM#3
1% AEP 60mn
       5.00
       5.00
#####START_DESIGN_RAIN
        100        60       1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#3
#####START_STORM#4
1% AEP 90mn
      15.00
      15.00
#####START_DESIGN_RAIN
        100        90       1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA         301850.00  6159300.00      50.00      46.25       9.81       2.72      97.35      20.36       6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
```

```
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#4
#####START_STORM#5
1% AEP 120mn
      15.00
      15.00
#####START_DESIGN_RAIN
       100       120       1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#5
#####START_STORM#6
1% AEP 180mn
      15.00
      15.00
#####START_DESIGN_RAIN
       100      180         1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#6
#####START_STORM#7
1% AEP 270mn
      15.00
      15.00
#####START_DESIGN_RAIN
       100       270       1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#7
#####START_STORM#8
PMF 2HR
      15.00
```

```
     15.00
#####START_DESIGN_RAIN
     9999        120        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#8
#####START_STORM#9
PMF 3HR
     15.00
     15.00
#####START_DESIGN_RAIN
     9999        180        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#9
#####START_STORM#10
PMF 270mn
     15.00
     15.00
#####START_DESIGN_RAIN
     9999        270        1.00
IFD_COEFFS_IN_THIS_FILE
         1
KIAMA              1KIAMA        301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1               0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#10
#####START_STORM#11
PMF 30min
      5.00
      5.00
#####START_DESIGN_RAIN
      9999         30        1.00
IFD_COEFFS_IN_THIS_FILE
         1
```

```
