Bevian Road Concept Application

Flood Impact Assessment

Bevian Road,
Rosedale,
Batemans Bay

Issued: July 2007

Patterson Britton
& Partners Pty Ltd
consulting engineers

Marsim (trading as Nature Coast Developments P/L)

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1 EXECUTIVE SUMMARY

Marsim (trading as Nature Coast Developments P/L) propose the 807 residential lot and 20 community lots at the Bevian Road Residential Development at Rosedale.

The Rosedale site consists of approximately 188 ha of cleared rural land at the southern end of the Batemans Bay urban area. It was delineated as an urban expansion zone in the Eurobodalla Rural Local Environmental Plan (1987).

This report addresses the flood impact issues relating to the Concept Plan Application to the Minister for Planning. The application seeks approval of two specific plans, being the Concept Approval Plans. These plans are:

- A plan of the Net Developable Area – known as The Constraints Map (refer **Figure 1**); and
- A 807 lot residential and 20 lot community subdivision generally in accordance with the layout proposal in the Concept Plan (refer **Figure 2**).

The Director General of NSW Planning has provided the issues to be addressed in the application in the Director General's requirements. The issues regarding flooding are:

- Issue 8.5 – *Undertake a Flood Study having regard to the requirements of the NSW Floodplain Management Manual. Address potential impacts of flooding on the development, the impact of development on flood behaviour (including cumulative impacts), and the impact of flooding on the safety of people over a full range of possible floods up to the probable maximum flood (PMF) and mitigation measures;*

- Issue 8.6 – *Address sea level rise and coastal inundation restricting where necessary development in low lying areas.*

This flood impact assessment has been prepared having regard to the requirements of the NSW government Floodplain Development Manual (2005). This manual has superseded the Floodplain Management Manual nominated in the Director General's requirements at Issue 8.5. As such, this study meets the requirements of Issue 8.5.

The estimated 100 year ARI and PMF flood levels would not inundate any proposed habitable floor levels in the development. Minor filling on one lot is proposed to raise it above the predicted PMF level. The predicted flood levels were based on a highly unlikely scenario that the runoff management measures proposed in the Water Management Report would not function. This scenario provides worst case flood levels which are unlikely to be achieved. Even in this worst case scenario, the flooding would not adversely impact on the proposed development. This meets the Director General's requirements at Issue 8.5.

The development would incorporate industry best practice runoff control measures to ensure peak flow rates do not increase above existing rates. This will ensure there is no adverse impact on

flooding behaviour either upstream or downstream of the site. The development is located at the upstream end of the site and as such could not cause any cumulative impacts on flood behaviour especially when peak flow rates will be controlled at existing rates. This meets the Director General's requirements at Issue 8.5.

The flooding would not inundate any of the proposed lots and would not pose a serious risk to the residents. The flood flows in the pipes and streets would be designed to achieve safe conditions for pedestrians and cars on the streets. All residents would have ready access to flood free land on their lots or to even higher ground in all floods up to the PMF. The safety of the residents therefore would be appropriately managed in all floods and would not be adversely affected. This meets the Director General's requirements at Issue 8.4.

No development would be located on low lying land likely to be affected by likely future sea level rise over the next 100 years. This is based on the high estimate of sea level rise. No development would be located to be affected by coastal inundation. This factor was considered in derivation of the predicted flood levels. As such, this meets Issue 8.6 in the Director General's requirements.

The Concept Approval Plans (The Constraints Map and The Concept Plan – **Figures 1** and **2**) have been formulated to address the flood behaviour and the requirements of flood risk management in the NSW government Floodplain Development Manual. As such, the Plans adequately address the flood related Director General's requirements and it is therefore concluded that the Concept Approval Plans are satisfactory.

2 INTRODUCTION

Patterson Britton & Partners (PBP) have been engaged by Marsim (trading as Nature Coast Developments Pty. Ltd.) to address the flooding issues for a concept plan application to the Minister for Planning, for the Bevian Road Residential Development at Rosedale, Batemans Bay. The application seeks approval of two specific plans, being the Concept Approval Plans. These plans are:

- a plan of the Net Developable Area-known as The Constraints Map (refer **Figure 1**); and
- a 807 lot residential and 20 lot community subdivision generally in accordance with the layout proposed in the Concept Plan (refer **Figure 2**).

The Eurobodalla Rural Local Environmental Plan (1987) delineated Rosedale as an urban expansion zone. Development Control Plan (DCP) No. 160 entitled "Rosedale Urban Expansion Area" was adopted by Eurobodalla Council in 1989.

The Director General of NSW Planning has provided the issues to be addressed in the application in the Director General's Requirements (refer to **Section 3**).

This report addresses the flooding issues and demonstrates how the development would manage the flood risks to conform to the Director General's requirements for the project.

3 BACKGROUND

3.1 DIRECTOR GENERAL'S REQUIREMENTS

Issue 8.5 of the Director General's requirements for the Rosedale development outlined the following:

> "*Undertake a Flood Study having regard to the requirements of the NSW Floodplain Management Manual. Address potential impacts of flooding on the development, the impact of development on flood behaviour (including cumulative impacts), and the impact of flooding on the safety of people over a full range of possible floods up to the probable maximum flood (PMF) and mitigation measures."*

Issue 8.6 of the Director General's requirements for the Rosedale development outlined the following:

> *"Address sea level rise and coastal inundation restricting where necessary development in low lying areas."*

Since submission of the Director General's letter to Marsim Group, the NSW Government's *'Floodplain Management Manual'* (*2001*) has been replaced by the *'Floodplain Development Manual'* (*2005*). Accordingly, this report has referenced the *'Floodplain Development Manual'* (*2005*).

The *'Floodplain Development Manual'* (*2005*) is a guideline document that has been prepared to assist in the implementation of the NSW Government's Flood Prone Land Policy. The Policy aims to reduce the impact of flooding and flood liability on owners and occupiers of flood prone property and reduce private and public losses resulting from flooding. At the same time, the Policy recognises the benefits associated with the use, occupation and development of flood prone land. In this way the Policy avoids the unnecessary sterilisation of flood prone land, however, it also ensures that flood prone land is not subject to uncontrolled development (*NSW Government, 2005*).

This report has been prepared to satisfy the requirements of the Manual. It recognises the potential value that development of the site may provide, however, ensures that future residents and dwellings will not be exposed to an unacceptable hazard. It also assesses the potential for the proposed development to impact on existing flood behaviour and increase the existing flood hazard in areas outside of the site.

3.2 DESCRIPTION OF EXISTING SITE

The Rosedale site occupies an area of about 188 ha and is located to the west of the existing Rosedale urban area (*refer* **Figure 3**). An aerial photograph of the site is provided in **Plate 1**. It shows that the site is predominately cleared.

State Forest adjoins the western and northern boundaries of the site and Bevian Wetland, a SEPP14 wetland, adjoins the southern boundary of the site. Land to the east of the site is currently undeveloped, however, it is understood that investigations are underway to assess the potential to develop this land for future residential use.

Survey information was gathered across the existing site and is reproduced in **Figure 4** as contours of ground surface elevation at 1 metre intervals. The survey was gathered using photogrammetric survey techniques.

As shown in **Figure 4**, a number of watercourses and drainage depressions extend through the site.

The northern half of the site is drained by three tributaries which carry runoff in an easterly direction into Salt Water Creek (*refer Salt Water Creek and Tributaries 1 and 2 in* **Figure 4**). This portion of the site consists of a number of valleys with relatively steep slopes. The creeklines are incised and only have isolated riparian vegetation. Six online farm dams are also located within the development site. The farm dams are considered to provide little attenuation during large storms. The catchment boundary of the Salt Water Creek catchment is located just outside the western boundary of the site.

The southern half of the site drains to Bevian Wetland. Bevian Wetland drains beneath George Bass drive via a quadruple cell culvert. The southern section of the site is undulating without any defined creeklines (*refer* **Plate 1**). The "drainage depressions" consist of broad grassed swales with the runoff generally travelling as sheetflow across the ground surface.

3.3 DESCRIPTION OF PROPOSED DEVELOPMENT

The layout of the proposed development is provided in **Figure 3**.

The creek lines in the northern portion of the site are located in erosion gullies generally capable of accommodating the 100 year recurrence flood flows. The bank full creek bank is much narrower and is located in the base of the wider erosion gully. The width of the gully can be up to 80 metres.

Figure 4 shows that an extensive vegetated creekline of variable width will be provided along the watercourses draining through the northern section of the site.

As shown in **Plate 2**, the existing creeks comprise limited riparian vegetation. Accordingly, it is proposed to re-establish the riparian corridor as part of the development using suitable native vegetation. The existing online farm dams will also be augmented and revegetated to form water quality control ponds. The ponds form part of a water management strategy that has been developed for the site and will also serve as attractive water features within the subdivision. A range of additional water management measures including rainwater tanks and bioretention swales will also be incorporated as part of the development to treat stormwater runoff. The implementation of these measures will ensure that runoff quantity will be reduced and quality will be improved as a result of the development.

Figure 4 also shows that Bevian Wetland adjoins the southern section of the development. In recognition of the environmental sensitivity of this wetland, a 50 metre wide wetland buffer will be provided as part of the development, as specified in the Director General requirements for the project. In addition, an Asset Protection Zone (*APZ*) will also be provided outside of the wetland buffer. The southern section of the site will also be serviced by a range of stormwater treatment measures to ensure that the proposed development will reduce the peak stormwater discharges and the pollutant loads into Bevian Wetland.

Plate 1 AERIAL PHOTOGRAPH OF THE ROSEDALE DEVELOPMENT SITE

Plate 2 VIEW LOOKING EAST ALONG TRIBUTARY 2 SHOWING NEGLIGIBLE RIPARIAN VEGETATION

4 EXISTING FLOOD BEHAVIOUR

4.1 EXISTING FLOOD CHARACTERISTICS

In order to assess the potential for the proposed development to impact on existing flood behaviour, existing flood behaviour must first be defined across the site for comparison. Accordingly, hydrologic and hydraulic computer modelling was undertaken to define design flood flows, levels and velocities for existing topographic and development conditions.

4.1.1 Hydrologic Analysis

Model Development

The Runoff Analysis and Flow Training Simulation (*RAFTS-XP*) software package was employed to quantify flood discharges from the catchments draining through the site under existing catchment conditions. RAFTS-XP is recognised in *'Australian Rainfall and Runoff – A Guideline to Flood Estimation'* (*1987*) as one of the available tools for use in flood routing within Australian catchments.

The layout of the RAFTS-XP models is presented in **Figure 5**. As shown in **Figure 5**, separate RAFTS model were developed for the northern (*i.e., Salt Water Creek*) and southern (*i.e., Bevian Wetland*) catchments.

As discussed, four online farm dams are located across the northern sections of the site. However, it was assumed that each dam was "full" prior to the onset of the design storm and contributed no flood storage volume.

The RAFTS-XP model was used to simulate the 20 and 100 year recurrence floods. The Probable Maximum Flood (*PMF*) was also simulated using probable maximum precipitation estimates derived using the Bureau of Meteorology document *'The Estimation of Probable Maximum Precipitation in Australia: Generalised Short Duration Method'* (*2001*).

An initial loss of 10 mm and a continuing loss rate of 2.5 mm/hour was adopted for each design simulation in accordance with recommendations outlined in *'Australian Rainfall and Runoff – A Guideline to Flood Estimation'* (*1987*) for design events.

A range of different storm durations were considered to establish the critical storm duration for each catchment. A critical storm duration of 120 minutes was determined for the Salt Water Creek, Tributary 1 and Tributary 2 catchments for all design storms. A critical storm duration of 90 minutes was determined for the Bevian Wetland catchments.

A summary of peak discharges for the Salt Water Creek and Bevian Wetland catchments for the 20 and 100 year recurrence events and PMF are presented in **Table 4-1** and **Table**

4-2 respectively. A complete listing of results generated by the RAFTS models is provided in **Appendix A**.

Table 4-1 – PEAK DESIGN FLOWS FOR SALT WATER CREEK SUB-CATCHMENTS FOR EXISTING CATCHMENT CONDITIONS

DESCRIPTION OF LOCATION	RAFTS MODEL NODE NUMBER (*refer Figure 4*)	PEAK DISCHARGE (m^3/s)		
		20 YEAR ARI	100 YEAR ARI	PMF
Outlet of Farm Dam 1	2.00	5.2	7.3	18.5
	4.00	5.5	7.7	18.9
	5.00	3.5	4.8	11.2
	2.01	16.5	23.3	60.2
Outlet of Farm Dam 2	2.02	17.7	25.1	68.9
Outlet of Farm Dam 3	2.03	18.3	25.9	73.5
Tributary 2 at eastern site boundary	2.04	18.7	26.4	76.5
	6.00	2.3	3.1	7.8
	3.00	2.0	2.7	6.2
	3.01	5.9	8.0	21.2
Salt Water Creek at eastern site boundary	3.02	6.3	8.5	24.3
Outlet of Farm Dam 4	7.00	4.5	6.6	16.9
Minor tributary inflow into northern end of site	8.00	6.4	9.4	28.7
	8.01	7.9	11.9	37.8
	1.00	2.4	3.2	7.1
Tributary 1 inflow at western site boundary	1.01	7.4	10.2	27.6
	1.02	8.9	12.3	35.7
	1.03	12.7	18.5	57.1
Tributary 1 at eastern site boundary	1.04	17.1	24.8	83.9
Confluence of Tributaries 1 and 2	1.05	35.8	50.5	162.1

Table 4-2 – PEAK DESIGN FLOWS FOR SOUTHERN SUB-CATCHMENTS FOR EXISTING CATCHMENT CONDITIONS

DESCRIPTION OF LOCATION	RAFTS MODEL NODE NUMBER (*refer Figure 4*)	PEAK DISCHARGE (m^3/s)		
		20 YEAR ARI	100 YEAR ARI	PMF
	9.00	4.9	7.4	23.8
	8.00	9.7	14.3	43.8
Downstream limit of eastern drainage gully immediately before it discharge to Bevian Wetland	8.01	11.8	17.5	53.3
	7.00	5.7	8.0	19.1
	7.01	11.1	15.7	41.1
Downstream limit of western drainage gully immediately before it discharge to Bevian Wetland	7.02	12.9	18.3	47.5
George Bass Drive culvert outlet for Bevian Wetland	7.03	34.1	50.1	149.8

4.1.2 Hydraulic Analysis

Hydraulic Model Development

Peak design flood levels were determined using a hydraulic computer model of each creek draining through the northern half of the development site. The hydraulic computer models were developed using the HEC-RAS software.

The HEC-RAS model was developed using creek cross-sections extracted from the contour information presented in **Figure 4**. The location of cross-sections used in the hydraulic model are shown in **Figure 6**.

Mannings 'n' roughness coefficients were determined for the main creek channels and floodplain based on field inspections. The field inspections determined that the creek channels generally comprised reeds and long grass with isolated trees and willows. A Mannings 'n' value of 0.060 was assigned to the creek channels. The overbank areas generally comprised medium length grass with isolated trees and shrubs. A Mannings 'n' value of 0.050 was assigned to the over bank areas.

As shown in **Figure 6**, the lower reaches of Tributary 1 and 2 drain across Bevian Road.

Hydraulic models were not developed for the gullies draining the southern half of the site into Bevian Wetland. As discussed, runoff from these local catchments will generally be discharged across the existing ground surface as "sheet flow". Hydraulic computer models are tailored towards defining flood behaviour across areas where floodwaters are concentrated along defined drainage paths. Moreover, it was considered that "backwater" flooding from Bevian Wetland would be more dominant across the lower, southern section

of the site during local catchment storms. A discussion on backwater flooding from Bevian Wetland is included in **Section 4.1.3**.

Model Results

A steady state simulation was performed using the HEC-RAS models to define flood behaviour for the 20 and 100 year recurrence floods as well as the PMF. Predicted peak floodwater levels and mean channel and overbank floodwater velocities are summarised in **Appendix B**.

Flood extent mapping was also prepared to define the extent of flood liable land within the northern sections of the development site for existing creek and catchment conditions. The flood extent mapping was developed using the peak design flood levels listed in **Appendix B** and the contour information shown in **Figure 4**.

The flood extent mapping for the 20 and 100 year recurrence event as well as the PMF is presented in **Figure 6**. The layout for the proposed developed is also provided in **Figure 6**.

Figure 6 shows that the extent of inundation during each design flood is contained within close proximity to each of the watercourses. **Figure 6** also shows that all sections of the development site where residential development is proposed would be located outside the predicted 100 year recurrence flood extent.

However, **Figure 6** shows that one allotment located adjacent to Tributary 1 is predicted to be inundated at the peak of the PMF if existing topographic conditions are maintained. The depth of inundation at this location is predicted to be less than 0.5 metres. This indicates that this section of the floodplain would be considered a low hazard area based on definitions provided in Appendix L of the NSW Government's *'Floodplain Development Manual'* (*2005*). It should also be recognised that the extent of inundation across this section of the floodplain is exaggerated by the assumed blockage of the Bevian Road culverts.

4.1.3 Bevian Wetland Analysis

General

The southern sections of the development site drain via two broad gullies into Bevian Wetland. Runoff would be discharged along the gullies as "sheet flow", which is characterised by shallow floodwater depths. As such flooding along these gullies would not present a significant flood hazard.

Nevertheless, there is potential for floodwaters to "back up" from Bevian Wetland should the George Bass Drive culvert outlet become blocked. Therefore, it was considered necessary to determine the extent of the development site that may be subject to "backwater" flooding from Bevian Wetland.

Hydraulic Assessment

In order to provide a conservative estimate of design flood levels in Bevian Wetland, the assessment was completed assuming that the George Bass Drive culverts were completely blocked by debris. That is, it was assumed that floodwaters needed to discharge across George Bass Drive.

A long section of George Bass Drive was extracted from the available survey information. The survey information indicates that the minimum crest elevation of the roadway embankment is about 4.2 m AHD. Accordingly, water in Bevian Wetland would pond to at least this elevation before it overtops the roadway.

The depth of overtopping across George Bass Drive for each design flood was estimated using the peak design discharges listed in **Table 4-2** (*refer node 7.03*) and by assuming that the roadway was approximated by a broad crested weir. The calculated peak design flood levels in Bevian Wetland for the 20 and 100 year recurrence floods as well as the PMF are summarised in **Table 4-3**.

Table 4-3 – PEAK DESIGN "BACK WATER" FLOOD LEVELS FOR BEVIAN WETLAND

DESIGN FLOOD	GEORGE BASS DRIVE ROADWAY ELEVATION (m AHD)	DEPTH OF ROADWAY OVERTOPPING (metres)	PEAK BEVIAN WETLAND LEVEL (m AHD)
20 Year ARI	4.2	0.12	4.32
100 Year ARI	4.2	0.15	4.35
PMF	4.2	0.31	4.51

The peak flood levels provided in **Table 4-3** were also combined with the survey information shown in **Figure 4** to estimate the extent of inundation across the southern sections of the site during each design flood. The flood extent mapping is provided in **Figure 7**. The layout of the proposed development is also superimposed on **Figure 7**.

As shown in **Figure 7**, all of the southern sections of the site where residential development is proposed are predicted to remain "flood free" during all events up to and including the PMF.

5 ASSESSMENT OF IMPACT OF DEVELOPMENT ON FLOOD BEHAVIOUR

5.1 IMPACTS OF PROPOSED DEVELOPMENT ON FLOOD BEHAVIOUR ALONG SALT WATER CREEK

5.1.1 General

The Concept Plans for the Rosedale subdivision have been developed so that all residential areas can have habitable floor levels at a minimum of 0.5m above the predicted 100 year recurrence flood extent (*refer* **Figures 6** *and* **7**). Accordingly, if existing creek and catchment conditions were maintained, no residential dwellings would be subject to inundation during all floods up to and including the 100 year recurrence event.

It is recommended that allotments for which the PMF encroach be filled so that all residential sections of the proposed development remain flood free during the PMF.

It is proposed to implement a water management strategy as part of the development. The water management strategy incorporates a range of stormwater controls and stormwater treatment devices including rainwater tanks, bio-retention swales and ponds to treat and attenuate stormwater runoff before it leaves the site.

The proposed stormwater management system will ensure that post-development stormwater runoff quality and quantity at the downstream site boundaries will be maintained below existing levels.

However, in order to provide a conservative estimate of the potential for the proposed development to impact on existing flood behaviour, it was assumed that the stormwater management system provided no flood detention or storage capacity.

Flood modelling of the proposed development has been undertaken to assess the impact of increased impervious area, revegetation of the riparian corridors and minor filling.

5.1.2 Hydrologic Model Modifications to Reflect Proposed Development

The RAFTS hydrologic model that was developed to quantify flood discharges from the site under existing catchment conditions was modified to quantify the potential increase in stormwater runoff from the developed site.

The modifications involved incorporating revised hydrologic model input parameters for each sub-catchment based on the proposed development layout (*refer* **Figure 3**) and estimates of percentage impervious and Manning's 'n' roughness for each land use type, which are listed in **Table 5-1**.

Table 5-1 – ADOPTED HYDROLOGIC MODEL PARAMETERS FOR EACH LAND USE TYPE

LAND USE	% IMPERVIOUS	PERVIOUS MANNINGS 'N'
Open Space	5	0.045
Residential	65	0.025
Rural Residential	10	0.035
Roadway	99	0.015

An initial loss of 10 mm of rainfall was adopted for the pervious portion of each sub catchment under post-development conditions. A continuing loss of 2.5 mm/hr was adopted for the remaining duration of the storm events that were modelled.

For the impervious portion of the sub-catchments, an initial loss of 1 mm and a continuing loss of 0 mm/hr were adopted.

The modified version of the RAFTS hydrologic model was used to simulate runoff across the developed catchment for the 20 and 100 year recurrence storms as well as the PMF. Peak discharges for each Salt Water Creek and Bevian Wetland sub-catchment are listed in **Table 5-2** and **Table 5-3** respectively. Peak sub-catchment discharges for existing conditions are also provided in **Table 5-2** and **Table 5-3** for comparison. A complete listing of the output from the RAFTS hydrologic models are included within **Appendix C**.

Table 5-2 and **Table 5-3** show worst case peak flows that would occur if a suitable water management system was not implemented for the site. These flows would not be as high in the proposed development however have been used to estimate the worst case flood levels (with no controls).

