HAWKESBURY CITY COUNCIL

BLIGH PARK

EVACUATION ROUTE STUDY

December 2007

Bewsher Consulting Pty Ltd

HAWKESBURY CITY COUNCIL

BLIGH PARK

EVACUATION ROUTE STUDY

December 2007

Prepared by:

BEWSHER CONSULTING PTY LTD
P O BOX 352 EPPING NSW 1710
Telephone (02) 9868 1966
Facsimile (02) 9868 5759
E-mail: postmaster@bewsher.com.au
ACN 003137068. ABN 24 312 540 210

TABLE OF CONTENTS

FIGURES

TABLE OF CONTENTS (continued)

Page

TABLES

APPENDICES

1. INTRODUCTION

This study is part of the Hawkesbury-Nepean Floodplain Management Strategy. As such it follows on from several key reports commissioned by the NSW State Government and entitled *Achieving a Hawkesbury-Nepean Floodplain Management Strategy* (**Reference 1**) and *Interim Regional Road Evacuation Route Upgrade Plan* (**Reference 2**).

In those studies, a number of population centres were identified as needing improved local evacuation routes to ensure effectiveness of the regional evacuation routes.

One such population centre is Bligh Park, which is within the Hawkesbury City Local Government Area (LGA). It is the focus of this report which undertakes an assessment of identified local overland flow 'points of interest' as an integral part of the assessment of the centre's local evacuation route constraints. It will be followed by a subsequent study which will be both evaluating the management options to address the constraints and preparing a plan of management. Both studies are being undertaken by Council as part of Council's preparation of a Local Floodplain Risk Management Plan for Bligh Park.

The principal objective of the study is to ensure that the existing local road infrastructure leading out of the flood risk areas allows all affected persons to be safely evacuated to regional flood evacuation routes and then to evacuation centres as described in the SES Hawkesbury-Nepean Flood Emergency Plans. For Bligh Park there is one primary State Emergency Service (SES) flood evacuation route — that is, via the Thorley Street link road to Richmond Road — and a number of SES–identified local area evacuation routes, as shown in **Figure 1**.

The Consultant worked under the guidance of a Technical Working Group (TWG) which comprised representatives from the then Department of Natural Resources (DNR), the SES and Hawkesbury City Council.

NORTH

0 150 300

metres

LEGEND

- Flood Evacuation Routes
- Direction of Evacuation Traffic
- Questionnaire Distribution
- Questionnaire Returned
- Stormwater Pipe
- BP1 Bligh Park point of interest

BP1 BP2 BP3 BP4 BP5 BP6 BP7 BP8 BP9 BP10 BP11 BP12 BP13 BP14

Sirius Road

Rifle Range Road

Berger Road

Marsden Crescent

Wetherill Crescent

Harradine Crescent

Jacobs Place

Colonial Drive

Bounty Reserve

Colonial Reserve

Alexander Street

Guardian Crescent

Denwent Place

Neilson Crescent

Settlers Crescent

Porpoise Crescent

Porpoise

Thorley Street exit

Bewsher Consulting Pty Ltd

Job No: J1434
File: J1434_Fig1_130508.pdf
Date: 13 May 2008

FIGURE 1
BLIGH PARK EVACUATION ROUTE STUDY
Study Area and Questionnaire Distribution

2. SCOPE OF WORK

To achieve the overall objective, the commission called for the following tasks to be undertaken:

- Familiarisation with the study area and compilation of sufficient ground and stormwater asset information to suit the study area's flood modelling requirements;
- Public consultation;
- Development of catchment flow (hydrologic) models to assess 20 year average recurrence interval (ARI), 50 year ARI, 100 year ARI, 200 year ARI, 500 year ARI and PMF event flows at all points of interest;
- Development of hydraulic models to assess flood levels and hazard at all points of interest; and
- Preparation of a report documenting the methodology and findings from the investigation.

2.1 FAMILIARISATION AND DATA COLLECTION/REVIEW

Bewsher Consulting had undertaken earlier *Local Hydraulic Specification Studies (LHSS)* which examined local flooding along the various regional evacuation routes (**Reference 3**) and along Bligh Park's Thorley Street Flood Evacuation Route (**Reference 5**). For this study, the TWG broadly adopted the same flood modelling approaches which had been used in those earlier studies.

The Consultant undertook a number of Bligh Park inspections, some of which formally included the TWG members. A key focus of the initial joint inspection was the identification/verification of the points of interest that had previously been identified by the SES and are shown in **Figure 1**. That inspection determined that location BP4 did not represent a 'point of interest' since it did not constitute a local sag point while BP13 and BP14 were recognised as being the one 'point of interest'. (It therefore follows that BP4 and BP14 did not require any analysis.)

Study area photographs were taken by the project surveyors and these are reproduced in **Appendix E**.

Both the SES and Council were approached regarding information about any historical flooding that has been experienced in Bligh Park. Council held some information regarding December 2004 flooding in Wetherill Crescent (adjacent to Bounty Reserve) and this was provided to the consultant.

Council provided design centreline road levels which had been extracted from its precinct plans. Hydrologic design details for the two Bligh Park flood retarding basins — located in Colonial Reserve (Guardian Crescent) and Bounty Reserve (Wetherill Crescent) were not available.

2.2 PUBLIC CONSULTATION

2.2.1 Questionnaire

An essential part of SES's identification of evacuation routes for Bligh Park was avoidance of low-lying areas that might have a greater probability of flooding. Given the flood evacuation route focus of this study, the public consultation phase has consisted of drainage questionnaires sent to residents who lived in the immediate vicinity of the evacuation routes.

120 questionnaires were delivered by Council and 17 (or 14%) were returned (see **Figure 1**). Of the returned questionnaires, eleven respondents referred to significant problems.

The questionnaire and its accompanying letter are reproduced in **Appendix A**.

Since there has been no recent Hawkesbury-Nepean flooding, it is clear that all of the study area problems are related to Bligh Park runoff issues rather than being "backwater" flooding from the river. While the reports of significant problems — as detailed below — are useful, it is noted that the responses typically did not include specific depth information nor provide accurate dates and hence or otherwise it has not been possible to assign average recurrence intervals to the events

2.2.2 Significant Responses

Rifle Range Road (including BP7 & BP8?)

Four residents reported problems in Rifle Range Road. While several were possibly referring to minor local problems at the two study area low points, all reported that the worst problems occurred north of Sirius Road where it is noted that the road and adjoining property levels are the lowest in the area. (The flood regime along Rifle Range Road north of Sirius Road has not been assessed under this study since as shown in **Figure 1** it is not a primary flood evacuation route for the Bligh Park community.)

Guardian Crescent (BP10)

BP10 corresponds to the sag point in Guardian Crescent where the Colonial Reserve basin pipework passes under the roadway and connects to the start of the trunk drainage swale (see location figure in **Appendix B**).

Just north of BP10 there is another sag point in Derwent Place just adjacent to the intersection with Guardian Crescent. A resident in Derwent Place reported that five instances of flooding had been observed over the last five years (with the worst occurring sometime in 2003) and on all those occasions cars could not pass through the water. The

three potential mechanisms to explain the Derwent Place flooding would be local stormwater unable to drain freely to the basin, significant ponding in the basin causing backwater ponding at the sag point or spill commencing from the basin (which would also cause inundation of that sag point).

A Guardian Crescent resident who lives immediately adjacent to BP10 also reported problems. Street flooding had been observed on three occasions over nine years (with the worst occasion being in October 2004) and on all three occasions cars had not been able to pass through it. It is assumed that the reported street flooding is related to either local stormwater unable to drain freely to the basin, or ponding in the basin being so high as to initiate spill into BP10. (The resident considered that a significant flood factor was blockage of the basin outlet stormwater grates whenever the reserve was mown and substantial grass clipping coverage of the grates was observed first hand during the study, see **Photo 1**).

Photograph No. 1: View of Colonial Reserve basin from near BP10 in Guardian Crescent. Basin outlet pit is in foreground.

Based on the above observations, it is difficult to determine if the Guardian Crescent historical ponding is a function of local runoff not being readily conveyed into the Colonial Reserve basin and/or the basin ponding having reached such a depth that it has commenced to spill into Guardian Crescent. However it can be seen from the sketch in **Appendix B** that some of the levels in Colonial Drive on the northern perimeter of the basin are very similar to those at BP10. Since no one has reported seeing similar ponding

occurring in Colonial Drive, it is concluded that the BP10 and nearby Derwent Place ponding has been related to local runoff issues rather than the basin spilling.

Porpoise Crescent area (adjacent to swale and upslope of BP12)

The swale that carries both pipe and surface outflows from the Colonial Reserve basin commences at Guardian Crescent and runs parallel to Porpoise Crescent for much of its length before passing under Rifle Range Road (see location figure in **Appendix D**). It therefore follows that any reports of flooding in Porpoise Crescent could relate to either the swale overtopping its banks or just local street drainage issues.

Four residents identified problems in the section of Porpoise Crescent which is adjacent to the swale. One Neilson Crescent resident referred to several recent occasions of ponding occurring at the intersection of Neilson Crescent and Porpoise Crescent; in the worst case (November/December 2004) vehicles could not pass through the water. It was unclear whether the occasions were related to the swale breaking its banks or a local ponding issue but based on the following observations — where there was no indication that the swale had ever carried enough floodwaters that corresponded to Porpoise Crescent being part of the 'flowpath' — it is clear that the intersection inundation was a local ponding issue.

One resident in Porpoise Crescent identified one occasion of minor ponding in the street — in October 2004 — but no location details were provided.

Another resident in Porpoise Crescent reported identified occasions when there had been lots of water in the adjacent swale but also in the street at the intersection with Settlers Crescent. Their initial recollections suggested very deep water in Porpoise Crescent but subsequent interviewing clarified that the ponding was limited to the intersection itself (and that the swale had never broken its banks).

The fourth resident who lived close to Rifle Range Road reported frequent occurrences of ponding at the adjacent Porpoise Crescent sag point. They thought that the worst ponding had occurred in Easter 2002.

It is noted that two of the respondents referred to the worst flooding occurring late in 2004 (i.e. in October or November/December). It is considered most likely that this was the same storm event (in December 2004) which saw local flooding occurring in Wetherill Crescent near the Bounty Reserve retarding basin.

Wetherill Crescent, near Bounty Reserve Retarding Basin

Two Wetherill Crescent residents who live near a sag point adjacent to the Bounty Reserve retarding basin reported a number of instances of water in the street. In the worst case (December 2004), one of them reported that the ponding was sufficient to lap into his garage. Although from the questionnaire returns it was unclear whether the problem was related to excessive ponding in the basin with resultant flooding in the street and/or difficulties with local stormwater entering the basin, previous Council enquiries had led to the conclusion that the local flooding had been due to backwater flooding from the basin.

This sag point issue is seen to be separate to the study's focus on 'points of interest' which are located along the various flood evacuation roadways (see **Figure 1**). Nonetheless the issues associated with this sag point are addressed in **Section 3.11** of the report.

2.3 MODELLING APPROACH

Since the focus of the study is on flood evacuation issues, the analysis has been conservatively based on the assumption that local stormwater pipe systems effectively have no capacity — that is, all runoff remains a surface flow issue. Hence pipe system capacity analysis is not required but rather the total surface flow hydrographs are quantified and their impacts assessed.

At the beginning of the investigation, it was clear that the various 'points of interest' could be classified into two scenarios as follows:

(a) The first scenario is where the location represents a sag point within the local road system (that is, at BP1-BP3, BP5-BP9, BP11 and BP13). Since the capacities of local stormwater pipe systems were to be ignored (i.e. be treated as fully blocked), all the sag point catchment's runoff would reach the low point and begin to pond. The depth of ponding would then be a function of the amount of storage that is available at the sag point plus the level at which the ponding is relieved through spill.

    The following hydrologic modelling approach was endorsed by the TWG for those 'points of interest' which are associated with such local roadway sag point ponding:

    – a separate sub-catchment would be defined for each such sag point. (Where there were one or more 'points of interest' located within a catchment whose overall flows are required to be calculated eg. as part of a downstream flood modelling exercise, each sag point sub-catchment would be 'nested' within the larger model);

    – the calculated runoff hydrograph for that sub-catchment would be treated as inflow to a 'basin' that would model the sag point ponding. The stage-storage relationship for the basin would be as defined by the field survey team while the discharge relationship would be based on a nominal diameter pipe outlet (to allow the basin to empty) and a weir flow relationship (where the governing weir levels would be extracted from the field survey plans).

(b) The second scenario is where the location is associated with flows in an open channel system, as at BP10 and BP12 (see **Photo 2**). The roadway overtopping regime at these locations would be assessed using (1D) flood modelling software to generate the flood levels along the open channel system and over the crossing. This approach was also endorsed by the TWG.

Photograph No. 2: View of BP12 and Rifle Range Road twin box culvert structure, looking upstream.

2.3.1 Hydrologic Modelling

Consistent with the approach that had been adopted for earlier LHSS studies, RAFTS hydrologic modelling software was adopted. For this study RAFTS version 2000 was used.

Figure 2, which defines the network of sub-catchments, shows how there are one principal and six smaller catchments in the study area. The principal catchment includes the Colonial Reserve retarding basin and the swale system that extends from the Reserve to the study area outlet while the most western catchment includes the Bounty Reserve retarding basin.

The sub-catchments presented in **Figure 2** were assessed by using a combination of as-available contour data, first-hand field inspections and additional fieldwork undertaken by the project surveyors. (In some locations in **Figure 2**, it can be noticed that some of the catchment boundaries are actually crossing the alignment of pipe systems. This anomaly arises where there were found to be differences between the physical catchment boundaries and the areas draining to underground pipe systems. For example, while

NORTH

0 150 300

metres

LEGEND

S1.0 RAFTS subcatchment node

Stormwater Pipe

BP1 Bligh Park point of interest

Reserve

BP1 BP2 BP3 BP4 BP5 BP6 BP7 BP8 BP9 BP10 BP11 BP12 BP13

S1.0 S1.05 S1.1 S1.2 S1.3 S1.4 S1.5 S1.6 S2.0 S3.0 S4.0 S5.0 S5.1 S6.0 S7.0

Sirius Road

Rifle Range Road

Marsden Crescent

Wetherill Crescent

Harradine Crescent

Colonial Drive

Alexander Street

Bounty Reserve

Colonial Reserve

Guardian Crescent

Neilson Crescent

Porpoise Crescent

Porpoise

Bewsher Consulting Pty Ltd

Job No: J1434
File: J1434_Fig2 130508.pdf
Date: 13 May 2008

FIGURE 2
BLIGH PARK EVACUATION ROUTE STUDY
RAFTS Catchment Plan

TABLE 1: SUBCATCHMENT DETAILS

BLIGH PARK: SUB-CATCHMENT AREAS & RAFTS HYDROLOGICAL MODEL DEFINITIONS						
Sub-Catchment Id	**Subcatchment**	**Average Slope**	Urban	Urban (undeveloped) i.e. parks, vegetation, etc	**RAFTS Catchment Definition**	
					Split Catchment 100% Impervious	Split Catchment Pervious (with 5% Impervious defn)
	(hectares)	(%)	(hectares)	(hectares)	(hectares)	(hectares)
S1.0	25.98	1.10	21.42	4.56	11.78	14.20
S1.05	0.95	1.10	0.95		0.52	0.43
S1.1	7.88	0.95	7.88		4.33	3.55
S1.2	6.32	0.53	6.32		3.48	2.84
S1.3	34.52	0.66	30.16	4.36	16.59	17.93
S1.4	4.35	0.40	4.35		2.39	1.96
S1.5	6.86	0.87	6.86		3.77	3.09
S1.6	14.31	1.00	0.00	14.31	0.00	14.31
S2.0	20.48	1.30	19.28	1.20	10.60	9.88
S3.0	3.46	1.50	3.46		1.90	1.56
S4.0	5.91	1.50	5.91		3.25	2.66
S5.0	10.65	1.10	10.65		5.86	4.79
S5.1	4.64	1.10	4.64		2.55	2.09
S6.0	8	1.10	8.00		4.40	3.60
S7.0	10.39	1.10	10.39		5.71	4.68
Total Area (ha)	164.70			Sub-Total	77.15	87.55
				Total	164.70	

NOTE:
1: Typical of such urban areas, the impervious percentage is 55%

Harradine Crescent can act as a de facto flowpath carrying flows from west to east, its runoff in frequent storm events would be collected by pipe systems which convey those flows in a northerly direction towards Rifle Range Road. Since as explained earlier the analysis was to be based on ignoring pipe system capacities, it was agreed by the TWG that in instances such as Harradine Crescent the catchment boundaries should not be based on pipe system catchment boundaries.)

BP1 RAFTS Model

One of the smaller catchments corresponds to point of interest BP1. Since it is located within the overall catchment draining to the Bounty Reserve retarding basin, its catchment flows were assessed by modifying the RAFTS model which had been developed for the 2004 *Thorley Street* study (**Reference 5**). That is, the 2004 model was amended to reflect the separate sub-catchment that drains to BP1.

'Bligh Park' RAFTS Model

For the remainder (and majority) of the study area, a separate RAFTS model was developed to assess the design flows for the 20 year, 50 year, 100 year, 200 year, 500 year and PMF events.

Table 1 lists the 'existing conditions' sub-catchment details.

Since there was no data to allow the 'Bligh Park' model to be calibrated, the principal catchment rural RAFTS flows were compared with a Probabilistic Rational Method (PRM) 100 year flow estimate as per the procedure presented in ARR, **Reference 4**. The details of the PRM flow calculations are presented in **Table 2**.

TABLE 2: PROBABILISTIC RATIONAL METHOD 100 YEAR FLOW

Principal Catchment (to Rifle Range Road)	
tc (minutes)	45
I (mm/h) for 45minutes	78.8
Area (ha)	99.1
C_{100}	0.52
Q	= 0.278*0.52*78.8*0.991
	11.28 m^3/s

Since the Probabilistic Rational Method is used for rural catchment assessments, the RAFTS sub-catchments were adjusted to reflect rural conditions as follows before comparing the 100 year flows with the PRM value:

Catchment	100% pervious
PERN	0.05
Initial Loss	10mm
Continuing Loss	2.5mm/hr

The design rainfall IFD data was consistent with that used in the 2004 *Thorley Street study* (**Reference 5**). The RAFTS B_x factor was adjusted and the model re-run until there was a 'good' match between the peak runoff response and PRM flow value. The resultant B_x value was 0.82 (and it is noted this is very similar to the value derived in the *Thorley Street study*).

The calibrated RAFTS model was then adjusted to reflect both existing development conditions in each of the sub-catchments (as per **Table 1**) and the Colonial Reserve basin, and the design PERN and loss values are presented in **Table 3**.

TABLE 3: RAFTS MODELLING PARAMETERS

	Losses	PERN
Urban (Pervious)		**0.025**
Initial loss (mm) **Continuing loss (mm/h)**	**10** **2.5**	
Urban (Impervious)		**0.015**
Initial loss (mm) **Continuing loss (mm/h)**	**1.5** **0**	

For the Colonial Reserve basin, its stage-storage relationship was defined by the project surveyors and the stage-discharge relationship was developed through an iterative process using results from the initial hydraulic model runs. That is, a series of flow profiles were developed from running a range of flows through the HEC-RAS model. This exercise produced a series of water levels at the outlet of the basin which were then imported back into RAFTS as the stage-discharge relationship. The RAFTS model was re-run and the revised RAFTS flows were then used as HEC-RAS inputs for each of the design events.

The stage-storage relationships for each 'point of interest' were also provided by the project surveyors for use in RAFTS. The corresponding stage-discharge relationships were derived by Bewsher Consulting using a weir calculation at each sag point's spill control point and each basin model also included a nominal 100mm diameter pipe outlet in order to allow the basin to empty. Details of key ground levels at such point of interest are included in **Appendix B**.

After inclusion of all of the above information concerning current day catchment conditions, the RAFTS models were run over a series of storm durations for each of the design flood events. Outputs from the model are presented in **Table 4** in the form of both peak flows

TABLE 4: BLIGH PARK DESIGN FLOOD FLOWS (m^3/s)

ARI = **20y**

RAFTS Node	Storm Duration min/hr																				Max
	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	1080	18	1440	24	
S1.0	5.95		5.55		**6.26**		5.54		3.92		3.31		2.87		3.02		2.16		2.10		6.26
S1.05_BP5	0.32		0.32		**0.35**		0.31		0.20		0.13		0.12		0.12		0.08		0.08		0.35
S1.1_BP9	2.40		2.20		**2.51**		2.22		1.61		1.20		1.05		1.07		0.75		0.72		2.51
Col_Bsn	8.29		7.67		**8.71**		7.75		5.49		4.51		3.91		4.09		2.91		2.82		8.71
S1.2_BP11	1.74		1.60		**1.79**		1.65		1.10		0.85		0.74		0.76		0.54		0.52		1.79
S1.3	9.01		8.35		**9.26**		8.18		6.04		5.15		7.13		7.61		4.17		5.94		9.26
S1.4	1.18		1.09		**1.21**		1.13		0.74		0.58		0.50		0.52		0.37		0.36		1.21
S1.5	1.89		1.74		**1.96**		1.81		1.21		0.93		0.81		0.83		0.58		0.56		1.96
Dummy	10.79		10.21		**11.23**		10.81		7.62		6.51		8.17		8.63		4.82		6.80		11.23
S1.6	11.21		10.78		**11.94**		11.49		8.28		7.52		9.39		9.78		5.72		7.77		11.94
S2.0_BP1	5.51		5.17		**5.87**		5.30		3.74		2.80		2.45		2.50		1.73		1.67		5.87
BSN_US	9.42		8.85		**10.05**		9.04		6.38		4.71		4.12		4.21		2.91		2.80		10.05
BSN_DS	1.10		2.69		2.95		3.21		2.98		3.17		3.33		**3.60**		2.46		2.64		3.60
S3.0_BP2	1.05		0.99		**1.13**		1.02		0.70		0.48		0.42		0.43		0.29		0.28		1.13
BP2_Out	0.93		0.90		**1.05**		0.92		0.64		0.48		0.42		0.43		0.29		0.28		1.05
S4.0_BP3	1.73		1.62		**1.89**		1.65		1.18		0.82		0.72		0.73		0.50		0.48		1.89
BP3_Out	1.69		1.58		**1.82**		1.62		1.16		0.82		0.72		0.73		0.50		0.48		1.82
S5.0_BP6	2.60		2.42		**2.66**		2.66		2.02		1.47		1.29		1.31		0.90		0.87		2.66
S5.1_BP7	2.98		3.17		3.31		**3.49**		2.78		2.10		1.84		1.88		1.30		1.25		3.49
Out	2.96		3.16		3.25		**3.45**		2.73		2.09		1.83		1.87		1.30		1.25		3.45
S6.0_BP8	2.29		2.16		**2.47**		2.27		1.56		1.11		0.97		0.99		0.68		0.65		2.47
BP8_Out	2.20		2.05		**2.37**		2.15		1.53		1.11		0.97		0.99		0.68		0.65		2.37
S7.0_BP13	2.97		2.78		**3.15**		2.92		1.98		1.44		1.26		1.28		0.88		0.85		3.15
BP13_Out	2.92		2.74		**3.11**		2.83		1.97		1.43		1.25		1.28		0.88		0.85		3.11

Storage Properties Associated with Sag Points within Colonial Reserve Basin Catchment

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3)	Total Inflow Avail	Vol. Used
S1.05_BP5	30.0	0.35	30.0	0.34	0.0	47.2
S1.1_BP9	30.0	2.51	30.0	2.45	0.0	244.0
Col_Bsn	30.0	8.71	93.0	0.99	0.0	15574.6
S1.2_BP11	30.0	1.79	31.0	1.55	0.0	413.9

TOP WATER LEVELS @ Road Sag Points (mAHD)

RAFTS Node	Storm Duration min/hr																				Top Water Level (mAHD)
	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	1080	18	1440	24	
S1.05_BP5	21.99		21.99		**22.00**		22.00		21.97		21.95		21.95		21.95		21.93		21.93		22.00
S1.1_BP9	18.65		18.65		**18.65**		18.65		18.63		18.62		18.61		18.62		18.61		18.60		18.65
Col_Bsn	18.39		18.54		18.58		18.60		18.60		18.61		18.64		**18.64**		18.61		18.62		18.64
S1.2_BP11	18.14		18.13		**18.14**		18.13		18.11		18.09		18.08		18.08		18.05		18.05		18.14
S2.0_BP1	18.13		18.12		**18.14**		18.13		18.09		18.06		18.05		18.05		18.02		18.02		18.14
BSN_US	17.31		17.50		17.52		17.53		17.52		17.53		17.54		**17.56**		17.48		17.49		17.56
S3.0_BP2	17.35		17.35		**17.36**		17.35		17.34		17.30		17.29		17.29		17.26		17.25		17.36
S4.0_BP3	17.30		17.29		**17.30**		17.29		17.27		17.25		17.25		17.25		17.24		17.23		17.30
S5.0_BP6	18.84		18.83		18.85		**18.85**		18.80		18.75		18.73		18.74		18.69		18.69		18.85
S5.1_BP7	17.32		17.33		17.33		**17.34**		17.32		17.30		17.29		17.30		17.28		17.27		17.34
S6.0_BP8	17.34		17.34		**17.35**		17.34		17.32		17.30		17.30		17.30		17.28		17.28		17.35
S7.0_BP13	17.50		17.49		**17.50**		17.50		17.47		17.46		17.45		17.45		17.43		17.43		17.50

TABLE 4: BLIGH PARK DESIGN FLOOD FLOWS (m^3/s)

ARI = **50y**

RAFTS Node	Storm Duration min/hr																				Max
	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	1080	18	1440	24	
S1.0	6.47		6.33		**7.10**		6.44		4.88		3.70		3.45		3.37		2.41		2.35		7.10
S1.05_BP5	0.36		0.36		**0.38**		0.36		0.24		0.15		0.14		0.13		0.09		0.09		0.38
S1.1_BP9	2.60		2.53		**2.86**		2.55		1.97		1.33		1.25		1.19		0.83		0.81		2.86
Col_Bsn	9.02		8.80		**9.91**		8.92		6.83		5.02		4.70		4.56		3.25		3.16		9.91
S1.2_BP11	1.87		1.81		**2.03**		1.83		1.37		0.94		0.88		0.85		0.59		0.58		2.03
S1.3	9.84		9.50		**10.54**		9.43		7.52		6.77		9.00		9.21		6.34		6.74		10.54
S1.4	1.28		1.23		**1.36**		1.25		0.90		0.64		0.60		0.58		0.41		0.40		1.36
S1.5	2.04		1.99		**2.25**		2.02		1.52		1.03		0.97		0.92		0.65		0.63		2.25
Dummy	11.85		11.75		**12.83**		12.14		9.41		7.69		10.34		10.48		7.21		7.71		12.83
S1.6	12.41		12.48		**13.74**		13.09		10.31		9.15		11.63		11.81		8.26		8.82		13.74
S2.0_BP1	6.01		5.92		**6.72**		6.02		4.62		3.08		2.91		2.77		1.93		1.87		6.72
BSN_US	10.26		10.15		**11.44**		10.32		7.83		5.18		4.90		4.66		3.23		3.14		11.44
BSN_DS	1.77		3.98		3.97		4.15		3.91		3.81		4.19		**4.22**		3.00		3.05		4.22
S3.0_BP2	1.15		1.14		**1.28**		1.16		0.85		0.53		0.50		0.48		0.33		0.32		1.28
BP2_Out	1.07		1.07		**1.22**		1.09		0.84		0.52		0.50		0.47		0.33		0.32		1.22
S4.0_BP3	1.89		1.91		**2.12**		1.93		1.43		0.90		0.86		0.81		0.56		0.54		2.12
BP3_Out	1.83		1.83		**2.05**		1.87		1.42		0.90		0.85		0.81		0.56		0.54		2.05
S5.0_BP6	2.92		2.85		**3.10**		**3.10**		2.47		1.62		1.53		1.45		1.01		0.98		3.10
S5.1_BP7	3.54		3.77		3.86		**4.11**		3.41		2.31		2.19		2.08		1.44		1.40		4.11
Out	3.51		3.75		3.79		**4.06**		3.35		2.30		2.18		2.07		1.44		1.40		4.06
S6.0_BP8	2.52		2.51		**2.80**		2.55		1.90		1.22		1.16		1.10		0.75		0.73		2.80
BP8_Out	2.40		2.40		**2.72**		2.46		1.87		1.22		1.16		1.09		0.75		0.73		2.72
S7.0_BP13	3.25		3.19		**3.59**		3.23		2.43		1.58		1.49		1.42		0.98		0.95		3.59
BP13_Out	3.19		3.15		**3.54**		3.20		2.41		1.58		1.49		1.42		0.98		0.95		3.54

Storage Properties Associated with Sag Points within Colonial Reserve Basin Catchment

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3)	Total Inflow Avail	Vol. Used
S1.05_BP5	30.0	0.38	30.0	0.38	0.0	48.6
S1.1_BP9	30.0	2.86	30.0	2.81	0.0	255.7
Col_Bsn	30.0	9.91	78.0	2.12	0.0	16581.7
S1.2_BP11	30.0	2.03	31.0	1.78	0.0	447.7

TOP WATER LEVELS @ Road Sag Points (mAHD)

RAFTS Node	Storm Duration min/hr																				Top Water Level (mAHD)
	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	1080	18	1440	24	
S1.05_BP5	22.00		22.00		**22.01**		22.00		21.98		21.96		21.96		21.95		21.94		21.94		22.01
S1.1_BP9	18.66		18.65		**18.66**		18.66		18.64		18.62		18.62		18.62		18.61		18.61		18.66
Col_Bsn	18.46		18.59		18.61		18.62		18.62		18.63		**18.65**		**18.65**		18.63		18.63		18.65
S1.2_BP11	18.14		18.14		**18.15**		18.14		18.12		18.10		18.09		18.09		18.06		18.06		18.15
S2.0_BP1	18.14		18.14		**18.16**		18.14		18.11		18.07		18.07		18.06		17.52		18.03		18.16
BSN_US	17.41		17.58		17.58		17.59		17.57		17.57		17.59		**17.59**		17.52		17.52		17.59
S3.0_BP2	17.36		17.36		**17.37**		17.36		17.35		17.31		17.30		17.30		17.26		17.26		17.37
S4.0_BP3	17.30		17.30		**17.31**		17.31		17.28		17.26		17.25		17.25		17.24		17.24		17.31
S5.0_BP6	18.87		18.87		18.88		**18.89**		18.84		18.77		18.76		18.75		18.70		18.70		18.89
S5.1_BP7	17.34		17.34		17.34		**17.35**		17.33		17.31		17.30		17.30		17.28		17.28		17.35
S6.0_BP8	17.35		17.35		**17.36**		17.35		17.33		17.31		17.31		17.30		17.28		17.28		17.36
S7.0_BP13	17.51		17.50		**17.51**		17.51		17.48		17.46		17.46		17.46		17.43		17.43		17.51

TABLE 4: BLIGH PARK DESIGN FLOOD FLOWS (m^3/s)

ARI = **100y**

RAFTS Node	Storm Duration min/hr																				Max
	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	1080	18	1440	24	
S1.0	7.37		7.20		**8.14**		7.31		5.26		4.16		3.64		3.78		2.73		2.68		8.14
S1.05_BP5	0.42		0.41		**0.43**		0.40		0.25		0.16		0.14		0.15		0.10		0.10		0.43
S1.1_BP9	2.95		2.93		**3.25**		2.93		2.09		1.49		1.32		1.34		0.94		0.92		3.25
Col_Bsn	10.26		10.07		**11.33**		10.17		7.33		5.64		4.95		5.11		3.66		3.60		11.33
S1.2_BP11	2.13		2.07		**2.33**		2.11		1.47		1.06		0.93		0.95		0.67		0.66		2.33
S1.3	11.19		10.83		**11.98**		10.73		8.03		8.48		9.67		10.39		7.64		7.73		11.98
S1.4	1.44		1.40		**1.55**		1.42		0.97		0.72		0.63		0.65		0.46		0.45		1.55
S1.5	2.33		2.29		**2.56**		2.32		1.61		1.16		1.02		1.04		0.73		0.71		2.56
Dummy	13.43		13.45		**14.67**		13.83		10.12		9.61		11.09		11.82		8.69		8.86		14.67
S1.6	14.13		14.35		**15.78**		15.01		11.16		11.29		12.48		13.34		9.90		10.15		15.78
S2.0_BP1	6.85		6.81		**7.66**		6.88		4.93		3.45		3.05		3.10		2.17		2.13		7.66
BSN_US	11.73		11.60		**13.06**		11.77		8.33		5.80		5.13		5.21		3.64		3.57		13.06
BSN_DS	2.49		5.05		5.04		**5.13**		4.35		4.59		4.51		4.82		3.48		3.51		5.13
S3.0_BP2	1.32		1.32		**1.47**		1.33		0.89		0.59		0.53		0.53		0.37		0.36		1.47
BP2_Out	1.25		1.26		**1.41**		1.26		0.88		0.59		0.52		0.53		0.37		0.36		1.41
S4.0_BP3	2.18		2.19		**2.42**		2.20		1.50		1.01		0.89		0.90		0.63		0.62		2.42
BP3_Out	2.08		2.10		**2.34**		2.13		1.49		1.01		0.89		0.90		0.63		0.62		2.34
S5.0_BP6	3.35		3.30		**3.56**		3.54		2.62		1.81		1.60		1.62		1.13		1.11		3.56
S5.1_BP7	4.12		4.37		4.43		**4.72**		3.63		2.58		2.29		2.32		1.63		1.59		4.72
Out	4.10		4.35		4.37		**4.68**		3.57		2.58		2.28		2.32		1.63		1.59		4.68
S6.0_BP8	2.90		2.87		**3.21**		2.90		2.00		1.36		1.21		1.22		0.85		0.83		3.21
BP8_Out	2.80		2.79		**3.12**		2.82		1.97		1.36		1.21		1.22		0.85		0.83		3.12
S7.0_BP13	3.68		3.66		**4.09**		3.69		2.57		1.76		1.56		1.58		1.11		1.08		4.09
BP13_Out	3.63		3.60		**4.03**		3.64		2.56		1.76		1.56		1.58		1.11		1.08		4.03

Storage Properties Associated with Sag Points within Colonial Reserve Basin Catchment

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3)	Total Inflow Avail	Vol. Used
S1.05_BP5	30.0	0.43	30.0	0.42	0.0	50.2
S1.1_BP9	30.0	3.25	30.0	3.19	0.0	268.2
Col_Bsn	30.0	11.33	74.0	2.87	0.0	17187.1
S1.2_BP11	30.0	2.33	31.0	2.04	0.0	486.5

TOP WATER LEVELS @ Road Sag Points (mAHD)

RAFTS Node	Storm Duration min/hr																				Top Water Level (mAHD)
	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	1080	18	1440	24	
S1.05_BP5	22.01		22.01		**22.01**		22.01		21.98		21.96		21.96		21.96		21.94		21.94		22.01
S1.1_BP9	18.66		18.66		**18.67**		18.66		18.65		18.63		18.62		18.62		18.61		18.61		18.67
Col_Bsn	18.51		18.61		18.63		18.64		18.63		18.64		18.65		**18.66**		18.64		18.64		18.66
S1.2_BP11	18.16		18.15		**18.17**		18.16		18.13		18.11		18.10		18.10		18.07		18.07		18.17
S2.0_BP1	18.16		18.16		**18.17**		18.16		18.12		18.08		18.07		18.07		18.04		18.04		18.17
BSN_US	17.48		17.63		17.63		**17.63**		17.60		17.61		17.61		17.62		17.55		17.55		17.63
S3.0_BP2	17.37		17.37		**17.38**		17.37		17.35		17.33		17.31		17.31		17.27		17.27		17.38
S4.0_BP3	17.32		17.32		**17.33**		17.32		17.29		17.26		17.26		17.26		17.24		17.24		17.33
S5.0_BP6	18.90		18.90		18.91		**18.92**		18.85		18.78		18.77		18.77		18.72		18.72		18.92
S5.1_BP7	17.35		17.36		17.36		**17.36**		17.34		17.31		17.31		17.31		17.29		17.29		17.36
S6.0_BP8	17.36		17.36		**17.37**		17.36		17.33		17.31		17.31		17.31		17.29		17.29		17.37
S7.0_BP13	17.51		17.51		**17.52**		17.51		17.49		17.47		17.46		17.46		17.44		17.44		17.52

TABLE 4: BLIGH PARK DESIGN FLOOD FLOWS (m^3/s)

ARI = **200y**

RAFTS	Storm Duration min/hr																
Node	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	Max
S1.0	8.04		7.88		**8.86**		8.00		5.75		4.53		3.97		4.07		8.86
S1.05_BP5	0.46		0.44		**0.47**		0.43		0.27		0.18		0.16		0.16		0.47
S1.1_BP9	3.27		3.19		**3.55**		3.19		2.28		1.62		1.42		1.44		3.55
Col_Bsn	11.22		11.00		**12.33**		11.13		7.99		6.14		5.38		5.51		12.33
S1.2_BP11	2.32		2.26		**2.53**		2.32		1.60		1.15		1.01		1.02		2.53
S1.3	12.26		11.76		**12.99**		11.72		8.79		9.59		10.56		11.25		12.99
S1.4	1.58		1.52		**1.70**		1.55		1.06		0.78		0.68		0.70		1.70
S1.5	2.55		2.50		**2.78**		2.54		1.76		1.25		1.10		1.12		2.78
Dummy	14.77		14.59		**15.99**		15.11		11.10		10.98		12.09		12.80		15.99
S1.6	15.57		15.65		**17.25**		16.42		12.27		12.82		13.63		14.46		17.25
S2.0_BP1	7.54		7.45		**8.33**		7.56		5.36		3.76		3.30		3.34		8.33
BSN_US	12.85		12.70		**14.24**		12.89		9.08		6.31		5.56		5.61		14.24
BSN_DS	3.19		5.86		5.84		**6.06**		4.79		5.31		4.99		5.24		6.06
S3.0_BP2	1.44		1.45		**1.59**		1.45		0.97		0.64		0.57		0.57		1.59
BP2_Out	1.37		1.38		**1.54**		1.39		0.96		0.64		0.56		0.57		1.54
S4.0_BP3	2.40		2.38		**2.63**		2.40		1.63		1.10		0.97		0.97		2.63
BP3_Out	2.29		2.29		**2.54**		2.32		1.62		1.10		0.97		0.97		2.54
S5.0_BP6	3.72		3.61		**3.87**		3.87		2.85		1.97		1.73		1.75		3.87
S5.1_BP7	4.58		4.78		4.85		**5.15**		3.97		2.81		2.48		2.50		5.15
Out	4.56		4.75		4.78		**5.10**		3.91		2.81		2.47		2.49		5.10
S6.0_BP8	3.18		3.14		**3.50**		3.17		2.18		1.48		1.31		1.32		3.50
BP8_Out	3.09		3.05		**3.41**		3.09		2.15		1.48		1.31		1.31		3.41
S7.0_BP13	4.05		4.00		**4.43**		4.05		2.80		1.92		1.69		1.70		4.43
BP13_Out	3.99		3.93		**4.37**		3.98		2.78		1.92		1.69		1.70		4.37

