MOOLARBEN COAL PROJECT

Stage 2

APPENDIX 6A

Surface Water Management Strategy

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MOOLARBEN COAL MINES PTY LTD

MOOLARBEN COAL PROJECT EA2

Surface Water Management Strategy

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MOOLARBEN COAL MINES PTY LTD

MOOLARBEN COAL PROJECT EA2
Surface Water Management Strategy

Project: MOOLARBEN COAL PROJECT EA2
SURFACE WATER MANAGEMENT STRATEGY

REV	DESCRIPTION	PREPARED BY	REVIEWED BY	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
1	Issued for Information	SMD	MST				
2	Updated To Reflect Client Comments	SMD	MST				
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CONTENTS

1. INTRODUCTION

Moolarben Coal Mines Pty Limited (*MCM*) plans to develop a series of coal mines at a site located 40 kilometres north-east of Mudgee and 25 kilometres east of Gulgong. The proposed mines are referred to as the Moolarben Coal Project (*MCP*) and are to be constructed within Exploration Licence No. 6288 (*EL6288*), which is located immediately east and south of the existing Ulan Colliery and near the village of Ulan (*refer* **Figure 1**).

Stage 1 of the MCP was approved by the Minister for Planning on 6th September 2007. Stage 1 includes three open cut pits (*OC1, OC2 and OC3*) and one underground pit (*UG4*), as well as associated surface facility areas for coal handling, preparation and loading.

The current proposal (*Stage* 2) comprises the development of further coal mining operations on EL 6288, including two underground mines (*UG1 and UG2*) and an open-cut mine (*OC4*) (*refer* **Figure 1**). Minor modifications to the mine plan and some of the infrastructure elements approved in Stage 1 are also proposed.

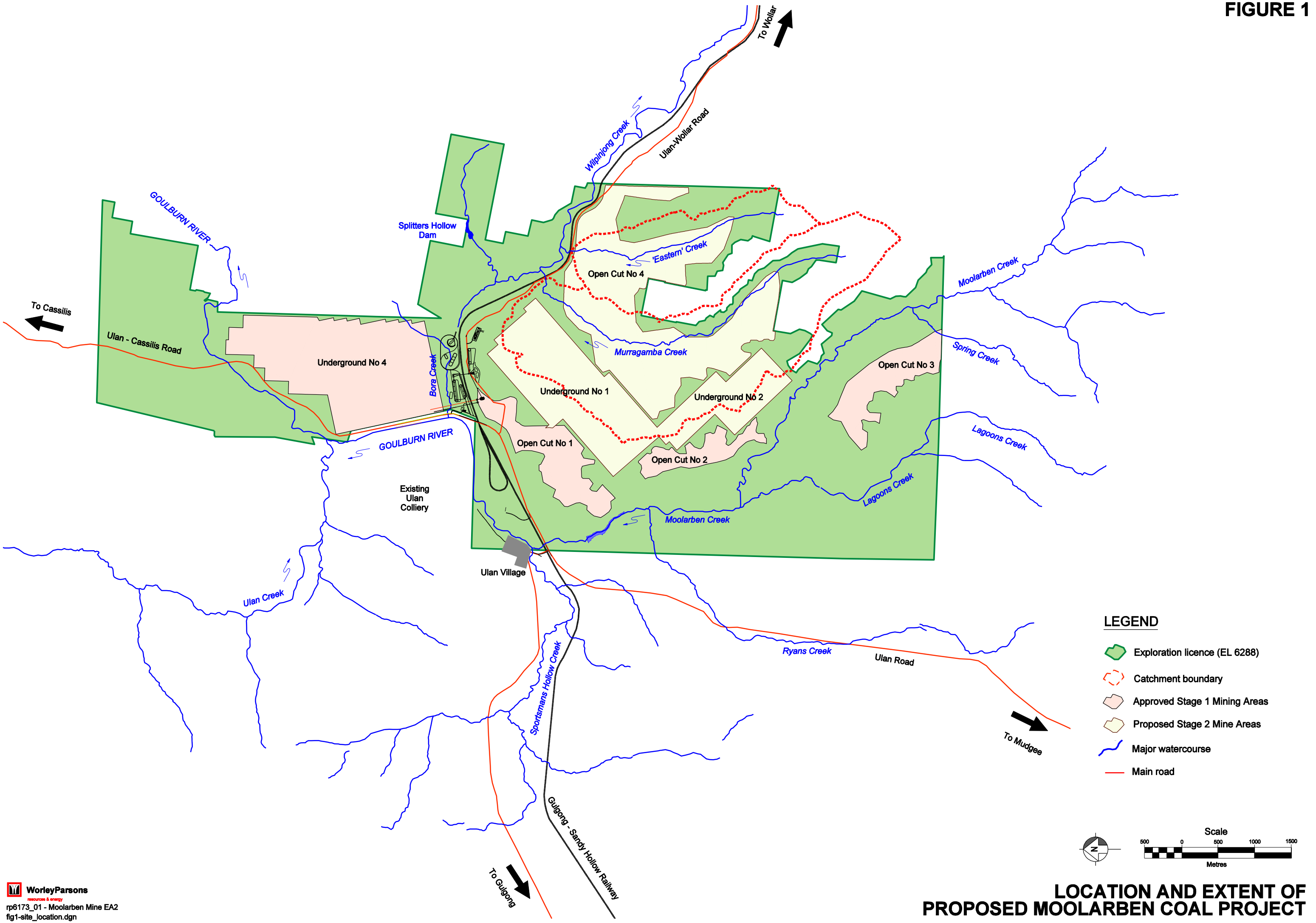
EL 6288 is bound to the west by the Ulan Coal Mine and to the east by the Wilpinjong Coal Mine. It covers an area of 11,000 hectares. However, mining operations for Stages 1 and 2 of the MCP are only expected to extend across about 2,260 hectares of the total area of the exploration licence.

Stage 2 seeks approval to increase production from the whole of the MCP to 13 Mtpa of product coal from a total of 17 Mtpa of ROM (*run of mine*) coal. Mine scheduling may also be modified to suit operational requirements but will comply with the environmental goals for the total approved ROM and product coal.

Stage 2 of the MCP consists of:

- Two underground mines (*UG1 and UG2*) which will produce up to 4 Mtpa of ROM coal.
- An open cut pit (*OC4*) which is to be located across the floor of the Murragamba Valley and which will produce up to 12 Mtpa of ROM coal.
- An upgrade to the surface facilities that were approved for Stage 1 of the MCP so that they have the capacity to handle 17 Mtpa of ROM coal and to produce 13 Mtpa of product coal. The proposed upgrade will involve:
  - increased processing capacity of the approved Stage 1 coal preparation plant and associated handling facilities (CHPP) from 12 to 17 Mtpa of ROM coal;
  - relocation of the approved UG4 entries to the south and within the OC1 void;
  - changes to the approved OC1 ROM coal system and conveyors to accommodate an increase from 8 to 12 Mtpa of ROM coal, thereby ensuring sufficient capacity to handle the projected production from the Stage 2 underground mines; and,
  - changes to the product coal handling and the rail loading facility to accommodate an increase from 10 Mtpa to 13 Mtpa of product coals.

FIGURE 1



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LOCATION AND EXTENT OF PROPOSED MOOLARBEN COAL PROJECT

The underground mines that are proposed as part of Stage 2 of the MCP are located below the sandstone ridges that form the catchment divide between Moolarben and Murragamba Creeks (*refer* **Figure 1**). The open cut mine is to be located within the floor of the Murragamba Valley and an adjoining valley to the east (*referred to as the 'Eastern Creek' Valley*) (*refer* **Figure 1**).

The Ulan Seam, which ranges from between 11 and 13 metres in thickness, will be mined with the full seam recovered in OC4 by the use of truck and excavator operations and a partial section in the UG1 and UG2 by longwall extraction. Both domestic and export thermal coal will be produced and transported from the site by rail.

At the time of compiling this report, MCM had made application pursuant to Section 75W of the EP & A Act 1979, to modify the layout for the main infrastructure area that had been approved by the Minister for Planning on 6th September 2007 for Stage 1 of MCP. The modification seeks approval to relocate the infrastructure area to the southern side of Bora Creek.

As shown in **Figure 1**, Murragamba and Eastern Creeks extend through part of Exploration Licence No. 6288 and run through the area proposed for Open Cut No.4 operations. A number of tributaries also drain through the exploration licence and discharge to both Murragamba and Eastern Creeks.

Murragamba and Eastern Creeks both drain to Wilpinjong Creek which is located to the north of the area proposed for Open Cut No 4 and runs parallel with the Ulan-Wollar Road. Due to the location of Open Cut No.4, it is proposed that the alignments of both Murragamba and Eastern Creeks be modified to maximise resource extraction.

The Goulburn River is located approximately 1 kilometre from the north-western boundary of the proposed Stage 2 extent of underground mining (*refer* **Figure 1**). It extends downstream from the Village of Ulan and follows a path between the exploration licence for the Moolarben Coal Project and the existing Ulan Coal Mine. Bora Creek discharges to the Goulburn River opposite the Ulan Coal Mine (*refer* **Figure 1**). It drains a relatively small catchment that extends to the eastern limit of the Goulburn River catchment.

Due to the nature and extent of the development, there will be a need to manage surface water runoff from both undisturbed and disturbed areas of the mine site. Systems will need to be implemented to capture runoff for re-use and to ensure that any runoff that enters the creek system does not adversely impact stream water quality. In addition, there will be a need to collect and store surplus water resources for re-use in mine production operation and mine site rehabilitation.

In recognition of these issues, Moolarben Coal Mines Pty Limited, commissioned WorleyParsons to investigate the extent of available water resources and the manner in which they could be best managed over the life of the project. The objectives of the investigation were to:

- establish the existing hydrologic characteristics of the land that will be subject to mining activities;
- examine and quantify the flooding characteristics of Murragamba and 'Eastern' Creeks;

- assess the quality of the water resources available to the mine project for both existing conditions and as mining proceeds;
- estimate the volume of water that could be made available for mine operations or which will need to be managed during the life of the mine;
- develop a design for the relocation/reinstatement of Murragamba and Eastern Creeks post-mining;
- describe the potential impacts that the proposed mining operation could have on the existing hydrologic regime within the catchments that drain through the site; and,
- describe the water management strategies that would need to be implemented at the mine site to achieve regulatory authority requirements, mitigate any potential impacts and suitably manage and/or treat surface water.

This report documents the findings of these investigations and includes an assessment of the potential impacts of mine development on the existing hydrologic regime. In this regard, it draws from conclusions arising from groundwater investigations undertaken by Aquaterra, which are documented in a report titled, *'Moolarben Stage 2 Groundwater Assessment'* (*November 2008*). Groundwater inflows estimated by Aquaterra have been incorporated within a consolidated water management strategy for the entire Moolarben Coal Project.

2. LEGISLATIVE FRAMEWORK

2.1 RELEVANT LEGISLATION

Stage 2 of the Moolarben Coal Project (*MCP*) is a Major Project pursuant to the provisions of the Environmental Planning and Assessment Act 1979 (*EP&A Act*). A Major Project Application and an Environmental Assessment Report have been prepared for the project for assessment and determination by the Minister for Planning. This surface water management strategy forms part of the Environmental Assessment Report.

The objective of this report is to provide sufficient information on the existing surface water environment within the MCP area and its immediate surrounds and to assess the potential impacts of the proposed mining operations on surface water resources, such that any concerns regarding are addressed to the satisfaction of the Minister for Planning. The report has been prepared having regard to the Director-General's requirements which were issued on 10th September 2008 and addresses the following key water issues:

- a description of water resources within the area where mining operations are proposed as part of Stage 2;
- an assessment of available water resources and measures that would need to be implemented to ensure that there is sufficient water during both Stages 1 and 2 of the project, including a water balance;
- a detailed assessment of the proposed relocation of Murragamba and 'Eastern' Creeks to allow open cut mining in both valleys, which demonstrates that the proposed creek relocations are both reasonable and feasible;
- development of concept designs for the relocation/reconstruction of both Murragamba and 'Eastern' Creeks based on consideration of the geomorphic characteristics of the existing streams, MCM's vision for the post-mining landform and the characteristics of flows that will need to be discharged through the valley post-mining;
- an assessment of flooding for the post-mining stream corridor and comparison of the findings with the existing flooding regime to assist in justifying the proposed creek relocation/reconstruction;
- details of mitigation measures that are proposed to protect environmental flows and which will ensure that the water supply for landowners in the region is maintained; and,
- determination of base environmental flows from the Murragamba Creek Valley and assessment of the potential impact of the mining operation on the maintenance of downstream water resources both during mining operations and post-mining, particularly in terms of the potential for water resources in the Wilpinjong Creek Valley to be depleted.

2.2 REGULATORY REGIME

The MCP is within an area that will be known as the Upper Goulburn Extraction Management Unit of the Hunter River Catchment under the *'Draft Hunter Unregulated and Alluvial Water Sources Water Sharing Plan'* (*DWSP*). However, until the DWSP is adopted, the licensing of activities, water use, water works and approvals, is governed by the Water Act 1912.

The DWSP was placed on public exhibition between 17th March and 2nd May 2008. At the time of writing, the Department of Water & Energy (*DWE*) was considering submissions before finalising the Plan. Advice from DWE indicates that it will be completed by late 2008 and will be implemented during the first half of 2009.

When the DWSP comes into operation, approvals and licensing of activities, water use and water works within the area covered by the MCP will need to be undertaken in accordance with the provisions of the Water Management Act 2000 (*WMA*) (*as contained within Parts 2 and 3 of Chapter 3 of the WMA*).

By virtue of Section 75U of the EP&A Act 1979, water use approvals under Section 89, water management work approvals under Section 90 and activity approvals under Section 91, are not required for a project which has been approved under Part 3A of the EP&A Act. However, it should be noted that Section 75U does not provide any exemption from the obligation to secure a Water Access Licence (*under section 56 WMA*).

2.2.1 Draft Hunter Unregulated and Alluvial Water Sources Water Sharing Plan

Once adopted, the DWSP will regulate surface water and alluvial aquifer extraction from the Upper Goulburn Extraction Management Unit. The MCP lies wholly within this Extraction Management Unit. Therefore, licences will need to be obtained in circumstances where water is to be extracted from alluvial aquifers or an unregulated river.

It should be noted that at this stage, the DWSP would not apply to water within "*fractured rock aquifers and basement rocks*". Consequently, the extraction of groundwater from aquifers below the alluvials will need to be licensed under the Water Act 1912.

The Report Card issued by DWE describes the existing licensed water within the Upper Goulburn River Water Source as follows:

- Fourteen (14) surface water licences with peak daily demand = 15 ML/day
- One groundwater licence with total entitlement (*alluvials*) = 2ML/year
- Total surface water entitlement = 2,490 ML/year
- Proportion of Total Goulburn Extraction Management Unit entitlement = 4.58%

The DWSP identifies the Upper Goulburn River as having high in-stream value. Consequently, water trading will be limited so that there is no increase in water entitlement. In some cases, trading may be implemented to achieve a reduction in water entitlement.

The DWSP indicates that there will be a prohibition on trading of water entitlements (*shares or allocations*) in areas extending upstream from the Lower Goulburn Extraction Management Unit to the Upper Goulburn Extraction Management Unit. If this prohibition is retained, there will be limited scope for MCM to purchase and utilise existing surface and alluvial water entitlements for use in the Project.

Apart from licences for test bores, MCM holds only one water licence within the Project Area. This licence is for Splitters Hollow Dam (*Licence No. 20SL060286*) which is licensed under the Water Act 1912 for stock and domestic uses only. The dam was constructed in 1996 by the then Soil Conservation Service. The original application was based on a "drawing capacity" of 10 ML. A Licensing Inspection that was undertaken circa 1999 established that the dam had at that time, a "maximum capacity" of 44 ML (*pers comm. Mr Bruce Westwood, DWE, 19/11/08*). Independent surveys undertaken for the MCP have been used to establish the current maximum storage volume of Splitters Hollow Dam, which is estimated to be 47 ML at full supply level.

Upon implementation of the DWSP, dams will require a water access licence only when:

- they are located on a 3rd-order or greater stream, irrespective of the dam capacity or purpose;
- if they exceed the maximum harvestable right for the property, which is equivalent to 10% of the mean annual runoff; or,
- if they are located on permanent (spring fed) 1st and 2nd order streams.

2.2.2 Water Act 1912

Part 5 of the Water Act 1912 specifies that Groundwater Licences are required where the following activities are undertaken:

(i) extraction of water from underground mining operations (*in respect of water which is to be extracted and utilised from the hardrock aquifers*);

(ii) open cut mining (*in respect of water which will be extracted and utilised from the hardrock aquifers*);

(iii) production bores (*in respect of water which will be extracted and utilised from the hardrock aquifers*); and,

(iv) groundwater monitoring piezometers (*in respect of production bores which will intersect into and take water from (for the purposes of water quality monitoring and test pumping) the hardrock aquifers*).

2.2.3 Additional Water Related Approvals for the Project

Part 3A of the EP& A Act effectively triggers a range of additional approvals that will be required for water use within the MCM Project. These include:

- groundwater licences under Part 5 of the Water Act 1912 in respect of each open cut mining pit;
- groundwater licences under Part 5 of the Water Act 1912 in respect of the underground workings;
- groundwater licences under Part 5 of the Water Act 1912, in respect of the dewatering borefield adjacent to Underground No. 4; and,
- groundwater licence under Part 5 of the Water Act 1912, in respect of any water which may be drawn from *fractured rock aquifers and basement rocks* in areas outside of the mining footprint.

2.3 CRITERIA FOR DEVELOPMENT OF WATER MANAGEMENT STRATEGY

2.3.1 Relevant Technical and Policy Guidelines

The Water Management Strategy for the MCP has been developed taking due consideration to a range of technical and policy guidelines, including the following documents:

- *'Floodplain Development Manual – the management of flood liable land'* (*DECC*)
- *'Managing Urban Stormwater: Soils and Construction'* (*Landcom*)
- *'Guidelines for Fresh and Marine Water Quality'* (*ANZECC*)
- *'Rehabilitation Manual for Australian Streams'* (*Land and Water Resources Research and Development Corporation*)
- NSW State Rivers and Estuaries Policy
- State Groundwater Policy
- *'Integrated Catchment Management Plan for the Hunter Catchment 2002'* (*Hunter – Central Rivers Catchment Management Authority*)
- *'Environmental Guidelines: Use of Effluent by Irrigation'* (*DEC*).

2.3.2 Director General's Requirements

In September 2008, the Department of Planning issued its Director General's requirements for the preparation of the EA for the project in accordance with Section 75F of the EP&A Act. As the proposed coal mining operations will extract and use available water resources on-site, surface water has been identified by the Department as one of the key issues that needs to be addressed within the EA.

The scope of the surface water investigations has been based on the Director General's requirements. The Director General's specific requirements are listed in **Table 1** along with a reference to where each requirement has been addressed within this report.

Table 1 DIRECTOR GENERAL'S REQUIREMENTS FOR STAGE 2 OF THE MOOLARBEN COAL PROJECT

DIRECTOR GENERALS REQUIREMENT	SECTION OF REPORT THAT ADDRESSES DGR'S
A site water balance, which includes a detailed description of the measures that would be implemented to minimise the water use on site and ensure that there is a secure water supply for both Stages 1 & 2 of the Moolarben Coal Project	Section 8.2 Section 8.3
A detailed assessment of the potential impacts of the project on the quantity, quality and long-term integrity of the surface and ground water resources in the project area, paying particular attention to all significant water courses and their associated tributaries	Section 6.2 Section 6.3 Section 7.1 Section 7.2 Section 8.6 Section 9.1
Detailed conceptual plans for the proposed relocation of Murragamba and 'Eastern Creeks', which clearly articulate the vision statement, design criteria, and completion criteria for the proposed creek relocations, and include sufficient evidence to demonstrate that the proposed creek relocations are both reasonable and feasible	Section 6.1 Section 8.4 Section 8.5

3. DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 CATCHMENT DESCRIPTION

The site for Stage 2 of the Moolarben Coal Mine Project is located within the upper Goulburn River catchment. Mining operations will predominantly occur within the catchments of Murragamba and Eastern Creeks, which drain to Wilpinjong Creek, an eastern tributary of the Goulburn River (*refer* **Figure 1**).

The combined catchments of Murragamba and Eastern Creeks cover an area of about 3150 hectares. Both creeks discharge to Wilpinjong Creek downstream of the Ulan-Wollar Road, which follows an alignment approximately parallel to Wilpinjong Creek. Willpinjong Creek joins Wollar Creek about 12 kilometres north-east of EL6288 and eventually discharges to the Goulburn River. The Goulburn River travels in a north-easterly direction and discharges to the Hunter River at Denman, about 80 kilometres from the MCP.

Stage 2 of the Moolarben Coal Project will involve the construction of two underground pits (*UG1 and UG2*) which are to be located beneath the ridgelines that separate Moolarben and Murragamba Creeks (*refer* **Figure 1**). Open Cut 4 (*OC4*) will be developed in the eastern section of EL6288 in an area that extends south from the Ulan-Wollar Road and which includes the valley floors of the Murragamba and Eastern Creek catchments.

The mine infrastructure area for Stage 2 of the project will be located adjacent to the existing Gulgong-Sandy Hollow Railway. This infrastructure will be a new facility that will be linked by conveyor to the primary infrastructure facilities that were approved during Stage 1 of the Moolarben Coal Project and which are to be sited adjacent to Bora Creek (*refer* **Figure 1**). The Stage 1 Infrastructure Area was originally proposed to be sited on both sides of Bora Creek, but MCM now plans to relocate the Stage 1 Infrastructure Area to the southern side of Bora Creek. This will allow better integration between the facilities proposed for Stages 1 and 2 of the project.

The catchments of Murragamba and Eastern Creeks are typically characterised by steep and heavily forested valley walls, with extensive areas of visible out-cropping of sandstone bedrock. These valley walls abruptly transition to a flat open and mostly cleared floodplain. Vegetation cover across the lower slopes is dominated by pasture with occasional stands of eucalypt. The majority of the open cut mining will take place on the lower slopes, which are characterised by cleared landforms with average slopes of no greater than 2%.

As reported by JAMMEL (*2005*), the majority of the mine site is located within the Ulan soil landscape. This soil landscape is generally characterised by yellow podsolic and yellow solidic soils that have a moderate to high erosion hazard and which are imperfect to poor drainage.

Average annual rainfall is 638 mm as recorded for Bureau of Meteorology Rainfall Gauge No. 62036, which is located at Ulan Post Office. Daily rainfall records have been recorded at this gauge since 1906. **Table 2** lists the monthly rainfall and evapo-transpiration rates for the Ulan Post Office Gauge.

Table 2 SUMMARY OF MONTHLY RAINFALL AND POTENTIAL EVAPO-TRANSPIRATION DATA FOR ULAN

MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Rainfall (mm)	73.9	61.7	52.7	41.8	46.2	44.7	47.7	48.7	43.3	55.8	56.2	66.6	**638**
Evapo-transpiration (mm)	222	168	144	83	63	59	56	78	163	140	255	226	**1657**

Source: Bureau of Meteorology (*2005*)

A comparison between monthly average rainfall and monthly average potential evapo-transpiration indicates that the area is an excess in evaporative capacity over rainfall in all months during an average year. As a consequence, the area is classified as having a semi-arid climate using the Köppen Climate Classification system. Notwithstanding, there is variability in monthly rainfall and rainfall can exceed evapo-transpiration, particularly during the winter months.

3.2 EXISTING HYDROLOGY

The Murragamba Creek catchment is the largest of the two catchments within Stage 2 of the project. Murragamba Creek rises in the Munghorn Gap Nature Reserve to the south of the area proposed for the Open Cut No.4 pit. It discharges in a northerly direction, following a relatively straight alignment through what is a relatively narrow valley. It is fed by a number of ephemeral streams that drain the western section of the catchment, before discharging to Wilpinjong Creek near the Ulan-Wollar Road.

Open Cut No 4 will also extend to the east of the Murragamba Creek valley and into an adjoining valley that is drained by an unnamed tributary of Wilpinjong Creek (*refer* **Figure 1**). This ephemeral stream is referred to as 'Eastern Creek'. It drains a catchment area of about 960 ha and follows a northerly direction before it discharges to Wilpinjong Creek about 800 metres downstream from the Murragamba / Wilpinjong Creeks confluence.

Wilpinjong Creek begins north east of the mine infrastructure area for Stage 1 of the MCP. From this point Wilpinjong Creek flows south-west and then follows a south east alignment thorough the MCP before entering the Wilpinjong Coal mine. Wilpinjong Creek continues in a south-easterly direction until it finishes with its confluence with Wollar Creek east of Wollar. Wollar Creek flows in a north-easterly direction through the Goulburn River National Park where it eventually meets the Goulburn River.

A small section of the Stage 2 project, primarily the infrastructure area, is located within the Moolarben and Bora Creeks catchments. Moolarben Creek flows in a northerly direction until its confluence with Sportsmans Hollow Creek at the village of Ulan. From this point the creek is referred to as the Goulburn River (*refer* **Figure 1**).

The Goulburn River flows east toward the MCP where it is joined by Bora Creek, which is a short ephemeral stream that has its headwaters in the ridges that separate the Moolarben and Wilpinjong Creek valleys.

A conceptual interpretation of the surface hydrology of the catchments is presented in **Figure 2**.

There is evidence of a number of springs and seeps that discharge groundwater to the surface throughout the catchments of Murragamba and Eastern Creeks. However, the majority of this spring water is captured by on-line farm dams.

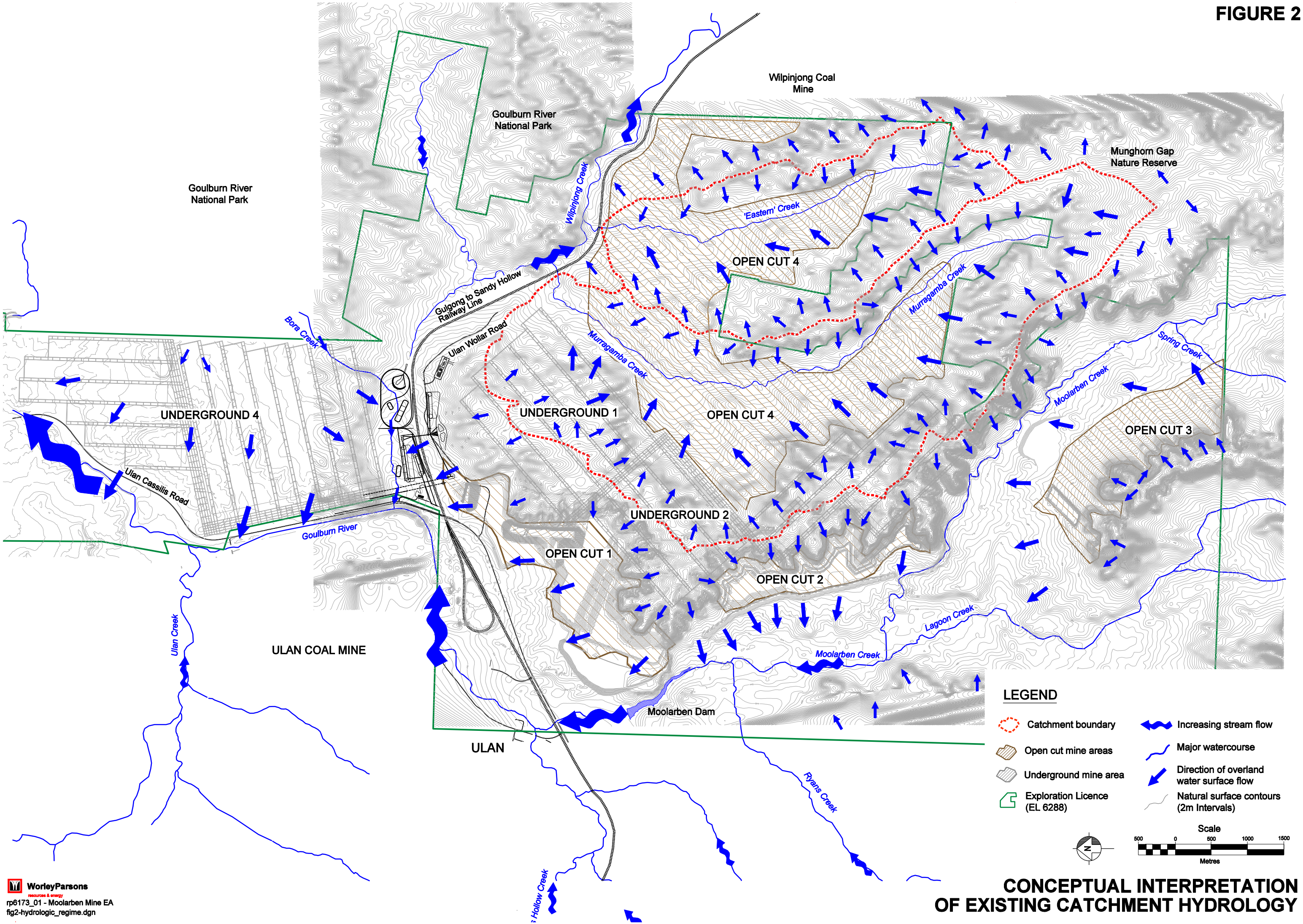
Based on the work undertaken for Stage 1 for the MCP, the volumes of individual spring and seep discharges within the catchment areas are relatively small. Many seeps are only visible as patches of dampness or lush grass. The flow rate of the largest spring flow observed in the study area is estimated at less than 1 L/s (*Aquaterra, 2008*). Nevertheless, the accumulation of groundwater discharges is sufficient to maintain semi-perennial flow in the downstream reaches of the major tributaries and virtually permanent flow in the Goulburn River (*either visible flow or flow within the sandy stream bed*).

Groundwater modelling undertaken by Aquaterra for Stage 2 of the Moolarben Coal Project has indicated that baseflows from the Murragamba and Eastern Creeks catchments are negligible. Essentially the creeks of the Murragamba and Eastern Creek valleys are considered ephemeral as baseflow is insufficient to maintain permanent creek flow.

Figure 2 shows the hydrologic regime across the proposed mine site. As shown, the upper reaches of Murragamba and Eastern Creeks originate in the Munghorn Gap Nature Reserve and drain the area south of Open Cut No 4. The Murragamba and Eastern Creeks valleys are relatively narrow, consisting of open grassland with relatively little slope. The valleys then reach the relatively steep elevated area of the escarpment, which forms a horseshoe shape surrounding the western, southern and eastern boundaries of the valleys for each creek.

During storms, runoff from the steep upper slopes above Open Cut No. 4 quickly becomes concentrated in numerous small ephemeral watercourses and gullies (*refer* **Figure 2**). These watercourses typically diminish at the boundary of the open cut area where the steep forested slopes meet the lower cleared slopes within the Murragamba and Eastern Creeks valleys. Runoff is discharged across these cleared areas of the catchment as either overland “sheet flow” or via ill-defined watercourses that ultimately drain to the main channels of Murragamba and Eastern Creeks.

FIGURE 2



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CONCEPTUAL INTERPRETATION OF EXISTING CATCHMENT HYDROLOGY

3.3 STREAM WATER QUALITY

3.3.1 Water Quality Monitoring Program

A surface water quality monitoring program was implemented by Moolarben Coal Mine for Stage 1 of the Moolarben Coal Project. The monitoring was conducted at monthly intervals from February 2005 to April 2008. The sampling and field testing has been carried out at the locations shown in **Figure 3**. The sampling sites are located within the catchment of Moolarben Creek and the Goulburn River and include:

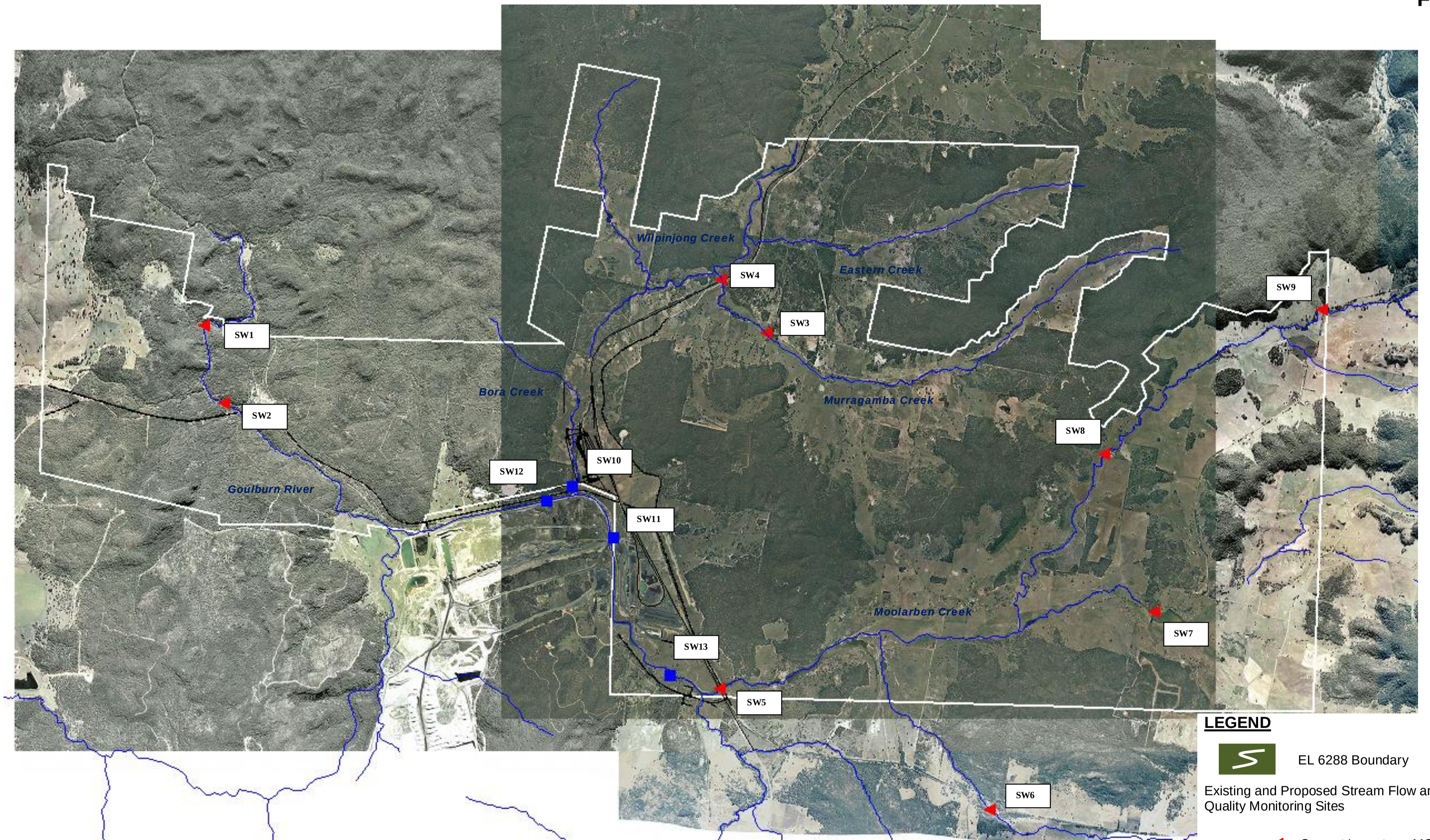
- **SW1**, which is located along the Goulburn River downstream of the 'The Drip' Picnic Area. This sampling site is located outside of the EL;
- **SW2**, which is located along the Goulburn River at 'The Drip' Picnic Area. This sampling site is located within the EL;
- **SW5**, which is located at the Ulan- Cassilis Road crossing of Moolarben Creek/Goulburn River, near Ulan Village. This sampling site is located within the EL;
- **SW6**, which is located along Ryans Creek near Ulan Road This sampling site is located outside of the EL;
- **SW7**, which is located within the "swampy section" of Lagoon Creek. This sampling site is located within the EL;
- **SW8**, which is located along Moolarben Creek approximately midway between its junction with Spring Creek and Lagoon Creek. This sampling site is located within the EL; and,
- **SW9**, which is along Moolarben Creek near the southern boundary of the EL. The sampling site is located within the EL.

Only two sampling sites are located outside the Moolarben Creek / Goulburn River catchment, being:

- **SW3**, which is located along Murragamba Creek near Murragamba Road. This sampling site is located within the EL.
- **SW4**, which is located along the lower reaches of Murragamba Creek near Wilpinjong Creek. This sampling site is located within the EL.

The water quality monitoring assessed a range of parameters including pH, salinity, DO, turbidity, chlorides, sulfates, calcium, potassium, magnesium, sodium, total nitrogen and total phosphorus. A summary of the results of the water quality sampling are listed in **Table 3**.

A draft Surface Water Management Plan was prepared by Moolarben Coal Mines for Stage 1 of the Moolarben Coal Project. The report identified a number of additional sites that would need to be implemented prior to mine operations commencing.



LEGEND

EL 6288 Boundary

Existing and Proposed Stream Flow and Water Quality Monitoring Sites

SW5 — Current Long-term MCM WQ Monitoring Site

SW13 — Proposed Additional MCM WQ Monitoring Sites

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Fig 3 – SurfaceWaterSites.doc

FLOW AND WATER QUALITY MONITORING SITES

The additional sites include:

- **SW11**, to be installed at the downstream end of Bora Creek near its confluence with the Goulburn River, this station would correspond to a licensed discharge point for the Moolarben Coal Project;
- **SW12**, **SW13** and **SW14**, to be installed along the Goulburn River downstream of Ulan.

The additional sites are shown in **Figure 3** and would monitor hydrometric and water quality data including flow, level, salinity, temperature, turbidity, pH and DO.

Rainfall data was obtained over the period of sampling from the Bureau of Meteorology. This data comprises daily rainfall totals for the nearest continuously monitored rain gauge, which is located about 20 km from the EL at Gulgong. Daily read rainfall depths recorded at the Gulgong gauge for the period from January 2005 to May 2008 are shown in **Figure 4**. The dates when water quality sampling was undertaken are superimposed.

Figure 4 shows that with the exception of April-May 2005, March 2006, October 2006 and September 2007, rainfall events generally preceded or coincided with sampling dates. A discussion of the results is outlined in the following sections.

3.3.2 ANZECC Guideline Trigger Values

Recorded maximum and minimum values for a range of water quality parameters were compared against 'trigger values' documented within the ANZECC's, *'Australian and New Zealand Guidelines for Fresh and Marine Water Quality'* (*ANZECC 2000*). The comparison included an assessment of recorded data over the sampling period for salinity, nutrients, turbidity and pH.

Relevant ANZECC guideline trigger values are summarised in **Table 4**.

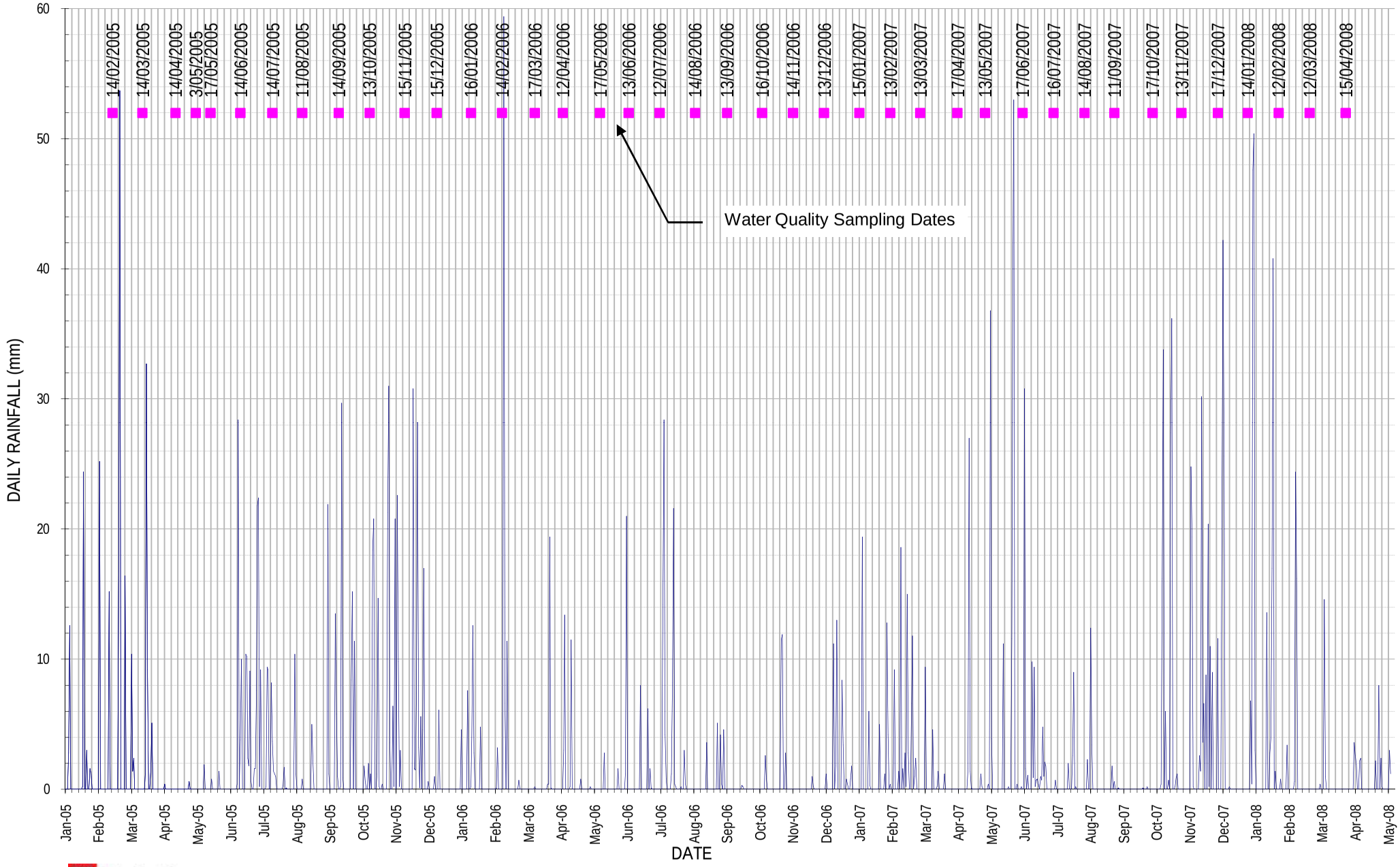
Table 3 ANZECC WATER QUALITY GUIDELINE TRIGGER VALUES

PARAMETER	DEFAULT TRIGGER VALUES FOR PHYSICAL AND CHEMICAL STRESSORS(1)		
	Upland River	Lowland River	Estuary
Total Nitrogen (mg/L)	0.25	0.50	0.30
Total Phosphorus (mg/L)	0.02	0.05	0.03
pH	6.5 – 8.0	6.5 – 8.0	7.0 – 8.5
Turbidity (NTU)	2 - 25	6 - 50	0.5 - 10
Salinity (µS/cm)	350	200 - 300	-

Source: ANZECC (2000)

1. Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems.

FIGURE 4



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DAILY RAINFALL DATA RECORDED AT GULGONG BOM GAUGE

6173 - Moolarben Mine EA
Figure 4 - Daily Rainfall Data Gulgong Gauge

Table 4 WATER QUALITY CHARACTERISTICS FOR THE MOOLARBEN COAL PROJECT

Monitoring Site	Description of Site	Sampling Dates	Value	pH - field	Electrical Conductivity uS/cm - field	Dissolved Oxygen mg/L	Turbidity (NTU)	Total Dissolved Solids@ 180 (mg/L)	Total Suspended Solids@105C (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Chloride (mg/L)	Sulfates (mg/L)	Alkalinity – Bicarbonate mg CaCO3/L	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
ANZECC 2000_A				**6.5 - 8.0**	**30 - 350**	**7.7 - 9.4**	**2 - 25**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.25**	**0.02**
ANZECC 2000_B				**6.0 - 9.0**	**<7500**			**<5000**										
SW1	**Goulburn River**	Monthly between Feb 2005-Apr 2008	Min Value	5.40	350	7.6	0.6	260	2.0	12.0	10.0	45.0	4.0	55.0	33.0	26.0	0.12	0.01
			Max Value	8.10	1500	13.9	150	480	73.0	30.0	21.0	96.0	11.0	110.0	170.0	170.0	0.65	0.10
			Av Value	6.67	784	**9.9**	11.6	372.6	8.4	19.0	14.9	72.8	7.3	78.7	86.2	91.7	**0.30**	**0.03**
SW2	**Goulburn River, The Drip Picnic Area**	Monthly between Feb 2005-Apr 2008	Min Value	4.40	520	5.7	1.4	280	2.0	11.0	8.8	43.0	3.7	51.0	29.0	24.0	0.19	0.01
			Max Value	7.70	1560	12.4	160	790	71.0	54.0	35.0	130.0	16.0	140.0	380.0	180.0	0.75	0.13
			Av Value	6.55	967	8.9	17	463.3	9.1	24.3	18.1	86.8	8.9	88.7	126.6	103.7	**0.34**	0.02
SW3	**Murragamba Ck, Road crossing**	Monthly between Feb 2005-Apr 2008	Min Value	5.30	190	5.4	6	120	5.0	3.5	4.0	10. 0	4.0	20.0	4.0	7.0	0.31	0.02
			Max Value	7.50	1320	11.7	390	650	150.0	30.0	29.0	120.0	15.0	320.0	59.0	76.0	3.10	0.34
			Av Value	**6.35**	689	8.1	**78.3**	413.8	42.3	16.4	16.2	61.6	6.9	152.3	25.3	33.8	**0.96**	**0.08**
SW4	**Wilpinjong Ck, Wollar Road**	Monthly between Feb 2005-Apr 2008	Min Value	5.10	150	0.7	8.4	190	5.0	2.3	3.8	15.0	3.60	22.0	2.9	15.0	0.55	0.02
			Max Value	7.50	2130	9.6	580	1100	200.0	34.0	47.0	270.0	11.0	530.0	160.0	180.0	1.50	0.36
			Av Value	**6.39**	866	**6.4**	**120.7**	520	45.0	15.1	19.4	95.7	7.5	176.7	28.2	77.7	**1.01**	**0.09**

Monitoring Site	Description of Site	Sampling Dates	Value	pH - field	Electrical Conductivity uS/cm - field	Dissolved Oxygen mg/L	Turbidity (NTU)	Total Dissolved Solids@ 180 (mg/L)	Total Suspended Solids@105C (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Chloride (mg/L)	Sulfates (mg/L)	Alkalinity – Bicarbonate mg CaCO3/L	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
SW5	Goulburn River, Ulan Village	Monthly between Feb 2005-Apr 2008	Min Value	5.70	290	3.5	2.7	290	2.0	6.0	3.8	28.0	2.4	28.0	1.6	2.0	0.53	0.01
			Max Value	7.60	1590	9.5	4200	830	2600.0	48.0	34.0	150.0	8.1	310.0	140.0	140.0	2.70	0.87
			Av Value	6.60	839	**7.0**	**229.6**	468.2	123.2	22.2	16.0	77.0	5.0	137.4	51.7	70.3	**1.00**	**0.10**
SW6	Ryan's Creek, Ulan Road	Monthly between Feb 2005-Apr 2008	Min Value	5.70	160	8.1	6.5	160	3.0	1.0	1.9	24.0	1.1	20.0	9.3	24.0	1.60	0.02
			Max Value	7.70	630	12.7	190	450	240.0	2.0	4.4	43.0	2.4	40.0	22.0	42.0	2.80	0.11
			Av Value	6.73	289	**9.8**	**34.3**	202.2	34.9	1.4	2.9	32.0	1.7	26.6	14.5	32.3	**2.05**	**0.04**
SW7	Head water Lagoon Ck	Monthly between Feb 2005-Apr 2008	Min Value	5.30	960	2.0	1.2	510	2.0	40.0	30.0	82.0	3.9	130.0	45.0	19.0	0.71	0.01
			Max Value	8.00	6540	14.8	44	4100	64.0	1800.0	240.0	670.0	31.0	1700.0	830.0	435.0	4.90	0.13
			Av Value	6.79	4134	**10.3**	7.3	2528.9	13.9	256.9	140.5	396.5	15.4	920.0	467.3	203.0	**1.53**	**0.04**
SW8	Moolarben Creek	Monthly between Feb 2005-Apr 2008	Min Value	5.30	2380	0.2	7.1	1500	2.0	39.0	83.0	280.0	8.0	630.0	110.0	3.0	0.31	0.01
			Max Value	7.30	6990	14.7	200	6400	290.0	230.0	470.0	1200.0	66.0	2600.0	980.0	260.0	18.0 0	0.85
			Av Value	**6.07**	4417	9.2	**46.7**	2581.4	37.4	71.8	172.8	504.1	22.2	1133.7	343.3	78.3	**2.66**	**0.12**
SW9	Moolarben Creek, Moolarben Road	Monthly between Feb 2005-Apr 2008	Min Value	5.50	3180	1.2	3.1	1800	3.0	65.0	110.0	310.0	13.0	730.0	200.0	95.0	0.25	0.02
			Max Value	7.90	5610	12.5	200	4000	80.0	150.0	250.0	640.0	28.0	1300.0	990.0	295.0	1.80	0.10
			Av Value	6.51	4218	**6.2**	**44.9**	2670.3	26.37	94.9	161.1	513.7	19.3	1037.4	462.2	207.6	**0.52**	**0.04**

Notes:

- **ANZECC A – represents the Aquatic Ecosystem Guidelines**
- **ANZECC B – represents the Livestock Drinking Water Guidelines**

These guideline trigger values are defined as concentrations of key performance indicators, below which there is a low risk that adverse biological effects will occur. The trigger values are not designed to be used as threshold values at which an environmental problem is inferred if they are exceeded. Rather, they are designed to be used in conjunction with professional judgment, to provide an initial assessment of the state of a water body regarding the issue in question (*ANZECC 2000*).

The guidelines recognise three levels of ecosystem conditions, namely:

1. High conservation / ecological value systems: effectively unmodified or other highly-valued ecosystems, typically occurring in national parks, conservation reserves or in remote and / or inaccessible locations.
2. Slightly to moderately disturbed systems: ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. The biological communities remain in a healthy condition and ecosystem integrity is largely retained. Typically, freshwater systems would have slightly to moderately cleared catchments and / or reasonably intact riparian vegetation.
3. Highly disturbed systems: these are measurably degraded ecosystems of lower ecological value.

The ANZECC guidelines present low-risk trigger values for Condition 2 and Condition 3 ecosystems, such that:

- Condition 2 corresponds to a slightly to moderately disturbed ecosystems where the objective is to maintain biological diversity.
- Condition 3 corresponds to a highly disturbed ecosystem, where the management target would be to maintain, and preferably improve the ecosystem. However, it is recognised that in many cases the possibility of restoring the system to a substantially natural ecosystem may not be realistic.

It is considered that Murragamba and Eastern Creeks are slightly to moderately disturbed systems and that Condition 2 would apply.

3.3.3 Assessment of Key Water Quality Parameters

Salinity

Salinity is a measurement of the concentration of salt present in water. Seawater has a worldwide average salt content of 35 mg/L or 35 parts per thousand (*ppt*). This is equivalent to a conductivity of 51500 µS/cm.

Salinity has been measured as conductivity with units in µS/cm. The data shows that average conductivity ranges from 289 µS/cm at site SW6 (*located along Ryans Creek*) to over 4417 µS/cm at site SW8 (*located along Moolarben Creek upstream of Lagoon Creek*).

These compare to the ANZECC 2000 trigger value of 350 µS/cm for NSW rivers. ANZECC 2000 notes that conductivity in upland streams varies depending on catchment soils and geology.

The results indicate that elevated conductivity is evident in stream flows in the upper sections of the entire MCP catchment, and particularly along Lagoon Creek and Moolarben Creek upstream from its confluence with Lagoon Creek. In contrast, the results show low salinity concentrations along Ryans Creek, which drains the western section of the catchment (*refer* **Figure 3**).

The elevated salinity concentrations are due to the presence of highly saline soils in the upper sections of the Moolarben Creek catchment. Soils in the western section of the catchment, including the Ryans Creek sub-catchment, are significantly less saline (*JAMMEL, 2006*).

Notably, the average conductivity recorded at site SW5 (*Moolarben Creek upstream of Ulan*) is less than 20% of the average recorded in the upstream section of Moolarben Creek (*refer to SW8*). This site is downstream of the Ryans Creek confluence and the results suggest that the lower conductivity at this location may be attributed to dilution due to increased streamflows.

The recorded data shown in **Table 3** indicates that conductivity levels do not vary greatly with distance downstream from site SW5. There is a slight increase in conductivity levels at site SW2, which could be a result of mixing with inflows from Bora Creek and/or Ulan Creek. However, upon reaching SW1, conductivity levels reduce to about 780 µS/cm.

The Murragamba Valley catchment exhibits similar salinity levels to those recorded in the Moolarben Creek catchment. As shown in **Table 3**, the average salinity level at SW3 (*Murragamba Creek road crossing*) is above the ANZECC threshold for the Aquatic Ecosystems Guidelines and below the Livestock Drinking Water threshold documented within the ANZECC 2000 Guidelines. This is also the case at sampling site SW4 (*Ulan-Wollar Road crossing of Wilpinjong Creek*).

The elevated salinity concentration in the Murragamba Creek catchment is most likely due to the presence of highly saline soils in the upper sections of the catchment.

Total Dissolved Solids

Total Dissolved Solids are also listed in **Table 3** for each of the sampling sites. This data shows that TDS concentrations along Murragamba Creek increase from 413mg/L at SW3 to 520mg/L at SW4. This indicates that there is a slight increase in total dissolved solids as you move from Murragamba Creek to its confluence with Wilpinjong Creek. This could be attributed to the larger catchment area that drains to SW4, which would collect a greater volume of salt.

The Australian Drinking Water Guidelines indicate that based on taste, TDS should not exceed 500 mg/l. Palatability is then rated according to TDS concentrations as follows:

- 80-500 mg/l is good;
- 500-800 mg/l is fair;
- 800-1000 mg/l is poor; and,
- greater than 1000 mg/l is unacceptable.

Typical values in major Australian reticulated water supplies range from 45 to 750 mg/l. Therefore, on the basis of TDS / conductivity concentrations, flows carried by the Goulburn River downstream of Ulan would be rated as good quality water.

Commonly accepted salinity tolerances for livestock presented in ANZECC (*1992*) indicate maximum TDS concentrations in water for beef cattle of 5000 mg/l. With the exception of the maximum recorded value at SW8, all TDS concentrations are below this level. In addition, the average TDS concentrations for all sampling sites are below 5000 mg/l.

pH

pH measures the acidity or alkalinity of water on a scale of 0 to 14. Extremes in either direction (*too acidic or too alkaline*) will have detrimental physiological effects on aquatic life.

pH is a useful parameter as it gives an indication of the origin of the water, the type of biological activity present, and whether any contamination of the water is occurring.

In fresh water, pronounced daily changes in pH may occur due to the uptake of carbon dioxide (*weak acid*) during photosynthesis throughout the day, and the release of carbon dioxide during respiration at night.

The average recorded pH values for the majority of the monitoring sites are generally within the recommended pH range of 6.5 to 8.0, as outlined in the ANZECC 2000 Guidelines. However, three sites SW3, SW4 and SW8 all recorded average pH values less than 6.5 and the minimum values at all sites were less than 6.0. This may suggest the presence of acid soils in the upper reaches of the Moolarben Creek and Murragamba Creek catchments.

The three sites that recorded an average pH value less than the 6.5 trigger value outlined within the ANZECC 2000 Guideline criteria only failed to match the criteria for the Aquatic Ecosystems Guidelines. All sites were still above the Livestock Drinking Water Guidelines within the ANZECC 2000 Guidelines.

For all sites the water quality could be regarded as being mildly acidic.

Turbidity

Turbidity measures the clarity of water or how much suspended material is carried in it. It refers to the ability of water to transmit light and is measured by optical assessment using an instrument that measure light scattering caused by particles suspended in the water. This scattering is due to the presence of suspended particles including clay, silt, phytoplankton, zooplankton and complex organic molecules.

Turbidity is generally used as a measure of the "muddiness" of a waterbody. High turbidity has an adverse impact on the recreational uses and aesthetic values of rivers and estuaries, and also reduces light penetration through the water column, which can hinder photosynthesis leading to damage of benthic flora. Contrastingly, the impediment to photosynthesis created by turbidity can also control algal growth.

The units of turbidity are Nephelometric Turbidity Units (*NTU*). The ANZECC 2000 Guideline for the protection of aquatic ecosystems states that the seasonal mean nephelmetric turbidity should not change by more than 10%. The ANZECC 2000 Guidelines also specify a turbidity trigger value of 25 NTU for upland streams.

As shown in **Table 3**, there is considerable variability in the turbidity of Moolarben Creek and the Goulburn River. Recorded maximum turbidity values exceed the ANZECC 2000 Guideline trigger value for upland streams at all monitoring sites. However, as shown in **Figure 5** and outlined in **Section 3.1**, this is likely to be due to the water quality monitoring having taken place following significant rainfall in the catchment.

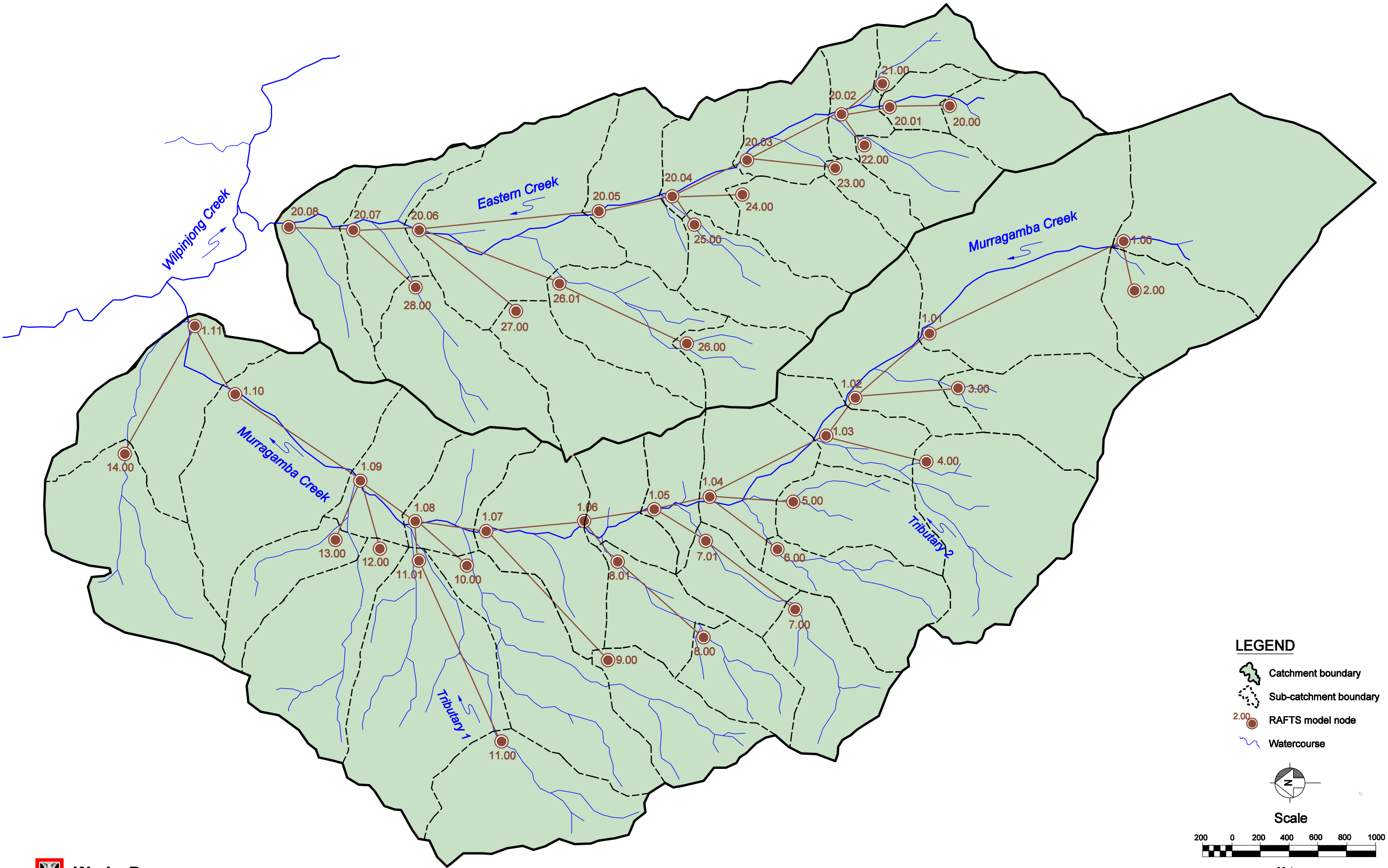
Table 3 shows that average turbidity values for sites SW7, SW2 and SW1 are within the recommended ANZECC 2000 Guideline range for inland rivers. In addition, the average turbidity values for site SW6 is only marginally above the trigger value of 25 NTU.

Elevated average turbidity levels were determined at sites SW3, SW4, SW5, SW8 and SW9. Of these sites SW5, SW8 and SW9 are located within the catchment that drains to Moolarben Creek and will not be impacted as part of the stage 2 mine proposal works. Sites SW3 and SW4 are located along Murragamba and Wilpinjong creek, these sites will be directly impacted upon as part of the current mine proposal.

High turbidity values can be related to either high sediment load from easily erodible soils, or to high nutrient levels which lead to algal proliferation in the water. Available soils mapping indicates the presence of Yellow Podzolic, Red Podzolic and Alluvial soils across the upper sections of the Moolarben, Murragamba and Eastern Creek catchments (*JAMMEL, 2006*).

The alluvial soils are all recent alluviums associated with Murragamba and Eastern Creek. These deposits comprise fine earthy sands and dispersive clays that have been eroded over time from the gullies that drain to Murragamba and Eastern Creeks. A number of these creeks show signs of erosion, with considerable gullying evident along Murragamba Creek as shown in **Plate 1**.

FIGURE 5



LEGEND

- Catchment boundary
- Sub-catchment boundary
- 2.00 RAFTS model node
- Watercourse

N

Scale

200 0 200 400 600 800 1000

Metres

NODE AND LINK ARRANGEMENT FOR RAFTS HYDROLOGIC MODEL

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rp6173_01 - Moolarben EA2
fig5-rafts_layout.dgn

Plate 1 View looking downstream along the lower reaches of Murragamba Creek showing the extent of bank undercutting and erosion

Accordingly, elevated turbidity levels are likely to be associated with rainfall events in the catchment leading to entrainment of these fine soils which have been previously eroded from the upper reaches of these streams and the gullies that feed them. A comparison of turbidity results and the daily rainfall data provided in **Figure 4** suggests a correlation between rainfall and increased turbidity levels.

Nutrients

Nutrients are a key indicator of water quality. Excessive nutrient quantities can lead to degradation of water quality by promoting excessive plant growth. Some nutrients can also be toxic to animals at high concentrations.

The nutrient results documented in **Table 3** indicate that phosphorus and nitrogen concentrations at all sampling sites are in excess of the ANZECC trigger values for the protection of aquatic ecosystems. Total nitrogen values range from 2.1 mg/l at SW6 to 0.3 mg/l at SW1.

Similar trends are evident for total phosphorus which ranges from 0.12 mg/l at SW8 to 0.02 mg/l at SW2.

Notwithstanding, the recorded total phosphorus concentrations for monitoring site SW2 is below the ANZECC trigger value, with the recorded total phosphorus concentrations for monitoring site SW1 only slightly exceeding the ANZECC trigger values. This indicates that TP concentrations are at acceptable level within the Goulburn River.

The recorded total phosphorus concentrations for monitoring site SW3 and SW4, which are situated in the Murragamba and Wilpinjong Creek catchments, are above the ANZECC trigger values. The data suggests that in-stream nutrient concentrations could be linked to agricultural land uses and associated practices across the adjoining floodplain.

4. DESCRIPTION OF PROPOSED MINE DEVELOPMENT

4.1 OVERVIEW

Stage 2 seeks approval to increase production from the whole of the MCP to 13Mtpa of product coal from a total of 17Mtpa of ROM coal. Mine scheduling may be modified to suit operational requirements and will comply with the environmental goals for the total approved ROM and product coal production.

The Stage 2 of the MCP consists of:

- Two underground mines (UG1 and UG2) below the sandstone ridges producing up to 4Mtpa of ROM coal with associated facilities;
- An open cut (OC4) within the floor of the Murragamba Valley producing up to 12Mtpa of ROM coal with associated facilities; and,
- Upgrade the operations of the Stage 1 approved Surface Facilities to a capacity to handle 17Mtpa of ROM coal producing 13Mtpa of product coal; that includes:
  - Increased processing capacity of the Approved Stage 1 coal preparation plant and associated handling facilities (CHPP) from 12 to 17Mtpa of ROM coal;
  - The relocation of the Approved UG4 entries south to the OC1 void;
  - Increased throughput of the Approved OC1 ROM coal system and conveyors from 8Mtpa to 12Mtpa to accommodate production from the Stage 2 underground mines; and
  - Increased throughput of product coal handling and the rail loading facility from 10Mtpa to 13 Mtpa of product coals.

A detailed illustration of the proposed general arrangement of Stage 2 is provided in Figure 4.1 of Section 4 of Volume 1 of the Stage 2 Environmental Assessment Report prepared by Wells Environmental Services.

The underground mines are located below sandstone ridges, whilst the open cut mine is in the floor of the Murragamba Valley and adjoining valley to the east. The Ulan Seam, which ranges from around 11 metres (m) to about 13m in thickness, will be mined with the full seam recovered in OC4 by the use of truck and excavator method and a partial section in the UG1 and UG2 by the use of the longwall extraction method. Both domestic and export thermal coal will be produced and transported from the site by rail.

The location and extent of the proposed operational mining areas have been defined based on site, economic and geological constraints, including:

- the Gulgong to Sandy Hollow Railway;
- Ulan / Wollar Road;

- Munghorn Gap Nature Reserve;
- Murragamba Creek;
- Eastern Creek; and,
- the steep slopes and vegetation along the mountain spurs.

Open Cut No 4 will cover an area of about 1270 hectares. The pit is to be located within the low lying area of the Murragamba and Eastern Creeks valleys, immediately to the south-east of the Gulgong-Sandy Hollow Railway and to the east of Open Cut 2 that was part of the Stage 1 approval for the Moolarben Coal Project. As shown in **Figure 1**, Open Cut 4 extends through the Murragamba Valley into the adjoining valley to the north-east. Mining will commence at the southern end of Murragamba Valley and progress to the north and east.

Underground 1 and 2 will be constructed along the western boundary of Open Cut 4 in the area east of Open Cut 1 and 2 and combined will cover an area of approximately 990 hectares. The extent of the underground mines is constrained to the west by Open Cut 1 and 2, to the north by the Ulan-Wollar Road, and to the east by Open Cut 4 and to the south by Moolarben Creek.

Table 5 lists the key characteristics of each of these mine components.

Table 5 CHARACTERISTICS OF MINING AREAS

MINE AREA	AREA (*ha*)	SCHEDULED PRODUCTION COMMENCEMENT	PROJECTED MINE LIFE* (*years*)	PROJECTED DATE OF MINE CLOSURE	ESTIMATED MAXIMUM ANNUAL RUN-OF-MINE PRODUCTION (*Mtpa*)
Open Cut 4	1270	2010	24	2034	12
Undergrounds No 1 & No 2	990	2014	14	2027	4

* *Assuming that all mines run at maximum production*

Stage 2 of the Moolarben Coal Project will operate in conjunction with Stage 1 so that a single mining complex comprising three underground and four open cut coal mines with Surface Facilities comprising coal handling, preparation, ROM and product stock piling and rail loading. Currently Surface Facilities have been approved for Stage 1 of the MCP. Stage 2 calls proposes that facilities are upgraded to enable increased production from the MCP.

It is proposed to upgrade the mine infrastructure areas first, followed by Open Cuts 4 then Underground 1 and 2. Mining of Open Cut 4 will commence in the south and proceed to the north and then east. Pit depths will generally be between 10 and 90 metres.

Development of Underground 1 is set to commence 5 years after approval of Stage 2 with coal production commencing after the development is complete. It is envisaged that development of Underground 2 will begin 10 years after approval of Stage 2 works with coal production commencing after the development is complete.

The main mine infrastructure for Stage 1 is located immediately to the north of the Ulan-Wollar Road (*refer* **Figure 1**), the facilities located here will be upgraded to incorporate the increase in coal production that will occur as part of Stage 2. The proposed upgrade of the Surface Facilities will involve increasing the handling capacity of the existing facilities and relatively minor adjustments to the physical layout. This will also include the construction of a conveyor to transport coal from the proposed Stage 2 infrastructure to the Stage 1 infrastructure area.

4.1.1 Open Cut 4

Mining is planned to commence at the southern end of Open Cut 4, then progress to the north and then east, with extraction to cease around Year 24 depending on mining conditions.

Overburden will initially be emplaced in and off cut emplacement area outside of the pit boundaries. The planned location for overburden stockpiles is to the south-east and south-west of Open Cut 4. However, once void space becomes available, in-pit dumping of waste will occur, starting in the southern end of Open Cut 4 which is likely to occur in approximately Year 5. Rehabilitation of the mine areas will proceed progressively following mining and overburden backfilling.

4.1.2 Underground No 1 and 2

Access to Underground 1 will occur via the approved Stage 1 high wall access within Open Cut No. 1. In order to make it possible to gain access to Underground No.1 it will be necessary for Open Cut No. 1 to progress past the proposed entrance to the underground mine. Access to Underground No.1 is expected to occur during approximately Years 3 to 4 of mining in Open Cut No. 1. Access into Underground 2 will be via the high wall of Open Cut 4, or from the Underground 1 entry.

Coal extraction from Underground 1 and 2 will occur by long wall mining. Extraction is projected to commence in Year 6 for Underground 1 and continue through until Year 14. Mining at Underground 2 will commence when mining has completed at Underground 1. Mining of Underground 2 is expected to continue until mining Year 17. The mine life for both Underground 1 and 2 is based on assuming a maximum production rate of 4 Mtpa ROM.

4.1.3 Coal Handling and Preparation Plant

Coal washing is proposed, with a washery plant to be constructed in the infrastructure area between Underground 4 and Open Cut 1 as part of the Stage 1 works (*refer* **Figure 1**). Coal stockpiles will also be maintained in this area for transport off-site by rail. A rail loop will be constructed to the east of the stockpile and coal washery area and will provide a transport connection to the Gulgong-Sandy Hollow Railway.

Water for coal washing will be stored in water supply dams that will be constructed within the proposed rail loop. Water stored in these dams will typically be derived from groundwater sources or from appropriately licensed facilities. Offices and amenities buildings will also be located in the mine infrastructure area and will be accessible from Ulan-Cassilis Road.

5. ASSESSMENT OF EXISTING FLOOD CHARACTERISTICS

5.1 CATCHMENT CHARACTERISTICS

Stage 2 of the Moolarben Coal Project is drained by two watercourses, namely Murragamba and 'Eastern' Creeks. Both creeks flow in a northerly from the Munghorn Gap Nature Reserve until they discharge to Wilpinjong Creek immediately north of the Ulan-Wollar Road and the Gulgong-Sandy Hollow Railway (*refer* **Figure 1**). Wilpinjong Creek drains in a north-easterly direction toward Wollar and discharges to Wollar Creek, which in turn flows into the Goulburn River. Open cut operations proposed as part of Stage 2 of the MCP will cover the majority of the floodplains of Eastern and Murragamba Creeks.

Vegetation coverage across the Murragamba and Eastern Creek catchments varies considerably. The floodplain areas that adjoin Murragamba and 'Eastern' Creeks are generally cleared with only occasional scattered trees, which are generally in close proximity to the creek lines (*refer* **Plate 2**). The steeper sections of the catchment are generally densely vegetated and uncleared, although the valley walls are typically defined by rocky outcrops.

Plate 2 View looking at section of upper Murragamba Creek Valley showing extent of sparsely vegetated floodplain lands

As shown in **Plate 2**, the upper reaches of both Murragamba Creek and 'Eastern' Creek are areas of wide, relatively flat floodplain. The 'creek' in the upper areas of both catchments is ill-defined and consists more of a depression in the floodplain than a creek channel. The creek channel becomes more defined with distance downstream and there is also an increase in the density of vegetation along the streambanks of the lower reaches of both creeks (*refer* **Plate 3**).

Land use across the catchment is predominately low density grazing. Dwellings are generally sparsely distributed throughout the catchment and are all associated with the low density grazing that occurs on the floodplain.

Topographic relief across the Stage 2 project area is considerable. Ground surface elevations vary from 400 mAHD to over 500 mAHD. Numerous intermittent streams extend across the lower-lying sections of the catchment and drain to Murragamba Creek and 'Eastern' Creek.

Plate 3 View looking downstream along the lower reaches of Eastern Creek south of the Ulan-Wollar Road crossing

5.2 STREAM CHARACTERISTICS

5.2.1 Murragamba Creek

Murragamba Creek is located in the upper reaches of the Wilpinjong Creek catchment, which is a major tributary of the Goulburn River. It drains a catchment of about 22.2 km^2.

As described in **Section 4.1**, the creek channel in the upper reaches of the Murragamba Creek valley is ill-defined and exists as more of a vegetated depression in the floodplain than an actual channel. The central section of Murragamba Creek contains a well defined channel with areas of exposed bedrock (*refer* **Plate 4**). The creek banks in this location are also highly vegetated with both small and large sized trees. This section of the creek is considered to be morphologically stable and able to withstand the erosive forces of floodwaters. This is due to the presence of exposed bedrock and the well-defined creek channel. The proposal to divert Murragamba Creek to enable resource extraction has recognised the geomorphic value of this section of the creek and aims to retain it intact.

Plate 4 **View looking downstream along the morphologically stable section of Murragamba Creek showing exposed bedrock and the pool and riffle sequence characteristics of the central section of the creek channel**

The lower reaches of Murragamba Creek also contain a more defined channel with vegetation lining the creek banks.

The longitudinal grade of Murragamba Creek is typically about 1 vertical in 100 horizontal, although some sections approach grades of 1(V) in 50(H). These sections where steeper grades are evident indicate that high velocity flows are likely to occur during floods.

Several roadways within EL6288 cross Murragamba Creek. These crossings include:

- A low level causeway located along the primary access road to the upper valley and which provides access to individual farming properties.
- Two major bridge crossings in the lower reaches which include the Ulan-Wollar Road crossing and the Gulgong-Sandy Hollow Railway crossing.

  Both crossings comprise substantial approach embankment which afford a significant impediment to the downstream distribution of floodwaters during floods in excess of the capacity of the bridge crossing.

5.2.2 'Eastern' Creek

'Eastern' Creek is also located in the upper reaches of the Willpinjong Creek catchment. It drains a catchment area of about 9.3 km^2 and is located immediately east of the Murragamba Creek valley (*refer* **Figure 1**).

'Eastern' Creek is a small intermittent watercourse that drains through the eastern section of the area designated for Open Cut No. 4 (*refer* **Figure 1**). It discharges to Wilpinjong Creek about 800 metres downstream from the Murragamba / Wilpinjong confluence.

'Eastern' Creek has similar channel characteristics to Murragamba Creek. In the upper reaches of the valley, the channel is typically poorly defined, existing as more of a vegetated depression in the floodplain than an actual channel. Channel definition increases with distance downstream.

The grade of the valley in the upper reaches is generally about 2%, which is considered to be hydraulically steep. As a result, flows carried by the channel in major floods are typically characterised by relatively high velocities. This has led to scouring of the channel down to bedrock in the central reaches (*refer* **Plate 5**), and results in the channel exhibiting a relatively straight planform geometry.

'Eastern' Creek flattens as it approaches the Ulan-Wollar Road and has a typical grade of about 1% in the lower reaches. The channel is more defined with vegetation cover comprising sparse trees that are typically limited to the immediate vicinity of the creek bank (*refer* **Plate 6**).

The Ulan-Wollar Road and the Gulgong-Sandy Hollow Railway cross the downstream end of Eastern Creek before it discharges to Wilpinjong Creek.

Plate 5 View looking upstream along steep and scoured central section of Eastern Creek

Plate 6 View looking downstream along lower reaches of 'Eastern' Creek

5.3 FLOOD HYDROLOGY

A hydrologic analysis of the Murragamba and 'Eastern' Creeks catchments was undertaken to quantify peak flood discharges that could be experienced through the Stage 2 area of the Moolarben Coal Project, and which may need to be managed as a function of any creek diversion that is undertaken to optimise resource extraction. The peak discharges derived from the hydrologic analysis were used as the upstream boundary conditions within flood models that were developed for both creeks to quantify flood characteristics such as peak level and section averaged flow velocity.

5.3.1 Hydrologic Model Development

Sub-Catchment Parameters

The Runoff Analysis and Flow Training Simulation (*RAFTS-XP*) software was employed to quantify flood discharges along Murragamba Creek and 'Eastern' Creek for existing catchment conditions. RAFTS-XP is a deterministic runoff routing model that simulates catchment runoff processes. It is recognised in *'Australian Rainfall and Runoff – A Guideline to Flood Estimation'* (*1998*) as one of the available tools for use in flood routing within Australian catchments.

The Murragamba Creek catchment was subdivided into 28 smaller sub-catchments to better define the runoff processes across the catchment. In addition to this, the 'Eastern' Creek catchment was subdivided into 18 smaller sub-catchments. Each of the sub-catchments is identified in **Figure 5**.

The location of each sub-catchment outlet was based on consideration of the local topography, the Open Cut No. 4 pit extent, the potential alignment for creek channel diversion, and the probable extent of the hydraulic model that was to be used to simulate flood characteristics along the watercourses.

The RAFTS-XP model was developed using the physical characteristics of the catchment including catchment area, slope, roughness and percentage impervious area. The physical characteristics of each sub-catchment were defined using ground surface contours available from 1:25,000 series topographic mapping, detailed photogrammetry of the catchment area (*which generated 1 metre contours of the floodplain*), air photo interpretation, and a visual inspection of the catchment.

Adopted parameter values for all sub-catchments are enclosed within **Appendix A**.

After sub-catchment delineation and parameter values were established, the data was input into the RAFTS-XP software package and separate hydrologic models were developed for each catchment. The node and link arrangement for each RAFTS-XP model is presented in **Figure 5**.

Rainfall Loss Model

In a typical storm event, not all of the rainfall that falls onto the catchment is converted to runoff. Some of the rainfall may be lost to the groundwater system through infiltration into the soil, or may be intercepted by vegetation and stored. This component of the overall rainfall is considered to be "lost" from the system and does not contribute to the estimated catchment runoff.

To account for rainfall losses of this nature, a rainfall loss model can be included within the RAFTS-XP model. For this study, the *Initial-Continuing Loss Model* was used to simulate rainfall losses across the catchment. This model assumes that a specified amount of rainfall (*e.g., 10 mm*) is lost from the system at the beginning of the storm being considered, and that further losses occur at a specified rate per hour (*e.g., 1.5 mm/hr*). These rainfall losses are effectively deducted from the total rainfall over the catchment, thereby leaving the remaining rainfall to be distributed through the catchment as runoff.

Continuing loss rates for the Hunter River catchment are documented in Table 3.1 of *'Australian Rainfall and Runoff'* (*1987*). Table 3.1 gives a mean continuing loss rate for the Hunter River Catchment of 5.7 mm/hr. Standard design rainfall losses for New South Wales are outlined in Table 3.2 of *'Australian Rainfall and Runoff'* (*1987*), and indicate initial losses can range between 10 and 35 mm, and continuing losses are typically 2.5 mm/hour.

However, these loss rates are not necessarily representative of loss rates within the upper sections of the Hunter River catchment. Therefore, more conservative values of 10 mm and 5 mm/hr were adopted for the initial and continuing losses, respectively.

5.3.2 Hydrologic Model Calibration

Flood routing models such as RAFTS should be calibrated and verified using rainfall and stream flow data from specific flood events. Rainfall records from a major storm that caused flooding are routed through the model and discharge hydrographs are generated at locations where stream flow records for the flood corresponding to the storm have been gathered. Calibration is completed by modifying model parameters to achieve the best match between recorded and model generated discharge hydrographs.

Continuous stream flow data for historic floods is required for the calibration and verification process. A review of the Department of Natural Resources' PINEENA database (*Version 8*) indicates that there are no streamflow gauges located on either Murragamba Creek or 'Eastern' Creek. The closest stream flow gauge that would monitor flows from these creeks is located along Wollar Creek. This gauge is located __ kilometres downstream of the area covered by Stage 2 of the MCP, and records flows from numerous other streams that discharge to Wilpinjong and Wollar Creeks. Furthermore, the stream gauge only provides monthly stream flow readings.

Hence, there is insufficient continuous stream flow information available to reliably calibrate the hydrologic model.

In the absence of suitable calibration data, RAFTS model parameter values were based on recommendations outlined in the RAFTS User Manual and documented in *'Australian Rainfall and Runoff'* (*1987*).

5.3.3 Predicted Peak Flood Discharges

The RAFTS-XP model was used to simulate the 5, 20, 100 and 200 year recurrence flood events, as well as the probable maximum flood (*PMF*). Simulations were based on the use of rainfall intensities and temporal patterns for the study area, which were derived from standard procedures outlined in *'Australian Rainfall and Runoff – A Guide to Flood Estimation'* (*1987*).

A range of different storm durations were considered to establish the critical storm duration for both the Murragamba and 'Eastern' Creek catchments. The critical duration for each catchment was defined as the storm duration that produced the highest peak discharge at the downstream boundary; that is, at the Ulan-Wollar Road crossing of each creek.

A critical storm duration of 6 hours was determined for the entire Murragamba Creek catchment for all of design storm events. A 6 hour storm duration was also determined to be the critical duration for runoff from the entire 'Eastern' Creek catchment. It should be noted that individual sub-catchments at locations throughout both catchments may have critical durations less than 6 hours. However, the focus for this investigation was the primary tributaries and the flow characteristics in their lower reaches near the proposed open cut operations.A summary of peak discharges for the 5, 20, 100 and 200 year recurrence flood events, and the PMF, is presented in **Table 6**. Peak discharges are listed at key locations along both Murragamba and Eastern Creeks.

It should be noted that the peak discharges listed in **Table 6** are based on the critical storm duration for the respective location within the catchment and may not be equal to the peak discharge for the 6 hour duration event at that location. Hence, the values listed in **Table 6** are considered to be the maximum flows that could be expected at each location for the storm frequencies that have been considered.

The results listed in **Table 6** indicate that the peak 100 year recurrence discharge for the Murragamba Creek catchment at the Ulan-Wollar Road crossing is predicted to be about 92 m^3/s. Smaller, channel forming events such as the 5 year recurrence event, are predicted to generate peak flows of about 39 m^3/s, or 40% of the 100 year recurrence flood flow.

Table 6 also shows that the peak 100 year recurrence flood discharge for the 'Eastern' Creek catchment at the Ulan-Wollar Road crossing is estimated to be 62 m^3/s. Peak 5 year recurrence flows are estimated to be about 26 m^3/s.

Table 6 PEAK DESIGN FLOWS FOR EXISTING CATCHMENT CONDITIONS

DESCRIPTION OF LOCATION	RAFTS MODEL NODE NUMBER (*refer* **Figure 5**)	PEAK DISCHARGE (m^3/s)				
		5 Yr ARI	20 Yr ARI	100 Yr ARI	200 Yr ARI	PMF
Murragamba Creek						
Southern end of Murragamba Creek	1.00	7.8	14.0	23.6	28.7	189
Upstream of morphologically sound section of Creek	1.03	20.7	33.1	52.6	62.3	482
Downstream of morphologically sound section of Creek	1.05	26.3	42.3	66.0	77.3	561
Upstream of 'Tributary 1'	1.07	29.5	47.4	73.8	86.3	720
Downstream of 'Tributary 1'	1.09	36.2	57.4	88.1	102.5	1024
Ulan-Wollar Road Crossing	**1.11**	**37.9**	**59.7**	**92.2**	**108**	**1191**
Eastern Creek						
Start of 'Eastern' Creek	20.02	8.6	13.9	22.3	26.2	168
1200 m downstream from start of creek	20.04	15.0	24.3	37.7	44.6	305
1000 m upstream from Ulan-Wollar Road crossing	20.06	23.1	36.2	54.3	63.2	504
Ulan-Wollar Road Crossing	**20.08**	**26.2**	**41.3**	**61.7**	**71.7**	**565**

5.4 FLOOD ANALYSIS

A HEC-RAS flood model was developed to define design flood behaviour along both Murragamba and Eastern Creeks.

The HEC-RAS software can be used to perform one-dimensional water surface profile calculations for steady state and gradually varied flow in natural or constructed channels. It was developed by the US Army Corp of Engineers and is based on solution of the Energy Equation using an iterative procedure known as the Standard Step method. It is the successor to the steady-flow *HEC-2 Water Surface Profiles* software, which has been used widely to simulate flood behaviour in river and channel systems, particularly where structures (*e.g., bridges*) constrain free surface flow.

5.4.1 HEC-RAS Model Development

To facilitate development of the HEC-RAS hydraulic model, cross-sections of Murragamba Creek and 'Eastern' Creek were gathered. The cross-sections were surveyed by Pegasus Technical during March 2008 and July 2008. Representative photographs of the watercourses were also taken as part of the survey for each cross-section to assist in defining suitable Manning's 'n' roughness values in the HEC-RAS model.

The location and extent of cross-sections used to develop the HEC-RAS model are shown in **Figure 6**. Plots of each cross-section are also enclosed within **Appendix B**.

Ground surface contours for the Stage 2 area were also provided by Pegasus Technical and are also shown in **Figure 6**. The contours were provided at 0.2 metre intervals and were used in conjunction with peak flood level estimates to map flood extents. The contours were derived using photogrammetric survey techniques and are considered to provide a vertical accuracy of ±500 mm.

The surveyed cross-sections were used to develop two separate HEC-RAS models. The first model extended upstream along Murragamba Creek from Ulan-Wollar Road crossing to the upper reaches of the catchment. The second model extended upstream along 'Eastern' Creek from the Ulan-Wollar Road crossing.

Channel and Floodplain Roughness

Main channel and overbank roughness's were determined for each model cross-section based on the photographs gathered during the topographic survey and from field observations undertaken to assess channel condition and floodplain vegetation density.

The adopted Manning's 'n' roughness values were determined by comparing observed vegetation density and soil types with standard photographic records of stream and floodplain condition for which Manning's 'n' values have been calculated.

Typical roughness values adopted in the model are summarised as follows:

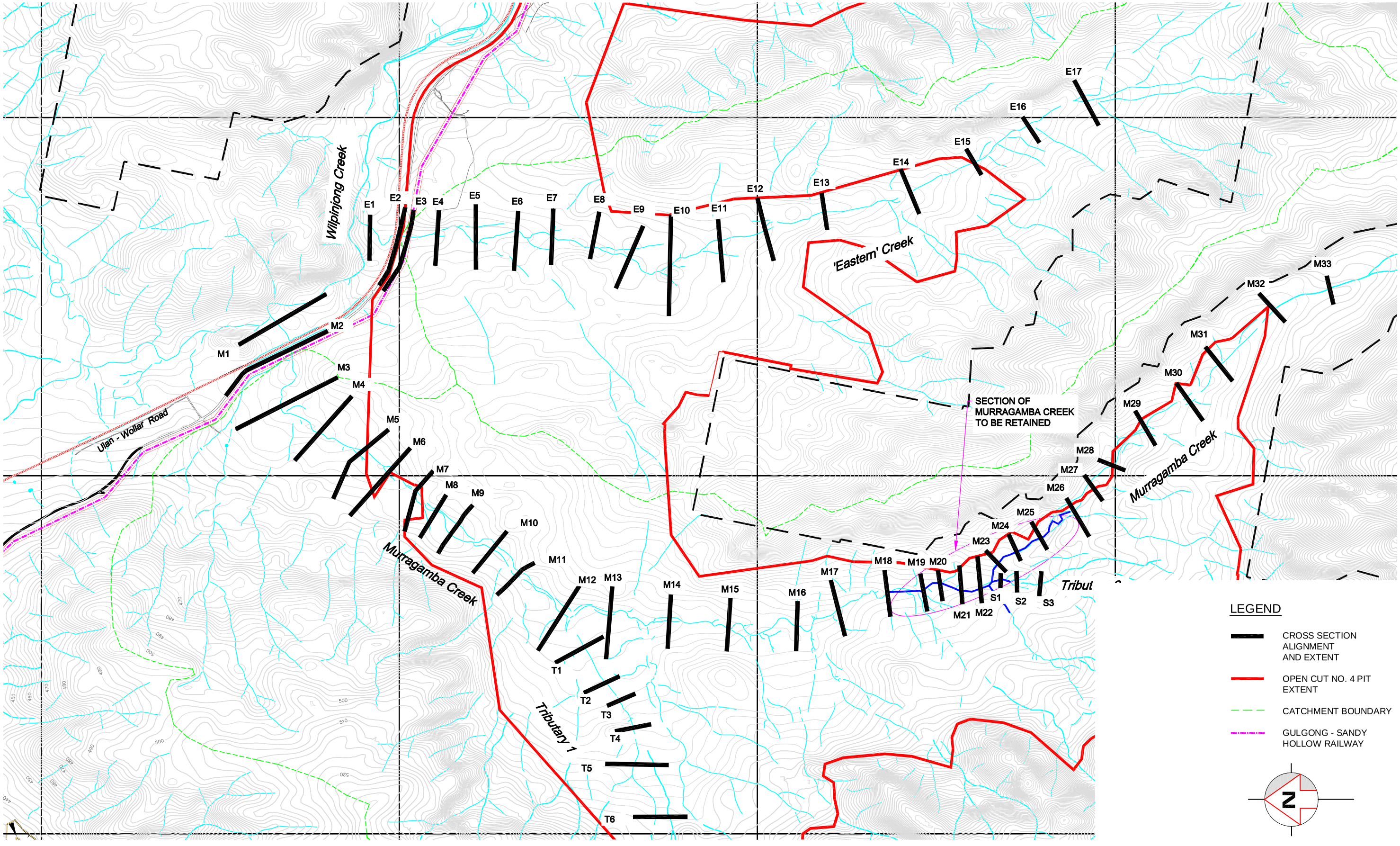
- Short to medium grass 0.030 – 0.045
- Long grass with/without trees 0.050 – 0.070
- Dense vegetation 0.080 – 0.100
- Dense vegetation with fallen trees 0.110

Boundary Conditions

Murragamba Creek

Boundary conditions for the Murragamba Creek flood model were based on the peak discharges determined from the RAFTS hydrologic model (*refer* **Table 6**). Peak flows were extracted for each HEC-RAS model cross-section based on the proximity of that cross-section to nodes within the RAFTS hydrologic model (*refer* **Figures 5** and **6**).

FIGURE 6



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LOCATIONS AND EXTENT OF CREEK CROSS SECTIONS

As mentioned in **Section 4.3.3**, the peak discharge at a particular location within each catchment did not always correspond to the discharge derived from the critical storm duration for the entire catchment (*i.e., 6 hours*). However, the peak flow from each node was used at each HEC-RAS model cross-section in order to ensure representation of a worst case flood scenario.

The downstream boundary condition for the Murragamba Creek model was based on the application of normal depth calculations assuming channel cross-section conveyance represented by Cross-sections M1, M2 and M3 (*refer* **Figure 6**). As the energy slope was not known, the slope of the channel bed was derived from creek channel elevations shown in these cross-sections. A slope of 1% was determined and adopted for modelling purposes.

Eastern Creek

As with Murragamba Creek, boundary conditions for the hydraulic model of 'Eastern' Creek were based on peak discharges determined from the RAFTS hydrologic model. Each cross-section within the HEC-RAS model was assigned a flow from the corresponding RAFTS node. Flows were extracted for the 100 year recurrence flood.

The downstream boundary condition for the hydraulic model of 'Eastern' Creek was based on the application of normal depth calculations assuming channel cross-section conveyance represented by Cross-sections E1, E2, E3 and E4 (*refer* **Figure 6**). As the energy slope was not known, the slope of the channel bed was derived from creek channel elevations shown in these cross-sections. A slope of 1% was determined and adopted for modelling purposes.

Bridge and Culvert Modelling

The details of all bridge, culvert and causeway crossings were also collected as part of the survey that was undertaken for the project by Pegasus Technical. This information is reproduced in **Appendix C**. Waterway areas and approach embankment details at all crossings were incorporated into the HEC-RAS model.

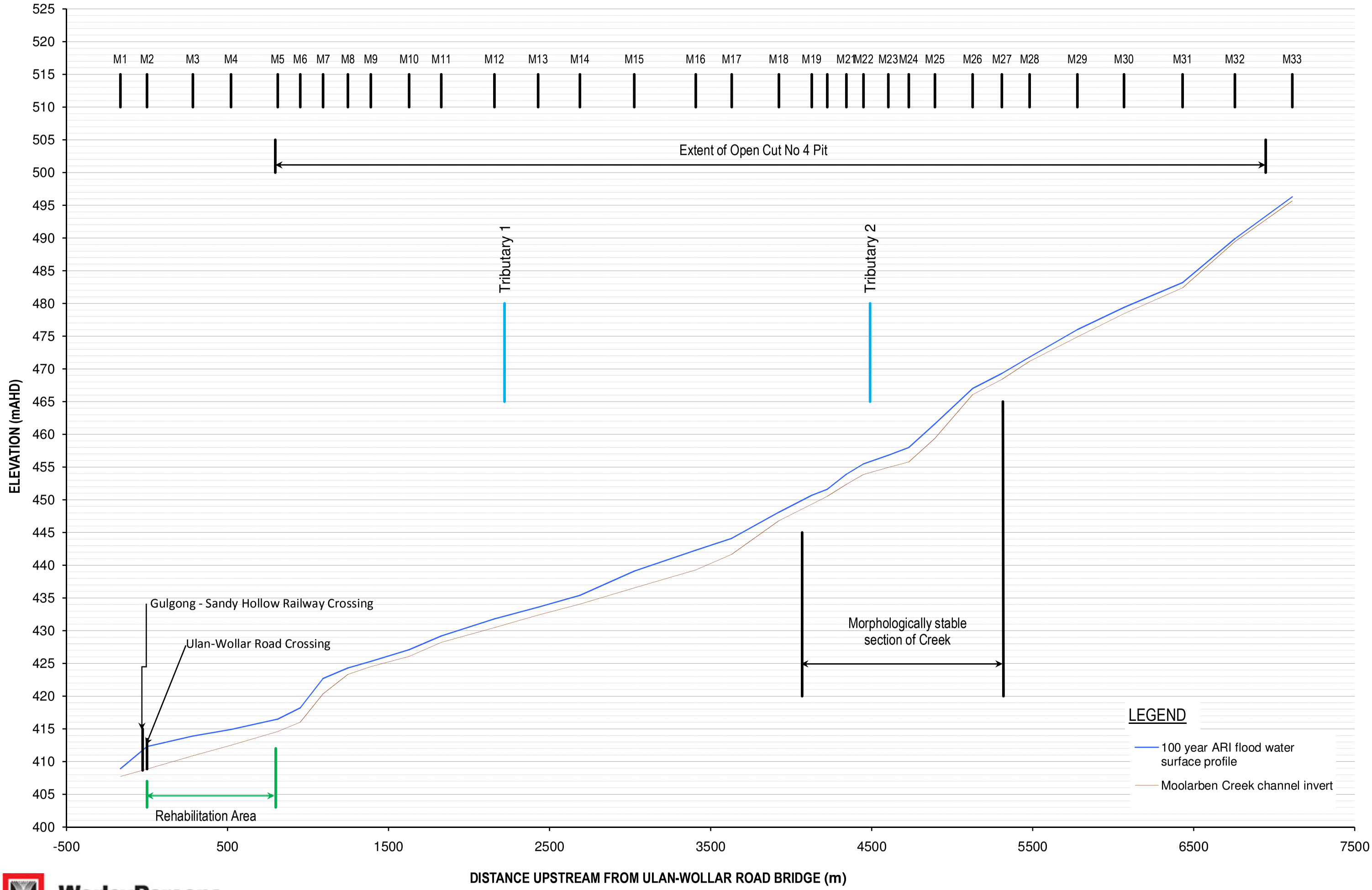
5.4.2 Flood Characteristics for Existing Conditions

The HEC-RAS models of Murragamba and 'Eastern' Creeks were used to simulate the 100 year recurrence flood. Peak flood levels and velocities for each model cross-section are summarised in **Tables 7** and **8**, for Murragamba and 'Eastern' Creeks, respectively.

Design water surface profiles for the 100 year recurrence flood are presented in **Figures 7** and **8** for Murragamba and Eastern Creeks, respectively.

HEC-RAS model outputs for the 5, 20, 100 and 200 year recurrence floods, and for the PMF, are enclosed within **Appendix E**.

FIGURE 7



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Murragamba Creek Plot

PREDICTED DESIGN 100 YEAR ARI FLOODWATER SURFACE PROFILE FOR MURRAGAMBA CREEK

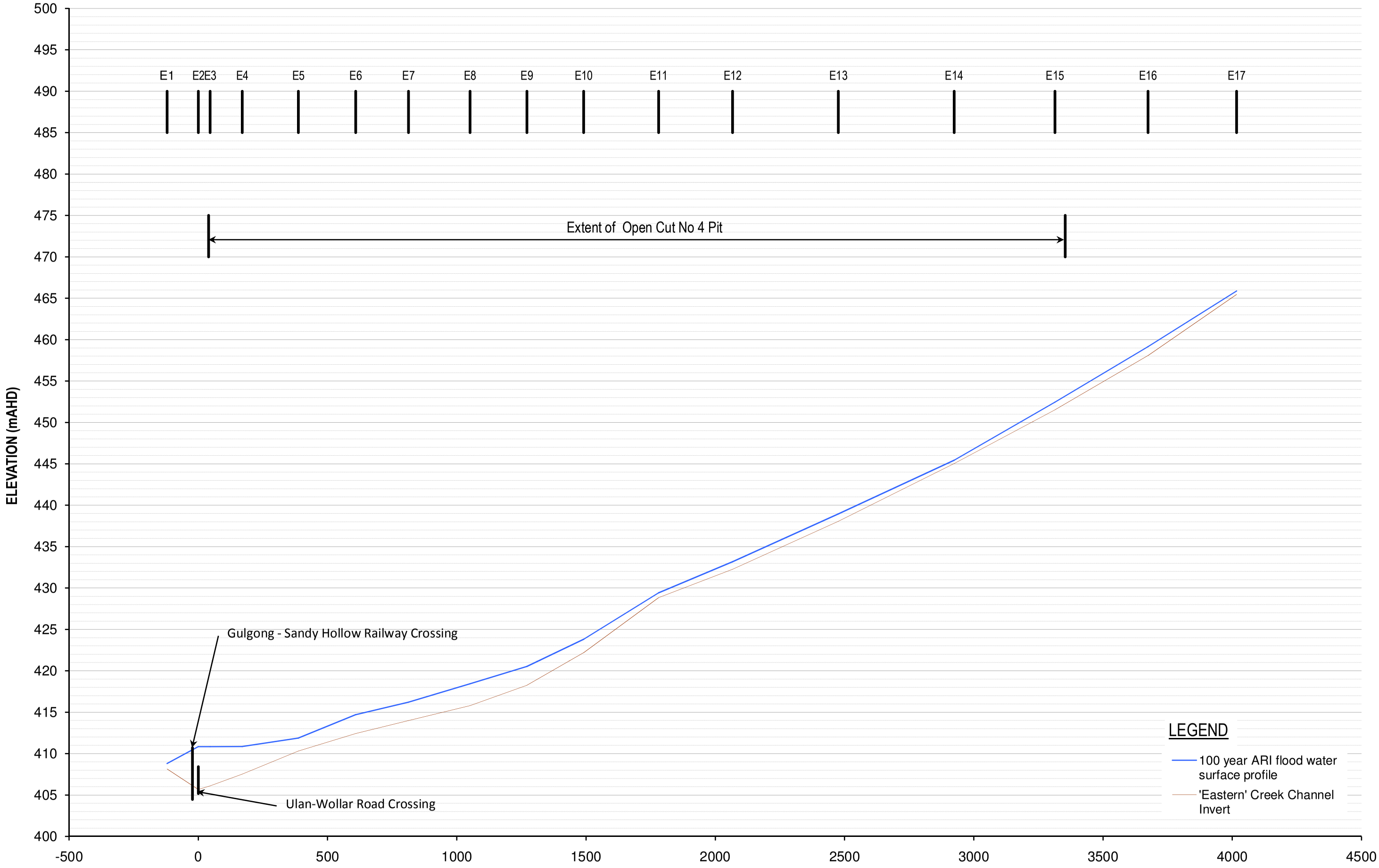

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Figure 7 & 8 fg6173_01_smd080702-WSP.xls
Eastern Creek Plot

PREDICTED DESIGN 100 YEAR ARL FLOODWATER SURFACE PROFILE FOR 'EASTERN' CREEK

Table 7 PEAK 100 YEAR ARI FLOOD LEVELS AND VELOCITIES FOR MURRAGAMBA CREEK FOR EXISTING CONDITIONS

HEC-RAS MODEL CROSS-SECTION	PEAK LEVEL (mAHD)	MAXIMUM SECTION AVERAGED VELOCITY (m/s)		
		Left	Channel	Right
M33	496.3	N/A	1.79	N/A
M32	489.9	0.78	1.53	0.89
M31	483.2	1.24	2.4	1.31
M30	479.4	N/A	1.43	1.21
M29	476	0.25	1.89	0.23
M28	471.8	0.57	1.35	0.74
M27	469.3	0.8	1.5	0.9
M26	467	0.71	1.01	0.61
M25	461.6	2.54	5.4	2.44
M24	458	0.73	3.26	0.68
M23	456.8	1.45	2.73	1.27
M22	455.5	0.72	2.12	0.84
M21	453.9	1.1	3.46	0.8
M20	451.6	1.29	3.26	1.85
M19	450.7	0.2	1.32	N/A
M18	448.1	N/A	2.66	N/A
M17	444.1	0.57	2.57	0.63
M16	442.3	1.16	4.25	1.04
M15	439.1	0.13	3.05	0.25
M14	435.4	0.75	2.68	0.39
M13	433.6	0.02	1.13	N/A
M12	431.8	0.04	1.07	N/A
M11	429.2	1.19	1.99	0.78
M10	427.1	1.78	1.72	0.87
M9	425.3	0.35	1.05	0.21
M8	424.3	0.33	1.11	N/A
M7	422.7	0.57	2.34	0.57
M6	418.2	N/A	3.57	N/A
M5	416.5	N/A	2.33	N/A
M4	414.9	N/A	2.69	N/A
M3	413.9	N/A	1.59	N/A
M2	412.3	0.28	1.55	0.38
M1	408.9	N/A	2.18	1.07
S3	461.3	0.43	0.96	0.46
S2	457.1	0.49	1.95	0.65
S1	455.9	0.79	1.55	0.62
T6	458.2	N/A	1.21	N/A
T5	450.1	0.14	1.41	N/A
T4	445.2	1.05	1.29	0.82
T3	441.3	0.42	1.7	0.9
T2	438.3	0.86	N/A	0.65
T1	438.4	N/A	2.17	N/A

Table 8 DESIGN 100 YEAR ARI FLOOD LEVELS AND VELOCITIES FOR 'EASTERN' CREEK FOR EXISTING CONDITIONS

HEC-RAS MODEL CROSS-SECTION	PEAK LEVEL (mAHD)	MAXIMUM SECTION AVERAGED VELOCITY (m/s)		
		Left	Channel	Right
E17	465.9	0.65	1.69	0.65
E16	459.2	1.25	2.52	0.99
E15	452.5	0.74	2.37	0.66
E14	445.4	0.46	1.65	0.62
E13	439	0.69	1.8	0.58
E12	433.2	0.08	1.06	N/A
E11	429.4	0.31	0.77	0.28
E10	423.8	N/A	3.1	N/A
E9	420.5	N/A	1.91	N/A
E8	418.4	N/A	1.94	0.21
E7	416.2	N/A	1.92	N/A
E6	414.7	0.02	1.87	N/A
E5	411.9	N/A	2.91	N/A
E4	410.9	0.17	0.65	0.11
E3	410.8	0.07	0.27	0.06
E2	410.8	0.08	0.21	0.07
E1	408.8	N/A	1.32	N/A

5.5 DISCUSSION

The results of the flood analysis indicate that the hydraulic gradient of the water surface profile along each of the watercourses is hydraulically steep, irrespective of flood magnitude. As a consequence, floodwaters are typically restricted to the channel and the immediate floodplain, and are characterised by relatively shallow fast moving water. This is confirmed by the results listed in **Tables 7** and **8** which indicate that flow velocities along each of the watercourses are generally in excess of 1 m/s during the design 100 year recurrence flood. In some areas, such as the most downstream kilometre of Murragamba Creek, floodwaters are predicted to be fully retained within the channel in the design 100 year recurrence event (*refer* **Table 7** *for cross-sections M3 to M7*).

The results listed in **Table 7** indicate that during the 100 year recurrence flood, peak in-channel flow velocities along Murragamba Creek typically range between 1 and 3 m/s. However, it should be noted that there are locations of extremely high flood flow velocity, particularly in the vicinity of Cross-section M25, which is located within the morphologically stable section of the creek. Peak flow velocities above 5 m/s are predicted to occur along this section of the creek during the design 100 year recurrence flood.

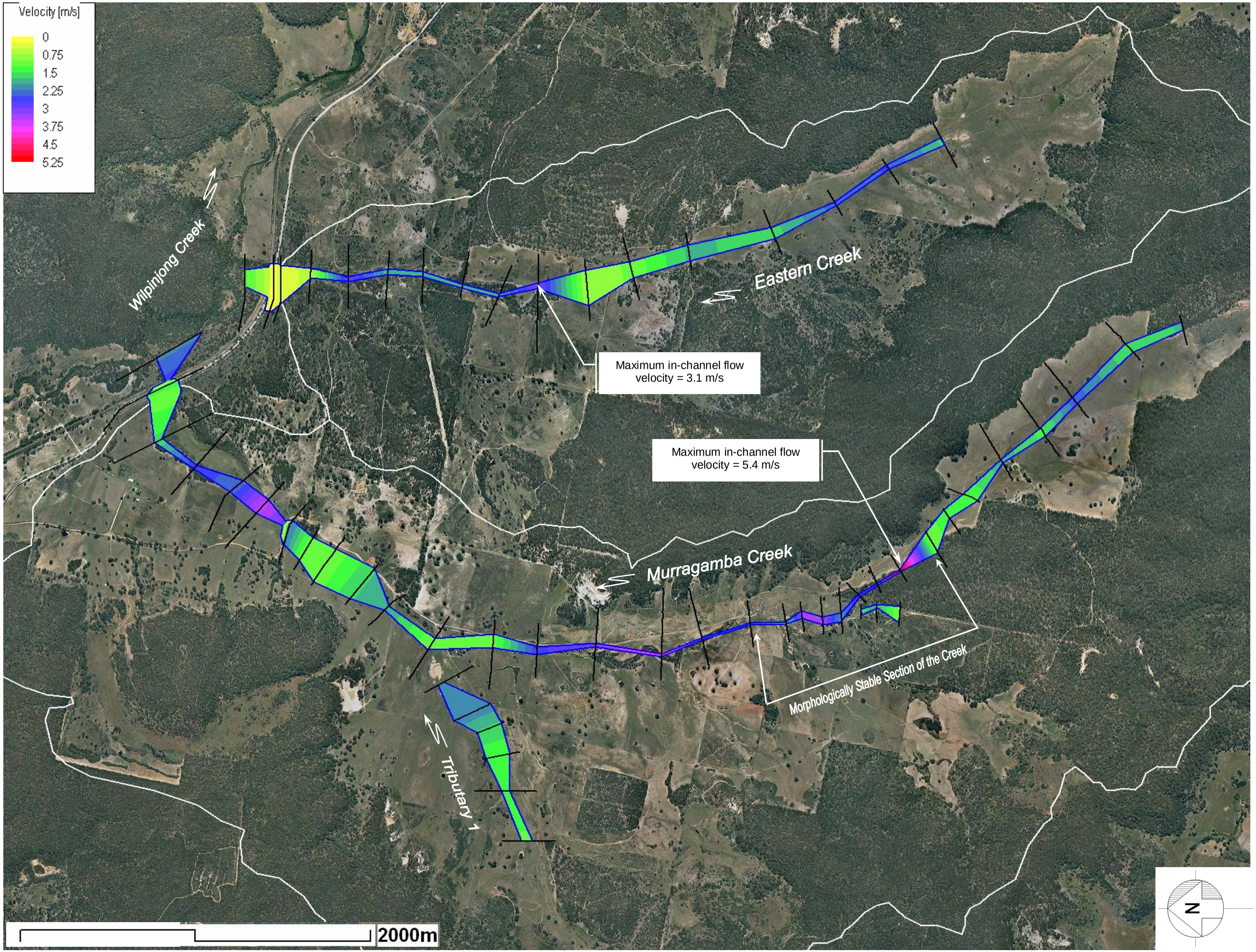
The proposed realignment of Murragamba Creek aims to retain the morphologically stable section of the creek as it is hydraulically stable due to the presence of bedrock along the channel base. With this in mind, it will be necessary to ensure that care is taken not to disturb this section of the creek and thereby ensure that the existing hydraulic conditions his area are retained as part of any future creek reconstruction works.

Eastern Creek also experiences relatively high in-channel flow velocities. In-channel flow velocities of between 1.5 and 3.5 m/s are predicted in the design 100 year recurrence flood. Areas of exposed bedrock along the central reaches of the channel bear witness to the erosion potential of flood flows carried by Eastern Creek. Accordingly, it will be necessary for the post-mining reconstructed Eastern Creek channel to be designed in a way that reduces flow velocities via increased meander planform and/or strategically located drop structures.

The results from the flood modelling for the 100 year recurrence extent were extracted and combined with the topographic survey data and used to generate flood extent mapping for both Murragamba and Eastern Creeks. The flood extent mapping is presented in **Figure 9**. It shows that floodwaters are typically constrained to the channels of both streams and do not inundate large areas of the adjoining floodplain. Hence, it can be concluded that for most storm events, runoff is concentrated in the channel of the primary streams and is discharged through the system without any significant transfer to flood storage areas.

As shown in **Figures 7** and **8**, the Open Cut No.4 pit will extend across the majority of the defined channels of both Murragamba and Eastern Creeks. As a result, it will be necessary to divert both creeks while mining is being undertaken. The proposed scheduling of the creek diversions is outlined in **Section 7.2**. As mentioned previously, a small section of the existing channel of Murragamba Creek will be retained while mining is undertaken in Open Cut No.4. This area is highlighted in **Figures 6** and **7**.

FIGURE 9



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PREDICTED 100 YEAR RECURRENCE FLOOD EXTENTS AND VARIATION IN MAXIMUM FLOW VELOCITY

6. ASSESSMENT OF THE PROPOSED CREEK DIVERSIONS

6.1 DESCRIPTION OF THE PROPOSED CREEK DIVERSION PROPOSAL

As described in **Section 4**, Stage 2 of the Moolarben Coal Project is proposed in order to maximise coal extraction from within EL 6288. It is proposed that the additional mining be undertaken in Open Cut No.4 and Underground No.1 and 2. As shown in **Figure 2**, Open Cut No 4 is situated over the existing alignment of Murragamba and 'Eastern' Creek.

To maximise extraction of the coal resource within Open Cut No. 4 it will be necessary to realign the channel and construct a new creek alignment for both Murragamba and 'Eastern' Creek.

6.1.1 Post-mining Creek Alignments

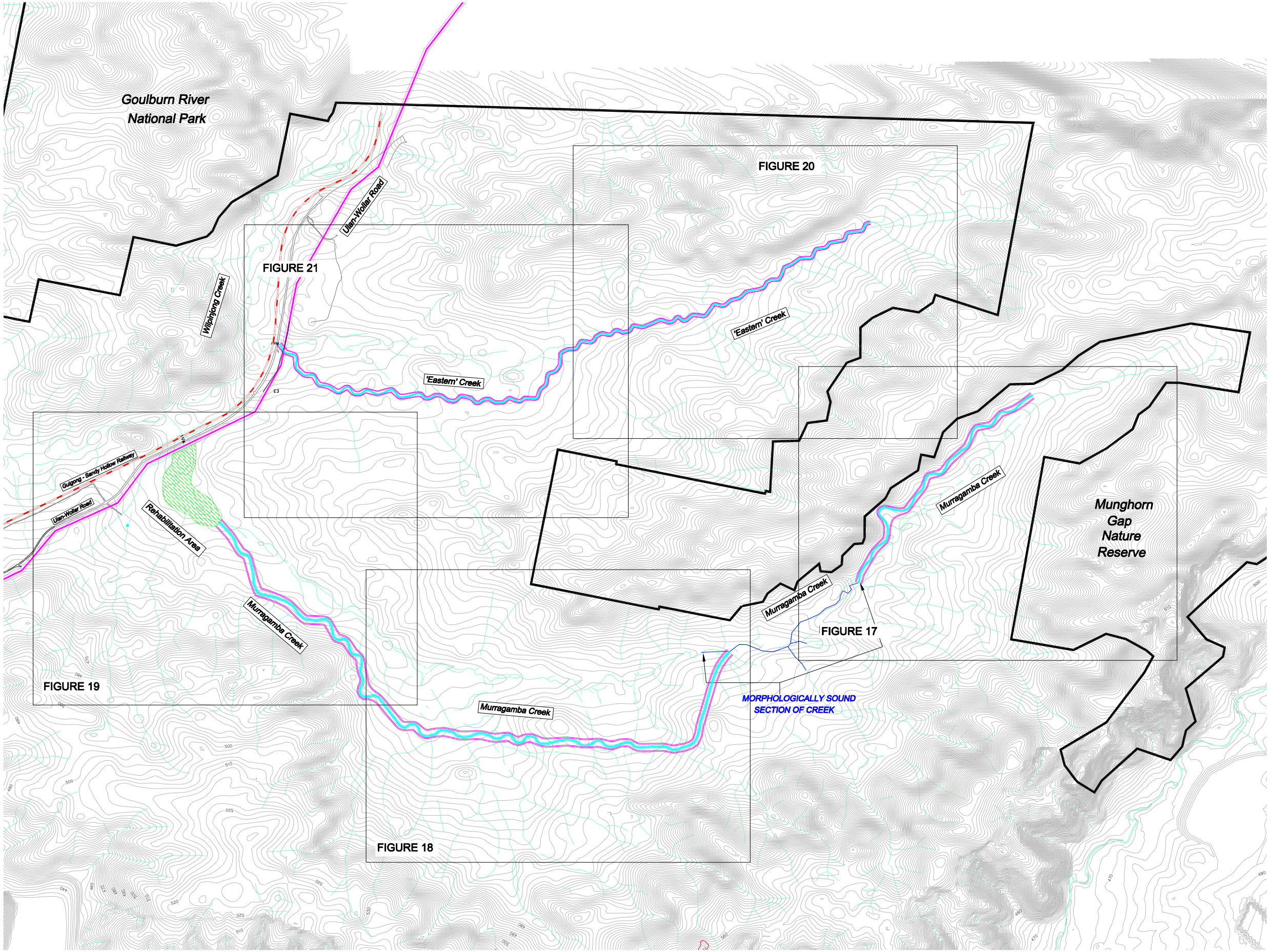
The proposed post-mining alignment for both Murragamba and Eastern Creeks is schematically shown in **Figures 10** to **15**. More detailed plans of the post-mining alignment will be conveyed in the Mining Operations Plan.

Murragamba Creek

The proposed realignment of Murragamba Creek is approximately 7.5 -8.0 kilometres long and connects to Wilpinjong Creek downstream of the Gulgong – Sandy Hollow Railway bridge crossing. An approximate length of the proposed realignment has been given as it may vary dependant on site conditions encountered during the detail design stage of the creek rehabilitation. The proposed realignment of Murragamba Creek will be constructed within the Open Cut No.4 mining area. Downstream of the boundary of Open Cut No. 4 the existing creek will be retained and rehabilitated to enhance the existing natural features of the creek.

The realignment of Murragamba Creek has been based on maximising the opportunity to incorporate meanders, while at the same time recognising critical restraints such as the morphologically sound section of creek, the extent and sequence of mining of Open Cut No.4, and the topography in the surrounding areas.

The proposed alignment incorporates numerous meanders between the headwaters of the creek and the Gulgong – Sandy Hollow Railway Line. These meanders have radii of curvature of approximately 50 metres. The radii of curvature and length of the meanders have been designed using empirical design guidelines outlined in the Cooperative Research Centre for Catchment Hydrology's (*CRCH*) document titled '*A Rehabilitation Manual for Australian Streams (Volume 2)*'. The empirical design has also been modified to replicate the meander characteristics of the existing channel.