Table 5-2 – PEAK DESIGN FLOWS FOR SALT WATER CREEK SUB-CATCHMENTS FOR POST-DEVELOPMENT CATCHMENT CONDITIONS

RAFTS MODEL NODE NUMBER (*refer Figure 4*)	PEAK DISCHARGE (m^3/s)		
	20 YEAR ARI	100 YEAR ARI	PMF
	Post	Post	Post
2.00	5.4	7.7	18.5
4.00	5.7	8.0	19.0
5.00	3.6	4.8	11.2
2.01	16.9	23.4	60.3
2.02	17.8	25.0	69.0
2.03	18.3	25.8	73.6
2.04	18.4	26.0	75.8
6.00	2.6	3.6	7.8
3.00	2.1	2.9	6.2
3.01	6.3	8.6	21.5
3.02	6.8	9.3	24.7
7.00	6.6	8.7	17.2
8.00	6.4	9.4	28.7
8.01	7.8	11.6	37.5
1.00	2.4	3.2	7.1
1.01	7.3	10.1	28.1
1.02	9.1	13.2	38.6
1.03	12.7	18.8	59.4
1.04	19.5	27.2	87.4
1.05	35.9	51.1	164.8

Table 5-3 – PEAK DESIGN FLOWS FOR BEVIAN WETLAND SUB-CATCHMENTS FOR POST-DEVELOPMENT CATCHMENT CONDITIONS

RAFTS MODEL NODE NUMBER (*refer Figure 4*)	PEAK DISCHARGE (m^3/s)		
	20 YEAR ARI	100 YEAR ARI	PMF
	Post	Post	Post
9.00	4.8	7.2	25.9
8.00	11.8	16.5	44.9
8.01	13.3	18.9	54.7
7.00	6.2	8.2	20.8
7.01	11.9	16.0	43.4
7.02	13.6	18.4	51.2
7.03	36.2	51.2	154.1

5.1.3 Hydraulic Model Modifications to Reflect Proposed Development

As shown in **Figures 6** and **7**, the proposed development "footprint" has been developed so that it is located outside of the predicted worst case extent of inundation at the peak of the 100 year recurrence flood. Accordingly, negligible filling will be required across any proposed residential allotments to satisfy Council's minimum floor level requirements.

However, **Figures 6** and **7** also shows that the worst case extent of inundation at the peak of the PMF is predicted to extend across one residential allotment. Accordingly, there is potential for any filling, earthworks or buildings across this allotment to restrict the path of floodwaters during the PMF. This has the potential to impact on existing PMF flood behaviour along Tributary 1.

Accordingly the HEC-RAS hydraulic model that was developed to define existing flood behaviour along Salt Water Creek and its tributaries was modified to incorporate the potential filling of this allotment to above the peak level of the worst case PMF. This involved altering the geometry of cross-section XS 4 in the HEC-RAS model.

Manning's 'n' roughness values assigned to each HEC-RAS model cross-section were also modified to reflect the increase in vegetation density associated with the proposed rehabilitation of the riparian areas. Manning's 'n' values assigned to the creek channel were increased from 0.06 to 0.075. Manning's 'n' values assigned to over bank areas were increased from 0.05 to 0.08.

As shown in **Figure 6**, a roadway crossing of Tributary 2 is proposed to "link" the northern and southern sections of the development. In order to provide a conservative assessment of the potential for this crossing to impact on existing flood behaviour along Tributary 2, it

was assumed that the roadway was constructed above the peak level of the 100 year recurrence flood and that the culvert/bridge was completely blocked by debris.

It should be noted that the culvert/bridge crossing at this location will be designed to safely convey the design 100 year recurrence flood. In addition, the implementation of the stormwater management system will help to ensure that gross pollutants that have the potential to block the culvert/bridge will be trapped prior to entering the watercourse.

Accordingly, it should be recognised that the flood modelling for the development represents the worst case scenario in which the runoff control measures were assumed not to work and all culverts were totally blocked. This results in a worst case scenario in which runoff flow rates are overestimated and flood levels are higher due to this and complete blockage of culverts and other drainage features.

Hydraulic Modelling Results

The modified model was used to simulate the 20 and 100 year recurrence flood as well as the PMF under post-development conditions (*i.e., incorporating the filling of allotments, roadway crossings and increased site runoff*).

Predicted peak floodwater levels for the worst case "post-development" conditions are summarised in **Table 5-4** and **Table 5-5** and **Table 5-6** for Tributary 1, Tributary 2 and Salt Water Creek respectively.

Table 5-4 – IMPACT OF DEVELOPMENT OF PEAK FLOOD LEVELS ALONG TRIBUTARY 1

HEC-RAS MODEL CROSS-SECTION (*refer Figure 4*)	PEAK FLOOD LEVEL (*m AHD*)		
	Probable Maximum Flood	100 Year Recurrence Event	20 Year Recurrence Event
	Post-Development	Post-Development	Post-Development
XS1	12.31	11.58	11.46
XS2	14.10	13.33	13.17
XS3	14.09	13.30	13.24
XS4	14.28	13.64	13.51
XS5	17.33	16.56	16.34
XS6	19.15	18.42	18.19
XS7	23.64	23.09	22.95
XS8	25.62	25.09	24.95
XS9	29.18	28.76	28.65
XS10	31.88	31.36	31.24

Table 5-5 – IMPACT OF DEVELOPMENT OF PEAK FLOOD LEVELS ALONG TRIBUTARY 2

HEC-RAS MODEL CROSS-SECTION (*refer Figure 4*)	PEAK FLOOD LEVEL (*m AHD*)		
	Probable Maximum Flood	100 Year Recurrence Event	20 Year Recurrence Event
	Post-Development	Post-Development	Post-Development
XS1	12.26	11.83	11.78
XS2	12.80	12.26	12.13
XS3	13.14	12.82	12.75
XS4	13.61	13.18	13.07
XS5	15.63	15.18	15.06
XS6	16.15	15.77	15.68
XS7	16.84	16.41	16.31
XS8	18.69	18.03	17.85
XS9	22.20	22.00	21.97
XS10	22.44	22.14	22.07
XS11	22.74	22.25	22.14
XS12	23.39	22.68	22.49
XS13	26.28	25.69	25.54
XS14	27.36	26.69	26.52
XS15	30.51	30.32	30.29
XS16	32.94	32.71	32.62

Table 5-6 – IMPACT OF DEVELOPMENT OF PEAK FLOOD LEVELS ALONG SALT WATER CREEK

HEC-RAS MODEL CROSS-SECTION (*refer Figure 4*)	PEAK FLOOD LEVEL (*m AHD*)		
	Probable Maximum Flood	100 Year Recurrence Event	20 Year Recurrence Event
	Post-Development	Post-Development	Post-Development
XS1	9.50	8.90	8.84
XS2	11.94	11.91	11.82
XS3	14.05	13.60	13.52
XS4	15.89	15.86	15.80

Predicted peak in-channel flow velocities for the worst case "post-development" conditions are summarised in **Table 5-7**, **Table 5-8**, and **Table 5-9** for Tributary 1, Tributary 2 and Salt Water Creek respectively. Peak in-channel flow velocities for existing conditions are also provided in **Table 5-7**, **Table 5-8**, and **Table 5-9** for comparison. Increases in peak worst case "post-development" flow velocities are highlighted in bold.

A complete listing of results generated by the post-development HEC-RAS model are included in **Appendix D**.

Impact of Development on Peak Flood Levels

As shown in **Figure 6**, a considerable "buffer" is provided between the PMF flood extent and the edge of the proposed development along Salt Water Creek and its tributaries.

Table 5-7 – IMPACT OF DEVELOPMENT OF PEAK FLOW VELOCITIES ALONG TRIBUTARY 1

HEC-RAS MODEL CROSS-SECTION (*refer Figure 4*)	PEAK FLOW VELOCITY (*m/s*)					
	Probable Maximum Flood		100 Year Recurrence Event		20 Year Recurrence Event	
	Pre-Development	Post-Development	Pre-Development	Post-Development	Pre-Development	Post-Development
XS1	3.6	3.6	2.4	2.6	2.0	2.3
XS2	1.4	1.3	1.0	0.9	0.9	0.8
XS3	1.6	1.3	1.6	1.7	1.5	1.5
XS4	2.6	2.7	2.2	2.3	2.0	2.1
XS5	2.2	1.8	1.3	1.1	1.2	0.9
XS6	3.3	3.4	2.5	2.6	2.4	2.5
XS7	2.9	2.1	1.8	1.4	1.5	1.2
XS8	2.4	2.6	2.1	2.2	2.1	2.1
XS9	2.8	2.2	1.9	1.4	1.6	1.2
XS10	2.7	2.7	2.1	2.1	2.0	2.0

Table 5-8 – IMPACT OF DEVELOPMENT OF PEAK FLOW VELOCITIES ALONG TRIBUTARY 2

HEC-RAS MODEL CROSS-SECTION (*refer Figure 4*)	PEAK FLOW VELOCITY (*m/s*)					
	Probable Maximum Flood		100 Year Recurrence Event		20 Year Recurrence Event	
	Pre-Development	Post-Development	Pre-Development	Post-Development	Pre-Development	Post-Development
XS1	2.8	2.8	2.2	2.1	1.8	1.8
XS2	1.3	1.1	0.9	0.7	0.8	0.6
XS3	2.5	2.6	1.8	1.9	1.7	1.7
XS4	2.4	1.3	1.6	0.8	1.1	0.7
XS5	1.4	1.4	1.1	1.0	1.1	1.0
XS6	2.8	2.9	2.1	2.1	1.9	1.9
XS7	2.9	2.4	2.2	1.6	1.9	1.4
XS8	0.9	1.3	0.4	0.9	0.3	0.8
XS9	2.4	2.0	2.2	1.4	2.0	1.2
XS10	0.9	0.7	0.4	0.3	0.3	0.3
XS11	1.8	1.4	1.0	0.9	0.9	0.7
XS12	2.5	1.9	1.6	1.2	1.4	1.1
XS13	3.4	3.4	2.6	2.6	2.3	2.3
XS14	2.8	2.0	2.1	1.5	1.9	1.3
XS15	2.0	2.0	1.6	1.5	1.4	1.3
XS16	1.6	1.6	1.7	1.1	1.6	1.1

NOTE*: Flow velocities listed are "in channel" flow velocities*

Table 5-9 – IMPACT OF DEVELOPMENT OF PEAK FLOW VELOCITIES ALONG SALT WATER CREEK

HEC-RAS MODEL CROSS-SECTION (*refer Figure 4*)	PEAK FLOW VELOCITY (*m/s*)					
	Probable Maximum Flood		100 Year Recurrence Event		20 Year Recurrence Event	
	Pre-Development	Post-Development	Pre-Development	Post-Development	Pre-Development	Post-Development
XS1	1.2	1.2	1.7	1.7	1.5	1.6
XS2	2.2	1.9	1.1	0.8	1.1	0.7
XS3	1.3	0.9	1.7	1.7	1.5	1.6
XS4	2.1	2.1	1.5	1.0	1.3	0.9

NOTE*: Flow velocities listed are "in channel" flow velocities*

Impact of Development on Peak Flow Velocities

Table 5-7, **Table 5-8**, and **Table 5-9** show that the proposed development is predicted to generate small increases in peak worst case design flow velocities at isolated locations along each tributary. The maximum increase in peak flow velocity is predicted to be about 0.5 m/s and occurs at XS 8 along Tributary 2 during the worst case 100 year recurrence flood. The increase in flow velocity at this location is associated with water discharging across the paved surface of the proposed roadway crossing and down the downstream face of the roadway embankment.

However, reductions in peak flow velocity are predicted at most locations along each watercourse. The decrease in flow velocity is associated with increase in riparian vegetation which impedes the path of flow along each creek.

There is potential for localised increases in peak flow velocity to occur at the location of the proposed roadway crossings if floodwaters are allowed to freely discharge (*i.e., there is no blockage*). However, it is considered that the impact of any increases in peak flow velocity at this location can be mitigated using suitable protection works.

5.2 IMPACTS OF PROPOSED DEVELOPMENT ON FLOOD BEHAVIOUR ACROSS BEVIAN WETLAND

5.2.1 Modifications to Reflect Proposed Development

A worst case flood level was predicted for Bevian Wetland by assuming the development had no stormwater management controls and the culverts under George Bass Drive were fully blocked. The post-development flood discharges for this worst case scenario are listed in **Table 5-3** and were used to develop revised worst case peak flood level estimates.

5.2.2 Results

Predicted worst case post-development design flood levels for Bevian Wetland are provided in **Table 5-10**.

The worst case flood extents in Bevian Wetland would not encroach onto the proposed development.

Table 5-10 – IMPACT OF DEVELOPMENT ON PEAK DESIGN "BACK WATER" FLOOD LEVELS FOR BEVIAN WETLAND

PEAK FLOOD LEVEL *(m AHD)*		
Probable Maximum Flood	100 Year Recurrence Event	20 Year Recurrence Event
Post-Development	**Post-Development**	**Post-Development**
4.52	4.35	4.32

Overall it is considered that the proposed development will generate minimal impacts on existing flood behaviour within the Salt Water Creek and Bevian Wetland catchments if a suitable stormwater management system is maintained.

5.3 FLOOD IMPACTS

It has been established that even for a worst case flood scenario, which would be highly unlikely, the:

- development would not be adversely affected by the flooding as all proposed development would be outside the 100yr flood extent;
- the minimal encroachment of the PMF flood extent onto one lot would be resolved with minor filling of this lot such that no development would be adversely affected;
- development would not adversely impact flooding for other development on the site – the proposed development and site extends too close to the upstream extent of the catchment and as such, there would be no adverse impacts on flooding upstream of the site; and
- development would not adversely impact on flooding downstream of the site as peak flows would be maintained at or below existing rates.

The proposed development therefore conforms to the requirements of the NSW Floodplain Development Manual and meets the Director General's requirements for Issue 8.5.

5.4 SEA LEVEL RISE AND COASTAL INUNDATION

Flood levels in the vicinity of the coastline are influenced by many factors including ocean levels. Other significant factors are the beach berm level for an intermittently closed entrance and the distance from the ocean.

The typical ocean levels adopted for the purposes of flood studies range between RL 2.0m AHD to RL 2.6m AHD depending on local conditions. This influence on peak flood levels can be secondary if the beach berm level can be at RL 3m AHD.

The most reliable estimates (adopted by NSW Government), at present, of possible future sea level rise up to 2100 are *(Source: Intergovernmental Panel on Climate Change)*:

- low 0.09 m
- median 0.48 m
- high 0.88 m

This would raise the design ocean level for the purposes of flood level estimation to between RL 2.09m AHD and RL 3.48m AHD.

The Salt Water Creek and Tributaries 1 and 2 flood levels at the site eastern boundary range between RL 8.8m to 11.8m AHD due to the varying site ground levels. The distance from the coast and the ground elevations would mean that any influence from potential sea level rise would be dissipated before the eastern boundary of the site.

The flood levels adopted for Bevian Wetland for the purposes of this flood impact assessment were controlled by the level of George Bass Drive at RL 4.2m AHD. The flood level in Bevian Wetland may be affected by future sea level rise. At worst, the flood level may increase by RL 0.88m AHD to RL 5m AHD due to the high estimate of sea level rise. This is highly unlikely

given the volume of flood storage available in lower lying areas downstream of the site. Notwithstanding this, the proposed development around the Bevian Wetland would have a minimum ground level of approximately RL 7m AHD. As such, even the present highest predicted sea level rise within the next 100 years combined with a highly unlikely worst case influence on flood levels would not adversely impact on the proposed development.

The NSW government Floodplain Development Manual recommends that the appropriate flood planning level for residential development should still be the 100 year ARI flood plus a 500mm freeboard even considering climate change issues. It recommends that the freeboard could be expected to account for reasonable change in risk overtime and therefore selection of a more conservative flood planning level may not generally be necessary *(Appendix G9.8 – NSW Floodplain Development Manual).*

The proposed development would therefore meet the Director General's requirement for Issue 8.6.

5.5 SAFETY

As shown in **Figures 6** and **7**, all proposed residential allotments would be located outside the predicted extent of inundation at the peak of the worst case 100 year recurrence flood. Accordingly, evacuation will not be required for any residential dwelling during all events up to and including the 100 year recurrence flood.

In addition, **Figures 6** and **7** show that the majority of the proposed residential areas are also located outside of the predicted worst case PMF extent. As such evacuation from the majority of the development site will not be required during all floods up to and including the PMF.

However, **Figure 6** also shows that the worst case PMF is predicted to extend across one residential allotment located adjacent to Tributary 1. Therefore, filling is proposed across this allotment. This will elevate the allotment above the peak level of the PMF and will ensure that evacuation will not be necessary. As outlined in **Section 5.1.3**, filling of this allotment is not predicted to expose any other section of the proposed development, or any adjoining properties to an increase in flood hazard.

The stormwater drainage system would be designed on a minor/major system approach as recommended by the Floodplain Development Manual. This system would include a pipe drainage system to convey the minor storms and the road system as the major flow path catering for runoff in excess of the pipe capacity. The road and pipe system would be designed to ensure safe flow conditions in the streets for both pedestrians and vehicles. The Floodplain Development Manual recommends that these safe conditions can be achieved with the product of the flood velocity and depth being less than $0.4m^2/s$ for pedestrians and $0.6m^2/s$ for vehicles. The development would be designed to achieve these safe flood conditions on the streets.

Accordingly it is considered that the flood hazard across the site can be suitably managed. This meets the Director General's requirements for Issue 8.5.

6 CONCLUSION

This flood impact assessment has been prepared having regard to the requirements of the NSW government Floodplain Development Manual (2005). This manual has superseded the Floodplain Management Manual nominated in the Director General's requirements at Issue 8.5. As such, this study meets the requirements of Issue 8.5.

The estimated 100 year ARI and PMF flood levels would not inundate any proposed habitable floor levels in the development. Minor filling on one lot is proposed to raise it above the predicted PMF level. The predicted flood levels were based on a highly unlikely scenario that the runoff management measures proposed in the Water Management Report would not function. This scenario provides worst case flood levels which are unlikely to be achieved. Even in this worst case scenario, the flooding would not adversely impact on the proposed development. This meets the Director General's requirements at Issue 8.5.

The development would incorporate industry best practice runoff control measures to ensure peak flow rates do not increase above existing rates. This will ensure there is no adverse impact on flooding behaviour either upstream or downstream of the site. The development is located at the upstream end of the site and as such could not cause any cumulative impacts on flood behaviour especially when peak flow rates will be controlled at existing rates. This meets the Director General's requirements at Issue 8.5.

The flooding would not inundate any of the proposed lots and would not pose a serious risk to the residents. The flood flows in the pipes and streets would be designed to achieve safe conditions for pedestrians and cars on the streets. All residents would have ready access to flood free land on their lots or to even higher ground in all floods up to the PMF. The safety of the residents therefore would be appropriately managed in all floods and would not be adversely affected. This meets the Director General's requirements at Issue 8.4.

No development would be located on low lying land likely to be affected by likely future sea level rise over the next 100 years. This is based on the high estimate of sea level rise. No development would be located to be affected by coastal inundation. This factor was considered in derivation of the predicted flood levels. As such, this meets Issue 8.6 in the Director General's requirements.

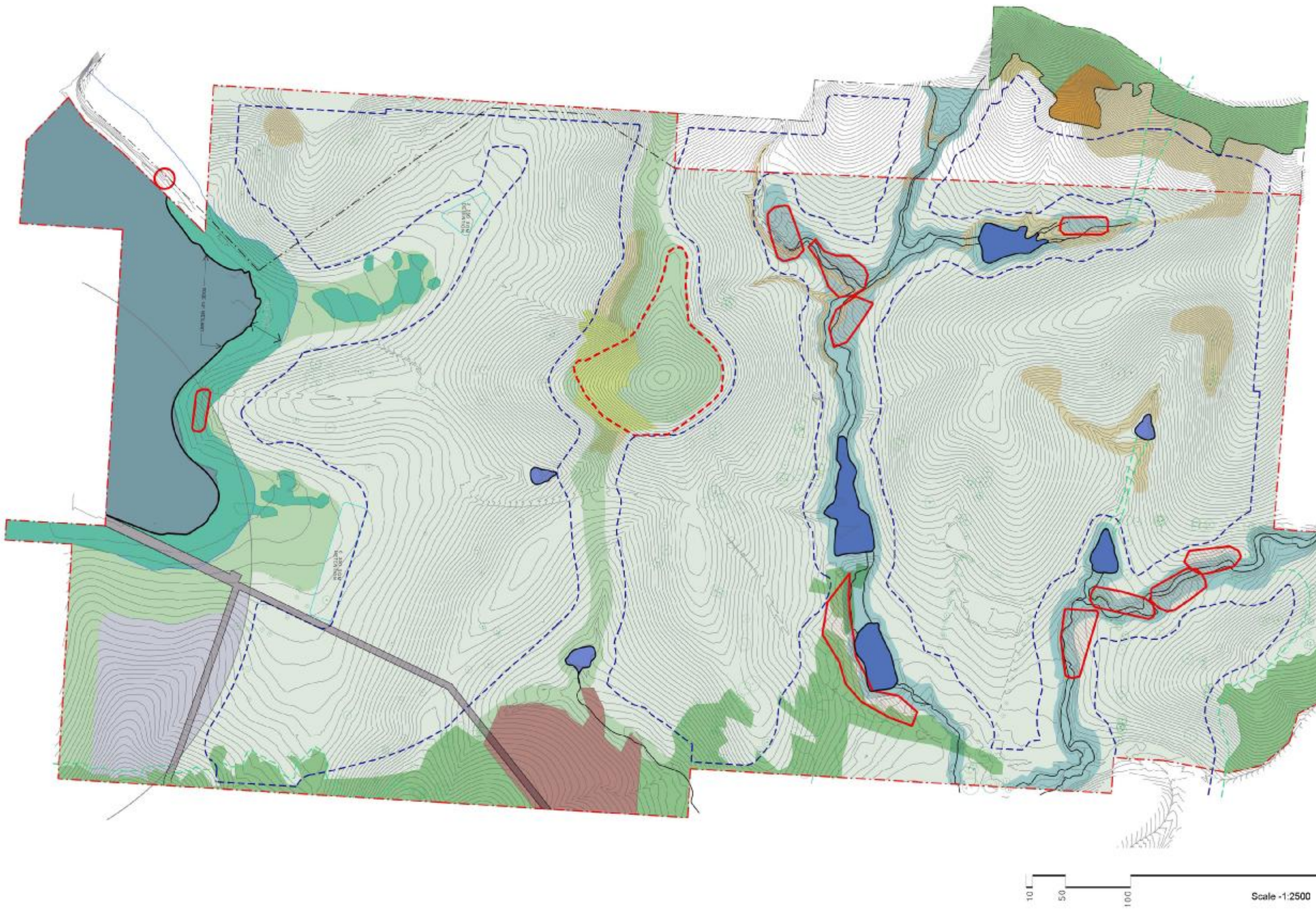
The Concept Approval Plans (The Constraints Map and Plan of Subdivision – **Figures 1** and **2**) have been formulated to address the flood behaviour and the requirements of flood risk management in the NSW government Floodplain Development Manual. As such, the Plans adequately address the flood related Director General's requirements and it is therefore concluded that the Concept Approval Plans are satisfactory.

