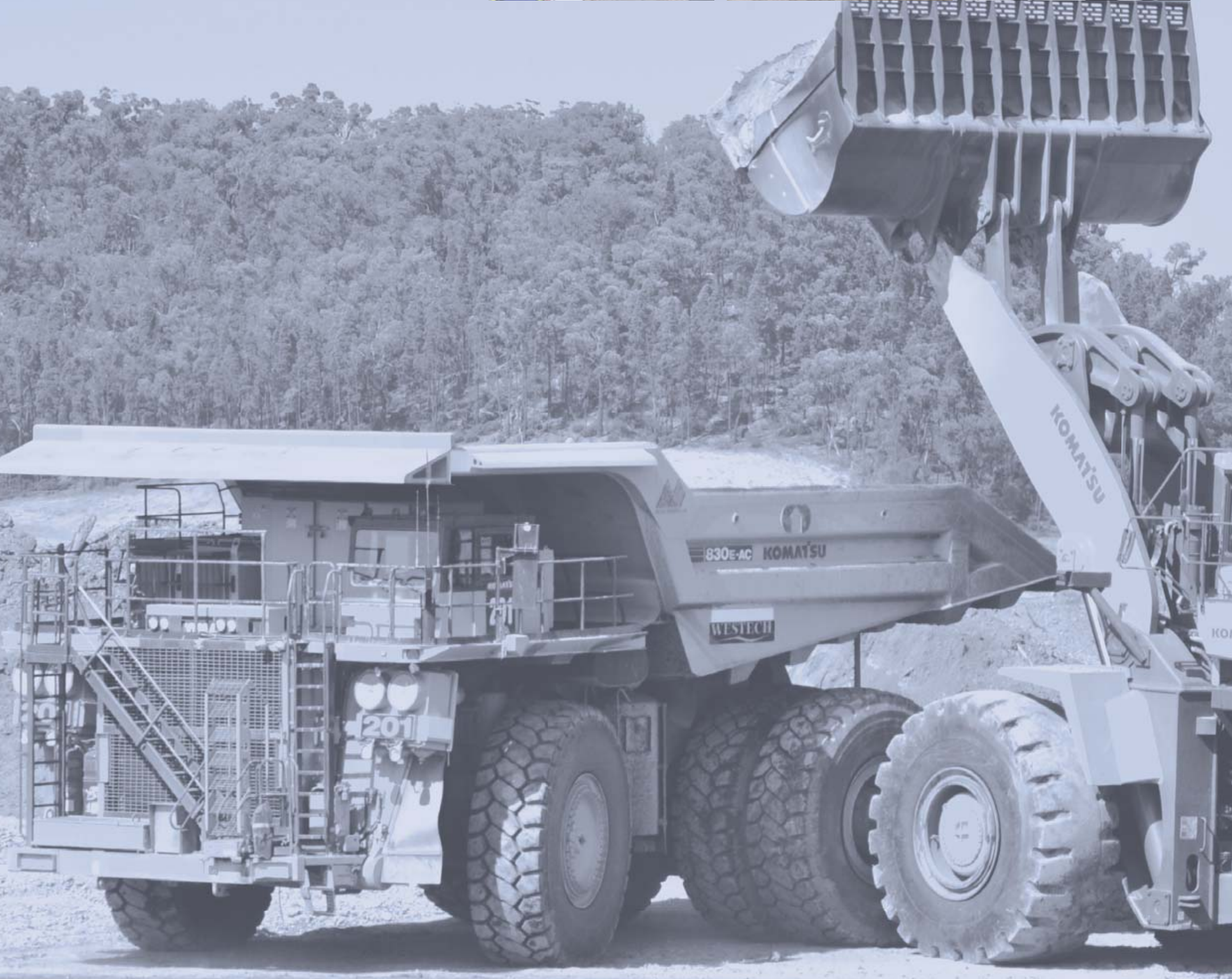
APPENDIX G

CONCEPT DESIGN FOR PROPOSED DIVERSIONS OF MURRAGAMBA & EASTERN CREEKS



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MOOLARBEN COAL PROJECT – STAGE 2 PREFERRED PROJECT

Concept Design for Proposed Diversions of Murragamba & Eastern Creeks

6173_05arm110512-M&E Creek Diversion Report.doc

Issue No. 2

25th May 2011

Water Resources
Level 12, 141 Walker Street
North Sydney 2060 Australia
Tel: +61 2 8456 7200
Fax: +61 2 8923 6877

www.worleyparsons.com

WorleyParsons Services Pty Ltd
ABN 61 001 279 812

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Disclaimer

Project: MOOLARBEN COAL PROJECT STAGE2 PPR
CONCEPT DESIGN FOR PROPOSED DIVERSIONS OF MURRAGAMBA & EASTERN CREEKS

REV	DESCRIPTION	PREPARED BY	REVIEWED BY	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
1	Issued for Client Review	ARM			8 April 11		
2	Final	ARM	CRT		25 May 11		
3							

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PROJECT OVERVIEW

CREEK DIVERSION CONCEPT DESIGN DEVELOPMENT

A feasibility design for the proposed modification and diversion of Murragamba Creek and 'Eastern' Creek was developed and documented in a report prepared by WorleyParsons titled, *'Moolarben Coal Project EA2 - Surface Water Management Strategy'* (*2008*). This report formed part of the Stage 2 Environmental Assessment (Stage 2 EA) of the Moolarben Coal Project (MCP) and included indicative diversion alignments, typical design cross sections and typical energy dissipation structures for both Murragamba Creek and 'Eastern' Creek.

The Department of Planning (*DoP*) reviewed the Surface Water Management Strategy (SWMS) in 2009 and requested additional information for the design of the creek diversion. This included a greater level of detail for the design and staging of the works.

In response, WorleyParsons prepared a report to document the concept design for the realignment / diversion of Murragamba Creek and 'Eastern' Creek. The following aspects were addressed in the progression of the creek realignment design from feasibility to concept stage:

(i) The provision of additional information detailing the creek realignment, including detailed plans documenting the proposed diversions for Murragamba and 'Eastern' Creeks, associated longitudinal profiles for both creeks, and typical design cross-sections.

(ii) Integration of the proposed creek diversion design with the riparian corridor ecological objectives for the post mining landform. These were outlined previously in the Environmental Assessment completed for Stage 2 of the Moolarben Coal Project.

(iii) A more in-depth description of the proposed staging of the creek diversion works, including details of the proposed integration of the diversion works with the planned mining operations.

(iv) Additional detail on the proposed construction methodologies, materials and contingency measures to be employed for the proposed creek diversions.

The report detailing the creek diversion concept design is titled *'Moolarben Coal Project – Stage 2, Concept Design for Proposed Diversion of Murragamba & 'Eastern' Creeks'* (*Issue No. 3, October 2009*).

Additionally, Mr Lindsay Gilbert reviewed the surface water management strategy, which included the concept design for the realignment / diversion of Murragamba Creek and 'Eastern' Creek. The details of his review can be found in his report dated 9th December 2009 titled *'Review of Surface Water Assessment and Water Balance Analyses for the Environmental Assessment of the Moolarben Coal Project – Stage 2'*.

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Mr Gilbert states in his review *"In relation to the information presented in the Relocation Concept Design Report I believe it is sufficient to conclude that the concepts are sound and I am confident that the reconstructed creek channel could be constructed to achieve the stated design objectives over time*." (*page 9*).

Mr Gilbert made two further comments, which concerned assessing the Probable Maximum Flood (*PMF*) and considering additional protection for the seepage control layer. However, as indicated in the review, both of these aspects of the design can be considered during the final design phase.

PREFERRED PROJECT REPORT CREEK DIVERSION STRATEGY

Subsequent to the submission of the Stage 2 EA, DoP has requested that Moolarben Coal Operations Pty Ltd (MCO) prepare a "Preferred Project Report" (*PPR*) for Stage 2 of the MCP (Stage 2) . A number of revisions to the Open Cut 4 mine plan are proposed as part of the Preferred Project which is the subject of the PPR. Those of which are relevant to this report include:

- A modified sequence for mining operations. Mining is proposed to commence mid-way up the Murragamba Creek valley (*refer* **Figure 17**) and there are some changes to the sequence and timing of mining in Open Cut 4 which result. The revised mine pit sequence can be seen graphically in **Figures 17** to **22**.

  Under the previous sequence, mining was proposed to commence at the southern end of the Murragamba Valley and progress north before turning south along the 'Eastern' Creek Valley.
- A revised mine footprint for Open Cut 4 mining operations.
- A significant reduction in the length of Murragamba Creek to be diverted as a consequence of mining. In total, the length of creek which is replaced by mining has been reduced by approximately 3 kilometres in total length. This reduction has resulted in the retention of the complete length of Murragamaba Creek upstream of and including the morphologically stable section of creek (*refer* **Figure 3**).
- A relocated Out-of-pit (OOP) emplacement area, the location of which can be seen in **Figure 17**.

An updated creek diversion concept design has been prepared to address the changes proposed as part of the PPR. The following is noted in regard to modifications to the creek diversion:

- The design of the diverted creek channel remains unchanged. That is, longitudinal slopes, cross section design and recommended construction techniques remain unchanged.
- No change is required to staging the creek diversion works in the 'Eastern' Creek valley. The only change to the 'Eastern' Creek diversion relates to commencement and completion dates

for mining and will bear no impact on the design of the creek diversion and associated infrastructure.

- In the Murragamba Creek valley, some minor changes have been made to dams and associated clean surface water infrastructures as a consequence of the revised sequence. However, this mainly relates to small modifications in sizing and location. None of the fundamental assumptions about the design criteria for surface water infrastructure has changed.
- Some revision to the staging of the proposed works in the Murragamba Valley has resulted from the modified mine pit sequence. However, the temporary and permanent diversion strategy previously developed is flexible and readily adaptable to the PPR mine sequence.