KIAMA 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#11
#####START_STORM#12
PMF 60min
5.00
5.00
#####START_DESIGN_RAIN
9999 60 1.00
IFD_COEFFS_IN_THIS_FILE
1
KIAMA 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63 Test IFD rainfall coeffs
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#12
#####START_STORM#13
1% AEP 25min
5.00
5.00
#####START_DESIGN_RAIN
100 25 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#13
#####START_STORM#14
1% AEP 20min
5.00
5.00
#####START_DESIGN_RAIN
100 20 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
```

```
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#14
#####START_STORM#15
20% AEP 30mn
       5.00
       5.00
#####START_DESIGN_RAIN
         5         30        1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama             1KIAMA         301850.00  6159300.00       50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#15
#####START_STORM#16
20% AEP 45mn
       5.00
       5.00
#####START_DESIGN_RAIN
   5        45         1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama             1KIAMA         301850.00  6159300.00       50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#16
#####START_STORM#17
20% AEP 60mn
       5.00
       5.00
#####START_DESIGN_RAIN
         5        60         1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama             1KIAMA         301850.00  6159300.00       50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1              0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
```

```
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#17
#####START_STORM#18
20% AEP 90mn
       5.00
       5.00
#####START_DESIGN_RAIN
        5       90      1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama           1KIAMA      301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27     15.81      0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#18