7 REFERENCES

1. Bureau of Meteorology (*December 1994, amended December 1996 and January 2003*), '*The Estimation of Probable Maximum Precipitation in Australia: Generalised Short Duration Method*'.
2. Institution of Engineers (*1987*), *'Australian Rainfall and Runoff – A Guide to Flood Estimation'*; edited by DH Pilgrim.
3. New South Wales Government (*2005*), *'Floodplain Development Manual: the management of flood liable land'*; ISBN 07313 03709.
4. Willing & Partners Pty Ltd (*1996*), *'RAFTS-XP User Manual'*.
5. Intergovernmental Panel on Climate Change (*IPCC, 2001a*), 'Summary for Policymakers, A Report of Working Group 1 of the Intergovernmental Panel on Climate Change'.

FIGURES

FIGURE 1



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J4561_02/FIG1_ConstraintsMap_FAReport.jpg

CONSTRAINTS MAP

FIGURE 2

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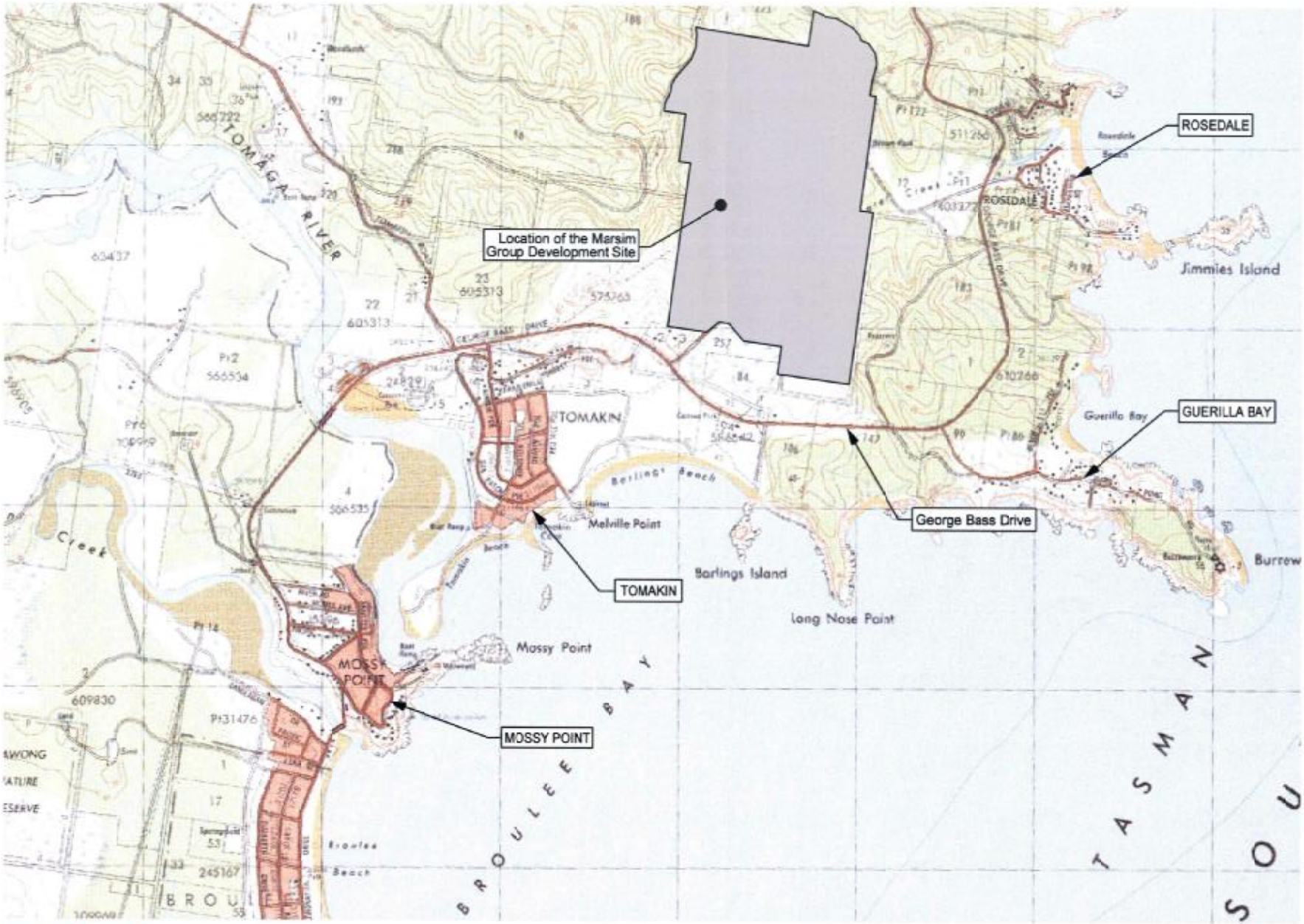
J4561_02/FIG2_ConceptPlan_FIAReport.jpg

CONCEPT PLAN

FIGURE 3



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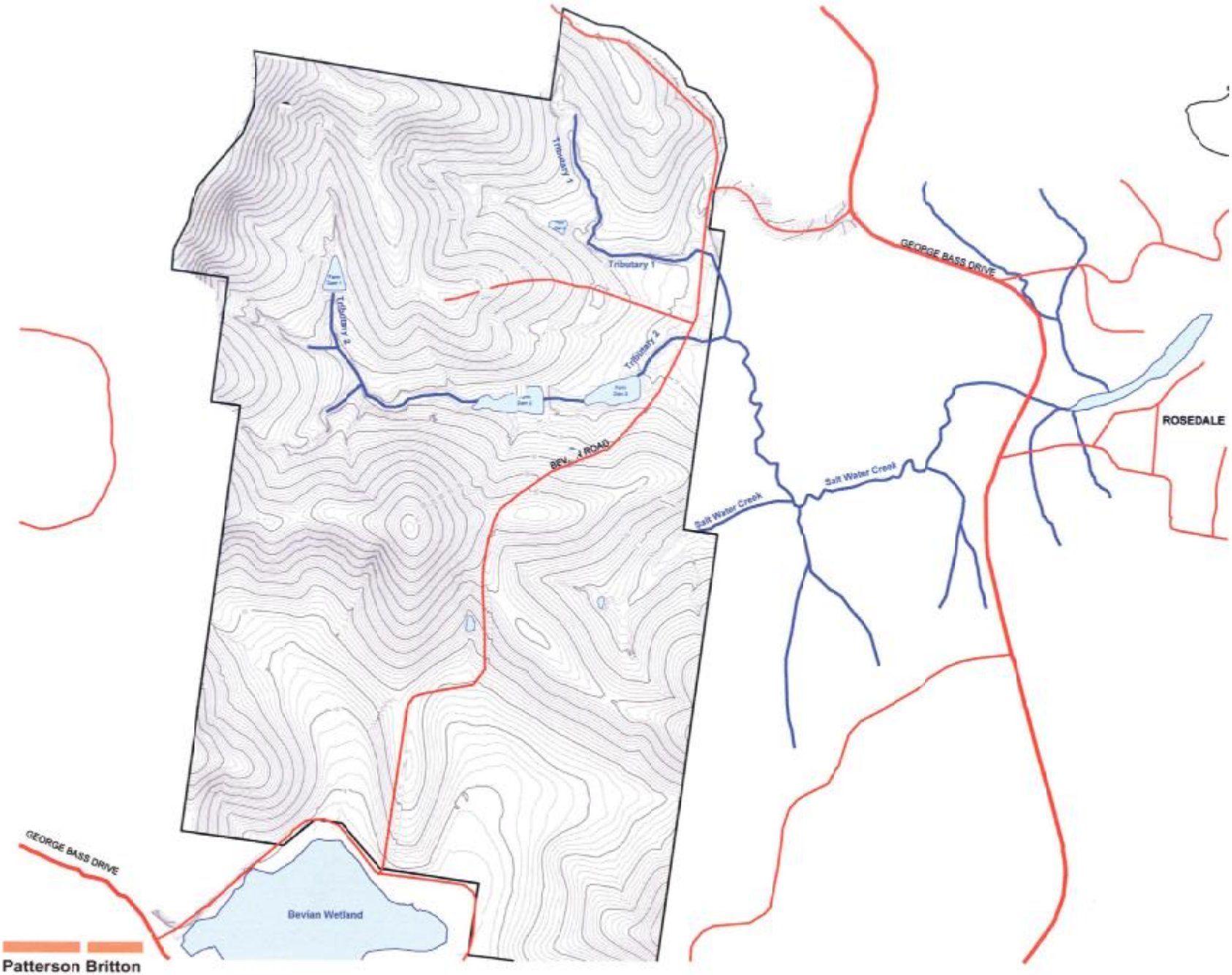
J4561_01/FIG3_DevelopmentArea.jpg

LOCATION OF THE ROSEDALE DEVELOPMENT SITE

FIGURE 4



LEGEND

- Contour of ground surface elevation relative to mAHD
- Watercourse alignment
- Road
- Development site

Scale

50 0 50 100 150 200 250

Metres

EXISTING TOPOGRAPHY ACROSS THE SITE

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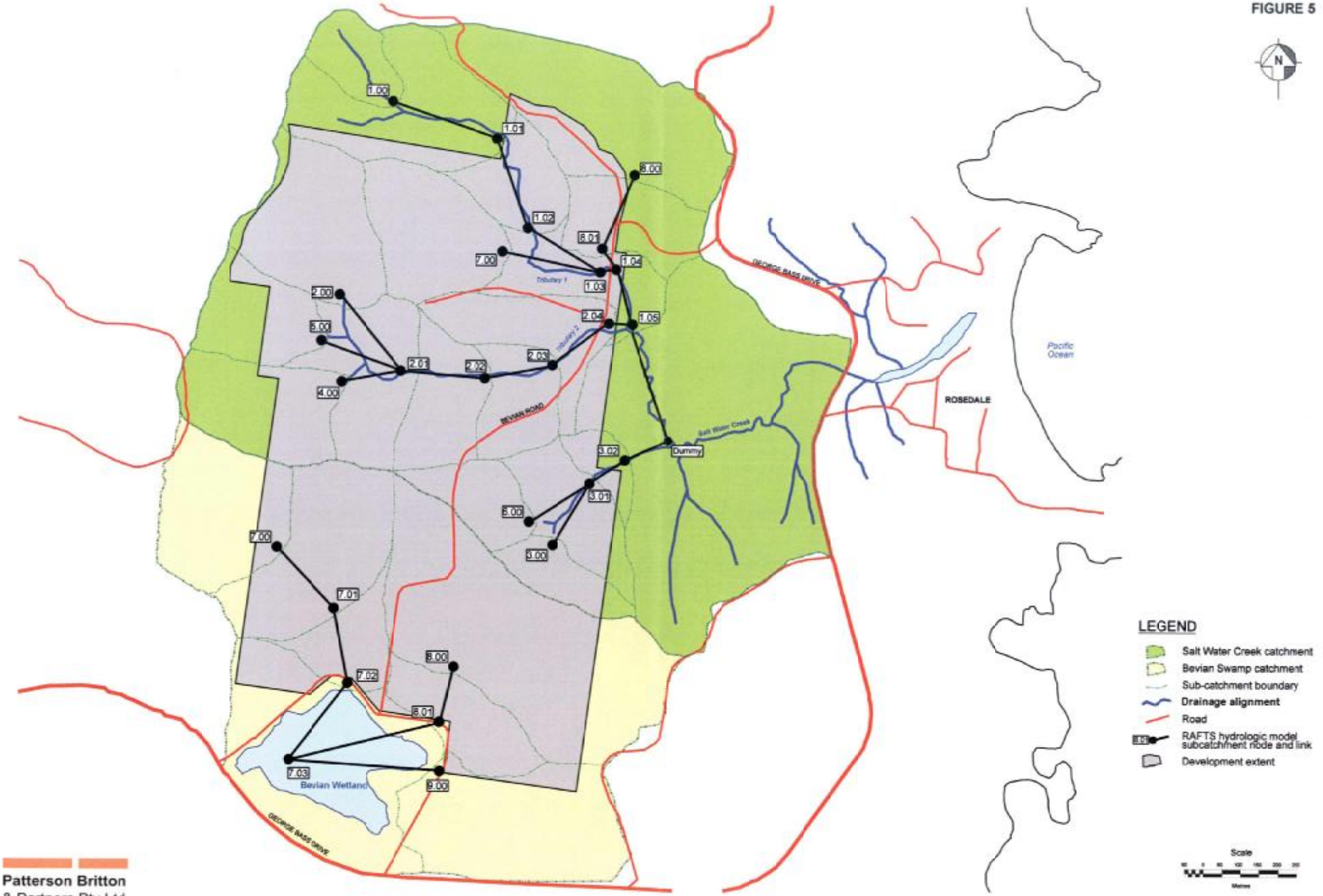
J4561_01/FIG4_ExistingTopography.jpg

FIGURE 5



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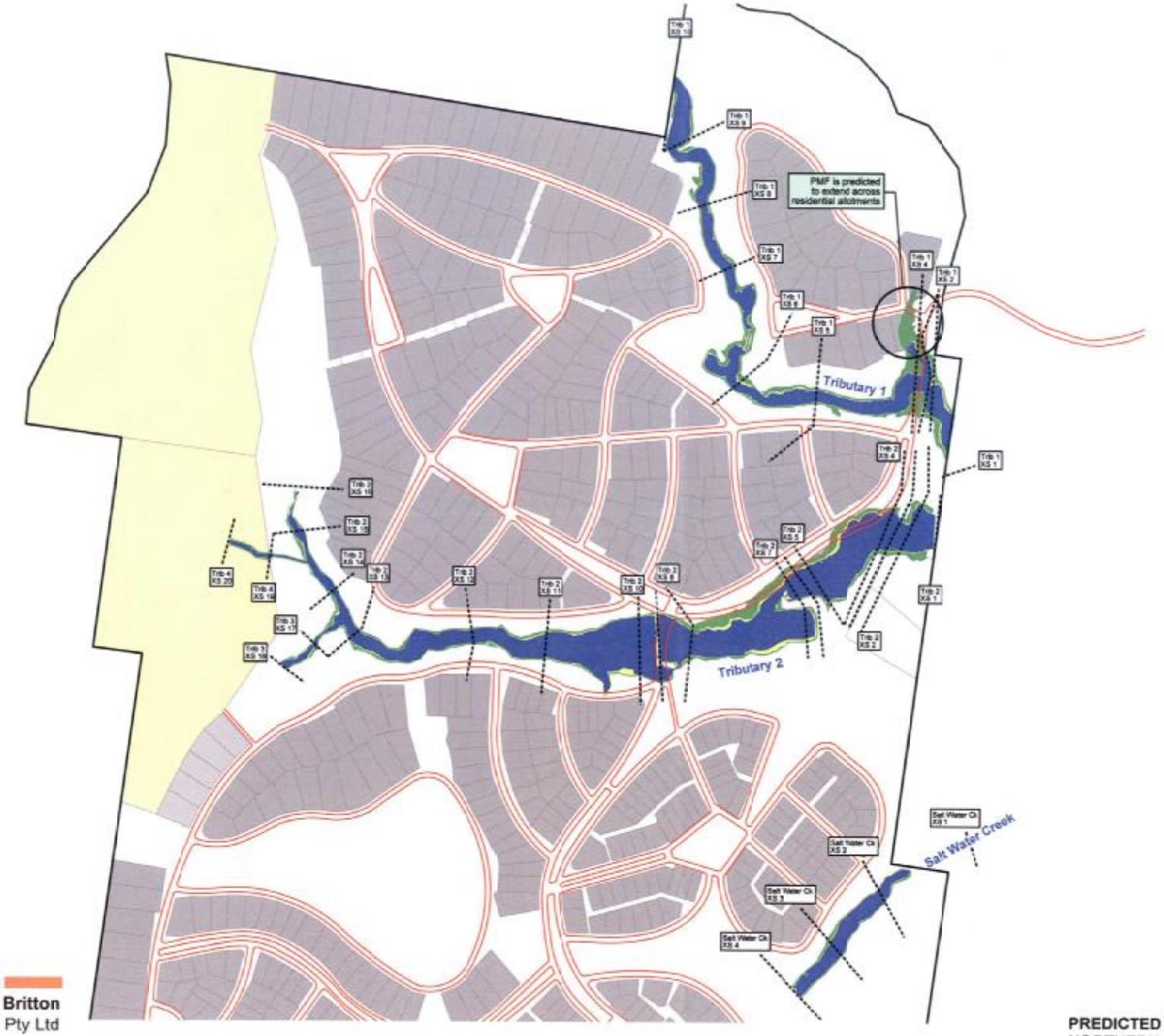
J4561_01/FIG5_HydrologicModel.jpg

LAYOUT OF RAFTS HYDROLOGIC MODEL

FIGURE 6



LEGEND

- HEC-RAS model cross-section
- Extent of inundation at peak of Probable Maximum Flood
- Extent of inundation at peak of 100 year recurrence flood
- Extent of inundation at peak of 20year recurrence flood
- Site boundary

Scale

50 0 50 100 150 200 250

Metres

PREDICTED DESIGN FLOOD EXTENTS ACROSS NORTHERN SECTIONS OF DEVELOPMENT SITE

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J4561_01/FIG6_PredictedDesignFlood.jpg

FIGURE 7

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J4581-01/FIG7_PredictedDesignFloodAcrossSouthernSections.jpg

PREDICTED DESIGN FLOOD EXTENTS ACROSS SOUTHERN SECTIONS OF DEVELOPMENT SITE

APPENDIX A
RAFTS MODEL OUTPUT FOR EXISTING CONDITIONS

```
 Run started at: 22nd  May  2007  17:22:25


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 1.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.082
 ESTIMATED PEAK FLOW         (CUMECS) =      2.41
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK 1.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          13.18
 ESTIMATED PEAK FLOW         (CUMECS) =      7.42
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 1.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          17.36
 ESTIMATED PEAK FLOW         (CUMECS) =      8.89
 ESTIMATED TIME TO PEAK         (MINS) =     40.00

 LINK 7.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          7.927
 ESTIMATED PEAK FLOW         (CUMECS) =      4.54
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 1.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          29.42
 ESTIMATED PEAK FLOW         (CUMECS) =     12.73
 ESTIMATED TIME TO PEAK         (MINS) =     52.00

 LINK 8.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          14.19
 ESTIMATED PEAK FLOW         (CUMECS) =      6.39
 ESTIMATED TIME TO PEAK         (MINS) =     36.00
```

```
LINK 8.01             3.001

ESTIMATED VOLUME (CU METRES*10**3) =          19.52
ESTIMATED PEAK FLOW         (CUMECS) =      7.94
ESTIMATED TIME TO PEAK         (MINS) =     44.00

LINK 1.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          48.92
ESTIMATED PEAK FLOW         (CUMECS) =     17.12
ESTIMATED TIME TO PEAK         (MINS) =     62.00

LINK 4.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          8.768
ESTIMATED PEAK FLOW         (CUMECS) =      5.48
ESTIMATED TIME TO PEAK         (MINS) =     28.00

LINK 2.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          8.616
ESTIMATED PEAK FLOW         (CUMECS) =      5.17
ESTIMATED TIME TO PEAK         (MINS) =     28.00

LINK 5.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          5.140
ESTIMATED PEAK FLOW         (CUMECS) =      3.47
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.01             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          28.80
ESTIMATED PEAK FLOW         (CUMECS) =     16.55
ESTIMATED TIME TO PEAK         (MINS) =     40.00

LINK 2.02             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          34.24
ESTIMATED PEAK FLOW         (CUMECS) =     17.71
ESTIMATED TIME TO PEAK         (MINS) =     48.00

LINK 2.03             4.003

ESTIMATED VOLUME (CU METRES*10**3) =          38.39
ESTIMATED PEAK FLOW         (CUMECS) =     18.30
ESTIMATED TIME TO PEAK         (MINS) =     58.00

LINK 2.04             4.004

ESTIMATED VOLUME (CU METRES*10**3) =          42.77
ESTIMATED PEAK FLOW         (CUMECS) =     18.65
ESTIMATED TIME TO PEAK         (MINS) =     68.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          95.49
ESTIMATED PEAK FLOW         (CUMECS) =     35.79
ESTIMATED TIME TO PEAK         (MINS) =     72.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          2.853
ESTIMATED PEAK FLOW         (CUMECS) =      2.01
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 6.00             8.000
```

```
 ESTIMATED VOLUME (CU METRES*10**3) =          3.622
 ESTIMATED PEAK FLOW         (CUMECS) =      2.29
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 3.01             7.001

 ESTIMATED VOLUME (CU METRES*10**3) =          10.13
 ESTIMATED PEAK FLOW         (CUMECS) =      5.86
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 3.02             7.002

 ESTIMATED VOLUME (CU METRES*10**3) =          12.13
 ESTIMATED PEAK FLOW         (CUMECS) =      6.27
 ESTIMATED TIME TO PEAK         (MINS) =     44.00

 LINK Dummy            1.006

 ESTIMATED VOLUME (CU METRES*10**3) =          112.2
 ESTIMATED PEAK FLOW         (CUMECS) =     37.27
 ESTIMATED TIME TO PEAK         (MINS) =     82.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - 20yr & 100yr ARI - Pre-development

Results for period from  0: 0.0  1/ 1/1990
                    to  4: 0.0  1/ 1/1990
################################################################################
#####


                          ROUTING INCREMENT (MINS) =       2.00
                          STORM DURATION (MINS)    =        60.
                          RETURN PERIOD (YRS)      =        20.
                          BX                       =     1.0000
                          TOTAL OF FIRST SUB-AREAS  (ha) =     180.09
                          TOTAL OF SECOND SUB-AREAS (ha) =       3.81
                          TOTAL OF ALL SUB-AREAS (ha)    =     183.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
1.00        5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  1.000
1.01       16.610  0.000  4.500 0.000  5.000 0.000  .035 0.00  .0539 0.000  1.001
1.02        6.860  0.000  4.500 0.000  5.000 0.000  .035 0.00  .0340 0.000  1.002
7.00       13.030  0.000  6.200 0.000  5.000 0.000  .035 0.00  .0405 0.000  2.000
1.03        4.550  1.900  4.300 4.300  5.000 39.00  .035 .019  .0281 .0037  1.003
8.00       23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  3.000
8.01        8.750  0.000  5.700 0.000  5.000 0.000  .035 0.00  .0343 0.000  3.001
1.04       .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  1.004
4.00       14.450  0.000  8.500 0.000  5.000 0.000  .035 0.00  .0365 0.000  4.000
2.00       14.190  0.000  7.300 0.000  5.000 0.000  .035 0.00  .0390 0.000  5.000
5.00        8.450  0.000  10.10 0.000  5.000 0.000  .035 0.00  .0253 0.000  6.000
2.01       10.310  0.000  5.400 0.000  5.000 0.000  .035 0.00  .0384 0.000  4.001
2.02        8.950  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0344 0.000  4.002
2.03        6.820  0.000  4.400 0.000  5.000 0.000  .035 0.00  .0343 0.000  4.003
2.04        7.200  0.000  3.400 0.000  5.000 0.000  .035 0.00  .0401 0.000  4.004
1.05        6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00        4.690  0.000  8.400 0.000  5.000 0.000  .035 0.00  .0205 0.000  7.000
6.00        5.950  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0278 0.000  8.000
3.01        6.010  0.000  6.500 0.000  5.000 0.000  .035 0.00  .0264 0.000  7.001
3.02        1.630  1.400  4.400 4.400  5.000 35.00  .025 .019  .0129 .0033  7.002
```

```
Dummy      6.920 0.5100  4.800 4.800  0.000 100.0  .035 .015  .0412 .0005  1.006
```