Furthermore, the mine sequence and mine footprint proposed for the PPR will realise the following benefits to the creek diversion:

- An increase in the length of creek to be retained due to a reduction in the proposed mine footprint. Under the old Project, the morphologically stable section of Murragamba Creek (*refer* **Figure 3**) was retained. Under the Preferred Project, the morphologically stable section of creek together with the length of Murragamba Creek, upstream of the morphologically stable section of Murragamba Creek will be retained. This will reduce the total length of Murragamba Creek permanent diversion from approximately 9 kilometres to 5 kilometres.
- Construction of certain sections of the creek diversion will commence earlier, providing additional time for rehabilitation to establish and monitoring to occur.

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1. INTRODUCTION

WorleyParsons was commissioned on behalf of MCO to undertake a Surface Water assessment for the Stage 2 Project. The purpose of this assessment is to form part of a Preferred Project Report (PPR) being prepared by Hansen Bailey to support the application for Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the development of a 24 year open cut and underground coal mine; associated infrastructure and integration with the existing Stage 1 operations.

Specifically, the Preferred Project will occur largely within the Project Boundary and consist of:

- The construction and operation of an open cut (OC) mining operation (OC4) extracting up to 12 Million tonnes per annum (Mtpa) Run of Mine (ROM) coal and up to 13 Mtpa combined rate with the Stage 1 open cuts;
- The construction and operation of two underground (UG) mining operations (UG1 and UG2) extracting up to 4 Mtpa ROM coal cumulative with the Stage 1 underground;
- The construction and operations of the Stage 2 ROM coal facility;
- Extension of the life of the Coal Handling and Preparation Plant (CHPP) to Year 24 of Stage 2 and increased throughput of up to 17 Mtpa (13 Mtpa open cut and 4 Mtpa underground);
- The development of the Northern OOP emplacement area;
- The construction and operation of two conveyors and associated facilities between the Stage 2 ROM coal facility and Stage 1 CHPP;
- The construction and operation of a Mine Access Road;
- The construction and operation of administration, workshop and related facilities;
- The construction and operation of water management infrastructure; and
- The installation of supporting power and communications infrastructure.

The underground mines that are proposed as part of Stage 2 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, which has been 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.

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As shown in **Figure 1**, Murragamba and 'Eastern' Creeks extend through part of Exploration Licence No. 6288 and run through the area proposed for OC4 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 OC4 and runs parallel with the Ulan-Wollar Road. Due to the location of OC4, it is proposed that the alignments of both Murragamba and 'Eastern' Creeks be modified to maximise resource extraction.

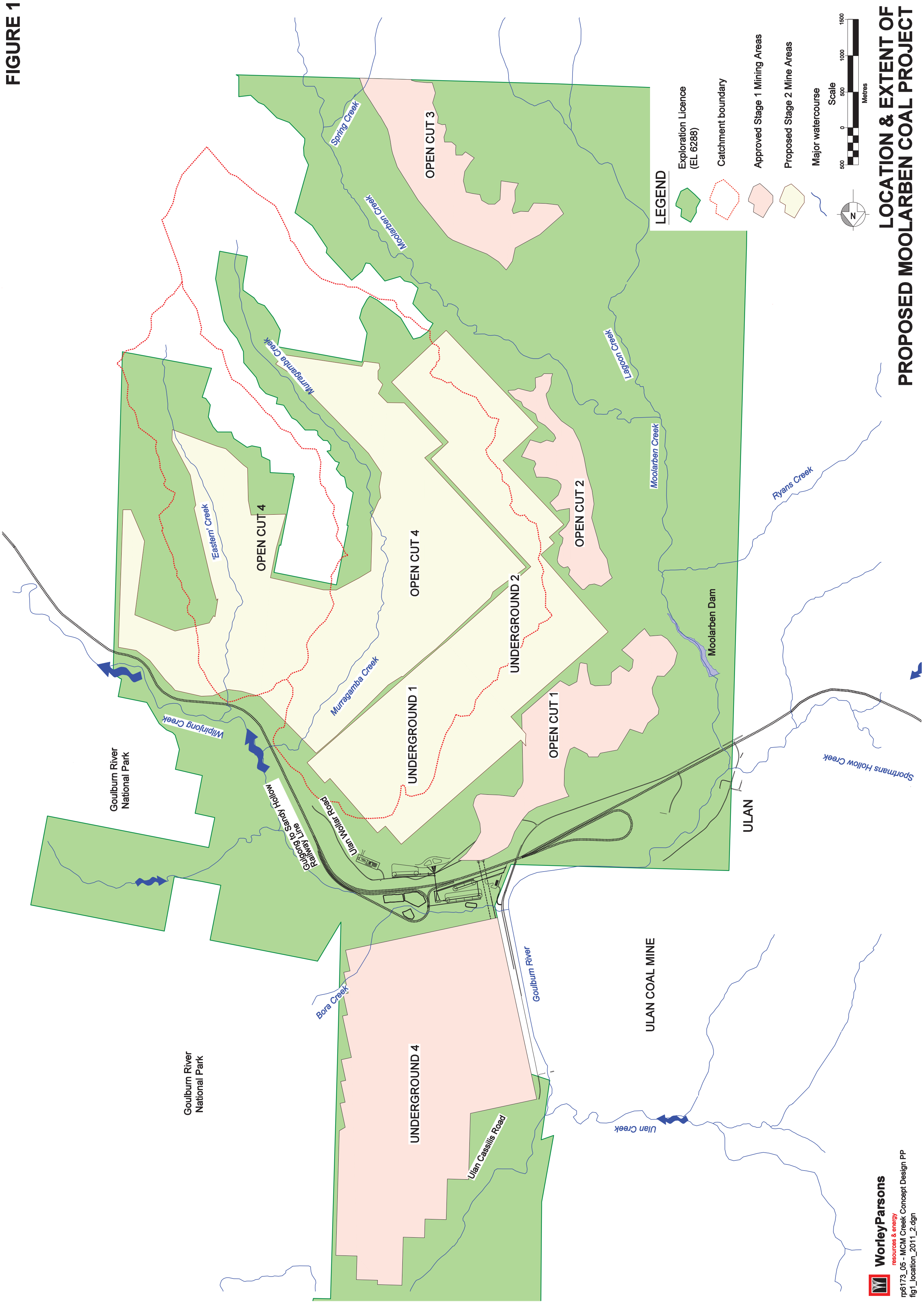
This report describes the proposed design of the diverted creek channel. Details of the construction sequencing, methodology and staging of the works are described in the following.

In part, the Concept Design has been prepared in response to comments received from Mr Gilbert's initial review of the Surface Water Management Strategy, which was completed in July 2009. A summary of Mr Gilbert's comments on the creek diversion as presented in the original review is summarised in **Table 1** below.

Table 1 SUMMARY OF ISSUES RAISED BY PEER REVIEW

SUMMARY OF ISSUE	IDENTIFIED RESPONSE (MITIGATION, MANAGEMENT, CONTINGENCY, COMMITMENT)
Hydraulic modelling results for 1 year ARI and PMF	*refer* **Appendix F**
Additional plans/ figures at critical periods showing construction sequence and how diversion construction will be integrated in mine plan	*refer* **Figures 16 to 22** and **Chapter 6**.
Details of the proposed design criteria, design process and construction methodology	*refer* **Chapter 4**, **Section 5.1**, **Section 5.2**, **Section 5.4**.
Integration of creek design with overall Impact Management Strategy	*refer* **Section 5.3**

FIGURE 1


LOCATION & EXTENT OF
PROPOSED MOOLARBEN COAL PROJECT
LEGEND
Exploration Licence
(EL 6288)
Catchment boundary
Approved Stage 1 Mining Areas
Proposed Stage 2 Mine Areas
Major watercourse
N
Scale
500
0
500
1000
1500
Metres
OPEN CUT 1
OPEN CUT 2
OPEN CUT 3
OPEN CUT 4
OPEN CUT 4
UNDERGROUND 1
UNDERGROUND 2
UNDERGROUND 4
Spring Creek
Moolarben Creek
Lagoon Creek
Moolarben Creek
Ryans Creek
Moolarben Dam
Murragamba Creek
Murragamba Creek
'Eastern' Creek
Wilpinjong Creek
Goulburn River
National Park
Goulburn River
National Park
Gulgong to Sandy Hollow
Railway Line
Ulan Wollar Road
Bora Creek
Goulburn River
ULAN COAL MINE
ULAN
Sportsmans Hollow Creek
Ulan Creek
Ulan Cassilis Road
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rp6173_05 - MCM Creek Concept Design PP
fig1_location_2011_2.dgn

2. DESCRIPTION OF THE EXISTING ENVIRONMENT

2.1 CATCHMENT DESCRIPTION

The site for the Preferred 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, a southern tributary of the Goulburn River (*refer* **Figure 1**).

The combined catchments of Murragamba and 'Eastern' Creeks cover an area of approximately 3400 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.

The Preferred Project will involve the construction of two underground mines (*UG1 and UG2*) which are to be located beneath the ridgelines that separate Moolarben and Murragamba Creeks (*refer* **Figure 1**). 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.

Stage 2 run of mine (ROM) coal facilities will be located adjacent to OC4, a raw coal stockpile will be located adjacent to the Stage 1 ROM coal facilities and OC4 surface facilities will be located at the northern extent of OC4, south of the Gulgong-Sandy Hollow Railway (*refer* **Figure 1**).

The catchments of Murragamba and 'Eastern' Creeks are typically characterised by steeply sloping wooded valley walls, with areas of out-cropping 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 have 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 average monthly rainfall and potential evapo-transpiration for the Ulan Post Office Gauge.

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Table 2 SUMMARY OF AVERAGE 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 average monthly 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.