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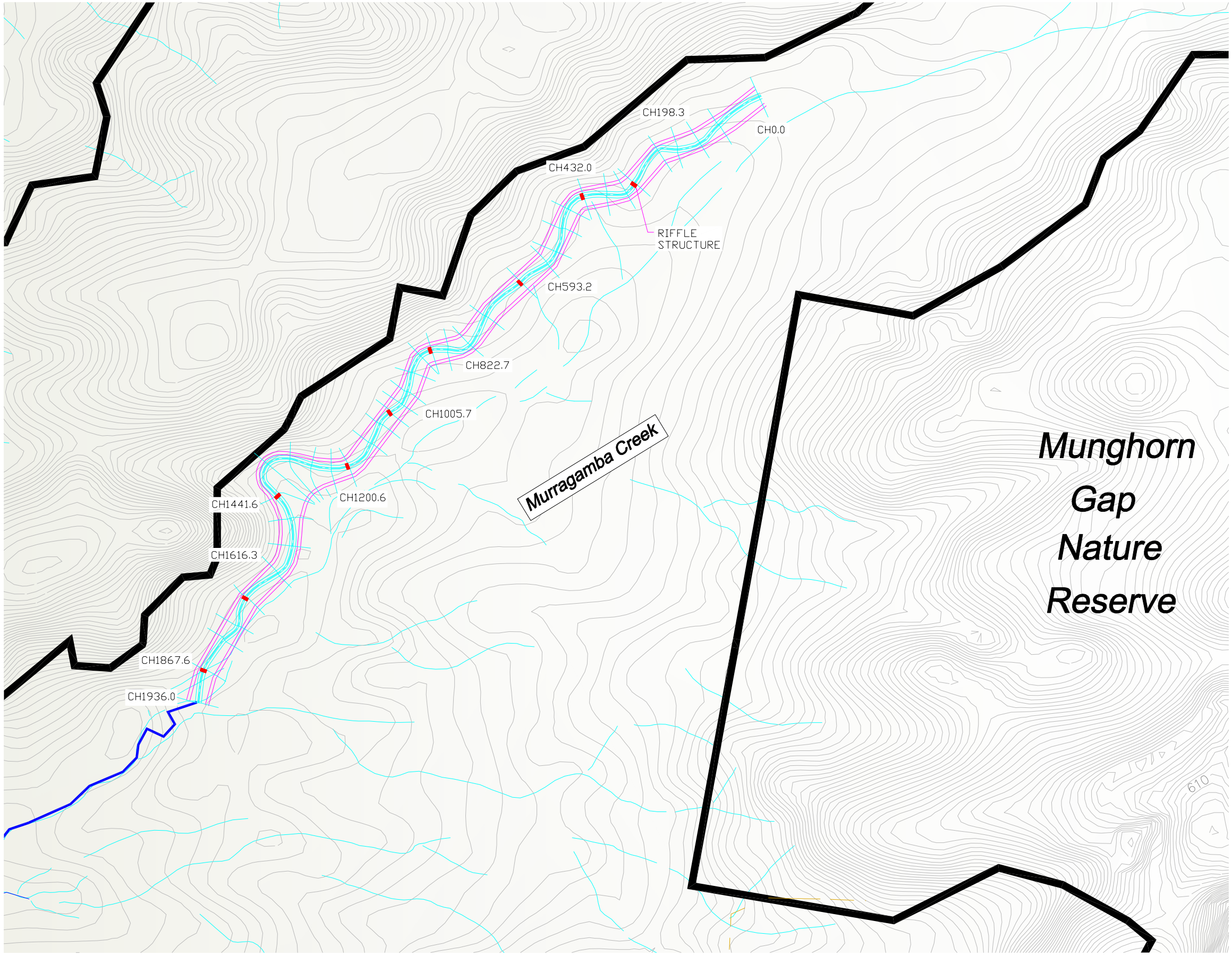
CONCEPTUAL POST-MINING CREEK ALIGNMENT FOR MURRAGAMBA AND EASTERN CREEK



LEGEND

- 100 YEAR FLOWPATH WIDTH
- LOW FLOW CHANNEL (1 YEAR ARI)
- RIFFLE STRUCTURE

0 100 200 300 400m
1:4000 (A1) 1:8000 (A3)

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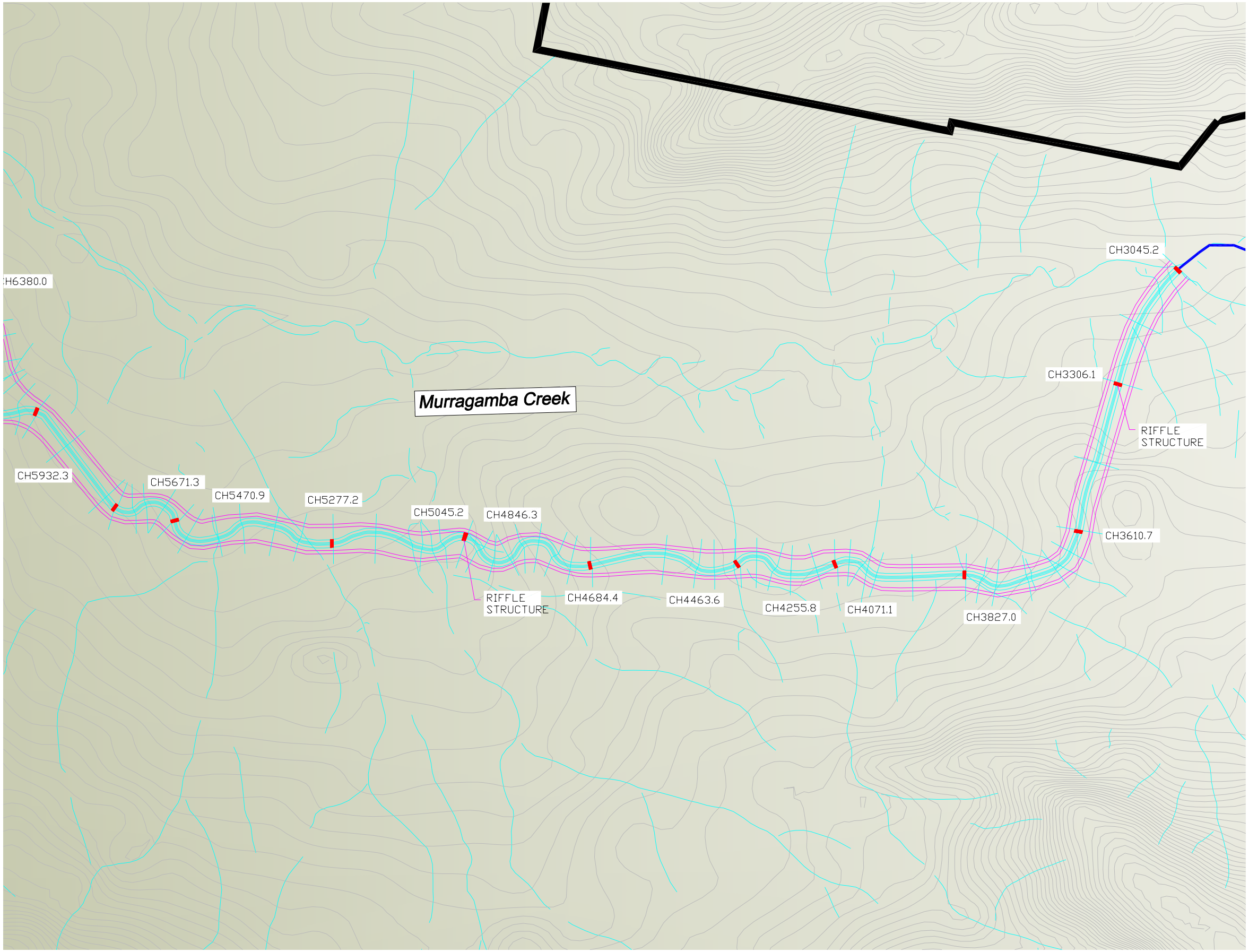
CONCEPTUAL POST-MINING CREEK ALIGNMENT FOR MURRAGAMBA CREEK
SHEET 1 OF 3



LEGEND

- 100 YEAR FLOWPATH WIDTH
- LOW FLOW CHANNEL (1 YEAR ARI)
- RIFFLE STRUCTURE

0 100 200 300 400m
1:4000 (A1) 1:8000 (A3)

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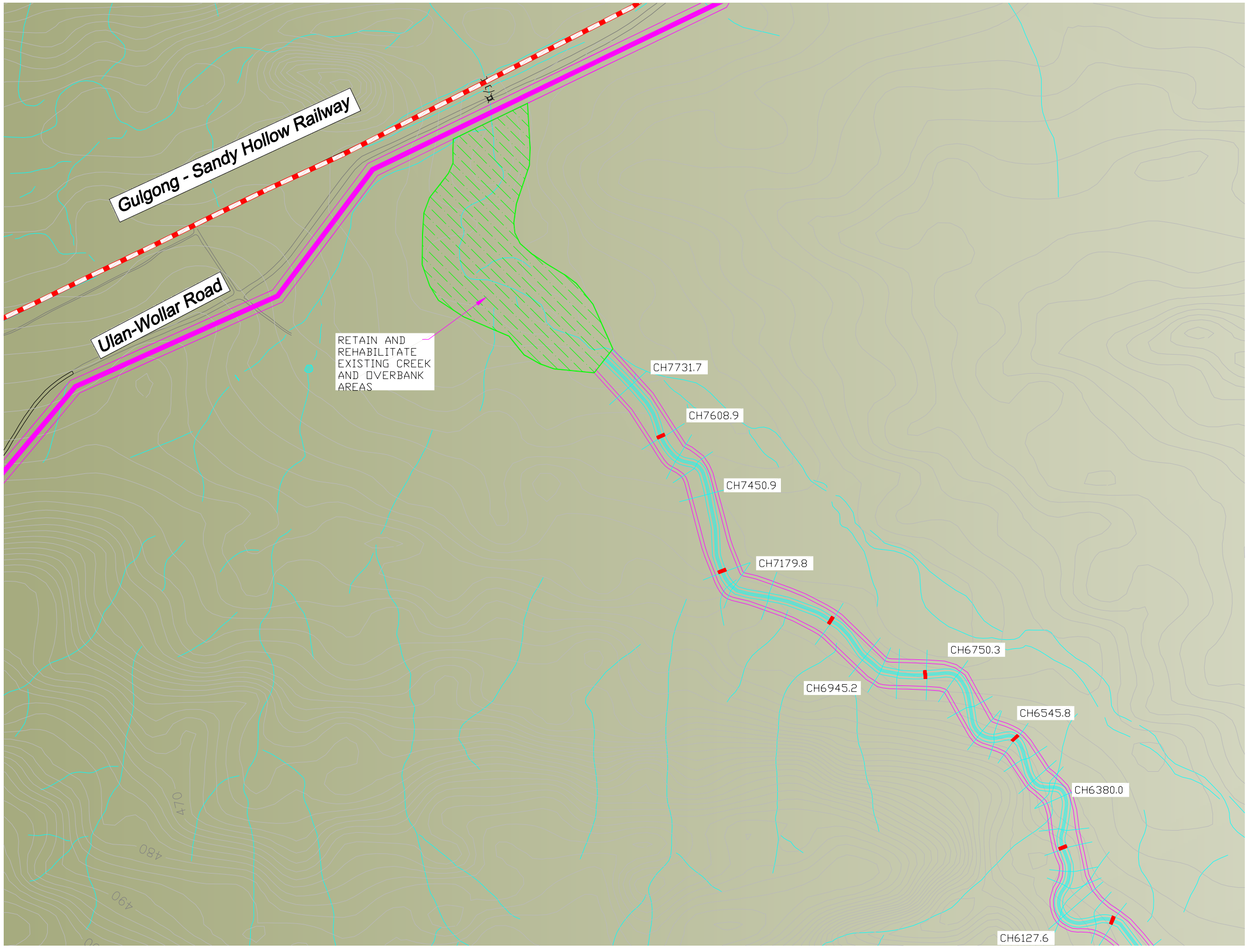
CONCEPTUAL POST-MINING CREEK ALIGNMENT FOR MURRAGAMBA CREEK SHEET 2 OF 3



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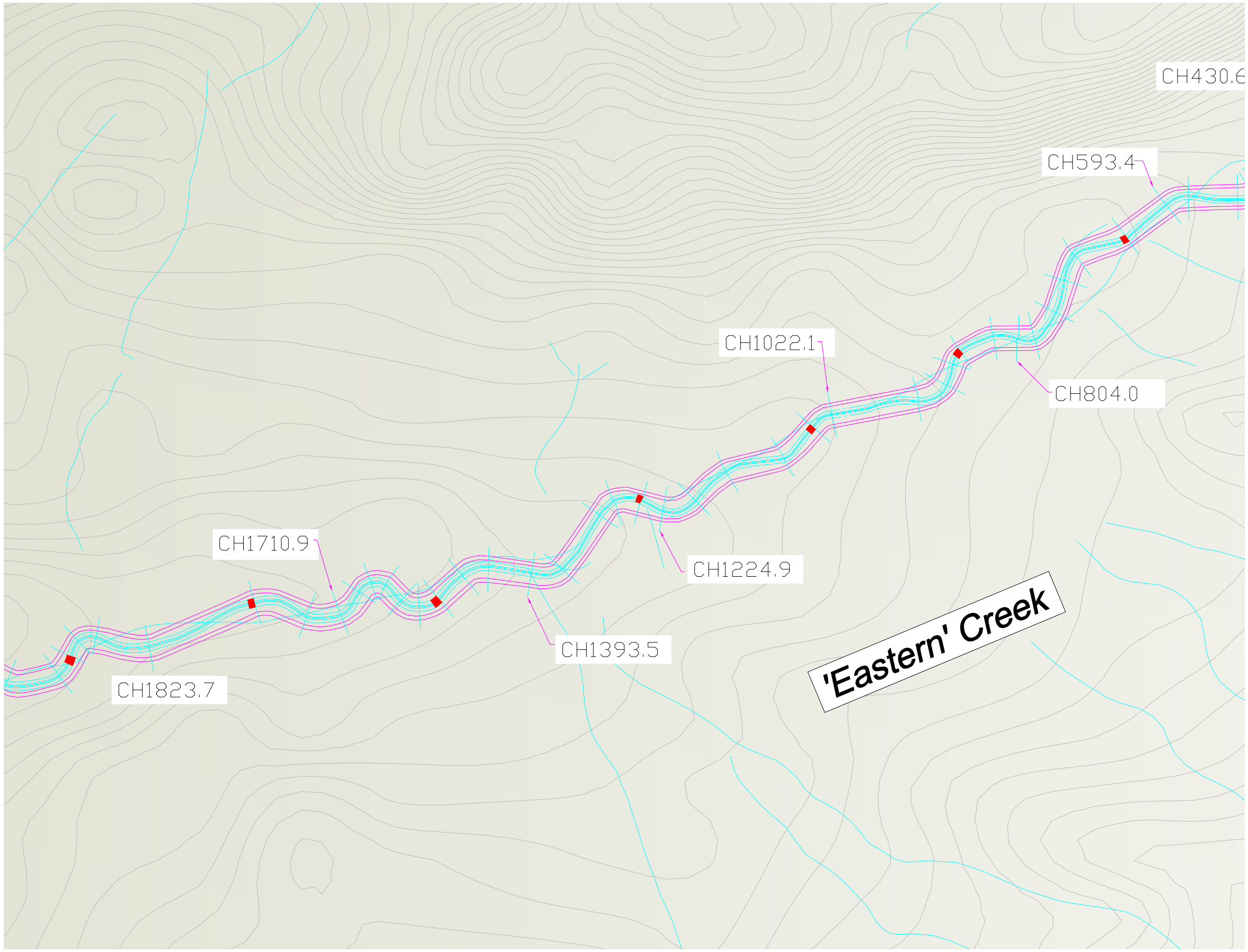
CONCEPTUAL POST-MINING CREEK ALIGNMENT FOR MURRAGAMBA CREEK
SHEET 3 OF 3



LEGEND

- 100 YEAR FLOWPATH WIDTH
- LOW FLOW CHANNEL (1 YEAR ARI)
- RIFFLE STRUCTURE

0 100 200 300 400m
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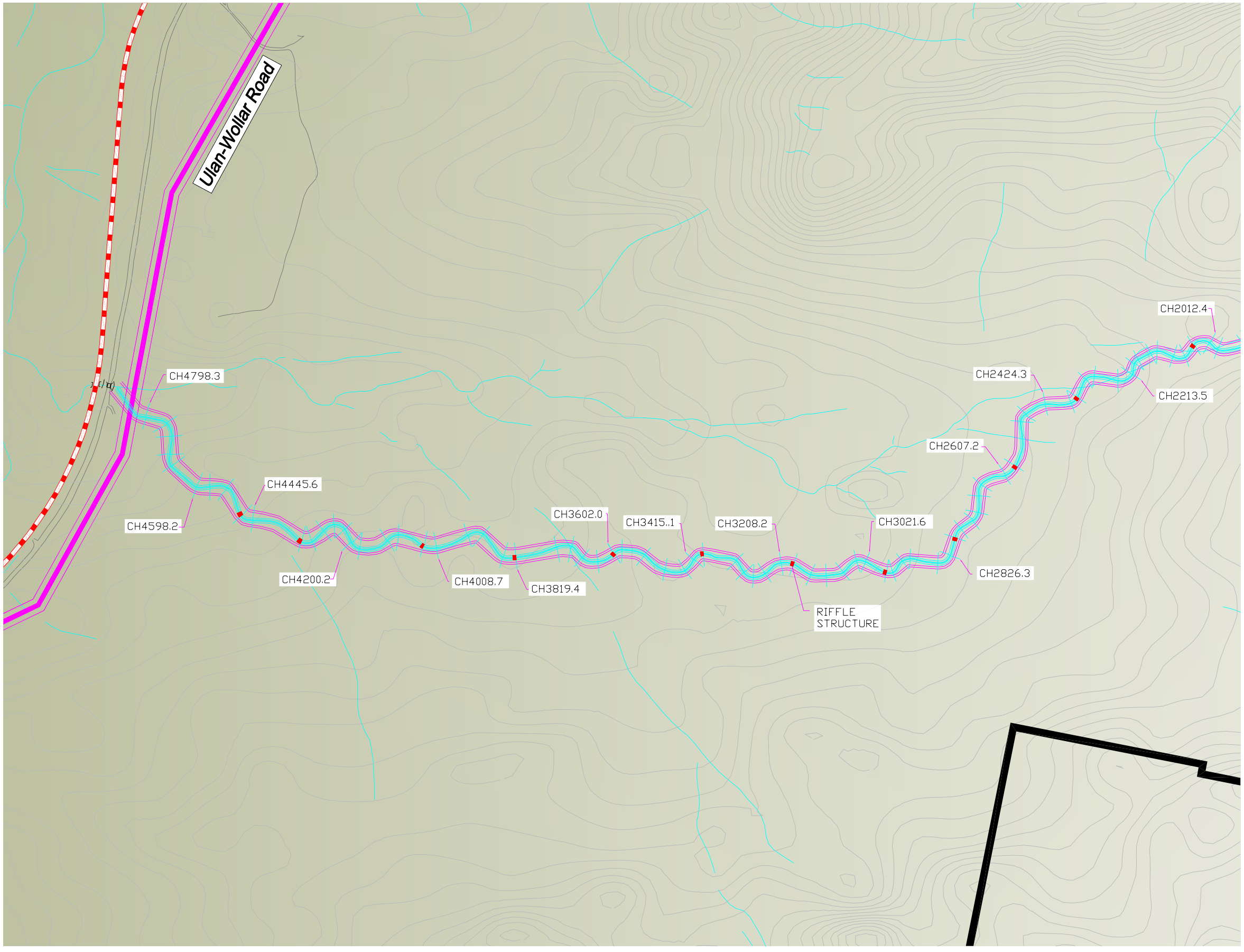
CONCEPTUAL POST-MINING CREEK ALIGNMENT FOR EASTERN CREEK
SHEET 1 OF 2



LEGEND

- 100 YEAR FLOWPATH WIDTH
- LOW FLOW CHANNEL (1 YEAR ARI)
- RIFFLE STRUCTURE

0 100 200 300 400m

1:4000 (A1) 1:8000 (A3)

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CONCEPTUAL POST-MINING CREEK ALIGNMENT FOR EASTERN CREEK
SHEET 2 OF 2

The meanders have been included to mimic existing conditions at the site as well as increase the length of the diverted channel, thereby increasing the potential for stream energy to be dissipated through bed friction and changes in flow velocity to be minimised.

As shown in **Figures 11** to **13**, the diversion initially follows a north-westerly path through Murragamba valley. The proposed creek alignment connects to the existing morphologically sound section of Murragamba Creek; this section of the existing creek is to be retained due to the presence of bedrock at this location. The bedrock can be used as a control to provide stability to the channel of the proposed creek realignment. The creek realignment continues from this point in a more northerly direction until it reaches the extent of Open Cut No.4. Upon leaving the open cut mine area the creek alignment follows the existing creek direction in a north-easterly direction toward the Gulgong – Sandy Hollow Railway Line. The proposed realignment enables the morphologically sound section of creek to be incorporated into the design as well as enabling mining to be undertaken in the open cut areas.

The stream length of the realigned Murragamba Creek channel upstream of the Gulgong – Sandy Hollow Railway Line, including the section of creek downstream of Open Cut No. 4 that is to be rehabilitated, is schematically shown as being 8.5 kilometres in length. This compares with the natural stream length of 7.5 kilometres.

Eastern Creek

The proposed realignment of Eastern Creek is approximately 4.8 – 5.2 km long and also connects to Wilpinjong Creek downstream of the Gulgong – Sandy Hollow railway bridge crossing. An approximate length of the proposed realigned creek has been given as the final length may vary dependant on constraints identified in the detail design stage of the creek rehabilitation.

As with the Murragamba Creek realignment, the Eastern Creek realignment is also based on maximising the opportunity to incorporate meanders, while at the same time recognising the restraints of the extent of mining of Open Cut No.4 and the topography of the surrounding area.

Figures 14 and **15** indicate that the proposed realignment of Eastern Creek follows a generally north to north-east path throughout the Eastern Creek valley. The stream length of the realigned Eastern Creek channel upstream of the Gulgong – Sandy Hollow Railway Line is schematically shown as being approximately 4.5 to 5.0 kilometres long. This compares with the natural stream length of 4.2 kilometres.

6.1.2 Concept Design for Proposed Channel Diversions

The concept design for the proposed diversion channels was developed considering the potential implications of flooding of the post-mining landform. The design also recognises the importance of geomorphic features, stream ecology and riverine corridor habitat.

Schematic sections for the proposed channel diversion are shown in **Figure 16**. They correspond to various locations along each of the post-mining creek alignments, as highlighted in **Figures 10** to **15**. The concept design for the diversion channel shape has been developed based on the following:

- Minimising the discharge of floodwaters across the mine site from the realigned channel in events up to and including the 100 year recurrence flood.
- Containment of flood flows within the creek alignment corridor for all events up to and including the 100 year recurrence flood.

The proposed post-mining alignment for Murragamba Creek will be excavated from virgin material between chainages 0 and 1936. Downstream of the morphologically sound section of creek, starting chainage 3045, the creek alignment will be constructed in the rehabilitated post-mining overburden areas. Overburden will be used as fill and bed material in this location for construction of the permanent creek alignment. The entire length of Eastern Creek will also be constructed using overburden in the post-mining rehabilitated areas.

The diversion is to comprise a trapezoidal shaped low flow channel with a base width ranging between 2 and 4.5 metres and a typical depth ranging between 0.65 and 1.45 metres. This low flow channel has been designed to carry the peak discharge in the 1 year recurrence flood. Low flow channel side-slopes are to be graded at 1(V) in 4(H), rising to an in-channel terrace. The in-channel terrace ranges in width dependant on the location in each of the creek alignments, with the side-slopes of the remaining section rising to the natural surface of the proposed post-mining floodplain.

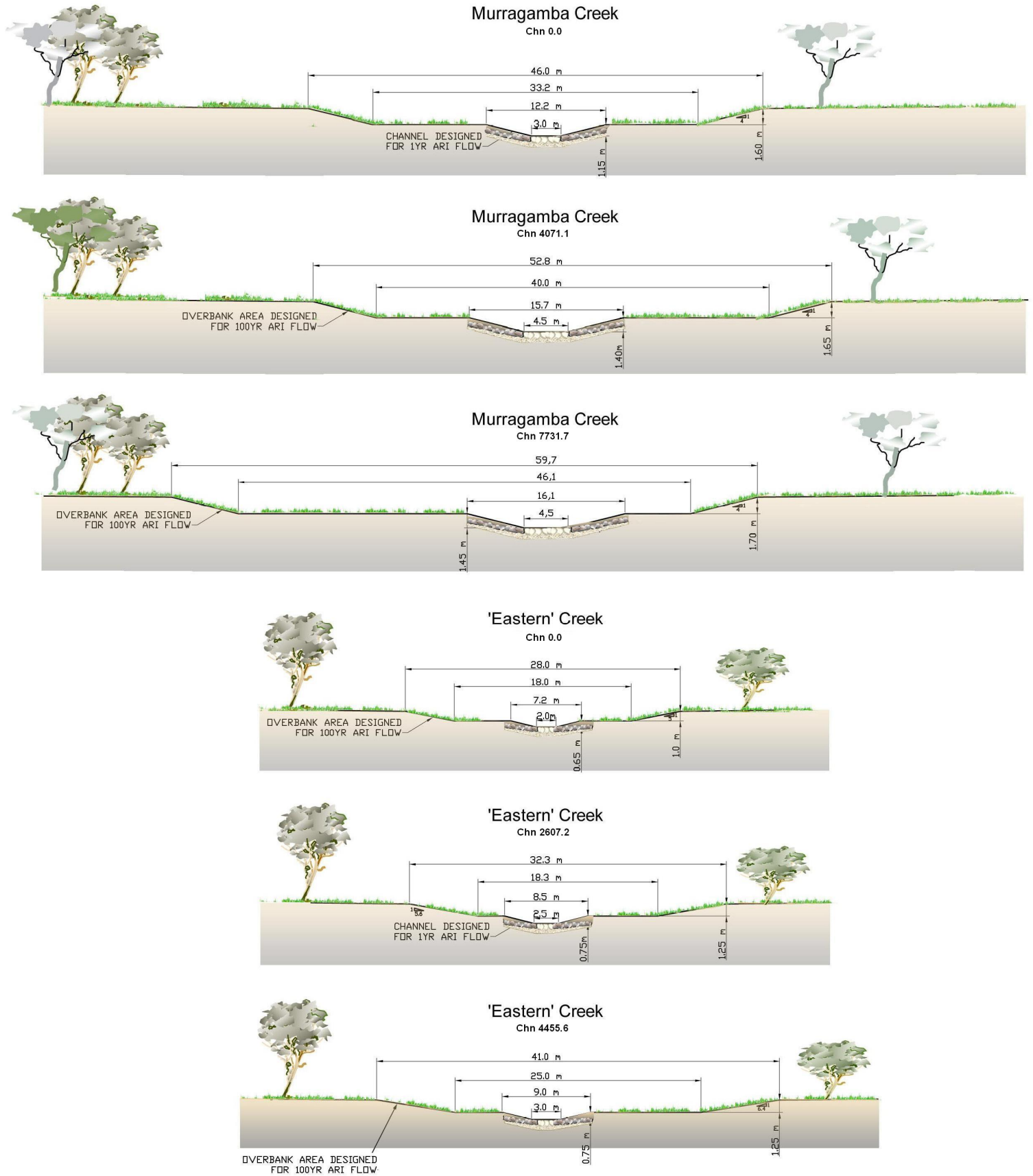
6.2 POTENTIAL IMPACTS OF MURRAGAMBA AND 'EASTERN' CREEKS DIVERSIONS

6.2.1 Flooding Impacts

The realignment of both Murragamba and 'Eastern' Creek will lead to a change in creek hydraulics encountered at the site. This will mean that the extent of flooding for the site will be altered. Due to the realignment of the Murragamba and 'Eastern' Creek it was necessary to develop a hydraulic model of the realigned creeks to determine the potential impacts from flooding. The results of this are detailed in Chapter 7.

As outlined in **Section 4.2** and explained in detail in **Chapter 7**; a section of Murragamba Creek located in the central portion of the catchment will be retained. This section will be retained to allow the proposed realignment of the creek channel to tie-in to the existing alignment of Murragamba Creek.

As shown in **Figure 9**, the 100 year flood extent at the morphologically sound section of Murragamba Creek is within 20m of Open Cut No 4. Due to the close proximity of the 100 year flood extent to Open Cut No. 4 an analysis of the impact of the 200 year recurrence flood on this section was undertaken using the HEC-RAS model of existing conditions.



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TYPICAL CROSS-SECTIONS FOR EACH SECTION OF THE CONCEPTUAL POST-MINING CREEK ALIGNMENTS

The results of the analysis show that the morphologically stable section of Murragamba Creek has the capacity to contain floods in excess of the 200 year recurrence event. Should protection be required for floods in excess of the 200 year recurrence including the Probable Maximum Flood, then it will be necessary to construct a bund/levee along this section of the creek.

It should be noted that the installation of a bund at this location would be a precautionary measure to protect against flooding in events in excess of the 200 year recurrence flood event. Should this level of protection be required detailed hydraulic analysis of flood events larger than the 200 year recurrence event would need to be undertaken to determine the exact requirements of the levee at this location.

6.2.2 Channel Scour and Bank Erosion

The construction of the Murragamba and Eastern Creek post-mining creek alignment has the potential to induce stream bed and bank erosion, which could result in sedimentation of the lower reaches of both creeks as well as Wilpinjong Creek.

The post-mining alignment of Murragamba and Eastern Creek has been designed to increase the stream length and sinuosity when compared to the existing creek alignments.

The post-mining alignment of Murragamba Creek will increase the overall stream length by approximately 1 kilometre. This will result in an approximate overall decrease in the average bed slope from 0.0106m/m to 0.0095m/m.

The post-mining alignment of Eastern Creek will increase the overall stream length by approximately 600 metres. This will also ensure that the post-mining alignment has a reduced average bed slope compared to the existing creek. The existing average bed slope for Eastern Creek is 0.0130m/m, this compares to an approximate post-mining bed slope of 0.0119m/m.

As mentioned in **Section 6.1.1**, the proposed creek realignment is an approximate representation of what will be required for the post mining creek realignment. The exact slope of the final channel may vary slightly dependant on conditions encountered during the detail design stage of the creek rehabilitation for Murragamba and Eastern Creek and mining conditions.

Despite the reduction in average bed slope for both creek alignments there will still be the potential for high flow velocities within the channel. These high flow velocities may cause bed and bank erosion due to the high shear stresses against the constructed channel surfaces.

It is proposed that the potential for channel scour in the creek channels be addressed by the inclusion of strategically located drop structures and constructed ramp riffles. The locations of these are shown in **Figures 11** to **15** and discussed in **Section 8.5**. The riffle structures have been located at intervals of approximately 200-300 metres. Spacing the structures at 200 – 300 metre intervals will allow for a more natural flow of water between structures while still maintaining the benefits of bed slope reduction provided by the riffle structures.

6.3 HYDRAULIC ANALYSIS OF PROPOSED CREEK DIVERSIONS

6.3.1 Changes to HEC-RAS Flood Model

In order to assess the potential impact of the post-mining channel alignments, the existing HEC-RAS model of Murragamba and Eastern Creek was modified to include the proposed changes. The modifications included:

- removal of all existing cross-sections located within the footprint of Open Cut No.4, except for those located within the morphologically sound section of Murragamba Creek;
- replacement of cross-sections along Murragamba and Eastern Creeks with the proposed post-mining channel cross-section;
- increases in the modelled length of both Murragamba and Eastern Creeks to reflect the increased length due to the proposed post-mining alignments; and,
- inclusion of drop structures within the proposed post-mining creek alignment to reduce peak flow velocities within the channel and reduce scour potential.

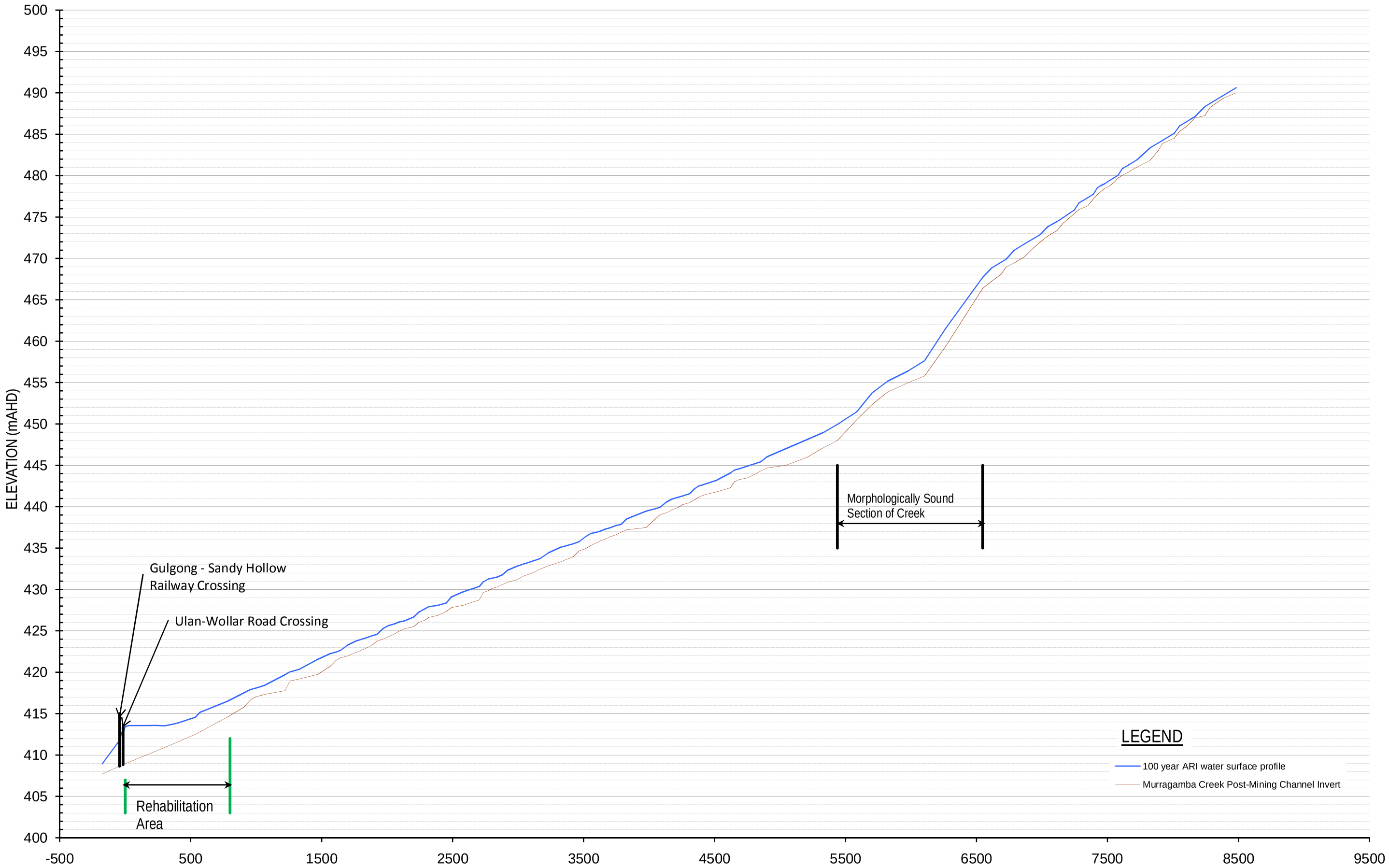
6.3.2 Results

Selected results from the analysis of the 100 year recurrence event flood have been extracted at approximately 200 metre intervals, the results are summarised in **Table 9** and **10** and the predicted water surface profiles for each of the proposed creek alignments are presented in **Figures 17** and **18**. HEC-RAS model outputs from the analysis are enclosed in **Appendix F**.

The extent of inundation of the site in the design 100 year recurrence flood with the proposed post-mining creek alignments in place is shown in **Figure 19**. It shows that the peak 100 year recurrence flood is contained within the proposed post-mining creek corridors for Murragamba and Eastern Creeks.

Table 9 and **10** show that there are still relatively high velocities of between 2 and 3 m/s within the channel of both Murragamba and Eastern Creek. With this in mind, it will be necessary to provide additional scour protection and locations where predicted velocities are high. It is proposed that scour protection at these locations be achieved through the use of rock rip-rap.

FIGURE 17



DISTANCE UPSTREAM FROM ULAN-WOLLAR ROAD BRIDGE **(km)**

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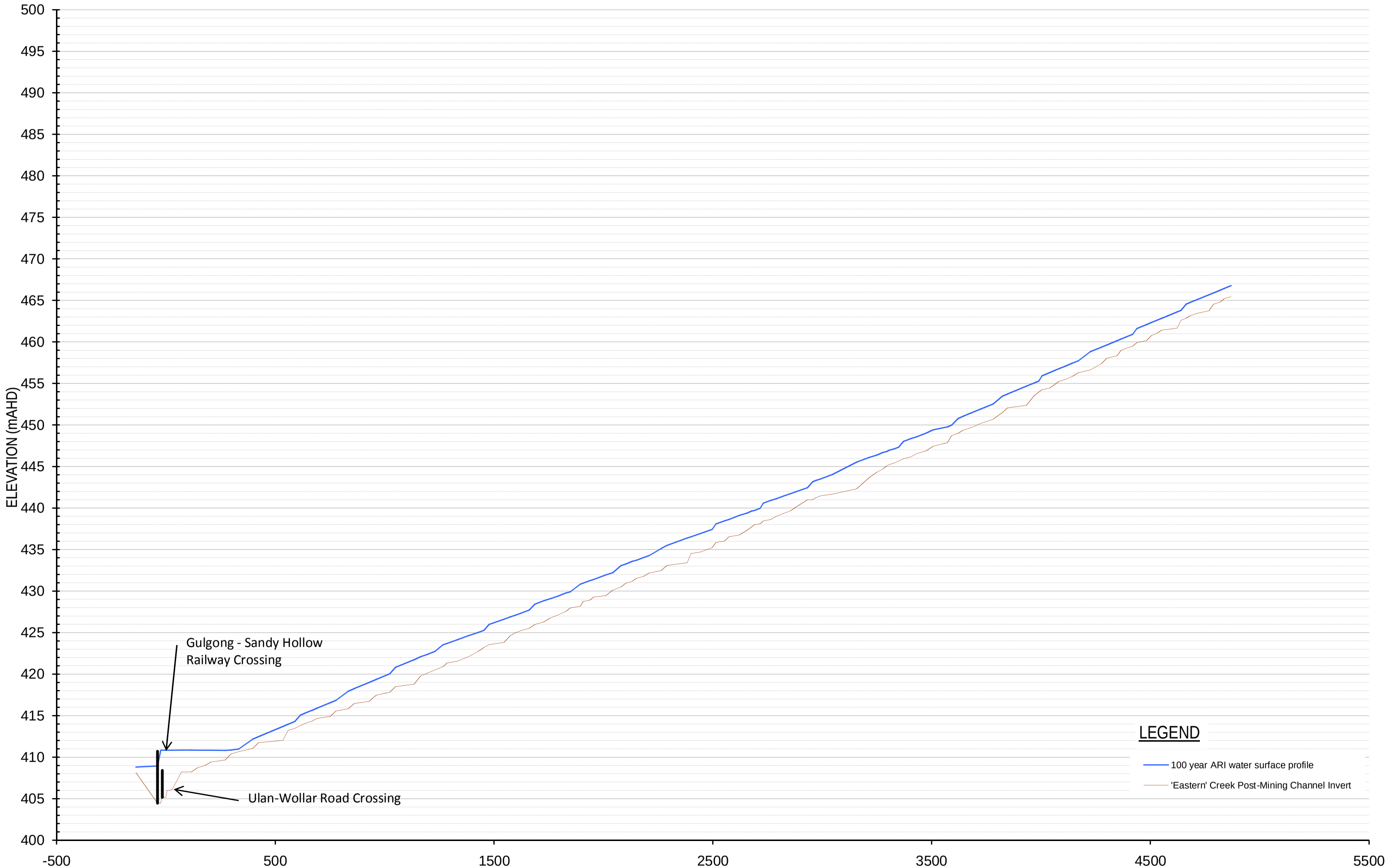
CONCEPTUAL POST- MINING DESIGN FLOODWATER SURFACE PROFILES FOR MURRAGAMBA CREEK

rp6173.00_Moolarben Creek FIA
figure 17-18
Figure 17 Murragamba WSP

FIGURE 18



DISTANCE UPSTREAM FROM ULAN-WOLLAR ROAD BRIDGE **(m)**

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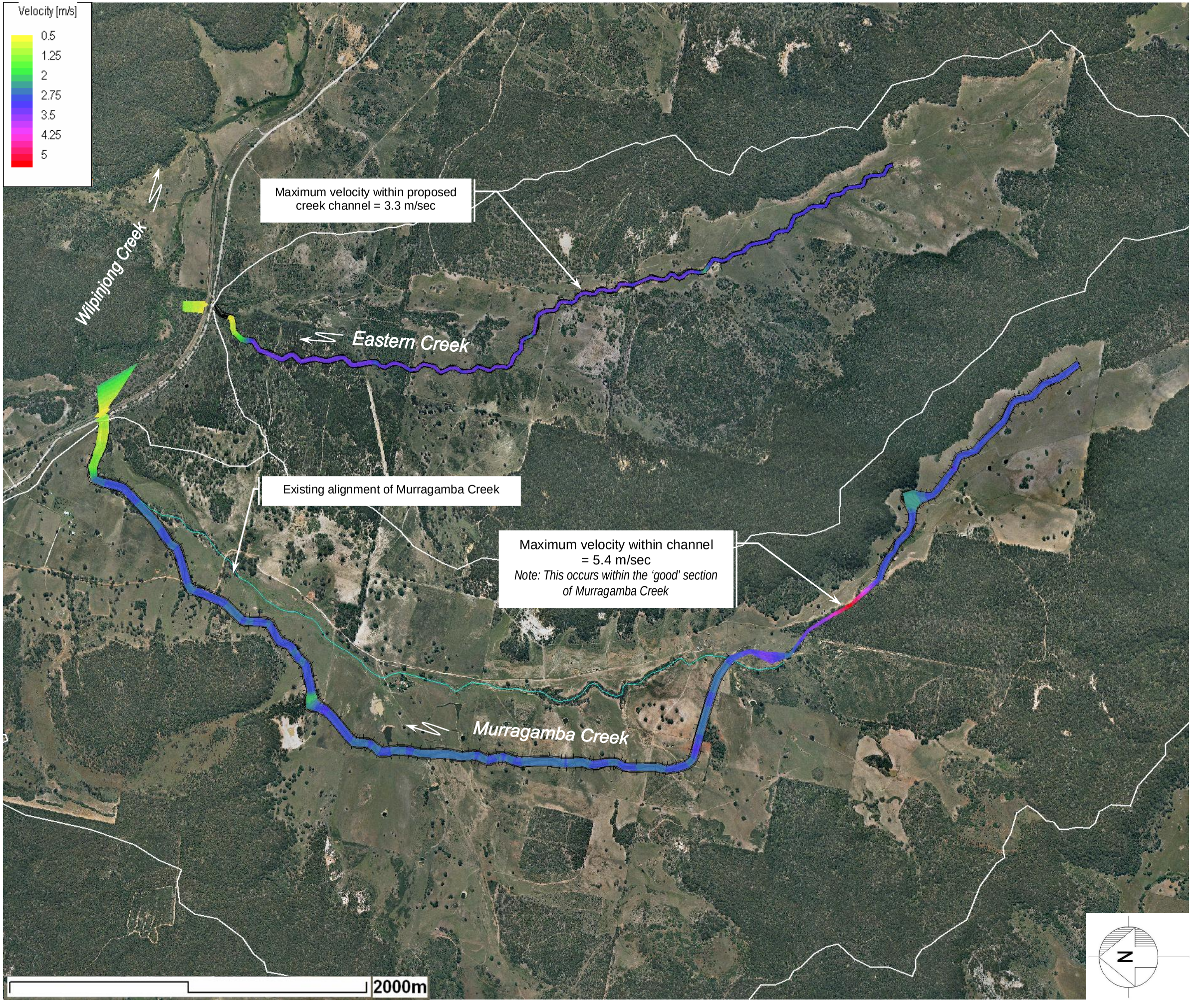
CONCEPTUAL POST-MINING DESIGN FLOODWATER SURFACE PROFILES FOR 'EASTERN' CREEK

rp6173.00_Moolarben Creek FIA
figure 17-18
Figure 18 Eastern WSP

FIGURE 19



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Rp6173_01 – Moolarben Mine EA2 WMS
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100 YEAR RECURRENCE FLOOD EXTENTS FOR THE CONCEPTUAL POST MINING CREEK ALIGNMENTS

Table 9 DESIGN 100 YEAR ARI FLOOD LEVELS AND VELOCITIES FOR MURRAGAMBA CREEK FOR POST-MINING CREEK ALIGNMENT

HEC-RAS MODEL CROSS-SECTION	RIVER CHAINAGE (m u/s from Wollar Rd)	PEAK LEVEL (mAHD)	MAXIMUM SECTION AVERAGED VELOCITY (m/s)		
			Left	Channel	Right
126	0	490.62	1.04	2.86	1.03
123	198.3	488.73	1.01	2.86	1.05
118	432.0	486	1.06	2.87	0.98
114	593.2	483.98	0.97	2.87	1.06
111	822.7	481.29	0.87	2.87	1.07
106	1005.7	479	1.08	3.06	1.05
101	1200.6	476.7	1.05	2.88	1.03
96	1441.6	473.8	0.86	2.5	0.79
93	1616.3	471.75	1.02	2.87	1.06
89	1867.6	468.85	1.07	2.87	0.93
88	1936.0	467.71	1.03	2.87	1.05
87.84	2217.8	461.57	2.36	5.38	2.27
87.7	2379.8	457.64	1.43	3.75	1.33
87.56	2506.8	456.39	1.5	3.47	1.23
87.42	2660.8	455.17	0.9	2.58	1.11
87.28	2778.7	453.77	1.07	3.37	0.8
87.14	2896.7	451.48	1.24	3.12	1.76
87	3045.2	449.95	1.12	3.17	1.1
85	3306.1	448.11	1.13	3.17	1.09
83	3610.7	446.04	1.12	3.17	1.11
79	3827.0	444.57	1.01	2.76	1.07
75	4071.1	442.81	1.03	2.78	1.06
70	4255.8	441.3	0.99	2.8	1.06
65	4463.6	439.77	0.96	2.69	1.04
63	4684.4	438.51	1.06	3.09	1.09
59	4846.3	437.3	1.03	2.67	0.97
54	5045.2	435.79	1	2.61	1
51	5277.2	434.46	1.03	3.09	1.1
48	5470.9	433.09	1.04	2.7	0.95
44	5671.3	431.51	1.07	2.84	0.97
39	5932.3	429.72	1.04	2.75	1.02
36	6127.6	428.07	0.76	2.34	0.86
31	6380.0	426.2	1.08	2.98	0.79
27	6545.8	425.26	1.1	3.11	1.01
23	6750.3	423.78	1.05	2.73	0.89
19	6945.2	422.26	1.01	2.63	1
17	7179.8	420.38	1.04	2.9	1.06
14	7450.9	418.41	1.08	2.91	0.97
11	7608.9	417.48	1.07	3.12	1.09
10	7731.7	416.49	1.02	2.6	0.95
9	7941.8	415.16	1.1	3.12	1.04
6	8104.3	413.91	1.03	2.74	1.02
3	8273.2	413.58	0.54	1.31	0.55
0	8485.3	413.56	0.31	0.71	0.31
-1	8509.3	413.46	0.4	1.26	0.19
-2	8512.3	413.47	0.2	1.03	0.33

Table 10 DESIGN 100 YEAR ARI FLOOD LEVELS AND VELOCITIES FOR EASTERN CREEK FOR POST-MINING CREEK ALIGNMENT

HEC-RAS MODEL CROSS-SECTION	RIVER CHAINAGE (m u/s from Wollar Rd)	PEAK LEVEL (mAHD)	MAXIMUM SECTION AVERAGED VELOCITY (m/s)		
			Left	Channel	Right
137	0	466.9	1.22	2.65	1.2
130	205.4	464.17	1.34	3.08	1.4
123	430.6	461.24	1.4	3.12	1.37
117	593.4	458.68	1.4	3.12	1.37
111	804	456.23	1.37	3.11	1.4
105	1022.1	453.38	1.41	3.12	1.36
100	1224.9	450.69	1.32	3.12	1.43
95	1393.5	448.61	1.28	2.79	1.18
87	1590.7	446.29	1.51	3.35	1.29
83	1823.7	443.59	1.12	2.43	1.04
77	2012.4	441.24	1.47	3.35	1.4
69	2213.5	438.9	1.23	3.34	1.53
63	2424.3	436.56	1.12	2.56	1.15
59	2607.2	434.53	0.69	2.32	0.83
52	2826.3	431.69	1.33	3.35	1.5
46	3021.6	429.54	1.51	3.35	1.29
40	3208.2	427.23	1.34	2.94	1.19
34	3415.1	424.78	1.49	3.35	1.37
29	3602	422.47	1.44	3.34	1.44
24	3819.4	420.01	1.38	3.32	1.51
20	4008.7	417.96	1.24	3.32	1.53
15	4200.2	415.95	1.3	3	1.38
9	4445.6	413.26	1.38	3.32	1.51
5	4598.2	411.51	1.01	2.38	1.14
0	4798.3	410.82	0.54	1.3	0.58
-3	4869.1	410.84	0.07	0.25	0.06
Bridge					

7. POTENTIAL IMPACT OF PROPOSED MINE ON SURFACE WATER HYDROLOGY

7.1 PROJECTED MINE WATER DEMAND

Once the project is operational, water will be required for coal washing, dust suppression in the vicinity of stockpile areas and for irrigation where revegetation and rehabilitation is planned. As mining progresses, increasing volumes of water will be required for dust suppression along haul roads and across trafficked sections of the mine infrastructure area. Potable water will also be required for administration and bathhouse facilities.

The projected annual water demand for the mine was determined from advice provided by Moolarben Coal Mines Pty Ltd. This advice indicates that 208 ML of water is typically required for each million tonnes of run of mine (ROM) coal. Therefore, at the peak of mine production, the water demand for the Moolarben Coal Project is estimated to be 3536 ML/year. This is based on the assumption that all coal is washed.

The projected distribution of this maximum annual water demand is summarised in **Table 11**. This is based on current experience at the Ashton Coal Mine near Ravensworth.

Table 11 DISTRIBUTION OF WATER DEMAND

AREA OF USE	MAXIMUM WATER DEMAND (ML/year)
Coal Handling and Preparation Plant	1414
Dust Suppression across Open Cut and Mine Infrastructure Areas	849
Potable (Bath-house)	50
Use in Underground area	601
Evaporation	622
TOTAL MAXIMUM MINE WATER DEMAND	**3536**

The water demand data listed in **Table 11** was combined with the projected annual production rates for ROM coal to determine the projected annual water demand over the life of the mine. The projected annual mine water demand over the life of the mine is summarised in **Table 12**.

Table 12 PROJECTED ANNUAL WATER DEMAND FOR MINE OPERATIONS

MINING YEAR	MINE WATER DEMAND		PROPOSED PRODUCTION RATE ROM Mtpa	COMMENTS
	ML/year	ML/day		
0	1000	2.74		Construction of Infrastructure, initial mining of Open Cut 1 and preparation for mining of Open Cut 4
1	1,456	3.99	7.0	
2	2,288	6.27	11.0	Mining commences for Open Cut 4
3	2,392	6.55	11.5	
4	2,496	6.84	12.0	
5	2,567	7.03	12.3	Underground 1 commences production
6	2,990	8.19	14.4	Open Cut 2 commences production
7	3,199	8.76	15.4	
8	3,377	9.25	16.2	Open Cut 1 completed, Open Cut 3 commences production
9	3,394	9.30	16.3	
10	3,408	9.34	16.4	Mining on Open Cut 1 and 2 completed, Underground 2 commences production
11	3,287	9.01	15.8	
12	3,399	9.31	16.3	
13	3,373	9.24	16.2	
14	3,194	8.75	15.4	
15	3,334	9.13	16.0	Underground 1 completed
16	3,172	8.69	15.3	
17	3,190	8.74	15.3	Underground 4 commences production
18	3,269	8.96	15.7	Underground 2 completed
19	3,501	9.59	16.8	
20	3,508	9.61	16.9	
21	3,453	9.46	16.6	
22	3,330	9.12	16.0	
23	3,064	8.39	14.7	
24	2,955	8.10	14.2	
25	990	2.71	4.8	Open Cut 4 completed
26	693	1.90	3.3	
27	670	1.84	3.2	All Open Cut mining completed
28	714	1.96	3.4	
29	719	1.97	3.5	
30 (2039)	371	1.02	1.8	All Underground mining completed

The projected annual mine water demand for Stage 2 of the project also takes into account mining operations that were approved as part of the Stage 1 Application. This means that the predicted mine water demand also takes into account operations from Open Cuts 1, 2 and 3, as well as Underground No.4.

The proposed approach to sourcing this water is to make use of all groundwater inflows to the open cut and underground mines, including Moolarben Coal Mines dewatering and production boreholes.

Aquaterra's groundwater assessment report (*November 2008*) highlights that mine water inflows will not be sufficient to meet water requirements except for in Year 23 and Years 25 to 30. As a result, water requirements during the first 20 years of mine operations will need to be supplemented from the Moolarben Coal Mine production bores. Water demand will also be supplemented by runoff captured from disturbed or rehabilitated areas of the mine site.

As mentioned previously, there is the potential for a deficit of water during the mine life. Methods for dealing with the potential deficit during these years include:

- entering into a water sharing arrangement with neighbouring coal mines;
- bypass washing of underground coals; and,
- reducing production rates to match water availability.

It should also be noted that the results of Aquaterra's groundwater investigations predict that there will be a surplus of water from Year 25 to the end of the mine life. Therefore, from Year 25 of the mine program, the primary surface water management issue for the mine will centre on the need to utilise or dispose of surplus groundwater.

In addition to the need to provide water for use in mine operations, there will be a requirement to maintain the environmental flows that are distributed from the Murragamba and Eastern Creeks catchments to Wilpinjong Creek. It is proposed that runoff from undisturbed areas upstream of Open Cut No. 4 be diverted around the pit shell so as to avoid contamination, and that this runoff be dedicated to recharge of the lower sections of Murragamba and Eastern Creeks.

It is also suggested that Splitters Hollow Dam could be utilised as an emergency water supply storage to supplement environmental flows during the mine life. Splitters Hollow Dam is located along the upper reaches of Wilpinjong Creek (*refer* **Figure 1**) and has a full supply level storage capacity of 47ML.

A discussion of the volume of water that will be required to maintain environmental flows distributed from the Murragamba and Eastern Creeks catchments to Wilpinjong Creek is provided in **Section 8.3.1**.

7.2 POTENTIAL IMPACTS OF MINING ON SURFACE WATER HYDROLOGY

The Moolarben Coal Project will impact on the existing hydrology of the Murragamba and Eastern Creeks catchments. In particular, the open cut operation will require the temporary diversion and permanent relocation of both Murragamba and Eastern Creeks. In addition, the open cut operation could reduce the inflow of groundwater or baseflows to Murragamba and Eastern Creeks. This could in turn reduce riparian flows within Wilpinjong Creek and reduce the salt buffering potential afforded by the current flow regime. The associated reduction in flow could also impact on riparian vegetation along Wilpinjong Creek and related aquatic ecosystems.

A discussion of the potential impacts of the mine on streamflows is outlined in each of the following sections.

7.2.1 Infrastructure Operations

At the time of compiling this report, MCM had made application pursuant to Section 75W of the EP&A Act 1979 to modify the layout of the main infrastructure area that had been approved by the Minister for Planning on 6th September 2007 as part of Stage 1 of the Moolarben Coal Project. The modification seeks the approval to relocate infrastructure to the southern side of Bora Creek.

An additional infrastructure area is proposed as part of the Stage 2 approval process. The Stage 2 infrastructure area will be located south of the Gulgong-Sandy Hollow Railway. Infrastructure that is required as part of the Stage 2 application includes:

- a ROM dump system;
- a conveyor belt system to connect Stage 1 and 2 stockpiles; and,
- offices and workshops that are required for Stage 2 of the project.

In the infrastructure area, the potential impacts on stream hydrology and water quality include:

- runoff from road and hardstand areas;
- runoff from the mine facilities area (*e.g., workshop buildings and vehicle re-fuelling hardstands*);
- effluent overflows from domestic sewerage; and,
- runoff and seepage from the ROM and product stockpiles.

These activities could adversely impact on the water quality of runoff carried by Bora Creek and subsequently on the water quality of flows within the upper reaches of the Goulburn River. Pollutants in the surface water could include hydrocarbons, acids, salts and sediment, which may or may not have collected other pollutants. All of these will be contained and treated on site through the adoption of appropriate management practices, and by the mitigation of accidental discharges during times of exceptionally high rainfall and/or flows using instituted emergency response procedures.

Within the infrastructure development area there will be an increase in impervious surfaces such as hardstands, car parks, buildings and associated drainage infrastructure. This will lead to more rapid throughput of runoff to receiving waters and will modify the hydrology of the Bora Creek catchment, potentially increasing inputs to the Goulburn River in a similar manner to small scale urban development.

Construction of the infrastructure area will incorporate disturbances to existing vegetation cover. The reduction in vegetation cover will amplify the potential for increased sediment loads to be carried by surface water runoff. The increased sediment loads may be distributed along Bora Creek and into the upper reaches of the Goulburn River.

There is also potential for increased sediment loadings to contribute to partial or complete blockage of the culverts that currently drain runoff along Bora Creek beneath the Ulan-Cassilis Road.

Investigations completed as part of the *'Moolarben Coal Project – Flood Impact Assessment'* (*May 2006*) indicate that partial blockage of the Ulan-Cassilis Road culverts will have a significant impact on flood behaviour along the lower reaches of Bora Creek.

It is noted that the upper reaches of the Goulburn River between Ulan and 'The Drip' is a substantially altered system. This section of the Goulburn River was realigned as part of works associated with the development of the Ulan Coal Mine and is no longer representative of the stream condition that formerly existed.

7.2.2 Open Cut Area

The potential impacts of the open cut pits on stream hydrology and water quality include:

- the effects of relocating sections of Murragamba and Eastern Creeks;
- reallocation/recomposition of catchment areas and subsequent impact on surface flows due to earthworks to construct the open cut pits and associated infrastructure;
- export of runoff (*e.g., incorporating increased sediment and salinity*) from disturbed mine areas into Murragamba and Eastern Creeks;
- alteration of runoff and groundwater seepage from active and partially rehabilitated mine waste areas;
- changes to ground water flows and salt flux due to water table drawdown effects from dewatering of the open cut areas;
- mine water from dewatering of the active open cut; and,
- alterations to surface water runoff and groundwater flows leading to reductions in riparian flows along Wilpinjong Creek.

As the open cut operation proceeds, it will be necessary to temporarily divert Murragamba Creek. This will enable sections of the Murragamba Valley to be mined as the open cut pit progresses in a northerly direction.

The permanent / post-mining creek channel for Murragamba Creek will be constructed as the mined open cut pit is "backfilled". Construction of the post-mining creek channel will occur within rehabilitated areas of the open cut pit.

As the mine moves to the north and east it will also be necessary to temporarily divert Eastern Creek. Eastern Creek will be relocated to a new permanent alignment once mining in this section of the valley is completed.

It should also be noted that as the open cut operation proceeds, there will be a sequential process of clearing land and then mining. As the mine progresses, land will be rehabilitated and revegetated. The earthworks associated with rehabilitation of the open cut areas will alter the size of subcatchments across the area covered by Open Cut No. 4. This could reduce the post-mining runoff volume distributed to Murragamba and Eastern Creeks.

However, due to the relatively minor catchment redistribution, the reduction in flow is predicted to be minimal relative to the total flow that will be distributed from the post-mining Murragamba and Eastern Creeks systems.

Notwithstanding, there is potential for some modification to the manner in which baseflows are distributed to Wilpinjong Creek, which in turn could impact on environmental flows.

The composition change of the catchment will be from vegetated land to unvegetated soils, with occasional areas of impervious hardstand. This may increase the rate and volume of surface water runoff. Associated with this is the potential for surface water runoff to collect pollutants as rain falls on open cut areas of coal / spoil. The primary impact of this is a likely increase in salinity due to the high salinity content of the soils used to fill the open cut voids.

Similarly, due to the increased rate of surface water runoff, the un-vegetated soils in the area may be susceptible to erosion which could lead to elevated sediment load in watercourses.

These impacts are applicable to both the operational and remediation stages of the project, requiring timely implementation of appropriate management strategies such as progressive rehabilitation and the control of erosion and sedimentation.

It is anticipated that the Moolarben Mine Project will require the diversion of Murragamba and Eastern Creeks, surface water and the development of a network of swales, channels and storage ponds to manage surface and groundwater from the mine areas and mitigate any potential adverse impacts on the environment of adjoining areas.

7.2.3 Undergrounds 1 and 2

The potential for subsidence cracking arising from longwall mining within Underground 1 and 2 has been identified in the mine subsidence report prepared by Mine Subsidence Engineering Consultants Pty Ltd. The report indicates that there is the potential for subsidence to occur in the drainage lines that are situated above Undergrounds 1 and 2, with a maximum predicted systematic subsidence of up to 2 metres (*1890 mm*) in some areas.

The maximum predicted systematic tilts along the alignments of the drainage lines vary between 35 mm/m (*i.e., 4%*) and 70 mm/m (*i.e., > 7 %*), or changes in grade between 1 in 30 and greater than 1 in 14 (*Min Subsidence Engineering Consultants, November 2008*).

In addition, it is expected that maximum predicted systematic tensile and compressive strains at the drainage lines located above Underground 1 and 2, at any time during or after the extraction of the proposed longwalls, will be greater than 50 mm/m and 40 mm/m, respectively. Strains of this magnitude suggest that fracturing and dilation of the bedrock will occur during longwall mining operations. Therefore, it is expected that this fracturing will result in some fracturing of the bedrock along drainage lines in the area above Undergrounds 1 and 2.

The drainage lines above Undergrounds 1 and 2 are ephemeral. As a result, they only carry flows during rainfall events and for short periods after each rain event. Ponding can occur along some sections of the drainage lines for short periods after major rain events. The predicted changes in grade along the drainage lines are generally less than most of the natural grades, which vary from approximately 20 mm/m to 500 mm/m. Therefore, it is not anticipated that any cracking due to mine subsidence will lead to substantial increases in the duration and area of ponding.

The drainage lines above Undergrounds 1 and 2 contain predominantly alluvial and colluvial deposits. Therefore, sections of the streambeds may erode during subsequent rain events, especially during times of high flow. However, it is expected that over time, the gradients of these drainage lines would approach grades similar to those which existed before mining. Therefore, the extent of additional ponding along the drainage lines would be expected to decrease with time.

In times of heavy rainfall it is not anticipated that the surface cracks would have an impact on surface water runoff. Runoff would be expected to flow over the any surface cracking in the streambeds and only a small proportion of the flow would be diverted into the fractured and dilated strata below.

However, during times of low flow, some of the surface water could be diverted into the strata below the streambeds and this could affect the quality and quantity of the water flowing from the drainage lines.

However, the overall impact due to surface cracking is expected to be minimal relative to the total flow distributed to Wilpinjong Creek from the Murragamba and Eastern Creeks catchments under post-mining conditions.

8. PROPOSED WATER MANAGEMENT STRATEGY

When undertaking extractive operations such as coal mining, there is the potential that the mining operations may have a negative impact on aquatic ecosystems and biodiversity. Additional impacts that may be caused due to mining operations include altering the stability and shape of land surfaces which in turn can impact upon the volume of water soaking into the ground and also the volume of surface water runoff.

The Hunter-Central Rivers Catchment Management Authority has developed a number of guidelines that should be considered throughout the life of a mining project. The aim of the guidelines is to achieve best practice in natural resource management and reduce potential impacts on the existing environment from mining operations.

The guidelines, documented in the *'Hunter- Central Rivers Catchment Action Plan' (January* 2007) highlight a number of issues that should be addressed in relation to the management of surface water and the rehabilitation of the post-mining landform.

When preparing the water management strategy for Stage 2 of the Moolarben Coal Project every precaution has been taken to address the issues that are raised within the guidelines. This has included:

- ensuring that surface water flows are not lost or diverted due to subsidence or geological cracking caused by extraction;
- preparing a water management plan to manage clean and potentially dirty water that will flow off the catchment for the entire duration of the Moolarben Coal Project;
- developing the post-mining creek alignments for Murragamba and Eastern Creek in line with the Catchment Action Plan;
- utilising the current best practice mine rehabilitation techniques for design of the post-mining landform including the post-mining alignments of Murragamba and Eastern Creeks;
- utilising excess timber and rock from cleared lands for use in stream rehabilitation works; and,
- ensuring that potential offsite impacts from mining were considered.

The following strategy outlines the steps undertaken to address the guidelines relevant to the management of surface water.

8.1 OVERALL STRATEGY

The Moolarben Coal Mine will require water for a range of purposes associated with coal extraction operations and with mine site rehabilitation. These processes will include:

- potable use;
- coal washing;
- dust suppression; and,
- irrigation for revegetation of rehabilitation areas.

This water demand can be sourced in part from the open cut and underground mines, the Moolarben Coal Mine bore fields and surface runoff from the disturbed areas of the mine.

Accordingly, the Water Management Strategy for the Moolarben Coal Mine is based on taking advantage of the good quality water that will be diverted around the site for use as environmental flows and the re-use of the increasing volumes of dirty water generated as open cut mining progresses. The broad objectives of the strategy are to:

- divert clean surface water runoff;
- utilise natural groundwater inflows to open cut mining areas;
- utilise water from the production bores for mining purposes;
- collect runoff from disturbed or operational areas of the mine site, store it in strategically located sedimentation ponds and treat it for re-use in dust suppression activities and for the irrigation of repatriated areas of Open Cut 4;
- maximise re-use of treated 'dirty water' on-site;
- engage in a water sharing agreement with neighbouring coal;
- treat surplus mine use water to a standard required by the Environment Protection Licence prior to discharge in accordance with the EPL; and,
- develop a Surface Water Monitoring Program for Stage 2 of the Project should approval be granted.

To meet these objectives, all potential ground and surface water sources have been identified and considered in terms of their projected quantity and quality, and their potential for re-use over the mine life. This has indicated a distinct delineation between the management of groundwater and surface water. The surface water management strategy is based on the re-use of all available mine pit inflows and surface runoff from disturbed areas, combined with the treatment of any surplus water so that it can be discharged in accordance with the Environment Protection Licence requirements.

Recycled water and surface runoff from disturbed areas following rainfall will be dealt with separately and retained within the site for subsequent re-use in mining processes.

In order for this system to function, it will be necessary to install a series of storages, drainage works and sedimentation ponds in and around the open cut mine pits and across the mine infrastructure area. These structures will include:

- diversion swales to divert clean surface water runoff around open cut pit areas and where feasible, into Murragamba and Eastern Creeks;
- diversion swales within the mine infrastructure area aimed at collecting and distributing clean surface water runoff;
- sedimentation ponds within the mine infrastructure area to capture runoff from active and disturbed areas for re-use or treatment in accordance with the Environment Protection Licence;
- sedimentation ponds located within Open Cut 4 which store runoff concentrated in the drainage swales within the open cut area and which will provide a water source for dust suppression and mine rehabilitation activities;
- drainage swales located along the down slope side of each open cut pit which will collect both surface water runoff that either enters the pit from upslope (*because it cannot be diverted around the pit*) or which collects within the floor of the pit as a consequence of runoff from re-use for dust suppression and/or irrigation of repatriated areas;
- re-use of dirty water runoff for use in the mining process or treating the water prior to discharge in accordance with an Environment Protection Licence ;
- the construction of treatment ponds and storage dams within the mine infrastructure area to contain and improve water quality.

The Water Management Strategy for the mine has been developed to incorporate these features which have been conceptually sized based on the results of water balance modelling. The water balance modelling incorporates provision for projected mine water supply, storage evaporation, projected open-cut re-use requirements and approved discharge. In terms of this latter item, it should be noted that contingencies have been considered to ensure that there is sufficient additional treatment pond storage capacity should the groundwater inflows predicted by Aquaterra be underestimated.

Notwithstanding, it should be noted that water management for the Moolarben Coal Project will be subject to the preparation of a detailed Water Management Plan as a component of MCM's Statement of Commitments and the Mine Operations Plan that is to be prepared prior to the commencement of physical works on-site.

8.2 GROUNDWATER INFLOWS

The impacts of the project on the groundwater resources have been assessed by Aquaterra with the aid of a numerical groundwater flow model. The results of the analysis are presented in **Table 13** which has been taken from Aquaterra's report titled, *'Moolarben Coal Project Groundwater Assessment Report'* (*November 2008*).

Based on the findings from the groundwater investigations, it is predicted that there will be negligible groundwater inflow to Underground 1, Open Cut 1 and Open Cut 2. The initial groundwater inflows to Open Cut 3 will also be very low, but will progressively increase as mining proceeds.

Aquaterra predict that there will be a substantial volume of groundwater inflow to Open Cut 4 during the life of the pit. However, as shown in **Table 13**, the greatest contribution to groundwater inflows will be generated in Underground 4, which will not become operational until Year 17 of the project.

Groundwater modelling undertaken by Aquaterra has determined that in order to meet the required water demand for the mine project it will be essential to capture and use all available surface water that falls within the extent of mine operations. The available water and the potential for its use are detailed in **Section 8.3.1**.

8.3 PROPOSED SURFACE WATER MANAGEMENT SYSTEM

The objective for managing surface water runoff for the Moolarben Coal Project is to manage both the clean water resource and the potential 'dirty' water resource. 'Dirty' water can be considered as any groundwater that flows into an open cut or underground mine, or surface water that will run off the catchment and become 'dirty' or polluted due to it flowing across either open pits, overburden emplacements/ rehabilitation areas or mine infrastructure areas. Clean water is water that falls outside of the mine operation areas or is captured/diverted upstream of the open cut pits where possible, and water pumped from production bores.

The surface water management of clean and 'dirty' water can be considered as two separate issues. Clean water that is captured or diverted around the mine operations will be utilised as an environmental flow resource for Murragamba and Eastern Creek. The proposed mine pit progression has the potential to disrupt surface flows entering into both Murragamba and Eastern Creek. In order, to maintain suitable flows to maintain the aquatic and terrestrial ecosystem of the creeks it will be necessary to provide environmental flows.

As highlighted in **Section 8.2.1**, there is a predicted deficit of water available for mining operations from Years 5 to 22 if water is sourced entirely from mine inflows and the Moolarben Coal Mine borefields. Accordingly, there is a need to control all runoff that enters the operational areas of the mine so that the re-use of 'dirty' water for use in mining operations can be maximised.

Table 13 ESTIMATED GROUNDWATER MAKE

MINING YEAR	TIME (Year)	MOOLARBEN PIT INFLOW (ML/yr)							TOTAL MOOLARBEN PIT INFLOWS (ML/yr)	POTENTIAL INFLOW FROM MOOLARBEN BOREFIELD (ML/yr)
		OC1	OC2	OC3	OC4	UG1	UG2	UG4		
1	2010	6	0	0	155	0	0	0	162	1252
2	2011	14	0	0	207	0	0	0	221	2100
3	2012	23	0	0	142	0	0	0	165	2228
4	2013	73	0	0	104	0	0	0	177	2196
5	2014	62	0	0	71	88	0	0	221	2016
6	2015	69	9	0	48	120	0	0	246	1937
7	2016	0	33	0	33	512	0	0	578	1790
8	2017	0	10	15	36	387	0	0	448	1758
9	2018	0	0	18	76	356	0	0	450	1713
10	2019	0	0	37	75	313	5	0	429	1709
11	2020	0	0	24	83	407	33	0	547	1659
12	2021	0	0	14	128	320	39	0	502	1661
13	2022	0	0	44	133	311	47	0	536	1611
14	2023	0	0	49	190	275	65	0	579	1616
15	2024	0	0	46	272	245	67	0	630	1631
16	2025	0	0	27	239	250	65	0	580	1689
17	2026	0	0	33	527	264	67	233	1124	1700
18	2027	0	0	36	430	0	0	269	735	1746
19	2028	0	0	54	719	0	0	570	1343	1825
20	2029	0	0	66	197	0	0	532	794	1896
21	2030	0	0	65	198	0	0	636	899	1947
22	2031	0	0	89	607	0	0	684	1380	1603
23	2032	0	0	85	694	0	0	1195	1974	556
24	2033	0	0	117	0	0	0	899	1016	1527
25	2034	0	0	107	0	0	0	1769	1876	
26	2035	0	0	0	0	0	0	2021	2021	
27	2036	0	0	0	0	0	0	2425	2425	
28	2037	0	0	0	0	0	0	2435	2435	
29	2038	0	0	0	0	0	0	2797	2797	
30	2039	0	0	0	0	0	0	2723	2723	

Source: Aquaterra (2008)

The objective of the surface water management strategy for the mine is to direct this water to strategically located sedimentation ponds and to re-use it within open cut operations and for irrigation for vegetation rehabilitation to minimise any water deficit and release of dirty water.

The amount of surface water that requires management at the mine is dependent on a number of factors:

- the amount of rainfall falling over the defined catchment areas;
- the amount of runoff generated from rainfall, dependent on percentage imperviousness and soil conditions (*e.g., the change from a typically grassed, pastoral area to bare, un-vegetated earth areas within the open cut pits*); and
- the loss of water from existing water storage and drainage structures through evaporation and seepage.

The following sections examine the use of both the clean and 'dirty' water resource throughout the Moolarben Coal Project. This was undertaken by developing a series of water balance models that examined various rainfall scenarios that could occur at the site over the life of the mine. The water balance models were used to determine a combined Stage 1 and Stage 2 surface water management strategy for the Moolarben Coal Project, and also to assess the surface water management for the Stage 2 works in isolation.

8.3.1 Mine Operations Surface Water Management

Water Balance Modelling

Several separate water balance models were developed to determine the maximum amount of surface water that will be available from the open cut and mine infrastructure areas over the mine life for a range of rainfall scenarios. In order to maximise the potential water available for re-use in mine operations, all potential ground and surface water sources were identified and considered in terms of their projected quantity and quality.

The proposed Water Management System for the mine site is presented schematically in **Figure 20**. This schematic representation of the proposed Water Management System highlights that water resources from both Stages 1 and 2 of the Moolarben Coal Project will be utilised. The proposed Water Management System shows a distinct delineation between the management of "dirty" and "clean" water sources at the site. This is fundamental to the strategy and is based on the re-use of as much groundwater make as possible, combined with capture of surface runoff from disturbed areas for use in mine processes, and the diversion and temporary storage of surface runoff from undisturbed areas, which will be used to maintain environmental flows to Wilpinjong Creek.

The mine water management system presented in **Figure 20** was used as a basis for developing a water balance model for the mine site. The water balance was undertaken using a bucket type model. The model was based on a range of key parameters including rainfall, infiltration and evaporation rates, and runoff, and incorporates storages for each to account for inputs and outputs.

FIGURE 20

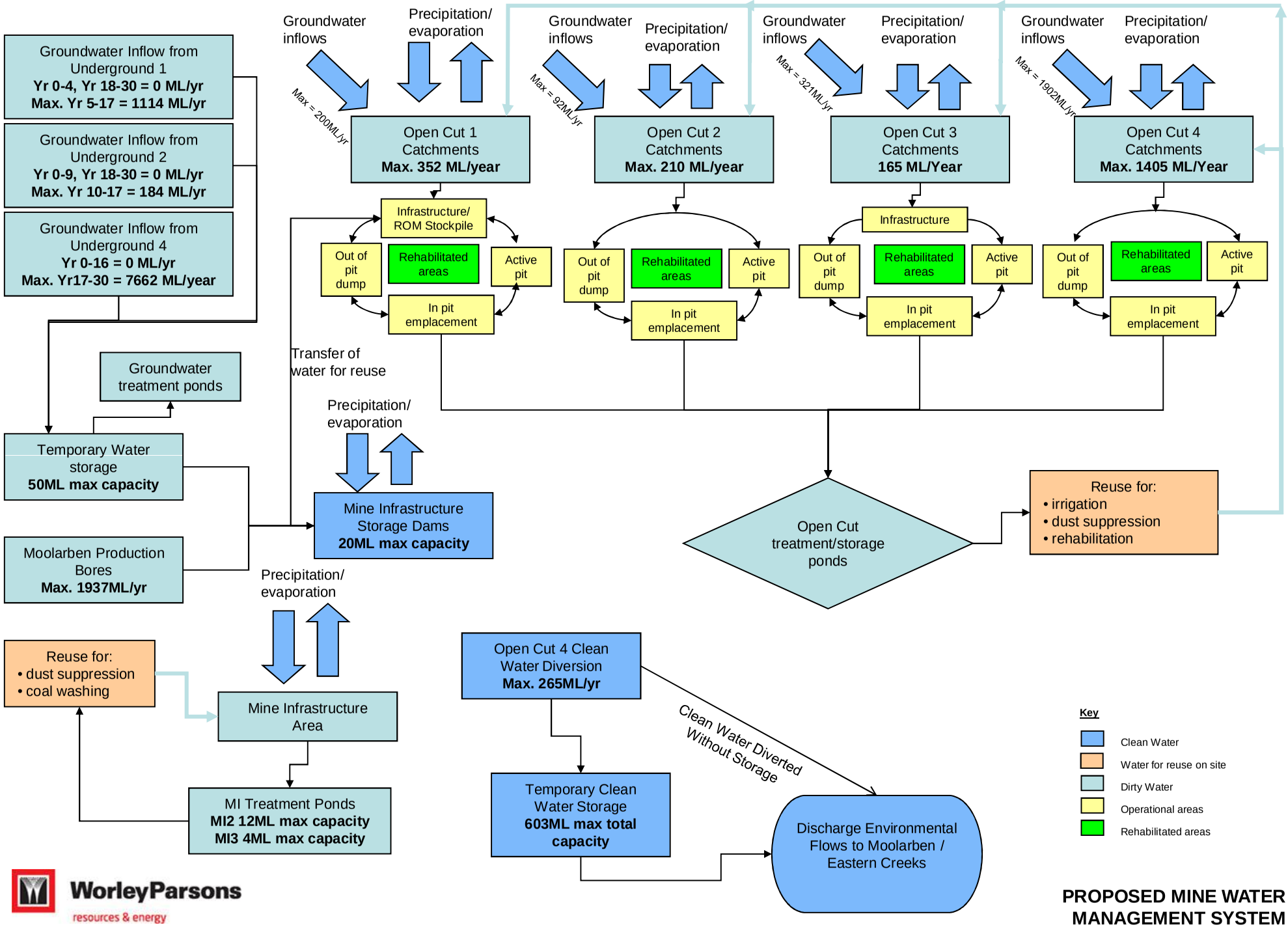

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Figure 20 - 6173.01 – Proposed Mine Water Management System.ppt

PROPOSED MINE WATER MANAGEMENT SYSTEM

The Moolarben Mine water balance model was developed assuming the following:

- that all open cut areas intercept rainfall according to the subcatchments delineation shown schematically in **Figure 21**;
- that rehabilitated areas are graded to allow gravity drainage to collection swales;
- all rain falling on the catchment is considered 'dirty';
- designated maximum storage areas for each stage in the mining process (*i.e., overall dam size can be broken up into smaller dams to have multiple dams within each area*); and,
- seepage losses from sedimentation ponds and swales are assumed to be negligible.

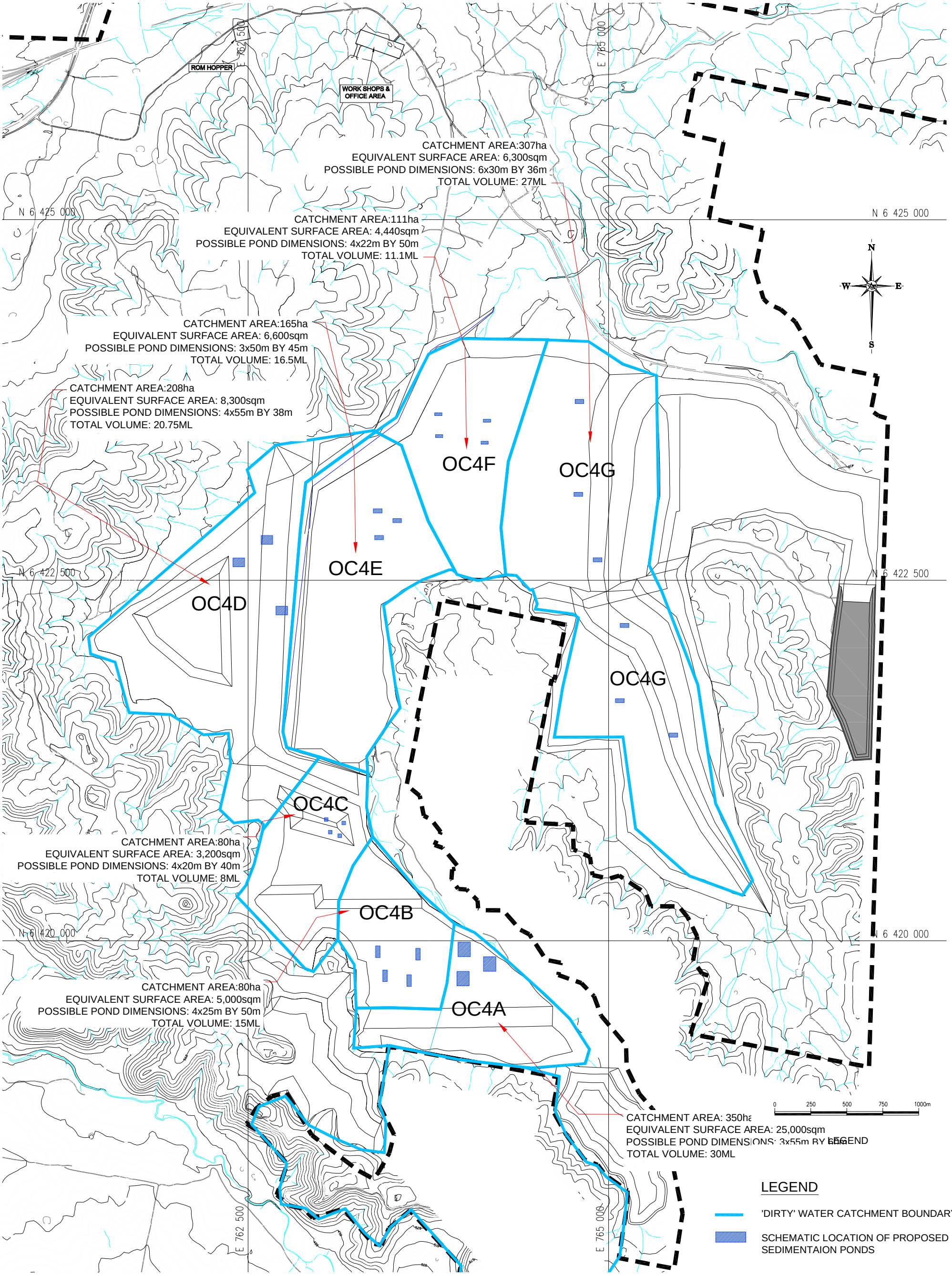
The water balance model requires annual rainfall data that is representative of the catchment area being investigated. This data is recorded at daily intervals as measured by a representative rain gauge. The nearest long term rain gauge is located at Ulan Post Office. Data recorded by this gauge has been analysed and indicates that the average annual rainfall at Ulan is 638 mm.

However, recorded rainfall data for the Gulgong Post Office gauge (*Gauge No. 62013*) provides a more continuous and extensive record of daily rainfall in the region. This gauge has daily read rainfall data extending back to 1881. Analysis of the gauge record indicates that the average annual rainfall recorded at the gauge is 649 mm. This compares well with the average annual rainfall determined from data recorded at the Ulan Post Office gauge.

Therefore, the Gulgong Post Office rainfall data was chosen for use in the water balance analysis as it provided a more complete record of regional rainfall and generated an average annual rainfall estimate that is very similar to the average annual rainfall recorded at Ulan.

The complete rainfall record for the Gulgong Post Office gauge was obtained from the Bureau of Meteorology. The record was analysed to identify rainfall data sets for a range of rainfall scenarios that may apply over the life of the mine. **Table 14** lists the various rainfall scenarios that were considered in the water balance modelling along with the rainfall data that was adopted.

The water balance model was used to determine the volume of runoff from each catchment area that will drain from the open cut pits, overburden areas, rehabilitated areas and the mine infrastructure area.



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SCHEMATIC LAYOUT OF SEDIMENTATION BASINS

Table 14 ADOPTED RAINFALL DATA

RAINFALL CONDITION	ADOPTED YEAR	ADOPTED ANNUAL RAINFALL (*mm*)	ESTIMATED EVAPORATION (*mm*)
Average Conditions	12/2006 – 12/2007	645	1657
"Dry Years" Scenario	Last 30 years of below average rainfall	519 [Range from 636 to 361]	1657
"Wet Years" Scenario	Last 30 years of above average rainfall	849 [Range from 695 to 1412]	1657
Worst Case "Dry Years" Scenario	11 lowest rainfall years ever recorded	358 [Range from 299 to 385]	1657

Treatment of Dirty Water

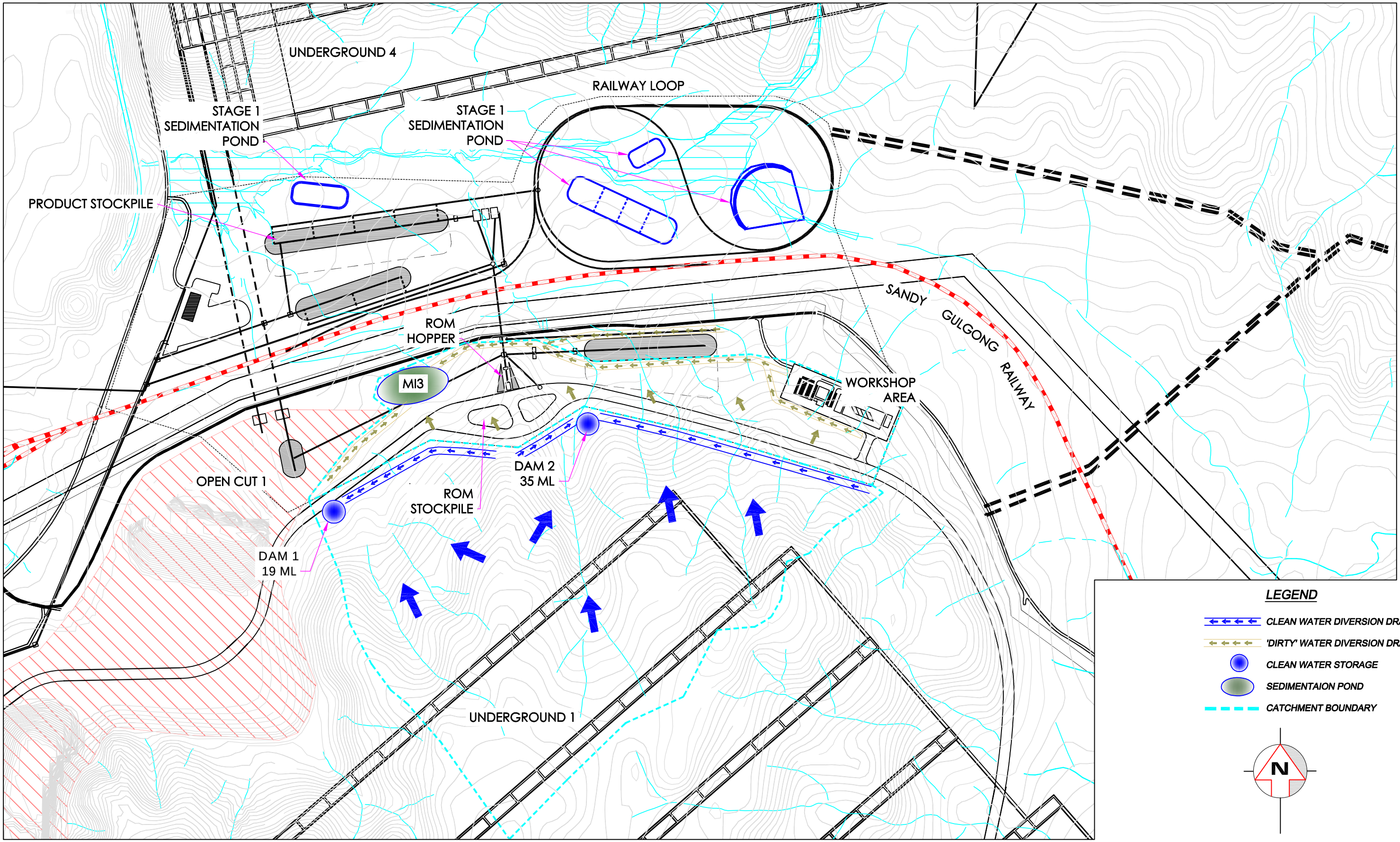
Water coming into contact with areas of mining operations needs to be treated prior to re-use. Sedimentation ponds will be the main form of treatment of this 'dirty' water.

A series of catch drains will be constructed across the open cut pits and at strategic locations within the mine infrastructure area to convey runoff from the overburden emplacement areas to the proposed sedimentation ponds. The catch drains will be designed to convey peak discharges in events up to the design 20 year recurrence storm. In addition, catch drains will be constructed to limit the potential for erosion at the base of emplacement areas or along the top of the pit wall.

It is proposed that additional sedimentation ponds will be strategically located throughout Open Cut 4 as part of the Stage 2 works. Rainwater and groundwater that accumulates within the open cut pits will be collected and either pumped or diverted to the sedimentation basins for treatment.

Figure 21 shows the schematic location of the proposed sedimentation ponds relative to their defined contributing catchment areas within Open Cut 4. Treated water will be extracted from the sedimentation ponds for use in dust suppression within the open cut pit. It is assumed that sedimentation ponds can be progressively constructed as open cut mining proceeds. For example, Ponds OC4A to OC4G will be progressively constructed as mining in Open Cut 4 proceeds from south to north.

Within the Stage 2 mine infrastructure area, a clean water swale located to the south and upslope from the Stage 2 ROM hopper, will divert clean water coming from the escarpment above Underground 1 to a small clean water dam to the east of the Stage 2 infrastructure area. This water will be available to supplement environmental flows. Runoff from Stage 2 of the Mine Infrastructure Area will be conveyed to sedimentation pond MI3 (*refer* **Figure 22**).



NOTE:
DAMS SIZE ON FIGURE NOT TOO SCALE

0 200 400 600 800 1000m
1:10000 (A1) 1:20000 (A3)

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PROPOSED SURFACE WATER MANAGEMENT FOR THE STAGE 2 INFRASTRUCTURE AREA

Sedimentation ponds will continue to operate following the completion of mining and during the rehabilitation phase until the water quality captured from rehabilitated areas reaches a satisfactory level in terms of pre-determined constituents such as salinity and turbidity.

Runoff from rehabilitated areas will be collected, conveyed to the sedimentation ponds for treatment and extracted for use in ongoing irrigation for rehabilitation of the mine site or dust suppression. Once the rehabilitated areas are satisfactorily established it may be possible to retain the ponds to enhance the post-mining aquatic and terrestrial ecosystems. If this is not possible the sedimentation ponds will be decommissioned and removed from the site.

The need for the surface water ponds has been highlighted in the report prepared by Ecovision Consulting titled *'Ecological Impact Assessment: Moolarben Coal Project – Stage 2, Murragamba Valley, Ulan'* (*September 2008*). The report outlines that water availability in the post-mining landform is critical to the spatial representation and survival of terrestrial and aquatic ecosystems. The report puts forward the idea that a chain of ponds connected through the Murragamba Valley could provide a reliable and meaningful habitat for fauna in the area.

The retention of these ponds could prove to be an effective post-mining use for environmental purposes provided accumulated sediments are removed from the sedimentation ponds. However, the final location of ponds will need to be determined by the ecological consultants.

Sizing of Sedimentation Ponds

The proposed sedimentation ponds have initially been sized as an overall required volume for that catchment for a number of mine stage years. The ponds have been sized to allow a maximum catchment to enable use of all available surface runoff from the mine and infrastructure areas.

The ponds have been sized assuming a maximum depth of 3.0 metres and it is recommended that they are designed to contain storm flows up to the 20 year recurrence event. Catchment areas and indicative sizing requirements for each of the sedimentation ponds is detailed in **Table 15**. The proposed location of sedimentation ponds within each area of the mine (*i.e., Open Cut 4 = OC4 etc*) are shown conceptually in **Figure 21**. It should be noted that the pond sizes shown in **Table 15** allow for water re-use in other areas of the mine.

8.3.2 Combined Stage 1 and Stage 2 Water Balance Assessment

'Average' Rainfall Condition Assessment

The results of water balance modelling for average rainfall conditions are listed in **Table 16**. It should be noted that the extraction rates for groundwater from the Moolarben Coal Mine production bores have been adjusted to ensure that only the required volume of water for mine operations is extracted. In periods where the volume of surface water that is captured is surplus to demand, the extraction rate from the borefields has been reduced.

Table 15 PROPOSED SEDIMENTATION POND CAPACITIES

DIRTY WATER POND IDENTIFIER	CONTRIBUTING CATCHMENT AREA (ha)	TOTAL POND VOLUME (m^3)	POND SURFACE AREA (m^2)
Open Cut 1			
OC1A	300	12,800	5,100
OC1B	95	4,000	1,600
OC1C	170	7,200	2,900
OC1D	97	4,100	1,700
OC1E	81	3100	1,300
Open Cut 2			
OC2A	110	4,700	1,900
OC2B	148	6,300	2,500
OC2C	188	8,000	3,200
Open Cut 4			
OC4A	350	30,000	10,000
OC4B	80	15,000	5,000
OC4C	80	8,000	3,200
OC4D	208	20,750	8,300
OC4E	165	16,500	6,600
OC4F	111	11,100	4,440
OC4G	158	15,750	6,300
Mine Infrastructure			
MI-1	100	12,000	4,800
MI-2	130	12,000	4,800
MI-3	45.78	4,000	1,600

In periods where a water deficit is predicted, the extraction rate shown from the production bores represents the extraction rate available from the modelled borefield.

The water balance modelling results show that under 'average' rainfall conditions, there is potential for a water deficit to occur between Year 6 and Year 17 of the project. This is in part due to the low mine pit inflows and the high production rate during these years.

A comparison of annual water demand and total available water from all sources is presented in **Figure 23** for all years throughout the mine life. This highlights the following for average rainfall conditions:

(i) A projected water deficit between Years 6 and 17.

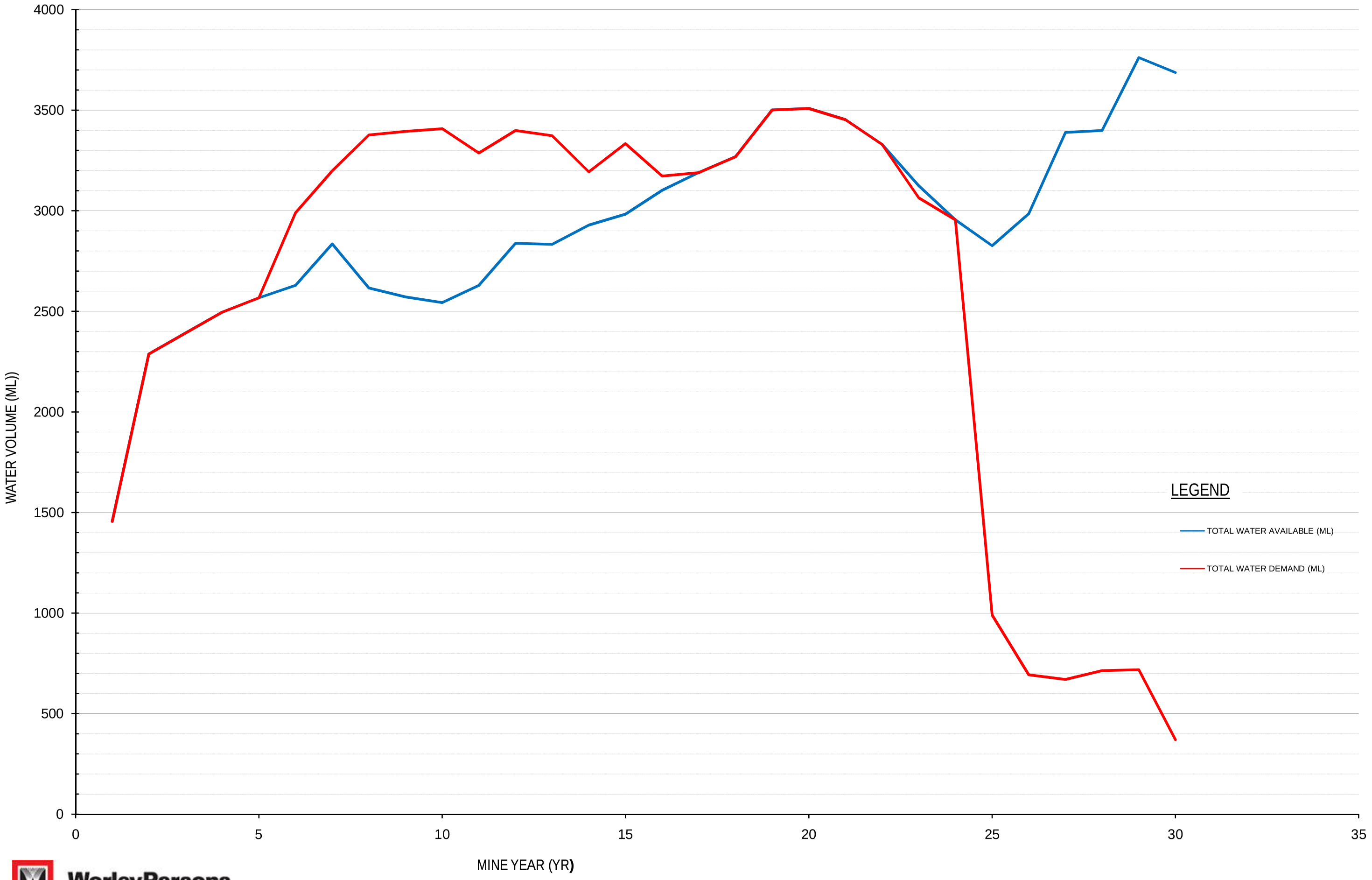
From Year 8 to 11 inclusive, the predicted water deficit under average rainfall conditions is estimated to be between 20 and 25% of total water demand for each year.

(ii) A projected water surplus beyond Year 25 until the completion of mining.

Figure 23 shows that even with maximum utilisation of both groundwater and surface water inflows to the project area, a water deficit can be expected between Year 6 and 17 if average rainfall conditions were to prevail over the duration of mining. Accordingly, it will be necessary to supplement available water resources from alternative sources in accordance with the strategies outlined in Water Management Plan for Stage 1.

It is envisaged that the predicted deficit could be made up through water sharing arrangements with nearby mines such as Ulan Coal Mine and Wilpinjong Coal Mine. In addition, the shortfall could be partly met by increased pumping from additional borefields located elsewhere within EL 6288.

FIGURE 23



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PREDICTED WATER SUPPLY AND DEMAND FOR THE MOOLARBEN COAL PROJECT

rp6173.01_Moolarben Stage2 SWMP
figure 23 Balance results updated 080917.xls
FIG23

Table 16 WATER BALANCE RESULTS FOR "AVERAGE" RAINFALL CONDITIONS

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Borefield Production (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
1	7.0	1456	162	952	342	1456	0
2	11.0	2288	221	1704	363	2288	0
3	11.5	2392	165	1865	362	2392	0
4	12.0	2496	177	1966	353	2496	0
5	12.3	2567	221	2004	342	2567	0
6	14.4	2990	246	1937	445	2628	-362
7	15.4	3199	578	1790	467	2835	-364
8	16.2	3377	448	1758	410	2616	-761
9	16.3	3394	450	1713	408	2571	-823
10	16.4	3408	429	1709	405	2543	-865
11	15.8	3287	547	1659	423	2629	-658
12	16.3	3399	502	1661	675	2838	-561
13	16.2	3373	536	1611	686	2833	-540
14	15.4	3194	579	1616	734	2929	-265
15	16.0	3334	630	1631	722	2983	-351
16	15.3	3172	580	1689	833	3102	-70
17	15.3	3190	1124	1162	904	3190	0
18	15.7	3269	735	1676	858	3269	0
19	16.8	3501	1343	1217	941	3501	0
20	16.9	3508	794	1826	888	3508	0
21	16.6	3453	899	1623	931	3453	0
22	16.0	3330	1380	999	951	3330	0
23	14.7	3064	1974	101	989	3064	0
24	14.2	2955	1016	1293	646	2955	0
25	4.8	990	1876	0	950	2826	1836
26	3.3	693	2021	0	964	2985	2292
27	3.2	670	2425	0	964	3389	2719
28	3.4	714	2435	0	964	3399	2685
29	3.5	719	2797	0	964	3761	3042
30	1.8	371	2723	0	964	3687	3316

'Below Average' Rainfall Condition Assessment

The initial water balance assessment was undertaken using a rainfall data-set that represented an 'average' years rainfall for the Moolarben catchment. Although, this assessment established that there would be a water deficit during a number of years over the mine life, it is considered that the volume of annual deficit can be overcome by meeting demand with water resources that are currently stored at nearby mines.

Notwithstanding, it is recognised that this conclusion is drawn from the results of an assessment based on the adoption of "average" rainfall conditions over the mine life. Average conditions are unlikely to prevail consistently over this period so it could be perceived that the adoption of average rainfall conditions could result in lower rainfall delivery than would typically occur. In the same context, an extended drought could result in significantly less rainfall over particular periods during the mine life.

Therefore, in order to understand the sensitivity of the water management system to rainfall conditions, a 'dry' weather scenario was determined and analysed using the water balance model. This scenario corresponded to below average rainfall for the entire 30 years of the mine life.

The dry weather rainfall scenario was based on adoption of the last 30 years of below average rainfall as recorded at the Gulgong Post Office gauge.

This data was extracted and combined to develop a continuous 30 year "below average" rainfall data-set. The below average rainfall data-set was then used in the water balance model to determine the potential deficit in available water for the Moolarben Coal Project for the dry weather scenario described above.

The results obtained from the water balance modelling for the below average rainfall condition data-set are listed in **Table 17**. It should be noted that the extraction rates of water from the Moolarben Coal mine production bores have been boosted to the maximum available permissible extraction rate advised by Aquaterra.

The water balance modelling results show that for the dry weather scenario there is potential for a water deficit over the period from Year 4 to Year 25. This represents an extension of the deficit period relative to the results of the water balance analysis for "average" rainfall conditions (*predicted to be from Year 6 to Year 17*).

However, comparison of the deficit volumes for both scenarios shows that there is only minor deficits predicted in the additional years outside the deficit period predicted under average rainfall conditions; i.e., Years 4 to 6 and Years 16 to 24.

This reflects the importance of the production borefields for meeting water demand, and also shows that water availability is not sensitive to fluctuations in average rainfall conditions.

Table 17 WATER BALANCE RESULTS FOR "BELOW AVERAGE" RAINFALL CONDITIONS

Mine Year	Total Mined ROM Coal (Mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
1	7.0	1456	162	1040	254	1456	0
2	11.0	2288	221	1795	272	2288	0
3	11.5	2392	165	1944	283	2392	0
4	12.0	2496	177	2196	106	2479	-17
5	12.3	2567	221	2016	305	2542	-25
6	14.4	2990	246	1937	340	2523	-467
7	15.4	3199	578	1790	180	2548	-650
8	16.2	3377	448	1758	507	2714	-663
9	16.3	3394	450	1713	378	2540	-854
10	16.4	3408	429	1709	399	2537	-871
11	15.8	3287	547	1659	197	2404	-883
12	16.3	3399	502	1661	688	2850	-549
13	16.2	3373	536	1611	570	2717	-656
14	15.4	3194	579	1616	461	2655	-538
15	16.0	3334	630	1631	581	2842	-492
16	15.3	3172	580	1689	890	3160	-13
17	15.3	3190	1124	1300	765	3190	0
18	15.7	3269	735	1746	727	3208	-61
19	16.8	3501	1343	1548	609	3501	0
20	16.9	3508	794	1896	677	3368	-140
21	16.6	3453	899	1947	492	3339	-114
22	16.0	3330	1380	995	955	3330	0
23	14.7	3064	1974	55	1035	3064	0
24	14.2	2955	1016	1527	382	2925	-30
25	4.8	990	1876	0	963	2839	1849
26	3.3	693	2021	0	964	2985	2292
27	3.2	670	2425	0	964	3389	2719
28	3.4	714	2435	0	964	3399	2685
29	3.5	719	2797	0	964	3761	3042
30	1.8	371	2723	0	964	3687	3316

'Above Average' Rainfall Scenario Assessment

An additional water balance simulation was undertaken to further understand the sensitivity of the water management system to rainfall conditions. This additional simulation looked at a 'wet years" scenario based on the application of above average rainfall for the entire 30 years of the mine life.

The "wet years" rainfall scenario was based on adoption of the last 30 years of above average rainfall as recorded at the Gulgong Post Office gauge. This data was extracted and combined to develop a continuous 30 year "above average" rainfall data-set. This data-set had an average annual rainfall of 849 mm or 30% more than the recorded average rainfall over the duration of the gauge record. It also included annual rainfall totals ranging between 695 and 1412 mm, all of which exceed the average annual rainfall over the complete gauge record.

The above average rainfall data-set was then used in the water balance model to determine the potential deficit in available water for the Moolarben Coal Project for the adopted wet weather scenario. The results obtained from the water balance modelling of the above average rainfall condition data-set are listed in **Table 18**.

The water balance modelling results show that for the above average rainfall scenario there is potential for a water deficit over the period from Year 6 to Year 17. This period of water deficit corresponds to that predicted for "average" rainfall conditions. However, there is a slight reduction in the deficit volume due to the increased surface runoff during the above average rainfall condition scenario. The reduction in deficit volume is typically less than 5% of water demand.

It should be noted that these results further reflect the importance of the production borefields for meeting water demand, and also show that water availability is not sensitive to fluctuations in typical annual rainfall conditions.

Worst Case Dry Weather Scenario Assessment

A final rainfall scenario was developed to further understand the sensitivity of the water management system to rainfall conditions. This additional simulation considered what was regarded to be the worst case 'dry weather' scenario that could reasonably be expected at the mine site. The scenario was based on applying below average rainfall conditions over a period corresponding to the predicted duration of water deficit years under an average rainfall scenario. That is, the application of below average rainfall conditions over the 11 year period of water deficit predicted between Years 6 and 17 under average rainfall conditions. A worst case scenario for the MCP could be considered to occur if during these peak water deficit years, catchment rainfall was at its lowest.

The Gulgong Post Office gauge record was analysed to determine the driest 11 years on record. This data was extracted and combined to develop a continuous 11 year worst case "dry weather" rainfall data-set.

Table 18 WATER BALANCE RESULTS FOR 'ABOVE AVERAGE' RAINFALL CONDITIONS

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
1	7.0	1456	162	682	612	1456	0
2	11.0	2288	221	1640	427	2288	0
3	11.5	2392	165	1901	326	2392	0
4	12.0	2496	177	1917	401	2496	0
5	12.3	2567	221	1807	539	2567	0
6	14.4	2990	246	1937	512	2990	-295
7	15.4	3199	578	1790	639	3199	-192
8	16.2	3377	448	1758	448	3377	-722
9	16.3	3394	450	1713	503	3394	-729
10	16.4	3408	429	1709	633	3408	-637
11	15.8	3287	547	1659	483	3287	-598
12	16.3	3399	502	1661	699	3399	-537
13	16.2	3373	536	1611	1174	3373	-52
14	15.4	3194	579	1616	737	3194	-262
15	16.0	3334	630	1631	794	3334	-279
16	15.3	3172	580	1689	805	3172	-98
17	15.3	3190	1124	975	1090	3190	0
18	15.7	3269	735	1552	982	3269	0
19	16.8	3501	1343	1201	957	3501	0
20	16.9	3508	794	1712	1002	3508	0
21	16.6	3453	899	1385	1168	3453	0
22	16.0	3330	1380	1046	904	3330	0
23	14.7	3064	1974	177	913	3064	0
24	14.2	2955	1016	1091	848	2955	0
25	4.8	990	1876	0	964	2840	1850
26	3.3	693	2021	0	964	2985	2292
27	3.2	670	2425	0	964	3389	2719
28	3.4	714	2435	0	964	3399	2685
29	3.5	719	2797	0	964	3761	3042
30	1.8	371	2723	0	964	3687	3316

The "worst case dry weather" rainfall data-set included annual rainfall records ranging from 299 to 385 mm. These annual rainfall totals are more than 280 mm lower than the adopted average rainfall for Ulan. The average of the annual totals adopted in the analysis is 358 mm, which is only 55% of the annual average rainfall for the area. These statistics confirm that an 11 year period of rainfalls corresponding to the lowest 11 annual rainfall records would be equivalent to a very rare and prolonged drought.

Notwithstanding, for the purposes of the sensitivity analysis, the water balance model was used to simulate the data-set and establish the potential impact of drought conditions on water resource availability for mining. The results from the analysis are listed in **Table 19**. It should be noted that the extraction rates of water from the Moolarben Coal Mine production bores have been boosted to the maximum available permissible extraction rate advised by Aquaterra.

The water balance modelling results show that for a "worst case dry weather" scenario, there would be a substantial extension to the water deficit during the period from Year 6 to Year 17. Under this drought condition scenario, the water available during this period would reduce by between 17 and 130 per cent. It should be noted that the likelihood of the driest 11 years occurring consecutively and at the same time as the potential mine deficit storage years is remote.

Table 19 WATER BALANCE RESULTS FOR THE 'WORST CASE DRY WEATHER' SCENARIO

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
6	14.4	2990	246	1937	218	2990	-589
7	15.4	3199	578	1790	241	3199	-589
8	16.2	3377	448	1758	162	3377	-1008
9	16.3	3394	450	1713	163	3394	-1069
10	16.4	3408	429	1709	260	3408	-1010
11	15.8	3287	547	1659	225	3287	-855
12	16.3	3399	502	1661	244	3399	-993
13	16.2	3373	536	1611	395	3373	-830
14	15.4	3194	579	1616	387	3194	-612
15	16.0	3334	630	1631	506	3334	-567
16	15.3	3172	580	1689	524	3172	-379

8.3.3 Water Balance Assessment for Stage 2 Only

As discussed, MCM plans to undertake Stages 1 and 2 of the MCP concurrently. That is, infrastructure development and resource extraction will begin to occur in areas covered by both stages of the project once approval is granted. Accordingly, the analysis outlined in the preceding section details the water balance for the combined Stage 1 and Stage 2 operation as per the proposed mine schedule.

Notwithstanding, in the context of the approval that MCM is seeking for Stage 2 of the MCP, an additional analysis was undertaken to assess water availability for Stage 2 of the project in isolation. A modified version of the water balance model described in **Section 8.3.2** was developed based on mine inflows and surface water inflows from the Stage 2 component of the project. It should be noted that the Stage 2 component of works involves extraction of coal from Open Cut 4 and Undergrounds 1 and 2 only. As a result, the water balance was only undertaken over the corresponding life of this section of the mine; that is, 24 years.

The results of this assessment are detailed in the following section.

'Average' Rainfall Condition Assessment [Stage 2 Only]

The results of water balance modelling for average rainfall conditions for Stage 2 only are listed in **Table 20**.

It should be noted that the extraction rates for groundwater from the Moolarben Coal Mine production bores have been adjusted to ensure that only the required volume of water for mine operations is extracted. The extraction rate from the borefields has been reduced for those periods where the volume of surface water that is captured is surplus to demand. In periods where a water deficit is predicted, the extraction rate shown from the production bores represents the extraction rate available from the modelled borefield. As advised by Aquaterra, the shortfall could be met by increased pumping from additional borefields located elsewhere within EL 6288.

The water balance modelling results show that under average rainfall conditions there is potential for a water deficit to occur between Years 9 and 17 of Stage 2 of the project. This is in part due to the low mine pit inflows and high production rate during these years.

It should be noted that compared to the combined Stage 1 and 2 results, the results shown in **Table 20** indicate that there will be a reduction in the number of years where a water deficit occurs. This is due to Stage 2 of the operation having a reduced volume of total mined ROM coal over this period. The reduction in ROM coal results in a reduced water demand for washing and processing.

Notwithstanding, a water deficit is still predicted if the Stage 2 operation were undertaken in isolation. Therefore, it will be necessary to supplement available water resources from alternative sources in accordance with the strategies outlined in Water Management Plan for Stage 1. It is envisaged that the deficit could be made up through water sharing arrangements with nearby mines such as Ulan Coal Mine and Wilpinjong Coal Mine.

Table 20 WATER BALANCE RESULTS FOR AVERAGE RAINFALL CONDITIONS FOR STAGE 2 ONLY [OC4, UG1 AND UG2 ONLY]

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
1	0.0	0	162	0	338	500	500
2	4.0	832	221	422	189	832	0
3	4.5	936	165	605	166	936	0
4	4.5	936	177	593	166	936	0
5	4.3	903	221	516	166	903	0
6	8.9	1846	246	1408	192	1846	0
7	7.4	1535	578	764	192	1535	0
8	7.2	1505	448	865	192	1505	0
9	14.6	3036	450	1713	118	3036	-756
10	15.4	3200	429	1709	150	3200	-912
11	14.8	3079	547	1659	150	3079	-722
12	15.3	3191	502	1661	185	3191	-844
13	15.2	3165	536	1611	194	3165	-824
14	14.4	2986	579	1616	194	2986	-597
15	15.0	3126	630	1631	185	3126	-680
16	14.3	2964	580	1689	316	2964	-379
17	14.0	2913	1124	1380	408	2913	0
18	12.0	2496	735	1353	409	2496	0
19	12.0	2496	1343	708	445	2496	0
20	12.0	2496	794	1245	457	2496	0
21	12.0	2496	899	1140	457	2496	0
22	11.5	2392	1380	555	457	2392	0
23	10.0	2080	1974	0	555	2529	449
24	9.4	1952	1016	767	169	1952	0

'Below Average' Rainfall Condition Assessment

As with the water balance assessment for the combined Stage 1 and Stage 2 works, it is necessary to understand the sensitivity of the water management system were Stage 2 of the operation undertaken in isolation. Accordingly, a 'dry weather' scenario was determined and analysed using the water balance model that was developed for Stage 2 of the operation.

The dry weather rainfall scenario that was used in **Section 8.3.2** was also used for the water balance simulation for Stage 2 of the Moolarben Coal Project. This scenario corresponds to the assumption that below average rainfall will occur for the entire 30 years of the mine life.

The results obtained from the water balance modelling of the below average rainfall condition data-set are listed in **Table 21**. It should be noted that the extraction rates of water from the Moolarben Coal mine production bores were boosted to the maximum available permissible extraction rate advised by Aquaterra.

The water balance modelling results show that for the dry weather scenario there potential for a water deficit to occur between Years 9 and 17 of Stage 2 of the project. This is similar to the deficit that is expected to occur for Stage 2 under "average" rainfall conditions. The reason that there is not a greater number of deficit years is due to the ability to maintain the high rate of water extraction from the Moolarben Mine borefields throughout the mine life. This confirms the importance of the production borefields for meeting water demand.

'Above Average' Rainfall Condition Assessment

As with the combined Stage 1 and Stage 2 assessment, a further sensitivity analysis was undertaken for the Stage 2 in isolation scenario in order to establish the sensitivity of the water management system to rainfall conditions. This additional simulation looked at a 'wet weather' scenario which corresponded to above average rainfall for the entire 24 years of the Stage 2 mine life.

The wet weather rainfall scenario that was adopted for the combined Stage 1 and Stage 2 assessment (*refer* **Section 8.3.2**) was also used to assess the sensitivity of water supply and demand during Stage 2 mining operations only, under above average rainfall conditions.

The results obtained from the water balance modelling of the above average rainfall condition data-set are listed in **Table 22**.

The water balance modelling results show that for the wet weather scenario there is potential for a water deficit to occur between Years 9 and 17 of Stage 2 of the project. This deficit will occur during the same period as is predicted for the "average" rainfall conditions scenario. However, there is a slight reduction in the deficit volume due to the increased surface runoff arising from the higher annual rainfall values.

Notwithstanding, the results indicate that water availability for a scenario in which Stage 2 operations occur in isolation, is not sensitive to fluctuations in average rainfall conditions.

Table 21 WATER BALANCE RESULTS FOR BELOW AVERAGE RAINFALL CONDITIONS FOR STAGE 2 ONLY [OC4, UG1 AND UG2 ONLY]

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
1	0.0	0	162	0	305	467	467
2	4.0	832	221	452	159	832	0
3	4.5	936	165	645	126	936	0
4	4.5	936	177	696	63	936	0
5	4.3	903	221	526	156	903	0
6	8.9	1846	246	1451	149	1846	0
7	7.4	1535	578	886	70	1535	0
8	7.2	1505	448	829	228	1505	0
9	14.6	3036	450	1713	85	3036	-789
10	15.4	3200	429	1709	104	3200	-958
11	14.8	3079	547	1659	36	3079	-837
12	15.3	3191	502	1661	222	3191	-807
13	15.2	3165	536	1611	133	3165	-885
14	14.4	2986	579	1616	146	2986	-644
15	15.0	3126	630	1631	146	3126	-719
16	14.3	2964	580	1689	290	2964	-404
17	14.0	2913	1124	1425	364	2913	0
18	12.0	2496	735	1381	380	2496	0
19	12.0	2496	1343	777	376	2496	0
20	12.0	2496	794	1356	345	2496	0
21	12.0	2496	899	1310	287	2496	0
22	11.5	2392	1380	558	454	2392	0
23	10.0	2080	1974	0	561	2535	455
24	9.4	1952	1016	817	119	1952	0

Table 22 WATER BALANCE RESULTS FOR ABOVE AVERAGE RAINFALL CONDITIONS FOR STAGE 2 ONLY [OC4, UG1 AND UG2 ONLY]

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
1	0.0	0	162	0	401	562	562
2	4.0	832	221	372	239	832	0
3	4.5	936	165	607	164	936	0
4	4.5	936	177	559	199	936	0
5	4.3	903	221	398	284	903	0
6	8.9	1846	246	1388	212	1846	0
7	7.4	1535	578	674	282	1535	0
8	7.2	1505	448	859	198	1505	0
9	14.6	3036	450	1713	163	3036	-711
10	15.4	3200	429	1709	143	3200	-919
11	14.8	3079	547	1659	140	3079	-732
12	15.3	3191	502	1661	189	3191	-839
13	15.2	3165	536	1611	302	3165	-715
14	14.4	2986	579	1616	252	2986	-539
15	15.0	3126	630	1631	244	3126	-621
16	14.3	2964	580	1689	387	2964	-308
17	14.0	2913	1124	1312	476	2913	0
18	12.0	2496	735	1316	445	2496	0
19	12.0	2496	1343	696	457	2496	0
20	12.0	2496	794	1214	487	2496	0
21	12.0	2496	899	1082	514	2496	0
22	11.5	2392	1380	589	423	2392	0
23	10.0	2080	1974	0	553	2527	447
24	9.4	1952	1016	719	217	1952	0

'Worst Case Dry Weather' Scenario Assessment

A final rainfall scenario was developed to further understand the sensitivity of the water management system to rainfall conditions assuming Stage 2 operations occur in isolation. This additional simulation considered the worst case 'dry weather' scenario outlined for the combined Stage 1 and 2 analysis as outlined in the **Section 8.3.2** (*refer page 68*). The scenario was based on applying below average rainfall conditions over the 8 year period of water deficit predicted between Years 9 and 17 under average rainfall conditions. A worst case scenario for Stage 2 of the MCP could be considered to occur if catchment rainfall was at its lowest during these peak water deficit years.

Although the water deficit is only predicted to occur for 8 years under a Stage 2 operation only scenario, it was determined that the same driest 11 years on record established for the combined Stage 1 and 2 scenario, should be applied in the analysis. It was considered that this would allow ease of comparison between the two operational scenarios, vis-a-vis, Stage 1 and 2 combined versus Stage 2 in isolation.

The results obtained from the water balance modelling of the "worst case dry weather" scenario are listed in **Table 23**. It should be noted that the extraction rates of water from the Moolarben Coal mine production bores have been boosted to the maximum available permissible extraction rate advised by Aquaterra.

Table 23 WATER BALANCE RESULTS FOR WORST CASE DRY WEATHER SCENARIO FOR STAGE 2 ONLY [OC4, UG1 AND UG2 ONLY]

Mine Year	Total Mined ROM Coal (mtpa)	Total Demand (ML/yr)	Mine Infows (ML/yr)	Required Bore field Inflows (ML/yr)	Surface Water Inflows (ML/yr)	Total Available Water (ML/yr)	Surplus / Deficit (ML)
6	8.9	1846	246	1521	79	1846	0
7	7.4	1535	578	864	92	1535	0
8	7.2	1505	448	1017	39	1505	0
9	14.6	3036	450	1713	76	3036	-797
10	15.4	3200	429	1709	75	3200	-987
11	14.8	3079	547	1659	41	3079	-831
12	15.3	3191	502	1661	71	3191	-958
13	15.2	3165	536	1611	97	3165	-921
14	14.4	2986	579	1616	128	2986	-663
15	15.0	3126	630	1631	119	3126	-746
16	14.3	2964	580	1689	209	2964	-486

The water balance modelling results show that for the "worst case dry weather" scenario there will be a water deficit over most of the mining operation should Stage 2 be undertaken in isolation. The deficit is predicted to be substantial between Year 9 and Year 17 and will amount to between 20 and 30 percent of demand during this period.

The water available during this period will reduce by between 5 and 30 per cent. It should be noted that the likelihood of the driest 11 years occurring consecutively and at the same time as the potential mine deficit storage years is remote.

8.3.4 Potential Options for Managing Potential Water Deficit

The results of the water balance analysis outlined in **Sections 8.3.2** and **8.3.3** indicate that there is potential for a substantial water deficit during the mine life irrespective of whether Stage 1 and Stage 2 areas are mined concurrently, or whether Stage 2 is mined in isolation. The analysis also shows that the periods of predicted water deficit are not sensitive to typical fluctuations in rainfall.

Therefore, in order for mining to proceed, it will be necessary to secure sufficient additional out-of-catchment water resources to meet the projected deficit. It is considered that this could be achieved by either or a combination of the following options:

(i) By entering into a water sharing agreement with coal mines in the immediate vicinity of the Moolarben Coal Project, such as from the nearby Ulan and Wilpinjong Coal Mines. This would have the dual benefit of meeting the water demands of the Moolarben Coal Project while also reducing excess volumes of water resource that are known to be stored at both mine sites and which are likely to continue to be generated as mining operations proceed.

(ii) By reducing the volume of water required for processing during years of deficit. In order to reduce the volume of water required for processing it may be necessary to bypass the washing of coals that are extracted from the underground mines.

(iii) By reducing the production/extraction rates during deficit years to match the water availability.

(iv) By increased pumping from additional borefields located elsewhere within EL 6288.

8.3.5 Clean Surface Water Management

As mentioned earlier, it will be necessary to divert and contain surface runoff upstream of the open cut pit and mine infrastructure area to prevent water contamination. The diverted water will be used as a clean water source for environmental flows for both Murragamba and Eastern Creek.

The surface water runoff from areas upstream of the mine would be diverted around the open cut pit and also the Stage 2 infrastructure area. Water will be diverted through trench drains either directly into the existing creek channel or into temporary clean water storage dams. Water stored in a clean water storage dam would then be piped to a suitable location to discharge into Murragamba and Eastern Creek. Clean water storage dams within the Murragamba and Eastern Creeks catchments will be connected to allow clean water transfer within and between each system.

The location of diversion drains and clean water storage dams has been schematically developed for a number of key years of Open Cut No 4. This can be observed in **Figures 24** to **30**. The clean water storage dams have been designed to contain the runoff from a 100 year recurrence event from the catchment upstream of each dam. The volume of each storage dam is also shown in **Figures 24** to **30**. Each of these dams will be progressively constructed when necessary according to the mine pit progression plan, and will also be decommissioned when rehabilitated areas are fully established.

In locations where it is not possible to gravity drain water from the proposed clean water dams to Murragamba or Eastern Creek it will be necessary to pump the water to a suitable discharge point. It will be necessary to locate the discharge point downstream of any disturbed areas.

Maintenance of Environmental Flows

The mine operations that will be undertaken as part of the proposed Stage 2 component of the Moolarben Coal Project have the potential to reduce the base environmental flows that enter the Wilpinjong creek system from the Murragamba and Eastern Creek catchments. Environmental flows are required to maintain a healthy creek system by maintaining a supply of water that can be utilised by the environment as well as downstream industries that require the water for extractive purposes.

In order to prevent the degradation of Wilpinjong Creek from the loss of environmental flows, it will be necessary to utilise any ‘clean’ water that is captured at the site to maintain the base environmental flows in the Wilpinjong creek system.

The most effective way to determine the environmental flow requirements for a creek system is to analyse stream flow data for that creek system. An analysis of available stream gauges in the area surrounding the Moolarben Coal Project found that there were no stream gauges on Murragamba or Eastern Creeks. The closest stream gauge that has continuous stream flow data is Station 210082, which is located on Wollar Creek upstream of the Goulburn River.