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	2.410	26.00	8.200
1.01	72.935	10.00	0.000	2.500	0.000	60.851	0.000	7.419	34.00	7.600
1.02	72.935	10.00	0.000	2.500	0.000	60.851	0.000	8.889	40.00	15.00
7.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	4.539	28.00	15.00
1.03	72.935	10.00	1.000	2.500	0.000	60.851	71.935	12.734	52.00	11.70
8.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	6.394	36.00	10.00
8.01	72.935	10.00	0.000	2.500	0.000	60.851	0.000	7.944	44.00	2.000
1.04	72.935	10.00	0.000	2.500	0.000	60.851	0.000	17.117	62.00	8.000
4.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	5.482	28.00	11.50
2.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	5.171	28.00	11.50
5.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	3.474	26.00	11.50
2.01	72.935	10.00	0.000	2.500	0.000	60.851	0.000	16.545	40.00	10.90
2.02	72.935	10.00	0.000	2.500	0.000	60.851	0.000	17.710	48.00	9.900
2.03	72.935	10.00	0.000	2.500	0.000	60.851	0.000	18.302	58.00	10.10
2.04	72.935	10.00	0.000	2.500	0.000	60.851	0.000	18.650	68.00	3.000
1.05	72.935	10.00	0.000	2.500	0.000	60.851	0.000	35.792	72.00	9.000
3.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	2.011	26.00	9.400
6.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	2.292	28.00	9.400
3.01	72.935	10.00	0.000	2.500	0.000	60.851	0.000	5.857	36.00	7.200
3.02	72.935	10.00	1.000	2.500	0.000	60.851	71.935	6.265	44.00	9.000
Dummy	72.935	10.00	1.000	2.500	0.000	60.851	71.935	37.266	82.00	0.000

```
 LINK 1.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          4.469
 ESTIMATED PEAK FLOW         (CUMECS) =      3.18
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK 1.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          19.10
 ESTIMATED PEAK FLOW         (CUMECS) =     10.20
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 1.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          25.13
 ESTIMATED PEAK FLOW         (CUMECS) =     12.33
 ESTIMATED TIME TO PEAK         (MINS) =     40.00

 LINK 7.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          11.48
 ESTIMATED PEAK FLOW         (CUMECS) =      6.55
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 1.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          42.48
 ESTIMATED PEAK FLOW         (CUMECS) =     18.48
 ESTIMATED TIME TO PEAK         (MINS) =     50.00

 LINK 8.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          20.57
 ESTIMATED PEAK FLOW         (CUMECS) =      9.44
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 8.01             3.001

 ESTIMATED VOLUME (CU METRES*10**3) =          28.28
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```
ESTIMATED PEAK FLOW         (CUMECS) =     11.90
ESTIMATED TIME TO PEAK         (MINS) =     40.00

LINK 1.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          70.76
ESTIMATED PEAK FLOW         (CUMECS) =     24.75
ESTIMATED TIME TO PEAK         (MINS) =     62.00

LINK 4.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          12.73
ESTIMATED PEAK FLOW         (CUMECS) =      7.68
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          12.50
ESTIMATED PEAK FLOW         (CUMECS) =      7.33
ESTIMATED TIME TO PEAK         (MINS) =     28.00

LINK 5.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          7.445
ESTIMATED PEAK FLOW         (CUMECS) =      4.78
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.01             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          41.77
ESTIMATED PEAK FLOW         (CUMECS) =     23.34
ESTIMATED TIME TO PEAK         (MINS) =     38.00

LINK 2.02             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          49.66
ESTIMATED PEAK FLOW         (CUMECS) =     25.07
ESTIMATED TIME TO PEAK         (MINS) =     48.00

LINK 2.03             4.003

ESTIMATED VOLUME (CU METRES*10**3) =          55.66
ESTIMATED PEAK FLOW         (CUMECS) =     25.92
ESTIMATED TIME TO PEAK         (MINS) =     58.00

LINK 2.04             4.004

ESTIMATED VOLUME (CU METRES*10**3) =          61.97
ESTIMATED PEAK FLOW         (CUMECS) =     26.43
ESTIMATED TIME TO PEAK         (MINS) =     68.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          138.2
ESTIMATED PEAK FLOW         (CUMECS) =     50.49
ESTIMATED TIME TO PEAK         (MINS) =     72.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          4.134
ESTIMATED PEAK FLOW         (CUMECS) =      2.68
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 6.00             8.000

ESTIMATED VOLUME (CU METRES*10**3) =          5.237
ESTIMATED PEAK FLOW         (CUMECS) =      3.13
ESTIMATED TIME TO PEAK         (MINS) =     28.00
```

```
 LINK 3.01              7.001

 ESTIMATED VOLUME (CU METRES*10**3) =           14.67
 ESTIMATED PEAK FLOW         (CUMECS) =      7.95
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 3.02              7.002

 ESTIMATED VOLUME (CU METRES*10**3) =           17.49
 ESTIMATED PEAK FLOW         (CUMECS) =      8.54
 ESTIMATED TIME TO PEAK         (MINS) =     44.00

 LINK Dummy             1.006

 ESTIMATED VOLUME (CU METRES*10**3) =           162.3
 ESTIMATED PEAK FLOW         (CUMECS) =     52.58
 ESTIMATED TIME TO PEAK         (MINS) =     82.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - 20yr & 100yr ARI - Pre-development

Results for period from  0: 0.0  1/ 1/1990
                    to  4: 0.0  1/ 1/1990
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       2.00
                                STORM DURATION (MINS)    =        60.
                                RETURN PERIOD (YRS)      =       100.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =     180.09
                                TOTAL OF SECOND SUB-AREAS (ha) =       3.81
                                TOTAL OF ALL SUB-AREAS (ha)    =     183.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
1.00        5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  1.000
1.01       16.610  0.000  4.500 0.000  5.000 0.000  .035 0.00  .0539 0.000  1.001
1.02        6.860  0.000  4.500 0.000  5.000 0.000  .035 0.00  .0340 0.000  1.002
7.00       13.030  0.000  6.200 0.000  5.000 0.000  .035 0.00  .0405 0.000  2.000
1.03        4.550  1.900  4.300 4.300  5.000 39.00  .035 .019  .0281 .0037  1.003
8.00       23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  3.000
8.01        8.750  0.000  5.700 0.000  5.000 0.000  .035 0.00  .0343 0.000  3.001
1.04       .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  1.004
4.00       14.450  0.000  8.500 0.000  5.000 0.000  .035 0.00  .0365 0.000  4.000
2.00       14.190  0.000  7.300 0.000  5.000 0.000  .035 0.00  .0390 0.000  5.000
5.00        8.450  0.000  10.10 0.000  5.000 0.000  .035 0.00  .0253 0.000  6.000
2.01       10.310  0.000  5.400 0.000  5.000 0.000  .035 0.00  .0384 0.000  4.001
2.02        8.950  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0344 0.000  4.002
2.03        6.820  0.000  4.400 0.000  5.000 0.000  .035 0.00  .0343 0.000  4.003
2.04        7.200  0.000  3.400 0.000  5.000 0.000  .035 0.00  .0401 0.000  4.004
1.05        6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00        4.690  0.000  8.400 0.000  5.000 0.000  .035 0.00  .0205 0.000  7.000
6.00        5.950  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0278 0.000  8.000
3.01        6.010  0.000  6.500 0.000  5.000 0.000  .035 0.00  .0264 0.000  7.001
3.02        1.630  1.400  4.400 4.400  5.000 35.00  .025 .019  .0129 .0033  7.002
Dummy       6.920 0.5100  4.800 4.800  0.000 100.0  .035 .015  .0412 .0005  1.006
```

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	3.177	26.00	8.200
1.01	100.35	10.00	0.000	2.500	0.000	88.181	0.000	10.202	32.00	7.600
1.02	100.35	10.00	0.000	2.500	0.000	88.181	0.000	12.328	40.00	15.00
7.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	6.551	28.00	15.00
1.03	100.35	10.00	1.000	2.500	0.000	88.181	99.347	18.476	50.00	11.70
8.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	9.444	32.00	10.00
8.01	100.35	10.00	0.000	2.500	0.000	88.181	0.000	11.899	40.00	2.000
1.04	100.35	10.00	0.000	2.500	0.000	88.181	0.000	24.753	62.00	8.000
4.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	7.680	26.00	11.50
2.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	7.325	28.00	11.50
5.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	4.780	26.00	11.50
2.01	100.35	10.00	0.000	2.500	0.000	88.181	0.000	23.336	38.00	10.90
2.02	100.35	10.00	0.000	2.500	0.000	88.181	0.000	25.069	48.00	9.900
2.03	100.35	10.00	0.000	2.500	0.000	88.181	0.000	25.923	58.00	10.10
2.04	100.35	10.00	0.000	2.500	0.000	88.181	0.000	26.435	68.00	3.000
1.05	100.35	10.00	0.000	2.500	0.000	88.181	0.000	50.486	72.00	9.000
3.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	2.677	26.00	9.400
6.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	3.128	28.00	9.400
3.01	100.35	10.00	0.000	2.500	0.000	88.181	0.000	7.955	36.00	7.200
3.02	100.35	10.00	1.000	2.500	0.000	88.181	99.347	8.536	44.00	9.000
Dummy	100.35	10.00	1.000	2.500	0.000	88.181	99.347	52.583	82.00	0.000

Run completed at: 22nd May 2007 17:22:25

mik open 0

```
 Run started at: 22nd  May  2007  17:24:02


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 2.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          43.57
 ESTIMATED PEAK FLOW         (CUMECS) =     18.50
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 4.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          44.37
 ESTIMATED PEAK FLOW         (CUMECS) =     18.88
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 5.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          25.96
 ESTIMATED PEAK FLOW         (CUMECS) =     11.15
 ESTIMATED TIME TO PEAK         (MINS) =     18.00

 LINK 2.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          145.6
 ESTIMATED PEAK FLOW         (CUMECS) =     60.16
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 2.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          173.1
 ESTIMATED PEAK FLOW         (CUMECS) =     68.85
 ESTIMATED TIME TO PEAK         (MINS) =     42.00

 LINK 2.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          194.0
 ESTIMATED PEAK FLOW         (CUMECS) =     73.52
 ESTIMATED TIME TO PEAK         (MINS) =     52.00
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```
LINK 2.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          216.2
ESTIMATED PEAK FLOW         (CUMECS) =     76.54
ESTIMATED TIME TO PEAK         (MINS) =     60.00

LINK 7.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          40.04
ESTIMATED PEAK FLOW         (CUMECS) =     16.86
ESTIMATED TIME TO PEAK         (MINS) =     22.00

LINK 1.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          15.58
ESTIMATED PEAK FLOW         (CUMECS) =      7.11
ESTIMATED TIME TO PEAK         (MINS) =     14.00

LINK 1.01             5.001

ESTIMATED VOLUME (CU METRES*10**3) =          66.62
ESTIMATED PEAK FLOW         (CUMECS) =     27.65
ESTIMATED TIME TO PEAK         (MINS) =     24.00

LINK 1.02             5.002

ESTIMATED VOLUME (CU METRES*10**3) =          87.68
ESTIMATED PEAK FLOW         (CUMECS) =     35.74
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK 1.03             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          147.8
ESTIMATED PEAK FLOW         (CUMECS) =     57.09
ESTIMATED TIME TO PEAK         (MINS) =     46.00

LINK 8.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          71.83
ESTIMATED PEAK FLOW         (CUMECS) =     28.68
ESTIMATED TIME TO PEAK         (MINS) =     28.00

LINK 8.01             6.001

ESTIMATED VOLUME (CU METRES*10**3) =          98.72
ESTIMATED PEAK FLOW         (CUMECS) =     37.77
ESTIMATED TIME TO PEAK         (MINS) =     38.00

LINK 1.04             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          246.5
ESTIMATED PEAK FLOW         (CUMECS) =     83.94
ESTIMATED TIME TO PEAK         (MINS) =     56.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          481.9
ESTIMATED PEAK FLOW         (CUMECS) =    162.12
ESTIMATED TIME TO PEAK         (MINS) =     64.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          14.41
ESTIMATED PEAK FLOW         (CUMECS) =      6.24
ESTIMATED TIME TO PEAK         (MINS) =     18.00

LINK 6.00             8.000
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```
 ESTIMATED VOLUME (CU METRES*10**3) =           18.27
 ESTIMATED PEAK FLOW         (CUMECS) =      7.78
 ESTIMATED TIME TO PEAK         (MINS) =     20.00

 LINK 3.01              7.001

 ESTIMATED VOLUME (CU METRES*10**3) =           51.15
 ESTIMATED PEAK FLOW         (CUMECS) =     21.17
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 3.02              7.002

 ESTIMATED VOLUME (CU METRES*10**3) =           60.63
 ESTIMATED PEAK FLOW         (CUMECS) =     24.32
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK Dummy             1.006

 ESTIMATED VOLUME (CU METRES*10**3) =           565.4
 ESTIMATED PEAK FLOW         (CUMECS) =    175.65
 ESTIMATED TIME TO PEAK         (MINS) =     74.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - Probable Maximum Flood - Pre-development

Results for period from  0: 0.0  1/ 1/1990
                     to  6:40.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =       60.
                              RETURN PERIOD (YRS)      =        0.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =     180.09
                              TOTAL OF SECOND SUB-AREAS (ha) =       3.81
                              TOTAL OF ALL SUB-AREAS (ha)    =     183.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
2.00      14.190  0.000  7.300 0.000  5.000 0.000  .035 0.00  .0390 0.000  1.000
4.00      14.450  0.000  8.500 0.000  5.000 0.000  .035 0.00  .0365 0.000  2.000
5.00       8.450  0.000  10.10 0.000  5.000 0.000  .035 0.00  .0253 0.000  3.000
2.01      10.310  0.000  5.400 0.000  5.000 0.000  .035 0.00  .0384 0.000  1.001
2.02       8.950  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0344 0.000  1.002
2.03       6.820  0.000  4.400 0.000  5.000 0.000  .035 0.00  .0343 0.000  1.003
2.04       7.200  0.000  3.400 0.000  5.000 0.000  .035 0.00  .0401 0.000  1.004
7.00      13.030  0.000  6.200 0.000  5.000 0.000  .035 0.00  .0405 0.000  4.000
1.00       5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  5.000
1.01      16.610  0.000  4.500 0.000  5.000 0.000  .035 0.00  .0539 0.000  5.001
1.02       6.860  0.000  4.500 0.000  5.000 0.000  .035 0.00  .0340 0.000  5.002
1.03       4.550  1.900  4.300 4.300  5.000 39.00  .035 .019  .0281 .0037  4.001
8.00      23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  6.000
8.01       8.750  0.000  5.700 0.000  5.000 0.000  .035 0.00  .0343 0.000  6.001
1.04      .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  4.002
1.05       6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00       4.690  0.000  8.400 0.000  5.000 0.000  .035 0.00  .0205 0.000  7.000
6.00       5.950  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0278 0.000  8.000
3.01       6.010  0.000  6.500 0.000  5.000 0.000  .035 0.00  .0264 0.000  7.001
3.02       1.630  1.400  4.400 4.400  5.000 35.00  .025 .019  .0129 .0033  7.002
```

```
Dummy      6.920 0.5100  4.800 4.800  0.000 100.0  .035 .015  .0412 .0005  1.006
```

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
2.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	18.496	22.00	11.50
4.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	18.877	22.00	11.50
5.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	11.154	18.00	11.50
2.01	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	60.164	32.00	10.90
2.02	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	68.852	42.00	9.900
2.03	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	73.524	52.00	10.10
2.04	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	76.535	60.00	3.000
7.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	16.863	22.00	15.00
1.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	7.110	14.00	8.200
1.01	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	27.646	24.00	7.600
1.02	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	35.740	30.00	15.00
1.03	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	57.093	46.00	11.70
8.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	28.683	28.00	10.00
8.01	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	37.769	38.00	2.000
1.04	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	83.942	56.00	8.000
1.05	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	162.12	64.00	9.000
3.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	6.237	18.00	9.400
6.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	7.778	20.00	9.400
3.01	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	21.175	30.00	7.200
3.02	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	24.318	36.00	9.000
Dummy	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	175.65	74.00	0.000

```
 Run completed at: 22nd  May  2007  17:24:02


 mik open         0
```

```
 Run started at:  7th  March  2007  14:30:31


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          8.784
 ESTIMATED PEAK FLOW         (CUMECS) =      5.72
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          18.72
 ESTIMATED PEAK FLOW         (CUMECS) =     11.08
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          22.38
 ESTIMATED PEAK FLOW         (CUMECS) =     12.92
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          21.60
 ESTIMATED PEAK FLOW         (CUMECS) =      9.70
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 8.01             2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          26.47
 ESTIMATED PEAK FLOW         (CUMECS) =     11.84
 ESTIMATED TIME TO PEAK         (MINS) =     38.00

 LINK 9.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          12.11
 ESTIMATED PEAK FLOW         (CUMECS) =      4.91
 ESTIMATED TIME TO PEAK         (MINS) =     36.00
```

```
 LINK 7.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          75.38
 ESTIMATED PEAK FLOW         (CUMECS) =     34.05
 ESTIMATED TIME TO PEAK         (MINS) =     44.00



################################################################################
#####
Rosedale - Bevian Swamp Catchment - 20yr & 100yr ARI - Pre-development

Results for period from  0: 0.0  1/ 1/1990
                     to  4: 0.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        60.
                              RETURN PERIOD (YRS)      =        20.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =     124.51
                              TOTAL OF SECOND SUB-AREAS (ha) =       0.00
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.51


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
7.00      14.493  0.000  10.17 0.000  5.000 0.000  .035 0.00  .0334 0.000  1.000
7.01      16.368  0.000  5.800 0.000  5.000 0.000  .035 0.00  .0471 0.000  1.001
7.02       5.997  0.000  4.890 0.000  5.000 0.000  .035 0.00  .0304 0.000  1.002
8.00      35.746  0.000  4.470 0.000  5.000 0.000  .035 0.00  .0806 0.000  2.000
8.01       8.030  0.000  2.660 0.000  5.000 0.000  .035 0.00  .0480 0.000  2.001
9.00      19.962  0.000  2.590 0.000  5.000 0.000  .035 0.00  .0781 0.000  3.000
7.03      23.918  0.000  1.710 0.000  5.000 0.000  .035 0.00  .1056 0.000  1.003


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
7.00      72.935 10.00 0.000  2.500 0.000  60.851  0.000   5.720  28.00 4.500
7.01      72.935 10.00 0.000  2.500 0.000  60.851  0.000  11.078  30.00 3.700
7.02      72.935 10.00 0.000  2.500 0.000  60.851  0.000  12.923  34.00 8.800
8.00      72.935 10.00 0.000  2.500 0.000  60.851  0.000   9.704  36.00 3.200
8.01      72.935 10.00 0.000  2.500 0.000  60.851  0.000  11.836  38.00 8.800
9.00      72.935 10.00 0.000  2.500 0.000  60.851  0.000   4.907  36.00 8.800
7.03      72.935 10.00 0.000  2.500 0.000  60.851  0.000  34.051  44.00 0.000


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          12.76
 ESTIMATED PEAK FLOW         (CUMECS) =      7.99
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          27.17
 ESTIMATED PEAK FLOW         (CUMECS) =     15.73
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          32.44
```

```
 ESTIMATED PEAK FLOW         (CUMECS) =     18.25
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.00              2.000

 ESTIMATED VOLUME (CU METRES*10**3) =           31.40
 ESTIMATED PEAK FLOW         (CUMECS) =     14.33
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.01              2.001

 ESTIMATED VOLUME (CU METRES*10**3) =           38.43
 ESTIMATED PEAK FLOW         (CUMECS) =     17.52
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 9.00              3.000

 ESTIMATED VOLUME (CU METRES*10**3) =           17.58
 ESTIMATED PEAK FLOW         (CUMECS) =      7.36
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 7.03              1.003

 ESTIMATED VOLUME (CU METRES*10**3) =           109.4
 ESTIMATED PEAK FLOW         (CUMECS) =     50.08
 ESTIMATED TIME TO PEAK         (MINS) =     42.00
```

```
################################################################################
#####
Rosedale - Bevian Swamp Catchment - 20yr & 100yr ARI - Pre-development

Results for period from  0: 0.0  1/ 1/1990
                    to  4: 0.0  1/ 1/1990
################################################################################
#####
```

```
                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =       60.
                              RETURN PERIOD (YRS)      =      100.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =     124.51
                              TOTAL OF SECOND SUB-AREAS (ha) =       0.00
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.51
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
7.00	14.493	0.000	10.17	0.000	5.000	0.000	.035	0.00	.0334	0.000	1.000
7.01	16.368	0.000	5.800	0.000	5.000	0.000	.035	0.00	.0471	0.000	1.001
7.02	5.997	0.000	4.890	0.000	5.000	0.000	.035	0.00	.0304	0.000	1.002
8.00	35.746	0.000	4.470	0.000	5.000	0.000	.035	0.00	.0806	0.000	2.000
8.01	8.030	0.000	2.660	0.000	5.000	0.000	.035	0.00	.0480	0.000	2.001
9.00	19.962	0.000	2.590	0.000	5.000	0.000	.035	0.00	.0781	0.000	3.000
7.03	23.918	0.000	1.710	0.000	5.000	0.000	.035	0.00	.1056	0.000	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
7.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	7.991	26.00	4.500
7.01	100.35	10.00	0.000	2.500	0.000	88.181	0.000	15.727	30.00	3.700
7.02	100.35	10.00	0.000	2.500	0.000	88.181	0.000	18.251	34.00	8.800

```
8.00      100.35 10.00 0.000  2.500 0.000  88.181  0.000  14.332  34.00 3.200
8.01      100.35 10.00 0.000  2.500 0.000  88.181  0.000  17.523  36.00 8.800
9.00      100.35 10.00 0.000  2.500 0.000  88.181  0.000   7.361  36.00 8.800
7.03      100.35 10.00 0.000  2.500 0.000  88.181  0.000  50.082  42.00 0.000