2.2 EXISTING HYDROLOGY

The Murragamba Creek catchment is the larger of the two catchments within the Stage 2 Project Boundary and drains an area of about 2390 ha. Murragamba Creek rises in the Munghorn Gap Nature Reserve to the south of the area proposed for the OC4 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.

OC4 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 1015 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 through 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 Preferred Project, primarily the ROM pad extension, 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 MCC 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.

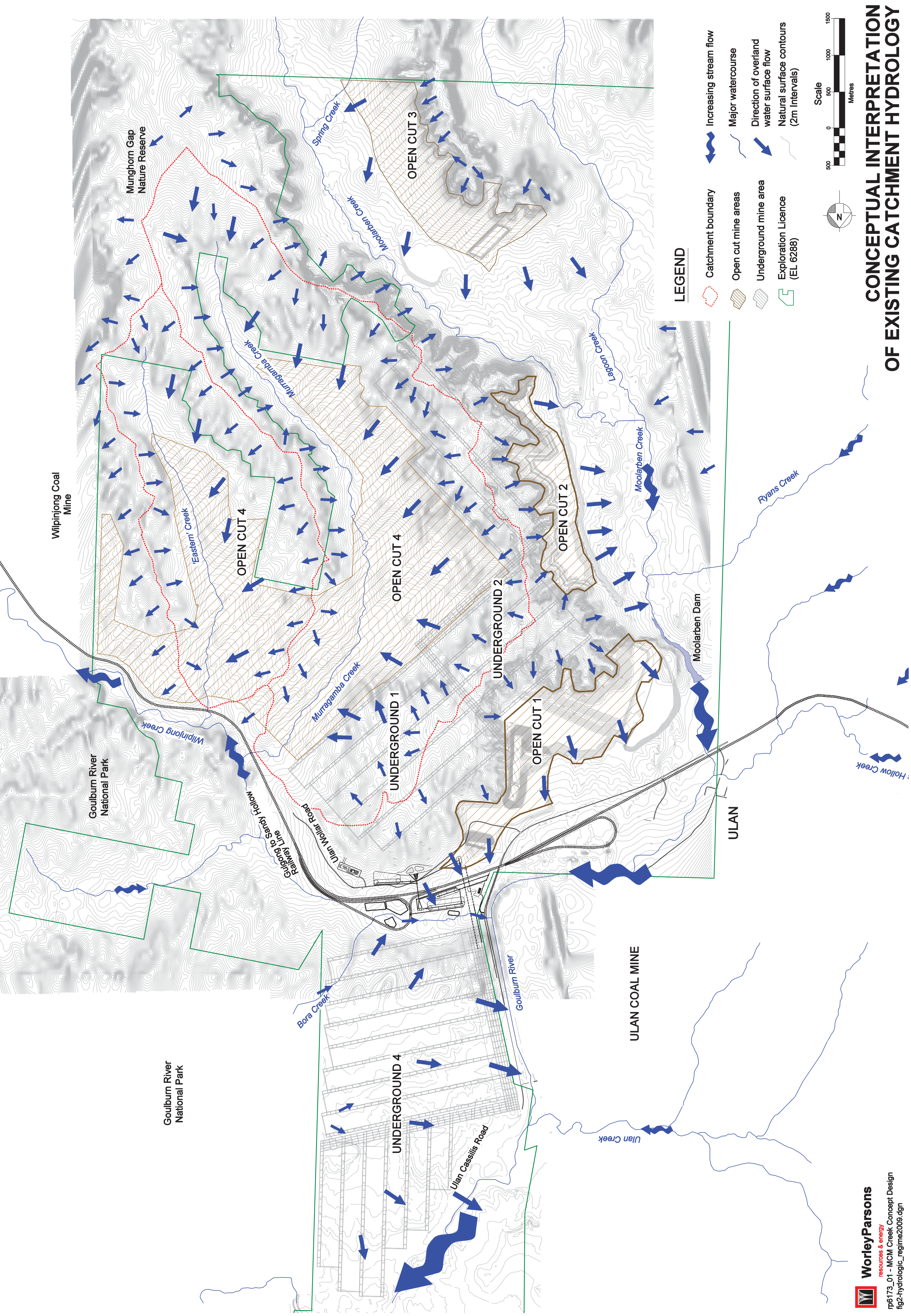
Based on the work undertaken for Stage 1 of the MCC, the volumes of individual spring and seep discharges within the catchment areas are relatively small. Many seeps are only visible as patches of dampness or lush grass. The flow rate of the largest spring flow observed in the study area is estimated at less than 1 L/s (*Aquaterra, 2008*).

Groundwater modelling undertaken by Aquaterra for the PPR has indicated that baseflows from the Murragamba and 'Eastern' Creek 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 OC4. The Murragamba and 'Eastern' Creek valleys are relatively narrow, consisting of open grassland with relatively little slope. Relatively steep elevated areas form 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 OC4 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 wooded slopes meet the lower cleared slopes within the Murragamba and 'Eastern' Creek 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



Munghorn Gap Nature Reserve
Wilpinjong Coal Mine
Goulburn River National Park
Goulburn River National Park
Spring Creek
Moolarben Creek
OPEN CUT 3
Murragamba Creek
'Eastern' Creek
OPEN CUT 4
OPEN CUT 4
UNDERGROUND 2
OPEN CUT 2
Lagoon Creek
Moolarben Creek
Ryans Creek
Moolarben Dam
Murragamba Creek
UNDERGROUND 1
OPEN CUT 1
Wilpinjong Creek
Gulgong to Sandy Hollow Railway Line
Ulan Wollar Road
ULAN
Hollow Creek
ULAN COAL MINE
Bora Creek
Goulburn River
UNDERGROUND 4
Ulan Cassilis Road
Ulan Creek
LEGEND
Catchment boundary
Open cut mine areas
Underground mine area
Exploration Licence (EL 6288)
Increasing stream flow
Major watercourse
Direction of overland water surface flow
Natural surface contours (2m Intervals)
Scale
500 0 500 1000 1500
Metres
N
CONCEPTUAL INTERPRETATION OF EXISTING CATCHMENT HYDROLOGY
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rp6173_01 - MCM Creek Concept Design
fig2-hydrologic_regime2009.dgn

3. PROPOSED CREEK DIVERSION

3.1 PRINCIPLES FOR CREEK DIVERSION DESIGN

As shown in **Figure 3**, the proposed OC4 mine will be situated over the existing alignment of Murragamba and 'Eastern' Creeks. Accordingly, works will be required to divert the flow that would otherwise travel along these creeks.

To maximise extraction of the coal resource within OC4 it will be necessary to realign the channel and construct a new creek alignment for both Murragamba and 'Eastern' Creeks. In undertaking the realignment, the principles outlined in the creek relocation vision statement:

> "*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*"

will be achieved by implementing the following:

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

(ii) preserving the existing morphologically, archaeologically and ecologically significant section of Murragamba Creek by preventing mining operations from occurring in these areas; and by,

(iii) developing riparian and in-stream habitat along the creek channel.

The criteria employed to achieve these objectives and the details of the proposed design are discussed in **Chapters 4** and **5** respectively.

3.2 DESCRIPTION OF PROPOSED CREEK DIVERSIONS

A description of the creek diversion proposal for Murragamba and 'Eastern' Creeks is provided in the following.

3.2.1 Murragamba Creek

The total length of the section of Murragamba Creek that is to be realigned upstream of Ulan-Wollar Road is approximately 5 kilometres. In comparison, the existing natural stream length over the same extent is about 4.1kilometres.

Downstream of the Ulan-Wollar Road, the creek will continue in its present condition for approximately 0.2 kilometres, down to its confluence with Wilpinjong Creek. An approximate length of the proposed realignment has been given as it may vary depending on site conditions encountered during the detail design for the creek diversion and rehabilitation.

The total length of the post-mining alignment of Murragamba Creek will consist of the following (*refer* **Figure 3**):

- a length of 5 kilometres of realigned creek channel which is to be constructed within the area of OC4 mining operations;
- the retained section of Murragamba Creek, which includes the section identified as morphologically stable (*approximately 1.1 kilometres*) and the section of creek upstream (*approximately 3 kilometres*); and
- the stretch of creek downstream of the OC4 mining area, upstream of Ulan-Wollar Road, which will be retained and rehabilitated (*approximately 0.7 kilometres*).

The proposed realignment of Murragamba Creek has been based on maximising the opportunity to incorporate channel meanders, while at the same time recognising critical constraints such as the existing morphologically sound section of creek, the extent and sequence of mining for OC4, and the topography across the surrounding areas.

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 **Figure 3**, the diversion commences downstream of 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.