Storage Properties Associated with Sag Points within Colonial Reserve Basin Catchment

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3)	Total Inflow Avail	Vol. Used
S1.05_BP5	30.0	0.47	30.0	0.45	0.0	51.4
S1.1_BP9	30.0	3.55	30.0	3.48	0.0	277.5
Col_Bsn	30.0	12.33	64.0	3.61	0.0	17600.9
S1.2_BP11	30.0	2.53	31.0	2.22	0.0	513.3

TOP WATER LEVELS @ Road Sag Points (mAHD)

RAFTS	Storm Duration min/hr																Top Water Level (mAHD)
Node	25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	
S1.05_BP5	22.01		22.01		**22.01**		22.01		21.99		21.97		21.96		21.96		22.01
S1.1_BP9	18.67		18.67		**18.67**		18.67		18.65		18.63		18.63		18.63		18.67
Col_Bsn	18.54		18.63		18.64		18.64		18.64		18.65		18.66		**18.66**		18.66
S1.2_BP11	18.17		18.16		**18.18**		18.17		18.14		18.11		18.11		18.11		18.18
S2.0_BP1	18.17		18.17		**18.19**		18.17		18.13		18.09		18.08		18.08		18.19
BSN_US	17.53		17.66		17.66		**17.67**		17.62		17.64		17.63		17.64		17.67
S3.0_BP2	17.38		17.38		**17.39**		17.38		17.36		17.34		17.32		17.32		17.39
S4.0_BP3	17.33		17.33		**17.34**		17.33		17.29		17.27		17.26		17.26		17.34
S5.0_BP6	18.92		18.92		18.94		**18.94**		18.87		18.80		18.78		18.78		18.94
S5.1_BP7	17.36		17.36		17.36		**17.37**		17.35		17.32		17.31		17.31		17.37
S6.0_BP8	17.36		17.36		**17.37**		17.36		17.34		17.32		17.31		17.31		17.37
S7.0_BP13	17.52		17.52		**17.53**		17.52		17.50		17.47		17.46		17.46		17.53

TABLE 4: BLIGH PARK DESIGN FLOOD FLOWS (m^3/s)

ARI = **500y**

RAFTS Node	Storm Duration min/hr 25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	Max
S1.0	9.10		8.98		**10.04**		9.12		6.56		5.06		4.42		4.55		10.04
S1.05_BP5	**0.52**		0.49		0.52		0.48		0.30		0.20		0.18		0.18		0.52
S1.1_BP9	3.73		3.64		**4.06**		3.63		2.58		1.80		1.59		1.61		4.06
Col_Bsn	12.74		12.53		**13.99**		12.67		9.13		6.86		6.00		6.15		13.99
S1.2_BP11	2.64		2.58		**2.86**		2.63		1.81		1.28		1.13		1.15		2.86
S1.3	13.85		13.32		**14.72**		13.17		10.53		11.10		11.90		12.63		14.72
S1.4	1.78		1.72		**1.95**		1.75		1.22		0.87		0.77		0.78		1.95
S1.5	2.90		2.84		**3.17**		2.86		1.99		1.40		1.23		1.25		3.17
Dummy	16.71		16.57		**18.13**		17.06		12.64		12.69		13.61		14.37		18.13
S1.6	17.70		17.84		**19.67**		18.65		14.11		14.82		15.36		16.27		19.67
S2.0_BP1	8.53		8.50		**9.47**		8.56		6.05		4.20		3.69		3.73		9.47
BSN_US	14.57		14.50		**16.14**		14.62		10.24		7.04		6.20		6.26		16.14
BSN_DS	4.39		7.24		7.22		**7.73**		5.66		6.30		5.68		5.93		7.73
S3.0_BP2	1.67		1.66		**1.79**		1.65		1.09		0.72		0.63		0.64		1.79
BP2_Out	1.58		1.59		**1.73**		1.58		1.08		0.72		0.62		0.63		1.73
S4.0_BP3	2.73		2.71		**2.97**		2.72		1.83		1.22		1.08		1.09		2.97
BP3_Out	2.61		2.59		**2.86**		2.62		1.81		1.22		1.08		1.09		2.86
S5.0_BP6	4.25		4.11		**4.42**		4.38		3.21		2.19		1.93		1.95		4.42
S5.1_BP7	5.25		5.43		5.54		**5.83**		4.49		3.14		2.76		2.79		5.83
Out	5.23		5.40		5.45		**5.78**		4.44		3.13		2.75		2.79		5.78
S6.0_BP8	3.60		3.60		**3.96**		3.60		2.46		1.65		1.46		1.47		3.96
BP8_Out	3.49		3.49		**3.86**		3.50		2.43		1.65		1.45		1.47		3.86
S7.0_BP13	4.61		4.53		**5.03**		4.57		3.15		2.14		1.89		1.90		5.03
BP13_Out	4.52		4.46		**4.96**		4.49		3.13		2.14		1.88		1.90		4.96

Storage Properties Associated with Sag Points within Colonial Reserve Basin Catchment

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3)	Total Inflow Avail	Vol. Used
S1.05_BP5	30.0	0.52	30.0	0.51	0.0	53.2
S1.1_BP9	30.0	4.06	30.0	3.96	0.0	293.2
Col_Bsn	30.0	13.99	60.0	4.82	0.0	18224.0
S1.2_BP11	30.0	2.86	31.0	2.52	0.0	557.4

TOP WATER LEVELS @ Road Sag Points (mAHD)

RAFTS Node	Storm Duration min/hr 25	0.42	60	60	90	1.5	120	2	180	3	360	6	540	9	720	12	Top Water Level (mAHD)
S1.05_BP5	**22.02**		22.02		**22.02**		22.02		22.00		21.97		21.96		21.97		22.02
S1.1_BP9	18.67		18.67		**18.68**		18.67		18.66		18.64		18.63		18.63		18.68
Col_Bsn	18.56		18.65		18.66		18.66		18.66		18.66		18.67		**18.67**		18.67
S1.2_BP11	18.18		18.18		**18.19**		18.18		18.15		18.12		18.11		18.11		18.19
S2.0_BP1	18.19		18.19		**18.21**		18.19		18.14		18.10		18.09		18.09		18.21
BSN_US	17.60		17.71		17.71		**17.73**		17.66		17.68		17.66		17.67		17.73
S3.0_BP2	17.39		17.39		**17.40**		17.39		17.36		17.34		17.34		17.34		17.40
S4.0_BP3	17.34		17.34		**17.36**		17.34		17.30		17.27		17.26		17.27		17.36
S5.0_BP6	18.96		18.96		18.97		**18.98**		18.90		18.82		18.80		18.80		18.98
S5.1_BP7	17.37		17.38		17.38		**17.38**		17.36		17.33		17.32		17.32		17.38
S6.0_BP8	17.37		17.37		**17.38**		17.37		17.35		17.32		17.32		17.32		17.38
S7.0_BP13	17.53		17.53		**17.54**		17.53		17.50		17.48		17.47		17.47		17.54

TABLE 4: BLIGH PARK DESIGN FLOOD FLOWS (m^3/s)

ARI = **PMF**

RAFTS Node	Storm Duration min/hr 15	0.25	30	30	45	0.75	60	1	90	1.5	120	2	150	2.5	180	3	Max
S1.0	**37.51**		35.84		35.31		35.04		30.72		28.84		25.96		23.89		37.51
S1.05_BP5	**2.20**		1.78		1.55		1.41		1.21		1.09		0.96		0.88		2.20
S1.1_BP9	**15.63**		14.19		13.23		12.14		11.00		10.00		8.91		8.17		15.63
Col_Bsn	**52.88**		49.33		48.27		47.17		41.65		38.84		34.87		32.06		52.88
S1.2_BP11	**10.97**		9.76		9.34		8.75		7.82		7.14		6.37		5.84		10.97
S1.3	58.60		87.28		93.27		**93.29**		87.65		81.28		73.77		68.43		93.29
S1.4	**7.48**		6.61		6.33		6.00		5.36		4.91		4.39		4.02		7.48
S1.5	**12.01**		10.79		10.26		9.51		8.52		7.76		6.92		6.35		12.01
Dummy	73.31		97.19		104.79		**105.45**		99.93		92.26		84.22		78.35		105.45
S1.6	81.62		110.24		119.50		**120.62**		114.56		105.99		97.21		90.57		120.62
S2.0_BP1	**34.61**		32.31		30.74		28.32		25.54		23.19		20.67		18.92		34.61
BSN_US	**59.18**		54.81		51.45		47.53		42.91		38.90		34.66		31.71		59.18
BSN_DS	**55.70**		52.61		49.85		46.75		42.55		38.75		34.58		31.67		55.70
S3.0_BP2	**6.86**		6.06		5.35		5.05		4.39		3.94		3.50		3.20		6.86
BP2_Out	**6.71**		5.94		5.32		5.02		4.38		3.94		3.50		3.20		6.71
S4.0_BP3	**11.02**		10.05		9.13		8.44		7.46		6.72		5.98		5.47		11.02
BP3_Out	**10.87**		9.95		8.99		8.40		7.45		6.72		5.98		5.47		10.87
S5.0_BP6	**20.20**		17.56		15.81		15.09		13.35		12.09		10.77		9.85		20.20
S5.1_BP7	**26.50**		24.62		22.78		21.06		18.92		17.25		15.41		14.12		26.50
Out	**26.38**		24.48		22.59		21.06		18.92		17.22		15.40		14.11		26.38
S6.0_BP8	**14.47**		13.38		12.28		11.32		10.07		9.09		8.09		7.40		14.47
BP8_Out	**14.22**		13.05		11.96		11.28		10.05		9.09		8.08		7.40		14.22
S7.0_BP13	**18.56**		17.01		15.83		14.48		13.04		11.80		10.50		9.61		18.56
BP13_Out	**18.33**		16.86		15.67		14.48		13.03		11.79		10.50		9.61		18.33

Storage Properties Associated with Sag Points within Colonial Reserve Basin Catchment

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3)	Total Inflow Avail	Vol. Used
S1.05_BP5	8.0	2.20	8.0	2.21	0.0	96.9
S1.1_BP9	8.0	15.63	9.0	15.42	0.0	593.9
Col_Bsn	8.0	52.88	15.0	35.11	0.0	27828.8
S1.2_BP11	5.0	10.97	9.0	10.34	0.0	1490.8

TOP WATER LEVELS @ Road Sag Points (mAHD)

RAFTS Node	Storm Duration min/hr 15	0.25	30	30	45	0.75	60	1	90	1.5	120	2	150	2.5	180	3	Top Water Level (mAHD)
S1.05_BP5	**22.13**		22.11		22.10		22.09		22.08		22.07		22.06		22.06		22.13
S1.1_BP9	**18.81**		18.80		18.79		18.78		18.77		18.76		18.75		18.74		18.81
Col_Bsn	18.92		**18.98**		18.97		18.97		18.95		18.93		18.91		18.90		18.98
S1.2_BP11	**18.43**		18.41		18.40		18.39		18.37		18.35		18.33		18.32		18.43
S2.0_BP1	**18.50**		18.47		18.46		18.44		18.41		18.38		18.36		18.33		18.50
BSN_US	**18.18**		18.16		18.15		18.13		18.10		18.07		18.04		18.02		18.18
S3.0_BP2	**17.56**		17.55		17.53		17.52		17.51		17.50		17.49		17.47		17.56
S4.0_BP3	**17.49**		17.48		17.47		17.46		17.45		17.44		17.43		17.43		17.49
S5.0_BP6	**20.02**		19.87		19.75		19.70		19.59		19.51		19.42		19.35		20.02
S5.1_BP7	**17.62**		17.61		17.59		17.58		17.56		17.54		17.52		17.50		17.62
S6.0_BP8	**17.54**		17.53		17.51		17.50		17.49		17.47		17.46		17.45		17.54
S7.0_BP13	**17.68**		17.67		17.66		17.65		17.63		17.62		17.61		17.60		17.68

at sub-catchment outlets (reference **Figure 2**) and top water levels at each point of interest. The maximum flow and water level values are highlighted in bold text and it shows that the critical storm duration is typically 90 minutes for the 20 year ARI to 500 year ARI events and 15 minutes for the PMF event.

The table shows that the peak 100 year ARI flow at RAFTS node S1.3 is 11.98m^3/s. Since this node corresponds to the Probabilistic Rational Method Rifle Range Road outlet (reference **Table 2**) it's flow can be directly compared with the 100 year rural catchment peak flow (of 11.28m^3/s). That the comparison shows the urban catchment flow is only slightly larger than the rural catchment flow confirms that the Colonial Reserve basin has a significant retardation impact on downstream catchment peak flows.

Summaries of the RAFTS 100 year and 500 year ARI storm outputs are reproduced in **Appendix C**.

2.3.2 Hydraulic Modelling

Consistent with the approach that had been adopted in the earlier LHSS assessments, the TWG agreed that HEC-RAS one-dimensional flood modelling software would be appropriate to assess flood levels, etc. along the swale with specific interest at Guardian Crescent (BP10) and Rifle Range Road (BP12).

Therefore the project surveyors were briefed to survey a number of cross sections and these were used to create the swale's HEC-RAS model. Mannings 'n' roughness coefficients were assessed following first hand inspection of the swale and its overbank areas. The coefficients varied between 0.05 and 0.1 representing the difference between the mown swale areas and the downstream end of the channel which has some dense vegetation.

There are two hydraulic structures in the model; the first at Rifle Ridge Road consists of two box culverts (2100mm x 860mm) as shown in **Photo 2**, and the second at Berger Road consists of two 900mm diameter reinforced concrete pipes. As with earlier LHSS investigations, the TWG specified that the within study area's Rifle Range Road structure be modelled under 0% and 50% blockage regimes. The pipe under the swale is not included in the model since being a 'low flow' system it can only convey very small flows (and indeed on the fine weather day of its inspection it was observed to be full of water).

The RAFTS sub-catchment peak flows were directly used in the HEC-RAS model with intermediate flow values being interpolated between each sub-catchment 'outlet' point.

To adequately define flood levels along the swale as it passes through the most north-easterly developed areas, the model was extended as far as Berger Road. Similar to earlier LHSS investigations, the TWG specified that the following constant water level approach should be adopted at the model's downstream boundary. For the study area's 20 year ARI event, a Hawkesbury-Nepean (H-N) 5 year peak was adopted; for the 50 year ARI event, a H-N 10 year ARI peak was adopted; for the 100 year ARI event, a H-N 20 year ARI peak was adopted; for the 200 year ARI and 500 year ARI events, a H-N 50 year peak was adopted and for the PMF event, a H-N 100 year peak was adopted.

Table 5 lists the design Hawkesbury-Nepean River flood levels at Windsor which were supplied by the Department of Natural Resources.

TABLE 5: WINDSOR FLOOD LEVELS

ARI (years)	RL (m AHD)
5	11.1
10	12.3
20	13.7
50	15.7
100	17.3
200	18.7
500	20.2
PMF	26.4

It was subsequently found that the Hawkesbury-Nepean backwater levels were relevant except for the 20 year ARI and 50 year ARI study catchment flood events where the HEC-RAS model defaulted to a (higher) starting water level based on uniform flow calculations.

Details of the HEC-RAS model are presented in **Appendix D**.

3 FLOOD MODEL RESULTS

Table 6 lists all the critical duration 'basin' inflows (Q_{in}) and outflows (Q_{out}), peak basin water levels and roadway centreline depths for the RAFTS-modelled 'points of interest' while **Tables 7** and **8** detail the corresponding HEC-RAS-calculated results for BP10 and BP12 respectively. The peak water levels are also included in the **Appendix B** diagrams while the flood regime at each of the locations is described in the following sections.

Locality photographs are also reproduced in **Appendix E**.

3.1 ALEXANDER STREET (BP1)

Table 6 shows that the maximum road centreline depth at BP1 varies between 160 and 230mm over the range of 20 year to 500 year ARI.

As shown in **Appendix B**, initial spill associated with BP1 sees flows following the gutter at the intersection of Alexander Street and Wetherill Crescent. While the gutter level at that spill location is RL 17.75m, spill can only alternatively occur across the Bounty Reserve area (and then directly into the reserve's flood basin) when the ponding is about 250mm higher than that gutter level. This means that a significant amount of the BP1 spill volume would be directed into Wetherill Crescent and therefore contribute to the low point flooding described in **Section 3.11**.

3.2 SIRIUS ROAD (BP2)

Table 6 shows that the maximum road centreline depth at BP2 varies between 350 and 390mm over the range of 20 year to 500 year ARI. That these depths are relatively significant is reflective of the fact that spill is only initiated when the ponding exceeds RL 17.19m (as shown in **Appendix B** sketch) which is 180mm above the road centreline level at the sag point.

3.3 SIRIUS ROAD (BP3)

Table 6 shows that the maximum road centreline depth at BP3 varies between 210 and 270mm over the range of 20 year to 500 year ARI. These depths reflect the fact that spilll is only initiated when the ponding exceeds RL 17.21m which is 120mm above the road centreline level at the sag point (see **Appendix B** sketch).

TABLE 6: CENTRELINE DEPTHS AT POINTS OF INTEREST

20 year ARI

ID	Street Name	Flood Event	Initial Spill	Centreline @ sag point	Grate Level	Q_{in}	Q_{out}	Water Level	Depth @ centreline
		ARI	(m AHD)	(m AHD)	(m AHD)	(m^3/s)	(m^3/s)	(m AHD)	(m)
BP1	Alexander St	20	17.75	17.98	17.63	5.87	5.81	18.14	0.16
BP2	Sirius Rd	20	17.19	17.01	16.76	1.13	1.05	17.36	0.35
BP3	Sirius Rd	20	17.21	17.09	16.86	1.89	1.82	17.3	0.21
BP5	Harradine Cr	20	21.86	21.69	21.44	0.35	0.34	22	0.31
BP6	Marsden Cr	20	18.47	18.30	18.2	2.67	2.59	18.85	0.55
BP7	Rifle Range Rd	20	16.96	17.00	16.77	3.49	3.45	17.34	0.34
BP8	Rifle Range Rd	20	17.2	17.03	16.87	2.47	2.36	17.35	0.32
BP9	Colonial Drv	20	18.48	18.53	18.28	2.51	2.45	18.65	0.12
BP11	Colonial Drv	20	17.97	17.86	17.65	1.79	1.55	18.14	0.28
BP13	Porpoise Cr	20	17.39	17.26	17.02	3.15	3.11	17.5	0.24

50 year ARI

ID	Street Name	Flood Event	Initial Spill	Centreline @ sag point	Grate Level	Q_{in}	Q_{out}	Water Level	Depth @ centreline
		ARI	(m AHD)	(m AHD)	(m AHD)	(m^3/s)	(m^3/s)	(m AHD)	(m)
BP1	Alexander St	50	17.75	17.98	17.63	6.72	6.64	18.16	0.18
BP2	Sirius Rd	50	17.19	17.01	16.76	1.28	1.22	17.37	0.36
BP3	Sirius Rd	50	17.21	17.09	16.86	2.12	2.05	17.31	0.22
BP5	Harradine Cr	50	21.86	21.69	21.44	0.38	0.37	22.01	0.32
BP6	Marsden Cr	50	18.47	18.30	18.2	3.1	3.03	18.89	0.59
BP7	Rifle Range Rd	50	16.96	17.00	16.77	4.11	4.06	17.35	0.35
BP8	Rifle Range Rd	50	17.2	17.03	16.87	2.8	2.72	17.36	0.33
BP9	Colonial Drv	50	18.48	18.53	18.28	2.86	2.81	18.66	0.13
BP11	Colonial Drv	50	17.97	17.86	17.65	2.03	1.78	18.15	0.29
BP13	Porpoise Cr	50	17.39	17.26	17.02	3.6	3.54	17.51	0.25

100 year ARI

ID	Street Name	Flood Event	Initial Spill	Centreline @ sag point	Grate Level	Q_{in}	Q_{out}	Water Level	Depth @ centreline
		ARI	(m AHD)	(m AHD)	(m AHD)	(m^3/s)	(m^3/s)	(m AHD)	(m)
BP1	Alexander St	100	17.75	17.98	17.63	7.66	7.6	18.17	0.19
BP2	Sirius Rd	100	17.19	17.01	16.76	1.47	1.41	17.38	0.37
BP3	Sirius Rd	100	17.21	17.09	16.86	2.42	2.34	17.33	0.24
BP5	Harradine Cr	100	21.86	21.69	21.44	0.43	0.42	22.01	0.32
BP6	Marsden Cr	100	18.47	18.30	18.2	3.54	3.46	18.92	0.62
BP7	Rifle Range Rd	100	16.96	17.00	16.77	4.72	4.68	17.36	0.36
BP8	Rifle Range Rd	100	17.2	17.03	16.87	3.21	3.12	17.37	0.34
BP9	Colonial Drv	100	18.48	18.53	18.28	3.25	3.19	18.67	0.14
BP11	Colonial Drv	100	17.97	17.86	17.65	2.33	2.04	18.17	0.31
BP13	Porpoise Cr	100	17.39	17.26	17.02	4.09	4.03	17.52	0.26

TABLE 6: CENTRELINE DEPTHS AT POINTS OF INTEREST

200 year ARI

ID	Street Name	Flood Event	Initial Spill	Centreline @ sag point	Grate Level	Q_{in}	Q_{out}	Water Level	Depth @ centreline
		ARI	(m AHD)	(m AHD)	(m AHD)	(m^3/s)	(m^3/s)	(m AHD)	(m)
BP1	Alexander St	200	17.75	17.98	17.63	8.33	8.25	18.19	0.21
BP2	Sirius Rd	200	17.19	17.01	16.76	1.59	1.54	17.39	0.38
BP3	Sirius Rd	200	17.21	17.09	16.86	2.63	2.54	17.34	0.25
BP5	Harradine Cr	200	21.86	21.69	21.44	0.47	0.45	22.01	0.32
BP6	Marsden Cr	200	18.47	18.30	18.2	3.89	3.78	18.94	0.64
BP7	Rifle Range Rd	200	16.96	17.00	16.77	5.15	5.1	17.37	0.37
BP8	Rifle Range Rd	200	17.2	17.03	16.87	3.5	3.41	17.37	0.34
BP9	Colonial Drv	200	18.48	18.53	18.28	3.55	3.48	18.67	0.14
BP11	Colonial Drv	200	17.97	17.86	17.65	2.53	2.22	18.18	0.32
BP13	Porpoise Cr	200	17.39	17.26	17.02	4.43	4.37	17.53	0.27

500 year ARI

ID	Street Name	Flood Event	Initial Spill	Centreline @ sag point	Grate Level	Q_{in}	Q_{out}	Water Level	Depth @ centreline
		ARI	(m AHD)	(m AHD)	(m AHD)	(m^3/s)	(m^3/s)	(m AHD)	(m)
BP1	Alexander St	500	17.75	17.98	17.63	9.47	9.35	18.21	0.23
BP2	Sirius Rd	500	17.19	17.01	16.76	1.79	1.73	17.4	0.39
BP3	Sirius Rd	500	17.21	17.09	16.86	2.97	2.86	17.36	0.27
BP5	Harradine Cr	500	21.86	21.69	21.44	0.52	0.51	22.02	0.33
BP6	Marsden Cr	500	18.47	18.30	18.2	4.38	4.29	18.98	0.68
BP7	Rifle Range Rd	500	16.96	17.00	16.77	5.83	5.78	17.38	0.38
BP8	Rifle Range Rd	500	17.2	17.03	16.87	3.96	3.86	17.38	0.35
BP9	Colonial Drv	500	18.48	18.53	18.28	4.06	3.96	18.68	0.15
BP11	Colonial Drv	500	17.97	17.86	17.65	2.86	2.52	18.19	0.33
BP13	Porpoise Cr	500	17.39	17.26	17.02	5.03	4.96	17.54	0.28

PMF

ID	Street Name	Flood Event	Initial Spill	Centreline @ sag point	Grate Level	Q_{in}	Q_{out}	Water Level	Depth @ centreline
		ARI	(m AHD)	(m AHD)	(m AHD)	(m^3/s)	(m^3/s)	(m AHD)	(m)
BP1	Alexander St	PMF	17.75	17.98	17.63	34.61	34.22	18.50	0.52
BP2	Sirius Rd	PMF	17.19	17.01	16.76	6.86	6.71	17.56	0.55
BP3	Sirius Rd	PMF	17.21	17.09	16.86	11.02	10.87	17.49	0.40
BP5	Harradine Cr	PMF	21.86	21.69	21.44	2.20	2.21	22.13	0.44
BP6	Marsden Cr	PMF	18.47	18.30	18.2	20.19	19.70	20.02	1.72
BP7	Rifle Range Rd	PMF	16.96	17.00	16.77	26.49	26.38	17.62	0.62
BP8	Rifle Range Rd	PMF	17.2	17.03	16.87	14.47	14.22	17.54	0.51
BP9	Colonial Drv	PMF	18.48	18.53	18.28	15.63	15.42	18.81	0.28
BP11	Colonial Drv	PMF	17.97	17.86	17.65	10.97	10.34	18.43	0.57
BP13	Porpoise Cr	PMF	17.39	17.26	17.02	18.56	18.33	17.68	0.42

3.4 HARRADINE CRESCENT/JACOBS PLACE (BP5)

Table 6 shows that the maximum road centreline depth at BP5 varies between 310 and 330mm over the range of 20 year to 500 year ARI. While these depths are significant, it is noted that the sag point is actually in the Jacobs Place cul-de-sac (as shown in **Appendix B** sketch). The corresponding centreline depth in Harradine Crescent is only nominal (being less than 50mm).

3.5 MARSDEN CRESCENT (BP6)

Table 6 shows that the maximum road centreline depth at BP6 varies between 550 and 680mm over the range of 20 year to 500 year ARI. That these depths are relatively significant is reflective of two factors; (a) spill is only initiated when the ponding exceeds the gutter level at the intersection of Marsden Crescent and Jenkyn Place (i.e. RL 18.47m) which is 170mm above the road centreline level at the sag point, and (b) the catchment is relatively large and therefore the flows are also relatively large.

3.6 RIFLE RANGE ROAD (BP7)

Table 6 shows that the maximum road centreline depth at BP7 varies between 340 and 380mm over the range of 20 year to 500 year ARI.

3.7 RIFLE RANGE ROAD (BP8)

Table 6 shows that the maximum road centreline depth at BP8 varies between 320 and 350mm over the range of 20 year to 500 year ARI. These depths reflect the fact that spill is only initiated when the ponding exceeds RL 17.20m (as shown in **Appendix B** sketch) which is 170mm above the road centreline level at the sag point.

TABLE 7: BP10 SUMMARY

RAFTS Node: **Col_Bsn**
Low Point ID: **BP10**
Road Centreline Level: 18.50 mAHD

ARI (Year)	Flow (m3/s)	Level (mAHD)	Depth @ Centreline (m)
20	1.0	18.59	0.09
50	2.1	18.62	0.12
100	2.9	18.65	0.15
200	3.6	18.67	0.17
500	4.8	18.70	0.20
PMF	35.1	19.67[1]	1.17[1]

Note 1: Since in the HEC-RAS model it is assumed that all contributing catchment runoff is conveyed via the formal swale system, the PMF level and depth values are considered to be conservative.

TABLE 8: BP12 SUMMARY
0% Blockage

RAFTS Node: **S1.3**
Low Point ID: **BP12**
Road Centreline Level: 17.23 mAHD

ARI (Year)	Flow (m3/s)	Level (mAHD)	Depth @ Centreline (m)
20	9.3	17.21	-
50	10.5	17.06	-
100	12.0	17.32	0.09
200	13.0	17.50	0.27
500	14.7	17.57	0.34
PMF	93.3	18.00	0.77

TABLE 8: BP12 SUMMARY

50% Blockage

RAFTS Node: **S1.3**
Low Point ID: **BP12**
Spill Level: 17.23 mAHD

ARI (Year)	Flow (m3/s)	Level (mAHD)	Depth @ Centreline (m)
20	9.3	17.53	0.30
50	10.5	17.54	0.31
100	12.0	17.55	0.32
200	13.0	17.57	0.34
500	14.7	17.60	0.37
PMF	93.3	17.93	0.70

3.8 COLONIAL RESERVE BASIN, COLONIAL DRIVE (BP9), GUARDIAN CRESCENT (BP10) AND COLONIAL DRIVE (BP11)

Table 6 shows that the maximum road centreline depth at BP9 varies between 120 and 150mm over the range of 20 year to 500 year ARI, **Table 7** shows that the maximum road centreline depth at BP10 varies between 90 and 200mm over the range of 20 year to 500 year ARI and **Table 6** shows that the maximum road centreline depth at BP11 varies between 280 and 330mm over the range of 20 year to 500 year ARI.

It is important to note that the ponding regimes at BP9, BP10 and BP11 should not be treated in isolation since the RAFTS modelling results indicate that their flood issues are interrelated. That is, although they are (necessarily) modelled as being independent, the results actually indicate otherwise. In particular as discussed below and shown in the **Appendix B** sketches, ponding in the basin and at BP9 are interrelated and their spill regimes impact on ponding at BP11.

- When the RAFTS model results for the Colonial Reserve basin are compared with the ground level survey, they indicate that when the top water levels are reached there would be water ponding in both adjoining Colonial Drive (where BP9 is located) and Guardian Crescent. It can be seen from **Table 4** and **Appendix B** that the generated maximum ponding levels in the basin and at BP9 are very similar for each design recurrence interval. In addition, the tabulated 'storage properties' in **Table 4** show that the basin's peak outflow condition occurs approximately one hour after the time of the peak inflow into the basin. It therefore follows that typically there would be prolonged flooding at BP9 due firstly to local catchment runoff and then the basin itself reaching its top water level.

- While the flows from BP9 should discharge into the basin – and this is how the stormwater pipes at BP9 are aligned (and also the flow regime is reflected in the RAFTS model) – the ground level survey data indicates that this is not necessarily the case. That is, while the **Appendix B** sketch shows that the initial spill from BP9 is towards the intersection of Colonial Drive and Guardian Crescent, the ground level data in the sketch also shows that at that intersection the spill can occur in two locations. Firstly, around the intersection gutter into Guardian Crescent and secondly, along the northern gutter of Colonial Drive. Whereas the first flowpath sees the flows still potentially reaching the Colonial Reserve basin, the second flowpath sees flows spilling towards BP11 (and therefore never spilling into the basin). Additionally, the **Appendix B** sketch shows that calculated peak water levels in the basin are such that a small portion of its outflows would also spill at the same intersection and hence also spill towards BP11.

  Hence there would be a flowpath operating along Colonial Drive between BP9 and BP11 and the centreline depths at BP11 would increase.

The above discussion notes show how the ponding regimes associated with the Colonial Reserve basin, BP9, BP10 and BP11 are all inter-related. Noting that both Colonial Drive and Guardian Crescent are flood evacuation routes, additional modelling — preferably using 2D hydraulic modelling software — is necessary if a better picture is required of that interrelationship and/or to assess works to reduce the problems.

3.9 RIFLE RANGE ROAD (BP12)

Table 8 shows that for the 0% blockage case, the road is not overtopped in either the 20 year or 50 year ARI events and the maximum road centreline depth varies between 90mm and 340mm over the range of 100 year to 500 year ARI. For the 50% blockage case the roadway is overtopped in all the design events and the maximum road centreline depth varies between 320mm and 370mm over the range of 100 year to 500 year ARI.

(The HEC-RAS software uses any one of a number of built-in approaches to assess culvert performance. The selected approach is based on a number of factors including adjacent computed water levels and culvert waterway area, invert and obvert levels, etc. On occasions the software can adopt a different analysis approach even though the culvert flow regime may seem little different to another ARI event. This can result in apparent anomalies in the computed flood levels at and near the culvert; e.g. the PMF flood levels tabulated in Table 8 and the 50 year ARI flood profiles plotted in Appendix D.)

3.10 PORPOISE CRESCENT (BP13)

Table 6 shows that the maximum road centreline depth at BP13 varies between 240 and 280mm over the range of 20 year to 500 year ARI.

3.11 WETHERILL CRESCENT SAG POINT

One of the questionnaire respondents living in Wetherill Crescent (and adjacent to the Bounty Reserve retarding basin) reported that they had once experienced water ponding to the point of entering their garage. They described how there was firstly water in the street, it then ponded in the nature strip and then continued to rise until it was at the point of entering the garage. They reported that this occurred in a storm in December 2004. While they also described seeing street ponding happening about three times over a six year period they did not recall any times that vehicles had been unable to use the street. This last recollection differed from a questionnaire returned by a nearby resident who wrote that the street had been impassable to vehicles on two or three occasions over about 4½ years.

Council gathered additional ground level data in the first resident's property and in Bounty Reserve. When combined with earlier ground level survey, the data showed:

- the local sag point pit in the street has a grate level of RL17.02m;
- there is a bank between the Wetherill Crescent roadway and the retarding basin. While there is a depression in that bank (where the minimum level is RL 17.4m) the bank levels are typically greater than RL 17.8m. (These levels show that in circumstances where the basin is filling and the street stormwater system performance is impacted by the basin then there would be not less than 400mm of

ponding in the street before the excess stormwater can commence spilling into the basin); and

- the resident's garage level is approximately RL 18.1m.

While the 2004 *Thorley Street* study did not look at floodtime conditions in the basin itself, it did determine top water levels at the basin's weir outlet which exists in the unformed portion of Thorley Street near the bus depot. That analysis determined that the peak 100 year flood level was about RL 17.6m. Running a slightly modified version of the same RAFTS model for the Bligh Park study, re-produced that 100 year level and also determined that the 20 year flood level would be about RL 17.5m.

That those basin water levels are well below the resident's garage level indicates that there must have been some local factor affecting the water level in Wetherill Crescent. Without any information about the magnitude of the December 2004 storm (and it is noted that there were some reports of local flooding but no major problems were reported to Council) it is impossible to quantify the peak rate of runoff associated with the Wetherill Crescent catchment. Nonetheless, testing a range of potential peak flows — of say 1.5 to 2.0m^3/s — that conceivably might have been generated by the December 2004 storm, and modelling them as 'weiring' over the bank between the street and the basin, showed that the peak water level in the street would be elevated but still be somewhat below the resident's observed water level.

Given that:

- there is no evidence to suggest that the resident 's recollections are inaccurate;

- It is unlikely that the basin's outlet weir was obstructed since a Council officer had undertaken a post December 2004 event inspection and only noted that the weir was overgrown;

- it is unlikely that there would have been waves generated by vehicles since local traffic would not have been able to negotiate the deep water in the street;

it is concluded that the water level in the street was elevated due to the extra flow that has arrived at the sag point due to spill from BP1 (as described in **Section 3.1**).

It is understood that in response to instances of elevated water levels in the vicinity of the basin, the Thorley Street weir levels were modified to increase the basin's outlet capacity. However the above description of one nearby resident's problems in the December 2004 event is a strong indication that there are still problems associated with the basin or at least with how surcharge flows enter the basin. Further analysis — including possible modelling of the December 2004 storm — is considered necessary if works are to be considered to address the problem.

4. CONCLUSIONS

As discussed in **Section 3**, the hydrologic and hydraulic flood modelling undertaken for this study indicates that there are pockets of potentially significant flooding in the Bligh Park local road network.

One particularly significant location is BP12 where Rifle Range Road crosses the main swale. This is of particular importance since it provides the only evacuation route for the population living east of the crossing.

Another significant location relates to the operation of the larger of the study area's two flood retarding basins – in Colonial Reserve. It is recommended that a 2D hydraulic model be established during the Stage 2 study if a better picture is required of the local area ponding regime in the vicinity of the reserve and/or to assess works to reduce the problems. With regard to the other flood retarding basin in Bounty Reserve, further analysis — including modelling of the December 2004 storm — may also be required in the Stage 2 study if local works are to be considered. Depending on the extent of the additional modelling, extra survey information may be required for either or both locations.

It is also noted that the future assessment of local overland flows may be more focussed on storm events less than the 100 year ARI event. In that situation, the modelling undertaken for this study may need to be enhanced such that the capacity of in-ground pipe systems can be formally assessed. This would also require detailed survey of the pipe systems.

5. REFERENCES

1. Hawkesbury-Nepean Flood Management Advisory Committee (1997). "*Achieving a Hawkesbury-Nepean Floodplain Management Strategy"*. November.

2. Department of Land and Water Conservation (2000). "*Interim Regional Road Evacuation Route Upgrade Plan"*. April.

3. Bewsher Consulting (2003). "*Road Evacuation Route Upgrade Strategy, Local Hydraulic Specification Study"*. May. Commissioned by the Department of Sustainable Resources.

4. Institution of Engineers (Aust) (2005). "*Australian Rainfall and Runoff".*

5. Bewsher Consulting (2004). "*Thorley Street (Bligh Park) Flood Evacuation Route LHSS"*. Commissioned by the Department of Infrastructure, Planning and Natural Resources. September. Bewsher Consulting, Job Number J1327.

APPENDIX A

RESIDENT LETTER AND QUESTIONNAIRE

Our Ref: CN 88242, 79346

8 July 2005

Dear Resident,

REQUEST FOR ASSISTANCE REGARDING OVERLAND FLOW STUDY

Council has received funding assistance from the Commonwealth and State Government to undertake an Overland Flow Study for Hobartville and Bligh Park.

This study is the culmination of previous reports undertaken by the NSW State Government entitled "Achieving a Hawkesbury-Nepean Floodplain Management Strategy", 1997 and "Interim Regional Road Evacuation Route Upgrade Plan", 2000.