 Run completed at:  7th  March  2007  14:30:31


 mik open         0
```

```
 Run started at:  7th  March  2007  14:35:37


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          44.52
 ESTIMATED PEAK FLOW         (CUMECS) =     19.06
 ESTIMATED TIME TO PEAK         (MINS) =     20.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          94.78
 ESTIMATED PEAK FLOW         (CUMECS) =     40.06
 ESTIMATED TIME TO PEAK         (MINS) =     24.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          113.2
 ESTIMATED PEAK FLOW         (CUMECS) =     47.48
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 8.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          109.7
 ESTIMATED PEAK FLOW         (CUMECS) =     43.79
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 8.01             2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          134.4
 ESTIMATED PEAK FLOW         (CUMECS) =     53.32
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 9.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          61.29
 ESTIMATED PEAK FLOW         (CUMECS) =     23.84
 ESTIMATED TIME TO PEAK         (MINS) =     30.00
```

LINK 7.03 1.003

ESTIMATED VOLUME (CU METRES*10**3) = 382.3
ESTIMATED PEAK FLOW (CUMECS) = 149.85
ESTIMATED TIME TO PEAK (MINS) = 38.00

##
#####
Rosedale - Bevian Swamp Catchment - Probable Maximum Flood - Pre-development

Results for period from 0: 0.0 1/ 1/1990
to 6:40.0 1/ 1/1990
##
#####

ROUTING INCREMENT (MINS) = 2.00
STORM DURATION (MINS) = 60.
RETURN PERIOD (YRS) = 0.
BX = 1.0000
TOTAL OF FIRST SUB-AREAS (ha) = 124.51
TOTAL OF SECOND SUB-AREAS (ha) = 0.00
TOTAL OF ALL SUB-AREAS (ha) = 124.51

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Pern #1	Pern #2	B #1	B #2	Link No.
7.00	14.493	0.000	10.17	0.000	5.000	0.000	.035	0.00	.0334	0.000	1.000
7.01	16.368	0.000	5.800	0.000	5.000	0.000	.035	0.00	.0471	0.000	1.001
7.02	5.997	0.000	4.890	0.000	5.000	0.000	.035	0.00	.0304	0.000	1.002
8.00	35.746	0.000	4.470	0.000	5.000	0.000	.035	0.00	.0806	0.000	2.000
8.01	8.030	0.000	2.660	0.000	5.000	0.000	.035	0.00	.0480	0.000	2.001
9.00	19.962	0.000	2.590	0.000	5.000	0.000	.035	0.00	.0781	0.000	3.000
7.03	23.918	0.000	1.710	0.000	5.000	0.000	.035	0.00	.1056	0.000	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
7.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	19.058	20.00	4.500
7.01	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	40.064	24.00	3.700
7.02	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	47.484	28.00	8.800
8.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	43.788	28.00	3.200
8.01	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	53.317	32.00	8.800
9.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	23.844	30.00	8.800
7.03	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	149.85	38.00	0.000

Run completed at: 7th March 2007 14:35:37

mik open 0

APPENDIX B
HEC-RAS MODEL OUTPUT FOR EXISTING CONDITIONS

HEC-RAS Plan: Tributary 1 River: Tributary 1 Reach: 1

Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	1	20yr ARI	17.10	0.050	0.060	0.050	10.74	11.46	11.39	11.66	0.027744	0.99	1.99	1.44	8.85	16.29	0.81
1	1	100yr ARI	24.80	0.050	0.060	0.050	10.74	11.58	11.54	11.85	0.030995	1.28	2.37	1.73	10.85	17.08	0.88
1	1	PMF	83.90	0.050	0.060	0.050	10.74	12.31	12.31	12.91	0.028039	2.29	3.59	2.64	25.17	21.91	0.94
1	2	20yr ARI	17.10	0.050	0.060		12.03	12.99	12.72	13.03	0.005792	0.91	0.88		19.10	35.85	0.37
1	2	100yr ARI	24.80	0.050	0.060	0.050	12.03	13.16	12.81	13.21	0.005306	0.92	0.99	0.30	25.89	45.04	0.37
1	2	PMF	83.90	0.050	0.060	0.050	12.03	13.92	13.31	13.99	0.003896	1.09	1.36	0.80	71.13	74.62	0.35
1	3	20yr ARI	17.10		0.015		12.97	13.22	13.22	13.33	0.003924		1.48		11.54	54.59	1.03
1	3	100yr ARI	24.80		0.015		12.97	13.28	13.28	13.42	0.003432		1.64		15.13	55.63	1.00
1	3	PMF	83.90		0.015	0.015	12.97	13.89	13.63	14.02	0.000738		1.60	0.75	53.88	71.46	0.56
1	4	20yr ARI	17.10		0.060		13.00	13.48	13.48	13.68	0.046235		1.99		8.61	20.80	0.98
1	4	100yr ARI	24.80		0.060		13.00	13.60	13.60	13.85	0.044070		2.21		11.22	22.21	0.99
1	4	PMF	83.90	0.050	0.060	0.050	13.00	14.28	14.28	14.60	0.024922	0.28	2.61	1.27	35.55	56.66	0.84
1	5	20yr ARI	12.70		0.060		14.96	16.14	15.74	16.21	0.007692		1.17		10.85	14.77	0.44
1	5	100yr ARI	18.50		0.060		14.96	16.34	15.91	16.43	0.008104		1.33		13.92	16.26	0.46
1	5	PMF	57.10		0.060	0.050	14.96	17.00	16.58	17.24	0.012703		2.17	0.40	26.33	21.25	0.61
1	6	20yr ARI	12.70	0.050	0.060		17.00	18.20	18.20	18.49	0.035910	0.82	2.41		5.51	10.70	0.91
1	6	100yr ARI	18.50	0.050	0.060	0.050	17.00	18.41	18.41	18.71	0.028875	1.21	2.52	0.34	8.11	14.24	0.84
1	6	PMF	57.10	0.050	0.060	0.050	17.00	19.07	19.07	19.51	0.023669	2.14	3.28	1.20	20.68	23.34	0.84
1	7	20yr ARI	8.90		0.060		21.99	22.81	22.62	22.93	0.017408		1.52		5.85	9.94	0.63
1	7	100yr ARI	12.30	0.050	0.060		21.99	22.87	22.75	23.02	0.021711	1.19	1.76		7.26	13.51	0.71
1	7	PMF	35.70	0.050	0.060	0.050	21.99	23.26	23.26	23.64	0.030854	1.95	2.85	0.76	13.49	18.10	0.92
1	8	20yr ARI	7.40		0.060		24.00	24.97	24.96	25.19	0.045093		2.07		3.58	7.69	0.97
1	8	100yr ARI	10.20	0.050	0.060		24.00	25.12	25.09	25.32	0.033662	1.12	2.03		5.23	11.06	0.86
1	8	PMF	27.60	0.050	0.060	0.050	24.00	25.65	25.52	25.92	0.021514	1.85	2.40	0.55	12.08	14.71	0.76
1	9	20yr ARI	7.40		0.060		27.97	28.53	28.44	28.66	0.025968		1.58		4.69	10.19	0.74
1	9	100yr ARI	10.20		0.060		27.97	28.59	28.54	28.78	0.033668		1.92		5.32	10.47	0.86
1	9	PMF	27.60		0.060		27.97	28.99	28.99	29.39	0.039750		2.82		9.80	12.14	1.00
1	10	20yr ARI	7.40	0.050	0.060		30.55	31.23	31.23	31.42	0.035179	1.11	2.00		4.01	10.46	0.88
1	10	100yr ARI	10.20	0.050	0.060		30.55	31.35	31.33	31.55	0.030389	1.41	2.07		5.31	11.18	0.84
1	10	PMF	27.60	0.050	0.060	0.050	30.55	31.80	31.74	32.13	0.027267	2.21	2.68	0.55	10.97	14.29	0.85

HEC-RAS Plan: Tributary2

River	Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
				(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Tributary 2	1	1	20yr ARI	18.70		0.060	0.050	11.27	11.78	11.73	11.91	0.029984		1.55	1.59	11.93	33.18	0.79
Tributary 2	1	1	100yr ARI	26.40		0.060	0.050	11.27	11.82	11.82	12.02	0.042359		1.94	2.03	13.35	33.95	0.95
Tributary 2	1	1	PMF	76.50	0.050	0.060	0.050	11.27	12.26	12.26	12.56	0.027061	1.09	2.38	2.53	33.08	56.65	0.84
Tributary 2	1	2	20yr ARI	18.70	0.050	0.060	0.050	11.29	12.09		12.11	0.002752	0.61	0.61	0.13	30.87	62.40	0.25
Tributary 2	1	2	100yr ARI	26.40	0.050	0.060	0.050	11.29	12.22		12.24	0.002661	0.69	0.68	0.23	38.65	64.27	0.26
Tributary 2	1	2	PMF	76.50	0.050	0.060	0.050	11.29	12.73		12.78	0.002966	1.08	1.03	0.55	73.44	72.02	0.30
Tributary 2	1	3	20yr ARI	18.70		0.015		12.00	12.35	12.35	12.49	0.003412		1.66		11.25	40.24	1.00
Tributary 2	1	3	100yr ARI	26.40		0.015		12.00	12.42	12.42	12.60	0.003206		1.85		14.28	41.53	1.01
Tributary 2	1	3	PMF	76.50		0.015		12.00	12.78	12.78	13.11	0.002596		2.52		30.40	47.48	1.00
Tributary 2	1	4	20yr ARI	18.70	0.050	0.060		11.93	12.90	12.90	12.96	0.016178	0.79	1.09		17.70	53.43	0.57
Tributary 2	1	4	100yr ARI	26.40	0.050	0.060		11.93	12.90	12.90	13.02	0.032245	1.11	1.54		17.70	53.43	0.80
Tributary 2	1	4	PMF	76.50	0.050	0.060	0.050	11.93	13.18	13.18	13.44	0.038254	1.99	2.30	0.24	34.10	66.85	0.95
Tributary 2	1	5	20yr ARI	18.30	0.050	0.060	0.000	14.10	15.07	14.89	15.11	0.007507	0.81	0.87	0.03	21.77	57.02	0.40
Tributary 2	1	5	100yr ARI	25.90	0.050	0.060	0.050	14.10	15.22	14.96	15.26	0.005243	0.85	0.83	0.21	31.43	75.47	0.35
Tributary 2	1	5	PMF	73.50	0.050	0.060	0.050	14.10	15.65	15.27	15.72	0.004743	1.19	1.14	0.83	65.02	80.96	0.37
Tributary 2	1	6	20yr ARI	18.30	0.050	0.060		14.97	15.68	15.68	15.83	0.044665	1.63	1.78		10.64	35.28	0.94
Tributary 2	1	6	100yr ARI	25.90	0.050	0.060		14.97	15.76	15.76	15.95	0.042870	1.82	1.97		13.56	37.40	0.95
Tributary 2	1	6	PMF	73.50	0.050	0.060	0.050	14.97	16.13	16.13	16.46	0.034544	2.44	2.61	0.50	29.11	46.32	0.94
Tributary 2	1	7	20yr ARI	18.30	0.050	0.060		15.51	16.19	16.17	16.33	0.027783	1.20	1.75		11.45	31.11	0.79
Tributary 2	1	7	100yr ARI	25.90	0.050	0.060		15.51	16.28	16.26	16.46	0.029907	1.47	1.99		14.20	33.10	0.84
Tributary 2	1	7	PMF	73.50	0.050	0.060		15.51	16.67	16.67	17.00	0.031346	2.27	2.74		28.98	42.58	0.92
Tributary 2	1	8	20yr ARI	17.70		0.060		17.00	17.77		17.81	0.004813		0.89		19.97	29.58	0.34
Tributary 2	1	8	100yr ARI	25.10		0.060		17.00	17.94		17.99	0.004888		1.00		25.05	31.21	0.36
Tributary 2	1	8	PMF	68.90	0.050	0.060	0.050	17.00	18.55		18.65	0.005205	0.51	1.47	0.83	49.21	46.87	0.40
Tributary 2	1	9	20yr ARI	17.70	0.050	0.060		20.98	21.65	21.65	21.85	0.042080	0.43	2.00		9.00	24.96	0.95
Tributary 2	1	9	100yr ARI	25.10	0.050	0.060		20.98	21.77	21.77	22.00	0.037483	1.06	2.18		11.99	25.88	0.93
Tributary 2	1	9	PMF	68.90	0.050	0.060		20.98	21.97	21.97	22.08	0.013492	1.40	1.58		47.41	89.23	0.58
Tributary 2	1	10	20yr ARI	17.70		0.060	0.050	21.00	21.90	21.20	21.90	0.000390		0.30	0.22	58.99	69.27	0.10
Tributary 2	1	10	100yr ARI	25.10	0.050	0.060	0.050	21.00	22.05	21.25	22.06	0.000451	0.16	0.36	0.26	70.65	74.01	0.11
Tributary 2	1	10	PMF	68.90	0.050	0.060	0.050	21.00	22.16	21.50	22.20	0.002422	0.43	0.90	0.62	78.67	75.62	0.27
Tributary 2	1	11	20yr ARI	16.50	0.050	0.060	0.050	21.00	21.97	21.47	22.00	0.002613	0.56	0.79	0.51	22.36	31.30	0.26
Tributary 2	1	11	100yr ARI	23.30	0.050	0.060	0.050	21.00	22.14	21.61	22.18	0.002782	0.65	0.91	0.64	27.58	33.21	0.28
Tributary 2	1	11	PMF	60.20	0.050	0.060	0.050	21.00	22.52	22.00	22.63	0.005724	1.14	1.60	1.17	41.19	38.28	0.42
Tributary 2	1	12	20yr ARI	16.50	0.050	0.060	0.050	21.12	22.33		22.40	0.007267	0.47	1.25	0.49	13.34	17.16	0.43
Tributary 2	1	12	100yr ARI	23.30	0.050	0.060	0.050	21.12	22.50		22.61	0.007598	0.64	1.45	0.67	16.42	18.15	0.46
Tributary 2	1	12	PMF	60.20	0.050	0.060	0.050	21.12	23.12		23.36	0.009434	1.23	2.22	1.24	28.67	21.73	0.55
Tributary 2	1	13	20yr ARI	16.50	0.050	0.060		24.74	25.53	25.53	25.81	0.042932	0.99	2.33		7.13	13.32	0.99
Tributary 2	1	13	100yr ARI	23.30	0.050	0.060		24.74	25.68	25.68	26.01	0.039560	1.31	2.57		9.20	14.24	0.99
Tributary 2	1	13	PMF	60.20	0.050	0.060	0.050	24.74	26.28	26.28	26.83	0.030145	2.12	3.35	1.28	18.76	17.94	0.95

HEC-RAS Plan: Tributary2 (Continued)

River	Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
				(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Tributary 2	2	14	20yr ARI	8.70	0.050	0.060	0.050	25.24	26.37		26.49	0.013768	0.78	1.55	0.25	5.74	8.78	0.58
Tributary 2	2	14	100yr ARI	12.10	0.050	0.060	0.050	25.24	26.52		26.68	0.013826	0.96	1.76	0.53	7.12	9.59	0.60
Tributary 2	2	14	PMF	29.70	0.050	0.060	0.050	25.24	27.13		27.38	0.011995	1.45	2.32	1.14	13.96	13.04	0.61
Tributary 2	2	14.5	20yr ARI	8.70	0.050	0.060	0.050	25.24	26.40		26.51	0.012372	0.77	1.50	0.28	5.94	8.90	0.55
Tributary 2	2	14.5	100yr ARI	12.10	0.050	0.060	0.050	25.24	26.55		26.69	0.012571	0.94	1.70	0.54	7.35	9.71	0.57
Tributary 2	2	14.5	PMF	29.70	0.050	0.060	0.050	25.24	27.15		27.40	0.011334	1.43	2.28	1.12	14.24	13.19	0.59
Tributary 2	3	15	20yr ARI	3.50	0.050	0.060		29.90	30.27	30.27	30.37	0.060887	0.74	1.43		2.46	12.21	1.01
Tributary 2	3	15	100yr ARI	4.80	0.050	0.060		29.90	30.32	30.32	30.44	0.055138	0.89	1.55		3.12	12.90	0.99
Tributary 2	3	15	PMF	11.20	0.050	0.060	0.050	29.90	30.51	30.51	30.70	0.047905	1.36	1.97	0.20	5.76	15.74	1.00
Tributary 2	3	16	20yr ARI	3.50		0.060		32.01	32.55	32.50	32.64	0.032905		1.32		2.66	9.12	0.78
Tributary 2	3	16	100yr ARI	4.80		0.060		32.01	32.62	32.57	32.73	0.035769		1.48		3.25	9.98	0.83
Tributary 2	3	16	PMF	11.20	0.050	0.060		32.01	32.82	32.81	33.02	0.041704	0.65	1.99		5.69	13.79	0.94
Tributary 3	1	17	20yr ARI	5.50	0.050	0.060	0.050	26.58	27.12	27.12	27.30	0.042444	1.38	1.94	0.62	3.01	8.74	0.94
Tributary 3	1	17	100yr ARI	7.70	0.050	0.060	0.050	26.58	27.22	27.22	27.43	0.038872	1.58	2.12	0.89	3.90	9.62	0.93
Tributary 3	1	17	PMF	18.90	0.050	0.060	0.050	26.58	27.58	27.58	27.89	0.030579	2.06	2.66	1.51	7.95	12.92	0.90
Tributary 3	1	18	20yr ARI	5.50	0.050	0.060	0.050	28.97	29.37	29.37	29.52	0.044550	1.23	1.82	1.43	3.18	10.27	0.95
Tributary 3	1	18	100yr ARI	7.70	0.050	0.060	0.050	28.97	29.45	29.45	29.64	0.040979	1.37	2.00	1.56	4.09	11.06	0.95
Tributary 3	1	18	PMF	18.90	0.050	0.060	0.050	28.97	29.77	29.77	30.06	0.033059	1.79	2.56	1.96	8.10	14.01	0.93
Tributary 4	1	19	20yr ARI	5.20	0.050	0.060	0.050	30.96	31.42	31.42	31.60	0.046847	1.08	1.88	0.76	2.83	8.20	0.97
Tributary 4	1	19	100yr ARI	7.30	0.050	0.060	0.050	30.96	31.52	31.52	31.73	0.042832	1.27	2.08	0.98	3.62	8.67	0.96
Tributary 4	1	19	PMF	18.50	0.050	0.060	0.050	30.96	31.89	31.89	32.25	0.033644	1.81	2.72	1.59	7.23	10.53	0.94
Tributary 4	1	20	20yr ARI	5.20		0.060		33.00	33.75	33.69	33.92	0.035849		1.84		2.83	5.97	0.85
Tributary 4	1	20	100yr ARI	7.30		0.060		33.00	33.85	33.81	34.08	0.039466		2.10		3.47	6.39	0.91
Tributary 4	1	20	PMF	18.50	0.050	0.060	0.050	33.00	34.28	34.28	34.69	0.035142	1.10	2.85	1.09	6.72	8.93	0.94

HEC-RAS Plan: Plan 02 River: Salt Water Ck Reach: 1

Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	1	20yr ARI	6.30		0.060		8.50	8.82	8.82	8.94	0.057303		1.51		4.17	17.82	1.00
1	1	100yr ARI	8.50		0.060	0.000	8.50	8.88	8.88	9.02	0.055605		1.65	0.05	5.15	18.87	1.01
1	1	PMF	24.30	0.050	0.060	0.050	8.50	9.50	9.16	9.57	0.006601	0.68	1.16	0.74	22.12	34.43	0.42
1	2	20yr ARI	5.90		0.060		10.98	11.73	11.55	11.76	0.010853		0.85		6.90	19.72	0.46
1	2	100yr ARI	8.00		0.060		10.98	11.80	11.63	11.84	0.011074		0.96		8.34	20.36	0.48
1	2	PMF	21.20		0.060		10.98	11.87	11.87	12.11	0.046978		2.16		9.82	20.99	1.01
1	3	20yr ARI	4.30	0.050	0.060		13.01	13.51	13.51	13.63	0.055455	0.30	1.52		2.83	12.14	0.99
1	3	100yr ARI	5.80	0.050	0.060		13.01	13.57	13.57	13.71	0.053350	0.57	1.66		3.54	13.58	0.99
1	3	PMF	14.00	0.050	0.060		13.01	13.98	13.79	14.03	0.009927	0.78	1.07		13.53	29.45	0.47
1	4	20yr ARI	4.30		0.060		15.00	15.69	15.55	15.75	0.017672		1.08		3.98	11.58	0.59
1	4	100yr ARI	5.80		0.060		15.00	15.76	15.63	15.84	0.018186		1.18		4.93	12.89	0.61
1	4	PMF	14.00		0.060		15.00	15.89	15.89	16.11	0.046767		2.09		6.70	15.04	1.00

APPENDIX C
RAFTS MODEL OUTPUT FOR POST-DEVELOPMENT CONDITIONS

```
 Run started at: 23rd  May  2007  13:12:07


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 1.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.082
 ESTIMATED PEAK FLOW         (CUMECS) =      2.41
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK 1.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          13.45
 ESTIMATED PEAK FLOW         (CUMECS) =      7.33
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 1.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          19.13
 ESTIMATED PEAK FLOW         (CUMECS) =      9.11
 ESTIMATED TIME TO PEAK         (MINS) =     40.00

 LINK 7.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          8.737
 ESTIMATED PEAK FLOW         (CUMECS) =      6.59
 ESTIMATED TIME TO PEAK         (MINS) =     24.00

 LINK 1.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          31.98
 ESTIMATED PEAK FLOW         (CUMECS) =     12.67
 ESTIMATED TIME TO PEAK         (MINS) =     50.00

 LINK 8.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          14.19
 ESTIMATED PEAK FLOW         (CUMECS) =      6.39
 ESTIMATED TIME TO PEAK         (MINS) =     36.00
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LINK 8.01             3.001

ESTIMATED VOLUME (CU METRES*10**3) =          19.72
ESTIMATED PEAK FLOW         (CUMECS) =      7.81
ESTIMATED TIME TO PEAK         (MINS) =     44.00

LINK 1.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          51.69
ESTIMATED PEAK FLOW         (CUMECS) =     19.53
ESTIMATED TIME TO PEAK         (MINS) =     52.00

LINK 4.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          8.934
ESTIMATED PEAK FLOW         (CUMECS) =      5.75
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          8.929
ESTIMATED PEAK FLOW         (CUMECS) =      5.42
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 5.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          5.211
ESTIMATED PEAK FLOW         (CUMECS) =      3.58
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.01             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          29.77
ESTIMATED PEAK FLOW         (CUMECS) =     16.89
ESTIMATED TIME TO PEAK         (MINS) =     38.00

LINK 2.02             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          35.72
ESTIMATED PEAK FLOW         (CUMECS) =     17.81
ESTIMATED TIME TO PEAK         (MINS) =     48.00

LINK 2.03             4.003

ESTIMATED VOLUME (CU METRES*10**3) =          40.13
ESTIMATED PEAK FLOW         (CUMECS) =     18.28
ESTIMATED TIME TO PEAK         (MINS) =     58.00

LINK 2.04             4.004

ESTIMATED VOLUME (CU METRES*10**3) =          44.93
ESTIMATED PEAK FLOW         (CUMECS) =     18.44
ESTIMATED TIME TO PEAK         (MINS) =     68.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          100.4
ESTIMATED PEAK FLOW         (CUMECS) =     35.51
ESTIMATED TIME TO PEAK         (MINS) =     70.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          3.019
ESTIMATED PEAK FLOW         (CUMECS) =      2.12
ESTIMATED TIME TO PEAK         (MINS) =     24.00