FIGURE 24

WILPINJONG COAL MINE

GOULBURN RIVER NATIONAL PARK

FIGURE 25

FIGURE 29 & 30

FIGURE 26

FIGURE 27

FIGURE 28

MUNGHORN GAP NATURE RESERVE

Eastern Creek

Murragamba Creek

Gulgong to Sandy Hollow Railway Line

Ulan Wollar Road

ULAN COAL MINE

LEGEND

Open Cut Mine No.4

Catchment Boundary

Contour of existing natural surface

N

Scale

200 0 200 400 600 800 1000

Metres

WorleyParsons

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rp6173_01 - Moolarben Mine EA2

fig_basefig.dgn

SURFACE WATER MANAGEMENT PLAN

FIGURE INDEX

FIGURE 25

Eastern Creek

Murragamba Creek

New Creek Alignment

2.6 m³/s

5.3 m³/s

Proposed Cleanwater Dam
[Capacity = 152,800 m3]

MUNGHORN GAP
NATURE RESERVE

10.7 m³/s

0.7 m³/s

0.1 m³/s

2.8 m³/s

Proposed Cleanwater Dam
[Capacity = 3,060 m3]

LEGEND

- Overburden Emplacement
- Active Pit
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Table Drain
- Proposed Bund
- 2.6 m³/s — Concentrated Clean Water Flow (Peak 100 year Flow)
- Pump/Gravity Flow System
- Clean Water Flow
- Dirty Water Flow
- Contour of existing natural surface

N

Scale

100 0 100 200 300 400 500

Metres

WorleyParsons
resources & energy

rp6173_01 - Moolarben Mine EA2
fig_swmp_year1_2.dgn.dgn

SURFACE WATER MANAGEMENT PLAN
YEAR 1-2

FIGURE 26

New Creek Alignment

Morphologically Sound
Section of Murragamba Creek

Murragamba Creek

MUNGHORN GAP
NATURE RESERVE

0.7 m^3/s

0.1 m^3/s

Proposed Cleanwater Dam
[Capacity = 3,060 m3]

11.1 m^3/s

3.1 m^3/s

Proposed Cleanwater Dam
[Capacity = 24,740 m3]

LEGEND

- Overburden Emplacement
- Active Pit
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Proposed Bunds
- Table Drain
- 2.6 m^3/s Concentrated Clean Water Flow (Peak 100 year Flow)
- Pump/Gravity Flow System
- Clean Water Flow
- Dirty Water Flow
- Contour of existing natural surface

N

Scale

100 0 100 200 300 400 500

Metres

WorleyParsons
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rp6173_01 - Moolarben Mine EA2
fig_swmp_year5.dgn

SURFACE WATER MANAGEMENT PLAN
YEAR 5

FIGURE 27

New Creek Alignment

Morphologically Sound
Section of Murragamba Creek

Murragamba Creek

MUNGHORN GAP
NATURE RESERVE

0.9 m^3/s

1.7 m^3/s

3.9 m^3/s

Proposed Cleanwater Dam
[Capacity = 18,020 m3]

Proposed Cleanwater Dam
[Capacity = 24,740 m3]

LEGEND

- Overburden Emplacement
- Active Pit
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Table Drain
- Proposed Bund
- Pump/Gravity Flow System
- 2.6 m /s — Concentrated Clean Water Flow (Peak 100 year Flow)
- Clean Water Flow
- Dirty Water Flow
- Contour of existing natural surface

N

Scale

100 0 100 200 300 400 500

Metres

WorleyParsons
resources & energy

rp6173_01 - Moolarben Mine EA2
fig_swmp_year8.dgn

SURFACE WATER MANAGEMENT PLAN
YEAR 8

FIGURE 28

Morphologically Sound Section of Murragamba Creek

Murragamba Creek

9.0 m^3/s

6.5 m^3/s

6.8 m^3/s

1.1 m^3/s

2.0 m^3/s

Proposed Cleanwater Dam [Capacity = 17,850 m3]

Proposed Cleanwater Dam [Capacity = 22,700 m3]

Proposed Cleanwater Dam [Capacity = 8,552 m3]

Proposed Cleanwater Dam [Capacity = 26,540 m3]

LEGEND

- Overburden Emplacement
- Active Pit
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Table Drain
- Proposed Bund
- Pump/Gravity Flow System
- 2.6 m^3/s Concentrated Clean Water Flow (Peak 100 year Flow)
- Clean Water Flow
- Dirty Water Flow
- Contour of existing natural surface

N

Scale

100 0 100 200 300 400 500

Metres

WorleyParsons
resources & energy

rp6173_01 - Moolarben Mine EA2
fig_swmp_year12_rg.dgn

SURFACE WATER MANAGEMENT PLAN
YEAR 12

FIGURE 29

Discharge to Wilpinjong Creek

Wilpinjong Creek

Gulgong to Sandy Hollow Railway Line

Ulan Wollar Road

3.2 m³/s

15.7 m³/s

Eastern Creek

Proposed Cleanwater Dam [Capacity = 362,000 m3]

New Creek Alignment

Murragamba Creek

Murragamba Creek [New Creek Alignment]

LEGEND

- Overburden Emplacement
- Active Pit
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Table Drain
- Pump/Gravity Flow System
- 2.6 m/s — Concentrated Clean Water Flow (Peak 100 year Flow)
- Clean Water Flow
- Dirty Water Flow
- Contour of existing natural surface

N

Scale

100 0 100 200 300 400 500

Metres

WorleyParsons
resources & energy

rp6173_01 - Moolarben Mine EA2
fig_swmp_year19.dgn

SURFACE WATER MANAGEMENT PLAN
YEAR 19

FIGURE 30

Proposed Cleanwater Dam
[Capacity = 35,000 m3]

Proposed Cleanwater Dam
[Capacity = 17,500 m3]

Proposed Cleanwater Dam
[Capacity = 138,000 m3]

4.5 m^3/s

3.5 m^3/s

2.9 m^3/s

1.0 m^3/s

6.4 m^3/s

7.3 m^3/s

Discharge to Wilpinjong Creek

Eastern Creek

New Creek Alignment

Wilpinjong Creek

Gulgong to Sandy Hollow
Railway Line

Ulan Wollar Road

Murragamba Creek
[New Creek Alignment]

Murragamba Creek

LEGEND

- Overburden Emplacement
- Active Pit
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Table Drain
- Pump/Gravity Flow System
- 2.6 m/s — Concentrated Clean Water Flow (Peak 100 year Flow)
- Clean Water Flow
- Dirty Water Flow
- Contour of existing natural surface

N

Scale

100 0 100 200 300 400 500

Metres

WorleyParsons
resources & energy

rp6173_01 - Moolarben Mine EA2
fig_swmp_year24.dgn

SURFACE WATER MANAGEMENT PLAN
YEAR 24

Despite the Wollar Creek catchment being much larger than the combined Murragamba and Eastern Creek catchments, its location relative to the Moolarben Coal Project and its similar meteorological and geological conditions indicate that it would have rainfall-runoff conditions that may be considered representative of those found at the Moolarben Coal Project site.

For this reason an analysis was undertaken to determine what the average stream flow was for the Wollar Creek catchment.

The analysis of base flow involved extracting the stream flow record at Wollar Creek from 1969-1997 and determining the 50th percentile flow for the catchment over that period. This figure was used to determine an average flow per kilometre square of catchment area and was then used to determine a relative average flow for both Murragamba and Eastern Creek based on their smaller catchment areas. The results of the analysis determined that the calculated average flow for the Murragamba and Eastern Creek catchments are:

- Murragamba Creek = 0.95 ML/d
- Eastern Creek = 0.4 ML/d

This level of environmental flow should be more than sufficient to maintain the quality of Wilpinjong Creek whilst mining operations are undertaken.

Potential Available 'Clean' Water for Environmental Flows

In order to maintain environmental flows in the Wilpinjong Creek system it will be necessary to provide water from the proposed temporary 'clean' water storage dams for the Moolarben coal Project. As described in **Section 8.3.1**, 'clean' water storage dams will be constructed upstream of the mine pit and overburden areas to prevent surface water from becoming contaminated to enable its use for environmental flows. As shown in **Figures 24** to **30**, the dams will be interconnected within both the Murragamba and Eastern Creek catchments. These dams, in most places, will be connected through gravity means and will then discharge into Murragamba and Eastern Creek at the required environmental flow rate. Wherever possible gravity means and existing drainage lines will be used to transport the water from the 'clean' water storage dams to the creek systems. However, during years when this is not possible, due to the mine pit progression, it will be necessary to pump water from these dams into the creek systems.

A water balance model was developed to ensure that there would be an adequate supply of 'clean' water for environmental flow needs. This model was similar to the model developed in **Section 8.3.1**; however the only demands on the water stored in the 'clean' water dams were the environmental flow demands and the losses associated with evaporation from the basin water surface.

In order to represent existing rainfall conditions at the site the model utilised the most recent 30 year rainfall record recorded at the Gulgong Post Office.

Results of Environmental Flow Water Balance

The results obtained from the water balance model for the 'clean' water storage system can be observed in **Figure 31**. It can be seen that throughout the entire 30 year mine period there is more than enough 'clean' water stored for use as environmental flows. At no time during the 30 year mine period will there be insufficient water available for environmental flows. **Figure 31** also indicates that there will be two periods when there is a large volume of 'clean' water stored. The two periods, Years 0 to 8 and 18 to 24, correspond to periods in which a number of temporary 'clean' water storage dams will be online. This is due to the large areas that will be mined during these periods.

8.3.6 Downstream Water Users

The proposed water management system has been designed to ensure that the water management needs of the project in terms of water quality control, management of pit inflows and prevention of ingress of floodwaters are achieved while minimising the impact on the Wilpinjong Creek system.

The system has been designed to utilise poorer quality runoff from the mining area for coal processing and dust suppression. This will minimise the potential for adverse off-site water quality impacts as a result of discharges. A staged water management system has been developed that seeks to minimise the catchment area of the mine water management system at any time while still providing adequate control for runoff from disturbed areas and prevention of inflows from drainage lines and creeks into the open cut pit.

As mining progresses, mined sections will be rehabilitated and a post-mining landform will be created. This will involve shaping the rehabilitated area to enable surface water runoff from the upper catchment to flow to the rehabilitated Murragamba and Eastern Creek alignments. The post-mining landform will be discussed in detail in **Section 8.6**. Based on current mine planning, rehabilitation is expected to occur from approximately Year 2 onwards.

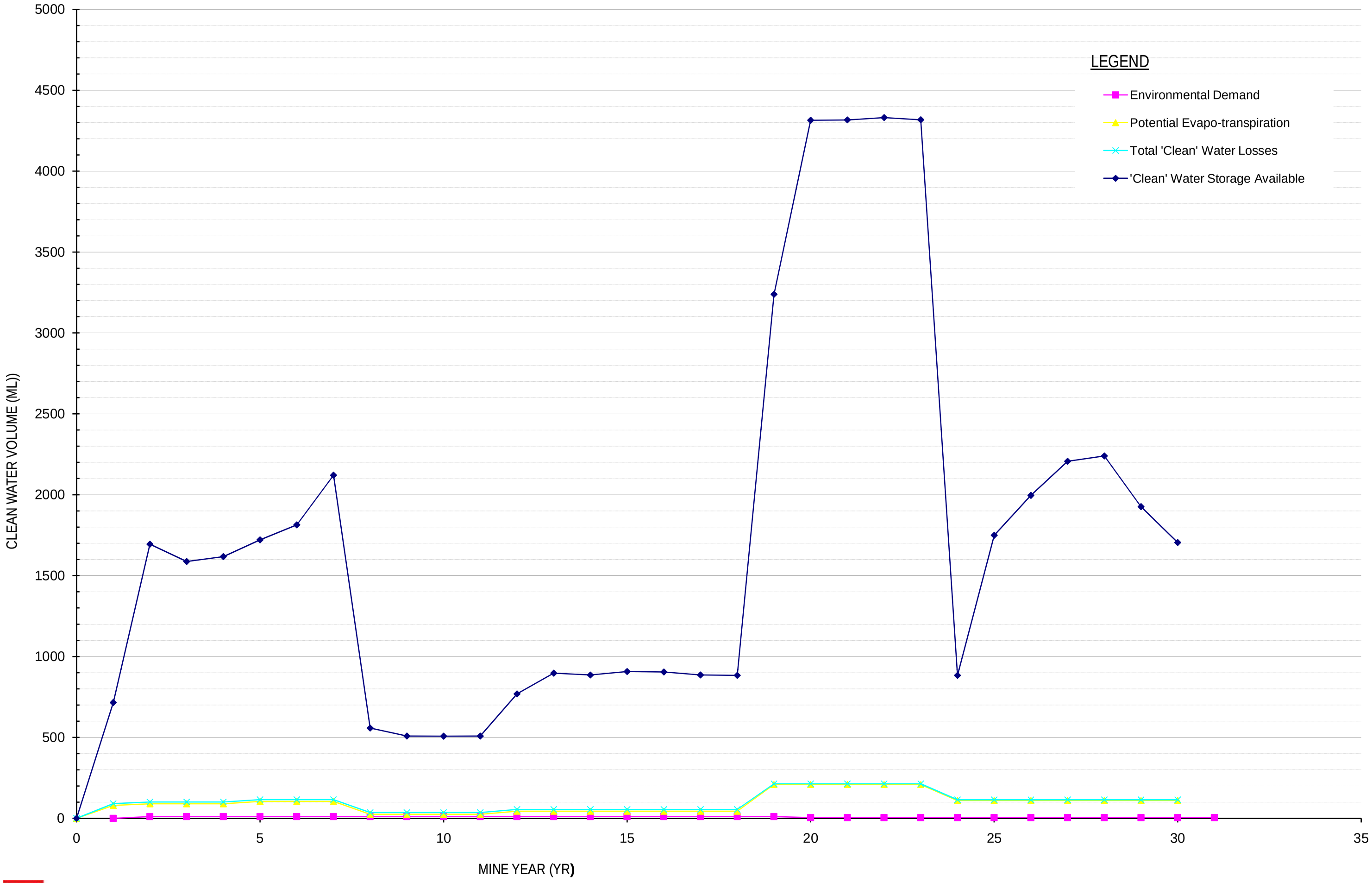
Once mining ceases and disturbed areas are rehabilitated, annual flows from Murragamba and Eastern Creek flowing into Wilpinjong Creek are expected to be similar to those existing prior to mining.

8.3.7 Potential Impact on Flows to Wilpinjong Creek

The mining operations that are proposed as part of Stage 2 of the Moolarben Coal Project have the potential to reduce baseflows from Murragamba and Eastern Creek that enter Wilpinjong Creek and the upper reaches of the Goulburn River.

Analysis was undertaken to determine the possible reduction in flows from the sub-catchments within Stage 2 of the Moolarben Coal Project. This involved determining the predicted runoff from the Murragamba and Eastern Creek catchments and comparing it to the expected runoff from the post-mining landscape.

FIGURE 31



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Clean water balance30 yr rainfall data.xls
FIG31

PREDICTED 'CLEAN' WATER SUPPLY AND DEMAND

The assessment of the potential reduction of flows was undertaken using the 2 year recurrence storm rainfall data for the Stage 2 area to determine pre and post mining runoffs from the site. The mining activities that are to occur in the Murragamba and Eastern Creek catchments could have the potential to reduce the volume of runoff that is potentially captured during storm events. As outlined in previous sections, this is due to a number of factors including the potential for subsidence cracks and higher infiltration rates in rehabilitated areas.

The analysis of the potential impact of the post-mining landscape on flows entering into Wilpinjong Creek determined that overall it is expected that there would be approximately 7% reduction in total surface water runoff entering the downstream creek systems. It should be noted that this would be the maximum potential reduction in surface water runoff and would occur immediately after mining operations had ceased. It is anticipated that this value would reduce progressively as the overburden areas consolidate and any surface cracks are naturally filled.

8.3.8 Surplus Dirty Water Management

As discussed in Section **8.3.1**, water balance modelling has established that there will be excess water in the latter years of the mine life (*Aquaterra, 2008*). This is in part due to the high inflow rates expected from UG 4 and surface water runoff from disturbed areas.

In order to effectively manage the excess of water in the latter stages of the mine life it will be necessary to adequately treat the excess water prior to discharge into Murragamba and Eastern Creeks.

The results of testing undertaken as part of the Stage 1 approvals (*refer Peter Dundon& Associates*) have indicated that the groundwater inflows from UG 4 will be of relatively good quality, with only some metal concentrations exceeding acceptable standards. Therefore, the water management strategy is based on the treatment of this surplus groundwater from UG4 (*and surface runoff*) to acceptable quality for discharge to Murragamba and Eastern Creeks.

It is recognised that an approval will be required for the controlled discharge of water into the local creek network. This is considered to be achievable due to the quality of water that will come from Underground No 4.

Erosion and Sediment Control

The surface water assessment was undertaken on the basis that erosion and sediment control measures will be adopted as part of the detailed construction documentation for components of the mine infrastructure area and that the associated control measures will be designed in accordance with:

- the relevant guidelines for erosion and sediment control, including those outlined by the Department of Housing (*1998*) and the Department of Natural Resources (*1999*); and,

- where relevant, to a standard consistent with guidelines outlined in the Landcom document titled, *'Managing Urban Stormwater Soils and Construction'* (*2004*), which is commonly referred to as the 'Blue Book'.

Construction Phase

Erosion and sediment control measures will be implemented during the construction phase of the Project to control the quality of runoff from the site. These measures will include:

- construction and regular maintenance of catch drains, silt fences and sedimentation ponds to contain sediment downslope of disturbed areas;
- construction of the sedimentation ponds within the mine infrastructure area;
- revegetation of disturbed areas;
- development of an appropriate inspection, maintenance and management system; and
- placement of oil management systems downslope of high trafficked hardstand areas and storage areas.

Operational Phase

Erosion and sediment control measures will also be implemented during the mine life. These will comprise:

- clear identification and delineation of areas that will be disturbed as part of the mining process so that disturbance is limited to those areas;
- minimising the clearing of vegetation to allow the works to proceed and to minimise machinery disturbance outside of these areas;
- limiting the number of roads and tracks established;
- construction of sediment dams to capture, contain and recirculate runoff from disturbed catchment areas;
- construction of drains upslope of areas to be disturbed to convey clean runoff away from most disturbed areas;
- constructing access road and earthworks cut and fill batters at slopes (*of 1V:3H or less, where possible*), to maximise long term stability;
- reshaping, topsoiling and vegetating road and cut and fill batters as soon as practical;
- progressively stripping and stockpiling topsoil for later use in rehabilitation;
- diversion of surface and road runoff away from disturbed areas;
- regular maintenance of erosion control works and rehabilitated areas; and,
- placement of oil management systems downslope of high trafficked hardstand areas and storage areas.

8.4 PROPOSED SCHEDULE FOR CREEK DIVERSION AND REALIGNMENT OF MURRAGAMBA AND EASTERN CREEKS

8.4.1 MCM Vision for Creek Diversion and Reconstruction

In order to successfully rehabilitate and realign Murragamba and Eastern Creeks it will be necessary to plan the re-construction based on the proposed staging of the mine progression for Open Cut 4, while incorporating the principles outlined in the creek relocation vision statement listed below: .

> "*Murragamba and 'Eastern' Creeks are rehabilitated to an ecologically sustainable and visually appealing landscape upon completion of mining operations for Stage 2 of the Moolarben Coal Project*"

This will be achieved by:

(i) designing a morphologically stable post-mining system of creek channels linked to an active adjacent floodplain;

(ii) preserving a number of morphologically significant sections of Murragamba Creek by preventing mining operations from occurring in these areas;

(iii) developing rich ecological areas for flora and fauna along the creek channel; and by

(iv) retaining and enhancing remanent native vegetation wherever possible.

The proposed schedule for the proposed diversion and reconstruction of affected sections of Murragamba and Eastern Creeks is outlined in the following sections.

8.4.2 Years 1 to 5

Mining is proposed to commence at the southern or upstream end of Murragamba Creek as shown in **Figure 32**. Accordingly, it will be necessary to divert the upstream section of Murragamba Creek to allow mining to proceed. This section of the stream is not incised into the floodplain and presents as a wide overland flowpath with isolated sand splays that are evidence of fluvial activity.

However, due to the extent of the valley that will be mined, it will not be possible to replicate this geomorphic feature during mining. Hence, it is proposed that a new channel be constructed along an alignment to the east of the pit shell and for that channel to be retained as a permanent alignment for the creek.

In summary, the creek diversion works over the period from Years 1 to 5 will involve the following:

- Construction of a temporary farm dam structure (*Dam 1*) which will be sited at the upstream end of the valley immediately upstream from the pit shell. This dam will serve to collect runoff from the upstream catchment (*including Munghorn Gap Nature Reserve*) and thereby prevent it from being discharged into the open cut pit.

Water stored in the dam will be used to "top up" environmental flows that will need to be maintained along Murragamba Creek over the mine life.

- A new channel will be constructed in virgin material along the eastern perimeter of the pit shell. The channel will extend from a spillway to be constructed within the downstream face of Dam 1, to the upstream end of the morphologically stable section of Murragamba Creek, as shown in **Figure 32**.

  An invert level of 492 mAHD is proposed at the upstream end of the creek near the base of the Dam 1 spillway. This elevation will allow sufficient slope for the diversion channel to discharge runoff under gravity flow conditions.

- As mining proceeds over the first five years, the pit will gradually increase in size and extend to the north. As this occurs, runoff from the catchment extending to the south-west will need to be diverted around the pit. This will allow it to be discharged to the diverted creek without contamination.

  This will be achieved by installing a "catch drain" along the south-western boundary of the pit which will collect runoff from the catchment and allow it to be directed by gravity flow to the north. Runoff collected from this section of the catchment will be directed by these catch drains to the open floodplain of Murragamba Creek and allowed to discharge into the new diversion channel.

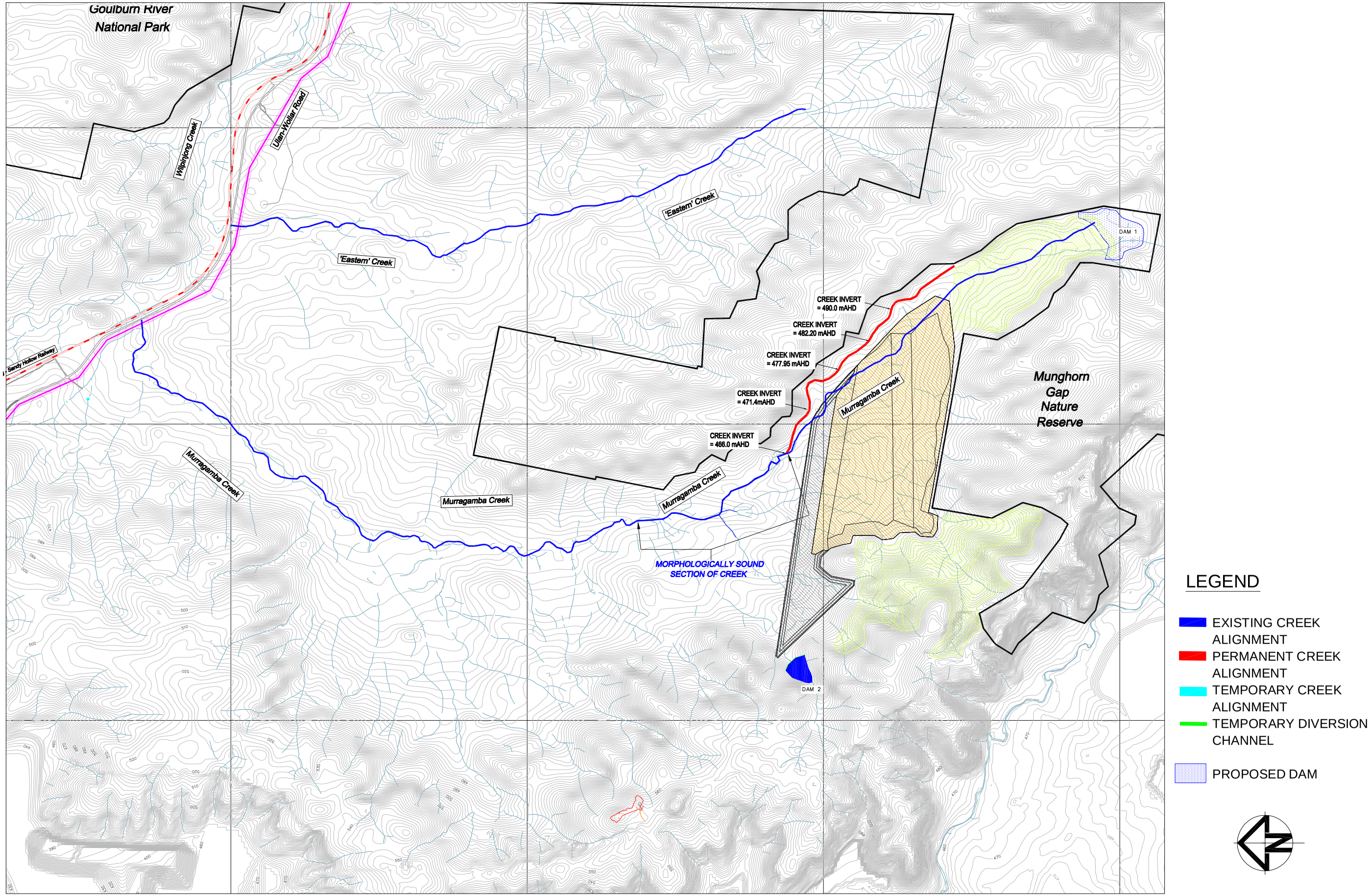
8.4.3 Years 5 to 7

By Year 5, mining within the open cut would have extended sufficiently to the north to prevent runoff collected from the catchment extending to the south-west of the pit to be allowed to discharge across the existing floodplain of Murragamba Creek. This is because the pit will effectively have extended into this floodplain.

Therefore, it will be necessary to construct a small dam to the south-east of the pit and for runoff collected by the catch drains to be directed to this dam (*Dam 2*). A suggested location for Dam 2 is shown in **Figure 33**. Water will be diverted from the slopes above the pit towards this dam. A temporary channel will be constructed to connect the dam to the undisturbed valley/creek to the north of the open cut pit. It is envisaged that water stored in Dam 2 could be used to "top-up" the environmental flows required for Murragamba Creek, and to supplement water resource requirements for the mining operation.

In addition to this, it is anticipated that by the start of Year 5 the creek realignment undertaken in Years 1-5 will have become hydraulically stable. That is, there would have been sufficient time for a substantial ground cover to be developed across the base of the channel and the potential for scour of the constructed channel will be greatly reduced. Once this stage has been reached it will be possible to decommission Dam 1. Effectively this will involve constructing a diversion channel around the eastern edge of the overburden emplacement, allowing waters from the upper catchment to flow freely into Murragamba Creek.

FIGURE 32



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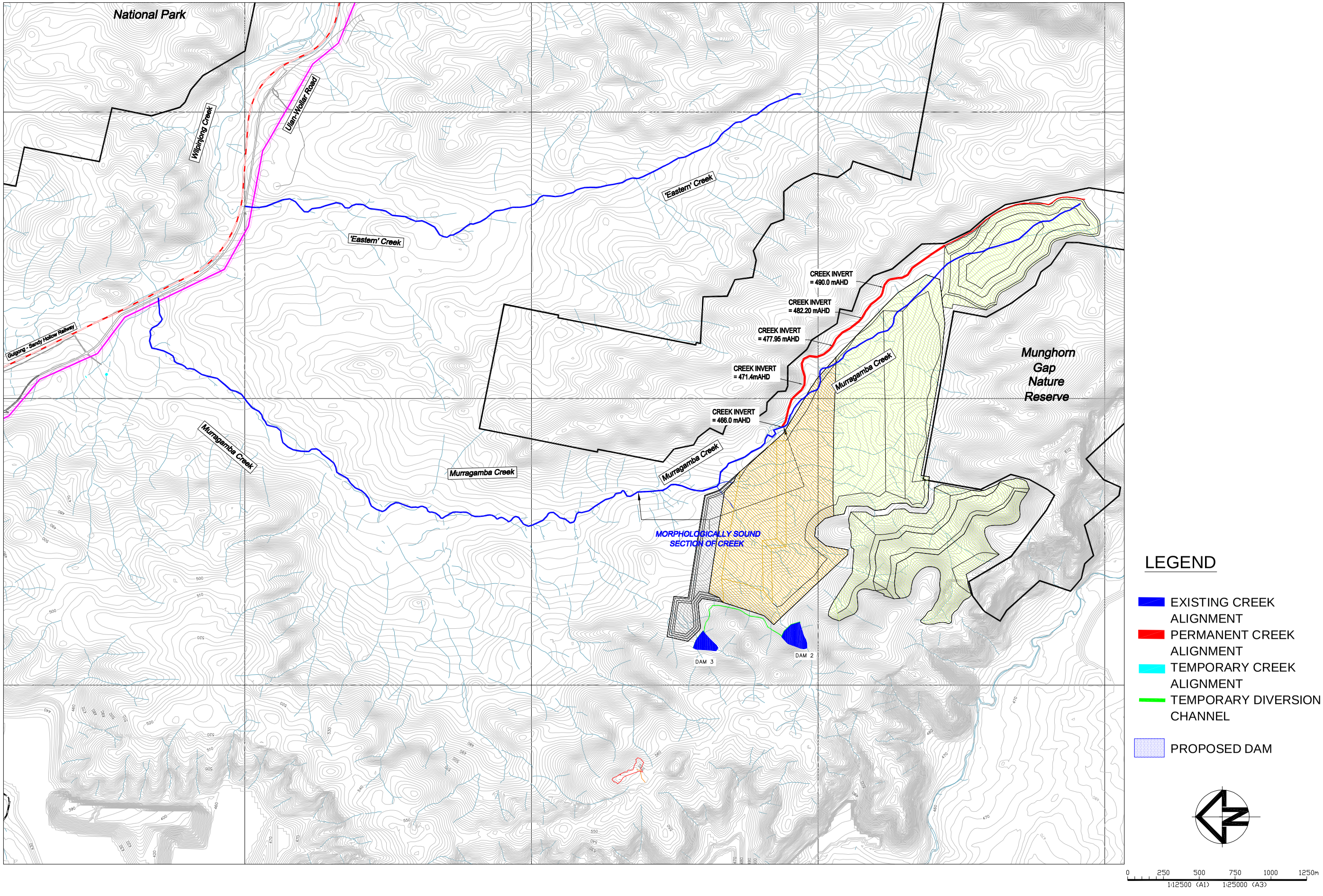
MINING YEARS 1 - 5
PROPOSED CREEK ALIGNMENT



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MINING YEARS 5 - 7
PROPOSED CREEK ALIGNMENT

8.4.4 Years 7 to 8

As the mining progresses to the north it will be necessary to construct another dam (*Dam 3 in* **Figure 34**) to collect runoff from the catchment extending to the south-west of the open-cut pit.

It is proposed that Dam 2 be connected to Dam 3 via a gravity fed system. It is recommended that this be designed as an open channel so that additional runoff from the slopes that extend to the south-west of Dams 2 and 3 can be intercepted to avoid sheet flows from entering the open cut pit. A channel will also need to be constructed in the area downstream from Dam 3 to convey dam overflows to the undisturbed valley/creek to the north. The system would therefore continue to function as a distributor of environmental flows to Murragamba Creek.

8.4.5 Years 8 to 12

By the beginning of Year 8, it is envisaged that all of the area upstream of the morphologically sound section of Murragamba Creek will have been mined and backfilling and rehabilitation of the pit will have progressively occurred.

Mining will continue in the section of Murragamba valley north of the morphologically sound section of creek. During this period mining will begin in the western section of the valley and continue in an easterly direction. Mining will progress in an easterly direction until a point where the Open Cut pit is approximately 300 to 400 metres west of the current creek alignment.

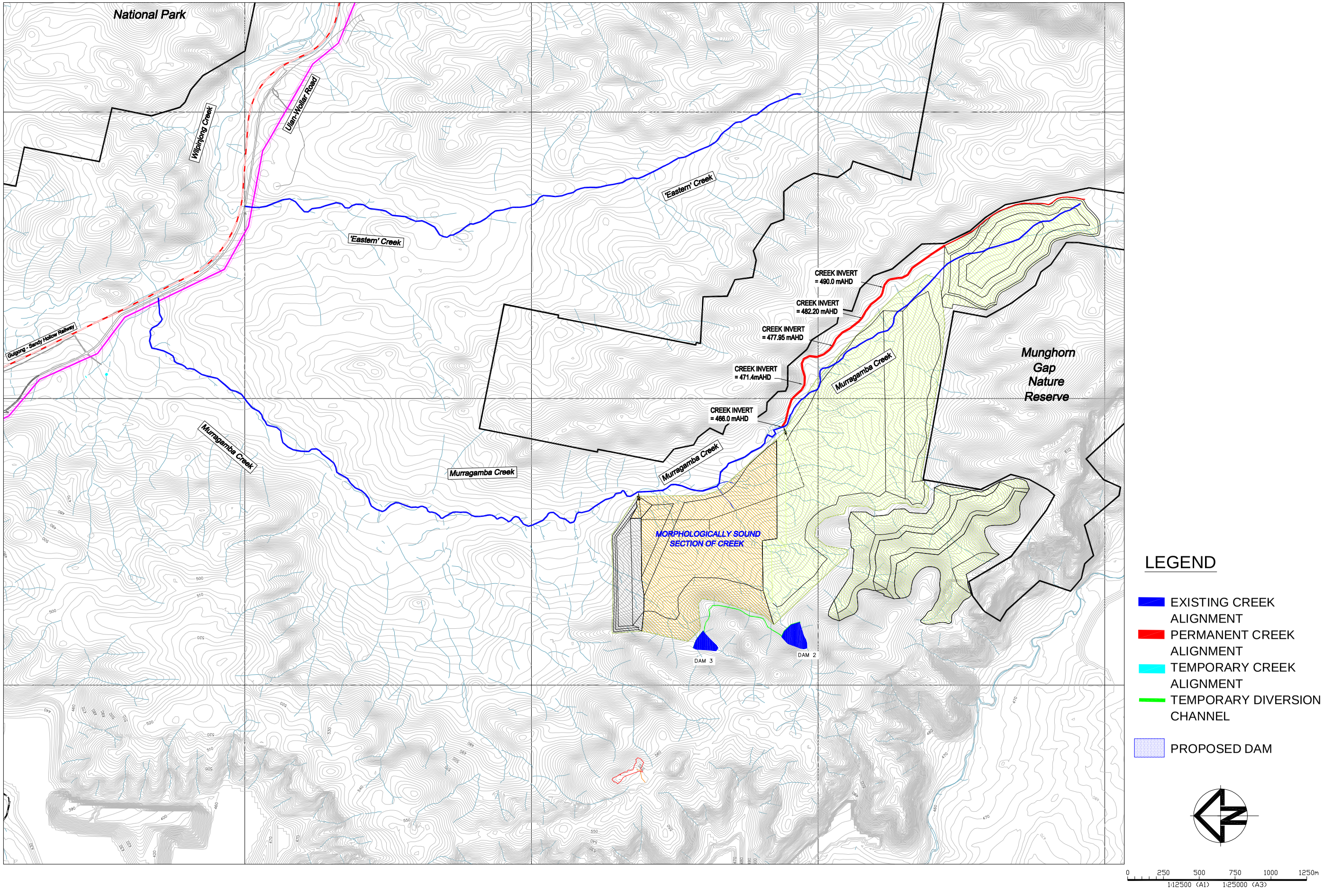
This approach will ensure that the existing flow path of Murragamba Creek is retained as long as possible in the area downstream of the morphologically stable section of creek. It will also allow the downstream discharge of flows in a manner that will prevent flooding of the open-cut pit.

The proposed future alignment of Murragamba Creek will be in the area 300 to 400m west of the current alignment. Mining this area at an early stage will mean that construction of the proposed alignment can be undertaken as soon as possible.

During the early stages of mining in the western section of Murragamba valley it will be necessary to construct an additional dam (*Dam 4*) in the area to the south-west of the open-cut pit. Dam 4 will be required to prevent surface water flows from the catchment to the south-west from entering the pit and for environmental flows. A potential location for Dam 4 is shown in **Figure 35**.

It is envisaged that it will be possible to connect Dam 3 to Dam 4 as a gravity-fed system. During the period that the western section of the open cut pit is being mined surface water flows from the western escarpment that are not diverted into Dam 4 will be diverted away from the Open Cut pit by a series of catch drains that will be connected to small dams along the western boundary of the Open Cut pit. Water stored in these dams could be pumped around the Open Cut pit to be used as 'base' environmental flows for Murragamba Creek

FIGURE 34



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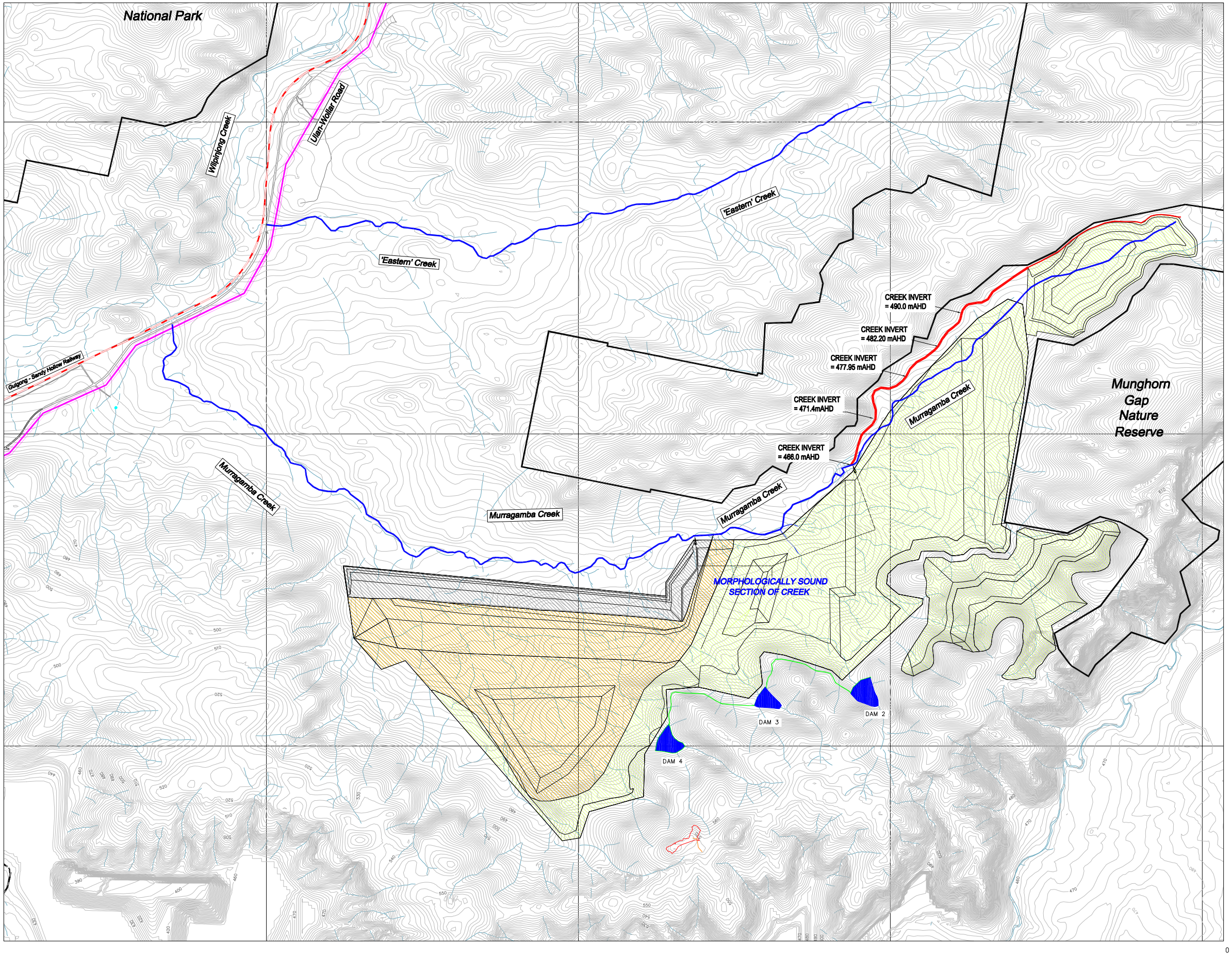
MINING YEARS 7 - 8
PROPOSED CREEK ALIGNMENT



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MINING YEARS 8 - 12
PROPOSED CREEK ALIGNMENT

8.4.6 Years 12 to 15

It is proposed that for Years 12 to 15 that a permanent diversion for Murragamba Creek be constructed in the area 300-400m west of the current creek alignment. The permanent diversion is conceptually presented in **Figure 36**.

It is proposed that the permanent diversion of Murragamba Creek be constructed as close to the start of Year 12 as possible, as it will not be possible to mine in the area of the existing alignment of Murragamba Creek until the proposed creek diversion is completed. Overburden from the area between the proposed creek alignment and the existing creek alignment will be used as fill and bed material for construction of the permanent creek.

At the completion of Year 15 the downstream extent of the Murragamba Creek realignment will have been reached. The creek realignment will extend until the edge of the proposed Open Cut 4 area which is approximately 800 to 900 metres upstream of the Ulan-Wollar Road bridge crossing. Upon reaching this location the constructed creek realignment will be keyed into the existing creek channel at this location.

The lower 800 to 900 metres of Murragamba Creek will be retained and rehabilitated. Rehabilitation will be undertaken to enhance the existing natural features of the creek and also to provide bank protection to the existing channel. It is anticipated that rehabilitation works will mainly involve landscaping and replanting of native species.

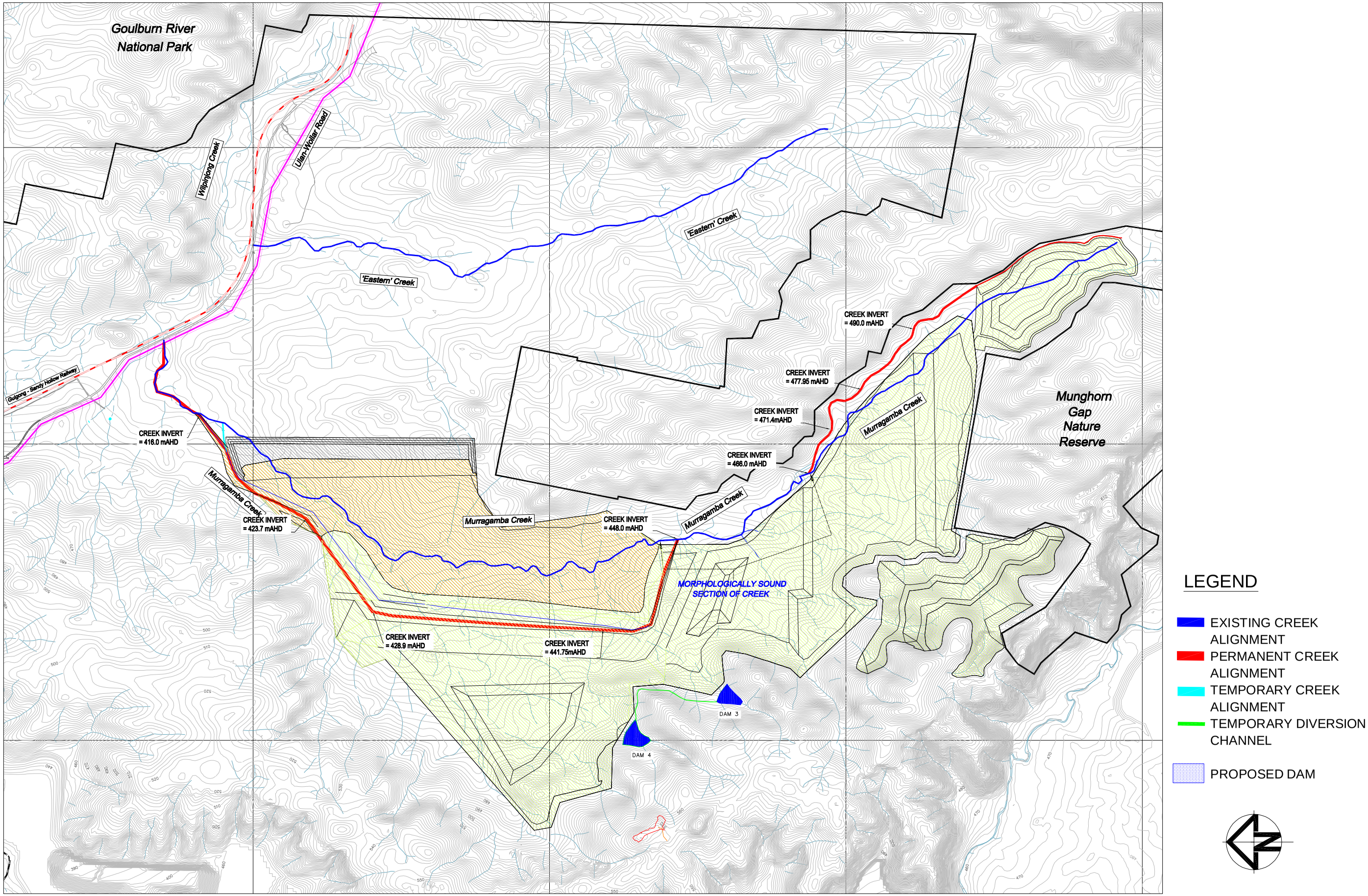
Upon completion of the proposed creek realignment it will be possible to continue mining in the area surrounding the existing alignment of Murragamba Creek. Mining will continue in an easterly direction continuing on through to 'Eastern Creek' valley.

8.4.7 Years 15 to 19

Before mining can commence in the 'Eastern Creek' valley it will be necessary to construct a temporary creek diversion for the lower reaches of 'Eastern Creek'. The temporary diversion will be located to the east of the current alignment of 'Eastern Creek'. The proposed location of the temporary creek alignment is shown in **Figure 37**. The temporary diversion channel will allow mining to occur in the northern section of the valley. Mining in this location will be undertaken in a westerly direction and will be an extension of the Open Cut pit that originated in Murragamba valley.

Once mining is completed in the northern section of the 'Eastern Creek' valley a permanent creek alignment will be constructed in the rehabilitated area of the open cut pit. The permanent creek alignment for 'Eastern Creek' will be located approximately 300m west of the existing creek alignment and is shown in **Figure 37**.

Mining in the 'Eastern Creek' valley will continue in the area upstream of where the permanent creek alignment has been constructed. To enable mining to be undertaken in this section it will be necessary to dam 'Eastern Creek' with a temporary structure. The dam will be built upstream of the Open Cut pit and will prevent water from entering the pit. As the mining pit progresses up the valley it will be necessary to relocate the temporary dam further upstream.



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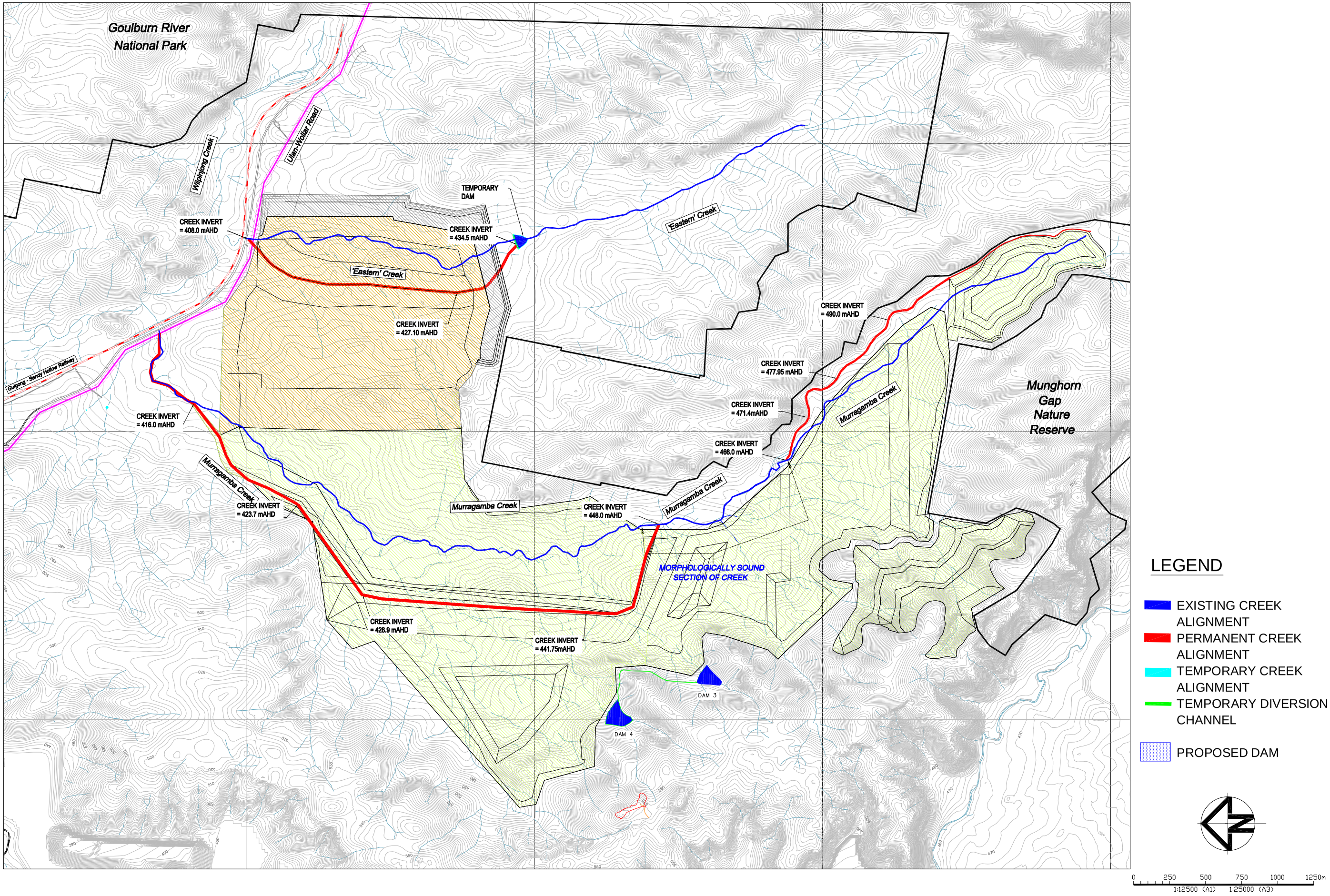
MINING YEARS 12 - 15
PROPOSED CREEK ALIGNMENT



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MINING YEARS 15 - 19
PROPOSED CREEK ALIGNMENT

Water that is stored in the temporary dam will be pumped to the permanent creek alignment to provide 'clean' water for environmental flows.

8.4.8 Years 19 to 24

While the mining is progressing in a southerly direction along 'Eastern Creek' valley the permanent creek alignment will also continue to progress up the valley. The construction of the permanent creek alignment will progress in a similar fashion as to what occurred during Years 15 to 19. That is, a temporary dam structure will be constructed upstream of the Open Cut pit. The temporary dam structure will prevent surface water from entering the pit and can be used for environmental flows in 'Eastern Creek'.

The permanent alignment for 'Eastern Creek' will also progress in a southerly direction through 'Eastern Creek' valley as mining progresses up the valley. As mining is completed in the Open Cut pit, the permanent alignment will be constructed in the rehabilitated area of the valley. As sections of the permanent creek alignment are completed, water will be pumped, or transferred by gravity means from the temporary dam structure to provide environmental flows.

By Year 24, mining in the 'Eastern Creek' valley will be completed, and the permanent realigned creek channel will be rehabilitated. The conceptual permanent alignment of 'Eastern Creek' can be viewed in **Figure 38**.

8.4.9 Comparison of Final Alignments to Existing Creek

The final alignments for Murragamba and 'Eastern' Creeks have been based on endeavouring to replicate a natural stream and to mimic the original flowpath of both creeks. The concept designs have been developed on the basis of providing a morphologically stable post-mining creek system while also preserving stable and environmentally sensitive sections along the original creek alignments.

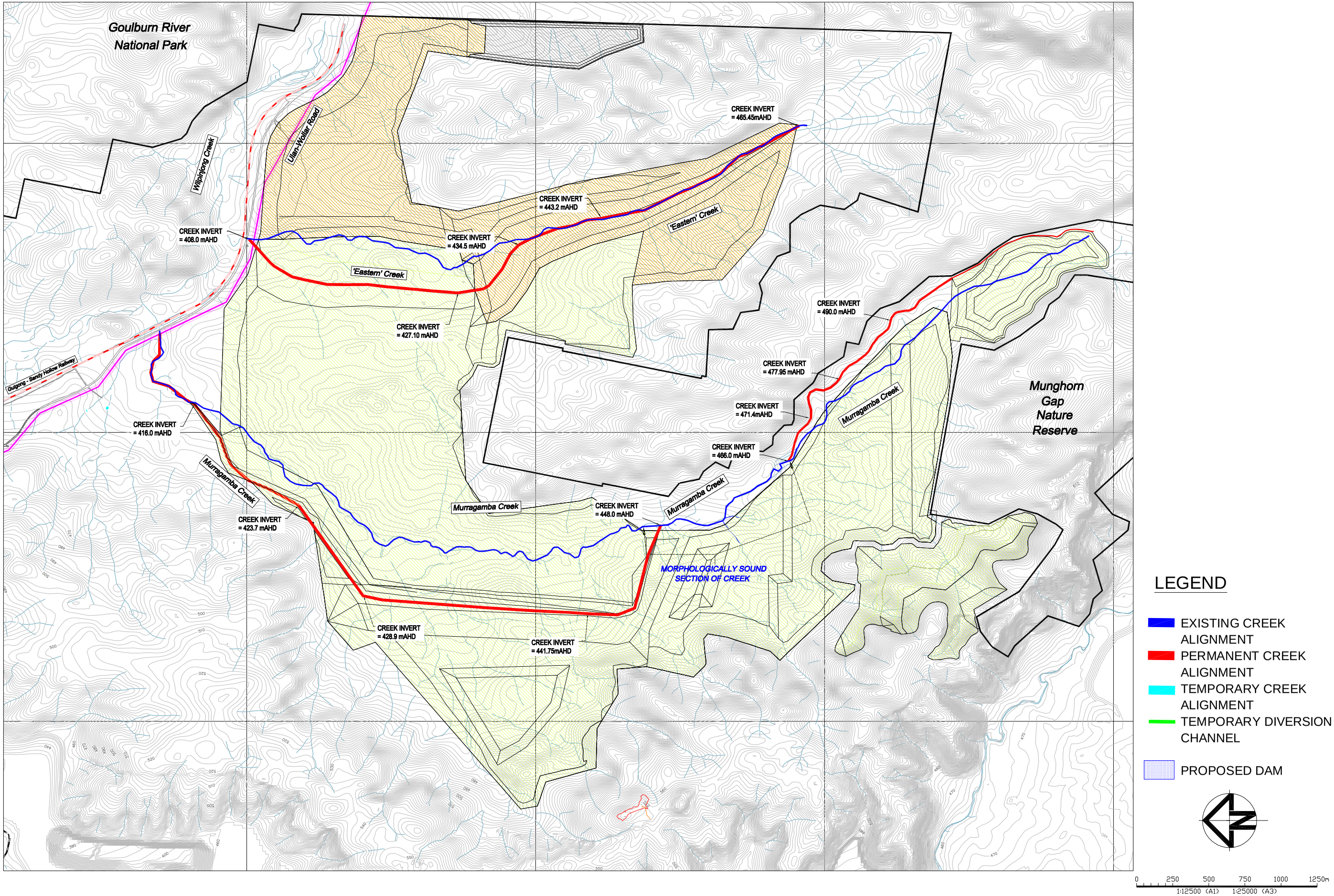
The proposed post-mining alignments for both Murragamba and Eastern Creeks are show in **Figure 39**. This figure shows that where possible, the proposed post-mining creek alignment follows the existing creek alignment.

8.5 PROPOSED CHANNEL SCOUR AND EROSION PROTECTION

8.5.1 Pool and Riffle Sequences

As outlined in **Section 6**, it is proposed that a pool and riffle sequence be incorporated into the post-mining channels for both Murragamba and Eastern Creeks. The pool and riffle sequence will allow the channels to mimic a more 'natural' creek regime while also reducing average channel bed slopes and thereby reducing peak flow velocities.

It is recommended that artificial riffles, or drop-structures, be constructed within the low flow channel at approximately 200 to 300 metre intervals over the length of each channel diversion. The conceptual locations for these structures are shown in **Figures 11** to **15**.



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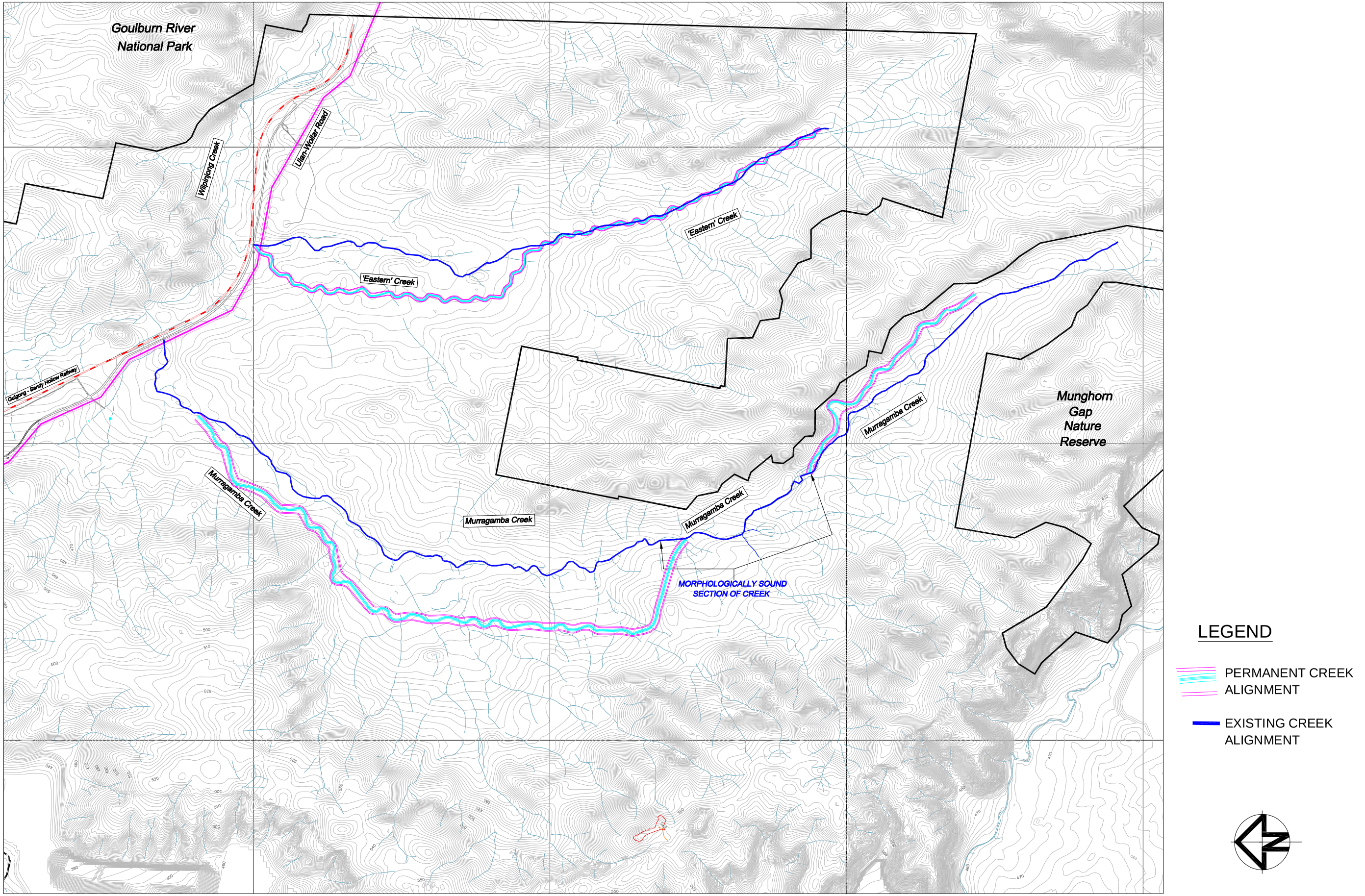
MINING YEARS 19- 24
PROPOSED CREEK ALIGNMENT



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COMPARISON OF THE EXISTING CREEK AND THE PROPOSED POST-MINING CREEK ALIGNMENTS

The riffle structures will control in-channel velocities and minimise the potential for bed scour and erosion along the low flow channel. They have been designed to allow for the passage of fish and can be constructed to replicate aquatic habitats encountered along the existing creek lines.

A typical long-section of the proposed riffle design is presented in **Figure 40**. The design has been developed in accordance with guidelines outlined in the literature.

The proposed pool and riffle sequence uses a rock ramp riffle which results in an effective channel bed drop of up to 0.5 metres. It is formed by a rock weir extending across the low flow channel, with loosely placed rock extending downstream from the weir at an average slope of 1(H) in 20(V).

The toe of the riffle is defined by connected 1 metre by 1 metre rockfilled gabions extending across the width of the channel. As part of the design, the gabion toe is "keyed" into the side-slopes of the low flow channel to provide stability, and to resist bank erosion through the process of outflanking. As an alternative to gabions, imported large armour stone (typically d_{50} of 600 mm) could be used to provide a more robust toe.

The purpose of the gabions or rock toe is to provide a mechanism for energy dissipation, thereby preventing the formation of head cuts and bed scour. Large sized rip-rap is to be placed at the ridge to provide roughness, increase the pool diversity and habitat, and to prevent excessive erosion.

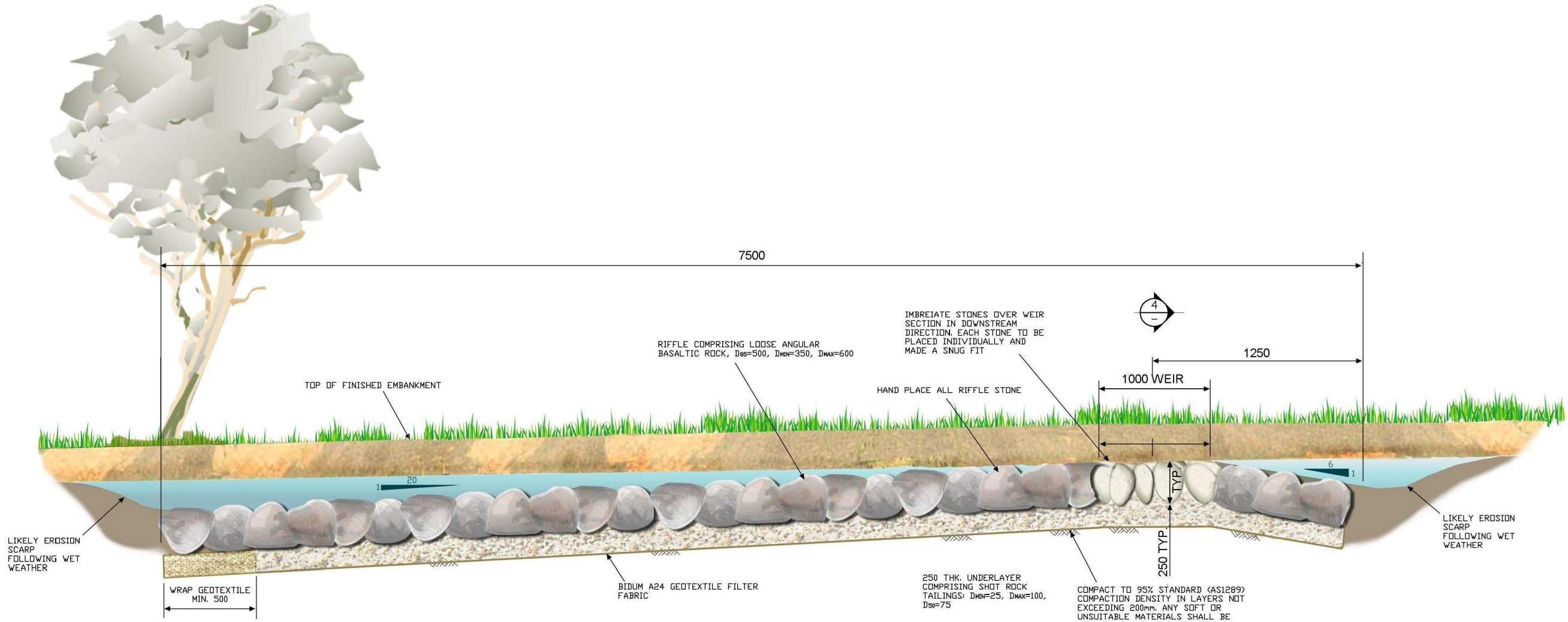
The rip-rap will consist of angular rock of various sizes packed tightly to reduce the porosity of the structure. Large oversized rocks will be included in the riffles and will protrude from the surface creating a more complex but natural surface condition, thereby increasing habitat potential. The design effectively creates a channel bed drop that will not impede the passage of fish.

It should be noted that wherever possible the use of large woody debris should be incorporated into the design of the pool and riffle structure. This will enable the development of a more natural design that will use materials that may be produced during the clearing of areas that are to be mined in Open Cut No .4.

8.5.2 Erosion and Sediment Control

Stream bed and bank erosion can be controlled using a range of both structural measures and vegetative techniques. There are three main types of erosion which will be addressed in the design of the realigned channel (Rutherford et al, 2000). They are:

- sub-aerial erosion;
- fluvial scour; and
- mass gravity failure.



TYPICAL RIFFLE SECTION
N.T.S.

SECTION 4
N.T.S.

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J6173_01_FIG33_LongSectProposedRiffle.jpg

LONG SECTION OF PROPOSED RIFFLE STRUCTURE

Sub-aerial erosion is caused by processes which are unrelated directly to channel flow e.g. rain splash, surface run-off, and rill erosion. This type of erosion is more common on the upper and mid banks and is heavily dependent on the bank slope, soil characteristics and vegetation cover. Mitigation measure to protect against sub-aerial erosion of the top soil layer include the planting of native perennial grasses which will increase soil cover and cohesion properties, and to increase hanging cover from trees which will decrease erosion from rain-splash.

Fluvial scour occurs due to the direct action of water flow eroding bed sediments and is directly related to flow velocity and shear stress. This type of erosion has the potential to cause problems in the realigned channel due to the decrease in channel length and therefore increase in velocity and shear stress. It is important to mitigate against this, as scour at the bank toe ultimately controls the rate of bank erosion. Lower bank vegetation can decrease flow velocities close to the bank and can also strengthen bank material making it harder to remove. Also macrophytes which grow close to the toe of the bank or in the main channel are particularly good.

Structural measures which will be adopted include the placement of rip-rap protection and grade control. The rip-rap is to be provided at the interface between the stream bed and the steeper lower banks to a depth of approximately 0.5 metres below the anticipated bed scour depth, to be determined at the detailed design stage. Grade control measures involve the construction of artificial riffles or drop structures placed at 200 to 300 metre intervals along the length of post-mining creek alignments. The drop structures will reduce the bed slope of the channel between the riffles and subsequently reduce in channel velocities.

On shallower runs rock, gravel, and river sand will be used to anchor the bed sediments. At the end of each riffle gavel gabions will be constructed and rocks placed to reduce the formation of scour pools.

Mass gravity failure occurs were large sections of bank collapse in the stream. Deep rooted riparian trees with soil binding characteristics can reinforce the failure plane and increase bank stability. A dense tree coverage increases the thickness of the boundary layer over the bank, substantially reducing shear stresses acting on the surface of the bank and increasing resistance to mass bank failure.

In order to protect the realigned channel from erosion it is proposed that a number of techniques be incorporated into the design of the channel. It is anticipated that the constructed creek channel will require rip-rap protection and rock protection of creek banks on the outside bends of the creek and areas where high flows are identified. In addition to this the conceptual design of the creek alignment has incorporated the following:

- oversizing of the low flow path to allow for some sedimentation and to limit potential scour during the early establishment phase.
- incorporation of a temporary retardation storage upstream of the inlet of the reconstructed creek to ameliorate potential scour associated with high flows during establishment phase.

It may also be necessary to incorporate temporary armouring and reinforcement of banks in riffle zones to provide stability during the vegetation establishment stage of the creek realignment.

The creek base for the realigned sections of Murragamba and Eastern Creek should be constructed from compacted overburden material. It would then be necessary to seed the base of the channels with native grasses to provide erosion protection. As both Murragamba and Eastern Creeks are both ephemeral and therefore receive insufficient runoff to maintain permanent creek flows, it is expected that the establishment of native grasses within the creek channel would provide sufficient protection during flows following local catchment storms.

In locations where it is necessary to maintain a permanent water source, it will be necessary to line the base of the channel with clay. This should be undertaken in the areas upstream of riffle structures. This will reduce the infiltration rate of the ponded waters into the overburden material.

The exact design of the pond areas will be determined in the detailed design stage and will require input from terrestrial and aquatic ecologists. There may be scope to provide deeper sub-surface aquaclades for long pool segments (*say in the form of deep clay lining*), overlaid with deep sands and then overlayed with surface water retention and energy dissipation structures as recommended by Ecovision Consulting in their Ecological Impact Assessment for Stage 2 of the Moolarben Coal Project.

8.5.3 Habitat Generation

Apart from the structural components of the proposed riffles and drop structures to be incorporated into the channel diversion, it is also proposed that the channel be vegetated to create a similar habitat to that found in the existing Murragamba and Eastern Creek channels. A conceptual section for the proposed realigned stream is shown in **Figure 16**.

As part of the channel design, the interface between the stream bed and the steeper lower banks will be protected by placed rip-rap. Rip-rap is to be provided to a depth of approximately 0.5 metres below the anticipated bed scour depth, which will be determined at the detail design stage. The structural measures are provided to mitigate bed and bank scour, as it is recognised that scour at the bank toe ultimately controls the rate of bank erosion.

Planting on the realigned channel will increase the riparian species diversity above the current diversity, which has been depleted by former land use practices (*ie., cattle grazing and trampling*). A combination of native shrubs, herbs, native grasses and tree species specially selected, will be determined as part of the detail design.

Examples of vegetation species that could be used (but not limited to) to create an appropriate varietal habitat within the realigned stream, are listed in **Table 24**.

Table 24 EXAMPLES OF VEGETATION SPECIES TO USED IN STREAM REHABILITATIONS WORKS

LOCATION	SPECIES
Lower banks	*Lomandra longifolia* *Phragmites Austraus* *Juncus Usitatus* Water Couch (*Paspalum distichum*) Swamp She-Oak (*Casuarina Glauca)* River She-Oak (*Casuarina cunninghamiana*)
Mid banks	Prickle Leaved Paperbark (*Melaleuca styphelioides*) *Melaleuca thymifolia* *Melaleuca decora* Rough-barked Apple (*Angophora floribunda*) Acacia Floribunda *Shorthair Plumegrass* (Dichelachne micrantha)
Upper banks	River Red Gum (*Eucalyptus camaldulensis*) *Eucalyptus Amplifolia*

A range of native grasses and trees are proposed for the in-channel bench and channel side-slopes (*refer* **Figure 16**). The potential for erosion along the in-channel terrace is to be mitigated through the use of dense copse of deep-rooted tree species with soil binding characteristics. A dense tree coverage increases the thickness of the boundary layer over the bank, thereby reducing shear stresses acting on the surface of the bank during high flows.

The dense copse will be aligned so as to centralise low and mid-bank flows, and thereby minimise erosion potential. The indigenous species selection and planting density will enhance habitat, and provide shade protection to the banks and in-stream habitat.

8.5.4 Subsidence Issues

An assessment on the potential for subsidence to influence the natural features and surface infrastructure as a direct result of longwall mining has been undertaken by Mining Subsidence Engineering Consultants (*July 2008*). The MSEC Report indicates that there is potential for fracture zones to extend from the Ulan Seam to the surface in areas above the proposed longwalls. This could lead to an increase in surface water capture in these fracture zones, effectively reducing potential surface runoff volumes. This could in turn reduce potential flows entering the post-mining creek channels of Murragamba and Eastern Creeks.

However, the MCES Report also indicates that the anticipated reduction in surface water flows to the major drainage lines would be greatest in the period immediately after mining has taken place.

In this context, it is expected that with time the fracture zones will gradually infill as sediments are transported with the surface water flows will eventually fill these cracks.

The main issue associated with potential subsidence will then relate to the post-mining rehabilitated alignment of Murragamba and Eastern Creeks. Accordingly, it will be necessary to ensure that areas within the creek channel that have the potential to retain water, such as those associated with the proposed pool and riffle sequence, are adequately protected against surface fractures. Protection for these areas of the creek could be achieved by clay lining the creek bed which would allow potential fracture zones to self anneal.

8.6 PROPOSED POST- MINING LANDFORM

Upon completion of mining in Open Cut 4 it will be necessary to rehabilitate the overburden areas of the open cut pit. This rehabilitation includes revegetation and also contouring the post-mining landform.

Contouring of the post-mining landform is necessary as it will allow the conveyance of surface water flows from the undisturbed upper reaches of the catchments down to the rehabilitated main channels of Murragamba and Eastern Creeks.

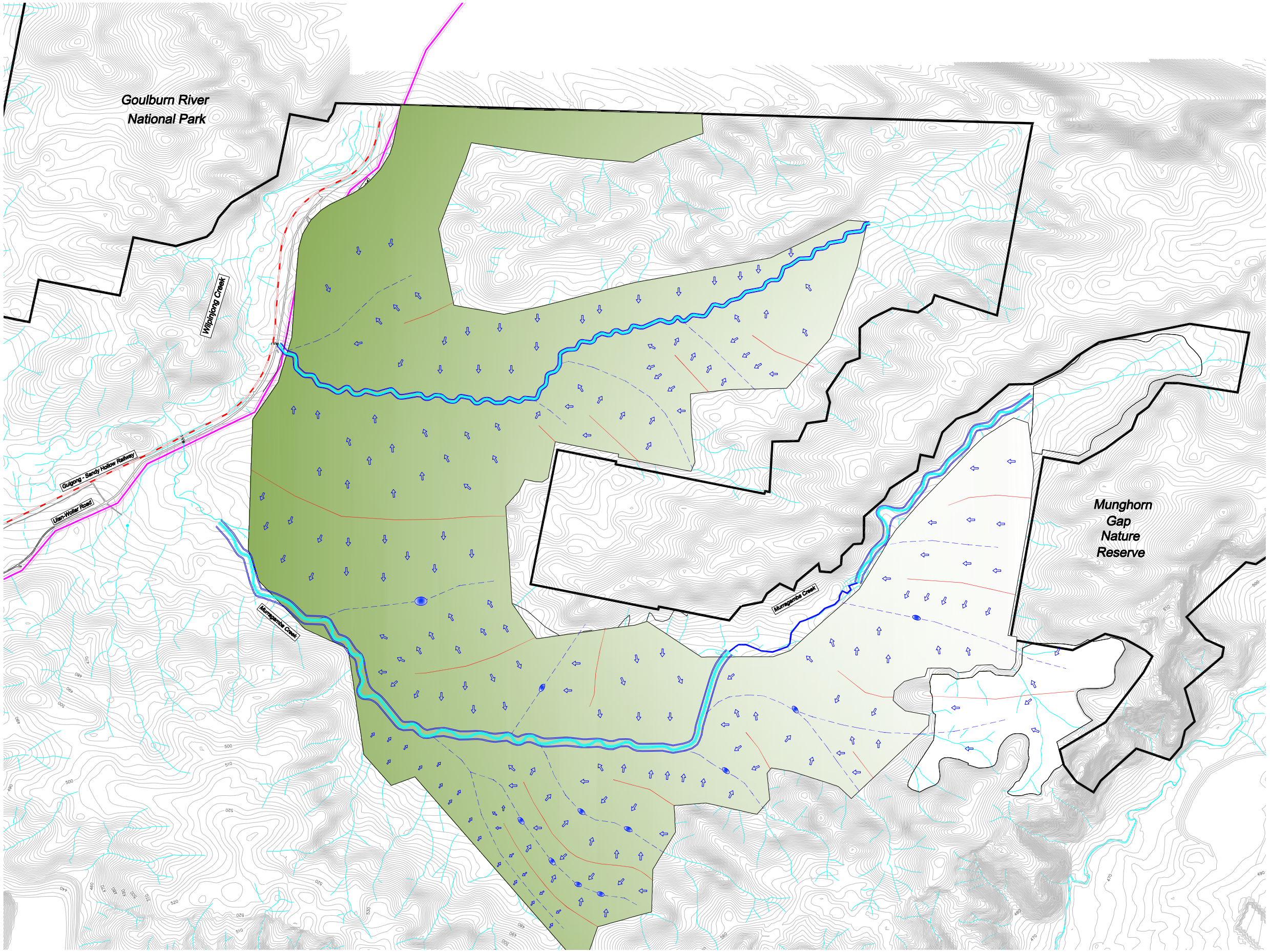
A conceptual post-mining landform has been prepared and is shown in **Figure 41**.

Figure 41 indicates that a series of ridges and gullies will be required to enable surface water flows to be concentrated and directed into both Murragamba and Eastern Creek. The conceptual design of these ridges and gullies requires the land to be sloped from the base of the gully to the ridge at a minimum of 1%. This will enable the free flow of surface water over the rehabilitated area towards local drainage networks that will be situated at the base of gullies.

The location of gullies has been designed so that the water storage areas that will be required as part of the mine surface water management strategy (*ie sedimentation ponds*) can be incorporated into the gullies of the post-mining landform. This will allow surface water to flow from the surrounding land into the series of ponds.

Upon reaching ponds, the water can be retained providing habitat for flora and fauna. The design of these areas will also require connection between ponds. This will enable water to freely flow towards the main drainage lines of Murragamba and Eastern Creek during periods of high flow. As mentioned in **Section 8.3.1**, it is recommended that a chain of ponds be utilised to enhance the aquatic and terrestrial ecosystem in the post-mining valley.

The proposed post-mining landform also aims to utilise the existing ridge lines of the surrounding catchment. It is proposed that the designed ridge lines be an extension of existing ridge lines that are present in the upper undisturbed portion of the catchment.



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SCHEMATIC REPRESENTATION OF THE POST-MINING LANDFORM FOR OC4

9. MONITORING AND CONTINGENCY MEASURES

9.1 SURFACE WATER MONITORING

The following recommendations are made for monitoring surface waters and the water management system during the mine life:

- A gauging station should be established at the downstream end of Murragamba and Eastern Creek for low flows and changes in EC
- A comprehensive monitoring and reporting programme should be included in a SWMP. The SWMP should also document management procedures for water pollution control and the operation of the water management system. The SWMP should be updated periodically.
- The baseline water quality monitoring programme should continue on Moolarben Creek and Bora Creek, and should also include additional sampling points including:
  - In the downstream reaches of Eastern Creek before discharging into Wilpinjong Creek;
  - downstream of Splitters Hollow dam before its confluence with Wilpinjong Creek,
  - a site located on Wilpinjong Creek as the creek flows out of EL 6288,
  - a site located on Wilpinjong creek upstream of its confluence with Murragamba Creek
  - a site located on Wilpinjong Creek upstream of its confluence with Eastern Creek.

Sampling should be conducted during representative flow events. Samples should analysed as for pH, turbidity, salinity and suspended solids as a minimum. The final locations of the additional baseline water quality monitoring stations will be determined through consultation with the DECC, as well as with Wilpinjong Coal Mine, which has a number of water quality monitoring sites in the area.

- Operational water quality monitoring should be conducted. Monitoring should target all significant runoff events (*i.e., greater than 20 mm in 24 hours*).
- Water levels (*reduced to a common datum*) should be recorded in all on site water storages areas on a monthly basis.
- The conceptual water balance model should be used to monitor the water balance performance of the Project and to inform planned upgrades or changes to the water management system.

9.2 CONTINGENCY MEASURES

There are a range of contingency measures that can be implemented if unforeseen or unacceptable levels of impact are identified during the mine life. These include:

- provision of flocculation equipment on sedimentation ponds to improve the rate of sedimentation;
- augmenting the sediment dams to create greater retention volume and residence time to increase the capacity for suspended sediment to settle out;
- increasing pumping capacity at each of the sedimentation ponds to minimise the potential for sediment laden discharges from the ponds;
- regular maintenance of sediment dams to maintain suitable free board;
- utilise captured dirty water for watering rehabilitated areas to promote plant growth;
- if greater than anticipated groundwater inflows occur, seek to enter into an agreement with Wilpinjong Coal Mine for them to take surplus groundwater from the Moolarben Coal Mine Project if they have insufficient water.

10. CONCLUSIONS

Stage 2 of the Moolarben Coal Project will involve an extension to mining operations proposed as part of Stage 1, which was approved by the Minister for Planning on 6th September 2007. The extension involves two new underground mines (*Underground No's 1 and 2*) and a new open cut mine (*Open Cut No 4*). The underground mines that are proposed as part of Stage 2 of the MCP will be located below the sandstone ridges that form the catchment divide between Moolarben and Murragamba Creeks. The open cut mine is to be located within the floor of the Murragamba Valley and an adjoining valley to the east which has been referred to as the 'Eastern Creek' Valley.

Murragamba and Eastern Creeks are ephemeral streams that drain self-contained catchments to Wilpinjong Creek, which is located immediately north of the exploration lease for the MCP (*EL 6288*). Due to their location within the proposed mining footprint for Open Cut No 4, it is proposed that extensive sections of both streams be mined for resource extraction. As a result, sections of both streams will need to be diverted during the mine life. Some of these sections of diverted channel will be temporary, while others will become the post-mining alignment for each creek. New sections of channel will need to be constructed where temporary diversions are required during the mining operation.

Investigations undertaken for this report have established that most of the lengths of both Murragamba and Eastern Creeks within the Open Cut No 4 footprint are either significantly altered or severely eroded. This observed erosion is due to unsustainable land management practices including wholesale clearing of the valley floor, and possibly, extended periods of overgrazing followed by intense rainfall events.

Accordingly, only a small section of Murragamba Creek is considered to be of sufficient geomorphic value to be considered for exclusion from mining. Hence, it is considered that stream geomorphology does not present as an impediment to mining of most of the lengths of both streams. In addition, flood characteristics for the existing streams indicate that flood flows are retained in-bank for most design events.

The streams themselves follow a relatively straight alignment and do not exhibit any notable meander characteristics. As a result, the adjoining landforms do not present as significant floodplain structures and are not critical to fluvial processes within either valley.

Therefore, diversion of the majority of the lengths of both streams is considered feasible and can occur with minimal impact on downstream river systems. The proposed diversions and associated channel re-instatement works have been considered and concept designs have been developed to describe the processes that would be followed for implementation. These processes include:

- preservation of a morphologically significant section of the central reach of Murragamba Creek;
- detail design of a morphologically stable post-mining system of creek channels linked to an active adjoining floodplain;

- the linking of sections of diverted channel to the preserved reach of Murragamba Creek, taking advantage of existing in-channel and floodplain controls (*i.e., bedrock*) and thereby minimising the potential for head-cuts and bed scour;
- the design of bed controls that will foster the formation of pool and riffle sequence post-mining, and which will provide a mechanism for reach by reach management of any episodes of scour or bank erosion in response to large flows;
- the development of a rich ecological area for flora and fauna along the diverted / reconstructed creek channel; and,
- retention and enhancement of remnant native vegetation wherever possible.

The implementation of these design process will ensure that the post-mining creek channel for both Murragamba Creek and Eastern Creek are morphologically stable and will not impact negatively on downstream river systems.

This report has also considered the extent of available water resources and the manner in which they could be best managed over the life of the mine project. This involved the development of a series of water balance models that were used to assess a range of rainfall conditions that may prevail over the mine life, in conjunction with projected mine water inflows determined from groundwater modelling undertaken by Aquaterra. The assessment examined the following rainfall conditions for the entire Moolarben Coal Project (*Stage 1 and Stage 2 combined*) and for a scenario in which Stage 2 operations occur in isolation:

- 'Average' rainfall conditions;
- 'Below Average' rainfall conditions;
- 'Above average' rainfall conditions; and,
- 'Worst case dry weather' scenario.

The results from the water balance modelling indicates that there is potential for a water deficit for a number of years of the mine life. The results for Stage 1 and Stage 2 combined assuming average rainfall conditions indicate the following:

(i) A projected water deficit between Years 6 and 17. From Year 8 to 11 inclusive, the predicted water deficit under average rainfall conditions is estimated to be between 20 and 25% of total water demand for each year.

(ii) A projected water surplus beyond Year 25 until the completion of mining.

A comparison between the water balance modelling for the various rainfall conditions indicates that water availability for mining operations is not sensitive to fluctuations in average annual rainfall conditions. It also highlights the importance of the production borefields for meeting water demand as well as the re-use of mine pit inflows.

The results of the water balance analysis indicate that there is potential for a substantial water deficit during the mine life irrespective of whether Stage 1 and Stage 2 areas are mined concurrently, or whether Stage 2 is mined in isolation. The analysis also shows that the periods of predicted water deficit are not sensitive to typical fluctuations in rainfall.

Therefore, in order for mining to proceed, it will be necessary to secure sufficient additional out-of-catchment water resources to meet the projected deficit. This could be achieved by either or a combination of the following options:

(1) By entering into a water sharing agreement with coal mines in the immediate vicinity of the Moolarben Coal Project, such as from the nearby Ulan and Wilpinjong Coal Mines. This would have the dual benefit of meeting the water demands of the Moolarben Coal Project while also reducing excess volumes of water resource that are known to be stored at both mine sites and which are likely to continue to be generated as mining operations proceed.

(2) By reducing the volume of water required for processing during years of deficit. In order to reduce the volume of water required for processing it may be necessary to bypass the washing of coals that are extracted from the underground mines.

(3) By reducing the production/extraction rates during deficit years to match the water availability.

(4) By increased pumping from additional borefields located elsewhere within EL 6288.

These options are considered to provide a credible means for dealing with the expected deficit in water availability for the project.

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Appendix A – ADOPTED RAFTS MODEL SUB-CATCHMENT PARAMETERS

MOOLARBEN COAL MINES

CATCHMENT SPECIFIC DATA - MURRAGAMBA CREEK

CATCHMENT #	AREA (Km2)	AREA (Ha)	LENGTH (Km)	VERT CH. (m)	SLOPE (m/m)	SLOPE (m/km)	IMPERVIOUS (%)
1.00	1.772	**177.20**	1.894	120	0.063	63.358	2.0
1.01	1.897	**189.70**	2.070	132	0.064	63.768	2.0
1.02	0.877	**87.70**	1.164	72	0.062	61.856	2.0
1.03	0.500	**50.01**	0.750	44	0.059	58.667	2.0
1.04	0.707	**70.70**	0.856	84	0.098	98.131	2.0
1.05	0.359	**35.90**	0.831	82	0.059	98.676	2.0
1.06	0.566	**56.60**	0.777	72	0.038	92.664	2.0
1.07	0.861	**86.10**	1.070	66	0.056	61.682	2.0
1.08	0.537	**53.70**	1.102	48	0.060	43.557	2.0
1.09	0.562	**56.20**	0.840	30	0.059	35.714	2.0
1.10	1.584	**158.40**	1.650	96	0.088	58.182	2.0
1.11	0.889	**88.90**	1.405	66	0.026	46.975	2.0
2.00	0.677	**67.71**	0.932	78	0.084	83.691	2.0
3.00	0.723	**72.25**	1.230	100	0.066	81.301	2.0
4.00	1.263	**126.32**	1.367	120	0.088	87.783	2.0
5.00	0.660	**66.00**	1.276	130	0.102	101.881	2.0
6.00	0.776	**77.63**	1.240	120	0.097	96.774	2.0
7.00	0.666	**66.64**	1.256	98	0.078	78.025	2.0
7.01	0.338	**33.80**	0.912	82	0.090	89.912	2.0
8.00	0.489	**48.90**	1.092	92	0.084	84.249	2.0
8.01	0.475	**47.50**	1.067	100	0.094	93.721	2.0
9.00	0.620	**62.00**	1.190	118	0.099	99.160	2.0
10.00	1.162	**116.22**	2.336	142	0.061	60.788	2.0
11.00	0.963	**96.30**	1.182	86	0.073	72.758	2.0
11.01	1.415	**141.47**	1.685	108	0.064	64.095	2.0
12.00	0.979	**97.85**	1.442	94	0.065	65.187	2.0
13.00	0.476	**47.64**	1.271	80	0.063	62.943	2.0
14.00	1.131	**113.10**	1.689	86	0.073	50.918	2.0

MOOLARBEN COAL MINES

LINK AND LAG SPECIFIC DATA - MURRAGAMBA CREEK

LINK #	LENGTH (km)	VERT CHANGE (m)	SLOPE (m/km)	AREA (ha)	AREA (km2)	AR&R LAG	BRANSBY LAG	AVERAGE
1	1.553	40	25.757	189.700	1.897	35	27	**31**
2	0.673	6	8.915	87.700	0.877	26	15	**21**
3	0.693	18	25.974	87.700	0.877	26	13	**19**
4	0.336	4	11.905	50.010	0.500	21	8	**14**
5	0.727	18	24.759	50.010	0.500	21	14	**18**
6	0.904	14	15.487	70.700	0.707	24	19	**21**
7	0.537	14	26.071	70.700	0.707	24	10	**17**
8	0.380	6	15.789	35.900	0.359	19	9	**14**
9	0.788	20	25.381	33.800	0.338	18	16	**17**
10	0.385	12	31.169	35.900	0.359	19	8	**13**
11	0.385	6	15.584	56.600	0.566	22	8	**15**
12	0.855	38	44.444	47.500	0.475	21	15	**18**
13	0.752	8	10.638	86.100	0.861	26	17	**21**
14	1.215	40	32.922	86.100	0.861	26	22	**24**
15	0.500	2	4.000	53.700	0.537	22	14	**18**
16	0.500	8	16.000	53.700	0.537	22	11	**16**
17	1.388	34	24.496	141.470	1.415	31	25	**28**
18	0.477	4	8.386	56.200	0.562	22	12	**17**
19	0.480	8	16.667	56.200	0.562	22	10	**16**
20	0.400	16	40.000	56.200	0.562	22	7	**15**
21	1.070	10	9.346	158.400	1.584	33	23	**28**
22	0.540	4	7.407	88.900	0.889	26	13	**20**
23	0.930	24	25.806	88.900	0.889	26	17	**22**

CATCHMENT SPECIFIC DATA - 'EASTERN' CREEK

CATCHMENT #	AREA (Km2)	AREA (Ha)	LENGTH (Km)	VERT CH. (m)	SLOPE (m/m)	SLOPE (m/km)	IMPERVIOUS (%)
20.00	0.595	**59.52**	1.174	76	0.065	64.736	2.0
20.01	0.196	**19.64**	0.514	58	0.113	112.840	2.0
20.02	0.288	**28.80**	0.722	48	0.066	66.482	2.0
20.03	0.438	**43.83**	1.010	56	0.055	55.446	2.0
20.04	0.435	**43.50**	0.951	68	0.072	71.504	2.0
20.05	0.596	**59.60**	0.870	64	0.074	73.563	2.0
20.06	1.413	**141.30**	1.721	56	0.033	32.539	2.0
20.07	0.528	**52.78**	1.608	48	0.030	29.851	2.0
20.08	0.511	**51.08**	1.317	42	0.032	31.891	2.0
21.00	0.303	**30.26**	0.809	68	0.084	84.054	2.0
22.00	0.516	**51.62**	1.067	78	0.073	73.102	2.0
23.00	0.189	**18.85**	0.830	68	0.082	81.928	2.0
24.00	0.637	**63.74**	1.325	90	0.068	67.925	2.0
25.00	0.583	**58.33**	1.234	88	0.071	71.313	2.0
26.00	0.500	**49.95**	0.963	70	0.073	72.690	2.0
26.01	0.686	**68.56**	1.381	94	0.068	68.067	2.0
27.00	0.778	**77.82**	1.589	94	0.059	59.157	2.0
28.00	0.935	**93.51**	1.600	60	0.038	37.500	2.0

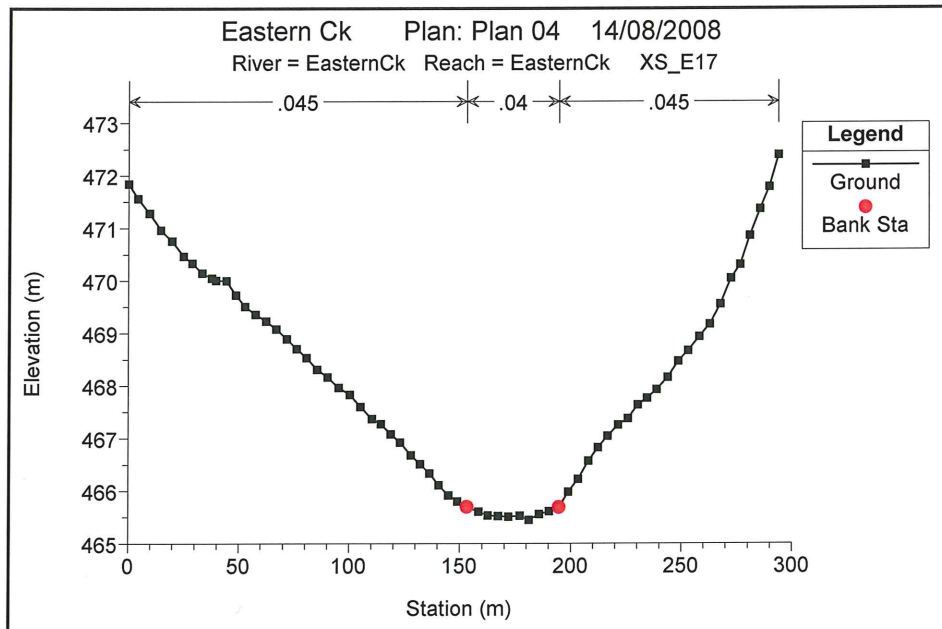
LINK AND LAG SPECIFIC DATA - 'EASTERN' CREEK

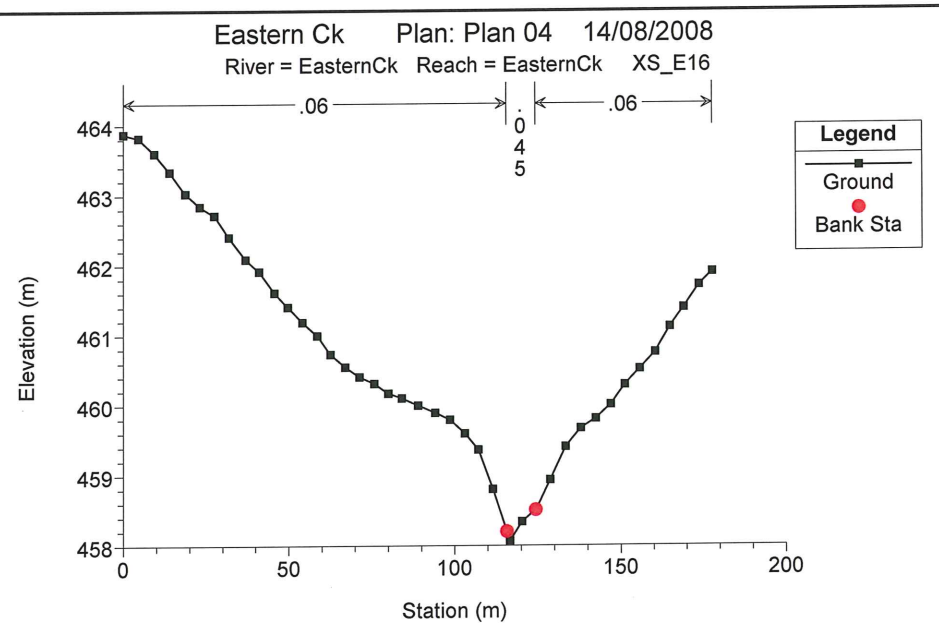
LINK #	LENGTH (km)	VERT CHANGE (m)	SLOPE (m/km)	AREA (ha)	AREA (km2)	AR&R LAG	BRANSBY LAG	AVERAGE
1	0.427	14.000	32.787	**19.64**	0.196	15	9	**12**
2	0.348	10.000	28.736	**28.80**	0.288	17	7	**12**
3	0.228	8.000	35.088	**28.80**	0.288	17	4	**11**
4	0.758	22.000	29.024	**43.83**	0.438	20	15	**17**
5	0.647	20.000	30.912	**43.83**	0.438	20	12	**16**
6	0.551	12.000	21.779	**43.50**	0.435	20	11	**16**
7	0.247	10.000	40.486	**43.50**	0.435	20	4	**12**
8	0.552	8.000	14.493	**59.60**	0.596	22	12	**17**
9	1.247	16.000	12.831	**141.30**	1.413	31	25	**28**
10	1.063	14.000	13.170	**141.30**	1.413	31	22	**26**
11	0.450	8.000	17.778	**52.78**	0.528	21	9	**15**
12	0.600	10.000	16.667	**52.78**	0.528	21	13	**17**
13	0.457	6.000	13.129	**51.08**	0.511	21	10	**16**
14	0.981	32.000	32.620	**68.560**	0.686	24	18	**21**

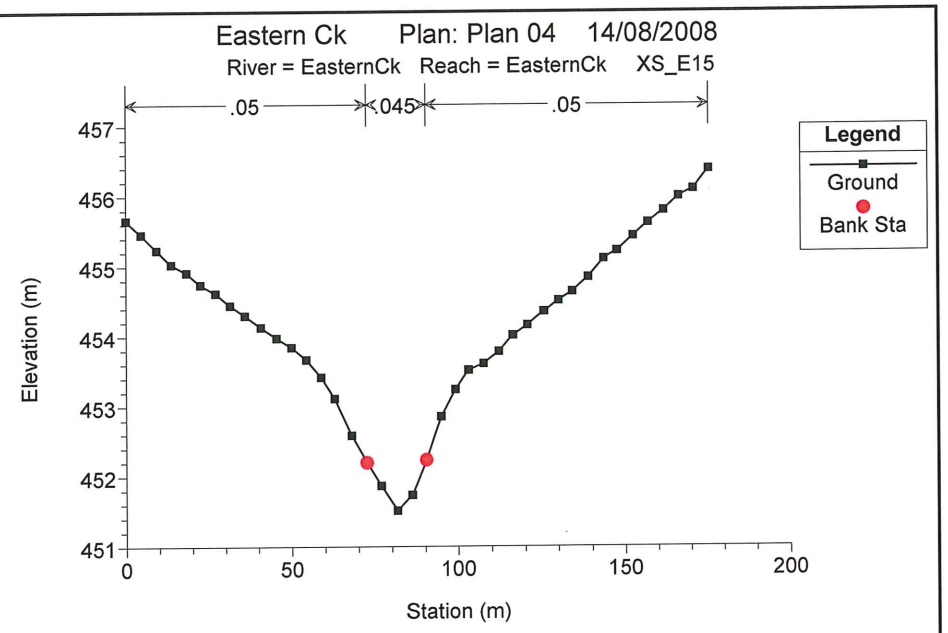
IFD COEFFICIENTS	
F_2	4.325
F_{50}	15.72
I_2D_1	25.3
I_2D_{12}	4.7
I_2D_{12}	4.7
I_2D_{72}	1.265
$I_{50}D_1$	48
$I_{50}D_{12}$	8.7
$I_{50}D_{72}$	2.2
IFD_POS	0
LAT	0
LONG	0
SKEW	0.32

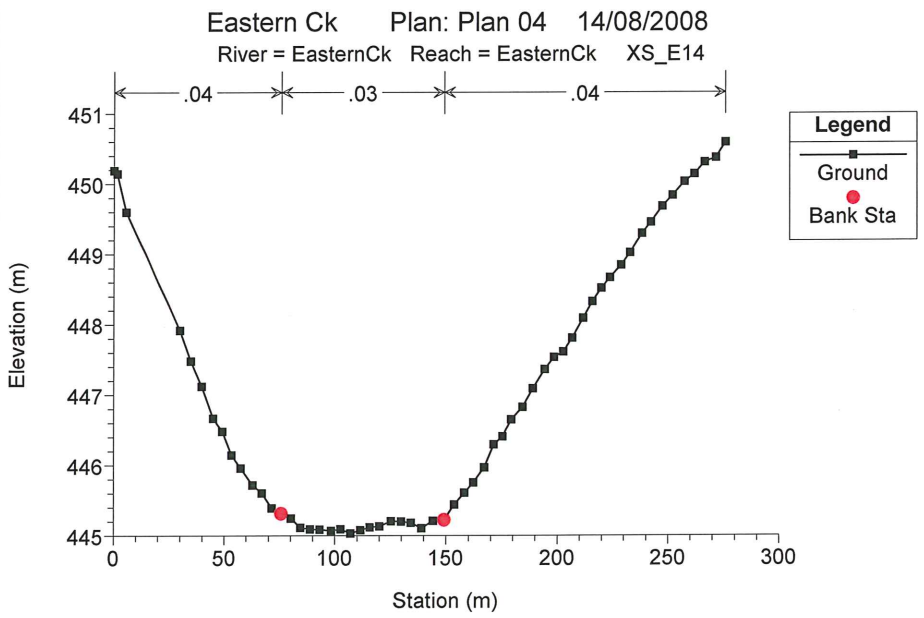
INITIAL LOSS	10mm
CONTINUING LOSS	5mm/hr

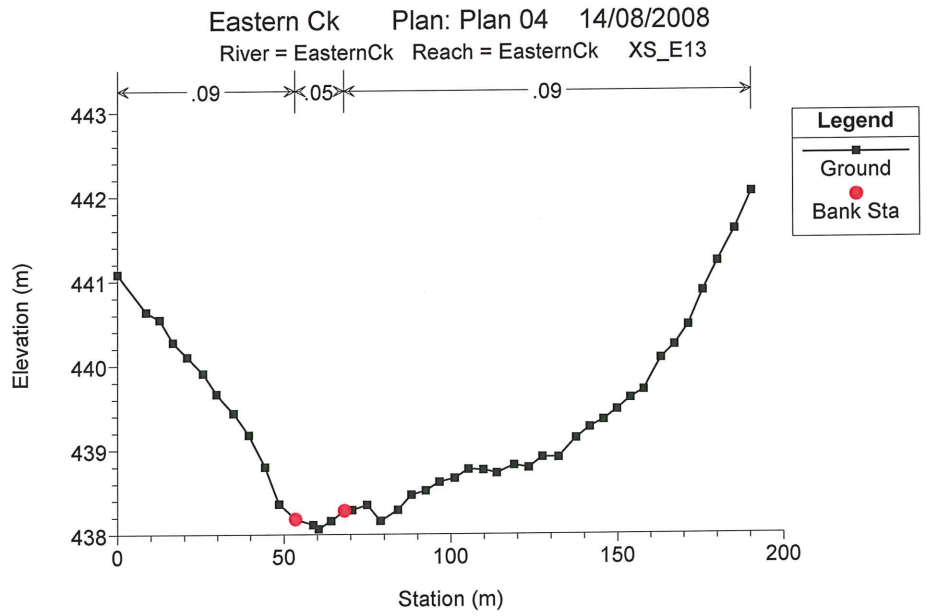
Appendix B – SURVEYED CROSS-SECTIONS OF MURRAGAMBA AND 'EASTERN' CREEKS

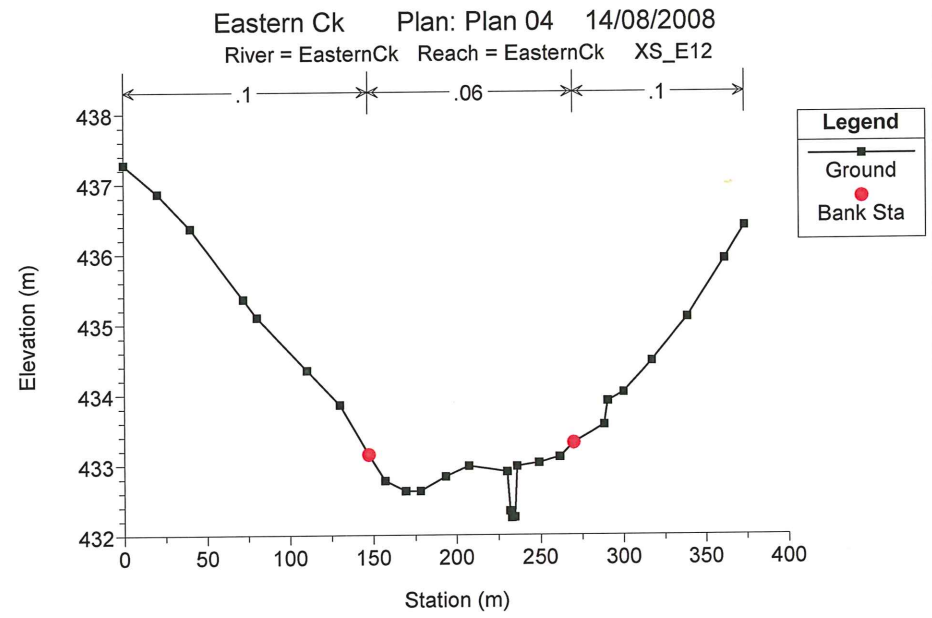

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E17
.045
.04
.045
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

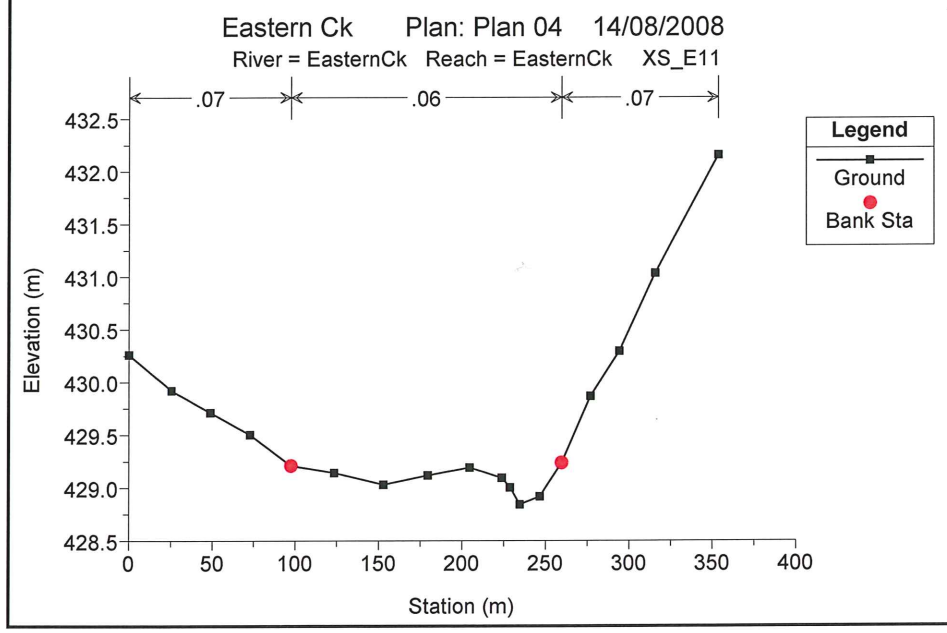

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E16
.06
.045
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

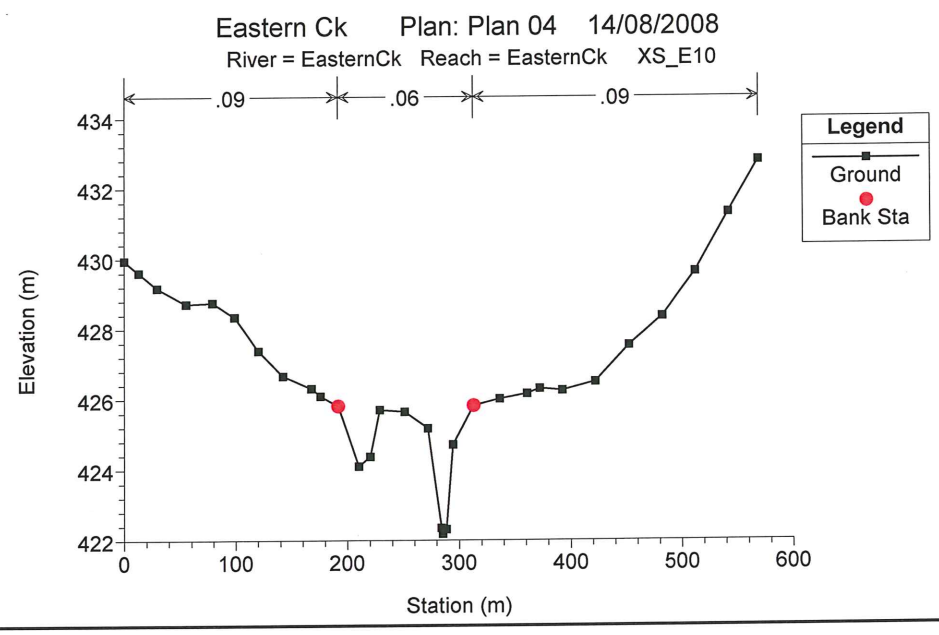

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E15
.05
.045
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

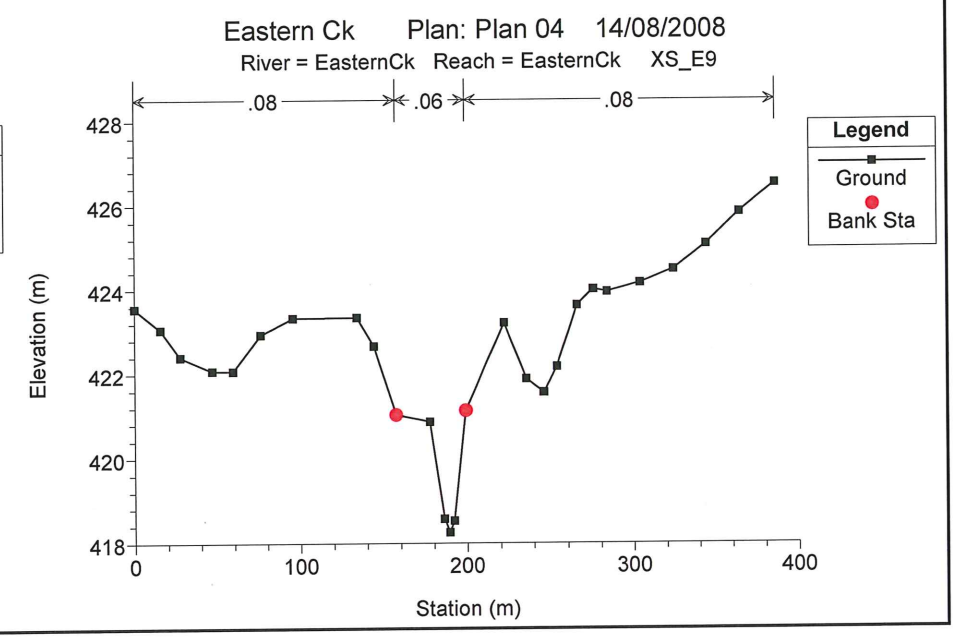

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E14
.04
.03
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E13
.09
.05
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E12
.1
.06
.1
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

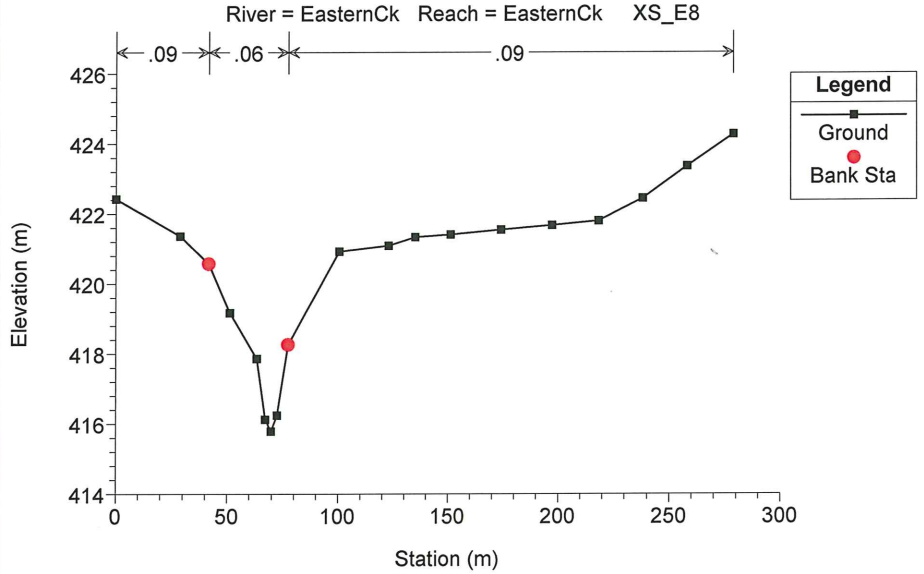

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E11
.07
.06
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E10
.09
.06
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E9
.08
.06
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

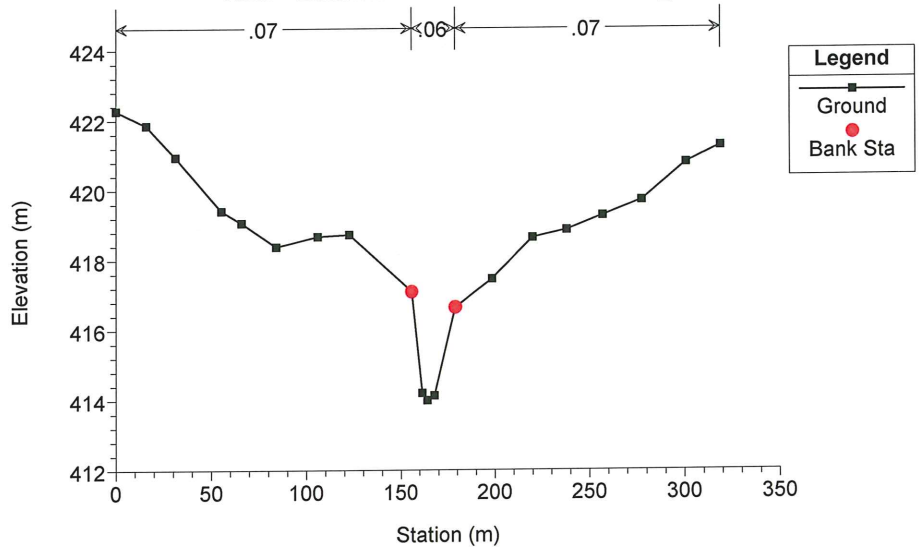
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E8



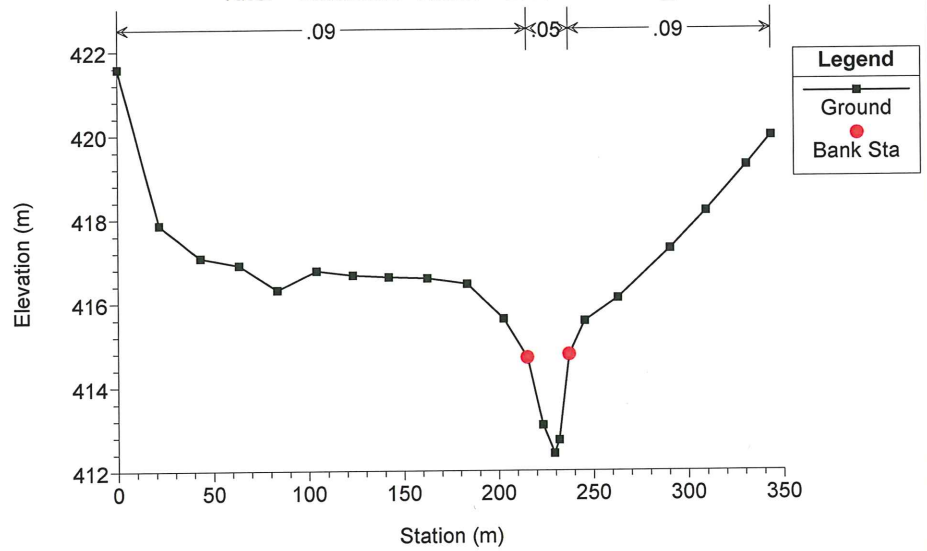
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E7



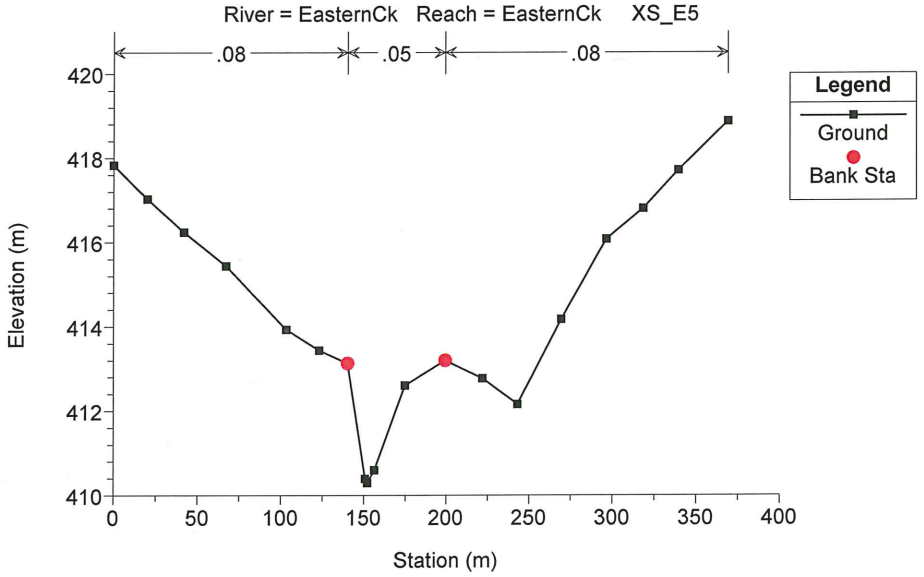
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E6



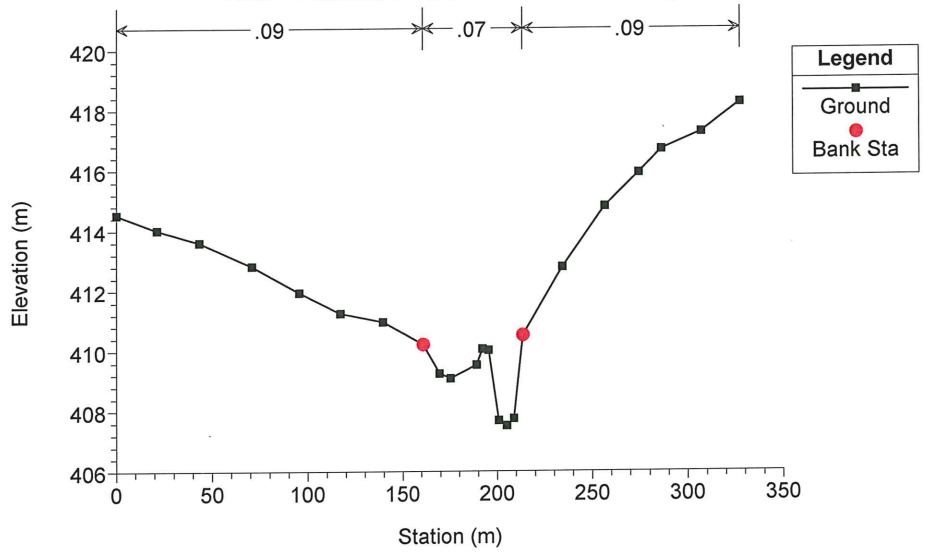
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E5



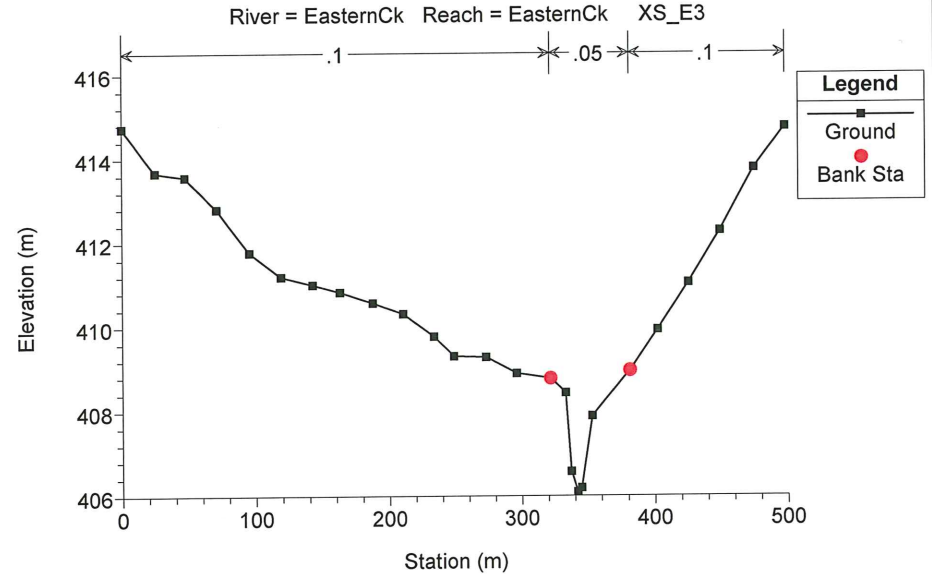
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E4