Key population centres including Richmond (Hobartville) and Bligh Park were identified to have improved evacuation routes. To ensure effectiveness of the regional evacuation routes, local evacuation route constraints need to be investigated.

A study of potential stormwater flooding at a number of low points in Hobartville and Bligh Park is being undertaken and one of those locations is adjacent to your property. The Study is being undertaken by Bewsher Consulting (consulting engineers) on behalf of Council.

It would be of considerable assistance in the assessment of potential flooding if you could share any knowledge you might have of occasions when there has been ponding in the street (and whether or not that ponding has been such that there have also been ponding problems within your property).

To assist with this process, a questionnaire has been prepared and you will find it enclosed with this letter. It would be appreciated if you could complete the questionnaire and return it to Council (using the replied paid envelope supplied) by Wednesday, 20 July 2005.

If you have any queries regarding the study, please do not hesitate to contact either myself on the number listed below or Mr Don Still of Bewsher Consulting (telephone no. 9686 1966).

Yours faithfully

Christopher Amit
Manager Design & Mapping Services

Direct Line : (02) 4560 4508

HAWKESBURY COUNCIL
LOCAL OVERLAND FLOW STUDY
JULY 2005

IMPORTANT QUESTIONNAIRE

Concerning Low Point Flooding in Bligh Park

Please complete this questionnaire for the property in which you have an interest.

House No ____ or Lot No. _____ Street Name_____

Name (optional) _____

Name of Business/Organisation (if applicable) _____

PART A: GENERAL INFORMATION

1. Type of development?

(Tick one or more boxes)

a. House ☐
b. Business. ☐
Please indicate type_____
c. Vacant land ☐
d. Other . ☐
Please specify _____
_____

2. Your residential status of the property

a. Owner residing or conducting business at property ☐
b. Tenant only ☐
c. Owner not residing nor conducting business at property ☐
d. Other. Please specify
_____

3. How long have you owned, lived at or conducted business at this property?

a. Less than 1 year ☐
b. 1 year to 5 years ☐
c. 5 years to 20 years ☐
d. More than 20 years ☐
If more than 20 years, how long? (_____Years)

PART B: FLOOD EXPERIENCE

4. Have you ever experienced water ponding in or flowing through the property ?

a. No ☐ (go to Question 7)
b. Yes ☐

If yes, which storms?
a. August 1986 ☐
b. April/May 1988 ☐
February 1990 ☐
d. August 1990 ☐
c. February 1992 ☐
d. Other ☐

If other, please specify the date or dates

5. What was the <u>date of the biggest storm event</u> you have experienced?

In that storm was the property flooded above <u>floor level</u>?

a. No ☐
b. Yes ☐

If yes, what was the depth of the water over the floor?

6. **In the biggest storm, what was the maximum depth of water in the property (as best you can remember)?**

7. **Have you ever observed flooding in the street adjacent to your property?**

a. No ☐ (go to Question 8)
b. Yes ☐

How many times have you observed water in the street?_____

Over how many years have those observations been made?_____

How many of those times was the street so badly flooded that cars could not pass through it?_____

Can you identify the month and year of the worst flooding in the street?_____

8. **This question is a repeat of Question 7 for those persons who are able to provide information for any other street flood problems other than adjacent to their property**

Location? _____ _____

How many times have you observed water in the street? _____ _____

Over how many years have those observations been made? _____ _____

How many of those times was the street so badly flooded that cars could not pass through it? _____ _____

Can you identify the month and year of the worst flooding at the low point? _____ _____

Please place your completed questionnaire in the postage paid envelope provided and return it to Council by Wednesday, 20 July 2005.

No postage stamp is required. If you have misplaced the supplied envelope or wish to send an additional submission the address is:

Reply paid Permit Number 352
FLOOD QUESTIONNAIRE
Bewsher Consulting Pty Ltd
P.O. Box 352,
EPPING NSW 1710

For additional questionnaires or further information, please contact:

Mr Christopher Amit
Hawkesbury City Council
PO Box 146
WINDSOR NSW 2756
Phone: (02) 4560 4444
Facsimile: (02) 4560 4400
E-mail: council@hawkesbury.nsw.gov.au

OR

Mr Don Still
Bewsher Consulting Pty Ltd
PO Box 352
EPPING NSW 1710
Phone: (02) 9868 1966
Facsimile: (02) 9868 5759.
E-mail: postmaster@bewsher.com.au

Thank you again for being part of this study

APPENDIX B

‘POINT OF INTEREST’ BASIN SKETCHES

BP1 Water Levels

(ARI)	(m AHD)
20	18.14
50	18.16
100	18.17
200	18.19
500	18.21
PMF	18.50

Garage inundation reported in this property

There is a history of significant flooding at this low point.

Bounty Reserve Basin

BP1

Sag gutter level is ~17.75m, spill initially occurs here before 'second stage' spill occurs into reserve (at 17.94 level)

C 'crest'

LP 'low point'

[Defined stage–storage relationship to RL 18.40m]

Alexander Street

Wetherill Cres

Carpark

Fullerton Cres

Legend

- Survey mark
- Power pole
- Light pole
- Elect. junction box
- Telephone Box
- Telephone pole
- Telstra cable marker
- Telstra single pit
- Telstra twin pit
- Telstra main pit
- Telstra distribution pillar
- Sewer manhole
- Water hydrant
- Stop valve
- Water meter
- Water Tap
- Gully Pit ot Gutter Line
- Inlet to drain sump
- Underground Power Service Pillar
- Transformer Cabinet
- Storm water junction box
- Unidentified service
- WL Water level point
- 17.89 Spot height
- Power line
- Table drain
- Tree area
- Centre line
- Edge pavement
- Guard rail
- Major contours 1.0m
- Minor contours 0.2m
- Fence line
- Cross Section
- Culvert showing direction of flow
- tb Top Bank
- bb Bottom Bank

Fence Type Legend

BK	Brick Wall
CB	Colourbond Fence
KL	Kopper Log Wall
PC	Picket Fence
PL	Paling Fence
SL	Sleeper Ret. Wall
ST	Steel Tube Fence
WM	Wire Mesh Fence
NF	No Fence

ZONE	REF.	REVISION	BY	CKD	DATE

SURVEY SERVICES
LEVEL 5
10 VALENTINE AVE
PARRAMATTA 2150

HAWKESBURY - OVERLAND FLOW STUDY
BLIGH PARK

State water

SURVEYED: DPG | FIELD BOOK: FB238 | DATE: 3/06/05 | DRAWING:\2070-RICHMOND | A3
DATUM: AHD | RL ORIGIN: SSM61300 & SSM 61321 | COORD. SYSTEM: ISG Zone 56/1
DRAWN:CMcC | DATE: 20/06/05 | EXAMINED: DPG | SCALE: 1:1000 | PLAN No: 2070 SHT2 of 11

N

BP2 Water Levels

(ARI)	(mAHD)
20	17.36
50	17.37
100	17.38
200	17.39
500	17.40
PMF	17.56

BP3 Water Levels

(ARI)	(mAHD)
20	17.30
50	17.31
100	17.33
200	17.34
500	17.36
PMF	17.49

BP3

BP2

Neighbourhood Centre

Shopping Centre

Bus Shelter

Scarsborough Crescent

Road

Sirius

Crest

Defined stage - storage relationship to RL 17.8m

low point key level adjacent to property frontage; spill in N direction commences when water level exceeds about 17.21m

low point key level at property frontage; spill in NW direction commences when water level exceeds about 17.19m

Defined stage - storage relationship to RL 17.8m

LP 'low point'

Legend

- Survey mark
- Power pole
- Light pole
- Elect. junction box
- Telephone Box
- Telephone pole
- Telstra cable marker
- Telstra single pit
- Telstra twin pit
- Telstra main pit
- Telstra distribution pillar
- Sewer manhole
- Water hydrant
- Stop valve
- Water meter
- Water Tap
- Gully Pit at Gutter Line
- Inlet to drain sump
- Underground Power Service Pillar
- Transformer Cabinet
- Storm water junction box
- Unidentified service
- Water level point
- 17.89 Spot height
- Power line
- Table drain
- Tree area
- Centre line
- Edge pavement
- Guard rail
- Major contours 1.0m
- Minor contours 0.2m
- Fence line
- Cross Section
- Culvert showing direction of flow
- Top Bank
- Bottom Bank

Fence Type Legend

BK	Brick Wall
CB	Colourbond Fence
KL	Kopper Log Wall
PC	Picket Fence
PL	Paling Fence
SL	Sleeper Ret. Wall
ST	Steel Tube Fence
WM	Wire Mesh Fence
NF	No Fence

ZONE	REF.	REVISION	BY	CKD	DATE

SURVEY SERVICES
LEVEL 5
10 VALENTINE AVE
PARRAMATTA 2150

Overland Flow Study
Bligh Park

sydney water

SURVEYED: DPG	FIELD BOOK: FB238	DATE: 3/06/05	DRAWING FILE: 2070-Richmond	A3
DATUM: AHD	RL ORIGIN: SSM 61300, SSM 61321		COORD. SYSTEM: ISG Zone 56/1	
DRAWN: MDH	DATE: 21/6/05	EXAMINED: DPG	SCALE: 1:1000	PLAN NO: 2070 SHT 3 of 11

E:\J1434\2070-Bligh Park Sh3_Sirius Rd_2000.dwg, 24/../05 02:29:44 PM, 1:1

Broome Place

Studdy Close

Walter Close

Crescent

Harradine

Jacobs Place

N

BP5 (composite weir relationship needed)

BP5 water Levels

(ARI)	(mAHD)
20	22.00
50	22.01
100	22.01
200	22.01
500	22.02
PMF	22.13

approx. crest level in gutter; spill from low point occurs when water level exceeds about 21.86m. Initially spill occurs in an E direction but 'second stage' spill could occur in W direction (RL 21.99m)

Defined stage-storage relationship to RL 23.0m

LP low point

Legend

- Survey mark
- Power pole
- Light pole
- Elect. junction box
- Telephone Box
- Telephone pole
- Telstra cable marker
- Telstra single pit
- Telstra twin pit
- Telstra main pit
- Telstra distribution pillar
- Sewer manhole
- Water hydrant
- Stop valve
- Water meter
- Water Tap
- Gully Pit at Gutter Line
- Inlet to drain sump
- Underground. Power Service Pillar
- Transformer Cabinet
- Storm water junction box
- Unidentified service
- Water level point
- 17.89 Spot height
- Power line
- Table drain
- Tree area
- Centre line
- Edge pavement
- Guard rail
- Major contours 1.0m
- Minor contours 0.2m
- Fence line
- Cross Section
- Culvert showing direction of flow
- tb — tb — Top Bank
- bb — bb — Bottom Bank

Fence Type Legend

- BK Brick Wall
- CB Colourbond Fence
- KL Kopper Log Wall
- PC Picket Fence
- PL Paling Fence
- SL Sleeper Ret. Wall
- ST Steel Tube Fence
- WM Wire Mesh Fence
- NF No Fence

ZONE	REF.	REVISION	BY	CKD	DATE

SURVEY SERVICES
LEVEL 5
10 VALENTINE AVE
PARRAMATTA 2150

Overland Flow Study
Bligh Park

State water

SURVEYED: DPG	FIELD BOOK: FB238	DATE: 3/06/05	DRAWING FILE: 2070-Richmond	A3
DATUM: AHD	RL ORIGIN: SSM 61308, SSM 61321	COORD. SYSTEM: ISG Zone 56/1		
DRAWN: MDH	DATE: 22/6/05	EXAMINED: DPG	SCALE: 1:1000	PLAN NO: 2070 SHT 4 of 11

Defined stage-storage relationship ± RL 18.4m

BP7

PB7 water levels (ARI)	(m AHD)
20	17.34
50	17.35
100	17.36
200	17.37
500	17.38
PMF	17.62

low point key level appears to be 17.2lm spill will occur in NE direction when water level exceeds this value

N

PB8 water levels (ARI)	(m AHD)
20	17.35
50	17.36
100	17.37
200	17.37
500	17.38
PMF	17.54

Defined stage-storage relationship ± RL 18.0m

low point key level (closest to boundary low point), 17.20m; NE spill will occur when water level exceeds this level.

BP8

PB6 water levels (ARI)	(m AHD)
20	18.85
50	18.89
100	18.92
200	18.94
500	18.98
PMF	20.02

BP6

spill will most likely occur down Jenkyn Pl. because corner allotment levels (ref. 18.60 & 18.66) are higher than gutter level (18.47m?)

Defined stage-storage to RL 19.0m

low point

Rd

Jenkyn Pl

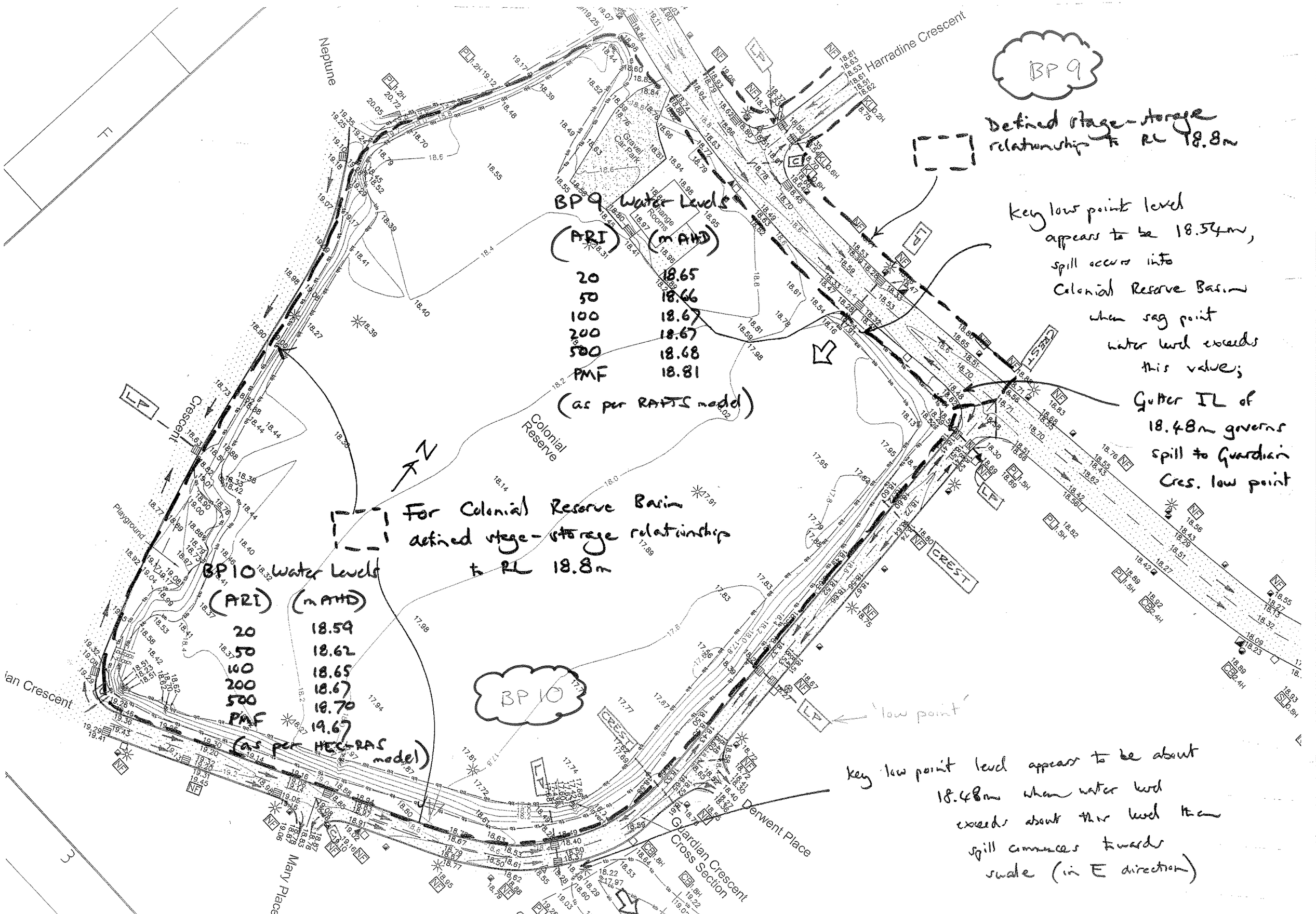
Marsden

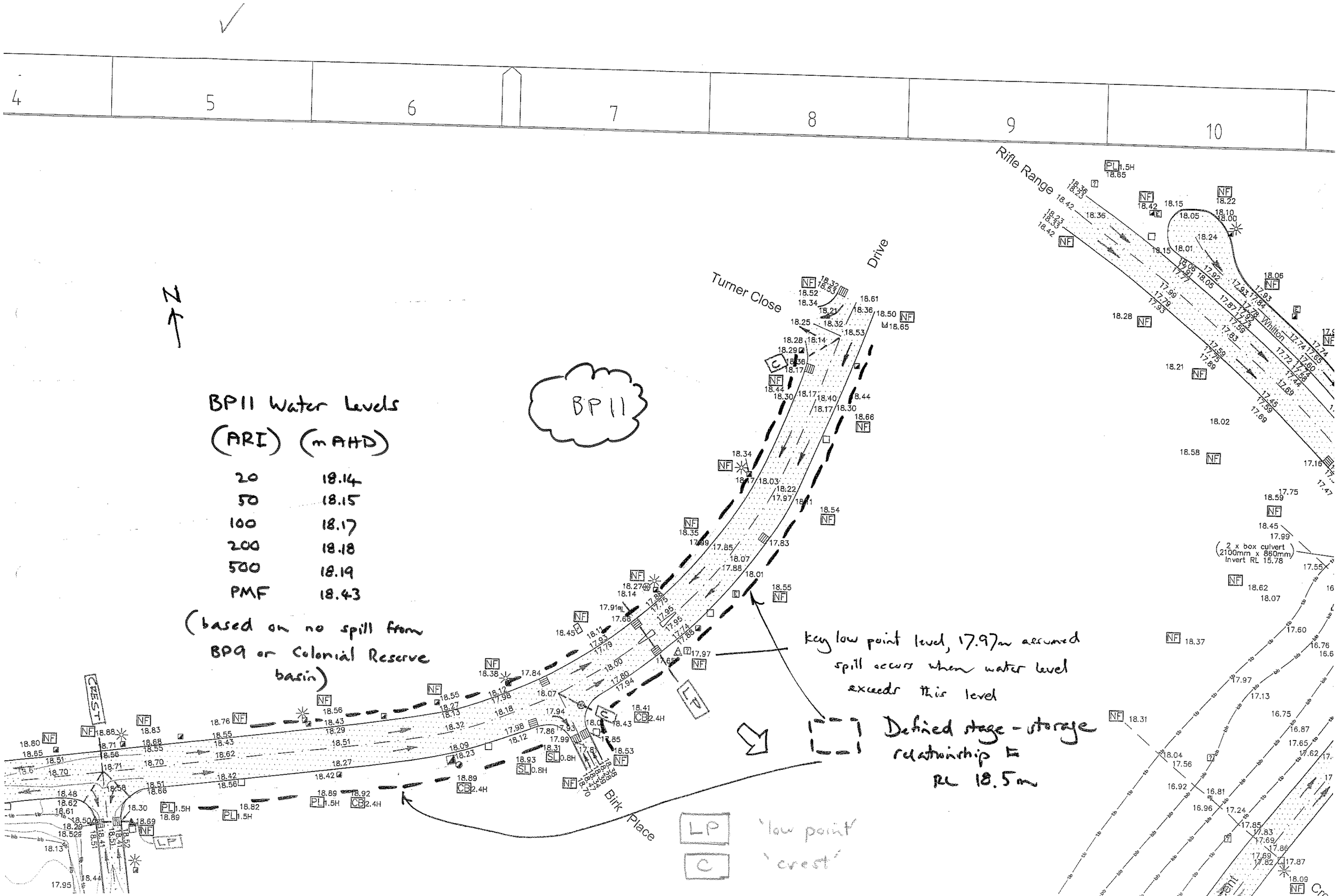
Range

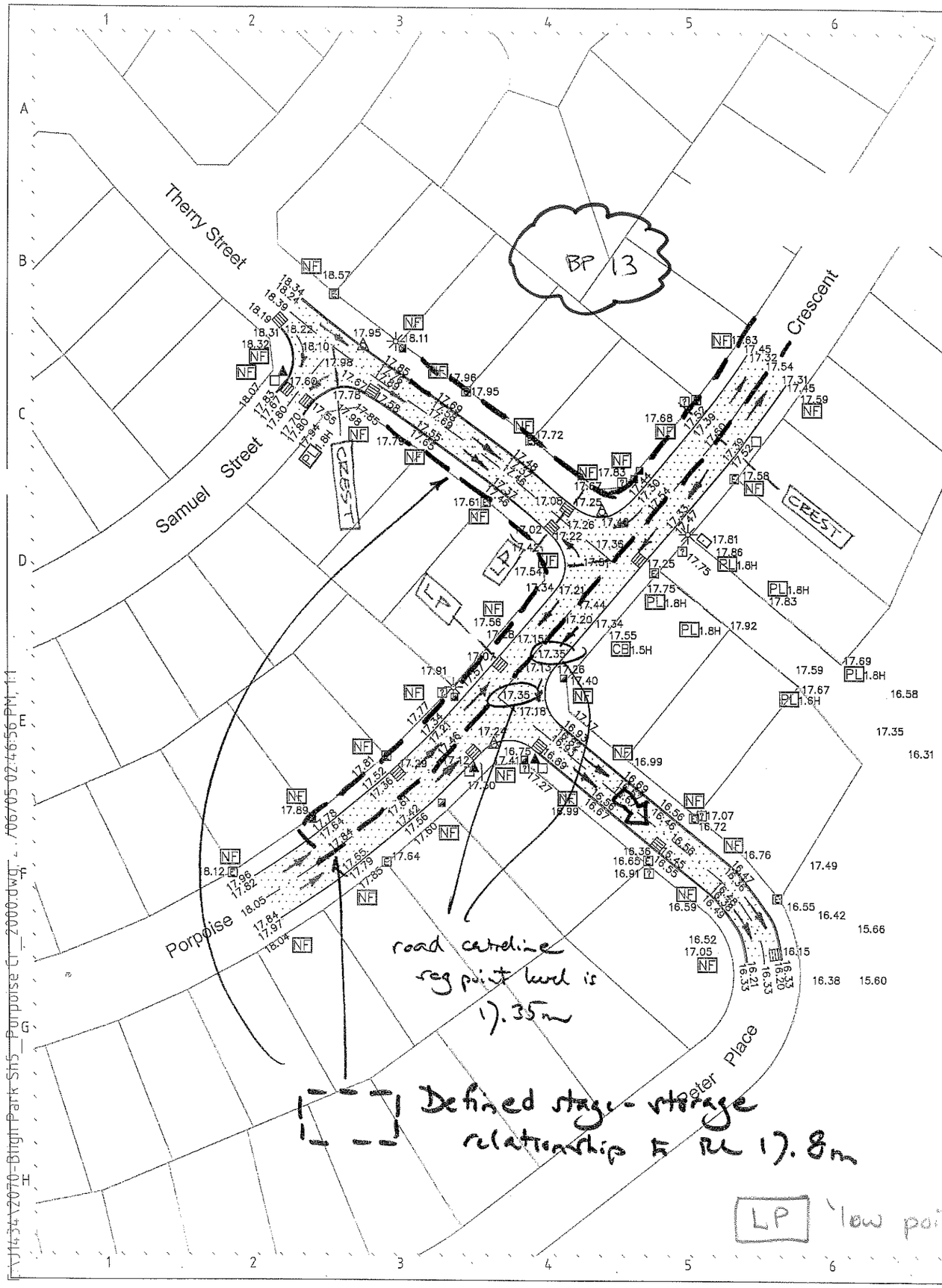
Rifle

Collith Ave

CREST


BP9
Defined stage-storage relationship to RL 18.8m
BP9 Water Levels
(ARI) (mAHD)
20 18.65
50 18.66
100 18.67
200 18.67
500 18.68
PMF 18.81
(as per RAFTS model)
Key low point level appears to be 18.54m, spill occurs into Colonial Reserve Basin when sag point water level exceeds this value;
Gutter IL of 18.48m governs spill to Guardian Cres. low point
For Colonial Reserve Basin defined stage-storage relationship to RL 18.8m
BP10 Water Levels
(ARI) (mAHD)
20 18.59
50 18.62
100 18.65
200 18.67
500 18.70
PMF 19.67
(as per HEC-RAS model)
BP10
Key low point level appears to be about 18.48m when water level exceeds about this level then spill commences towards swale (in E direction)
Neptune Crescent
Harradine Crescent
Colonial Reserve
Gravel Car Park
Range Rooms
Playground
Mary Place
Guardian Crescent Cross Section
Derwent Place
CREST
LP
low point


4
5
6
7
8
9
10
Rifle Range
Turner Close
Drive
Whitton
Birk Place
CREST
BP11
BP11 Water Levels
(ARI) (m AHD)
20 18.14
50 18.15
100 18.17
200 18.18
500 18.19
PMF 18.43
(based on no spill from BP9 or Colonial Reserve basin)
key low point level, 17.97m assumed spill occurs when water level exceeds this level
Defined stage - storage relationship = RL 18.5m
LP 'low point'
C 'crest'
2 x box culvert (2100mm x 860mm) Invert RL 15.78



BP 13 Water Levels

(ARI)	(mAHD)
20	17.50
50	17.51
100	17.52
200	17.53
500	17.54
PMF	17.68

N

Legend

- Survey mark
- Power pole
- Light pole
- Elect. junction box
- Telephone Box
- Telephone pole
- Telstra cable marker
- Telstra single pit
- Telstra twin pit
- Telstra main pit
- Telstra distribution pillar
- Sewer manhole
- Water hydrant
- Stop valve
- Water meter
- Water Tap
- Gully Pit at Gutter Line
- Inlet to drain sump
- Underground Power Service Pillar
- Transformer Cabinet
- Storm water junction box
- Unidentified service
- WL Water level point
- 17.89 Spot height
- Power line
- Table drain
- Tree area
- Centre line
- Edge pavement
- Guard rail
- Major contours 1.0m
- Minor contours 0.2m
- Fence line
- Cross Section
- Culvert showing direction of flow
- tb Top Bank
- bb Bottom Bank

Fence Type Legend

BK	Brick Wall
CB	Colourbond Fence
KL	Kopper Log Wall
PC	Picket Fence
PL	Paling Fence
SL	Sleeper Ret. Wall
ST	Steel Tube Fence
WM	Wire Mesh Fence
NF	No Fence

ZONE | REF. | REVISION | BY | CKD | DATE

SURVEY SERVICES
LEVEL 5
10 VALENTINE AVE
PARRAMATTA 2150

Overland Flow Study
Bligh Park

SURVEYED: DPG | FIELD BOOK: FB238 | DATE: 3/06/05 | DWG FILE: 2070-Richmond | A3
DATUM: AHD | RL ORIGIN: SSM 61300, SSM 61321 | COORD. SYSTEM: ISG Zone 56/1
DRAWN: MDH | DATE: 21/6/05 | EXAMINED: DPG | SCALE: 1:1000 | PLAN NO: 2070 SHT 5 of 11

APPENDIX C

RAFTS MODEL OUTPUTS

100 YEAR ARI OUTPUT

MAIN BLIGH PARK RAFTS MODEL

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	25.
RETURN PERIOD (YRS)	=	100.
BX	=	0.8200
TOTAL OF FIRST SUB-AREAS (km2)	=	58.31
TOTAL OF SECOND SUB-AREAS (km2)	=	42.86
TOTAL OF ALL SUB-AREAS (km2)	=	101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	108.30	10.00	1.500	2.500	0.000	34.292	43.625	7.365	15.00	0.000
S1.05_BP5	108.30	10.00	1.500	2.500	0.000	34.292	43.625	0.4175	15.00	2.500
S1.1_BP9	108.30	10.00	1.500	2.500	0.000	34.292	43.625	2.952	15.00	0.000
Col_Bsn	108.30	10.00	0.000	2.500	0.000	34.292	0.000	10.258	15.00	6.000
S1.2_BP11	108.30	10.00	1.500	2.500	0.000	34.292	43.625	2.128	15.00	4.000
S1.3	108.30	10.00	1.500	2.500	0.000	34.292	43.625	11.193	15.00	2.500
S1.4	108.30	10.00	1.500	2.500	0.000	34.292	43.625	1.442	15.00	0.000
S1.5	108.30	10.00	1.500	2.500	0.000	34.292	43.625	2.325	15.00	0.000
Dummy	108.30	10.00	0.000	2.500	0.000	34.292	0.000	13.433	16.00	3.000
S1.6	108.30	10.00	0.000	2.500	0.000	34.292	0.000	14.126	19.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	15.00	.4175	15.00	.4021	374.19	0.0000	49.530	22.008
S1.1_BP9	15.00	2.951	15.00	2.892	3467.0	0.0000	258.51	18.661
Col_Bsn	15.00	10.26	188.0	.0261	13427.7	0.0000	13066.1	18.505
S1.2_BP11	15.00	2.127	16.00	1.891	2498.7	0.0000	464.38	18.157

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 60.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	66.800	10.00	1.500	2.500	0.000	54.758	65.300	7.202	25.00	0.000
S1.05_BP5	66.800	10.00	1.500	2.500	0.000	54.758	65.300	0.4081	25.00	2.500
S1.1_BP9	66.800	10.00	1.500	2.500	0.000	54.758	65.300	2.928	25.00	0.000
Col_Bsn	66.800	10.00	0.000	2.500	0.000	54.758	0.000	10.065	25.00	6.000
S1.2_BP11	66.800	10.00	1.500	2.500	0.000	54.758	65.300	2.071	25.00	4.000
S1.3	66.800	10.00	1.500	2.500	0.000	54.758	65.300	10.826	25.00	2.500
S1.4	66.800	10.00	1.500	2.500	0.000	54.758	65.300	1.395	25.00	0.000
S1.5	66.800	10.00	1.500	2.500	0.000	54.758	65.300	2.287	25.00	0.000
Dummy	66.800	10.00	0.000	2.500	0.000	54.758	0.000	13.452	26.00	3.000
S1.6	66.800	10.00	0.000	2.500	0.000	54.758	0.000	14.349	29.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	25.00	.4081	25.00	.3991	575.62	0.0000	49.421	22.008
S1.1_BP9	25.00	2.927	25.00	2.863	5343.8	0.0000	257.54	18.661
Col_Bsn	25.00	10.07	63.00	2.147	20754.5	0.0000	16599.8	18.612
S1.2_BP11	25.00	2.071	26.00	1.840	3827.0	0.0000	456.79	18.154

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	52.600	10.00	1.500	2.500	0.000	65.608	77.400	8.141	30.00	0.000
S1.05_BP5	52.600	10.00	1.500	2.500	0.000	65.608	77.400	0.4302	30.00	2.500
S1.1_BP9	52.600	10.00	1.500	2.500	0.000	65.608	77.400	3.247	30.00	0.000

Col_Bsn	52.600	10.00	0.000	2.500	0.000	65.608	0.000	11.331	30.00	6.000
S1.2_BP11	52.600	10.00	1.500	2.500	0.000	65.608	77.400	2.330	30.00	4.000
S1.3	52.600	10.00	1.500	2.500	0.000	65.608	77.400	11.981	30.00	2.500
S1.4	52.600	10.00	1.500	2.500	0.000	65.608	77.400	1.552	30.00	0.000
S1.5	52.600	10.00	1.500	2.500	0.000	65.608	77.400	2.558	30.00	0.000
Dummy	52.600	10.00	0.000	2.500	0.000	65.608	0.000	14.665	31.00	3.000
S1.6	52.600	10.00	0.000	2.500	0.000	65.608	0.000	15.780	34.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	30.00	.4302	30.00	.4220	684.80	0.0000	50.238	22.010
S1.1_BP9	30.00	3.247	30.00	3.190	6355.5	0.0000	268.21	18.667
Col_Bsn	30.00	11.33	74.00	2.873	24706.4	0.0000	17187.1	18.628
S1.2_BP11	30.00	2.330	31.00	2.040	4556.8	0.0000	486.50	18.166

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 10: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000

Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	44.200	10.00	1.500	2.500	0.000	74.025	86.900	7.310	35.00	0.000
S1.05_BP5	44.200	10.00	1.500	2.500	0.000	74.025	86.900	0.3996	35.00	2.500
S1.1_BP9	44.200	10.00	1.500	2.500	0.000	74.025	86.900	2.932	35.00	0.000
Col_Bsn	44.200	10.00	0.000	2.500	0.000	74.025	0.000	10.173	35.00	6.000
S1.2_BP11	44.200	10.00	1.500	2.500	0.000	74.025	86.900	2.109	35.00	4.000
S1.3	44.200	10.00	1.500	2.500	0.000	74.025	86.900	10.730	35.00	2.500
S1.4	44.200	10.00	1.500	2.500	0.000	74.025	86.900	1.420	34.00	0.000
S1.5	44.200	10.00	1.500	2.500	0.000	74.025	86.900	2.324	35.00	0.000
Dummy	44.200	10.00	0.000	2.500	0.000	74.025	0.000	13.829	38.00	3.000
S1.6	44.200	10.00	0.000	2.500	0.000	74.025	0.000	15.006	41.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	35.00	.3996	35.00	.3899	770.19	0.0000	49.094	22.007
S1.1_BP9	35.00	2.932	36.00	2.902	7152.6	0.0000	258.83	18.662
Col_Bsn	35.00	10.17	82.00	3.314	27872.0	0.0000	17444.6	18.635
S1.2_BP11	35.00	2.108	37.00	1.865	5133.9	0.0000	460.47	18.156

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 8:20.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 180.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1	#2	Pern #1	#2	B #1	#2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	34.500	10.00	1.500	2.500	0.000	86.750	102.00	5.264	45.00	0.000
S1.05_BP5	34.500	10.00	1.500	2.500	0.000	86.750	102.00	0.2516	45.00	2.500
S1.1_BP9	34.500	10.00	1.500	2.500	0.000	86.750	102.00	2.092	45.00	0.000
Col_Bsn	34.500	10.00	0.000	2.500	0.000	86.750	0.000	7.326	45.00	6.000
S1.2_BP11	34.500	10.00	1.500	2.500	0.000	86.750	102.00	1.466	45.00	4.000
S1.3	34.500	10.00	1.500	2.500	0.000	86.750	102.00	8.026	45.00	2.500
S1.4	34.500	10.00	1.500	2.500	0.000	86.750	102.00	0.9677	45.00	0.000
S1.5	34.500	10.00	1.500	2.500	0.000	86.750	102.00	1.612	45.00	0.000
Dummy	34.500	10.00	0.000	2.500	0.000	86.750	0.000	10.115	45.00	3.000
S1.6	34.500	10.00	0.000	2.500	0.000	86.750	0.000	11.157	48.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	45.00	.2516	45.00	.2512	903.33	0.0000	42.485	21.984
S1.1_BP9	45.00	2.091	45.00	2.062	8392.8	0.0000	227.28	18.645
Col_Bsn	45.00	7.326	92.00	3.246	32697.6	0.0000	17409.2	18.634
S1.2_BP11	45.00	1.465	45.00	1.389	6012.8	0.0000	389.99	18.128

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
                    to 20: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 360.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	22.500	10.00	1.500	2.500	0.000	111.75	133.50	4.156	120.0	0.000
S1.05_BP5	22.500	10.00	1.500	2.500	0.000	111.75	133.50	0.1632	118.0	2.500
S1.1_BP9	22.500	10.00	1.500	2.500	0.000	111.75	133.50	1.485	120.0	0.000
Col_Bsn	22.500	10.00	0.000	2.500	0.000	111.75	0.000	5.636	120.0	6.000
S1.2_BP11	22.500	10.00	1.500	2.500	0.000	111.75	133.50	1.056	120.0	4.000
S1.3	22.500	10.00	1.500	2.500	0.000	111.75	133.50	8.477	150.0	2.500
S1.4	22.500	10.00	1.500	2.500	0.000	111.75	133.50	0.7170	120.0	0.000
S1.5	22.500	10.00	1.500	2.500	0.000	111.75	133.50	1.155	120.0	0.000
Dummy	22.500	10.00	0.000	2.500	0.000	111.75	0.000	9.612	150.0	3.000
S1.6	22.500	10.00	0.000	2.500	0.000	111.75	0.000	11.285	153.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	118.0	.1632	119.0	.1629	1174.3	0.0000	37.110	21.962
S1.1_BP9	120.0	1.484	120.0	1.480	10904.0	0.0000	194.80	18.627
Col_Bsn	120.0	5.636	151.0	3.877	42466.4	0.0000	17739.5	18.643
S1.2_BP11	120.0	1.056	120.0	1.042	7819.2	0.0000	338.57	18.108

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

```
################################################################################
Bligh Park- Existing Conditions 100y ARI

Results for period from  0: 0.0  1/ 1/1990
                     to  9:20.0  2/ 1/1990
################################################################################
```

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	540.
RETURN PERIOD (YRS)	=	100.
BX	=	0.8200
TOTAL OF FIRST SUB-AREAS (km2)	=	58.31
TOTAL OF SECOND SUB-AREAS (km2)	=	42.86
TOTAL OF ALL SUB-AREAS (km2)	=	101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1 (%)	#2	Pern #1	#2	B #1	#2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	17.700	10.00	1.500	2.500	0.000	128.80	157.80	3.638	300.0	0.000
S1.05_BP5	17.700	10.00	1.500	2.500	0.000	128.80	157.80	0.1449	300.0	2.500
S1.1_BP9	17.700	10.00	1.500	2.500	0.000	128.80	157.80	1.315	300.0	0.000
Col_Bsn	17.700	10.00	0.000	2.500	0.000	128.80	0.000	4.948	300.0	6.000
S1.2_BP11	17.700	10.00	1.500	2.500	0.000	128.80	157.80	0.9272	300.0	4.000
S1.3	17.700	10.00	1.500	2.500	0.000	128.80	157.80	9.674	300.0	2.500
S1.4	17.700	10.00	1.500	2.500	0.000	128.80	157.80	0.6310	300.0	0.000
S1.5	17.700	10.00	1.500	2.500	0.000	128.80	157.80	1.015	300.0	0.000
Dummy	17.700	10.00	0.000	2.500	0.000	128.80	0.000	11.089	303.0	3.000
S1.6	17.700	10.00	0.000	2.500	0.000	128.80	0.000	12.483	306.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	--------- Basin --------- Vol. Avail	Vol. Used	Stage Used
S1.05_BP5	300.0	.1449	300.0	.1449	1374.1	0.0000	36.009	21.957
S1.1_BP9	300.0	1.315	300.0	1.310	12754.3	0.0000	185.30	18.622
Col_Bsn	300.0	4.947	303.0	4.519	49585.5	0.0000	18075.4	18.652
S1.2_BP11	300.0	.9272	301.0	.9052	9147.5	0.0000	317.46	18.099