LINK 6.00             8.000
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 ESTIMATED VOLUME (CU METRES*10**3) =          3.877
 ESTIMATED PEAK FLOW         (CUMECS) =      2.65
 ESTIMATED TIME TO PEAK         (MINS) =     24.00

 LINK 3.01             7.001

 ESTIMATED VOLUME (CU METRES*10**3) =          10.83
 ESTIMATED PEAK FLOW         (CUMECS) =      6.31
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 3.02             7.002

 ESTIMATED VOLUME (CU METRES*10**3) =          12.74
 ESTIMATED PEAK FLOW         (CUMECS) =      6.83
 ESTIMATED TIME TO PEAK         (MINS) =     42.00

 LINK Dummy            1.006

 ESTIMATED VOLUME (CU METRES*10**3) =          117.7
 ESTIMATED PEAK FLOW         (CUMECS) =     36.93
 ESTIMATED TIME TO PEAK         (MINS) =     80.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - 20yr & 100yr ARI - Post-development

Results for period from  0: 0.0  1/ 1/1990
                    to  4: 0.0  1/ 1/1990
################################################################################
#####


                          ROUTING INCREMENT (MINS) =       2.00
                          STORM DURATION (MINS)    =        60.
                          RETURN PERIOD (YRS)      =        20.
                          BX                       =     1.0000
                          TOTAL OF FIRST SUB-AREAS  (ha) =     143.39
                          TOTAL OF SECOND SUB-AREAS (ha) =      42.51
                          TOTAL OF ALL SUB-AREAS (ha)    =     185.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
1.00        5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  1.000
1.01       14.310  2.300  4.500 4.500  5.000 99.00  .033 .015  .0478 .0011  1.001
1.02        6.230  2.630  4.500 4.500  5.000 99.00  .035 .015  .0324 .0012  1.002
7.00        5.750  7.280  6.200 6.200  5.000 99.00  .028 .015  .0226 .0017  2.000
1.03        4.760  1.690  4.300 4.300  5.000 99.00  .035 .015  .0288 .0010  1.003
8.00       23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  3.000
8.01        6.850  1.900  5.700 5.700  5.000 99.00  .035 .015  .0302 .0009  3.001
1.04       .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  1.004
4.00       12.980  1.470  8.500 8.500  5.000 99.00  .031 .015  .0316 .0006  4.000
2.00       11.460  2.730  7.300 7.300  5.000 99.00  .032 .015  .0327 .0009  5.000
5.00        7.820 0.6300  10.10 10.10  5.000 99.00  .032 .015  .0228 .0004  6.000
2.01        6.480  3.830  5.400 5.400  5.000 99.00  .033 .015  .0289 .0013  4.001
2.02        4.380  4.570  5.800 5.800  5.000 99.00  .035 .015  .0237 .0014  4.002
2.03        4.490  2.330  4.400 4.400  5.000 99.00  .034 .015  .0270 .0011  4.003
2.04        3.350  3.850  3.400 3.400  5.000 99.00  .035 .015  .0270 .0017  4.004
1.05        6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00        3.220  1.470  8.400 8.400  5.000 99.00  .036 .015  .0172 .0006  7.000
6.00        3.650  2.300  5.800 5.800  5.000 99.00  .034 .015  .0211 .0010  8.000
3.01        3.570  2.440  6.500 6.500  5.000 99.00  .033 .015  .0193 .0009  7.001
3.02        2.450 0.5800  4.400 4.400  5.000 99.00  .040 .015  .0223 .0005  7.002
```

Dummy 6.920 0.5100 4.800 4.800 0.000 100.0 .035 .015 .0412 .0005 1.006

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	2.410	26.00	8.200
1.01	72.935	10.00	1.000	2.500	0.000	60.851	71.935	7.325	32.00	7.600
1.02	72.935	10.00	1.000	2.500	0.000	60.851	71.935	9.108	40.00	15.00
7.00	72.935	10.00	1.000	2.500	0.000	60.851	71.935	6.592	24.00	15.00
1.03	72.935	10.00	1.000	2.500	0.000	60.851	71.935	12.671	50.00	11.70
8.00	72.935	10.00	0.000	2.500	0.000	60.851	0.000	6.394	36.00	10.00
8.01	72.935	10.00	1.000	2.500	0.000	60.851	71.935	7.806	44.00	2.000
1.04	72.935	10.00	0.000	2.500	0.000	60.851	0.000	19.526	52.00	8.000
4.00	72.935	10.00	1.000	2.500	0.000	60.851	71.935	5.747	26.00	11.50
2.00	72.935	10.00	1.000	2.500	0.000	60.851	71.935	5.420	26.00	11.50
5.00	72.935	10.00	1.000	2.500	0.000	60.851	71.935	3.582	26.00	11.50
2.01	72.935	10.00	1.000	2.500	0.000	60.851	71.935	16.888	38.00	10.90
2.02	72.935	10.00	1.000	2.500	0.000	60.851	71.935	17.811	48.00	9.900
2.03	72.935	10.00	1.000	2.500	0.000	60.851	71.935	18.282	58.00	10.10
2.04	72.935	10.00	1.000	2.500	0.000	60.851	71.935	18.438	68.00	3.000
1.05	72.935	10.00	0.000	2.500	0.000	60.851	0.000	35.505	70.00	9.000
3.00	72.935	10.00	1.000	2.500	0.000	60.851	71.935	2.120	24.00	9.400
6.00	72.935	10.00	1.000	2.500	0.000	60.851	71.935	2.649	24.00	9.400
3.01	72.935	10.00	1.000	2.500	0.000	60.851	71.935	6.309	34.00	7.200
3.02	72.935	10.00	1.000	2.500	0.000	60.851	71.935	6.829	42.00	9.000
Dummy	72.935	10.00	1.000	2.500	0.000	60.851	71.935	36.929	80.00	0.000

LINK 1.00 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.469
ESTIMATED PEAK FLOW (CUMECS) = 3.18
ESTIMATED TIME TO PEAK (MINS) = 26.00

LINK 1.01 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 19.37
ESTIMATED PEAK FLOW (CUMECS) = 10.06
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 1.02 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 27.47
ESTIMATED PEAK FLOW (CUMECS) = 13.22
ESTIMATED TIME TO PEAK (MINS) = 34.00

LINK 7.00 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 12.30
ESTIMATED PEAK FLOW (CUMECS) = 8.65
ESTIMATED TIME TO PEAK (MINS) = 24.00

LINK 1.03 1.003

ESTIMATED VOLUME (CU METRES*10**3) = 45.63
ESTIMATED PEAK FLOW (CUMECS) = 18.83
ESTIMATED TIME TO PEAK (MINS) = 48.00

LINK 8.00 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 20.59
ESTIMATED PEAK FLOW (CUMECS) = 9.44
ESTIMATED TIME TO PEAK (MINS) = 32.00

LINK 8.01 3.001

ESTIMATED VOLUME (CU METRES*10**3) = 28.51

```
ESTIMATED PEAK FLOW         (CUMECS) =     11.59
ESTIMATED TIME TO PEAK         (MINS) =     40.00

LINK 1.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          74.15
ESTIMATED PEAK FLOW         (CUMECS) =     27.22
ESTIMATED TIME TO PEAK         (MINS) =     52.00

LINK 4.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          12.89
ESTIMATED PEAK FLOW         (CUMECS) =      7.97
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          12.81
ESTIMATED PEAK FLOW         (CUMECS) =      7.68
ESTIMATED TIME TO PEAK         (MINS) =     24.00

LINK 5.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          7.516
ESTIMATED PEAK FLOW         (CUMECS) =      4.82
ESTIMATED TIME TO PEAK         (MINS) =     26.00

LINK 2.01             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          42.73
ESTIMATED PEAK FLOW         (CUMECS) =     23.37
ESTIMATED TIME TO PEAK         (MINS) =     36.00

LINK 2.02             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          51.13
ESTIMATED PEAK FLOW         (CUMECS) =     24.97
ESTIMATED TIME TO PEAK         (MINS) =     46.00

LINK 2.03             4.003

ESTIMATED VOLUME (CU METRES*10**3) =          57.38
ESTIMATED PEAK FLOW         (CUMECS) =     25.78
ESTIMATED TIME TO PEAK         (MINS) =     56.00

LINK 2.04             4.004

ESTIMATED VOLUME (CU METRES*10**3) =          64.16
ESTIMATED PEAK FLOW         (CUMECS) =     26.03
ESTIMATED TIME TO PEAK         (MINS) =     66.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          143.8
ESTIMATED PEAK FLOW         (CUMECS) =     51.14
ESTIMATED TIME TO PEAK         (MINS) =     70.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          4.293
ESTIMATED PEAK FLOW         (CUMECS) =      2.86
ESTIMATED TIME TO PEAK         (MINS) =     24.00

LINK 6.00             8.000

ESTIMATED VOLUME (CU METRES*10**3) =          5.486
ESTIMATED PEAK FLOW         (CUMECS) =      3.65
ESTIMATED TIME TO PEAK         (MINS) =     24.00
```

```
 LINK 3.01              7.001

 ESTIMATED VOLUME (CU METRES*10**3) =           15.35
 ESTIMATED PEAK FLOW         (CUMECS) =      8.57
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 3.02              7.002

 ESTIMATED VOLUME (CU METRES*10**3) =           18.09
 ESTIMATED PEAK FLOW         (CUMECS) =      9.31
 ESTIMATED TIME TO PEAK         (MINS) =     42.00

 LINK Dummy             1.006

 ESTIMATED VOLUME (CU METRES*10**3) =           168.5
 ESTIMATED PEAK FLOW         (CUMECS) =     53.21
 ESTIMATED TIME TO PEAK         (MINS) =     80.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - 20yr & 100yr ARI - Post-development

Results for period from  0: 0.0  1/ 1/1990
                    to  6: 0.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        60.
                              RETURN PERIOD (YRS)      =       100.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =     143.39
                              TOTAL OF SECOND SUB-AREAS (ha) =      42.51
                              TOTAL OF ALL SUB-AREAS (ha)    =     185.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
1.00       5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  1.000
1.01      14.310  2.300  4.500 4.500  5.000 99.00  .033 .015  .0478 .0011  1.001
1.02       6.230  2.630  4.500 4.500  5.000 99.00  .035 .015  .0324 .0012  1.002
7.00       5.750  7.280  6.200 6.200  5.000 99.00  .028 .015  .0226 .0017  2.000
1.03       4.760  1.690  4.300 4.300  5.000 99.00  .035 .015  .0288 .0010  1.003
8.00      23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  3.000
8.01       6.850  1.900  5.700 5.700  5.000 99.00  .035 .015  .0302 .0009  3.001
1.04      .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  1.004
4.00      12.980  1.470  8.500 8.500  5.000 99.00  .031 .015  .0316 .0006  4.000
2.00      11.460  2.730  7.300 7.300  5.000 99.00  .032 .015  .0327 .0009  5.000
5.00       7.820 0.6300  10.10 10.10  5.000 99.00  .032 .015  .0228 .0004  6.000
2.01       6.480  3.830  5.400 5.400  5.000 99.00  .033 .015  .0289 .0013  4.001
2.02       4.380  4.570  5.800 5.800  5.000 99.00  .035 .015  .0237 .0014  4.002
2.03       4.490  2.330  4.400 4.400  5.000 99.00  .034 .015  .0270 .0011  4.003
2.04       3.350  3.850  3.400 3.400  5.000 99.00  .035 .015  .0270 .0017  4.004
1.05       6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00       3.220  1.470  8.400 8.400  5.000 99.00  .036 .015  .0172 .0006  7.000
6.00       3.650  2.300  5.800 5.800  5.000 99.00  .034 .015  .0211 .0010  8.000
3.01       3.570  2.440  6.500 6.500  5.000 99.00  .033 .015  .0193 .0009  7.001
3.02       2.450 0.5800  4.400 4.400  5.000 99.00  .040 .015  .0223 .0005  7.002
Dummy      6.920 0.5100  4.800 4.800  0.000 100.0  .035 .015  .0412 .0005  1.006
```

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	3.177	26.00	8.200
1.01	100.35	10.00	1.000	2.500	0.000	88.181	99.347	10.059	32.00	7.600
1.02	100.35	10.00	1.000	2.500	0.000	88.181	99.347	13.222	34.00	15.00
7.00	100.35	10.00	1.000	2.500	0.000	88.181	99.347	8.650	24.00	15.00
1.03	100.35	10.00	1.000	2.500	0.000	88.181	99.347	18.832	48.00	11.70
8.00	100.35	10.00	0.000	2.500	0.000	88.181	0.000	9.444	32.00	10.00
8.01	100.35	10.00	1.000	2.500	0.000	88.181	99.347	11.595	40.00	2.000
1.04	100.35	10.00	0.000	2.500	0.000	88.181	0.000	27.218	52.00	8.000
4.00	100.35	10.00	1.000	2.500	0.000	88.181	99.347	7.968	26.00	11.50
2.00	100.35	10.00	1.000	2.500	0.000	88.181	99.347	7.678	24.00	11.50
5.00	100.35	10.00	1.000	2.500	0.000	88.181	99.347	4.822	26.00	11.50
2.01	100.35	10.00	1.000	2.500	0.000	88.181	99.347	23.368	36.00	10.90
2.02	100.35	10.00	1.000	2.500	0.000	88.181	99.347	24.974	46.00	9.900
2.03	100.35	10.00	1.000	2.500	0.000	88.181	99.347	25.775	56.00	10.10
2.04	100.35	10.00	1.000	2.500	0.000	88.181	99.347	26.030	66.00	3.000
1.05	100.35	10.00	0.000	2.500	0.000	88.181	0.000	51.136	70.00	9.000
3.00	100.35	10.00	1.000	2.500	0.000	88.181	99.347	2.856	24.00	9.400
6.00	100.35	10.00	1.000	2.500	0.000	88.181	99.347	3.649	24.00	9.400
3.01	100.35	10.00	1.000	2.500	0.000	88.181	99.347	8.569	34.00	7.200
3.02	100.35	10.00	1.000	2.500	0.000	88.181	99.347	9.309	42.00	9.000
Dummy	100.35	10.00	1.000	2.500	0.000	88.181	99.347	53.207	80.00	0.000

Run completed at: 23rd May 2007 13:12:08

mik open 0

```
 Run started at: 23rd  May  2007  13:15:08


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 1.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          15.58
 ESTIMATED PEAK FLOW         (CUMECS) =      7.11
 ESTIMATED TIME TO PEAK         (MINS) =     14.00

 LINK 1.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          66.89
 ESTIMATED PEAK FLOW         (CUMECS) =     28.06
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 1.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          94.42
 ESTIMATED PEAK FLOW         (CUMECS) =     38.55
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          40.90
 ESTIMATED PEAK FLOW         (CUMECS) =     17.17
 ESTIMATED TIME TO PEAK         (MINS) =     18.00

 LINK 1.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          155.3
 ESTIMATED PEAK FLOW         (CUMECS) =     59.43
 ESTIMATED TIME TO PEAK         (MINS) =     44.00

 LINK 8.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          71.83
 ESTIMATED PEAK FLOW         (CUMECS) =     28.68
 ESTIMATED TIME TO PEAK         (MINS) =     28.00
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```
LINK 8.01             3.001

ESTIMATED VOLUME (CU METRES*10**3) =          98.94
ESTIMATED PEAK FLOW         (CUMECS) =     37.49
ESTIMATED TIME TO PEAK         (MINS) =     38.00

LINK 1.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          254.3
ESTIMATED PEAK FLOW         (CUMECS) =     87.39
ESTIMATED TIME TO PEAK         (MINS) =     56.00

LINK 4.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          44.56
ESTIMATED PEAK FLOW         (CUMECS) =     18.97
ESTIMATED TIME TO PEAK         (MINS) =     20.00

LINK 2.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          43.91
ESTIMATED PEAK FLOW         (CUMECS) =     18.54
ESTIMATED TIME TO PEAK         (MINS) =     22.00

LINK 5.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          26.03
ESTIMATED PEAK FLOW         (CUMECS) =     11.21
ESTIMATED TIME TO PEAK         (MINS) =     18.00

LINK 2.01             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          146.6
ESTIMATED PEAK FLOW         (CUMECS) =     60.32
ESTIMATED TIME TO PEAK         (MINS) =     30.00

LINK 2.02             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          174.7
ESTIMATED PEAK FLOW         (CUMECS) =     68.96
ESTIMATED TIME TO PEAK         (MINS) =     40.00

LINK 2.03             4.003

ESTIMATED VOLUME (CU METRES*10**3) =          195.9
ESTIMATED PEAK FLOW         (CUMECS) =     73.57
ESTIMATED TIME TO PEAK         (MINS) =     50.00

LINK 2.04             4.004

ESTIMATED VOLUME (CU METRES*10**3) =          218.5
ESTIMATED PEAK FLOW         (CUMECS) =     75.78
ESTIMATED TIME TO PEAK         (MINS) =     60.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          492.0
ESTIMATED PEAK FLOW         (CUMECS) =    164.82
ESTIMATED TIME TO PEAK         (MINS) =     64.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          14.59
ESTIMATED PEAK FLOW         (CUMECS) =      6.22
ESTIMATED TIME TO PEAK         (MINS) =     18.00

LINK 6.00             8.000
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```
 ESTIMATED VOLUME (CU METRES*10**3) =           18.56
 ESTIMATED PEAK FLOW         (CUMECS) =      7.81
 ESTIMATED TIME TO PEAK         (MINS) =     18.00

 LINK 3.01              7.001

 ESTIMATED VOLUME (CU METRES*10**3) =           51.91
 ESTIMATED PEAK FLOW         (CUMECS) =     21.53
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 3.02              7.002

 ESTIMATED VOLUME (CU METRES*10**3) =           61.30
 ESTIMATED PEAK FLOW         (CUMECS) =     24.75
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK Dummy             1.006

 ESTIMATED VOLUME (CU METRES*10**3) =           576.2
 ESTIMATED PEAK FLOW         (CUMECS) =    177.50
 ESTIMATED TIME TO PEAK         (MINS) =     74.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - Probable Maximum Flood - Post-
development

Results for period from  0: 0.0  1/ 1/1990
                    to  6:40.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        60.
                              RETURN PERIOD (YRS)      =         0.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =     143.39
                              TOTAL OF SECOND SUB-AREAS (ha) =      42.51
                              TOTAL OF ALL SUB-AREAS (ha)    =     185.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
1.00       5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  1.000
1.01      14.310  2.300  4.500 4.500  5.000 99.00  .033 .015  .0478 .0011  1.001
1.02       6.230  2.630  4.500 4.500  5.000 99.00  .035 .015  .0324 .0012  1.002
7.00       5.750  7.280  6.200 6.200  5.000 99.00  .028 .015  .0226 .0017  2.000
1.03       4.760  1.690  4.300 4.300  5.000 99.00  .035 .015  .0288 .0010  1.003
8.00      23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  3.000
8.01       6.850  1.900  5.700 5.700  5.000 99.00  .035 .015  .0302 .0009  3.001
1.04      .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  1.004
4.00      12.980  1.470  8.500 8.500  5.000 99.00  .031 .015  .0316 .0006  4.000
2.00      11.460  2.730  7.300 7.300  5.000 99.00  .032 .015  .0327 .0009  5.000
5.00       7.820 0.6300  10.10 10.10  5.000 99.00  .032 .015  .0228 .0004  6.000
2.01       6.480  3.830  5.400 5.400  5.000 99.00  .033 .015  .0289 .0013  4.001
2.02       4.380  4.570  5.800 5.800  5.000 99.00  .035 .015  .0237 .0014  4.002
2.03       4.490  2.330  4.400 4.400  5.000 99.00  .034 .015  .0270 .0011  4.003
2.04       3.350  3.850  3.400 3.400  5.000 99.00  .035 .015  .0270 .0017  4.004
1.05       6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00       3.220  1.470  8.400 8.400  5.000 99.00  .036 .015  .0172 .0006  7.000
6.00       3.650  2.300  5.800 5.800  5.000 99.00  .034 .015  .0211 .0010  8.000
3.01       3.570  2.440  6.500 6.500  5.000 99.00  .033 .015  .0193 .0009  7.001
```

3.02	2.450	0.5800	4.400	4.400	5.000	99.00	.040	.015	.0223	.0005	7.002
Dummy	6.920	0.5100	4.800	4.800	0.000	100.0	.035	.015	.0412	.0005	1.006

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	7.110	14.00	8.200
1.01	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	28.058	22.00	7.600
1.02	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	38.554	30.00	15.00
7.00	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	17.166	18.00	15.00
1.03	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	59.426	44.00	11.70
8.00	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	28.683	28.00	10.00
8.01	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	37.492	38.00	2.000
1.04	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	87.394	56.00	8.000
4.00	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	18.974	20.00	11.50
2.00	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	18.541	22.00	11.50
5.00	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	11.212	18.00	11.50
2.01	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	60.323	30.00	10.90
2.02	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	68.961	40.00	9.900
2.03	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	73.570	50.00	10.10
2.04	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	75.784	60.00	3.000
1.05	-1.000	10.00	0.000	2.500	0.000	307.67	0.000	164.82	64.00	9.000
3.00	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	6.216	18.00	9.400
6.00	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	7.812	18.00	9.400
3.01	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	21.528	28.00	7.200
3.02	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	24.745	36.00	9.000
Dummy	-1.000	10.00	1.000	2.500	0.000	307.67	319.00	177.50	74.00	0.000

LINK 1.00 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 20.08
ESTIMATED PEAK FLOW (CUMECS) = 6.12
ESTIMATED TIME TO PEAK (MINS) = 18.00

LINK 1.01 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 86.16
ESTIMATED PEAK FLOW (CUMECS) = 24.51
ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 1.02 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 121.6
ESTIMATED PEAK FLOW (CUMECS) = 34.23
ESTIMATED TIME TO PEAK (MINS) = 34.00

LINK 7.00 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 52.55
ESTIMATED PEAK FLOW (CUMECS) = 14.96
ESTIMATED TIME TO PEAK (MINS) = 18.00

LINK 1.03 1.003

ESTIMATED VOLUME (CU METRES*10**3) = 199.9
ESTIMATED PEAK FLOW (CUMECS) = 54.76
ESTIMATED TIME TO PEAK (MINS) = 50.00

LINK 8.00 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 92.61
ESTIMATED PEAK FLOW (CUMECS) = 25.82
ESTIMATED TIME TO PEAK (MINS) = 34.00

LINK 8.01 3.001

```
ESTIMATED VOLUME (CU METRES*10**3) =          127.5
ESTIMATED PEAK FLOW         (CUMECS) =     34.86
ESTIMATED TIME TO PEAK         (MINS) =     42.00