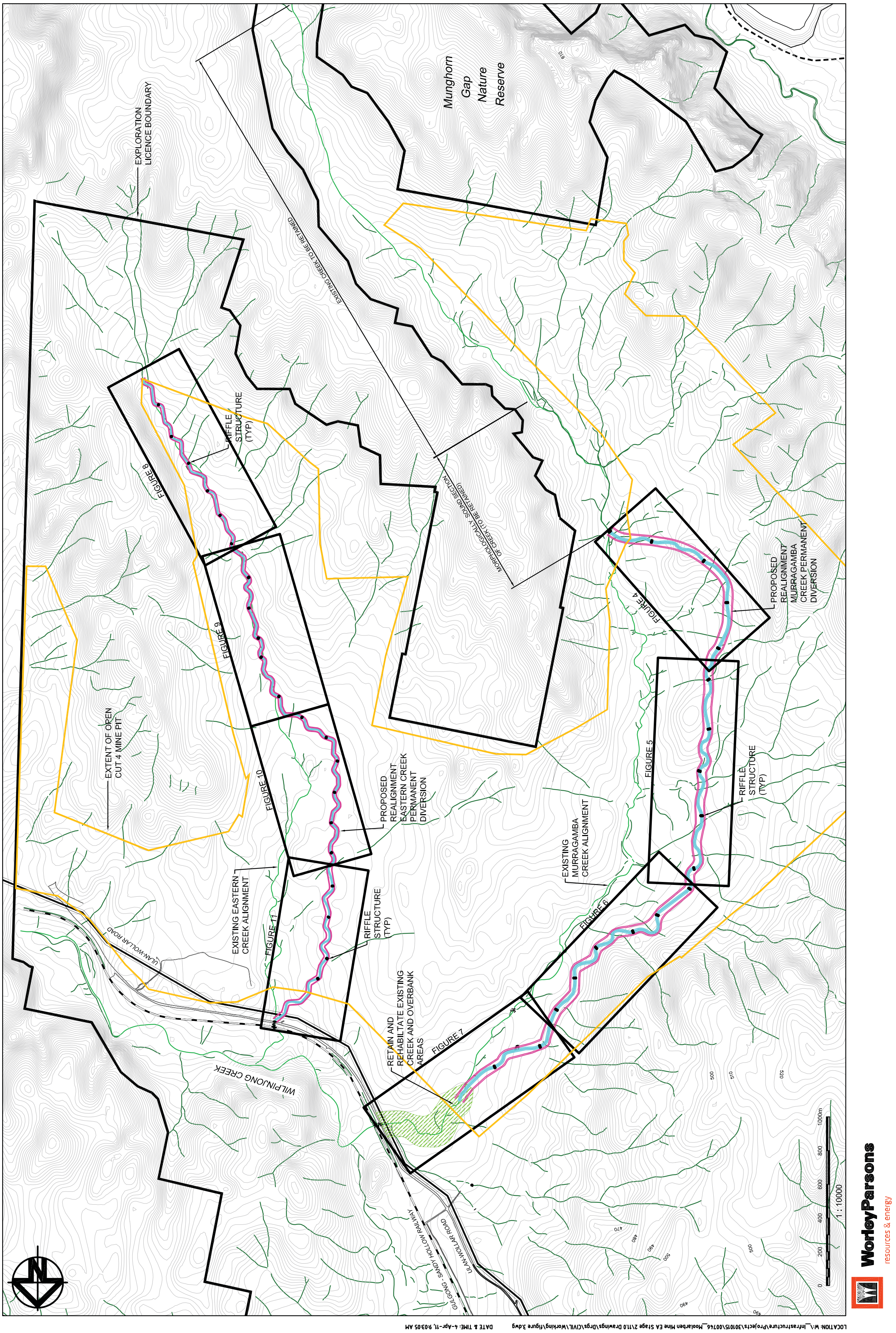
The creek realignment begins from this point in a westerly, then northerly, then north easterly direction until it reaches the northern boundary of OC4. Upon leaving the open cut mine area the creek alignment follows parallel to the existing creek in a north-easterly direction toward the Ulan-Wollar Road. 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.

3.2.2 Eastern Creek

The length of the ‘Eastern’ Creek realignment is approximately 4.9 kilometres, and covers the entire length of the creek upstream from Ulan-Wollar Road. This compares with the natural stream length of 4.2 kilometres.

‘Eastern’ Creek connects to Wilpinjong Creek approximately 0.3 kilometres downstream of Ulan-Wollar Road. The final adopted creek length may vary depending on constraints identified in the detail design stage of the creek reconstruction and rehabilitation. The entire length of the creek diversion is to be constructed within the extent of Open Cut 4.

FIGURE 3



MOOLARBEN COAL PROJECT - STAGE 2
CREEK DIVERSION GENERAL ARRANGEMENT

rp6173_01-MCM Creek Concept Design PPR
Fig 3 - Creek Diversion GA

As with the Murragamba Creek realignment, the 'Eastern' Creek diversion is also based on maximising the opportunity to incorporate meanders, while at the same time accounting for the extent of mining operations for OC4 and the topography of the surrounding area.

Figure 3 shows that the proposed realignment of 'Eastern' Creek will follow a northerly path through the 'Eastern' Creek valley.

4. CREEK DIVERSION DESIGN CRITERIA

The proposed creek diversion design has been developed based on a number of identified criteria. The criteria relate to specific river and hydraulic post alignment conditions. The following sections contain a summary of the criteria which have been targeted in the development of the design.

4.1 EXISTING CREEK CONDITIONS

The existing creek conditions were documented previously as part of the *'Surface Water Management Strategy'* (2008). This information has been extracted and is included for reference in **Appendix A**. This includes hydrologic and hydraulic modelling completed to document the existing creek conditions. Where possible, the existing creek conditions have provided a starting point for developing the design for the creek realignment. However, the aim for the works is to also improve on the conditions encountered within the existing creek.

4.2 HYDRAULIC CRITERIA

A number of critical hydraulic parameters have guided the decision making for the design. These parameters include:

(i) The Froude number for the creek diversion channel and the associated in-channel velocity;

(ii) The required channel conveyance; and

(iii) The magnitude of the design flood event which will form the basis for the design of the rock riffle structures.

In regard to (i), it is preferable that the channel slope be defined as hydraulically "gentle" for the sections of the realigned creek channel. That is, a creek design has been developed to achieve, where possible, a Froude Number of less than 1. This will also limit the main channel velocity that can be expected along the creek.

In regard to (ii), the concept design for the diversion channel shape (*i.e. channel cross-section*) 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.
- Designing the main channel section to be capable of containing flows during events up to and including the 1 year recurrence flood.

In regard to (iii), a flood with a recurrence event of 1:20 years will be targeted for the design of the riffle structures.

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Concept Design For Proposed Diversions Of Murragamba & Eastern Creeks

4.3 RIVER REHABILITATION CRITERIA

The concept design has been configured to ensure that the typical characteristics of a natural creek are reinstated. In particular, numerous meanders have been incorporated between the headwaters of each creek and Ulan Wollar Road.

These meanders have radii of curvature of approximately 50 metres. The radii of curvature and length of the meanders have been designed using the "empirical" design guidelines outlined in the Cooperative Research Centre for Catchment Hydrology's (*CRCH*) document titled, *'A Rehabilitation Manual for Australian Streams'* (*Volume 2*).

In addition, the design of the channel has also been modified to replicate the meander characteristics of the existing channel.

5. DESIGN AND CONSTRUCTION METHOD

5.1 CREEK DIVERSION CONCEPT DESIGN

The concept design for the proposed creeks diversion works was developed considering the potential implications of flooding across the post-mining landform. Erosion and sediment control and wildlife habitat requirements have also been considered. The design also recognises the importance of geomorphic features, stream ecology and the riparian corridor.

5.1.1 Post-mining Creek Alignments

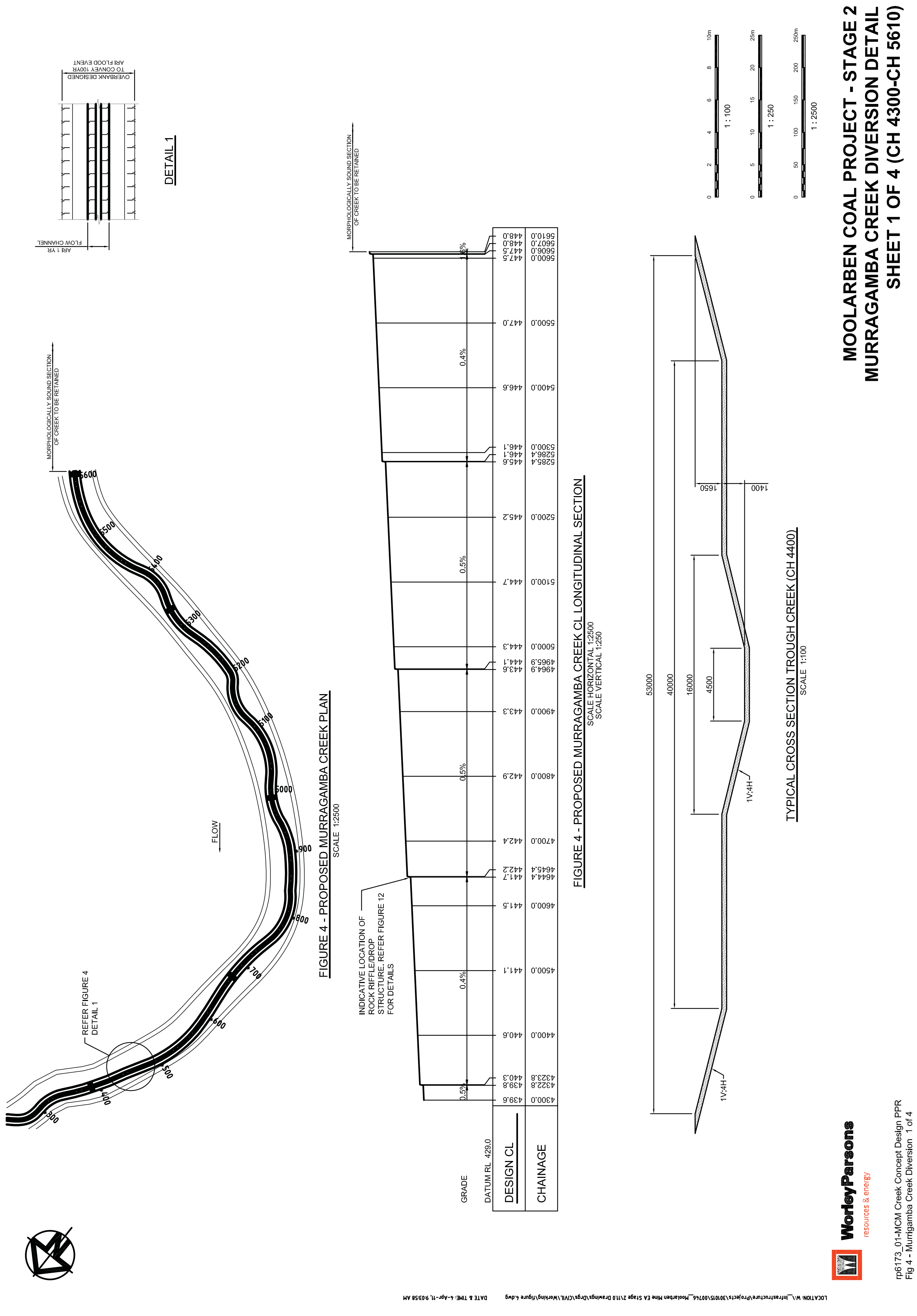
A summary of the figures that have been prepared to document the concept design for the proposed creek diversion is provided in **Table 3**.