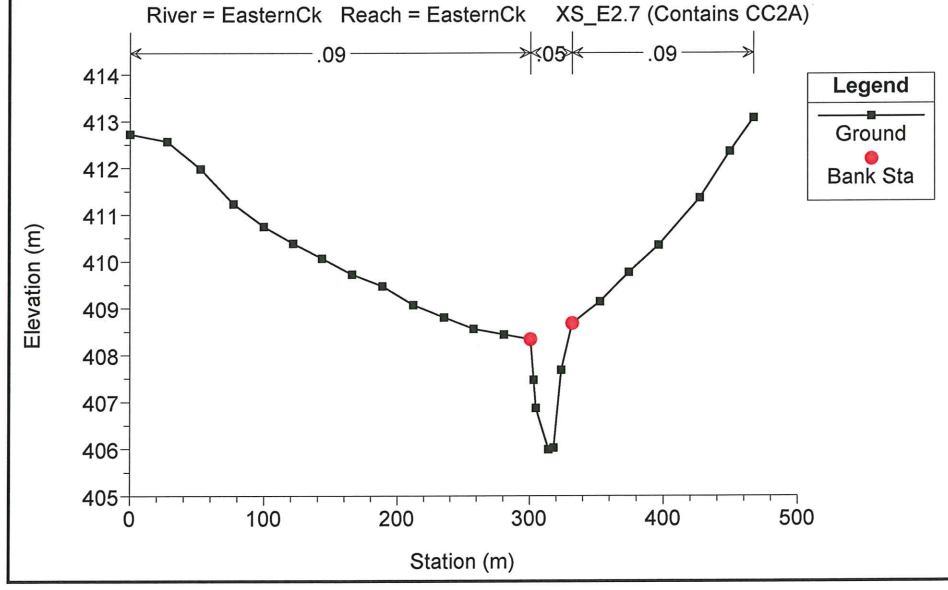
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E3



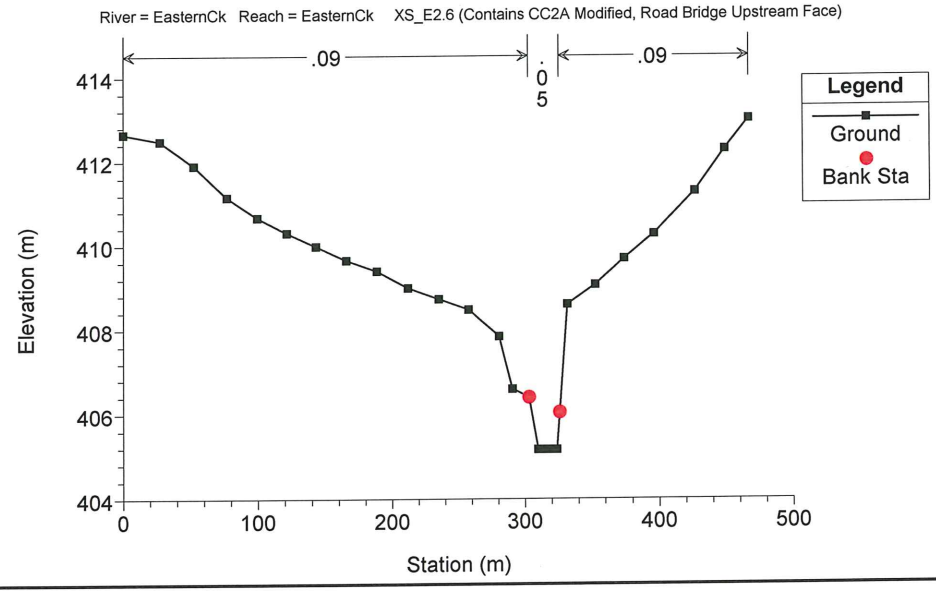
Eastern Ck Plan: Plan 04 14/08/2008

River = EasternCk Reach = EasternCk XS_E2.7 (Contains CC2A)



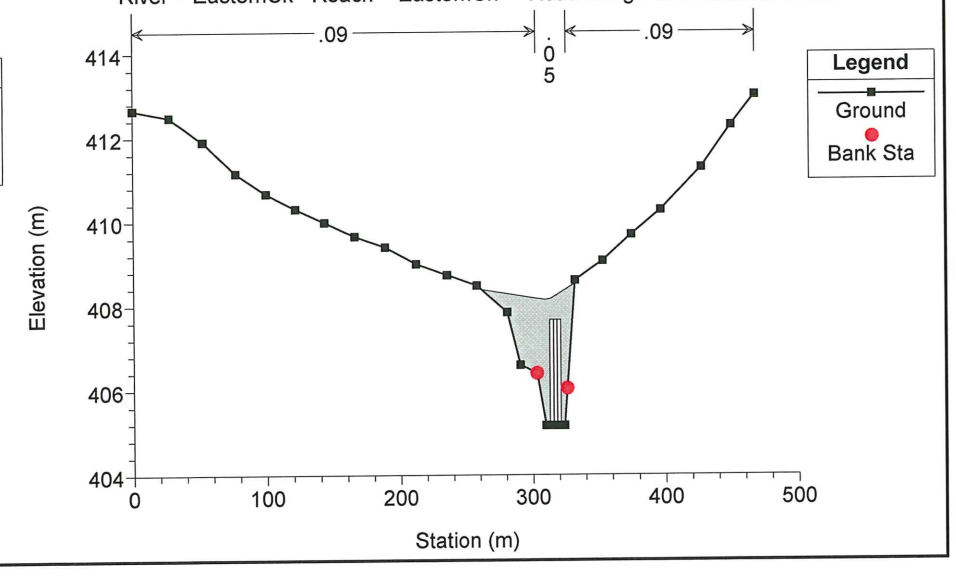
Eastern Ck Plan: Plan 04 14/08/2008

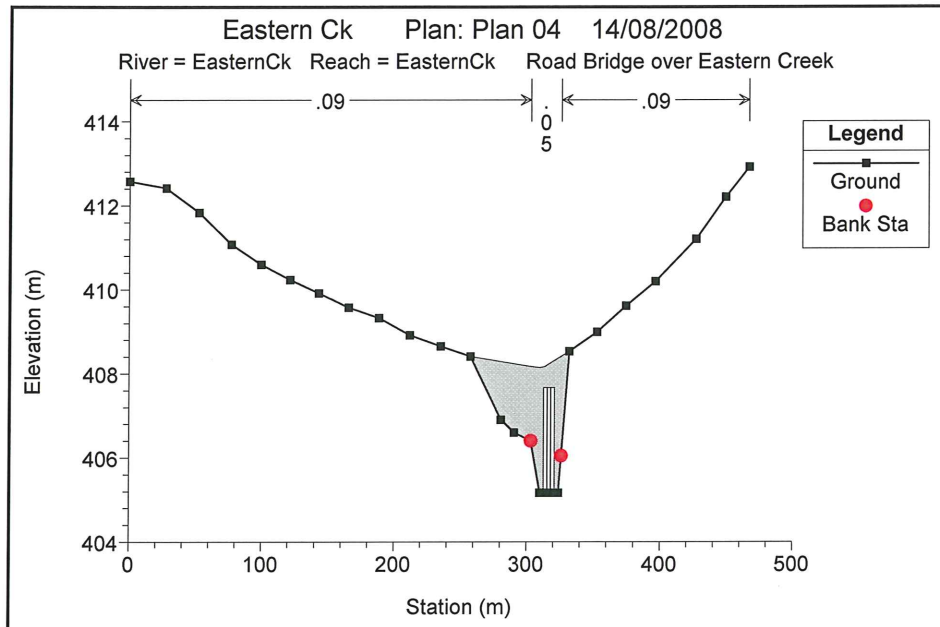
River = EasternCk Reach = EasternCk XS_E2.6 (Contains CC2A Modified, Road Bridge Upstream Face)

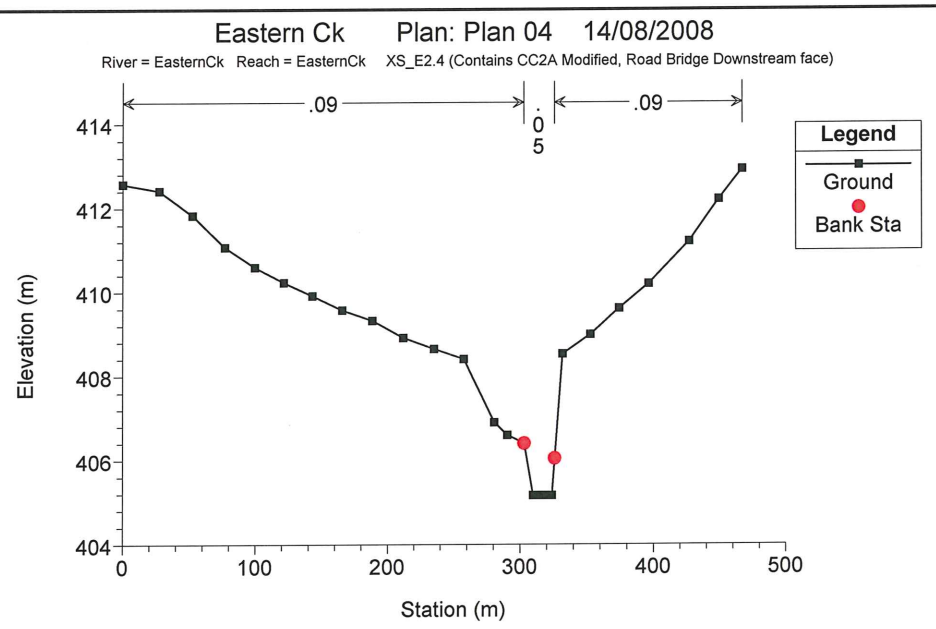


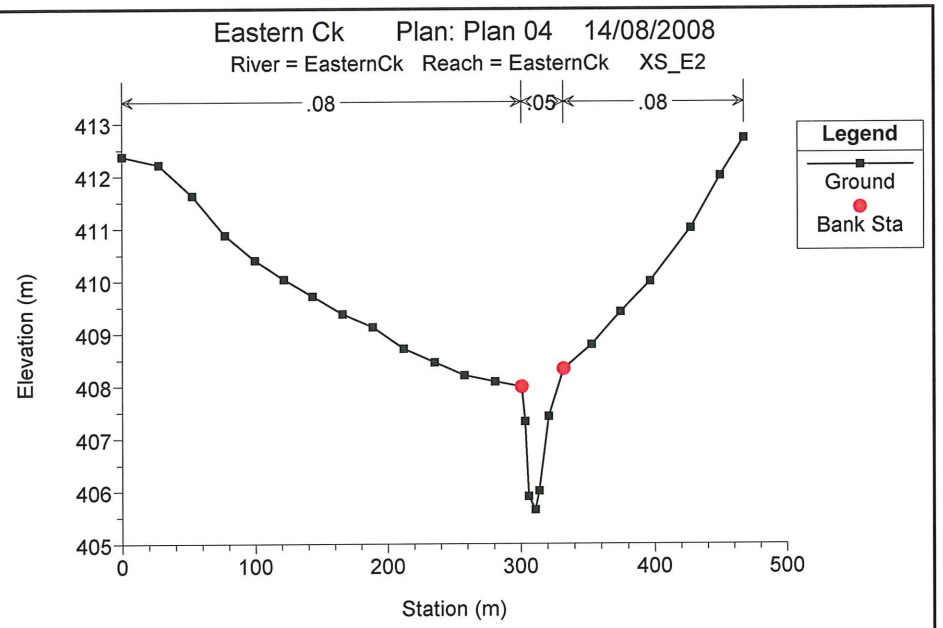
Eastern Ck Plan: Plan 04 14/08/2008

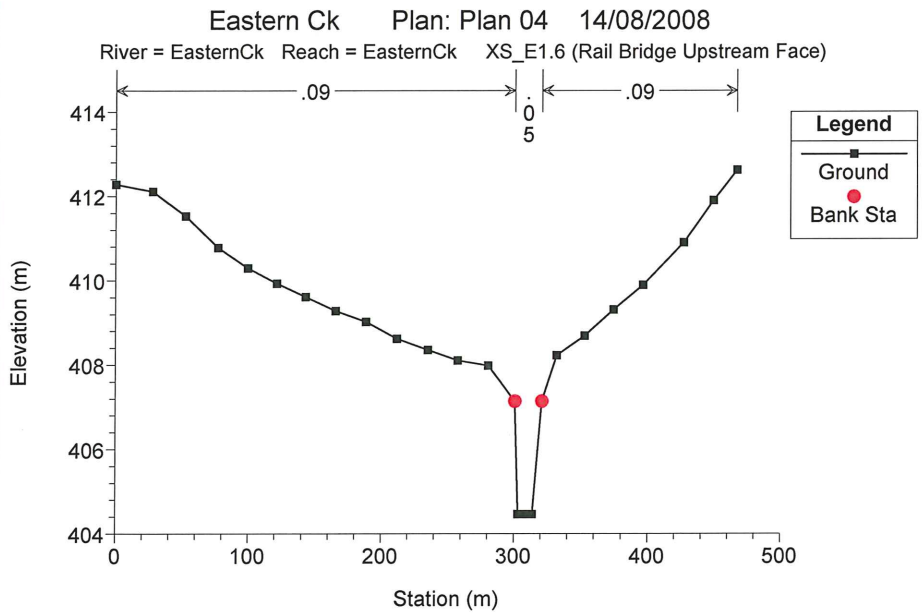
River = EasternCk Reach = EasternCk Road Bridge over Eastern Creek

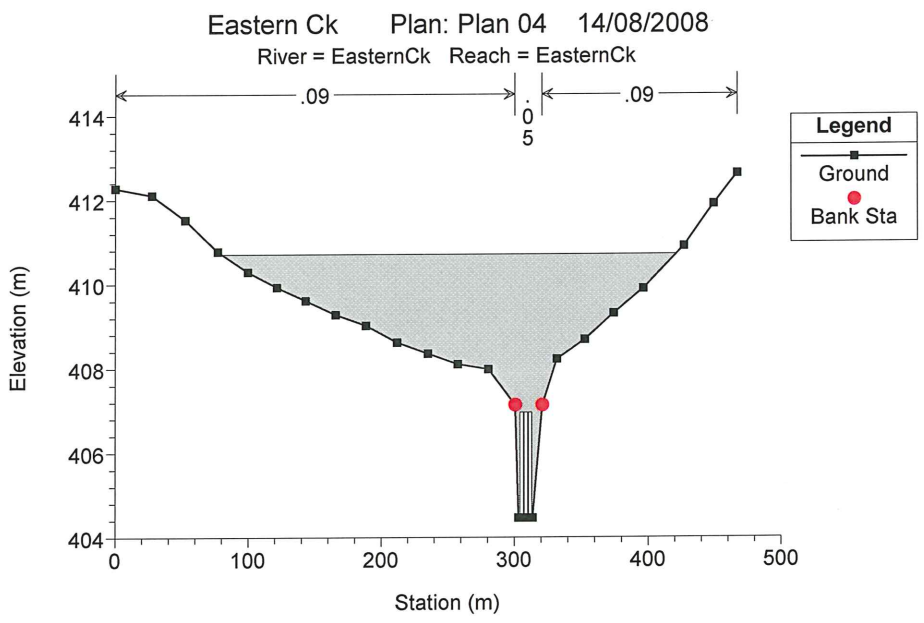


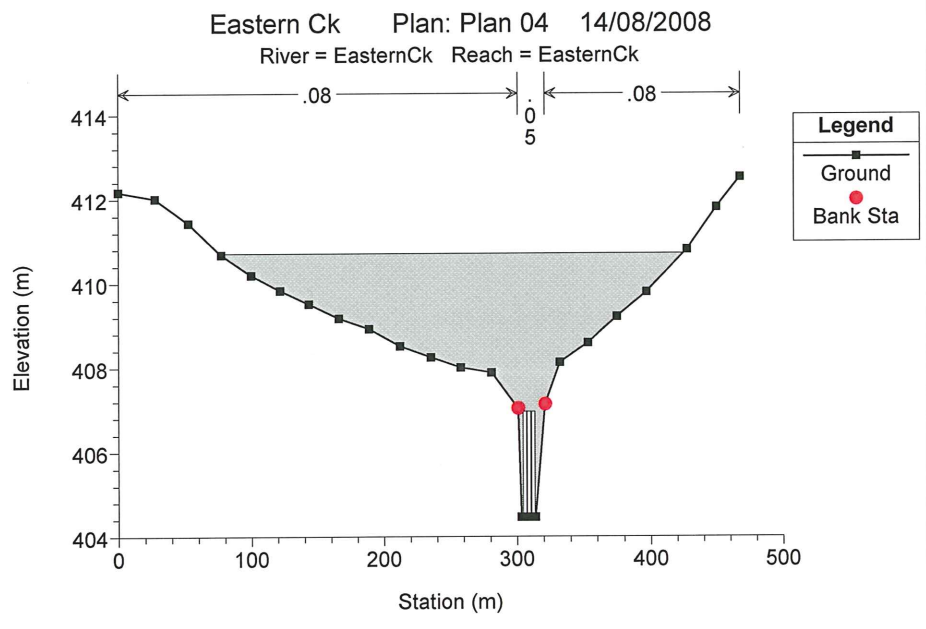

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk Road Bridge over Eastern Creek
.09
.05
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

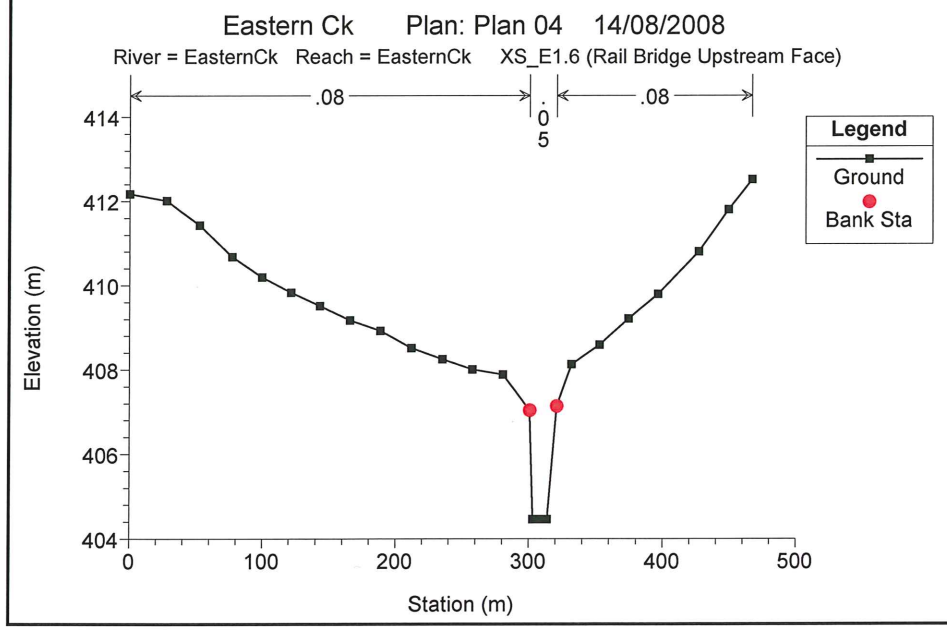

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E2.4 (Contains CC2A Modified, Road Bridge Downstream face)
.09
.05
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

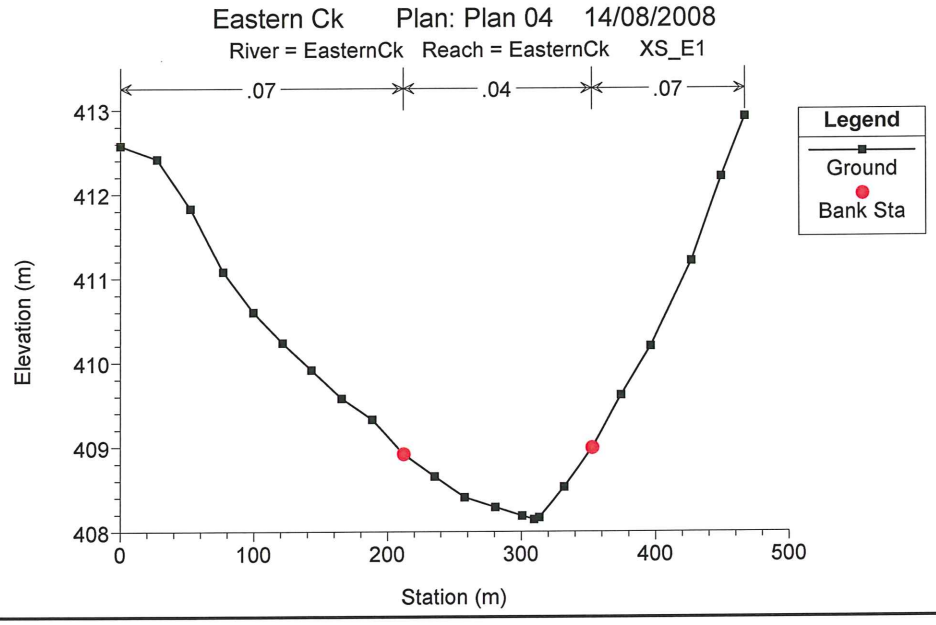

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E2
.08
.05
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

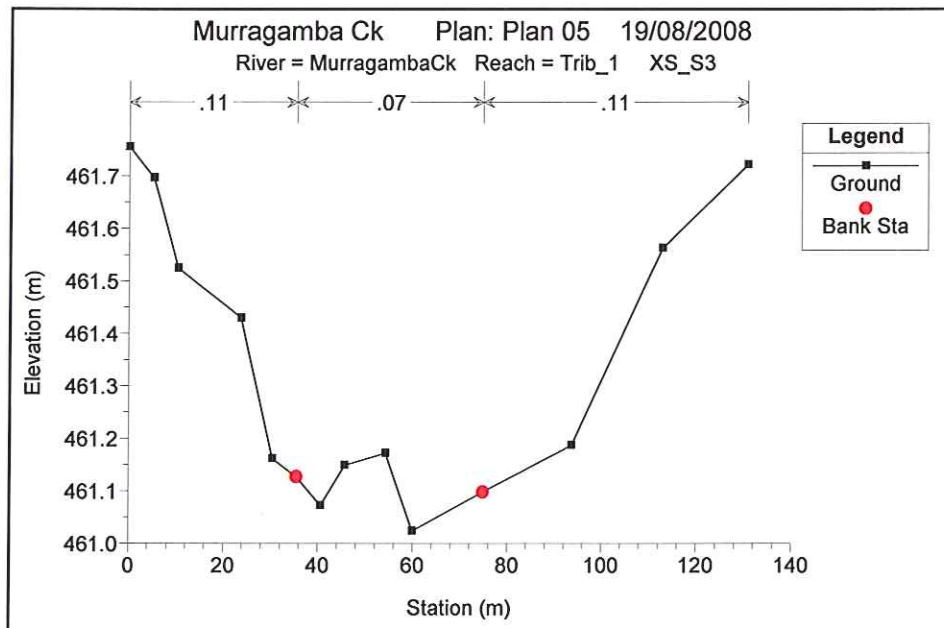

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E1.6 (Rail Bridge Upstream Face)
.09
.05
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

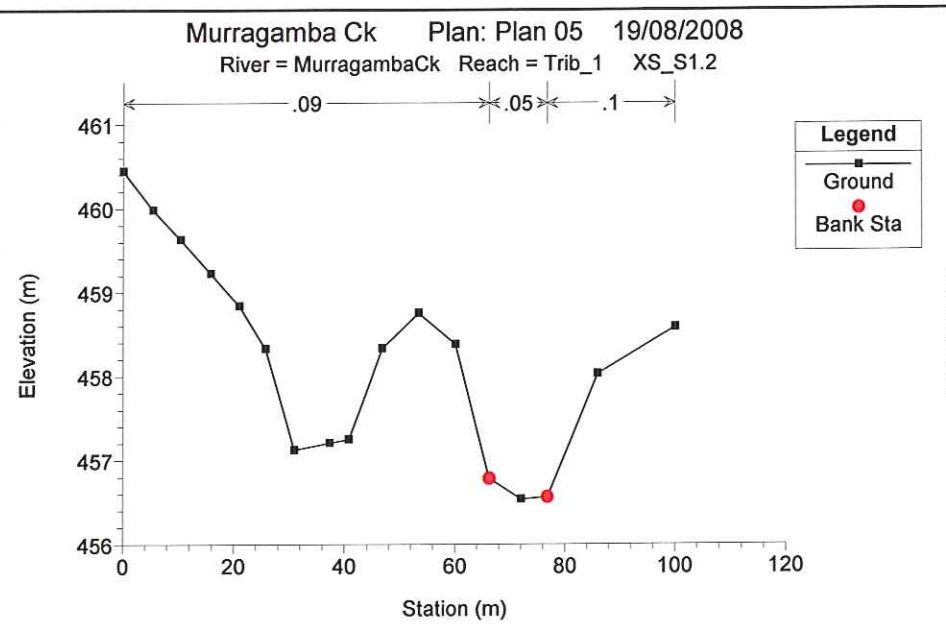

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk
.09
.05
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

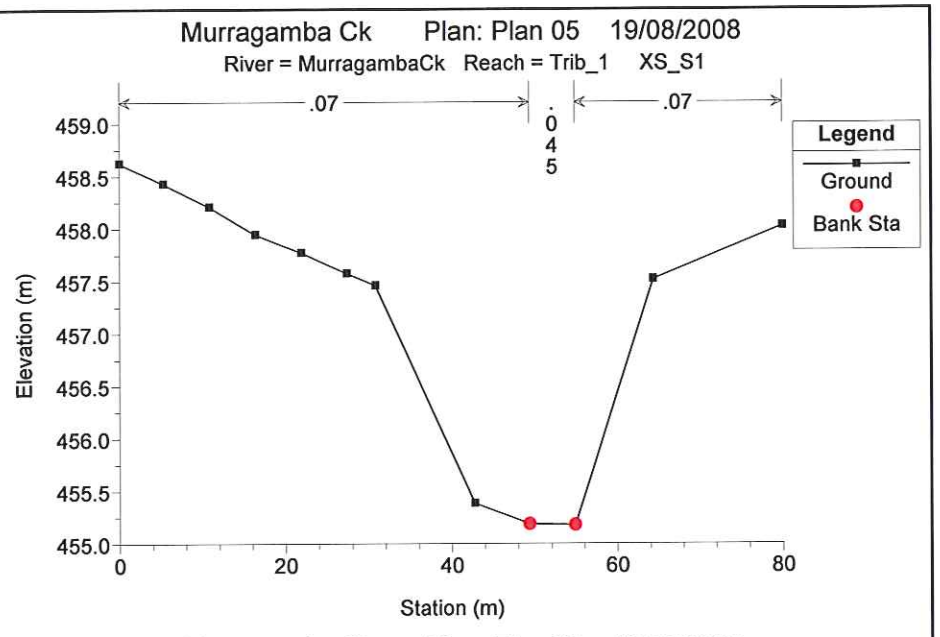

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk
.08
.05
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

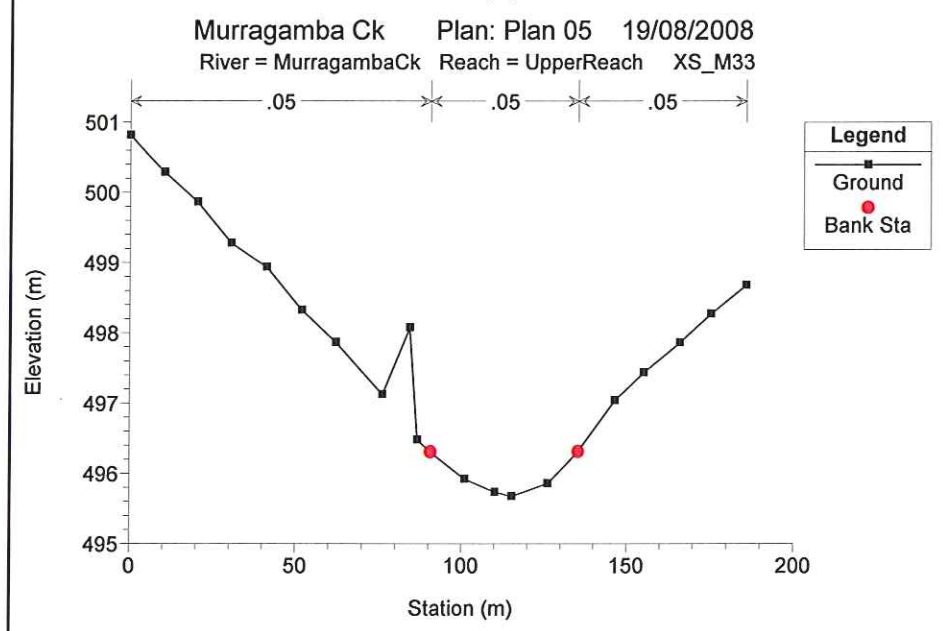

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E1.6 (Rail Bridge Upstream Face)
.08
.05
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

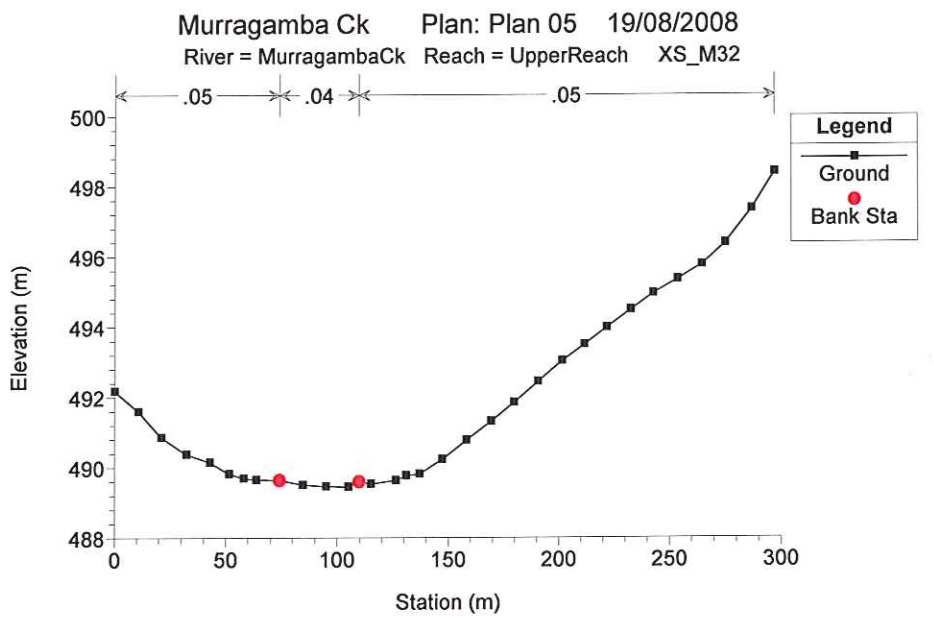

Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E1
.07
.04
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

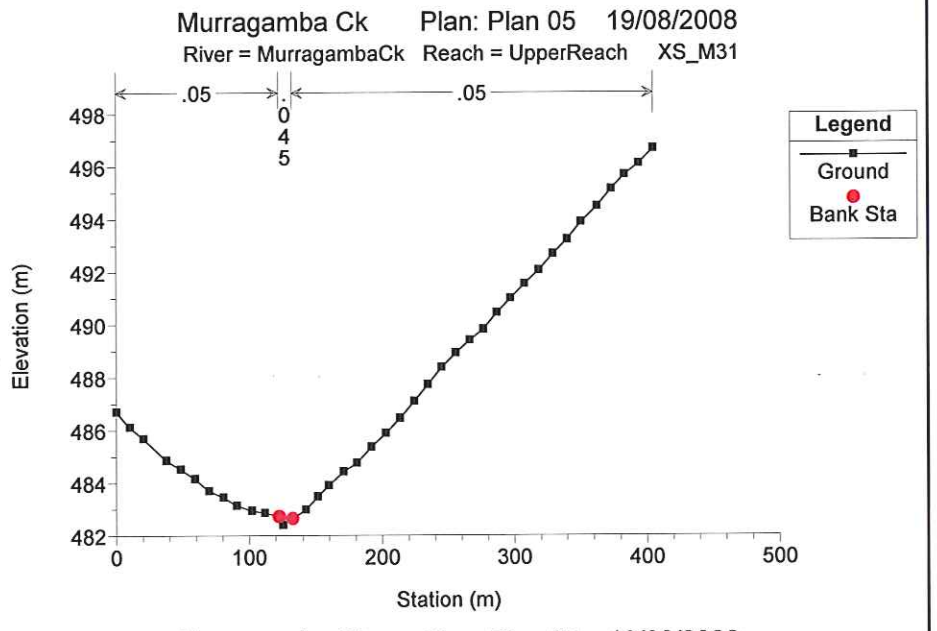

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_1 XS_S3
.11
.07
.11
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

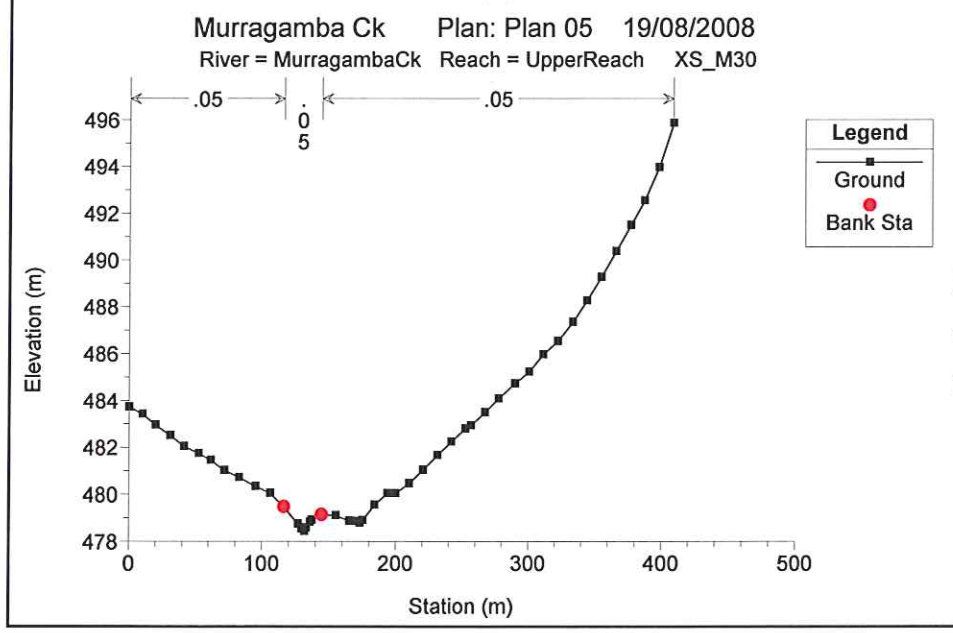

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_1 XS_S1.2
.09
.05
.1
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

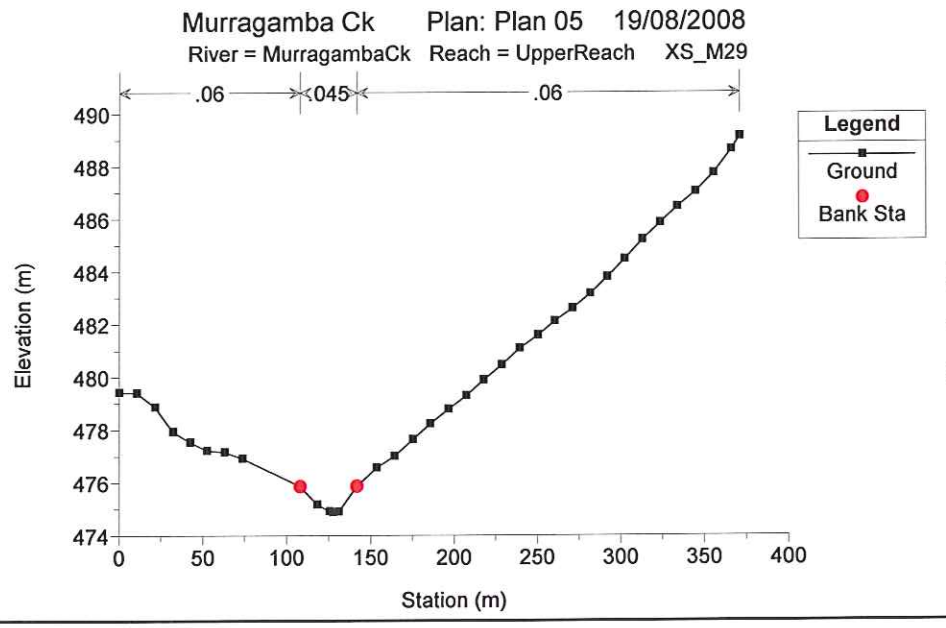

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_1 XS_S1
.07
.045
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

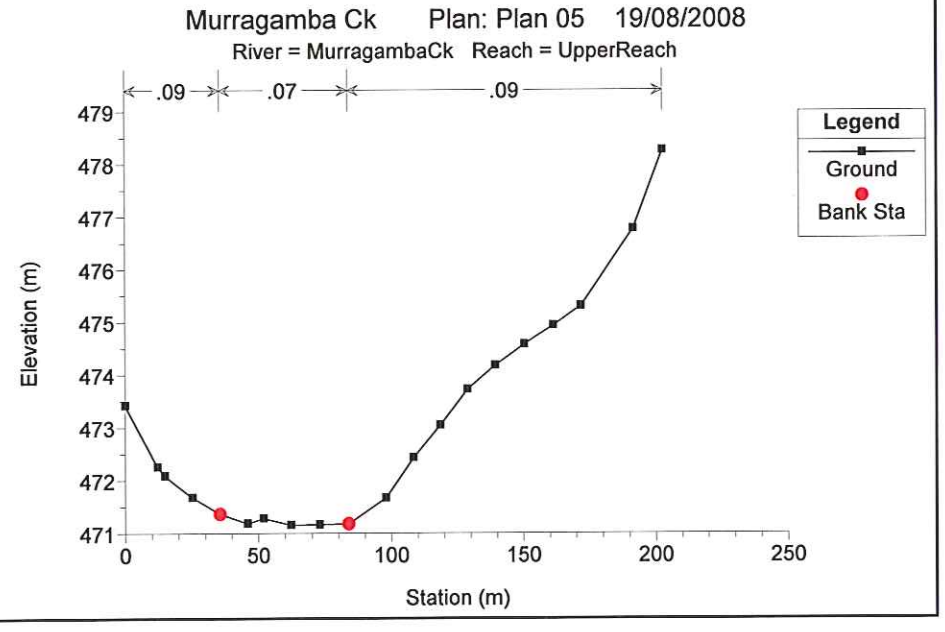

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M33
.05
.05
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

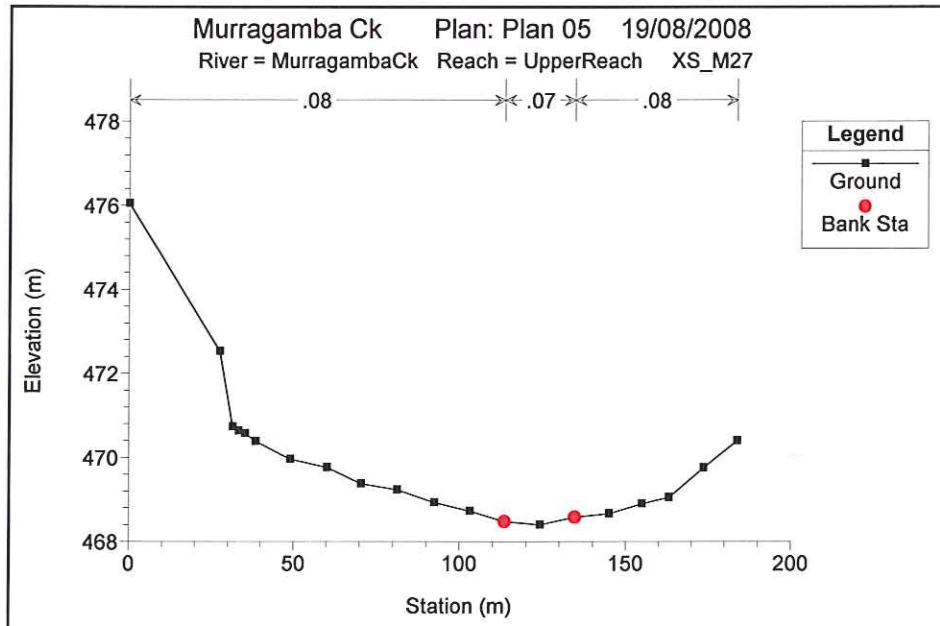

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M32
.05
.04
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

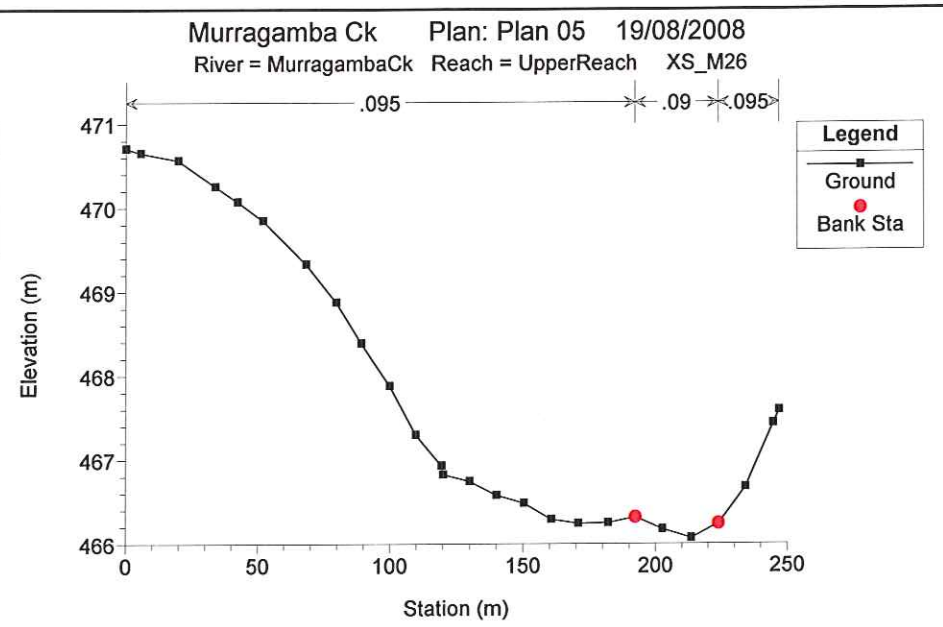

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M31
.05
.045
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

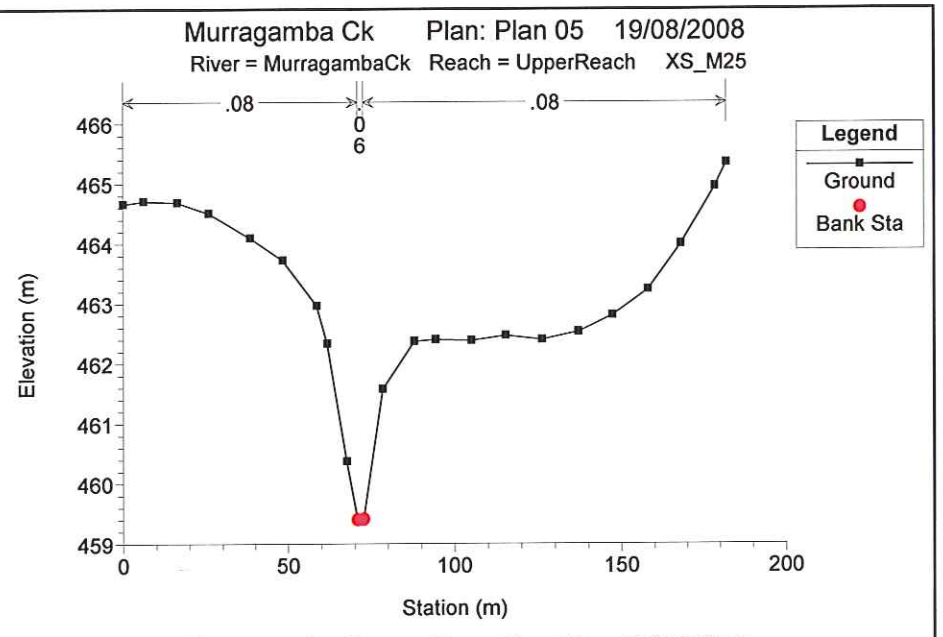

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M30
.05
.05
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

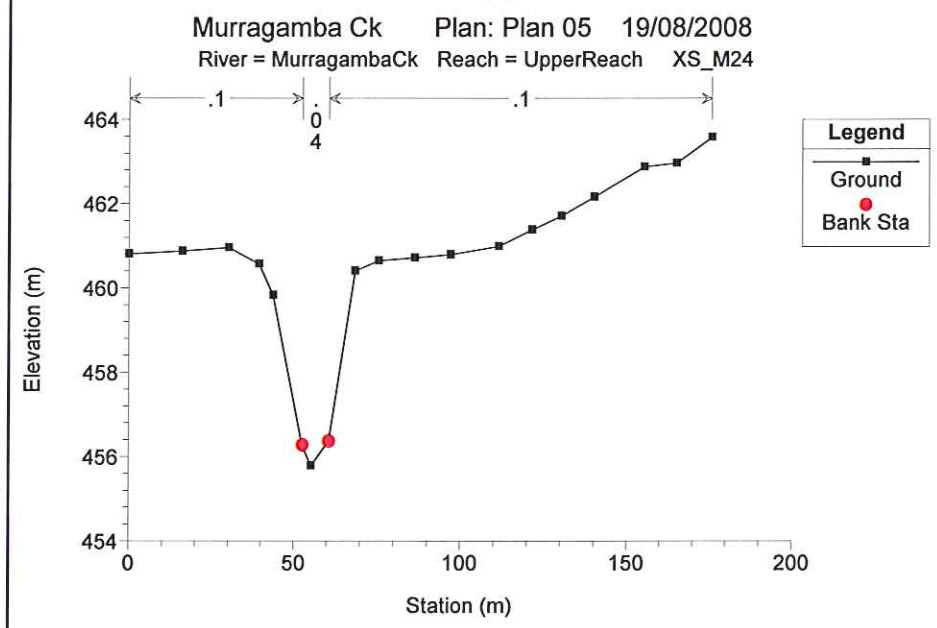

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M29
.06
.045
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

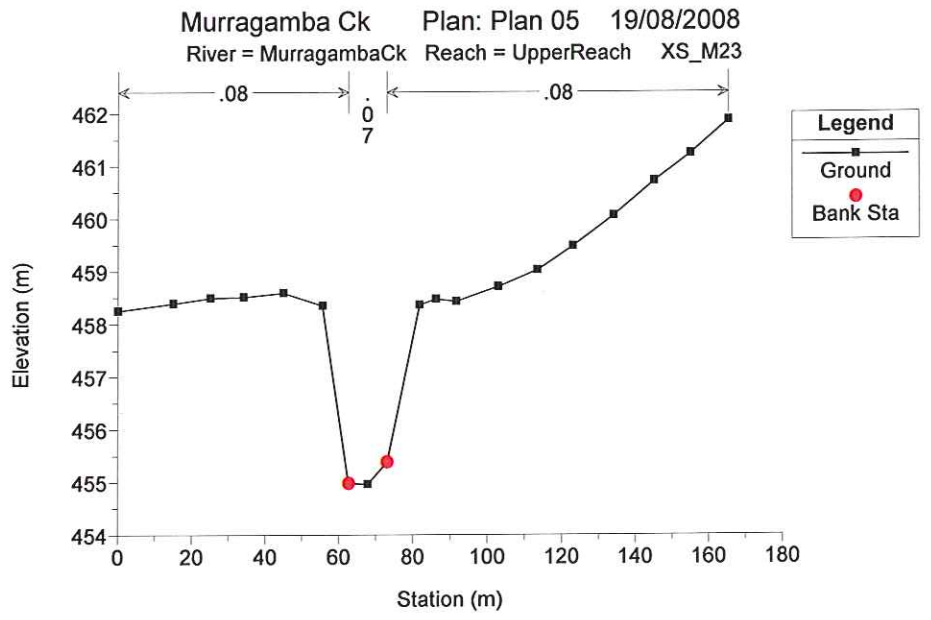

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach
.09
.07
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

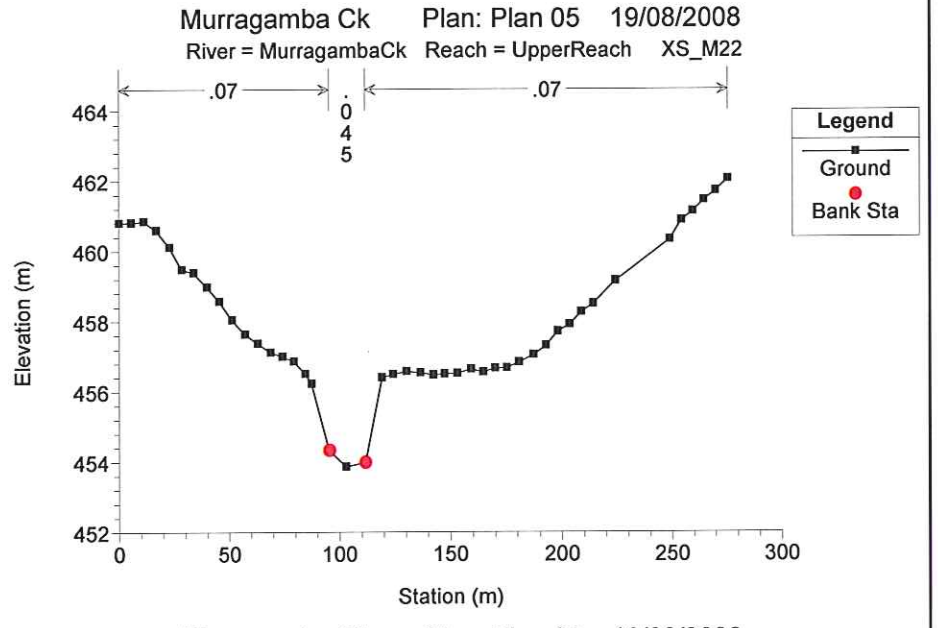

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M27
.08
.07
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

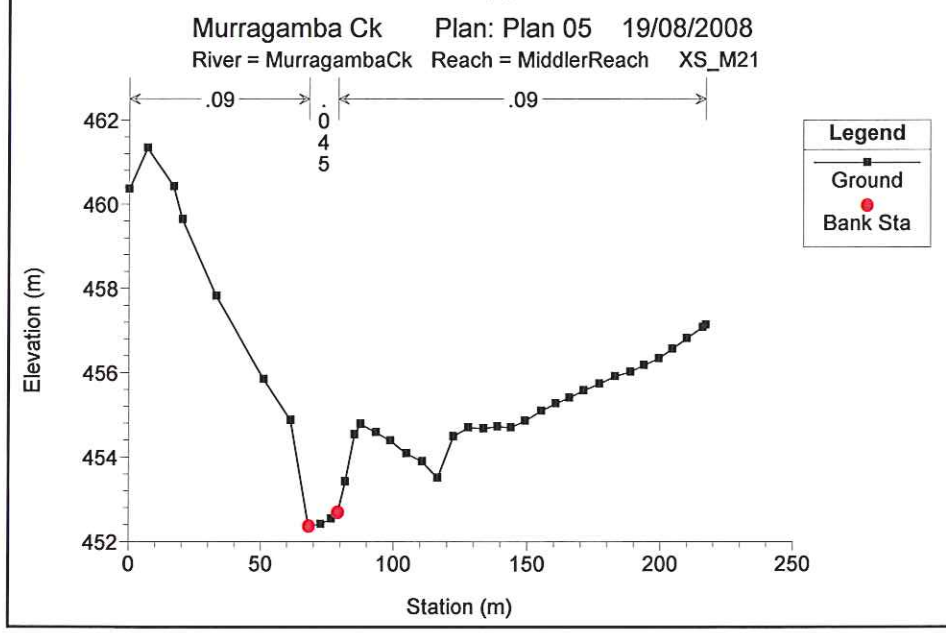

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M26
.095
.09
.095
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

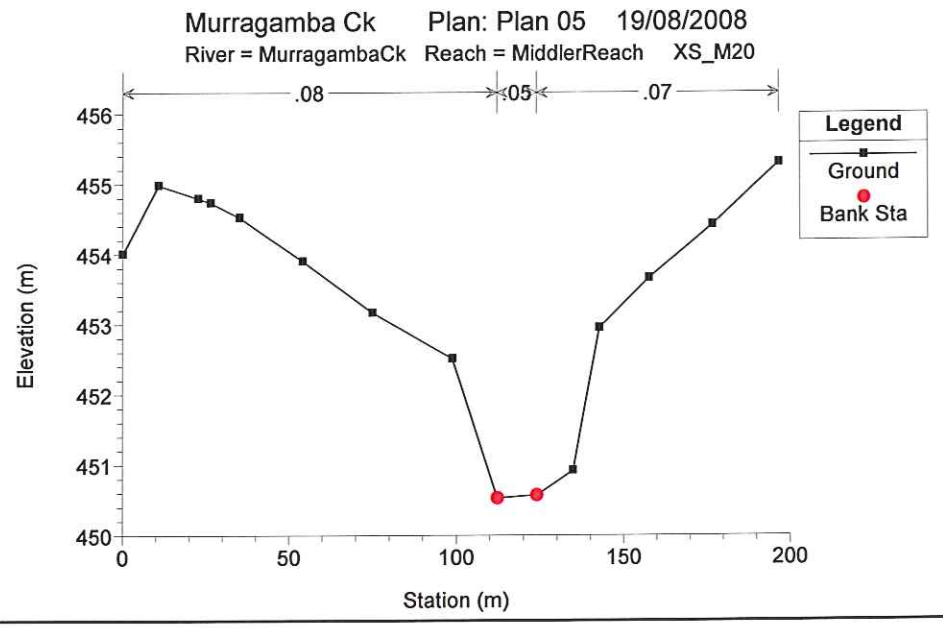

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M25
.08
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

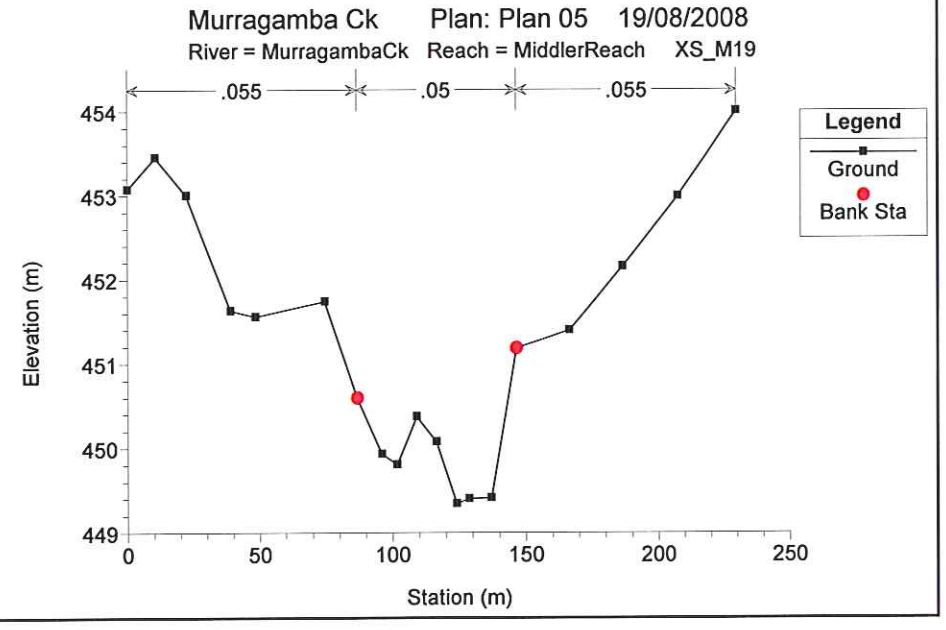

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M24
.1
.1
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

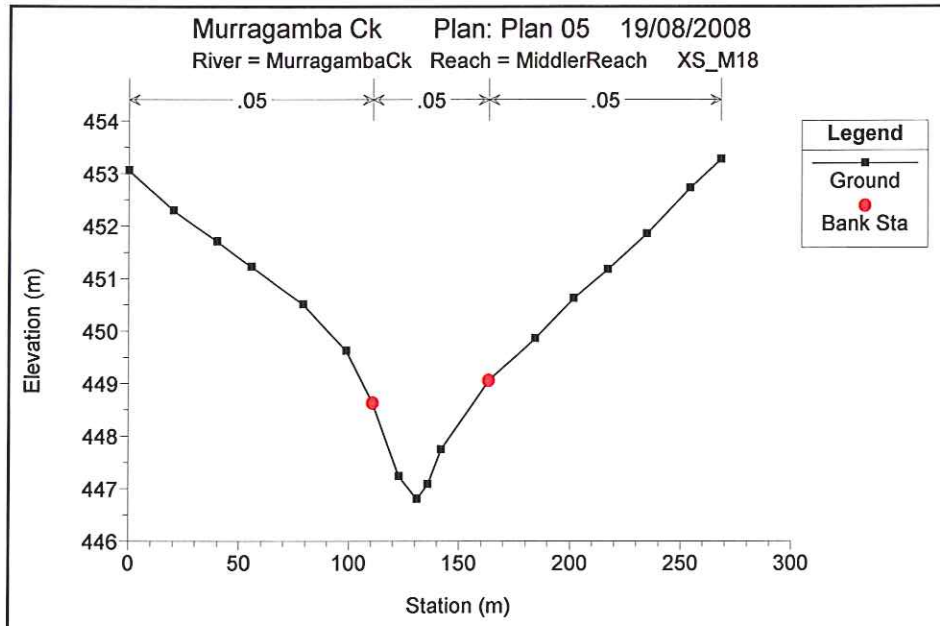

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M23
.08
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

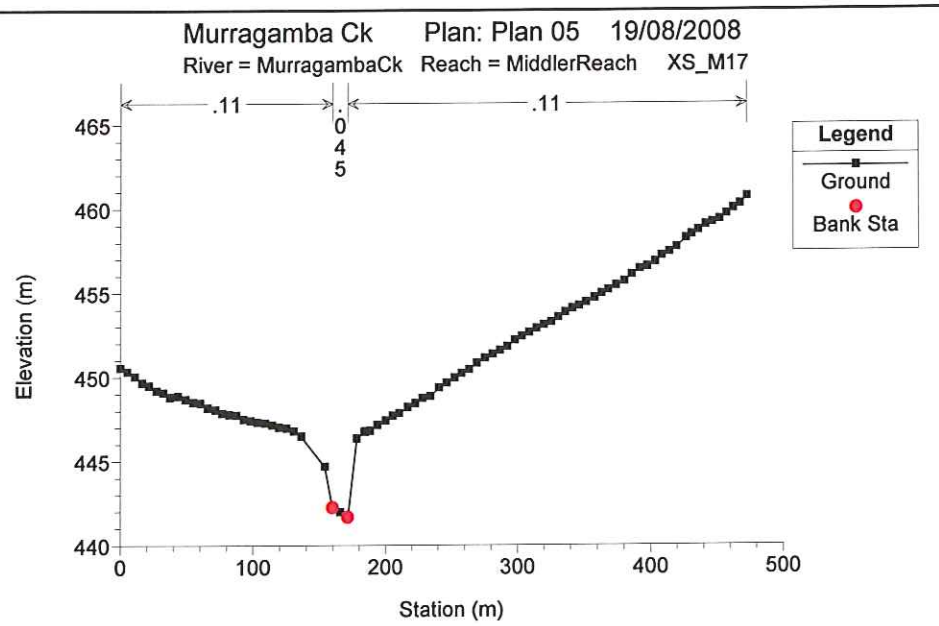

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M22
.07
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

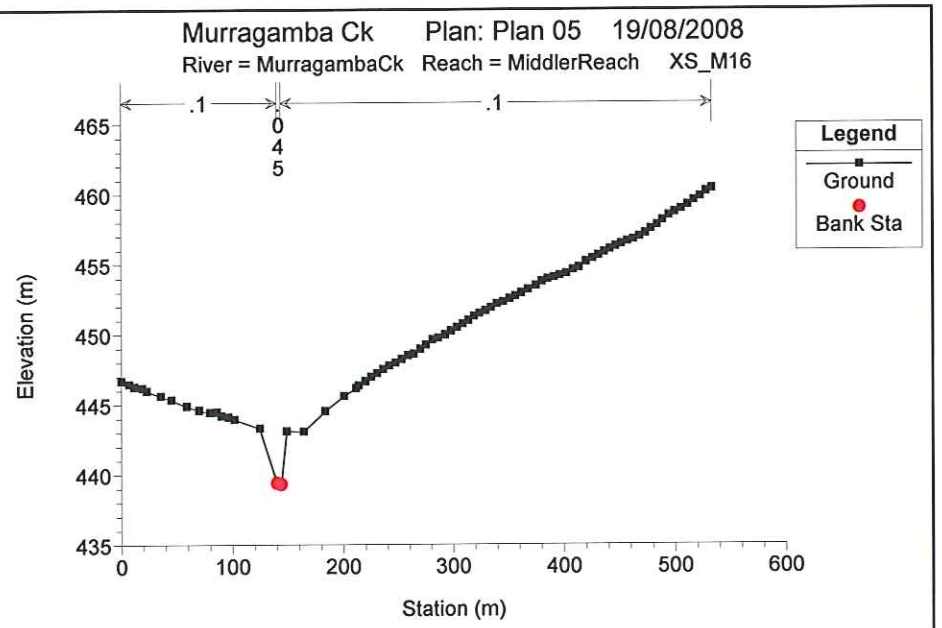

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M21
.09
.09
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

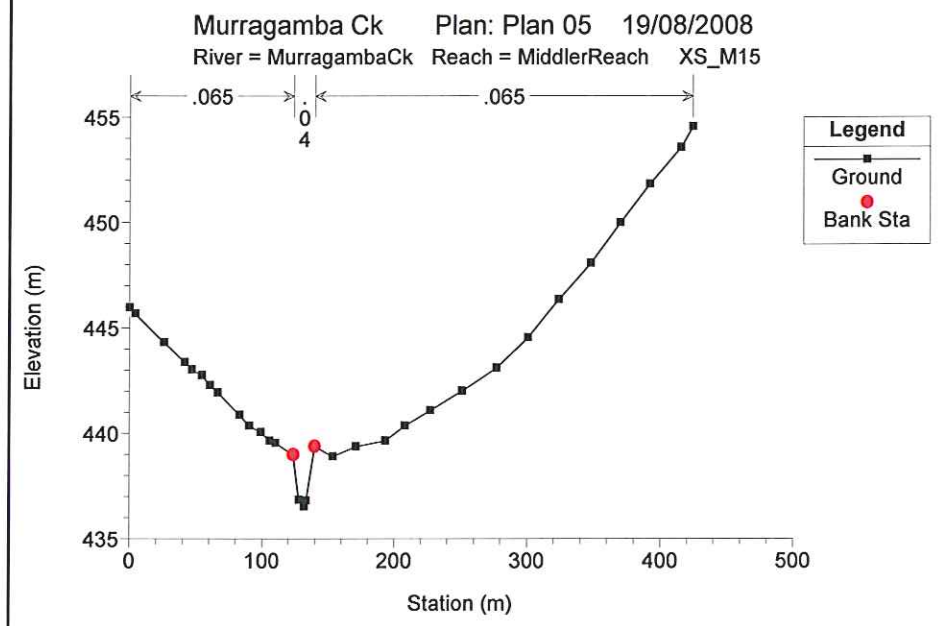

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M20
.08
.05
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

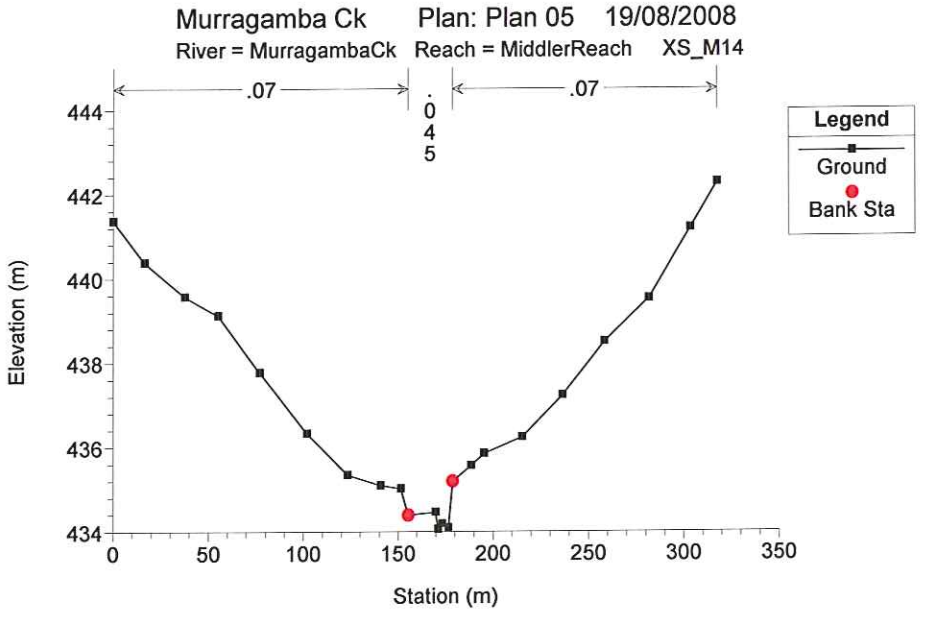

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M19
.055
.05
.055
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

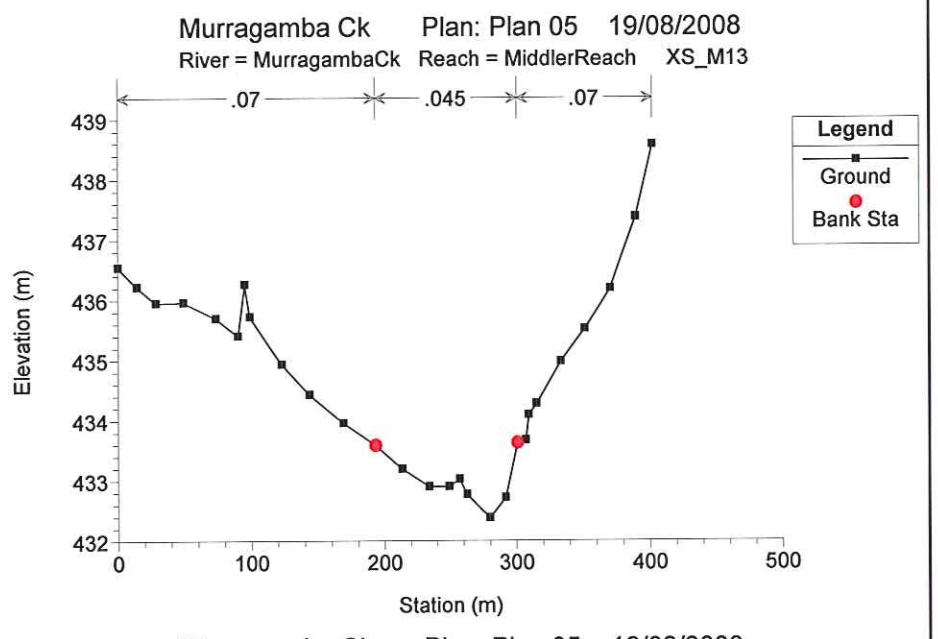

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M18
.05 .05 .05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

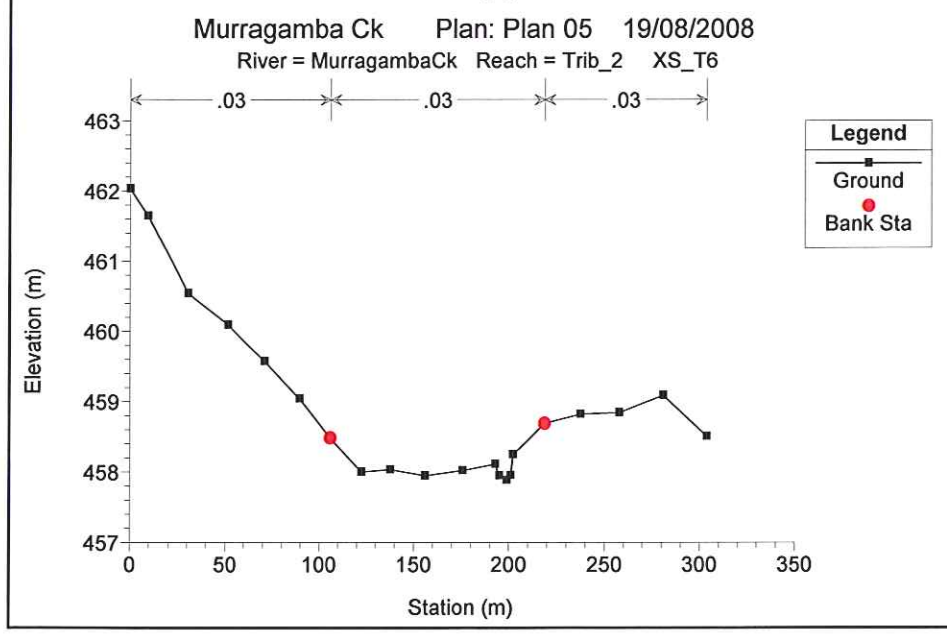

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M17
.11 .045 .11
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

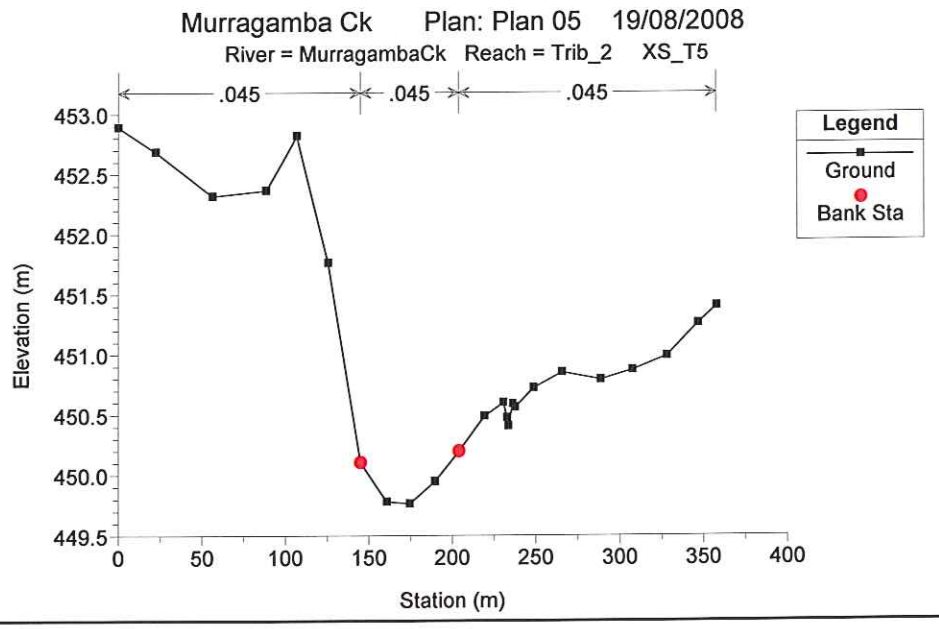

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M16
.1 .045 .1
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

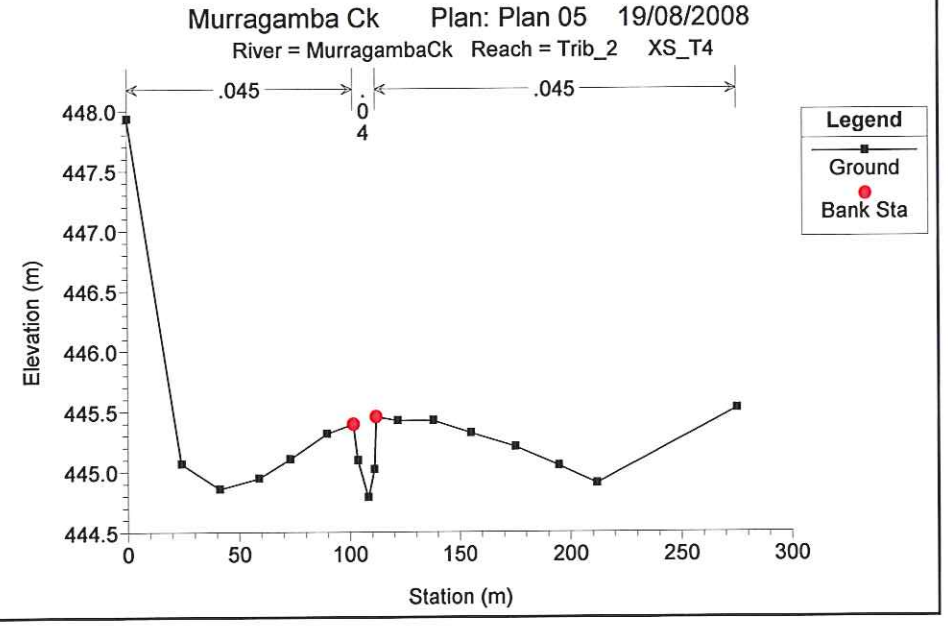

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M15
.065 .04 .065
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

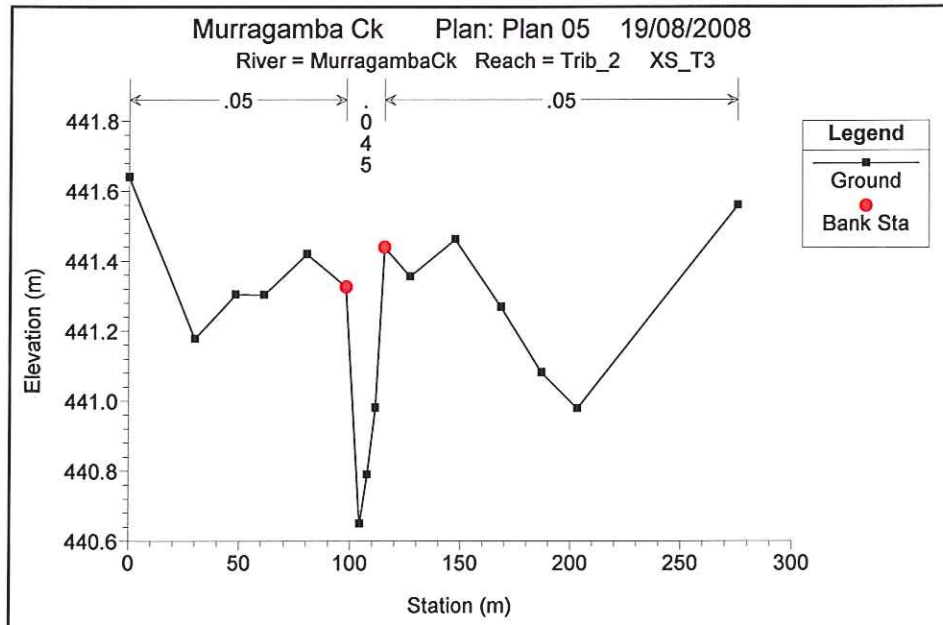

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M14
.07 .045 .07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

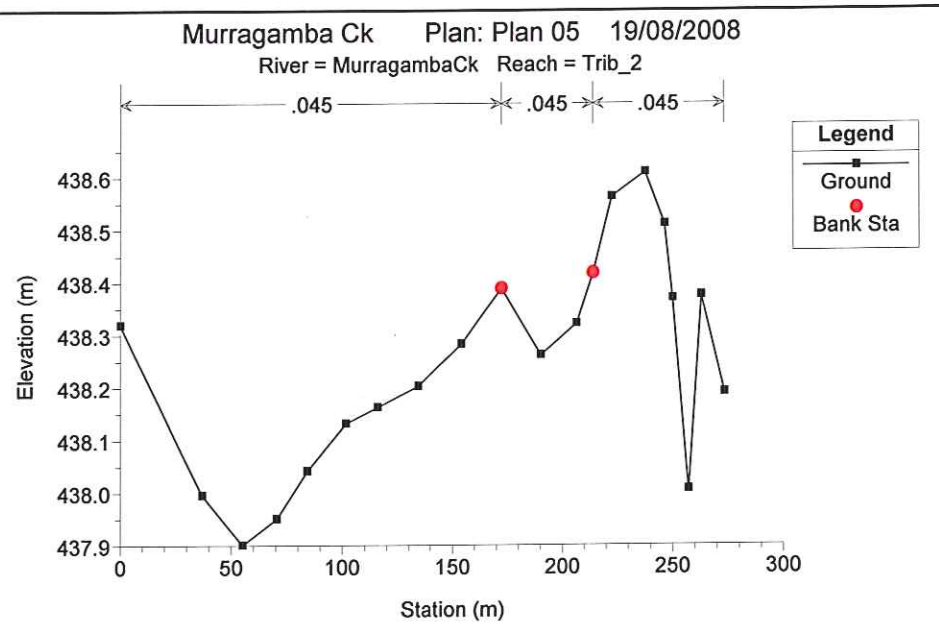

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddlerReach XS_M13
.07 .045 .07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

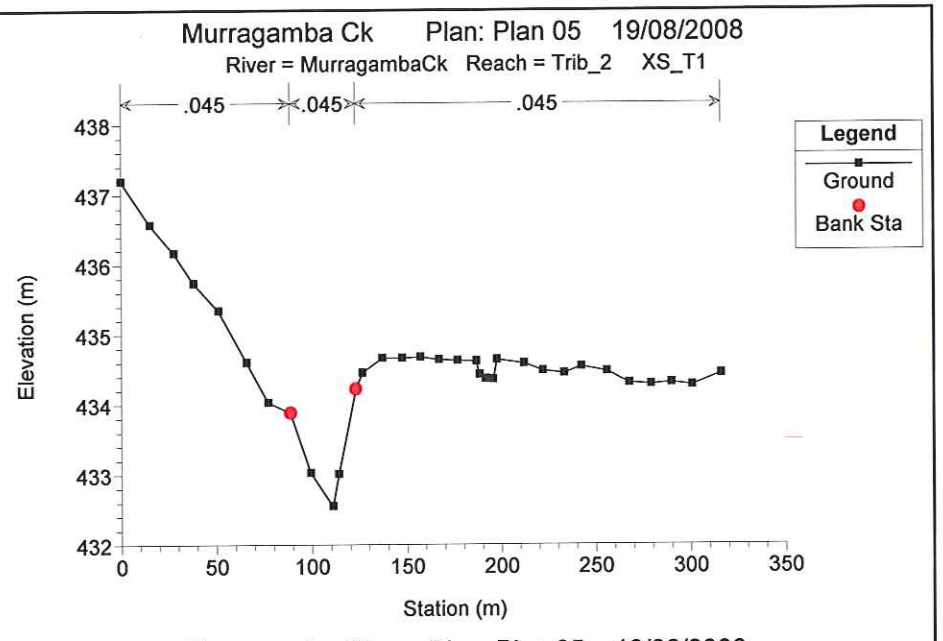

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2 XS_T6
.03 .03 .03
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

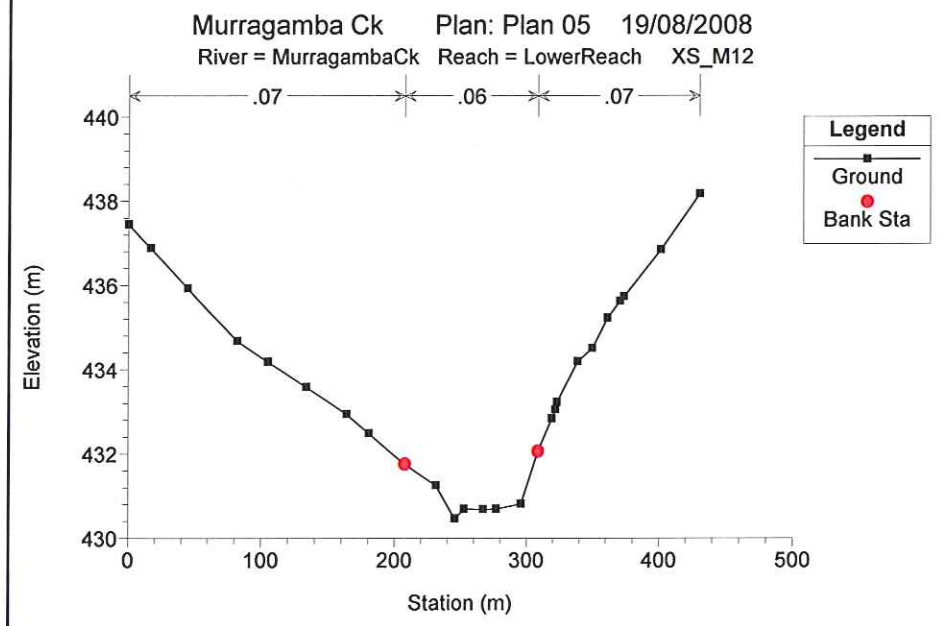

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2 XS_T5
.045 .045 .045
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

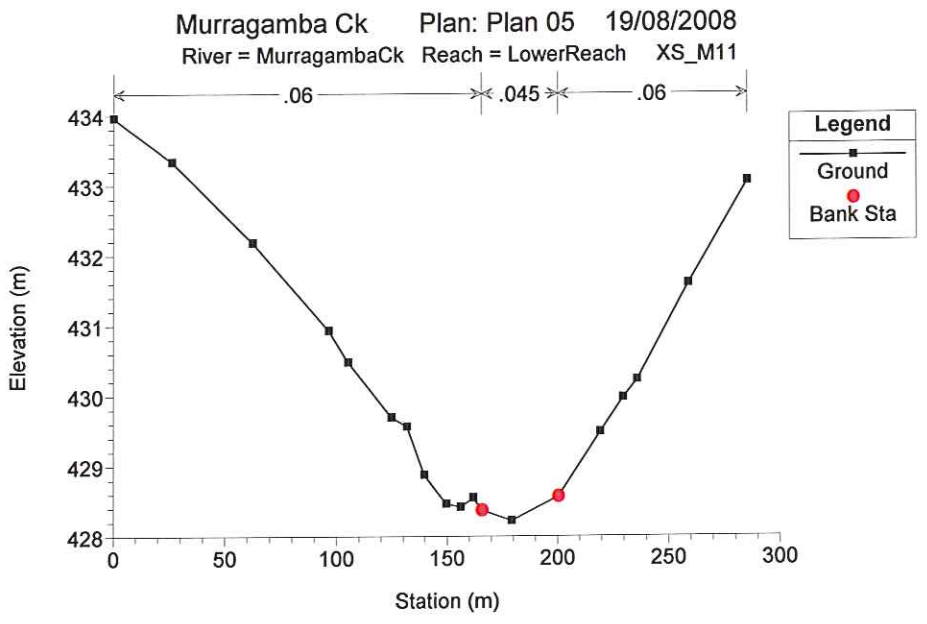

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2 XS_T4
.045 .04 .045
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

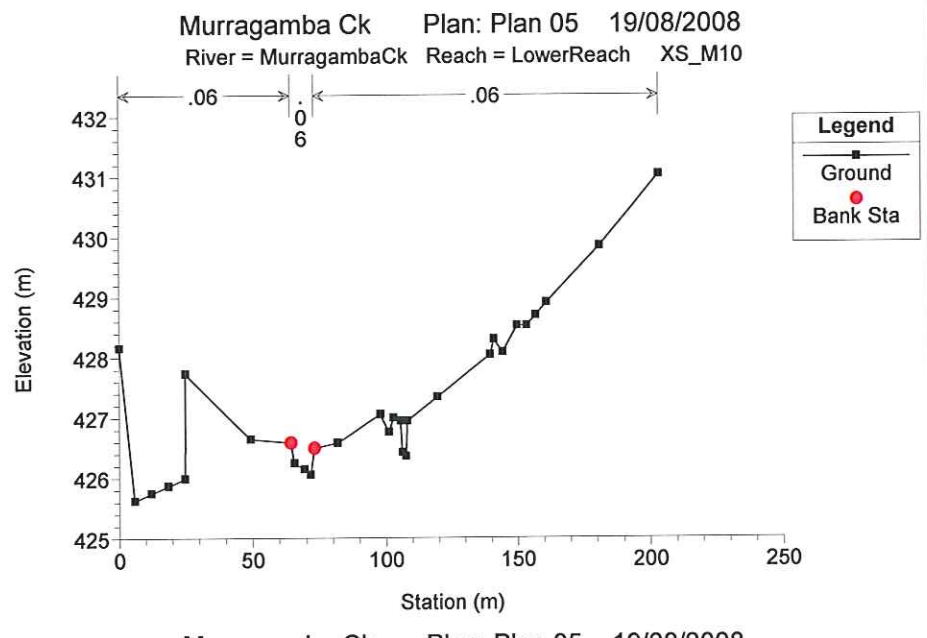

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2 XS_T3
.05
.045
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

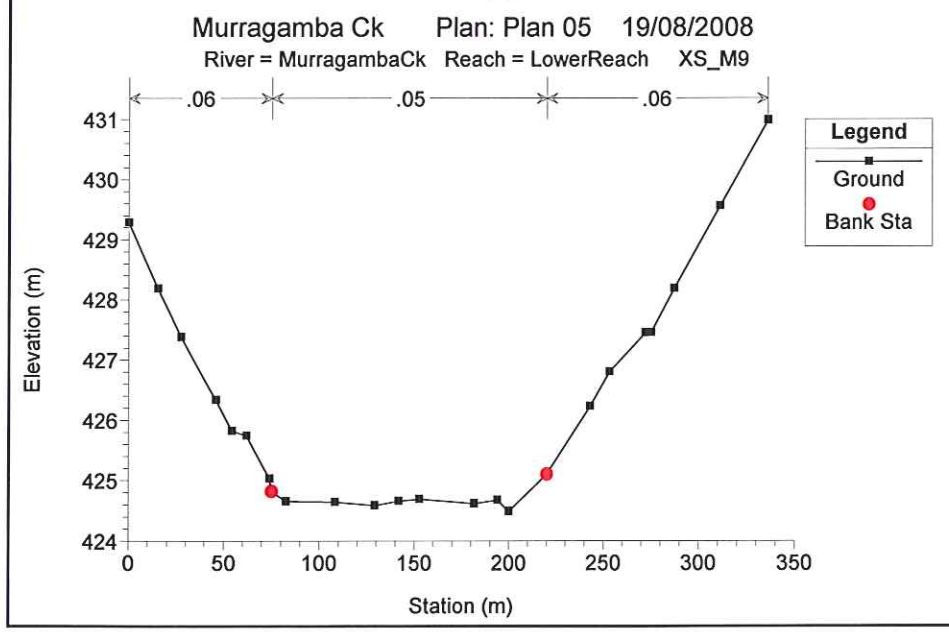

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2
.045
.045
.045
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

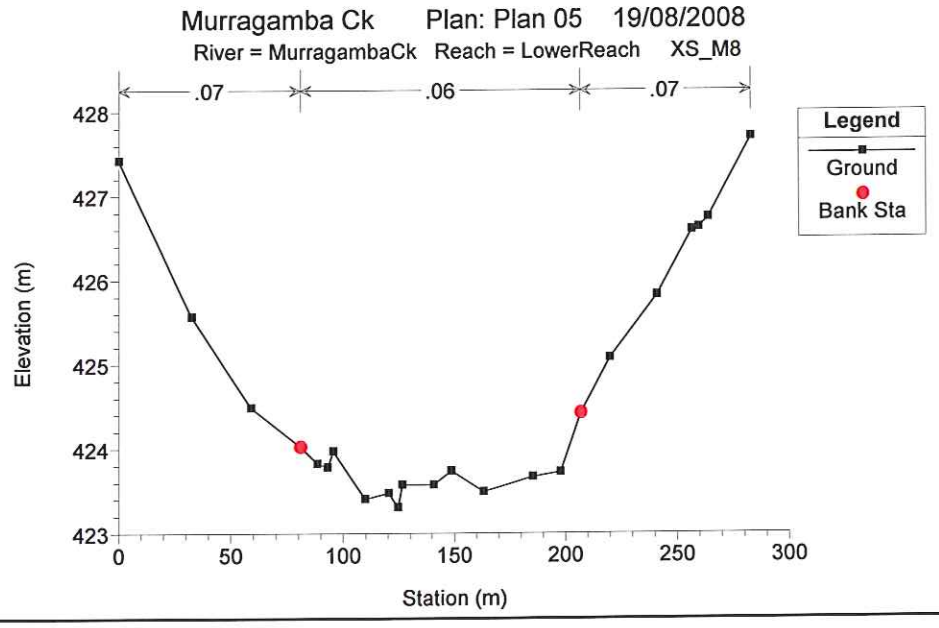

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2 XS_T1
.045
.045
.045
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

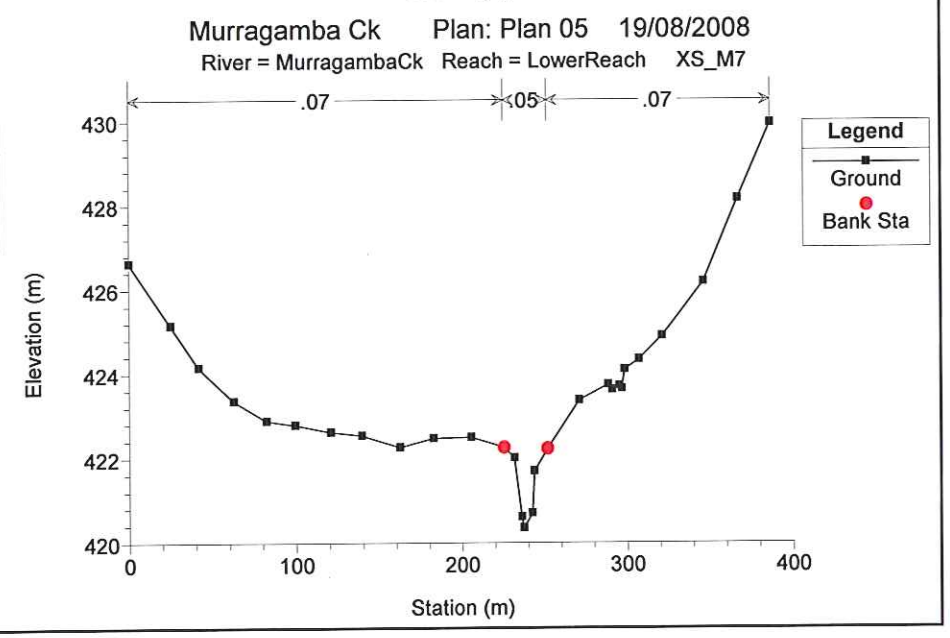

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M12
.07
.06
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

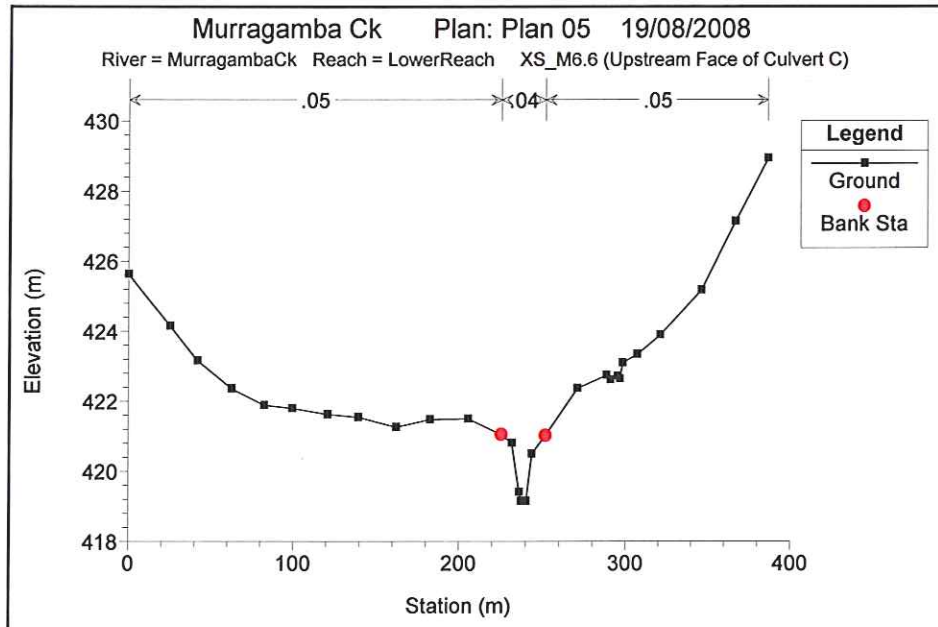

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M11
.06
.045
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

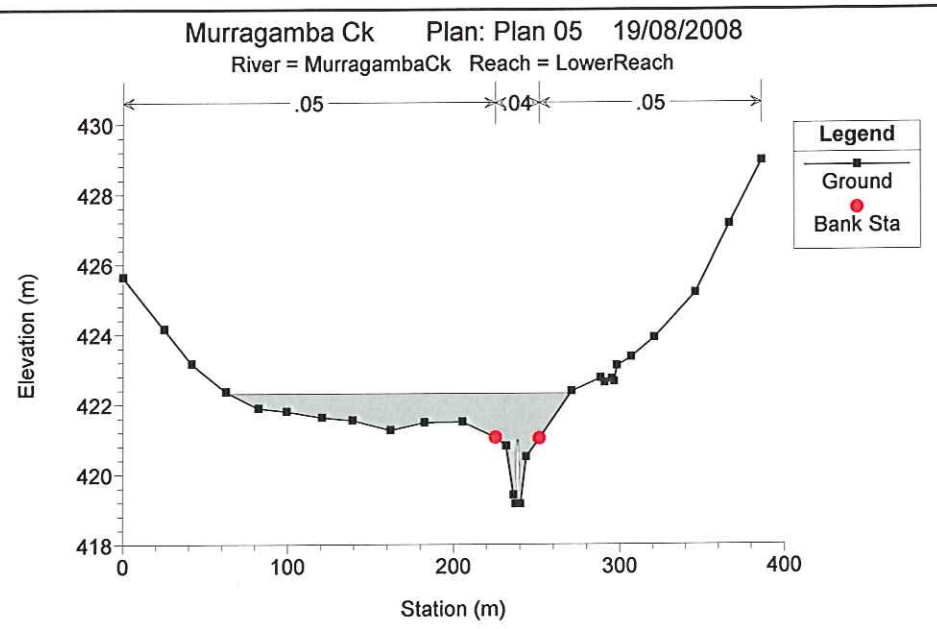

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M10
.06
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

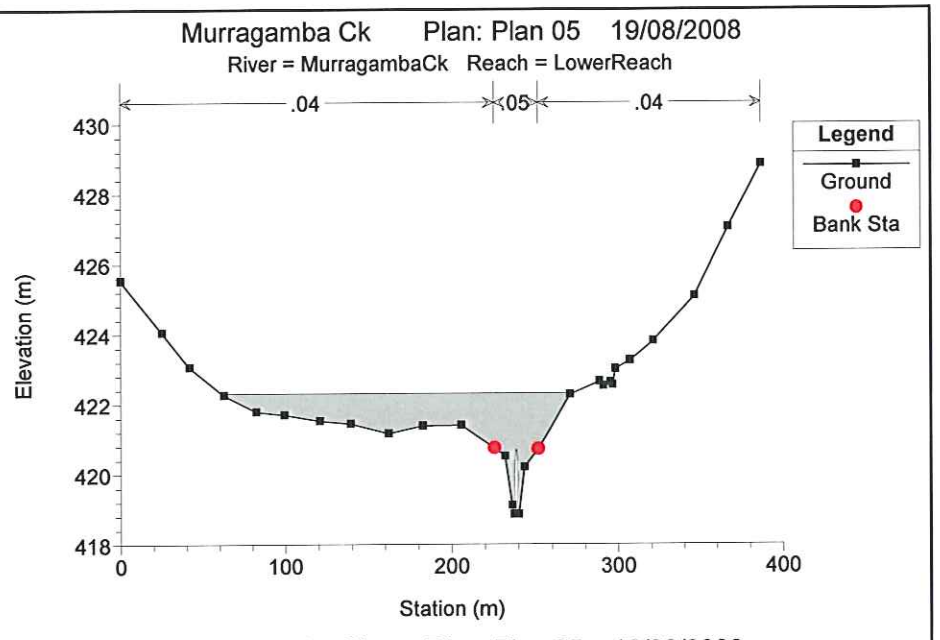

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M9
.06
.05
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

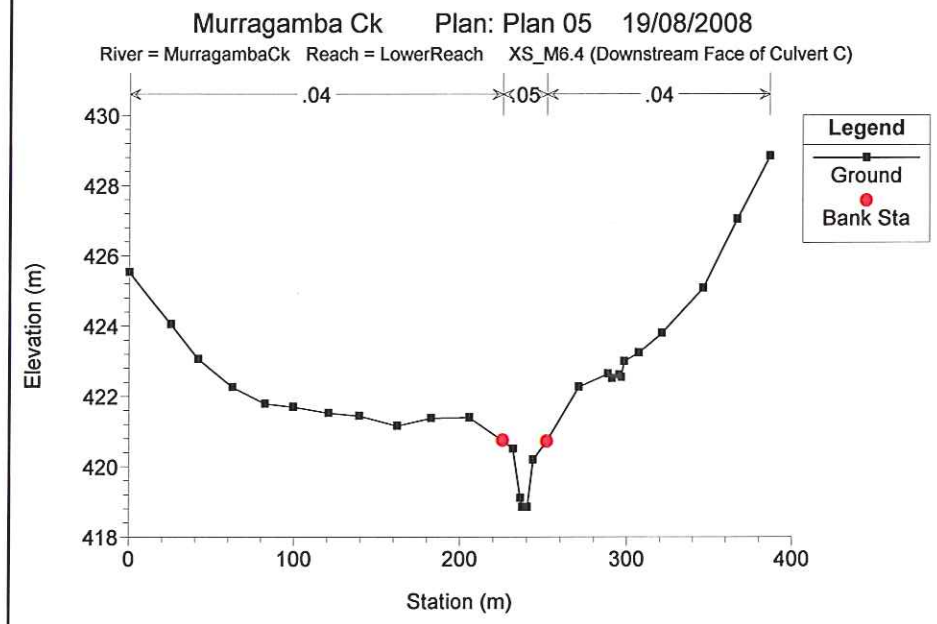

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M8
.07
.06
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

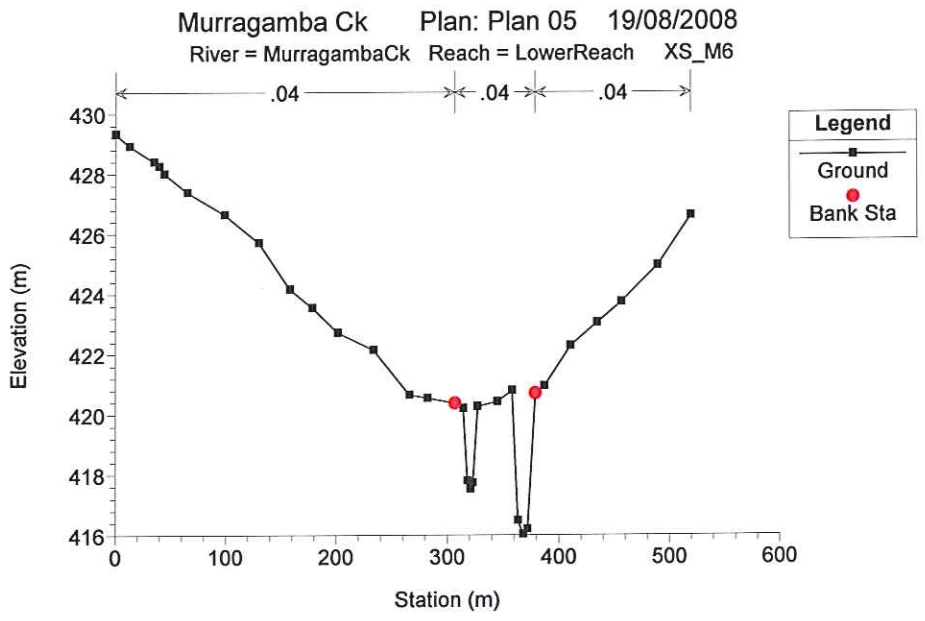

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M7
.07
.05
.07
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

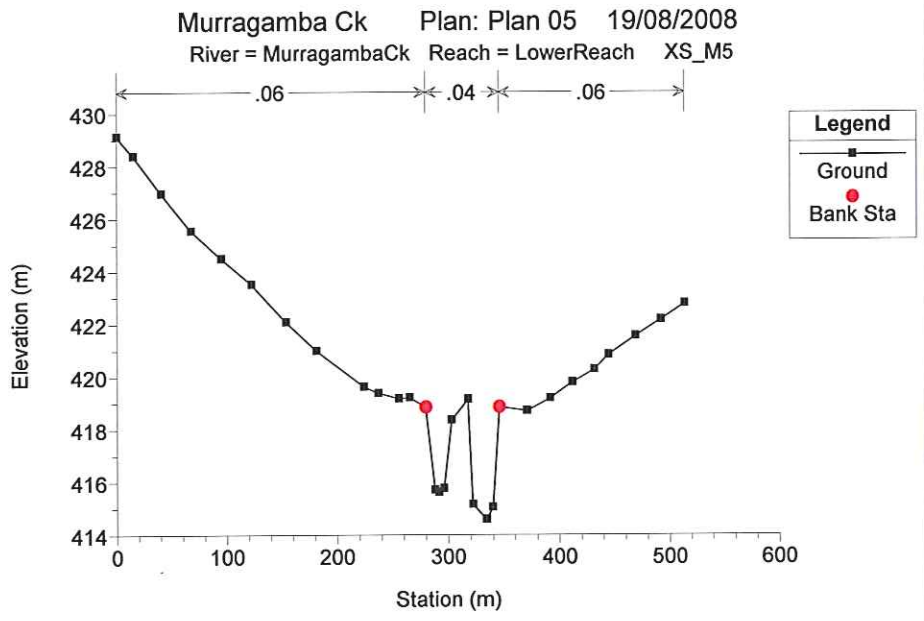

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M6.6 (Upstream Face of Culvert C)
.05
.04
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

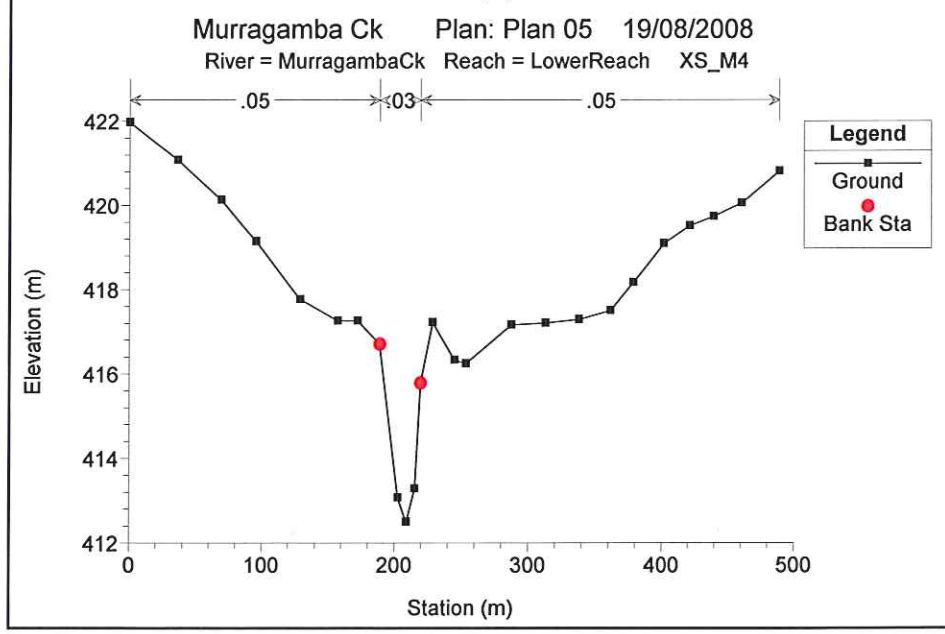

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach
.05
.04
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

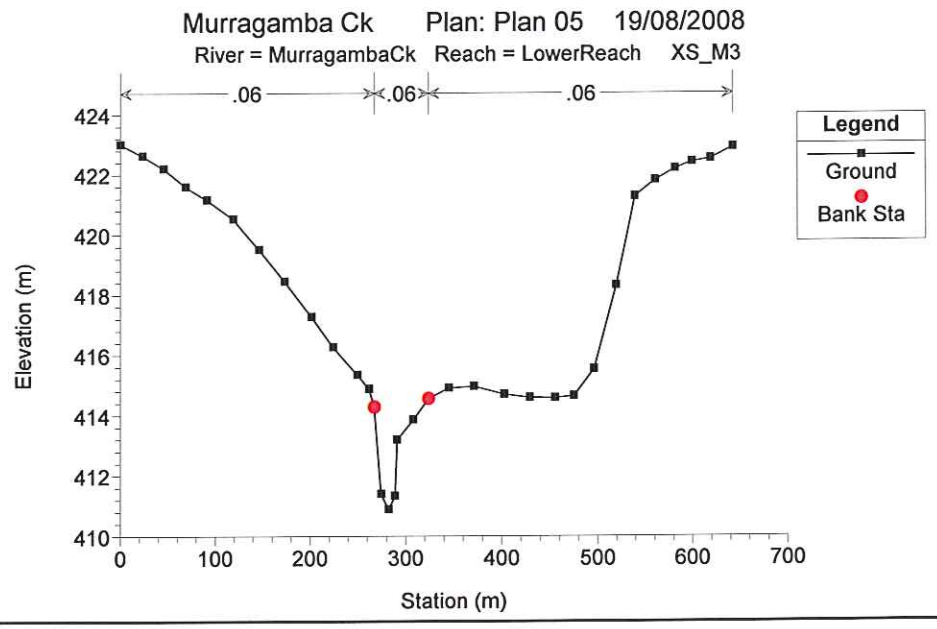

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach
.04
.05
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

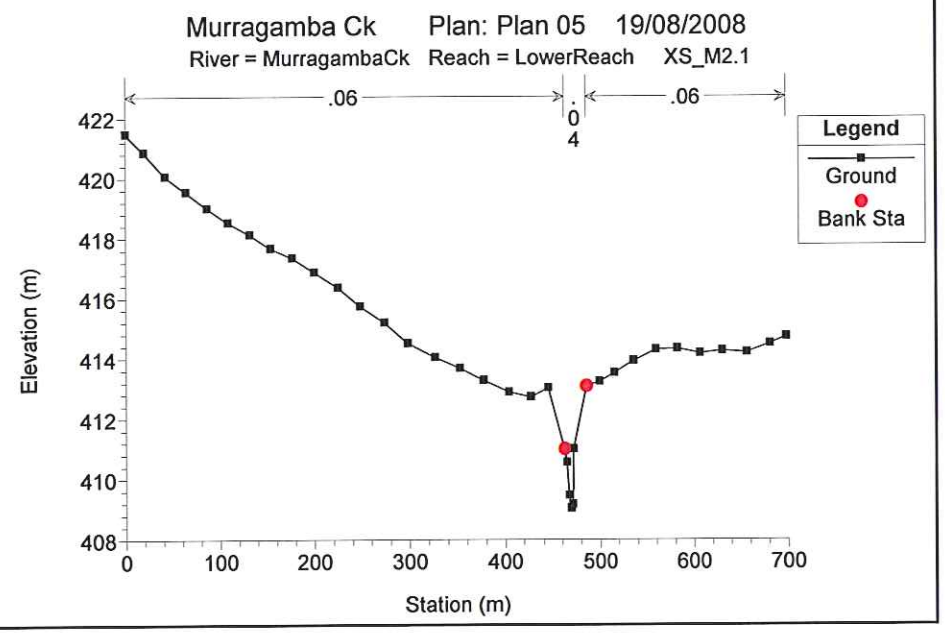

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M6.4 (Downstream Face of Culvert C)
.04
.05
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

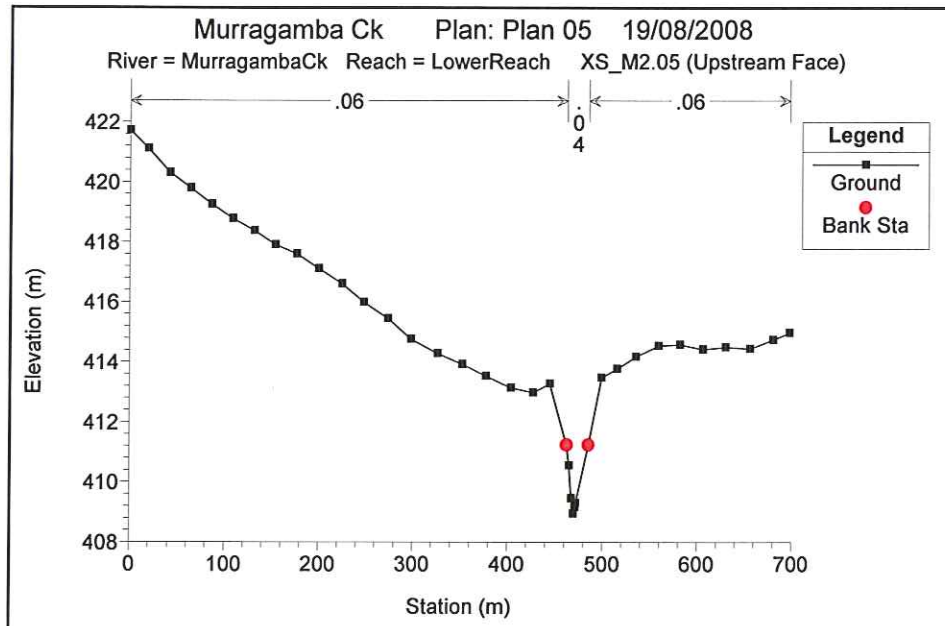

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M6
.04
.04
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

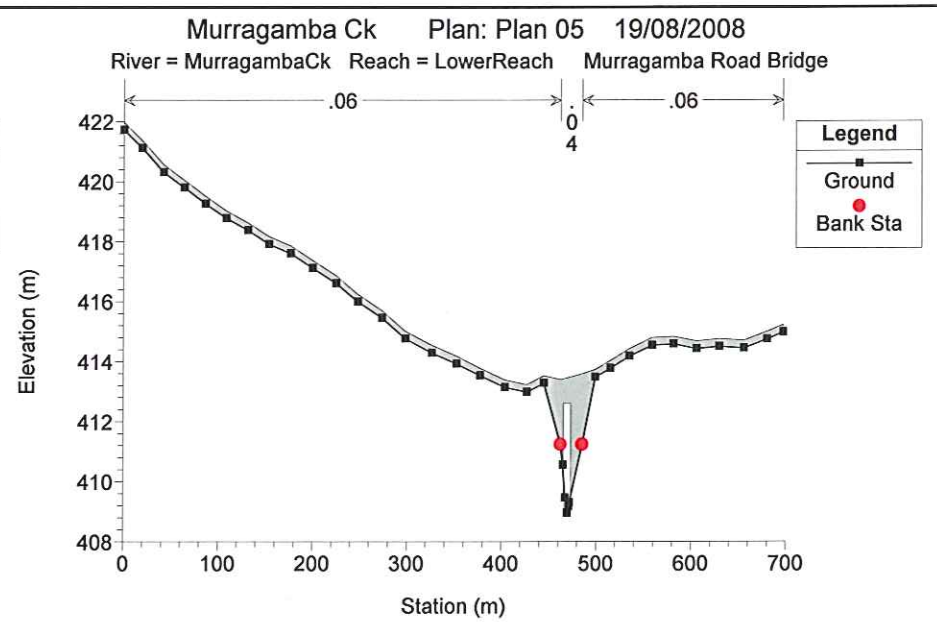

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M5
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

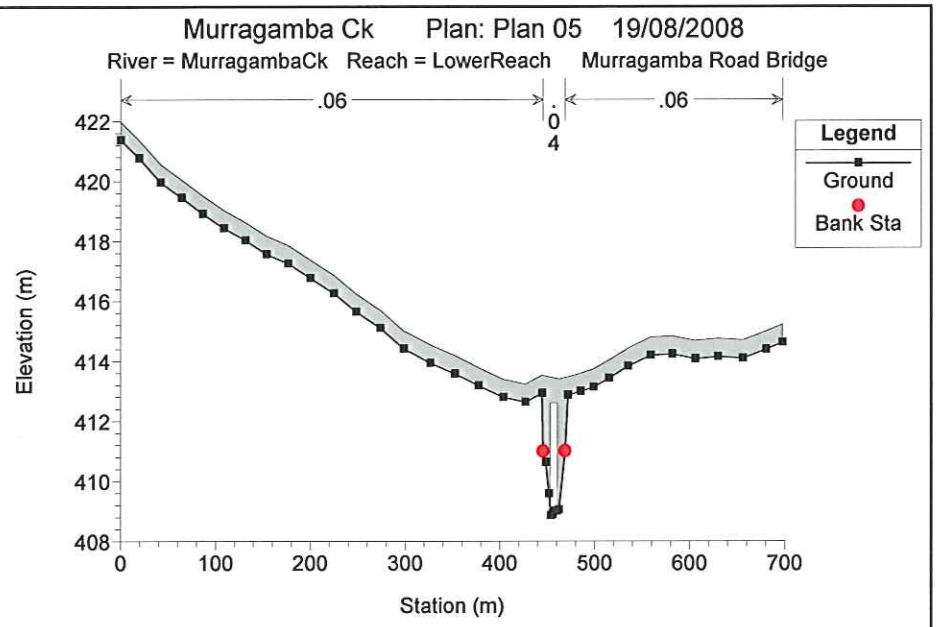

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M4
.05
.03
.05
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

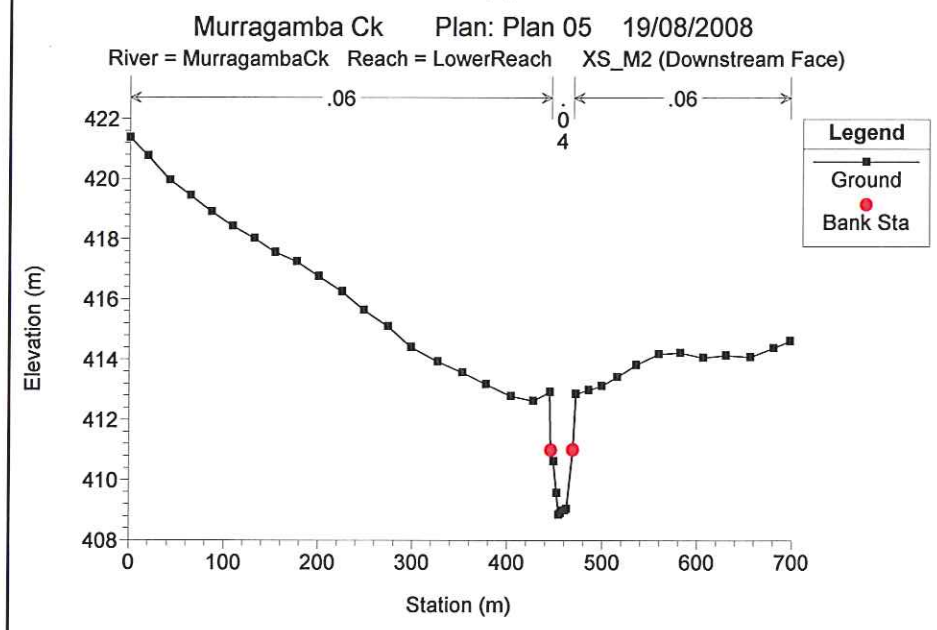

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M3
.06
.06
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

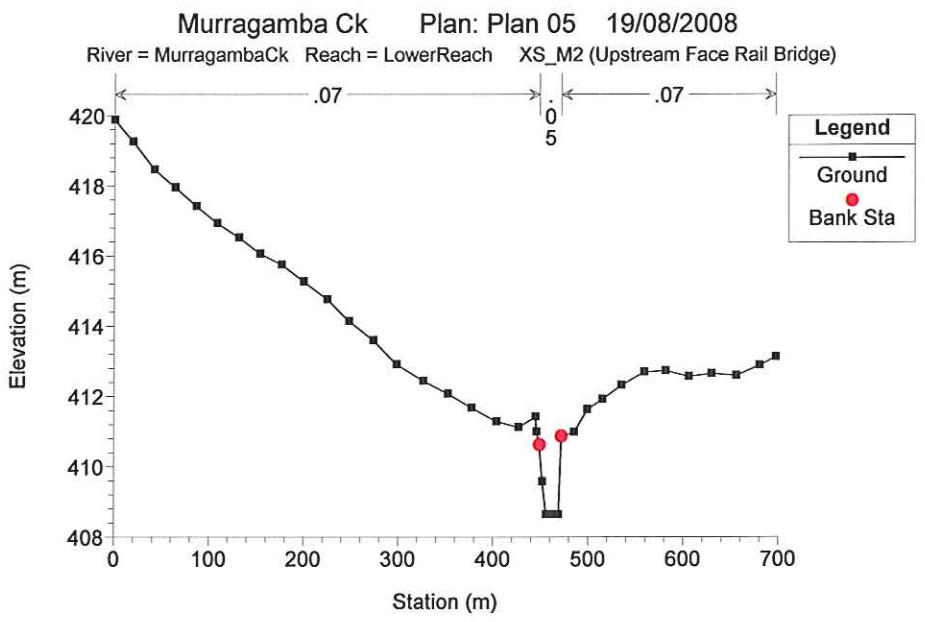

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M2.1
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

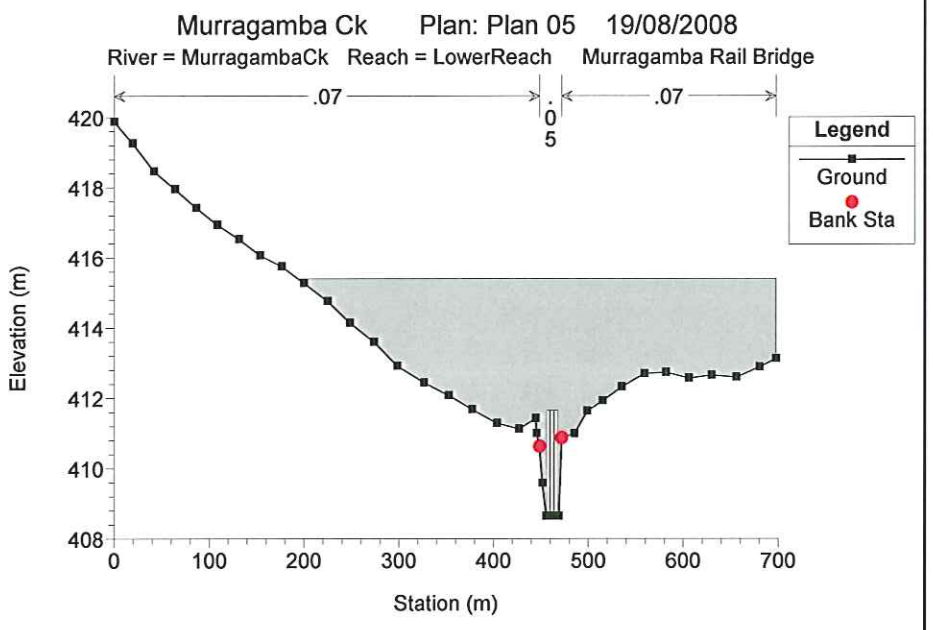

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M2.05 (Upstream Face)
.06
.06
0.4
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

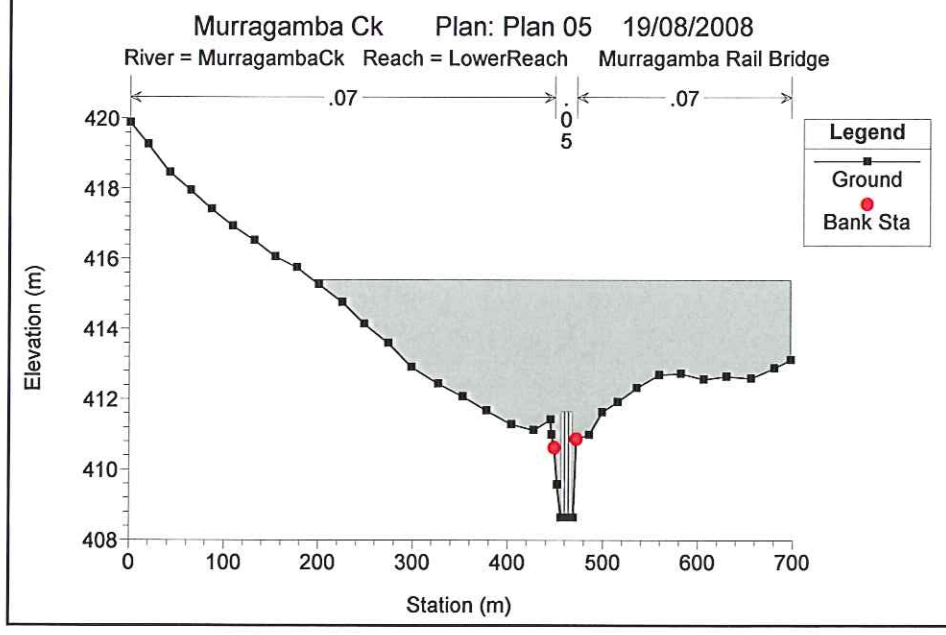

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach Murragamba Road Bridge
.06
.06
0.4
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

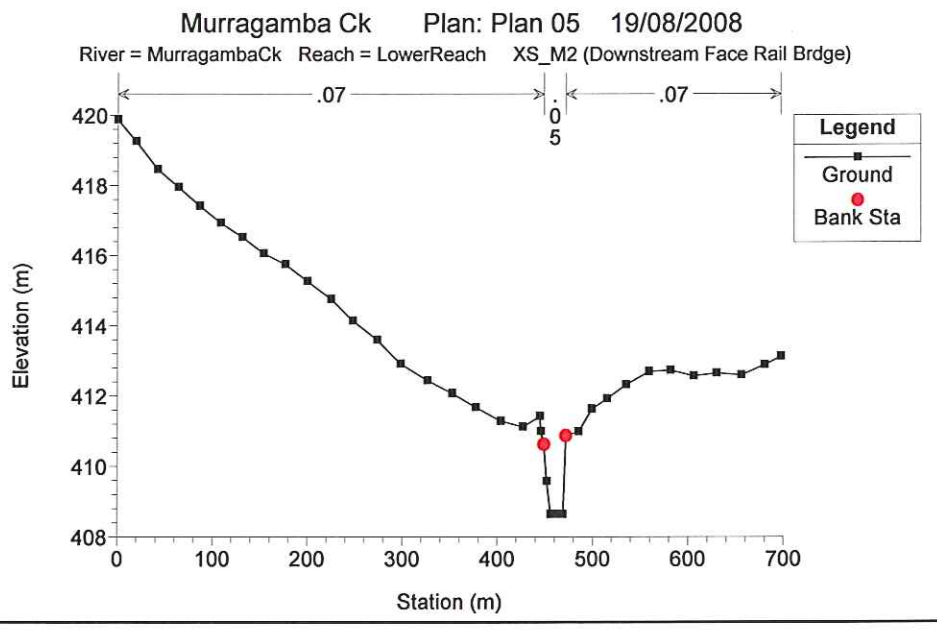

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach Murragamba Road Bridge
.06
.06
0.4
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

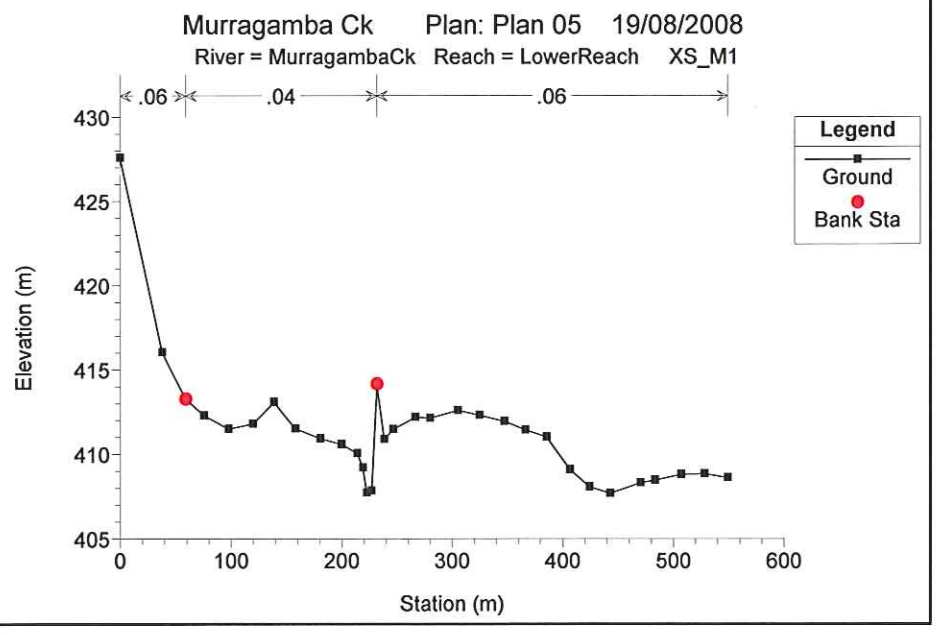

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M2 (Downstream Face)
.06
.06
0.4
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M2 (Upstream Face Rail Bridge)
.07
.07
0.5
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

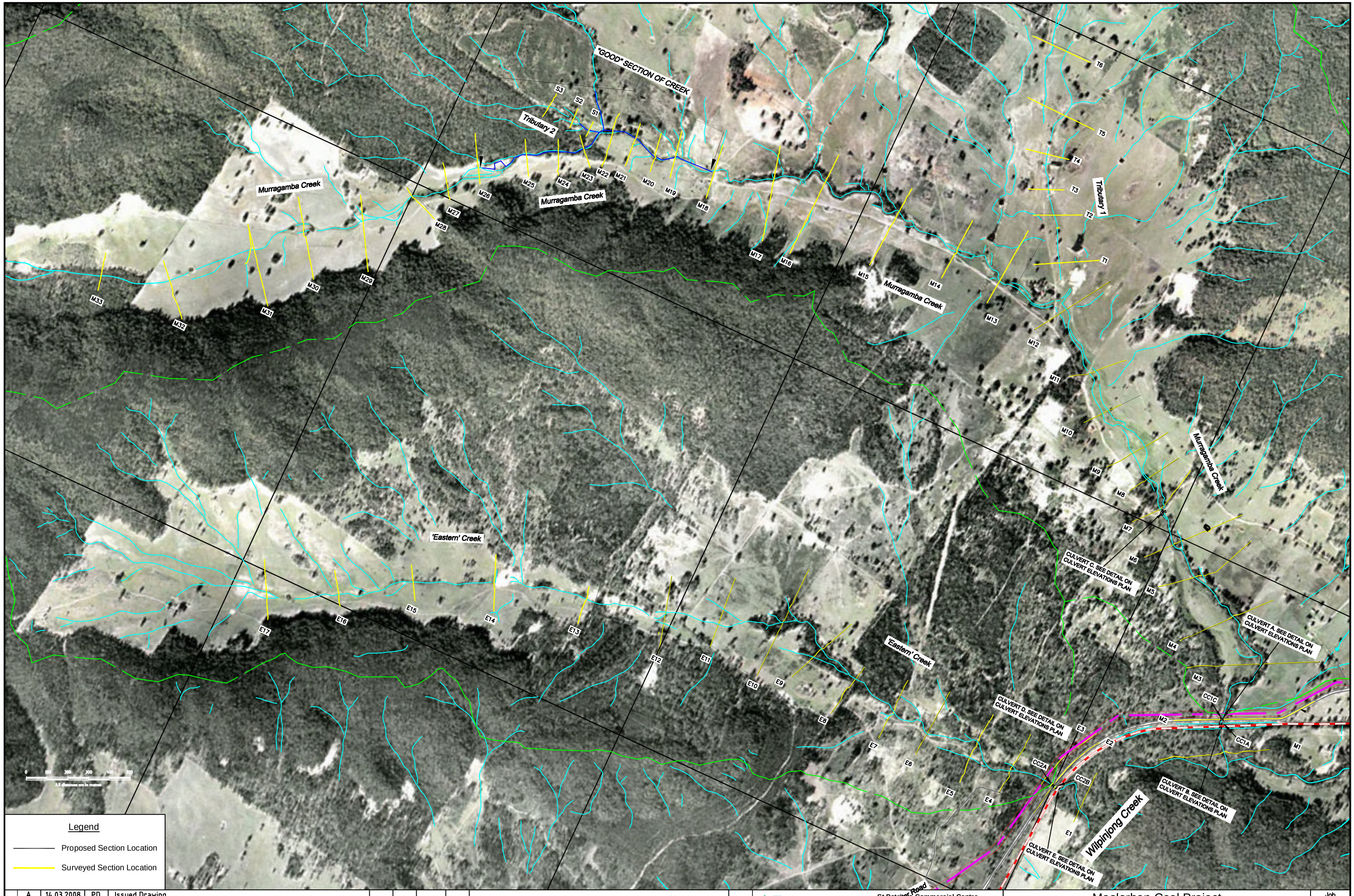

Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach Murragamba Rail Bridge
.07
.07
0.5
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach Murragamba Rail Bridge
.07
.07
0.5
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M2 (Downstream Face Rail Brdge)
.07
.07
0.5
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M1
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

Appendix C – DETAILS OF BRIDGE CROSSINGS OF MURRAGAMBA AND 'EASTERN' CREEKS



REVISIONS										
A	14.03.2008	PD	Issued Drawing							
B	03.07.2008	PD	Extension to Creek Survey and Section Locations							
C	22.07.2008	PD	Culvert Sections Added							
REV.	DATE	BY	DESCRIPTION	CHK.	REV.	DATE	BY	DESCRIPTION	CHK.	