#####START_STORM#19
20% AEP 120mn
       5.00
       5.00
#####START_DESIGN_RAIN
        5       120     1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama           1KIAMA      301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27     15.81      0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#19
#####START_STORM#20
20% AEP 180mn
       5.00
       5.00
#####START_DESIGN_RAIN
        5       180     1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama           1KIAMA      301850.00  6159300.00      50.00      46.25      9.81      2.72      97.35      20.36      6.73
4.27     15.81      0.00    1100.00         25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00      2.00      0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#20
#####START_STORM#21
20% AEP 270mn
       5.00
```

```
      5.00
#####START_DESIGN_RAIN
        5       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#21
#####START_STORM#22
10% AEP 30mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10        30       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#22
#####START_STORM#23
10% AEP 45mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10        45       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72      97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#23
#####START_STORM#24
10% AEP 60mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10        60       1.00
IFD_COEFFS_IN_THIS_FILE
        1
```

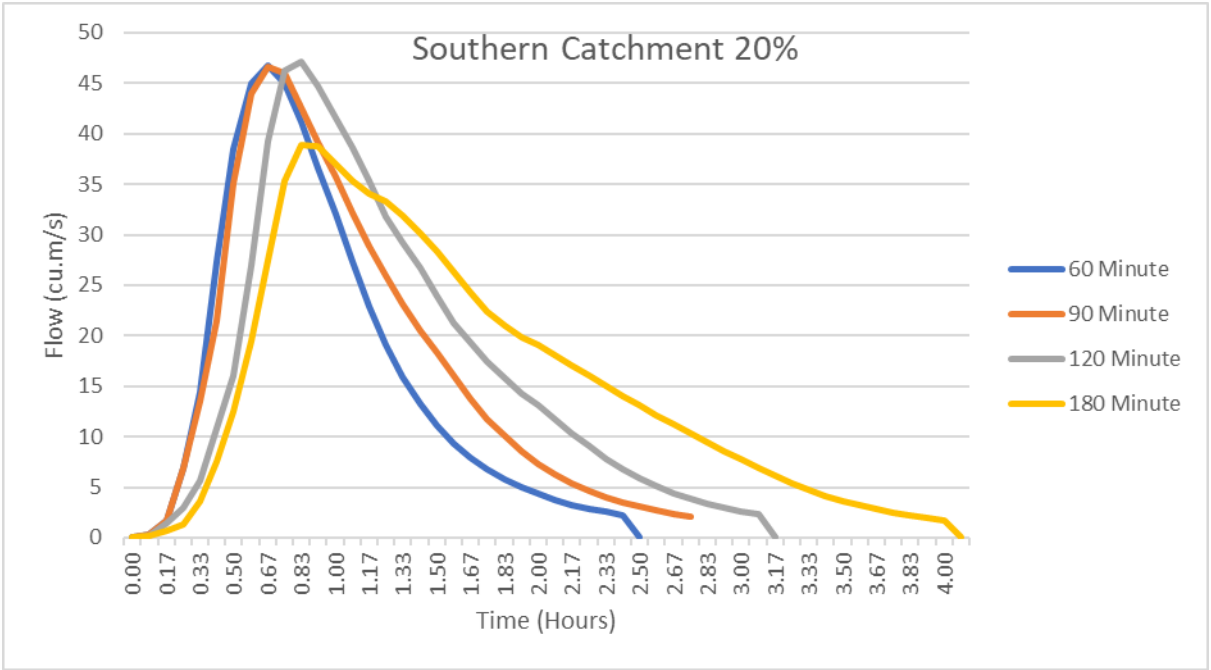
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#24
#####START_STORM#25
10% AEP 90mn
5.00
5.00
#####START_DESIGN_RAIN
10 90 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#25
#####START_STORM#26
10% AEP 120mn
5.00