Table 3 LIST OF FIGURES FOR CREEK DIVERSION CONCEPT DESIGN

FIGURE NO.	FIGURE CONTENT
3	Murragamba & 'Eastern' Creek Post Mining Diversion – General Arrangement
4	Murragamba Creek Post Mining Diversion Layout – Channel Section 1 of 4
5	Murragamba Creek Post Mining Diversion Layout – Channel Section 2 of 4
6	Murragamba Creek Post Mining Diversion Layout – Channel Section 3 of 4
7	Murragamba Creek Post Mining Diversion Layout – Channel Section 4 of 4
8	'Eastern' Creek Post Mining Diversion Layout – Channel Section 1 of 4
9	'Eastern' Creek Post Mining Diversion Layout – Channel Section 2 of 4
10	'Eastern' Creek Post Mining Diversion Layout – Channel Section 3 of 4
11	'Eastern' Creek Post Mining Diversion Layout – Channel Section 4 of 4
12	Murragamba & 'Eastern' Creek Post Mining Diversion – Typical Details

Figure 3 outlines the general arrangement of the Murragamba and 'Eastern' Creek realignment. More in-depth detail of the proposed creek realignment along each of the creeks is provided in **Figures 4 to 11**. Each figure includes a plan section along the river reach, the longitudinal profile along the channel diversion and a typical channel cross section.

FIGURE 4



CHAINAGE	DESIGN CL
4300.0	439.6
4322.8	439.8
4323.8	440.3
4400.0	440.6
4500.0	441.1
4600.0	441.5
4644.4	441.7
4645.4	442.2
4700.0	442.4
4800.0	442.9
4900.0	443.3
4964.9	443.6
4965.9	444.1
5000.0	444.3
5100.0	444.7
5200.0	445.2
5285.4	445.6
5286.4	446.1
5300.0	446.1
5400.0	446.6
5500.0	447.0
5600.0	447.5
5606.0	447.5
5607.0	448.0
5610.0	448.0

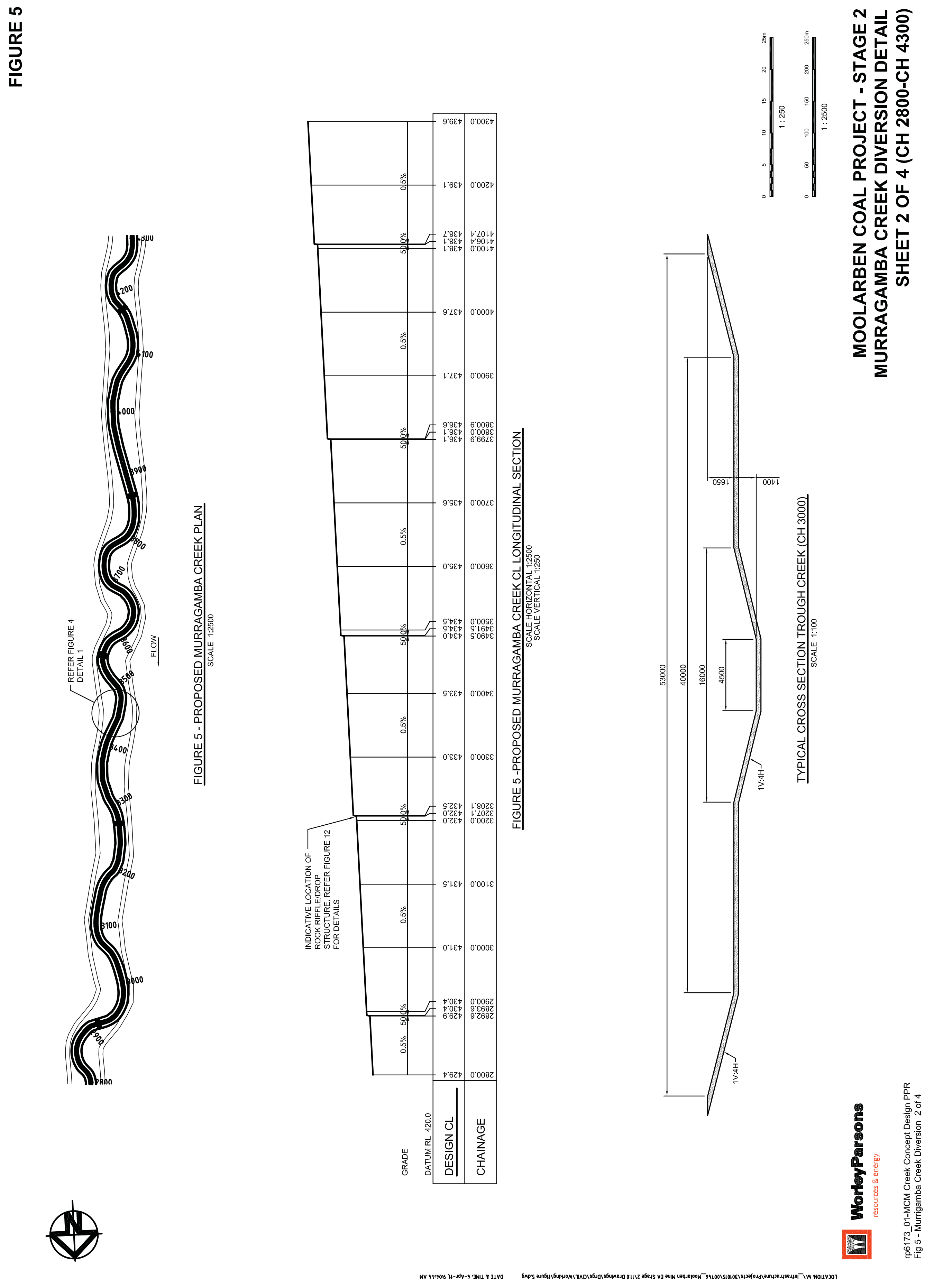


FIGURE 5
MOOLARBEN COAL PROJECT - STAGE 2
MURRAGAMBA CREEK DIVERSION DETAIL
SHEET 2 OF 4 (CH 2800-CH 4300)
FIGURE 5 - PROPOSED MURRAGAMBA CREEK PLAN
SCALE 1:2500
REFER FIGURE 4 DETAIL 1
FLOW
FIGURE 5 -PROPOSED MURRAGAMBA CREEK CL LONGITUDINAL SECTION
SCALE HORIZONTAL 1:2500
SCALE VERTICAL 1:250
INDICATIVE LOCATON OF ROCK RIFFLE/DROP STRUCTURE. REFER FIGURE 12 FOR DETAILS
GRADE
DATUM RL 420.0
DESIGN CL
CHAINAGE
TYPICAL CROSS SECTION TROUGH CREEK (CH 3000)
SCALE 1:100
1V:4H
53000
40000
16000
4500
1650
1400
1 : 250
1 : 2500
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Fig 5 - Murrigamba Creek Diversion 2 of 4

FIGURE 6

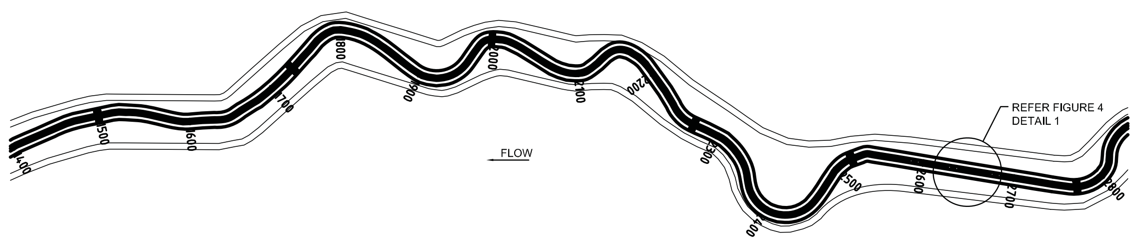


FIGURE 6 - PROPOSED MURRAGAMBA CREEK PLAN
SCALE 1:2500

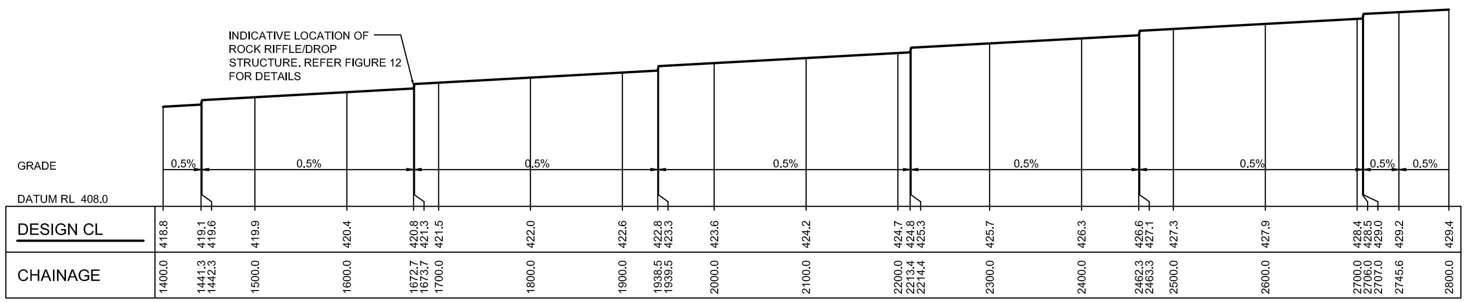
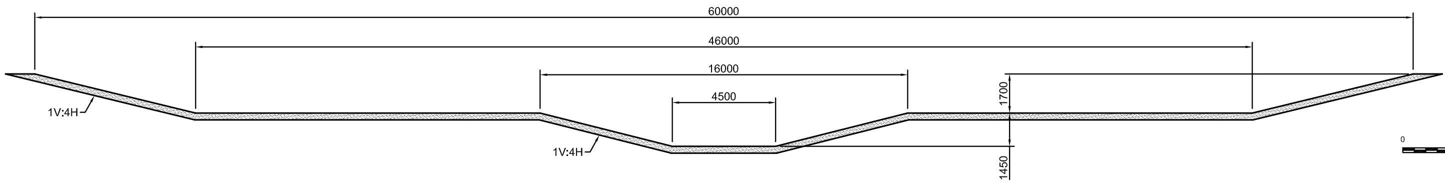