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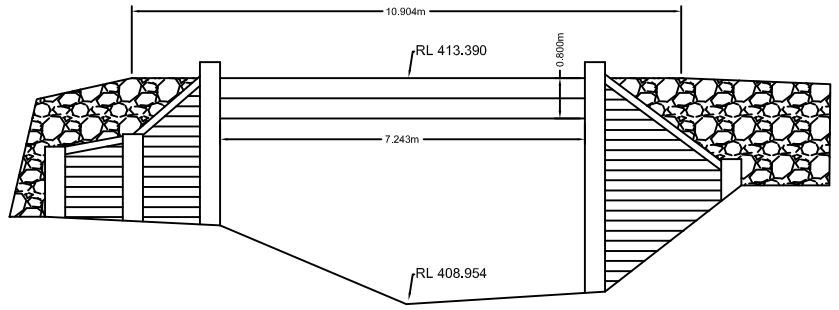
Website: www.pegasus.net.au

Moolarben Coal Project

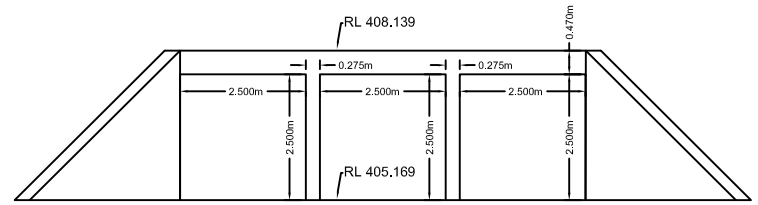
Section Location Plan

Job	Dwg No.	Rev.
55k1k	02921	C

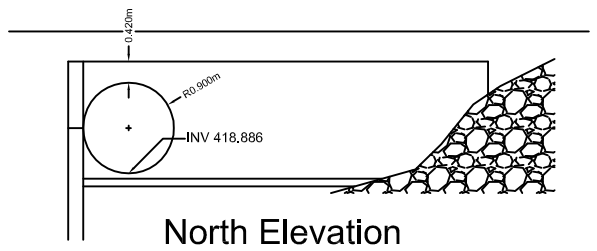
Date	Scale:	Drawn	Checked	Approved	Sheet Size	Sheet No.
22.07.08	1:8000	TB	JF		A1	1 OF 1



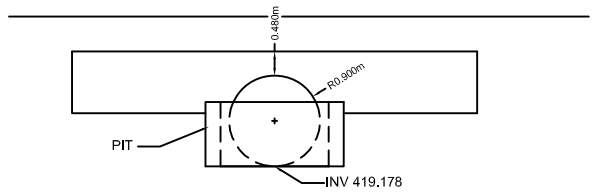
Culvert B
Bridge
Road Crossing



Culvert D
Box Culvert
Road Crossing

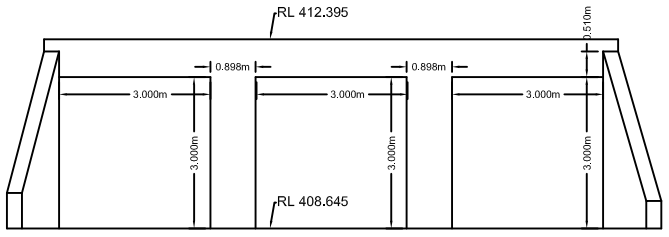


North Elevation

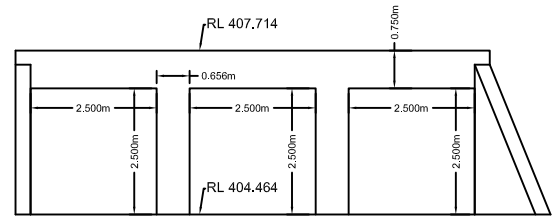


South Elevation

Culvert C
Creek Crossing



Culvert A
Box Culvert
Rail Crossing



Culvert E
Box Culvert
Rail Crossing

REVISIONS											
REV.	DATE	BY	DESCRIPTION	CHK.	REV.	DATE	BY	DESCRIPTION	CHK.		

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Moolarben Coal Project

Cuvlert Elevations

Date	Scale:	Drawn	Checked	Approved
22.07.08	1:150	TB	PD	

Job 55k1k
Dwg No. 02921
Rev. C
Sheet A3

Appendix D – RAFTS MODEL OUTPUT FOR DESIGN FLOOD SIMULATIONS

Eastern Creek RAFTS Results

Run started at: 18th July 2008 9:37:52

##

RUNTIME RESULTS

##

Max. no. of links allowed = 2000

Max. no. of routng increments allowed = 25000

Max no. of ratng curve points = 25000

Max. no. of storm temporal points = 25000

Max. no. of channel subreaches = 25

Max link stack level = 25

Input Version number = 650

LINK 20.00 1.000

ESTIMATED VOLUME (CU METRES*10**3) = 12.77

ESTIMATED PEAK FLOW (CUMECS) = 2.57

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 20.01 1.001

ESTIMATED VOLUME (CU METRES*10**3) = 16.98

ESTIMATED PEAK FLOW (CUMECS) = 4.17

ESTIMATED TIME TO PEAK (MINS) = 28.00

LINK 21.00 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 6.468

ESTIMATED PEAK FLOW (CUMECS) = 2.01

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 22.00 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 10.95

ESTIMATED PEAK FLOW (CUMECS) = 2.97

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 20.02 1.002

ESTIMATED VOLUME (CU METRES*10**3) = 40.59

ESTIMATED PEAK FLOW (CUMECS) = 10.42

ESTIMATED TIME TO PEAK (MINS) = 39.00

LINK 23.00 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 4.037

ESTIMATED PEAK FLOW (CUMECS) = 2.12

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 20.03 1.003

ESTIMATED VOLUME (CU METRES*10**3) = 53.97

ESTIMATED PEAK FLOW (CUMECS) = 12.78

ESTIMATED TIME TO PEAK (MINS) = 54.00

LINK 24.00 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 13.51

ESTIMATED PEAK FLOW (CUMECS) = 3.24

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 25.00 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 12.37

ESTIMATED PEAK FLOW (CUMECS) = 3.15

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 20.04 1.004

ESTIMATED VOLUME (CU METRES*10**3) = 89.13

ESTIMATED PEAK FLOW (CUMECS) = 18.04

ESTIMATED TIME TO PEAK (MINS) = 60.00

LINK 20.05 1.005

ESTIMATED VOLUME (CU METRES*10**3) = 101.8

ESTIMATED PEAK FLOW (CUMECS) = 19.07

ESTIMATED TIME TO PEAK (MINS) = 77.00

LINK 26.00 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 10.59

ESTIMATED PEAK FLOW (CUMECS) = 2.90

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 26.01 7.001

ESTIMATED VOLUME (CU METRES*10**3) = 25.12

ESTIMATED PEAK FLOW (CUMECS) = 6.18

ESTIMATED TIME TO PEAK (MINS) = 37.00

LINK 27.00 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 16.48

ESTIMATED PEAK FLOW (CUMECS) = 3.35

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 20.06 1.006

ESTIMATED VOLUME (CU METRES*10**3) = 173.1

ESTIMATED PEAK FLOW (CUMECS) = 26.61

ESTIMATED TIME TO PEAK (MINS) = 100.00

LINK 28.00 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 19.78

ESTIMATED PEAK FLOW (CUMECS) = 3.09

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 20.07 1.007

ESTIMATED VOLUME (CU METRES*10**3) = 204.1

ESTIMATED PEAK FLOW (CUMECS) = 28.78

ESTIMATED TIME TO PEAK (MINS) = 108.00

LINK 20.08 1.008

ESTIMATED VOLUME (CU METRES*10**3) = 215.0

ESTIMATED PEAK FLOW (CUMECS) = 29.25

ESTIMATED TIME TO PEAK (MINS) = 107.00

Run started at: 2nd June 2008 11:42:30

Murragamba Creek RAFTS Results

```
##########################################################################################
###

                RUNTIME        RESULTS

##########################################################################################
###

 Max. no. of links allowed =  2000

Max. no. of routng increments allowed = 25000

Max. no. of ratng curve points = 25000

Max. no. of storm temporal points = 25000

Max. no. of channel subreaches =    25

Max link stack level =    25

Input Version number =         650


 LINK 2.00          1.000

 ESTIMATED VOLUME (CU METRES*10**3) =         14.35

 ESTIMATED PEAK FLOW       (CUMECS) =     3.26

 ESTIMATED TIME TO PEAK       (MINS) =    16.00


 LINK 1.00          1.001

 ESTIMATED VOLUME (CU METRES*10**3) =         52.29

 ESTIMATED PEAK FLOW       (CUMECS) =     8.61

 ESTIMATED TIME TO PEAK       (MINS) =    16.00


 LINK 1.01          1.002

 ESTIMATED VOLUME (CU METRES*10**3) =         92.85

 ESTIMATED PEAK FLOW       (CUMECS) =    14.19
```

ESTIMATED TIME TO PEAK (MINS) = 47.00

LINK 3.00 2.000

ESTIMATED VOLUME (CU METRES*10**3) = 15.30

ESTIMATED PEAK FLOW (CUMECS) = 2.89

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.02 1.003

ESTIMATED VOLUME (CU METRES*10**3) = 126.7

ESTIMATED PEAK FLOW (CUMECS) = 19.46

ESTIMATED TIME TO PEAK (MINS) = 68.00

LINK 4.00 3.000

ESTIMATED VOLUME (CU METRES*10**3) = 27.11

ESTIMATED PEAK FLOW (CUMECS) = 5.38

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.03 1.004

ESTIMATED VOLUME (CU METRES*10**3) = 164.4

ESTIMATED PEAK FLOW (CUMECS) = 24.57

ESTIMATED TIME TO PEAK (MINS) = 76.00

LINK 5.00 4.000

ESTIMATED VOLUME (CU METRES*10**3) = 14.05

ESTIMATED PEAK FLOW (CUMECS) = 3.70

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 6.00 5.000

ESTIMATED VOLUME (CU METRES*10**3) = 16.59

ESTIMATED PEAK FLOW (CUMECS) = 4.02

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.04 1.005

ESTIMATED VOLUME (CU METRES*10**3) = 210.2

ESTIMATED PEAK FLOW (CUMECS) = 27.45

ESTIMATED TIME TO PEAK (MINS) = 97.00

LINK 7.00 6.000

ESTIMATED VOLUME (CU METRES*10**3) = 14.13

ESTIMATED PEAK FLOW (CUMECS) = 3.07

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 7.01 6.001

ESTIMATED VOLUME (CU METRES*10**3) = 21.37

ESTIMATED PEAK FLOW (CUMECS) = 5.18

ESTIMATED TIME TO PEAK (MINS) = 33.00

LINK 1.05 1.006

ESTIMATED VOLUME (CU METRES*10**3) = 239.2

ESTIMATED PEAK FLOW (CUMECS) = 31.46

ESTIMATED TIME TO PEAK (MINS) = 74.00

LINK 8.00 7.000

ESTIMATED VOLUME (CU METRES*10**3) = 10.43

ESTIMATED PEAK FLOW (CUMECS) = 2.67

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 8.01 7.001

ESTIMATED VOLUME (CU METRES*10**3) = 20.51

ESTIMATED PEAK FLOW (CUMECS) = 5.70

ESTIMATED TIME TO PEAK (MINS) = 34.00

LINK 1.06 1.007

ESTIMATED VOLUME (CU METRES*10**3) = 271.8

ESTIMATED PEAK FLOW (CUMECS) = 34.85

ESTIMATED TIME TO PEAK (MINS) = 82.00

LINK 9.00 8.000

ESTIMATED VOLUME (CU METRES*10**3) = 13.14

ESTIMATED PEAK FLOW (CUMECS) = 3.44

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.07 1.008

ESTIMATED VOLUME (CU METRES*10**3) = 303.3

ESTIMATED PEAK FLOW (CUMECS) = 36.67

ESTIMATED TIME TO PEAK (MINS) = 102.00

LINK 11.00 9.000

ESTIMATED VOLUME (CU METRES*10**3) = 20.61

ESTIMATED PEAK FLOW (CUMECS) = 4.65

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 11.01 9.001

ESTIMATED VOLUME (CU METRES*10**3) = 50.82

ESTIMATED PEAK FLOW (CUMECS) = 9.13

ESTIMATED TIME TO PEAK (MINS) = 44.00

LINK 10.00 10.000

ESTIMATED VOLUME (CU METRES*10**3) = 24.85

ESTIMATED PEAK FLOW (CUMECS) = 4.65

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.08 1.009

ESTIMATED VOLUME (CU METRES*10**3) = 390.3

ESTIMATED PEAK FLOW (CUMECS) = 43.67

ESTIMATED TIME TO PEAK (MINS) = 89.00

LINK 12.00 11.000

ESTIMATED VOLUME (CU METRES*10**3) = 20.68

ESTIMATED PEAK FLOW (CUMECS) = 3.48

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 13.00 12.000

ESTIMATED VOLUME (CU METRES*10**3) = 10.21

ESTIMATED PEAK FLOW (CUMECS) = 2.21

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.09 1.010

ESTIMATED VOLUME (CU METRES*10**3) = 433.0

ESTIMATED PEAK FLOW (CUMECS) = 46.58

ESTIMATED TIME TO PEAK (MINS) = 105.00

LINK 1.10 1.011

ESTIMATED VOLUME (CU METRES*10**3) = 466.7

ESTIMATED PEAK FLOW (CUMECS) = 47.12

ESTIMATED TIME TO PEAK (MINS) = 133.00

LINK 14.00 13.000

ESTIMATED VOLUME (CU METRES*10**3) = 24.21

ESTIMATED PEAK FLOW (CUMECS) = 4.29

ESTIMATED TIME TO PEAK (MINS) = 16.00

LINK 1.11 1.012

ESTIMATED VOLUME (CU METRES*10**3) = 509.7

ESTIMATED PEAK FLOW (CUMECS) = 48.57

ESTIMATED TIME TO PEAK (MINS) = 153.00

Appendix E – HEC-RAS MODEL OUTPUT FOR EXISTING CONDITIONS

Plan: murr MurragambaCk Trib_1 RS: 1.3 Profile: PF 1

E.G. Elev (m)	461.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.110	0.070	0.110
W.S. Elev (m)	461.29	Reach Len. (m)	125.00	125.00	125.00
Crit W.S. (m)		Flow Area (m2)	0.94	7.48	3.05
E.G. Slope (m/m)	0.040874	Area (m2)	0.94	7.48	3.05
Q Total (m3/s)	8.96	Flow (m3/s)	0.41	7.14	1.41
Top Width (m)	71.70	Top Width (m)	8.25	39.33	24.12
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.43	0.96	0.46
Max Chl Dpth (m)	0.27	Hydr. Depth (m)	0.11	0.19	0.13
Conv. Total (m3/s)	44.3	Conv. (m3/s)	2.0	35.3	7.0
Length Wtd. (m)	125.00	Wetted Per. (m)	8.26	39.33	24.12
Min Ch El (m)	461.02	Shear (N/m2)	45.73	76.22	50.64
Alpha	1.26	Stream Power (N/m s)	19.77	72.79	23.44
Frctn Loss (m)	4.07	Cum Volume (1000 m3)	0.79	2.31	0.62
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.12	3.91	2.01

Plan: murr MurragambaCk Trib_1 RS: 1.2 Profile: PF 1

E.G. Elev (m)	457.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.090	0.050	0.100
W.S. Elev (m)	457.07	Reach Len. (m)	99.00	99.00	99.00
Crit W.S. (m)	457.05	Flow Area (m2)	0.16	4.83	0.79
E.G. Slope (m/m)	0.027034	Area (m2)	0.16	4.83	0.79
Q Total (m3/s)	10.00	Flow (m3/s)	0.08	9.41	0.51
Top Width (m)	14.82	Top Width (m)	1.10	10.57	3.15
Vel Total (m/s)	1.73	Avg. Vel. (m/s)	0.49	1.95	0.65
Max Chl Dpth (m)	0.53	Hydr. Depth (m)	0.14	0.46	0.25
Conv. Total (m3/s)	60.8	Conv. (m3/s)	0.5	57.2	3.1
Length Wtd. (m)	99.00	Wetted Per. (m)	1.14	10.57	3.19
Min Ch El (m)	456.54	Shear (N/m2)	36.63	121.01	65.77
Alpha	1.20	Stream Power (N/m s)	17.88	235.90	42.69
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	0.72	1.54	0.38
C & E Loss (m)	0.03	Cum SA (1000 m2)	0.54	0.80	0.30

Plan: murr MurragambaCk Trib_1 RS: 1.1 Profile: PF 1

E.G. Elev (m)	456.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (m)	455.92	Reach Len. (m)	114.00	114.00	114.00
Crit W.S. (m)		Flow Area (m2)	5.07	4.07	1.11
E.G. Slope (m/m)	0.007302	Area (m2)	5.07	4.07	1.11
Q Total (m3/s)	11.00	Flow (m3/s)	3.99	6.32	0.69
Top Width (m)	18.24	Top Width (m)	9.74	5.50	3.00
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.79	1.55	0.62
Max Chl Dpth (m)	0.74	Hydr. Depth (m)	0.52	0.74	0.37
Conv. Total (m3/s)	128.7	Conv. (m3/s)	46.7	74.0	8.1
Length Wtd. (m)	114.00	Wetted Per. (m)	9.79	5.50	3.09
Min Ch El (m)	455.18	Shear (N/m2)	37.06	52.98	25.83
Alpha	1.42	Stream Power (N/m s)	29.16	82.30	15.98
Frctn Loss (m)	1.55	Cum Volume (1000 m3)	0.46	1.10	0.28
C & E Loss (m)	0.05	Cum SA (1000 m2)			

Plan: murr MurragambaCk UpperReach RS: 33 Profile: PF 1

E.G. Elev (m)	496.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.		0.050	
W.S. Elev (m)	496.30	Reach Len. (m)	283.70	356.00	428.40
Crit W.S. (m)	496.27	Flow Area (m2)		16.79	
E.G. Slope (m/m)	0.028828	Area (m2)		16.79	
Q Total (m3/s)	30.01	Flow (m3/s)		30.01	

Plan: murr MurragambaCk UpperReach RS: 33 Profile: PF 1 (Continued)

Top Width (m)	43.97	Top Width (m)		43.97	
Vel Total (m/s)	1.79	Avg. Vel. (m/s)		1.79	
Max Chl Dpth (m)	0.62	Hydr. Depth (m)		0.38	
Conv. Total (m3/s)	176.8	Conv. (m3/s)		176.8	
Length Wtd. (m)	358.94	Wetted Per. (m)		44.00	
Min Ch El (m)	495.68	Shear (N/m2)		107.91	
Alpha	1.00	Stream Power (N/m s)		192.83	
Frctn Loss (m)	6.43	Cum Volume (1000 m3)	21.55	47.71	16.42
C & E Loss (m)	0.02	Cum SA (1000 m2)	53.69	68.45	42.01

Plan: murr MurragambaCk UpperReach RS: 32 Profile: PF 1

E.G. Elev (m)	490.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (m)	489.91	Reach Len. (m)	441.00	425.00	418.10
Crit W.S. (m)	489.87	Flow Area (m2)	5.12	14.38	7.39
E.G. Slope (m/m)	0.012543	Area (m2)	5.12	14.38	7.39
Q Total (m3/s)	32.54	Flow (m3/s)	4.01	21.99	6.54
Top Width (m)	90.17	Top Width (m)	24.79	35.65	29.73
Vel Total (m/s)	1.21	Avg. Vel. (m/s)	0.78	1.53	0.89
Max Chl Dpth (m)	0.46	Hydr. Depth (m)	0.21	0.40	0.25
Conv. Total (m3/s)	290.5	Conv. (m3/s)	35.8	196.3	58.4
Length Wtd. (m)	427.71	Wetted Per. (m)	24.79	35.66	29.74
Min Ch El (m)	489.45	Shear (N/m2)	25.42	49.62	30.56
Alpha	1.24	Stream Power (N/m s)	19.90	75.85	27.06
Frctn Loss (m)	6.58	Cum Volume (1000 m3)	20.82	42.16	14.83
C & E Loss (m)	0.01	Cum SA (1000 m2)	50.17	54.28	35.64

Plan: murr MurragambaCk UpperReach RS: 31 Profile: PF 1

E.G. Elev (m)	483.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.050	0.045	0.050
W.S. Elev (m)	483.24	Reach Len. (m)	275.00	264.00	255.80
Crit W.S. (m)		Flow Area (m2)	10.69	6.96	4.90
E.G. Slope (m/m)	0.018809	Area (m2)	10.69	6.96	4.90
Q Total (m3/s)	36.39	Flow (m3/s)	13.24	16.74	6.42
Top Width (m)	59.97	Top Width (m)	35.22	9.91	14.84
Vel Total (m/s)	1.61	Avg. Vel. (m/s)	1.24	2.40	1.31
Max Chl Dpth (m)	0.84	Hydr. Depth (m)	0.30	0.70	0.33
Conv. Total (m3/s)	265.3	Conv. (m3/s)	96.5	122.0	46.8
Length Wtd. (m)	263.18	Wetted Per. (m)	35.22	9.93	14.86
Min Ch El (m)	482.40	Shear (N/m2)	55.97	129.28	60.84
Alpha	1.35	Stream Power (N/m s)	69.32	310.90	79.66
Frctn Loss (m)	3.87	Cum Volume (1000 m3)	17.33	37.62	12.26
C & E Loss (m)	0.03	Cum SA (1000 m2)	36.94	44.60	26.32

Plan: murr MurragambaCk UpperReach RS: 30 Profile: PF 1

E.G. Elev (m)	479.53	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.050	0.050
W.S. Elev (m)	479.44	Reach Len. (m)	300.70	288.50	264.40
Crit W.S. (m)	479.31	Flow Area (m2)		14.46	15.64
E.G. Slope (m/m)	0.012028	Area (m2)		14.46	15.64
Q Total (m3/s)	39.60	Flow (m3/s)		20.67	18.93
Top Width (m)	65.57	Top Width (m)		27.43	38.14
Vel Total (m/s)	1.32	Avg. Vel. (m/s)		1.43	1.21
Max Chl Dpth (m)	1.00	Hydr. Depth (m)		0.53	0.41
Conv. Total (m3/s)	361.1	Conv. (m3/s)		188.5	172.6
Length Wtd. (m)	283.05	Wetted Per. (m)		27.49	38.17
Min Ch El (m)	478.44	Shear (N/m2)		62.05	48.33

Plan: murr MurragambaCk UpperReach RS: 30 Profile: PF 1 (Continued)

Alpha	1.02	Stream Power (N/m s)		88.70	58.49
Frctn Loss (m)	3.36	Cum Volume (1000 m3)	15.86	34.80	9.64
C & E Loss (m)	0.01	Cum SA (1000 m2)	32.10	39.67	19.55

Plan: murr MurragambaCk UpperReach RS: 29 Profile: PF 1

E.G. Elev (m)	476.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (m)	475.97	Reach Len. (m)	226.70	297.20	409.10
Crit W.S. (m)	475.83	Flow Area (m2)	0.17	23.34	0.07
E.G. Slope (m/m)	0.011758	Area (m2)	0.17	23.34	0.07
Q Total (m3/s)	44.09	Flow (m3/s)	0.04	44.03	0.02
Top Width (m)	38.52	Top Width (m)	3.31	33.62	1.59
Vel Total (m/s)	1.87	Avg. Vel. (m/s)	0.25	1.89	0.23
Max Chl Dpth (m)	1.08	Hydr. Depth (m)	0.05	0.69	0.05
Conv. Total (m3/s)	406.6	Conv. (m3/s)	0.4	406.1	0.2
Length Wtd. (m)	301.09	Wetted Per. (m)	3.32	33.69	1.60
Min Ch El (m)	474.89	Shear (N/m2)	5.87	79.88	5.34
Alpha	1.02	Stream Power (N/m s)	1.46	150.70	1.24
Frctn Loss (m)	4.20	Cum Volume (1000 m3)	15.84	29.34	7.56
C & E Loss (m)	0.03	Cum SA (1000 m2)	31.60	30.86	14.29

Plan: murr MurragambaCk UpperReach RS: 28 Profile: PF 1

E.G. Elev (m)	471.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.090	0.070	0.090
W.S. Elev (m)	471.84	Reach Len. (m)	217.00	172.40	118.90
Crit W.S. (m)		Flow Area (m2)	3.62	30.24	6.10
E.G. Slope (m/m)	0.016601	Area (m2)	3.62	30.24	6.10
Q Total (m3/s)	47.33	Flow (m3/s)	2.06	40.79	4.48
Top Width (m)	79.26	Top Width (m)	14.50	48.19	16.57
Vel Total (m/s)	1.18	Avg. Vel. (m/s)	0.57	1.35	0.74
Max Chl Dpth (m)	0.68	Hydr. Depth (m)	0.25	0.63	0.37
Conv. Total (m3/s)	367.3	Conv. (m3/s)	16.0	316.6	34.8
Length Wtd. (m)	168.90	Wetted Per. (m)	14.51	48.20	16.58
Min Ch El (m)	471.16	Shear (N/m2)	40.67	102.14	59.89
Alpha	1.16	Stream Power (N/m s)	23.09	137.78	44.03
Frctn Loss (m)	2.54	Cum Volume (1000 m3)	15.41	21.38	6.30
C & E Loss (m)	0.00	Cum SA (1000 m2)	29.58	18.70	10.58

Plan: murr MurragambaCk UpperReach RS: 27 Profile: PF 1

E.G. Elev (m)	469.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.080	0.070	0.080
W.S. Elev (m)	469.31	Reach Len. (m)	212.00	182.00	163.00
Crit W.S. (m)		Flow Area (m2)	15.14	17.79	15.45
E.G. Slope (m/m)	0.013793	Area (m2)	15.14	17.79	15.45
Q Total (m3/s)	52.60	Flow (m3/s)	12.10	26.63	13.86
Top Width (m)	91.11	Top Width (m)	37.68	21.10	32.32
Vel Total (m/s)	1.09	Avg. Vel. (m/s)	0.80	1.50	0.90
Max Chl Dpth (m)	0.91	Hydr. Depth (m)	0.40	0.84	0.48
Conv. Total (m3/s)	447.9	Conv. (m3/s)	103.1	226.8	118.1
Length Wtd. (m)	189.59	Wetted Per. (m)	37.69	21.10	32.34
Min Ch El (m)	468.40	Shear (N/m2)	54.34	114.01	64.63
Alpha	1.26	Stream Power (N/m s)	43.44	170.69	57.99
Frctn Loss (m)	2.39	Cum Volume (1000 m3)	13.37	17.24	5.01
C & E Loss (m)	0.01	Cum SA (1000 m2)	23.92	12.73	7.67

Plan: murr MurragambaCk UpperReach RS: 26 Profile: PF 1

E.G. Elev (m)	466.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.095	0.090	0.095
W.S. Elev (m)	466.95	Reach Len. (m)	245.00	233.60	236.30
Crit W.S. (m)	466.63	Flow Area (m2)	36.22	24.52	5.49
E.G. Slope (m/m)	0.011583	Area (m2)	36.22	24.52	5.49
Q Total (m3/s)	53.76	Flow (m3/s)	25.69	24.73	3.34
Top Width (m)	118.72	Top Width (m)	73.09	31.67	13.95
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.71	1.01	0.61
Max Chl Dpth (m)	0.88	Hydr. Depth (m)	0.50	0.77	0.39
Conv. Total (m3/s)	499.5	Conv. (m3/s)	238.7	229.8	31.0
Length Wtd. (m)	238.79	Wetted Per. (m)	73.11	31.67	13.97
Min Ch El (m)	466.07	Shear (N/m2)	56.27	87.95	44.68
Alpha	1.11	Stream Power (N/m s)	39.92	88.68	27.17
Frctn Loss (m)	4.60	Cum Volume (1000 m3)	7.93	13.39	3.31
C & E Loss (m)	0.07	Cum SA (1000 m2)	12.17	7.93	3.90

Plan: murr MurragambaCk UpperReach RS: 25 Profile: PF 1

E.G. Elev (m)	462.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.74	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (m)	461.57	Reach Len. (m)	164.00	162.00	145.20
Crit W.S. (m)	461.57	Flow Area (m2)	7.63	3.72	6.35
E.G. Slope (m/m)	0.037591	Area (m2)	7.63	3.72	6.35
Q Total (m3/s)	54.91	Flow (m3/s)	19.35	20.06	15.50
Top Width (m)	14.40	Top Width (m)	6.78	1.72	5.90
Vel Total (m/s)	3.10	Avg. Vel. (m/s)	2.54	5.40	2.44
Max Chl Dpth (m)	2.16	Hydr. Depth (m)	1.12	2.16	1.08
Conv. Total (m3/s)	283.2	Conv. (m3/s)	99.8	103.5	79.9
Length Wtd. (m)	159.77	Wetted Per. (m)	7.12	1.72	6.28
Min Ch El (m)	459.40	Shear (N/m2)	394.92	795.33	372.70
Alpha	1.51	Stream Power (N/m s)	1002.08	4291.14	909.90
Frctn Loss (m)	2.16	Cum Volume (1000 m3)	2.56	10.09	1.91
C & E Loss (m)	0.07	Cum SA (1000 m2)	2.39	4.03	1.56

Plan: murr MurragambaCk UpperReach RS: 24 Profile: PF 1

E.G. Elev (m)	458.53	Element	Left OB	Channel	Right OB
Vel Head (m)	0.50	Wt. n-Val.	0.100	0.040	0.100
W.S. Elev (m)	458.03	Reach Len. (m)	127.00	127.00	157.60
Crit W.S. (m)		Flow Area (m2)	3.78	15.80	2.68
E.G. Slope (m/m)	0.006980	Area (m2)	3.78	15.80	2.68
Q Total (m3/s)	56.07	Flow (m3/s)	2.74	51.49	1.83
Top Width (m)	15.59	Top Width (m)	4.32	8.03	3.24
Vel Total (m/s)	2.52	Avg. Vel. (m/s)	0.73	3.26	0.68
Max Chl Dpth (m)	2.25	Hydr. Depth (m)	0.87	1.97	0.83
Conv. Total (m3/s)	671.1	Conv. (m3/s)	32.9	616.4	21.9
Length Wtd. (m)	128.47	Wetted Per. (m)	4.66	8.11	3.64
Min Ch El (m)	455.79	Shear (N/m2)	55.48	133.41	50.52
Alpha	1.54	Stream Power (N/m s)	40.29	434.81	34.47
Frctn Loss (m)	1.36	Cum Volume (1000 m3)	1.62	8.51	1.25
C & E Loss (m)	0.05	Cum SA (1000 m2)	1.48	3.24	0.89

Plan: murr MurragambaCk UpperReach RS: 23 Profile: PF 1

E.G. Elev (m)	457.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.080	0.070	0.080
W.S. Elev (m)	456.78	Reach Len. (m)	222.00	154.00	70.50
Crit W.S. (m)		Flow Area (m2)	3.34	17.89	2.85
E.G. Slope (m/m)	0.017876	Area (m2)	3.34	17.89	2.85
Q Total (m3/s)	57.23	Flow (m3/s)	4.86	48.77	3.61

Plan: murr MurragambaCk UpperReach RS: 23 Profile: PF 1 (Continued)

Top Width (m)	18.29	Top Width (m)	3.71	10.48	4.10
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.45	2.73	1.27
Max Chl Dpth (m)	1.82	Hydr. Depth (m)	0.90	1.71	0.70
Conv. Total (m3/s)	428.1	Conv. (m3/s)	36.3	364.8	27.0
Length Wtd. (m)	153.25	Wetted Per. (m)	4.12	10.50	4.33
Min Ch El (m)	454.96	Shear (N/m2)	142.09	298.77	115.47
Alpha	1.17	Stream Power (N/m s)	206.43	814.22	146.10
Frctn Loss (m)	1.34	Cum Volume (1000 m3)	1.17	6.37	0.82
C & E Loss (m)	0.04	Cum SA (1000 m2)	0.97	2.06	0.32

Plan: murr MurragambaCk UpperReach RS: 22 Profile: PF 1

E.G. Elev (m)	455.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.21	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (m)	455.53	Reach Len. (m)	154.00	154.00	154.00
Crit W.S. (m)		Flow Area (m2)	3.00	24.85	3.74
E.G. Slope (m/m)	0.005204	Area (m2)	3.00	24.85	3.74
Q Total (m3/s)	58.00	Flow (m3/s)	2.15	52.71	3.14
Top Width (m)	26.19	Top Width (m)	5.02	16.31	4.86
Vel Total (m/s)	1.84	Avg. Vel. (m/s)	0.72	2.12	0.84
Max Chl Dpth (m)	1.67	Hydr. Depth (m)	0.60	1.52	0.77
Conv. Total (m3/s)	804.0	Conv. (m3/s)	29.8	730.7	43.5
Length Wtd. (m)	154.00	Wetted Per. (m)	5.16	16.33	5.10
Min Ch El (m)	453.86	Shear (N/m2)	29.66	77.68	37.43
Alpha	1.23	Stream Power (N/m s)	21.28	164.79	31.37
Frctn Loss (m)	1.29	Cum Volume (1000 m3)	0.47	3.08	0.58
C & E Loss (m)	0.03	Cum SA (1000 m2)			

Plan: murr MurragambaCk MiddlerReach RS: 21 Profile: PF 1

E.G. Elev (m)	454.41	Element	Left OB	Channel	Right OB
Vel Head (m)	0.55	Wt. n-Val.	0.090	0.045	0.090
W.S. Elev (m)	453.87	Reach Len. (m)	112.10	118.00	12.50
Crit W.S. (m)	453.87	Flow Area (m2)	3.05	15.16	3.85
E.G. Slope (m/m)	0.015624	Area (m2)	3.05	15.16	3.85
Q Total (m3/s)	58.77	Flow (m3/s)	3.34	52.37	3.06
Top Width (m)	26.45	Top Width (m)	4.09	10.92	11.45
Vel Total (m/s)	2.66	Avg. Vel. (m/s)	1.10	3.46	0.80
Max Chl Dpth (m)	1.49	Hydr. Depth (m)	0.75	1.39	0.34
Conv. Total (m3/s)	470.2	Conv. (m3/s)	26.7	418.9	24.5
Length Wtd. (m)	99.39	Wetted Per. (m)	4.35	10.92	11.65
Min Ch El (m)	452.37	Shear (N/m2)	107.33	212.58	50.61
Alpha	1.51	Stream Power (N/m s)	117.57	734.53	40.28
Frctn Loss (m)	2.00	Cum Volume (1000 m3)	10.60	74.85	3.59
C & E Loss (m)	0.04	Cum SA (1000 m2)	17.05	49.15	7.98

Plan: murr MurragambaCk MiddlerReach RS: 20 Profile: PF 1

E.G. Elev (m)	451.95	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.080	0.050	0.070
W.S. Elev (m)	451.55	Reach Len. (m)	102.70	97.20	100.20
Crit W.S. (m)	451.55	Flow Area (m2)	3.50	11.73	9.45
E.G. Slope (m/m)	0.026618	Area (m2)	3.50	11.73	9.45
Q Total (m3/s)	60.31	Flow (m3/s)	4.53	38.28	17.50
Top Width (m)	31.84	Top Width (m)	6.87	11.73	13.25
Vel Total (m/s)	2.44	Avg. Vel. (m/s)	1.29	3.26	1.85
Max Chl Dpth (m)	1.02	Hydr. Depth (m)	0.51	1.00	0.71
Conv. Total (m3/s)	369.7	Conv. (m3/s)	27.8	234.6	107.3
Length Wtd. (m)	97.84	Wetted Per. (m)	6.94	11.73	13.33
Min Ch El (m)	450.53	Shear (N/m2)	131.71	261.09	184.98

Plan: murr MurragambaCk MiddlerReach RS: 20 Profile: PF 1 (Continued)

Alpha	1.32	Stream Power (N/m s)	170.24	852.09	342.68
Frctn Loss (m)	1.05	Cum Volume (1000 m3)	10.23	73.27	3.51
C & E Loss (m)	0.09	Cum SA (1000 m2)	16.44	47.81	7.82

Plan: murr MurragambaCk MiddlerReach RS: 19 Profile: PF 1

E.G. Elev (m)	450.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.055	0.050	
W.S. Elev (m)	450.71	Reach Len. (m)	209.00	204.20	200.20
Crit W.S. (m)		Flow Area (m2)	0.07	46.23	
E.G. Slope (m/m)	0.005841	Area (m2)	0.07	46.23	
Q Total (m3/s)	61.17	Flow (m3/s)	0.01	61.16	
Top Width (m)	58.40	Top Width (m)	1.19	57.20	
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	0.20	1.32	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)	0.06	0.81	
Conv. Total (m3/s)	800.4	Conv. (m3/s)	0.2	800.2	
Length Wtd. (m)	204.20	Wetted Per. (m)	1.20	57.41	
Min Ch El (m)	449.34	Shear (N/m2)	3.23	46.12	
Alpha	1.00	Stream Power (N/m s)	0.66	61.01	
Frctn Loss (m)	2.27	Cum Volume (1000 m3)	10.04	70.45	3.04
C & E Loss (m)	0.03	Cum SA (1000 m2)	16.03	44.46	7.16

Plan: murr MurragambaCk MiddlerReach RS: 18 Profile: PF 1

E.G. Elev (m)	448.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.		0.050	
W.S. Elev (m)	448.14	Reach Len. (m)	275.90	292.50	340.80
Crit W.S. (m)	448.14	Flow Area (m2)		24.02	
E.G. Slope (m/m)	0.027487	Area (m2)		24.02	
Q Total (m3/s)	64.02	Flow (m3/s)		64.02	
Top Width (m)	33.22	Top Width (m)		33.22	
Vel Total (m/s)	2.66	Avg. Vel. (m/s)		2.66	
Max Chl Dpth (m)	1.33	Hydr. Depth (m)		0.72	
Conv. Total (m3/s)	386.1	Conv. (m3/s)		386.1	
Length Wtd. (m)	293.17	Wetted Per. (m)		33.34	
Min Ch El (m)	446.81	Shear (N/m2)		194.22	
Alpha	1.00	Stream Power (N/m s)		517.59	
Frctn Loss (m)	2.78	Cum Volume (1000 m3)	10.04	63.28	3.04
C & E Loss (m)	0.01	Cum SA (1000 m2)	15.90	35.23	7.16

Plan: murr MurragambaCk MiddlerReach RS: 17 Profile: PF 1

E.G. Elev (m)	444.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.110	0.045	0.110
W.S. Elev (m)	444.09	Reach Len. (m)	286.00	223.00	145.00
Crit W.S. (m)		Flow Area (m2)	4.12	24.45	4.17
E.G. Slope (m/m)	0.004919	Area (m2)	4.12	24.45	4.17
Q Total (m3/s)	67.78	Flow (m3/s)	2.36	62.78	2.64
Top Width (m)	19.50	Top Width (m)	4.49	11.55	3.47
Vel Total (m/s)	2.07	Avg. Vel. (m/s)	0.57	2.57	0.63
Max Chl Dpth (m)	2.41	Hydr. Depth (m)	0.92	2.12	1.20
Conv. Total (m3/s)	966.4	Conv. (m3/s)	33.6	895.1	37.7
Length Wtd. (m)	228.28	Wetted Per. (m)	4.85	11.56	4.22
Min Ch El (m)	441.68	Shear (N/m2)	41.01	102.01	47.70
Alpha	1.43	Stream Power (N/m s)	23.46	261.96	30.19
Frctn Loss (m)	1.46	Cum Volume (1000 m3)	9.47	56.19	2.32
C & E Loss (m)	0.03	Cum SA (1000 m2)	15.28	28.68	6.57

Plan: murr MurragambaCk MiddlerReach RS: 16 Profile: PF 1

E.G. Elev (m)	442.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.60	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (m)	442.31	Reach Len. (m)	388.60	382.00	388.60
Crit W.S. (m)		Flow Area (m2)	17.35	10.54	5.91
E.G. Slope (m/m)	0.008488	Area (m2)	17.35	10.54	5.91
Q Total (m3/s)	71.06	Flow (m3/s)	20.15	44.78	6.13
Top Width (m)	19.37	Top Width (m)	11.91	3.52	3.94
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.16	4.25	1.04
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.46	2.99	1.50
Conv. Total (m3/s)	771.3	Conv. (m3/s)	218.7	486.1	66.6
Length Wtd. (m)	383.22	Wetted Per. (m)	12.26	3.53	4.95
Min Ch El (m)	439.29	Shear (N/m2)	117.78	248.79	99.40
Alpha	2.68	Stream Power (N/m s)	136.77	1056.93	103.08
Frctn Loss (m)	3.35	Cum Volume (1000 m3)	6.40	52.29	1.59
C & E Loss (m)	0.04	Cum SA (1000 m2)	12.94	27.00	6.03

Plan: murr MurragambaCk MiddlerReach RS: 15 Profile: PF 1

E.G. Elev (m)	439.53	Element	Left OB	Channel	Right OB
Vel Head (m)	0.47	Wt. n-Val.	0.065	0.040	0.065
W.S. Elev (m)	439.05	Reach Len. (m)	329.80	337.00	352.00
Crit W.S. (m)	438.77	Flow Area (m2)	0.04	23.56	0.68
E.G. Slope (m/m)	0.009012	Area (m2)	0.04	23.56	0.68
Q Total (m3/s)	72.14	Flow (m3/s)	0.00	71.96	0.17
Top Width (m)	26.01	Top Width (m)	1.38	15.15	9.49
Vel Total (m/s)	2.97	Avg. Vel. (m/s)	0.13	3.05	0.25
Max Chl Dpth (m)	2.52	Hydr. Depth (m)	0.03	1.56	0.07
Conv. Total (m3/s)	759.9	Conv. (m3/s)	0.1	758.0	1.8
Length Wtd. (m)	336.67	Wetted Per. (m)	1.38	16.13	9.49
Min Ch El (m)	436.53	Shear (N/m2)	2.42	129.07	6.35
Alpha	1.05	Stream Power (N/m s)	0.32	394.29	1.60
Frctn Loss (m)	3.73	Cum Volume (1000 m3)	3.02	45.77	0.31
C & E Loss (m)	0.04	Cum SA (1000 m2)	10.36	23.44	3.42

Plan: murr MurragambaCk MiddlerReach RS: 14 Profile: PF 1

E.G. Elev (m)	435.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (m)	435.42	Reach Len. (m)	273.20	260.00	250.00
Crit W.S. (m)	435.42	Flow Area (m2)	9.99	24.47	0.64
E.G. Slope (m/m)	0.013924	Area (m2)	9.99	24.47	0.64
Q Total (m3/s)	73.22	Flow (m3/s)	7.53	65.45	0.25
Top Width (m)	62.66	Top Width (m)	33.40	23.43	5.82
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	0.75	2.68	0.39
Max Chl Dpth (m)	1.36	Hydr. Depth (m)	0.30	1.04	0.11
Conv. Total (m3/s)	620.5	Conv. (m3/s)	63.8	554.6	2.1
Length Wtd. (m)	260.65	Wetted Per. (m)	33.46	23.74	5.83
Min Ch El (m)	434.06	Shear (N/m2)	40.78	140.70	14.93
Alpha	1.48	Stream Power (N/m s)	30.72	376.38	5.76
Frctn Loss (m)	1.95	Cum Volume (1000 m3)	1.37	37.68	0.08
C & E Loss (m)	0.08	Cum SA (1000 m2)	4.62	16.94	0.73

Plan: murr MurragambaCk MiddlerReach RS: 13 Profile: PF 1

E.G. Elev (m)	433.65	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.070	0.045	
W.S. Elev (m)	433.59	Reach Len. (m)	353.00	353.00	353.00
Crit W.S. (m)	433.28	Flow Area (m2)	0.00	67.82	
E.G. Slope (m/m)	0.004730	Area (m2)	0.00	67.82	
Q Total (m3/s)	76.52	Flow (m3/s)	0.00	76.52	

Plan: murr MurragambaCk MiddlerReach RS: 13 Profile: PF 1 (Continued)

Top Width (m)	107.28	Top Width (m)	0.43	106.85	
Vel Total (m/s)	1.13	Avg. Vel. (m/s)	0.02	1.13	
Max Chl Dpth (m)	1.21	Hydr. Depth (m)	0.00	0.63	
Conv. Total (m3/s)	1112.6	Conv. (m3/s)	0.0	1112.6	
Length Wtd. (m)	353.00	Wetted Per. (m)	0.43	106.92	
Min Ch El (m)	432.38	Shear (N/m2)	0.15	29.42	
Alpha	1.00	Stream Power (N/m s)	0.00	33.20	
Frctn Loss (m)	1.82	Cum Volume (1000 m3)	0.00	25.68	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Plan: murr MurragambaCk Trib_2 RS: 2.6 Profile: PF 1

E.G. Elev (m)	458.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.		0.030	
W.S. Elev (m)	458.16	Reach Len. (m)	327.00	297.00	298.00
Crit W.S. (m)	458.16	Flow Area (m2)		12.16	
E.G. Slope (m/m)	0.017535	Area (m2)		12.16	
Q Total (m3/s)	14.71	Flow (m3/s)		14.71	
Top Width (m)	84.66	Top Width (m)		84.66	
Vel Total (m/s)	1.21	Avg. Vel. (m/s)		1.21	
Max Chl Dpth (m)	0.27	Hydr. Depth (m)		0.14	
Conv. Total (m3/s)	111.1	Conv. (m3/s)		111.1	
Length Wtd. (m)	297.00	Wetted Per. (m)		84.70	
Min Ch El (m)	457.89	Shear (N/m2)		24.68	
Alpha	1.00	Stream Power (N/m s)		29.87	
Frctn Loss (m)	6.70	Cum Volume (1000 m3)	6.53	16.58	3.76
C & E Loss (m)	0.00	Cum SA (1000 m2)	39.23	32.85	26.94

Plan: murr MurragambaCk Trib_2 RS: 2.5 Profile: PF 1

E.G. Elev (m)	450.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.10	Wt. n-Val.	0.045	0.045	
W.S. Elev (m)	450.12	Reach Len. (m)	188.00	206.00	248.00
Crit W.S. (m)	450.11	Flow Area (m2)	0.00	12.49	
E.G. Slope (m/m)	0.028654	Area (m2)	0.00	12.49	
Q Total (m3/s)	17.56	Flow (m3/s)	0.00	17.56	
Top Width (m)	54.84	Top Width (m)	0.16	54.68	
Vel Total (m/s)	1.41	Avg. Vel. (m/s)	0.14	1.41	
Max Chl Dpth (m)	0.36	Hydr. Depth (m)	0.01	0.23	
Conv. Total (m3/s)	103.7	Conv. (m3/s)	0.0	103.7	
Length Wtd. (m)	207.77	Wetted Per. (m)	0.16	54.69	
Min Ch El (m)	449.77	Shear (N/m2)	1.94	64.19	
Alpha	1.00	Stream Power (N/m s)	0.26	90.23	
Frctn Loss (m)	4.99	Cum Volume (1000 m3)	6.53	12.92	3.76
C & E Loss (m)	0.01	Cum SA (1000 m2)	39.20	12.16	26.94

Plan: murr MurragambaCk Trib_2 RS: 2.4 Profile: PF 1

E.G. Elev (m)	445.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.045	0.040	0.045
W.S. Elev (m)	445.16	Reach Len. (m)	149.00	172.00	193.00
Crit W.S. (m)	445.14	Flow Area (m2)	10.16	1.75	7.47
E.G. Slope (m/m)	0.020697	Area (m2)	10.16	1.75	7.47
Q Total (m3/s)	18.99	Flow (m3/s)	10.62	2.27	6.10
Top Width (m)	120.23	Top Width (m)	54.26	8.07	57.91
Vel Total (m/s)	0.98	Avg. Vel. (m/s)	1.05	1.29	0.82
Max Chl Dpth (m)	0.37	Hydr. Depth (m)	0.19	0.22	0.13
Conv. Total (m3/s)	132.0	Conv. (m3/s)	73.8	15.8	42.4
Length Wtd. (m)	174.39	Wetted Per. (m)	54.26	8.13	57.91
Min Ch El (m)	444.79	Shear (N/m2)	37.99	43.82	26.18

Plan: murr MurragambaCk Trib_2 RS: 2.4 Profile: PF 1 (Continued)

Alpha	1.07	Stream Power (N/m s)	39.73	56.71	21.36
Frctn Loss (m)	3.84	Cum Volume (1000 m3)	5.58	11.45	2.83
C & E Loss (m)	0.00	Cum SA (1000 m2)	34.09	5.69	19.76

Plan: murr MurragambaCk Trib_2 RS: 2.3 Profile: PF 1

E.G. Elev (m)	441.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.045	0.050
W.S. Elev (m)	441.28	Reach Len. (m)	149.00	138.00	128.00
Crit W.S. (m)	441.28	Flow Area (m2)	1.11	5.52	11.74
E.G. Slope (m/m)	0.023344	Area (m2)	1.11	5.52	11.74
Q Total (m3/s)	20.41	Flow (m3/s)	0.47	9.41	10.54
Top Width (m)	110.75	Top Width (m)	21.49	15.45	73.81
Vel Total (m/s)	1.11	Avg. Vel. (m/s)	0.42	1.70	0.90
Max Chl Dpth (m)	0.63	Hydr. Depth (m)	0.05	0.36	0.16
Conv. Total (m3/s)	133.6	Conv. (m3/s)	3.1	61.6	69.0
Length Wtd. (m)	140.91	Wetted Per. (m)	21.49	15.51	73.81
Min Ch El (m)	440.65	Shear (N/m2)	11.78	81.45	36.42
Alpha	1.42	Stream Power (N/m s)	4.98	138.85	32.67
Frctn Loss (m)	2.64	Cum Volume (1000 m3)	4.74	10.83	0.98
C & E Loss (m)	0.02	Cum SA (1000 m2)	28.44	3.67	7.05

Plan: murr MurragambaCk Trib_2 RS: 2.2 Profile: PF 1

E.G. Elev (m)	438.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.045		0.045
W.S. Elev (m)	438.26	Reach Len. (m)	233.00	233.00	242.00
Crit W.S. (m)	438.21	Flow Area (m2)	24.38		1.23
E.G. Slope (m/m)	0.015571	Area (m2)	24.38		1.23
Q Total (m3/s)	21.84	Flow (m3/s)	21.04		0.80
Top Width (m)	153.10	Top Width (m)	140.53		12.57
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.86		0.65
Max Chl Dpth (m)	0.36	Hydr. Depth (m)	0.17		0.10
Conv. Total (m3/s)	175.0	Conv. (m3/s)	168.6		6.4
Length Wtd. (m)	233.16	Wetted Per. (m)	140.54		12.65
Min Ch El (m)	438.26	Shear (N/m2)	26.50		14.88
Alpha	1.01	Stream Power (N/m s)	22.86		9.71
Frctn Loss (m)	4.62	Cum Volume (1000 m3)	2.84	10.44	0.15
C & E Loss (m)	0.02	Cum SA (1000 m2)	16.37	2.61	1.52

Plan: murr MurragambaCk Trib_2 RS: 2.1 Profile: PF 1

E.G. Elev (m)	433.66	Element	Left OB	Channel	Right OB
Vel Head (m)	0.24	Wt. n-Val.		0.045	
W.S. Elev (m)	433.42	Reach Len. (m)	208.00	208.00	208.00
Crit W.S. (m)	433.42	Flow Area (m2)		10.72	
E.G. Slope (m/m)	0.025552	Area (m2)		10.72	
Q Total (m3/s)	23.26	Flow (m3/s)		23.26	
Top Width (m)	22.37	Top Width (m)		22.37	
Vel Total (m/s)	2.17	Avg. Vel. (m/s)		2.17	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.48	
Conv. Total (m3/s)	145.5	Conv. (m3/s)		145.5	
Length Wtd. (m)	208.00	Wetted Per. (m)		22.46	
Min Ch El (m)	432.55	Shear (N/m2)		119.61	
Alpha	1.00	Stream Power (N/m s)		259.52	
Frctn Loss (m)	1.49	Cum Volume (1000 m3)	0.00	9.20	
C & E Loss (m)	0.05	Cum SA (1000 m2)			

Plan: murr MurragambaCk LowerReach RS: 12 Profile: PF 1

E.G. Elev (m)	431.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.070	0.060	
W.S. Elev (m)	431.78	Reach Len. (m)	389.00	330.00	274.00
Crit W.S. (m)		Flow Area (m2)	0.00	77.70	
E.G. Slope (m/m)	0.005573	Area (m2)	0.00	77.70	
Q Total (m3/s)	82.96	Flow (m3/s)	0.00	82.96	
Top Width (m)	98.19	Top Width (m)	0.52	97.67	
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.04	1.07	
Max Chl Dpth (m)	1.30	Hydr. Depth (m)	0.01	0.80	
Conv. Total (m3/s)	1111.3	Conv. (m3/s)	0.0	1111.3	
Length Wtd. (m)	336.56	Wetted Per. (m)	0.52	97.75	
Min Ch El (m)	430.47	Shear (N/m2)	0.38	43.44	
Alpha	1.00	Stream Power (N/m s)	0.01	46.38	
Frctn Loss (m)	2.43	Cum Volume (1000 m3)	22.08	102.43	15.27
C & E Loss (m)	0.01	Cum SA (1000 m2)	38.91	109.08	37.35

Plan: murr MurragambaCk LowerReach RS: 11 Profile: PF 1

E.G. Elev (m)	429.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (m)	429.23	Reach Len. (m)	180.00	200.00	242.00
Crit W.S. (m)		Flow Area (m2)	18.71	30.19	4.62
E.G. Slope (m/m)	0.009609	Area (m2)	18.71	30.19	4.62
Q Total (m3/s)	86.04	Flow (m3/s)	22.23	60.18	3.62
Top Width (m)	78.51	Top Width (m)	30.14	34.49	13.87
Vel Total (m/s)	1.61	Avg. Vel. (m/s)	1.19	1.99	0.78
Max Chl Dpth (m)	1.01	Hydr. Depth (m)	0.62	0.88	0.33
Conv. Total (m3/s)	877.7	Conv. (m3/s)	226.8	614.0	36.9
Length Wtd. (m)	193.47	Wetted Per. (m)	30.17	34.50	13.89
Min Ch El (m)	428.22	Shear (N/m2)	58.44	82.48	31.33
Alpha	1.23	Stream Power (N/m s)	69.44	164.40	24.57
Frctn Loss (m)	2.15	Cum Volume (1000 m3)	18.44	84.62	14.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	32.95	87.27	35.45

Plan: murr MurragambaCk LowerReach RS: 10 Profile: PF 1

E.G. Elev (m)	427.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.15	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (m)	427.09	Reach Len. (m)	222.00	238.00	240.00
Crit W.S. (m)	426.91	Flow Area (m2)	36.18	7.60	12.22
E.G. Slope (m/m)	0.012999	Area (m2)	36.18	7.60	12.22
Q Total (m3/s)	88.09	Flow (m3/s)	64.44	13.06	10.59
Top Width (m)	95.45	Top Width (m)	47.50	8.72	39.23
Vel Total (m/s)	1.57	Avg. Vel. (m/s)	1.78	1.72	0.87
Max Chl Dpth (m)	1.46	Hydr. Depth (m)	0.76	0.87	0.31
Conv. Total (m3/s)	772.6	Conv. (m3/s)	565.2	114.5	92.9
Length Wtd. (m)	232.26	Wetted Per. (m)	48.80	8.83	39.70
Min Ch El (m)	426.06	Shear (N/m2)	94.50	109.69	39.24
Alpha	1.15	Stream Power (N/m s)	168.32	188.58	34.00
Frctn Loss (m)	1.90	Cum Volume (1000 m3)	13.50	80.85	12.60
C & E Loss (m)	0.03	Cum SA (1000 m2)	25.96	82.95	29.03

Plan: murr MurragambaCk LowerReach RS: 9 Profile: PF 1

E.G. Elev (m)	425.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.060	0.050	0.060
W.S. Elev (m)	425.25	Reach Len. (m)	134.00	142.00	161.00
Crit W.S. (m)		Flow Area (m2)	0.71	84.28	0.21
E.G. Slope (m/m)	0.005627	Area (m2)	0.71	84.28	0.21
Q Total (m3/s)	88.40	Flow (m3/s)	0.25	88.10	0.04

Plan: murr MurragambaCk LowerReach RS: 9 Profile: PF 1 (Continued)

Top Width (m)	152.46	Top Width (m)	4.66	144.89	2.91
Vel Total (m/s)	1.04	Avg. Vel. (m/s)	0.35	1.05	0.21
Max Chl Dpth (m)	0.76	Hydr. Depth (m)	0.15	0.58	0.07
Conv. Total (m3/s)	1178.5	Conv. (m3/s)	3.3	1174.5	0.6
Length Wtd. (m)	141.97	Wetted Per. (m)	4.69	144.90	2.91
Min Ch El (m)	424.50	Shear (N/m2)	8.33	32.10	3.92
Alpha	1.01	Stream Power (N/m s)	2.95	33.55	0.84
Frctn Loss (m)	0.95	Cum Volume (1000 m3)	9.41	69.91	11.11
C & E Loss (m)	0.00	Cum SA (1000 m2)	20.17	64.67	23.97

Plan: murr MurragambaCk LowerReach RS: 8 Profile: PF 1

E.G. Elev (m)	424.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.070	0.060	
W.S. Elev (m)	424.29	Reach Len. (m)	89.00	154.00	151.00
Crit W.S. (m)		Flow Area (m2)	1.67	79.32	
E.G. Slope (m/m)	0.008080	Area (m2)	1.67	79.32	
Q Total (m3/s)	88.65	Flow (m3/s)	0.56	88.09	
Top Width (m)	136.77	Top Width (m)	12.55	124.22	
Vel Total (m/s)	1.09	Avg. Vel. (m/s)	0.33	1.11	
Max Chl Dpth (m)	0.98	Hydr. Depth (m)	0.13	0.64	
Conv. Total (m3/s)	986.2	Conv. (m3/s)	6.2	980.0	
Length Wtd. (m)	148.30	Wetted Per. (m)	12.55	124.29	
Min Ch El (m)	423.31	Shear (N/m2)	10.52	50.57	
Alpha	1.02	Stream Power (N/m s)	3.52	56.16	
Frctn Loss (m)	1.41	Cum Volume (1000 m3)	9.25	58.30	11.09
C & E Loss (m)	0.02	Cum SA (1000 m2)	19.01	45.56	23.74

Plan: murr MurragambaCk LowerReach RS: 7 Profile: PF 1

E.G. Elev (m)	422.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.070	0.050	0.070
W.S. Elev (m)	422.69	Reach Len. (m)	7.00	7.00	7.00
Crit W.S. (m)	422.69	Flow Area (m2)	26.04	31.12	1.79
E.G. Slope (m/m)	0.011426	Area (m2)	26.04	31.12	1.79
Q Total (m3/s)	88.88	Flow (m3/s)	14.97	72.89	1.03
Top Width (m)	147.10	Top Width (m)	112.78	26.54	7.78
Vel Total (m/s)	1.51	Avg. Vel. (m/s)	0.57	2.34	0.57
Max Chl Dpth (m)	2.34	Hydr. Depth (m)	0.23	1.17	0.23
Conv. Total (m3/s)	831.5	Conv. (m3/s)	140.0	681.9	9.6
Length Wtd. (m)	7.00	Wetted Per. (m)	112.79	27.14	7.79
Min Ch El (m)	420.36	Shear (N/m2)	25.87	128.49	25.78
Alpha	2.01	Stream Power (N/m s)	14.87	300.95	14.78
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	8.01	49.79	10.96
C & E Loss (m)	0.07	Cum SA (1000 m2)	13.44	33.95	23.15

Plan: murr MurragambaCk LowerReach RS: 6.6 Profile: PF 1

E.G. Elev (m)	422.69	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (m)	422.68	Reach Len. (m)	12.50	12.50	12.50
Crit W.S. (m)	421.48	Flow Area (m2)	178.67	62.51	21.31
E.G. Slope (m/m)	0.000175	Area (m2)	178.67	62.51	21.31
Q Total (m3/s)	88.88	Flow (m3/s)	48.67	36.12	4.09
Top Width (m)	236.42	Top Width (m)	170.99	26.54	38.89
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.27	0.58	0.19
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.04	2.35	0.55
Conv. Total (m3/s)	6719.0	Conv. (m3/s)	3679.3	2730.5	309.1
Length Wtd. (m)	12.50	Wetted Per. (m)	171.01	27.06	38.95
Min Ch El (m)	419.16	Shear (N/m2)	1.79	3.96	0.94

Plan: murr MurragambaCk LowerReach RS: 6.6 Profile: PF 1 (Continued)

Alpha	1.55	Stream Power (N/m s)	0.49	2.29	0.18
Frctn Loss (m)		Cum Volume (1000 m3)	7.30	49.46	10.88
C & E Loss (m)		Cum SA (1000 m2)	12.44	33.77	22.99

Plan: murr MurragambaCk LowerReach RS: 6.4 Profile: PF 1

E.G. Elev (m)	421.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.040	0.050	0.040
W.S. Elev (m)	421.14	Reach Len. (m)	160.50	122.50	303.50
Crit W.S. (m)	421.14	Flow Area (m2)	2.22	29.43	1.03
E.G. Slope (m/m)	0.018714	Area (m2)	2.22	29.43	1.03
Q Total (m3/s)	88.88	Flow (m3/s)	2.52	85.15	1.21
Top Width (m)	43.24	Top Width (m)	11.63	26.54	5.07
Vel Total (m/s)	2.72	Avg. Vel. (m/s)	1.13	2.89	1.18
Max Chl Dpth (m)	2.28	Hydr. Depth (m)	0.19	1.11	0.20
Conv. Total (m3/s)	649.7	Conv. (m3/s)	18.4	622.4	8.8
Length Wtd. (m)	124.27	Wetted Per. (m)	11.64	27.06	5.08
Min Ch El (m)	418.86	Shear (N/m2)	35.06	199.57	37.09
Alpha	1.09	Stream Power (N/m s)	39.78	577.40	43.68
Frctn Loss (m)	2.17	Cum Volume (1000 m3)	6.17	48.89	10.74
C & E Loss (m)	0.02	Cum SA (1000 m2)	11.30	33.44	22.71

Plan: murr MurragambaCk LowerReach RS: 6 Profile: PF 1

E.G. Elev (m)	418.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.65	Wt. n-Val.		0.040	
W.S. Elev (m)	418.24	Reach Len. (m)	130.00	140.00	161.00
Crit W.S. (m)	418.24	Flow Area (m2)		25.01	
E.G. Slope (m/m)	0.016301	Area (m2)		25.01	
Q Total (m3/s)	89.20	Flow (m3/s)		89.20	
Top Width (m)	19.67	Top Width (m)		19.67	
Vel Total (m/s)	3.57	Avg. Vel. (m/s)		3.57	
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		1.27	
Conv. Total (m3/s)	698.7	Conv. (m3/s)		698.7	
Length Wtd. (m)	140.00	Wetted Per. (m)		21.18	
Min Ch El (m)	416.03	Shear (N/m2)		188.77	
Alpha	1.00	Stream Power (N/m s)		673.18	
Frctn Loss (m)	1.48	Cum Volume (1000 m3)	5.99	45.55	10.58
C & E Loss (m)	0.11	Cum SA (1000 m2)	10.37	30.61	21.94

Plan: murr MurragambaCk LowerReach RS: 5 Profile: PF 1

E.G. Elev (m)	416.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.		0.040	
W.S. Elev (m)	416.48	Reach Len. (m)	305.00	290.00	280.00
Crit W.S. (m)		Flow Area (m2)		38.36	
E.G. Slope (m/m)	0.007431	Area (m2)		38.36	
Q Total (m3/s)	89.51	Flow (m3/s)		89.51	
Top Width (m)	32.82	Top Width (m)		32.82	
Vel Total (m/s)	2.33	Avg. Vel. (m/s)		2.33	
Max Chl Dpth (m)	1.88	Hydr. Depth (m)		1.17	
Conv. Total (m3/s)	1038.3	Conv. (m3/s)		1038.3	
Length Wtd. (m)	290.00	Wetted Per. (m)		34.06	
Min Ch El (m)	414.60	Shear (N/m2)		82.09	
Alpha	1.00	Stream Power (N/m s)		191.53	
Frctn Loss (m)	1.51	Cum Volume (1000 m3)	5.99	41.12	10.58
C & E Loss (m)	0.01	Cum SA (1000 m2)	10.37	26.93	21.94

Plan: murr MurragambaCk LowerReach RS: 4 Profile: PF 1

E.G. Elev (m)	415.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.37	Wt. n-Val.		0.030	
W.S. Elev (m)	414.87	Reach Len. (m)	378.00	237.00	130.00
Crit W.S. (m)		Flow Area (m2)		33.62	
E.G. Slope (m/m)	0.003857	Area (m2)		33.62	
Q Total (m3/s)	90.30	Flow (m3/s)		90.30	
Top Width (m)	22.03	Top Width (m)		22.03	
Vel Total (m/s)	2.69	Avg. Vel. (m/s)		2.69	
Max Chl Dpth (m)	2.37	Hydr. Depth (m)		1.53	
Conv. Total (m3/s)	1454.0	Conv. (m3/s)		1454.0	
Length Wtd. (m)	237.00	Wetted Per. (m)		22.76	
Min Ch El (m)	412.50	Shear (N/m2)		55.89	
Alpha	1.00	Stream Power (N/m s)		150.08	
Frctn Loss (m)	1.13	Cum Volume (1000 m3)	5.99	30.68	10.58
C & E Loss (m)	0.07	Cum SA (1000 m2)	10.37	18.98	21.94

Plan: murr MurragambaCk LowerReach RS: 3 Profile: PF 1

E.G. Elev (m)	414.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.		0.060	
W.S. Elev (m)	413.91	Reach Len. (m)	184.00	266.00	261.00
Crit W.S. (m)		Flow Area (m2)		57.28	
E.G. Slope (m/m)	0.006015	Area (m2)		57.28	
Q Total (m3/s)	91.25	Flow (m3/s)		91.25	
Top Width (m)	40.66	Top Width (m)		40.66	
Vel Total (m/s)	1.59	Avg. Vel. (m/s)		1.59	
Max Chl Dpth (m)	3.01	Hydr. Depth (m)		1.41	
Conv. Total (m3/s)	1176.5	Conv. (m3/s)		1176.5	
Length Wtd. (m)	257.20	Wetted Per. (m)		41.88	
Min Ch El (m)	410.89	Shear (N/m2)		80.69	
Alpha	1.00	Stream Power (N/m s)		128.54	
Frctn Loss (m)	0.63	Cum Volume (1000 m3)	5.99	19.91	10.58
C & E Loss (m)	0.01	Cum SA (1000 m2)	10.37	11.55	21.94

Plan: murr MurragambaCk LowerReach RS: 2.1 Profile: PF 1

E.G. Elev (m)	413.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (m)	413.31	Reach Len. (m)	3.00	3.00	3.00
Crit W.S. (m)		Flow Area (m2)	47.98	49.34	2.15
E.G. Slope (m/m)	0.001321	Area (m2)	47.98	49.34	2.15
Q Total (m3/s)	91.25	Flow (m3/s)	19.57	71.36	0.32
Top Width (m)	127.39	Top Width (m)	86.69	22.85	17.85
Vel Total (m/s)	0.92	Avg. Vel. (m/s)	0.41	1.45	0.15
Max Chl Dpth (m)	4.27	Hydr. Depth (m)	0.55	2.16	0.12
Conv. Total (m3/s)	2510.5	Conv. (m3/s)	538.5	1963.3	8.7
Length Wtd. (m)	3.00	Wetted Per. (m)	86.82	24.57	17.85
Min Ch El (m)	409.04	Shear (N/m2)	7.16	26.01	1.56
Alpha	1.99	Stream Power (N/m s)	2.92	37.62	0.23
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	1.57	5.73	10.30
C & E Loss (m)	0.01	Cum SA (1000 m2)	2.39	3.10	19.61

Plan: murr MurragambaCk LowerReach RS: 2.05 Profile: PF 1

E.G. Elev (m)	413.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (m)	413.33	Reach Len. (m)	16.00	16.00	16.00
Crit W.S. (m)	411.26	Flow Area (m2)	29.74	73.88	13.36
E.G. Slope (m/m)	0.000415	Area (m2)	29.74	73.88	13.36
Q Total (m3/s)	91.25	Flow (m3/s)	5.63	81.00	4.62

Plan: murr MurragambaCk LowerReach RS: 2.05 Profile: PF 1 (Continued)

Top Width (m)	107.03	Top Width (m)	71.32	22.85	12.86
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.19	1.10	0.35
Max Chl Dpth (m)	4.37	Hydr. Depth (m)	0.42	3.23	1.04
Conv. Total (m3/s)	4476.8	Conv. (m3/s)	276.3	3974.1	226.4
Length Wtd. (m)	16.00	Wetted Per. (m)	71.44	23.41	13.02
Min Ch El (m)	408.95	Shear (N/m2)	1.70	12.86	4.18
Alpha	1.77	Stream Power (N/m s)	0.32	14.10	1.44
Frctn Loss (m)		Cum Volume (1000 m3)	1.46	5.54	10.28
C & E Loss (m)		Cum SA (1000 m2)	2.16	3.03	19.57

Plan: murr MurragambaCk LowerReach RS: 2 Profile: PF 1

E.G. Elev (m)	412.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (m)	412.30	Reach Len. (m)	11.00	11.00	11.00
Crit W.S. (m)		Flow Area (m2)	0.55	59.18	1.43
E.G. Slope (m/m)	0.001107	Area (m2)	0.55	59.18	1.43
Q Total (m3/s)	92.20	Flow (m3/s)	0.15	91.51	0.54
Top Width (m)	25.81	Top Width (m)	0.85	22.74	2.21
Vel Total (m/s)	1.51	Avg. Vel. (m/s)	0.28	1.55	0.38
Max Chl Dpth (m)	3.45	Hydr. Depth (m)	0.65	2.60	0.65
Conv. Total (m3/s)	2771.6	Conv. (m3/s)	4.6	2750.8	16.2
Length Wtd. (m)	11.00	Wetted Per. (m)	1.55	23.34	2.56
Min Ch El (m)	408.85	Shear (N/m2)	3.86	27.51	6.06
Alpha	1.04	Stream Power (N/m s)	1.07	42.55	2.28
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	1.22	4.48	10.16
C & E Loss (m)	0.03	Cum SA (1000 m2)	1.58	2.67	19.45

Plan: murr MurragambaCk LowerReach RS: 1.6 Profile: PF 1

E.G. Elev (m)	412.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.070	0.050	0.070
W.S. Elev (m)	412.36	Reach Len. (m)	16.00	16.00	16.00
Crit W.S. (m)	410.19	Flow Area (m2)	89.82	76.00	47.71
E.G. Slope (m/m)	0.000355	Area (m2)	89.82	76.00	47.71
Q Total (m3/s)	92.20	Flow (m3/s)	20.30	61.51	10.38
Top Width (m)	205.37	Top Width (m)	116.57	23.16	65.63
Vel Total (m/s)	0.43	Avg. Vel. (m/s)	0.23	0.81	0.22
Max Chl Dpth (m)	3.72	Hydr. Depth (m)	0.77	3.28	0.73
Conv. Total (m3/s)	4893.9	Conv. (m3/s)	1077.8	3265.1	551.0
Length Wtd. (m)	16.00	Wetted Per. (m)	116.68	24.14	65.65
Min Ch El (m)	408.65	Shear (N/m2)	2.68	10.96	2.53
Alpha	2.43	Stream Power (N/m s)	0.61	8.87	0.55
Frctn Loss (m)		Cum Volume (1000 m3)	0.72	3.73	9.89
C & E Loss (m)		Cum SA (1000 m2)	0.93	2.42	19.07

Plan: murr MurragambaCk LowerReach RS: 1.4 Profile: PF 1

E.G. Elev (m)	410.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.		0.050	
W.S. Elev (m)	410.61	Reach Len. (m)	170.00	133.00	265.00
Crit W.S. (m)	410.19	Flow Area (m2)		35.51	
E.G. Slope (m/m)	0.009794	Area (m2)		35.51	
Q Total (m3/s)	92.20	Flow (m3/s)		92.20	
Top Width (m)	22.75	Top Width (m)		22.75	
Vel Total (m/s)	2.60	Avg. Vel. (m/s)		2.60	
Max Chl Dpth (m)	1.97	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	931.6	Conv. (m3/s)		931.6	
Length Wtd. (m)	187.75	Wetted Per. (m)		23.64	
Min Ch El (m)	408.65	Shear (N/m2)		144.28	

Plan: murr MurragambaCk LowerReach RS: 1.4 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (N/m s)		374.58	
Frctn Loss (m)	1.86	Cum Volume (1000 m3)		2.84	9.51
C & E Loss (m)	0.08	Cum SA (1000 m2)		2.05	18.55

Plan: murr MurragambaCk LowerReach RS: 1 Profile: PF 1

E.G. Elev (m)	409.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.040	0.060
W.S. Elev (m)	408.93	Reach Len. (m)			
Crit W.S. (m)	408.67	Flow Area (m2)		7.21	71.76
E.G. Slope (m/m)	0.010001	Area (m2)		7.21	71.76
Q Total (m3/s)	92.20	Flow (m3/s)		15.72	76.48
Top Width (m)	148.06	Top Width (m)		8.07	139.99
Vel Total (m/s)	1.17	Avg. Vel. (m/s)		2.18	1.07
Max Chl Dpth (m)	1.24	Hydr. Depth (m)		0.89	0.51
Conv. Total (m3/s)	922.0	Conv. (m3/s)		157.2	764.8
Length Wtd. (m)		Wetted Per. (m)		8.86	140.34
Min Ch El (m)	407.72	Shear (N/m2)		79.83	50.14
Alpha	1.29	Stream Power (N/m s)		174.00	53.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

Plan: east EasternCk EasternCk RS: 17 Profile: PF 1

E.G. Elev (m)	466.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.045	0.040	0.045
W.S. Elev (m)	465.87	Reach Len. (m)	345.00	343.00	354.80
Crit W.S. (m)	465.87	Flow Area (m2)	0.59	12.91	0.23
E.G. Slope (m/m)	0.021612	Area (m2)	0.59	12.91	0.23
Q Total (m3/s)	22.31	Flow (m3/s)	0.39	21.78	0.15
Top Width (m)	50.74	Top Width (m)	6.65	41.53	2.56
Vel Total (m/s)	1.62	Avg. Vel. (m/s)	0.65	1.69	0.65
Max Chl Dpth (m)	0.42	Hydr. Depth (m)	0.09	0.31	0.09
Conv. Total (m3/s)	151.8	Conv. (m3/s)	2.6	148.1	1.0
Length Wtd. (m)	343.75	Wetted Per. (m)	6.65	41.54	2.56
Min Ch El (m)	465.45	Shear (N/m2)	18.86	65.88	18.70
Alpha	1.06	Stream Power (N/m s)	12.28	111.12	12.10
Frctn Loss (m)	6.31	Cum Volume (1000 m3)	60.62	129.00	21.94
C & E Loss (m)	0.01	Cum SA (1000 m2)	69.48	191.84	44.92

Plan: east EasternCk EasternCk RS: 16 Profile: PF 1

E.G. Elev (m)	459.41	Element	Left OB	Channel	Right OB
Vel Head (m)	0.26	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (m)	459.15	Reach Len. (m)	369.00	360.00	362.00
Crit W.S. (m)	459.11	Flow Area (m2)	3.17	7.37	2.11
E.G. Slope (m/m)	0.016020	Area (m2)	3.17	7.37	2.11
Q Total (m3/s)	24.63	Flow (m3/s)	3.97	18.57	2.09
Top Width (m)	21.99	Top Width (m)	6.84	8.67	6.48
Vel Total (m/s)	1.95	Avg. Vel. (m/s)	1.25	2.52	0.99
Max Chl Dpth (m)	1.08	Hydr. Depth (m)	0.46	0.85	0.33
Conv. Total (m3/s)	194.6	Conv. (m3/s)	31.4	146.7	16.5
Length Wtd. (m)	360.83	Wetted Per. (m)	6.91	8.69	6.51
Min Ch El (m)	458.07	Shear (N/m2)	71.98	133.22	50.83
Alpha	1.35	Stream Power (N/m s)	90.25	335.68	50.53
Frctn Loss (m)	6.67	Cum Volume (1000 m3)	59.97	125.52	21.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	67.15	183.24	43.32

Plan: east EasternCk EasternCk RS: 15 Profile: PF 1

E.G. Elev (m)	452.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.	0.050	0.045	0.050
W.S. Elev (m)	452.45	Reach Len. (m)	411.00	390.00	384.00
Crit W.S. (m)	452.45	Flow Area (m2)	0.39	11.15	0.17
E.G. Slope (m/m)	0.021323	Area (m2)	0.39	11.15	0.17
Q Total (m3/s)	26.78	Flow (m3/s)	0.29	26.38	0.11
Top Width (m)	22.45	Top Width (m)	3.05	17.83	1.56
Vel Total (m/s)	2.29	Avg. Vel. (m/s)	0.74	2.37	0.66
Max Chl Dpth (m)	0.94	Hydr. Depth (m)	0.13	0.62	0.11
Conv. Total (m3/s)	183.4	Conv. (m3/s)	2.0	180.6	0.8
Length Wtd. (m)	390.11	Wetted Per. (m)	3.07	17.89	1.58
Min Ch El (m)	451.51	Shear (N/m2)	26.63	130.25	22.52
Alpha	1.06	Stream Power (N/m s)	19.69	308.27	14.89
Frctn Loss (m)	6.18	Cum Volume (1000 m3)	59.31	122.19	21.11
C & E Loss (m)	0.04	Cum SA (1000 m2)	65.32	178.47	41.86

Plan: east EasternCk EasternCk RS: 14 Profile: PF 1

E.G. Elev (m)	445.56	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.040	0.030	0.040
W.S. Elev (m)	445.43	Reach Len. (m)	474.00	448.00	411.90
Crit W.S. (m)	445.43	Flow Area (m2)	0.31	20.98	0.43
E.G. Slope (m/m)	0.012972	Area (m2)	0.31	20.98	0.43
Q Total (m3/s)	34.96	Flow (m3/s)	0.14	34.55	0.27

Plan: east EasternCk EasternCk RS: 14 Profile: PF 1 (Continued)

Top Width (m)	82.51	Top Width (m)	4.86	73.43	4.22
Vel Total (m/s)	1.61	Avg. Vel. (m/s)	0.46	1.65	0.62
Max Chl Dpth (m)	0.39	Hydr. Depth (m)	0.06	0.29	0.10
Conv. Total (m3/s)	306.9	Conv. (m3/s)	1.2	303.4	2.3
Length Wtd. (m)	442.46	Wetted Per. (m)	4.87	73.43	4.22
Min Ch El (m)	445.03	Shear (N/m2)	8.15	36.34	12.94
Alpha	1.04	Stream Power (N/m s)	3.71	59.85	8.03
Frctn Loss (m)	5.23	Cum Volume (1000 m3)	59.17	115.93	21.00
C & E Loss (m)	0.01	Cum SA (1000 m2)	63.70	160.67	40.75

Plan: east EasternCk EasternCk RS: 13 Profile: PF 1

E.G. Elev (m)	439.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.10	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	438.95	Reach Len. (m)	404.00	409.00	415.00
Crit W.S. (m)		Flow Area (m2)	5.11	11.77	23.29
E.G. Slope (m/m)	0.010915	Area (m2)	5.11	11.77	23.29
Q Total (m3/s)	38.37	Flow (m3/s)	3.53	21.23	13.62
Top Width (m)	90.95	Top Width (m)	11.12	14.69	65.14
Vel Total (m/s)	0.96	Avg. Vel. (m/s)	0.69	1.80	0.58
Max Chl Dpth (m)	0.89	Hydr. Depth (m)	0.46	0.80	0.36
Conv. Total (m3/s)	367.3	Conv. (m3/s)	33.7	203.2	130.4
Length Wtd. (m)	409.83	Wetted Per. (m)	11.16	14.69	65.16
Min Ch El (m)	438.06	Shear (N/m2)	49.04	85.78	38.26
Alpha	2.15	Stream Power (N/m s)	33.83	154.64	22.37
Frctn Loss (m)	5.81	Cum Volume (1000 m3)	57.88	108.59	16.11
C & E Loss (m)	0.01	Cum SA (1000 m2)	59.91	140.93	26.47

Plan: east EasternCk EasternCk RS: 12 Profile: PF 1

E.G. Elev (m)	433.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.100	0.060	
W.S. Elev (m)	433.17	Reach Len. (m)	315.00	286.00	255.00
Crit W.S. (m)	433.08	Flow Area (m2)	0.01	36.34	
E.G. Slope (m/m)	0.019157	Area (m2)	0.01	36.34	
Q Total (m3/s)	38.43	Flow (m3/s)	0.00	38.43	
Top Width (m)	117.46	Top Width (m)	0.67	116.79	
Vel Total (m/s)	1.06	Avg. Vel. (m/s)	0.08	1.06	
Max Chl Dpth (m)	0.93	Hydr. Depth (m)	0.01	0.31	
Conv. Total (m3/s)	277.7	Conv. (m3/s)	0.0	277.6	
Length Wtd. (m)	286.15	Wetted Per. (m)	0.67	117.09	
Min Ch El (m)	432.25	Shear (N/m2)	2.56	58.31	
Alpha	1.00	Stream Power (N/m s)	0.20	61.66	
Frctn Loss (m)	3.78	Cum Volume (1000 m3)	56.85	98.75	11.28
C & E Loss (m)	0.01	Cum SA (1000 m2)	57.53	114.04	12.95

Plan: east EasternCk EasternCk RS: 11 Profile: PF 1

E.G. Elev (m)	429.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.070	0.060	0.070
W.S. Elev (m)	429.41	Reach Len. (m)	358.00	290.00	260.00
Crit W.S. (m)	429.28	Flow Area (m2)	1.72	51.72	0.43
E.G. Slope (m/m)	0.009791	Area (m2)	1.72	51.72	0.43
Q Total (m3/s)	40.47	Flow (m3/s)	0.53	39.82	0.12
Top Width (m)	183.98	Top Width (m)	17.02	162.14	4.83
Vel Total (m/s)	0.75	Avg. Vel. (m/s)	0.31	0.77	0.28
Max Chl Dpth (m)	0.57	Hydr. Depth (m)	0.10	0.32	0.09
Conv. Total (m3/s)	409.0	Conv. (m3/s)	5.3	402.5	1.2
Length Wtd. (m)	290.38	Wetted Per. (m)	17.02	162.14	4.83
Min Ch El (m)	428.84	Shear (N/m2)	9.71	30.63	8.45

Plan: east EasternCk EasternCk RS: 11 Profile: PF 1 (Continued)

Alpha	1.04	Stream Power (N/m s)	2.98	23.58	2.36
Frctn Loss (m)	5.10	Cum Volume (1000 m3)	56.57	86.16	11.22
C & E Loss (m)	0.05	Cum SA (1000 m2)	54.74	74.16	12.33

Plan: east EasternCk EasternCk RS: 10 Profile: PF 1

E.G. Elev (m)	424.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.49	Wt. n-Val.		0.060	
W.S. Elev (m)	423.81	Reach Len. (m)	344.00	220.00	266.00
Crit W.S. (m)	423.80	Flow Area (m2)		14.29	
E.G. Slope (m/m)	0.036850	Area (m2)		14.29	
Q Total (m3/s)	44.31	Flow (m3/s)		44.31	
Top Width (m)	14.50	Top Width (m)		14.50	
Vel Total (m/s)	3.10	Avg. Vel. (m/s)		3.10	
Max Chl Dpth (m)	1.63	Hydr. Depth (m)		0.98	
Conv. Total (m3/s)	230.8	Conv. (m3/s)		230.8	
Length Wtd. (m)	220.00	Wetted Per. (m)		14.96	
Min Ch El (m)	422.18	Shear (N/m2)		344.97	
Alpha	1.00	Stream Power (N/m s)		1070.03	
Frctn Loss (m)	3.50	Cum Volume (1000 m3)	56.27	76.59	11.17
C & E Loss (m)	0.09	Cum SA (1000 m2)	51.69	48.54	11.71

Plan: east EasternCk EasternCk RS: 9 Profile: PF 1

E.G. Elev (m)	420.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.060	
W.S. Elev (m)	420.52	Reach Len. (m)	219.00	220.00	266.00
Crit W.S. (m)		Flow Area (m2)		25.19	
E.G. Slope (m/m)	0.009192	Area (m2)		25.19	
Q Total (m3/s)	48.16	Flow (m3/s)		48.16	
Top Width (m)	18.60	Top Width (m)		18.60	
Vel Total (m/s)	1.91	Avg. Vel. (m/s)		1.91	
Max Chl Dpth (m)	2.26	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	502.3	Conv. (m3/s)		502.3	
Length Wtd. (m)	220.01	Wetted Per. (m)		19.25	
Min Ch El (m)	418.25	Shear (N/m2)		117.96	
Alpha	1.00	Stream Power (N/m s)		225.51	
Frctn Loss (m)	2.09	Cum Volume (1000 m3)	56.27	72.24	11.17
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.69	44.90	11.71

Plan: east EasternCk EasternCk RS: 8 Profile: PF 1

E.G. Elev (m)	418.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.060	0.090
W.S. Elev (m)	418.43	Reach Len. (m)	218.00	238.00	267.00
Crit W.S. (m)		Flow Area (m2)		25.74	0.11
E.G. Slope (m/m)	0.009781	Area (m2)		25.74	0.11
Q Total (m3/s)	50.00	Flow (m3/s)		49.98	0.02
Top Width (m)	20.67	Top Width (m)		19.27	1.41
Vel Total (m/s)	1.93	Avg. Vel. (m/s)		1.94	0.21
Max Chl Dpth (m)	2.64	Hydr. Depth (m)		1.34	0.08
Conv. Total (m3/s)	505.6	Conv. (m3/s)		505.3	0.2
Length Wtd. (m)	238.01	Wetted Per. (m)		20.13	1.42
Min Ch El (m)	415.79	Shear (N/m2)		122.64	7.77
Alpha	1.01	Stream Power (N/m s)		238.13	1.60
Frctn Loss (m)	2.23	Cum Volume (1000 m3)	56.27	66.64	11.15
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.69	40.74	11.52

Plan: east EasternCk EasternCk RS: 7 Profile: PF 1

E.G. Elev (m)	416.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.060	
W.S. Elev (m)	416.20	Reach Len. (m)	215.00	204.00	200.00
Crit W.S. (m)		Flow Area (m2)		27.12	
E.G. Slope (m/m)	0.008997	Area (m2)		27.12	
Q Total (m3/s)	52.00	Flow (m3/s)		52.00	
Top Width (m)	19.57	Top Width (m)		19.57	
Vel Total (m/s)	1.92	Avg. Vel. (m/s)		1.92	
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		1.39	
Conv. Total (m3/s)	548.2	Conv. (m3/s)		548.2	
Length Wtd. (m)	204.00	Wetted Per. (m)		20.29	
Min Ch El (m)	413.99	Shear (N/m2)		117.88	
Alpha	1.00	Stream Power (N/m s)		226.07	
Frctn Loss (m)	1.51	Cum Volume (1000 m3)	56.27	60.35	11.14
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.69	36.12	11.33

Plan: east EasternCk EasternCk RS: 6 Profile: PF 1

E.G. Elev (m)	414.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.000	0.050	
W.S. Elev (m)	414.70	Reach Len. (m)	207.00	222.00	243.00
Crit W.S. (m)	414.10	Flow Area (m2)	0.00	28.99	
E.G. Slope (m/m)	0.006230	Area (m2)	0.00	28.99	
Q Total (m3/s)	54.31	Flow (m3/s)	0.00	54.31	
Top Width (m)	21.95	Top Width (m)	0.11	21.84	
Vel Total (m/s)	1.87	Avg. Vel. (m/s)	0.02	1.87	
Max Chl Dpth (m)	2.29	Hydr. Depth (m)	0.00	1.33	
Conv. Total (m3/s)	688.1	Conv. (m3/s)	0.0	688.1	
Length Wtd. (m)	222.00	Wetted Per. (m)	0.11	22.42	
Min Ch El (m)	412.41	Shear (N/m2)		78.99	
Alpha	1.00	Stream Power (N/m s)		147.98	
Frctn Loss (m)	2.55	Cum Volume (1000 m3)	56.27	54.63	11.14
C & E Loss (m)	0.03	Cum SA (1000 m2)	51.68	31.89	11.33

Plan: east EasternCk EasternCk RS: 5 Profile: PF 1

E.G. Elev (m)	412.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.		0.050	
W.S. Elev (m)	411.87	Reach Len. (m)	321.00	217.00	208.00
Crit W.S. (m)	411.87	Flow Area (m2)		19.70	
E.G. Slope (m/m)	0.026331	Area (m2)		19.70	
Q Total (m3/s)	57.28	Flow (m3/s)		57.28	
Top Width (m)	22.97	Top Width (m)		22.97	
Vel Total (m/s)	2.91	Avg. Vel. (m/s)		2.91	
Max Chl Dpth (m)	1.57	Hydr. Depth (m)		0.86	
Conv. Total (m3/s)	353.0	Conv. (m3/s)		353.0	
Length Wtd. (m)	217.85	Wetted Per. (m)		23.24	
Min Ch El (m)	410.30	Shear (N/m2)		218.90	
Alpha	1.00	Stream Power (N/m s)		636.34	
Frctn Loss (m)	0.60	Cum Volume (1000 m3)	56.27	49.22	11.14
C & E Loss (m)	0.12	Cum SA (1000 m2)	51.67	26.92	11.33

Plan: east EasternCk EasternCk RS: 4 Profile: PF 1

E.G. Elev (m)	410.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.090	0.070	0.090
W.S. Elev (m)	410.85	Reach Len. (m)	325.00	170.00	140.00
Crit W.S. (m)		Flow Area (m2)	5.83	91.20	0.50
E.G. Slope (m/m)	0.001028	Area (m2)	5.83	91.20	0.50
Q Total (m3/s)	60.25	Flow (m3/s)	0.97	59.23	0.05

Plan: east EasternCk EasternCk RS: 4 Profile: PF 1 (Continued)

Top Width (m)	73.99	Top Width (m)	18.24	52.70	3.04
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.17	0.65	0.11
Max Chl Dpth (m)	3.34	Hydr. Depth (m)	0.32	1.73	0.17
Conv. Total (m3/s)	1878.9	Conv. (m3/s)	30.2	1846.9	1.7
Length Wtd. (m)	186.74	Wetted Per. (m)	18.26	54.03	3.06
Min Ch El (m)	407.51	Shear (N/m2)	3.22	17.02	1.66
Alpha	1.09	Stream Power (N/m s)	0.54	11.05	0.18
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	55.33	37.19	11.09
C & E Loss (m)	0.01	Cum SA (1000 m2)	48.74	18.71	11.01

Plan: east EasternCk EasternCk RS: 3 Profile: PF 1

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.100	0.050	0.100
W.S. Elev (m)	410.84	Reach Len. (m)	24.00	24.00	24.00
Crit W.S. (m)		Flow Area (m2)	177.50	174.23	37.26
E.G. Slope (m/m)	0.000044	Area (m2)	177.50	174.23	37.26
Q Total (m3/s)	61.68	Flow (m3/s)	12.67	46.64	2.37
Top Width (m)	257.51	Top Width (m)	158.20	59.86	39.45
Vel Total (m/s)	0.16	Avg. Vel. (m/s)	0.07	0.27	0.06
Max Chl Dpth (m)	4.75	Hydr. Depth (m)	1.12	2.91	0.94
Conv. Total (m3/s)	9329.1	Conv. (m3/s)	1916.4	7054.4	358.4
Length Wtd. (m)	24.00	Wetted Per. (m)	158.22	60.49	39.50
Min Ch El (m)	406.09	Shear (N/m2)	0.48	1.23	0.40
Alpha	2.20	Stream Power (N/m s)	0.03	0.33	0.03
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	25.54	14.63	8.44
C & E Loss (m)	0.00	Cum SA (1000 m2)	20.07	9.14	8.04

Plan: east EasternCk EasternCk RS: 2.7 Profile: PF 1

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	5.00	5.00	5.00
Crit W.S. (m)		Flow Area (m2)	300.89	118.63	91.44
E.G. Slope (m/m)	0.000031	Area (m2)	300.89	118.63	91.44
Q Total (m3/s)	61.68	Flow (m3/s)	23.96	31.54	6.18
Top Width (m)	316.24	Top Width (m)	205.12	31.42	79.70
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.08	0.27	0.07
Max Chl Dpth (m)	4.85	Hydr. Depth (m)	1.47	3.78	1.15
Conv. Total (m3/s)	11111.8	Conv. (m3/s)	4315.8	5682.8	1113.3
Length Wtd. (m)	5.00	Wetted Per. (m)	205.14	32.00	79.73
Min Ch El (m)	405.99	Shear (N/m2)	0.44	1.12	0.35
Alpha	2.68	Stream Power (N/m s)	0.04	0.30	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	19.80	11.12	6.90
C & E Loss (m)	0.00	Cum SA (1000 m2)	15.71	8.04	6.61

Plan: east EasternCk EasternCk RS: 2.6 Profile: PF 1

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	9.00	9.00	9.00
Crit W.S. (m)	406.28	Flow Area (m2)	360.86	125.36	118.25
E.G. Slope (m/m)	0.000017	Area (m2)	360.86	125.36	118.25
Q Total (m3/s)	61.68	Flow (m3/s)	23.53	31.60	6.55
Top Width (m)	321.73	Top Width (m)	210.89	23.00	87.84
Vel Total (m/s)	0.10	Avg. Vel. (m/s)	0.07	0.25	0.06
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.71	5.45	1.35
Conv. Total (m3/s)	15030.8	Conv. (m3/s)	5734.3	7701.3	1595.2
Length Wtd. (m)	9.00	Wetted Per. (m)	210.99	23.29	88.39
Min Ch El (m)	405.16	Shear (N/m2)	0.28	0.89	0.22

Plan: east EasternCk EasternCk RS: 2.6 Profile: PF 1 (Continued)

Alpha	3.31	Stream Power (N/m s)	0.02	0.22	0.01
Frctn Loss (m)		Cum Volume (1000 m3)	18.15	10.51	6.37
C & E Loss (m)		Cum SA (1000 m2)	14.67	7.91	6.19

Plan: east EasternCk EasternCk RS: 2.4 Profile: PF 1

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	7.50	7.50	7.50
Crit W.S. (m)		Flow Area (m2)	390.27	125.33	124.90
E.G. Slope (m/m)	0.000015	Area (m2)	390.27	125.33	124.90
Q Total (m3/s)	61.68	Flow (m3/s)	25.10	29.91	6.67
Top Width (m)	327.71	Top Width (m)	214.53	23.00	90.19
Vel Total (m/s)	0.10	Avg. Vel. (m/s)	0.06	0.24	0.05
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.82	5.45	1.38
Conv. Total (m3/s)	15876.1	Conv. (m3/s)	6460.7	7697.7	1717.7
Length Wtd. (m)	7.50	Wetted Per. (m)	214.60	23.29	90.71
Min Ch El (m)	405.16	Shear (N/m2)	0.27	0.80	0.20
Alpha	3.19	Stream Power (N/m s)	0.02	0.19	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	14.77	9.38	5.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	12.76	7.70	5.39

Plan: east EasternCk EasternCk RS: 2 Profile: PF 1

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.050	0.080
W.S. Elev (m)	410.84	Reach Len. (m)	7.00	7.00	7.00
Crit W.S. (m)		Flow Area (m2)	375.27	121.99	121.06
E.G. Slope (m/m)	0.000018	Area (m2)	375.27	121.99	121.06
Q Total (m3/s)	62.00	Flow (m3/s)	28.60	25.51	7.90
Top Width (m)	343.17	Top Width (m)	221.52	31.42	90.23
Vel Total (m/s)	0.10	Avg. Vel. (m/s)	0.08	0.21	0.07
Max Chl Dpth (m)	5.19	Hydr. Depth (m)	1.69	3.88	1.34
Conv. Total (m3/s)	14451.0	Conv. (m3/s)	6665.8	5945.0	1840.3
Length Wtd. (m)	7.00	Wetted Per. (m)	221.54	32.07	90.27
Min Ch El (m)	405.65	Shear (N/m2)	0.31	0.69	0.24
Alpha	2.11	Stream Power (N/m s)	0.02	0.14	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	11.90	8.45	4.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	11.12	7.50	4.71

Plan: east EasternCk EasternCk RS: 1.6 Profile: PF 1

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	405.85	Flow Area (m2)	404.93	116.33	165.42
E.G. Slope (m/m)	0.000015	Area (m2)	404.93	116.33	165.42
Q Total (m3/s)	62.00	Flow (m3/s)	25.41	27.05	9.54
Top Width (m)	350.03	Top Width (m)	225.37	20.26	104.40
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.06	0.23	0.06
Max Chl Dpth (m)	6.37	Hydr. Depth (m)	1.80	5.74	1.58
Conv. Total (m3/s)	16222.0	Conv. (m3/s)	6648.8	7076.7	2496.5
Length Wtd. (m)	15.00	Wetted Per. (m)	225.41	21.93	104.49
Min Ch El (m)	404.46	Shear (N/m2)	0.26	0.76	0.23
Alpha	3.15	Stream Power (N/m s)	0.02	0.18	0.01
Frctn Loss (m)		Cum Volume (1000 m3)	9.16	7.62	3.35
C & E Loss (m)		Cum SA (1000 m2)	9.56	7.32	4.03

Plan: east EasternCk EasternCk RS: 1.4 Profile: PF 1

E.G. Elev (m)	408.95	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.050	0.080
W.S. Elev (m)	408.94	Reach Len. (m)	124.70	98.70	132.70
Crit W.S. (m)		Flow Area (m2)	87.72	77.92	28.63
E.G. Slope (m/m)	0.000165	Area (m2)	87.72	77.92	28.63
Q Total (m3/s)	62.00	Flow (m3/s)	11.90	46.65	3.44
Top Width (m)	176.88	Top Width (m)	112.62	20.26	44.00
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.14	0.60	0.12
Max Chl Dpth (m)	4.47	Hydr. Depth (m)	0.78	3.85	0.65
Conv. Total (m3/s)	4833.7	Conv. (m3/s)	928.1	3637.1	268.5
Length Wtd. (m)	102.14	Wetted Per. (m)	112.65	21.86	44.05
Min Ch El (m)	404.46	Shear (N/m2)	1.26	5.75	1.05
Alpha	2.69	Stream Power (N/m s)	0.17	3.44	0.13
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	5.47	6.16	1.90
C & E Loss (m)	0.01	Cum SA (1000 m2)	7.02	7.01	2.92

Plan: east EasternCk EasternCk RS: 1 Profile: PF 1

E.G. Elev (m)	408.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.040	
W.S. Elev (m)	408.80	Reach Len. (m)			
Crit W.S. (m)	408.69	Flow Area (m2)		46.87	
E.G. Slope (m/m)	0.010005	Area (m2)		46.87	
Q Total (m3/s)	62.00	Flow (m3/s)		62.00	
Top Width (m)	121.84	Top Width (m)		121.84	
Vel Total (m/s)	1.32	Avg. Vel. (m/s)		1.32	
Max Chl Dpth (m)	0.66	Hydr. Depth (m)		0.38	
Conv. Total (m3/s)	619.8	Conv. (m3/s)		619.8	
Length Wtd. (m)		Wetted Per. (m)		121.85	
Min Ch El (m)	408.14	Shear (N/m2)		37.74	
Alpha	1.00	Stream Power (N/m s)		49.93	
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

Appendix F – HEC-RAS MODEL OUTPUT FOR THE POST-MINING CREEK ALIGNMENTS

Plan: Plan 06 Eastern 1 RS: 137 Profile: 100 year

E.G. Elev (m)	467.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	466.77	Reach Len. (m)	17.70	31.30	48.10
Crit W.S. (m)	466.77	Flow Area (m2)	5.01	7.84	4.55
E.G. Slope (m/m)	0.010935	Area (m2)	5.01	7.84	4.55
Q Total (m3/s)	37.68	Flow (m3/s)	6.99	24.42	6.28
Top Width (m)	24.76	Top Width (m)	9.12	7.20	8.45
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.40	3.12	1.38
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.54
Conv. Total (m3/s)	360.3	Conv. (m3/s)	66.8	233.5	60.0
Length Wtd. (m)		Wetted Per. (m)	9.18	7.36	8.51
Min Ch El (m)	465.45	Shear (N/m2)	58.45	114.19	57.36
Alpha	1.49	Stream Power (N/m s)	81.56	355.76	79.06
Frctn Loss (m)		Cum Volume (1000 m3)	76.62	66.68	49.81
C & E Loss (m)		Cum SA (1000 m2)	94.17	50.10	61.05

Plan: Plan 06 Eastern 1 RS: 136 Profile: 100 year

E.G. Elev (m)	466.78	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	466.43	Reach Len. (m)	7.48	18.50	21.95
Crit W.S. (m)	466.43	Flow Area (m2)	5.31	7.79	4.41
E.G. Slope (m/m)	0.010975	Area (m2)	5.31	7.79	4.41
Q Total (m3/s)	37.68	Flow (m3/s)	7.44	24.20	6.04
Top Width (m)	25.12	Top Width (m)	9.63	7.20	8.29
Vel Total (m/s)	2.15	Avg. Vel. (m/s)	1.40	3.11	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.08	0.53
Conv. Total (m3/s)	359.7	Conv. (m3/s)	71.0	231.0	57.7
Length Wtd. (m)		Wetted Per. (m)	9.70	7.36	8.36
Min Ch El (m)	465.11	Shear (N/m2)	58.89	113.87	56.84
Alpha	1.49	Stream Power (N/m s)	82.56	353.88	77.82
Frctn Loss (m)		Cum Volume (1000 m3)	76.53	66.44	49.60
C & E Loss (m)		Cum SA (1000 m2)	94.00	49.87	60.65

Plan: Plan 06 Eastern 1 RS: 135 Profile: 100 year

E.G. Elev (m)	466.59	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	466.23	Reach Len. (m)	42.70	30.40	12.90
Crit W.S. (m)	466.23	Flow Area (m2)	5.28	7.83	4.31
E.G. Slope (m/m)	0.010939	Area (m2)	5.28	7.83	4.31
Q Total (m3/s)	37.68	Flow (m3/s)	7.41	24.38	5.89
Top Width (m)	24.82	Top Width (m)	9.53	7.20	8.09
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.40	3.11	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.53
Conv. Total (m3/s)	360.3	Conv. (m3/s)	70.8	233.1	56.3
Length Wtd. (m)		Wetted Per. (m)	9.60	7.36	8.16
Min Ch El (m)	464.91	Shear (N/m2)	58.98	114.12	56.66
Alpha	1.49	Stream Power (N/m s)	82.79	355.38	77.44
Frctn Loss (m)		Cum Volume (1000 m3)	76.49	66.29	49.50
C & E Loss (m)		Cum SA (1000 m2)	93.93	49.74	60.47

Plan: Plan 06 Eastern 1 RS: 134 Profile: 100 year

E.G. Elev (m)	466.26	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	465.90	Reach Len. (m)	29.80	21.10	9.60
Crit W.S. (m)	465.90	Flow Area (m2)	2.91	7.84	6.63
E.G. Slope (m/m)	0.010919	Area (m2)	2.91	7.84	6.63
Q Total (m3/s)	37.68	Flow (m3/s)	3.73	24.41	9.55

Plan: Plan 06 Eastern 1 RS: 134 Profile: 100 year (Continued)

Top Width (m)	24.73	Top Width (m)	6.01	7.20	11.53
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.28	3.11	1.44
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.48	1.09	0.58
Conv. Total (m3/s)	360.6	Conv. (m3/s)	35.7	233.6	91.4
Length Wtd. (m)	19.61	Wetted Per. (m)	6.07	7.36	11.59
Min Ch El (m)	464.58	Shear (N/m2)	51.33	114.04	61.23
Alpha	1.48	Stream Power (N/m s)	65.72	355.07	88.16
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	76.32	66.05	49.43
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.60	49.52	60.34

Plan: Plan 06 Eastern 1 RS: 133 Profile: 100 year

E.G. Elev (m)	466.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	465.68	Reach Len. (m)	58.20	58.50	59.47
Crit W.S. (m)	465.67	Flow Area (m2)	4.31	7.88	5.34
E.G. Slope (m/m)	0.010692	Area (m2)	4.31	7.88	5.34
Q Total (m3/s)	37.68	Flow (m3/s)	5.85	24.37	7.45
Top Width (m)	24.80	Top Width (m)	8.05	7.20	9.56
Vel Total (m/s)	2.15	Avg. Vel. (m/s)	1.36	3.09	1.40
Max Chl Dpth (m)	1.33	Hydr. Depth (m)	0.54	1.09	0.56
Conv. Total (m3/s)	364.4	Conv. (m3/s)	56.6	235.7	72.1
Length Wtd. (m)	58.62	Wetted Per. (m)	8.11	7.36	9.62
Min Ch El (m)	464.35	Shear (N/m2)	55.73	112.28	58.16
Alpha	1.48	Stream Power (N/m s)	75.62	347.22	81.20
Frctn Loss (m)	0.63	Cum Volume (1000 m3)	76.21	65.89	49.37
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.39	49.37	60.24

Plan: Plan 06 Eastern 1 RS: 132 Profile: 100 year

E.G. Elev (m)	465.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	465.04	Reach Len. (m)	3.80	26.60	42.80
Crit W.S. (m)	465.04	Flow Area (m2)	5.26	7.84	4.28
E.G. Slope (m/m)	0.010942	Area (m2)	5.26	7.84	4.28
Q Total (m3/s)	37.68	Flow (m3/s)	7.39	24.43	5.85
Top Width (m)	24.74	Top Width (m)	9.50	7.20	8.04
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.40	3.12	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.53
Conv. Total (m3/s)	360.2	Conv. (m3/s)	70.7	233.6	55.9
Length Wtd. (m)	25.06	Wetted Per. (m)	9.56	7.36	8.10
Min Ch El (m)	463.72	Shear (N/m2)	59.05	114.29	56.67
Alpha	1.49	Stream Power (N/m s)	82.96	356.25	77.46
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	75.93	65.43	49.09
C & E Loss (m)	0.01	Cum SA (1000 m2)	92.88	48.94	59.72

Plan: Plan 06 Eastern 1 RS: 131 Profile: 100 year

E.G. Elev (m)	465.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	464.77	Reach Len. (m)	11.50	19.00	28.80
Crit W.S. (m)		Flow Area (m2)	4.91	7.98	5.00
E.G. Slope (m/m)	0.010149	Area (m2)	4.91	7.98	5.00
Q Total (m3/s)	37.68	Flow (m3/s)	6.66	24.22	6.79
Top Width (m)	24.97	Top Width (m)	8.82	7.20	8.94
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.36	3.04	1.36
Max Chl Dpth (m)	1.34	Hydr. Depth (m)	0.56	1.11	0.56
Conv. Total (m3/s)	374.0	Conv. (m3/s)	66.1	240.5	67.4
Length Wtd. (m)	19.73	Wetted Per. (m)	8.89	7.36	9.01
Min Ch El (m)	463.43	Shear (N/m2)	54.98	107.87	55.17

Plan: Plan 06 Eastern 1 RS: 131 Profile: 100 year (Continued)

Alpha	1.48	Stream Power (N/m s)	74.59	327.59	75.01
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	75.91	65.22	48.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.84	48.75	59.35

Plan: Plan 06 Eastern 1 RS: 130 Profile: 100 year

E.G. Elev (m)	464.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	464.54	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	464.54	Flow Area (m2)	3.94	7.83	5.64
E.G. Slope (m/m)	0.010950	Area (m2)	3.94	7.83	5.64
Q Total (m3/s)	37.68	Flow (m3/s)	5.31	24.38	7.99
Top Width (m)	24.82	Top Width (m)	7.54	7.20	10.08
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.35	3.11	1.42
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.52	1.09	0.56
Conv. Total (m3/s)	360.1	Conv. (m3/s)	50.8	233.0	76.3
Length Wtd. (m)	1.00	Wetted Per. (m)	7.61	7.36	10.15
Min Ch El (m)	463.22	Shear (N/m2)	55.58	114.19	59.73
Alpha	1.49	Stream Power (N/m s)	75.00	355.70	84.55
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	75.86	65.07	48.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.75	48.62	59.08

Plan: Plan 06 Eastern 1 RS: 129.5 Profile: 100 year

E.G. Elev (m)	464.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	464.04	Reach Len. (m)	34.50	22.60	8.20
Crit W.S. (m)	464.04	Flow Area (m2)	3.94	7.83	5.64
E.G. Slope (m/m)	0.010950	Area (m2)	3.94	7.83	5.64
Q Total (m3/s)	37.68	Flow (m3/s)	5.31	24.38	7.99
Top Width (m)	24.82	Top Width (m)	7.54	7.20	10.08
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.35	3.11	1.42
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.52	1.09	0.56
Conv. Total (m3/s)	360.1	Conv. (m3/s)	50.8	233.0	76.3
Length Wtd. (m)	20.65	Wetted Per. (m)	7.61	7.36	10.15
Min Ch El (m)	462.72	Shear (N/m2)	55.58	114.19	59.73
Alpha	1.49	Stream Power (N/m s)	75.00	355.70	84.55
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	75.86	65.06	48.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.74	48.61	59.07

Plan: Plan 06 Eastern 1 RS: 129 Profile: 100 year

E.G. Elev (m)	464.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	463.80	Reach Len. (m)	26.50	17.40	1.20
Crit W.S. (m)	463.80	Flow Area (m2)	2.88	7.82	6.71
E.G. Slope (m/m)	0.010933	Area (m2)	2.88	7.82	6.71
Q Total (m3/s)	37.68	Flow (m3/s)	3.68	24.33	9.66
Top Width (m)	24.85	Top Width (m)	5.98	7.20	11.68
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.28	3.11	1.44
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.48	1.09	0.57
Conv. Total (m3/s)	360.4	Conv. (m3/s)	35.2	232.7	92.4
Length Wtd. (m)	13.71	Wetted Per. (m)	6.04	7.36	11.74
Min Ch El (m)	462.48	Shear (N/m2)	51.18	113.94	61.27
Alpha	1.48	Stream Power (N/m s)	65.38	354.46	88.23
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	75.74	64.88	48.68
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.51	48.45	58.98

Plan: Plan 06 Eastern 1 RS: 128 Profile: 100 year

E.G. Elev (m)	463.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	463.61	Reach Len. (m)	72.00	71.60	70.60
Crit W.S. (m)	463.61	Flow Area (m2)	2.05	7.85	7.54
E.G. Slope (m/m)	0.010785	Area (m2)	2.05	7.85	7.54
Q Total (m3/s)	37.68	Flow (m3/s)	2.42	24.32	10.94
Top Width (m)	24.78	Top Width (m)	4.73	7.20	12.86
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.18	3.10	1.45
Max Chl Dpth (m)	1.33	Hydr. Depth (m)	0.43	1.09	0.59
Conv. Total (m3/s)	362.8	Conv. (m3/s)	23.3	234.2	105.3
Length Wtd. (m)	71.47	Wetted Per. (m)	4.79	7.36	12.92
Min Ch El (m)	462.29	Shear (N/m2)	45.27	112.82	61.72
Alpha	1.48	Stream Power (N/m s)	53.40	349.50	89.52
Frctn Loss (m)	0.78	Cum Volume (1000 m3)	75.68	64.75	48.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.37	48.32	58.97

Plan: Plan 06 Eastern 1 RS: 127 Profile: 100 year

E.G. Elev (m)	463.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	462.83	Reach Len. (m)	3.00	18.90	33.60
Crit W.S. (m)	462.83	Flow Area (m2)	6.79	7.83	2.76
E.G. Slope (m/m)	0.010922	Area (m2)	6.79	7.83	2.76
Q Total (m3/s)	37.68	Flow (m3/s)	9.80	24.39	3.50
Top Width (m)	24.76	Top Width (m)	11.77	7.20	5.78
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.44	3.11	1.27
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.09	0.48
Conv. Total (m3/s)	360.5	Conv. (m3/s)	93.8	233.3	33.5
Length Wtd. (m)		Wetted Per. (m)	11.84	7.36	5.85
Min Ch El (m)	461.51	Shear (N/m2)	61.43	114.00	50.53
Alpha	1.48	Stream Power (N/m s)	88.62	354.87	64.00
Frctn Loss (m)		Cum Volume (1000 m3)	75.36	64.19	48.31
C & E Loss (m)		Cum SA (1000 m2)	91.77	47.81	58.31

Plan: Plan 06 Eastern 1 RS: 126 Profile: 100 year

E.G. Elev (m)	462.98	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	462.63	Reach Len. (m)	31.40	26.50	18.40
Crit W.S. (m)	462.63	Flow Area (m2)	5.82	7.84	3.73
E.G. Slope (m/m)	0.010930	Area (m2)	5.82	7.84	3.73
Q Total (m3/s)	37.68	Flow (m3/s)	8.26	24.42	5.00
Top Width (m)	24.75	Top Width (m)	10.32	7.20	7.23
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.42	3.12	1.34
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.56	1.09	0.52
Conv. Total (m3/s)	360.4	Conv. (m3/s)	79.0	233.6	47.8
Length Wtd. (m)		Wetted Per. (m)	10.38	7.36	7.29
Min Ch El (m)	461.31	Shear (N/m2)	60.03	114.16	54.87
Alpha	1.48	Stream Power (N/m s)	85.28	355.64	73.42
Frctn Loss (m)		Cum Volume (1000 m3)	75.34	64.04	48.20
C & E Loss (m)		Cum SA (1000 m2)	91.74	47.67	58.09

Plan: Plan 06 Eastern 1 RS: 125 Profile: 100 year

E.G. Elev (m)	462.69	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	462.34	Reach Len. (m)	31.40	23.10	10.60
Crit W.S. (m)	462.34	Flow Area (m2)	2.42	7.83	7.14
E.G. Slope (m/m)	0.010917	Area (m2)	2.42	7.83	7.14
Q Total (m3/s)	37.68	Flow (m3/s)	2.98	24.36	10.34