LINK 1.04             1.004

ESTIMATED VOLUME (CU METRES*10**3) =          327.5
ESTIMATED PEAK FLOW         (CUMECS) =     84.40
ESTIMATED TIME TO PEAK         (MINS) =     62.00

LINK 4.00             4.000

ESTIMATED VOLUME (CU METRES*10**3) =          57.41
ESTIMATED PEAK FLOW         (CUMECS) =     16.47
ESTIMATED TIME TO PEAK         (MINS) =     22.00

LINK 2.00             5.000

ESTIMATED VOLUME (CU METRES*10**3) =          56.56
ESTIMATED PEAK FLOW         (CUMECS) =     16.07
ESTIMATED TIME TO PEAK         (MINS) =     24.00

LINK 5.00             6.000

ESTIMATED VOLUME (CU METRES*10**3) =          33.56
ESTIMATED PEAK FLOW         (CUMECS) =      9.84
ESTIMATED TIME TO PEAK         (MINS) =     20.00

LINK 2.01             4.001

ESTIMATED VOLUME (CU METRES*10**3) =          188.9
ESTIMATED PEAK FLOW         (CUMECS) =     53.70
ESTIMATED TIME TO PEAK         (MINS) =     34.00

LINK 2.02             4.002

ESTIMATED VOLUME (CU METRES*10**3) =          224.9
ESTIMATED PEAK FLOW         (CUMECS) =     62.62
ESTIMATED TIME TO PEAK         (MINS) =     44.00

LINK 2.03             4.003

ESTIMATED VOLUME (CU METRES*10**3) =          252.2
ESTIMATED PEAK FLOW         (CUMECS) =     68.59
ESTIMATED TIME TO PEAK         (MINS) =     52.00

LINK 2.04             4.004

ESTIMATED VOLUME (CU METRES*10**3) =          281.3
ESTIMATED PEAK FLOW         (CUMECS) =     74.39
ESTIMATED TIME TO PEAK         (MINS) =     62.00

LINK 1.05             1.005

ESTIMATED VOLUME (CU METRES*10**3) =          633.5
ESTIMATED PEAK FLOW         (CUMECS) =    162.68
ESTIMATED TIME TO PEAK         (MINS) =     68.00

LINK 3.00             7.000

ESTIMATED VOLUME (CU METRES*10**3) =          18.77
ESTIMATED PEAK FLOW         (CUMECS) =      5.43
ESTIMATED TIME TO PEAK         (MINS) =     20.00

LINK 6.00             8.000

ESTIMATED VOLUME (CU METRES*10**3) =          23.87
ESTIMATED PEAK FLOW         (CUMECS) =      6.75
```

```
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 3.01              7.001

 ESTIMATED VOLUME (CU METRES*10**3) =           66.78
 ESTIMATED PEAK FLOW         (CUMECS) =     18.79
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 3.02              7.002

 ESTIMATED VOLUME (CU METRES*10**3) =           78.86
 ESTIMATED PEAK FLOW         (CUMECS) =     21.93
 ESTIMATED TIME TO PEAK         (MINS) =     38.00

 LINK Dummy             1.006

 ESTIMATED VOLUME (CU METRES*10**3) =           741.9
 ESTIMATED PEAK FLOW         (CUMECS) =    183.55
 ESTIMATED TIME TO PEAK         (MINS) =     78.00



################################################################################
#####
Rosedale - Salt Water Creek Catchment - Probable Maximum Flood - Post-
development

Results for period from  0: 0.0  1/ 1/1990
                    to  6:40.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =         0.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =     143.39
                              TOTAL OF SECOND SUB-AREAS (ha) =      42.51
                              TOTAL OF ALL SUB-AREAS (ha)    =     185.90


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area      Slope    % Impervious     Pern        B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
            (ha)             (%)          (%)
1.00        5.070  0.000  14.00 0.000  5.000 0.000  .025 0.00  .0130 0.000  1.000
1.01       14.310  2.300  4.500 4.500  5.000 99.00  .033 .015  .0478 .0011  1.001
1.02        6.230  2.630  4.500 4.500  5.000 99.00  .035 .015  .0324 .0012  1.002
7.00        5.750  7.280  6.200 6.200  5.000 99.00  .028 .015  .0226 .0017  2.000
1.03        4.760  1.690  4.300 4.300  5.000 99.00  .035 .015  .0288 .0010  1.003
8.00       23.390  0.000  5.800 0.000  0.000 0.000  .035 0.00  .0705 0.000  3.000
8.01        6.850  1.900  5.700 5.700  5.000 99.00  .035 .015  .0302 .0009  3.001
1.04       .00001  0.000  .0010 0.000  0.000 0.000  .025 0.00  .0021 0.000  1.004
4.00       12.980  1.470  8.500 8.500  5.000 99.00  .031 .015  .0316 .0006  4.000
2.00       11.460  2.730  7.300 7.300  5.000 99.00  .032 .015  .0327 .0009  5.000
5.00        7.820 0.6300  10.10 10.10  5.000 99.00  .032 .015  .0228 .0004  6.000
2.01        6.480  3.830  5.400 5.400  5.000 99.00  .033 .015  .0289 .0013  4.001
2.02        4.380  4.570  5.800 5.800  5.000 99.00  .035 .015  .0237 .0014  4.002
2.03        4.490  2.330  4.400 4.400  5.000 99.00  .034 .015  .0270 .0011  4.003
2.04        3.350  3.850  3.400 3.400  5.000 99.00  .035 .015  .0270 .0017  4.004
1.05        6.260  0.000  7.300 0.000  0.000 0.000  .035 0.00  .0317 0.000  1.005
3.00        3.220  1.470  8.400 8.400  5.000 99.00  .036 .015  .0172 .0006  7.000
6.00        3.650  2.300  5.800 5.800  5.000 99.00  .034 .015  .0211 .0010  8.000
3.01        3.570  2.440  6.500 6.500  5.000 99.00  .033 .015  .0193 .0009  7.001
3.02        2.450 0.5800  4.400 4.400  5.000 99.00  .040 .015  .0223 .0005  7.002
Dummy       6.920 0.5100  4.800 4.800  0.000 100.0  .035 .015  .0412 .0005  1.006
```

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
1.00	-1.000	10.00	0.000	2.500	0.000	396.50	0.000	6.120	18.00	8.200
1.01	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	24.508	28.00	7.600
1.02	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	34.232	34.00	15.00
7.00	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	14.960	18.00	15.00
1.03	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	54.764	50.00	11.70
8.00	-1.000	10.00	0.000	2.500	0.000	396.50	0.000	25.825	34.00	10.00
8.01	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	34.859	42.00	2.000
1.04	-1.000	10.00	0.000	2.500	0.000	396.50	0.000	84.403	62.00	8.000
4.00	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	16.471	22.00	11.50
2.00	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	16.071	24.00	11.50
5.00	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	9.837	20.00	11.50
2.01	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	53.698	34.00	10.90
2.02	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	62.622	44.00	9.900
2.03	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	68.591	52.00	10.10
2.04	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	74.394	62.00	3.000
1.05	-1.000	10.00	0.000	2.500	0.000	396.50	0.000	162.68	68.00	9.000
3.00	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	5.431	20.00	9.400
6.00	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	6.748	22.00	9.400
3.01	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	18.793	30.00	7.200
3.02	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	21.935	38.00	9.000
Dummy	-1.000	10.00	1.000	2.500	0.000	396.50	409.00	183.55	78.00	0.000

Run completed at: 23rd May 2007 13:15:09

mik open 0

Run started at: 4th June 2007 13:51:05

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################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####

Max. no. of links allowed =  2000

Max. no. of routng increments allowed = 25000

Max. no. of rating curve points = 25000

Max. no. of storm temporal points = 25000

Max. no. of channel subreaches =    25

Max link stack level =    25

Input Version number =          650

 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          2.746
 ESTIMATED PEAK FLOW         (CUMECS) =      1.38
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          6.381
 ESTIMATED PEAK FLOW         (CUMECS) =      2.61
 ESTIMATED TIME TO PEAK         (MINS) =     42.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          7.628
 ESTIMATED PEAK FLOW         (CUMECS) =      2.97
 ESTIMATED TIME TO PEAK         (MINS) =     48.00

 LINK 8.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          7.428
 ESTIMATED PEAK FLOW         (CUMECS) =      2.25
 ESTIMATED TIME TO PEAK         (MINS) =     24.00

 LINK 8.01             2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          8.923
 ESTIMATED PEAK FLOW         (CUMECS) =      2.47
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 9.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          3.369
 ESTIMATED PEAK FLOW         (CUMECS) =      1.02
 ESTIMATED TIME TO PEAK         (MINS) =     54.00
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 LINK 7.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          24.35
 ESTIMATED PEAK FLOW         (CUMECS) =      7.12
 ESTIMATED TIME TO PEAK         (MINS) =     54.00



################################################################################
#####
Rosedale - Bevian Swamp Catchment - 20yr & 100yr ARI - Post-development

Results for period from  0: 0.0  1/ 1/1990
                     to 12: 0.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       6.00
                              STORM DURATION (MINS)    =        60.
                              RETURN PERIOD (YRS)      =         1.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      98.25
                              TOTAL OF SECOND SUB-AREAS (ha) =      26.24
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.49


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area       Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
7.00      12.370  2.120  10.17 10.17  5.000 99.00  .035 .015  .0308 .0007  1.000
7.01       9.100  7.260  5.800 5.800  5.000 99.00  .032 .015  .0325 .0018  1.001
7.02       4.250  1.740  4.890 4.890  5.000 99.00  .035 .015  .0255 .0009  1.002
8.00      24.020 11.730  4.470 4.470  0.000 99.00  .036 .015  .0832 .0026  2.000
8.01       7.470 0.5600  2.660 2.660  0.000 99.00  .044 .015  .0684 .0007  2.001
9.00      19.962  0.000  2.590 0.000  5.000 0.000  .035 0.00  .0781 0.000  3.000
7.03      21.080  2.830  1.710 1.710  5.000 99.00  .035 .015  .0989 .0020  1.003


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
7.00      29.473 10.00 1.000  2.500 0.000  17.473 28.473   1.380  36.00 4.500
7.01      29.473 10.00 1.000  2.500 0.000  17.473 28.473   2.611  42.00 3.700
7.02      29.473 10.00 1.000  2.500 0.000  17.473 28.473   2.974  48.00 8.800
8.00      29.473 10.00 1.000  2.500 0.000  17.473 28.473   2.245  24.00 3.200
8.01      29.473 10.00 1.000  2.500 0.000  17.473 28.473   2.472  36.00 8.800
9.00      29.473 10.00 0.000  2.500 0.000  17.473  0.000   1.019  54.00 8.800
7.03      29.473 10.00 1.000  2.500 0.000  17.473 28.473   7.123  54.00 0.000


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          10.57
 ESTIMATED PEAK FLOW         (CUMECS) =      6.21
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          23.12
 ESTIMATED PEAK FLOW         (CUMECS) =     11.87
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          27.60
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```
 ESTIMATED PEAK FLOW         (CUMECS) =     13.56
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.00              2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          26.85
 ESTIMATED PEAK FLOW         (CUMECS) =     11.79
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 8.01              2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          32.61
 ESTIMATED PEAK FLOW         (CUMECS) =     13.30
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 9.00              3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          14.17
 ESTIMATED PEAK FLOW         (CUMECS) =      4.82
 ESTIMATED TIME TO PEAK         (MINS) =     38.00

 LINK 7.03              1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          91.63
 ESTIMATED PEAK FLOW         (CUMECS) =     36.16
 ESTIMATED TIME TO PEAK         (MINS) =     42.00
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################################################################################
#####
Rosedale - Bevian Swamp Catchment - 20yr & 100yr ARI - Post-development

Results for period from  0: 0.0  1/ 1/1990
                    to  4: 0.0  1/ 1/1990
################################################################################
#####
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                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =        20.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      98.25
                              TOTAL OF SECOND SUB-AREAS (ha) =      26.24
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.49
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area (ha) #1	#2	Slope (%) #1	#2	% Impervious (%) #1	#2	Pern #1	#2	B #1	#2	Link No.
7.00	12.370	2.120	10.17	10.17	5.000	99.00	.035	.015	.0308	.0007	1.000
7.01	9.100	7.260	5.800	5.800	5.000	99.00	.032	.015	.0325	.0018	1.001
7.02	4.250	1.740	4.890	4.890	5.000	99.00	.035	.015	.0255	.0009	1.002
8.00	24.020	11.730	4.470	4.470	0.000	99.00	.036	.015	.0832	.0026	2.000
8.01	7.470	0.5600	2.660	2.660	0.000	99.00	.044	.015	.0684	.0007	2.001
9.00	19.962	0.000	2.590	0.000	5.000	0.000	.035	0.00	.0781	0.000	3.000
7.03	21.080	2.830	1.710	1.710	5.000	99.00	.035	.015	.0989	.0020	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	#2	Cont. Loss #1 (mm/h)	#2	Excess Rain #1 (mm)	#2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
7.00	56.391	10.00	1.000	2.500	0.000	71.254	83.587	6.213	30.00	4.500
7.01	56.391	10.00	1.000	2.500	0.000	71.254	83.587	11.872	30.00	3.700
7.02	56.391	10.00	1.000	2.500	0.000	71.254	83.587	13.564	34.00	8.800

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8.00      56.391 10.00 1.000  2.500 0.000  71.254 83.587  11.794  30.00 3.200
8.01      56.391 10.00 1.000  2.500 0.000  71.254 83.587  13.301  34.00 8.800
9.00      56.391 10.00 0.000  2.500 0.000  71.254  0.000   4.820  38.00 8.800
7.03      56.391 10.00 1.000  2.500 0.000  71.254 83.587  36.158  42.00 0.000


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          15.10
 ESTIMATED PEAK FLOW         (CUMECS) =      8.21
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          32.76
 ESTIMATED PEAK FLOW         (CUMECS) =     16.04
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          39.12
 ESTIMATED PEAK FLOW         (CUMECS) =     18.31
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          38.05
 ESTIMATED PEAK FLOW         (CUMECS) =     16.49
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 8.01             2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          46.36
 ESTIMATED PEAK FLOW         (CUMECS) =     18.86
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 9.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          20.43
 ESTIMATED PEAK FLOW         (CUMECS) =      7.16
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 7.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          130.6
 ESTIMATED PEAK FLOW         (CUMECS) =     51.17
 ESTIMATED TIME TO PEAK         (MINS) =     42.00



################################################################################
#####
Rosedale - Pre-development

Results for period from  0: 0.0  1/ 1/1990
                     to  6: 0.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =       100.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      98.25
                              TOTAL OF SECOND SUB-AREAS (ha) =      26.24
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.49
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
7.00	12.370	2.120	10.17	10.17	5.000	99.00	.035	.015	.0308	.0007	1.000
7.01	9.100	7.260	5.800	5.800	5.000	99.00	.032	.015	.0325	.0018	1.001
7.02	4.250	1.740	4.890	4.890	5.000	99.00	.035	.015	.0255	.0009	1.002
8.00	24.020	11.730	4.470	4.470	0.000	99.00	.036	.015	.0832	.0026	2.000
8.01	7.470	0.5600	2.660	2.660	0.000	99.00	.044	.015	.0684	.0007	2.001
9.00	19.962	0.000	2.590	0.000	5.000	0.000	.035	0.00	.0781	0.000	3.000
7.03	21.080	2.830	1.710	1.710	5.000	99.00	.035	.015	.0989	.0020	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
7.00	77.275	10.00	1.000	2.500	0.000	102.50	114.91	8.210	30.00	4.500
7.01	77.275	10.00	1.000	2.500	0.000	102.50	114.91	16.041	30.00	3.700
7.02	77.275	10.00	1.000	2.500	0.000	102.50	114.91	18.309	34.00	8.800
8.00	77.275	10.00	1.000	2.500	0.000	102.50	114.91	16.486	30.00	3.200
8.01	77.275	10.00	1.000	2.500	0.000	102.50	114.91	18.856	34.00	8.800
9.00	77.275	10.00	0.000	2.500	0.000	102.50	0.000	7.164	36.00	8.800
7.03	77.275	10.00	1.000	2.500	0.000	102.50	114.91	51.168	42.00	0.000

Run completed at: 4th June 2007 13:51:05

mik open 0

```
 Run started at: 23rd  May  2007  11:16:52


################################################################################
#####
                          RUNTIME          RESULTS
################################################################################
#####


Max. no. of links allowed =  2000


Max. no. of routng increments allowed = 25000


Max. no. of rating curve points = 25000


Max. no. of storm temporal points = 25000


Max. no. of channel subreaches =    25


Max link stack level =    25


Input Version number =          650


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          38.80
 ESTIMATED PEAK FLOW         (CUMECS) =     20.83
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          83.17
 ESTIMATED PEAK FLOW         (CUMECS) =     43.36
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          99.29
 ESTIMATED PEAK FLOW         (CUMECS) =     51.19
 ESTIMATED TIME TO PEAK         (MINS) =     26.00

 LINK 8.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          96.41
 ESTIMATED PEAK FLOW         (CUMECS) =     44.90
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 8.01             2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          117.8
 ESTIMATED PEAK FLOW         (CUMECS) =     54.70
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 9.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          53.02
 ESTIMATED PEAK FLOW         (CUMECS) =     25.87
 ESTIMATED TIME TO PEAK         (MINS) =     28.00
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```
 LINK 7.03              1.003

 ESTIMATED VOLUME (CU METRES*10**3) =           333.9
 ESTIMATED PEAK FLOW         (CUMECS) =    154.06
 ESTIMATED TIME TO PEAK         (MINS) =     34.00



################################################################################
#####
Rosedale - Bevian Swamp Catchment - Probable Maximum Flood - Post-development

Results for period from  0: 0.0  1/ 1/1990
                     to  6:40.0  1/ 1/1990
################################################################################
#####


                                ROUTING INCREMENT (MINS) =       2.00
                                STORM DURATION (MINS)    =        45.
                                RETURN PERIOD (YRS)      =         0.
                                BX                       =     1.0000
                                TOTAL OF FIRST SUB-AREAS  (ha) =      98.25
                                TOTAL OF SECOND SUB-AREAS (ha) =      26.24
                                TOTAL OF ALL SUB-AREAS (ha)    =     124.49


     SUMMARY OF CATCHMENT AND RAINFALL DATA
 Link      Catch. Area       Slope    % Impervious     Pern         B        Link
 Label      #1     #2     #1    #2      #1   #2     #1    #2    #1   #2     No.
             (ha)             (%)          (%)
7.00      12.370  2.120  10.17 10.17  0.000 99.00  .042 .015  .0439 .0007  1.000
7.01       9.100  7.260  5.800 5.800  0.000 99.00  .032 .015  .0405 .0018  1.001
7.02       4.250  1.740  4.890 4.890  0.000 99.00  .037 .015  .0330 .0009  1.002
8.00      24.020 11.730  4.470 4.470  0.000 99.00  .036 .015  .0832 .0026  2.000
8.01       7.470 0.5600  2.660 2.660  0.000 99.00  .044 .015  .0684 .0007  2.001
9.00      19.962  0.000  2.590 0.000  5.000 0.000  .035 0.00  .0781 0.000  3.000
7.03      21.080  2.830  1.710 1.710  0.000 99.00  .043 .015  .1436 .0020  1.003


 Link    Average  Init. Loss  Cont. Loss    Excess Rain   Peak    Time   Link
 Label  Intensity  #1    #2    #1    #2      #1    #2    Inflow   to     Lag
          (mm/h)    ( mm )      (mm/h)        ( mm )     (m^3/s)  Peak  mins
7.00      -1.000 10.00 1.500  2.500 0.000  267.03 277.19  20.830  22.00 4.500
7.01      -1.000 10.00 1.500  2.500 0.000  267.03 277.19  43.363  22.00 3.700
7.02      -1.000 10.00 1.500  2.500 0.000  267.03 277.19  51.192  26.00 8.800
8.00      -1.000 10.00 1.500  2.500 0.000  267.03 277.19  44.904  28.00 3.200
8.01      -1.000 10.00 1.500  2.500 0.000  267.03 277.19  54.701  32.00 8.800
9.00      -1.000 10.00 0.000  2.500 0.000  267.03  0.000  25.871  28.00 8.800
7.03      -1.000 10.00 1.500  2.500 0.000  267.03 277.19  154.06  34.00 0.000


 LINK 7.00              1.000

 ESTIMATED VOLUME (CU METRES*10**3) =           44.76
 ESTIMATED PEAK FLOW         (CUMECS) =     18.47
 ESTIMATED TIME TO PEAK         (MINS) =     22.00

 LINK 7.01              1.001

 ESTIMATED VOLUME (CU METRES*10**3) =           95.82
 ESTIMATED PEAK FLOW         (CUMECS) =     39.02
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 7.02              1.002

 ESTIMATED VOLUME (CU METRES*10**3) =           114.4
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 ESTIMATED PEAK FLOW         (CUMECS) =     45.65
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 8.00              2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          111.1
 ESTIMATED PEAK FLOW         (CUMECS) =     42.80
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 8.01              2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          135.9
 ESTIMATED PEAK FLOW         (CUMECS) =     51.84
 ESTIMATED TIME TO PEAK         (MINS) =     32.00

 LINK 9.00              3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          61.29
 ESTIMATED PEAK FLOW         (CUMECS) =     23.84
 ESTIMATED TIME TO PEAK         (MINS) =     30.00

 LINK 7.03              1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          385.4
 ESTIMATED PEAK FLOW         (CUMECS) =    144.07
 ESTIMATED TIME TO PEAK         (MINS) =     40.00
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################################################################################
#####
Rosedale - Bevian Swamp Catchment - Probable Maximum Flood - Post-development

Results for period from  0: 0.0  1/ 1/1990
                     to  6:40.0  1/ 1/1990
################################################################################
#####
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                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =       60.
                              RETURN PERIOD (YRS)      =        0.
                              BX                       =    1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      98.25
                              TOTAL OF SECOND SUB-AREAS (ha) =      26.24
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.49
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2 (%)	Pern #1	Pern #2	B #1	B #2	Link No.
7.00	12.370	2.120	10.17	10.17	0.000	99.00	.042	.015	.0439	.0007	1.000
7.01	9.100	7.260	5.800	5.800	0.000	99.00	.032	.015	.0405	.0018	1.001
7.02	4.250	1.740	4.890	4.890	0.000	99.00	.037	.015	.0330	.0009	1.002
8.00	24.020	11.730	4.470	4.470	0.000	99.00	.036	.015	.0832	.0026	2.000
8.01	7.470	0.5600	2.660	2.660	0.000	99.00	.044	.015	.0684	.0007	2.001
9.00	19.962	0.000	2.590	0.000	5.000	0.000	.035	0.00	.0781	0.000	3.000
7.03	21.080	2.830	1.710	1.710	0.000	99.00	.043	.015	.1436	.0020	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
7.00	-1.000	10.00	1.500	2.500	0.000	307.67	318.50	18.473	22.00	4.500
7.01	-1.000	10.00	1.500	2.500	0.000	307.67	318.50	39.017	28.00	3.700
7.02	-1.000	10.00	1.500	2.500	0.000	307.67	318.50	45.647	32.00	8.800