FIGURE 6 - PROPOSED MURRAGAMBA CREEK CL LONGITUDINAL SECTION
SCALE HORIZONTAL 1:2500
SCALE VERTICAL 1:250



TYPICAL CROSS SECTION TROUGH CREEK (CH 2000)
SCALE 1:100

0 2 4 6 8 10m
1 : 100

0 5 10 15 20 25m
1 : 250

0 50 100 150 200 250m
1 : 2500

LOCATION: W:_Infrastructure\Projects\301015\00746_Moolarben Mine EA Stage 2\11.0 Drawings\Drgs\CIVIL\Working\figure 6.dwg DATE & TIME: 4-Apr-11, 9:05:07 AM

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Fig 6 - Murrigamba Creek Diversion 3 of 4

MOOLARBEN COAL PROJECT - STAGE 2
MURRAGAMBA CREEK DIVERSION DETAIL
SHEET 3 OF 4 (CH 1400-CH 2800)

FIGURE 7

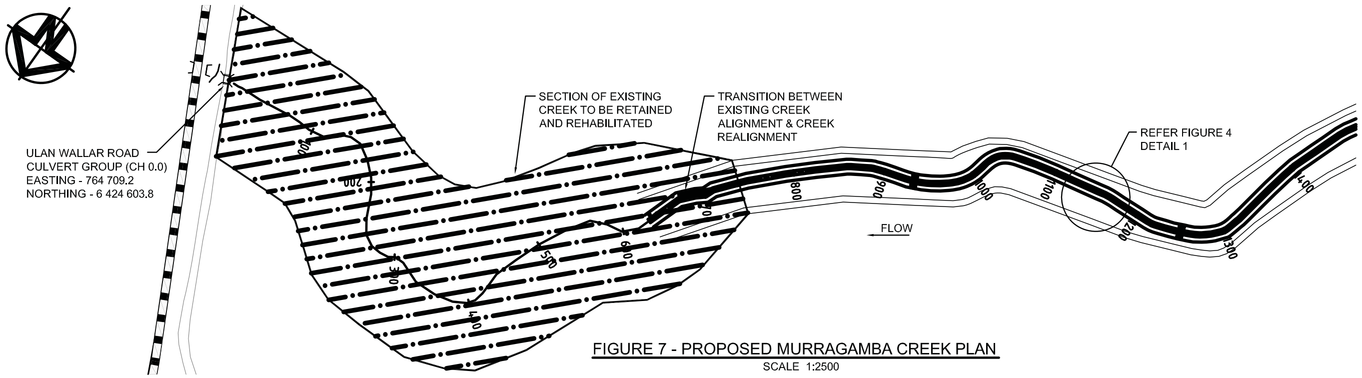


FIGURE 7 - PROPOSED MURRAGAMBA CREEK PLAN
SCALE 1:2500

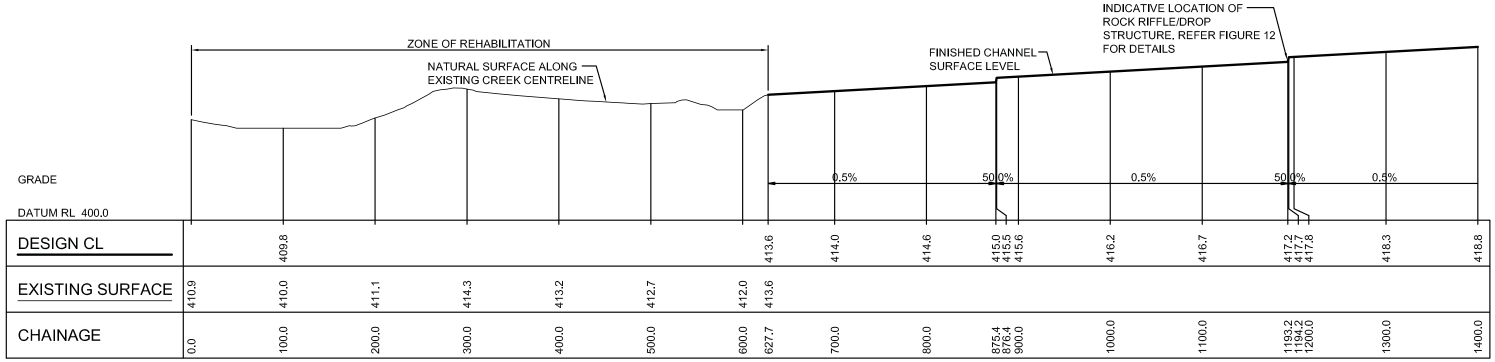
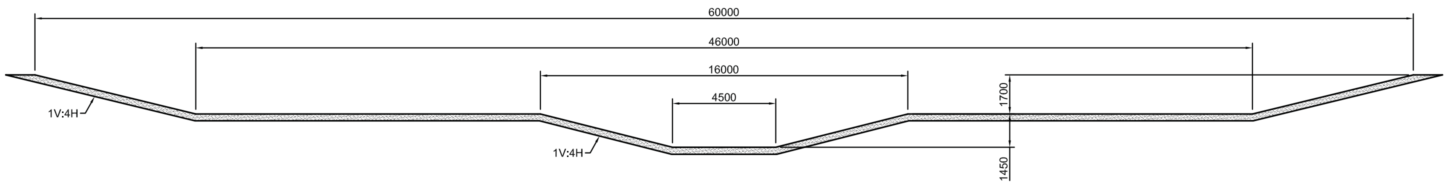


FIGURE 7 - PROPOSED MURRAGAMBA CREEK CL LONGITUDINAL SECTION
SCALE HORIZONTAL 1:2500
SCALE VERTICAL 1:250



TYPICAL CROSS SECTION TROUGH CREEK (CH 900)
SCALE 1:100

0 2 4 6 8 10m
1 : 100

0 5 10 15 20 25m
1 : 250

0 50 100 150 200 250m
1 : 2500

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Fig 7 - Murrigamba Creek Diversion 4 of 4

MOOLARBEN COAL PROJECT - STAGE 2
MURRAGAMBA CREEK DIVERSION DETAIL
SHEET 4 OF 4 (CH 0-CH 1400)

LOCATION: W:_Infrastructure\Projects\301015\00746_Moolarben Mine EA Stage 2\110 Drawings\Drgs\CIVIL\Working\figure 7.dwg DATE & TIME: 4-Apr-11, 9:05:45 AM

FIGURE 8

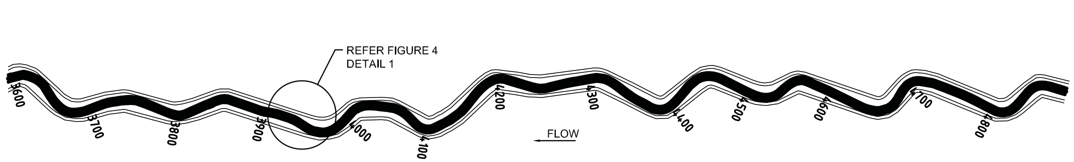


FIGURE 8 - PROPOSED EASTERN CREEK PLAN
SCALE 1:2500

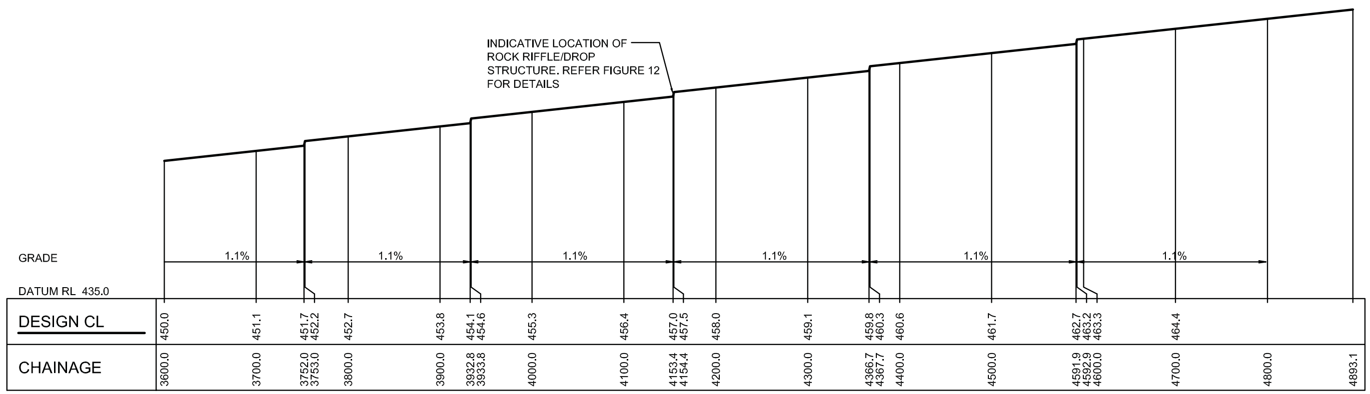
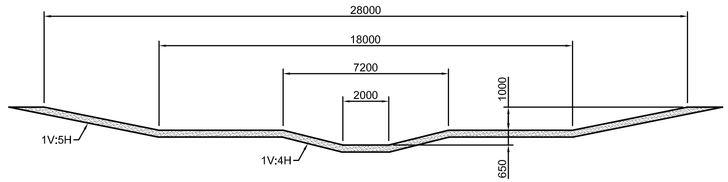