Plan: Plan 06 Eastern 1 RS: 125 Profile: 100 year (Continued)

Top Width (m)	24.78	Top Width (m)	5.28	7.20	12.30
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.23	3.11	1.45
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.46	1.09	0.58
Conv. Total (m3/s)	360.6	Conv. (m3/s)	28.5	233.1	99.0
Length Wtd. (m)	20.53	Wetted Per. (m)	5.35	7.36	12.37
Min Ch El (m)	461.02	Shear (N/m2)	48.45	113.89	61.79
Alpha	1.48	Stream Power (N/m s)	59.67	354.31	89.51
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	75.21	63.83	48.10
C & E Loss (m)	0.00	Cum SA (1000 m2)	91.49	47.48	57.91

Plan: Plan 06 Eastern 1 RS: 124 Profile: 100 year

E.G. Elev (m)	462.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	462.09	Reach Len. (m)	42.10	44.10	45.00
Crit W.S. (m)	462.09	Flow Area (m2)	2.93	7.86	6.70
E.G. Slope (m/m)	0.010746	Area (m2)	2.93	7.86	6.70
Q Total (m3/s)	37.68	Flow (m3/s)	3.73	24.34	9.61
Top Width (m)	24.82	Top Width (m)	6.02	7.20	11.59
Vel Total (m/s)	2.15	Avg. Vel. (m/s)	1.27	3.10	1.43
Max Chl Dpth (m)	1.33	Hydr. Depth (m)	0.49	1.09	0.58
Conv. Total (m3/s)	363.5	Conv. (m3/s)	36.0	234.8	92.7
Length Wtd. (m)	44.00	Wetted Per. (m)	6.09	7.36	11.66
Min Ch El (m)	460.77	Shear (N/m2)	50.73	112.59	60.57
Alpha	1.48	Stream Power (N/m s)	64.61	348.49	86.82
Frctn Loss (m)	0.48	Cum Volume (1000 m3)	75.12	63.65	48.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	91.32	47.31	57.78

Plan: Plan 06 Eastern 1 RS: 123 Profile: 100 year

E.G. Elev (m)	461.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	461.61	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	461.61	Flow Area (m2)	5.14	7.84	4.41
E.G. Slope (m/m)	0.010931	Area (m2)	5.14	7.84	4.41
Q Total (m3/s)	37.68	Flow (m3/s)	7.20	24.43	6.06
Top Width (m)	24.75	Top Width (m)	9.32	7.20	8.24
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.40	3.12	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.54
Conv. Total (m3/s)	360.4	Conv. (m3/s)	68.8	233.6	57.9
Length Wtd. (m)	1.00	Wetted Per. (m)	9.38	7.36	8.30
Min Ch El (m)	460.29	Shear (N/m2)	58.73	114.18	56.98
Alpha	1.49	Stream Power (N/m s)	82.22	355.75	78.18
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	74.95	63.30	47.77
C & E Loss (m)	0.00	Cum SA (1000 m2)	90.99	47.00	57.34

Plan: Plan 06 Eastern 1 RS: 122.5 Profile: 100 year

E.G. Elev (m)	461.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	461.11	Reach Len. (m)	0.30	18.30	33.50
Crit W.S. (m)	461.11	Flow Area (m2)	5.14	7.84	4.41
E.G. Slope (m/m)	0.010935	Area (m2)	5.14	7.84	4.41
Q Total (m3/s)	37.68	Flow (m3/s)	7.20	24.42	6.06
Top Width (m)	24.75	Top Width (m)	9.32	7.20	8.24
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.40	3.12	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.54
Conv. Total (m3/s)	360.3	Conv. (m3/s)	68.8	233.6	57.9
Length Wtd. (m)	16.20	Wetted Per. (m)	9.38	7.36	8.30
Min Ch El (m)	459.79	Shear (N/m2)	58.75	114.21	57.00

Plan: Plan 06 Eastern 1 RS: 122.5 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	82.27	355.85	78.22
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	74.95	63.29	47.77
C & E Loss (m)	0.00	Cum SA (1000 m2)	90.98	46.99	57.33

Plan: Plan 06 Eastern 1 RS: 122 Profile: 100 year

E.G. Elev (m)	461.26	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	460.91	Reach Len. (m)	28.70	32.70	35.30
Crit W.S. (m)	460.91	Flow Area (m2)	6.77	7.84	2.83
E.G. Slope (m/m)	0.010881	Area (m2)	6.77	7.84	2.83
Q Total (m3/s)	37.68	Flow (m3/s)	9.74	24.35	3.59
Top Width (m)	24.82	Top Width (m)	11.74	7.20	5.89
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.44	3.11	1.27
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.09	0.48
Conv. Total (m3/s)	361.2	Conv. (m3/s)	93.4	233.4	34.5
Length Wtd. (m)	32.27	Wetted Per. (m)	11.80	7.36	5.95
Min Ch El (m)	459.59	Shear (N/m2)	61.17	113.59	50.71
Alpha	1.48	Stream Power (N/m s)	88.07	352.96	64.43
Frctn Loss (m)	0.35	Cum Volume (1000 m3)	74.95	63.15	47.65
C & E Loss (m)	0.00	Cum SA (1000 m2)	90.98	46.86	57.09

Plan: Plan 06 Eastern 1 RS: 121 Profile: 100 year

E.G. Elev (m)	460.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	460.56	Reach Len. (m)	32.40	20.90	4.80
Crit W.S. (m)	460.56	Flow Area (m2)	4.19	7.83	5.40
E.G. Slope (m/m)	0.010940	Area (m2)	4.19	7.83	5.40
Q Total (m3/s)	37.68	Flow (m3/s)	5.70	24.38	7.60
Top Width (m)	24.82	Top Width (m)	7.91	7.20	9.71
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.36	3.11	1.41
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.53	1.09	0.56
Conv. Total (m3/s)	360.2	Conv. (m3/s)	54.5	233.1	72.7
Length Wtd. (m)	18.76	Wetted Per. (m)	7.98	7.36	9.78
Min Ch El (m)	459.24	Shear (N/m2)	56.32	114.12	59.23
Alpha	1.49	Stream Power (N/m s)	76.67	355.37	83.38
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	74.79	62.89	47.50
C & E Loss (m)	0.00	Cum SA (1000 m2)	90.70	46.62	56.82

Plan: Plan 06 Eastern 1 RS: 120 Profile: 100 year

E.G. Elev (m)	460.68	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	460.33	Reach Len. (m)	27.00	16.80	2.90
Crit W.S. (m)	460.33	Flow Area (m2)	3.07	7.83	6.51
E.G. Slope (m/m)	0.010925	Area (m2)	3.07	7.83	6.51
Q Total (m3/s)	37.68	Flow (m3/s)	3.97	24.36	9.35
Top Width (m)	24.81	Top Width (m)	6.25	7.20	11.36
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.29	3.11	1.44
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.49	1.09	0.57
Conv. Total (m3/s)	360.5	Conv. (m3/s)	38.0	233.1	89.4
Length Wtd. (m)		Wetted Per. (m)	6.32	7.36	11.43
Min Ch El (m)	459.01	Shear (N/m2)	52.10	113.97	61.01
Alpha	1.48	Stream Power (N/m s)	67.36	354.66	87.62
Frctn Loss (m)		Cum Volume (1000 m3)	74.67	62.73	47.47
C & E Loss (m)		Cum SA (1000 m2)	90.47	46.47	56.77

Plan: Plan 06 Eastern 1 RS: 119 Profile: 100 year

E.G. Elev (m)	460.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	460.15	Reach Len. (m)	48.30	48.70	48.30
Crit W.S. (m)	460.15	Flow Area (m2)	3.03	7.84	6.51
E.G. Slope (m/m)	0.010919	Area (m2)	3.03	7.84	6.51
Q Total (m3/s)	37.68	Flow (m3/s)	3.91	24.41	9.36
Top Width (m)	24.74	Top Width (m)	6.19	7.20	11.35
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.29	3.11	1.44
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.49	1.09	0.57
Conv. Total (m3/s)	360.6	Conv. (m3/s)	37.5	233.6	89.5
Length Wtd. (m)		Wetted Per. (m)	6.25	7.36	11.41
Min Ch El (m)	458.83	Shear (N/m2)	51.94	114.05	61.07
Alpha	1.48	Stream Power (N/m s)	67.01	355.14	87.77
Frctn Loss (m)		Cum Volume (1000 m3)	74.59	62.60	47.45
C & E Loss (m)		Cum SA (1000 m2)	90.30	46.35	56.73

Plan: Plan 06 Eastern 1 RS: 118 Profile: 100 year

E.G. Elev (m)	459.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	459.62	Reach Len. (m)	8.20	24.40	36.20
Crit W.S. (m)	459.62	Flow Area (m2)	6.68	7.83	2.89
E.G. Slope (m/m)	0.010915	Area (m2)	6.68	7.83	2.89
Q Total (m3/s)	37.68	Flow (m3/s)	9.62	24.36	3.69
Top Width (m)	24.81	Top Width (m)	11.62	7.20	5.98
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.44	3.11	1.28
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.09	0.48
Conv. Total (m3/s)	360.7	Conv. (m3/s)	92.1	233.2	35.4
Length Wtd. (m)		Wetted Per. (m)	11.69	7.36	6.05
Min Ch El (m)	458.30	Shear (N/m2)	61.20	113.89	51.17
Alpha	1.48	Stream Power (N/m s)	88.10	354.32	65.37
Frctn Loss (m)		Cum Volume (1000 m3)	74.36	62.22	47.23
C & E Loss (m)		Cum SA (1000 m2)	89.87	46.00	56.31

Plan: Plan 06 Eastern 1 RS: 117 Profile: 100 year

E.G. Elev (m)	459.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	459.36	Reach Len. (m)	51.60	50.50	49.90
Crit W.S. (m)	459.36	Flow Area (m2)	5.32	7.87	4.31
E.G. Slope (m/m)	0.010761	Area (m2)	5.32	7.87	4.31
Q Total (m3/s)	37.68	Flow (m3/s)	7.43	24.38	5.87
Top Width (m)	24.80	Top Width (m)	9.54	7.20	8.06
Vel Total (m/s)	2.15	Avg. Vel. (m/s)	1.40	3.10	1.36
Max Chl Dpth (m)	1.33	Hydr. Depth (m)	0.56	1.09	0.54
Conv. Total (m3/s)	363.2	Conv. (m3/s)	71.7	235.0	56.5
Length Wtd. (m)	50.54	Wetted Per. (m)	9.61	7.36	8.13
Min Ch El (m)	458.03	Shear (N/m2)	58.40	112.82	56.01
Alpha	1.48	Stream Power (N/m s)	81.66	349.60	76.18
Frctn Loss (m)	0.55	Cum Volume (1000 m3)	74.31	62.03	47.10
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.79	45.82	56.06

Plan: Plan 06 Eastern 1 RS: 116 Profile: 100 year

E.G. Elev (m)	459.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	458.81	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	458.81	Flow Area (m2)	2.86	7.84	6.68
E.G. Slope (m/m)	0.010909	Area (m2)	2.86	7.84	6.68
Q Total (m3/s)	37.68	Flow (m3/s)	3.65	24.41	9.62

Plan: Plan 06 Eastern 1 RS: 116 Profile: 100 year (Continued)

Top Width (m)	24.73	Top Width (m)	5.93	7.20	11.60
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.28	3.11	1.44
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.48	1.09	0.58
Conv. Total (m3/s)	360.8	Conv. (m3/s)	34.9	233.7	92.1
Length Wtd. (m)	1.00	Wetted Per. (m)	6.00	7.36	11.67
Min Ch El (m)	457.48	Shear (N/m2)	51.03	113.97	61.27
Alpha	1.48	Stream Power (N/m s)	65.09	354.78	88.26
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	74.10	61.63	46.82
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.39	45.46	55.57

Plan: Plan 06 Eastern 1 RS: 115.5 Profile: 100 year

E.G. Elev (m)	458.66	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	458.31	Reach Len. (m)	50.80	53.70	51.80
Crit W.S. (m)	458.31	Flow Area (m2)	2.86	7.84	6.68
E.G. Slope (m/m)	0.010905	Area (m2)	2.86	7.84	6.68
Q Total (m3/s)	37.68	Flow (m3/s)	3.65	24.41	9.62
Top Width (m)	24.73	Top Width (m)	5.93	7.20	11.60
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.28	3.11	1.44
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.48	1.09	0.58
Conv. Total (m3/s)	360.8	Conv. (m3/s)	34.9	233.8	92.1
Length Wtd. (m)		Wetted Per. (m)	6.00	7.36	11.67
Min Ch El (m)	456.98	Shear (N/m2)	51.02	113.95	61.24
Alpha	1.48	Stream Power (N/m s)	65.05	354.68	88.21
Frctn Loss (m)		Cum Volume (1000 m3)	74.09	61.62	46.82
C & E Loss (m)		Cum SA (1000 m2)	89.38	45.45	55.56

Plan: Plan 06 Eastern 1 RS: 115 Profile: 100 year

E.G. Elev (m)	458.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	457.72	Reach Len. (m)	11.80	27.00	39.60
Crit W.S. (m)	457.72	Flow Area (m2)	5.85	7.81	3.79
E.G. Slope (m/m)	0.010953	Area (m2)	5.85	7.81	3.79
Q Total (m3/s)	37.68	Flow (m3/s)	8.31	24.29	5.08
Top Width (m)	24.95	Top Width (m)	10.42	7.20	7.34
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.42	3.11	1.34
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.56	1.08	0.52
Conv. Total (m3/s)	360.0	Conv. (m3/s)	79.4	232.1	48.5
Length Wtd. (m)		Wetted Per. (m)	10.48	7.36	7.40
Min Ch El (m)	456.40	Shear (N/m2)	59.97	113.96	55.01
Alpha	1.49	Stream Power (N/m s)	85.11	354.50	73.70
Frctn Loss (m)		Cum Volume (1000 m3)	73.87	61.20	46.55
C & E Loss (m)		Cum SA (1000 m2)	88.97	45.07	55.07

Plan: Plan 06 Eastern 1 RS: 114 Profile: 100 year

E.G. Elev (m)	457.79	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	457.44	Reach Len. (m)	36.60	33.00	28.50
Crit W.S. (m)	457.43	Flow Area (m2)	5.68	7.87	3.94
E.G. Slope (m/m)	0.010767	Area (m2)	5.68	7.87	3.94
Q Total (m3/s)	37.68	Flow (m3/s)	8.01	24.38	5.28
Top Width (m)	24.79	Top Width (m)	10.09	7.20	7.51
Vel Total (m/s)	2.15	Avg. Vel. (m/s)	1.41	3.10	1.34
Max Chl Dpth (m)	1.33	Hydr. Depth (m)	0.56	1.09	0.52
Conv. Total (m3/s)	363.1	Conv. (m3/s)	77.2	235.0	50.9
Length Wtd. (m)	32.85	Wetted Per. (m)	10.15	7.36	7.57
Min Ch El (m)	456.11	Shear (N/m2)	59.12	112.87	54.89

Plan: Plan 06 Eastern 1 RS: 114 Profile: 100 year (Continued)

Alpha	1.48	Stream Power (N/m s)	83.34	349.82	73.66
Frctn Loss (m)	0.36	Cum Volume (1000 m3)	73.80	60.99	46.39
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.84	44.87	54.77

Plan: Plan 06 Eastern 1 RS: 113 Profile: 100 year

E.G. Elev (m)	457.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	457.07	Reach Len. (m)	49.90	28.20	12.30
Crit W.S. (m)	457.07	Flow Area (m2)	3.96	7.84	5.59
E.G. Slope (m/m)	0.010933	Area (m2)	3.96	7.84	5.59
Q Total (m3/s)	37.68	Flow (m3/s)	5.34	24.42	7.91
Top Width (m)	24.75	Top Width (m)	7.56	7.20	9.99
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.35	3.12	1.41
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.52	1.09	0.56
Conv. Total (m3/s)	360.4	Conv. (m3/s)	51.1	233.6	75.7
Length Wtd. (m)		Wetted Per. (m)	7.62	7.36	10.05
Min Ch El (m)	455.75	Shear (N/m2)	55.64	114.19	59.64
Alpha	1.48	Stream Power (N/m s)	75.14	355.80	84.37
Frctn Loss (m)		Cum Volume (1000 m3)	73.63	60.73	46.26
C & E Loss (m)		Cum SA (1000 m2)	88.52	44.63	54.53

Plan: Plan 06 Eastern 1 RS: 112 Profile: 100 year

E.G. Elev (m)	457.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	456.77	Reach Len. (m)	22.50	17.20	9.90
Crit W.S. (m)	456.77	Flow Area (m2)	3.26	7.83	6.31
E.G. Slope (m/m)	0.010927	Area (m2)	3.26	7.83	6.31
Q Total (m3/s)	37.68	Flow (m3/s)	4.26	24.39	9.03
Top Width (m)	24.78	Top Width (m)	6.52	7.20	11.05
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.31	3.11	1.43
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.50	1.09	0.57
Conv. Total (m3/s)	360.5	Conv. (m3/s)	40.7	233.3	86.4
Length Wtd. (m)	16.35	Wetted Per. (m)	6.59	7.36	11.12
Min Ch El (m)	455.44	Shear (N/m2)	52.97	114.05	60.76
Alpha	1.48	Stream Power (N/m s)	69.23	355.09	87.03
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	73.45	60.51	46.18
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.17	44.43	54.40

Plan: Plan 06 Eastern 1 RS: 111 Profile: 100 year

E.G. Elev (m)	456.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	456.58	Reach Len. (m)	19.10	24.70	28.60
Crit W.S. (m)		Flow Area (m2)	4.57	7.85	5.29
E.G. Slope (m/m)	0.010612	Area (m2)	4.57	7.85	5.29
Q Total (m3/s)	37.68	Flow (m3/s)	6.21	24.14	7.33
Top Width (m)	25.17	Top Width (m)	8.45	7.20	9.52
Vel Total (m/s)	2.13	Avg. Vel. (m/s)	1.36	3.07	1.39
Max Chl Dpth (m)	1.33	Hydr. Depth (m)	0.54	1.09	0.56
Conv. Total (m3/s)	365.8	Conv. (m3/s)	60.3	234.3	71.2
Length Wtd. (m)	24.12	Wetted Per. (m)	8.51	7.36	9.58
Min Ch El (m)	455.26	Shear (N/m2)	55.81	111.05	57.43
Alpha	1.49	Stream Power (N/m s)	75.90	341.32	79.61
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	73.36	60.38	46.13
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.00	44.31	54.29

Plan: Plan 06 Eastern 1 RS: 110 Profile: 100 year

E.G. Elev (m)	456.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	456.31	Reach Len. (m)	26.80	35.80	43.20
Crit W.S. (m)	456.31	Flow Area (m2)	6.57	7.83	3.00
E.G. Slope (m/m)	0.010927	Area (m2)	6.57	7.83	3.00
Q Total (m3/s)	37.68	Flow (m3/s)	9.44	24.37	3.87
Top Width (m)	24.80	Top Width (m)	11.45	7.20	6.15
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.44	3.11	1.29
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.57	1.09	0.49
Conv. Total (m3/s)	360.5	Conv. (m3/s)	90.3	233.1	37.0
Length Wtd. (m)	34.21	Wetted Per. (m)	11.52	7.36	6.22
Min Ch El (m)	454.99	Shear (N/m2)	61.10	114.00	51.79
Alpha	1.48	Stream Power (N/m s)	87.84	354.82	66.68
Frctn Loss (m)	0.37	Cum Volume (1000 m3)	73.25	60.18	46.01
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.81	44.13	54.07

Plan: Plan 06 Eastern 1 RS: 109 Profile: 100 year

E.G. Elev (m)	456.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	455.92	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	455.92	Flow Area (m2)	6.87	7.82	2.73
E.G. Slope (m/m)	0.010935	Area (m2)	6.87	7.82	2.73
Q Total (m3/s)	37.68	Flow (m3/s)	9.92	24.31	3.45
Top Width (m)	24.88	Top Width (m)	11.93	7.20	5.75
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.44	3.11	1.26
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.09	0.47
Conv. Total (m3/s)	360.3	Conv. (m3/s)	94.8	232.5	33.0
Length Wtd. (m)	1.00	Wetted Per. (m)	12.00	7.36	5.82
Min Ch El (m)	454.60	Shear (N/m2)	61.44	113.89	50.35
Alpha	1.48	Stream Power (N/m s)	88.64	354.19	63.62
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	73.07	59.90	45.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.50	43.87	53.81

Plan: Plan 06 Eastern 1 RS: 108.5 Profile: 100 year

E.G. Elev (m)	455.77	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	455.42	Reach Len. (m)	1.00	13.70	26.40
Crit W.S. (m)	455.42	Flow Area (m2)	6.88	7.82	2.73
E.G. Slope (m/m)	0.010931	Area (m2)	6.88	7.82	2.73
Q Total (m3/s)	37.68	Flow (m3/s)	9.92	24.31	3.45
Top Width (m)	24.88	Top Width (m)	11.93	7.20	5.75
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.44	3.11	1.26
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.09	0.48
Conv. Total (m3/s)	360.4	Conv. (m3/s)	94.9	232.5	33.0
Length Wtd. (m)	12.29	Wetted Per. (m)	12.00	7.36	5.82
Min Ch El (m)	454.10	Shear (N/m2)	61.44	113.85	50.35
Alpha	1.48	Stream Power (N/m s)	88.64	354.02	63.62
Frctn Loss (m)	0.13	Cum Volume (1000 m3)	73.07	59.89	45.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.49	43.86	53.81

Plan: Plan 06 Eastern 1 RS: 108 Profile: 100 year

E.G. Elev (m)	455.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	455.28	Reach Len. (m)	24.80	21.60	18.00
Crit W.S. (m)	455.28	Flow Area (m2)	5.37	7.84	4.18
E.G. Slope (m/m)	0.010923	Area (m2)	5.37	7.84	4.18
Q Total (m3/s)	37.68	Flow (m3/s)	7.56	24.42	5.69

Plan: Plan 06 Eastern 1 RS: 108 Profile: 100 year (Continued)

Top Width (m)	24.75	Top Width (m)	9.66	7.20	7.89
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.41	3.11	1.36
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.56	1.09	0.53
Conv. Total (m3/s)	360.5	Conv. (m3/s)	72.4	233.7	54.5
Length Wtd. (m)		Wetted Per. (m)	9.73	7.36	7.96
Min Ch El (m)	453.95	Shear (N/m2)	59.19	114.12	56.29
Alpha	1.49	Stream Power (N/m s)	83.30	355.46	76.63
Frctn Loss (m)		Cum Volume (1000 m3)	73.06	59.79	45.79
C & E Loss (m)		Cum SA (1000 m2)	87.48	43.77	53.63

Plan: Plan 06 Eastern 1 RS: 107 Profile: 100 year

E.G. Elev (m)	455.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	455.04	Reach Len. (m)	50.30	34.60	11.80
Crit W.S. (m)	455.04	Flow Area (m2)	3.30	7.82	6.29
E.G. Slope (m/m)	0.010935	Area (m2)	3.30	7.82	6.29
Q Total (m3/s)	37.68	Flow (m3/s)	4.33	24.35	9.00
Top Width (m)	24.84	Top Width (m)	6.60	7.20	11.05
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.31	3.11	1.43
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.50	1.09	0.57
Conv. Total (m3/s)	360.3	Conv. (m3/s)	41.4	232.9	86.1
Length Wtd. (m)	30.87	Wetted Per. (m)	6.66	7.36	11.11
Min Ch El (m)	453.72	Shear (N/m2)	53.14	114.00	60.69
Alpha	1.48	Stream Power (N/m s)	69.61	354.80	86.86
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	72.95	59.62	45.69
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.27	43.61	53.46

Plan: Plan 06 Eastern 1 RS: 106 Profile: 100 year

E.G. Elev (m)	455.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	454.67	Reach Len. (m)	84.60	86.70	85.10
Crit W.S. (m)	454.66	Flow Area (m2)	3.26	7.84	6.47
E.G. Slope (m/m)	0.010743	Area (m2)	3.26	7.84	6.47
Q Total (m3/s)	37.68	Flow (m3/s)	4.23	24.23	9.23
Top Width (m)	25.01	Top Width (m)	6.52	7.20	11.29
Vel Total (m/s)	2.14	Avg. Vel. (m/s)	1.30	3.09	1.43
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.50	1.09	0.57
Conv. Total (m3/s)	363.5	Conv. (m3/s)	40.8	233.7	89.0
Length Wtd. (m)	86.05	Wetted Per. (m)	6.59	7.36	11.36
Min Ch El (m)	453.34	Shear (N/m2)	52.13	112.26	60.06
Alpha	1.48	Stream Power (N/m s)	67.59	346.81	85.59
Frctn Loss (m)	0.93	Cum Volume (1000 m3)	72.79	59.35	45.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.94	43.36	53.32

Plan: Plan 06 Eastern 1 RS: 105 Profile: 100 year

E.G. Elev (m)	454.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	453.73	Reach Len. (m)	8.20	23.20	36.30
Crit W.S. (m)	453.73	Flow Area (m2)	5.39	7.84	4.16
E.G. Slope (m/m)	0.010940	Area (m2)	5.39	7.84	4.16
Q Total (m3/s)	37.68	Flow (m3/s)	7.59	24.43	5.66
Top Width (m)	24.74	Top Width (m)	9.69	7.20	7.86
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.41	3.12	1.36
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.56	1.09	0.53
Conv. Total (m3/s)	360.3	Conv. (m3/s)	72.6	233.6	54.1
Length Wtd. (m)		Wetted Per. (m)	9.75	7.36	7.92
Min Ch El (m)	452.40	Shear (N/m2)	59.29	114.25	56.29

Plan: Plan 06 Eastern 1 RS: 105 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	83.52	356.08	76.61
Frctn Loss (m)		Cum Volume (1000 m3)	72.42	58.67	45.17
C & E Loss (m)		Cum SA (1000 m2)	86.26	42.74	52.51

Plan: Plan 06 Eastern 1 RS: 104 Profile: 100 year

E.G. Elev (m)	453.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	453.47	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	453.47	Flow Area (m2)	5.22	7.84	4.33
E.G. Slope (m/m)	0.010929	Area (m2)	5.22	7.84	4.33
Q Total (m3/s)	37.68	Flow (m3/s)	7.33	24.43	5.92
Top Width (m)	24.75	Top Width (m)	9.44	7.20	8.11
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.40	3.12	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.53
Conv. Total (m3/s)	360.4	Conv. (m3/s)	70.1	233.7	56.7
Length Wtd. (m)	1.00	Wetted Per. (m)	9.51	7.36	8.18
Min Ch El (m)	452.15	Shear (N/m2)	58.91	114.17	56.74
Alpha	1.49	Stream Power (N/m s)	82.65	355.69	77.65
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	72.38	58.48	45.01
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.18	42.57	52.22

Plan: Plan 06 Eastern 1 RS: 103.5 Profile: 100 year

E.G. Elev (m)	453.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	452.97	Reach Len. (m)	47.80	41.70	33.20
Crit W.S. (m)	452.97	Flow Area (m2)	5.23	7.84	4.33
E.G. Slope (m/m)	0.010922	Area (m2)	5.23	7.84	4.33
Q Total (m3/s)	37.68	Flow (m3/s)	7.33	24.43	5.92
Top Width (m)	24.75	Top Width (m)	9.44	7.20	8.11
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.40	3.11	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.53
Conv. Total (m3/s)	360.6	Conv. (m3/s)	70.1	233.8	56.7
Length Wtd. (m)		Wetted Per. (m)	9.51	7.36	8.18
Min Ch El (m)	451.65	Shear (N/m2)	58.88	114.12	56.71
Alpha	1.49	Stream Power (N/m s)	82.58	355.48	77.58
Frctn Loss (m)		Cum Volume (1000 m3)	72.37	58.48	45.01
C & E Loss (m)		Cum SA (1000 m2)	86.17	42.56	52.21

Plan: Plan 06 Eastern 1 RS: 103 Profile: 100 year

E.G. Elev (m)	452.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	452.52	Reach Len. (m)	57.10	59.40	55.70
Crit W.S. (m)	452.52	Flow Area (m2)	3.36	7.82	6.27
E.G. Slope (m/m)	0.010938	Area (m2)	3.36	7.82	6.27
Q Total (m3/s)	37.68	Flow (m3/s)	4.41	24.31	8.96
Top Width (m)	24.92	Top Width (m)	6.69	7.20	11.03
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.31	3.11	1.43
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.50	1.09	0.57
Conv. Total (m3/s)	360.3	Conv. (m3/s)	42.2	232.4	85.7
Length Wtd. (m)		Wetted Per. (m)	6.76	7.36	11.10
Min Ch El (m)	451.20	Shear (N/m2)	53.35	113.90	60.60
Alpha	1.48	Stream Power (N/m s)	70.05	354.23	86.62
Frctn Loss (m)		Cum Volume (1000 m3)	72.17	58.15	44.83
C & E Loss (m)		Cum SA (1000 m2)	85.79	42.26	51.89

Plan: Plan 06 Eastern 1 RS: 102 Profile: 100 year

E.G. Elev (m)	452.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	451.89	Reach Len. (m)	36.00	41.50	49.10
Crit W.S. (m)		Flow Area (m2)	5.45	7.94	4.46
E.G. Slope (m/m)	0.010253	Area (m2)	5.45	7.94	4.46
Q Total (m3/s)	37.68	Flow (m3/s)	7.51	24.19	5.98
Top Width (m)	25.04	Top Width (m)	9.64	7.20	8.20
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.38	3.04	1.34
Max Chl Dpth (m)	1.34	Hydr. Depth (m)	0.57	1.10	0.54
Conv. Total (m3/s)	372.1	Conv. (m3/s)	74.2	238.9	59.1
Length Wtd. (m)	42.05	Wetted Per. (m)	9.71	7.36	8.27
Min Ch El (m)	450.55	Shear (N/m2)	56.44	108.53	54.22
Alpha	1.48	Stream Power (N/m s)	77.78	330.40	72.75
Frctn Loss (m)	0.44	Cum Volume (1000 m3)	71.92	57.68	44.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	85.32	41.83	51.36

Plan: Plan 06 Eastern 1 RS: 101 Profile: 100 year

E.G. Elev (m)	451.78	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	451.43	Reach Len. (m)	52.30	36.00	11.80
Crit W.S. (m)	451.43	Flow Area (m2)	3.63	7.84	5.92
E.G. Slope (m/m)	0.010928	Area (m2)	3.63	7.84	5.92
Q Total (m3/s)	37.68	Flow (m3/s)	4.84	24.41	8.43
Top Width (m)	24.75	Top Width (m)	7.08	7.20	10.48
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.33	3.11	1.42
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.51	1.09	0.57
Conv. Total (m3/s)	360.5	Conv. (m3/s)	46.3	233.5	80.6
Length Wtd. (m)	32.57	Wetted Per. (m)	7.14	7.36	10.54
Min Ch El (m)	450.10	Shear (N/m2)	54.49	114.12	60.19
Alpha	1.48	Stream Power (N/m s)	72.57	355.47	85.66
Frctn Loss (m)	0.36	Cum Volume (1000 m3)	71.75	57.35	44.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	85.02	41.54	50.90

Plan: Plan 06 Eastern 1 RS: 100 Profile: 100 year

E.G. Elev (m)	451.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	451.04	Reach Len. (m)	25.70	23.60	17.80
Crit W.S. (m)	451.04	Flow Area (m2)	3.50	7.84	6.05
E.G. Slope (m/m)	0.010916	Area (m2)	3.50	7.84	6.05
Q Total (m3/s)	37.68	Flow (m3/s)	4.62	24.43	8.63
Top Width (m)	24.73	Top Width (m)	6.87	7.20	10.66
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.32	3.11	1.43
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.51	1.09	0.57
Conv. Total (m3/s)	360.7	Conv. (m3/s)	44.3	233.8	82.6
Length Wtd. (m)		Wetted Per. (m)	6.94	7.36	10.73
Min Ch El (m)	449.71	Shear (N/m2)	53.93	114.08	60.36
Alpha	1.48	Stream Power (N/m s)	71.34	355.28	86.09
Frctn Loss (m)		Cum Volume (1000 m3)	71.57	57.07	44.21
C & E Loss (m)		Cum SA (1000 m2)	84.65	41.28	50.78

Plan: Plan 06 Eastern 1 RS: 99 Profile: 100 year

E.G. Elev (m)	451.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	450.77	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	450.77	Flow Area (m2)	7.08	7.81	2.56
E.G. Slope (m/m)	0.010941	Area (m2)	7.08	7.81	2.56
Q Total (m3/s)	37.68	Flow (m3/s)	10.23	24.26	3.19

Plan: Plan 06 Eastern 1 RS: 99 Profile: 100 year (Continued)

Top Width (m)	24.96	Top Width (m)	12.25	7.20	5.50
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.45	3.11	1.25
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.08	0.47
Conv. Total (m3/s)	360.2	Conv. (m3/s)	97.8	231.9	30.5
Length Wtd. (m)	1.00	Wetted Per. (m)	12.32	7.36	5.57
Min Ch El (m)	449.46	Shear (N/m2)	61.62	113.78	49.36
Alpha	1.48	Stream Power (N/m s)	89.07	353.62	61.53
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	71.43	56.89	44.13
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.41	41.11	50.63

Plan: Plan 06 Eastern 1 RS: 98.5 Profile: 100 year

E.G. Elev (m)	450.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	450.27	Reach Len. (m)	11.50	27.40	39.90
Crit W.S. (m)	450.27	Flow Area (m2)	7.08	7.80	2.56
E.G. Slope (m/m)	0.010945	Area (m2)	7.08	7.80	2.56
Q Total (m3/s)	37.68	Flow (m3/s)	10.23	24.26	3.19
Top Width (m)	24.96	Top Width (m)	12.25	7.20	5.50
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.45	3.11	1.25
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.58	1.08	0.47
Conv. Total (m3/s)	360.2	Conv. (m3/s)	97.8	231.8	30.5
Length Wtd. (m)		Wetted Per. (m)	12.32	7.36	5.57
Min Ch El (m)	448.96	Shear (N/m2)	61.65	113.81	49.38
Alpha	1.48	Stream Power (N/m s)	89.13	353.73	61.57
Frctn Loss (m)		Cum Volume (1000 m3)	71.42	56.88	44.13
C & E Loss (m)		Cum SA (1000 m2)	84.40	41.10	50.63

Plan: Plan 06 Eastern 1 RS: 98 Profile: 100 year

E.G. Elev (m)	450.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	449.98	Reach Len. (m)	4.30	19.70	32.00
Crit W.S. (m)	449.98	Flow Area (m2)	5.15	7.83	4.43
E.G. Slope (m/m)	0.010950	Area (m2)	5.15	7.83	4.43
Q Total (m3/s)	37.68	Flow (m3/s)	7.21	24.38	6.09
Top Width (m)	24.83	Top Width (m)	9.35	7.20	8.28
Vel Total (m/s)	2.16	Avg. Vel. (m/s)	1.40	3.12	1.37
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.55	1.09	0.54
Conv. Total (m3/s)	360.1	Conv. (m3/s)	68.9	233.0	58.2
Length Wtd. (m)		Wetted Per. (m)	9.41	7.36	8.35
Min Ch El (m)	448.66	Shear (N/m2)	58.76	114.20	57.04
Alpha	1.49	Stream Power (N/m s)	82.27	355.73	78.30
Frctn Loss (m)		Cum Volume (1000 m3)	71.35	56.67	43.99
C & E Loss (m)		Cum SA (1000 m2)	84.27	40.90	50.35

Plan: Plan 06 Eastern 1 RS: 97 Profile: 100 year

E.G. Elev (m)	450.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	449.77	Reach Len. (m)	67.10	65.20	62.50
Crit W.S. (m)	449.77	Flow Area (m2)	5.57	7.84	3.99
E.G. Slope (m/m)	0.010918	Area (m2)	5.57	7.84	3.99
Q Total (m3/s)	37.68	Flow (m3/s)	7.87	24.43	5.39
Top Width (m)	24.75	Top Width (m)	9.95	7.20	7.60
Vel Total (m/s)	2.17	Avg. Vel. (m/s)	1.41	3.11	1.35
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.56	1.09	0.52
Conv. Total (m3/s)	360.6	Conv. (m3/s)	75.3	233.8	51.5
Length Wtd. (m)	65.15	Wetted Per. (m)	10.02	7.36	7.67
Min Ch El (m)	448.44	Shear (N/m2)	59.53	114.08	55.66

Plan: Plan 06 Eastern 1 RS: 97 Profile: 100 year (Continued)

Alpha	1.48	Stream Power (N/m s)	84.12	355.31	75.21
Frctn Loss (m)	0.39	Cum Volume (1000 m3)	71.33	56.51	43.86
C & E Loss (m)	0.06	Cum SA (1000 m2)	84.23	40.76	50.10

Plan: Plan 06 Eastern 1 RS: 96 Profile: 100 year

E.G. Elev (m)	449.57	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	449.41	Reach Len. (m)	52.80	31.70	9.40
Crit W.S. (m)		Flow Area (m2)	8.59	10.33	7.78
E.G. Slope (m/m)	0.003733	Area (m2)	8.59	10.33	7.78
Q Total (m3/s)	37.68	Flow (m3/s)	8.00	22.61	7.07
Top Width (m)	32.06	Top Width (m)	12.83	7.20	12.03
Vel Total (m/s)	1.41	Avg. Vel. (m/s)	0.93	2.19	0.91
Max Chl Dpth (m)	1.67	Hydr. Depth (m)	0.67	1.44	0.65
Conv. Total (m3/s)	616.7	Conv. (m3/s)	130.9	370.1	115.7
Length Wtd. (m)	32.98	Wetted Per. (m)	12.93	7.36	12.13
Min Ch El (m)	447.74	Shear (N/m2)	24.33	51.39	23.48
Alpha	1.61	Stream Power (N/m s)	22.65	112.48	21.33
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	70.85	55.92	43.49
C & E Loss (m)	0.02	Cum SA (1000 m2)	83.47	40.29	49.48

Plan: Plan 06 Eastern 1 RS: 95 Profile: 100 year

E.G. Elev (m)	449.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	449.03	Reach Len. (m)	39.60	42.80	45.30
Crit W.S. (m)		Flow Area (m2)	8.78	11.69	5.27
E.G. Slope (m/m)	0.007592	Area (m2)	8.78	11.69	5.27
Q Total (m3/s)	54.31	Flow (m3/s)	12.13	35.49	6.69
Top Width (m)	29.27	Top Width (m)	12.36	8.50	8.42
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.38	3.04	1.27
Max Chl Dpth (m)	1.64	Hydr. Depth (m)	0.71	1.38	0.63
Conv. Total (m3/s)	623.3	Conv. (m3/s)	139.3	407.3	76.7
Length Wtd. (m)	42.33	Wetted Per. (m)	12.43	8.68	8.49
Min Ch El (m)	447.39	Shear (N/m2)	52.57	100.23	46.22
Alpha	1.49	Stream Power (N/m s)	72.65	304.21	58.61
Frctn Loss (m)	0.36	Cum Volume (1000 m3)	70.40	55.57	43.43
C & E Loss (m)	0.01	Cum SA (1000 m2)	82.80	40.04	49.39

Plan: Plan 06 Eastern 1 RS: 94 Profile: 100 year

E.G. Elev (m)	449.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	448.57	Reach Len. (m)	8.90	28.00	42.30
Crit W.S. (m)	448.57	Flow Area (m2)	8.33	11.16	3.39
E.G. Slope (m/m)	0.009810	Area (m2)	8.33	11.16	3.39
Q Total (m3/s)	54.31	Flow (m3/s)	12.61	37.34	4.36
Top Width (m)	27.29	Top Width (m)	12.38	8.50	6.42
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.51	3.35	1.29
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.67	1.31	0.53
Conv. Total (m3/s)	548.3	Conv. (m3/s)	127.3	377.0	44.0
Length Wtd. (m)	25.21	Wetted Per. (m)	12.45	8.68	6.49
Min Ch El (m)	447.00	Shear (N/m2)	64.34	123.64	50.29
Alpha	1.48	Stream Power (N/m s)	97.46	413.57	64.64
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	70.06	55.08	43.23
C & E Loss (m)	0.01	Cum SA (1000 m2)	82.31	39.68	49.05

Plan: Plan 06 Eastern 1 RS: 93 Profile: 100 year

E.G. Elev (m)	448.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	448.35	Reach Len. (m)	33.50	33.10	32.10
Crit W.S. (m)		Flow Area (m2)	7.75	11.50	4.71
E.G. Slope (m/m)	0.008709	Area (m2)	7.75	11.50	4.71
Q Total (m3/s)	54.31	Flow (m3/s)	11.16	36.95	6.20
Top Width (m)	27.72	Top Width (m)	11.37	8.50	7.86
Vel Total (m/s)	2.27	Avg. Vel. (m/s)	1.44	3.21	1.32
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.68	1.35	0.60
Conv. Total (m3/s)	582.0	Conv. (m3/s)	119.5	396.0	66.5
Length Wtd. (m)	33.03	Wetted Per. (m)	11.44	8.68	7.93
Min Ch El (m)	446.74	Shear (N/m2)	57.84	113.05	50.67
Alpha	1.49	Stream Power (N/m s)	83.26	363.38	66.78
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	69.99	54.76	43.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	82.21	39.44	48.75

Plan: Plan 06 Eastern 1 RS: 92 Profile: 100 year

E.G. Elev (m)	448.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	448.01	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	448.01	Flow Area (m2)	5.49	11.17	6.23
E.G. Slope (m/m)	0.009829	Area (m2)	5.49	11.17	6.23
Q Total (m3/s)	54.31	Flow (m3/s)	7.82	37.42	9.07
Top Width (m)	27.28	Top Width (m)	8.94	8.50	9.84
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.42	3.35	1.46
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.61	1.31	0.63
Conv. Total (m3/s)	547.8	Conv. (m3/s)	78.8	377.4	91.5
Length Wtd. (m)	1.00	Wetted Per. (m)	9.02	8.68	9.92
Min Ch El (m)	446.43	Shear (N/m2)	58.68	123.97	60.61
Alpha	1.49	Stream Power (N/m s)	83.57	415.32	88.20
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	69.76	54.39	42.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	81.87	39.16	48.47

Plan: Plan 06 Eastern 1 RS: 91.5 Profile: 100 year

E.G. Elev (m)	447.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	447.52	Reach Len. (m)	34.30	20.50	5.40
Crit W.S. (m)		Flow Area (m2)	5.62	11.30	6.38
E.G. Slope (m/m)	0.009378	Area (m2)	5.62	11.30	6.38
Q Total (m3/s)	54.31	Flow (m3/s)	7.90	37.25	9.16
Top Width (m)	27.45	Top Width (m)	9.02	8.50	9.93
Vel Total (m/s)	2.33	Avg. Vel. (m/s)	1.40	3.30	1.44
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.62	1.33	0.64
Conv. Total (m3/s)	560.8	Conv. (m3/s)	81.6	384.7	94.6
Length Wtd. (m)	20.02	Wetted Per. (m)	9.10	8.68	10.00
Min Ch El (m)	445.93	Shear (N/m2)	56.82	119.64	58.69
Alpha	1.49	Stream Power (N/m s)	79.82	394.47	84.25
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	69.76	54.38	42.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	81.86	39.15	48.46

Plan: Plan 06 Eastern 1 RS: 91 Profile: 100 year

E.G. Elev (m)	447.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	447.33	Reach Len. (m)	35.70	19.90	1.60
Crit W.S. (m)		Flow Area (m2)	5.72	11.26	6.19
E.G. Slope (m/m)	0.009515	Area (m2)	5.72	11.26	6.19
Q Total (m3/s)	54.31	Flow (m3/s)	8.11	37.31	8.89

Plan: Plan 06 Eastern 1 RS: 91 Profile: 100 year (Continued)

Top Width (m)	27.40	Top Width (m)	9.17	8.50	9.73
Vel Total (m/s)	2.34	Avg. Vel. (m/s)	1.42	3.31	1.44
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.62	1.32	0.64
Conv. Total (m3/s)	556.8	Conv. (m3/s)	83.1	382.5	91.2
Length Wtd. (m)	19.14	Wetted Per. (m)	9.24	8.68	9.80
Min Ch El (m)	445.74	Shear (N/m2)	57.77	120.96	58.94
Alpha	1.49	Stream Power (N/m s)	81.86	400.79	84.65
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	69.56	54.15	42.84
C & E Loss (m)	0.00	Cum SA (1000 m2)	81.54	38.98	48.40

Plan: Plan 06 Eastern 1 RS: 90 Profile: 100 year

E.G. Elev (m)	447.56	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	447.13	Reach Len. (m)	17.50	21.80	21.10
Crit W.S. (m)		Flow Area (m2)	5.39	11.19	6.32
E.G. Slope (m/m)	0.009791	Area (m2)	5.39	11.19	6.32
Q Total (m3/s)	54.31	Flow (m3/s)	7.64	37.46	9.21
Top Width (m)	27.25	Top Width (m)	8.81	8.50	9.93
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.42	3.35	1.46
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.61	1.32	0.64
Conv. Total (m3/s)	548.9	Conv. (m3/s)	77.3	378.5	93.1
Length Wtd. (m)	21.01	Wetted Per. (m)	8.89	8.68	10.01
Min Ch El (m)	445.55	Shear (N/m2)	58.24	123.71	60.65
Alpha	1.49	Stream Power (N/m s)	82.59	414.10	88.37
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	69.36	53.92	42.83
C & E Loss (m)	0.02	Cum SA (1000 m2)	81.22	38.81	48.39

Plan: Plan 06 Eastern 1 RS: 89 Profile: 100 year

E.G. Elev (m)	447.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.37	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.98	Reach Len. (m)	1.40	14.70	35.00
Crit W.S. (m)		Flow Area (m2)	6.78	11.63	6.16
E.G. Slope (m/m)	0.008223	Area (m2)	6.78	11.63	6.16
Q Total (m3/s)	54.31	Flow (m3/s)	9.35	36.61	8.35
Top Width (m)	28.10	Top Width (m)	10.15	8.50	9.44
Vel Total (m/s)	2.21	Avg. Vel. (m/s)	1.38	3.15	1.36
Max Chl Dpth (m)	1.63	Hydr. Depth (m)	0.67	1.37	0.65
Conv. Total (m3/s)	598.9	Conv. (m3/s)	103.2	403.7	92.1
Length Wtd. (m)	14.74	Wetted Per. (m)	10.23	8.68	9.52
Min Ch El (m)	445.35	Shear (N/m2)	53.46	107.98	52.13
Alpha	1.49	Stream Power (N/m s)	73.71	339.90	70.69
Frctn Loss (m)	0.13	Cum Volume (1000 m3)	69.26	53.67	42.70
C & E Loss (m)	0.01	Cum SA (1000 m2)	81.06	38.62	48.18

Plan: Plan 06 Eastern 1 RS: 88 Profile: 100 year

E.G. Elev (m)	447.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.79	Reach Len. (m)	3.10	15.40	27.70
Crit W.S. (m)	446.79	Flow Area (m2)	7.62	11.17	4.09
E.G. Slope (m/m)	0.009812	Area (m2)	7.62	11.17	4.09
Q Total (m3/s)	54.31	Flow (m3/s)	11.42	37.40	5.49
Top Width (m)	27.27	Top Width (m)	11.51	8.50	7.25
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.50	3.35	1.34
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.66	1.31	0.56
Conv. Total (m3/s)	548.3	Conv. (m3/s)	115.3	377.6	55.4
Length Wtd. (m)		Wetted Per. (m)	11.59	8.68	7.33
Min Ch El (m)	445.21	Shear (N/m2)	63.28	123.79	53.70

Plan: Plan 06 Eastern 1 RS: 88 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	94.81	414.39	72.11
Frctn Loss (m)		Cum Volume (1000 m3)	69.25	53.51	42.52
C & E Loss (m)		Cum SA (1000 m2)	81.04	38.50	47.89

Plan: Plan 06 Eastern 1 RS: 87 Profile: 100 year

E.G. Elev (m)	447.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.69	Reach Len. (m)	41.80	29.70	14.30
Crit W.S. (m)		Flow Area (m2)	8.86	11.53	3.68
E.G. Slope (m/m)	0.008572	Area (m2)	8.86	11.53	3.68
Q Total (m3/s)	54.31	Flow (m3/s)	12.91	36.84	4.56
Top Width (m)	27.78	Top Width (m)	12.61	8.50	6.67
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.46	3.20	1.24
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.70	1.36	0.55
Conv. Total (m3/s)	586.6	Conv. (m3/s)	139.4	397.9	49.2
Length Wtd. (m)	29.68	Wetted Per. (m)	12.69	8.68	6.75
Min Ch El (m)	445.07	Shear (N/m2)	58.70	111.60	45.91
Alpha	1.49	Stream Power (N/m s)	85.55	356.58	56.79
Frctn Loss (m)	0.27	Cum Volume (1000 m3)	69.22	53.33	42.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	81.00	38.37	47.70

Plan: Plan 06 Eastern 1 RS: 86 Profile: 100 year

E.G. Elev (m)	446.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.37	Reach Len. (m)	49.20	34.40	16.82
Crit W.S. (m)		Flow Area (m2)	4.53	11.15	7.15
E.G. Slope (m/m)	0.009894	Area (m2)	4.53	11.15	7.15
Q Total (m3/s)	54.31	Flow (m3/s)	6.24	37.43	10.65
Top Width (m)	27.26	Top Width (m)	7.80	8.50	10.97
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.38	3.36	1.49
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.58	1.31	0.65
Conv. Total (m3/s)	546.0	Conv. (m3/s)	62.7	376.3	107.0
Length Wtd. (m)	32.92	Wetted Per. (m)	7.87	8.68	11.04
Min Ch El (m)	444.79	Shear (N/m2)	55.86	124.55	62.84
Alpha	1.49	Stream Power (N/m s)	76.90	418.10	93.57
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	68.94	52.99	42.34
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.58	38.11	47.57

Plan: Plan 06 Eastern 1 RS: 85 Profile: 100 year

E.G. Elev (m)	446.48	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.08	Reach Len. (m)	38.50	56.10	66.10
Crit W.S. (m)		Flow Area (m2)	5.35	11.39	6.92
E.G. Slope (m/m)	0.009035	Area (m2)	5.35	11.39	6.92
Q Total (m3/s)	54.31	Flow (m3/s)	7.34	37.05	9.91
Top Width (m)	27.64	Top Width (m)	8.66	8.50	10.49
Vel Total (m/s)	2.30	Avg. Vel. (m/s)	1.37	3.25	1.43
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.62	1.34	0.66
Conv. Total (m3/s)	571.4	Conv. (m3/s)	77.2	389.8	104.3
Length Wtd. (m)	55.03	Wetted Per. (m)	8.73	8.68	10.56
Min Ch El (m)	444.47	Shear (N/m2)	54.31	116.18	58.02
Alpha	1.49	Stream Power (N/m s)	74.51	378.01	83.18
Frctn Loss (m)	0.52	Cum Volume (1000 m3)	68.70	52.61	42.22
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.17	37.82	47.39

Plan: Plan 06 Eastern 1 RS: 84 Profile: 100 year

E.G. Elev (m)	445.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	445.53	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	445.53	Flow Area (m2)	6.34	11.17	5.39
E.G. Slope (m/m)	0.009822	Area (m2)	6.34	11.17	5.39
Q Total (m3/s)	54.31	Flow (m3/s)	9.25	37.41	7.65
Top Width (m)	27.29	Top Width (m)	9.97	8.50	8.82
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.46	3.35	1.42
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.64	1.31	0.61
Conv. Total (m3/s)	548.0	Conv. (m3/s)	93.3	377.5	77.1
Length Wtd. (m)	1.00	Wetted Per. (m)	10.04	8.68	8.89
Min Ch El (m)	443.95	Shear (N/m2)	60.81	123.90	58.35
Alpha	1.49	Stream Power (N/m s)	88.70	414.95	82.80
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	68.47	51.97	41.81
C & E Loss (m)	0.00	Cum SA (1000 m2)	79.81	37.34	46.75

Plan: Plan 06 Eastern 1 RS: 83.5 Profile: 100 year

E.G. Elev (m)	445.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	445.03	Reach Len. (m)	114.40	111.80	110.20
Crit W.S. (m)		Flow Area (m2)	6.37	11.20	5.42
E.G. Slope (m/m)	0.009729	Area (m2)	6.37	11.20	5.42
Q Total (m3/s)	54.31	Flow (m3/s)	9.27	37.38	7.66
Top Width (m)	27.33	Top Width (m)	9.99	8.50	8.84
Vel Total (m/s)	2.36	Avg. Vel. (m/s)	1.45	3.34	1.42
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.64	1.32	0.61
Conv. Total (m3/s)	550.6	Conv. (m3/s)	94.0	378.9	77.7
Length Wtd. (m)	112.07	Wetted Per. (m)	10.06	8.68	8.91
Min Ch El (m)	443.45	Shear (N/m2)	60.42	123.00	57.97
Alpha	1.49	Stream Power (N/m s)	87.90	410.58	82.05
Frctn Loss (m)	1.03	Cum Volume (1000 m3)	68.47	51.96	41.81
C & E Loss (m)	0.01	Cum SA (1000 m2)	79.80	37.34	46.74

Plan: Plan 06 Eastern 1 RS: 83 Profile: 100 year

E.G. Elev (m)	444.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	444.03	Reach Len. (m)	61.50	54.40	45.20
Crit W.S. (m)		Flow Area (m2)	7.55	11.51	4.95
E.G. Slope (m/m)	0.008654	Area (m2)	7.55	11.51	4.95
Q Total (m3/s)	54.31	Flow (m3/s)	10.80	36.93	6.58
Top Width (m)	27.75	Top Width (m)	11.12	8.50	8.13
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.43	3.21	1.33
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.68	1.35	0.61
Conv. Total (m3/s)	583.8	Conv. (m3/s)	116.1	397.0	70.7
Length Wtd. (m)	54.89	Wetted Per. (m)	11.20	8.68	8.21
Min Ch El (m)	442.41	Shear (N/m2)	57.23	112.51	51.20
Alpha	1.49	Stream Power (N/m s)	81.88	360.88	68.01
Frctn Loss (m)	0.51	Cum Volume (1000 m3)	67.67	50.69	41.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	78.60	36.38	45.81

Plan: Plan 06 Eastern 1 RS: 82 Profile: 100 year

E.G. Elev (m)	443.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	443.48	Reach Len. (m)	0.20	18.40	36.00
Crit W.S. (m)	443.48	Flow Area (m2)	7.87	11.16	3.86
E.G. Slope (m/m)	0.009823	Area (m2)	7.87	11.16	3.86
Q Total (m3/s)	54.31	Flow (m3/s)	11.84	37.36	5.11

Plan: Plan 06 Eastern 1 RS: 82 Profile: 100 year (Continued)

Top Width (m)	27.30	Top Width (m)	11.83	8.50	6.98
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.50	3.35	1.33
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.67	1.31	0.55
Conv. Total (m3/s)	548.0	Conv. (m3/s)	119.5	376.9	51.6
Length Wtd. (m)	16.34	Wetted Per. (m)	11.90	8.68	7.05
Min Ch El (m)	441.91	Shear (N/m2)	63.71	123.79	52.69
Alpha	1.49	Stream Power (N/m s)	95.88	414.32	69.85
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	67.20	50.08	41.04
C & E Loss (m)	0.01	Cum SA (1000 m2)	77.89	35.92	45.47

Plan: Plan 06 Eastern 1 RS: 81 Profile: 100 year

E.G. Elev (m)	443.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	443.33	Reach Len. (m)	10.50	16.90	23.90
Crit W.S. (m)		Flow Area (m2)	7.65	11.32	4.52
E.G. Slope (m/m)	0.009228	Area (m2)	7.65	11.32	4.52
Q Total (m3/s)	54.31	Flow (m3/s)	11.21	37.06	6.04
Top Width (m)	27.62	Top Width (m)	11.41	8.50	7.71
Vel Total (m/s)	2.31	Avg. Vel. (m/s)	1.47	3.27	1.34
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.67	1.33	0.59
Conv. Total (m3/s)	565.4	Conv. (m3/s)	116.7	385.8	62.9
Length Wtd. (m)	16.59	Wetted Per. (m)	11.48	8.68	7.78
Min Ch El (m)	441.73	Shear (N/m2)	60.28	117.92	52.53
Alpha	1.49	Stream Power (N/m s)	88.33	386.13	70.23
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	67.20	49.87	40.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	77.89	35.77	45.20

Plan: Plan 06 Eastern 1 RS: 80 Profile: 100 year

E.G. Elev (m)	443.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	443.15	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	443.15	Flow Area (m2)	6.32	11.14	5.48
E.G. Slope (m/m)	0.009844	Area (m2)	6.32	11.14	5.48
Q Total (m3/s)	54.31	Flow (m3/s)	9.21	37.30	7.80
Top Width (m)	27.42	Top Width (m)	9.96	8.50	8.95
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.46	3.35	1.42
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.63	1.31	0.61
Conv. Total (m3/s)	547.4	Conv. (m3/s)	92.8	375.9	78.7
Length Wtd. (m)	1.00	Wetted Per. (m)	10.04	8.68	9.03
Min Ch El (m)	441.58	Shear (N/m2)	60.76	123.86	58.64
Alpha	1.49	Stream Power (N/m s)	88.55	414.60	83.47
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	67.12	49.68	40.77
C & E Loss (m)	0.01	Cum SA (1000 m2)	77.78	35.62	45.00

Plan: Plan 06 Eastern 1 RS: 79.5 Profile: 100 year

E.G. Elev (m)	443.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	442.68	Reach Len. (m)	30.80	22.00	9.80
Crit W.S. (m)		Flow Area (m2)	6.56	11.35	5.70
E.G. Slope (m/m)	0.009120	Area (m2)	6.56	11.35	5.70
Q Total (m3/s)	54.31	Flow (m3/s)	9.35	37.02	7.94
Top Width (m)	27.69	Top Width (m)	10.10	8.50	9.09
Vel Total (m/s)	2.30	Avg. Vel. (m/s)	1.43	3.26	1.39
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.65	1.34	0.63
Conv. Total (m3/s)	568.7	Conv. (m3/s)	97.9	387.6	83.1
Length Wtd. (m)	21.12	Wetted Per. (m)	10.17	8.68	9.16
Min Ch El (m)	441.08	Shear (N/m2)	57.67	116.88	55.65

Plan: Plan 06 Eastern 1 RS: 79.5 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	82.21	381.19	77.47
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	67.12	49.67	40.76
C & E Loss (m)	0.00	Cum SA (1000 m2)	77.77	35.61	45.00

Plan: Plan 06 Eastern 1 RS: 79 Profile: 100 year

E.G. Elev (m)	442.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	442.45	Reach Len. (m)	73.40	54.60	27.90
Crit W.S. (m)	442.45	Flow Area (m2)	4.38	11.17	7.32
E.G. Slope (m/m)	0.009819	Area (m2)	4.38	11.17	7.32
Q Total (m3/s)	54.31	Flow (m3/s)	5.97	37.42	10.92
Top Width (m)	27.26	Top Width (m)	7.60	8.50	11.15
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.36	3.35	1.49
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.58	1.31	0.66
Conv. Total (m3/s)	548.1	Conv. (m3/s)	60.3	377.7	110.2
Length Wtd. (m)		Wetted Per. (m)	7.68	8.68	11.23
Min Ch El (m)	440.87	Shear (N/m2)	54.93	123.89	62.81
Alpha	1.49	Stream Power (N/m s)	74.89	414.93	93.63
Frctn Loss (m)		Cum Volume (1000 m3)	66.95	49.42	40.70
C & E Loss (m)		Cum SA (1000 m2)	77.49	35.43	44.90

Plan: Plan 06 Eastern 1 RS: 78 Profile: 100 year

E.G. Elev (m)	442.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.95	Reach Len. (m)	23.70	21.40	16.90
Crit W.S. (m)		Flow Area (m2)	2.58	11.20	9.21
E.G. Slope (m/m)	0.009642	Area (m2)	2.58	11.20	9.21
Q Total (m3/s)	54.31	Flow (m3/s)	3.06	37.22	14.04
Top Width (m)	27.33	Top Width (m)	5.43	8.50	13.40
Vel Total (m/s)	2.36	Avg. Vel. (m/s)	1.18	3.32	1.52
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.48	1.32	0.69
Conv. Total (m3/s)	553.1	Conv. (m3/s)	31.1	379.0	142.9
Length Wtd. (m)	20.80	Wetted Per. (m)	5.50	8.68	13.47
Min Ch El (m)	440.37	Shear (N/m2)	44.31	121.92	64.64
Alpha	1.48	Stream Power (N/m s)	52.51	405.20	98.51
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	66.69	48.81	40.47
C & E Loss (m)	0.00	Cum SA (1000 m2)	77.02	34.96	44.55

Plan: Plan 06 Eastern 1 RS: 77 Profile: 100 year

E.G. Elev (m)	442.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.74	Reach Len. (m)	5.80	35.80	56.00
Crit W.S. (m)	441.74	Flow Area (m2)	6.73	11.14	5.08
E.G. Slope (m/m)	0.009837	Area (m2)	6.73	11.14	5.08
Q Total (m3/s)	54.31	Flow (m3/s)	9.90	37.28	7.13
Top Width (m)	27.43	Top Width (m)	10.46	8.50	8.46
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.47	3.35	1.40
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.64	1.31	0.60
Conv. Total (m3/s)	547.6	Conv. (m3/s)	99.8	375.9	71.8
Length Wtd. (m)	32.71	Wetted Per. (m)	10.54	8.68	8.54
Min Ch El (m)	440.17	Shear (N/m2)	61.61	123.77	57.39
Alpha	1.49	Stream Power (N/m s)	90.65	414.13	80.53
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	66.58	48.57	40.35
C & E Loss (m)	0.01	Cum SA (1000 m2)	76.83	34.78	44.37

Plan: Plan 06 Eastern 1 RS: 76 Profile: 100 year

E.G. Elev (m)	441.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.43	Reach Len. (m)	32.80	29.80	23.10
Crit W.S. (m)		Flow Area (m2)	7.45	11.36	5.09
E.G. Slope (m/m)	0.008940	Area (m2)	7.45	11.36	5.09
Q Total (m3/s)	54.31	Flow (m3/s)	10.72	36.72	6.87
Top Width (m)	27.99	Top Width (m)	11.13	8.50	8.36
Vel Total (m/s)	2.27	Avg. Vel. (m/s)	1.44	3.23	1.35
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.67	1.34	0.61
Conv. Total (m3/s)	574.4	Conv. (m3/s)	113.4	388.3	72.6
Length Wtd. (m)	28.94	Wetted Per. (m)	11.20	8.68	8.43
Min Ch El (m)	439.83	Shear (N/m2)	58.26	114.70	52.88
Alpha	1.49	Stream Power (N/m s)	83.91	370.64	71.39
Frctn Loss (m)	0.27	Cum Volume (1000 m3)	66.54	48.17	40.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	76.77	34.48	43.90

Plan: Plan 06 Eastern 1 RS: 75 Profile: 100 year

E.G. Elev (m)	441.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.13	Reach Len. (m)	38.20	25.60	5.40
Crit W.S. (m)	441.13	Flow Area (m2)	2.89	11.13	8.88
E.G. Slope (m/m)	0.009822	Area (m2)	2.89	11.13	8.88
Q Total (m3/s)	54.31	Flow (m3/s)	3.57	37.19	13.55
Top Width (m)	27.40	Top Width (m)	5.82	8.50	13.09
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.23	3.34	1.53
Max Chl Dpth (m)	1.57	Hydr. Depth (m)	0.50	1.31	0.68
Conv. Total (m3/s)	548.0	Conv. (m3/s)	36.0	375.3	136.8
Length Wtd. (m)		Wetted Per. (m)	5.89	8.68	13.16
Min Ch El (m)	439.56	Shear (N/m2)	47.30	123.45	65.03
Alpha	1.48	Stream Power (N/m s)	58.35	412.43	99.21
Frctn Loss (m)		Cum Volume (1000 m3)	66.37	47.83	39.90
C & E Loss (m)		Cum SA (1000 m2)	76.49	34.22	43.65

Plan: Plan 06 Eastern 1 RS: 74 Profile: 100 year

E.G. Elev (m)	441.32	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	440.92	Reach Len. (m)	27.50	34.50	39.90
Crit W.S. (m)		Flow Area (m2)	5.40	11.40	6.89
E.G. Slope (m/m)	0.008998	Area (m2)	5.40	11.40	6.89
Q Total (m3/s)	54.31	Flow (m3/s)	7.41	37.05	9.85
Top Width (m)	27.65	Top Width (m)	8.70	8.50	10.44
Vel Total (m/s)	2.29	Avg. Vel. (m/s)	1.37	3.25	1.43
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.62	1.34	0.66
Conv. Total (m3/s)	572.6	Conv. (m3/s)	78.1	390.6	103.9
Length Wtd. (m)	34.03	Wetted Per. (m)	8.78	8.68	10.52
Min Ch El (m)	439.32	Shear (N/m2)	54.26	115.84	57.78
Alpha	1.49	Stream Power (N/m s)	74.43	376.41	82.65
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	66.21	47.54	39.86
C & E Loss (m)	0.00	Cum SA (1000 m2)	76.21	34.01	43.59

Plan: Plan 06 Eastern 1 RS: 73 Profile: 100 year

E.G. Elev (m)	441.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	440.58	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	440.58	Flow Area (m2)	7.74	11.17	3.98
E.G. Slope (m/m)	0.009817	Area (m2)	7.74	11.17	3.98
Q Total (m3/s)	54.31	Flow (m3/s)	11.62	37.38	5.31

Plan: Plan 06 Eastern 1 RS: 73 Profile: 100 year (Continued)

Top Width (m)	27.28	Top Width (m)	11.66	8.50	7.12
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.50	3.35	1.33
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.66	1.31	0.56
Conv. Total (m3/s)	548.1	Conv. (m3/s)	117.3	377.3	53.6
Length Wtd. (m)	1.00	Wetted Per. (m)	11.73	8.68	7.19
Min Ch El (m)	439.00	Shear (N/m2)	63.49	123.79	53.22
Alpha	1.49	Stream Power (N/m s)	95.32	414.39	71.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	66.03	47.16	39.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	75.93	33.71	43.24

Plan: Plan 06 Eastern 1 RS: 72.5 Profile: 100 year

E.G. Elev (m)	440.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	440.08	Reach Len. (m)	0.90	13.10	24.00
Crit W.S. (m)	440.08	Flow Area (m2)	7.74	11.17	3.98
E.G. Slope (m/m)	0.009819	Area (m2)	7.74	11.17	3.98
Q Total (m3/s)	54.31	Flow (m3/s)	11.62	37.39	5.31
Top Width (m)	27.28	Top Width (m)	11.66	8.50	7.12
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.50	3.35	1.33
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.66	1.31	0.56
Conv. Total (m3/s)	548.1	Conv. (m3/s)	117.2	377.3	53.6
Length Wtd. (m)		Wetted Per. (m)	11.73	8.68	7.19
Min Ch El (m)	438.50	Shear (N/m2)	63.50	123.81	53.23
Alpha	1.49	Stream Power (N/m s)	95.34	414.48	71.05
Frctn Loss (m)		Cum Volume (1000 m3)	66.03	47.14	39.64
C & E Loss (m)		Cum SA (1000 m2)	75.92	33.70	43.23

Plan: Plan 06 Eastern 1 RS: 72 Profile: 100 year

E.G. Elev (m)	440.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.98	Reach Len. (m)	27.70	27.70	27.50
Crit W.S. (m)		Flow Area (m2)	7.85	11.43	4.44
E.G. Slope (m/m)	0.008935	Area (m2)	7.85	11.43	4.44
Q Total (m3/s)	54.31	Flow (m3/s)	11.43	37.05	5.83
Top Width (m)	27.62	Top Width (m)	11.55	8.50	7.57
Vel Total (m/s)	2.29	Avg. Vel. (m/s)	1.46	3.24	1.32
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.68	1.34	0.59
Conv. Total (m3/s)	574.5	Conv. (m3/s)	120.9	391.9	61.7
Length Wtd. (m)	27.68	Wetted Per. (m)	11.62	8.68	7.65
Min Ch El (m)	438.38	Shear (N/m2)	59.19	115.27	50.83
Alpha	1.49	Stream Power (N/m s)	86.15	373.78	66.85
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	66.02	47.00	39.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	75.91	33.59	43.05

Plan: Plan 06 Eastern 1 RS: 71 Profile: 100 year

E.G. Elev (m)	440.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.70	Reach Len. (m)	1.20	11.10	20.60
Crit W.S. (m)	439.70	Flow Area (m2)	8.12	11.16	3.59
E.G. Slope (m/m)	0.009815	Area (m2)	8.12	11.16	3.59
Q Total (m3/s)	54.31	Flow (m3/s)	12.27	37.36	4.68
Top Width (m)	27.28	Top Width (m)	12.13	8.50	6.66
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.51	3.35	1.30
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.67	1.31	0.54
Conv. Total (m3/s)	548.2	Conv. (m3/s)	123.9	377.0	47.3
Length Wtd. (m)		Wetted Per. (m)	12.20	8.68	6.73
Min Ch El (m)	438.12	Shear (N/m2)	64.08	123.72	51.38

Plan: Plan 06 Eastern 1 RS: 71 Profile: 100 year (Continued)

Alpha	1.48	Stream Power (N/m s)	96.81	414.01	66.99
Frctn Loss (m)		Cum Volume (1000 m3)	65.80	46.68	39.42
C & E Loss (m)		Cum SA (1000 m2)	75.58	33.36	42.86

Plan: Plan 06 Eastern 1 RS: 70 Profile: 100 year

E.G. Elev (m)	440.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.63	Reach Len. (m)	20.30	22.50	21.50
Crit W.S. (m)		Flow Area (m2)	7.86	11.45	4.74
E.G. Slope (m/m)	0.008721	Area (m2)	7.86	11.45	4.74
Q Total (m3/s)	54.31	Flow (m3/s)	11.32	36.75	6.25
Top Width (m)	27.94	Top Width (m)	11.53	8.50	7.91
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.44	3.21	1.32
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.68	1.35	0.60
Conv. Total (m3/s)	581.6	Conv. (m3/s)	121.2	393.5	66.9
Length Wtd. (m)	22.02	Wetted Per. (m)	11.60	8.68	7.98
Min Ch El (m)	438.01	Shear (N/m2)	57.91	112.78	50.74
Alpha	1.49	Stream Power (N/m s)	83.40	361.86	66.90
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	65.79	46.56	39.34
C & E Loss (m)	0.00	Cum SA (1000 m2)	75.57	33.26	42.71

Plan: Plan 06 Eastern 1 RS: 69 Profile: 100 year

E.G. Elev (m)	439.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.38	Reach Len. (m)	51.40	33.80	7.80
Crit W.S. (m)	439.38	Flow Area (m2)	2.87	11.16	8.84
E.G. Slope (m/m)	0.009807	Area (m2)	2.87	11.16	8.84
Q Total (m3/s)	54.31	Flow (m3/s)	3.53	37.30	13.48
Top Width (m)	27.28	Top Width (m)	5.78	8.50	13.00
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.23	3.34	1.53
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.50	1.31	0.68
Conv. Total (m3/s)	548.4	Conv. (m3/s)	35.6	376.7	136.2
Length Wtd. (m)	30.31	Wetted Per. (m)	5.85	8.68	13.07
Min Ch El (m)	437.81	Shear (N/m2)	47.09	123.53	65.01
Alpha	1.48	Stream Power (N/m s)	57.93	413.03	99.17
Frctn Loss (m)	0.28	Cum Volume (1000 m3)	65.68	46.30	39.19
C & E Loss (m)	0.01	Cum SA (1000 m2)	75.39	33.07	42.48

Plan: Plan 06 Eastern 1 RS: 68 Profile: 100 year

E.G. Elev (m)	439.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.38	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.11	Reach Len. (m)	51.90	48.50	44.70
Crit W.S. (m)		Flow Area (m2)	6.09	11.55	6.58
E.G. Slope (m/m)	0.008514	Area (m2)	6.09	11.55	6.58
Q Total (m3/s)	54.31	Flow (m3/s)	8.36	36.81	9.15
Top Width (m)	27.90	Top Width (m)	9.42	8.50	9.98
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.37	3.19	1.39
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.65	1.36	0.66
Conv. Total (m3/s)	588.6	Conv. (m3/s)	90.6	398.9	99.1
Length Wtd. (m)	48.58	Wetted Per. (m)	9.50	8.68	10.06
Min Ch El (m)	437.49	Shear (N/m2)	53.54	111.01	54.61
Alpha	1.49	Stream Power (N/m s)	73.46	353.84	75.95
Frctn Loss (m)	0.45	Cum Volume (1000 m3)	65.45	45.92	39.13
C & E Loss (m)	0.00	Cum SA (1000 m2)	75.00	32.78	42.39

Plan: Plan 06 Eastern 1 RS: 67 Profile: 100 year

E.G. Elev (m)	439.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	438.61	Reach Len. (m)	2.60	18.40	37.30
Crit W.S. (m)		Flow Area (m2)	7.31	11.13	4.33
E.G. Slope (m/m)	0.009957	Area (m2)	7.31	11.13	4.33
Q Total (m3/s)	54.31	Flow (m3/s)	10.95	37.44	5.92
Top Width (m)	27.25	Top Width (m)	11.18	8.50	7.56
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.50	3.36	1.37
Max Chl Dpth (m)	1.57	Hydr. Depth (m)	0.65	1.31	0.57
Conv. Total (m3/s)	544.3	Conv. (m3/s)	109.7	375.2	59.4
Length Wtd. (m)	17.29	Wetted Per. (m)	11.26	8.68	7.64
Min Ch El (m)	437.04	Shear (N/m2)	63.44	125.13	55.38
Alpha	1.49	Stream Power (N/m s)	94.98	420.87	75.73
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	65.10	45.37	38.89
C & E Loss (m)	0.01	Cum SA (1000 m2)	74.47	32.37	42.00

Plan: Plan 06 Eastern 1 RS: 66 Profile: 100 year

E.G. Elev (m)	438.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	438.47	Reach Len. (m)	32.30	40.50	42.50
Crit W.S. (m)		Flow Area (m2)	7.63	11.37	4.62
E.G. Slope (m/m)	0.009076	Area (m2)	7.63	11.37	4.62
Q Total (m3/s)	54.31	Flow (m3/s)	11.12	37.03	6.16
Top Width (m)	27.64	Top Width (m)	11.34	8.50	7.80
Vel Total (m/s)	2.30	Avg. Vel. (m/s)	1.46	3.26	1.33
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.67	1.34	0.59
Conv. Total (m3/s)	570.1	Conv. (m3/s)	116.7	388.7	64.6
Length Wtd. (m)	39.56	Wetted Per. (m)	11.42	8.68	7.88
Min Ch El (m)	436.87	Shear (N/m2)	59.49	116.51	52.15
Alpha	1.49	Stream Power (N/m s)	86.66	379.53	69.57
Frctn Loss (m)	0.37	Cum Volume (1000 m3)	65.08	45.16	38.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.44	32.22	41.71

Plan: Plan 06 Eastern 1 RS: 65 Profile: 100 year

E.G. Elev (m)	438.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	438.07	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	438.07	Flow Area (m2)	4.16	11.17	7.57
E.G. Slope (m/m)	0.009822	Area (m2)	4.16	11.17	7.57
Q Total (m3/s)	54.31	Flow (m3/s)	5.60	37.38	11.33
Top Width (m)	27.30	Top Width (m)	7.34	8.50	11.46
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.35	3.35	1.50
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.57	1.31	0.66
Conv. Total (m3/s)	548.0	Conv. (m3/s)	56.5	377.2	114.3
Length Wtd. (m)	1.00	Wetted Per. (m)	7.41	8.68	11.53
Min Ch El (m)	436.49	Shear (N/m2)	54.02	123.82	63.22
Alpha	1.49	Stream Power (N/m s)	72.81	414.52	94.63
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	64.89	44.71	38.46
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.13	31.87	41.31

Plan: Plan 06 Eastern 1 RS: 64.5 Profile: 100 year

E.G. Elev (m)	438.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.57	Reach Len. (m)	28.70	16.00	1.00
Crit W.S. (m)	437.57	Flow Area (m2)	4.16	11.17	7.57
E.G. Slope (m/m)	0.009822	Area (m2)	4.16	11.17	7.57
Q Total (m3/s)	54.31	Flow (m3/s)	5.60	37.38	11.33

Plan: Plan 06 Eastern 1 RS: 64.5 Profile: 100 year (Continued)

Top Width (m)	27.30	Top Width (m)	7.34	8.50	11.46
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.35	3.35	1.50
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.57	1.31	0.66
Conv. Total (m3/s)	548.0	Conv. (m3/s)	56.5	377.2	114.3
Length Wtd. (m)		Wetted Per. (m)	7.41	8.68	11.53
Min Ch El (m)	435.99	Shear (N/m2)	54.02	123.82	63.22
Alpha	1.49	Stream Power (N/m s)	72.81	414.52	94.63
Frctn Loss (m)		Cum Volume (1000 m3)	64.89	44.70	38.46
C & E Loss (m)		Cum SA (1000 m2)	74.13	31.86	41.29

Plan: Plan 06 Eastern 1 RS: 64 Profile: 100 year

E.G. Elev (m)	437.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.43	Reach Len. (m)	54.60	52.60	47.30
Crit W.S. (m)		Flow Area (m2)	3.84	11.28	8.12
E.G. Slope (m/m)	0.009419	Area (m2)	3.84	11.28	8.12
Q Total (m3/s)	54.31	Flow (m3/s)	5.00	37.21	12.10
Top Width (m)	27.43	Top Width (m)	6.92	8.50	12.01
Vel Total (m/s)	2.34	Avg. Vel. (m/s)	1.30	3.30	1.49
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.55	1.33	0.68
Conv. Total (m3/s)	559.6	Conv. (m3/s)	51.5	383.4	124.6
Length Wtd. (m)	51.78	Wetted Per. (m)	7.00	8.68	12.09
Min Ch El (m)	435.84	Shear (N/m2)	50.71	119.93	62.08
Alpha	1.49	Stream Power (N/m s)	66.00	395.79	92.46
Frctn Loss (m)	0.49	Cum Volume (1000 m3)	64.77	44.52	38.45
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.92	31.73	41.28

Plan: Plan 06 Eastern 1 RS: 63 Profile: 100 year

E.G. Elev (m)	437.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	436.94	Reach Len. (m)	26.90	44.50	58.30
Crit W.S. (m)		Flow Area (m2)	5.44	11.22	6.50
E.G. Slope (m/m)	0.009597	Area (m2)	5.44	11.22	6.50
Q Total (m3/s)	54.31	Flow (m3/s)	7.65	37.22	9.44
Top Width (m)	27.48	Top Width (m)	8.85	8.50	10.13
Vel Total (m/s)	2.35	Avg. Vel. (m/s)	1.41	3.32	1.45
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.61	1.32	0.64
Conv. Total (m3/s)	554.4	Conv. (m3/s)	78.1	380.0	96.3
Length Wtd. (m)	44.32	Wetted Per. (m)	8.93	8.68	10.21
Min Ch El (m)	435.35	Shear (N/m2)	57.31	121.53	59.97
Alpha	1.49	Stream Power (N/m s)	80.67	403.35	87.01
Frctn Loss (m)	0.41	Cum Volume (1000 m3)	64.52	43.92	38.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	73.49	31.28	40.76

Plan: Plan 06 Eastern 1 RS: 62 Profile: 100 year

E.G. Elev (m)	436.94	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	436.54	Reach Len. (m)	5.10	17.80	32.20
Crit W.S. (m)		Flow Area (m2)	5.89	11.39	6.57
E.G. Slope (m/m)	0.008930	Area (m2)	5.89	11.39	6.57
Q Total (m3/s)	54.31	Flow (m3/s)	8.18	36.84	9.30
Top Width (m)	27.87	Top Width (m)	9.29	8.50	10.09
Vel Total (m/s)	2.28	Avg. Vel. (m/s)	1.39	3.23	1.41
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.63	1.34	0.65
Conv. Total (m3/s)	574.7	Conv. (m3/s)	86.5	389.8	98.4
Length Wtd. (m)	17.46	Wetted Per. (m)	9.36	8.68	10.16
Min Ch El (m)	434.94	Shear (N/m2)	55.11	114.84	56.66

Plan: Plan 06 Eastern 1 RS: 62 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	76.48	371.46	80.11
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	64.37	43.42	37.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.25	30.90	40.17

Plan: Plan 06 Eastern 1 RS: 61 Profile: 100 year

E.G. Elev (m)	436.78	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	436.38	Reach Len. (m)	99.00	92.10	77.50
Crit W.S. (m)		Flow Area (m2)	7.91	11.36	4.25
E.G. Slope (m/m)	0.009143	Area (m2)	7.91	11.36	4.25
Q Total (m3/s)	54.31	Flow (m3/s)	11.62	37.10	5.58
Top Width (m)	27.56	Top Width (m)	11.68	8.50	7.37
Vel Total (m/s)	2.31	Avg. Vel. (m/s)	1.47	3.27	1.31
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.68	1.34	0.58
Conv. Total (m3/s)	568.0	Conv. (m3/s)	121.5	388.0	58.4
Length Wtd. (m)	90.45	Wetted Per. (m)	11.76	8.68	7.45
Min Ch El (m)	434.78	Shear (N/m2)	60.34	117.25	51.12
Alpha	1.49	Stream Power (N/m s)	88.62	383.07	67.21
Frctn Loss (m)	0.86	Cum Volume (1000 m3)	64.33	43.22	37.55
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.19	30.75	39.89

Plan: Plan 06 Eastern 1 RS: 60 Profile: 100 year

E.G. Elev (m)	435.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.50	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	435.50	Flow Area (m2)	2.70	11.16	8.99
E.G. Slope (m/m)	0.009805	Area (m2)	2.70	11.16	8.99
Q Total (m3/s)	54.31	Flow (m3/s)	3.27	37.30	13.74
Top Width (m)	27.26	Top Width (m)	5.58	8.50	13.18
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.21	3.34	1.53
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.48	1.31	0.68
Conv. Total (m3/s)	548.5	Conv. (m3/s)	33.0	376.7	138.7
Length Wtd. (m)	1.00	Wetted Per. (m)	5.66	8.68	13.26
Min Ch El (m)	433.92	Shear (N/m2)	45.93	123.52	65.20
Alpha	1.48	Stream Power (N/m s)	55.59	412.97	99.66
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	63.81	42.18	37.03
C & E Loss (m)	0.03	Cum SA (1000 m2)	72.34	29.97	39.09

Plan: Plan 06 Eastern 1 RS: 59.5 Profile: 100 year

E.G. Elev (m)	435.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.13	Reach Len. (m)	36.10	27.50	15.30
Crit W.S. (m)		Flow Area (m2)	3.51	12.31	10.82
E.G. Slope (m/m)	0.006522	Area (m2)	3.51	12.31	10.82
Q Total (m3/s)	54.31	Flow (m3/s)	3.78	35.82	14.70
Top Width (m)	28.78	Top Width (m)	6.34	8.50	13.94
Vel Total (m/s)	2.04	Avg. Vel. (m/s)	1.08	2.91	1.36
Max Chl Dpth (m)	1.71	Hydr. Depth (m)	0.55	1.45	0.78
Conv. Total (m3/s)	672.5	Conv. (m3/s)	46.9	443.6	182.1
Length Wtd. (m)	25.17	Wetted Per. (m)	6.42	8.68	14.02
Min Ch El (m)	433.42	Shear (N/m2)	34.92	90.63	49.35
Alpha	1.48	Stream Power (N/m s)	37.67	263.81	67.06
Frctn Loss (m)	0.12	Cum Volume (1000 m3)	63.80	42.17	37.02
C & E Loss (m)	0.03	Cum SA (1000 m2)	72.33	29.96	39.08

Plan: Plan 06 Eastern 1 RS: 59 Profile: 100 year

E.G. Elev (m)	435.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.20	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.09	Reach Len. (m)	401.00	53.30	57.50
Crit W.S. (m)		Flow Area (m2)	7.05	14.14	12.27
E.G. Slope (m/m)	0.003625	Area (m2)	7.05	14.14	12.27
Q Total (m3/s)	54.31	Flow (m3/s)	7.02	33.65	13.65
Top Width (m)	31.50	Top Width (m)	9.28	8.50	13.71
Vel Total (m/s)	1.62	Avg. Vel. (m/s)	0.99	2.38	1.11
Max Chl Dpth (m)	1.93	Hydr. Depth (m)	0.76	1.66	0.89
Conv. Total (m3/s)	902.0	Conv. (m3/s)	116.5	558.9	226.6
Length Wtd. (m)	108.90	Wetted Per. (m)	9.39	8.68	13.82
Min Ch El (m)	433.16	Shear (N/m2)	26.70	57.86	31.56
Alpha	1.50	Stream Power (N/m s)	26.56	137.73	35.10
Frctn Loss (m)	0.60	Cum Volume (1000 m3)	63.61	41.81	36.85
C & E Loss (m)	0.02	Cum SA (1000 m2)	72.05	29.72	38.87

Plan: Plan 06 Eastern 1 RS: 58 Profile: 100 year

E.G. Elev (m)	434.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	434.26	Reach Len. (m)	11.60	24.00	36.80
Crit W.S. (m)		Flow Area (m2)	6.94	11.26	5.09
E.G. Slope (m/m)	0.009433	Area (m2)	6.94	11.26	5.09
Q Total (m3/s)	54.31	Flow (m3/s)	10.10	37.17	7.03
Top Width (m)	27.53	Top Width (m)	10.61	8.50	8.41
Vel Total (m/s)	2.33	Avg. Vel. (m/s)	1.46	3.30	1.38
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.65	1.33	0.61
Conv. Total (m3/s)	559.2	Conv. (m3/s)	104.0	382.8	72.4
Length Wtd. (m)	23.61	Wetted Per. (m)	10.69	8.68	8.49
Min Ch El (m)	432.67	Shear (N/m2)	60.05	119.97	55.48
Alpha	1.49	Stream Power (N/m s)	87.45	395.94	76.64
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	60.81	41.13	36.35
C & E Loss (m)	0.01	Cum SA (1000 m2)	68.06	29.27	38.23

Plan: Plan 06 Eastern 1 RS: 57 Profile: 100 year

E.G. Elev (m)	434.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	434.05	Reach Len. (m)	36.30	33.30	30.30
Crit W.S. (m)		Flow Area (m2)	6.45	11.43	5.96
E.G. Slope (m/m)	0.008871	Area (m2)	6.45	11.43	5.96
Q Total (m3/s)	54.31	Flow (m3/s)	9.08	36.96	8.27
Top Width (m)	27.74	Top Width (m)	9.91	8.50	9.34
Vel Total (m/s)	2.28	Avg. Vel. (m/s)	1.41	3.23	1.39
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.65	1.35	0.64
Conv. Total (m3/s)	576.6	Conv. (m3/s)	96.4	392.4	87.8
Length Wtd. (m)	33.11	Wetted Per. (m)	9.98	8.68	9.41
Min Ch El (m)	432.44	Shear (N/m2)	56.19	114.53	55.07
Alpha	1.49	Stream Power (N/m s)	79.10	370.22	76.47
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	60.73	40.86	36.14
C & E Loss (m)	0.00	Cum SA (1000 m2)	67.94	29.07	37.90

Plan: Plan 06 Eastern 1 RS: 56 Profile: 100 year

E.G. Elev (m)	434.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.71	Reach Len. (m)	34.30	20.10	6.40
Crit W.S. (m)	433.71	Flow Area (m2)	3.56	11.15	8.19
E.G. Slope (m/m)	0.009824	Area (m2)	3.56	11.15	8.19
Q Total (m3/s)	54.31	Flow (m3/s)	4.63	37.30	12.39

Plan: Plan 06 Eastern 1 RS: 56 Profile: 100 year (Continued)

Top Width (m)	27.35	Top Width (m)	6.62	8.50	12.23
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.30	3.35	1.51
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.54	1.31	0.67
Conv. Total (m3/s)	547.9	Conv. (m3/s)	46.7	376.3	125.0
Length Wtd. (m)		Wetted Per. (m)	6.69	8.68	12.30
Min Ch El (m)	432.13	Shear (N/m2)	51.21	123.68	64.16
Alpha	1.48	Stream Power (N/m s)	66.61	413.74	97.00
Frctn Loss (m)		Cum Volume (1000 m3)	60.55	40.48	35.93
C & E Loss (m)		Cum SA (1000 m2)	67.64	28.78	37.58

Plan: Plan 06 Eastern 1 RS: 55 Profile: 100 year

E.G. Elev (m)	433.94	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.58	Reach Len. (m)	28.70	29.70	24.70
Crit W.S. (m)		Flow Area (m2)	5.72	11.59	7.56
E.G. Slope (m/m)	0.008128	Area (m2)	5.72	11.59	7.56
Q Total (m3/s)	54.31	Flow (m3/s)	7.60	36.20	10.52
Top Width (m)	28.53	Top Width (m)	8.97	8.50	11.06
Vel Total (m/s)	2.18	Avg. Vel. (m/s)	1.33	3.12	1.39
Max Chl Dpth (m)	1.63	Hydr. Depth (m)	0.64	1.36	0.68
Conv. Total (m3/s)	602.4	Conv. (m3/s)	84.2	401.5	116.7
Length Wtd. (m)	28.78	Wetted Per. (m)	9.05	8.68	11.14
Min Ch El (m)	431.95	Shear (N/m2)	50.39	106.39	54.07
Alpha	1.49	Stream Power (N/m s)	66.92	332.20	75.27
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	60.39	40.25	35.88
C & E Loss (m)	0.01	Cum SA (1000 m2)	67.38	28.61	37.50

Plan: Plan 06 Eastern 1 RS: 54 Profile: 100 year

E.G. Elev (m)	433.68	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.25	Reach Len. (m)	7.10	21.80	34.00
Crit W.S. (m)		Flow Area (m2)	7.56	11.18	4.20
E.G. Slope (m/m)	0.009758	Area (m2)	7.56	11.18	4.20
Q Total (m3/s)	54.31	Flow (m3/s)	11.29	37.36	5.66
Top Width (m)	27.31	Top Width (m)	11.43	8.50	7.38
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.49	3.34	1.35
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.66	1.32	0.57
Conv. Total (m3/s)	549.8	Conv. (m3/s)	114.3	378.2	57.2
Length Wtd. (m)	20.75	Wetted Per. (m)	11.50	8.68	7.45
Min Ch El (m)	431.67	Shear (N/m2)	62.89	123.23	53.89
Alpha	1.49	Stream Power (N/m s)	93.93	411.68	72.61
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	60.20	39.91	35.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	67.08	28.36	37.27

Plan: Plan 06 Eastern 1 RS: 53 Profile: 100 year

E.G. Elev (m)	433.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.05	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	433.05	Flow Area (m2)	5.78	11.17	5.96
E.G. Slope (m/m)	0.009827	Area (m2)	5.78	11.17	5.96
Q Total (m3/s)	54.31	Flow (m3/s)	8.30	37.41	8.60
Top Width (m)	27.30	Top Width (m)	9.29	8.50	9.51
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.44	3.35	1.44
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.62	1.31	0.63
Conv. Total (m3/s)	547.9	Conv. (m3/s)	83.7	377.4	86.8
Length Wtd. (m)	1.00	Wetted Per. (m)	9.36	8.68	9.58
Min Ch El (m)	431.47	Shear (N/m2)	59.44	123.93	59.91

Plan: Plan 06 Eastern 1 RS: 53 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	85.39	415.11	86.52
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	60.15	39.67	35.56
C & E Loss (m)	0.01	Cum SA (1000 m2)	67.01	28.18	36.99

Plan: Plan 06 Eastern 1 RS: 52.5 Profile: 100 year

E.G. Elev (m)	432.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	432.58	Reach Len. (m)	36.80	35.90	34.90
Crit W.S. (m)		Flow Area (m2)	6.07	11.44	6.26
E.G. Slope (m/m)	0.008899	Area (m2)	6.07	11.44	6.26
Q Total (m3/s)	54.31	Flow (m3/s)	8.48	37.05	8.79
Top Width (m)	27.66	Top Width (m)	9.47	8.50	9.69
Vel Total (m/s)	2.28	Avg. Vel. (m/s)	1.40	3.24	1.40
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.64	1.35	0.65
Conv. Total (m3/s)	575.7	Conv. (m3/s)	89.9	392.7	93.2
Length Wtd. (m)	35.82	Wetted Per. (m)	9.54	8.68	9.76
Min Ch El (m)	430.97	Shear (N/m2)	55.53	114.94	55.97
Alpha	1.49	Stream Power (N/m s)	77.51	372.24	78.54
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	60.14	39.66	35.56
C & E Loss (m)	0.00	Cum SA (1000 m2)	67.00	28.17	36.98

Plan: Plan 06 Eastern 1 RS: 52 Profile: 100 year

E.G. Elev (m)	432.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	432.21	Reach Len. (m)	54.80	31.80	3.60
Crit W.S. (m)	432.21	Flow Area (m2)	3.92	11.16	7.83
E.G. Slope (m/m)	0.009822	Area (m2)	3.92	11.16	7.83
Q Total (m3/s)	54.31	Flow (m3/s)	5.21	37.33	11.77
Top Width (m)	27.33	Top Width (m)	7.05	8.50	11.78
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.33	3.35	1.50
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.56	1.31	0.66
Conv. Total (m3/s)	548.0	Conv. (m3/s)	52.6	376.7	118.8
Length Wtd. (m)		Wetted Per. (m)	7.13	8.68	11.86
Min Ch El (m)	430.63	Shear (N/m2)	52.95	123.73	63.61
Alpha	1.49	Stream Power (N/m s)	70.44	414.01	95.62
Frctn Loss (m)		Cum Volume (1000 m3)	59.96	39.25	35.31
C & E Loss (m)		Cum SA (1000 m2)	66.70	27.86	36.60

Plan: Plan 06 Eastern 1 RS: 51 Profile: 100 year

E.G. Elev (m)	432.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.95	Reach Len. (m)	56.10	56.40	56.50
Crit W.S. (m)		Flow Area (m2)	5.18	11.43	7.14
E.G. Slope (m/m)	0.008924	Area (m2)	5.18	11.43	7.14
Q Total (m3/s)	54.31	Flow (m3/s)	7.03	37.05	10.24
Top Width (m)	27.64	Top Width (m)	8.43	8.50	10.71
Vel Total (m/s)	2.29	Avg. Vel. (m/s)	1.36	3.24	1.43
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.61	1.34	0.67
Conv. Total (m3/s)	574.9	Conv. (m3/s)	74.4	392.2	108.4
Length Wtd. (m)	56.36	Wetted Per. (m)	8.51	8.68	10.79
Min Ch El (m)	430.34	Shear (N/m2)	53.26	115.17	57.90
Alpha	1.49	Stream Power (N/m s)	72.27	373.31	83.05
Frctn Loss (m)	0.53	Cum Volume (1000 m3)	59.71	38.90	35.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	66.27	27.59	36.56

Plan: Plan 06 Eastern 1 RS: 50 Profile: 100 year

E.G. Elev (m)	431.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.39	Reach Len. (m)	1.80	16.30	30.10
Crit W.S. (m)	431.39	Flow Area (m2)	8.59	11.15	3.15
E.G. Slope (m/m)	0.009815	Area (m2)	8.59	11.15	3.15
Q Total (m3/s)	54.31	Flow (m3/s)	13.06	37.27	3.97
Top Width (m)	27.34	Top Width (m)	12.72	8.50	6.13
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.52	3.34	1.26
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.68	1.31	0.51
Conv. Total (m3/s)	548.2	Conv. (m3/s)	131.9	376.2	40.1
Length Wtd. (m)		Wetted Per. (m)	12.79	8.68	6.20
Min Ch El (m)	429.81	Shear (N/m2)	64.68	123.54	48.91
Alpha	1.48	Stream Power (N/m s)	98.32	413.03	61.70
Frctn Loss (m)		Cum Volume (1000 m3)	59.33	38.26	34.99
C & E Loss (m)		Cum SA (1000 m2)	65.68	27.11	36.09

Plan: Plan 06 Eastern 1 RS: 49 Profile: 100 year

E.G. Elev (m)	431.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.25	Reach Len. (m)	35.60	30.30	19.30
Crit W.S. (m)		Flow Area (m2)	9.20	11.29	2.74
E.G. Slope (m/m)	0.009362	Area (m2)	9.20	11.29	2.74
Q Total (m3/s)	54.31	Flow (m3/s)	13.89	37.15	3.27
Top Width (m)	27.40	Top Width (m)	13.29	8.50	5.62
Vel Total (m/s)	2.34	Avg. Vel. (m/s)	1.51	3.29	1.19
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.69	1.33	0.49
Conv. Total (m3/s)	561.3	Conv. (m3/s)	143.6	384.0	33.8
Length Wtd. (m)	29.41	Wetted Per. (m)	13.36	8.68	5.69
Min Ch El (m)	429.66	Shear (N/m2)	63.24	119.29	44.27
Alpha	1.48	Stream Power (N/m s)	95.46	392.70	52.68
Frctn Loss (m)	0.28	Cum Volume (1000 m3)	59.31	38.08	34.90
C & E Loss (m)	0.00	Cum SA (1000 m2)	65.66	26.97	35.91

Plan: Plan 06 Eastern 1 RS: 48 Profile: 100 year

E.G. Elev (m)	431.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	430.96	Reach Len. (m)	23.40	13.50	0.31
Crit W.S. (m)	430.96	Flow Area (m2)	2.68	11.15	9.03
E.G. Slope (m/m)	0.009807	Area (m2)	2.68	11.15	9.03
Q Total (m3/s)	54.31	Flow (m3/s)	3.24	37.27	13.80
Top Width (m)	27.30	Top Width (m)	5.56	8.50	13.24
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.21	3.34	1.53
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.48	1.31	0.68
Conv. Total (m3/s)	548.4	Conv. (m3/s)	32.7	376.4	139.4
Length Wtd. (m)	10.82	Wetted Per. (m)	5.63	8.68	13.31
Min Ch El (m)	429.38	Shear (N/m2)	45.78	123.47	65.22
Alpha	1.48	Stream Power (N/m s)	55.29	412.69	99.72
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	59.10	37.74	34.79
C & E Loss (m)	0.00	Cum SA (1000 m2)	65.32	26.72	35.73

Plan: Plan 06 Eastern 1 RS: 47 Profile: 100 year

E.G. Elev (m)	431.26	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	430.83	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	430.83	Flow Area (m2)	2.95	11.14	8.81
E.G. Slope (m/m)	0.009815	Area (m2)	2.95	11.14	8.81
Q Total (m3/s)	54.31	Flow (m3/s)	3.65	37.23	13.42

Plan: Plan 06 Eastern 1 RS: 47 Profile: 100 year (Continued)

Top Width (m)	27.36	Top Width (m)	5.88	8.50	12.98
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.24	3.34	1.52
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.50	1.31	0.68
Conv. Total (m3/s)	548.2	Conv. (m3/s)	36.9	375.8	135.5
Length Wtd. (m)	1.00	Wetted Per. (m)	5.95	8.68	13.05
Min Ch El (m)	429.26	Shear (N/m2)	47.64	123.47	64.93
Alpha	1.48	Stream Power (N/m s)	59.05	412.63	98.96
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	59.03	37.59	34.79
C & E Loss (m)	0.01	Cum SA (1000 m2)	65.19	26.60	35.72

Plan: Plan 06 Eastern 1 RS: 46.5 Profile: 100 year

E.G. Elev (m)	430.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	430.37	Reach Len. (m)	49.90	46.00	39.70
Crit W.S. (m)		Flow Area (m2)	3.16	11.44	9.27
E.G. Slope (m/m)	0.008781	Area (m2)	3.16	11.44	9.27
Q Total (m3/s)	54.31	Flow (m3/s)	3.80	36.82	13.69
Top Width (m)	27.76	Top Width (m)	6.08	8.50	13.18
Vel Total (m/s)	2.27	Avg. Vel. (m/s)	1.20	3.22	1.48
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.52	1.35	0.70
Conv. Total (m3/s)	579.6	Conv. (m3/s)	40.5	392.9	146.1
Length Wtd. (m)	45.54	Wetted Per. (m)	6.16	8.68	13.26
Min Ch El (m)	428.76	Shear (N/m2)	44.20	113.46	60.23
Alpha	1.48	Stream Power (N/m s)	53.10	365.08	88.95
Frctn Loss (m)	0.42	Cum Volume (1000 m3)	59.03	37.57	34.78
C & E Loss (m)	0.00	Cum SA (1000 m2)	65.18	26.59	35.71

Plan: Plan 06 Eastern 1 RS: 46 Profile: 100 year

E.G. Elev (m)	430.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	429.90	Reach Len. (m)	2.00	18.80	31.60
Crit W.S. (m)	429.90	Flow Area (m2)	8.32	11.16	3.40
E.G. Slope (m/m)	0.009810	Area (m2)	8.32	11.16	3.40
Q Total (m3/s)	54.31	Flow (m3/s)	12.60	37.34	4.37
Top Width (m)	27.29	Top Width (m)	12.37	8.50	6.43
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.51	3.35	1.29
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.67	1.31	0.53
Conv. Total (m3/s)	548.3	Conv. (m3/s)	127.2	377.0	44.2
Length Wtd. (m)		Wetted Per. (m)	12.44	8.68	6.50
Min Ch El (m)	428.33	Shear (N/m2)	64.32	123.64	50.33
Alpha	1.48	Stream Power (N/m s)	97.43	413.58	64.74
Frctn Loss (m)		Cum Volume (1000 m3)	58.74	37.05	34.53
C & E Loss (m)		Cum SA (1000 m2)	64.72	26.20	35.32

Plan: Plan 06 Eastern 1 RS: 45 Profile: 100 year

E.G. Elev (m)	430.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	429.77	Reach Len. (m)	26.30	35.40	44.20
Crit W.S. (m)		Flow Area (m2)	7.32	11.53	5.25
E.G. Slope (m/m)	0.008597	Area (m2)	7.32	11.53	5.25
Q Total (m3/s)	54.31	Flow (m3/s)	10.40	36.88	7.04
Top Width (m)	27.81	Top Width (m)	10.85	8.50	8.47
Vel Total (m/s)	2.25	Avg. Vel. (m/s)	1.42	3.20	1.34
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.68	1.36	0.62
Conv. Total (m3/s)	585.7	Conv. (m3/s)	112.2	397.7	75.9
Length Wtd. (m)	35.71	Wetted Per. (m)	10.92	8.68	8.54
Min Ch El (m)	428.15	Shear (N/m2)	56.51	111.89	51.80

Plan: Plan 06 Eastern 1 RS: 45 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	80.26	357.98	69.43
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	58.73	36.84	34.39
C & E Loss (m)	0.00	Cum SA (1000 m2)	64.70	26.04	35.09

Plan: Plan 06 Eastern 1 RS: 44 Profile: 100 year

E.G. Elev (m)	429.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	429.40	Reach Len. (m)	48.10	35.60	19.60
Crit W.S. (m)		Flow Area (m2)	3.54	11.15	8.16
E.G. Slope (m/m)	0.009860	Area (m2)	3.54	11.15	8.16
Q Total (m3/s)	54.31	Flow (m3/s)	4.61	37.35	12.35
Top Width (m)	27.28	Top Width (m)	6.60	8.50	12.19
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.30	3.35	1.51
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.54	1.31	0.67
Conv. Total (m3/s)	546.9	Conv. (m3/s)	46.4	376.2	124.4
Length Wtd. (m)	33.66	Wetted Per. (m)	6.67	8.68	12.26
Min Ch El (m)	427.82	Shear (N/m2)	51.31	124.11	64.34
Alpha	1.48	Stream Power (N/m s)	66.78	415.87	97.39
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	58.58	36.44	34.09
C & E Loss (m)	0.00	Cum SA (1000 m2)	64.47	25.74	34.63

Plan: Plan 06 Eastern 1 RS: 43 Profile: 100 year

E.G. Elev (m)	429.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	429.08	Reach Len. (m)	41.20	31.30	20.80
Crit W.S. (m)		Flow Area (m2)	5.09	11.23	6.80
E.G. Slope (m/m)	0.009582	Area (m2)	5.09	11.23	6.80
Q Total (m3/s)	54.31	Flow (m3/s)	7.07	37.30	9.94
Top Width (m)	27.40	Top Width (m)	8.42	8.50	10.47
Vel Total (m/s)	2.35	Avg. Vel. (m/s)	1.39	3.32	1.46
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.60	1.32	0.65
Conv. Total (m3/s)	554.8	Conv. (m3/s)	72.3	381.0	101.5
Length Wtd. (m)	30.88	Wetted Per. (m)	8.50	8.68	10.55
Min Ch El (m)	427.49	Shear (N/m2)	56.25	121.55	60.59
Alpha	1.49	Stream Power (N/m s)	78.22	403.57	88.54
Frctn Loss (m)	0.28	Cum Volume (1000 m3)	58.38	36.04	33.95
C & E Loss (m)	0.01	Cum SA (1000 m2)	64.11	25.44	34.41

Plan: Plan 06 Eastern 1 RS: 42 Profile: 100 year

E.G. Elev (m)	429.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	428.82	Reach Len. (m)	38.50	40.20	41.30
Crit W.S. (m)		Flow Area (m2)	6.09	11.51	6.47
E.G. Slope (m/m)	0.008648	Area (m2)	6.09	11.51	6.47
Q Total (m3/s)	54.31	Flow (m3/s)	8.40	36.88	9.03
Top Width (m)	27.82	Top Width (m)	9.44	8.50	9.88
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.38	3.21	1.40
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.64	1.35	0.65
Conv. Total (m3/s)	584.0	Conv. (m3/s)	90.4	396.6	97.1
Length Wtd. (m)	40.09	Wetted Per. (m)	9.52	8.68	9.96
Min Ch El (m)	427.20	Shear (N/m2)	54.24	112.36	55.09
Alpha	1.49	Stream Power (N/m s)	74.88	360.13	76.86
Frctn Loss (m)	0.37	Cum Volume (1000 m3)	58.15	35.69	33.81
C & E Loss (m)	0.00	Cum SA (1000 m2)	63.74	25.17	34.20

Plan: Plan 06 Eastern 1 RS: 41 Profile: 100 year

E.G. Elev (m)	428.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	428.41	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	428.41	Flow Area (m2)	6.42	11.17	5.30
E.G. Slope (m/m)	0.009822	Area (m2)	6.42	11.17	5.30
Q Total (m3/s)	54.31	Flow (m3/s)	9.38	37.43	7.50
Top Width (m)	27.28	Top Width (m)	10.06	8.50	8.71
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.46	3.35	1.41
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.64	1.31	0.61
Conv. Total (m3/s)	548.0	Conv. (m3/s)	94.7	377.7	75.7
Length Wtd. (m)	1.00	Wetted Per. (m)	10.14	8.68	8.79
Min Ch El (m)	426.83	Shear (N/m2)	61.00	123.93	58.10
Alpha	1.49	Stream Power (N/m s)	89.16	415.11	82.21
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	57.91	35.23	33.57
C & E Loss (m)	0.00	Cum SA (1000 m2)	63.36	24.83	33.81

Plan: Plan 06 Eastern 1 RS: 40.5 Profile: 100 year

E.G. Elev (m)	428.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.90	Reach Len. (m)	12.00	24.30	34.60
Crit W.S. (m)		Flow Area (m2)	6.40	11.16	5.28
E.G. Slope (m/m)	0.009879	Area (m2)	6.40	11.16	5.28
Q Total (m3/s)	54.31	Flow (m3/s)	9.37	37.45	7.49
Top Width (m)	27.26	Top Width (m)	10.05	8.50	8.70
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.46	3.36	1.42
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.64	1.31	0.61
Conv. Total (m3/s)	546.4	Conv. (m3/s)	94.3	376.7	75.4
Length Wtd. (m)	23.09	Wetted Per. (m)	10.13	8.68	8.78
Min Ch El (m)	426.33	Shear (N/m2)	61.24	124.46	58.33
Alpha	1.49	Stream Power (N/m s)	89.67	417.71	82.69
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	57.90	35.22	33.56
C & E Loss (m)	0.01	Cum SA (1000 m2)	63.35	24.82	33.80

Plan: Plan 06 Eastern 1 RS: 40 Profile: 100 year

E.G. Elev (m)	428.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.71	Reach Len. (m)	27.50	39.40	48.20
Crit W.S. (m)		Flow Area (m2)	8.18	11.41	4.08
E.G. Slope (m/m)	0.008981	Area (m2)	8.18	11.41	4.08
Q Total (m3/s)	54.31	Flow (m3/s)	11.99	37.05	5.27
Top Width (m)	27.60	Top Width (m)	11.95	8.50	7.16
Vel Total (m/s)	2.30	Avg. Vel. (m/s)	1.47	3.25	1.29
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.68	1.34	0.57
Conv. Total (m3/s)	573.1	Conv. (m3/s)	126.5	390.9	55.6
Length Wtd. (m)	38.85	Wetted Per. (m)	12.02	8.68	7.23
Min Ch El (m)	426.10	Shear (N/m2)	59.92	115.68	49.63
Alpha	1.49	Stream Power (N/m s)	87.85	375.67	64.19
Frctn Loss (m)	0.36	Cum Volume (1000 m3)	57.81	34.94	33.40
C & E Loss (m)	0.00	Cum SA (1000 m2)	63.22	24.62	33.53

Plan: Plan 06 Eastern 1 RS: 39 Profile: 100 year

E.G. Elev (m)	427.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.31	Reach Len. (m)	39.30	25.50	8.60
Crit W.S. (m)	427.31	Flow Area (m2)	4.06	11.17	7.66
E.G. Slope (m/m)	0.009820	Area (m2)	4.06	11.17	7.66
Q Total (m3/s)	54.31	Flow (m3/s)	5.44	37.38	11.49

Plan: Plan 06 Eastern 1 RS: 39 Profile: 100 year (Continued)

Top Width (m)	27.29	Top Width (m)	7.22	8.50	11.57
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.34	3.35	1.50
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.56	1.31	0.66
Conv. Total (m3/s)	548.0	Conv. (m3/s)	54.9	377.2	115.9
Length Wtd. (m)		Wetted Per. (m)	7.29	8.68	11.64
Min Ch El (m)	425.73	Shear (N/m2)	53.59	123.82	63.37
Alpha	1.49	Stream Power (N/m s)	71.86	414.51	95.02
Frctn Loss (m)		Cum Volume (1000 m3)	57.64	34.50	33.12
C & E Loss (m)		Cum SA (1000 m2)	62.96	24.28	33.08

Plan: Plan 06 Eastern 1 RS: 38 Profile: 100 year

E.G. Elev (m)	427.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.08	Reach Len. (m)	37.10	21.90	1.40
Crit W.S. (m)	427.08	Flow Area (m2)	4.28	11.17	7.44
E.G. Slope (m/m)	0.009821	Area (m2)	4.28	11.17	7.44
Q Total (m3/s)	54.31	Flow (m3/s)	5.81	37.39	11.11
Top Width (m)	27.29	Top Width (m)	7.49	8.50	11.30
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.36	3.35	1.49
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.57	1.31	0.66
Conv. Total (m3/s)	548.0	Conv. (m3/s)	58.6	377.3	112.1
Length Wtd. (m)	19.46	Wetted Per. (m)	7.56	8.68	11.37
Min Ch El (m)	425.50	Shear (N/m2)	54.54	123.83	63.00
Alpha	1.49	Stream Power (N/m s)	74.00	414.58	94.10
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	57.48	34.21	33.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	62.67	24.06	32.98

Plan: Plan 06 Eastern 1 RS: 37 Profile: 100 year

E.G. Elev (m)	427.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	426.89	Reach Len. (m)	26.20	28.30	29.50
Crit W.S. (m)		Flow Area (m2)	4.72	11.30	7.41
E.G. Slope (m/m)	0.009280	Area (m2)	4.72	11.30	7.41
Q Total (m3/s)	54.31	Flow (m3/s)	6.38	37.09	10.84
Top Width (m)	27.59	Top Width (m)	7.95	8.50	11.14
Vel Total (m/s)	2.32	Avg. Vel. (m/s)	1.35	3.28	1.46
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.59	1.33	0.67
Conv. Total (m3/s)	563.8	Conv. (m3/s)	66.2	385.0	112.5
Length Wtd. (m)	28.09	Wetted Per. (m)	8.03	8.68	11.22
Min Ch El (m)	425.29	Shear (N/m2)	53.50	118.46	60.15
Alpha	1.49	Stream Power (N/m s)	72.34	388.70	87.94
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	57.31	33.97	33.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.38	23.88	32.96

Plan: Plan 06 Eastern 1 RS: 36 Profile: 100 year

E.G. Elev (m)	427.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	426.62	Reach Len. (m)	45.50	68.60	84.90
Crit W.S. (m)		Flow Area (m2)	8.60	11.23	3.38
E.G. Slope (m/m)	0.009490	Area (m2)	8.60	11.23	3.38
Q Total (m3/s)	54.31	Flow (m3/s)	12.93	37.11	4.28
Top Width (m)	27.51	Top Width (m)	12.63	8.50	6.38
Vel Total (m/s)	2.34	Avg. Vel. (m/s)	1.50	3.30	1.27
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.68	1.32	0.53
Conv. Total (m3/s)	557.5	Conv. (m3/s)	132.7	380.9	43.9
Length Wtd. (m)	65.35	Wetted Per. (m)	12.71	8.68	6.46
Min Ch El (m)	425.03	Shear (N/m2)	63.02	120.35	48.70

Plan: Plan 06 Eastern 1 RS: 36 Profile: 100 year (Continued)

Alpha	1.48	Stream Power (N/m s)	94.69	397.60	61.62
Frctn Loss (m)	0.63	Cum Volume (1000 m3)	57.14	33.65	32.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.11	23.64	32.71

Plan: Plan 06 Eastern 1 RS: 35 Profile: 100 year

E.G. Elev (m)	426.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	425.97	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	425.97	Flow Area (m2)	6.86	11.17	4.86
E.G. Slope (m/m)	0.009823	Area (m2)	6.86	11.17	4.86
Q Total (m3/s)	54.31	Flow (m3/s)	10.13	37.41	6.76
Top Width (m)	27.28	Top Width (m)	10.60	8.50	8.18
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.48	3.35	1.39
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.65	1.31	0.59
Conv. Total (m3/s)	548.0	Conv. (m3/s)	102.2	377.5	68.2
Length Wtd. (m)	1.00	Wetted Per. (m)	10.67	8.68	8.25
Min Ch El (m)	424.39	Shear (N/m2)	61.94	123.91	56.69
Alpha	1.49	Stream Power (N/m s)	91.45	414.99	78.90
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	56.79	32.88	32.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	61.58	23.05	32.09

Plan: Plan 06 Eastern 1 RS: 34.5 Profile: 100 year

E.G. Elev (m)	425.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	425.47	Reach Len. (m)	2.90	21.20	37.60
Crit W.S. (m)	425.47	Flow Area (m2)	6.86	11.17	4.86
E.G. Slope (m/m)	0.009823	Area (m2)	6.86	11.17	4.86
Q Total (m3/s)	54.31	Flow (m3/s)	10.13	37.41	6.76
Top Width (m)	27.28	Top Width (m)	10.60	8.50	8.18
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.48	3.35	1.39
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.65	1.31	0.59
Conv. Total (m3/s)	548.0	Conv. (m3/s)	102.2	377.5	68.2
Length Wtd. (m)	19.65	Wetted Per. (m)	10.67	8.68	8.25
Min Ch El (m)	423.89	Shear (N/m2)	61.94	123.91	56.69
Alpha	1.49	Stream Power (N/m s)	91.45	414.99	78.90
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	56.78	32.87	32.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	61.57	23.05	32.08

Plan: Plan 06 Eastern 1 RS: 34 Profile: 100 year

E.G. Elev (m)	425.69	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	425.27	Reach Len. (m)	32.30	28.60	19.90
Crit W.S. (m)		Flow Area (m2)	7.28	11.18	4.59
E.G. Slope (m/m)	0.009696	Area (m2)	7.28	11.18	4.59
Q Total (m3/s)	54.31	Flow (m3/s)	10.79	37.24	6.29
Top Width (m)	27.46	Top Width (m)	11.10	8.50	7.86
Vel Total (m/s)	2.35	Avg. Vel. (m/s)	1.48	3.33	1.37
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.66	1.32	0.58
Conv. Total (m3/s)	551.6	Conv. (m3/s)	109.5	378.2	63.9
Length Wtd. (m)	27.67	Wetted Per. (m)	11.17	8.68	7.93
Min Ch El (m)	423.69	Shear (N/m2)	61.99	122.43	55.07
Alpha	1.49	Stream Power (N/m s)	91.80	407.65	75.36
Frctn Loss (m)	0.27	Cum Volume (1000 m3)	56.76	32.63	32.35
C & E Loss (m)	0.00	Cum SA (1000 m2)	61.54	22.87	31.78

Plan: Plan 06 Eastern 1 RS: 33 Profile: 100 year

E.G. Elev (m)	425.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.99	Reach Len. (m)	57.80	41.70	22.70
Crit W.S. (m)	424.99	Flow Area (m2)	3.82	11.13	8.00
E.G. Slope (m/m)	0.009841	Area (m2)	3.82	11.13	8.00
Q Total (m3/s)	54.31	Flow (m3/s)	5.05	37.21	12.05
Top Width (m)	27.46	Top Width (m)	6.94	8.50	12.01
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.32	3.34	1.51
Max Chl Dpth (m)	1.57	Hydr. Depth (m)	0.55	1.31	0.67
Conv. Total (m3/s)	547.5	Conv. (m3/s)	51.0	375.1	121.5
Length Wtd. (m)		Wetted Per. (m)	7.02	8.68	12.09
Min Ch El (m)	423.42	Shear (N/m2)	52.54	123.65	63.86
Alpha	1.49	Stream Power (N/m s)	69.51	413.42	96.20
Frctn Loss (m)		Cum Volume (1000 m3)	56.58	32.31	32.22
C & E Loss (m)		Cum SA (1000 m2)	61.25	22.62	31.58

Plan: Plan 06 Eastern 1 RS: 32 Profile: 100 year

E.G. Elev (m)	425.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.38	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.65	Reach Len. (m)	60.60	51.00	39.30
Crit W.S. (m)		Flow Area (m2)	5.40	11.52	7.26
E.G. Slope (m/m)	0.008557	Area (m2)	5.40	11.52	7.26
Q Total (m3/s)	54.31	Flow (m3/s)	7.27	36.78	10.27
Top Width (m)	27.92	Top Width (m)	8.64	8.50	10.77
Vel Total (m/s)	2.25	Avg. Vel. (m/s)	1.34	3.19	1.41
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.63	1.36	0.67
Conv. Total (m3/s)	587.1	Conv. (m3/s)	78.5	397.6	111.0
Length Wtd. (m)	51.51	Wetted Per. (m)	8.72	8.68	10.85
Min Ch El (m)	423.03	Shear (N/m2)	51.99	111.35	56.12
Alpha	1.49	Stream Power (N/m s)	69.90	355.35	79.41
Frctn Loss (m)	0.47	Cum Volume (1000 m3)	56.31	31.84	32.05
C & E Loss (m)	0.00	Cum SA (1000 m2)	60.80	22.27	31.32

Plan: Plan 06 Eastern 1 RS: 31 Profile: 100 year

E.G. Elev (m)	424.56	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.14	Reach Len. (m)	30.70	47.50	58.90
Crit W.S. (m)	424.14	Flow Area (m2)	9.34	11.15	2.33
E.G. Slope (m/m)	0.009801	Area (m2)	9.34	11.15	2.33
Q Total (m3/s)	54.31	Flow (m3/s)	14.34	37.26	2.71
Top Width (m)	27.26	Top Width (m)	13.62	8.50	5.14
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.53	3.34	1.16
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.69	1.31	0.45
Conv. Total (m3/s)	548.6	Conv. (m3/s)	144.8	376.4	27.3
Length Wtd. (m)		Wetted Per. (m)	13.69	8.68	5.21
Min Ch El (m)	422.56	Shear (N/m2)	65.59	123.42	43.05
Alpha	1.48	Stream Power (N/m s)	100.67	412.41	49.90
Frctn Loss (m)		Cum Volume (1000 m3)	55.87	31.26	31.86
C & E Loss (m)		Cum SA (1000 m2)	60.12	21.83	31.01

Plan: Plan 06 Eastern 1 RS: 30 Profile: 100 year

E.G. Elev (m)	424.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	423.69	Reach Len. (m)	2.40	18.10	30.30
Crit W.S. (m)	423.69	Flow Area (m2)	8.57	11.16	3.13
E.G. Slope (m/m)	0.009808	Area (m2)	8.57	11.16	3.13
Q Total (m3/s)	54.31	Flow (m3/s)	13.04	37.34	3.94

Plan: Plan 06 Eastern 1 RS: 30 Profile: 100 year (Continued)

Top Width (m)	27.27	Top Width (m)	12.68	8.50	6.10
Vel Total (m/s)	2.38	Avg. Vel. (m/s)	1.52	3.34	1.26
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.68	1.31	0.51
Conv. Total (m3/s)	548.4	Conv. (m3/s)	131.6	377.0	39.8
Length Wtd. (m)	16.38	Wetted Per. (m)	12.75	8.68	6.17
Min Ch El (m)	422.12	Shear (N/m2)	64.69	123.62	48.76
Alpha	1.48	Stream Power (N/m s)	98.35	413.48	61.40
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	55.59	30.73	31.70
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.72	21.43	30.68