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 720.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	14.900	10.00	1.500	2.500	0.000	142.02	177.30	3.781	420.0	0.000
S1.05_BP5	14.900	10.00	1.500	2.500	0.000	142.02	177.30	0.1460	420.0	2.500
S1.1_BP9	14.900	10.00	1.500	2.500	0.000	142.02	177.30	1.335	420.0	0.000
Col_Bsn	14.900	10.00	0.000	2.500	0.000	142.02	0.000	5.114	420.0	6.000
S1.2_BP11	14.900	10.00	1.500	2.500	0.000	142.02	177.30	0.9479	420.0	4.000
S1.3	14.900	10.00	1.500	2.500	0.000	142.02	177.30	10.385	420.0	2.500
S1.4	14.900	10.00	1.500	2.500	0.000	142.02	177.30	0.6472	420.0	0.000
S1.5	14.900	10.00	1.500	2.500	0.000	142.02	177.30	1.035	420.0	0.000
Dummy	14.900	10.00	0.000	2.500	0.000	142.02	0.000	11.819	420.0	3.000
S1.6	14.900	10.00	0.000	2.500	0.000	142.02	0.000	13.339	423.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	420.0	.1460	420.0	.1460	1532.1	0.0000	36.079	21.957
S1.1_BP9	420.0	1.335	420.0	1.332	14216.7	0.0000	186.56	18.623
Col_Bsn	420.0	5.113	421.0	4.807	55198.9	0.0000	18219.3	18.656
S1.2_BP11	420.0	.9479	420.0	.9369	10200.6	0.0000	322.87	18.101

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 18:40.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 1080.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

Link Label	Average Intensity	Init. Loss #1	Init. Loss #2	Cont. Loss #1	Cont. Loss #2	Excess Rain #1	Excess Rain #2	Peak Inflow	Time to	Link Lag

	(mm/h)	(mm)		(mm/h)		(mm)		(m^3/s)	Peak	mins
S1.0	11.900	10.00	1.500	2.500	0.000	164.02	212.70	2.725	420.0	0.000
S1.05_BP5	11.900	10.00	1.500	2.500	0.000	164.02	212.70	0.1010	419.0	2.500
S1.1_BP9	11.900	10.00	1.500	2.500	0.000	164.02	212.70	0.9376	420.0	0.000
Col_Bsn	11.900	10.00	0.000	2.500	0.000	164.02	0.000	3.662	420.0	6.000
S1.2_BP11	11.900	10.00	1.500	2.500	0.000	164.02	212.70	0.6707	420.0	4.000
S1.3	11.900	10.00	1.500	2.500	0.000	164.02	212.70	7.635	420.0	2.500
S1.4	11.900	10.00	1.500	2.500	0.000	164.02	212.70	0.4613	420.0	0.000
S1.5	11.900	10.00	1.500	2.500	0.000	164.02	212.70	0.7285	420.0	0.000
Dummy	11.900	10.00	0.000	2.500	0.000	164.02	0.000	8.694	420.0	3.000
S1.6	11.900	10.00	0.000	2.500	0.000	164.02	0.000	9.901	423.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	419.0	.1010	409.0	.1010	1810.8	0.0000	32.434	21.943
S1.1_BP9	420.0	.9376	420.0	.9374	16846.5	0.0000	164.48	18.611
Col_Bsn	420.0	3.662	421.0	3.510	65128.1	0.0000	17547.2	18.638
S1.2_BP11	420.0	.6707	420.0	.6695	12057.3	0.0000	264.88	18.069

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 11:20.0 4/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 1440.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001

Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	10.200	10.00	1.500	2.500	0.000	184.04	243.30	2.680	720.0	0.000
S1.05_BP5	10.200	10.00	1.500	2.500	0.000	184.04	243.30	0.0991	717.0	2.500
S1.1_BP9	10.200	10.00	1.500	2.500	0.000	184.04	243.30	0.9201	720.0	0.000
Col_Bsn	10.200	10.00	0.000	2.500	0.000	184.04	0.000	3.600	720.0	6.000
S1.2_BP11	10.200	10.00	1.500	2.500	0.000	184.04	243.30	0.6583	720.0	4.000
S1.3	10.200	10.00	1.500	2.500	0.000	184.04	243.30	7.730	720.0	2.500
S1.4	10.200	10.00	1.500	2.500	0.000	184.04	243.30	0.4529	720.0	0.000
S1.5	10.200	10.00	1.500	2.500	0.000	184.04	243.30	0.7149	720.0	0.000
Dummy	10.200	10.00	0.000	2.500	0.000	184.04	0.000	8.861	720.0	3.000
S1.6	10.200	10.00	0.000	2.500	0.000	184.04	0.000	10.147	723.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	717.0	.0991	708.0	.0991	2055.8	0.0000	32.199	21.942
S1.1_BP9	720.0	.9201	720.0	.9199	19118.7	0.0000	163.51	18.610
Col_Bsn	720.0	3.600	720.0	3.556	73834.5	0.0000	17571.4	18.638
S1.2_BP11	720.0	.6583	720.0	.6575	13689.2	0.0000	262.21	18.068

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

Run completed at: 26th August 2005 13:04:59

BP1/**THORLEY STREET RAFTS MODEL**

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	25.
RETURN PERIOD (YRS)	=	100.
BX	=	0.8200
TOTAL OF FIRST SUB-AREAS (km2)	=	16.11
TOTAL OF SECOND SUB-AREAS (km2)	=	18.21
TOTAL OF ALL SUB-AREAS (km2)	=	34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Perm #1	Perm #2	B #1	B #2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	108.30	10.00	1.500	2.500	0.000	34.292	43.625	6.849	15.00	0.000
BSN_US	108.30	10.00	1.500	2.500	0.000	34.292	43.625	11.731	15.00	0.000
BSN_DS	108.30	10.00	0.000	2.500	0.000	34.292	0.000	2.487	31.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	15.00	6.849	15.00	6.768	7989.8	0.0000	217.87	18.158
BSN_US	15.00	11.73	31.00	2.486	13433.5	0.0000	9324.0	17.481

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 60.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	66.800	10.00	1.500	2.500	0.000	54.758	65.300	6.808	25.00	0.000
BSN_US	66.800	10.00	1.500	2.500	0.000	54.758	65.300	11.601	25.00	0.000
BSN_DS	66.800	10.00	0.000	2.500	0.000	54.758	0.000	5.047	45.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	25.00	6.807	25.00	6.731	12335.4	0.0000	217.10	18.158
BSN_US	25.00	11.60	45.00	5.046	20681.3	0.0000	11216.5	17.629

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	52.600	10.00	1.500	2.500	0.000	65.608	77.400	7.663	30.00	0.000
BSN_US	52.600	10.00	1.500	2.500	0.000	65.608	77.400	13.055	30.00	0.000
BSN_DS	52.600	10.00	0.000	2.500	0.000	65.608	0.000	5.041	46.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	30.00	7.663	30.00	7.604	14680.8	0.0000	235.45	18.174
BSN_US	30.00	13.06	46.00	5.041	24623.1	0.0000	11213.1	17.629

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
#####
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
                     to 10: 0.0 1/ 1/1990
##
#####

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS)   = 120.
RETURN PERIOD (YRS)   = 100.
BX   = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2)   = 34.32

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.

S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	44.200	10.00	1.500	2.500	0.000	74.025	86.900	6.883	35.00	0.000
BSN_US	44.200	10.00	1.500	2.500	0.000	74.025	86.900	11.771	35.00	0.000
BSN_DS	44.200	10.00	0.000	2.500	0.000	74.025	0.000	5.134	52.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	35.00	6.883	35.00	6.813	16535.9	0.0000	218.82	18.159
BSN_US	35.00	11.77	52.00	5.133	27745.0	0.0000	11266.7	17.633

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 8:20.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 180.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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

S2.0_BP1	34.500	10.00	1.500	2.500	0.000	86.750	102.00	4.926	45.00	0.000
BSN_US	34.500	10.00	1.500	2.500	0.000	86.750	102.00	8.334	45.00	0.000
BSN_DS	34.500	10.00	0.000	2.500	0.000	86.750	0.000	4.352	76.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	45.00	4.925	45.00	4.897	19393.3	0.0000	171.77	18.118
BSN_US	45.00	8.333	76.00	4.351	32538.7	0.0000	10809.3	17.597

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 20: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 360.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1	% Impervious #2	Perm #1	Perm #2	B #1	B #2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	22.500	10.00	1.500	2.500	0.000	111.75	133.50	3.453	120.0	0.000
BSN_US	22.500	10.00	1.500	2.500	0.000	111.75	133.50	5.804	120.0	0.000
BSN_DS	22.500	10.00	0.000	2.500	0.000	111.75	0.000	4.589	124.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used

Label	to Peak	Inflow (m^3/s)	to Peak	Outflow (m^3/s)	Inflow (m^3)	Vol. Avail	Vol. Used	Stage Used
S2.0_BP1	120.0	3.453	120.0	3.449	25190.4	0.0000	135.02	18.081
BSN_US	120.0	5.804	124.0	4.589	42263.9	0.0000	10952.6	17.608

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 9:20.0 2/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 540.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1	#2	Pern #1	#2	B #1	#2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	17.700	10.00	1.500	2.500	0.000	128.80	157.80	3.050	300.0	0.000
BSN_US	17.700	10.00	1.500	2.500	0.000	128.80	157.80	5.133	300.0	0.000
BSN_DS	17.700	10.00	0.000	2.500	0.000	128.80	0.000	4.510	303.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	--------- Basin --------- Vol. Avail	Vol. Used	Stage Used
S2.0_BP1	300.0	3.050	300.0	3.045	29450.7	0.0000	124.98	18.069
BSN_US	300.0	5.132	303.0	4.510	49441.8	0.0000	10907.0	17.605

SUMMARY OF BASIN OUTLET RESULTS

Link	No.	S/D	Dia	Width	Pipe	Pipe

Label	of	Factor			Length	Slope
		(m)	(m)	(m)	(m)	(%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 100y ARI

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 720.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link	Catch. Area		Slope		% Impervious		Perm		B		Link
Label	#1	#2	#1	#2	#1	#2	#1	#2	#1	#2	No.
	(ha)		(%)		(%)						
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	14.900	10.00	1.500	2.500	0.000	142.02	177.30	3.099	420.0	0.000
BSN_US	14.900	10.00	1.500	2.500	0.000	142.02	177.30	5.209	420.0	0.000
BSN_DS	14.900	10.00	0.000	2.500	0.000	142.02	0.000	4.822	421.0	0.000

SUMMARY OF BASIN RESULTS

Link	Time	Peak	Time	Peak	Total	--------- Basin ---------		
Label	to	Inflow	to	Outflow	Inflow	Vol.	Vol.	Stage
	Peak	(m^3/s)	Peak	(m^3/s)	(m^3)	Avail	Used	Used
S2.0_BP1	420.0	3.099	420.0	3.096	32819.7	0.0000	126.24	18.070
BSN_US	420.0	5.208	421.0	4.822	55112.6	0.0000	11086.9	17.619

SUMMARY OF BASIN OUTLET RESULTS

Link	No.	S/D	Dia	Width	Pipe	Pipe
Label	of	Factor			Length	Slope
		(m)	(m)	(m)	(m)	(%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

```
################################################################################
Bligh Park- Existing Conditions 100y ARI

Results for period from  0: 0.0  1/ 1/1990
                      to 18:40.0  3/ 1/1990
################################################################################
```

ROUTING INCREMENT (MINS) =	1.00
STORM DURATION (MINS) =	1080.
RETURN PERIOD (YRS) =	100.
BX =	0.8200
TOTAL OF FIRST SUB-AREAS (km2) =	16.11
TOTAL OF SECOND SUB-AREAS (km2) =	18.21
TOTAL OF ALL SUB-AREAS (km2) =	34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	11.900	10.00	1.500	2.500	0.000	164.02	212.70	2.172	420.0	0.000
BSN_US	11.900	10.00	1.500	2.500	0.000	164.02	212.70	3.644	420.0	0.000
BSN_DS	11.900	10.00	0.000	2.500	0.000	164.02	0.000	3.480	421.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	420.0	2.172	420.0	2.172	38741.4	0.0000	100.82	18.040
BSN_US	420.0	3.643	421.0	3.480	65112.2	0.0000	10209.7	17.550

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

```
################################################################################
Bligh Park- Existing Conditions 100y ARI

Results for period from  0: 0.0  1/ 1/1990
                      to 11:20.0  4/ 1/1990
################################################################################
```

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 1440.
RETURN PERIOD (YRS) = 100.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Pern #1	Pern #2	B #1	B #2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	10.200	10.00	1.500	2.500	0.000	184.04	243.30	2.131	720.0	0.000
BSN_US	10.200	10.00	1.500	2.500	0.000	184.04	243.30	3.574	720.0	0.000
BSN_DS	10.200	10.00	0.000	2.500	0.000	184.04	0.000	3.507	721.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	720.0	2.131	720.0	2.131	43957.8	0.0000	99.361	18.038
BSN_US	720.0	3.574	721.0	3.506	73905.7	0.0000	10227.9	17.552

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

Run completed at: 25th August 2005 14:42:33

500 YEAR ARI OUTPUT

MAIN BLIGH PARK RAFTS MODEL

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 25.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	130.10	10.00	1.500	2.500	0.000	43.375	52.708	9.101	15.00	0.000
S1.05_BP5	130.10	10.00	1.500	2.500	0.000	43.375	52.708	0.5223	15.00	2.500
S1.1_BP9	130.10	10.00	1.500	2.500	0.000	43.375	52.708	3.726	15.00	0.000
Col_Bsn	130.10	10.00	0.000	2.500	0.000	43.375	0.000	12.737	15.00	6.000
S1.2_BP11	130.10	10.00	1.500	2.500	0.000	43.375	52.708	2.641	15.00	4.000
S1.3	130.10	10.00	1.500	2.500	0.000	43.375	52.708	13.851	15.00	2.500
S1.4	130.10	10.00	1.500	2.500	0.000	43.375	52.708	1.782	15.00	0.000
S1.5	130.10	10.00	1.500	2.500	0.000	43.375	52.708	2.902	15.00	0.000
Dummy	130.10	10.00	0.000	2.500	0.000	43.375	0.000	16.705	16.00	3.000
S1.6	130.10	10.00	0.000	2.500	0.000	43.375	0.000	17.696	19.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	15.00	.5223	15.00	.5057	460.86	0.0000	53.220	22.019

S1.1_BP9	15.00	3.726	15.00	3.635	4282.5	0.0000	282.75	18.674
Col_Bsn	15.00	12.74	66.00	.5283	16585.0	0.0000	14985.2	18.564
S1.2_BP11	15.00	2.641	16.00	2.346	3071.0	0.0000	531.85	18.184

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 60.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	80.000	10.00	1.500	2.500	0.000	67.917	78.500	8.977	25.00	0.000
S1.05_BP5	80.000	10.00	1.500	2.500	0.000	67.917	78.500	0.4934	25.00	2.500
S1.1_BP9	80.000	10.00	1.500	2.500	0.000	67.917	78.500	3.637	25.00	0.000
Col_Bsn	80.000	10.00	0.000	2.500	0.000	67.917	0.000	12.525	25.00	6.000
S1.2_BP11	80.000	10.00	1.500	2.500	0.000	67.917	78.500	2.579	25.00	4.000

S1.3	80.000	10.00	1.500	2.500	0.000	67.917	78.500	13.317	25.00	2.500
S1.4	80.000	10.00	1.500	2.500	0.000	67.917	78.500	1.717	25.00	0.000
S1.5	80.000	10.00	1.500	2.500	0.000	67.917	78.500	2.840	25.00	0.000
Dummy	80.000	10.00	0.000	2.500	0.000	67.917	0.000	16.570	26.00	3.000
S1.6	80.000	10.00	0.000	2.500	0.000	67.917	0.000	17.838	29.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	25.00	.4934	25.00	.4821	700.53	0.0000	52.377	22.016
S1.1_BP9	25.00	3.637	25.00	3.548	6500.5	0.0000	279.90	18.673
Col_Bsn	25.00	12.52	56.00	4.169	25314.2	0.0000	17892.1	18.647
S1.2_BP11	25.00	2.579	26.00	2.286	4656.7	0.0000	522.93	18.181

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000

S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	63.000	10.00	1.500	2.500	0.000	81.167	93.000	10.036	30.00	0.000
S1.05_BP5	63.000	10.00	1.500	2.500	0.000	81.167	93.000	0.5187	30.00	2.500
S1.1_BP9	63.000	10.00	1.500	2.500	0.000	81.167	93.000	4.063	30.00	0.000
Col_Bsn	63.000	10.00	0.000	2.500	0.000	81.167	0.000	13.992	30.00	6.000
S1.2_BP11	63.000	10.00	1.500	2.500	0.000	81.167	93.000	2.863	30.00	4.000
S1.3	63.000	10.00	1.500	2.500	0.000	81.167	93.000	14.723	30.00	2.500
S1.4	63.000	10.00	1.500	2.500	0.000	81.167	93.000	1.948	30.00	0.000
S1.5	63.000	10.00	1.500	2.500	0.000	81.167	93.000	3.169	30.00	0.000
Dummy	63.000	10.00	0.000	2.500	0.000	81.167	0.000	18.133	31.00	3.000
S1.6	63.000	10.00	0.000	2.500	0.000	81.167	0.000	19.669	34.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	30.00	.5187	30.00	.5063	832.66	0.0000	53.241	22.019
S1.1_BP9	30.00	4.063	30.00	3.955	7734.4	0.0000	293.20	18.680
Col_Bsn	30.00	13.99	60.00	4.817	30129.7	0.0000	18224.0	18.656
S1.2_BP11	30.00	2.862	31.00	2.519	5533.4	0.0000	557.40	18.194

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 10: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	53.000	10.00	1.500	2.500	0.000	91.500	104.50	9.120	35.00	0.000
S1.05_BP5	53.000	10.00	1.500	2.500	0.000	91.500	104.50	0.4813	35.00	2.500
S1.1_BP9	53.000	10.00	1.500	2.500	0.000	91.500	104.50	3.625	35.00	0.000
Col_Bsn	53.000	10.00	0.000	2.500	0.000	91.500	0.000	12.665	35.00	6.000
S1.2_BP11	53.000	10.00	1.500	2.500	0.000	91.500	104.50	2.627	35.00	4.000
S1.3	53.000	10.00	1.500	2.500	0.000	91.500	104.50	13.169	35.00	2.500
S1.4	53.000	10.00	1.500	2.500	0.000	91.500	104.50	1.745	35.00	0.000
S1.5	53.000	10.00	1.500	2.500	0.000	91.500	104.50	2.856	35.00	0.000
Dummy	53.000	10.00	0.000	2.500	0.000	91.500	0.000	17.057	38.00	3.000
S1.6	53.000	10.00	0.000	2.500	0.000	91.500	0.000	18.651	41.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	35.00	.4813	35.00	.4701	937.07	0.0000	51.950	22.015
S1.1_BP9	35.00	3.624	36.00	3.600	8707.8	0.0000	281.60	18.674
Col_Bsn	35.00	12.66	67.00	5.257	33960.4	0.0000	18439.9	18.662
S1.2_BP11	35.00	2.626	37.00	2.321	6241.2	0.0000	528.13	18.183

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

Results for period from 0: 0.0 1/ 1/1990
to 8:20.0 1/ 1/1990

##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 180.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1 (%)	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	41.400	10.00	1.500	2.500	0.000	107.41	122.70	6.564	45.00	0.000
S1.05_BP5	41.400	10.00	1.500	2.500	0.000	107.41	122.70	0.3029	45.00	2.500
S1.1_BP9	41.400	10.00	1.500	2.500	0.000	107.41	122.70	2.584	45.00	0.000
Col_Bsn	41.400	10.00	0.000	2.500	0.000	107.41	0.000	9.127	45.00	6.000
S1.2_BP11	41.400	10.00	1.500	2.500	0.000	107.41	122.70	1.814	45.00	4.000
S1.3	41.400	10.00	1.500	2.500	0.000	107.41	122.70	10.533	75.00	2.500
S1.4	41.400	10.00	1.500	2.500	0.000	107.41	122.70	1.221	45.00	0.000
S1.5	41.400	10.00	1.500	2.500	0.000	107.41	122.70	1.993	45.00	0.000
Dummy	41.400	10.00	0.000	2.500	0.000	107.41	0.000	12.635	45.00	3.000
S1.6	41.400	10.00	0.000	2.500	0.000	107.41	0.000	14.113	81.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	45.00	.3029	45.00	.3018	1099.6	0.0000	45.568	21.996
S1.1_BP9	45.00	2.583	45.00	2.563	10202.0	0.0000	247.77	18.656
Col_Bsn	45.00	9.127	78.00	4.878	39866.3	0.0000	18253.8	18.657
S1.2_BP11	45.00	1.813	45.00	1.738	7322.1	0.0000	441.73	18.148

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 20: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 360.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	27.100	10.00	1.500	2.500	0.000	139.14	161.10	5.061	120.0	0.000
S1.05_BP5	27.100	10.00	1.500	2.500	0.000	139.14	161.10	0.1969	120.0	2.500
S1.1_BP9	27.100	10.00	1.500	2.500	0.000	139.14	161.10	1.800	120.0	0.000
Col_Bsn	27.100	10.00	0.000	2.500	0.000	139.14	0.000	6.856	120.0	6.000
S1.2_BP11	27.100	10.00	1.500	2.500	0.000	139.14	161.10	1.284	120.0	4.000
S1.3	27.100	10.00	1.500	2.500	0.000	139.14	161.10	11.104	141.0	2.500
S1.4	27.100	10.00	1.500	2.500	0.000	139.14	161.10	0.8748	120.0	0.000
S1.5	27.100	10.00	1.500	2.500	0.000	139.14	161.10	1.398	120.0	0.000
Dummy	27.100	10.00	0.000	2.500	0.000	139.14	0.000	12.690	143.0	3.000

S1.6	27.100	10.00	0.000	2.500	0.000	139.14	0.000	14.818	146.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	120.0	.1969	120.0	.1969	1435.5	0.0000	39.178	21.970
S1.1_BP9	120.0	1.800	120.0	1.795	13333.1	0.0000	212.39	18.637
Col_Bsn	120.0	6.856	140.0	5.107	52030.9	0.0000	18366.5	18.660
S1.2_BP11	120.0	1.284	120.0	1.271	9557.7	0.0000	372.45	18.121

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 9:20.0 2/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 540.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

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.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	21.200	10.00	1.500	2.500	0.000	160.09	189.30	4.423	300.0	0.000
S1.05_BP5	21.200	10.00	1.500	2.500	0.000	160.09	189.30	0.1753	300.0	2.500
S1.1_BP9	21.200	10.00	1.500	2.500	0.000	160.09	189.30	1.585	300.0	0.000
Col_Bsn	21.200	10.00	0.000	2.500	0.000	160.09	0.000	6.003	300.0	6.000
S1.2_BP11	21.200	10.00	1.500	2.500	0.000	160.09	189.30	1.130	300.0	4.000
S1.3	21.200	10.00	1.500	2.500	0.000	160.09	189.30	11.901	300.0	2.500
S1.4	21.200	10.00	1.500	2.500	0.000	160.09	189.30	0.7654	300.0	0.000
S1.5	21.200	10.00	1.500	2.500	0.000	160.09	189.30	1.230	300.0	0.000
Dummy	21.200	10.00	0.000	2.500	0.000	160.09	0.000	13.609	303.0	3.000
S1.6	21.200	10.00	0.000	2.500	0.000	160.09	0.000	15.363	306.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	300.0	.1753	300.0	.1742	1672.2	0.0000	37.794	21.964
S1.1_BP9	300.0	1.584	300.0	1.579	15522.2	0.0000	200.32	18.630
Col_Bsn	300.0	6.002	302.0	5.568	60511.0	0.0000	18592.5	18.666
S1.2_BP11	300.0	1.130	300.0	1.114	11131.8	0.0000	349.23	18.112

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 720.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 58.31
TOTAL OF SECOND SUB-AREAS (km2) = 42.86
TOTAL OF ALL SUB-AREAS (km2) = 101.17

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1 (%)	#2	Pern #1	#2	B #1	#2	Link No.
S1.0	14.200	11.780	.7300	.7300	5.000	100.0	.025	.015	.0797	.0052	1.000
S1.05_BP5	0.4300	0.5200	1.100	1.100	5.000	100.0	.025	.015	.0105	.0008	2.000
S1.1_BP9	3.550	4.330	.6300	.6300	5.000	100.0	.025	.015	.0417	.0033	2.001
Col_Bsn	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.001
S1.2_BP11	2.840	3.480	.5300	.5300	5.000	100.0	.025	.015	.0405	.0032	3.000
S1.3	17.930	16.590	.6600	.6600	5.000	100.0	.025	.015	.0946	.0065	1.002
S1.4	1.960	2.390	.4000	.4000	5.000	100.0	.025	.015	.0384	.0030	4.000
S1.5	3.090	3.770	.6000	.6000	5.000	100.0	.025	.015	.0398	.0031	5.000
Dummy	.00001	0.000	1.000	0.000	0.000	0.000	.050	0.00	0.000	0.000	1.003
S1.6	14.310	0.000	.6600	0.000	5.000	0.000	.050	0.00	.1403	0.000	1.004

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
S1.0	17.800	10.00	1.500	2.500	0.000	175.87	212.10	4.553	420.0	0.000
S1.05_BP5	17.800	10.00	1.500	2.500	0.000	175.87	212.10	0.1762	420.0	2.500
S1.1_BP9	17.800	10.00	1.500	2.500	0.000	175.87	212.10	1.605	420.0	0.000
Col_Bsn	17.800	10.00	0.000	2.500	0.000	175.87	0.000	6.154	420.0	6.000
S1.2_BP11	17.800	10.00	1.500	2.500	0.000	175.87	212.10	1.147	420.0	4.000
S1.3	17.800	10.00	1.500	2.500	0.000	175.87	212.10	12.628	420.0	2.500
S1.4	17.800	10.00	1.500	2.500	0.000	175.87	212.10	0.7807	420.0	0.000
S1.5	17.800	10.00	1.500	2.500	0.000	175.87	212.10	1.247	420.0	0.000
Dummy	17.800	10.00	0.000	2.500	0.000	175.87	0.000	14.373	420.0	3.000
S1.6	17.800	10.00	0.000	2.500	0.000	175.87	0.000	16.269	423.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S1.05_BP5	420.0	.1762	420.0	.1751	1858.5	0.0000	37.848	21.965
S1.1_BP9	420.0	1.605	420.0	1.601	17251.0	0.0000	201.58	18.631
Col_Bsn	420.0	6.154	421.0	5.832	67137.4	0.0000	18722.5	18.670
S1.2_BP11	420.0	1.147	420.0	1.137	12373.2	0.0000	352.64	18.113

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S1.05_BP5	1.0		.1000	0.000	0.5000	0.2000
S1.1_BP9	1.0		.1000	0.000	0.5000	0.2000
Col_Bsn	1.0		.1000	0.000	0.5000	0.2000
S1.2_BP11	1.0		.1000	0.000	0.5000	0.2000

Run completed at: 25th August 2005 16:54:09

BP1/THORLEY STREET RAFTS MODEL

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
                    to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS)	=	1.00
STORM DURATION (MINS)	=	25.
RETURN PERIOD (YRS)	=	500.
BX	=	0.8200
TOTAL OF FIRST SUB-AREAS (km2)	=	16.11
TOTAL OF SECOND SUB-AREAS (km2)	=	18.21
TOTAL OF ALL SUB-AREAS (km2)	=	34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	130.10	10.00	1.500	2.500	0.000	43.375	52.708	8.533	15.00	0.000
BSN_US	130.10	10.00	1.500	2.500	0.000	43.375	52.708	14.573	15.00	0.000
BSN_DS	130.10	10.00	0.000	2.500	0.000	43.375	0.000	4.393	28.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	15.00	8.533	15.00	8.406	9829.4	0.0000	252.31	18.189
BSN_US	15.00	14.57	28.00	4.393	16531.7	0.0000	10838.0	17.599

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
                    to 5: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS)   = 60.
RETURN PERIOD (YRS)   = 500.
BX   = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2)   = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	80.000	10.00	1.500	2.500	0.000	67.917	78.500	8.502	25.00	0.000
BSN_US	80.000	10.00	1.500	2.500	0.000	67.917	78.500	14.497	25.00	0.000
BSN_DS	80.000	10.00	0.000	2.500	0.000	67.917	0.000	7.244	40.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	25.00	8.501	25.00	8.396	15027.4	0.0000	252.11	18.189
BSN_US	25.00	14.50	40.00	7.243	25214.0	0.0000	12284.3	17.712

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 5: 0.0 1/ 1/1990

##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 90.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	63.000	10.00	1.500	2.500	0.000	81.167	93.000	9.468	30.00	0.000
BSN_US	63.000	10.00	1.500	2.500	0.000	81.167	93.000	16.136	30.00	0.000
BSN_DS	63.000	10.00	0.000	2.500	0.000	81.167	0.000	7.219	42.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	30.00	9.468	30.00	9.350	17880.7	0.0000	271.91	18.205
BSN_US	30.00	16.14	42.00	7.218	30005.6	0.0000	12274.3	17.711

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##

Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 10: 0.0 1/ 1/1990

##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 120.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Area #2	Slope #1 (%)	Slope #2	% Impervious #1	% Impervious #2	Pern #1	Pern #2	B #1	B #2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	53.000	10.00	1.500	2.500	0.000	91.500	104.50	8.555	35.00	0.000
BSN_US	53.000	10.00	1.500	2.500	0.000	91.500	104.50	14.616	35.00	0.000
BSN_DS	53.000	10.00	0.000	2.500	0.000	91.500	0.000	7.730	47.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	35.00	8.554	35.00	8.483	20109.6	0.0000	253.92	18.190
BSN_US	35.00	14.62	47.00	7.730	33743.0	0.0000	12477.2	17.727

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 8:20.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 180.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11

TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	41.400	10.00	1.500	2.500	0.000	107.41	122.70	6.046	45.00	0.000
BSN_US	41.400	10.00	1.500	2.500	0.000	107.41	122.70	10.236	45.00	0.000
BSN_DS	41.400	10.00	0.000	2.500	0.000	107.41	0.000	5.663	54.00	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	45.00	6.045	45.00	6.012	23624.5	0.0000	200.53	18.143
BSN_US	45.00	10.24	54.00	5.662	39627.0	0.0000	11557.8	17.655

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 20: 0.0 1/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 360.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1	#2	Pern #1	#2	B #1	#2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	27.100	10.00	1.500	2.500	0.000	139.14	161.10	4.195	120.0	0.000
BSN_US	27.100	10.00	1.500	2.500	0.000	139.14	161.10	7.044	120.0	0.000
BSN_DS	27.100	10.00	0.000	2.500	0.000	139.14	0.000	6.298	122.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	120.0	4.195	120.0	4.191	30816.5	0.0000	153.54	18.102
BSN_US	120.0	7.043	122.0	6.298	51716.2	0.0000	11862.8	17.679

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 9:20.0 2/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 540.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	#2	Slope #1 (%)	#2	% Impervious #1	#2	Pern #1	#2	B #1	#2	Link No.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001

BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

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
S2.0_BP1	21.200	10.00	1.500	2.500	0.000	160.09	189.30	3.691	300.0	0.000
BSN_US	21.200	10.00	1.500	2.500	0.000	160.09	189.30	6.204	300.0	0.000
BSN_DS	21.200	10.00	0.000	2.500	0.000	160.09	0.000	5.676	302.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	300.0	3.691	300.0	3.686	35882.7	0.0000	140.91	18.087
BSN_US	300.0	6.203	302.0	5.675	60224.5	0.0000	11564.1	17.656

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

##
Bligh Park- Existing Conditions 500y ARI

Results for period from 0: 0.0 1/ 1/1990
to 2: 0.0 3/ 1/1990
##

ROUTING INCREMENT (MINS) = 1.00
STORM DURATION (MINS) = 720.
RETURN PERIOD (YRS) = 500.
BX = 0.8200
TOTAL OF FIRST SUB-AREAS (km2) = 16.11
TOTAL OF SECOND SUB-AREAS (km2) = 18.21
TOTAL OF ALL SUB-AREAS (km2) = 34.32

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.
S2.0_BP1	9.880	10.600	1.200	1.200	5.000	100.0	.025	.015	.0515	.0038	1.000
BSN_US	6.228	7.612	1.200	1.200	5.000	100.0	.025	.015	.0405	.0032	1.001
BSN_DS	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0017	0.000	1.002

Link	Average	Init. Loss	Cont. Loss	Excess Rain	Peak	Time	Link

Label	Intensity (mm/h)	#1 (mm)	#2	#1 (mm/h)	#2	#1 (mm)	#2	Inflow (m^3/s)	to Peak	Lag mins
S2.0_BP1	17.800	10.00	1.500	2.500	0.000	175.87	212.10	3.729	420.0	0.000
BSN_US	17.800	10.00	1.500	2.500	0.000	175.87	212.10	6.264	420.0	0.000
BSN_DS	17.800	10.00	0.000	2.500	0.000	175.87	0.000	5.934	421.0	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
S2.0_BP1	420.0	3.729	420.0	3.726	39844.4	0.0000	141.90	18.089
BSN_US	420.0	6.263	421.0	5.934	66892.1	0.0000	11688.3	17.666

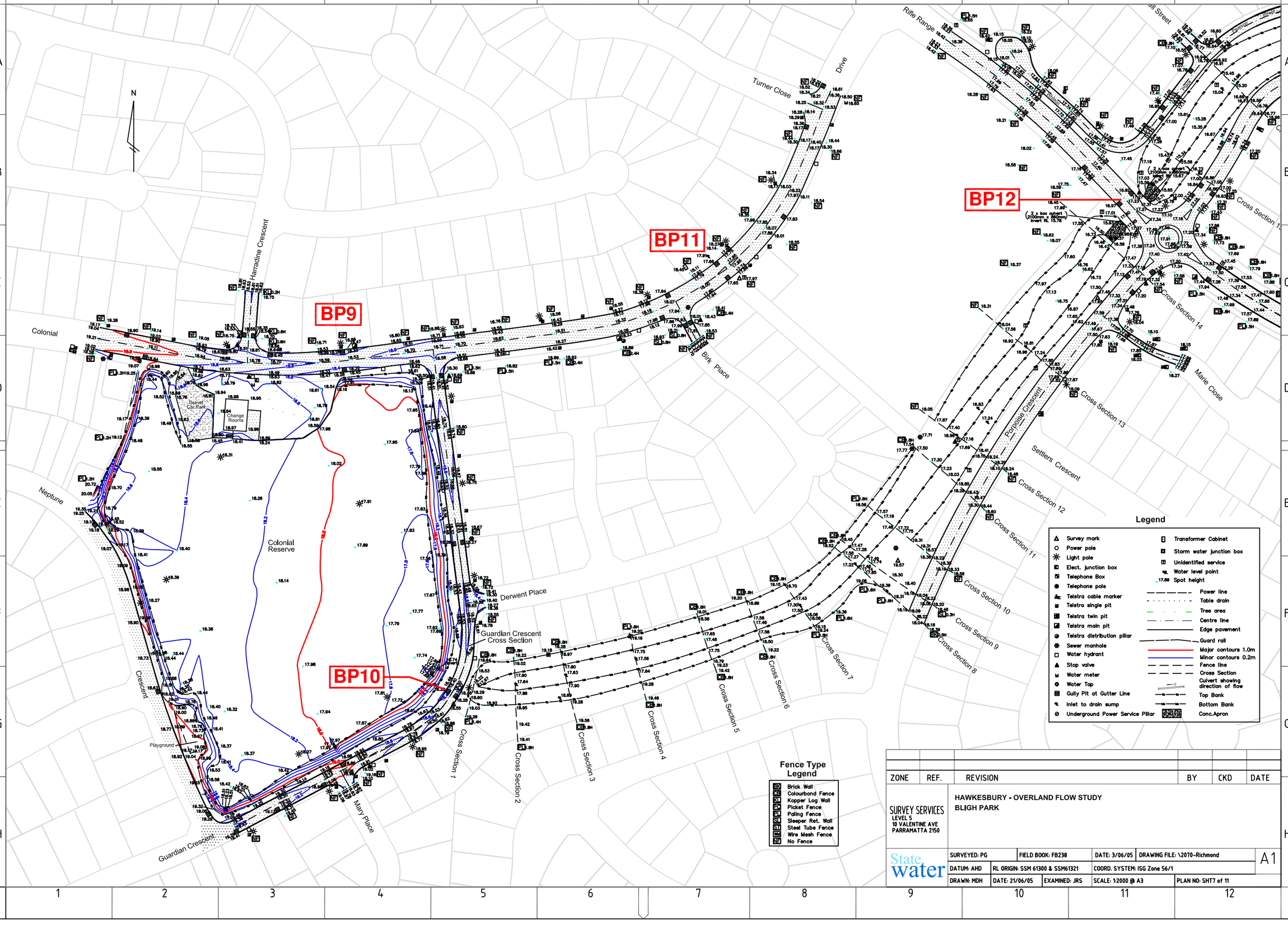
SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
S2.0_BP1	1.0		.1000	0.000	0.5000	0.2000
BSN_US	1.0		.4500	0.000	22.000	0.2000