FIGURE 8 - PROPOSED EASTERN CREEK CL LONGITUDINAL SECTION
SCALE HORIZONTAL 1:2500
SCALE VERTICAL 1:250



TYPICAL CROSS SECTION TROUGH CREEK (CH 4800)
SCALE 1:100

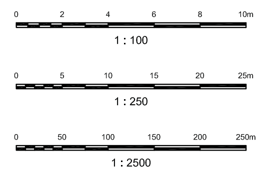


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Fig 8 - Eastern Creek Diversion 1 of 4

MOOLARBEN COAL PROJECT - STAGE 2
EASTERN CREEK DIVERSION DETAIL
SHEET 1 OF 4 (CH 3600-CH 4893)

LOCATION: W:_Infrastructure\Projects\301015\00746_Moolarben Mine EA Stage 2\11.0 Drawings\Drgs\CIVIL\Working\figure 8.dwg
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FIGURE 9

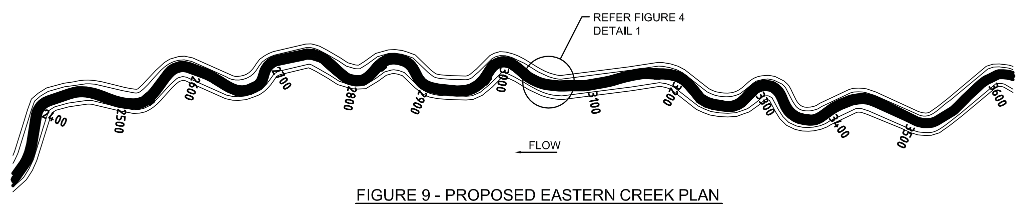


FIGURE 9 - PROPOSED EASTERN CREEK PLAN
SCALE 1:2500

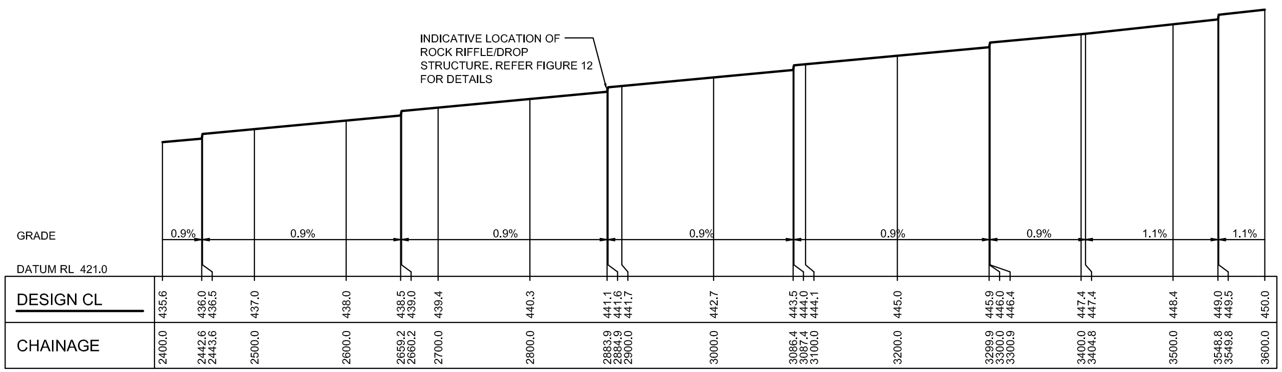
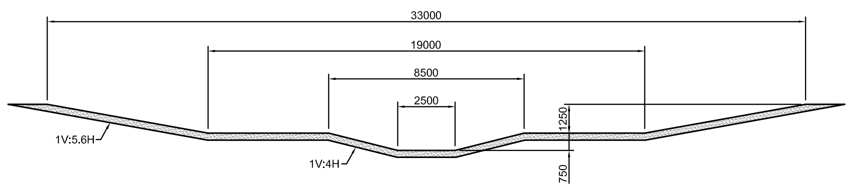


FIGURE 9 - PROPOSED EASTERN CREEK CL LONGITUDINAL SECTION
SCALE HORIZONTAL 1:2500
SCALE VERTICAL 1:250



TYPICAL CROSS SECTION TROUGH CREEK (CH 2700)
SCALE 1:100

0 2 4 6 8 10m
1 : 100

0 5 10 15 20 25m
1 : 250

0 50 100 150 200 250m
1 : 2500

MOOLARBEN COAL PROJECT - STAGE 2
EASTERN CREEK DIVERSION DETAIL
SHEET 2 OF 4 (CH 2400-CH 3600)

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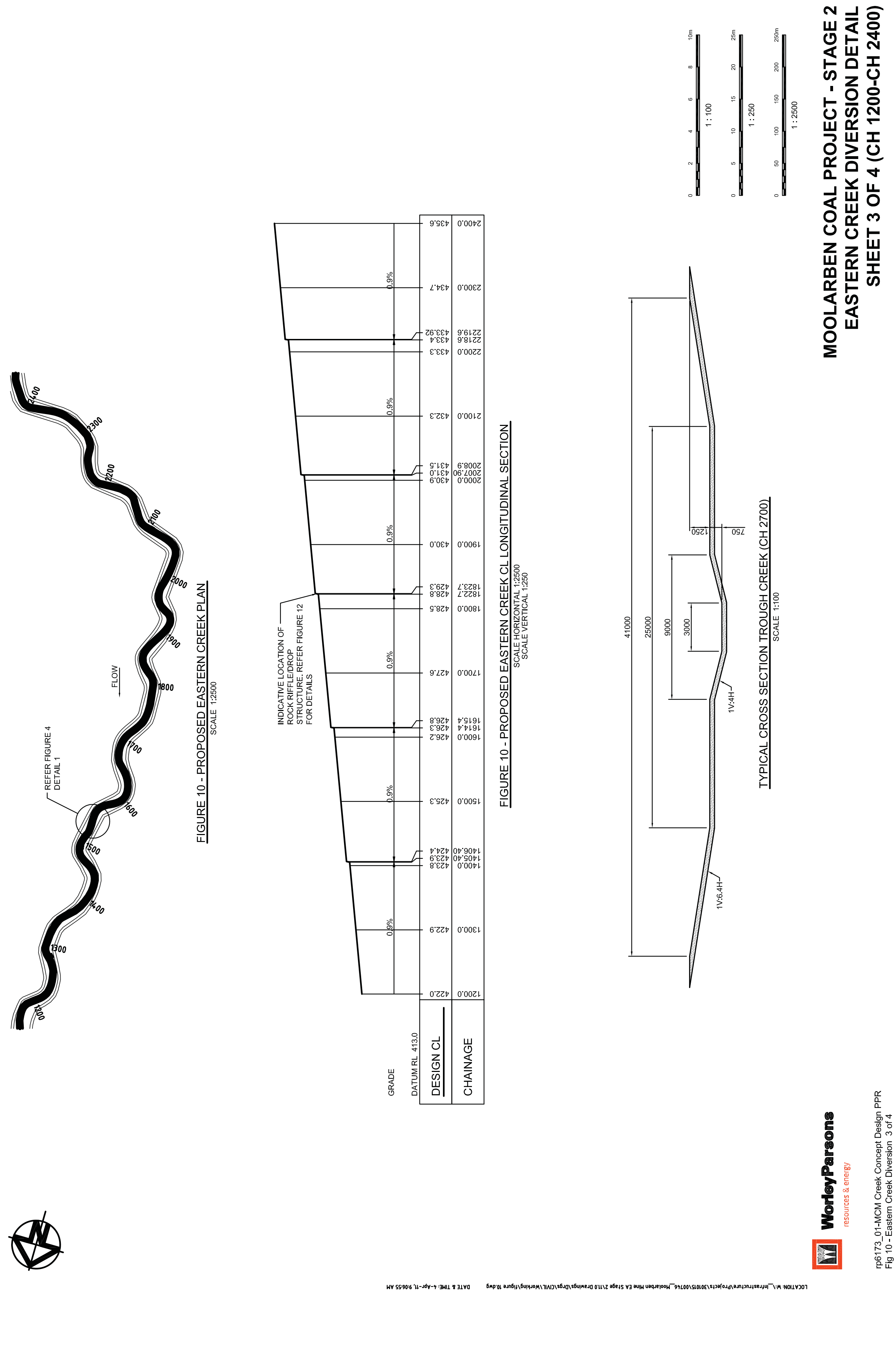
Fig 9 - Eastern Creek Diversion 2 of 4

LOCATION: W:_Infrastructure\Projects\301015\00746_Moolarben Mine EA Stage 2\11.0 Drawings\Drgs\CIVIL\Working\figure 9.dwg DATE & TIME: 4-Apr-11, 9:06:35 AM