Plan: Plan 06 Eastern 1 RS: 29 Profile: 100 year

E.G. Elev (m)	423.94	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	423.52	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	423.52	Flow Area (m2)	5.96	11.11	5.95
E.G. Slope (m/m)	0.009861	Area (m2)	5.96	11.11	5.95
Q Total (m3/s)	54.31	Flow (m3/s)	8.60	37.13	8.57
Top Width (m)	27.60	Top Width (m)	9.56	8.50	9.54
Vel Total (m/s)	2.36	Avg. Vel. (m/s)	1.44	3.34	1.44
Max Chl Dpth (m)	1.57	Hydr. Depth (m)	0.62	1.31	0.62
Conv. Total (m3/s)	546.9	Conv. (m3/s)	86.6	373.9	86.3
Length Wtd. (m)	1.00	Wetted Per. (m)	9.63	8.68	9.61
Min Ch El (m)	421.95	Shear (N/m2)	59.87	123.68	59.83
Alpha	1.49	Stream Power (N/m s)	86.37	413.47	86.27
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	55.57	30.53	31.56
C & E Loss (m)	0.01	Cum SA (1000 m2)	59.69	21.28	30.44

Plan: Plan 06 Eastern 1 RS: 28.5 Profile: 100 year

E.G. Elev (m)	423.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	423.04	Reach Len. (m)	45.90	36.60	25.60
Crit W.S. (m)		Flow Area (m2)	6.17	11.29	6.16
E.G. Slope (m/m)	0.009207	Area (m2)	6.17	11.29	6.16
Q Total (m3/s)	54.31	Flow (m3/s)	8.73	36.88	8.70
Top Width (m)	27.84	Top Width (m)	9.68	8.50	9.66
Vel Total (m/s)	2.30	Avg. Vel. (m/s)	1.41	3.27	1.41
Max Chl Dpth (m)	1.59	Hydr. Depth (m)	0.64	1.33	0.64
Conv. Total (m3/s)	566.0	Conv. (m3/s)	91.0	384.3	90.7
Length Wtd. (m)	36.21	Wetted Per. (m)	9.76	8.68	9.74
Min Ch El (m)	421.45	Shear (N/m2)	57.13	117.39	57.09
Alpha	1.49	Stream Power (N/m s)	80.80	383.36	80.70
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	55.57	30.52	31.56
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.68	21.27	30.43

Plan: Plan 06 Eastern 1 RS: 28 Profile: 100 year

E.G. Elev (m)	423.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.72	Reach Len. (m)	50.50	33.90	14.10
Crit W.S. (m)		Flow Area (m2)	5.76	11.44	6.58
E.G. Slope (m/m)	0.008890	Area (m2)	5.76	11.44	6.58
Q Total (m3/s)	54.31	Flow (m3/s)	7.96	37.05	9.30
Top Width (m)	27.65	Top Width (m)	9.10	8.50	10.05
Vel Total (m/s)	2.28	Avg. Vel. (m/s)	1.38	3.24	1.41
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.63	1.35	0.65
Conv. Total (m3/s)	576.0	Conv. (m3/s)	84.4	392.9	98.6
Length Wtd. (m)	33.56	Wetted Per. (m)	9.18	8.68	10.13
Min Ch El (m)	421.11	Shear (N/m2)	54.71	114.87	56.62

Plan: Plan 06 Eastern 1 RS: 28 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	75.63	371.91	80.08
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	55.29	30.10	31.40
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.25	20.96	30.18

Plan: Plan 06 Eastern 1 RS: 27 Profile: 100 year

E.G. Elev (m)	422.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.37	Reach Len. (m)	14.90	31.30	40.00
Crit W.S. (m)	422.37	Flow Area (m2)	6.56	11.17	5.17
E.G. Slope (m/m)	0.009827	Area (m2)	6.56	11.17	5.17
Q Total (m3/s)	54.31	Flow (m3/s)	9.62	37.41	7.28
Top Width (m)	27.30	Top Width (m)	10.24	8.50	8.56
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.47	3.35	1.41
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.64	1.31	0.60
Conv. Total (m3/s)	547.9	Conv. (m3/s)	97.1	377.3	73.5
Length Wtd. (m)	28.00	Wetted Per. (m)	10.31	8.68	8.63
Min Ch El (m)	420.79	Shear (N/m2)	61.31	123.92	57.71
Alpha	1.49	Stream Power (N/m s)	89.92	415.06	81.28
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	54.98	29.72	31.31
C & E Loss (m)	0.05	Cum SA (1000 m2)	58.77	20.67	30.05

Plan: Plan 06 Eastern 1 RS: 26 Profile: 100 year

E.G. Elev (m)	422.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.25	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.10	Reach Len. (m)	17.60	30.50	39.70
Crit W.S. (m)		Flow Area (m2)	14.13	11.32	4.25
E.G. Slope (m/m)	0.006467	Area (m2)	14.13	11.32	4.25
Q Total (m3/s)	54.31	Flow (m3/s)	18.57	31.04	4.70
Top Width (m)	34.95	Top Width (m)	19.06	8.50	7.39
Vel Total (m/s)	1.83	Avg. Vel. (m/s)	1.31	2.74	1.10
Max Chl Dpth (m)	1.60	Hydr. Depth (m)	0.74	1.33	0.58
Conv. Total (m3/s)	675.3	Conv. (m3/s)	230.9	386.0	58.4
Length Wtd. (m)	27.59	Wetted Per. (m)	19.14	8.68	7.47
Min Ch El (m)	420.50	Shear (N/m2)	46.83	82.67	36.11
Alpha	1.49	Stream Power (N/m s)	61.54	226.68	39.89
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	54.83	29.37	31.12
C & E Loss (m)	0.01	Cum SA (1000 m2)	58.55	20.40	29.73

Plan: Plan 06 Eastern 1 RS: 25 Profile: 100 year

E.G. Elev (m)	422.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.38	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	421.73	Reach Len. (m)	86.10	84.10	80.70
Crit W.S. (m)	421.73	Flow Area (m2)	10.86	11.37	5.53
E.G. Slope (m/m)	0.010123	Area (m2)	10.86	11.37	5.53
Q Total (m3/s)	61.68	Flow (m3/s)	16.38	37.68	7.62
Top Width (m)	35.36	Top Width (m)	16.67	9.00	9.68
Vel Total (m/s)	2.22	Avg. Vel. (m/s)	1.51	3.31	1.38
Max Chl Dpth (m)	1.51	Hydr. Depth (m)	0.65	1.26	0.57
Conv. Total (m3/s)	613.0	Conv. (m3/s)	162.8	374.5	75.7
Length Wtd. (m)	83.84	Wetted Per. (m)	16.73	9.18	9.74
Min Ch El (m)	420.22	Shear (N/m2)	64.43	122.88	56.31
Alpha	1.53	Stream Power (N/m s)	97.19	407.22	77.64
Frctn Loss (m)	0.85	Cum Volume (1000 m3)	54.61	29.02	30.93
C & E Loss (m)	0.00	Cum SA (1000 m2)	58.23	20.14	29.39

Plan: Plan 06 Eastern 1 RS: 24 Profile: 100 year

E.G. Elev (m)	421.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	420.82	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	420.82	Flow Area (m2)	5.50	11.44	10.65
E.G. Slope (m/m)	0.010091	Area (m2)	5.50	11.44	10.65
Q Total (m3/s)	61.68	Flow (m3/s)	7.59	38.01	16.08
Top Width (m)	34.87	Top Width (m)	9.59	9.00	16.27
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.38	3.32	1.51
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.57	1.27	0.65
Conv. Total (m3/s)	614.0	Conv. (m3/s)	75.5	378.4	160.1
Length Wtd. (m)	1.00	Wetted Per. (m)	9.65	9.18	16.33
Min Ch El (m)	419.30	Shear (N/m2)	56.34	123.25	64.51
Alpha	1.53	Stream Power (N/m s)	77.75	409.51	97.44
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	53.90	28.06	30.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	57.10	19.38	28.34

Plan: Plan 06 Eastern 1 RS: 23.5 Profile: 100 year

E.G. Elev (m)	420.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	420.32	Reach Len. (m)	34.50	25.30	12.50
Crit W.S. (m)	420.32	Flow Area (m2)	5.50	11.44	10.65
E.G. Slope (m/m)	0.010082	Area (m2)	5.50	11.44	10.65
Q Total (m3/s)	61.68	Flow (m3/s)	7.59	38.01	16.08
Top Width (m)	34.87	Top Width (m)	9.60	9.00	16.28
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.38	3.32	1.51
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.57	1.27	0.65
Conv. Total (m3/s)	614.3	Conv. (m3/s)	75.5	378.5	160.2
Length Wtd. (m)	22.94	Wetted Per. (m)	9.66	9.18	16.34
Min Ch El (m)	418.79	Shear (N/m2)	56.30	123.18	64.46
Alpha	1.53	Stream Power (N/m s)	77.67	409.17	97.34
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	53.90	28.05	30.27
C & E Loss (m)	0.00	Cum SA (1000 m2)	57.09	19.37	28.33

Plan: Plan 06 Eastern 1 RS: 23 Profile: 100 year

E.G. Elev (m)	420.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	420.04	Reach Len. (m)	68.80	61.40	48.50
Crit W.S. (m)	420.04	Flow Area (m2)	5.00	11.43	11.21
E.G. Slope (m/m)	0.010085	Area (m2)	5.00	11.43	11.21
Q Total (m3/s)	61.68	Flow (m3/s)	6.77	37.92	16.99
Top Width (m)	34.98	Top Width (m)	8.95	9.00	17.02
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.36	3.32	1.52
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.56	1.27	0.66
Conv. Total (m3/s)	614.2	Conv. (m3/s)	67.4	377.6	169.2
Length Wtd. (m)	60.83	Wetted Per. (m)	9.01	9.18	17.08
Min Ch El (m)	418.52	Shear (N/m2)	54.81	123.03	64.87
Alpha	1.53	Stream Power (N/m s)	74.27	408.32	98.35
Frctn Loss (m)	0.61	Cum Volume (1000 m3)	53.72	27.76	30.13
C & E Loss (m)	0.00	Cum SA (1000 m2)	56.77	19.14	28.12

Plan: Plan 06 Eastern 1 RS: 22 Profile: 100 year

E.G. Elev (m)	419.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	419.36	Reach Len. (m)	2.30	33.60	52.50
Crit W.S. (m)	419.36	Flow Area (m2)	13.07	11.41	3.14
E.G. Slope (m/m)	0.010070	Area (m2)	13.07	11.41	3.14
Q Total (m3/s)	61.68	Flow (m3/s)	20.05	37.79	3.83

Plan: Plan 06 Eastern 1 RS: 22 Profile: 100 year (Continued)

Top Width (m)	35.02	Top Width (m)	19.48	9.00	6.54
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.53	3.31	1.22
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.67	1.27	0.48
Conv. Total (m3/s)	614.6	Conv. (m3/s)	199.8	376.6	38.2
Length Wtd. (m)	27.08	Wetted Per. (m)	19.54	9.18	6.60
Min Ch El (m)	417.84	Shear (N/m2)	66.03	122.66	46.91
Alpha	1.52	Stream Power (N/m s)	101.34	406.36	57.32
Frctn Loss (m)	0.27	Cum Volume (1000 m3)	53.10	27.06	29.78
C & E Loss (m)	0.00	Cum SA (1000 m2)	55.79	18.59	27.55

Plan: Plan 06 Eastern 1 RS: 21 Profile: 100 year

E.G. Elev (m)	419.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	418.99	Reach Len. (m)	70.20	68.00	63.00
Crit W.S. (m)	418.99	Flow Area (m2)	9.38	11.39	6.94
E.G. Slope (m/m)	0.010128	Area (m2)	9.38	11.39	6.94
Q Total (m3/s)	61.68	Flow (m3/s)	13.95	37.80	9.93
Top Width (m)	35.21	Top Width (m)	14.70	9.00	11.51
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.49	3.32	1.43
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.64	1.27	0.60
Conv. Total (m3/s)	612.9	Conv. (m3/s)	138.6	375.6	98.6
Length Wtd. (m)	67.13	Wetted Per. (m)	14.76	9.18	11.57
Min Ch El (m)	417.48	Shear (N/m2)	63.11	123.16	59.55
Alpha	1.53	Stream Power (N/m s)	93.89	408.77	85.22
Frctn Loss (m)	0.68	Cum Volume (1000 m3)	53.07	26.68	29.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	55.75	18.29	27.07

Plan: Plan 06 Eastern 1 RS: 20 Profile: 100 year

E.G. Elev (m)	418.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	418.25	Reach Len. (m)	36.40	27.30	12.40
Crit W.S. (m)	418.25	Flow Area (m2)	3.37	11.43	12.77
E.G. Slope (m/m)	0.010071	Area (m2)	3.37	11.43	12.77
Q Total (m3/s)	61.68	Flow (m3/s)	4.19	37.90	19.59
Top Width (m)	34.88	Top Width (m)	6.84	9.00	19.05
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.24	3.32	1.53
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.49	1.27	0.67
Conv. Total (m3/s)	614.6	Conv. (m3/s)	41.7	377.7	195.2
Length Wtd. (m)	23.45	Wetted Per. (m)	6.90	9.18	19.11
Min Ch El (m)	416.73	Shear (N/m2)	48.22	122.88	65.99
Alpha	1.52	Stream Power (N/m s)	60.00	407.58	101.24
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	52.62	25.90	28.90
C & E Loss (m)	0.00	Cum SA (1000 m2)	55.00	17.68	26.11

Plan: Plan 06 Eastern 1 RS: 19 Profile: 100 year

E.G. Elev (m)	418.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	417.94	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	417.94	Flow Area (m2)	4.27	11.40	11.99
E.G. Slope (m/m)	0.010100	Area (m2)	4.27	11.40	11.99
Q Total (m3/s)	61.68	Flow (m3/s)	5.61	37.79	18.28
Top Width (m)	35.12	Top Width (m)	8.03	9.00	18.10
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.31	3.32	1.52
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.53	1.27	0.66
Conv. Total (m3/s)	613.7	Conv. (m3/s)	55.8	376.0	181.9
Length Wtd. (m)	1.00	Wetted Per. (m)	8.09	9.18	18.16
Min Ch El (m)	416.43	Shear (N/m2)	52.33	122.91	65.41

Plan: Plan 06 Eastern 1 RS: 19 Profile: 100 year (Continued)

Alpha	1.52	Stream Power (N/m s)	68.74	407.55	99.71
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	52.48	25.59	28.74
C & E Loss (m)	0.00	Cum SA (1000 m2)	54.73	17.43	25.88

Plan: Plan 06 Eastern 1 RS: 18.5 Profile: 100 year

E.G. Elev (m)	417.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	417.44	Reach Len. (m)	48.30	55.10	58.50
Crit W.S. (m)	417.44	Flow Area (m2)	4.27	11.40	11.99
E.G. Slope (m/m)	0.010095	Area (m2)	4.27	11.40	11.99
Q Total (m3/s)	61.68	Flow (m3/s)	5.61	37.79	18.28
Top Width (m)	35.12	Top Width (m)	8.03	9.00	18.10
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.31	3.32	1.52
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.53	1.27	0.66
Conv. Total (m3/s)	613.9	Conv. (m3/s)	55.8	376.2	181.9
Length Wtd. (m)	54.43	Wetted Per. (m)	8.09	9.18	18.16
Min Ch El (m)	415.93	Shear (N/m2)	52.30	122.87	65.38
Alpha	1.52	Stream Power (N/m s)	68.69	407.34	99.64
Frctn Loss (m)	0.55	Cum Volume (1000 m3)	52.48	25.58	28.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	54.72	17.42	25.86

Plan: Plan 06 Eastern 1 RS: 18 Profile: 100 year

E.G. Elev (m)	417.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	416.84	Reach Len. (m)	3.90	25.70	38.70
Crit W.S. (m)	416.84	Flow Area (m2)	12.03	11.41	4.19
E.G. Slope (m/m)	0.010087	Area (m2)	12.03	11.41	4.19
Q Total (m3/s)	61.68	Flow (m3/s)	18.35	37.85	5.47
Top Width (m)	35.02	Top Width (m)	18.12	9.00	7.91
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.53	3.32	1.31
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.66	1.27	0.53
Conv. Total (m3/s)	614.1	Conv. (m3/s)	182.7	376.9	54.5
Length Wtd. (m)	22.65	Wetted Per. (m)	18.18	9.18	7.97
Min Ch El (m)	415.32	Shear (N/m2)	65.47	122.92	51.97
Alpha	1.52	Stream Power (N/m s)	99.87	407.70	67.98
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	52.09	24.95	28.26
C & E Loss (m)	0.00	Cum SA (1000 m2)	54.09	16.93	25.10

Plan: Plan 06 Eastern 1 RS: 17 Profile: 100 year

E.G. Elev (m)	416.94	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	416.56	Reach Len. (m)	74.40	61.30	36.60
Crit W.S. (m)	416.56	Flow Area (m2)	7.16	11.38	9.19
E.G. Slope (m/m)	0.010127	Area (m2)	7.16	11.38	9.19
Q Total (m3/s)	61.68	Flow (m3/s)	10.29	37.76	13.63
Top Width (m)	35.28	Top Width (m)	11.81	9.00	14.46
Vel Total (m/s)	2.22	Avg. Vel. (m/s)	1.44	3.32	1.48
Max Chl Dpth (m)	1.51	Hydr. Depth (m)	0.61	1.26	0.64
Conv. Total (m3/s)	612.9	Conv. (m3/s)	102.3	375.2	135.4
Length Wtd. (m)	56.29	Wetted Per. (m)	11.87	9.18	14.52
Min Ch El (m)	415.04	Shear (N/m2)	59.91	123.07	62.83
Alpha	1.53	Stream Power (N/m s)	86.08	408.26	93.20
Frctn Loss (m)	0.57	Cum Volume (1000 m3)	52.05	24.66	28.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	54.03	16.69	24.67

Plan: Plan 06 Eastern 1 RS: 16 Profile: 100 year

E.G. Elev (m)	416.28	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	415.89	Reach Len. (m)	34.80	21.10	0.80
Crit W.S. (m)	415.89	Flow Area (m2)	3.58	11.43	12.57
E.G. Slope (m/m)	0.010070	Area (m2)	3.58	11.43	12.57
Q Total (m3/s)	61.68	Flow (m3/s)	4.52	37.91	19.25
Top Width (m)	34.90	Top Width (m)	7.12	9.00	18.79
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.26	3.32	1.53
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.50	1.27	0.67
Conv. Total (m3/s)	614.7	Conv. (m3/s)	45.1	377.8	191.8
Length Wtd. (m)	17.05	Wetted Per. (m)	7.18	9.18	18.85
Min Ch El (m)	414.37	Shear (N/m2)	49.29	122.88	65.84
Alpha	1.52	Stream Power (N/m s)	62.25	407.56	100.85
Frctn Loss (m)	0.17	Cum Volume (1000 m3)	51.65	23.96	27.60
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.33	16.14	24.06

Plan: Plan 06 Eastern 1 RS: 15 Profile: 100 year

E.G. Elev (m)	416.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.38	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	415.65	Reach Len. (m)	28.60	30.10	27.90
Crit W.S. (m)	415.65	Flow Area (m2)	6.56	11.37	9.84
E.G. Slope (m/m)	0.010132	Area (m2)	6.56	11.37	9.84
Q Total (m3/s)	61.68	Flow (m3/s)	9.30	37.68	14.70
Top Width (m)	35.38	Top Width (m)	11.04	9.00	15.34
Vel Total (m/s)	2.22	Avg. Vel. (m/s)	1.42	3.31	1.49
Max Chl Dpth (m)	1.51	Hydr. Depth (m)	0.59	1.26	0.64
Conv. Total (m3/s)	612.8	Conv. (m3/s)	92.4	374.3	146.0
Length Wtd. (m)		Wetted Per. (m)	11.10	9.18	15.40
Min Ch El (m)	414.14	Shear (N/m2)	58.72	122.96	63.49
Alpha	1.53	Stream Power (N/m s)	83.26	407.59	94.82
Frctn Loss (m)		Cum Volume (1000 m3)	51.47	23.72	27.59
C & E Loss (m)		Cum SA (1000 m2)	53.01	15.95	24.05

Plan: Plan 06 Eastern 1 RS: 14 Profile: 100 year

E.G. Elev (m)	415.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	415.33	Reach Len. (m)	1.60	24.40	40.80
Crit W.S. (m)	415.33	Flow Area (m2)	13.22	11.43	2.91
E.G. Slope (m/m)	0.010053	Area (m2)	13.22	11.43	2.91
Q Total (m3/s)	61.68	Flow (m3/s)	20.32	37.87	3.49
Top Width (m)	34.88	Top Width (m)	19.64	9.00	6.25
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.54	3.31	1.20
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.67	1.27	0.47
Conv. Total (m3/s)	615.2	Conv. (m3/s)	202.6	377.7	34.8
Length Wtd. (m)	18.46	Wetted Per. (m)	19.70	9.18	6.31
Min Ch El (m)	413.81	Shear (N/m2)	66.16	122.67	45.52
Alpha	1.52	Stream Power (N/m s)	101.70	406.53	54.54
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	51.19	23.38	27.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	52.57	15.68	23.75

Plan: Plan 06 Eastern 1 RS: 13 Profile: 100 year

E.G. Elev (m)	415.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	415.06	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	415.06	Flow Area (m2)	11.96	11.44	4.19
E.G. Slope (m/m)	0.010075	Area (m2)	11.96	11.44	4.19
Q Total (m3/s)	61.68	Flow (m3/s)	18.24	37.96	5.48

Plan: Plan 06 Eastern 1 RS: 13 Profile: 100 year (Continued)

Top Width (m)	34.88	Top Width (m)	17.98	9.00	7.90
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.53	3.32	1.31
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.66	1.27	0.53
Conv. Total (m3/s)	614.5	Conv. (m3/s)	181.8	378.1	54.6
Length Wtd. (m)	1.00	Wetted Per. (m)	18.04	9.18	7.96
Min Ch El (m)	413.54	Shear (N/m2)	65.48	123.02	51.98
Alpha	1.52	Stream Power (N/m s)	99.91	408.31	68.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	51.17	23.10	27.27
C & E Loss (m)	0.00	Cum SA (1000 m2)	52.54	15.46	23.46

Plan: Plan 06 Eastern 1 RS: 12.5 Profile: 100 year

E.G. Elev (m)	414.95	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	414.56	Reach Len. (m)	8.10	24.10	36.90
Crit W.S. (m)	414.56	Flow Area (m2)	11.95	11.43	4.19
E.G. Slope (m/m)	0.010080	Area (m2)	11.95	11.43	4.19
Q Total (m3/s)	61.68	Flow (m3/s)	18.25	37.95	5.48
Top Width (m)	34.88	Top Width (m)	17.98	9.00	7.90
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.53	3.32	1.31
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.66	1.27	0.53
Conv. Total (m3/s)	614.3	Conv. (m3/s)	181.7	378.0	54.6
Length Wtd. (m)	21.67	Wetted Per. (m)	18.04	9.18	7.96
Min Ch El (m)	413.04	Shear (N/m2)	65.51	123.05	52.01
Alpha	1.52	Stream Power (N/m s)	99.98	408.48	68.06
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	51.16	23.09	27.27
C & E Loss (m)	0.00	Cum SA (1000 m2)	52.52	15.45	23.45

Plan: Plan 06 Eastern 1 RS: 12 Profile: 100 year

E.G. Elev (m)	414.68	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	414.29	Reach Len. (m)	36.50	31.50	22.10
Crit W.S. (m)	414.29	Flow Area (m2)	8.96	11.43	7.26
E.G. Slope (m/m)	0.010105	Area (m2)	8.96	11.43	7.26
Q Total (m3/s)	61.68	Flow (m3/s)	13.27	37.95	10.46
Top Width (m)	35.00	Top Width (m)	14.10	9.00	11.89
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.48	3.32	1.44
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.64	1.27	0.61
Conv. Total (m3/s)	613.6	Conv. (m3/s)	132.0	377.6	104.1
Length Wtd. (m)	29.89	Wetted Per. (m)	14.16	9.18	11.95
Min Ch El (m)	412.77	Shear (N/m2)	62.66	123.26	60.15
Alpha	1.53	Stream Power (N/m s)	92.82	409.46	86.71
Frctn Loss (m)	0.30	Cum Volume (1000 m3)	51.07	22.81	27.05
C & E Loss (m)	0.00	Cum SA (1000 m2)	52.39	15.24	23.08

Plan: Plan 06 Eastern 1 RS: 11 Profile: 100 year

E.G. Elev (m)	414.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.95	Reach Len. (m)	35.80	23.20	1.80
Crit W.S. (m)	413.95	Flow Area (m2)	3.22	11.43	12.94
E.G. Slope (m/m)	0.010060	Area (m2)	3.22	11.43	12.94
Q Total (m3/s)	61.68	Flow (m3/s)	3.96	37.87	19.85
Top Width (m)	34.92	Top Width (m)	6.64	9.00	19.27
Vel Total (m/s)	2.24	Avg. Vel. (m/s)	1.23	3.31	1.53
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.48	1.27	0.67
Conv. Total (m3/s)	615.0	Conv. (m3/s)	39.5	377.6	197.9
Length Wtd. (m)	17.38	Wetted Per. (m)	6.70	9.18	19.33
Min Ch El (m)	412.43	Shear (N/m2)	47.35	122.72	66.00

Plan: Plan 06 Eastern 1 RS: 11 Profile: 100 year (Continued)

Alpha	1.52	Stream Power (N/m s)	58.23	406.76	101.28
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	50.85	22.45	26.83
C & E Loss (m)	0.00	Cum SA (1000 m2)	52.01	14.95	22.74

Plan: Plan 06 Eastern 1 RS: 10 Profile: 100 year

E.G. Elev (m)	414.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.69	Reach Len. (m)	102.50	111.10	109.80
Crit W.S. (m)	413.69	Flow Area (m2)	3.84	11.41	12.38
E.G. Slope (m/m)	0.010084	Area (m2)	3.84	11.41	12.38
Q Total (m3/s)	61.68	Flow (m3/s)	4.92	37.84	18.92
Top Width (m)	35.03	Top Width (m)	7.45	9.00	18.57
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.28	3.32	1.53
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.51	1.27	0.67
Conv. Total (m3/s)	614.2	Conv. (m3/s)	49.0	376.8	188.4
Length Wtd. (m)	109.85	Wetted Per. (m)	7.51	9.18	18.63
Min Ch El (m)	412.17	Shear (N/m2)	50.50	122.86	65.67
Alpha	1.52	Stream Power (N/m s)	64.79	407.36	100.40
Frctn Loss (m)	1.11	Cum Volume (1000 m3)	50.72	22.19	26.81
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.76	14.74	22.70

Plan: Plan 06 Eastern 1 RS: 9 Profile: 100 year

E.G. Elev (m)	412.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	412.47	Reach Len. (m)	39.60	26.20	6.10
Crit W.S. (m)	412.47	Flow Area (m2)	5.57	11.44	10.60
E.G. Slope (m/m)	0.010086	Area (m2)	5.57	11.44	10.60
Q Total (m3/s)	61.68	Flow (m3/s)	7.70	37.98	16.00
Top Width (m)	34.91	Top Width (m)	9.69	9.00	16.22
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.38	3.32	1.51
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.57	1.27	0.65
Conv. Total (m3/s)	614.2	Conv. (m3/s)	76.7	378.2	159.3
Length Wtd. (m)	22.25	Wetted Per. (m)	9.75	9.18	16.28
Min Ch El (m)	410.95	Shear (N/m2)	56.48	123.16	64.40
Alpha	1.53	Stream Power (N/m s)	78.09	409.01	97.17
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	50.24	20.92	25.55
C & E Loss (m)	0.00	Cum SA (1000 m2)	50.88	13.74	20.79

Plan: Plan 06 Eastern 1 RS: 8 Profile: 100 year

E.G. Elev (m)	412.57	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	412.18	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	412.18	Flow Area (m2)	4.67	11.42	11.53
E.G. Slope (m/m)	0.010088	Area (m2)	4.67	11.42	11.53
Q Total (m3/s)	61.68	Flow (m3/s)	6.25	37.90	17.53
Top Width (m)	35.00	Top Width (m)	8.54	9.00	17.46
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.34	3.32	1.52
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.55	1.27	0.66
Conv. Total (m3/s)	614.1	Conv. (m3/s)	62.3	377.3	174.5
Length Wtd. (m)	1.00	Wetted Per. (m)	8.60	9.18	17.52
Min Ch El (m)	410.67	Shear (N/m2)	53.77	123.00	65.12
Alpha	1.53	Stream Power (N/m s)	71.94	408.14	98.98
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	50.04	20.62	25.48
C & E Loss (m)	0.00	Cum SA (1000 m2)	50.52	13.51	20.69

Plan: Plan 06 Eastern 1 RS: 7.5 Profile: 100 year

E.G. Elev (m)	412.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	411.69	Reach Len. (m)	54.10	63.20	62.40
Crit W.S. (m)	411.69	Flow Area (m2)	4.67	11.42	11.53
E.G. Slope (m/m)	0.010088	Area (m2)	4.67	11.42	11.53
Q Total (m3/s)	61.68	Flow (m3/s)	6.25	37.90	17.53
Top Width (m)	35.00	Top Width (m)	8.54	9.00	17.46
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.34	3.32	1.52
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.55	1.27	0.66
Conv. Total (m3/s)	614.1	Conv. (m3/s)	62.3	377.3	174.5
Length Wtd. (m)	61.30	Wetted Per. (m)	8.60	9.18	17.52
Min Ch El (m)	410.17	Shear (N/m2)	53.77	123.00	65.12
Alpha	1.53	Stream Power (N/m s)	71.94	408.14	98.98
Frctn Loss (m)	0.62	Cum Volume (1000 m3)	50.04	20.61	25.47
C & E Loss (m)	0.00	Cum SA (1000 m2)	50.51	13.50	20.67

Plan: Plan 06 Eastern 1 RS: 7 Profile: 100 year

E.G. Elev (m)	411.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.38	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.98	Reach Len. (m)	16.00	35.40	48.60
Crit W.S. (m)	410.98	Flow Area (m2)	11.43	11.35	5.02
E.G. Slope (m/m)	0.010116	Area (m2)	11.43	11.35	5.02
Q Total (m3/s)	61.68	Flow (m3/s)	17.30	37.58	6.80
Top Width (m)	35.48	Top Width (m)	17.44	9.00	9.03
Vel Total (m/s)	2.22	Avg. Vel. (m/s)	1.51	3.31	1.35
Max Chl Dpth (m)	1.51	Hydr. Depth (m)	0.66	1.26	0.56
Conv. Total (m3/s)	613.3	Conv. (m3/s)	172.0	373.6	67.6
Length Wtd. (m)	32.59	Wetted Per. (m)	17.50	9.18	9.09
Min Ch El (m)	409.47	Shear (N/m2)	64.77	122.63	54.80
Alpha	1.53	Stream Power (N/m s)	98.05	405.88	74.22
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	49.60	19.89	24.95
C & E Loss (m)	0.05	Cum SA (1000 m2)	49.81	12.93	19.85

Plan: Plan 06 Eastern 1 RS: 6 Profile: 100 year

E.G. Elev (m)	411.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.21	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.86	Reach Len. (m)	34.20	26.80	14.70
Crit W.S. (m)		Flow Area (m2)	12.05	13.74	11.28
E.G. Slope (m/m)	0.004565	Area (m2)	12.05	13.74	11.28
Q Total (m3/s)	61.68	Flow (m3/s)	14.01	34.70	12.98
Top Width (m)	38.29	Top Width (m)	15.02	9.00	14.27
Vel Total (m/s)	1.66	Avg. Vel. (m/s)	1.16	2.53	1.15
Max Chl Dpth (m)	1.78	Hydr. Depth (m)	0.80	1.53	0.79
Conv. Total (m3/s)	912.9	Conv. (m3/s)	207.3	513.5	192.1
Length Wtd. (m)	24.95	Wetted Per. (m)	15.10	9.18	14.35
Min Ch El (m)	409.08	Shear (N/m2)	35.72	66.97	35.18
Alpha	1.51	Stream Power (N/m s)	41.52	169.11	40.49
Frctn Loss (m)	0.08	Cum Volume (1000 m3)	49.41	19.44	24.56
C & E Loss (m)	0.02	Cum SA (1000 m2)	49.55	12.61	19.28

Plan: Plan 06 Eastern 1 RS: 5 Profile: 100 year

E.G. Elev (m)	410.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.82	Reach Len. (m)	79.60	66.40	49.20
Crit W.S. (m)		Flow Area (m2)	10.52	16.06	20.75
E.G. Slope (m/m)	0.002601	Area (m2)	10.52	16.06	20.75
Q Total (m3/s)	61.68	Flow (m3/s)	8.26	33.97	19.45

Plan: Plan 06 Eastern 1 RS: 5 Profile: 100 year (Continued)

Top Width (m)	47.95	Top Width (m)	15.49	9.00	23.45
Vel Total (m/s)	1.30	Avg. Vel. (m/s)	0.78	2.11	0.94
Max Chl Dpth (m)	2.03	Hydr. Depth (m)	0.68	1.78	0.88
Conv. Total (m3/s)	1209.3	Conv. (m3/s)	162.0	665.9	381.4
Length Wtd. (m)	62.12	Wetted Per. (m)	15.59	9.18	23.55
Min Ch El (m)	408.79	Shear (N/m2)	17.22	44.60	22.48
Alpha	1.66	Stream Power (N/m s)	13.52	94.34	21.07
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	49.03	19.04	24.32
C & E Loss (m)	0.03	Cum SA (1000 m2)	49.03	12.37	19.00

Plan: Plan 06 Eastern 1 RS: 4 Profile: 100 year

E.G. Elev (m)	410.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.84	Reach Len. (m)	34.80	24.60	5.80
Crit W.S. (m)		Flow Area (m2)	22.80	22.79	46.79
E.G. Slope (m/m)	0.000463	Area (m2)	22.80	22.79	46.79
Q Total (m3/s)	61.68	Flow (m3/s)	10.41	25.68	25.59
Top Width (m)	60.94	Top Width (m)	20.07	9.00	31.87
Vel Total (m/s)	0.67	Avg. Vel. (m/s)	0.46	1.13	0.55
Max Chl Dpth (m)	2.78	Hydr. Depth (m)	1.14	2.53	1.47
Conv. Total (m3/s)	2867.1	Conv. (m3/s)	483.9	1193.9	1189.3
Length Wtd. (m)	19.86	Wetted Per. (m)	20.85	9.18	32.65
Min Ch El (m)	408.06	Shear (N/m2)	4.96	11.26	6.50
Alpha	1.54	Stream Power (N/m s)	2.27	12.69	3.56
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	47.70	17.75	22.66
C & E Loss (m)	0.00	Cum SA (1000 m2)	47.61	11.77	17.64

Plan: Plan 06 Eastern 1 RS: 3 Profile: 100 year

E.G. Elev (m)	410.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.84	Reach Len. (m)	36.40	36.30	36.60
Crit W.S. (m)		Flow Area (m2)	39.45	25.23	45.28
E.G. Slope (m/m)	0.000280	Area (m2)	39.45	25.23	45.28
Q Total (m3/s)	61.68	Flow (m3/s)	17.43	23.65	20.61
Top Width (m)	61.41	Top Width (m)	24.94	9.00	27.47
Vel Total (m/s)	0.56	Avg. Vel. (m/s)	0.44	0.94	0.46
Max Chl Dpth (m)	3.05	Hydr. Depth (m)	1.58	2.80	1.65
Conv. Total (m3/s)	3688.9	Conv. (m3/s)	1042.2	1414.2	1232.5
Length Wtd. (m)	36.42	Wetted Per. (m)	25.99	9.18	28.52
Min Ch El (m)	407.79	Shear (N/m2)	4.16	7.53	4.35
Alpha	1.47	Stream Power (N/m s)	1.84	7.06	1.98
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	46.62	17.16	22.39
C & E Loss (m)	0.00	Cum SA (1000 m2)	46.83	11.55	17.47

Plan: Plan 06 Eastern 1 RS: 2 Profile: 100 year

E.G. Elev (m)	410.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.84	Reach Len. (m)	12.00	28.10	39.70
Crit W.S. (m)		Flow Area (m2)	67.73	28.81	36.70
E.G. Slope (m/m)	0.000153	Area (m2)	67.73	28.81	36.70
Q Total (m3/s)	61.68	Flow (m3/s)	26.97	21.82	12.89
Top Width (m)	60.99	Top Width (m)	31.74	9.00	20.25
Vel Total (m/s)	0.46	Avg. Vel. (m/s)	0.40	0.76	0.35
Max Chl Dpth (m)	3.45	Hydr. Depth (m)	2.13	3.20	1.81
Conv. Total (m3/s)	4985.2	Conv. (m3/s)	2179.5	1763.9	1041.8
Length Wtd. (m)	24.34	Wetted Per. (m)	33.19	9.18	21.70
Min Ch El (m)	407.39	Shear (N/m2)	3.06	4.71	2.54

Plan: Plan 06 Eastern 1 RS: 2 Profile: 100 year (Continued)

Alpha	1.39	Stream Power (N/m s)	1.22	3.57	0.89
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	44.67	16.18	20.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.80	11.22	16.60

Plan: Plan 06 Eastern 1 RS: 1 Profile: 100 year

E.G. Elev (m)	410.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.85	Reach Len. (m)	21.50	44.70	60.50
Crit W.S. (m)		Flow Area (m2)	83.12	36.01	64.95
E.G. Slope (m/m)	0.000057	Area (m2)	83.12	36.01	64.95
Q Total (m3/s)	61.68	Flow (m3/s)	24.20	19.36	18.12
Top Width (m)	61.57	Top Width (m)	28.88	9.00	23.69
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.29	0.54	0.28
Max Chl Dpth (m)	4.25	Hydr. Depth (m)	2.88	4.00	2.74
Conv. Total (m3/s)	8153.2	Conv. (m3/s)	3199.5	2558.5	2395.1
Length Wtd. (m)	42.05	Wetted Per. (m)	31.13	9.18	25.94
Min Ch El (m)	406.60	Shear (N/m2)	1.50	2.20	1.41
Alpha	1.31	Stream Power (N/m s)	0.44	1.18	0.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	43.76	15.27	18.87
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.44	10.97	15.73

Plan: Plan 06 Eastern 1 RS: 0 Profile: 100 year

E.G. Elev (m)	410.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	410.85	Reach Len. (m)	272.10	41.80	179.80
Crit W.S. (m)		Flow Area (m2)	76.53	40.43	95.49
E.G. Slope (m/m)	0.000036	Area (m2)	76.53	40.43	95.49
Q Total (m3/s)	61.68	Flow (m3/s)	18.73	18.69	24.26
Top Width (m)	61.11	Top Width (m)	23.68	9.00	28.43
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.24	0.46	0.25
Max Chl Dpth (m)	4.74	Hydr. Depth (m)	3.23	4.49	3.36
Conv. Total (m3/s)	10240.9	Conv. (m3/s)	3110.1	3102.3	4028.4
Length Wtd. (m)	130.25	Wetted Per. (m)	26.42	9.18	31.17
Min Ch El (m)	406.10	Shear (N/m2)	1.03	1.57	1.09
Alpha	1.28	Stream Power (N/m s)	0.25	0.72	0.28
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	42.04	13.56	14.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	44.87	10.57	14.15

Plan: Plan 06 Eastern 1 RS: -1 Profile: 100 year

E.G. Elev (m)	410.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.100	0.050	0.100
W.S. Elev (m)	410.84	Reach Len. (m)	24.00	24.00	24.00
Crit W.S. (m)		Flow Area (m2)	178.02	174.43	37.39
E.G. Slope (m/m)	0.000044	Area (m2)	178.02	174.43	37.39
Q Total (m3/s)	61.68	Flow (m3/s)	12.69	46.62	2.37
Top Width (m)	257.89	Top Width (m)	158.51	59.86	39.52
Vel Total (m/s)	0.16	Avg. Vel. (m/s)	0.07	0.27	0.06
Max Chl Dpth (m)	4.75	Hydr. Depth (m)	1.12	2.91	0.95
Conv. Total (m3/s)	9351.1	Conv. (m3/s)	1923.3	7067.7	360.1
Length Wtd. (m)	24.00	Wetted Per. (m)	158.53	60.49	39.57
Min Ch El (m)	406.09	Shear (N/m2)	0.48	1.23	0.40
Alpha	2.20	Stream Power (N/m s)	0.03	0.33	0.03
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	7.41	9.07	2.07
C & E Loss (m)	0.00	Cum SA (1000 m2)	20.08	9.13	8.04

Plan: Plan 06 Eastern 1 RS: -2 Profile: 100 year

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	5.00	5.00	5.00
Crit W.S. (m)		Flow Area (m2)	301.57	118.73	91.71
E.G. Slope (m/m)	0.000031	Area (m2)	301.57	118.73	91.71
Q Total (m3/s)	61.68	Flow (m3/s)	23.98	31.51	6.19
Top Width (m)	316.49	Top Width (m)	205.28	31.42	79.80
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.08	0.27	0.07
Max Chl Dpth (m)	4.86	Hydr. Depth (m)	1.47	3.78	1.15
Conv. Total (m3/s)	11138.6	Conv. (m3/s)	4329.9	5691.1	1117.7
Length Wtd. (m)	5.00	Wetted Per. (m)	205.30	32.00	79.83
Min Ch El (m)	405.99	Shear (N/m2)	0.44	1.12	0.35
Alpha	2.68	Stream Power (N/m s)	0.04	0.30	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	1.66	5.55	0.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	15.72	8.03	6.61

Plan: Plan 06 Eastern 1 RS: -3 Profile: 100 year

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	9.00	9.00	9.00
Crit W.S. (m)	406.28	Flow Area (m2)	361.56	125.44	118.54
E.G. Slope (m/m)	0.000017	Area (m2)	361.56	125.44	118.54
Q Total (m3/s)	61.68	Flow (m3/s)	23.55	31.57	6.56
Top Width (m)	321.98	Top Width (m)	211.04	23.00	87.94
Vel Total (m/s)	0.10	Avg. Vel. (m/s)	0.07	0.25	0.06
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.71	5.45	1.35
Conv. Total (m3/s)	15059.6	Conv. (m3/s)	5750.0	7709.1	1600.5
Length Wtd. (m)	9.00	Wetted Per. (m)	211.15	23.29	88.50
Min Ch El (m)	405.16	Shear (N/m2)	0.28	0.89	0.22
Alpha	3.31	Stream Power (N/m s)	0.02	0.22	0.01
Frctn Loss (m)		Cum Volume (1000 m3)		4.94	
C & E Loss (m)		Cum SA (1000 m2)	14.68	7.90	6.19

Plan: Plan 06 Eastern 1 RS: -4 Profile: 100 year

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	7.50	7.50	7.50
Crit W.S. (m)		Flow Area (m2)	390.92	125.39	125.18
E.G. Slope (m/m)	0.000015	Area (m2)	390.92	125.39	125.18
Q Total (m3/s)	61.68	Flow (m3/s)	25.12	29.88	6.68
Top Width (m)	327.95	Top Width (m)	214.67	23.00	90.28
Vel Total (m/s)	0.10	Avg. Vel. (m/s)	0.06	0.24	0.05
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.82	5.45	1.39
Conv. Total (m3/s)	15903.3	Conv. (m3/s)	6475.7	7704.8	1722.8
Length Wtd. (m)	7.50	Wetted Per. (m)	214.74	23.29	90.80
Min Ch El (m)	405.16	Shear (N/m2)	0.27	0.79	0.20
Alpha	3.19	Stream Power (N/m s)	0.02	0.19	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	5.61	3.19	1.93
C & E Loss (m)	0.00	Cum SA (1000 m2)	12.76	7.69	5.39

Plan: Plan 06 Eastern 1 RS: -5 Profile: 100 year

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.050	0.080
W.S. Elev (m)	410.84	Reach Len. (m)	7.00	7.00	7.00
Crit W.S. (m)		Flow Area (m2)	375.94	122.09	121.33
E.G. Slope (m/m)	0.000018	Area (m2)	375.94	122.09	121.33
Q Total (m3/s)	61.68	Flow (m3/s)	28.46	25.35	7.86

Plan: Plan 06 Eastern 1 RS: -5 Profile: 100 year (Continued)

Top Width (m)	343.41	Top Width (m)	221.66	31.42	90.32
Vel Total (m/s)	0.10	Avg. Vel. (m/s)	0.08	0.21	0.06
Max Chl Dpth (m)	5.19	Hydr. Depth (m)	1.70	3.89	1.34
Conv. Total (m3/s)	14481.3	Conv. (m3/s)	6682.7	5952.6	1846.0
Length Wtd. (m)	7.00	Wetted Per. (m)	221.68	32.07	90.36
Min Ch El (m)	405.65	Shear (N/m2)	0.30	0.68	0.24
Alpha	2.11	Stream Power (N/m s)	0.02	0.14	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	2.74	2.26	1.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	11.13	7.49	4.71

Plan: Plan 06 Eastern 1 RS: -6 Profile: 100 year

E.G. Elev (m)	410.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.090	0.050	0.090
W.S. Elev (m)	410.84	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	405.84	Flow Area (m2)	405.61	116.39	165.73
E.G. Slope (m/m)	0.000014	Area (m2)	405.61	116.39	165.73
Q Total (m3/s)	61.68	Flow (m3/s)	25.30	26.88	9.50
Top Width (m)	350.22	Top Width (m)	225.47	20.26	104.50
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.06	0.23	0.06
Max Chl Dpth (m)	6.38	Hydr. Depth (m)	1.80	5.75	1.59
Conv. Total (m3/s)	16251.3	Conv. (m3/s)	6665.5	7082.9	2502.9
Length Wtd. (m)	15.00	Wetted Per. (m)	225.51	21.93	104.59
Min Ch El (m)	404.46	Shear (N/m2)	0.25	0.75	0.22
Alpha	3.15	Stream Power (N/m s)	0.02	0.17	0.01
Frctn Loss (m)		Cum Volume (1000 m3)		1.43	
C & E Loss (m)		Cum SA (1000 m2)	9.56	7.31	4.03

Plan: Plan 06 Eastern 1 RS: -7 Profile: 100 year

E.G. Elev (m)	408.95	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.050	0.080
W.S. Elev (m)	408.93	Reach Len. (m)	124.97	98.70	132.70
Crit W.S. (m)		Flow Area (m2)	87.51	77.89	28.54
E.G. Slope (m/m)	0.000163	Area (m2)	87.51	77.89	28.54
Q Total (m3/s)	61.68	Flow (m3/s)	11.82	46.44	3.42
Top Width (m)	176.63	Top Width (m)	112.45	20.26	43.93
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.14	0.60	0.12
Max Chl Dpth (m)	4.47	Hydr. Depth (m)	0.78	3.84	0.65
Conv. Total (m3/s)	4826.7	Conv. (m3/s)	925.3	3634.0	267.4
Length Wtd. (m)	102.16	Wetted Per. (m)	112.47	21.86	43.98
Min Ch El (m)	404.46	Shear (N/m2)	1.25	5.71	1.04
Alpha	2.69	Stream Power (N/m s)	0.17	3.40	0.12
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	5.47	6.15	1.89
C & E Loss (m)	0.01	Cum SA (1000 m2)	7.03	7.00	2.91

Plan: Plan 06 Eastern 1 RS: -8 Profile: 100 year

E.G. Elev (m)	408.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.040	
W.S. Elev (m)	408.80	Reach Len. (m)			
Crit W.S. (m)	408.69	Flow Area (m2)		46.70	
E.G. Slope (m/m)	0.010004	Area (m2)		46.70	
Q Total (m3/s)	61.68	Flow (m3/s)		61.68	
Top Width (m)	121.65	Top Width (m)		121.65	
Vel Total (m/s)	1.32	Avg. Vel. (m/s)		1.32	
Max Chl Dpth (m)	0.66	Hydr. Depth (m)		0.38	
Conv. Total (m3/s)	616.7	Conv. (m3/s)		616.7	
Length Wtd. (m)		Wetted Per. (m)		121.66	
Min Ch El (m)	408.14	Shear (N/m2)		37.66	

Plan: Plan 06 Eastern 1 RS: -8 Profile: 100 year (Continued)

Alpha	1.00	Stream Power (N/m s)		49.74	
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

Plan: Plan 06 Murragamba 1 RS: 126 Profile: 100 year

E.G. Elev (m)	490.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	490.62	Reach Len. (m)	90.80	98.90	105.80
Crit W.S. (m)	490.62	Flow Area (m2)	5.91	14.49	4.89
E.G. Slope (m/m)	0.008199	Area (m2)	5.91	14.49	4.89
Q Total (m3/s)	52.60	Flow (m3/s)	6.15	41.41	5.04
Top Width (m)	37.04	Top Width (m)	13.50	12.20	11.34
Vel Total (m/s)	2.08	Avg. Vel. (m/s)	1.04	2.86	1.03
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.43
Conv. Total (m3/s)	580.9	Conv. (m3/s)	67.9	457.4	55.6
Length Wtd. (m)	98.41	Wetted Per. (m)	13.56	12.48	11.40
Min Ch El (m)	489.00	Shear (N/m2)	35.04	93.34	34.49
Alpha	1.54	Stream Power (N/m s)	36.47	266.74	35.53
Frctn Loss (m)	0.81	Cum Volume (1000 m3)	113.46	185.62	83.85
C & E Loss (m)	0.00	Cum SA (1000 m2)	166.70	124.28	146.26

Plan: Plan 06 Murragamba 1 RS: 125 Profile: 100 year

E.G. Elev (m)	490.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	489.68	Reach Len. (m)	52.00	52.40	49.60
Crit W.S. (m)	489.68	Flow Area (m2)	7.03	14.52	3.45
E.G. Slope (m/m)	0.008248	Area (m2)	7.03	14.52	3.45
Q Total (m3/s)	52.60	Flow (m3/s)	7.43	41.68	3.50
Top Width (m)	36.21	Top Width (m)	15.78	12.20	8.24
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.06	2.87	1.01
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.42
Conv. Total (m3/s)	579.2	Conv. (m3/s)	81.8	458.9	38.5
Length Wtd. (m)	52.02	Wetted Per. (m)	15.83	12.48	8.29
Min Ch El (m)	488.05	Shear (N/m2)	35.89	94.09	33.68
Alpha	1.53	Stream Power (N/m s)	37.93	270.04	34.11
Frctn Loss (m)	0.43	Cum Volume (1000 m3)	112.88	184.19	83.40
C & E Loss (m)	0.00	Cum SA (1000 m2)	165.37	123.07	145.22

Plan: Plan 06 Murragamba 1 RS: 124 Profile: 100 year

E.G. Elev (m)	489.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	489.18	Reach Len. (m)	56.40	47.00	32.60
Crit W.S. (m)	489.18	Flow Area (m2)	1.46	14.52	9.03
E.G. Slope (m/m)	0.008233	Area (m2)	1.46	14.52	9.03
Q Total (m3/s)	52.60	Flow (m3/s)	1.33	41.65	9.62
Top Width (m)	36.24	Top Width (m)	4.04	12.20	20.00
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	0.91	2.87	1.07
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.36	1.19	0.45
Conv. Total (m3/s)	579.7	Conv. (m3/s)	14.7	459.0	106.0
Length Wtd. (m)	45.07	Wetted Per. (m)	4.10	12.48	20.06
Min Ch El (m)	487.55	Shear (N/m2)	28.81	93.93	36.34
Alpha	1.52	Stream Power (N/m s)	26.31	269.36	38.73
Frctn Loss (m)	0.37	Cum Volume (1000 m3)	112.65	183.43	83.09
C & E Loss (m)	0.00	Cum SA (1000 m2)	164.85	122.43	144.52

Plan: Plan 06 Murragamba 1 RS: 123 Profile: 100 year

E.G. Elev (m)	489.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	488.73	Reach Len. (m)	23.00	40.40	48.20
Crit W.S. (m)	488.73	Flow Area (m2)	3.43	14.50	7.23
E.G. Slope (m/m)	0.008224	Area (m2)	3.43	14.50	7.23
Q Total (m3/s)	52.60	Flow (m3/s)	3.46	41.52	7.62
Top Width (m)	36.65	Top Width (m)	8.20	12.20	16.25
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.01	2.86	1.05
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.42	1.19	0.44
Conv. Total (m3/s)	580.0	Conv. (m3/s)	38.1	457.8	84.1
Length Wtd. (m)	38.79	Wetted Per. (m)	8.26	12.48	16.31
Min Ch El (m)	487.11	Shear (N/m2)	33.47	93.68	35.75
Alpha	1.53	Stream Power (N/m s)	33.78	268.23	37.70
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	112.52	182.75	82.83
C & E Loss (m)	0.00	Cum SA (1000 m2)	164.51	121.86	143.93

Plan: Plan 06 Murragamba 1 RS: 122 Profile: 100 year

E.G. Elev (m)	488.68	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	488.34	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	488.34	Flow Area (m2)	9.48	14.52	1.09
E.G. Slope (m/m)	0.008213	Area (m2)	9.48	14.52	1.09
Q Total (m3/s)	52.60	Flow (m3/s)	10.10	41.56	0.94
Top Width (m)	36.44	Top Width (m)	20.98	12.20	3.26
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.07	2.86	0.86
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.33
Conv. Total (m3/s)	580.4	Conv. (m3/s)	111.4	458.6	10.4
Length Wtd. (m)	1.00	Wetted Per. (m)	21.04	12.48	3.32
Min Ch El (m)	486.72	Shear (N/m2)	36.29	93.66	26.44
Alpha	1.53	Stream Power (N/m s)	38.66	268.18	22.81
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	112.37	182.16	82.63
C & E Loss (m)	0.00	Cum SA (1000 m2)	164.17	121.36	143.46

Plan: Plan 06 Murragamba 1 RS: 121.5 Profile: 100 year

E.G. Elev (m)	488.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	487.84	Reach Len. (m)	64.10	79.90	88.20
Crit W.S. (m)	487.84	Flow Area (m2)	9.48	14.52	1.09
E.G. Slope (m/m)	0.008213	Area (m2)	9.48	14.52	1.09
Q Total (m3/s)	52.60	Flow (m3/s)	10.10	41.56	0.94
Top Width (m)	36.44	Top Width (m)	20.98	12.20	3.26
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.07	2.86	0.86
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.33
Conv. Total (m3/s)	580.4	Conv. (m3/s)	111.4	458.6	10.4
Length Wtd. (m)	78.29	Wetted Per. (m)	21.04	12.48	3.32
Min Ch El (m)	486.22	Shear (N/m2)	36.29	93.66	26.44
Alpha	1.53	Stream Power (N/m s)	38.66	268.18	22.81
Frctn Loss (m)	0.64	Cum Volume (1000 m3)	112.36	182.14	82.63
C & E Loss (m)	0.00	Cum SA (1000 m2)	164.15	121.35	143.46

Plan: Plan 06 Murragamba 1 RS: 121 Profile: 100 year

E.G. Elev (m)	487.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	487.08	Reach Len. (m)	38.40	26.10	9.90
Crit W.S. (m)	487.08	Flow Area (m2)	4.33	14.53	6.10
E.G. Slope (m/m)	0.008259	Area (m2)	4.33	14.53	6.10
Q Total (m3/s)	52.60	Flow (m3/s)	4.46	41.73	6.41

Plan: Plan 06 Murragamba 1 RS: 121 Profile: 100 year (Continued)

Top Width (m)	36.07	Top Width (m)	10.07	12.20	13.81
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.03	2.87	1.05
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.43	1.19	0.44
Conv. Total (m3/s)	578.8	Conv. (m3/s)	49.1	459.2	70.6
Length Wtd. (m)	24.44	Wetted Per. (m)	10.13	12.48	13.87
Min Ch El (m)	485.46	Shear (N/m2)	34.60	94.25	35.63
Alpha	1.52	Stream Power (N/m s)	35.66	270.74	37.45
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	111.92	180.98	82.31
C & E Loss (m)	0.00	Cum SA (1000 m2)	163.16	120.38	142.70

Plan: Plan 06 Murragamba 1 RS: 120 Profile: 100 year

E.G. Elev (m)	487.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	486.83	Reach Len. (m)	52.40	39.80	20.60
Crit W.S. (m)	486.83	Flow Area (m2)	1.96	14.51	8.67
E.G. Slope (m/m)	0.008216	Area (m2)	1.96	14.51	8.67
Q Total (m3/s)	52.60	Flow (m3/s)	1.87	41.54	9.19
Top Width (m)	36.61	Top Width (m)	5.10	12.20	19.31
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	0.95	2.86	1.06
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.39	1.19	0.45
Conv. Total (m3/s)	580.3	Conv. (m3/s)	20.6	458.2	101.4
Length Wtd. (m)	38.00	Wetted Per. (m)	5.16	12.48	19.37
Min Ch El (m)	485.21	Shear (N/m2)	30.69	93.65	36.06
Alpha	1.53	Stream Power (N/m s)	29.23	268.10	38.25
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	111.80	180.61	82.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	162.87	120.06	142.54

Plan: Plan 06 Murragamba 1 RS: 119 Profile: 100 year

E.G. Elev (m)	486.79	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	486.45	Reach Len. (m)	37.40	46.50	53.60
Crit W.S. (m)	486.45	Flow Area (m2)	5.27	14.52	5.25
E.G. Slope (m/m)	0.008240	Area (m2)	5.27	14.52	5.25
Q Total (m3/s)	52.60	Flow (m3/s)	5.49	41.65	5.47
Top Width (m)	36.32	Top Width (m)	12.07	12.20	12.04
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.04	2.87	1.04
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.44
Conv. Total (m3/s)	579.5	Conv. (m3/s)	60.4	458.8	60.3
Length Wtd. (m)	45.81	Wetted Per. (m)	12.13	12.48	12.10
Min Ch El (m)	484.83	Shear (N/m2)	35.09	93.98	35.08
Alpha	1.53	Stream Power (N/m s)	36.53	269.57	36.52
Frctn Loss (m)	0.38	Cum Volume (1000 m3)	111.61	180.03	82.09
C & E Loss (m)	0.00	Cum SA (1000 m2)	162.42	119.57	142.22

Plan: Plan 06 Murragamba 1 RS: 118 Profile: 100 year

E.G. Elev (m)	486.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	486.00	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	486.00	Flow Area (m2)	8.06	14.52	2.42
E.G. Slope (m/m)	0.008245	Area (m2)	8.06	14.52	2.42
Q Total (m3/s)	52.60	Flow (m3/s)	8.56	41.67	2.37
Top Width (m)	36.20	Top Width (m)	17.95	12.20	6.06
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.06	2.87	0.98
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.40
Conv. Total (m3/s)	579.3	Conv. (m3/s)	94.3	458.9	26.1
Length Wtd. (m)	1.00	Wetted Per. (m)	18.00	12.48	6.11
Min Ch El (m)	484.38	Shear (N/m2)	36.19	94.06	32.02

Plan: Plan 06 Murragamba 1 RS: 118 Profile: 100 year (Continued)

Alpha	1.52	Stream Power (N/m s)	38.45	269.90	31.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	111.36	179.35	81.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	161.86	119.01	141.73

Plan: Plan 06 Murragamba 1 RS: 117.5 Profile: 100 year

E.G. Elev (m)	485.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	485.50	Reach Len. (m)	3.00	41.20	67.80
Crit W.S. (m)	485.50	Flow Area (m2)	8.06	14.52	2.42
E.G. Slope (m/m)	0.008244	Area (m2)	8.06	14.52	2.42
Q Total (m3/s)	52.60	Flow (m3/s)	8.56	41.67	2.37
Top Width (m)	36.20	Top Width (m)	17.95	12.20	6.06
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.06	2.87	0.98
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.40
Conv. Total (m3/s)	579.3	Conv. (m3/s)	94.3	458.9	26.1
Length Wtd. (m)	36.03	Wetted Per. (m)	18.00	12.48	6.11
Min Ch El (m)	483.88	Shear (N/m2)	36.18	94.05	32.01
Alpha	1.52	Stream Power (N/m s)	38.43	269.89	31.34
Frctn Loss (m)	0.30	Cum Volume (1000 m3)	111.35	179.34	81.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	161.84	118.99	141.73

Plan: Plan 06 Murragamba 1 RS: 117 Profile: 100 year

E.G. Elev (m)	485.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	485.11	Reach Len. (m)	36.80	40.50	43.40
Crit W.S. (m)	485.11	Flow Area (m2)	8.24	14.53	2.16
E.G. Slope (m/m)	0.008253	Area (m2)	8.24	14.53	2.16
Q Total (m3/s)	52.60	Flow (m3/s)	8.78	41.73	2.09
Top Width (m)	36.02	Top Width (m)	18.32	12.20	5.50
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.06	2.87	0.97
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.39
Conv. Total (m3/s)	579.0	Conv. (m3/s)	96.6	459.4	23.0
Length Wtd. (m)	40.21	Wetted Per. (m)	18.38	12.48	5.56
Min Ch El (m)	483.49	Shear (N/m2)	36.31	94.21	31.45
Alpha	1.52	Stream Power (N/m s)	38.66	270.58	30.42
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	111.32	178.74	81.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	161.78	118.49	141.33

Plan: Plan 06 Murragamba 1 RS: 116 Profile: 100 year

E.G. Elev (m)	485.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	484.72	Reach Len. (m)	47.40	48.60	46.40
Crit W.S. (m)	484.72	Flow Area (m2)	5.30	14.50	5.39
E.G. Slope (m/m)	0.008219	Area (m2)	5.30	14.50	5.39
Q Total (m3/s)	52.60	Flow (m3/s)	5.51	41.50	5.60
Top Width (m)	36.74	Top Width (m)	12.18	12.20	12.36
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.04	2.86	1.04
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.44
Conv. Total (m3/s)	580.2	Conv. (m3/s)	60.7	457.7	61.8
Length Wtd. (m)	48.20	Wetted Per. (m)	12.24	12.48	12.42
Min Ch El (m)	483.10	Shear (N/m2)	34.93	93.61	34.97
Alpha	1.53	Stream Power (N/m s)	36.27	267.93	36.35
Frctn Loss (m)	0.40	Cum Volume (1000 m3)	111.08	178.15	81.57
C & E Loss (m)	0.00	Cum SA (1000 m2)	161.22	118.00	140.95

Plan: Plan 06 Murragamba 1 RS: 115 Profile: 100 year

E.G. Elev (m)	484.60	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	484.26	Reach Len. (m)	46.00	29.90	8.80
Crit W.S. (m)	484.26	Flow Area (m2)	0.87	14.53	9.53
E.G. Slope (m/m)	0.008238	Area (m2)	0.87	14.53	9.53
Q Total (m3/s)	52.60	Flow (m3/s)	0.72	41.70	10.19
Top Width (m)	36.01	Top Width (m)	2.78	12.20	21.03
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	0.82	2.87	1.07
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.31	1.19	0.45
Conv. Total (m3/s)	579.5	Conv. (m3/s)	7.9	459.4	112.3
Length Wtd. (m)	26.56	Wetted Per. (m)	2.84	12.48	21.09
Min Ch El (m)	482.64	Shear (N/m2)	24.72	94.03	36.51
Alpha	1.52	Stream Power (N/m s)	20.38	269.82	39.03
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	110.93	177.45	81.22
C & E Loss (m)	0.00	Cum SA (1000 m2)	160.87	117.40	140.17

Plan: Plan 06 Murragamba 1 RS: 114 Profile: 100 year

E.G. Elev (m)	484.32	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	483.98	Reach Len. (m)	60.10	64.10	64.80
Crit W.S. (m)	483.98	Flow Area (m2)	2.25	14.53	8.17
E.G. Slope (m/m)	0.008252	Area (m2)	2.25	14.53	8.17
Q Total (m3/s)	52.60	Flow (m3/s)	2.19	41.72	8.69
Top Width (m)	36.06	Top Width (m)	5.69	12.20	18.17
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	0.97	2.87	1.06
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.40	1.19	0.45
Conv. Total (m3/s)	579.0	Conv. (m3/s)	24.1	459.3	95.7
Length Wtd. (m)	63.83	Wetted Per. (m)	5.75	12.48	18.23
Min Ch El (m)	482.35	Shear (N/m2)	31.67	94.18	36.27
Alpha	1.52	Stream Power (N/m s)	30.78	270.47	38.60
Frctn Loss (m)	0.53	Cum Volume (1000 m3)	110.86	177.01	81.14
C & E Loss (m)	0.00	Cum SA (1000 m2)	160.67	117.04	140.00

Plan: Plan 06 Murragamba 1 RS: 113 Profile: 100 year

E.G. Elev (m)	483.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	483.36	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	483.36	Flow Area (m2)	6.70	14.53	3.71
E.G. Slope (m/m)	0.008258	Area (m2)	6.70	14.53	3.71
Q Total (m3/s)	52.60	Flow (m3/s)	7.07	41.74	3.78
Top Width (m)	36.03	Top Width (m)	15.06	12.20	8.77
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.06	2.87	1.02
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.42
Conv. Total (m3/s)	578.8	Conv. (m3/s)	77.8	459.3	41.6
Length Wtd. (m)	1.00	Wetted Per. (m)	15.12	12.48	8.83
Min Ch El (m)	481.74	Shear (N/m2)	35.87	94.26	34.05
Alpha	1.52	Stream Power (N/m s)	37.89	270.82	34.73
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	110.59	176.08	80.76
C & E Loss (m)	0.00	Cum SA (1000 m2)	160.05	116.26	139.13

Plan: Plan 06 Murragamba 1 RS: 112.5 Profile: 100 year

E.G. Elev (m)	483.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	482.86	Reach Len. (m)	89.70	99.00	103.70
Crit W.S. (m)	482.86	Flow Area (m2)	6.70	14.53	3.71
E.G. Slope (m/m)	0.008258	Area (m2)	6.70	14.53	3.71
Q Total (m3/s)	52.60	Flow (m3/s)	7.07	41.74	3.78

Plan: Plan 06 Murragamba 1 RS: 112.5 Profile: 100 year (Continued)

Top Width (m)	36.03	Top Width (m)	15.06	12.20	8.77
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.06	2.87	1.02
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.42
Conv. Total (m3/s)	578.8	Conv. (m3/s)	77.8	459.3	41.6
Length Wtd. (m)	98.03	Wetted Per. (m)	15.12	12.48	8.83
Min Ch El (m)	481.24	Shear (N/m2)	35.87	94.26	34.05
Alpha	1.52	Stream Power (N/m s)	37.88	270.82	34.73
Frctn Loss (m)	0.81	Cum Volume (1000 m3)	110.58	176.07	80.76
C & E Loss (m)	0.00	Cum SA (1000 m2)	160.03	116.25	139.12

Plan: Plan 06 Murragamba 1 RS: 112 Profile: 100 year

E.G. Elev (m)	482.26	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	481.92	Reach Len. (m)	66.40	65.40	54.40
Crit W.S. (m)	481.92	Flow Area (m2)	7.09	14.52	3.37
E.G. Slope (m/m)	0.008250	Area (m2)	7.09	14.52	3.37
Q Total (m3/s)	52.60	Flow (m3/s)	7.50	41.70	3.40
Top Width (m)	36.15	Top Width (m)	15.91	12.20	8.05
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.06	2.87	1.01
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.42
Conv. Total (m3/s)	579.1	Conv. (m3/s)	82.6	459.1	37.5
Length Wtd. (m)	64.09	Wetted Per. (m)	15.97	12.48	8.11
Min Ch El (m)	480.29	Shear (N/m2)	35.94	94.13	33.59
Alpha	1.52	Stream Power (N/m s)	38.01	270.22	33.96
Frctn Loss (m)	0.53	Cum Volume (1000 m3)	109.96	174.63	80.39
C & E Loss (m)	0.00	Cum SA (1000 m2)	158.65	115.04	138.25

Plan: Plan 06 Murragamba 1 RS: 111 Profile: 100 year

E.G. Elev (m)	481.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	481.29	Reach Len. (m)	69.40	48.00	18.20
Crit W.S. (m)	481.29	Flow Area (m2)	1.12	14.53	9.31
E.G. Slope (m/m)	0.008236	Area (m2)	1.12	14.53	9.31
Q Total (m3/s)	52.60	Flow (m3/s)	0.98	41.68	9.94
Top Width (m)	36.09	Top Width (m)	3.32	12.20	20.57
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	0.87	2.87	1.07
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.34	1.19	0.45
Conv. Total (m3/s)	579.6	Conv. (m3/s)	10.8	459.3	109.5
Length Wtd. (m)	45.05	Wetted Per. (m)	3.38	12.48	20.63
Min Ch El (m)	479.67	Shear (N/m2)	26.89	94.00	36.45
Alpha	1.52	Stream Power (N/m s)	23.44	269.66	38.92
Frctn Loss (m)	0.37	Cum Volume (1000 m3)	109.69	173.68	80.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	158.01	114.24	137.47

Plan: Plan 06 Murragamba 1 RS: 110 Profile: 100 year

E.G. Elev (m)	481.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	480.83	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	480.83	Flow Area (m2)	5.53	14.50	5.11
E.G. Slope (m/m)	0.008227	Area (m2)	5.53	14.50	5.11
Q Total (m3/s)	52.60	Flow (m3/s)	5.76	41.54	5.30
Top Width (m)	36.61	Top Width (m)	12.65	12.20	11.76
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.04	2.86	1.04
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.43
Conv. Total (m3/s)	579.9	Conv. (m3/s)	63.5	458.0	58.4
Length Wtd. (m)	1.00	Wetted Per. (m)	12.71	12.48	11.82
Min Ch El (m)	479.21	Shear (N/m2)	35.11	93.74	34.88

Plan: Plan 06 Murragamba 1 RS: 110 Profile: 100 year (Continued)

Alpha	1.53	Stream Power (N/m s)	36.57	268.49	36.18
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	109.46	172.98	79.91
C & E Loss (m)	0.00	Cum SA (1000 m2)	157.45	113.65	137.17

Plan: Plan 06 Murragamba 1 RS: 109.5 Profile: 100 year

E.G. Elev (m)	480.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	480.33	Reach Len. (m)	25.50	31.70	35.20
Crit W.S. (m)	480.33	Flow Area (m2)	5.53	14.50	5.11
E.G. Slope (m/m)	0.008227	Area (m2)	5.53	14.50	5.11
Q Total (m3/s)	52.60	Flow (m3/s)	5.76	41.54	5.30
Top Width (m)	36.61	Top Width (m)	12.65	12.20	11.76
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.04	2.86	1.04
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.43
Conv. Total (m3/s)	579.9	Conv. (m3/s)	63.5	458.0	58.4
Length Wtd. (m)	31.05	Wetted Per. (m)	12.71	12.48	11.82
Min Ch El (m)	478.71	Shear (N/m2)	35.11	93.74	34.88
Alpha	1.53	Stream Power (N/m s)	36.57	268.49	36.18
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	109.45	172.97	79.91
C & E Loss (m)	0.00	Cum SA (1000 m2)	157.44	113.64	137.16

Plan: Plan 06 Murragamba 1 RS: 109 Profile: 100 year

E.G. Elev (m)	480.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	480.03	Reach Len. (m)	2.29	25.10	40.99
Crit W.S. (m)	480.03	Flow Area (m2)	8.68	14.53	1.75
E.G. Slope (m/m)	0.008245	Area (m2)	8.68	14.53	1.75
Q Total (m3/s)	52.60	Flow (m3/s)	9.26	41.70	1.64
Top Width (m)	36.08	Top Width (m)	19.25	12.20	4.63
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.07	2.87	0.94
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.38
Conv. Total (m3/s)	579.3	Conv. (m3/s)	101.9	459.3	18.1
Length Wtd. (m)	21.68	Wetted Per. (m)	19.31	12.48	4.69
Min Ch El (m)	478.41	Shear (N/m2)	36.36	94.10	30.12
Alpha	1.52	Stream Power (N/m s)	38.76	270.13	28.32
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	109.27	172.51	79.79
C & E Loss (m)	0.00	Cum SA (1000 m2)	157.03	113.26	136.87

Plan: Plan 06 Murragamba 1 RS: 108 Profile: 100 year

E.G. Elev (m)	480.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	479.79	Reach Len. (m)	15.00	38.10	55.90
Crit W.S. (m)	479.79	Flow Area (m2)	8.42	14.53	1.98
E.G. Slope (m/m)	0.008252	Area (m2)	8.42	14.53	1.98
Q Total (m3/s)	52.60	Flow (m3/s)	8.97	41.74	1.89
Top Width (m)	35.99	Top Width (m)	18.68	12.20	5.11
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.07	2.87	0.96
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.39
Conv. Total (m3/s)	579.1	Conv. (m3/s)	98.8	459.5	20.8
Length Wtd. (m)	34.60	Wetted Per. (m)	18.74	12.48	5.17
Min Ch El (m)	478.17	Shear (N/m2)	36.35	94.20	30.93
Alpha	1.52	Stream Power (N/m s)	38.74	270.57	29.59
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	109.25	172.14	79.71
C & E Loss (m)	0.00	Cum SA (1000 m2)	156.99	112.95	136.67

Plan: Plan 06 Murragamba 1 RS: 107 Profile: 100 year

E.G. Elev (m)	479.77	Element	Left OB	Channel	Right OB
Vel Head (m)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	479.41	Reach Len. (m)	50.40	39.10	26.70
Crit W.S. (m)		Flow Area (m2)	8.73	14.37	1.36
E.G. Slope (m/m)	0.008669	Area (m2)	8.73	14.37	1.36
Q Total (m3/s)	52.60	Flow (m3/s)	9.38	41.97	1.25
Top Width (m)	35.92	Top Width (m)	19.85	12.20	3.86
Vel Total (m/s)	2.15	Avg. Vel. (m/s)	1.07	2.92	0.92
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.44	1.18	0.35
Conv. Total (m3/s)	564.9	Conv. (m3/s)	100.8	450.8	13.4
Length Wtd. (m)	40.19	Wetted Per. (m)	19.91	12.48	3.92
Min Ch El (m)	477.80	Shear (N/m2)	37.28	97.84	29.42
Alpha	1.52	Stream Power (N/m s)	40.07	285.83	27.00
Frctn Loss (m)	0.37	Cum Volume (1000 m3)	109.12	171.59	79.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	156.70	112.48	136.42

Plan: Plan 06 Murragamba 1 RS: 106 Profile: 100 year

E.G. Elev (m)	479.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	479.00	Reach Len. (m)	26.20	27.20	26.80
Crit W.S. (m)		Flow Area (m2)	5.85	13.90	3.63
E.G. Slope (m/m)	0.009927	Area (m2)	5.85	13.90	3.63
Q Total (m3/s)	52.60	Flow (m3/s)	6.30	42.49	3.81
Top Width (m)	36.32	Top Width (m)	14.69	12.20	9.43
Vel Total (m/s)	2.25	Avg. Vel. (m/s)	1.08	3.06	1.05
Max Chl Dpth (m)	1.57	Hydr. Depth (m)	0.40	1.14	0.38
Conv. Total (m3/s)	527.9	Conv. (m3/s)	63.2	426.5	38.3
Length Wtd. (m)	27.06	Wetted Per. (m)	14.74	12.48	9.48
Min Ch El (m)	477.43	Shear (N/m2)	38.64	108.37	37.25
Alpha	1.53	Stream Power (N/m s)	41.59	331.35	39.13
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	108.76	171.04	79.55
C & E Loss (m)	0.02	Cum SA (1000 m2)	155.83	112.01	136.25

Plan: Plan 06 Murragamba 1 RS: 105 Profile: 100 year

E.G. Elev (m)	479.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	478.79	Reach Len. (m)	29.80	26.90	21.30
Crit W.S. (m)	478.79	Flow Area (m2)	3.54	14.53	6.87
E.G. Slope (m/m)	0.008260	Area (m2)	3.54	14.53	6.87
Q Total (m3/s)	52.60	Flow (m3/s)	3.60	41.74	7.27
Top Width (m)	36.05	Top Width (m)	8.41	12.20	15.44
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.02	2.87	1.06
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.42	1.19	0.45
Conv. Total (m3/s)	578.8	Conv. (m3/s)	39.6	459.2	80.0
Length Wtd. (m)	26.63	Wetted Per. (m)	8.47	12.48	15.50
Min Ch El (m)	477.17	Shear (N/m2)	33.85	94.27	35.93
Alpha	1.52	Stream Power (N/m s)	34.40	270.84	37.98
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	108.63	170.65	79.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	155.53	111.68	135.91

Plan: Plan 06 Murragamba 1 RS: 104 Profile: 100 year

E.G. Elev (m)	478.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	478.53	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	478.53	Flow Area (m2)	7.16	14.50	3.48
E.G. Slope (m/m)	0.008221	Area (m2)	7.16	14.50	3.48
Q Total (m3/s)	52.60	Flow (m3/s)	7.55	41.53	3.52

Plan: Plan 06 Murragamba 1 RS: 104 Profile: 100 year (Continued)

Top Width (m)	36.63	Top Width (m)	16.11	12.20	8.32
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.05	2.86	1.01
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.42
Conv. Total (m3/s)	580.1	Conv. (m3/s)	83.3	458.0	38.8
Length Wtd. (m)	1.00	Wetted Per. (m)	16.17	12.48	8.38
Min Ch El (m)	476.91	Shear (N/m2)	35.73	93.67	33.53
Alpha	1.53	Stream Power (N/m s)	37.66	268.20	33.88
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	108.47	170.26	79.30
C & E Loss (m)	0.00	Cum SA (1000 m2)	155.16	111.35	135.66

Plan: Plan 06 Murragamba 1 RS: 103.5 Profile: 100 year

E.G. Elev (m)	478.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	478.03	Reach Len. (m)	27.60	31.10	33.20
Crit W.S. (m)	478.03	Flow Area (m2)	7.16	14.50	3.48
E.G. Slope (m/m)	0.008221	Area (m2)	7.16	14.50	3.48
Q Total (m3/s)	52.60	Flow (m3/s)	7.55	41.53	3.52
Top Width (m)	36.63	Top Width (m)	16.11	12.20	8.32
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.05	2.86	1.01
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.42
Conv. Total (m3/s)	580.1	Conv. (m3/s)	83.3	458.0	38.8
Length Wtd. (m)	30.64	Wetted Per. (m)	16.17	12.48	8.38
Min Ch El (m)	476.41	Shear (N/m2)	35.73	93.67	33.53
Alpha	1.53	Stream Power (N/m s)	37.66	268.21	33.88
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	108.47	170.25	79.30
C & E Loss (m)	0.00	Cum SA (1000 m2)	155.15	111.34	135.65

Plan: Plan 06 Murragamba 1 RS: 103 Profile: 100 year

E.G. Elev (m)	478.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	477.74	Reach Len. (m)	42.40	43.30	42.20
Crit W.S. (m)	477.74	Flow Area (m2)	8.86	14.52	1.67
E.G. Slope (m/m)	0.008232	Area (m2)	8.86	14.52	1.67
Q Total (m3/s)	52.60	Flow (m3/s)	9.43	41.61	1.56
Top Width (m)	36.34	Top Width (m)	19.66	12.20	4.47
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.06	2.87	0.93
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.37
Conv. Total (m3/s)	579.7	Conv. (m3/s)	104.0	458.6	17.2
Length Wtd. (m)	43.10	Wetted Per. (m)	19.72	12.48	4.53
Min Ch El (m)	476.11	Shear (N/m2)	36.27	93.87	29.74
Alpha	1.53	Stream Power (N/m s)	38.61	269.09	27.74
Frctn Loss (m)	0.36	Cum Volume (1000 m3)	108.25	169.80	79.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	154.65	110.96	135.44

Plan: Plan 06 Murragamba 1 RS: 102 Profile: 100 year

E.G. Elev (m)	477.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	477.32	Reach Len. (m)	87.30	65.40	45.50
Crit W.S. (m)	477.32	Flow Area (m2)	4.00	14.52	6.49
E.G. Slope (m/m)	0.008246	Area (m2)	4.00	14.52	6.49
Q Total (m3/s)	52.60	Flow (m3/s)	4.10	41.67	6.83
Top Width (m)	36.23	Top Width (m)	9.40	12.20	14.64
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.02	2.87	1.05
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.43	1.19	0.44
Conv. Total (m3/s)	579.2	Conv. (m3/s)	45.1	458.9	75.2
Length Wtd. (m)	65.45	Wetted Per. (m)	9.45	12.48	14.69
Min Ch El (m)	475.70	Shear (N/m2)	34.24	94.07	35.70

Plan: Plan 06 Murragamba 1 RS: 102 Profile: 100 year (Continued)

Alpha	1.53	Stream Power (N/m s)	35.07	269.94	37.58
Frctn Loss (m)	0.54	Cum Volume (1000 m3)	107.97	169.17	79.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	154.04	110.43	135.04

Plan: Plan 06 Murragamba 1 RS: 101 Profile: 100 year

E.G. Elev (m)	477.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	476.70	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	476.70	Flow Area (m2)	6.00	14.55	4.22
E.G. Slope (m/m)	0.008290	Area (m2)	6.00	14.55	4.22
Q Total (m3/s)	52.60	Flow (m3/s)	6.32	41.91	4.36
Top Width (m)	35.57	Top Width (m)	13.54	12.20	9.82
Vel Total (m/s)	2.12	Avg. Vel. (m/s)	1.05	2.88	1.03
Max Chl Dpth (m)	1.63	Hydr. Depth (m)	0.44	1.19	0.43
Conv. Total (m3/s)	577.7	Conv. (m3/s)	69.4	460.3	47.9
Length Wtd. (m)	1.00	Wetted Per. (m)	13.60	12.48	9.88
Min Ch El (m)	475.08	Shear (N/m2)	35.83	94.75	34.75
Alpha	1.52	Stream Power (N/m s)	37.79	272.96	35.90
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.54	168.22	78.79
C & E Loss (m)	0.00	Cum SA (1000 m2)	153.04	109.63	134.48

Plan: Plan 06 Murragamba 1 RS: 100.5 Profile: 100 year

E.G. Elev (m)	476.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	476.20	Reach Len. (m)	39.60	34.70	15.20
Crit W.S. (m)	476.20	Flow Area (m2)	6.00	14.55	4.22
E.G. Slope (m/m)	0.008290	Area (m2)	6.00	14.55	4.22
Q Total (m3/s)	52.60	Flow (m3/s)	6.32	41.91	4.36
Top Width (m)	35.57	Top Width (m)	13.54	12.20	9.82
Vel Total (m/s)	2.12	Avg. Vel. (m/s)	1.05	2.88	1.03
Max Chl Dpth (m)	1.63	Hydr. Depth (m)	0.44	1.19	0.43
Conv. Total (m3/s)	577.7	Conv. (m3/s)	69.4	460.3	47.9
Length Wtd. (m)	34.04	Wetted Per. (m)	13.60	12.48	9.88
Min Ch El (m)	474.58	Shear (N/m2)	35.83	94.75	34.75
Alpha	1.52	Stream Power (N/m s)	37.79	272.96	35.90
Frctn Loss (m)	0.28	Cum Volume (1000 m3)	107.53	168.20	78.79
C & E Loss (m)	0.01	Cum SA (1000 m2)	153.02	109.62	134.47

Plan: Plan 06 Murragamba 1 RS: 100 Profile: 100 year

E.G. Elev (m)	476.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	475.85	Reach Len. (m)	30.10	39.80	30.40
Crit W.S. (m)	475.85	Flow Area (m2)	9.23	14.31	3.27
E.G. Slope (m/m)	0.007961	Area (m2)	9.23	14.31	3.27
Q Total (m3/s)	52.60	Flow (m3/s)	9.46	39.96	3.18
Top Width (m)	41.40	Top Width (m)	21.13	12.20	8.08
Vel Total (m/s)	1.96	Avg. Vel. (m/s)	1.03	2.79	0.97
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.44	1.17	0.40
Conv. Total (m3/s)	589.5	Conv. (m3/s)	106.1	447.8	35.6
Length Wtd. (m)	37.04	Wetted Per. (m)	21.18	12.48	8.13
Min Ch El (m)	474.24	Shear (N/m2)	34.01	89.50	31.39
Alpha	1.60	Stream Power (N/m s)	34.88	249.91	30.52
Frctn Loss (m)	0.28	Cum Volume (1000 m3)	107.23	167.70	78.73
C & E Loss (m)	0.02	Cum SA (1000 m2)	152.34	109.19	134.33

Plan: Plan 06 Murragamba 1 RS: 99 Profile: 100 year

E.G. Elev (m)	475.65	Element	Left OB	Channel	Right OB
Vel Head (m)	0.24	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	475.41	Reach Len. (m)	8.60	45.00	51.40
Crit W.S. (m)	475.41	Flow Area (m2)	17.11	13.58	2.10
E.G. Slope (m/m)	0.007352	Area (m2)	17.11	13.58	2.10
Q Total (m3/s)	52.60	Flow (m3/s)	15.64	35.19	1.77
Top Width (m)	62.22	Top Width (m)	43.93	12.20	6.10
Vel Total (m/s)	1.60	Avg. Vel. (m/s)	0.91	2.59	0.84
Max Chl Dpth (m)	1.55	Hydr. Depth (m)	0.39	1.11	0.35
Conv. Total (m3/s)	613.4	Conv. (m3/s)	182.4	410.4	20.6
Length Wtd. (m)	32.43	Wetted Per. (m)	43.98	12.48	6.15
Min Ch El (m)	473.86	Shear (N/m2)	28.06	78.44	24.68
Alpha	1.85	Stream Power (N/m s)	25.65	203.26	20.72
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	106.83	167.15	78.65
C & E Loss (m)	0.02	Cum SA (1000 m2)	151.36	108.71	134.12

Plan: Plan 06 Murragamba 1 RS: 98 Profile: 100 year

E.G. Elev (m)	475.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	474.93	Reach Len. (m)	11.10	46.90	75.30
Crit W.S. (m)	474.93	Flow Area (m2)	26.09	12.92	0.45
E.G. Slope (m/m)	0.006869	Area (m2)	26.09	12.92	0.45
Q Total (m3/s)	52.60	Flow (m3/s)	21.03	31.30	0.27
Top Width (m)	91.06	Top Width (m)	76.87	12.20	1.99
Vel Total (m/s)	1.33	Avg. Vel. (m/s)	0.81	2.42	0.60
Max Chl Dpth (m)	1.49	Hydr. Depth (m)	0.34	1.06	0.22
Conv. Total (m3/s)	634.7	Conv. (m3/s)	253.8	377.6	3.3
Length Wtd. (m)	32.25	Wetted Per. (m)	76.91	12.48	2.03
Min Ch El (m)	473.43	Shear (N/m2)	22.85	69.71	14.81
Alpha	2.11	Stream Power (N/m s)	18.42	168.88	8.95
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	106.65	166.55	78.59
C & E Loss (m)	0.01	Cum SA (1000 m2)	150.84	108.16	133.91

Plan: Plan 06 Murragamba 1 RS: 97 Profile: 100 year

E.G. Elev (m)	474.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	474.45	Reach Len. (m)	2.34	73.60	111.40
Crit W.S. (m)	474.45	Flow Area (m2)	30.43	12.57	0.91
E.G. Slope (m/m)	0.006583	Area (m2)	30.43	12.57	0.91
Q Total (m3/s)	52.60	Flow (m3/s)	22.72	29.29	0.60
Top Width (m)	113.22	Top Width (m)	97.49	12.20	3.54
Vel Total (m/s)	1.20	Avg. Vel. (m/s)	0.75	2.33	0.65
Max Chl Dpth (m)	1.46	Hydr. Depth (m)	0.31	1.03	0.26
Conv. Total (m3/s)	648.3	Conv. (m3/s)	280.0	361.0	7.4
Length Wtd. (m)	46.83	Wetted Per. (m)	97.53	12.48	3.58
Min Ch El (m)	472.99	Shear (N/m2)	20.14	65.02	16.50
Alpha	2.28	Stream Power (N/m s)	15.04	151.45	10.78
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	106.33	165.95	78.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	149.87	107.59	133.70

Plan: Plan 06 Murragamba 1 RS: 96 Profile: 100 year

E.G. Elev (m)	474.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	473.80	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	473.80	Flow Area (m2)	20.84	13.25	1.90
E.G. Slope (m/m)	0.007092	Area (m2)	20.84	13.25	1.90
Q Total (m3/s)	52.60	Flow (m3/s)	17.92	33.18	1.50

Plan: Plan 06 Murragamba 1 RS: 96 Profile: 100 year (Continued)

Top Width (m)	75.15	Top Width (m)	57.08	12.20	5.87
Vel Total (m/s)	1.46	Avg. Vel. (m/s)	0.86	2.50	0.79
Max Chl Dpth (m)	1.52	Hydr. Depth (m)	0.37	1.09	0.32
Conv. Total (m3/s)	624.6	Conv. (m3/s)	212.8	394.0	17.8
Length Wtd. (m)	1.00	Wetted Per. (m)	57.13	12.48	5.92
Min Ch El (m)	472.28	Shear (N/m2)	25.37	73.83	22.31
Alpha	1.98	Stream Power (N/m s)	21.82	184.88	17.61
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.27	165.00	78.38
C & E Loss (m)	0.01	Cum SA (1000 m2)	149.69	106.69	133.18

Plan: Plan 06 Murragamba 1 RS: 95.5 Profile: 100 year

E.G. Elev (m)	473.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	473.34	Reach Len. (m)	29.30	53.50	37.70
Crit W.S. (m)		Flow Area (m2)	23.09	13.73	2.13
E.G. Slope (m/m)	0.005790	Area (m2)	23.09	13.73	2.13
Q Total (m3/s)	52.60	Flow (m3/s)	19.17	31.82	1.61
Top Width (m)	75.46	Top Width (m)	57.24	12.20	6.03
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.83	2.32	0.76
Max Chl Dpth (m)	1.56	Hydr. Depth (m)	0.40	1.13	0.35
Conv. Total (m3/s)	691.3	Conv. (m3/s)	252.0	418.1	21.2
Length Wtd. (m)	46.42	Wetted Per. (m)	57.29	12.48	6.08
Min Ch El (m)	471.78	Shear (N/m2)	22.88	62.46	19.91
Alpha	1.93	Stream Power (N/m s)	19.00	144.70	15.07
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	106.25	164.99	78.38
C & E Loss (m)	0.01	Cum SA (1000 m2)	149.63	106.68	133.17

Plan: Plan 06 Murragamba 1 RS: 95 Profile: 100 year

E.G. Elev (m)	473.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	472.88	Reach Len. (m)	57.10	56.00	43.20
Crit W.S. (m)	472.88	Flow Area (m2)	6.65	14.32	5.74
E.G. Slope (m/m)	0.007975	Area (m2)	6.65	14.32	5.74
Q Total (m3/s)	52.60	Flow (m3/s)	6.76	40.05	5.80
Top Width (m)	41.12	Top Width (m)	15.45	12.20	13.47
Vel Total (m/s)	1.97	Avg. Vel. (m/s)	1.02	2.80	1.01
Max Chl Dpth (m)	1.61	Hydr. Depth (m)	0.43	1.17	0.43
Conv. Total (m3/s)	589.0	Conv. (m3/s)	75.6	448.4	64.9
Length Wtd. (m)	54.34	Wetted Per. (m)	15.51	12.48	13.53
Min Ch El (m)	471.27	Shear (N/m2)	33.54	89.73	33.21
Alpha	1.60	Stream Power (N/m s)	34.07	250.91	33.52
Frctn Loss (m)	0.44	Cum Volume (1000 m3)	105.82	164.24	78.23
C & E Loss (m)	0.00	Cum SA (1000 m2)	148.57	106.02	132.80

Plan: Plan 06 Murragamba 1 RS: 94 Profile: 100 year

E.G. Elev (m)	472.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	472.36	Reach Len. (m)	87.70	64.20	29.10
Crit W.S. (m)	472.36	Flow Area (m2)	2.29	14.53	8.11
E.G. Slope (m/m)	0.008256	Area (m2)	2.29	14.53	8.11
Q Total (m3/s)	52.60	Flow (m3/s)	2.23	41.74	8.63
Top Width (m)	36.01	Top Width (m)	5.78	12.20	18.03
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	0.97	2.87	1.06
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.40	1.19	0.45
Conv. Total (m3/s)	578.9	Conv. (m3/s)	24.6	459.4	94.9
Length Wtd. (m)	60.23	Wetted Per. (m)	5.84	12.48	18.09
Min Ch El (m)	470.74	Shear (N/m2)	31.79	94.24	36.28

Plan: Plan 06 Murragamba 1 RS: 94 Profile: 100 year (Continued)

Alpha	1.52	Stream Power (N/m s)	30.98	270.71	38.62
Frctn Loss (m)	0.50	Cum Volume (1000 m3)	105.56	163.43	77.93
C & E Loss (m)	0.00	Cum SA (1000 m2)	147.96	105.34	132.12

Plan: Plan 06 Murragamba 1 RS: 93 Profile: 100 year

E.G. Elev (m)	472.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	471.75	Reach Len. (m)	75.60	79.70	79.40
Crit W.S. (m)	471.75	Flow Area (m2)	3.64	14.52	6.86
E.G. Slope (m/m)	0.008247	Area (m2)	3.64	14.52	6.86
Q Total (m3/s)	52.60	Flow (m3/s)	3.70	41.66	7.24
Top Width (m)	36.26	Top Width (m)	8.63	12.20	15.42
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.02	2.87	1.06
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.42	1.19	0.44
Conv. Total (m3/s)	579.2	Conv. (m3/s)	40.8	458.7	79.7
Length Wtd. (m)	79.15	Wetted Per. (m)	8.69	12.48	15.48
Min Ch El (m)	470.12	Shear (N/m2)	33.88	94.06	35.82
Alpha	1.53	Stream Power (N/m s)	34.44	269.92	37.80
Frctn Loss (m)	0.65	Cum Volume (1000 m3)	105.30	162.50	77.71
C & E Loss (m)	0.00	Cum SA (1000 m2)	147.33	104.56	131.64

Plan: Plan 06 Murragamba 1 RS: 92 Profile: 100 year

E.G. Elev (m)	471.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	470.98	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	470.98	Flow Area (m2)	9.15	14.51	1.43
E.G. Slope (m/m)	0.008218	Area (m2)	9.15	14.51	1.43
Q Total (m3/s)	52.60	Flow (m3/s)	9.74	41.56	1.30
Top Width (m)	36.46	Top Width (m)	20.29	12.20	3.96
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.06	2.86	0.91
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.36
Conv. Total (m3/s)	580.2	Conv. (m3/s)	107.5	458.4	14.3
Length Wtd. (m)	1.00	Wetted Per. (m)	20.35	12.48	4.02
Min Ch El (m)	469.36	Shear (N/m2)	36.25	93.69	28.61
Alpha	1.53	Stream Power (N/m s)	38.58	268.31	26.00
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	104.82	161.34	77.38
C & E Loss (m)	0.00	Cum SA (1000 m2)	146.23	103.59	130.87

Plan: Plan 06 Murragamba 1 RS: 91.5 Profile: 100 year

E.G. Elev (m)	470.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	470.48	Reach Len. (m)	43.50	59.70	66.60
Crit W.S. (m)	470.48	Flow Area (m2)	9.15	14.51	1.43
E.G. Slope (m/m)	0.008218	Area (m2)	9.15	14.51	1.43
Q Total (m3/s)	52.60	Flow (m3/s)	9.74	41.56	1.30
Top Width (m)	36.46	Top Width (m)	20.29	12.20	3.96
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.06	2.86	0.91
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.36
Conv. Total (m3/s)	580.2	Conv. (m3/s)	107.5	458.4	14.3
Length Wtd. (m)	58.74	Wetted Per. (m)	20.35	12.48	4.02
Min Ch El (m)	468.86	Shear (N/m2)	36.25	93.69	28.61
Alpha	1.53	Stream Power (N/m s)	38.58	268.31	26.00
Frctn Loss (m)	0.48	Cum Volume (1000 m3)	104.81	161.33	77.38
C & E Loss (m)	0.00	Cum SA (1000 m2)	146.21	103.57	130.86

Plan: Plan 06 Murragamba 1 RS: 91 Profile: 100 year

E.G. Elev (m)	470.26	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	469.91	Reach Len. (m)	41.40	39.00	33.50
Crit W.S. (m)	469.91	Flow Area (m2)	1.33	14.52	9.19
E.G. Slope (m/m)	0.008228	Area (m2)	1.33	14.52	9.19
Q Total (m3/s)	52.60	Flow (m3/s)	1.20	41.61	9.79
Top Width (m)	36.29	Top Width (m)	3.75	12.20	20.34
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	0.90	2.87	1.07
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.35	1.19	0.45
Conv. Total (m3/s)	579.9	Conv. (m3/s)	13.2	458.7	108.0
Length Wtd. (m)	38.44	Wetted Per. (m)	3.81	12.48	20.39
Min Ch El (m)	468.29	Shear (N/m2)	28.15	93.85	36.35
Alpha	1.52	Stream Power (N/m s)	25.30	268.99	38.75
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	104.58	160.46	77.03
C & E Loss (m)	0.00	Cum SA (1000 m2)	145.69	102.85	130.05

Plan: Plan 06 Murragamba 1 RS: 90 Profile: 100 year

E.G. Elev (m)	469.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	469.54	Reach Len. (m)	67.80	71.90	75.20
Crit W.S. (m)	469.54	Flow Area (m2)	6.53	14.49	4.25
E.G. Slope (m/m)	0.008206	Area (m2)	6.53	14.49	4.25
Q Total (m3/s)	52.60	Flow (m3/s)	6.84	41.42	4.34
Top Width (m)	36.96	Top Width (m)	14.81	12.20	9.96
Vel Total (m/s)	2.08	Avg. Vel. (m/s)	1.05	2.86	1.02
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.44	1.19	0.43
Conv. Total (m3/s)	580.7	Conv. (m3/s)	75.5	457.2	48.0
Length Wtd. (m)	71.45	Wetted Per. (m)	14.86	12.48	10.01
Min Ch El (m)	467.92	Shear (N/m2)	35.37	93.40	34.13
Alpha	1.54	Stream Power (N/m s)	37.04	266.97	34.91
Frctn Loss (m)	0.59	Cum Volume (1000 m3)	104.42	159.89	76.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	145.31	102.37	129.55

Plan: Plan 06 Murragamba 1 RS: 89 Profile: 100 year

E.G. Elev (m)	469.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	468.85	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	468.85	Flow Area (m2)	8.88	14.52	1.60
E.G. Slope (m/m)	0.008236	Area (m2)	8.88	14.52	1.60
Q Total (m3/s)	52.60	Flow (m3/s)	9.46	41.66	1.49
Top Width (m)	36.20	Top Width (m)	19.68	12.20	4.33
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.07	2.87	0.93
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.37
Conv. Total (m3/s)	579.6	Conv. (m3/s)	104.2	459.0	16.4
Length Wtd. (m)	1.00	Wetted Per. (m)	19.73	12.48	4.38
Min Ch El (m)	467.23	Shear (N/m2)	36.33	93.96	29.50
Alpha	1.52	Stream Power (N/m s)	38.71	269.51	27.35
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	103.89	158.85	76.58
C & E Loss (m)	0.00	Cum SA (1000 m2)	144.14	101.49	129.01

Plan: Plan 06 Murragamba 1 RS: 88.5 Profile: 100 year

E.G. Elev (m)	468.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	468.35	Reach Len. (m)	53.20	67.40	75.10
Crit W.S. (m)	468.35	Flow Area (m2)	8.88	14.52	1.60
E.G. Slope (m/m)	0.008236	Area (m2)	8.88	14.52	1.60
Q Total (m3/s)	52.60	Flow (m3/s)	9.46	41.66	1.49

Plan: Plan 06 Murragamba 1 RS: 88.5 Profile: 100 year (Continued)

Top Width (m)	36.20	Top Width (m)	19.68	12.20	4.33
Vel Total (m/s)	2.10	Avg. Vel. (m/s)	1.07	2.87	0.93
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.45	1.19	0.37
Conv. Total (m3/s)	579.6	Conv. (m3/s)	104.2	459.0	16.4
Length Wtd. (m)	66.05	Wetted Per. (m)	19.73	12.48	4.38
Min Ch El (m)	466.73	Shear (N/m2)	36.33	93.97	29.50
Alpha	1.52	Stream Power (N/m s)	38.72	269.52	27.36
Frctn Loss (m)	0.54	Cum Volume (1000 m3)	103.89	158.84	76.58
C & E Loss (m)	0.00	Cum SA (1000 m2)	144.12	101.48	129.01

Plan: Plan 06 Murragamba 1 RS: 88 Profile: 100 year

E.G. Elev (m)	468.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	467.71	Reach Len. (m)	263.40	281.80	190.30
Crit W.S. (m)	467.71	Flow Area (m2)	4.53	14.52	5.92
E.G. Slope (m/m)	0.008257	Area (m2)	4.53	14.52	5.92
Q Total (m3/s)	52.60	Flow (m3/s)	4.68	41.71	6.21
Top Width (m)	36.13	Top Width (m)	10.51	12.20	13.43
Vel Total (m/s)	2.11	Avg. Vel. (m/s)	1.03	2.87	1.05
Max Chl Dpth (m)	1.62	Hydr. Depth (m)	0.43	1.19	0.44
Conv. Total (m3/s)	578.9	Conv. (m3/s)	51.5	459.0	68.3
Length Wtd. (m)	259.82	Wetted Per. (m)	10.56	12.48	13.48
Min Ch El (m)	466.09	Shear (N/m2)	34.73	94.21	35.52
Alpha	1.52	Stream Power (N/m s)	35.90	270.56	37.27
Frctn Loss (m)	2.63	Cum Volume (1000 m3)	103.53	157.86	76.30
C & E Loss (m)	0.04	Cum SA (1000 m2)	143.32	100.66	128.34

Plan: Plan 06 Murragamba 1 RS: 87.84 Profile: 100 year

E.G. Elev (m)	462.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.73	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	461.57	Reach Len. (m)	164.00	162.00	145.20
Crit W.S. (m)	461.57	Flow Area (m2)	7.66	3.73	6.38
E.G. Slope (m/m)	0.012670	Area (m2)	7.66	3.73	6.38
Q Total (m3/s)	52.60	Flow (m3/s)	18.08	20.04	14.48
Top Width (m)	14.43	Top Width (m)	6.80	1.72	5.91
Vel Total (m/s)	2.96	Avg. Vel. (m/s)	2.36	5.38	2.27
Max Chl Dpth (m)	2.17	Hydr. Depth (m)	1.13	2.16	1.08
Conv. Total (m3/s)	467.3	Conv. (m3/s)	160.6	178.0	128.7
Length Wtd. (m)	159.76	Wetted Per. (m)	7.13	1.72	6.29
Min Ch El (m)	459.40	Shear (N/m2)	133.40	268.67	125.90
Alpha	1.64	Stream Power (N/m s)	314.89	1444.83	285.94
Frctn Loss (m)	1.75	Cum Volume (1000 m3)	101.92	155.29	75.13
C & E Loss (m)	0.02	Cum SA (1000 m2)	141.04	98.70	126.50

Plan: Plan 06 Murragamba 1 RS: 87.7 Profile: 100 year

E.G. Elev (m)	458.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.65	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	457.64	Reach Len. (m)	127.00	127.00	157.60
Crit W.S. (m)	457.64	Flow Area (m2)	2.26	12.61	1.55
E.G. Slope (m/m)	0.009564	Area (m2)	2.26	12.61	1.55
Q Total (m3/s)	52.60	Flow (m3/s)	3.23	47.30	2.07
Top Width (m)	13.83	Top Width (m)	3.34	8.03	2.46
Vel Total (m/s)	3.20	Avg. Vel. (m/s)	1.43	3.75	1.33
Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.68	1.57	0.63
Conv. Total (m3/s)	537.9	Conv. (m3/s)	33.0	483.7	21.1
Length Wtd. (m)	128.12	Wetted Per. (m)	3.60	8.11	2.77
Min Ch El (m)	455.79	Shear (N/m2)	58.75	145.90	52.64

Plan: Plan 06 Murragamba 1 RS: 87.7 Profile: 100 year (Continued)

Alpha	1.25	Stream Power (N/m s)	84.12	547.31	70.06
Frctn Loss (m)	1.27	Cum Volume (1000 m3)	101.11	153.96	74.55
C & E Loss (m)	0.03	Cum SA (1000 m2)	140.21	97.91	125.89

Plan: Plan 06 Murragamba 1 RS: 87.56 Profile: 100 year

E.G. Elev (m)	456.95	Element	Left OB	Channel	Right OB
Vel Head (m)	0.57	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	456.39	Reach Len. (m)	222.00	154.00	70.50
Crit W.S. (m)	456.39	Flow Area (m2)	2.04	13.75	1.46
E.G. Slope (m/m)	0.010317	Area (m2)	2.04	13.75	1.46
Q Total (m3/s)	52.60	Flow (m3/s)	3.05	47.76	1.80
Top Width (m)	16.31	Top Width (m)	2.89	10.48	2.93
Vel Total (m/s)	3.05	Avg. Vel. (m/s)	1.50	3.47	1.23
Max Chl Dpth (m)	1.42	Hydr. Depth (m)	0.70	1.31	0.50
Conv. Total (m3/s)	517.8	Conv. (m3/s)	30.0	470.2	17.7
Length Wtd. (m)	153.46	Wetted Per. (m)	3.22	10.50	3.10
Min Ch El (m)	454.96	Shear (N/m2)	64.01	132.49	47.70
Alpha	1.20	Stream Power (N/m s)	95.83	460.19	58.69
Frctn Loss (m)	1.26	Cum Volume (1000 m3)	100.84	152.29	74.32
C & E Loss (m)	0.07	Cum SA (1000 m2)	139.81	96.73	125.47

Plan: Plan 06 Murragamba 1 RS: 87.42 Profile: 100 year

E.G. Elev (m)	455.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	455.17	Reach Len. (m)	112.70	117.90	114.20
Crit W.S. (m)		Flow Area (m2)	1.45	18.93	2.18
E.G. Slope (m/m)	0.006698	Area (m2)	1.45	18.93	2.18
Q Total (m3/s)	52.60	Flow (m3/s)	1.30	48.87	2.43
Top Width (m)	23.52	Top Width (m)	3.49	16.31	3.72
Vel Total (m/s)	2.33	Avg. Vel. (m/s)	0.90	2.58	1.11
Max Chl Dpth (m)	1.30	Hydr. Depth (m)	0.42	1.16	0.59
Conv. Total (m3/s)	642.7	Conv. (m3/s)	15.9	597.1	29.7
Length Wtd. (m)	117.53	Wetted Per. (m)	3.59	16.33	3.90
Min Ch El (m)	453.86	Shear (N/m2)	26.58	76.17	36.81
Alpha	1.15	Stream Power (N/m s)	23.80	196.61	40.96
Frctn Loss (m)	1.17	Cum Volume (1000 m3)	100.45	149.77	74.19
C & E Loss (m)	0.02	Cum SA (1000 m2)	139.10	94.67	125.23

Plan: Plan 06 Murragamba 1 RS: 87.28 Profile: 100 year

E.G. Elev (m)	454.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.53	Wt. n-Val.	0.090	0.045	0.090
W.S. Elev (m)	453.77	Reach Len. (m)	112.10	118.00	12.50
Crit W.S. (m)	453.77	Flow Area (m2)	2.67	14.10	2.85
E.G. Slope (m/m)	0.016331	Area (m2)	2.67	14.10	2.85
Q Total (m3/s)	52.60	Flow (m3/s)	2.86	47.46	2.29
Top Width (m)	23.89	Top Width (m)	3.82	10.92	9.15
Vel Total (m/s)	2.68	Avg. Vel. (m/s)	1.07	3.37	0.80
Max Chl Dpth (m)	1.39	Hydr. Depth (m)	0.70	1.29	0.31
Conv. Total (m3/s)	411.6	Conv. (m3/s)	22.3	371.4	17.9
Length Wtd. (m)	100.34	Wetted Per. (m)	4.07	10.92	9.33
Min Ch El (m)	452.37	Shear (N/m2)	104.90	206.69	48.92
Alpha	1.43	Stream Power (N/m s)	112.34	695.80	39.26
Frctn Loss (m)	2.07	Cum Volume (1000 m3)	100.22	147.83	73.90
C & E Loss (m)	0.05	Cum SA (1000 m2)	138.69	93.06	124.50

Plan: Plan 06 Murragamba 1 RS: 87.14 Profile: 100 year

E.G. Elev (m)	451.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.37	Wt. n-Val.	0.080	0.050	0.070
W.S. Elev (m)	451.48	Reach Len. (m)	73.30	119.50	163.00
Crit W.S. (m)	451.48	Flow Area (m2)	3.02	10.88	8.50
E.G. Slope (m/m)	0.026827	Area (m2)	3.02	10.88	8.50
Q Total (m3/s)	52.60	Flow (m3/s)	3.74	33.91	14.95
Top Width (m)	31.07	Top Width (m)	6.38	11.73	12.97
Vel Total (m/s)	2.35	Avg. Vel. (m/s)	1.24	3.12	1.76
Max Chl Dpth (m)	0.95	Hydr. Depth (m)	0.47	0.93	0.66
Conv. Total (m3/s)	321.1	Conv. (m3/s)	22.8	207.0	91.3
Length Wtd. (m)	121.78	Wetted Per. (m)	6.45	11.73	13.04
Min Ch El (m)	450.53	Shear (N/m2)	123.33	244.12	171.46
Alpha	1.32	Stream Power (N/m s)	152.39	760.80	301.58
Frctn Loss (m)	1.37	Cum Volume (1000 m3)	99.90	146.35	73.83
C & E Loss (m)	0.01	Cum SA (1000 m2)	138.12	91.73	124.36

Plan: Plan 06 Murragamba 1 RS: 87 Profile: 100 year

E.G. Elev (m)	450.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	449.95	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	449.95	Flow Area (m2)	8.52	22.74	5.94
E.G. Slope (m/m)	0.007714	Area (m2)	8.52	22.74	5.94
Q Total (m3/s)	88.09	Flow (m3/s)	9.56	71.99	6.54
Top Width (m)	44.24	Top Width (m)	16.62	15.70	11.91
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.12	3.17	1.10
Max Chl Dpth (m)	1.95	Hydr. Depth (m)	0.51	1.45	0.50
Conv. Total (m3/s)	1002.9	Conv. (m3/s)	108.9	819.6	74.5
Length Wtd. (m)	1.00	Wetted Per. (m)	16.69	16.04	11.98
Min Ch El (m)	448.00	Shear (N/m2)	38.62	107.21	37.52
Alpha	1.50	Stream Power (N/m s)	43.33	339.42	41.29
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.48	144.34	72.65
C & E Loss (m)	0.03	Cum SA (1000 m2)	137.27	90.09	122.33

Plan: Plan 06 Murragamba 1 RS: 86.5 Profile: 100 year

E.G. Elev (m)	449.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	449.56	Reach Len. (m)	119.70	134.90	146.80
Crit W.S. (m)		Flow Area (m2)	10.49	24.57	7.36
E.G. Slope (m/m)	0.005500	Area (m2)	10.49	24.57	7.36
Q Total (m3/s)	88.09	Flow (m3/s)	11.21	69.19	7.69
Top Width (m)	45.15	Top Width (m)	17.08	15.70	12.37
Vel Total (m/s)	2.08	Avg. Vel. (m/s)	1.07	2.82	1.04
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.61	1.57	0.60
Conv. Total (m3/s)	1187.8	Conv. (m3/s)	151.2	932.9	103.7
Length Wtd. (m)	133.72	Wetted Per. (m)	17.16	16.04	12.45
Min Ch El (m)	447.50	Shear (N/m2)	32.98	82.61	31.89
Alpha	1.50	Stream Power (N/m s)	35.24	232.59	33.33
Frctn Loss (m)	0.64	Cum Volume (1000 m3)	99.47	144.32	72.65
C & E Loss (m)	0.02	Cum SA (1000 m2)	137.26	90.07	122.32

Plan: Plan 06 Murragamba 1 RS: 86 Profile: 100 year

E.G. Elev (m)	449.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	448.97	Reach Len. (m)	116.70	125.00	131.90
Crit W.S. (m)		Flow Area (m2)	13.71	26.22	7.28
E.G. Slope (m/m)	0.004153	Area (m2)	13.71	26.22	7.28
Q Total (m3/s)	88.09	Flow (m3/s)	14.01	66.98	7.10

Plan: Plan 06 Murragamba 1 RS: 86 Profile: 100 year (Continued)

Top Width (m)	45.97	Top Width (m)	19.31	15.70	10.95
Vel Total (m/s)	1.87	Avg. Vel. (m/s)	1.02	2.55	0.98
Max Chl Dpth (m)	2.17	Hydr. Depth (m)	0.71	1.67	0.66
Conv. Total (m3/s)	1367.0	Conv. (m3/s)	217.5	1039.4	110.2
Length Wtd. (m)	124.36	Wetted Per. (m)	19.41	16.05	11.05
Min Ch El (m)	446.80	Shear (N/m2)	28.76	66.55	26.82
Alpha	1.49	Stream Power (N/m s)	29.40	169.98	26.17
Frctn Loss (m)	0.69	Cum Volume (1000 m3)	98.02	140.89	71.57
C & E Loss (m)	0.02	Cum SA (1000 m2)	135.08	87.95	120.61

Plan: Plan 06 Murragamba 1 RS: 85 Profile: 100 year

E.G. Elev (m)	448.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	448.11	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	448.11	Flow Area (m2)	9.14	22.74	5.32
E.G. Slope (m/m)	0.007716	Area (m2)	9.14	22.74	5.32
Q Total (m3/s)	88.09	Flow (m3/s)	10.29	71.98	5.81
Top Width (m)	44.25	Top Width (m)	17.76	15.70	10.78
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.13	3.17	1.09
Max Chl Dpth (m)	1.95	Hydr. Depth (m)	0.51	1.45	0.49
Conv. Total (m3/s)	1002.8	Conv. (m3/s)	117.1	819.5	66.2
Length Wtd. (m)	1.00	Wetted Per. (m)	17.83	16.04	10.85
Min Ch El (m)	446.16	Shear (N/m2)	38.80	107.22	37.11
Alpha	1.50	Stream Power (N/m s)	43.67	339.49	40.54
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	96.68	137.83	70.74
C & E Loss (m)	0.03	Cum SA (1000 m2)	132.92	85.99	119.17

Plan: Plan 06 Murragamba 1 RS: 84.5 Profile: 100 year

E.G. Elev (m)	448.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	447.72	Reach Len. (m)	164.10	164.40	164.40
Crit W.S. (m)		Flow Area (m2)	11.16	24.50	6.56
E.G. Slope (m/m)	0.005573	Area (m2)	11.16	24.50	6.56
Q Total (m3/s)	88.09	Flow (m3/s)	11.99	69.28	6.81
Top Width (m)	45.12	Top Width (m)	18.20	15.70	11.22
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.07	2.83	1.04
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.61	1.56	0.58
Conv. Total (m3/s)	1180.0	Conv. (m3/s)	160.7	928.1	91.2
Length Wtd. (m)	164.36	Wetted Per. (m)	18.28	16.04	11.30
Min Ch El (m)	445.66	Shear (N/m2)	33.37	83.44	31.71
Alpha	1.50	Stream Power (N/m s)	35.86	235.99	32.93
Frctn Loss (m)	0.78	Cum Volume (1000 m3)	96.67	137.81	70.73
C & E Loss (m)	0.02	Cum SA (1000 m2)	132.90	85.98	119.16

Plan: Plan 06 Murragamba 1 RS: 84 Profile: 100 year

E.G. Elev (m)	447.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.26	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.99	Reach Len. (m)	132.80	139.20	144.30
Crit W.S. (m)		Flow Area (m2)	10.62	26.32	10.51
E.G. Slope (m/m)	0.004093	Area (m2)	10.62	26.32	10.51
Q Total (m3/s)	88.09	Flow (m3/s)	10.65	66.90	10.54
Top Width (m)	45.96	Top Width (m)	15.20	15.70	15.06
Vel Total (m/s)	1.86	Avg. Vel. (m/s)	1.00	2.54	1.00
Max Chl Dpth (m)	2.18	Hydr. Depth (m)	0.70	1.68	0.70
Conv. Total (m3/s)	1376.9	Conv. (m3/s)	166.5	1045.7	164.7
Length Wtd. (m)	139.00	Wetted Per. (m)	15.30	16.04	15.16
Min Ch El (m)	444.81	Shear (N/m2)	27.87	65.83	27.84

Plan: Plan 06 Murragamba 1 RS: 84 Profile: 100 year (Continued)

Alpha	1.49	Stream Power (N/m s)	27.96	167.36	27.91
Frctn Loss (m)	0.76	Cum Volume (1000 m3)	94.89	133.63	69.33
C & E Loss (m)	0.02	Cum SA (1000 m2)	130.16	83.40	117.00

Plan: Plan 06 Murragamba 1 RS: 83 Profile: 100 year

E.G. Elev (m)	446.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	446.04	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	446.04	Flow Area (m2)	7.97	22.74	6.45
E.G. Slope (m/m)	0.007723	Area (m2)	7.97	22.74	6.45
Q Total (m3/s)	88.09	Flow (m3/s)	8.93	72.03	7.13
Top Width (m)	44.16	Top Width (m)	15.62	15.70	12.83
Vel Total (m/s)	2.37	Avg. Vel. (m/s)	1.12	3.17	1.11
Max Chl Dpth (m)	1.95	Hydr. Depth (m)	0.51	1.45	0.50
Conv. Total (m3/s)	1002.4	Conv. (m3/s)	101.6	819.6	81.2
Length Wtd. (m)	1.00	Wetted Per. (m)	15.69	16.04	12.90
Min Ch El (m)	444.09	Shear (N/m2)	38.49	107.33	37.84
Alpha	1.50	Stream Power (N/m s)	43.08	340.00	41.88
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	93.65	130.22	68.11
C & E Loss (m)	0.04	Cum SA (1000 m2)	128.11	81.21	114.99

Plan: Plan 06 Murragamba 1 RS: 82.5 Profile: 100 year

E.G. Elev (m)	446.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	445.69	Reach Len. (m)	62.40	46.10	30.70
Crit W.S. (m)		Flow Area (m2)	10.29	25.03	8.36
E.G. Slope (m/m)	0.005089	Area (m2)	10.29	25.03	8.36
Q Total (m3/s)	88.09	Flow (m3/s)	10.82	68.60	8.67
Top Width (m)	45.29	Top Width (m)	16.19	15.70	13.40
Vel Total (m/s)	2.02	Avg. Vel. (m/s)	1.05	2.74	1.04
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.64	1.59	0.62
Conv. Total (m3/s)	1234.8	Conv. (m3/s)	151.7	961.6	121.5
Length Wtd. (m)	46.81	Wetted Per. (m)	16.28	16.04	13.49
Min Ch El (m)	443.59	Shear (N/m2)	31.56	77.84	30.93
Alpha	1.50	Stream Power (N/m s)	33.17	213.39	32.08
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	93.64	130.20	68.10
C & E Loss (m)	0.00	Cum SA (1000 m2)	128.09	81.19	114.98

Plan: Plan 06 Murragamba 1 RS: 82 Profile: 100 year

E.G. Elev (m)	445.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	445.45	Reach Len. (m)	66.30	45.50	25.39
Crit W.S. (m)		Flow Area (m2)	11.45	25.04	7.28
E.G. Slope (m/m)	0.005068	Area (m2)	11.45	25.04	7.28
Q Total (m3/s)	88.09	Flow (m3/s)	12.09	68.54	7.46
Top Width (m)	45.37	Top Width (m)	17.83	15.70	11.83
Vel Total (m/s)	2.01	Avg. Vel. (m/s)	1.06	2.74	1.03
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.64	1.60	0.62
Conv. Total (m3/s)	1237.4	Conv. (m3/s)	169.8	962.7	104.8
Length Wtd. (m)	46.51	Wetted Per. (m)	17.92	16.04	11.92
Min Ch El (m)	443.36	Shear (N/m2)	31.75	77.57	30.36
Alpha	1.50	Stream Power (N/m s)	33.53	212.30	31.12
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	92.97	129.04	67.86
C & E Loss (m)	0.00	Cum SA (1000 m2)	127.03	80.47	114.59

Plan: Plan 06 Murragamba 1 RS: 81 Profile: 100 year

E.G. Elev (m)	445.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	445.21	Reach Len. (m)	78.40	58.80	39.60
Crit W.S. (m)		Flow Area (m2)	10.80	24.94	7.74
E.G. Slope (m/m)	0.005159	Area (m2)	10.80	24.94	7.74
Q Total (m3/s)	88.09	Flow (m3/s)	11.41	68.68	8.01
Top Width (m)	45.32	Top Width (m)	17.03	15.70	12.59
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.06	2.75	1.03
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.63	1.59	0.62
Conv. Total (m3/s)	1226.5	Conv. (m3/s)	158.8	956.2	111.5
Length Wtd. (m)	59.17	Wetted Per. (m)	17.12	16.04	12.68
Min Ch El (m)	443.12	Shear (N/m2)	31.91	78.64	30.90
Alpha	1.50	Stream Power (N/m s)	33.72	216.54	31.95
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	92.23	127.90	67.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	125.88	79.76	114.28