Run completed at: 25th August 2005 14:55:12

APPENDIX D

HEC-RAS MODEL DETAILS



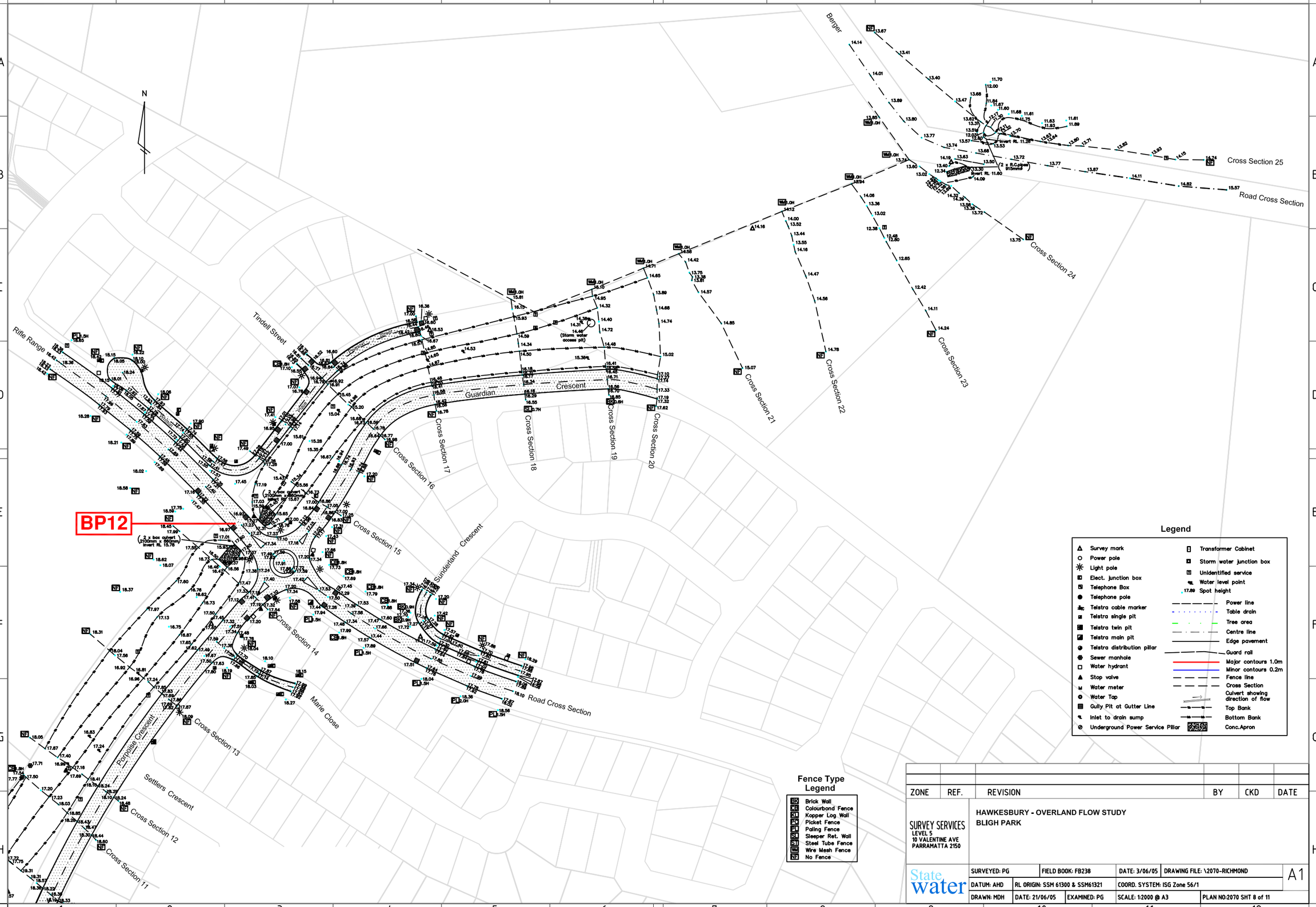
ZONE	REF.	REVISION	BY	CKD	DATE

SURVEY SERVICES
LEVEL 5
10 VALENTINE AVE
PARRAMATTA 2150

HAWKESBURY - OVERLAND FLOW STUDY
BLIGH PARK

State water

SURVEYED: PG	FIELD BOOK: FB238	DATE: 3/06/05	DRAWING FILE: \2070-Richmond	A1
DATUM: AHD	RL ORIGIN: SSM 61300 & SSM61321		COORD. SYSTEM: ISG Zone 56/1	
DRAWN: MDH	DATE: 21/06/05	EXAMINED: JRS	SCALE: 1:2000 @ A3	PLAN NO: SHT7 of 11



Legend

- Survey mark
- Power pole
- Light pole
- Elect. junction box
- Telephone Box
- Telephone pole
- Telstra cable marker
- Telstra single pit
- Telstra twin pit
- Telstra main pit
- Telstra distribution pillar
- Sewer manhole
- Water hydrant
- Stop valve
- Water meter
- Water Tap
- Gully Pit at Gutter Line
- Inlet to drain sump
- Underground Power Service Pillar
- Transformer Cabinet
- Storm water junction box
- Unidentified service
- Water level point
- 17.89 Spot height
- Power line
- Table drain
- Tree area
- Centre line
- Edge pavement
- Guard rail
- Major contours 1.0m
- Minor contours 0.2m
- Fence line
- Cross Section
- Culvert showing direction of flow
- Top Bank
- Bottom Bank
- Conc.Apron

Fence Type Legend

- BW Brick Wall
- CW Colourbond Fence
- KW Kopper Log Wall
- PK Picket Fence
- PA Paling Fence
- SR Sleeper Ret. Wall
- ST Steel Tube Fence
- WM Wire Mesh Fence
- NF No Fence

ZONE	REF.	REVISION	BY	CKD	DATE

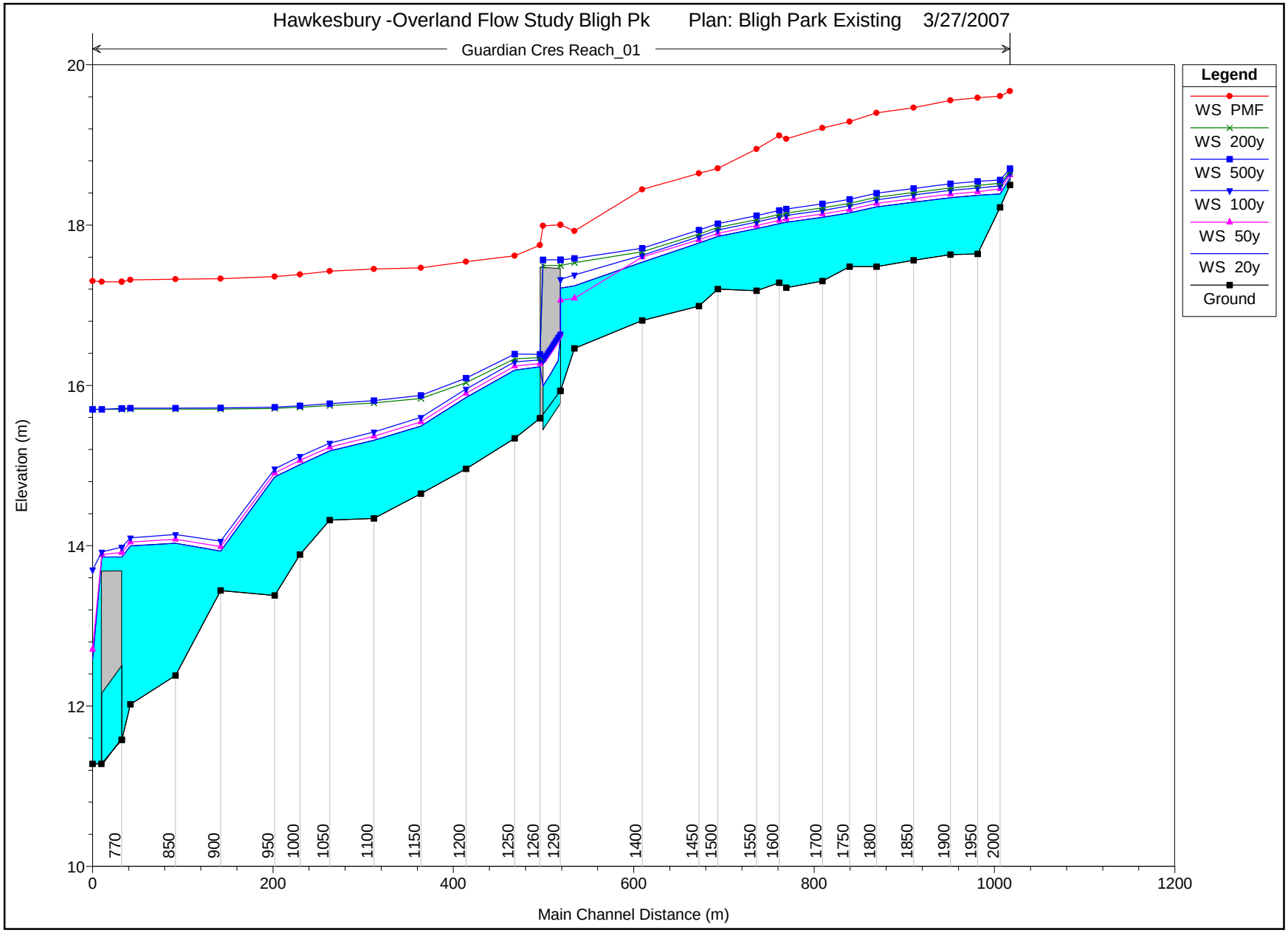
SURVEY SERVICES
LEVEL 5
10 VALENTINE AVE
PARRAMATTA 2150

HAWKESBURY - OVERLAND FLOW STUDY
BLIGH PARK

State water

SURVEYED: PG	FIELD BOOK: FB238	DATE: 3/06/05	DRAWING FILE: \2070-RICHMOND	A1
DATUM: AHD	RL ORIGIN: SSM 61300 & SSM61321		COORD. SYSTEM: ISG Zone 56/1	
DRAWN: MDH	DATE: 21/06/05	EXAMINED: PG	SCALE: 1:2000 @ A3	PLAN NO:2070 SHT 8 of 11

0% BLOCKAGE AT RIFLE RANGE ROAD


Hawkesbury -Overland Flow Study Bligh Pk
Plan: Bligh Park Existing
3/27/2007
Guardian Cres Reach_01
Legend
WS PMF
WS 200y
WS 500y
WS 100y
WS 50y
WS 20y
Ground
Elevation (m)
Main Channel Distance (m)
20
18
16
14
12
10
0
200
400
600
800
1000
1200
770
850
900
950
1000
1050
1100
1150
1200
1250
1260
1290
1400
1450
1500
1550
1600
1700
1750
1800
1850
1900
1950
2000

HEC-RAS Plan: BP_Exg River: Guardian Cres Reach: Reach_01

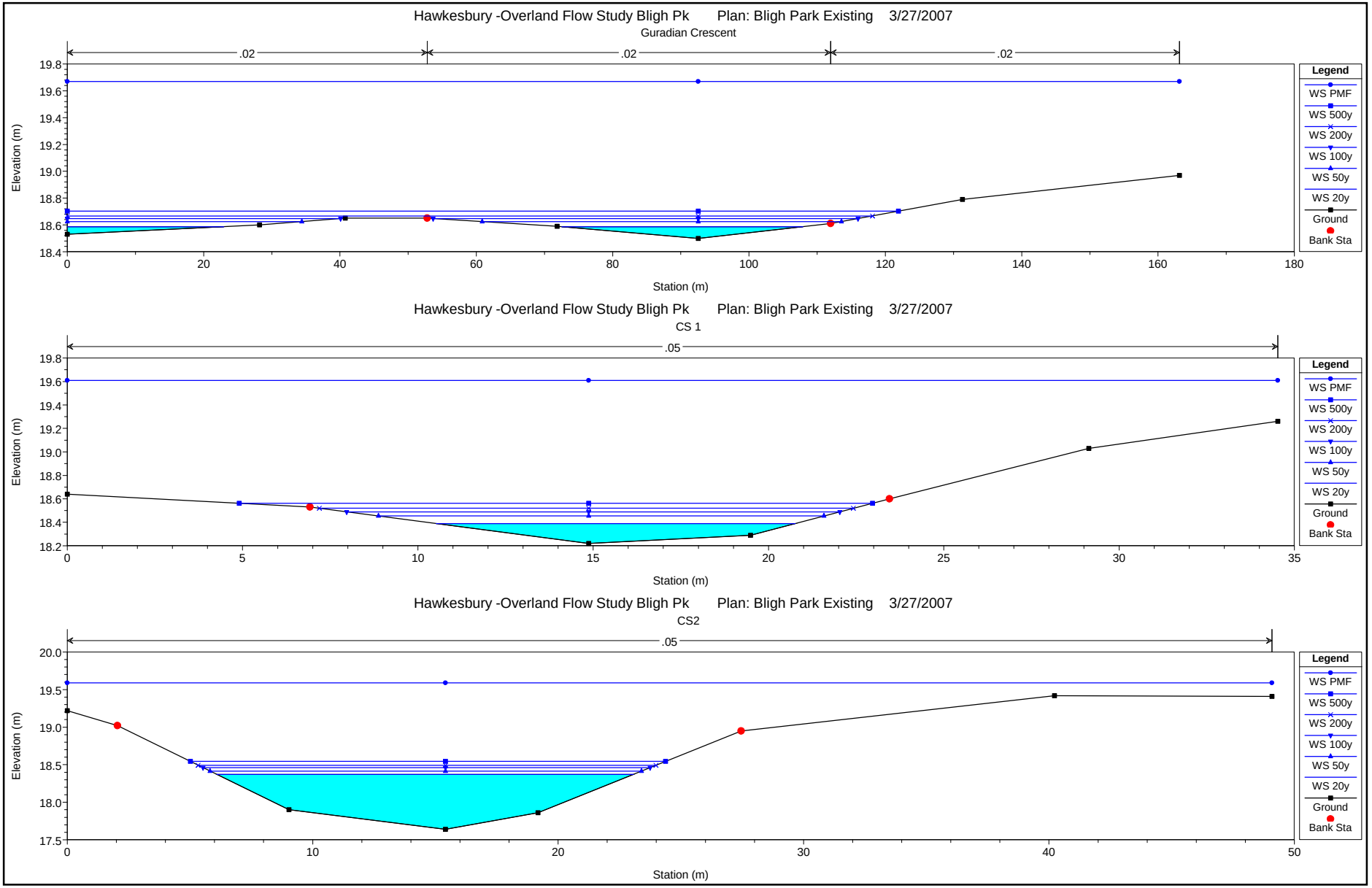
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach_01	2100	20y	0.99	18.50	18.59	18.58	18.60	0.006265	0.49	2.19	58.27	0.75
Reach_01	2100	50y	2.12	18.50	18.62	18.60	18.63	0.003251	0.45	4.96	87.06	0.57
Reach_01	2100	100y	2.87	18.50	18.65	18.61	18.66	0.002218	0.42	7.10	102.38	0.49
Reach_01	2100	200y	3.61	18.50	18.67	18.62	18.67	0.001640	0.42	9.39	118.13	0.44
Reach_01	2100	500y	4.82	18.50	18.70	18.64	18.71	0.000886	0.38	13.63	121.92	0.34
Reach_01	2100	PMF	35.11	18.50	19.67	18.80	19.67	0.000018	0.22	165.31	163.14	0.07
Reach_01	2000	20y	0.99	18.22	18.39	18.38	18.43	0.045938	0.94	1.05	10.24	0.94
Reach_01	2000	50y	2.12	18.22	18.45	18.45	18.53	0.047892	1.18	1.79	12.71	1.01
Reach_01	2000	100y	2.87	18.22	18.49	18.49	18.57	0.046098	1.27	2.26	14.06	1.01
Reach_01	2000	200y	3.61	18.22	18.52	18.52	18.61	0.044516	1.33	2.71	15.23	1.01
Reach_01	2000	500y	4.82	18.22	18.56	18.56	18.67	0.040591	1.42	3.41	18.06	0.99
Reach_01	2000	PMF	35.11	18.22	19.61		19.66	0.002430	1.14	34.76	34.53	0.33
Reach_01	1950	20y	3.09	17.64	18.37		18.38	0.001079	0.39	7.87	16.98	0.18
Reach_01	1950	50y	3.51	17.64	18.42	17.99	18.42	0.001079	0.41	8.62	17.58	0.19
Reach_01	1950	100y	3.99	17.64	18.46	18.01	18.47	0.001075	0.42	9.46	18.22	0.19
Reach_01	1950	200y	4.33	17.64	18.49	18.03	18.50	0.001073	0.43	10.03	18.65	0.19
Reach_01	1950	500y	4.91	17.64	18.54	18.05	18.55	0.001068	0.45	10.99	19.35	0.19
Reach_01	1950	PMF	31.10	17.64	19.59		19.62	0.000999	0.80	43.85	49.09	0.21
Reach_01	1900	20y	3.09	17.63	18.34		18.35	0.000972	0.38	8.24	17.58	0.17
Reach_01	1900	50y	3.51	17.63	18.38		18.39	0.000973	0.39	9.01	18.16	0.18
Reach_01	1900	100y	3.99	17.63	18.43		18.44	0.000969	0.40	9.88	18.80	0.18
Reach_01	1900	200y	4.33	17.63	18.46		18.47	0.000969	0.41	10.47	19.23	0.18
Reach_01	1900	500y	4.91	17.63	18.51		18.52	0.000965	0.43	11.46	19.92	0.18
Reach_01	1900	PMF	31.10	17.63	19.56		19.59	0.001128	0.79	40.75	43.44	0.22
Reach_01	1850	20y	4.03	17.56	18.29		18.30	0.001503	0.48	8.38	17.06	0.22
Reach_01	1850	50y	4.56	17.56	18.33		18.34	0.001507	0.50	9.12	17.54	0.22
Reach_01	1850	100y	5.18	17.56	18.38		18.39	0.001516	0.52	9.94	18.06	0.22
Reach_01	1850	200y	5.61	17.56	18.41		18.42	0.001519	0.53	10.50	18.40	0.23
Reach_01	1850	500y	6.35	17.56	18.46		18.47	0.001522	0.55	11.44	18.96	0.23
Reach_01	1850	PMF	38.48	17.56	19.47		19.52	0.002000	1.06	37.42	40.09	0.30
Reach_01	1800	20y	4.03	17.48	18.23		18.24	0.001466	0.46	8.82	19.06	0.21
Reach_01	1800	50y	4.56	17.48	18.27		18.28	0.001460	0.47	9.65	19.77	0.22
Reach_01	1800	100y	5.18	17.48	18.32		18.33	0.001457	0.49	10.59	20.54	0.22
Reach_01	1800	200y	5.61	17.48	18.35		18.36	0.001451	0.50	11.23	21.06	0.22
Reach_01	1800	500y	6.35	17.48	18.40		18.41	0.001438	0.52	12.32	21.91	0.22
Reach_01	1800	PMF	38.48	17.48	19.40		19.45	0.001542	0.97	41.21	35.86	0.26
Reach_01	1750	20y	4.96	17.48	18.15		18.17	0.002912	0.65	7.68	16.49	0.30
Reach_01	1750	50y	5.61	17.48	18.19		18.22	0.002905	0.67	8.38	17.05	0.30
Reach_01	1750	100y	6.37	17.48	18.24		18.26	0.002903	0.69	9.18	17.67	0.31
Reach_01	1750	200y	6.89	17.48	18.27		18.30	0.002885	0.71	9.73	18.08	0.31
Reach_01	1750	500y	7.80	17.48	18.32		18.35	0.002869	0.73	10.66	18.75	0.31
Reach_01	1750	PMF	45.87	17.48	19.29		19.38	0.003213	1.32	36.53	33.99	0.37
Reach_01	1700	20y	4.96	17.30	18.10		18.11	0.001531	0.52	9.60	19.57	0.22
Reach_01	1700	50y	5.61	17.30	18.14		18.15	0.001555	0.54	10.43	20.10	0.23
Reach_01	1700	100y	6.37	17.30	18.18		18.20	0.001581	0.57	11.35	20.67	0.23
Reach_01	1700	200y	6.89	17.30	18.21		18.23	0.001584	0.58	12.00	21.07	0.23
Reach_01	1700	500y	7.80	17.30	18.26		18.28	0.001598	0.61	13.08	21.70	0.24
Reach_01	1700	PMF	45.87	17.30	19.21		19.29	0.002531	1.27	38.72	32.70	0.34
Reach_01	1650	20y	5.90	17.22	18.04	17.60	18.05	0.001414	0.54	11.39	21.65	0.22
Reach_01	1650	50y	6.66	17.22	18.08	17.63	18.09	0.001458	0.57	12.27	22.17	0.23
Reach_01	1650	100y	7.55	17.22	18.12	17.66	18.14	0.001508	0.60	13.25	22.72	0.23
Reach_01	1650	200y	8.17	17.22	18.15	17.67	18.17	0.001529	0.62	13.94	23.11	0.23
Reach_01	1650	500y	9.24	17.22	18.20	17.70	18.22	0.001566	0.65	15.09	23.73	0.24
Reach_01	1650	PMF	53.25	17.22	19.07	18.40	19.17	0.003118	1.45	39.93	31.87	0.37
Reach_01	1600	20y	5.90	17.28	18.02	17.68	18.04	0.002173	0.61	10.30	25.14	0.27
Reach_01	1600	50y	6.66	17.28	18.06	17.70	18.08	0.002154	0.63	11.35	27.09	0.27
Reach_01	1600	100y	7.55	17.28	18.10	17.73	18.12	0.002136	0.65	12.54	31.28	0.27
Reach_01	1600	200y	8.17	17.28	18.13	17.74	18.15	0.002100	0.67	13.43	34.26	0.27
Reach_01	1600	500y	9.24	17.28	18.18	17.77	18.20	0.002050	0.68	14.92	39.17	0.27
Reach_01	1600	PMF	53.25	17.28	19.12	18.46	19.14	0.000692	0.68	75.99	68.65	0.18
Reach_01	1550	20y	6.84	17.18	17.95	17.62	17.98	0.002509	0.67	10.60	21.79	0.29
Reach_01	1550	50y	7.71	17.18	17.99	17.65	18.02	0.002533	0.70	11.47	22.22	0.29
Reach_01	1550	100y	8.74	17.18	18.04	17.67	18.06	0.002579	0.73	12.42	22.69	0.30
Reach_01	1550	200y	9.46	17.18	18.07	17.69	18.10	0.002577	0.75	13.11	23.02	0.30
Reach_01	1550	500y	10.69	17.18	18.12	17.72	18.15	0.002585	0.78	14.25	23.56	0.30
Reach_01	1550	PMF	60.63	17.18	18.95	18.42	19.09	0.004918	1.73	37.23	30.42	0.47
Reach_01	1500	20y	6.84	17.20	17.86	17.55	17.87	0.002220	0.58	11.86	24.41	0.26
Reach_01	1500	50y	7.71	17.20	17.90	17.56	17.92	0.002213	0.60	12.83	24.75	0.27
Reach_01	1500	100y	8.74	17.20	17.94	17.59	17.96	0.002251	0.63	13.85	25.10	0.27
Reach_01	1500	200y	9.46	17.20	17.97	17.60	17.99	0.002226	0.65	14.64	25.37	0.27
Reach_01	1500	500y	10.69	17.20	18.02	17.62	18.04	0.002210	0.67	15.91	25.79	0.27
Reach_01	1500	PMF	60.63	17.20	18.71	18.23	18.86	0.005778	1.76	35.63	31.62	0.49
Reach_01	1450	20y	7.78	16.99	17.78		17.81	0.004774	0.77	10.15	24.50	0.38
Reach_01	1450	50y	8.75	16.99	17.82		17.85	0.004636	0.78	11.17	25.52	0.38
Reach_01	1450	100y	9.93	16.99	17.86		17.89	0.004692	0.81	12.19	26.50	0.38
Reach_01	1450	200y	10.74	16.99	17.89		17.92	0.004692	0.82	13.06	28.01	0.38

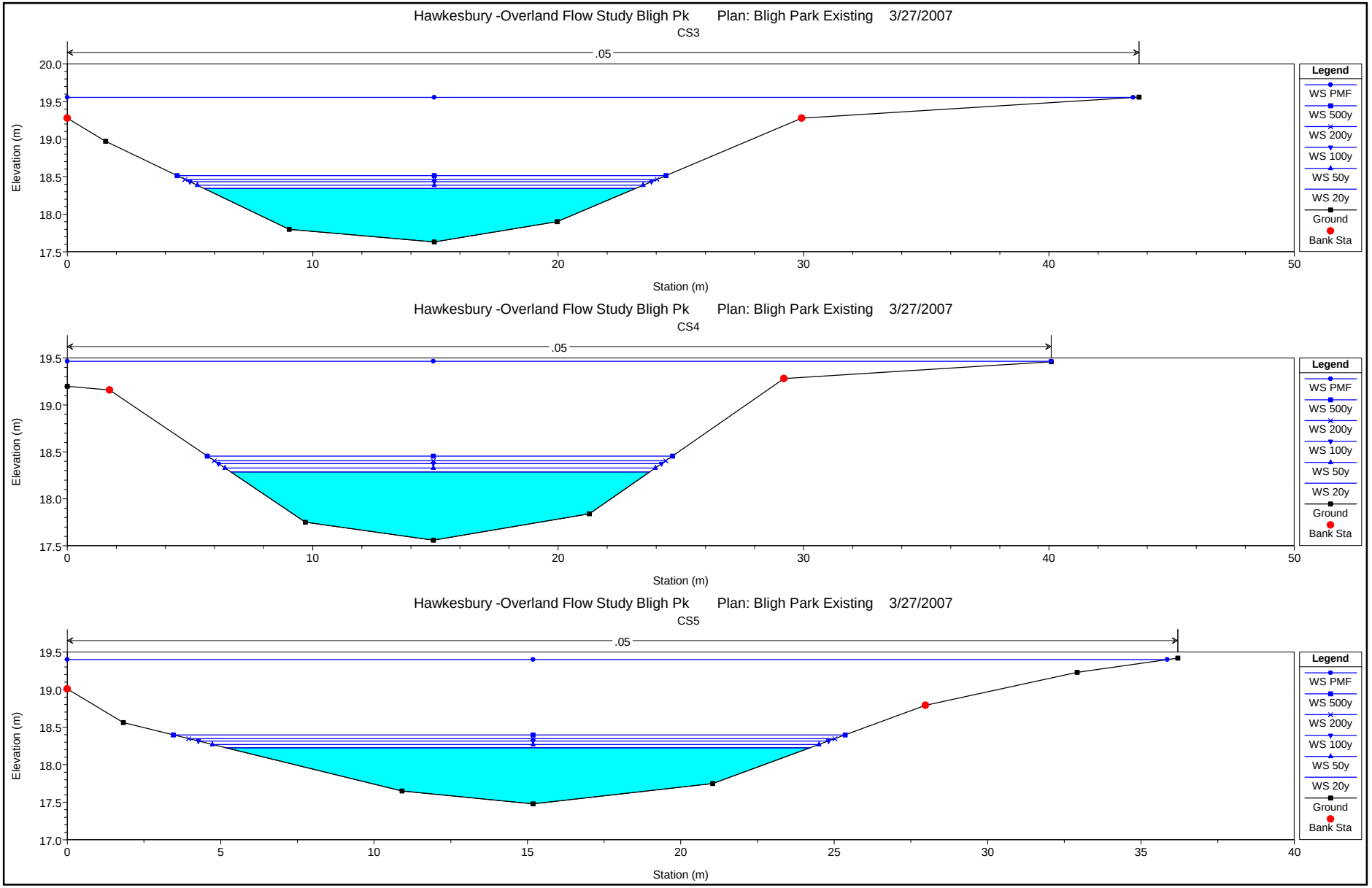
HEC-RAS Plan: BP_Exg River: Guardian Cres Reach: Reach_01 (Continued)

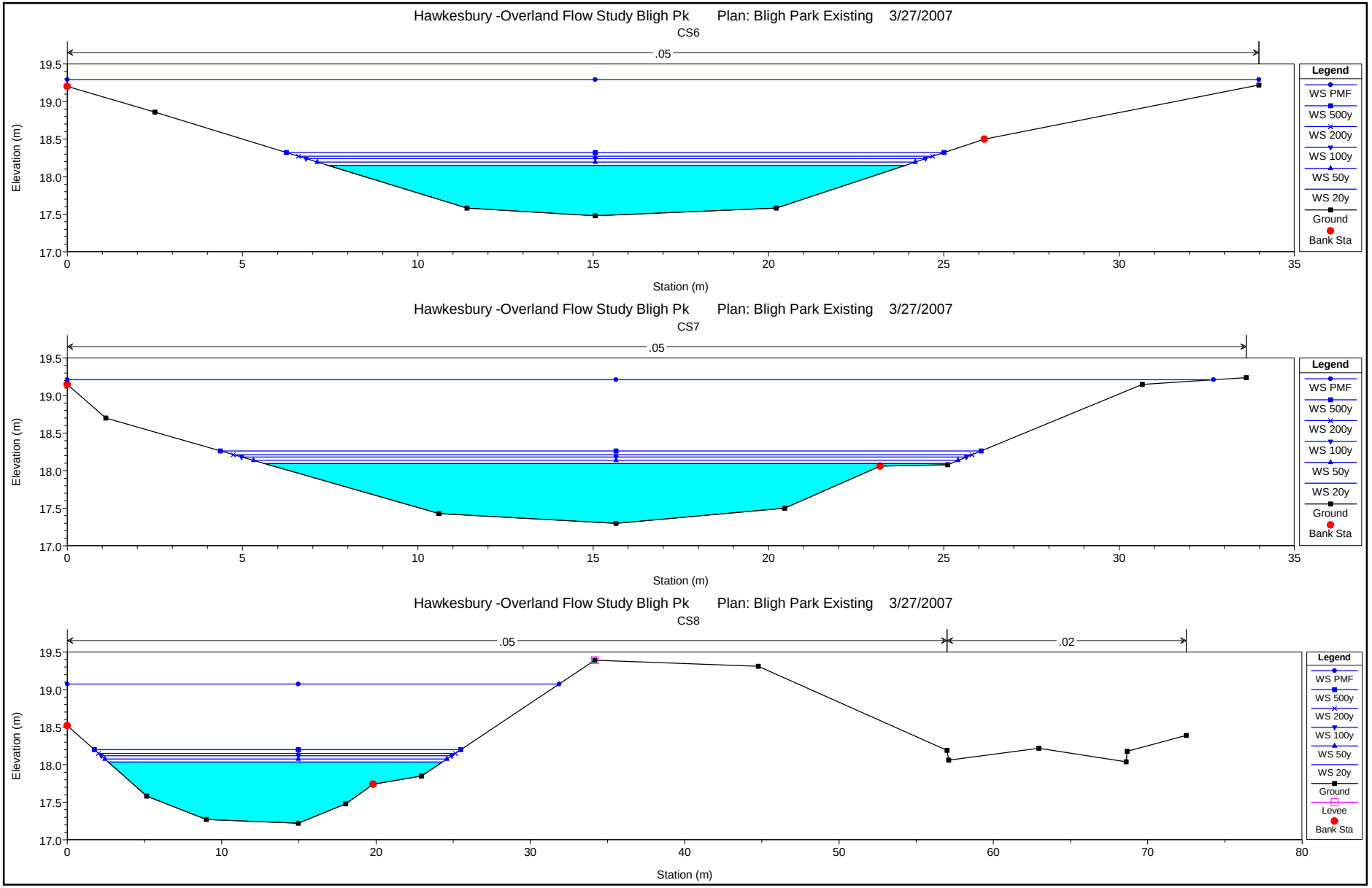
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach_01	1450	500y	12.13	16.99	17.94		17.97	0.004864	0.84	14.52	31.25	0.39
Reach_01	1450	PMF	68.02	16.99	18.65		18.74	0.004249	1.32	50.62	62.24	0.41
Reach_01	1400	20y	7.78	16.81	17.54		17.56	0.003195	0.66	11.73	26.03	0.32
Reach_01	1400	50y	8.75	16.81	17.60		17.62	0.002749	0.65	13.40	27.20	0.30
Reach_01	1400	100y	9.93	16.81	17.62		17.65	0.003112	0.71	14.00	27.54	0.32
Reach_01	1400	200y	10.74	16.81	17.67		17.69	0.002833	0.70	15.24	28.24	0.31
Reach_01	1400	500y	12.13	16.81	17.71		17.74	0.002878	0.74	16.49	30.25	0.31
Reach_01	1400	PMF	68.02	16.81	18.44		18.53	0.002629	1.17	56.75	68.09	0.34
Reach_01	1350	20y	9.26	16.46	17.24		17.28	0.004438	0.80	11.55	26.97	0.37
Reach_01	1350	50y	10.54	16.46	17.09		17.18	0.015690	1.32	7.97	20.72	0.68
Reach_01	1350	100y	11.98	16.46	17.38		17.41	0.003307	0.76	15.96	40.45	0.33
Reach_01	1350	200y	12.99	16.46	17.53		17.55	0.001437	0.56	23.42	52.86	0.22
Reach_01	1350	500y	14.72	16.46	17.59		17.60	0.001285	0.56	26.30	54.37	0.21
Reach_01	1350	PMF	93.29	16.46	17.93		18.16	0.008520	1.88	46.71	65.28	0.59
Reach_01	1320	20y	9.26	15.93	17.21	16.48	17.26	0.000386	0.95	9.75	7.75	0.27
Reach_01	1320	50y	10.54	15.93	17.06	16.53	17.14	0.000733	1.23	8.59	7.75	0.37
Reach_01	1320	100y	11.98	15.93	17.32	16.58	17.39	0.000505	1.13	10.59	7.75	0.31
Reach_01	1320	200y	12.99	15.93	17.50	16.61	17.53	0.000388	0.86	17.04	134.24	0.60
Reach_01	1320	500y	14.72	15.93	17.57	16.67	17.59	0.000366	0.71	27.35	185.09	0.43
Reach_01	1320	PMF	93.29	15.93	18.00	17.79	18.06	0.001404	1.25	128.50	290.98	0.47
Reach_01	1290		Culvert									
Reach_01	1260	20y	9.26	15.59	16.23		16.39	0.002715	1.76	5.26	8.20	0.70
Reach_01	1260	50y	10.54	15.59	16.27		16.45	0.002884	1.88	5.61	8.20	0.73
Reach_01	1260	100y	11.98	15.59	16.32		16.52	0.003085	2.01	5.95	8.20	0.75
Reach_01	1260	200y	12.99	15.59	16.35		16.57	0.003204	2.10	6.19	8.20	0.77
Reach_01	1260	500y	14.72	15.59	16.39		16.65	0.003477	2.25	6.54	8.20	0.80
Reach_01	1260	PMF	93.29	15.59	17.75	17.75	17.92	0.004264	1.95	56.68	189.38	0.90
Reach_01	1250	20y	9.26	15.34	16.19		16.25	0.006480	1.04	8.89	16.97	0.46
Reach_01	1250	50y	10.54	15.34	16.24		16.30	0.006506	1.08	9.76	17.69	0.46
Reach_01	1250	100y	11.98	15.34	16.29		16.36	0.006520	1.12	10.71	18.46	0.47
Reach_01	1250	200y	12.99	15.34	16.33		16.40	0.006414	1.14	11.44	19.02	0.47
Reach_01	1250	500y	14.72	15.34	16.39		16.46	0.006417	1.17	12.54	19.85	0.47
Reach_01	1250	PMF	93.29	15.34	17.62	17.17	17.72	0.002945	1.44	64.45	64.37	0.37
Reach_01	1200	20y	9.26	14.96	15.85	15.59	15.90	0.006249	1.02	9.04	17.22	0.45
Reach_01	1200	50y	10.54	14.96	15.90	15.63	15.96	0.006171	1.06	9.95	17.85	0.45
Reach_01	1200	100y	11.98	14.96	15.96	15.66	16.02	0.006095	1.09	10.94	18.51	0.45
Reach_01	1200	200y	12.99	14.96	16.03	15.69	16.09	0.005011	1.04	12.43	19.46	0.42
Reach_01	1200	500y	14.72	14.96	16.09	15.73	16.15	0.005098	1.09	13.51	20.13	0.42
Reach_01	1200	PMF	93.29	14.96	17.54	16.85	17.61	0.001252	1.05	80.57	66.84	0.25
Reach_01	1150	20y	9.26	14.65	15.49	15.24	15.56	0.007495	1.16	8.00	14.50	0.50
Reach_01	1150	50y	10.54	14.65	15.55	15.28	15.62	0.007460	1.20	8.79	15.04	0.50
Reach_01	1150	100y	11.98	14.65	15.60	15.32	15.68	0.007443	1.24	9.64	15.60	0.50
Reach_01	1150	200y	12.99	14.65	15.84	15.35	15.88	0.003346	0.95	13.62	17.99	0.35
Reach_01	1150	500y	14.72	14.65	15.88	15.40	15.93	0.003746	1.03	14.31	18.38	0.37
Reach_01	1150	PMF	93.29	14.65	17.47	16.67	17.55	0.001354	1.19	79.00	55.46	0.26
Reach_01	1100	20y	9.26	14.34	15.32	14.87	15.34	0.002434	0.71	13.01	21.13	0.29
Reach_01	1100	50y	10.54	14.34	15.37	14.91	15.39	0.002531	0.75	14.09	21.85	0.30
Reach_01	1100	100y	11.98	14.34	15.42	14.94	15.45	0.002624	0.79	15.26	22.61	0.31
Reach_01	1100	200y	12.99	14.34	15.78	14.97	15.80	0.000850	0.53	24.42	27.86	0.18
Reach_01	1100	500y	14.72	14.34	15.81	15.01	15.83	0.000998	0.58	25.24	28.31	0.20
Reach_01	1100	PMF	93.29	14.34	17.45	15.99	17.49	0.000547	0.81	110.23	57.99	0.17
Reach_01	1050	20y	9.26	14.32	15.18		15.19	0.003689	0.47	21.41	38.01	0.18
Reach_01	1050	50y	10.54	14.32	15.23		15.24	0.003726	0.49	23.23	38.28	0.18
Reach_01	1050	100y	11.98	14.32	15.28		15.29	0.003767	0.51	25.15	38.56	0.19
Reach_01	1050	200y	12.99	14.32	15.75		15.75	0.000792	0.32	43.85	41.22	0.09
Reach_01	1050	500y	14.72	14.32	15.77		15.78	0.000952	0.36	44.80	41.35	0.10
Reach_01	1050	PMF	93.29	14.32	17.42		17.45	0.001215	0.71	131.06	61.52	0.13
Reach_01	1000	20y	11.23	13.89	15.01		15.03	0.006449	0.65	20.96	51.35	0.24
Reach_01	1000	50y	12.83	13.89	15.06		15.08	0.006154	0.67	23.62	52.08	0.24
Reach_01	1000	100y	14.67	13.89	15.12		15.14	0.005951	0.68	26.36	52.35	0.24
Reach_01	1000	200y	15.99	13.89	15.73		15.73	0.000632	0.32	59.27	55.43	0.09
Reach_01	1000	500y	18.13	13.89	15.75		15.75	0.000770	0.36	60.28	55.52	0.09
Reach_01	1000	PMF	105.45	13.89	17.38		17.41	0.001340	0.78	159.99	77.13	0.14
Reach_01	950	20y	11.23	13.38	14.86	14.26	14.88	0.004352	0.60	22.17	48.69	0.20
Reach_01	950	50y	12.83	13.38	14.91	14.30	14.93	0.004492	0.63	24.70	54.96	0.21
Reach_01	950	100y	14.67	13.38	14.96	14.34	14.98	0.004656	0.66	27.54	61.24	0.22
Reach_01	950	200y	15.99	13.38	15.71		15.72	0.000290	0.24	83.95	75.68	0.06
Reach_01	950	500y	18.13	13.38	15.73		15.73	0.000358	0.27	85.11	75.68	0.07
Reach_01	950	PMF	105.45	13.38	17.36		17.37	0.000703	0.59	208.24	75.68	0.10
Reach_01	900	20y	11.23	13.44	13.93	13.93	14.11	0.137056	1.88	5.98	16.46	1.00
Reach_01	900	50y	12.83	13.44	13.99	13.97	14.16	0.115665	1.85	6.94	17.25	0.93
Reach_01	900	100y	14.67	13.44	14.06	14.01	14.22	0.092041	1.80	8.23	20.61	0.85
Reach_01	900	200y	15.99	13.44	15.70		15.71	0.000113	0.17	117.77	84.15	0.04
Reach_01	900	500y	18.13	13.44	15.72		15.72	0.000141	0.19	118.88	84.15	0.04
Reach_01	900	PMF	105.45	13.44	17.33		17.34	0.000416	0.49	254.56	84.15	0.08