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8.00      -1.000 10.00 1.500  2.500 0.000  307.67 318.50  42.801  28.00 3.200
8.01      -1.000 10.00 1.500  2.500 0.000  307.67 318.50  51.837  32.00 8.800
9.00      -1.000 10.00 0.000  2.500 0.000  307.67  0.000  23.844  30.00 8.800
7.03      -1.000 10.00 1.500  2.500 0.000  307.67 318.50  144.07  40.00 0.000


 LINK 7.00             1.000

 ESTIMATED VOLUME (CU METRES*10**3) =          57.66
 ESTIMATED PEAK FLOW         (CUMECS) =     16.17
 ESTIMATED TIME TO PEAK         (MINS) =     28.00

 LINK 7.01             1.001

 ESTIMATED VOLUME (CU METRES*10**3) =          123.4
 ESTIMATED PEAK FLOW         (CUMECS) =     34.40
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 7.02             1.002

 ESTIMATED VOLUME (CU METRES*10**3) =          147.3
 ESTIMATED PEAK FLOW         (CUMECS) =     41.00
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.00             2.000

 ESTIMATED VOLUME (CU METRES*10**3) =          143.0
 ESTIMATED PEAK FLOW         (CUMECS) =     38.85
 ESTIMATED TIME TO PEAK         (MINS) =     34.00

 LINK 8.01             2.001

 ESTIMATED VOLUME (CU METRES*10**3) =          174.9
 ESTIMATED PEAK FLOW         (CUMECS) =     47.21
 ESTIMATED TIME TO PEAK         (MINS) =     38.00

 LINK 9.00             3.000

 ESTIMATED VOLUME (CU METRES*10**3) =          78.98
 ESTIMATED PEAK FLOW         (CUMECS) =     21.65
 ESTIMATED TIME TO PEAK         (MINS) =     36.00

 LINK 7.03             1.003

 ESTIMATED VOLUME (CU METRES*10**3) =          496.3
 ESTIMATED PEAK FLOW         (CUMECS) =    131.24
 ESTIMATED TIME TO PEAK         (MINS) =     46.00



################################################################################
#####
Rosedale - Bevian Swamp Catchment - Probable Maximum Flood - Post-development

Results for period from  0: 0.0  1/ 1/1990
                     to  6:40.0  1/ 1/1990
################################################################################
#####


                              ROUTING INCREMENT (MINS) =       2.00
                              STORM DURATION (MINS)    =        90.
                              RETURN PERIOD (YRS)      =         0.
                              BX                       =     1.0000
                              TOTAL OF FIRST SUB-AREAS  (ha) =      98.25
                              TOTAL OF SECOND SUB-AREAS (ha) =      26.24
                              TOTAL OF ALL SUB-AREAS (ha)    =     124.49
```

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Pern #1	Pern #2	B #1	B #2	Link No.
7.00	12.370	2.120	10.17	10.17	0.000	99.00	.042	.015	.0439	.0007	1.000
7.01	9.100	7.260	5.800	5.800	0.000	99.00	.032	.015	.0405	.0018	1.001
7.02	4.250	1.740	4.890	4.890	0.000	99.00	.037	.015	.0330	.0009	1.002
8.00	24.020	11.730	4.470	4.470	0.000	99.00	.036	.015	.0832	.0026	2.000
8.01	7.470	0.5600	2.660	2.660	0.000	99.00	.044	.015	.0684	.0007	2.001
9.00	19.962	0.000	2.590	0.000	5.000	0.000	.035	0.00	.0781	0.000	3.000
7.03	21.080	2.830	1.710	1.710	0.000	99.00	.043	.015	.1436	.0020	1.003

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2 (mm)	Cont. Loss #1 (mm/h)	Cont. Loss #2 (mm/h)	Excess Rain #1 (mm)	Excess Rain #2 (mm)	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
7.00	-1.000	10.00	1.500	2.500	0.000	396.50	408.50	16.172	28.00	4.500
7.01	-1.000	10.00	1.500	2.500	0.000	396.50	408.50	34.398	34.00	3.700
7.02	-1.000	10.00	1.500	2.500	0.000	396.50	408.50	40.997	34.00	8.800
8.00	-1.000	10.00	1.500	2.500	0.000	396.50	408.50	38.854	34.00	3.200
8.01	-1.000	10.00	1.500	2.500	0.000	396.50	408.50	47.215	38.00	8.800
9.00	-1.000	10.00	0.000	2.500	0.000	396.50	0.000	21.649	36.00	8.800
7.03	-1.000	10.00	1.500	2.500	0.000	396.50	408.50	131.24	46.00	0.000

Run completed at: 23rd May 2007 11:16:52

mik open 0

APPENDIX D
HEC-RAS MODEL OUTPUT FOR POST-DEVELOPMENT CONDITIONS

HEC-RAS Plan: Tributary 1 River: Tributary 1 Reach: 1

Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	1	20yr ARI	19.50	0.050	0.060	0.050	10.74	11.46	11.44	11.71	0.036079	1.13	2.27	1.65	8.85	16.29	0.93
1	1	100yr ARI	27.20	0.050	0.060	0.050	10.74	11.58	11.58	11.91	0.036822	1.40	2.59	1.89	10.89	17.10	0.96
1	1	PMF	83.90	0.050	0.060	0.050	10.74	12.31	12.31	12.91	0.028039	2.29	3.59	2.64	25.17	21.91	0.94
1	2	20yr ARI	19.50	0.080	0.075	0.080	12.03	13.17	12.75	13.20	0.005847	0.61	0.84	0.21	26.47	45.42	0.31
1	2	100yr ARI	27.20	0.080	0.075	0.080	12.03	13.33	12.85	13.37	0.005589	0.66	0.94	0.30	34.21	49.24	0.31
1	2	PMF	83.90	0.080	0.075	0.080	12.03	14.10	13.26	14.16	0.004792	0.84	1.30	0.41	86.30	90.60	0.32
1	3	20yr ARI	19.50		0.015		12.97	13.24	13.24	13.36	0.003721		1.53		12.72	54.93	1.02
1	3	100yr ARI	27.20		0.015		12.97	13.30	13.30	13.45	0.003346		1.68		16.15	55.92	1.00
1	3	PMF	83.90		0.015	0.015	12.97	14.09	13.63	14.17	0.000355		1.27	0.41	71.05	101.56	0.40
1	4	20yr ARI	19.50		0.075		13.00	13.51	13.51	13.74	0.073247		2.08		9.36	21.21	1.00
1	4	100yr ARI	27.20		0.075		13.00	13.64	13.64	13.90	0.066988		2.26		12.05	22.64	0.99
1	4	PMF	83.90	0.080	0.075	0.080	13.00	14.28	14.28	14.62	0.040567	0.22	2.67	1.01	35.60	56.74	0.85
1	5	20yr ARI	12.70		0.075		14.96	16.34	15.73	16.38	0.005872		0.91		14.00	16.29	0.31
1	5	100yr ARI	18.80		0.075		14.96	16.56	15.91	16.61	0.006717		1.06		17.68	17.91	0.34
1	5	PMF	59.40	0.080	0.075	0.080	14.96	17.33	16.61	17.49	0.009847	0.34	1.78	0.40	34.65	29.28	0.45
1	6	20yr ARI	12.70	0.080	0.075		17.00	18.19	18.19	18.50	0.059050	0.64	2.45		5.42	10.54	0.93
1	6	100yr ARI	18.80	0.080	0.075	0.080	17.00	18.42	18.42	18.73	0.046924	0.98	2.58	0.29	8.22	14.33	0.86
1	6	PMF	59.40	0.080	0.075	0.080	17.00	19.15	19.15	19.60	0.036943	1.79	3.39	0.96	22.59	24.05	0.84
1	7	20yr ARI	9.10	0.080	0.075		21.99	22.95	22.63	23.02	0.012444	0.64	1.15		8.45	14.07	0.44
1	7	100yr ARI	13.20	0.080	0.075	0.080	21.99	23.09	22.79	23.18	0.014392	0.71	1.37	0.10	10.52	16.21	0.48
1	7	PMF	38.60	0.080	0.075	0.080	21.99	23.64	23.31	23.84	0.017428	1.18	2.13	0.71	21.16	22.26	0.58
1	8	20yr ARI	7.30		0.075		24.00	24.95	24.95	25.18	0.075198		2.11		3.45	7.54	1.00
1	8	100yr ARI	10.10	0.080	0.075		24.00	25.09	25.08	25.32	0.062850	0.87	2.15		4.91	10.86	0.94
1	8	PMF	28.10	0.080	0.075	0.080	24.00	25.62	25.54	25.94	0.040930	1.56	2.60	0.43	11.71	14.53	0.84
1	9	20yr ARI	7.30		0.075		27.97	28.65	28.44	28.73	0.019500		1.23		5.92	10.73	0.53
1	9	100yr ARI	10.10		0.075		27.97	28.76	28.53	28.86	0.021542		1.42		7.11	11.18	0.57
1	9	PMF	28.10	0.080	0.075	0.080	27.97	29.18	29.00	29.41	0.028519	0.75	2.17	0.40	14.37	22.70	0.70
1	10	20yr ARI	7.30	0.080	0.075		30.55	31.24	31.23	31.43	0.053110	0.88	1.98		4.09	10.51	0.86
1	10	100yr ARI	10.10	0.080	0.075		30.55	31.36	31.33	31.56	0.047332	1.13	2.09		5.42	11.24	0.84
1	10	PMF	28.10	0.080	0.075	0.080	30.55	31.88	31.77	32.19	0.038611	1.70	2.68	0.50	12.09	15.18	0.82

HEC-RAS Plan: Tributary 2

River	Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
				(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Tributary 2	1	1	20yr ARI	18.40		0.040	0.050	11.27	11.78	11.74	11.91	0.016895		1.75	1.20	11.93	33.18	0.89
Tributary 2	1	1	100yr ARI	26.00		0.040	0.050	11.27	11.83	11.83	12.03	0.022259		2.14	1.50	13.71	34.14	1.04
Tributary 2	1	1	PMF	75.80	0.050	0.040	0.050	11.27	12.26	12.26	12.58	0.016281	0.85	2.78	1.97	33.14	56.67	0.98
Tributary 2	1	2	20yr ARI	18.40	0.080	0.075	0.080	11.29	12.13		12.15	0.004176	0.49	0.62	0.12	33.20	62.96	0.25
Tributary 2	1	2	100yr ARI	26.00	0.080	0.075	0.080	11.29	12.26		12.28	0.004052	0.56	0.70	0.20	41.69	64.99	0.26
Tributary 2	1	2	PMF	75.80	0.080	0.075	0.080	11.29	12.80		12.85	0.004776	0.89	1.09	0.46	78.85	73.15	0.31
Tributary 2	1	3	20yr ARI	18.40	0.080	0.075	0.080	11.88	12.75	12.75	12.88	0.051175	0.72	1.72	0.84	12.59	45.23	0.82
Tributary 2	1	3	100yr ARI	26.00	0.080	0.075	0.080	11.88	12.82	12.82	12.98	0.059096	1.01	1.87	1.13	16.26	50.79	0.89
Tributary 2	1	3	PMF	75.80	0.080	0.075	0.080	11.88	13.14	13.14	13.41	0.058612	1.75	2.58	1.46	34.92	67.64	0.96
Tributary 2	1	4	20yr ARI	18.40	0.050	0.060		11.93	13.03	12.90	13.06	0.005549	0.61	0.76		24.92	57.80	0.35
Tributary 2	1	4	100yr ARI	26.00	0.050	0.060		11.93	13.13	12.90	13.17	0.005846	0.73	0.86		31.08	63.97	0.37
Tributary 2	1	4	PMF	75.80	0.050	0.060	0.050	11.93	13.55	13.18	13.63	0.006276	1.04	1.28	0.49	63.78	98.68	0.41
Tributary 2	1	5	20yr ARI	18.30	0.080	0.075		14.10	15.01	14.91	15.06	0.025142	0.82	1.19		18.00	54.26	0.58
Tributary 2	1	5	100yr ARI	25.80	0.080	0.075	0.080	14.10	15.13	14.96	15.18	0.019671	0.90	1.18	0.16	24.91	61.38	0.53
Tributary 2	1	5	PMF	73.60	0.080	0.075	0.080	14.10	15.54	15.28	15.64	0.015439	1.24	1.52	0.79	56.01	79.59	0.52
Tributary 2	1	6	20yr ARI	18.30	0.080	0.075		14.97	15.68	15.68	15.84	0.081288	1.38	1.92		10.70	35.32	1.02
Tributary 2	1	6	100yr ARI	25.80	0.080	0.075		14.97	15.77	15.77	15.96	0.074321	1.52	2.10		13.87	37.63	1.01
Tributary 2	1	6	PMF	73.60	0.080	0.075	0.080	14.97	16.15	16.15	16.48	0.062537	2.08	2.85	0.46	29.82	46.65	1.02
Tributary 2	1	7	20yr ARI	18.30	0.080	0.075		15.51	16.31	16.17	16.39	0.021657	0.82	1.40		15.20	33.85	0.57
Tributary 2	1	7	100yr ARI	25.80	0.080	0.075		15.51	16.41	16.26	16.52	0.023460	0.97	1.59		18.91	36.50	0.61
Tributary 2	1	7	PMF	73.60	0.080	0.075	0.080	15.51	16.84	16.69	17.07	0.029308	1.56	2.38	0.41	36.80	46.37	0.73
Tributary 2	1	8	20yr ARI	17.80		0.075		17.00	17.85		17.88	0.005506		0.80		22.22	30.31	0.30
Tributary 2	1	8	100yr ARI	25.00		0.075	0.080	17.00	18.03		18.07	0.005565		0.90	0.10	27.97	35.89	0.31
Tributary 2	1	8	PMF	69.00	0.080	0.075	0.080	17.00	18.69		18.78	0.005696	0.42	1.31	0.62	56.37	49.63	0.34
Tributary 2	1	9	20yr ARI	17.80	0.015	0.015		21.80	21.97	21.97	22.05	0.003327	1.18	1.17		15.11	88.73	0.91
Tributary 2	1	9	100yr ARI	25.00	0.015	0.015	0.000	21.80	22.00	22.00	22.11	0.003873	1.41	1.39	0.07	17.76	89.48	1.01
Tributary 2	1	9	PMF	69.00	0.015	0.015	0.015	21.80	22.20	22.20	22.39	0.002999	1.94	1.95	0.77	35.59	91.96	1.00
Tributary 2	1	10	20yr ARI	17.80	0.080	0.075	0.080	21.00	22.07	21.20	22.07	0.000345	0.09	0.26	0.14	71.63	74.21	0.08
Tributary 2	1	10	100yr ARI	25.00	0.080	0.075	0.080	21.00	22.14	21.25	22.14	0.000546	0.12	0.34	0.18	76.83	75.25	0.10
Tributary 2	1	10	PMF	69.00	0.080	0.075	0.080	21.00	22.44	21.50	22.46	0.001826	0.31	0.72	0.38	100.22	79.80	0.19
Tributary 2	1	11	20yr ARI	16.90	0.080	0.075	0.080	21.00	22.14	21.48	22.16	0.002466	0.38	0.69	0.37	27.64	33.23	0.21
Tributary 2	1	11	100yr ARI	23.40	0.080	0.075	0.080	21.00	22.25	21.60	22.28	0.003322	0.47	0.85	0.47	31.24	34.64	0.25
Tributary 2	1	11	PMF	60.30	0.080	0.075	0.080	21.00	22.74	22.01	22.83	0.005816	0.79	1.42	0.82	49.99	41.32	0.35
Tributary 2	1	12	20yr ARI	16.90	0.075	0.080	0.075	21.12	22.49		22.55	0.007337	0.42	1.06	0.44	16.27	18.11	0.34
Tributary 2	1	12	100yr ARI	23.40	0.075	0.080	0.075	21.12	22.68		22.75	0.007828	0.54	1.23	0.57	19.72	19.04	0.36
Tributary 2	1	12	PMF	60.30	0.075	0.080	0.075	21.12	23.39		23.56	0.009840	0.97	1.88	0.94	34.76	23.70	0.43
Tributary 2	1	13	20yr ARI	16.90	0.080	0.075		24.74	25.54	25.54	25.82	0.065761	0.79	2.34		7.30	13.39	0.99
Tributary 2	1	13	100yr ARI	23.40	0.080	0.075		24.74	25.69	25.69	26.02	0.061477	1.02	2.57		9.26	14.27	0.98
Tributary 2	1	13	PMF	60.30	0.080	0.075	0.080	24.74	26.28	26.28	26.84	0.048126	1.68	3.40	1.02	18.83	17.97	0.96

HEC-RAS Plan: Tributary 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
				(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Tributary 2	2	14	20yr ARI	9.00	0.080	0.075	0.080	25.24	26.52		26.61	0.012169	0.56	1.32	0.31	7.11	9.58	0.45
Tributary 2	2	14	100yr ARI	12.50	0.080	0.075	0.080	25.24	26.69		26.80	0.012753	0.69	1.51	0.46	8.78	10.47	0.47
Tributary 2	2	14	PMF	29.70	0.080	0.075	0.080	25.24	27.36		27.54	0.011413	1.04	1.99	0.79	17.11	14.40	0.48
Tributary 2	2	14.5	20yr ARI	9.00	0.080	0.075	0.080	25.24	26.54		26.62	0.011390	0.56	1.29	0.31	7.28	9.67	0.43
Tributary 2	2	14.5	100yr ARI	12.50	0.080	0.075	0.080	25.24	26.71		26.82	0.011979	0.68	1.48	0.46	8.97	10.57	0.46
Tributary 2	2	14.5	PMF	29.70	0.080	0.075	0.080	25.24	27.38		27.56	0.010932	1.03	1.96	0.78	17.39	14.53	0.48
Tributary 2	3	15	20yr ARI	3.60	0.080	0.075		29.90	30.29	30.29	30.38	0.073213	0.56	1.33		2.73	12.50	0.90
Tributary 2	3	15	100yr ARI	4.80	0.080	0.075		29.90	30.32	30.32	30.44	0.086487	0.70	1.55		3.12	12.90	0.99
Tributary 2	3	15	PMF	11.20	0.080	0.075	0.080	29.90	30.51	30.51	30.71	0.075439	1.06	1.98	0.16	5.77	15.75	1.00
Tributary 2	3	16	20yr ARI	3.60		0.075		32.01	32.62	32.50	32.68	0.029554		1.08		3.32	10.08	0.60
Tributary 2	3	16	100yr ARI	4.80		0.075		32.01	32.71	32.57	32.77	0.027246		1.13		4.23	11.27	0.59
Tributary 2	3	16	PMF	11.20	0.080	0.075		32.01	32.94	32.81	33.06	0.030261	0.63	1.56		7.34	14.32	0.66
Tributary 3	1	17	20yr ARI	5.70	0.080	0.075	0.080	26.58	27.18	27.13	27.33	0.045748	1.02	1.76	0.54	3.58	9.31	0.80
Tributary 3	1	17	100yr ARI	8.00	0.080	0.075	0.080	26.58	27.28	27.23	27.46	0.046462	1.19	2.00	0.72	4.52	10.18	0.83
Tributary 3	1	17	PMF	19.00	0.080	0.075	0.080	26.58	27.72		27.95	0.029997	1.41	2.33	1.14	9.90	13.94	0.73
Tributary 3	1	18	20yr ARI	5.70	0.080	0.075	0.080	28.97	29.43	29.38	29.56	0.044676	0.87	1.63	0.99	3.89	10.88	0.78
Tributary 3	1	18	100yr ARI	8.00	0.080	0.075	0.080	28.97	29.53	29.47	29.68	0.043332	0.98	1.82	1.10	4.95	11.75	0.80
Tributary 3	1	18	PMF	19.00	0.080	0.075	0.080	28.97	29.79	29.79	30.10	0.054700	1.46	2.67	1.60	8.34	14.17	0.96
Tributary 4	1	19	20yr ARI	5.40	0.080	0.075	0.080	30.96	31.43	31.43	31.62	0.072988	0.87	1.91	0.62	2.91	8.25	0.98
Tributary 4	1	19	100yr ARI	7.70	0.080	0.075	0.080	30.96	31.54	31.54	31.76	0.066682	1.02	2.13	0.80	3.77	8.76	0.97
Tributary 4	1	19	PMF	18.50	0.080	0.075	0.080	30.96	31.90	31.90	32.26	0.053754	1.44	2.77	1.26	7.30	10.56	0.95
Tributary 4	1	20	20yr ARI	5.40		0.075		33.00	33.90	33.70	34.00	0.026972		1.44		3.76	6.57	0.61
Tributary 4	1	20	100yr ARI	7.70	0.080	0.075	0.080	33.00	34.02	33.83	34.17	0.028886	0.23	1.67	0.23	4.63	7.25	0.64
Tributary 4	1	20	PMF	18.50	0.080	0.075	0.080	33.00	34.41	34.28	34.71	0.034892	0.84	2.47	0.88	7.93	9.70	0.76

HEC-RAS Plan: Plan 03 River: Salt Water Ck Reach: 1

Reach	River Sta	Profile	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Chl
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	1	20yr ARI	6.80		0.075		8.50	8.84	8.84	8.96	0.091413		1.56		4.35	18.03	1.01
1	1	100yr ARI	9.30		0.075	0.080	8.50	8.90	8.90	9.04	0.083464		1.68	0.18	5.53	19.26	1.00
1	1	PMF	24.70	0.080	0.075	0.080	8.50	9.50	9.17	9.57	0.011099	0.55	1.21	0.60	22.12	34.43	0.43
1	2	20yr ARI	6.30		0.075		10.98	11.82	11.56	11.84	0.009187		0.72		8.77	20.55	0.35
1	2	100yr ARI	8.60		0.075		10.98	11.91	11.64	11.94	0.009598		0.81		10.59	21.31	0.37
1	2	PMF	21.50		0.075		10.98	11.94	11.88	12.12	0.048871		1.90		11.33	21.62	0.84
1	3	20yr ARI	4.70	0.080	0.075		13.01	13.52	13.52	13.65	0.091154	0.29	1.59		2.96	12.41	1.02
1	3	100yr ARI	6.50	0.080	0.075		13.01	13.60	13.60	13.74	0.078234	0.52	1.68		3.93	14.32	0.97
1	3	PMF	14.00	0.080	0.075	0.080	13.01	14.05	13.79	14.09	0.010018	0.55	0.94	0.13	15.85	30.78	0.39
1	4	20yr ARI	4.70		0.075		15.00	15.80	15.58	15.84	0.014654		0.87		5.39	13.49	0.44
1	4	100yr ARI	6.50		0.075		15.00	15.89	15.66	15.94	0.015709		0.97		6.70	15.05	0.46
1	4	PMF	14.00		0.075		15.00	15.89	15.89	16.11	0.073073		2.09		6.70	15.04	1.00