5.00
#####START_DESIGN_RAIN
10 120 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#26
#####START_STORM#28
10% AEP 270mn
5.00
5.00
#####START_DESIGN_RAIN
10 270 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES

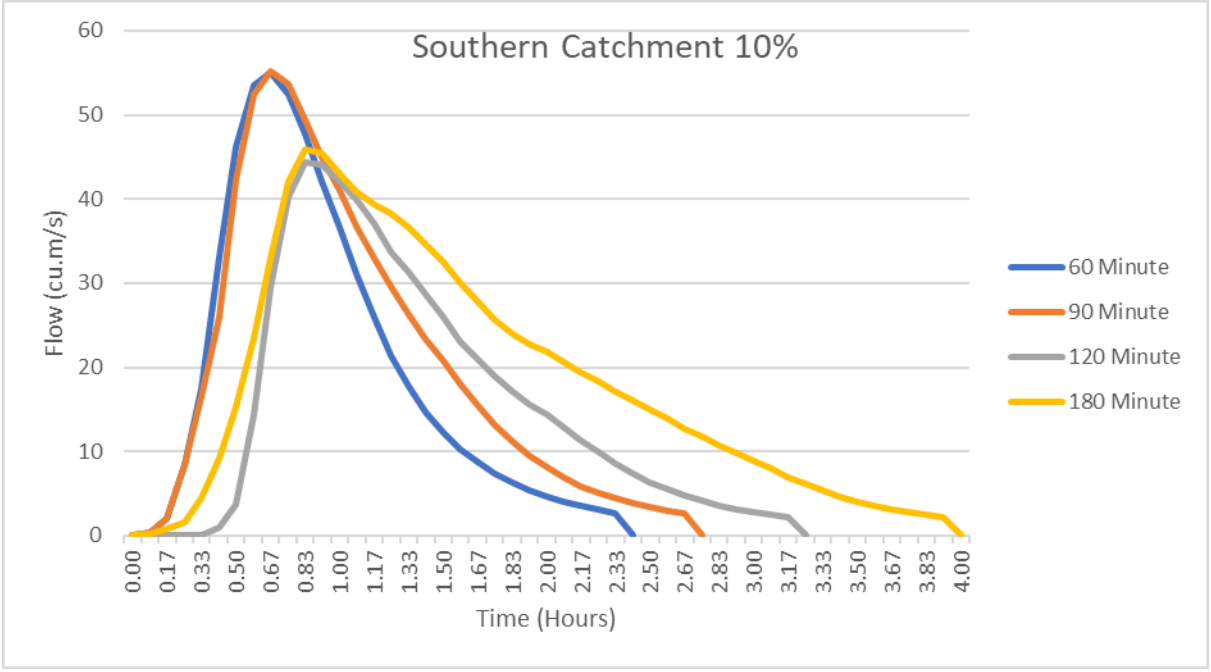
```
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#28
#####START_STORM#29
5% AEP 30mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20         30       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA         301850.00  6159300.00       50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27       15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#29
#####START_STORM#30
5% AEP 45mn
       5.00
       5.00
#####START_DESIGN_RAIN
        20         45       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA         301850.00  6159300.00       50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27       15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
         0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#30
#####START_STORM#31
5% AEP 60mn
       5.00
       5.00
#####START_DESIGN_RAIN
    20           60       1.00
IFD_COEFFS_IN_THIS_FILE
         1
Kiama              1KIAMA         301850.00  6159300.00       50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27       15.81       0.00     1100.00          25        0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1            0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
         0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
```

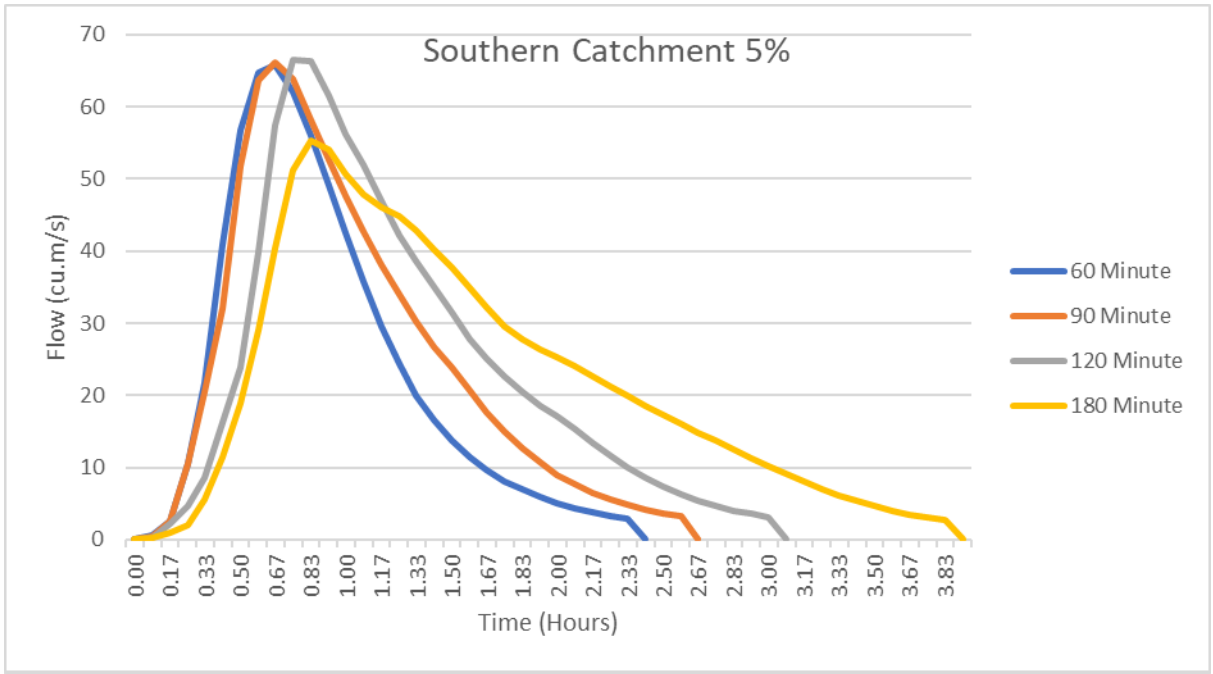
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#31
#####START_STORM#32
5% AEP 90mn
5.00
5.00
#####START_DESIGN_RAIN
20 90 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#32
#####START_STORM#33
5% AEP 120mn
5.00
5.00