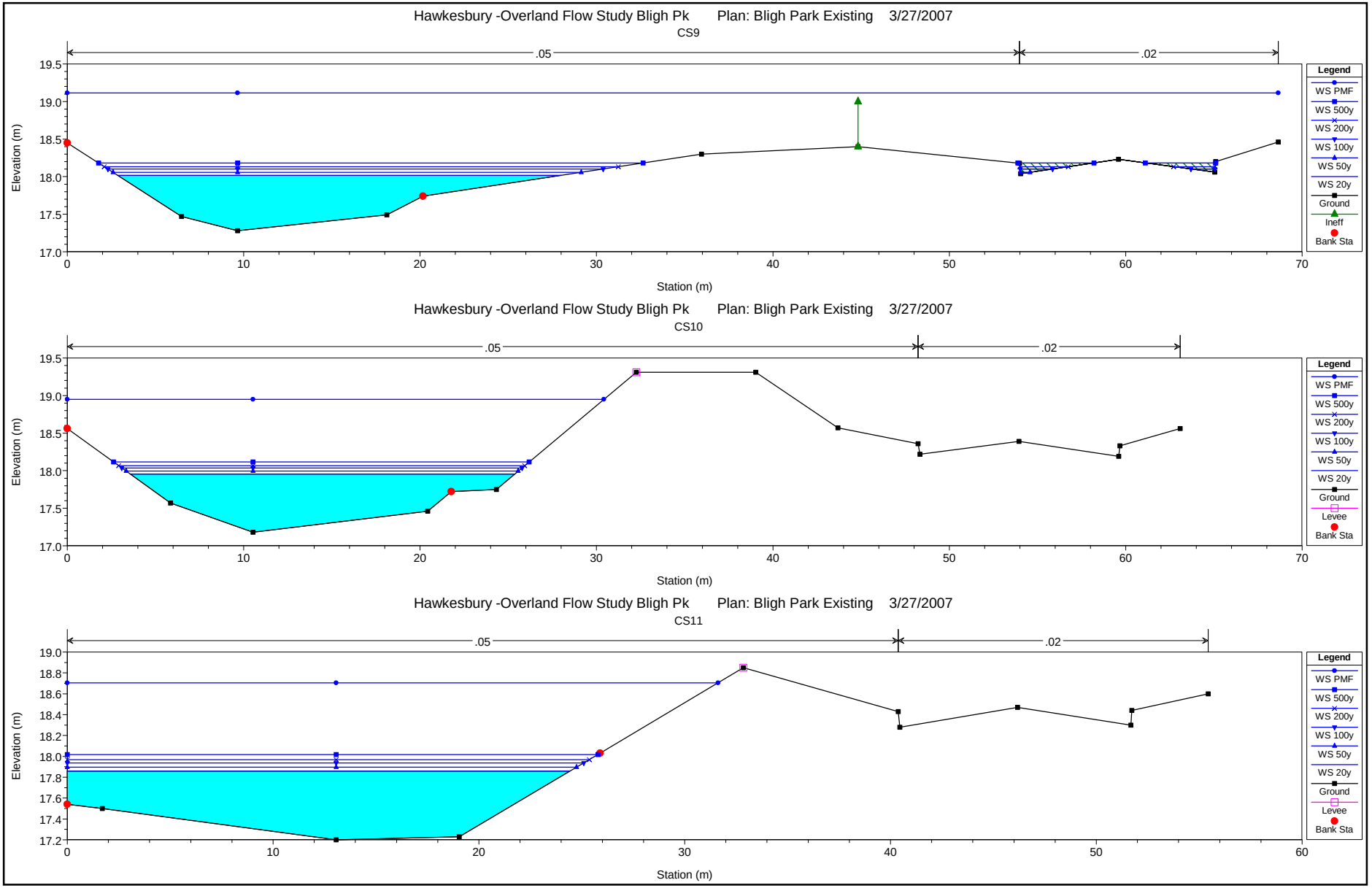
HEC-RAS Plan: BP_Exg River: Guardian Cres Reach: Reach_01 (Continued)

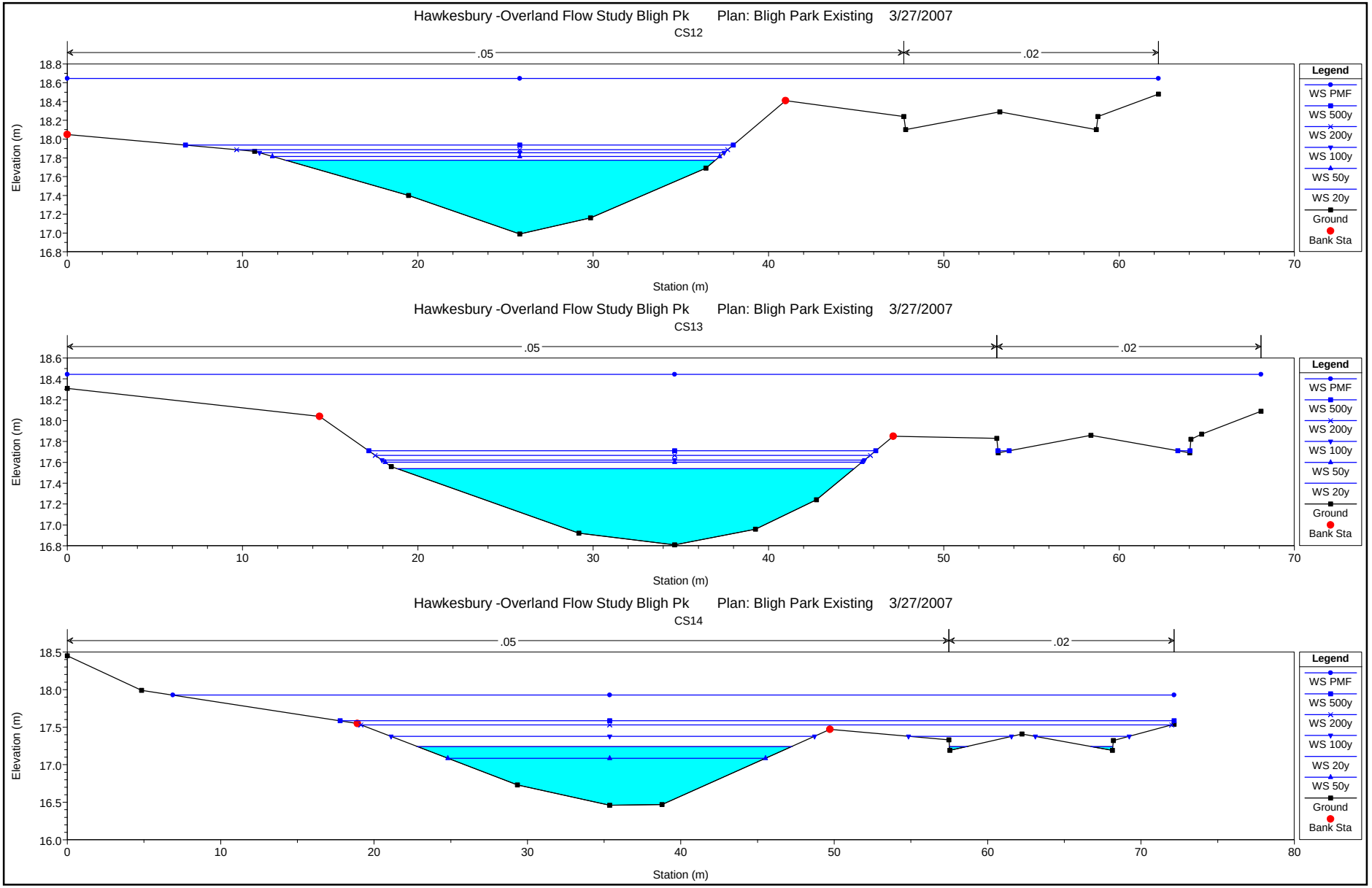
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach_01	850	20y	11.23	12.38	14.03		14.03	0.000127	0.14	87.04	80.69	0.04
Reach_01	850	50y	12.83	12.38	14.08		14.08	0.000150	0.16	91.20	83.77	0.04
Reach_01	850	100y	14.67	12.38	14.14		14.14	0.000177	0.18	96.10	86.75	0.05
Reach_01	850	200y	15.99	12.38	15.70		15.70	0.000012	0.07	246.80	96.57	0.01
Reach_01	850	500y	18.13	12.38	15.72		15.72	0.000015	0.08	248.06	96.57	0.02
Reach_01	850	PMF	105.45	12.38	17.32		17.33	0.000109	0.29	403.27	96.57	0.04
Reach_01	800	20y	11.94	12.02	14.00	13.20	14.01	0.002521	0.51	29.80	61.50	0.16
Reach_01	800	50y	13.74	12.02	14.05	13.25	14.06	0.002675	0.54	32.66	61.94	0.16
Reach_01	800	100y	15.78	12.02	14.10	13.30	14.11	0.002756	0.57	36.02	62.46	0.17
Reach_01	800	200y	17.25	12.02	15.70	13.34	15.70	0.000023	0.09	226.23	109.93	0.02
Reach_01	800	500y	19.67	12.02	15.72	13.40	15.72	0.000029	0.10	227.63	109.93	0.02
Reach_01	800	PMF	120.62	12.02	17.32	14.32	17.32	0.000171	0.34	403.49	109.93	0.05
Reach_01	790	20y	11.94	11.58	13.86	12.88	13.97	0.003381	1.53	10.57	60.15	0.76
Reach_01	790	50y	13.74	11.58	13.92	13.00	14.03	0.002725	1.50	14.07	60.71	0.70
Reach_01	790	100y	15.78	11.58	13.98	13.14	14.08	0.002166	1.46	18.15	61.35	0.63
Reach_01	790	200y	17.25	11.58	15.70	13.24	15.70	0.000008	0.24	212.51	109.93	0.05
Reach_01	790	500y	19.67	11.58	15.71	13.95	15.72	0.000011	0.27	213.86	109.93	0.06
Reach_01	790	PMF	120.62	11.58	17.29	14.64	17.32	0.000063	0.93	387.44	109.93	0.15
Reach_01	770		Culvert									
Reach_01	750	20y	11.94	11.28	12.58	12.58	13.23	0.003647	3.57	3.34	10.67	1.01
Reach_01	750	50y	13.74	11.28	12.71	12.71	13.42	0.003497	3.73	3.68	11.18	1.00
Reach_01	750	100y	15.78	11.28	13.70	12.84	14.02	0.000786	2.52	6.26	83.55	0.52
Reach_01	750	200y	17.25	11.28	15.70	12.94	15.70	0.000005	0.18	316.13	169.26	0.04
Reach_01	750	500y	19.67	11.28	15.70	13.08	15.70	0.000006	0.20	316.13	169.26	0.04
Reach_01	750	PMF	120.62	11.28	17.30	14.49	17.31	0.000032	0.67	586.98	169.26	0.11

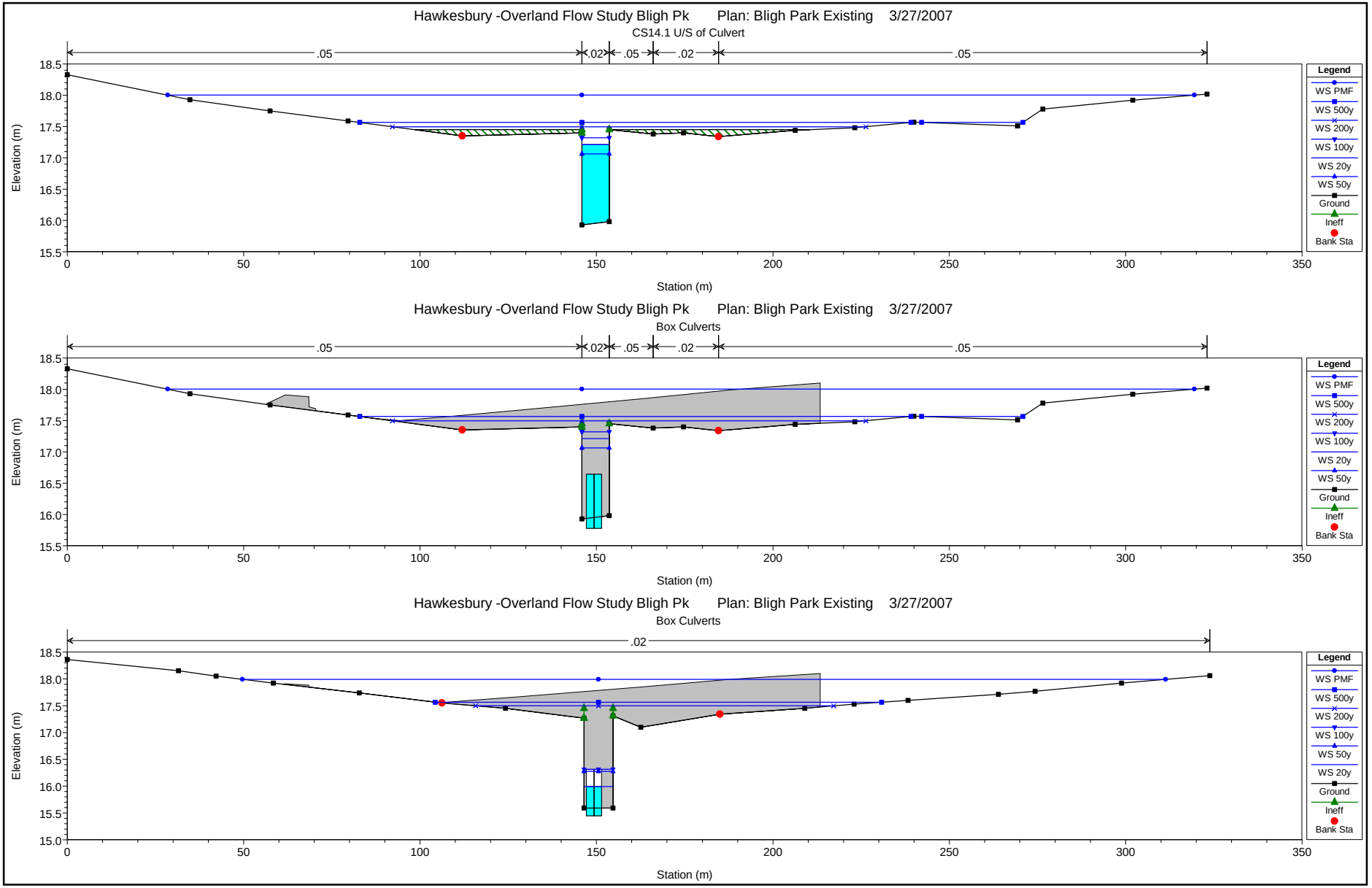

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
Guradian Crescent
.02
.02
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS 1
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS2
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta

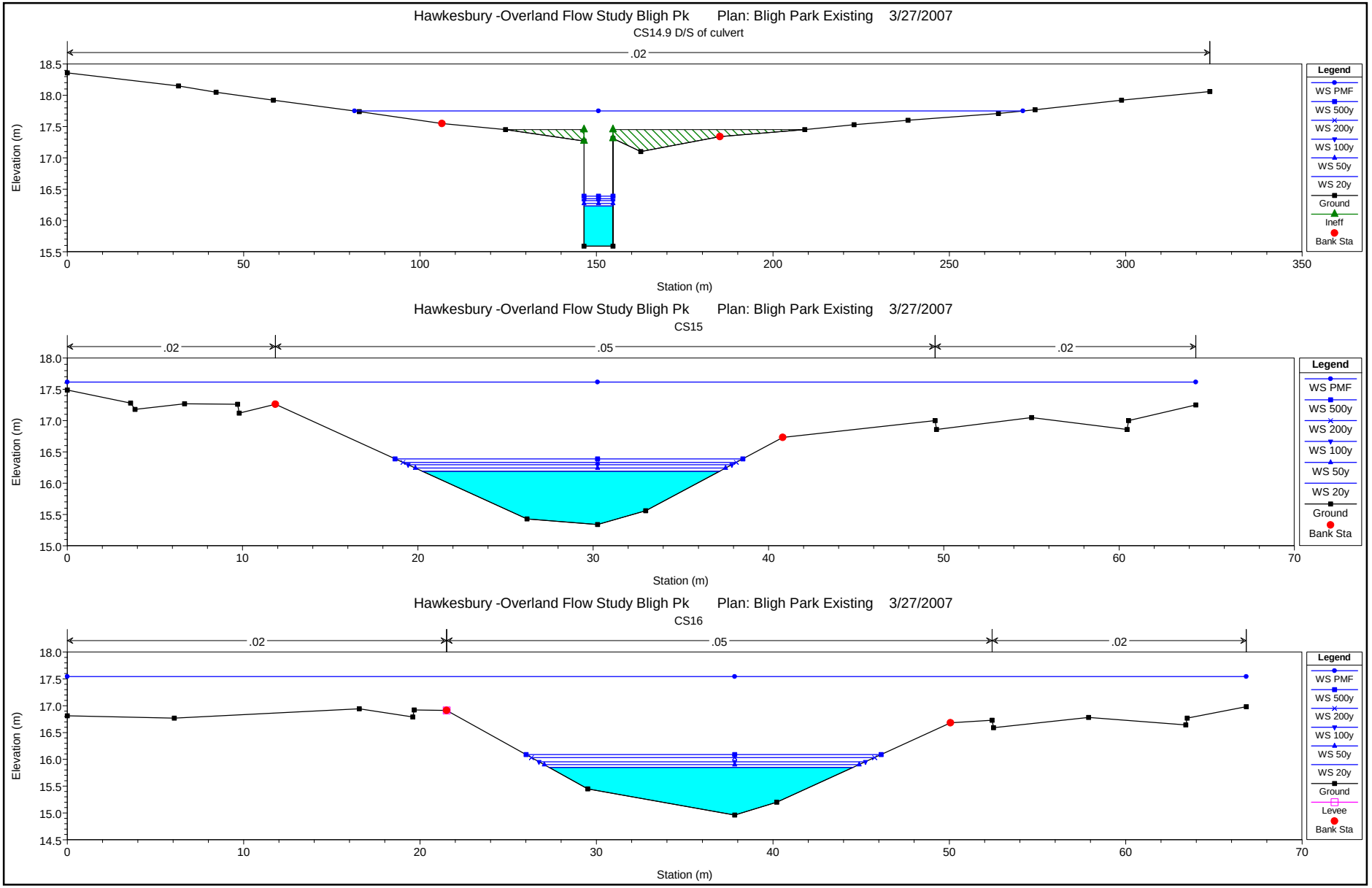

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS3
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS4
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS5
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta

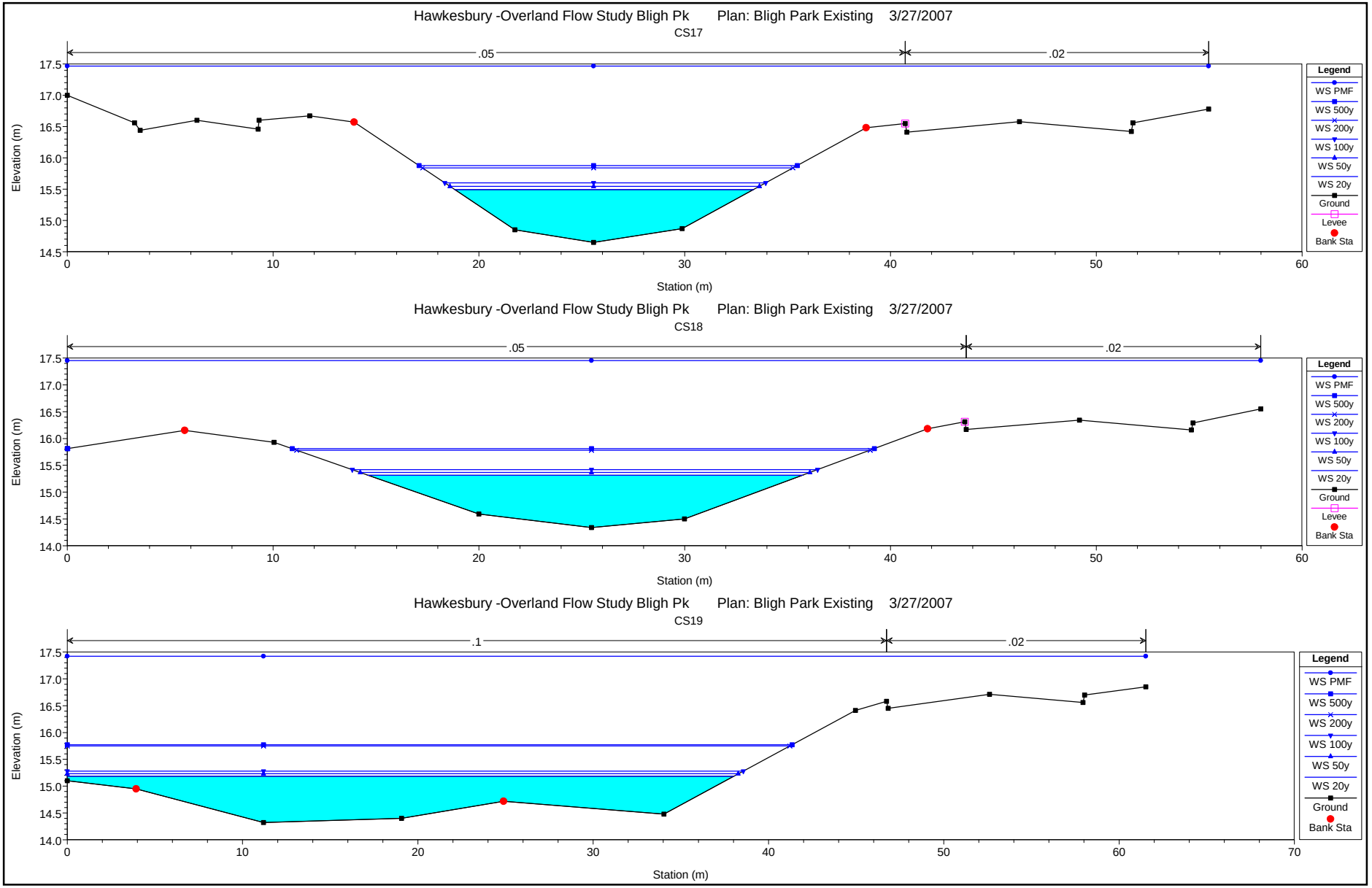

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS6
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS7
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS8
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta

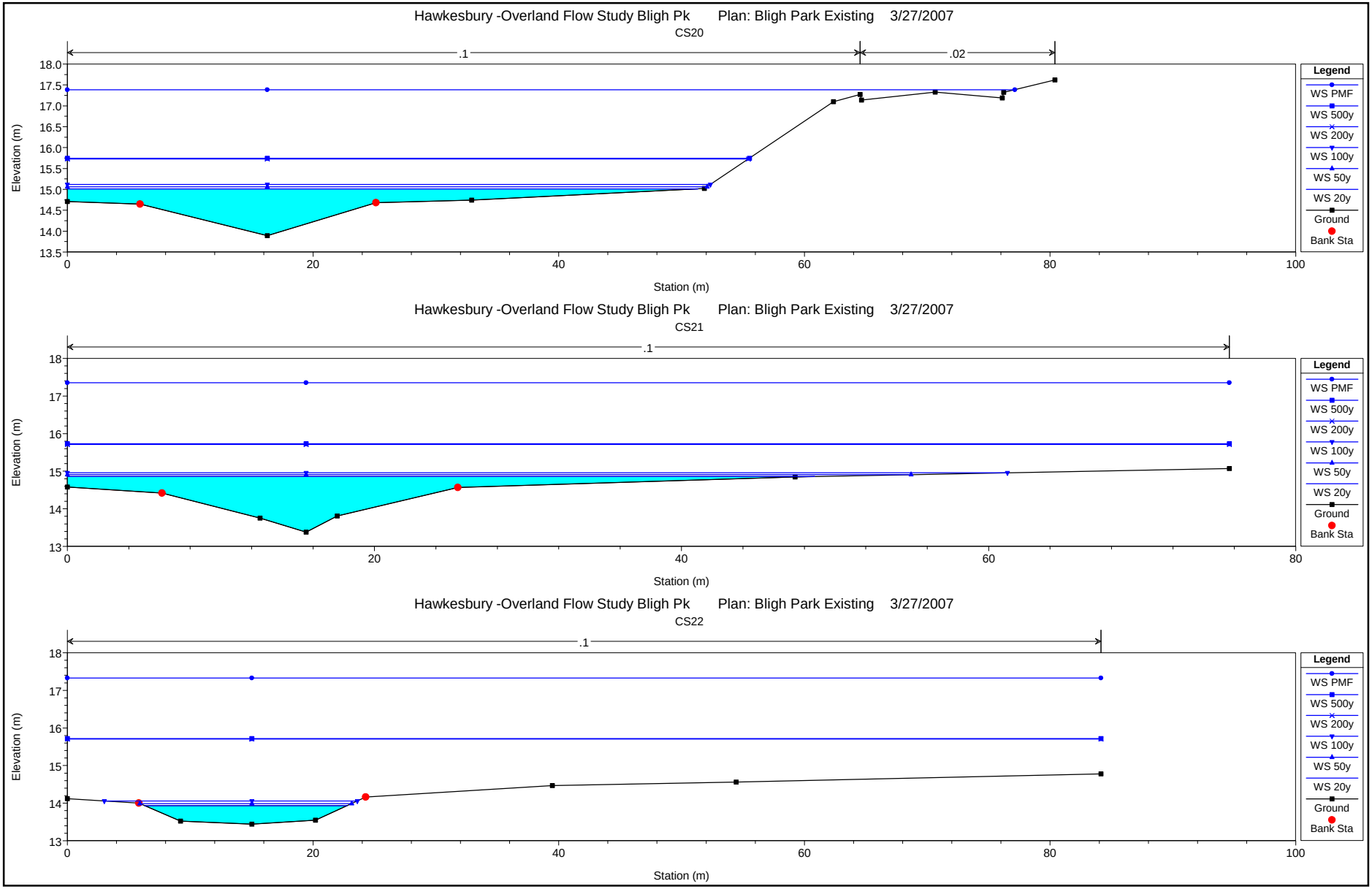

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS9
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS10
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS11
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta

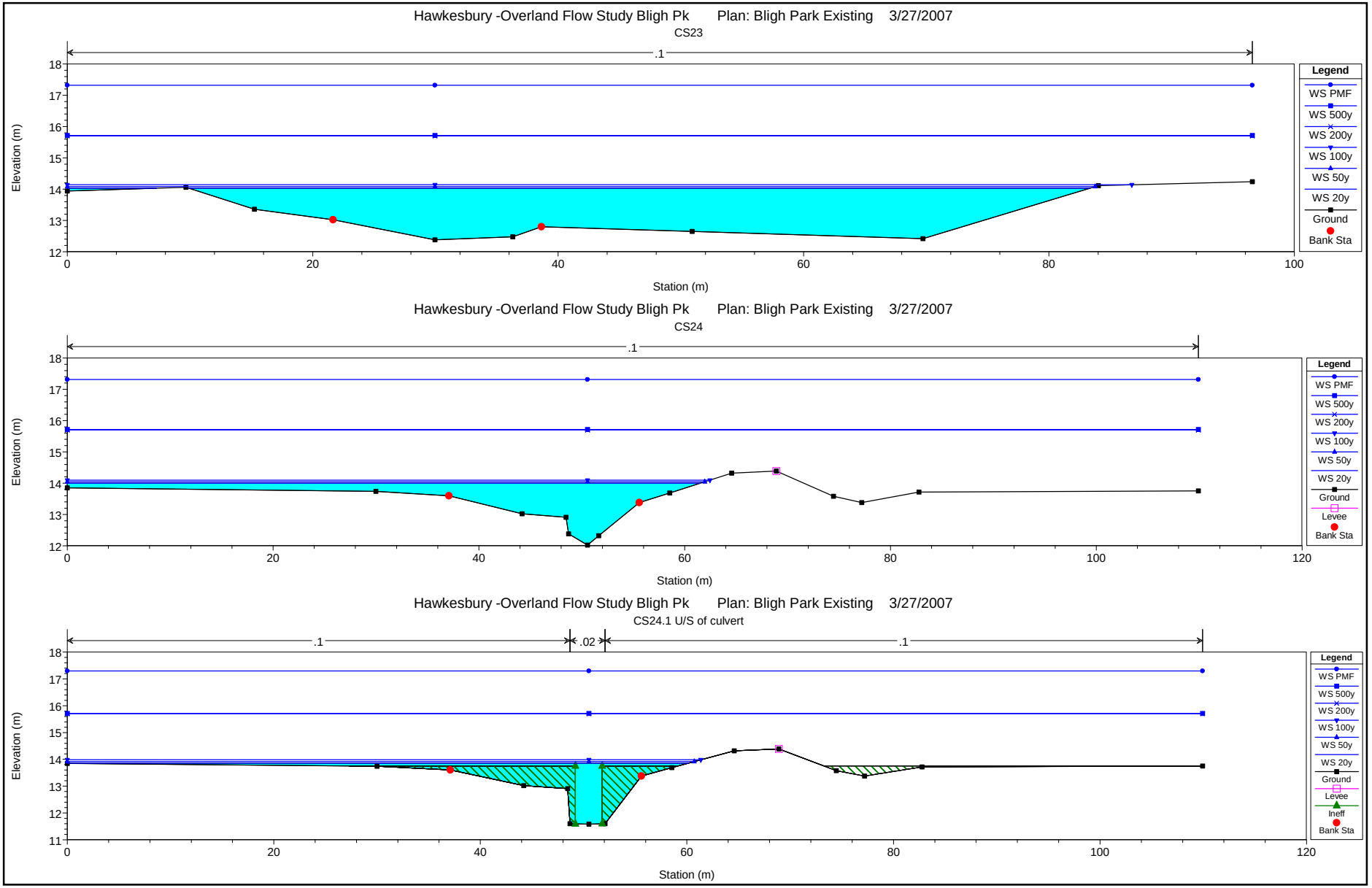

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS12
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS13
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS14
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 20y
WS 50y
Ground
Bank Sta

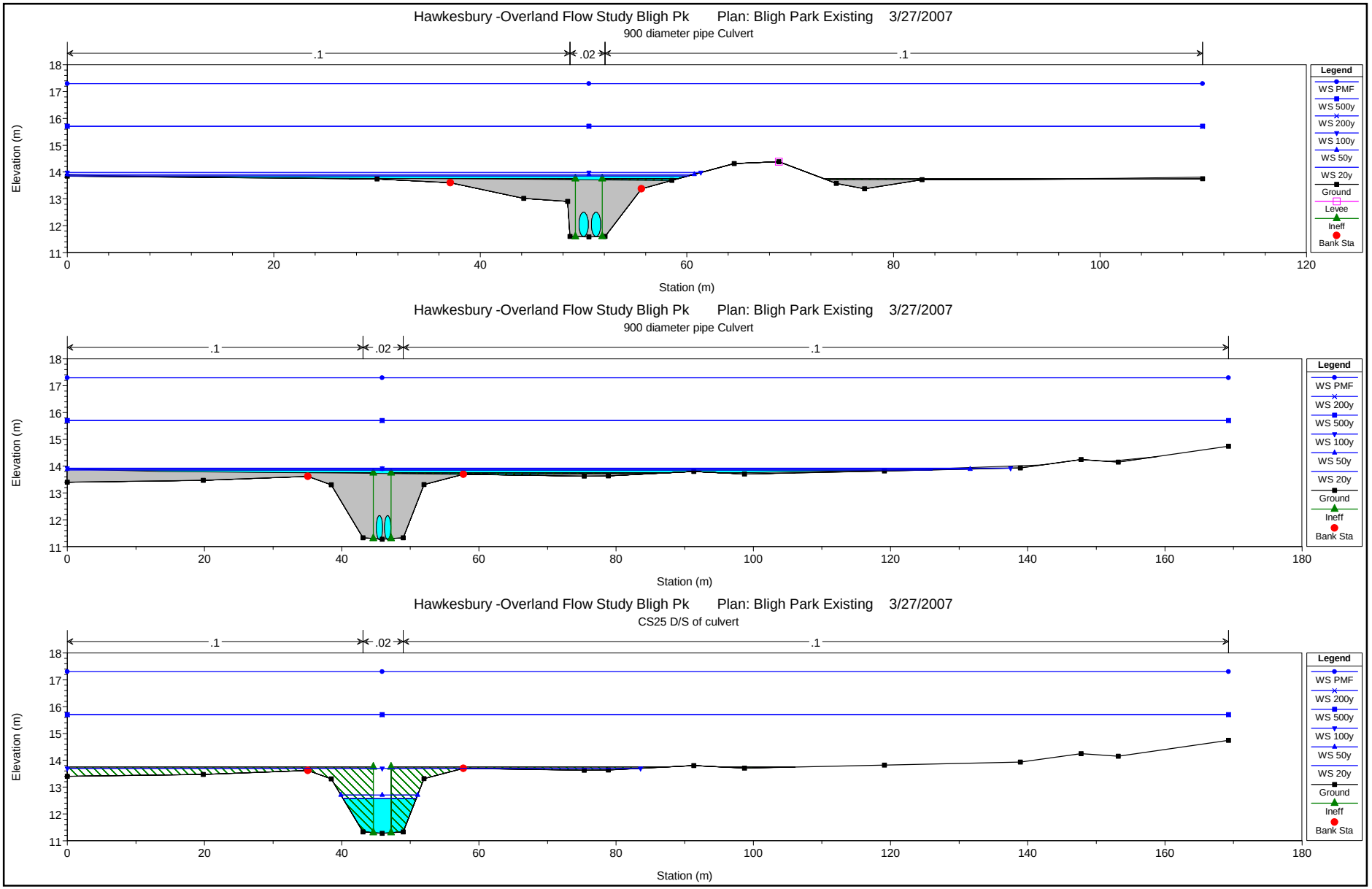

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS14.1 U/S of Culvert
.05
.02
.05
.02
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 20y
WS 50y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
Box Culverts
.05
.02
.05
.02
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 20y
WS 50y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
Box Culverts
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS14.9 D/S of culvert
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS15
.02
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS16
.02
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta

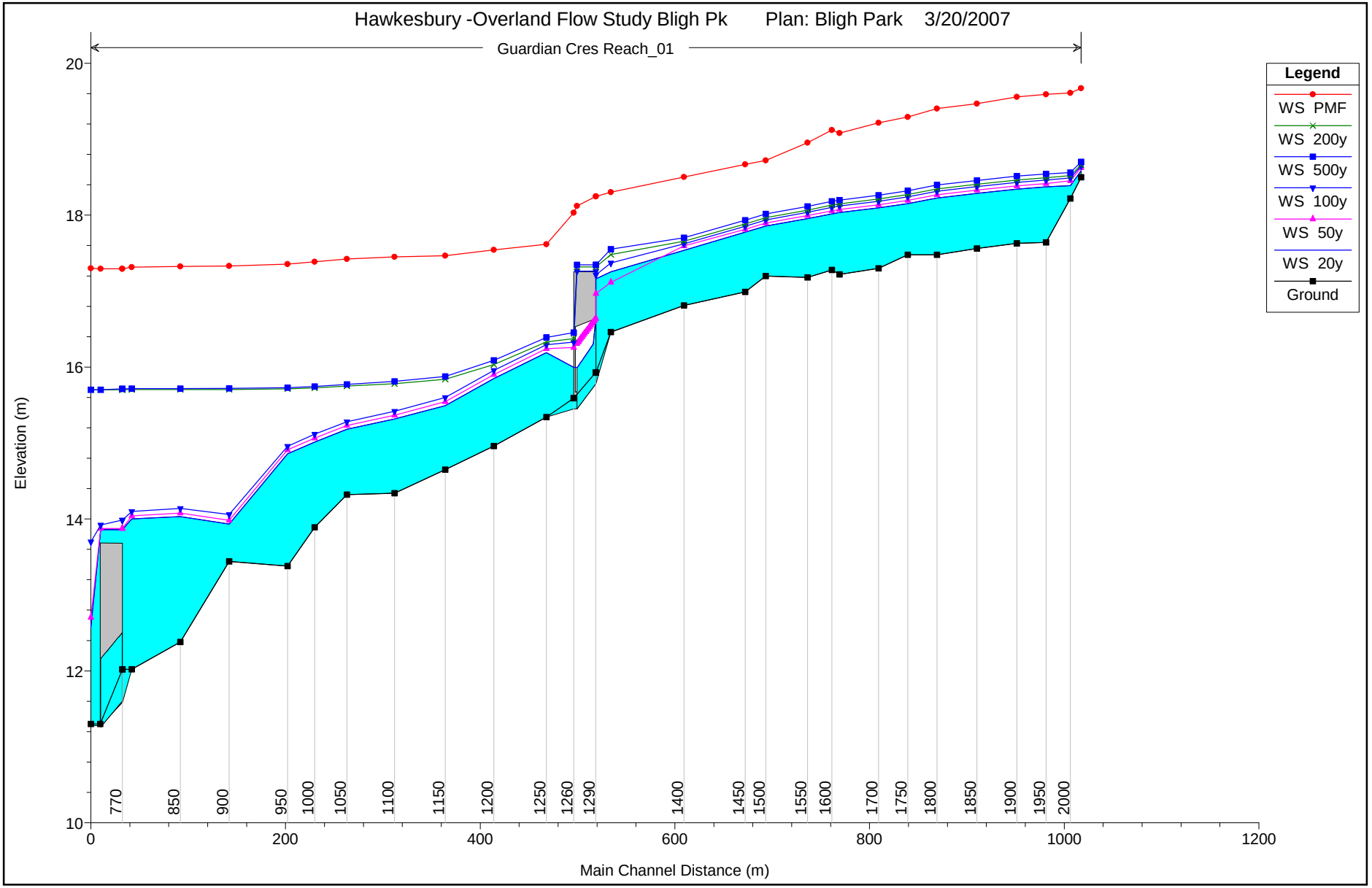

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS17
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS18
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS19
.1
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS20
.1
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS21
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS22
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS23
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS24
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS24.1 U/S of culvert
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Ineff
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
900 diameter pipe Culvert
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
900 diameter pipe Culvert
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 200y
WS 500y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park Existing 3/27/2007
CS25 D/S of culvert
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 200y
WS 500y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta

50% BLOCKAGE AT RIFLE RANGE ROAD


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
Guardian Cres Reach_01
Legend
WS PMF
WS 200y
WS 500y
WS 100y
WS 50y
WS 20y
Ground
Elevation (m)
Main Channel Distance (m)
10
12
14
16
18
20
0
200
400
600
800
1000
1200
770
850
900
950
1000
1050
1100
1150
1200
1250
1260
1290
1400
1450
1500
1550
1600
1700
1750
1800
1850
1900
1950
2000

HEC-RAS Plan: BP200307 River: Guardian Cres Reach: Reach_01

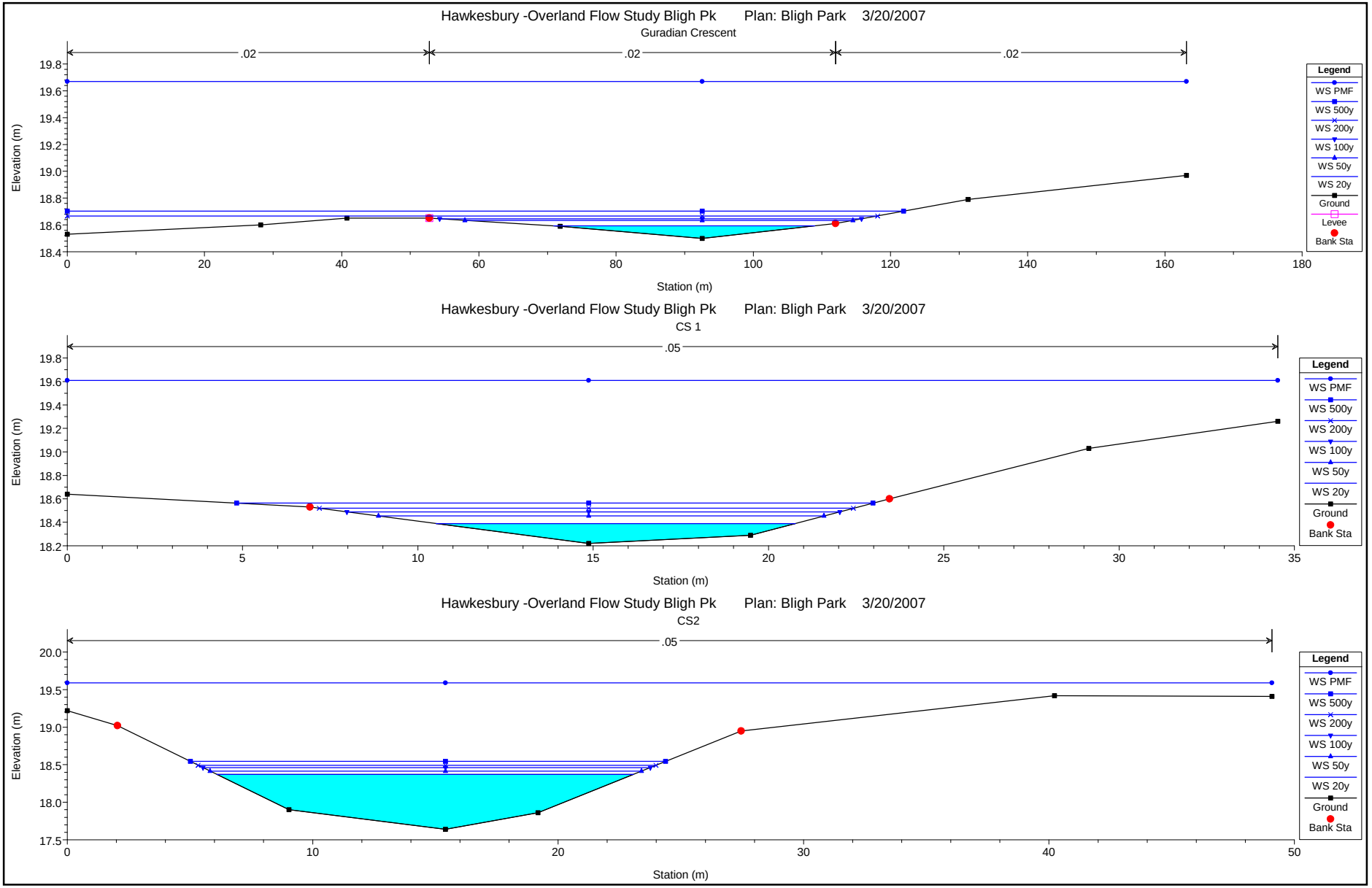
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach_01	2100	20y	0.99	18.50	18.59	18.59	18.61	0.007702	0.56	1.75	38.06	0.84
Reach_01	2100	50y	2.12	18.50	18.63	18.62	18.65	0.004804	0.58	3.70	56.55	0.71
Reach_01	2100	100y	2.87	18.50	18.65	18.63	18.67	0.005547	0.66	4.38	61.48	0.77
Reach_01	2100	200y	3.61	18.50	18.67	18.64	18.67	0.001640	0.42	9.39	118.13	0.44
Reach_01	2100	500y	4.82	18.50	18.70	18.65	18.71	0.000890	0.38	13.61	121.90	0.34
Reach_01	2100	PMF	35.11	18.50	19.67	18.80	19.67	0.000018	0.22	165.35	163.14	0.07
Reach_01	2000	20y	0.99	18.22	18.39	18.38	18.43	0.045530	0.94	1.06	10.25	0.93
Reach_01	2000	50y	2.12	18.22	18.45	18.45	18.53	0.047892	1.18	1.79	12.71	1.01
Reach_01	2000	100y	2.87	18.22	18.49	18.49	18.57	0.046137	1.27	2.26	14.06	1.01
Reach_01	2000	200y	3.61	18.22	18.52	18.52	18.61	0.044513	1.33	2.71	15.23	1.01
Reach_01	2000	500y	4.82	18.22	18.56	18.56	18.67	0.039874	1.42	3.43	18.15	0.98
Reach_01	2000	PMF	35.11	18.22	19.61		19.67	0.002428	1.14	34.77	34.53	0.33
Reach_01	1950	20y	3.09	17.64	18.37		18.38	0.001078	0.39	7.88	16.98	0.18
Reach_01	1950	50y	3.51	17.64	18.42	17.99	18.42	0.001078	0.41	8.62	17.58	0.19
Reach_01	1950	100y	3.99	17.64	18.46	18.01	18.47	0.001073	0.42	9.46	18.23	0.19
Reach_01	1950	200y	4.33	17.64	18.49	18.03	18.50	0.001072	0.43	10.03	18.65	0.19
Reach_01	1950	500y	4.91	17.64	18.54	18.05	18.55	0.001067	0.45	11.00	19.36	0.19
Reach_01	1950	PMF	31.10	17.64	19.59		19.62	0.000998	0.80	43.87	49.09	0.21
Reach_01	1900	20y	3.09	17.63	18.34		18.35	0.000970	0.37	8.24	17.58	0.17
Reach_01	1900	50y	3.51	17.63	18.39		18.39	0.000972	0.39	9.01	18.17	0.18
Reach_01	1900	100y	3.99	17.63	18.43		18.44	0.000968	0.40	9.88	18.81	0.18
Reach_01	1900	200y	4.33	17.63	18.46		18.47	0.000968	0.41	10.47	19.23	0.18
Reach_01	1900	500y	4.91	17.63	18.51		18.52	0.000964	0.43	11.47	19.92	0.18
Reach_01	1900	PMF	31.10	17.63	19.56		19.59	0.001127	0.79	40.76	43.45	0.22
Reach_01	1850	20y	4.03	17.56	18.29		18.30	0.001499	0.48	8.39	17.07	0.22
Reach_01	1850	50y	4.56	17.56	18.33		18.34	0.001505	0.50	9.12	17.54	0.22
Reach_01	1850	100y	5.18	17.56	18.38		18.39	0.001513	0.52	9.95	18.06	0.22
Reach_01	1850	200y	5.61	17.56	18.41		18.42	0.001517	0.53	10.51	18.40	0.23
Reach_01	1850	500y	6.35	17.56	18.46		18.47	0.001521	0.55	11.45	18.96	0.23
Reach_01	1850	PMF	38.48	17.56	19.47		19.52	0.001998	1.06	37.43	40.09	0.30
Reach_01	1800	20y	4.03	17.48	18.23		18.24	0.001461	0.46	8.83	19.07	0.21
Reach_01	1800	50y	4.56	17.48	18.27		18.28	0.001457	0.47	9.66	19.78	0.22
Reach_01	1800	100y	5.18	17.48	18.32		18.33	0.001453	0.49	10.60	20.55	0.22
Reach_01	1800	200y	5.61	17.48	18.35		18.36	0.001448	0.50	11.24	21.07	0.22
Reach_01	1800	500y	6.35	17.48	18.40		18.41	0.001437	0.52	12.33	21.91	0.22
Reach_01	1800	PMF	38.48	17.48	19.40		19.45	0.001540	0.97	41.23	35.87	0.26
Reach_01	1750	20y	4.96	17.48	18.15		18.17	0.002895	0.64	7.69	16.50	0.30
Reach_01	1750	50y	5.61	17.48	18.19		18.22	0.002896	0.67	8.39	17.06	0.30
Reach_01	1750	100y	6.37	17.48	18.24		18.27	0.002892	0.69	9.19	17.68	0.31
Reach_01	1750	200y	6.89	17.48	18.27		18.30	0.002878	0.71	9.74	18.09	0.31
Reach_01	1750	500y	7.80	17.48	18.32		18.35	0.002865	0.73	10.66	18.76	0.31
Reach_01	1750	PMF	45.87	17.48	19.29		19.38	0.003207	1.32	36.55	33.99	0.37
Reach_01	1700	20y	4.96	17.30	18.10		18.11	0.001520	0.52	9.62	19.58	0.22
Reach_01	1700	50y	5.61	17.30	18.14		18.15	0.001549	0.54	10.44	20.11	0.23
Reach_01	1700	100y	6.37	17.30	18.18		18.20	0.001573	0.57	11.38	20.68	0.23
Reach_01	1700	200y	6.89	17.30	18.21		18.23	0.001580	0.58	12.02	21.07	0.23
Reach_01	1700	500y	7.80	17.30	18.26		18.28	0.001595	0.61	13.09	21.71	0.24
Reach_01	1700	PMF	45.87	17.30	19.21		19.29	0.002527	1.27	38.75	32.72	0.34
Reach_01	1650	20y	5.90	17.22	18.04	17.60	18.05	0.001399	0.54	11.43	21.68	0.22
Reach_01	1650	50y	6.66	17.22	18.08	17.63	18.09	0.001450	0.57	12.29	22.18	0.23
Reach_01	1650	100y	7.55	17.22	18.12	17.66	18.14	0.001498	0.60	13.28	22.74	0.23
Reach_01	1650	200y	8.17	17.22	18.15	17.67	18.17	0.001523	0.61	13.96	23.12	0.23
Reach_01	1650	500y	9.24	17.22	18.20	17.70	18.22	0.001562	0.64	15.10	23.74	0.24
Reach_01	1650	PMF	53.25	17.22	19.08	18.40	19.17	0.003110	1.45	39.96	31.88	0.37
Reach_01	1600	20y	5.90	17.28	18.02	17.68	18.04	0.002144	0.61	10.36	25.22	0.27
Reach_01	1600	50y	6.66	17.28	18.06	17.70	18.08	0.002139	0.63	11.38	27.17	0.27
Reach_01	1600	100y	7.55	17.28	18.10	17.73	18.12	0.002116	0.65	12.59	31.43	0.27
Reach_01	1600	200y	8.17	17.28	18.13	17.74	18.15	0.002089	0.67	13.45	34.35	0.27
Reach_01	1600	500y	9.24	17.28	18.18	17.77	18.21	0.002044	0.68	14.93	39.25	0.27
Reach_01	1600	PMF	53.25	17.28	19.12	18.46	19.14	0.000690	0.68	76.07	68.65	0.18
Reach_01	1550	20y	6.84	17.18	17.96	17.62	17.98	0.002461	0.66	10.67	21.82	0.29
Reach_01	1550	50y	7.71	17.18	18.00	17.65	18.02	0.002507	0.69	11.51	22.24	0.29
Reach_01	1550	100y	8.74	17.18	18.04	17.67	18.07	0.002548	0.73	12.47	22.71	0.30
Reach_01	1550	200y	9.46	17.18	18.07	17.69	18.10	0.002560	0.75	13.14	23.04	0.30
Reach_01	1550	500y	10.69	17.18	18.12	17.72	18.15	0.002574	0.78	14.27	23.57	0.30
Reach_01	1550	PMF	60.63	17.18	18.95	18.42	19.09	0.004899	1.73	37.28	30.43	0.47
Reach_01	1500	20y	6.84	17.20	17.86	17.55	17.88	0.002132	0.57	12.02	24.47	0.26
Reach_01	1500	50y	7.71	17.20	17.90	17.56	17.92	0.002169	0.60	12.92	24.78	0.26
Reach_01	1500	100y	8.74	17.20	17.94	17.59	17.96	0.002200	0.63	13.96	25.13	0.27
Reach_01	1500	200y	9.46	17.20	17.97	17.60	17.99	0.002199	0.64	14.70	25.39	0.27
Reach_01	1500	500y	10.69	17.20	18.02	17.62	18.04	0.002194	0.67	15.94	25.80	0.27
Reach_01	1500	PMF	60.63	17.20	18.71	18.23	18.86	0.005719	1.75	35.75	31.65	0.49
Reach_01	1450	20y	7.78	16.99	17.79		17.81	0.004428	0.75	10.43	24.79	0.37
Reach_01	1450	50y	8.75	16.99	17.82		17.85	0.004469	0.77	11.32	25.67	0.37
Reach_01	1450	100y	9.93	16.99	17.86		17.89	0.004501	0.80	12.37	26.68	0.38
Reach_01	1450	200y	10.74	16.99	17.89		17.92	0.004625	0.82	13.16	28.24	0.38

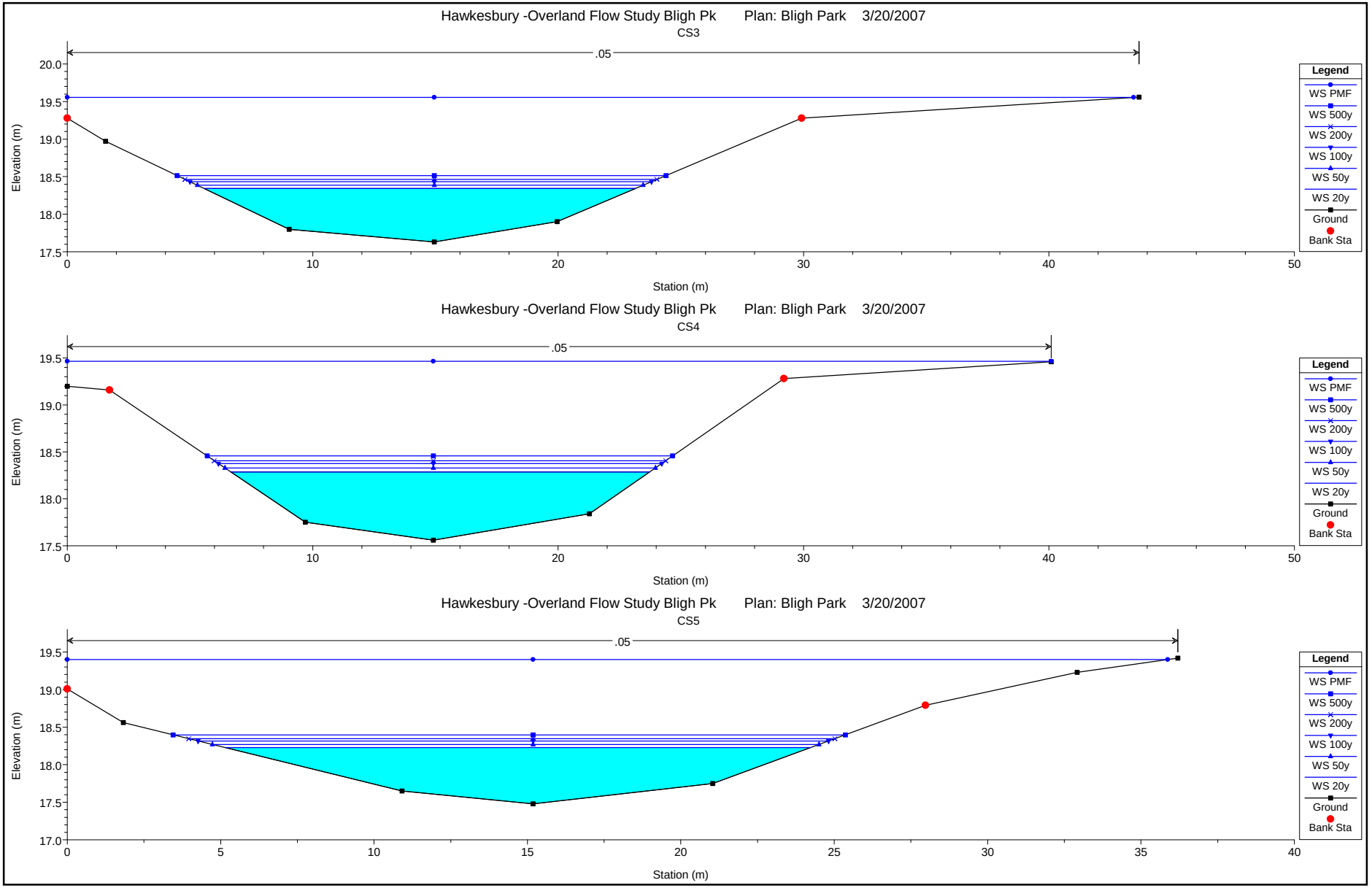
HEC-RAS Plan: BP200307 River: Guardian Cres Reach: Reach_01 (Continued)

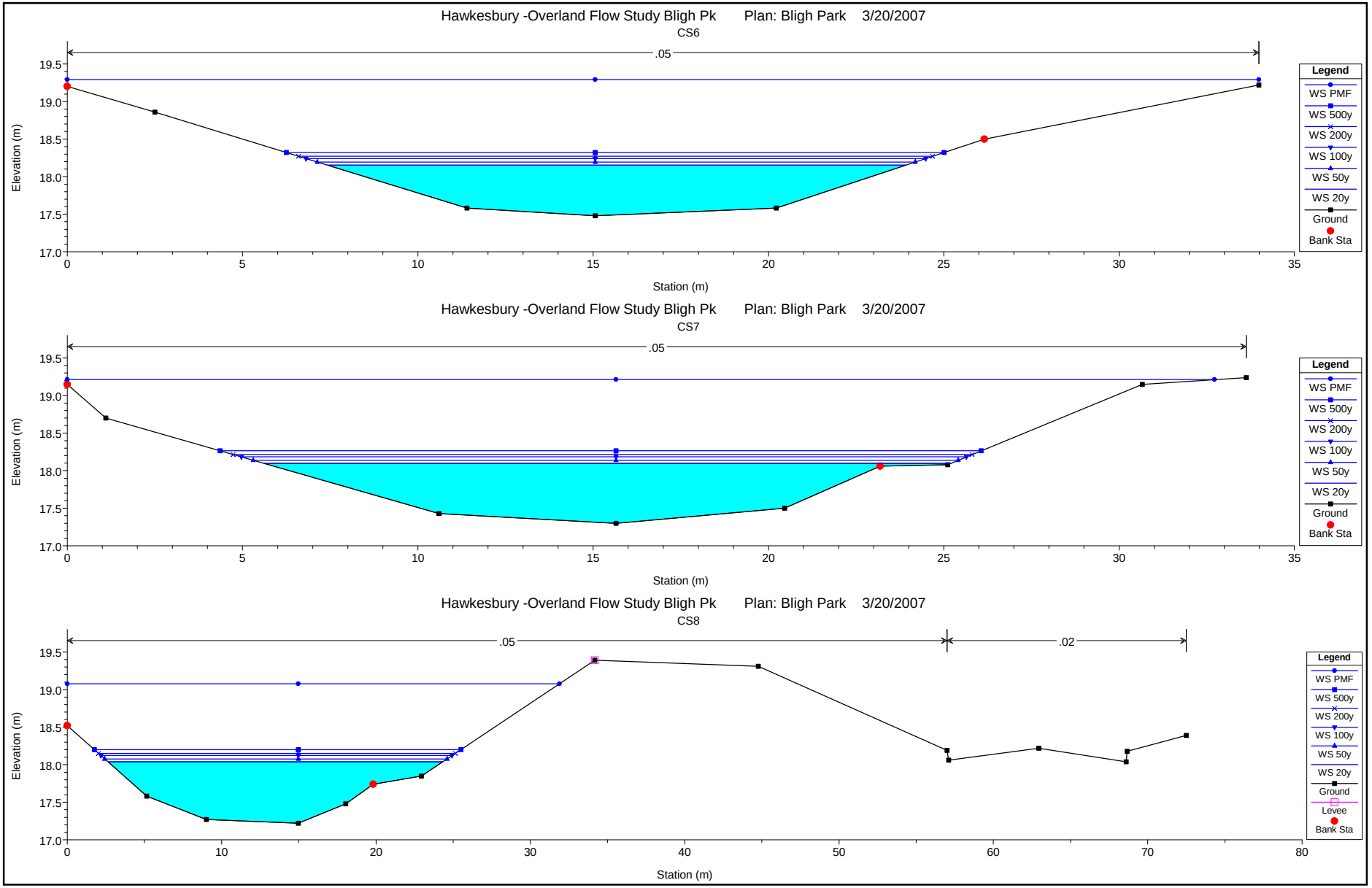
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach_01	1450	500y	12.13	16.99	17.94		17.97	0.004814	0.83	14.59	31.40	0.39
Reach_01	1450	PMF	68.02	16.99	18.65		18.74	0.004148	1.31	50.99	62.24	0.41
Reach_01	1400	20y	7.78	16.81	17.62		17.63	0.001994	0.56	13.79	27.42	0.25
Reach_01	1400	50y	8.75	16.81	17.64		17.66	0.002222	0.61	14.40	27.77	0.27
Reach_01	1400	100y	9.93	16.81	17.67		17.69	0.002445	0.65	15.19	28.21	0.28
Reach_01	1400	200y	10.74	16.81	17.69		17.71	0.002571	0.68	15.76	28.53	0.29
Reach_01	1400	500y	12.13	16.81	17.72		17.75	0.002710	0.72	16.85	31.20	0.30
Reach_01	1400	PMF	68.02	16.81	18.46		18.54	0.002484	1.15	57.80	68.09	0.33
Reach_01	1350	20y	9.26	16.46	17.54		17.55	0.000672	0.39	24.09	53.17	0.15
Reach_01	1350	50y	10.54	16.46	17.55		17.56	0.000823	0.43	24.54	53.33	0.17
Reach_01	1350	100y	11.98	16.46	17.57		17.58	0.000946	0.47	25.45	53.87	0.18
Reach_01	1350	200y	12.99	16.46	17.58		17.60	0.001014	0.49	26.19	54.31	0.19
Reach_01	1350	500y	14.72	16.46	17.62		17.63	0.001052	0.52	28.00	55.36	0.20
Reach_01	1350	PMF	93.29	16.46	17.86	17.77	18.13	0.011367	2.07	42.51	63.19	0.68
Reach_01	1320	20y	9.26	15.93	17.53	16.48	17.55	0.000170	0.52	21.98	157.67	0.33
Reach_01	1320	50y	10.54	15.93	17.54	16.53	17.56	0.000214	0.57	22.90	162.73	0.37
Reach_01	1320	100y	11.98	15.93	17.55	16.58	17.57	0.000256	0.61	25.49	176.11	0.38
Reach_01	1320	200y	12.99	15.93	17.57	16.61	17.59	0.000281	0.62	27.88	187.56	0.38
Reach_01	1320	500y	14.72	15.93	17.60	16.67	17.62	0.000298	0.61	34.55	194.22	0.35
Reach_01	1320	PMF	93.29	15.93	17.93	17.79	18.01	0.001962	1.45	108.93	270.20	0.58
Reach_01	1290		Culvert									
Reach_01	1260	20y	9.26	15.59	16.23		16.39	0.002715	1.76	5.26	8.20	0.70
Reach_01	1260	50y	10.54	15.59	16.27		16.45	0.002884	1.88	5.61	8.20	0.73
Reach_01	1260	100y	11.98	15.59	16.32		16.52	0.003085	2.01	5.95	8.20	0.75
Reach_01	1260	200y	12.99	15.59	16.35		16.57	0.003204	2.10	6.19	8.20	0.77
Reach_01	1260	500y	14.72	15.59	16.39		16.65	0.003479	2.25	6.54	8.20	0.81
Reach_01	1260	PMF	93.29	15.59	17.75	17.75	17.92	0.004264	1.95	56.68	189.38	0.90
Reach_01	1250	20y	9.26	15.34	16.19		16.25	0.006480	1.04	8.89	16.97	0.46
Reach_01	1250	50y	10.54	15.34	16.24		16.30	0.006506	1.08	9.76	17.69	0.46
Reach_01	1250	100y	11.98	15.34	16.29		16.36	0.006520	1.12	10.71	18.46	0.47
Reach_01	1250	200y	12.99	15.34	16.33		16.40	0.006415	1.14	11.43	19.02	0.47
Reach_01	1250	500y	14.72	15.34	16.39		16.46	0.006425	1.17	12.53	19.84	0.47
Reach_01	1250	PMF	93.29	15.34	17.60	17.17	17.71	0.003077	1.47	63.60	64.37	0.38
Reach_01	1200	20y	9.26	14.96	15.85	15.59	15.90	0.006249	1.02	9.04	17.22	0.45
Reach_01	1200	50y	10.54	14.96	15.90	15.63	15.96	0.006171	1.06	9.95	17.85	0.45
Reach_01	1200	100y	11.98	14.96	15.96	15.66	16.02	0.006095	1.09	10.94	18.51	0.45
Reach_01	1200	200y	12.99	14.96	16.03	15.69	16.09	0.005024	1.05	12.42	19.46	0.42
Reach_01	1200	500y	14.72	14.96	16.09	15.73	16.15	0.005167	1.09	13.45	20.09	0.43
Reach_01	1200	PMF	93.29	14.96	17.52	16.85	17.60	0.001317	1.07	79.41	66.84	0.25
Reach_01	1150	20y	9.26	14.65	15.49	15.24	15.56	0.007495	1.16	8.00	14.50	0.50
Reach_01	1150	50y	10.54	14.65	15.55	15.28	15.62	0.007456	1.20	8.79	15.04	0.50
Reach_01	1150	100y	11.98	14.65	15.60	15.32	15.68	0.007433	1.24	9.64	15.60	0.50
Reach_01	1150	200y	12.99	14.65	15.84	15.35	15.88	0.003363	0.96	13.59	17.98	0.35
Reach_01	1150	500y	14.72	14.65	15.87	15.40	15.92	0.003863	1.04	14.16	18.29	0.38
Reach_01	1150	PMF	93.29	14.65	17.46	16.69	17.54	0.001173	1.10	78.73	55.46	0.24
Reach_01	1100	20y	9.26	14.34	15.32	14.87	15.34	0.002434	0.71	13.01	21.13	0.29
Reach_01	1100	50y	10.54	14.34	15.37	14.91	15.40	0.002527	0.75	14.10	21.86	0.30
Reach_01	1100	100y	11.98	14.34	15.42	14.94	15.45	0.002615	0.78	15.28	22.62	0.30
Reach_01	1100	200y	12.99	14.34	15.78	14.97	15.79	0.000855	0.53	24.37	27.84	0.18
Reach_01	1100	500y	14.72	14.34	15.80	15.01	15.82	0.001032	0.59	24.93	28.13	0.20
Reach_01	1100	PMF	93.29	14.34	17.44	15.99	17.48	0.000555	0.82	109.76	57.99	0.17
Reach_01	1050	20y	9.26	14.32	15.18		15.19	0.003688	0.47	21.42	38.01	0.18
Reach_01	1050	50y	10.54	14.32	15.23		15.24	0.003713	0.49	23.25	38.28	0.18
Reach_01	1050	100y	11.98	14.32	15.28		15.29	0.003737	0.51	25.22	38.57	0.19
Reach_01	1050	200y	12.99	14.32	15.75		15.75	0.000797	0.32	43.77	41.20	0.09
Reach_01	1050	500y	14.72	14.32	15.76		15.77	0.000987	0.36	44.29	41.27	0.10
Reach_01	1050	PMF	93.29	14.32	17.41		17.44	0.001234	0.71	130.53	61.52	0.13
Reach_01	1000	20y	11.23	13.89	15.01		15.03	0.006437	0.65	20.98	51.37	0.24
Reach_01	1000	50y	12.83	13.89	15.07		15.08	0.006077	0.66	23.73	52.09	0.24
Reach_01	1000	100y	14.67	13.89	15.12		15.14	0.005799	0.68	26.60	52.37	0.24
Reach_01	1000	200y	15.99	13.89	15.72		15.73	0.000635	0.32	59.15	55.42	0.09
Reach_01	1000	500y	18.13	13.89	15.73		15.74	0.000801	0.36	59.53	55.46	0.10
Reach_01	1000	PMF	105.45	13.89	17.38		17.40	0.001358	0.78	159.28	77.00	0.14
Reach_01	950	20y	11.23	13.38	14.86	14.26	14.88	0.004337	0.60	22.20	48.78	0.20
Reach_01	950	50y	12.83	13.38	14.91	14.30	14.93	0.004387	0.62	24.97	55.59	0.21
Reach_01	950	100y	14.67	13.38	14.97	14.34	14.99	0.004429	0.65	28.19	62.60	0.21
Reach_01	950	200y	15.99	13.38	15.71		15.71	0.000292	0.24	83.78	75.68	0.06
Reach_01	950	500y	18.13	13.38	15.71		15.72	0.000372	0.28	84.03	75.68	0.07
Reach_01	950	PMF	105.45	13.38	17.35		17.36	0.000711	0.59	207.52	75.68	0.10
Reach_01	900	20y	11.23	13.44	13.93	13.93	14.11	0.140405	1.89	5.93	16.42	1.01
Reach_01	900	50y	12.83	13.44	13.97	13.97	14.16	0.137564	1.96	6.54	16.93	1.01
Reach_01	900	100y	14.67	13.44	14.01	14.01	14.22	0.133575	2.03	7.24	17.75	1.00
Reach_01	900	200y	15.99	13.44	15.70		15.70	0.000114	0.17	117.58	84.15	0.04
Reach_01	900	500y	18.13	13.44	15.70		15.70	0.000146	0.20	117.65	84.15	0.04
Reach_01	900	PMF	105.45	13.44	17.32		17.33	0.000421	0.49	253.73	84.15	0.08

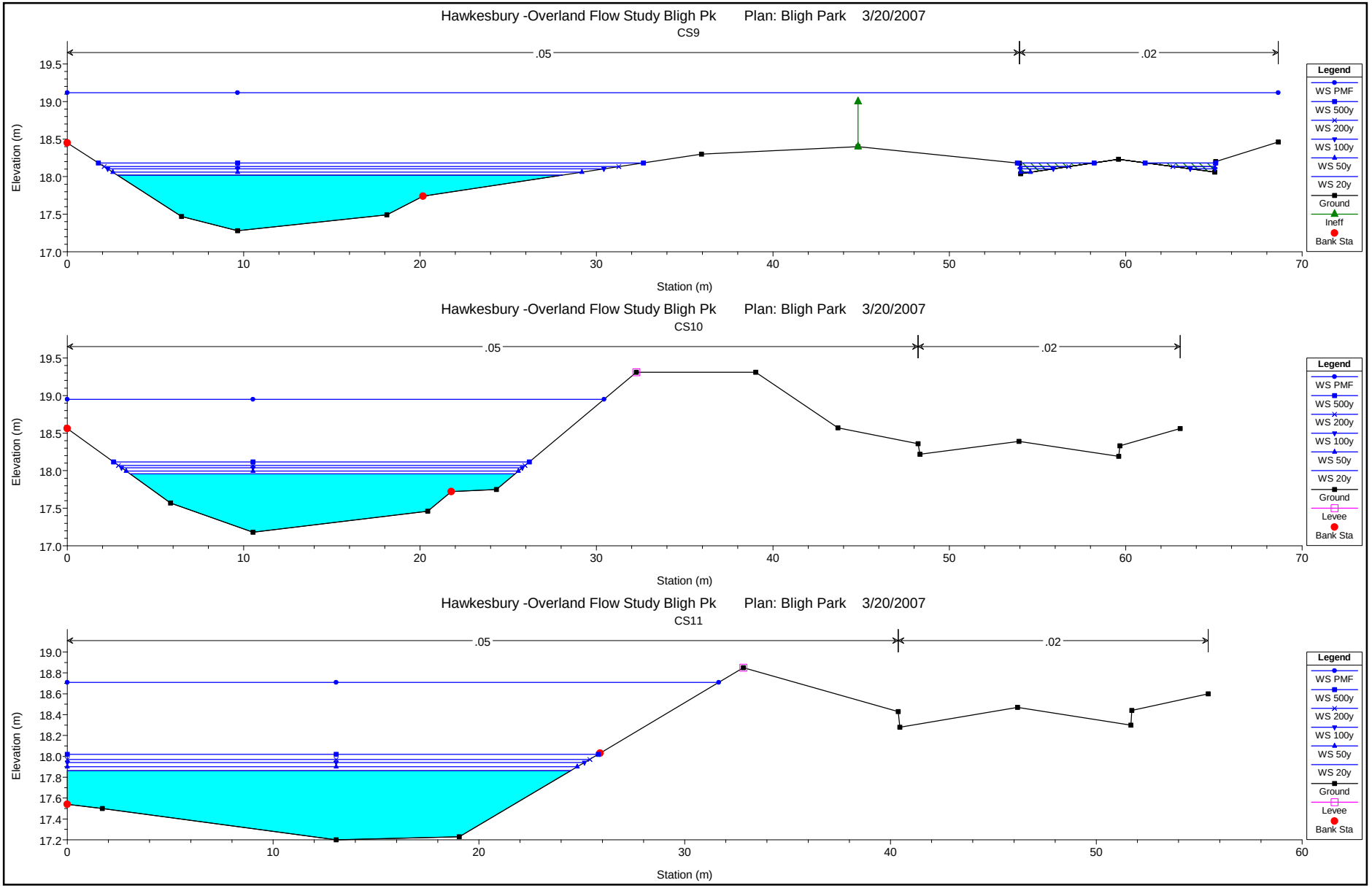
HEC-RAS Plan: BP200307 River: Guardian Cres Reach: Reach_01 (Continued)