Plan: Plan 06 Murragamba 1 RS: 80 Profile: 100 year

E.G. Elev (m)	445.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	444.90	Reach Len. (m)	80.90	64.90	47.70
Crit W.S. (m)		Flow Area (m2)	9.10	24.87	9.46
E.G. Slope (m/m)	0.005202	Area (m2)	9.10	24.87	9.46
Q Total (m3/s)	88.09	Flow (m3/s)	9.52	68.64	9.93
Top Width (m)	45.51	Top Width (m)	14.64	15.70	15.17
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.05	2.76	1.05
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.62	1.58	0.62
Conv. Total (m3/s)	1221.4	Conv. (m3/s)	132.0	951.7	137.6
Length Wtd. (m)	63.97	Wetted Per. (m)	14.73	16.04	15.26
Min Ch El (m)	442.82	Shear (N/m2)	31.52	79.07	31.64
Alpha	1.50	Stream Power (N/m s)	32.98	218.22	33.19
Frctn Loss (m)	0.33	Cum Volume (1000 m3)	91.45	126.44	67.33
C & E Loss (m)	0.00	Cum SA (1000 m2)	124.64	78.83	113.73

Plan: Plan 06 Murragamba 1 RS: 79 Profile: 100 year

E.G. Elev (m)	444.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	444.57	Reach Len. (m)	32.30	31.80	23.70
Crit W.S. (m)		Flow Area (m2)	5.58	24.88	12.86
E.G. Slope (m/m)	0.005207	Area (m2)	5.58	24.88	12.86
Q Total (m3/s)	88.09	Flow (m3/s)	5.62	68.73	13.73
Top Width (m)	45.31	Top Width (m)	9.48	15.70	20.12
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.01	2.76	1.07
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.59	1.58	0.64
Conv. Total (m3/s)	1220.8	Conv. (m3/s)	77.9	952.5	190.3
Length Wtd. (m)	30.85	Wetted Per. (m)	9.57	16.04	20.21
Min Ch El (m)	442.48	Shear (N/m2)	29.78	79.19	32.50
Alpha	1.50	Stream Power (N/m s)	30.00	218.74	34.70
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	90.85	124.83	66.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	123.66	77.81	112.89

Plan: Plan 06 Murragamba 1 RS: 78 Profile: 100 year

E.G. Elev (m)	444.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	444.43	Reach Len. (m)	21.60	32.90	42.50
Crit W.S. (m)		Flow Area (m2)	12.10	25.37	7.98
E.G. Slope (m/m)	0.004706	Area (m2)	12.10	25.37	7.98
Q Total (m3/s)	88.09	Flow (m3/s)	12.55	67.48	8.06

Plan: Plan 06 Murragamba 1 RS: 78 Profile: 100 year (Continued)

Top Width (m)	46.55	Top Width (m)	18.30	15.70	12.54
Vel Total (m/s)	1.94	Avg. Vel. (m/s)	1.04	2.66	1.01
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.66	1.62	0.64
Conv. Total (m3/s)	1284.1	Conv. (m3/s)	183.0	983.6	117.5
Length Wtd. (m)	32.11	Wetted Per. (m)	18.39	16.04	12.63
Min Ch El (m)	442.32	Shear (N/m2)	30.35	72.96	29.14
Alpha	1.51	Stream Power (N/m s)	31.50	194.09	29.43
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	90.57	124.03	66.55
C & E Loss (m)	0.01	Cum SA (1000 m2)	123.21	77.31	112.50

Plan: Plan 06 Murragamba 1 RS: 77 Profile: 100 year

E.G. Elev (m)	444.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	444.09	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	444.09	Flow Area (m2)	9.89	22.71	4.87
E.G. Slope (m/m)	0.007683	Area (m2)	9.89	22.71	4.87
Q Total (m3/s)	88.09	Flow (m3/s)	11.12	71.70	5.27
Top Width (m)	44.86	Top Width (m)	19.17	15.70	9.99
Vel Total (m/s)	2.35	Avg. Vel. (m/s)	1.12	3.16	1.08
Max Chl Dpth (m)	1.95	Hydr. Depth (m)	0.52	1.45	0.49
Conv. Total (m3/s)	1005.0	Conv. (m3/s)	126.8	818.0	60.1
Length Wtd. (m)	1.00	Wetted Per. (m)	19.24	16.04	10.06
Min Ch El (m)	442.15	Shear (N/m2)	38.72	106.64	36.52
Alpha	1.51	Stream Power (N/m s)	43.55	336.68	39.50
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	90.33	123.24	66.28
C & E Loss (m)	0.04	Cum SA (1000 m2)	122.81	76.80	112.02

Plan: Plan 06 Murragamba 1 RS: 76.5 Profile: 100 year

E.G. Elev (m)	444.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	443.74	Reach Len. (m)	103.70	105.90	107.50
Crit W.S. (m)		Flow Area (m2)	12.67	24.96	6.34
E.G. Slope (m/m)	0.005083	Area (m2)	12.67	24.96	6.34
Q Total (m3/s)	88.09	Flow (m3/s)	13.41	68.27	6.41
Top Width (m)	45.97	Top Width (m)	19.72	15.70	10.54
Vel Total (m/s)	2.00	Avg. Vel. (m/s)	1.06	2.73	1.01
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.64	1.59	0.60
Conv. Total (m3/s)	1235.6	Conv. (m3/s)	188.1	957.5	89.9
Length Wtd. (m)	105.73	Wetted Per. (m)	19.81	16.05	10.63
Min Ch El (m)	441.65	Shear (N/m2)	31.88	77.55	29.75
Alpha	1.51	Stream Power (N/m s)	33.74	212.09	30.07
Frctn Loss (m)	0.54	Cum Volume (1000 m3)	90.32	123.21	66.27
C & E Loss (m)	0.00	Cum SA (1000 m2)	122.79	76.78	112.01

Plan: Plan 06 Murragamba 1 RS: 76 Profile: 100 year

E.G. Elev (m)	443.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	443.19	Reach Len. (m)	87.00	72.50	56.70
Crit W.S. (m)		Flow Area (m2)	10.47	24.94	8.08
E.G. Slope (m/m)	0.005156	Area (m2)	10.47	24.94	8.08
Q Total (m3/s)	88.09	Flow (m3/s)	11.05	68.66	8.38
Top Width (m)	45.34	Top Width (m)	16.56	15.70	13.08
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.05	2.75	1.04
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.63	1.59	0.62
Conv. Total (m3/s)	1226.8	Conv. (m3/s)	153.8	956.2	116.7
Length Wtd. (m)	72.24	Wetted Per. (m)	16.65	16.04	13.17
Min Ch El (m)	441.10	Shear (N/m2)	31.82	78.60	31.03

Plan: Plan 06 Murragamba 1 RS: 76 Profile: 100 year (Continued)

Alpha	1.50	Stream Power (N/m s)	33.55	216.39	32.19
Frctn Loss (m)	0.38	Cum Volume (1000 m3)	89.12	120.57	65.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.91	75.12	110.74

Plan: Plan 06 Murragamba 1 RS: 75 Profile: 100 year

E.G. Elev (m)	443.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	442.81	Reach Len. (m)	46.90	35.60	21.30
Crit W.S. (m)		Flow Area (m2)	7.33	24.80	10.98
E.G. Slope (m/m)	0.005279	Area (m2)	7.33	24.80	10.98
Q Total (m3/s)	88.09	Flow (m3/s)	7.59	68.84	11.66
Top Width (m)	45.30	Top Width (m)	12.11	15.70	17.48
Vel Total (m/s)	2.04	Avg. Vel. (m/s)	1.03	2.78	1.06
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.61	1.58	0.63
Conv. Total (m3/s)	1212.4	Conv. (m3/s)	104.5	947.4	160.5
Length Wtd. (m)	35.22	Wetted Per. (m)	12.20	16.04	17.57
Min Ch El (m)	440.73	Shear (N/m2)	31.12	80.03	32.35
Alpha	1.50	Stream Power (N/m s)	32.20	222.11	34.36
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	88.35	118.77	64.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	119.66	73.98	109.88

Plan: Plan 06 Murragamba 1 RS: 74 Profile: 100 year

E.G. Elev (m)	442.94	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	442.63	Reach Len. (m)	2.50	28.00	49.20
Crit W.S. (m)		Flow Area (m2)	10.93	24.86	7.83
E.G. Slope (m/m)	0.005182	Area (m2)	10.93	24.86	7.83
Q Total (m3/s)	88.09	Flow (m3/s)	11.53	68.47	8.09
Top Width (m)	45.82	Top Width (m)	17.33	15.70	12.79
Vel Total (m/s)	2.02	Avg. Vel. (m/s)	1.06	2.75	1.03
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.63	1.58	0.61
Conv. Total (m3/s)	1223.7	Conv. (m3/s)	160.2	951.2	112.3
Length Wtd. (m)	26.29	Wetted Per. (m)	17.41	16.05	12.87
Min Ch El (m)	440.54	Shear (N/m2)	31.89	78.74	30.89
Alpha	1.51	Stream Power (N/m s)	33.65	216.87	31.92
Frctn Loss (m)	0.13	Cum Volume (1000 m3)	87.92	117.88	64.75
C & E Loss (m)	0.00	Cum SA (1000 m2)	118.97	73.42	109.55

Plan: Plan 06 Murragamba 1 RS: 73 Profile: 100 year

E.G. Elev (m)	442.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	442.50	Reach Len. (m)	18.10	26.80	32.70
Crit W.S. (m)		Flow Area (m2)	12.04	25.08	6.77
E.G. Slope (m/m)	0.005034	Area (m2)	12.04	25.08	6.77
Q Total (m3/s)	88.09	Flow (m3/s)	12.73	68.47	6.89
Top Width (m)	45.40	Top Width (m)	18.63	15.70	11.07
Vel Total (m/s)	2.01	Avg. Vel. (m/s)	1.06	2.73	1.02
Max Chl Dpth (m)	2.10	Hydr. Depth (m)	0.65	1.60	0.61
Conv. Total (m3/s)	1241.5	Conv. (m3/s)	179.4	965.0	97.1
Length Wtd. (m)	26.36	Wetted Per. (m)	18.72	16.04	11.16
Min Ch El (m)	440.40	Shear (N/m2)	31.75	77.17	29.96
Alpha	1.50	Stream Power (N/m s)	33.57	210.69	30.47
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	87.89	117.18	64.40
C & E Loss (m)	0.01	Cum SA (1000 m2)	118.92	72.98	108.97

Plan: Plan 06 Murragamba 1 RS: 72 Profile: 100 year

E.G. Elev (m)	442.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	442.21	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	442.21	Flow Area (m2)	6.48	22.70	8.39
E.G. Slope (m/m)	0.007676	Area (m2)	6.48	22.70	8.39
Q Total (m3/s)	88.09	Flow (m3/s)	7.14	71.59	9.36
Top Width (m)	45.11	Top Width (m)	12.95	15.70	16.45
Vel Total (m/s)	2.34	Avg. Vel. (m/s)	1.10	3.15	1.12
Max Chl Dpth (m)	1.94	Hydr. Depth (m)	0.50	1.45	0.51
Conv. Total (m3/s)	1005.4	Conv. (m3/s)	81.5	817.2	106.8
Length Wtd. (m)	1.00	Wetted Per. (m)	13.02	16.04	16.52
Min Ch El (m)	440.26	Shear (N/m2)	37.48	106.48	38.23
Alpha	1.51	Stream Power (N/m s)	41.25	335.88	42.64
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	87.72	116.54	64.15
C & E Loss (m)	0.04	Cum SA (1000 m2)	118.64	72.56	108.52

Plan: Plan 06 Murragamba 1 RS: 71.5 Profile: 100 year

E.G. Elev (m)	442.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.86	Reach Len. (m)	31.20	40.40	50.10
Crit W.S. (m)		Flow Area (m2)	8.45	25.02	10.87
E.G. Slope (m/m)	0.005005	Area (m2)	8.45	25.02	10.87
Q Total (m3/s)	88.09	Flow (m3/s)	8.69	68.03	11.37
Top Width (m)	46.26	Top Width (m)	13.53	15.70	17.03
Vel Total (m/s)	1.99	Avg. Vel. (m/s)	1.03	2.72	1.05
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.62	1.59	0.64
Conv. Total (m3/s)	1245.2	Conv. (m3/s)	122.9	961.6	160.7
Length Wtd. (m)	41.34	Wetted Per. (m)	13.62	16.04	17.12
Min Ch El (m)	439.76	Shear (N/m2)	30.45	76.55	31.18
Alpha	1.51	Stream Power (N/m s)	31.34	208.09	32.60
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	87.71	116.52	64.14
C & E Loss (m)	0.01	Cum SA (1000 m2)	118.62	72.55	108.50

Plan: Plan 06 Murragamba 1 RS: 71 Profile: 100 year

E.G. Elev (m)	441.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.57	Reach Len. (m)	65.30	52.90	32.40
Crit W.S. (m)		Flow Area (m2)	2.54	23.82	14.74
E.G. Slope (m/m)	0.006156	Area (m2)	2.54	23.82	14.74
Q Total (m3/s)	88.09	Flow (m3/s)	2.42	69.49	16.18
Top Width (m)	46.12	Top Width (m)	5.32	15.70	25.10
Vel Total (m/s)	2.14	Avg. Vel. (m/s)	0.95	2.92	1.10
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.48	1.52	0.59
Conv. Total (m3/s)	1122.7	Conv. (m3/s)	30.8	885.7	206.3
Length Wtd. (m)	49.64	Wetted Per. (m)	5.40	16.04	25.18
Min Ch El (m)	439.55	Shear (N/m2)	28.44	89.62	35.34
Alpha	1.52	Stream Power (N/m s)	27.02	261.45	38.80
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	87.54	115.53	63.50
C & E Loss (m)	0.01	Cum SA (1000 m2)	118.33	71.91	107.44

Plan: Plan 06 Murragamba 1 RS: 70 Profile: 100 year

E.G. Elev (m)	441.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.30	Reach Len. (m)	45.90	34.80	19.00
Crit W.S. (m)		Flow Area (m2)	4.92	23.92	15.31
E.G. Slope (m/m)	0.005648	Area (m2)	4.92	23.92	15.31
Q Total (m3/s)	88.09	Flow (m3/s)	4.87	67.02	16.20

Plan: Plan 06 Murragamba 1 RS: 70 Profile: 100 year (Continued)

Top Width (m)	50.68	Top Width (m)	9.15	15.70	25.83
Vel Total (m/s)	2.00	Avg. Vel. (m/s)	0.99	2.80	1.06
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.54	1.52	0.59
Conv. Total (m3/s)	1172.1	Conv. (m3/s)	64.8	891.8	215.6
Length Wtd. (m)	32.87	Wetted Per. (m)	9.23	16.05	25.91
Min Ch El (m)	439.28	Shear (N/m2)	29.55	82.57	32.73
Alpha	1.57	Stream Power (N/m s)	29.21	231.36	34.64
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	87.30	114.27	63.01
C & E Loss (m)	0.01	Cum SA (1000 m2)	117.86	71.08	106.62

Plan: Plan 06 Murragamba 1 RS: 69 Profile: 100 year

E.G. Elev (m)	441.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	441.14	Reach Len. (m)	23.60	46.40	53.90
Crit W.S. (m)		Flow Area (m2)	7.97	24.16	13.86
E.G. Slope (m/m)	0.005261	Area (m2)	7.97	24.16	13.86
Q Total (m3/s)	88.09	Flow (m3/s)	8.00	65.78	14.31
Top Width (m)	52.46	Top Width (m)	13.76	15.70	22.99
Vel Total (m/s)	1.92	Avg. Vel. (m/s)	1.00	2.72	1.03
Max Chl Dpth (m)	2.04	Hydr. Depth (m)	0.58	1.54	0.60
Conv. Total (m3/s)	1214.5	Conv. (m3/s)	110.3	906.8	197.3
Length Wtd. (m)	43.41	Wetted Per. (m)	13.84	16.04	23.07
Min Ch El (m)	439.10	Shear (N/m2)	29.70	77.68	30.99
Alpha	1.58	Stream Power (N/m s)	29.82	211.50	32.01
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	87.00	113.43	62.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	117.33	70.54	106.16

Plan: Plan 06 Murragamba 1 RS: 68 Profile: 100 year

E.G. Elev (m)	441.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	440.92	Reach Len. (m)	29.00	40.90	44.50
Crit W.S. (m)		Flow Area (m2)	19.52	24.45	2.07
E.G. Slope (m/m)	0.005081	Area (m2)	19.52	24.45	2.07
Q Total (m3/s)	88.09	Flow (m3/s)	20.40	65.95	1.75
Top Width (m)	51.20	Top Width (m)	31.04	15.70	4.47
Vel Total (m/s)	1.91	Avg. Vel. (m/s)	1.04	2.70	0.84
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.63	1.56	0.46
Conv. Total (m3/s)	1235.9	Conv. (m3/s)	286.2	925.2	24.5
Length Wtd. (m)	39.09	Wetted Per. (m)	31.12	16.04	4.55
Min Ch El (m)	438.86	Shear (N/m2)	31.26	75.93	22.69
Alpha	1.56	Stream Power (N/m s)	32.66	204.78	19.15
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	86.68	112.31	62.30
C & E Loss (m)	0.01	Cum SA (1000 m2)	116.80	69.81	105.42

Plan: Plan 06 Murragamba 1 RS: 67 Profile: 100 year

E.G. Elev (m)	440.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	440.58	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	440.58	Flow Area (m2)	9.17	22.41	8.92
E.G. Slope (m/m)	0.007369	Area (m2)	9.17	22.41	8.92
Q Total (m3/s)	88.09	Flow (m3/s)	9.85	68.67	9.56
Top Width (m)	52.16	Top Width (m)	18.48	15.70	17.99
Vel Total (m/s)	2.18	Avg. Vel. (m/s)	1.07	3.06	1.07
Max Chl Dpth (m)	1.93	Hydr. Depth (m)	0.50	1.43	0.50
Conv. Total (m3/s)	1026.2	Conv. (m3/s)	114.8	800.0	111.4
Length Wtd. (m)	1.00	Wetted Per. (m)	18.54	16.05	18.05
Min Ch El (m)	438.65	Shear (N/m2)	35.75	100.93	35.69

Plan: Plan 06 Murragamba 1 RS: 67 Profile: 100 year (Continued)

Alpha	1.60	Stream Power (N/m s)	38.40	309.30	38.29
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	86.26	111.35	62.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	116.09	69.16	104.92

Plan: Plan 06 Murragamba 1 RS: 66.5 Profile: 100 year

E.G. Elev (m)	440.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	440.21	Reach Len. (m)	52.60	49.30	40.00
Crit W.S. (m)		Flow Area (m2)	11.72	24.54	11.40
E.G. Slope (m/m)	0.004853	Area (m2)	11.72	24.54	11.40
Q Total (m3/s)	88.09	Flow (m3/s)	11.79	64.84	11.45
Top Width (m)	53.25	Top Width (m)	19.02	15.70	18.53
Vel Total (m/s)	1.85	Avg. Vel. (m/s)	1.01	2.64	1.00
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.62	1.56	0.62
Conv. Total (m3/s)	1264.5	Conv. (m3/s)	169.3	930.8	164.4
Length Wtd. (m)	47.90	Wetted Per. (m)	19.10	16.04	18.61
Min Ch El (m)	438.15	Shear (N/m2)	29.21	72.79	29.15
Alpha	1.58	Stream Power (N/m s)	29.39	192.34	29.29
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	86.25	111.32	62.05
C & E Loss (m)	0.00	Cum SA (1000 m2)	116.07	69.15	104.90

Plan: Plan 06 Murragamba 1 RS: 66 Profile: 100 year

E.G. Elev (m)	440.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.93	Reach Len. (m)	42.40	35.40	24.30
Crit W.S. (m)		Flow Area (m2)	1.88	24.07	18.74
E.G. Slope (m/m)	0.005472	Area (m2)	1.88	24.07	18.74
Q Total (m3/s)	88.09	Flow (m3/s)	1.59	66.66	19.84
Top Width (m)	50.83	Top Width (m)	4.23	15.70	30.90
Vel Total (m/s)	1.97	Avg. Vel. (m/s)	0.85	2.77	1.06
Max Chl Dpth (m)	2.03	Hydr. Depth (m)	0.44	1.53	0.61
Conv. Total (m3/s)	1190.9	Conv. (m3/s)	21.5	901.2	268.1
Length Wtd. (m)	33.29	Wetted Per. (m)	4.31	16.04	30.98
Min Ch El (m)	437.90	Shear (N/m2)	23.36	80.49	32.46
Alpha	1.56	Stream Power (N/m s)	19.85	222.93	34.36
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	85.89	110.13	61.45
C & E Loss (m)	0.01	Cum SA (1000 m2)	115.46	68.37	103.91

Plan: Plan 06 Murragamba 1 RS: 65 Profile: 100 year

E.G. Elev (m)	440.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.77	Reach Len. (m)	64.00	71.30	69.70
Crit W.S. (m)		Flow Area (m2)	4.90	24.42	17.07
E.G. Slope (m/m)	0.005063	Area (m2)	4.90	24.42	17.07
Q Total (m3/s)	88.09	Flow (m3/s)	4.69	65.70	17.69
Top Width (m)	51.86	Top Width (m)	8.79	15.70	27.37
Vel Total (m/s)	1.90	Avg. Vel. (m/s)	0.96	2.69	1.04
Max Chl Dpth (m)	2.05	Hydr. Depth (m)	0.56	1.56	0.62
Conv. Total (m3/s)	1238.0	Conv. (m3/s)	66.0	923.3	248.7
Length Wtd. (m)	70.04	Wetted Per. (m)	8.87	16.04	27.45
Min Ch El (m)	437.71	Shear (N/m2)	27.42	75.58	30.87
Alpha	1.57	Stream Power (N/m s)	26.27	203.32	32.01
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	85.75	109.27	61.01
C & E Loss (m)	0.01	Cum SA (1000 m2)	115.18	67.82	103.20

Plan: Plan 06 Murragamba 1 RS: 64 Profile: 100 year

E.G. Elev (m)	439.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.25	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	439.47	Reach Len. (m)	137.80	149.50	152.30
Crit W.S. (m)		Flow Area (m2)	21.14	25.56	2.77
E.G. Slope (m/m)	0.004185	Area (m2)	21.14	25.56	2.77
Q Total (m3/s)	88.09	Flow (m3/s)	21.37	64.42	2.31
Top Width (m)	51.49	Top Width (m)	30.53	15.70	5.26
Vel Total (m/s)	1.78	Avg. Vel. (m/s)	1.01	2.52	0.83
Max Chl Dpth (m)	2.13	Hydr. Depth (m)	0.69	1.63	0.53
Conv. Total (m3/s)	1361.7	Conv. (m3/s)	330.3	995.8	35.6
Length Wtd. (m)	147.93	Wetted Per. (m)	30.62	16.04	5.35
Min Ch El (m)	437.35	Shear (N/m2)	28.34	65.36	21.23
Alpha	1.55	Stream Power (N/m s)	28.64	164.77	17.70
Frctn Loss (m)	0.81	Cum Volume (1000 m3)	84.92	107.49	60.32
C & E Loss (m)	0.01	Cum SA (1000 m2)	113.92	66.70	102.06

Plan: Plan 06 Murragamba 1 RS: 63 Profile: 100 year

E.G. Elev (m)	438.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	438.51	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	438.51	Flow Area (m2)	5.58	22.48	11.70
E.G. Slope (m/m)	0.007440	Area (m2)	5.58	22.48	11.70
Q Total (m3/s)	88.09	Flow (m3/s)	5.90	69.39	12.81
Top Width (m)	50.35	Top Width (m)	11.57	15.70	23.09
Vel Total (m/s)	2.22	Avg. Vel. (m/s)	1.06	3.09	1.09
Max Chl Dpth (m)	1.93	Hydr. Depth (m)	0.48	1.43	0.51
Conv. Total (m3/s)	1021.3	Conv. (m3/s)	68.4	804.4	148.5
Length Wtd. (m)	1.00	Wetted Per. (m)	11.63	16.05	23.15
Min Ch El (m)	436.57	Shear (N/m2)	35.00	102.23	36.87
Alpha	1.58	Stream Power (N/m s)	37.00	315.49	40.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	83.08	103.89	59.22
C & E Loss (m)	0.03	Cum SA (1000 m2)	111.02	64.35	99.91

Plan: Plan 06 Murragamba 1 RS: 62.5 Profile: 100 year

E.G. Elev (m)	438.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	438.12	Reach Len. (m)	50.90	40.80	25.70
Crit W.S. (m)		Flow Area (m2)	6.89	24.23	14.30
E.G. Slope (m/m)	0.005292	Area (m2)	6.89	24.23	14.30
Q Total (m3/s)	88.09	Flow (m3/s)	6.90	66.30	14.89
Top Width (m)	51.24	Top Width (m)	12.01	15.70	23.53
Vel Total (m/s)	1.94	Avg. Vel. (m/s)	1.00	2.74	1.04
Max Chl Dpth (m)	2.04	Hydr. Depth (m)	0.57	1.54	0.61
Conv. Total (m3/s)	1210.9	Conv. (m3/s)	94.8	911.4	204.7
Length Wtd. (m)	38.45	Wetted Per. (m)	12.09	16.04	23.61
Min Ch El (m)	436.07	Shear (N/m2)	29.59	78.38	31.43
Alpha	1.57	Stream Power (N/m s)	29.61	214.43	32.74
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	83.07	103.87	59.20
C & E Loss (m)	0.00	Cum SA (1000 m2)	111.01	64.34	99.88

Plan: Plan 06 Murragamba 1 RS: 62 Profile: 100 year

E.G. Elev (m)	438.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.87	Reach Len. (m)	47.70	38.50	21.50
Crit W.S. (m)		Flow Area (m2)	2.42	23.72	17.42
E.G. Slope (m/m)	0.005850	Area (m2)	2.42	23.72	17.42
Q Total (m3/s)	88.09	Flow (m3/s)	2.21	67.27	18.61

Plan: Plan 06 Murragamba 1 RS: 62 Profile: 100 year (Continued)

Top Width (m)	50.65	Top Width (m)	5.19	15.70	29.76
Vel Total (m/s)	2.02	Avg. Vel. (m/s)	0.91	2.84	1.07
Max Chl Dpth (m)	2.01	Hydr. Depth (m)	0.47	1.51	0.59
Conv. Total (m3/s)	1151.7	Conv. (m3/s)	28.9	879.5	243.3
Length Wtd. (m)	35.98	Wetted Per. (m)	5.27	16.04	29.84
Min Ch El (m)	435.86	Shear (N/m2)	26.40	84.82	33.49
Alpha	1.57	Stream Power (N/m s)	24.07	240.54	35.78
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	82.83	102.89	58.80
C & E Loss (m)	0.02	Cum SA (1000 m2)	110.57	63.70	99.20

Plan: Plan 06 Murragamba 1 RS: 61 Profile: 100 year

E.G. Elev (m)	437.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.73	Reach Len. (m)	22.10	46.00	53.80
Crit W.S. (m)		Flow Area (m2)	10.11	24.54	14.03
E.G. Slope (m/m)	0.004740	Area (m2)	10.11	24.54	14.03
Q Total (m3/s)	88.09	Flow (m3/s)	9.97	64.06	14.06
Top Width (m)	54.81	Top Width (m)	16.59	15.70	22.52
Vel Total (m/s)	1.81	Avg. Vel. (m/s)	0.99	2.61	1.00
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.61	1.56	0.62
Conv. Total (m3/s)	1279.5	Conv. (m3/s)	144.8	930.4	204.3
Length Wtd. (m)	42.66	Wetted Per. (m)	16.67	16.04	22.60
Min Ch El (m)	435.67	Shear (N/m2)	28.18	71.08	28.86
Alpha	1.60	Stream Power (N/m s)	27.80	185.57	28.93
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	82.53	101.96	58.46
C & E Loss (m)	0.01	Cum SA (1000 m2)	110.05	63.09	98.64

Plan: Plan 06 Murragamba 1 RS: 60 Profile: 100 year

E.G. Elev (m)	437.77	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.45	Reach Len. (m)	17.00	35.60	53.00
Crit W.S. (m)		Flow Area (m2)	18.50	23.88	1.65
E.G. Slope (m/m)	0.005676	Area (m2)	18.50	23.88	1.65
Q Total (m3/s)	88.09	Flow (m3/s)	19.70	67.01	1.38
Top Width (m)	50.66	Top Width (m)	31.06	15.70	3.90
Vel Total (m/s)	2.00	Avg. Vel. (m/s)	1.06	2.81	0.84
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.60	1.52	0.42
Conv. Total (m3/s)	1169.2	Conv. (m3/s)	261.5	889.4	18.4
Length Wtd. (m)	32.47	Wetted Per. (m)	31.14	16.04	3.98
Min Ch El (m)	435.43	Shear (N/m2)	33.07	82.85	23.10
Alpha	1.56	Stream Power (N/m s)	35.22	232.47	19.36
Frctn Loss (m)	0.17	Cum Volume (1000 m3)	82.22	100.85	58.04
C & E Loss (m)	0.01	Cum SA (1000 m2)	109.53	62.37	97.93

Plan: Plan 06 Murragamba 1 RS: 59 Profile: 100 year

E.G. Elev (m)	437.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.30	Reach Len. (m)	13.00	37.60	40.90
Crit W.S. (m)		Flow Area (m2)	16.38	24.46	6.16
E.G. Slope (m/m)	0.004968	Area (m2)	16.38	24.46	6.16
Q Total (m3/s)	88.09	Flow (m3/s)	16.84	65.26	5.99
Top Width (m)	52.62	Top Width (m)	26.23	15.70	10.69
Vel Total (m/s)	1.87	Avg. Vel. (m/s)	1.03	2.67	0.97
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.62	1.56	0.58
Conv. Total (m3/s)	1249.8	Conv. (m3/s)	238.9	925.9	85.0
Length Wtd. (m)	35.35	Wetted Per. (m)	26.31	16.04	10.77
Min Ch El (m)	435.24	Shear (N/m2)	30.33	74.27	27.88

Plan: Plan 06 Murragamba 1 RS: 59 Profile: 100 year (Continued)

Alpha	1.58	Stream Power (N/m s)	31.18	198.14	27.09
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	81.92	99.99	57.83
C & E Loss (m)	0.01	Cum SA (1000 m2)	109.04	61.81	97.54

Plan: Plan 06 Murragamba 1 RS: 58 Profile: 100 year

E.G. Elev (m)	437.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	437.05	Reach Len. (m)	62.60	34.90	0.84
Crit W.S. (m)		Flow Area (m2)	2.64	23.53	16.77
E.G. Slope (m/m)	0.006071	Area (m2)	2.64	23.53	16.77
Q Total (m3/s)	88.09	Flow (m3/s)	2.47	67.62	18.00
Top Width (m)	50.54	Top Width (m)	5.61	15.70	29.23
Vel Total (m/s)	2.05	Avg. Vel. (m/s)	0.93	2.87	1.07
Max Chl Dpth (m)	2.00	Hydr. Depth (m)	0.47	1.50	0.57
Conv. Total (m3/s)	1130.6	Conv. (m3/s)	31.7	867.9	231.1
Length Wtd. (m)	28.99	Wetted Per. (m)	5.69	16.05	29.31
Min Ch El (m)	435.05	Shear (N/m2)	27.65	87.31	34.06
Alpha	1.57	Stream Power (N/m s)	25.84	250.88	36.57
Frctn Loss (m)	0.17	Cum Volume (1000 m3)	81.80	99.09	57.36
C & E Loss (m)	0.01	Cum SA (1000 m2)	108.83	61.22	96.72

Plan: Plan 06 Murragamba 1 RS: 57 Profile: 100 year

E.G. Elev (m)	437.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	436.90	Reach Len. (m)	48.80	37.20	10.20
Crit W.S. (m)		Flow Area (m2)	3.90	23.98	16.69
E.G. Slope (m/m)	0.005551	Area (m2)	3.90	23.98	16.69
Q Total (m3/s)	88.09	Flow (m3/s)	3.74	66.72	17.63
Top Width (m)	51.06	Top Width (m)	7.48	15.70	27.89
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.96	2.78	1.06
Max Chl Dpth (m)	2.03	Hydr. Depth (m)	0.52	1.53	0.60
Conv. Total (m3/s)	1182.4	Conv. (m3/s)	50.2	895.5	236.6
Length Wtd. (m)	34.30	Wetted Per. (m)	7.55	16.04	27.96
Min Ch El (m)	434.87	Shear (N/m2)	28.10	81.35	32.49
Alpha	1.57	Stream Power (N/m s)	26.95	226.35	34.32
Frctn Loss (m)	0.17	Cum Volume (1000 m3)	81.59	98.26	57.35
C & E Loss (m)	0.02	Cum SA (1000 m2)	108.42	60.67	96.70

Plan: Plan 06 Murragamba 1 RS: 56 Profile: 100 year

E.G. Elev (m)	437.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.25	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	436.77	Reach Len. (m)	20.40	37.80	45.20
Crit W.S. (m)		Flow Area (m2)	15.24	25.01	9.70
E.G. Slope (m/m)	0.004378	Area (m2)	15.24	25.01	9.70
Q Total (m3/s)	88.09	Flow (m3/s)	15.12	63.57	9.40
Top Width (m)	54.49	Top Width (m)	23.40	15.70	15.39
Vel Total (m/s)	1.76	Avg. Vel. (m/s)	0.99	2.54	0.97
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.65	1.59	0.63
Conv. Total (m3/s)	1331.3	Conv. (m3/s)	228.6	960.7	142.0
Length Wtd. (m)	35.01	Wetted Per. (m)	23.49	16.04	15.48
Min Ch El (m)	434.68	Shear (N/m2)	27.87	66.92	26.90
Alpha	1.59	Stream Power (N/m s)	27.65	170.09	26.07
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	81.13	97.35	57.21
C & E Loss (m)	0.01	Cum SA (1000 m2)	107.67	60.09	96.48

Plan: Plan 06 Murragamba 1 RS: 55 Profile: 100 year

E.G. Elev (m)	436.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	436.42	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	436.42	Flow Area (m2)	15.90	22.50	1.22
E.G. Slope (m/m)	0.007437	Area (m2)	15.90	22.50	1.22
Q Total (m3/s)	88.09	Flow (m3/s)	17.57	69.46	1.06
Top Width (m)	49.98	Top Width (m)	30.92	15.70	3.36
Vel Total (m/s)	2.22	Avg. Vel. (m/s)	1.11	3.09	0.87
Max Chl Dpth (m)	1.93	Hydr. Depth (m)	0.51	1.43	0.36
Conv. Total (m3/s)	1021.5	Conv. (m3/s)	203.8	805.4	12.3
Length Wtd. (m)	1.00	Wetted Per. (m)	30.99	16.04	3.43
Min Ch El (m)	434.48	Shear (N/m2)	37.42	102.27	26.02
Alpha	1.57	Stream Power (N/m s)	41.36	315.70	22.57
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	80.81	96.45	56.97
C & E Loss (m)	0.02	Cum SA (1000 m2)	107.11	59.49	96.05

Plan: Plan 06 Murragamba 1 RS: 54.5 Profile: 100 year

E.G. Elev (m)	436.32	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.99	Reach Len. (m)	16.10	50.40	67.20
Crit W.S. (m)		Flow Area (m2)	18.26	23.70	1.49
E.G. Slope (m/m)	0.005876	Area (m2)	18.26	23.70	1.49
Q Total (m3/s)	88.09	Flow (m3/s)	19.55	67.30	1.24
Top Width (m)	50.59	Top Width (m)	31.22	15.70	3.66
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.07	2.84	0.83
Max Chl Dpth (m)	2.01	Hydr. Depth (m)	0.58	1.51	0.41
Conv. Total (m3/s)	1149.2	Conv. (m3/s)	255.1	878.0	16.1
Length Wtd. (m)	45.60	Wetted Per. (m)	31.30	16.04	3.74
Min Ch El (m)	433.98	Shear (N/m2)	33.62	85.09	22.95
Alpha	1.56	Stream Power (N/m s)	35.99	241.68	19.05
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	80.79	96.43	56.96
C & E Loss (m)	0.02	Cum SA (1000 m2)	107.08	59.48	96.05

Plan: Plan 06 Murragamba 1 RS: 54 Profile: 100 year

E.G. Elev (m)	436.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.79	Reach Len. (m)	55.20	44.70	36.70
Crit W.S. (m)		Flow Area (m2)	11.65	24.69	12.05
E.G. Slope (m/m)	0.004698	Area (m2)	11.65	24.69	12.05
Q Total (m3/s)	88.09	Flow (m3/s)	11.62	64.43	12.04
Top Width (m)	53.67	Top Width (m)	18.69	15.70	19.29
Vel Total (m/s)	1.82	Avg. Vel. (m/s)	1.00	2.61	1.00
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.62	1.57	0.62
Conv. Total (m3/s)	1285.2	Conv. (m3/s)	169.5	940.0	175.7
Length Wtd. (m)	44.79	Wetted Per. (m)	18.77	16.04	19.37
Min Ch El (m)	433.72	Shear (N/m2)	28.59	70.88	28.67
Alpha	1.58	Stream Power (N/m s)	28.52	185.00	28.64
Frctn Loss (m)	0.22	Cum Volume (1000 m3)	80.55	95.21	56.51
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.68	58.69	95.28

Plan: Plan 06 Murragamba 1 RS: 53 Profile: 100 year

E.G. Elev (m)	435.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.53	Reach Len. (m)	91.10	98.60	89.20
Crit W.S. (m)		Flow Area (m2)	8.67	24.14	12.40
E.G. Slope (m/m)	0.005374	Area (m2)	8.67	24.14	12.40
Q Total (m3/s)	88.09	Flow (m3/s)	8.84	66.39	12.87

Plan: Plan 06 Murragamba 1 RS: 53 Profile: 100 year (Continued)

Top Width (m)	51.32	Top Width (m)	14.89	15.70	20.74
Vel Total (m/s)	1.95	Avg. Vel. (m/s)	1.02	2.75	1.04
Max Chl Dpth (m)	2.04	Hydr. Depth (m)	0.58	1.54	0.60
Conv. Total (m3/s)	1201.6	Conv. (m3/s)	120.5	905.6	175.5
Length Wtd. (m)	96.51	Wetted Per. (m)	14.97	16.04	20.82
Min Ch El (m)	433.49	Shear (N/m2)	30.53	79.29	31.39
Alpha	1.57	Stream Power (N/m s)	31.11	218.06	32.58
Frctn Loss (m)	0.46	Cum Volume (1000 m3)	79.99	94.12	56.06
C & E Loss (m)	0.01	Cum SA (1000 m2)	105.75	57.99	94.54

Plan: Plan 06 Murragamba 1 RS: 52 Profile: 100 year

E.G. Elev (m)	435.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.26	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	435.10	Reach Len. (m)	82.70	88.70	86.90
Crit W.S. (m)		Flow Area (m2)	20.79	25.41	2.83
E.G. Slope (m/m)	0.004292	Area (m2)	20.79	25.41	2.83
Q Total (m3/s)	88.09	Flow (m3/s)	21.10	64.60	2.39
Top Width (m)	51.48	Top Width (m)	30.40	15.70	5.38
Vel Total (m/s)	1.80	Avg. Vel. (m/s)	1.01	2.54	0.84
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.68	1.62	0.53
Conv. Total (m3/s)	1344.7	Conv. (m3/s)	322.0	986.2	36.5
Length Wtd. (m)	87.67	Wetted Per. (m)	30.49	16.04	5.47
Min Ch El (m)	432.98	Shear (N/m2)	28.69	66.64	21.79
Alpha	1.55	Stream Power (N/m s)	29.12	169.45	18.40
Frctn Loss (m)	0.49	Cum Volume (1000 m3)	78.65	91.67	55.38
C & E Loss (m)	0.01	Cum SA (1000 m2)	103.69	56.44	93.38

Plan: Plan 06 Murragamba 1 RS: 51 Profile: 100 year

E.G. Elev (m)	434.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	434.46	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	434.46	Flow Area (m2)	3.94	22.50	13.12
E.G. Slope (m/m)	0.007457	Area (m2)	3.94	22.50	13.12
Q Total (m3/s)	88.09	Flow (m3/s)	4.07	69.57	14.46
Top Width (m)	49.86	Top Width (m)	8.46	15.70	25.70
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.03	3.09	1.10
Max Chl Dpth (m)	1.93	Hydr. Depth (m)	0.47	1.43	0.51
Conv. Total (m3/s)	1020.1	Conv. (m3/s)	47.1	805.6	167.4
Length Wtd. (m)	1.00	Wetted Per. (m)	8.53	16.04	25.77
Min Ch El (m)	432.53	Shear (N/m2)	33.79	102.56	37.25
Alpha	1.57	Stream Power (N/m s)	34.88	317.05	41.03
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	77.63	89.55	54.69
C & E Loss (m)	0.03	Cum SA (1000 m2)	102.08	55.05	92.03

Plan: Plan 06 Murragamba 1 RS: 50.5 Profile: 100 year

E.G. Elev (m)	434.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	434.07	Reach Len. (m)	79.20	67.60	51.10
Crit W.S. (m)		Flow Area (m2)	4.87	24.19	15.90
E.G. Slope (m/m)	0.005376	Area (m2)	4.87	24.19	15.90
Q Total (m3/s)	88.09	Flow (m3/s)	4.75	66.62	16.72
Top Width (m)	50.72	Top Width (m)	8.89	15.70	26.13
Vel Total (m/s)	1.96	Avg. Vel. (m/s)	0.98	2.75	1.05
Max Chl Dpth (m)	2.04	Hydr. Depth (m)	0.55	1.54	0.61
Conv. Total (m3/s)	1201.5	Conv. (m3/s)	64.8	908.6	228.0
Length Wtd. (m)	65.36	Wetted Per. (m)	8.97	16.04	26.21
Min Ch El (m)	432.03	Shear (N/m2)	28.63	79.47	31.99

Plan: Plan 06 Murragamba 1 RS: 50.5 Profile: 100 year (Continued)

Alpha	1.56	Stream Power (N/m s)	27.94	218.88	33.62
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	77.62	89.52	54.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.08	55.03	92.00

Plan: Plan 06 Murragamba 1 RS: 50 Profile: 100 year

E.G. Elev (m)	434.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.73	Reach Len. (m)	49.60	57.10	56.80
Crit W.S. (m)		Flow Area (m2)	6.83	24.42	14.79
E.G. Slope (m/m)	0.005111	Area (m2)	6.83	24.42	14.79
Q Total (m3/s)	88.09	Flow (m3/s)	6.77	66.00	15.32
Top Width (m)	51.34	Top Width (m)	11.74	15.70	23.90
Vel Total (m/s)	1.91	Avg. Vel. (m/s)	0.99	2.70	1.04
Max Chl Dpth (m)	2.05	Hydr. Depth (m)	0.58	1.56	0.62
Conv. Total (m3/s)	1232.2	Conv. (m3/s)	94.7	923.2	214.3
Length Wtd. (m)	56.00	Wetted Per. (m)	11.82	16.05	23.98
Min Ch El (m)	431.68	Shear (N/m2)	28.95	76.28	30.91
Alpha	1.57	Stream Power (N/m s)	28.71	206.17	32.02
Frctn Loss (m)	0.30	Cum Volume (1000 m3)	77.16	87.88	53.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.26	53.97	90.72

Plan: Plan 06 Murragamba 1 RS: 49 Profile: 100 year

E.G. Elev (m)	433.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.41	Reach Len. (m)	48.30	68.00	79.30
Crit W.S. (m)		Flow Area (m2)	17.22	24.01	3.22
E.G. Slope (m/m)	0.005547	Area (m2)	17.22	24.01	3.22
Q Total (m3/s)	88.09	Flow (m3/s)	18.23	66.84	3.01
Top Width (m)	50.72	Top Width (m)	28.64	15.70	6.37
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	1.06	2.78	0.94
Max Chl Dpth (m)	2.03	Hydr. Depth (m)	0.60	1.53	0.50
Conv. Total (m3/s)	1182.7	Conv. (m3/s)	244.8	897.5	40.5
Length Wtd. (m)	64.42	Wetted Per. (m)	28.72	16.04	6.45
Min Ch El (m)	431.38	Shear (N/m2)	32.61	81.40	27.12
Alpha	1.56	Stream Power (N/m s)	34.53	226.63	25.41
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	76.56	86.50	53.38
C & E Loss (m)	0.01	Cum SA (1000 m2)	100.26	53.07	89.87

Plan: Plan 06 Murragamba 1 RS: 48 Profile: 100 year

E.G. Elev (m)	433.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	433.09	Reach Len. (m)	45.50	54.70	53.10
Crit W.S. (m)		Flow Area (m2)	17.30	24.40	4.54
E.G. Slope (m/m)	0.005096	Area (m2)	17.30	24.40	4.54
Q Total (m3/s)	88.09	Flow (m3/s)	17.97	65.80	4.32
Top Width (m)	51.74	Top Width (m)	27.78	15.70	8.25
Vel Total (m/s)	1.91	Avg. Vel. (m/s)	1.04	2.70	0.95
Max Chl Dpth (m)	2.05	Hydr. Depth (m)	0.62	1.55	0.55
Conv. Total (m3/s)	1234.0	Conv. (m3/s)	251.8	921.7	60.5
Length Wtd. (m)	53.43	Wetted Per. (m)	27.86	16.04	8.33
Min Ch El (m)	431.03	Shear (N/m2)	31.02	75.99	27.21
Alpha	1.57	Stream Power (N/m s)	32.23	204.93	25.91
Frctn Loss (m)	0.28	Cum Volume (1000 m3)	75.73	84.85	53.07
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.90	52.00	89.29

Plan: Plan 06 Murragamba 1 RS: 47 Profile: 100 year

E.G. Elev (m)	433.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	432.79	Reach Len. (m)	89.40	66.10	19.80
Crit W.S. (m)		Flow Area (m2)	2.45	24.11	18.27
E.G. Slope (m/m)	0.005430	Area (m2)	2.45	24.11	18.27
Q Total (m3/s)	88.09	Flow (m3/s)	2.18	66.61	19.30
Top Width (m)	50.86	Top Width (m)	5.12	15.70	30.04
Vel Total (m/s)	1.96	Avg. Vel. (m/s)	0.89	2.76	1.06
Max Chl Dpth (m)	2.04	Hydr. Depth (m)	0.48	1.54	0.61
Conv. Total (m3/s)	1195.4	Conv. (m3/s)	29.6	903.9	262.0
Length Wtd. (m)	56.56	Wetted Per. (m)	5.20	16.04	30.12
Min Ch El (m)	430.75	Shear (N/m2)	25.05	80.03	32.31
Alpha	1.56	Stream Power (N/m s)	22.33	221.06	34.13
Frctn Loss (m)	0.36	Cum Volume (1000 m3)	75.28	83.53	52.46
C & E Loss (m)	0.01	Cum SA (1000 m2)	98.15	51.15	88.27

Plan: Plan 06 Murragamba 1 RS: 46 Profile: 100 year

E.G. Elev (m)	432.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	432.34	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	432.34	Flow Area (m2)	0.85	22.45	16.77
E.G. Slope (m/m)	0.007389	Area (m2)	0.85	22.45	16.77
Q Total (m3/s)	88.09	Flow (m3/s)	0.67	68.98	18.44
Top Width (m)	51.10	Top Width (m)	2.66	15.70	32.74
Vel Total (m/s)	2.20	Avg. Vel. (m/s)	0.79	3.07	1.10
Max Chl Dpth (m)	1.93	Hydr. Depth (m)	0.32	1.43	0.51
Conv. Total (m3/s)	1024.8	Conv. (m3/s)	7.8	802.6	214.5
Length Wtd. (m)	1.00	Wetted Per. (m)	2.72	16.04	32.80
Min Ch El (m)	430.41	Shear (N/m2)	22.52	101.39	37.05
Alpha	1.58	Stream Power (N/m s)	17.77	311.52	40.72
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	75.13	81.99	52.12
C & E Loss (m)	0.02	Cum SA (1000 m2)	97.80	50.11	87.65

Plan: Plan 06 Murragamba 1 RS: 45.5 Profile: 100 year

E.G. Elev (m)	432.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.93	Reach Len. (m)	49.00	40.00	20.10
Crit W.S. (m)		Flow Area (m2)	1.11	23.92	19.85
E.G. Slope (m/m)	0.005526	Area (m2)	1.11	23.92	19.85
Q Total (m3/s)	88.09	Flow (m3/s)	0.83	66.30	20.95
Top Width (m)	51.84	Top Width (m)	3.03	15.70	33.11
Vel Total (m/s)	1.96	Avg. Vel. (m/s)	0.75	2.77	1.06
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.37	1.52	0.60
Conv. Total (m3/s)	1185.0	Conv. (m3/s)	11.2	891.9	281.8
Length Wtd. (m)	36.75	Wetted Per. (m)	3.11	16.04	33.19
Min Ch El (m)	429.91	Shear (N/m2)	19.40	80.79	32.42
Alpha	1.57	Stream Power (N/m s)	14.54	223.95	34.21
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	75.13	81.96	52.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	97.80	50.09	87.61

Plan: Plan 06 Murragamba 1 RS: 45 Profile: 100 year

E.G. Elev (m)	432.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.77	Reach Len. (m)	21.00	38.60	47.00
Crit W.S. (m)		Flow Area (m2)	10.62	24.61	12.88
E.G. Slope (m/m)	0.004764	Area (m2)	10.62	24.61	12.88
Q Total (m3/s)	88.09	Flow (m3/s)	10.58	64.56	12.95

Plan: Plan 06 Murragamba 1 RS: 45 Profile: 100 year (Continued)

Top Width (m)	53.61	Top Width (m)	17.26	15.70	20.65
Vel Total (m/s)	1.83	Avg. Vel. (m/s)	1.00	2.62	1.01
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.62	1.57	0.62
Conv. Total (m3/s)	1276.2	Conv. (m3/s)	153.2	935.3	187.6
Length Wtd. (m)	36.60	Wetted Per. (m)	17.34	16.04	20.73
Min Ch El (m)	429.70	Shear (N/m2)	28.62	71.67	29.04
Alpha	1.58	Stream Power (N/m s)	28.50	188.00	29.19
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	74.84	80.99	51.77
C & E Loss (m)	0.01	Cum SA (1000 m2)	97.30	49.46	87.07

Plan: Plan 06 Murragamba 1 RS: 44 Profile: 100 year

E.G. Elev (m)	431.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.51	Reach Len. (m)	0.40	41.30	65.40
Crit W.S. (m)		Flow Area (m2)	16.15	23.68	3.58
E.G. Slope (m/m)	0.005899	Area (m2)	16.15	23.68	3.58
Q Total (m3/s)	88.09	Flow (m3/s)	17.25	67.38	3.46
Top Width (m)	50.59	Top Width (m)	27.78	15.70	7.11
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.07	2.84	0.97
Max Chl Dpth (m)	2.01	Hydr. Depth (m)	0.58	1.51	0.50
Conv. Total (m3/s)	1146.9	Conv. (m3/s)	224.6	877.3	45.1
Length Wtd. (m)	34.18	Wetted Per. (m)	27.86	16.04	7.19
Min Ch El (m)	429.50	Shear (N/m2)	33.54	85.40	28.85
Alpha	1.57	Stream Power (N/m s)	35.82	242.95	27.87
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	74.56	80.06	51.38
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.83	48.86	86.42

Plan: Plan 06 Murragamba 1 RS: 43 Profile: 100 year

E.G. Elev (m)	431.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.37	Reach Len. (m)	23.50	27.10	22.20
Crit W.S. (m)		Flow Area (m2)	17.68	24.75	4.86
E.G. Slope (m/m)	0.004784	Area (m2)	17.68	24.75	4.86
Q Total (m3/s)	88.09	Flow (m3/s)	18.18	65.32	4.59
Top Width (m)	51.75	Top Width (m)	27.50	15.70	8.54
Vel Total (m/s)	1.86	Avg. Vel. (m/s)	1.03	2.64	0.94
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.64	1.58	0.57
Conv. Total (m3/s)	1273.6	Conv. (m3/s)	262.9	944.4	66.4
Length Wtd. (m)	25.99	Wetted Per. (m)	27.59	16.04	8.63
Min Ch El (m)	429.29	Shear (N/m2)	30.07	72.38	26.44
Alpha	1.56	Stream Power (N/m s)	30.92	190.98	24.96
Frctn Loss (m)	0.12	Cum Volume (1000 m3)	74.55	79.06	51.11
C & E Loss (m)	0.01	Cum SA (1000 m2)	96.81	48.21	85.91

Plan: Plan 06 Murragamba 1 RS: 42 Profile: 100 year

E.G. Elev (m)	431.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.24	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	431.27	Reach Len. (m)	56.50	38.60	9.60
Crit W.S. (m)		Flow Area (m2)	9.02	25.50	15.87
E.G. Slope (m/m)	0.004128	Area (m2)	9.02	25.50	15.87
Q Total (m3/s)	88.09	Flow (m3/s)	8.65	63.74	15.71
Top Width (m)	53.01	Top Width (m)	13.92	15.70	23.38
Vel Total (m/s)	1.75	Avg. Vel. (m/s)	0.96	2.50	0.99
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.65	1.62	0.68
Conv. Total (m3/s)	1371.0	Conv. (m3/s)	134.6	992.0	244.4
Length Wtd. (m)	35.44	Wetted Per. (m)	14.01	16.04	23.47
Min Ch El (m)	429.15	Shear (N/m2)	26.07	64.33	27.37

Plan: Plan 06 Murragamba 1 RS: 42 Profile: 100 year (Continued)

Alpha	1.57	Stream Power (N/m s)	24.99	160.81	27.09
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	74.24	78.38	50.88
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.33	47.78	85.56

Plan: Plan 06 Murragamba 1 RS: 41 Profile: 100 year

E.G. Elev (m)	431.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	430.91	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	430.91	Flow Area (m2)	6.42	22.87	12.08
E.G. Slope (m/m)	0.007471	Area (m2)	6.42	22.87	12.08
Q Total (m3/s)	92.20	Flow (m3/s)	7.04	71.53	13.63
Top Width (m)	51.20	Top Width (m)	12.66	15.70	22.83
Vel Total (m/s)	2.23	Avg. Vel. (m/s)	1.10	3.13	1.13
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.51	1.46	0.53
Conv. Total (m3/s)	1066.7	Conv. (m3/s)	81.4	827.6	157.7
Length Wtd. (m)	1.00	Wetted Per. (m)	12.73	16.04	22.90
Min Ch El (m)	428.95	Shear (N/m2)	36.96	104.43	38.64
Alpha	1.58	Stream Power (N/m s)	40.49	326.63	43.60
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	73.80	77.45	50.74
C & E Loss (m)	0.04	Cum SA (1000 m2)	95.58	47.18	85.33

Plan: Plan 06 Murragamba 1 RS: 40.5 Profile: 100 year

E.G. Elev (m)	430.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	430.57	Reach Len. (m)	49.80	29.00	6.80
Crit W.S. (m)		Flow Area (m2)	8.54	25.43	15.85
E.G. Slope (m/m)	0.004614	Area (m2)	8.54	25.43	15.85
Q Total (m3/s)	92.20	Flow (m3/s)	8.59	67.09	16.53
Top Width (m)	52.50	Top Width (m)	13.32	15.70	23.49
Vel Total (m/s)	1.85	Avg. Vel. (m/s)	1.01	2.64	1.04
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.64	1.62	0.67
Conv. Total (m3/s)	1357.3	Conv. (m3/s)	126.4	987.6	243.3
Length Wtd. (m)	27.53	Wetted Per. (m)	13.40	16.05	23.57
Min Ch El (m)	428.45	Shear (N/m2)	28.82	71.71	30.42
Alpha	1.56	Stream Power (N/m s)	28.99	189.19	31.72
Frctn Loss (m)	0.14	Cum Volume (1000 m3)	73.80	77.42	50.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.56	47.16	85.31

Plan: Plan 06 Murragamba 1 RS: 40 Profile: 100 year

E.G. Elev (m)	430.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	430.38	Reach Len. (m)	132.00	124.00	125.60
Crit W.S. (m)		Flow Area (m2)	8.87	25.17	11.79
E.G. Slope (m/m)	0.005489	Area (m2)	8.87	25.17	11.79
Q Total (m3/s)	92.20	Flow (m3/s)	9.14	70.73	12.33
Top Width (m)	51.14	Top Width (m)	15.22	16.10	19.81
Vel Total (m/s)	2.01	Avg. Vel. (m/s)	1.03	2.81	1.05
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.58	1.56	0.60
Conv. Total (m3/s)	1244.4	Conv. (m3/s)	123.4	954.7	166.4
Length Wtd. (m)	125.15	Wetted Per. (m)	15.30	16.46	19.89
Min Ch El (m)	428.29	Shear (N/m2)	31.21	82.33	31.90
Alpha	1.56	Stream Power (N/m s)	32.15	231.37	33.36
Frctn Loss (m)	0.67	Cum Volume (1000 m3)	73.36	76.69	50.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.85	46.70	85.16

Plan: Plan 06 Murragamba 1 RS: 39 Profile: 100 year

E.G. Elev (m)	430.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	429.72	Reach Len. (m)	68.00	89.70	100.00
Crit W.S. (m)		Flow Area (m2)	12.60	25.53	8.81
E.G. Slope (m/m)	0.005155	Area (m2)	12.60	25.53	8.81
Q Total (m3/s)	92.20	Flow (m3/s)	13.06	70.18	8.96
Top Width (m)	51.26	Top Width (m)	20.46	16.10	14.70
Vel Total (m/s)	1.96	Avg. Vel. (m/s)	1.04	2.75	1.02
Max Chl Dpth (m)	2.11	Hydr. Depth (m)	0.62	1.59	0.60
Conv. Total (m3/s)	1284.2	Conv. (m3/s)	181.9	977.5	124.8
Length Wtd. (m)	87.24	Wetted Per. (m)	20.54	16.46	14.78
Min Ch El (m)	427.62	Shear (N/m2)	31.00	78.42	30.12
Alpha	1.56	Stream Power (N/m s)	32.14	215.58	30.63
Frctn Loss (m)	0.53	Cum Volume (1000 m3)	71.95	73.55	49.34
C & E Loss (m)	0.01	Cum SA (1000 m2)	92.50	44.70	83.00

Plan: Plan 06 Murragamba 1 RS: 38 Profile: 100 year

E.G. Elev (m)	429.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	429.10	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	429.10	Flow Area (m2)	13.61	23.42	5.27
E.G. Slope (m/m)	0.007247	Area (m2)	13.61	23.42	5.27
Q Total (m3/s)	92.20	Flow (m3/s)	14.69	72.05	5.46
Top Width (m)	54.05	Top Width (m)	26.89	16.10	11.07
Vel Total (m/s)	2.18	Avg. Vel. (m/s)	1.08	3.08	1.03
Max Chl Dpth (m)	1.98	Hydr. Depth (m)	0.51	1.45	0.48
Conv. Total (m3/s)	1083.0	Conv. (m3/s)	172.6	846.3	64.1
Length Wtd. (m)	1.00	Wetted Per. (m)	26.95	16.46	11.13
Min Ch El (m)	427.13	Shear (N/m2)	35.89	101.12	33.68
Alpha	1.61	Stream Power (N/m s)	38.74	311.15	34.85
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	71.06	71.35	48.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	90.89	43.26	81.71

Plan: Plan 06 Murragamba 1 RS: 37.5 Profile: 100 year

E.G. Elev (m)	429.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.43	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	428.56	Reach Len. (m)	14.90	37.20	36.70
Crit W.S. (m)		Flow Area (m2)	12.55	22.78	4.84
E.G. Slope (m/m)	0.008240	Area (m2)	12.55	22.78	4.84
Q Total (m3/s)	92.20	Flow (m3/s)	13.74	73.37	5.09
Top Width (m)	53.74	Top Width (m)	26.73	16.10	10.91
Vel Total (m/s)	2.30	Avg. Vel. (m/s)	1.09	3.22	1.05
Max Chl Dpth (m)	1.94	Hydr. Depth (m)	0.47	1.41	0.44
Conv. Total (m3/s)	1015.7	Conv. (m3/s)	151.3	808.3	56.1
Length Wtd. (m)	34.67	Wetted Per. (m)	26.79	16.46	10.97
Min Ch El (m)	426.63	Shear (N/m2)	37.85	111.84	35.65
Alpha	1.61	Stream Power (N/m s)	41.44	360.23	37.51
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	71.04	71.33	48.63
C & E Loss (m)	0.03	Cum SA (1000 m2)	90.86	43.24	81.70

Plan: Plan 06 Murragamba 1 RS: 37 Profile: 100 year

E.G. Elev (m)	428.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	428.37	Reach Len. (m)	89.50	67.40	26.00
Crit W.S. (m)	428.37	Flow Area (m2)	6.79	22.92	17.65
E.G. Slope (m/m)	0.006843	Area (m2)	6.79	22.92	17.65
Q Total (m3/s)	92.20	Flow (m3/s)	6.70	67.55	17.95

Plan: Plan 06 Murragamba 1 RS: 37 Profile: 100 year (Continued)

Top Width (m)	67.37	Top Width (m)	14.68	16.10	36.58
Vel Total (m/s)	1.95	Avg. Vel. (m/s)	0.99	2.95	1.02
Max Chl Dpth (m)	1.95	Hydr. Depth (m)	0.46	1.42	0.48
Conv. Total (m3/s)	1114.6	Conv. (m3/s)	81.0	816.7	217.0
Length Wtd. (m)	56.89	Wetted Per. (m)	14.74	16.46	36.65
Min Ch El (m)	426.42	Shear (N/m2)	30.90	93.45	32.32
Alpha	1.75	Stream Power (N/m s)	30.49	275.44	32.86
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	70.90	70.48	48.22
C & E Loss (m)	0.05	Cum SA (1000 m2)	90.55	42.65	80.82

Plan: Plan 06 Murragamba 1 RS: 36 Profile: 100 year

E.G. Elev (m)	428.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	428.07	Reach Len. (m)	106.00	65.70	8.90
Crit W.S. (m)		Flow Area (m2)	3.06	24.01	39.19
E.G. Slope (m/m)	0.004056	Area (m2)	3.06	24.01	39.19
Q Total (m3/s)	92.20	Flow (m3/s)	2.33	56.20	33.67
Top Width (m)	93.30	Top Width (m)	6.55	16.10	70.64
Vel Total (m/s)	1.39	Avg. Vel. (m/s)	0.76	2.34	0.86
Max Chl Dpth (m)	2.01	Hydr. Depth (m)	0.47	1.49	0.55
Conv. Total (m3/s)	1447.7	Conv. (m3/s)	36.6	882.4	528.7
Length Wtd. (m)	47.63	Wetted Per. (m)	6.62	16.46	70.71
Min Ch El (m)	426.05	Shear (N/m2)	18.37	58.03	22.04
Alpha	1.87	Stream Power (N/m s)	13.98	135.82	18.94
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	70.46	68.90	47.48
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.60	41.56	79.43

Plan: Plan 06 Murragamba 1 RS: 35 Profile: 100 year

E.G. Elev (m)	428.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.93	Reach Len. (m)	16.70	30.50	22.40
Crit W.S. (m)		Flow Area (m2)	5.32	27.49	33.81
E.G. Slope (m/m)	0.002799	Area (m2)	5.32	27.49	33.81
Q Total (m3/s)	92.20	Flow (m3/s)	4.13	58.51	29.56
Top Width (m)	69.38	Top Width (m)	8.38	16.10	44.90
Vel Total (m/s)	1.38	Avg. Vel. (m/s)	0.78	2.13	0.87
Max Chl Dpth (m)	2.23	Hydr. Depth (m)	0.63	1.71	0.75
Conv. Total (m3/s)	1742.9	Conv. (m3/s)	78.0	1106.0	558.9
Length Wtd. (m)	27.84	Wetted Per. (m)	8.48	16.46	45.00
Min Ch El (m)	425.70	Shear (N/m2)	17.23	45.85	20.62
Alpha	1.64	Stream Power (N/m s)	13.36	97.57	18.03
Frctn Loss (m)	0.10	Cum Volume (1000 m3)	70.01	67.20	47.16
C & E Loss (m)	0.02	Cum SA (1000 m2)	88.81	40.50	78.92

Plan: Plan 06 Murragamba 1 RS: 34 Profile: 100 year

E.G. Elev (m)	427.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.66	Reach Len. (m)	29.70	47.10	51.60
Crit W.S. (m)		Flow Area (m2)	4.34	25.83	15.86
E.G. Slope (m/m)	0.005106	Area (m2)	4.34	25.83	15.86
Q Total (m3/s)	92.20	Flow (m3/s)	4.17	71.24	16.79
Top Width (m)	48.64	Top Width (m)	7.76	16.10	24.78
Vel Total (m/s)	2.00	Avg. Vel. (m/s)	0.96	2.76	1.06
Max Chl Dpth (m)	2.13	Hydr. Depth (m)	0.56	1.60	0.64
Conv. Total (m3/s)	1290.3	Conv. (m3/s)	58.4	996.9	235.0
Length Wtd. (m)	47.17	Wetted Per. (m)	7.84	16.46	24.86
Min Ch El (m)	425.53	Shear (N/m2)	27.68	78.60	31.94

Plan: Plan 06 Murragamba 1 RS: 34 Profile: 100 year (Continued)

Alpha	1.53	Stream Power (N/m s)	26.65	216.74	33.82
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	69.93	66.39	46.60
C & E Loss (m)	0.01	Cum SA (1000 m2)	88.68	40.01	78.14

Plan: Plan 06 Murragamba 1 RS: 33 Profile: 100 year

E.G. Elev (m)	427.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	427.26	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	427.26	Flow Area (m2)	3.25	23.59	13.67
E.G. Slope (m/m)	0.007414	Area (m2)	3.25	23.59	13.67
Q Total (m3/s)	92.20	Flow (m3/s)	3.30	73.78	15.12
Top Width (m)	49.73	Top Width (m)	7.12	16.10	26.51
Vel Total (m/s)	2.28	Avg. Vel. (m/s)	1.01	3.13	1.11
Max Chl Dpth (m)	1.99	Hydr. Depth (m)	0.46	1.47	0.52
Conv. Total (m3/s)	1070.8	Conv. (m3/s)	38.3	856.9	175.6
Length Wtd. (m)	1.00	Wetted Per. (m)	7.19	16.46	26.58
Min Ch El (m)	425.27	Shear (N/m2)	32.88	104.22	37.41
Alpha	1.56	Stream Power (N/m s)	33.36	325.94	41.37
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	69.82	65.23	45.84
C & E Loss (m)	0.02	Cum SA (1000 m2)	88.46	39.25	76.81

Plan: Plan 06 Murragamba 1 RS: 32.5 Profile: 100 year

E.G. Elev (m)	427.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	426.84	Reach Len. (m)	48.80	38.40	27.40
Crit W.S. (m)		Flow Area (m2)	3.86	24.94	15.91
E.G. Slope (m/m)	0.005769	Area (m2)	3.86	24.94	15.91
Q Total (m3/s)	92.20	Flow (m3/s)	3.76	71.42	17.03
Top Width (m)	50.40	Top Width (m)	7.46	16.10	26.85
Vel Total (m/s)	2.06	Avg. Vel. (m/s)	0.97	2.86	1.07
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.52	1.55	0.59
Conv. Total (m3/s)	1213.8	Conv. (m3/s)	49.5	940.2	224.2
Length Wtd. (m)	37.34	Wetted Per. (m)	7.53	16.46	26.92
Min Ch El (m)	424.77	Shear (N/m2)	29.01	85.75	33.44
Alpha	1.55	Stream Power (N/m s)	28.23	245.52	35.78
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	69.82	65.20	45.82
C & E Loss (m)	0.01	Cum SA (1000 m2)	88.45	39.24	76.79

Plan: Plan 06 Murragamba 1 RS: 32 Profile: 100 year

E.G. Elev (m)	426.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	426.65	Reach Len. (m)	46.10	69.70	80.70
Crit W.S. (m)		Flow Area (m2)	8.97	25.27	12.50
E.G. Slope (m/m)	0.005321	Area (m2)	8.97	25.27	12.50
Q Total (m3/s)	92.20	Flow (m3/s)	9.15	70.08	12.97
Top Width (m)	52.13	Top Width (m)	15.27	16.10	20.77
Vel Total (m/s)	1.97	Avg. Vel. (m/s)	1.02	2.77	1.04
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.59	1.57	0.60
Conv. Total (m3/s)	1263.9	Conv. (m3/s)	125.5	960.7	177.8
Length Wtd. (m)	66.84	Wetted Per. (m)	15.35	16.46	20.85
Min Ch El (m)	424.56	Shear (N/m2)	30.51	80.11	31.30
Alpha	1.57	Stream Power (N/m s)	31.12	222.21	32.47
Frctn Loss (m)	0.39	Cum Volume (1000 m3)	69.50	64.24	45.43
C & E Loss (m)	0.01	Cum SA (1000 m2)	87.89	38.62	76.13

Plan: Plan 06 Murragamba 1 RS: 31 Profile: 100 year

E.G. Elev (m)	426.57	Element	Left OB	Channel	Right OB
Vel Head (m)	0.37	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	426.20	Reach Len. (m)	0.79	38.10	55.50
Crit W.S. (m)		Flow Area (m2)	18.08	24.10	1.01
E.G. Slope (m/m)	0.006541	Area (m2)	18.08	24.10	1.01
Q Total (m3/s)	92.20	Flow (m3/s)	19.59	71.81	0.80
Top Width (m)	51.91	Top Width (m)	32.90	16.10	2.92
Vel Total (m/s)	2.13	Avg. Vel. (m/s)	1.08	2.98	0.79
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.55	1.50	0.35
Conv. Total (m3/s)	1140.0	Conv. (m3/s)	242.2	887.9	9.8
Length Wtd. (m)	32.57	Wetted Per. (m)	32.97	16.46	2.99
Min Ch El (m)	424.18	Shear (N/m2)	35.18	93.94	21.74
Alpha	1.57	Stream Power (N/m s)	38.12	279.92	17.09
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	68.88	62.52	44.89
C & E Loss (m)	0.03	Cum SA (1000 m2)	86.78	37.50	75.18

Plan: Plan 06 Murragamba 1 RS: 30 Profile: 100 year

E.G. Elev (m)	426.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	426.09	Reach Len. (m)	43.20	36.30	18.60
Crit W.S. (m)		Flow Area (m2)	13.60	25.68	11.77
E.G. Slope (m/m)	0.004617	Area (m2)	13.60	25.68	11.77
Q Total (m3/s)	92.20	Flow (m3/s)	13.50	67.09	11.61
Top Width (m)	56.78	Top Width (m)	21.71	16.10	18.97
Vel Total (m/s)	1.81	Avg. Vel. (m/s)	0.99	2.61	0.99
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.63	1.60	0.62
Conv. Total (m3/s)	1356.9	Conv. (m3/s)	198.7	987.3	170.8
Length Wtd. (m)	34.06	Wetted Per. (m)	21.79	16.46	19.05
Min Ch El (m)	423.97	Shear (N/m2)	28.26	70.66	27.98
Alpha	1.60	Stream Power (N/m s)	28.05	184.58	27.59
Frctn Loss (m)	0.17	Cum Volume (1000 m3)	68.87	61.57	44.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	86.76	36.88	74.57

Plan: Plan 06 Murragamba 1 RS: 29 Profile: 100 year

E.G. Elev (m)	426.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	425.85	Reach Len. (m)	53.10	46.60	34.00
Crit W.S. (m)		Flow Area (m2)	3.32	25.03	17.19
E.G. Slope (m/m)	0.005608	Area (m2)	3.32	25.03	17.19
Q Total (m3/s)	92.20	Flow (m3/s)	3.13	70.80	18.26
Top Width (m)	51.33	Top Width (m)	6.55	16.10	28.69
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	0.94	2.83	1.06
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.51	1.55	0.60
Conv. Total (m3/s)	1231.2	Conv. (m3/s)	41.8	945.5	243.9
Length Wtd. (m)	45.03	Wetted Per. (m)	6.62	16.46	28.76
Min Ch El (m)	423.78	Shear (N/m2)	27.54	83.63	32.86
Alpha	1.56	Stream Power (N/m s)	26.01	236.62	34.92
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	68.50	60.65	44.26
C & E Loss (m)	0.01	Cum SA (1000 m2)	86.15	36.30	74.13

Plan: Plan 06 Murragamba 1 RS: 28 Profile: 100 year

E.G. Elev (m)	425.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	425.64	Reach Len. (m)	21.00	44.80	59.40
Crit W.S. (m)		Flow Area (m2)	10.71	25.68	11.65
E.G. Slope (m/m)	0.004950	Area (m2)	10.71	25.68	11.65
Q Total (m3/s)	92.20	Flow (m3/s)	10.88	69.44	11.88

Plan: Plan 06 Murragamba 1 RS: 28 Profile: 100 year (Continued)

Top Width (m)	52.27	Top Width (m)	17.38	16.10	18.79
Vel Total (m/s)	1.92	Avg. Vel. (m/s)	1.02	2.70	1.02
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.62	1.59	0.62
Conv. Total (m3/s)	1310.5	Conv. (m3/s)	154.6	987.0	168.9
Length Wtd. (m)	42.59	Wetted Per. (m)	17.46	16.46	18.87
Min Ch El (m)	423.52	Shear (N/m2)	29.76	75.74	29.96
Alpha	1.56	Stream Power (N/m s)	30.23	204.81	30.56
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	68.13	59.47	43.77
C & E Loss (m)	0.01	Cum SA (1000 m2)	85.52	35.55	73.32

Plan: Plan 06 Murragamba 1 RS: 27 Profile: 100 year

E.G. Elev (m)	425.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	425.26	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	425.26	Flow Area (m2)	14.13	23.55	3.28
E.G. Slope (m/m)	0.007369	Area (m2)	14.13	23.55	3.28
Q Total (m3/s)	92.20	Flow (m3/s)	15.54	73.34	3.32
Top Width (m)	50.79	Top Width (m)	27.48	16.10	7.21
Vel Total (m/s)	2.25	Avg. Vel. (m/s)	1.10	3.11	1.01
Max Chl Dpth (m)	1.98	Hydr. Depth (m)	0.51	1.46	0.46
Conv. Total (m3/s)	1074.1	Conv. (m3/s)	181.1	854.3	38.7
Length Wtd. (m)	1.00	Wetted Per. (m)	27.55	16.46	7.28
Min Ch El (m)	423.28	Shear (N/m2)	37.07	103.40	32.63
Alpha	1.57	Stream Power (N/m s)	40.78	322.03	32.96
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	67.87	58.37	43.33
C & E Loss (m)	0.02	Cum SA (1000 m2)	85.05	34.83	72.55

Plan: Plan 06 Murragamba 1 RS: 26.5 Profile: 100 year

E.G. Elev (m)	425.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.85	Reach Len. (m)	19.20	45.40	57.90
Crit W.S. (m)		Flow Area (m2)	16.46	24.91	3.91
E.G. Slope (m/m)	0.005715	Area (m2)	16.46	24.91	3.91
Q Total (m3/s)	92.20	Flow (m3/s)	17.51	70.91	3.78
Top Width (m)	51.46	Top Width (m)	27.82	16.10	7.55
Vel Total (m/s)	2.04	Avg. Vel. (m/s)	1.06	2.85	0.97
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.59	1.55	0.52
Conv. Total (m3/s)	1219.7	Conv. (m3/s)	231.6	938.1	50.0
Length Wtd. (m)	43.33	Wetted Per. (m)	27.89	16.46	7.62
Min Ch El (m)	422.78	Shear (N/m2)	33.07	84.81	28.72
Alpha	1.56	Stream Power (N/m s)	35.17	241.47	27.80
Frctn Loss (m)	0.26	Cum Volume (1000 m3)	67.85	58.34	43.33
C & E Loss (m)	0.00	Cum SA (1000 m2)	85.02	34.81	72.54

Plan: Plan 06 Murragamba 1 RS: 26 Profile: 100 year

E.G. Elev (m)	424.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.57	Reach Len. (m)	45.90	29.90	2.40
Crit W.S. (m)		Flow Area (m2)	5.85	24.45	13.89
E.G. Slope (m/m)	0.006164	Area (m2)	5.85	24.45	13.89
Q Total (m3/s)	92.20	Flow (m3/s)	5.97	71.40	14.83
Top Width (m)	51.87	Top Width (m)	11.08	16.10	24.68
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.02	2.92	1.07
Max Chl Dpth (m)	2.04	Hydr. Depth (m)	0.53	1.52	0.56
Conv. Total (m3/s)	1174.4	Conv. (m3/s)	76.1	909.4	188.9
Length Wtd. (m)	25.91	Wetted Per. (m)	11.16	16.46	24.76
Min Ch El (m)	422.53	Shear (N/m2)	31.70	89.79	33.90

Plan: Plan 06 Murragamba 1 RS: 26 Profile: 100 year (Continued)

Alpha	1.57	Stream Power (N/m s)	32.37	262.23	36.21
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	67.64	57.22	42.81
C & E Loss (m)	0.01	Cum SA (1000 m2)	84.64	34.08	71.61

Plan: Plan 06 Murragamba 1 RS: 25 Profile: 100 year

E.G. Elev (m)	424.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.44	Reach Len. (m)	75.10	58.70	31.90
Crit W.S. (m)		Flow Area (m2)	4.26	24.94	16.86
E.G. Slope (m/m)	0.005590	Area (m2)	4.26	24.94	16.86
Q Total (m3/s)	92.20	Flow (m3/s)	4.13	70.28	17.79
Top Width (m)	52.58	Top Width (m)	8.11	16.10	28.38
Vel Total (m/s)	2.00	Avg. Vel. (m/s)	0.97	2.82	1.05
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.53	1.55	0.59
Conv. Total (m3/s)	1233.2	Conv. (m3/s)	55.2	940.1	237.9
Length Wtd. (m)	56.03	Wetted Per. (m)	8.18	16.46	28.45
Min Ch El (m)	422.37	Shear (N/m2)	28.57	83.07	32.48
Alpha	1.58	Stream Power (N/m s)	27.67	234.11	34.27
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	67.41	56.48	42.77
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.20	33.60	71.54

Plan: Plan 06 Murragamba 1 RS: 24 Profile: 100 year

E.G. Elev (m)	424.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	424.11	Reach Len. (m)	37.20	69.50	86.30
Crit W.S. (m)		Flow Area (m2)	10.86	24.82	9.68
E.G. Slope (m/m)	0.005760	Area (m2)	10.86	24.82	9.68
Q Total (m3/s)	92.20	Flow (m3/s)	11.36	70.77	10.07
Top Width (m)	52.03	Top Width (m)	18.93	16.10	17.01
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.05	2.85	1.04
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.57	1.54	0.57
Conv. Total (m3/s)	1214.8	Conv. (m3/s)	149.7	932.4	132.7
Length Wtd. (m)	65.19	Wetted Per. (m)	19.00	16.46	17.08
Min Ch El (m)	422.05	Shear (N/m2)	32.30	85.19	32.03
Alpha	1.57	Stream Power (N/m s)	33.77	242.92	33.31
Frctn Loss (m)	0.35	Cum Volume (1000 m3)	66.84	55.02	42.35
C & E Loss (m)	0.01	Cum SA (1000 m2)	83.19	32.65	70.82

Plan: Plan 06 Murragamba 1 RS: 23 Profile: 100 year

E.G. Elev (m)	424.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	423.78	Reach Len. (m)	24.50	61.30	84.00
Crit W.S. (m)		Flow Area (m2)	18.84	25.59	2.80
E.G. Slope (m/m)	0.005078	Area (m2)	18.84	25.59	2.80
Q Total (m3/s)	92.20	Flow (m3/s)	19.76	69.94	2.50
Top Width (m)	51.44	Top Width (m)	29.79	16.10	5.55
Vel Total (m/s)	1.95	Avg. Vel. (m/s)	1.05	2.73	0.89
Max Chl Dpth (m)	2.11	Hydr. Depth (m)	0.63	1.59	0.50
Conv. Total (m3/s)	1293.9	Conv. (m3/s)	277.2	981.6	35.1
Length Wtd. (m)	56.78	Wetted Per. (m)	29.87	16.46	5.63
Min Ch El (m)	421.66	Shear (N/m2)	31.42	77.44	24.74
Alpha	1.55	Stream Power (N/m s)	32.94	211.63	22.11
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	66.29	53.27	41.81
C & E Loss (m)	0.01	Cum SA (1000 m2)	82.28	31.53	69.85

Plan: Plan 06 Murragamba 1 RS: 22 Profile: 100 year

E.G. Elev (m)	423.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	423.32	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	423.32	Flow Area (m2)	9.08	23.56	8.18
E.G. Slope (m/m)	0.007390	Area (m2)	9.08	23.56	8.18
Q Total (m3/s)	92.20	Flow (m3/s)	9.87	73.49	8.84
Top Width (m)	50.47	Top Width (m)	18.03	16.10	16.34
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.09	3.12	1.08
Max Chl Dpth (m)	1.99	Hydr. Depth (m)	0.50	1.46	0.50
Conv. Total (m3/s)	1072.5	Conv. (m3/s)	114.8	854.9	102.9
Length Wtd. (m)	1.00	Wetted Per. (m)	18.10	16.46	16.41
Min Ch El (m)	421.33	Shear (N/m2)	36.38	103.74	36.13
Alpha	1.57	Stream Power (N/m s)	39.50	323.62	39.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	65.94	51.76	41.35
C & E Loss (m)	0.03	Cum SA (1000 m2)	81.70	30.55	68.93

Plan: Plan 06 Murragamba 1 RS: 21.5 Profile: 100 year

E.G. Elev (m)	423.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.92	Reach Len. (m)	58.90	56.70	54.30
Crit W.S. (m)		Flow Area (m2)	10.96	25.21	9.88
E.G. Slope (m/m)	0.005440	Area (m2)	10.96	25.21	9.88
Q Total (m3/s)	92.20	Flow (m3/s)	11.39	70.60	10.21
Top Width (m)	51.30	Top Width (m)	18.44	16.10	16.75
Vel Total (m/s)	2.00	Avg. Vel. (m/s)	1.04	2.80	1.03
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.59	1.57	0.59
Conv. Total (m3/s)	1250.1	Conv. (m3/s)	154.4	957.2	138.5
Length Wtd. (m)	56.70	Wetted Per. (m)	18.52	16.46	16.83
Min Ch El (m)	420.83	Shear (N/m2)	31.56	81.72	31.31
Alpha	1.56	Stream Power (N/m s)	32.80	228.84	32.37
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	65.93	51.74	41.34
C & E Loss (m)	0.01	Cum SA (1000 m2)	81.68	30.53	68.91

Plan: Plan 06 Murragamba 1 RS: 21 Profile: 100 year

E.G. Elev (m)	422.94	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.64	Reach Len. (m)	58.02	34.10	17.70
Crit W.S. (m)		Flow Area (m2)	11.45	25.72	10.70
E.G. Slope (m/m)	0.004947	Area (m2)	11.45	25.72	10.70
Q Total (m3/s)	92.20	Flow (m3/s)	11.69	69.62	10.89
Top Width (m)	51.83	Top Width (m)	18.42	16.10	17.31
Vel Total (m/s)	1.93	Avg. Vel. (m/s)	1.02	2.71	1.02
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.62	1.60	0.62
Conv. Total (m3/s)	1310.9	Conv. (m3/s)	166.2	989.9	154.8
Length Wtd. (m)	35.44	Wetted Per. (m)	18.50	16.46	17.39
Min Ch El (m)	420.52	Shear (N/m2)	30.01	75.82	29.85
Alpha	1.56	Stream Power (N/m s)	30.65	205.21	30.37
Frctn Loss (m)	0.18	Cum Volume (1000 m3)	65.27	50.30	40.78
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	29.62	67.99

Plan: Plan 06 Murragamba 1 RS: 20 Profile: 100 year

E.G. Elev (m)	422.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.43	Reach Len. (m)	48.50	41.80	28.90
Crit W.S. (m)		Flow Area (m2)	11.75	25.37	8.77
E.G. Slope (m/m)	0.005374	Area (m2)	11.75	25.37	8.77
Q Total (m3/s)	92.20	Flow (m3/s)	12.28	70.89	9.02

Plan: Plan 06 Murragamba 1 RS: 20 Profile: 100 year (Continued)

Top Width (m)	50.36	Top Width (m)	19.43	16.10	14.83
Vel Total (m/s)	2.01	Avg. Vel. (m/s)	1.05	2.79	1.03
Max Chl Dpth (m)	2.10	Hydr. Depth (m)	0.60	1.58	0.59
Conv. Total (m3/s)	1257.7	Conv. (m3/s)	167.6	967.0	123.1
Length Wtd. (m)	41.28	Wetted Per. (m)	19.51	16.46	14.91
Min Ch El (m)	420.33	Shear (N/m2)	31.74	81.23	30.99
Alpha	1.55	Stream Power (N/m s)	33.18	227.03	31.90
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	64.60	49.42	40.61
C & E Loss (m)	0.01	Cum SA (1000 m2)	79.49	29.07	67.70

Plan: Plan 06 Murragamba 1 RS: 19 Profile: 100 year

E.G. Elev (m)	422.53	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	422.26	Reach Len. (m)	93.00	97.80	101.40
Crit W.S. (m)		Flow Area (m2)	12.10	26.24	11.06
E.G. Slope (m/m)	0.004538	Area (m2)	12.10	26.24	11.06
Q Total (m3/s)	92.20	Flow (m3/s)	12.19	68.93	11.09
Top Width (m)	51.90	Top Width (m)	18.64	16.10	17.16
Vel Total (m/s)	1.87	Avg. Vel. (m/s)	1.01	2.63	1.00
Max Chl Dpth (m)	2.15	Hydr. Depth (m)	0.65	1.63	0.64
Conv. Total (m3/s)	1368.7	Conv. (m3/s)	180.9	1023.2	164.6
Length Wtd. (m)	97.42	Wetted Per. (m)	18.73	16.46	17.25
Min Ch El (m)	420.11	Shear (N/m2)	28.76	70.96	28.55
Alpha	1.55	Stream Power (N/m s)	28.96	186.39	28.61
Frctn Loss (m)	0.56	Cum Volume (1000 m3)	64.02	48.35	40.33
C & E Loss (m)	0.01	Cum SA (1000 m2)	78.57	28.40	67.24

Plan: Plan 06 Murragamba 1 RS: 18 Profile: 100 year

E.G. Elev (m)	421.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	421.56	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	421.56	Flow Area (m2)	12.82	23.56	4.43
E.G. Slope (m/m)	0.007385	Area (m2)	12.82	23.56	4.43
Q Total (m3/s)	92.20	Flow (m3/s)	14.09	73.50	4.61
Top Width (m)	50.43	Top Width (m)	24.98	16.10	9.34
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.10	3.12	1.04
Max Chl Dpth (m)	1.99	Hydr. Depth (m)	0.51	1.46	0.47
Conv. Total (m3/s)	1072.9	Conv. (m3/s)	163.9	855.2	53.7
Length Wtd. (m)	1.00	Wetted Per. (m)	25.05	16.46	9.41
Min Ch El (m)	419.57	Shear (N/m2)	37.05	103.70	34.12
Alpha	1.57	Stream Power (N/m s)	40.73	323.45	35.51
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	62.86	45.91	39.54
C & E Loss (m)	0.03	Cum SA (1000 m2)	76.54	26.82	65.90

Plan: Plan 06 Murragamba 1 RS: 17.5 Profile: 100 year

E.G. Elev (m)	421.48	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	421.17	Reach Len. (m)	118.00	135.80	145.30
Crit W.S. (m)		Flow Area (m2)	15.74	25.43	5.55
E.G. Slope (m/m)	0.005229	Area (m2)	15.74	25.43	5.55
Q Total (m3/s)	92.20	Flow (m3/s)	16.50	70.25	5.45
Top Width (m)	51.36	Top Width (m)	25.45	16.10	9.81
Vel Total (m/s)	1.97	Avg. Vel. (m/s)	1.05	2.76	0.98
Max Chl Dpth (m)	2.10	Hydr. Depth (m)	0.62	1.58	0.57
Conv. Total (m3/s)	1275.0	Conv. (m3/s)	228.2	971.4	75.4
Length Wtd. (m)	134.29	Wetted Per. (m)	25.53	16.46	9.89
Min Ch El (m)	419.07	Shear (N/m2)	31.63	79.26	28.76

Plan: Plan 06 Murragamba 1 RS: 17.5 Profile: 100 year (Continued)

Alpha	1.56	Stream Power (N/m s)	33.15	218.89	28.29
Frctn Loss (m)	0.75	Cum Volume (1000 m3)	62.85	45.89	39.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	76.52	26.81	65.89

Plan: Plan 06 Murragamba 1 RS: 17 Profile: 100 year

E.G. Elev (m)	420.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	420.38	Reach Len. (m)	77.80	74.10	56.20
Crit W.S. (m)		Flow Area (m2)	8.20	24.66	11.51
E.G. Slope (m/m)	0.005999	Area (m2)	8.20	24.66	11.51
Q Total (m3/s)	92.20	Flow (m3/s)	8.55	71.45	12.20
Top Width (m)	51.15	Top Width (m)	14.79	16.10	20.27
Vel Total (m/s)	2.08	Avg. Vel. (m/s)	1.04	2.90	1.06
Max Chl Dpth (m)	2.05	Hydr. Depth (m)	0.55	1.53	0.57
Conv. Total (m3/s)	1190.4	Conv. (m3/s)	110.4	922.5	157.5
Length Wtd. (m)	71.69	Wetted Per. (m)	14.86	16.46	20.34
Min Ch El (m)	418.33	Shear (N/m2)	32.47	88.15	33.29
Alpha	1.56	Stream Power (N/m s)	33.84	255.43	35.28
Frctn Loss (m)	0.39	Cum Volume (1000 m3)	61.44	42.48	38.30
C & E Loss (m)	0.02	Cum SA (1000 m2)	74.14	24.62	63.70

Plan: Plan 06 Murragamba 1 RS: 16 Profile: 100 year

E.G. Elev (m)	420.32	Element	Left OB	Channel	Right OB
Vel Head (m)	0.28	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	420.04	Reach Len. (m)	69.90	37.20	0.90
Crit W.S. (m)		Flow Area (m2)	7.85	25.64	15.65
E.G. Slope (m/m)	0.004842	Area (m2)	7.85	25.64	15.65
Q Total (m3/s)	92.20	Flow (m3/s)	7.71	68.52	15.96
Top Width (m)	54.10	Top Width (m)	13.13	16.10	24.87
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	0.98	2.67	1.02
Max Chl Dpth (m)	2.12	Hydr. Depth (m)	0.60	1.59	0.63
Conv. Total (m3/s)	1325.0	Conv. (m3/s)	110.9	984.7	229.4
Length Wtd. (m)	33.39	Wetted Per. (m)	13.21	16.46	24.95
Min Ch El (m)	417.93	Shear (N/m2)	28.20	73.99	29.79
Alpha	1.58	Stream Power (N/m s)	27.73	197.71	30.38
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	60.81	40.62	37.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	73.06	23.43	62.43

Plan: Plan 06 Murragamba 1 RS: 15 Profile: 100 year

E.G. Elev (m)	420.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	419.71	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	419.71	Flow Area (m2)	4.23	23.56	13.00
E.G. Slope (m/m)	0.007389	Area (m2)	4.23	23.56	13.00
Q Total (m3/s)	92.20	Flow (m3/s)	4.38	73.51	14.30
Top Width (m)	50.40	Top Width (m)	8.96	16.10	25.33
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.04	3.12	1.10
Max Chl Dpth (m)	1.99	Hydr. Depth (m)	0.47	1.46	0.51
Conv. Total (m3/s)	1072.6	Conv. (m3/s)	51.0	855.2	166.4
Length Wtd. (m)	1.00	Wetted Per. (m)	9.03	16.46	25.40
Min Ch El (m)	417.72	Shear (N/m2)	33.94	103.75	37.09
Alpha	1.57	Stream Power (N/m s)	35.19	323.68	40.81
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	60.39	39.71	37.52
C & E Loss (m)	0.03	Cum SA (1000 m2)	72.29	22.83	62.41

Plan: Plan 06 Murragamba 1 RS: 14.5 Profile: 100 year

E.G. Elev (m)	419.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	419.33	Reach Len. (m)	162.10	158.80	152.50
Crit W.S. (m)		Flow Area (m2)	5.39	25.59	16.23
E.G. Slope (m/m)	0.005088	Area (m2)	5.39	25.59	16.23
Q Total (m3/s)	92.20	Flow (m3/s)	5.25	70.01	16.94
Top Width (m)	51.41	Top Width (m)	9.47	16.10	25.84
Vel Total (m/s)	1.95	Avg. Vel. (m/s)	0.97	2.74	1.04
Max Chl Dpth (m)	2.11	Hydr. Depth (m)	0.57	1.59	0.63
Conv. Total (m3/s)	1292.5	Conv. (m3/s)	73.6	981.4	237.5
Length Wtd. (m)	158.52	Wetted Per. (m)	9.55	16.46	25.92
Min Ch El (m)	417.22	Shear (N/m2)	28.17	77.59	31.24
Alpha	1.56	Stream Power (N/m s)	27.45	212.27	32.61
Frctn Loss (m)	0.88	Cum Volume (1000 m3)	60.39	39.68	37.50
C & E Loss (m)	0.00	Cum SA (1000 m2)	72.28	22.81	62.38

Plan: Plan 06 Murragamba 1 RS: 14 Profile: 100 year

E.G. Elev (m)	418.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	418.41	Reach Len. (m)	40.30	65.00	80.10
Crit W.S. (m)		Flow Area (m2)	16.15	24.63	3.35
E.G. Slope (m/m)	0.006050	Area (m2)	16.15	24.63	3.35
Q Total (m3/s)	92.20	Flow (m3/s)	17.37	71.60	3.24
Top Width (m)	50.90	Top Width (m)	28.04	16.10	6.77
Vel Total (m/s)	2.09	Avg. Vel. (m/s)	1.08	2.91	0.97
Max Chl Dpth (m)	2.05	Hydr. Depth (m)	0.58	1.53	0.49
Conv. Total (m3/s)	1185.3	Conv. (m3/s)	223.3	920.5	41.6
Length Wtd. (m)	61.19	Wetted Per. (m)	28.11	16.46	6.84
Min Ch El (m)	416.36	Shear (N/m2)	34.09	88.78	29.04
Alpha	1.56	Stream Power (N/m s)	36.65	258.13	28.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	58.64	35.69	36.01
C & E Loss (m)	0.01	Cum SA (1000 m2)	69.24	20.25	59.90

Plan: Plan 06 Murragamba 1 RS: 13 Profile: 100 year

E.G. Elev (m)	418.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	418.09	Reach Len. (m)	14.60	40.00	54.10
Crit W.S. (m)		Flow Area (m2)	16.03	25.27	5.99
E.G. Slope (m/m)	0.005253	Area (m2)	16.03	25.27	5.99
Q Total (m3/s)	92.20	Flow (m3/s)	16.68	69.63	5.89
Top Width (m)	52.98	Top Width (m)	26.27	16.10	10.62
Vel Total (m/s)	1.95	Avg. Vel. (m/s)	1.04	2.76	0.98
Max Chl Dpth (m)	2.09	Hydr. Depth (m)	0.61	1.57	0.56
Conv. Total (m3/s)	1272.1	Conv. (m3/s)	230.1	960.6	81.3
Length Wtd. (m)	37.98	Wetted Per. (m)	26.34	16.46	10.69
Min Ch El (m)	416.00	Shear (N/m2)	31.34	79.09	28.84
Alpha	1.58	Stream Power (N/m s)	32.61	217.96	28.39
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	57.99	34.07	35.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	68.14	19.21	59.20

Plan: Plan 06 Murragamba 1 RS: 12 Profile: 100 year

E.G. Elev (m)	418.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.29	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	417.91	Reach Len. (m)	76.40	53.00	26.60
Crit W.S. (m)		Flow Area (m2)	8.86	25.83	13.36
E.G. Slope (m/m)	0.004873	Area (m2)	8.86	25.83	13.36
Q Total (m3/s)	92.20	Flow (m3/s)	8.89	69.59	13.72

Plan: Plan 06 Murragamba 1 RS: 12 Profile: 100 year (Continued)

Top Width (m)	51.62	Top Width (m)	14.44	16.10	21.09
Vel Total (m/s)	1.92	Avg. Vel. (m/s)	1.00	2.69	1.03
Max Chl Dpth (m)	2.13	Hydr. Depth (m)	0.61	1.60	0.63
Conv. Total (m3/s)	1320.7	Conv. (m3/s)	127.4	996.8	196.5
Length Wtd. (m)	51.40	Wetted Per. (m)	14.52	16.46	21.17
Min Ch El (m)	415.78	Shear (N/m2)	29.15	75.01	30.15
Alpha	1.56	Stream Power (N/m s)	29.27	202.08	30.97
Frctn Loss (m)	0.31	Cum Volume (1000 m3)	57.81	33.05	35.11
C & E Loss (m)	0.01	Cum SA (1000 m2)	67.85	18.56	58.35

Plan: Plan 06 Murragamba 1 RS: 11 Profile: 100 year

E.G. Elev (m)	417.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	417.48	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	417.48	Flow Area (m2)	6.65	23.56	10.66
E.G. Slope (m/m)	0.007383	Area (m2)	6.65	23.56	10.66
Q Total (m3/s)	92.20	Flow (m3/s)	7.10	73.45	11.64
Top Width (m)	50.56	Top Width (m)	13.48	16.10	20.98
Vel Total (m/s)	2.26	Avg. Vel. (m/s)	1.07	3.12	1.09
Max Chl Dpth (m)	1.99	Hydr. Depth (m)	0.49	1.46	0.51
Conv. Total (m3/s)	1073.0	Conv. (m3/s)	82.7	854.8	135.5
Length Wtd. (m)	1.00	Wetted Per. (m)	13.55	16.46	21.05
Min Ch El (m)	415.49	Shear (N/m2)	35.52	103.63	36.68
Alpha	1.57	Stream Power (N/m s)	37.97	323.13	40.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	57.22	31.74	34.80
C & E Loss (m)	0.02	Cum SA (1000 m2)	66.78	17.71	57.79

Plan: Plan 06 Murragamba 1 RS: 10.5 Profile: 100 year

E.G. Elev (m)	417.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.34	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	417.05	Reach Len. (m)	109.10	121.80	127.90
Crit W.S. (m)		Flow Area (m2)	7.68	24.78	12.27
E.G. Slope (m/m)	0.005872	Area (m2)	7.68	24.78	12.27
Q Total (m3/s)	92.20	Flow (m3/s)	7.94	71.27	12.99
Top Width (m)	51.17	Top Width (m)	13.79	16.10	21.29
Vel Total (m/s)	2.06	Avg. Vel. (m/s)	1.03	2.88	1.06
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.56	1.54	0.58
Conv. Total (m3/s)	1203.2	Conv. (m3/s)	103.6	930.1	169.5
Length Wtd. (m)	120.62	Wetted Per. (m)	13.86	16.46	21.36
Min Ch El (m)	414.99	Shear (N/m2)	31.91	86.70	33.06
Alpha	1.56	Stream Power (N/m s)	32.99	249.38	35.01
Frctn Loss (m)	0.61	Cum Volume (1000 m3)	57.21	31.72	34.78
C & E Loss (m)	0.02	Cum SA (1000 m2)	66.77	17.69	57.76

Plan: Plan 06 Murragamba 1 RS: 10 Profile: 100 year

E.G. Elev (m)	416.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	416.49	Reach Len. (m)	207.85	210.10	207.25
Crit W.S. (m)		Flow Area (m2)	17.65	26.41	5.77
E.G. Slope (m/m)	0.004417	Area (m2)	17.65	26.41	5.77
Q Total (m3/s)	92.20	Flow (m3/s)	17.99	68.75	5.46
Top Width (m)	51.80	Top Width (m)	26.18	16.10	9.52
Vel Total (m/s)	1.85	Avg. Vel. (m/s)	1.02	2.60	0.95
Max Chl Dpth (m)	2.16	Hydr. Depth (m)	0.67	1.64	0.61
Conv. Total (m3/s)	1387.4	Conv. (m3/s)	270.7	1034.4	82.2
Length Wtd. (m)	209.55	Wetted Per. (m)	26.27	16.46	9.61
Min Ch El (m)	414.33	Shear (N/m2)	29.10	69.51	26.01

Plan: Plan 06 Murragamba 1 RS: 10 Profile: 100 year (Continued)

Alpha	1.55	Stream Power (N/m s)	29.67	180.92	24.61
Frctn Loss (m)	1.18	Cum Volume (1000 m3)	55.83	28.60	33.63
C & E Loss (m)	0.01	Cum SA (1000 m2)	64.59	15.73	55.79

Plan: Plan 06 Murragamba 1 RS: 9 Profile: 100 year

E.G. Elev (m)	415.57	Element	Left OB	Channel	Right OB
Vel Head (m)	0.41	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	415.16	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	415.16	Flow Area (m2)	13.10	23.55	4.29
E.G. Slope (m/m)	0.007375	Area (m2)	13.10	23.55	4.29
Q Total (m3/s)	92.20	Flow (m3/s)	14.39	73.36	4.45
Top Width (m)	50.77	Top Width (m)	25.57	16.10	9.10
Vel Total (m/s)	2.25	Avg. Vel. (m/s)	1.10	3.12	1.04
Max Chl Dpth (m)	1.99	Hydr. Depth (m)	0.51	1.46	0.47
Conv. Total (m3/s)	1073.6	Conv. (m3/s)	167.5	854.3	51.8
Length Wtd. (m)	1.00	Wetted Per. (m)	25.64	16.46	9.17
Min Ch El (m)	413.18	Shear (N/m2)	36.96	103.48	33.88
Alpha	1.57	Stream Power (N/m s)	40.58	322.39	35.11
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	52.63	23.35	32.59
C & E Loss (m)	0.02	Cum SA (1000 m2)	59.21	12.35	53.86

Plan: Plan 06 Murragamba 1 RS: 8.5 Profile: 100 year

E.G. Elev (m)	415.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	414.75	Reach Len. (m)	22.00	34.40	50.30
Crit W.S. (m)		Flow Area (m2)	15.33	24.94	5.10
E.G. Slope (m/m)	0.005687	Area (m2)	15.33	24.94	5.10
Q Total (m3/s)	92.20	Flow (m3/s)	16.26	70.88	5.07
Top Width (m)	51.46	Top Width (m)	25.91	16.10	9.44
Vel Total (m/s)	2.03	Avg. Vel. (m/s)	1.06	2.84	0.99
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.59	1.55	0.54
Conv. Total (m3/s)	1222.6	Conv. (m3/s)	215.6	939.9	67.2
Length Wtd. (m)	32.99	Wetted Per. (m)	25.99	16.46	9.52
Min Ch El (m)	412.68	Shear (N/m2)	32.89	84.50	29.85
Alpha	1.56	Stream Power (N/m s)	34.88	240.20	29.67
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	52.62	23.33	32.58
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.18	12.34	53.86

Plan: Plan 06 Murragamba 1 RS: 8 Profile: 100 year

E.G. Elev (m)	414.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	414.56	Reach Len. (m)	18.30	38.70	46.30
Crit W.S. (m)		Flow Area (m2)	15.85	24.88	4.50
E.G. Slope (m/m)	0.005741	Area (m2)	15.85	24.88	4.50
Q Total (m3/s)	92.20	Flow (m3/s)	16.85	70.93	4.43
Top Width (m)	51.52	Top Width (m)	26.90	16.10	8.52
Vel Total (m/s)	2.04	Avg. Vel. (m/s)	1.06	2.85	0.98
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.59	1.55	0.53
Conv. Total (m3/s)	1216.9	Conv. (m3/s)	222.3	936.1	58.4
Length Wtd. (m)	36.01	Wetted Per. (m)	26.98	16.46	8.60
Min Ch El (m)	412.49	Shear (N/m2)	33.07	85.10	29.46
Alpha	1.57	Stream Power (N/m s)	35.15	242.63	28.99
Frctn Loss (m)	0.20	Cum Volume (1000 m3)	52.28	22.47	32.34
C & E Loss (m)	0.00	Cum SA (1000 m2)	58.60	11.78	53.40

Plan: Plan 06 Murragamba 1 RS: 7 Profile: 100 year

E.G. Elev (m)	414.69	Element	Left OB	Channel	Right OB
Vel Head (m)	0.32	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	414.36	Reach Len. (m)	88.10	88.40	88.40
Crit W.S. (m)		Flow Area (m2)	11.94	25.15	8.77
E.G. Slope (m/m)	0.005499	Area (m2)	11.94	25.15	8.77
Q Total (m3/s)	92.20	Flow (m3/s)	12.49	70.69	9.02
Top Width (m)	51.29	Top Width (m)	20.10	16.10	15.09
Vel Total (m/s)	2.01	Avg. Vel. (m/s)	1.05	2.81	1.03
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.59	1.56	0.58
Conv. Total (m3/s)	1243.3	Conv. (m3/s)	168.4	953.2	121.7
Length Wtd. (m)	88.36	Wetted Per. (m)	20.18	16.46	15.17
Min Ch El (m)	412.28	Shear (N/m2)	31.93	82.40	31.17
Alpha	1.56	Stream Power (N/m s)	33.38	231.63	32.08
Frctn Loss (m)	0.47	Cum Volume (1000 m3)	52.02	21.50	32.03
C & E Loss (m)	0.01	Cum SA (1000 m2)	58.17	11.16	52.86

Plan: Plan 06 Murragamba 1 RS: 6 Profile: 100 year

E.G. Elev (m)	414.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.30	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.91	Reach Len. (m)	72.10	48.10	22.50
Crit W.S. (m)		Flow Area (m2)	11.35	25.57	10.21
E.G. Slope (m/m)	0.005115	Area (m2)	11.35	25.57	10.21
Q Total (m3/s)	92.20	Flow (m3/s)	11.68	70.07	10.45
Top Width (m)	51.39	Top Width (m)	18.51	16.10	16.78
Vel Total (m/s)	1.96	Avg. Vel. (m/s)	1.03	2.74	1.02
Max Chl Dpth (m)	2.11	Hydr. Depth (m)	0.61	1.59	0.61
Conv. Total (m3/s)	1289.1	Conv. (m3/s)	163.3	979.8	146.1
Length Wtd. (m)	48.86	Wetted Per. (m)	18.59	16.46	16.86
Min Ch El (m)	411.80	Shear (N/m2)	30.62	77.93	30.36
Alpha	1.56	Stream Power (N/m s)	31.51	213.59	31.07
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.00	19.26	31.20
C & E Loss (m)	0.01	Cum SA (1000 m2)	56.47	9.74	51.45

Plan: Plan 06 Murragamba 1 RS: 5 Profile: 100 year

E.G. Elev (m)	413.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.26	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.71	Reach Len. (m)	110.30	60.70	17.00
Crit W.S. (m)		Flow Area (m2)	15.00	26.68	9.36
E.G. Slope (m/m)	0.004193	Area (m2)	15.00	26.68	9.36
Q Total (m3/s)	92.20	Flow (m3/s)	14.99	68.10	9.10
Top Width (m)	52.42	Top Width (m)	22.03	16.10	14.30
Vel Total (m/s)	1.81	Avg. Vel. (m/s)	1.00	2.55	0.97
Max Chl Dpth (m)	2.18	Hydr. Depth (m)	0.68	1.66	0.65
Conv. Total (m3/s)	1423.9	Conv. (m3/s)	231.5	1051.8	140.6
Length Wtd. (m)	66.09	Wetted Per. (m)	22.12	16.46	14.39
Min Ch El (m)	411.53	Shear (N/m2)	27.88	66.65	26.75
Alpha	1.55	Stream Power (N/m s)	27.87	170.14	26.02
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	50.05	18.00	30.98
C & E Loss (m)	0.02	Cum SA (1000 m2)	55.01	8.96	51.10

Plan: Plan 06 Murragamba 1 RS: 4 Profile: 100 year

E.G. Elev (m)	413.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.53	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)		Flow Area (m2)	21.06	29.12	8.58
E.G. Slope (m/m)	0.002856	Area (m2)	21.06	29.12	8.58
Q Total (m3/s)	92.20	Flow (m3/s)	19.67	65.04	7.49

Plan: Plan 06 Murragamba 1 RS: 4 Profile: 100 year (Continued)

Top Width (m)	53.28	Top Width (m)	25.67	16.10	11.50
Vel Total (m/s)	1.57	Avg. Vel. (m/s)	0.93	2.23	0.87
Max Chl Dpth (m)	2.33	Hydr. Depth (m)	0.82	1.81	0.75
Conv. Total (m3/s)	1725.4	Conv. (m3/s)	368.1	1217.0	140.3
Length Wtd. (m)	1.00	Wetted Per. (m)	25.78	16.46	11.61
Min Ch El (m)	411.20	Shear (N/m2)	22.88	49.55	20.69
Alpha	1.53	Stream Power (N/m s)	21.36	110.67	18.08
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	48.06	16.31	30.82
C & E Loss (m)	0.03	Cum SA (1000 m2)	52.38	7.98	50.88

Plan: Plan 06 Murragamba 1 RS: 3.5 Profile: 100 year

E.G. Elev (m)	413.69	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.61	Reach Len. (m)	72.50	59.10	45.40
Crit W.S. (m)		Flow Area (m2)	36.60	38.44	15.91
E.G. Slope (m/m)	0.000856	Area (m2)	36.60	38.44	15.91
Q Total (m3/s)	92.20	Flow (m3/s)	25.50	56.56	10.14
Top Width (m)	57.91	Top Width (m)	27.99	16.10	13.82
Vel Total (m/s)	1.01	Avg. Vel. (m/s)	0.70	1.47	0.64
Max Chl Dpth (m)	2.91	Hydr. Depth (m)	1.31	2.39	1.15
Conv. Total (m3/s)	3151.2	Conv. (m3/s)	871.4	1933.2	346.6
Length Wtd. (m)	60.00	Wetted Per. (m)	28.17	16.46	14.00
Min Ch El (m)	410.70	Shear (N/m2)	10.91	19.61	9.54
Alpha	1.47	Stream Power (N/m s)	7.60	28.85	6.08
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	48.03	16.28	30.81
C & E Loss (m)	0.01	Cum SA (1000 m2)	52.35	7.97	50.87

Plan: Plan 06 Murragamba 1 RS: 3 Profile: 100 year

E.G. Elev (m)	413.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.58	Reach Len. (m)	67.70	71.20	72.40
Crit W.S. (m)		Flow Area (m2)	30.76	43.13	34.35
E.G. Slope (m/m)	0.000585	Area (m2)	30.76	43.13	34.35
Q Total (m3/s)	92.20	Flow (m3/s)	16.58	56.66	18.95
Top Width (m)	70.03	Top Width (m)	25.94	16.10	27.99
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.54	1.31	0.55
Max Chl Dpth (m)	3.20	Hydr. Depth (m)	1.19	2.68	1.23
Conv. Total (m3/s)	3812.2	Conv. (m3/s)	685.7	2342.8	783.7
Length Wtd. (m)	70.46	Wetted Per. (m)	26.15	16.46	28.20
Min Ch El (m)	410.38	Shear (N/m2)	6.75	15.03	6.99
Alpha	1.62	Stream Power (N/m s)	3.64	19.75	3.86
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	45.59	13.87	29.67
C & E Loss (m)	0.01	Cum SA (1000 m2)	50.40	7.02	49.92

Plan: Plan 06 Murragamba 1 RS: 2 Profile: 100 year

E.G. Elev (m)	413.61	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.57	Reach Len. (m)	59.30	76.70	88.90
Crit W.S. (m)		Flow Area (m2)	70.40	49.13	23.68
E.G. Slope (m/m)	0.000340	Area (m2)	70.40	49.13	23.68
Q Total (m3/s)	92.20	Flow (m3/s)	31.27	53.67	7.26
Top Width (m)	99.73	Top Width (m)	52.81	16.10	30.82
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.44	1.09	0.31
Max Chl Dpth (m)	3.57	Hydr. Depth (m)	1.33	3.05	0.77
Conv. Total (m3/s)	5000.5	Conv. (m3/s)	1696.0	2910.8	393.7
Length Wtd. (m)	73.37	Wetted Per. (m)	53.24	16.46	31.25
Min Ch El (m)	409.99	Shear (N/m2)	4.41	9.95	2.53

Plan: Plan 06 Murragamba 1 RS: 2 Profile: 100 year (Continued)

Alpha	1.85	Stream Power (N/m s)	1.96	10.87	0.77
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	42.16	10.58	27.57
C & E Loss (m)	0.01	Cum SA (1000 m2)	47.73	5.87	47.79

Plan: Plan 06 Murragamba 1 RS: 1 Profile: 100 year

E.G. Elev (m)	413.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.56	Reach Len. (m)	64.10	64.20	63.70
Crit W.S. (m)		Flow Area (m2)	67.57	55.79	61.02
E.G. Slope (m/m)	0.000175	Area (m2)	67.57	55.79	61.02
Q Total (m3/s)	92.20	Flow (m3/s)	23.78	47.52	20.89
Top Width (m)	99.70	Top Width (m)	43.09	16.10	40.51
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.35	0.85	0.34
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	1.57	3.47	1.51
Conv. Total (m3/s)	6979.6	Conv. (m3/s)	1800.4	3597.4	1581.7
Length Wtd. (m)	64.05	Wetted Per. (m)	43.94	16.46	41.36
Min Ch El (m)	409.57	Shear (N/m2)	2.63	5.80	2.52
Alpha	1.73	Stream Power (N/m s)	0.93	4.94	0.86
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	38.07	6.56	23.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	44.89	4.63	44.62

Plan: Plan 06 Murragamba 1 RS: 0 Profile: 100 year

E.G. Elev (m)	413.57	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.56	Reach Len. (m)	461.00	24.00	477.00
Crit W.S. (m)		Flow Area (m2)	81.76	61.39	75.88
E.G. Slope (m/m)	0.000106	Area (m2)	81.76	61.39	75.88
Q Total (m3/s)	92.20	Flow (m3/s)	25.48	43.50	23.22
Top Width (m)	99.70	Top Width (m)	42.82	16.10	40.78
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.31	0.71	0.31
Max Chl Dpth (m)	4.34	Hydr. Depth (m)	1.91	3.81	1.86
Conv. Total (m3/s)	8941.8	Conv. (m3/s)	2471.2	4218.6	2252.0
Length Wtd. (m)	202.00	Wetted Per. (m)	44.02	16.46	41.98
Min Ch El (m)	409.22	Shear (N/m2)	1.94	3.89	1.88
Alpha	1.62	Stream Power (N/m s)	0.60	2.76	0.58
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	33.29	2.80	19.44
C & E Loss (m)	0.00	Cum SA (1000 m2)	42.13	3.60	42.03

Plan: Plan 06 Murragamba 1 RS: -1 Profile: 100 year

E.G. Elev (m)	413.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	413.46	Reach Len. (m)	3.00	3.00	3.00
Crit W.S. (m)		Flow Area (m2)	61.98	52.84	5.52
E.G. Slope (m/m)	0.000703	Area (m2)	61.98	52.84	5.52
Q Total (m3/s)	92.20	Flow (m3/s)	24.49	66.68	1.04
Top Width (m)	145.28	Top Width (m)	96.24	22.85	26.19
Vel Total (m/s)	0.77	Avg. Vel. (m/s)	0.40	1.26	0.19
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	0.64	2.31	0.21
Conv. Total (m3/s)	3477.6	Conv. (m3/s)	923.6	2515.0	39.0
Length Wtd. (m)	3.00	Wetted Per. (m)	96.37	24.57	26.19
Min Ch El (m)	409.04	Shear (N/m2)	4.43	14.82	1.45
Alpha	2.03	Stream Power (N/m s)	1.75	18.71	0.27
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	0.15	1.43	0.03
C & E Loss (m)	0.00	Cum SA (1000 m2)	10.08	3.13	26.06

Plan: Plan 06 Murragamba 1 RS: -2 Profile: 100 year

E.G. Elev (m)	413.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (m)	413.47	Reach Len. (m)	16.00	16.00	16.00
Crit W.S. (m)	411.27	Flow Area (m2)	40.56	77.13	15.25
E.G. Slope (m/m)	0.000345	Area (m2)	40.56	77.13	15.25
Q Total (m3/s)	92.20	Flow (m3/s)	7.91	79.27	5.02
Top Width (m)	117.46	Top Width (m)	80.88	22.85	13.74
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.20	1.03	0.33
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	0.50	3.38	1.11
Conv. Total (m3/s)	4966.3	Conv. (m3/s)	426.3	4269.8	270.2
Length Wtd. (m)	16.00	Wetted Per. (m)	81.00	23.41	13.91
Min Ch El (m)	408.95	Shear (N/m2)	1.69	11.14	3.70
Alpha	1.91	Stream Power (N/m s)	0.33	11.44	1.22
Frctn Loss (m)		Cum Volume (1000 m3)		1.23	
C & E Loss (m)		Cum SA (1000 m2)	9.81	3.06	26.00

Plan: Plan 06 Murragamba 1 RS: -3 Profile: 100 year

E.G. Elev (m)	412.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (m)	412.66	Reach Len. (m)	11.00	11.00	11.00
Crit W.S. (m)		Flow Area (m2)	0.98	67.27	2.33
E.G. Slope (m/m)	0.000716	Area (m2)	0.98	67.27	2.33
Q Total (m3/s)	92.20	Flow (m3/s)	0.24	91.13	0.83
Top Width (m)	32.37	Top Width (m)	6.81	22.74	2.82
Vel Total (m/s)	1.31	Avg. Vel. (m/s)	0.24	1.35	0.36
Max Chl Dpth (m)	3.80	Hydr. Depth (m)	0.14	2.96	0.83
Conv. Total (m3/s)	3446.1	Conv. (m3/s)	8.9	3406.3	31.0
Length Wtd. (m)	11.00	Wetted Per. (m)	7.70	23.34	3.27
Min Ch El (m)	408.85	Shear (N/m2)	0.89	20.23	5.00
Alpha	1.06	Stream Power (N/m s)	0.22	27.41	1.78
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	0.74	1.27	0.46
C & E Loss (m)	0.02	Cum SA (1000 m2)	9.11	2.70	25.86

Plan: Plan 06 Murragamba 1 RS: -4 Profile: 100 year

E.G. Elev (m)	412.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.070	0.050	0.070
W.S. Elev (m)	412.71	Reach Len. (m)	16.00	16.00	16.00
Crit W.S. (m)	410.19	Flow Area (m2)	134.03	84.02	80.62
E.G. Slope (m/m)	0.000192	Area (m2)	134.03	84.02	80.62
Q Total (m3/s)	92.20	Flow (m3/s)	26.01	53.52	12.68
Top Width (m)	336.77	Top Width (m)	138.17	23.16	175.43
Vel Total (m/s)	0.31	Avg. Vel. (m/s)	0.19	0.64	0.16
Max Chl Dpth (m)	4.07	Hydr. Depth (m)	0.97	3.63	0.46
Conv. Total (m3/s)	6648.5	Conv. (m3/s)	1875.3	3859.2	914.1
Length Wtd. (m)	16.00	Wetted Per. (m)	138.28	24.14	175.46
Min Ch El (m)	408.65	Shear (N/m2)	1.83	6.56	0.87
Alpha	2.62	Stream Power (N/m s)	0.35	4.18	0.14
Frctn Loss (m)		Cum Volume (1000 m3)		0.43	
C & E Loss (m)		Cum SA (1000 m2)	8.32	2.45	24.88

Plan: Plan 06 Murragamba 1 RS: -5 Profile: 100 year

E.G. Elev (m)	411.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.070	0.500	0.070
W.S. Elev (m)	411.78	Reach Len. (m)	170.00	133.00	265.00
Crit W.S. (m)		Flow Area (m2)	33.61	62.49	18.34
E.G. Slope (m/m)	0.018368	Area (m2)	33.61	62.49	18.34
Q Total (m3/s)	92.20	Flow (m3/s)	37.24	31.93	23.03

Plan: Plan 06 Murragamba 1 RS: -5 Profile: 100 year (Continued)

Top Width (m)	135.80	Top Width (m)	77.53	23.16	35.10
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	1.11	0.51	1.26
Max Chl Dpth (m)	3.14	Hydr. Depth (m)	0.43	2.70	0.52
Conv. Total (m3/s)	680.3	Conv. (m3/s)	274.8	235.6	169.9
Length Wtd. (m)	211.70	Wetted Per. (m)	77.63	24.14	35.12
Min Ch El (m)	408.65	Shear (N/m2)	77.99	466.30	94.06
Alpha	1.51	Stream Power (N/m s)	86.41	238.29	118.09
Frctn Loss (m)	2.80	Cum Volume (1000 m3)	2.86	4.64	11.94
C & E Loss (m)	0.00	Cum SA (1000 m2)	6.59	2.08	23.20

Plan: Plan 06 Murragamba 1 RS: -6 Profile: 100 year

E.G. Elev (m)	409.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.040	0.060
W.S. Elev (m)	408.93	Reach Len. (m)			
Crit W.S. (m)	408.67	Flow Area (m2)		7.21	71.76
E.G. Slope (m/m)	0.010001	Area (m2)		7.21	71.76
Q Total (m3/s)	92.20	Flow (m3/s)		15.72	76.48
Top Width (m)	148.06	Top Width (m)		8.07	139.99
Vel Total (m/s)	1.17	Avg. Vel. (m/s)		2.18	1.07
Max Chl Dpth (m)	1.24	Hydr. Depth (m)		0.89	0.51
Conv. Total (m3/s)	922.0	Conv. (m3/s)		157.2	764.8
Length Wtd. (m)		Wetted Per. (m)		8.86	140.34
Min Ch El (m)	407.72	Shear (N/m2)		79.83	50.14
Alpha	1.29	Stream Power (N/m s)		174.00	53.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			