#####START_DESIGN_RAIN
20 120 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#33
#####START_STORM#34
5% AEP 180mn
5.00
5.00
#####START_DESIGN_RAIN
20 180 1.00
IFD_COEFFS_IN_THIS_FILE
1
Kiama 1KIAMA 301850.00 6159300.00 50.00 46.25 9.81 2.72 97.35 20.36 6.73
4.27 15.81 0.00 1100.00 25 0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1 0.00 2.00 0.00
#####END_LOSS_RATESS
#####START_RECORDED_HYDROGRAPHS
0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#34
#####START_STORM#35
5% AEP 270mn
5.00

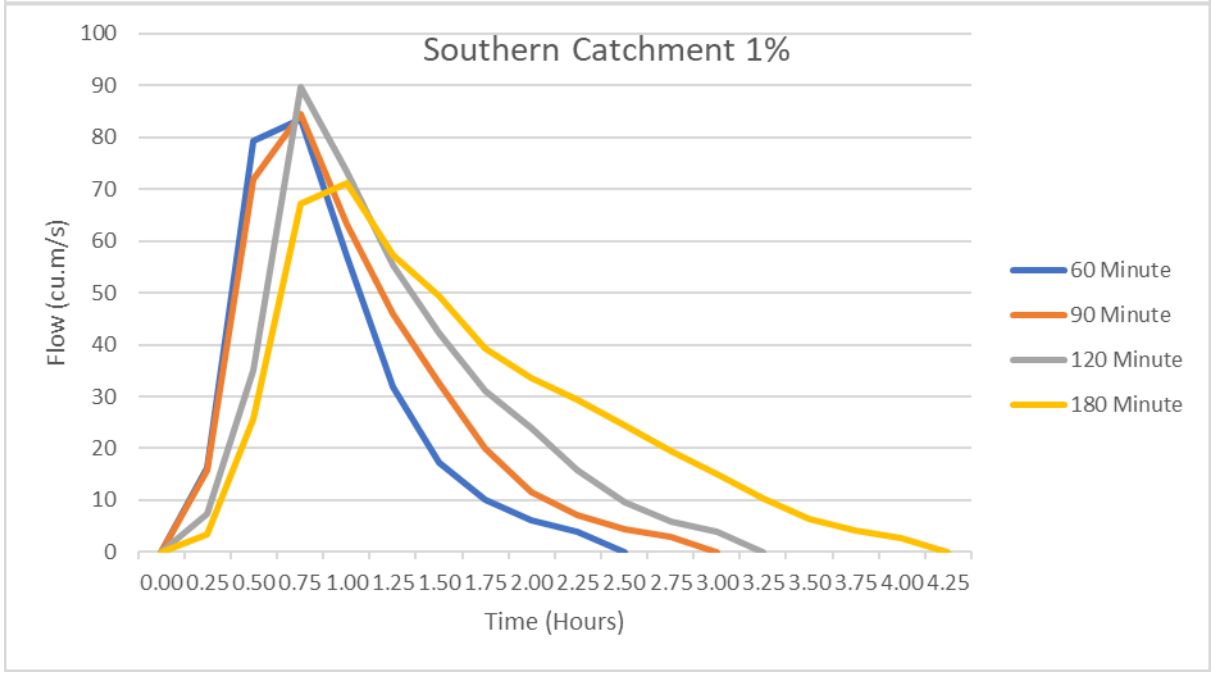
```
      5.00
#####START_DESIGN_RAIN
       20       270       1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#35
#####START_STORM#35
10% AEP 180mn
      5.00
      5.00
#####START_DESIGN_RAIN
       10       180      -1.00
IFD_COEFFS_IN_THIS_FILE
        1
Kiama              1KIAMA         301850.00  6159300.00      50.00      46.25      9.81       2.72       97.35      20.36      6.73
4.27      15.81       0.00     1100.00          25       0.63
#####END_DESIGN_RAIN
#####START_CALC_RAINGAUGE_WEIGHTS
#####END_CALC_RAINGAUGE_WEIGHTS
#####START_LOSS_RATES
SUB1             0.00       2.00       0.00
#####END_LOSS_RATES
#####START_RECORDED_HYDROGRAPHS
        0
#####END_RECORDED_HYDROGRAPHS
#####START_IMPORTED_HYDROGRAPHS
        0
#####END_IMPORTED_HYDROGRAPHS
#####END_STORM#35
#####END_STORM_BLOCK##########################################################################
```

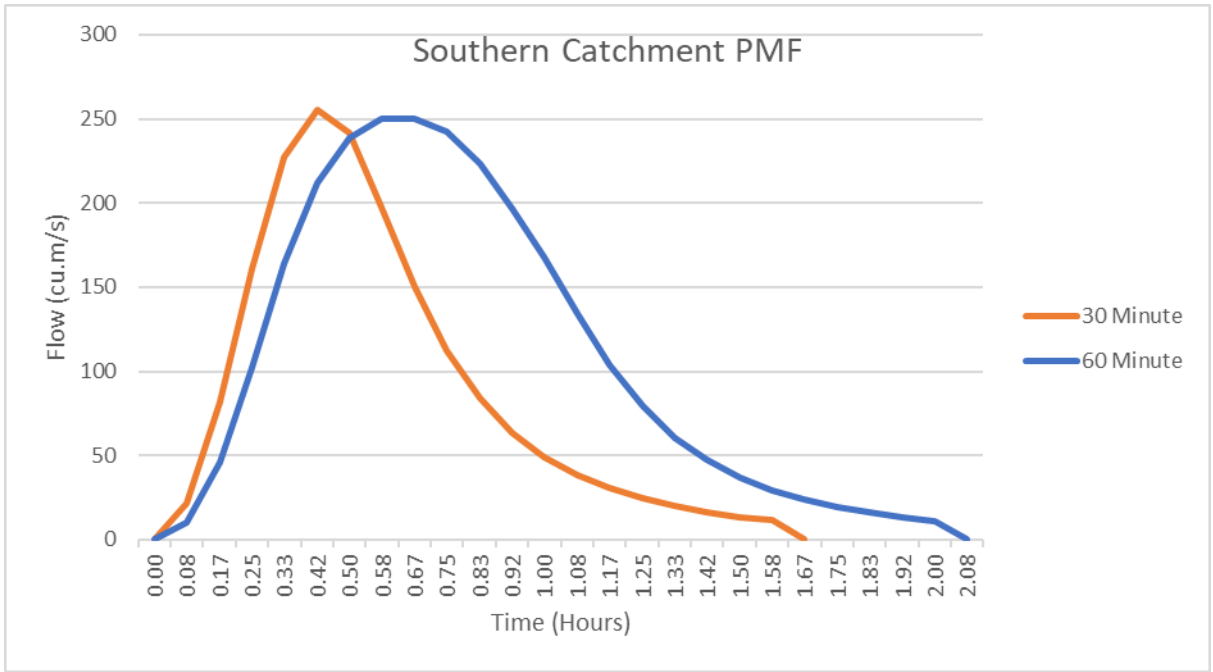
APPENDIX D
Inflow Hydrograph Details

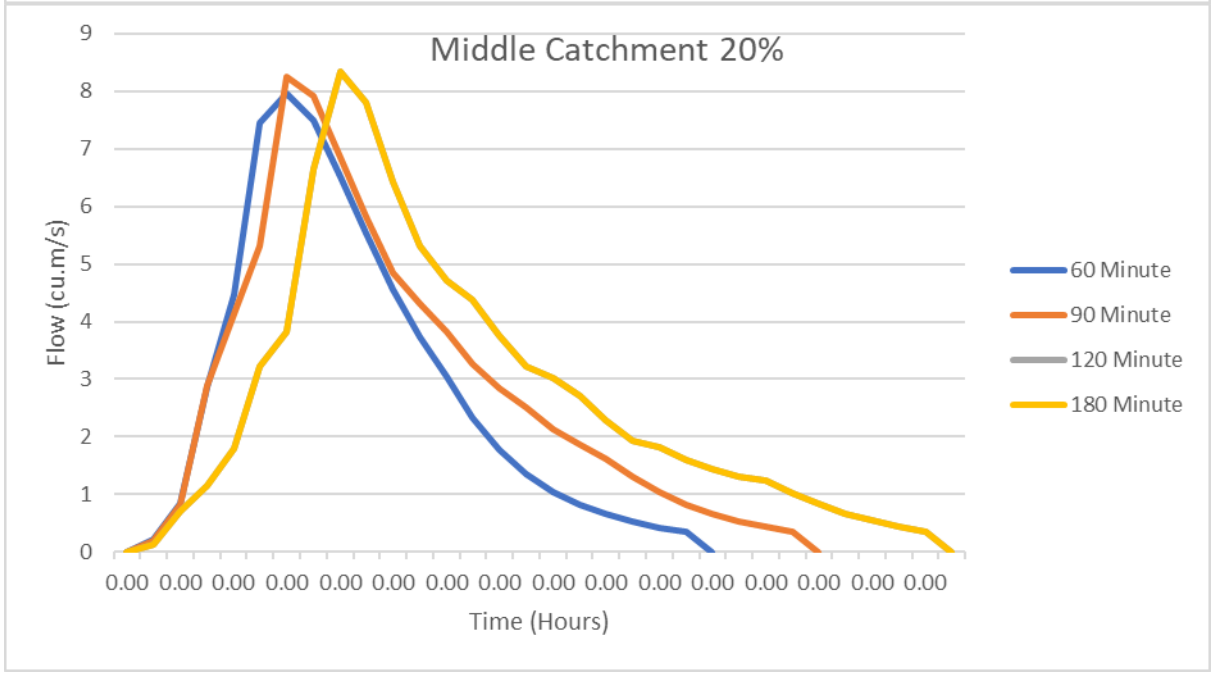

Southern Catchment 20%
Flow (cu.m/s)
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

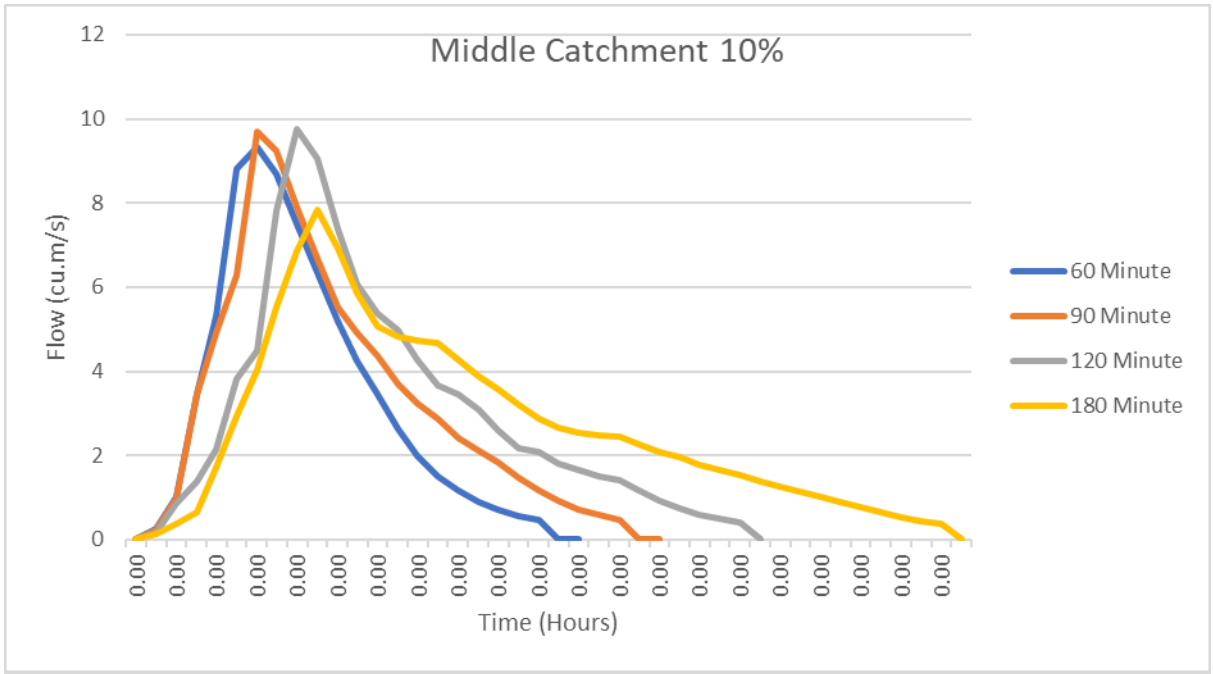

Southern Catchment 10%
Flow (cu.m/s)
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

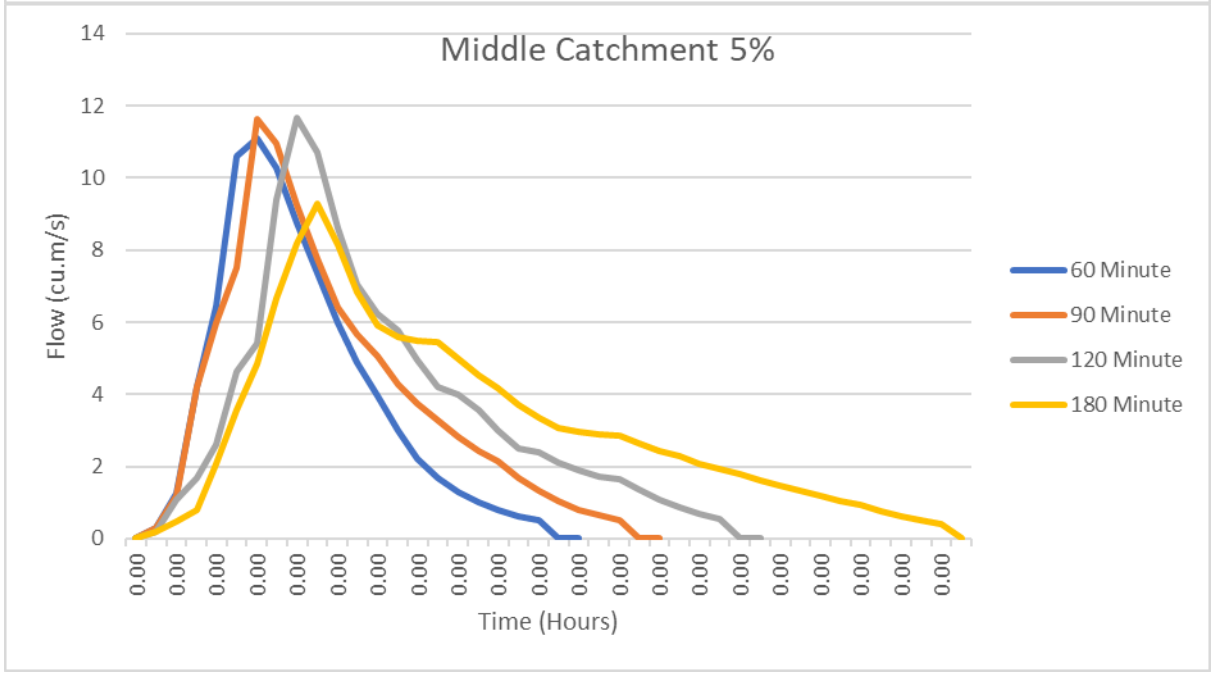