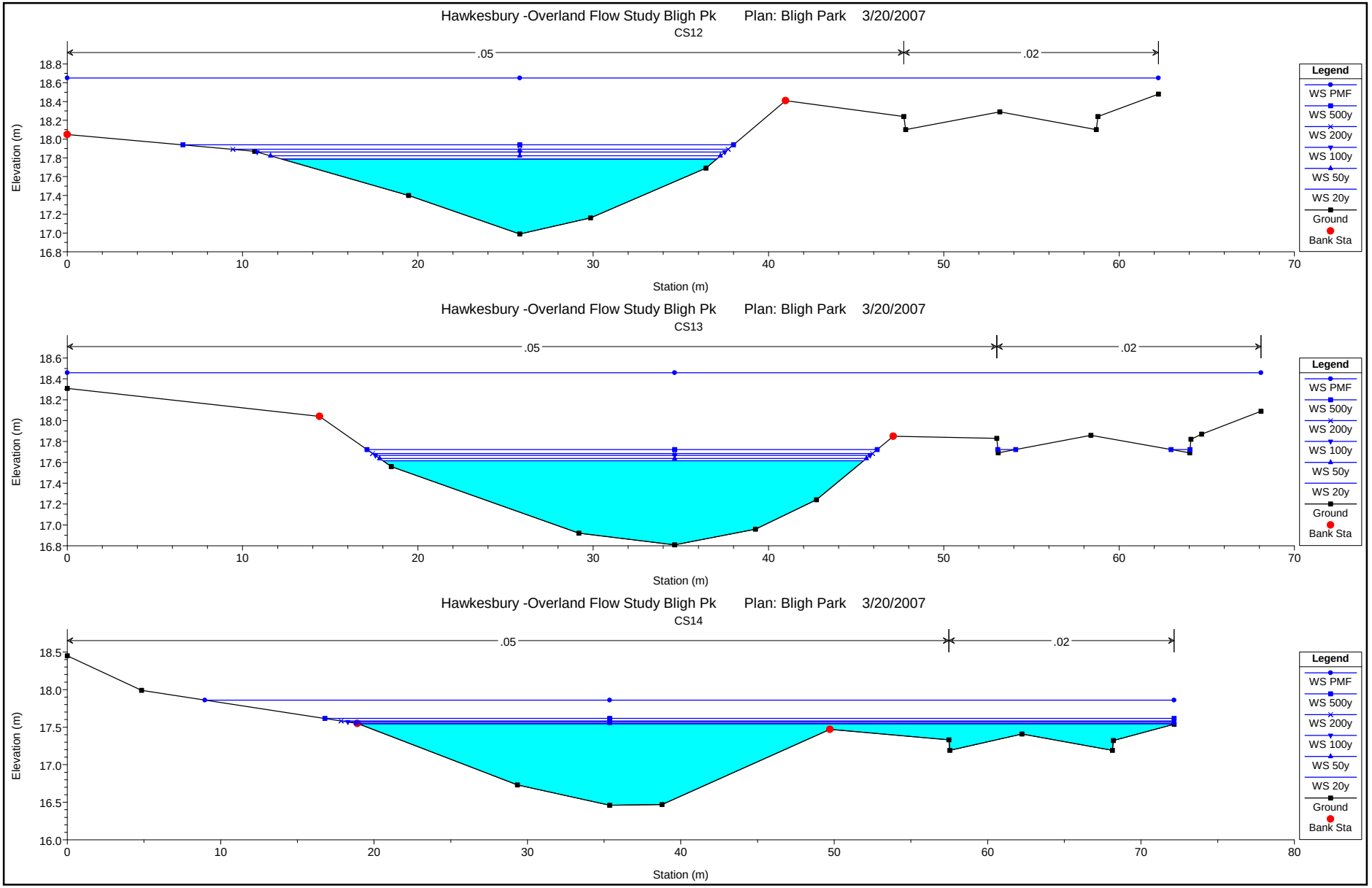
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach_01	850	20y	11.23	12.38	13.94	12.76	13.95	0.000159	0.15	80.51	72.42	0.04
Reach_01	850	50y	12.83	12.38	13.97	12.78	13.97	0.000194	0.17	82.41	74.92	0.05
Reach_01	850	100y	14.67	12.38	14.02	12.80	14.02	0.000222	0.19	86.31	79.82	0.05
Reach_01	850	200y	15.99	12.38	15.70		15.70	0.000012	0.07	246.58	96.57	0.01
Reach_01	850	500y	18.13	12.38	15.70		15.70	0.000016	0.08	246.64	96.57	0.02
Reach_01	850	PMF	105.45	12.38	17.31		17.32	0.000110	0.29	402.31	96.57	0.04
Reach_01	800	20y	11.94	12.02	13.90	13.20	13.92	0.004126	0.61	23.81	60.56	0.20
Reach_01	800	50y	13.74	12.02	13.92	13.25	13.94	0.005038	0.68	24.77	60.71	0.22
Reach_01	800	100y	15.78	12.02	13.96	13.30	13.99	0.005294	0.72	27.51	61.14	0.23
Reach_01	800	200y	17.25	12.02	15.70	13.34	15.70	0.000023	0.09	225.98	109.93	0.02
Reach_01	800	500y	19.67	12.02	15.70	13.40	15.70	0.000030	0.11	226.01	109.93	0.02
Reach_01	800	PMF	120.62	12.02	17.31	14.32	17.31	0.000172	0.34	402.39	109.93	0.05
Reach_01	790	20y	11.94	12.02	13.88	13.18	13.90	0.000766	0.71	23.27	101.33	0.30
Reach_01	790	50y	13.74	12.02	13.89	13.23	13.92	0.000978	0.81	24.24	102.85	0.34
Reach_01	790	100y	15.78	12.02	13.93	13.29	13.97	0.001091	0.84	28.81	109.80	0.34
Reach_01	790	200y	17.25	12.02	15.70	13.33	15.70	0.000010	0.10	293.33	153.59	0.02
Reach_01	790	500y	19.67	12.02	15.70	13.39	15.70	0.000013	0.11	293.36	153.59	0.02
Reach_01	790	PMF	120.62	12.02	17.31	14.35	17.31	0.000075	0.35	539.82	153.59	0.06
Reach_01	770		Culvert									
Reach_01	750	20y	11.94	11.30	12.40	12.40	12.71	0.071416	2.47	4.84	8.30	1.00
Reach_01	750	50y	13.74	11.30	12.46	12.46	12.80	0.069816	2.59	5.30	8.64	1.00
Reach_01	750	100y	15.78	11.30	13.70	12.52	13.76	0.002871	1.05	15.01	124.26	0.24
Reach_01	750	200y	17.25	11.30	15.70	12.57	15.70	0.000007	0.06	404.52	209.97	0.01
Reach_01	750	500y	19.67	11.30	15.70	12.65	15.70	0.000009	0.07	404.52	209.97	0.01
Reach_01	750	PMF	120.62	11.30	17.30	14.13	17.30	0.000047	0.23	740.51	209.97	0.04

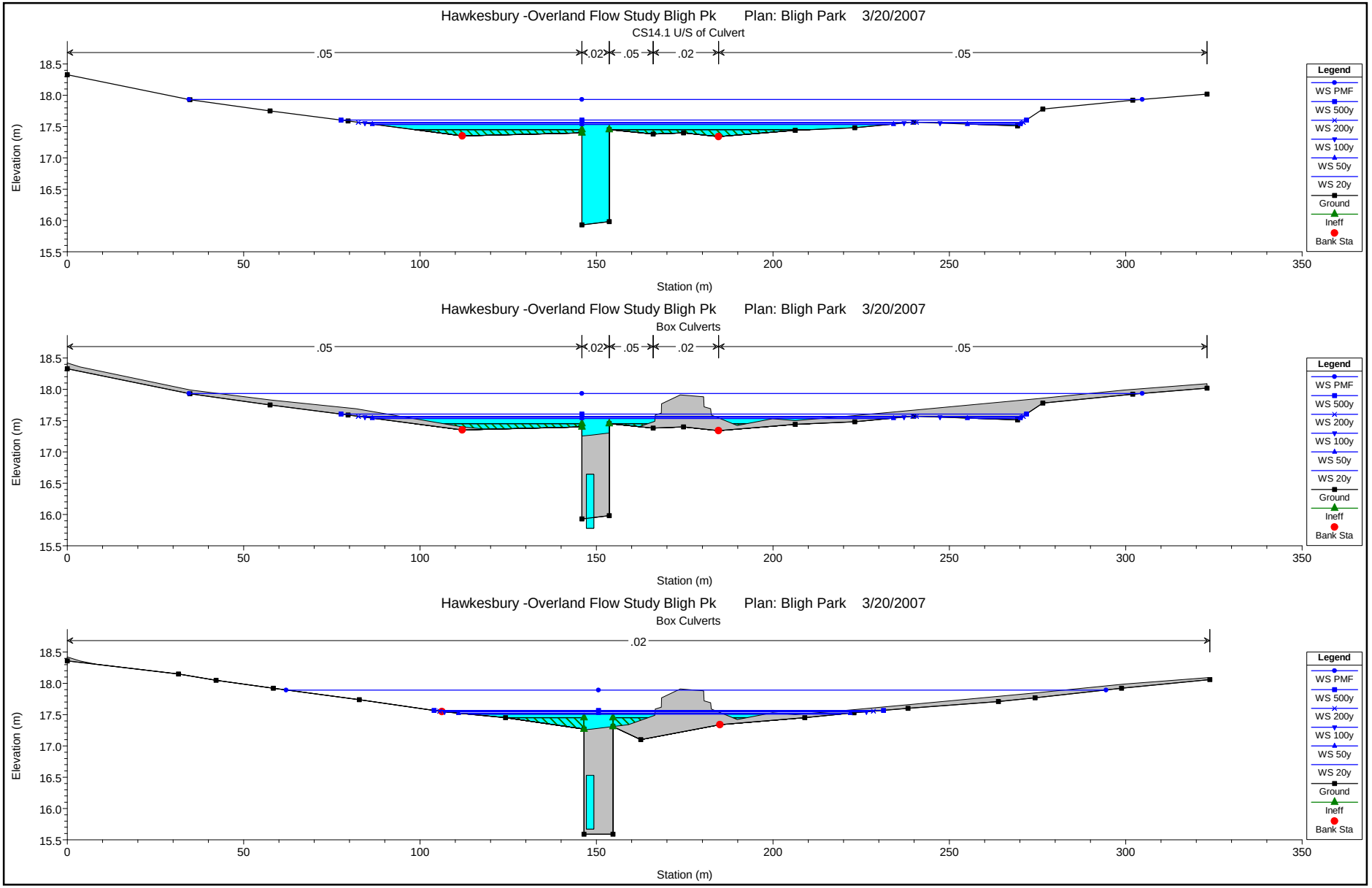

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
Guradian Crescent
.02
.02
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS 1
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS2
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta

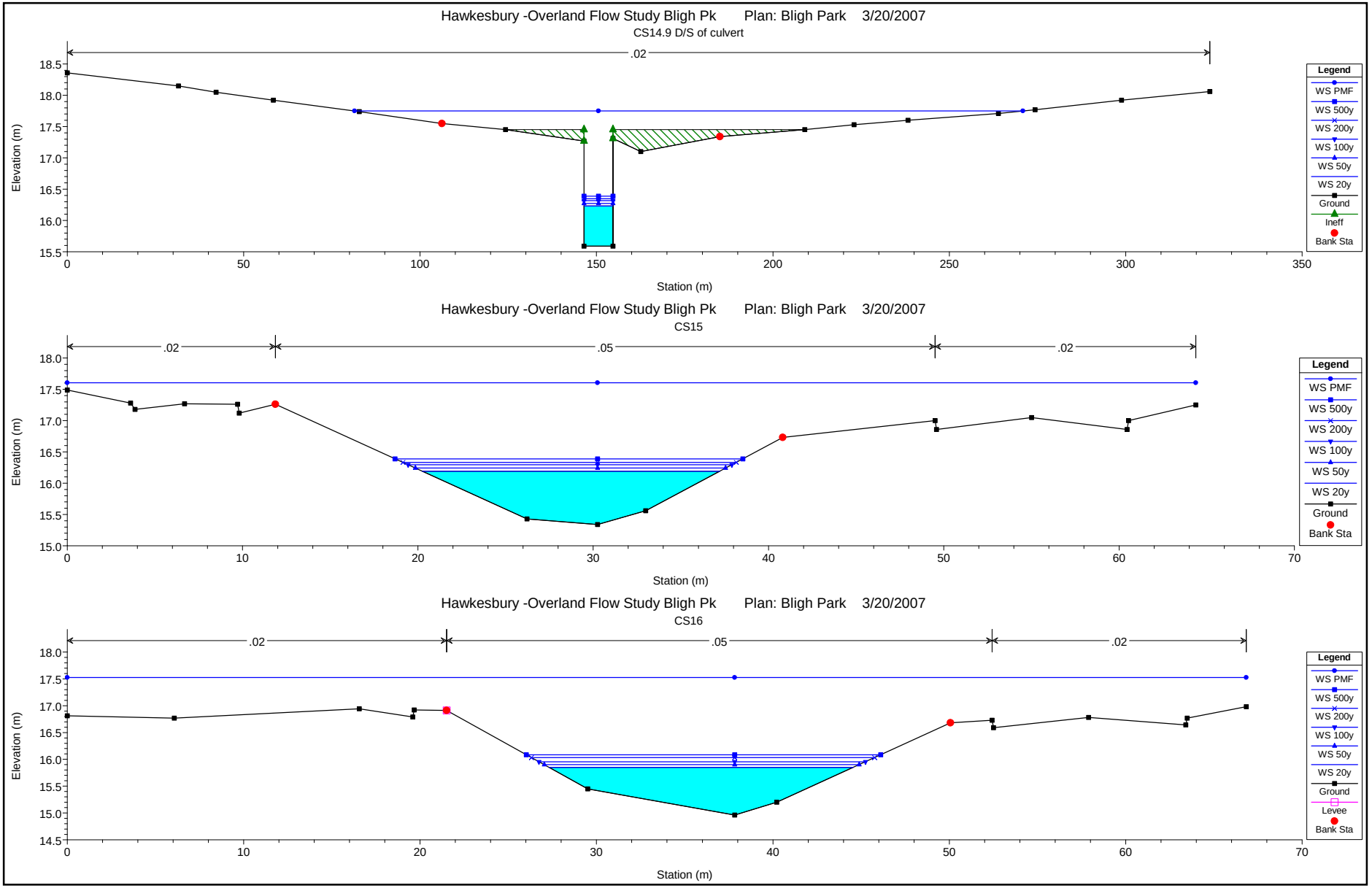

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS3
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS4
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS5
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta

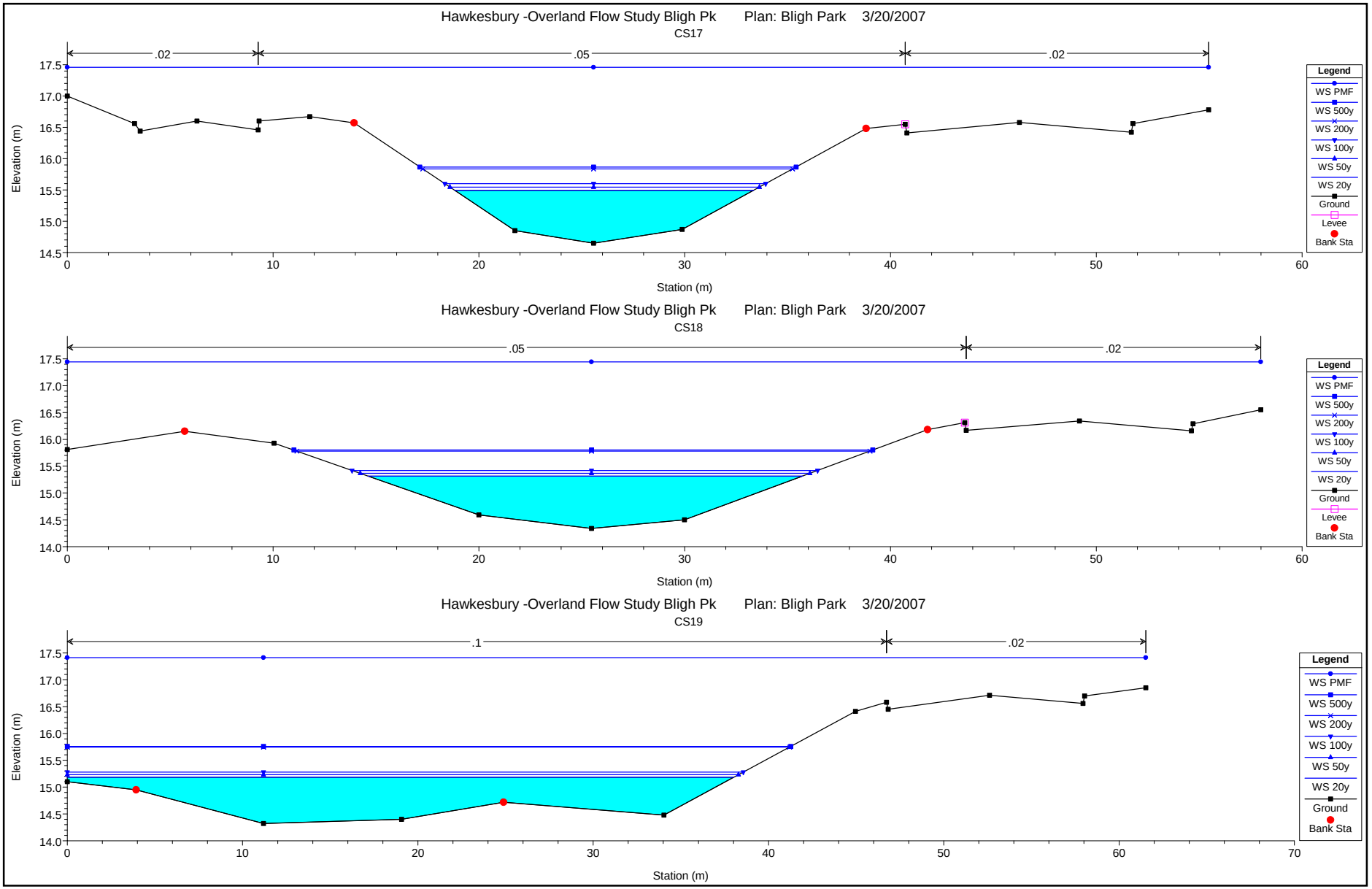

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS6
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS7
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS8
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta

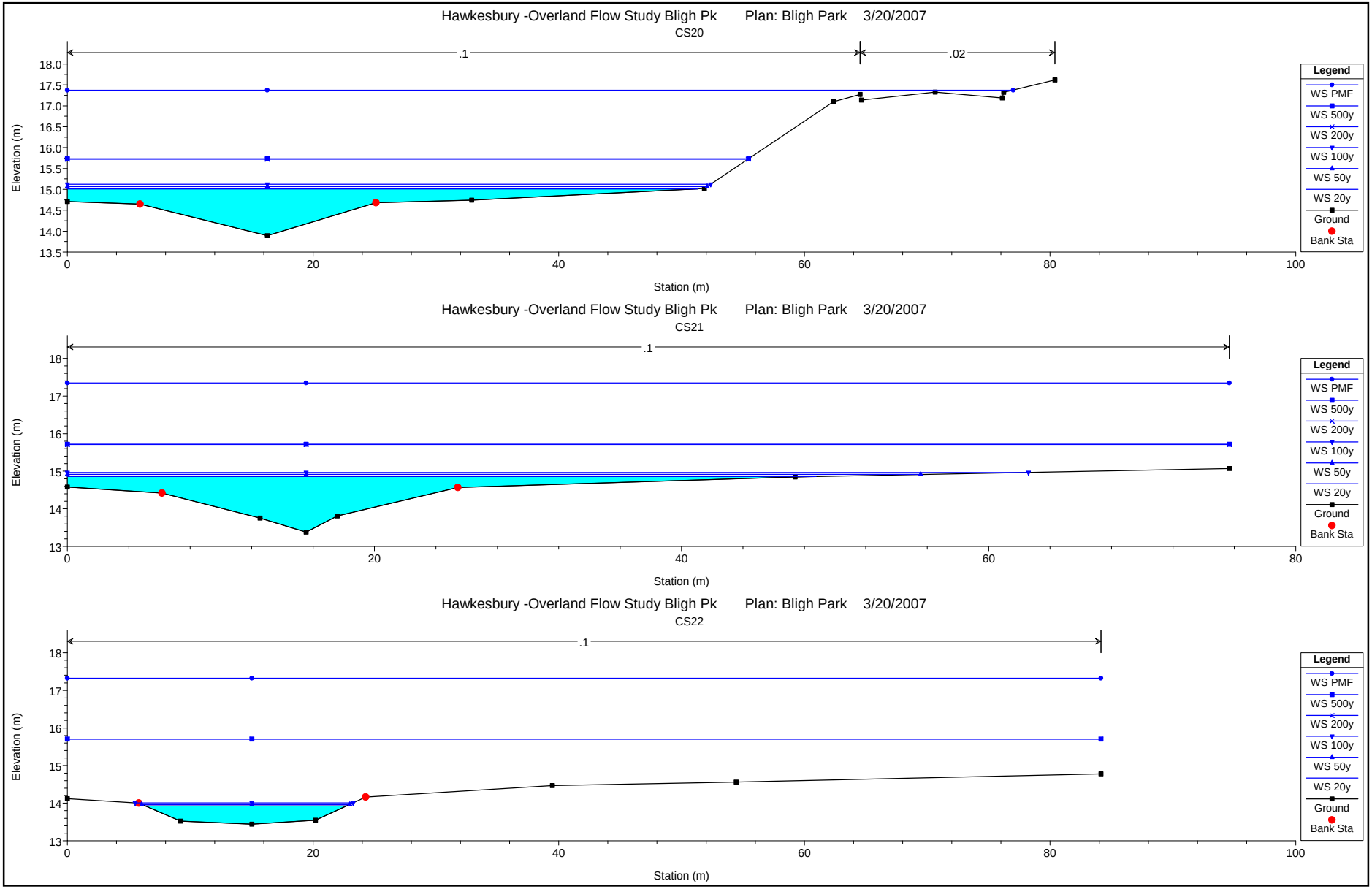

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS9
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS10
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS11
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta

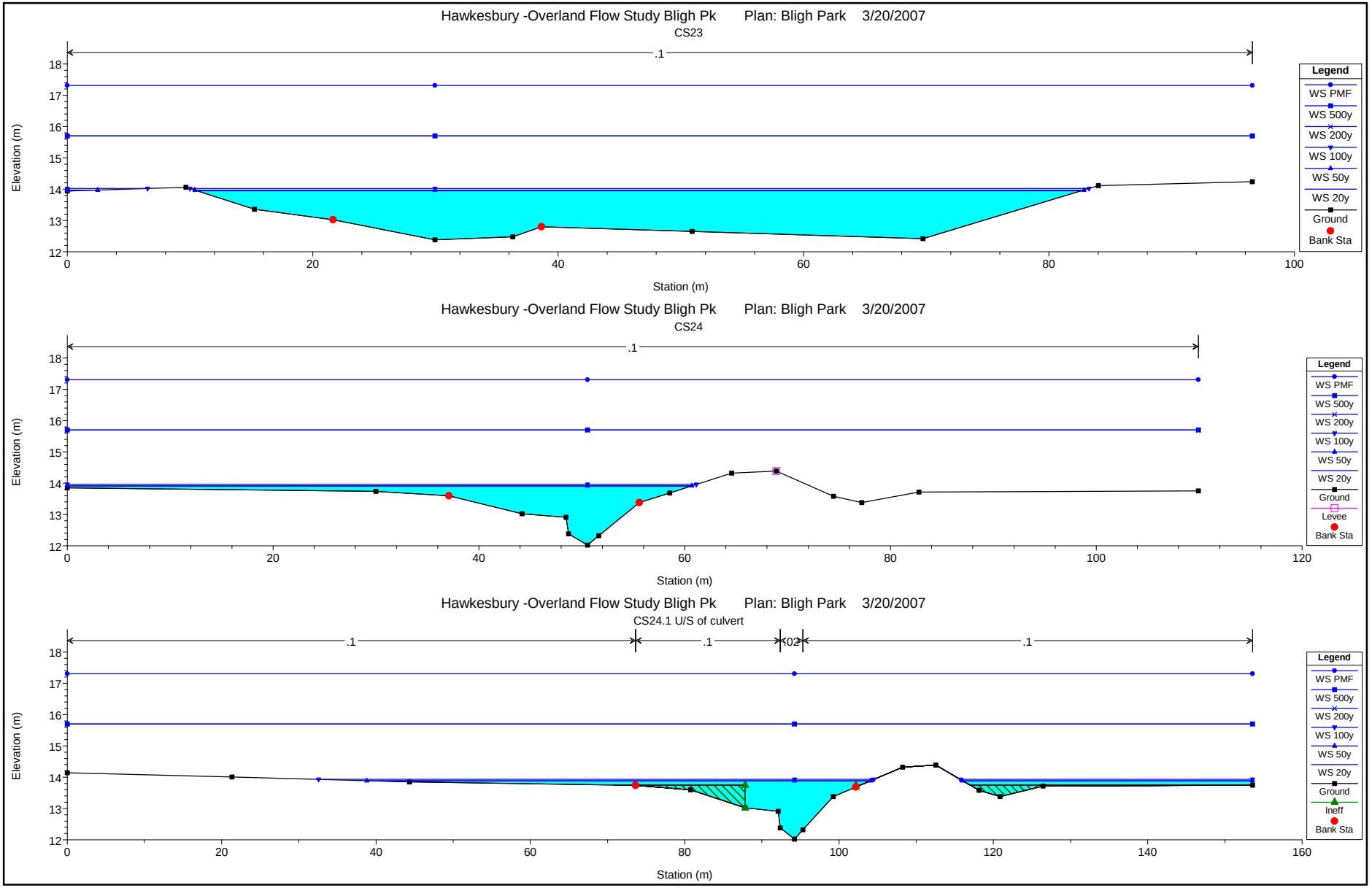

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS12
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS13
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS14
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta

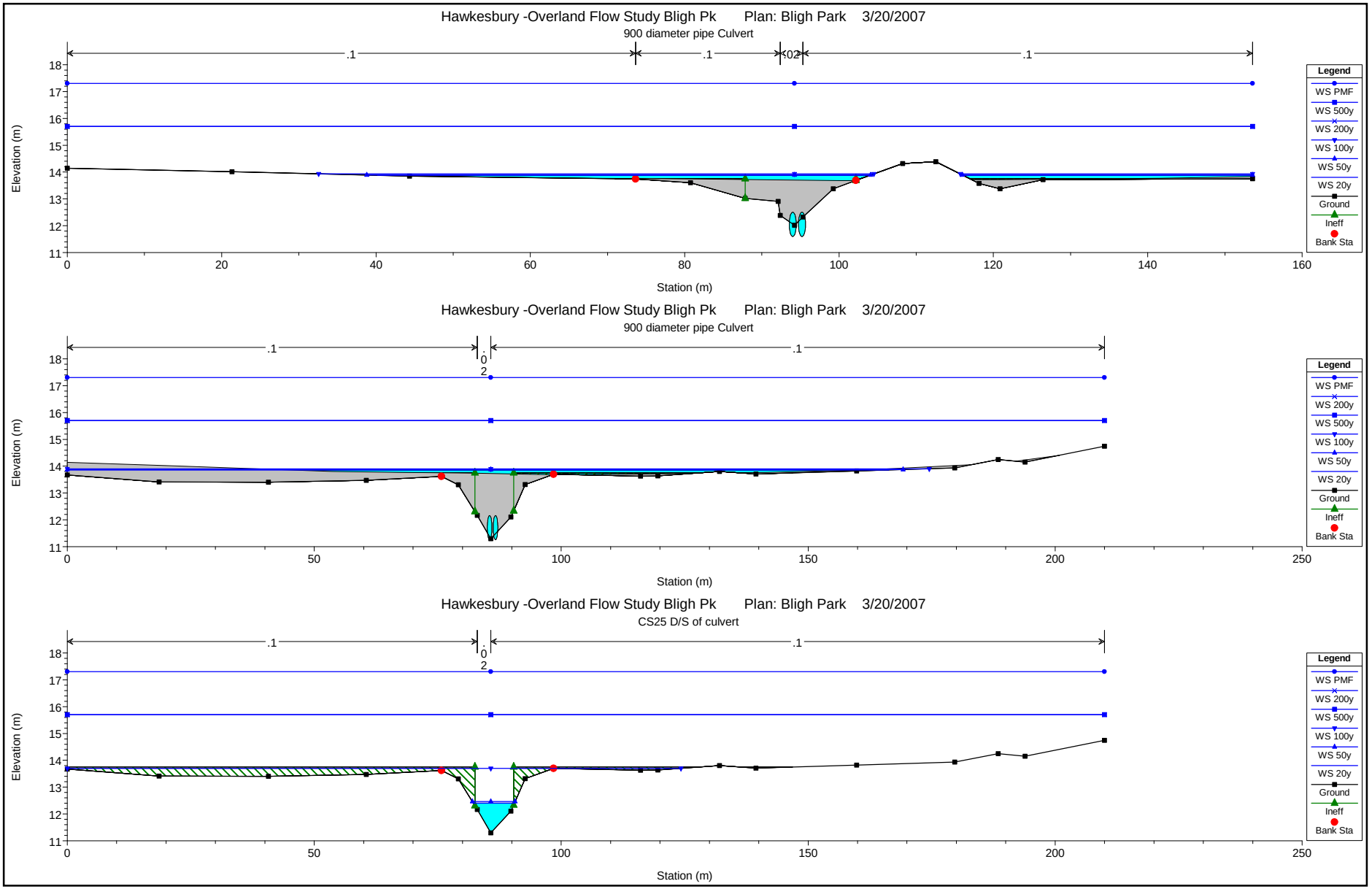

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS14.1 U/S of Culvert
.05
.02
.05
.02
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
Box Culverts
.05
.02
.05
.02
.05
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
Box Culverts
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS14.9 D/S of culvert
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS15
.02
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS16
.02
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS17
.02
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS18
.05
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS19
.1
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta

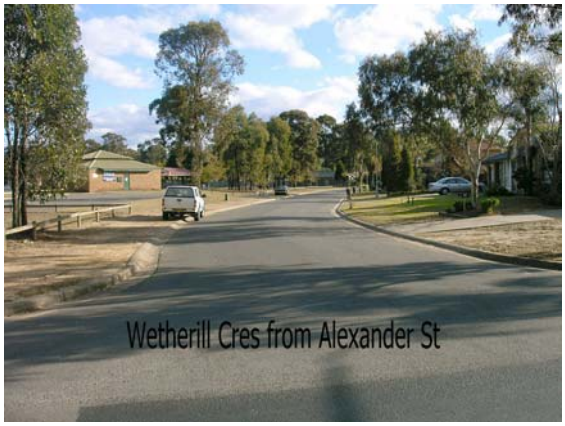

Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS20
.1
.02
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS21
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS22
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS23
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS24
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Levee
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS24.1 U/S of culvert
.1
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta


Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
900 diameter pipe Culvert
.1
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 500y
WS 200y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
900 diameter pipe Culvert
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 200y
WS 500y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta
Hawkesbury -Overland Flow Study Bligh Pk Plan: Bligh Park 3/20/2007
CS25 D/S of culvert
.1
.02
.1
Elevation (m)
Station (m)
Legend
WS PMF
WS 200y
WS 500y
WS 100y
WS 50y
WS 20y
Ground
Ineff
Bank Sta

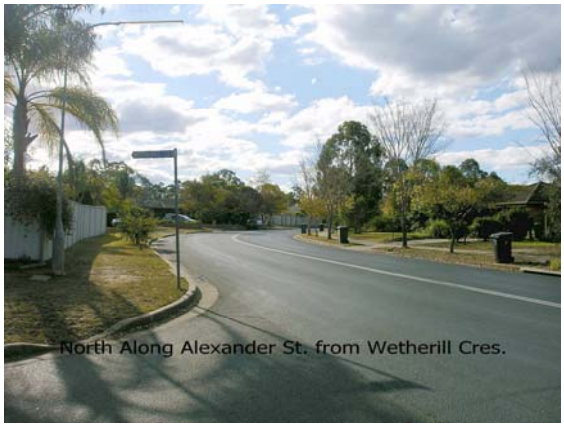
APPENDIX E

STUDY AREA PHOTOGRAPHS

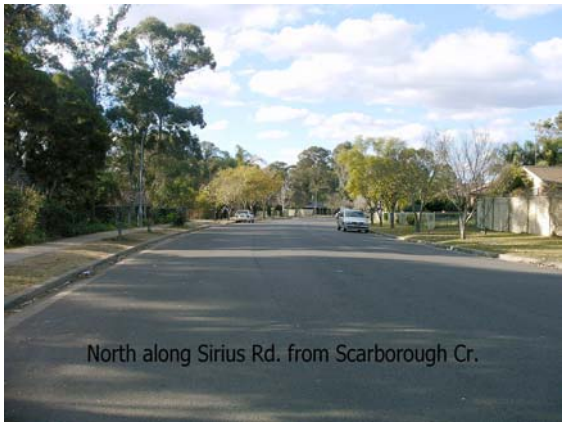

Wetherill Cres from Alexander St


East from Alexander St.


Looking South along Alexander St.


North Along Alexander St. from Wetherill Cres.


Sirius Rd. from Colonial Dr.

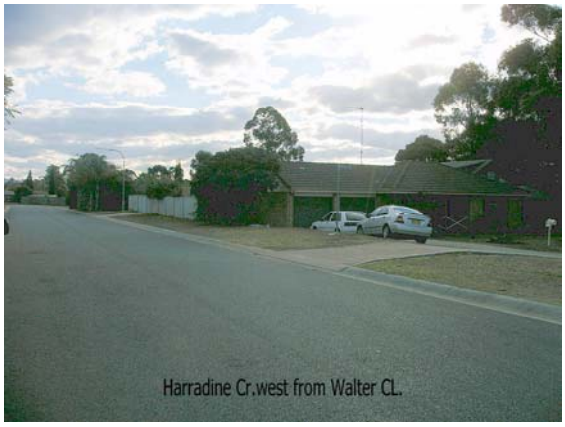

North along Sirius Rd. from Scarborough Cr.


South along Sirius Rd. from Scarborough Cr


Scarborough Cr. from Sirius Rd.


Shopping Centre at Colonial Dr and Sirius Rd.


East along Harradine Cr. from Jacobs Pl.


Harradine Cr.west from Walter CL.


Jacobs Pl. from Harradine Cr.


Harradine Cr.west from Walter Cl.


West along Harradine from Jacobs Pl.

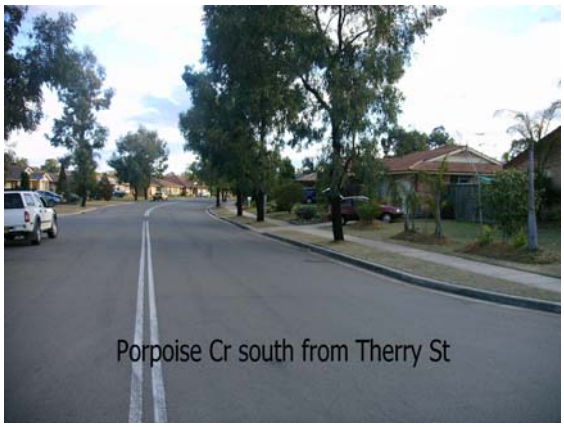

Studdy Cl. from Haradine.Cr.


Walter Cl. from Harradine Cr.


Harradine Cr. west towards Broome Pl.


Broome Pl. from Harradine Cr.


Harradine Cr.west from Broome PL.


Porpoise Cr south from Therry St


Porpoise Cr north from Peter PL


Peter Pl from Porpoise Cr


Porpoise Cr north from Therry St


Porpoise Cr south from Peter Pl


South along Sirius Rd. from Rifle Range Rd.


East along Rifle Range Rd. from Collith Av.


East along Rifle Range Rd. from Sirius Rd.


West along Rifle Range Rd. from Collith Av.


West along Rifle Range Road from Sirius Rd.

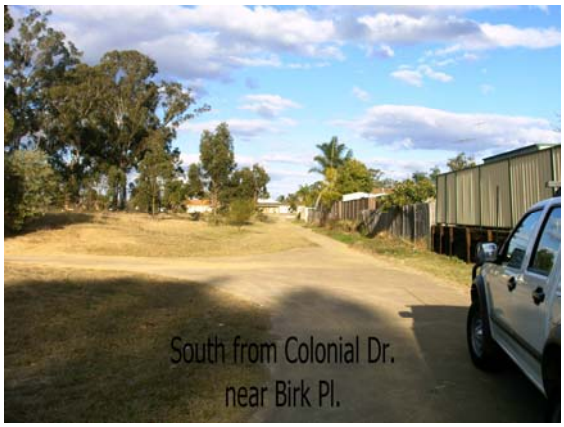

Marsden Cr. from Rifle Range Rd.


Collith Av. from Rifle Range Rd.


East along Rifle Range Rd. from Marsden Cr.


West along rifle Range Rd.
from Marsden Cr.


North along Colonial Dr from Turner Cl.


South from Colonial Dr.
near Birk Pl.


Colonial Dr. south from Turner Cl.

East along ColonialDr. from Harradine Cr.


Turner Cl. from Colonial Dr.


Harradine Cr. from Colonial Dr.


North from Colonial Dr.at low point
near Birk Pl.


Colonial Dr. west from Colonial Reserve.


Guardian Cr. south towards Derwent Pl.


Colonial Reserve near Colonial Dr.


Guardian Cr. north towards Colonial Dr.


Inlet Colonial Reserve


Colonial Reserve near Colonial Dr.


Colonial Reserve from inlet


North along Guardian Cr


East from Guardian Cr


South along Guardian Cr


Inlet east side of Guardian CR


West from Cross Section 8


Marie Cl from Porpoise Cr


South from Cross Section 8


Rifle Range Rd from Porpoise Cr


East from Cross Section 8


West from Rifle Range Rd


East from Cross Section 8


South side of Rifle Range Rd


West along Rifle Range Rd


North side of Rifle Range Rd

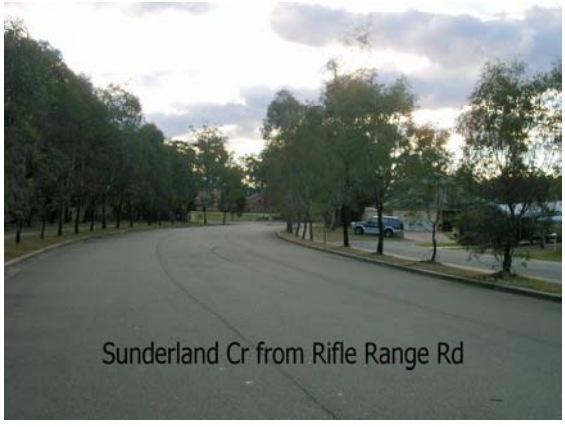

Northside of Rifle Range Rd
at round about


Waterway north from Rifle Range Rd


East along Rifle Range Rd from PorpoiseCr

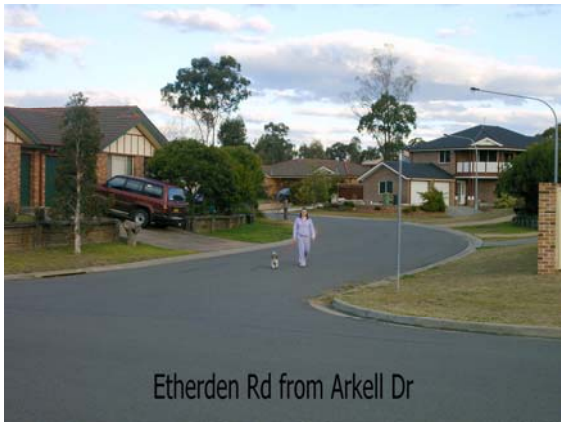

Tindell St from Pearson St


Arkell Dr from Rifle Range Rd


Sunderland Cr from Rifle Range Rd


Arkell Dr north from etherden Rd


Culvert at Berger Rd


Etherden Rd from Arkell Dr


South from Berger Rd


East from Cross Section 19


East along Berger Rd


West from Cross Section 19


West along Berger Rd


Culvert north side of Berger Rd


North from culvert