Southern Catchment 5%
Flow (cu.m/s)
70
60
50
40
30
20
10
0
0.00 0.17 0.33 0.50 0.67 0.83 1.00 1.17 1.33 1.50 1.67 1.83 2.00 2.17 2.33 2.50 2.67 2.83 3.00 3.17 3.33 3.50 3.67 3.83
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

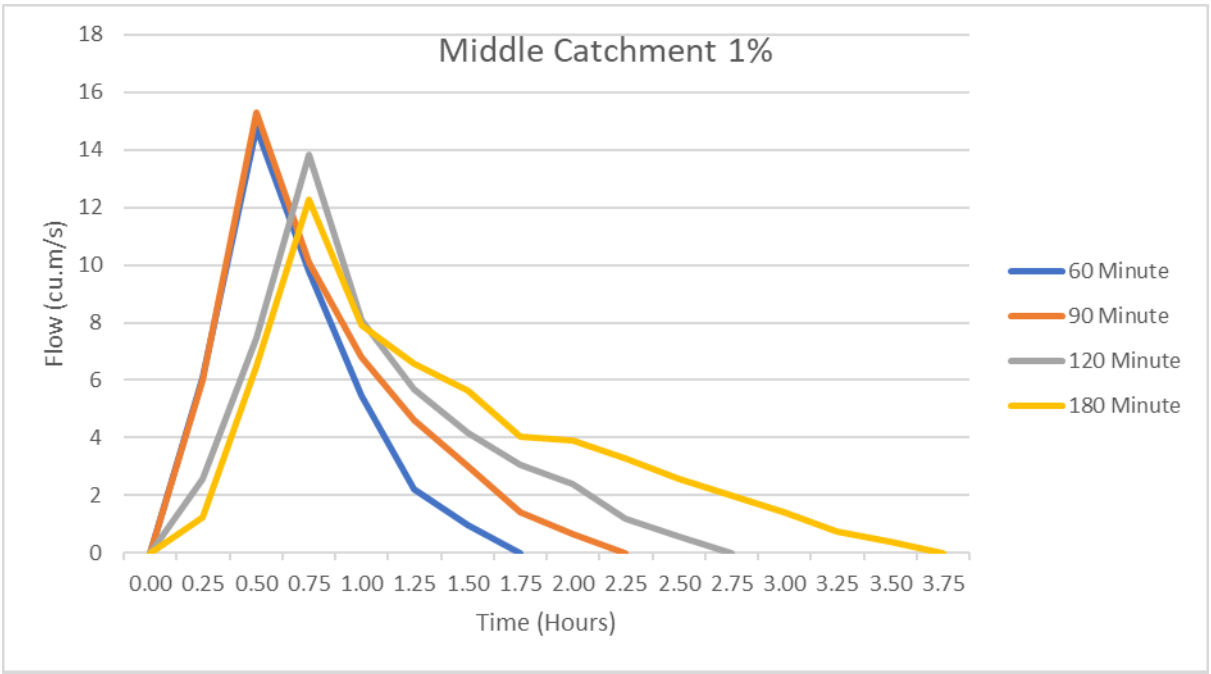

Southern Catchment 1%
Flow (cu.m/s)
100
90
80
70
60
50
40
30
20
10
0
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75 4.00 4.25
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

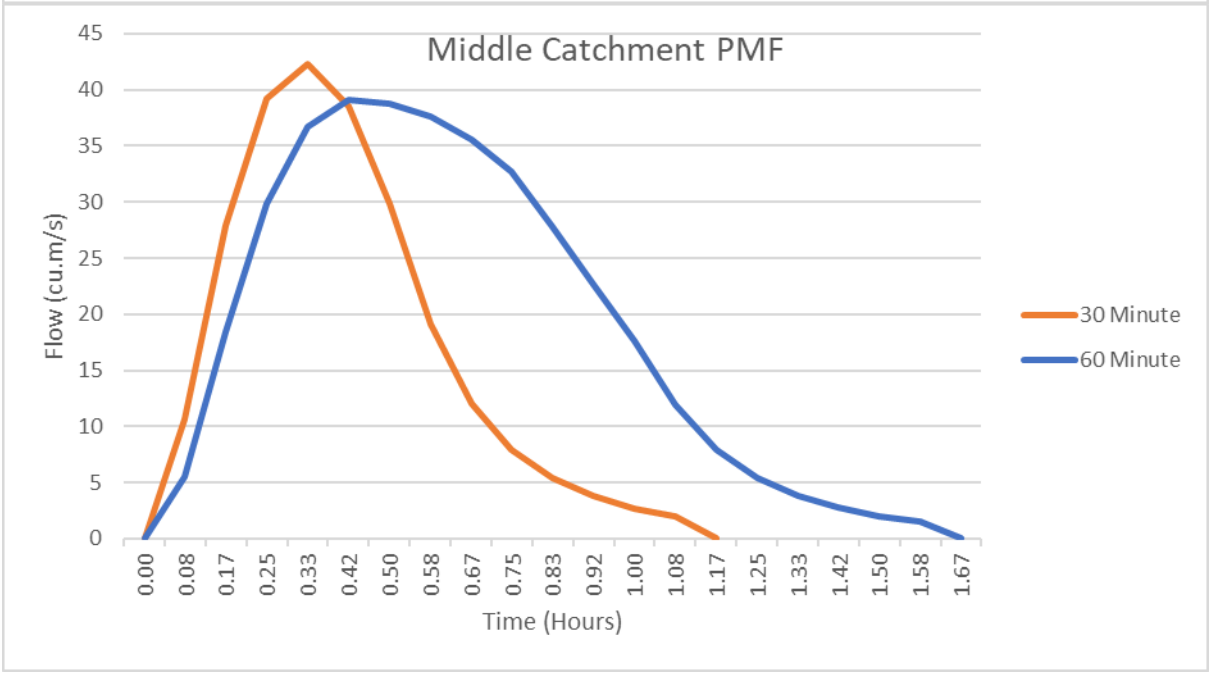

Southern Catchment PMF
Flow (cu.m/s)
300
250
200
150
100
50
0
0.00
0.08
0.17
0.25
0.33
0.42
0.50
0.58
0.67
0.75
0.83
0.92
1.00
1.08
1.17
1.25
1.33
1.42
1.50
1.58
1.67
1.75
1.83
1.92
2.00
2.08
Time (Hours)
30 Minute
60 Minute

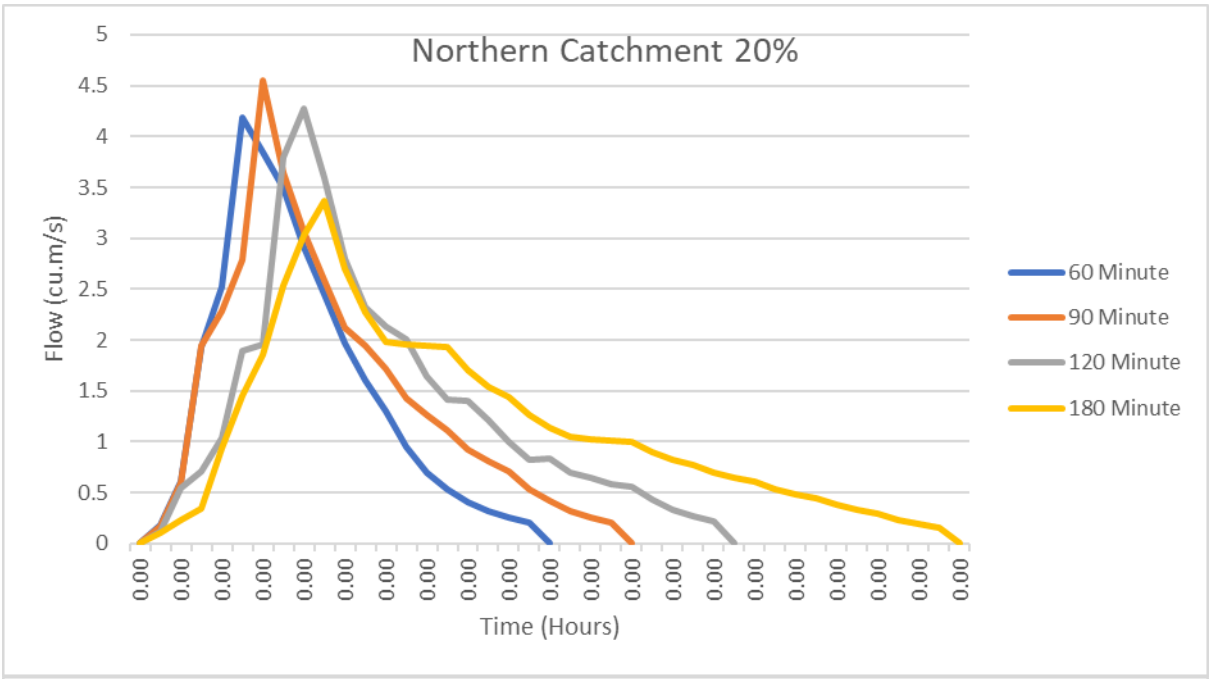

Middle Catchment 20%
Flow (cu.m/s)
9
8
7
6
5
4
3
2
1
0
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

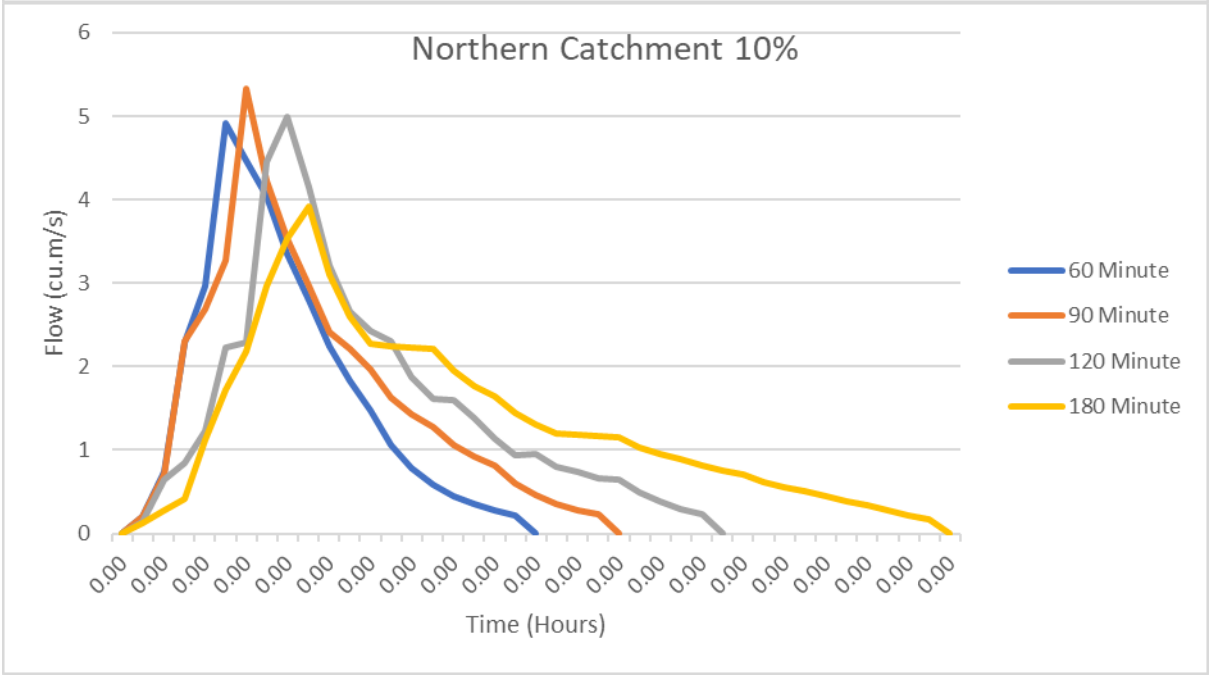

Middle Catchment 10%
Flow (cu.m/s)
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

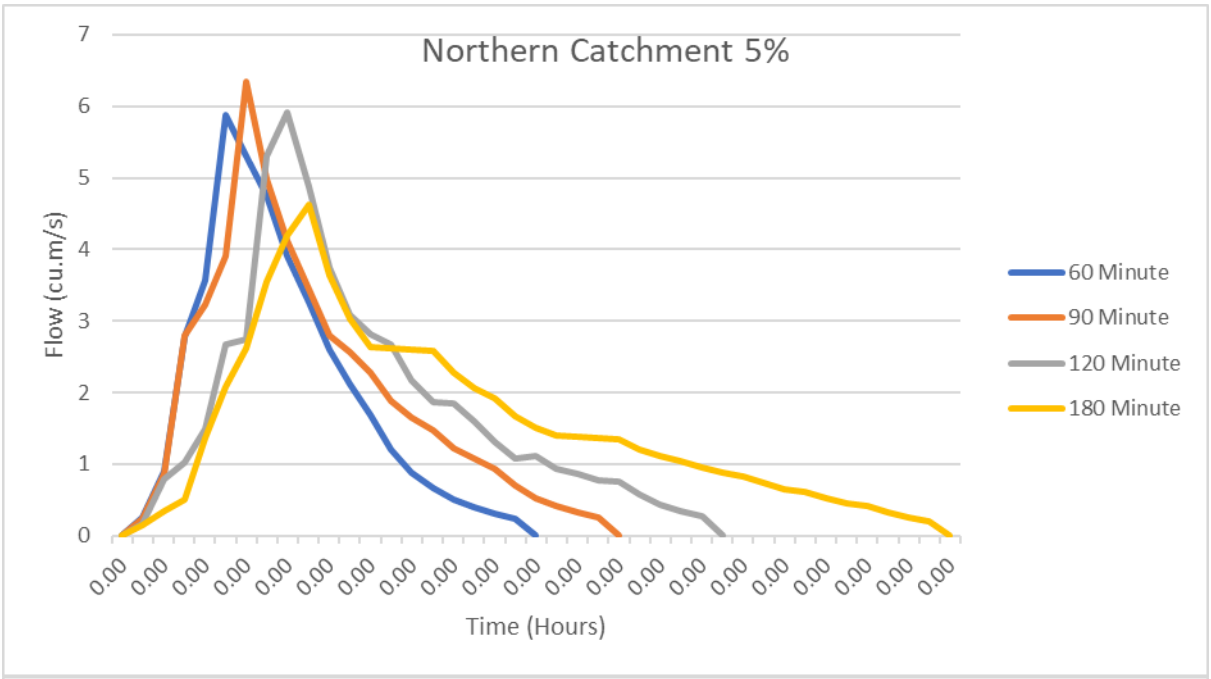

Middle Catchment 5%
Flow (cu.m/s)
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

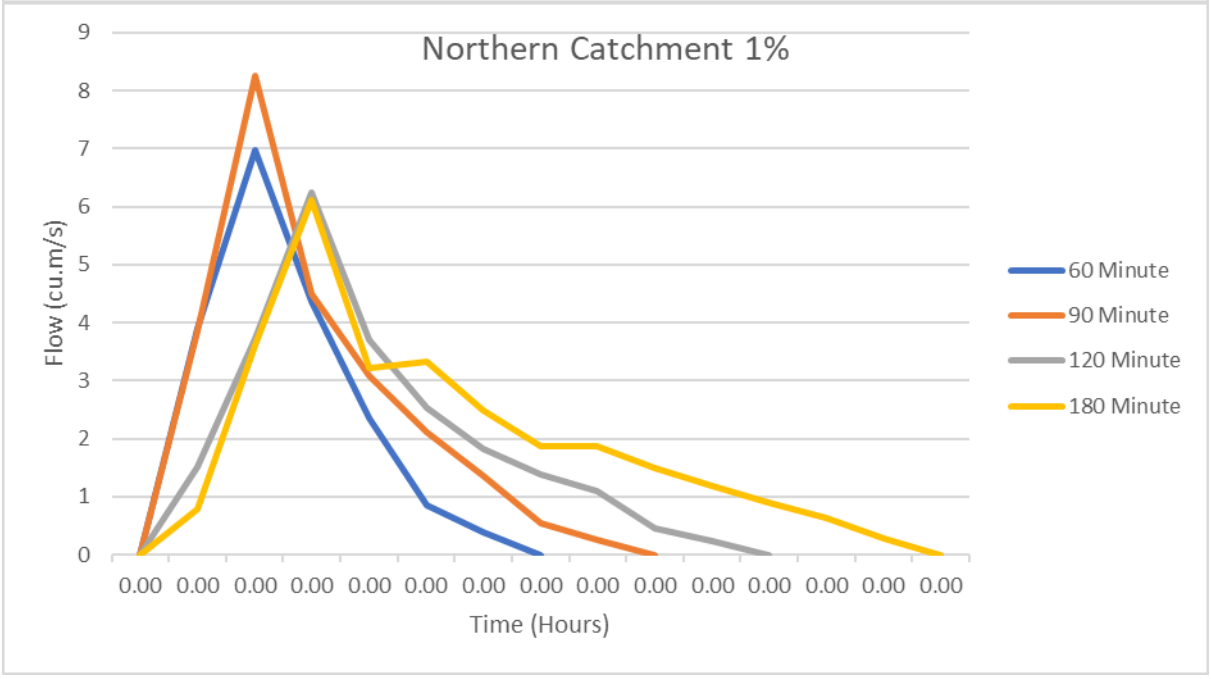

Middle Catchment 1%
Flow (cu.m/s)
18
16
14
12
10
8
6
4
2
0
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25 3.50 3.75
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

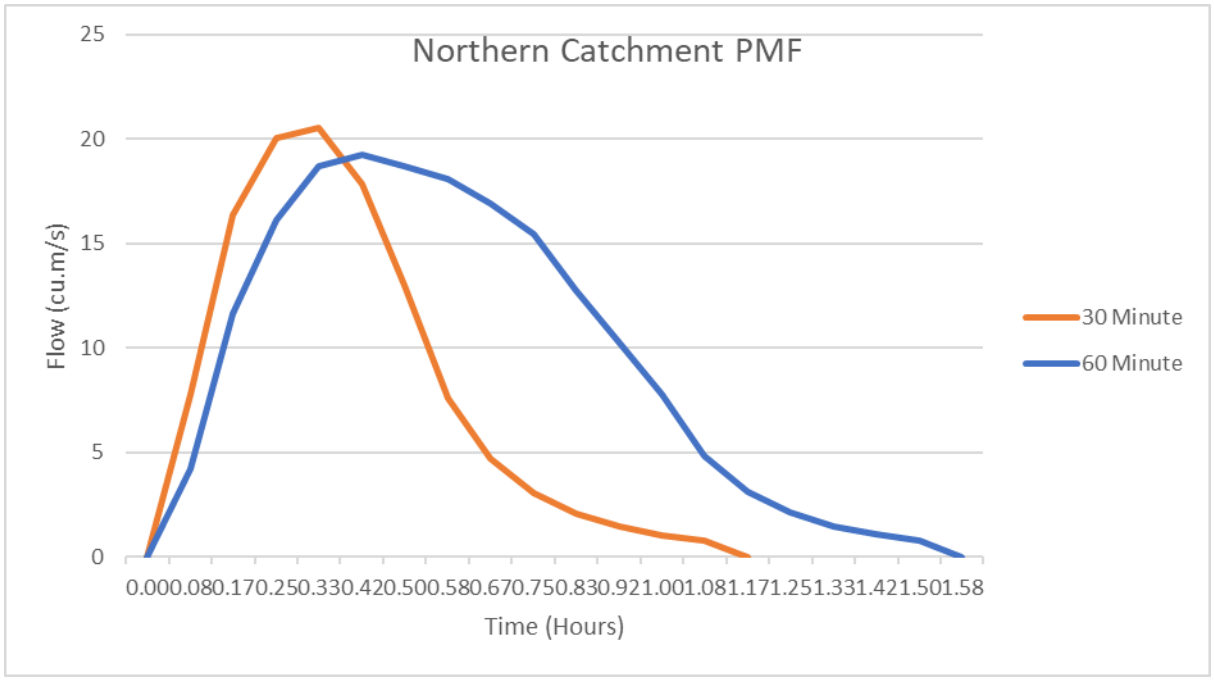

Middle Catchment PMF
Flow (cu.m/s)
45
40
35
30
25
20
15
10
5
0
0.00 0.08 0.17 0.25 0.33 0.42 0.50 0.58 0.67 0.75 0.83 0.92 1.00 1.08 1.17 1.25 1.33 1.42 1.50 1.58 1.67
Time (Hours)
30 Minute
60 Minute


Northern Catchment 20%
Flow (cu.m/s)
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute

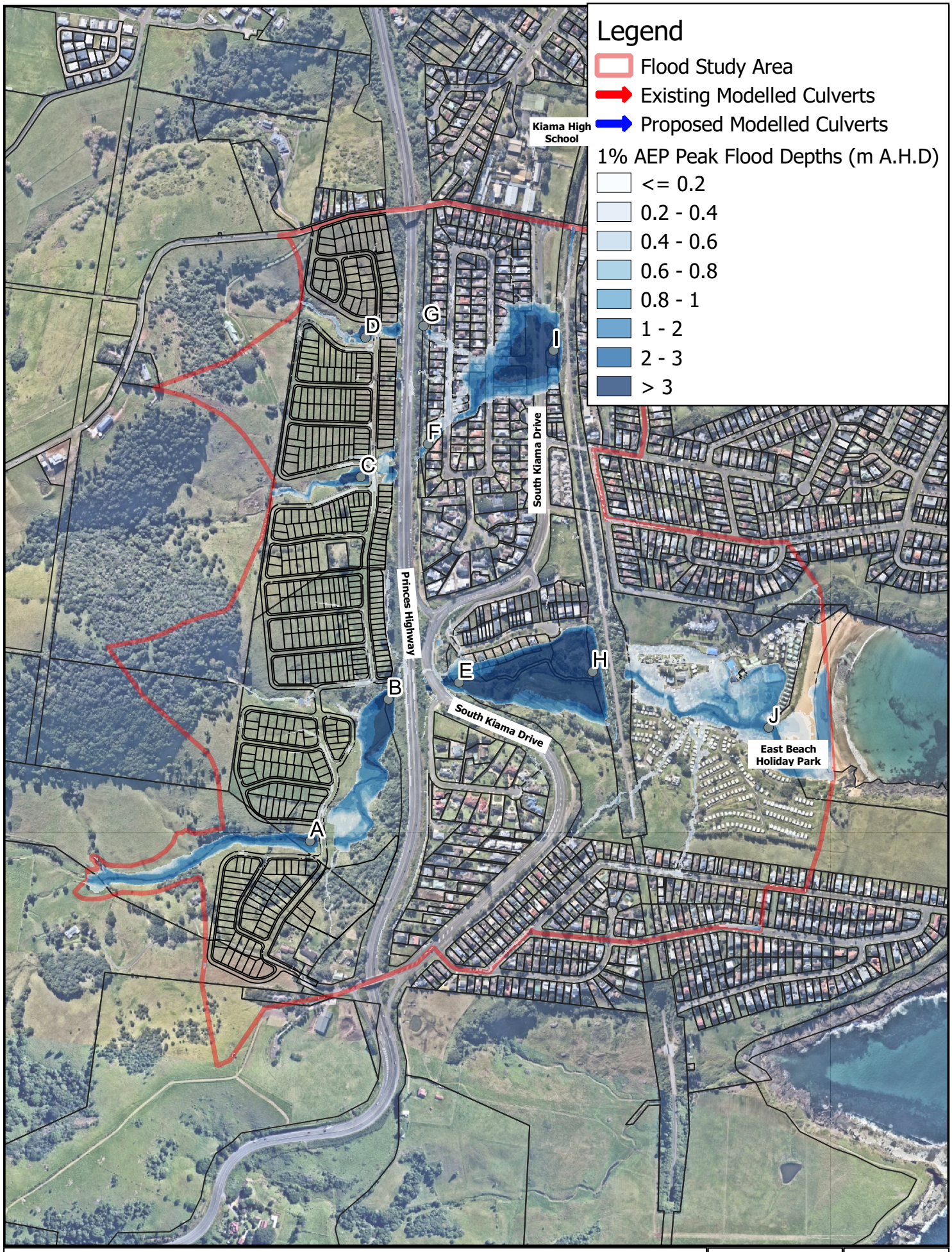

Northern Catchment 10%
Flow (cu.m/s)
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute


Northern Catchment 5%
Flow (cu.m/s)
0
1
2
3
4
5
6
7
0.00
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute


Northern Catchment 1%
Flow (cu.m/s)
0
1
2
3
4
5
6
7
8
9
0.00
Time (Hours)
60 Minute
90 Minute
120 Minute
180 Minute


Northern Catchment PMF
25
20
15
10
5
0
Flow (cu.m/s)
0.00 0.08 0.17 0.25 0.33 0.42 0.50 0.58 0.67 0.75 0.83 0.92 1.00 1.08 1.17 1.25 1.33 1.42 1.50 1.58
Time (Hours)
30 Minute
60 Minute

APPENDIX E
Table Summary of Results



Title:
South Kiama - Observation Locations

Figure: **Appendix E**

Rev: **C**

N

0 100 200 300 400 500 m

siteplus

Summary of Peak Flood Levels and Maximum Flow Rates

	Location	20%		20%		10%		10%		5%		5%		1%		1%		PMF		PMF	
		Existing		Proposed		Existing		Proposed		Existing		Proposed		Existing		Proposed		Existing		Proposed	
		Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked	Unblocked	Blocked
Peak Flow (m3/s)	**A**	47.51	47.51	47.30	47.21	55.43	55.43	55.50	55.49	67.64	67.64	67.25	67.30	91.23	91.23	90.18	90.17	256.56	250.69	254.78	253.75
Flood Level (m)		17.53	17.52	18.08	18.08	17.62	17.61	18.31	18.31	17.72	17.68	18.63	18.64	17.90	17.90	19.35	19.34	21.57	22.30	22.14	22.62
Peak Flow (m3/s)	**B**	50.92	50.80	50.85	50.78	60.53	59.62	60.06	59.17	71.58	70.11	70.66	69.19	91.62	88.03	86.93	83.66	197.57	184.81	206.98	193.14
Flood Level (m)		11.33	11.51	11.34	11.52	11.84	12.22	11.82	12.21	12.66	12.99	12.62	12.98	14.26	14.68	14.26	14.70	21.56	22.29	21.84	22.58
Peak Flow (m3/s)	**C**	8.75	8.75	8.18	8.44	10.24	10.24	9.99	9.87	12.64	12.64	11.83	11.31	17.08	17.08	16.08	15.92	46.38	46.38	48.79	48.94
Flood Level (m)		33.46	33.43	34.98	35.03	33.48	33.50	35.24	35.36	33.56	33.54	35.68	35.95	33.68	33.68	36.12	36.34	34.12	34.10	37.94	38.02
Peak Flow (m3/s)	**D**	5.18	5.19	5.35	5.21	6.51	6.51	6.36	6.35	7.54	7.54	7.62	7.43	10.96	10.96	10.52	9.64	25.80	25.80	27.28	27.27
Flood Level (m)		34.66	34.62	35.01	35.16	34.70	34.70	35.32	35.38	34.75	34.75	35.66	35.83	34.86	34.86	36.37	36.96	35.15	35.11	37.85	37.88
Peak Flow (m3/s)	**E**	51.17	51.25	51.12	51.13	59.75	58.89	59.43	58.92	70.64	69.27	70.48	69.09	86.52	82.99	85.92	82.88	191.90	180.72	195.91	187.82
Flood Level (m)		8.88	8.88	8.88	8.88	9.00	8.99	9.00	9.00	9.59	10.01	9.61	10.04	10.92	11.48	10.95	11.52	17.34	17.46	17.47	17.64
Peak Flow (m3/s)	**F**	10.32	10.32	9.22	9.18	12.34	12.34	10.72	10.46	15.16	15.10	12.50	11.75	20.47	19.41	18.62	18.16	37.11	34.14	34.75	31.22
Flood Level (m)		26.26	26.22	26.16	26.15	26.29	26.29	26.28	26.25	26.40	26.58	26.32	26.49	26.45	26.61	26.45	26.61	26.95	27.17	26.97	27.15
Peak Flow (m3/s)	**G**	6.06	6.03	6.05	6.01	7.61	7.57	7.35	7.31	8.71	8.21	8.68	8.20	10.93	9.65	10.90	9.63	17.08	15.45	19.35	18.16
Flood Level (m)		28.61	28.62	28.61	28.62	28.66	28.66	28.66	28.65	28.63	28.67	68.62	28.67	28.74	28.70	28.67	28.70	28.78	28.72	28.78	28.73
Peak Flow (m3/s)	**H**	37.65	35.97	37.96	36.24	41.22	38.81	41.41	38.99	45.63	39.75	45.81	39.91	52.38	44.51	52.50	44.60	72.00	57.89	72.34	58.25
Flood Level (m)		8.27	8.42	8.30	8.46	8.73	8.91	8.77	8.94	9.54	10.00	9.57	10.03	10.92	11.48	10.95	11.52	17.34	17.46	17.47	17.64
Peak Flow (m3/s)	**I**	9.24	7.25	9.24	7.24	9.70	7.57	9.68	7.57	10.35	5.58	10.35	5.56	11.37	6.03	11.37	6.03	54.10	57.89	51.33	60.33
Flood Level (m)		21.08	21.42	21.08	21.42	21.50	21.85	21.48	21.84	22.02	22.75	22.01	22.74	22.98	23.75	22.97	23.75	26.51	26.65	26.49	26.63
Peak Flow (m3/s)	**J**	38.83	37.12	39.13	37.39	42.40	39.95	42.59	40.12	47.41	41.25	47.55	41.37	54.61	46.41	54.69	46.43	84.30	72.60	84.12	72.43
Flood Level (m)		2.79	2.78	2.79	2.78	2.82	2.80	2.82	2.80	2.85	2.81	2.85	2.81	2.90	2.85	2.90	2.85	3.07	3.02	3.07	3.01