FIGURE 10



DESIGN CL	CHAINAGE
422.0	1200.0
422.9	1300.0
423.8	1400.0
423.9	1405.40
424.4	1406.40
425.3	1500.0
426.2	1600.0
426.3	1614.4
426.8	1615.4
427.6	1700.0
428.5	1800.0
428.8	1822.7
429.3	1823.7
430.0	1900.0
430.9	2000.0
431.0	2007.90
431.5	2008.9
432.3	2100.0
433.3	2200.0
433.4	2218.6
433.92	2219.6
434.7	2300.0
435.6	2400.0

FIGURE 11

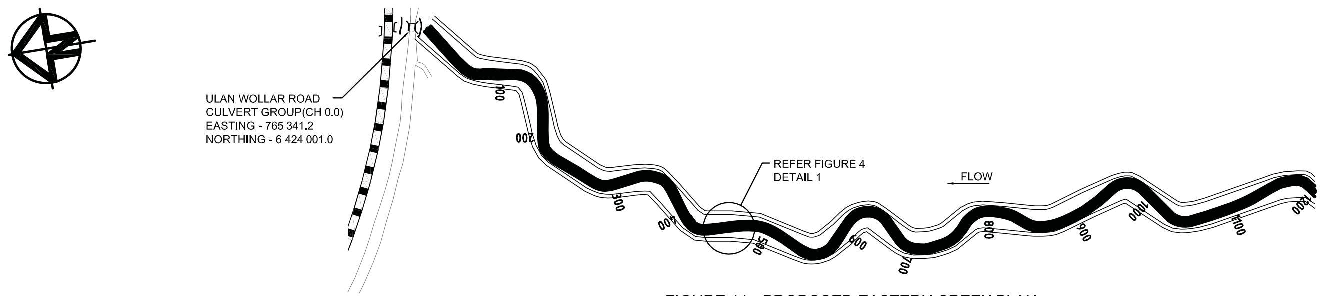


FIGURE 11 - PROPOSED EASTERN CREEK PLAN
SCALE 1:2500

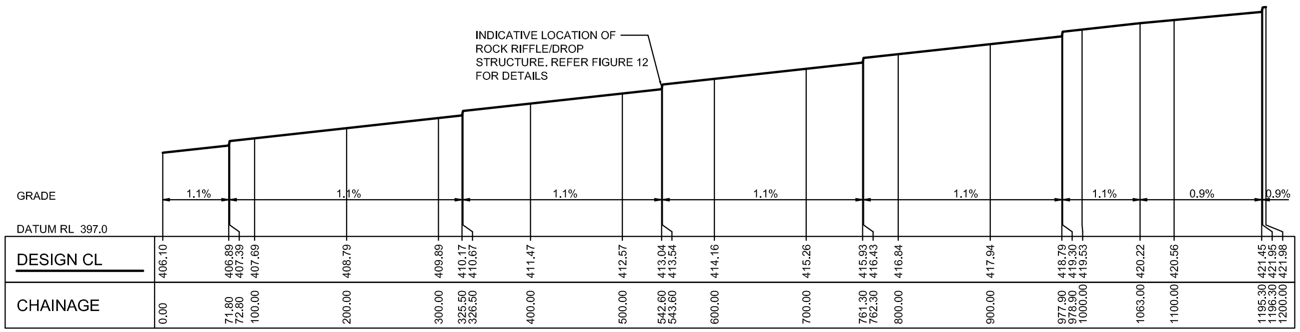
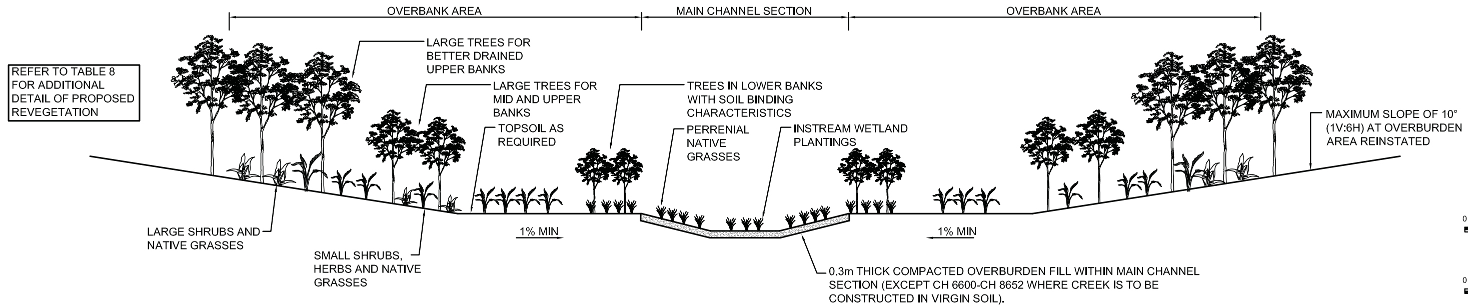


FIGURE 11 - PROPOSED EASTERN CREEK CL LONGITUDINAL SECTION
SCALE HORIZONTAL 1:2500
SCALE VERTICAL 1:250



TYPICAL CHANNEL DETAIL (ALL CROSS SECTIONS)
SCALE 1:100

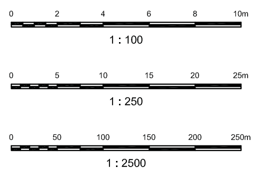


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Fig 11 - Eastern Creek Diversion 4 of 4

MOOLARBEN COAL PROJECT - STAGE 2
EASTERN CREEK DIVERSION DETAIL
SHEET 4 OF 4 (CH 0-CH 1200)

Chainages to indicate the length of the respective creek realignments and provide a reference point have been developed and are documented in **Figures 4** to **11.** The zero chainage point has been defined as the location where the respective creek lines intersect the upstream side of the culvert structure beneath Ulan-Wollar Road. From this point, chainages increase in an upstream direction. The grid reference point for the zero chainage is documented on **Figure 7** for Murragamba Creek and **Figure 11** for 'Eastern' Creek.

The morphologically stable section of Murragamba Creek (*CH5600 to CH6700*) together with the creek alignment upstream of this section will not be mined. Accordingly, the post-mining landscape will be integrated with the existing creek lines. The existing Murragamba Creek section which is proposed to remain in place post-mining is identified in **Figure 3**.

The creek realignment downstream of the morphologically sound section of creek (*CH700 – CH5600)* will be constructed in the rehabilitated post-mining overburden areas. The overburden will form the bed material of the permanent realignment for this reach of Murragamba Creek. Details of the proposed realignment are provided in **Figures 4** to **7**.

The entire length of 'Eastern' Creek will be constructed using overburden material in the post-mining rehabilitated areas. Details of the 'Eastern' Creek realignment are provided in **Figures 8** to **11**.

5.1.2 Channel Cross Section Description

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).

To either side of the low flow channel, the design incorporates an in-channel terrace. The in-channel terrace ranges in width depending on the location within each of the creek alignments. From the terraces, the channel rises to the finished surface of the proposed post-mining floodplain. The terrace section has been sized to convey the 100 year recurrence flood.

Indicative channel sections at various locations along the realigned creeks are provided in **Figures 4** to **11**.

5.1.3 Longitudinal Slope

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.

This will ensure that the post-mining alignment has a reduced average bed slope compared to the existing creek.

The post-mining alignment of Murragamba Creek will increase the overall stream length by approximately 900 metres. This will result in an approximate overall decrease in the average bed slope from 0.0115m/m to 0.0104m/m.

The post-mining alignment of 'Eastern' Creek will increase the overall stream length by approximately 700 metres. The existing average bed slope for 'Eastern' Creek is 0.0144m/m, this compares to an approximate post-mining bed slope of 0.0123m/m.

As mentioned in **Section 3.2**, 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 depending 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. Details of the riffle structures, including indicative spacing between the structures is discussed following in **Section 5.2.1**.

Indicative slopes along each of the realigned creeks are provided on **Figures 4** to **11**. It is noted that the bed slope reported in the figures for the realigned creeks is typically less than the average bed slope discussed above for the majority of the realigned creeks. This is a result of the inclusion of the drop structures discussed above, which allow for more gradual channel grades between the structures.

5.2 ADDITIONAL CHANNEL DESIGN DETAILS

5.2.1 Pool and Riffle Sequences

A pool and riffle sequence will 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.

Artificial riffles, or drop-structures, will be constructed within the low flow channel at requisite intervals sufficient to reduce peak flow velocities over the length of each channel diversion. The conceptual locations for these structures are shown in **Figures 4** to **11**.

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 channel slope 1(V) in 20(H) is proposed for the rock riffle. This is the standard slope employed in the design of rock ramp/riffle structures throughout NSW to facilitate fish passage. A typical long-section of the proposed riffle design is presented in **Figure 12**.

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(V) in 20(H).

The toe of the riffle is defined by a row of large armour stone (*nominal diameter of 800 mm*) extending across the width of the channel. As part of the design, the armour stone is "keyed" into the side-slopes of the low flow channel to provide stability, and to resist bank erosion through the process of outflanking.

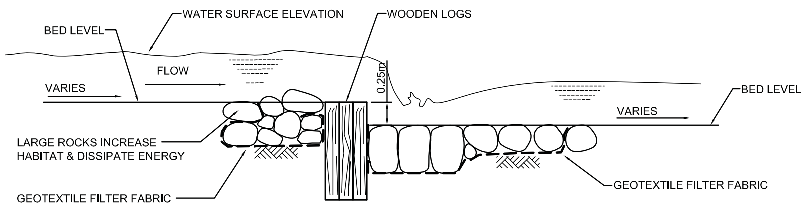
The purpose of the rock ramp riffle is to provide a mechanism for energy dissipation, thereby preventing the formation of head cuts and bed scour. Large sized rip-rap is to be placed at the ridge to provide roughness, increase the pool diversity and habitat, and to prevent excessive erosion.

The rip-rap will consist of angular rock of various sizes packed tightly to reduce the porosity of the structure. Large oversized rocks (*nom dia. = 600mm*) 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.

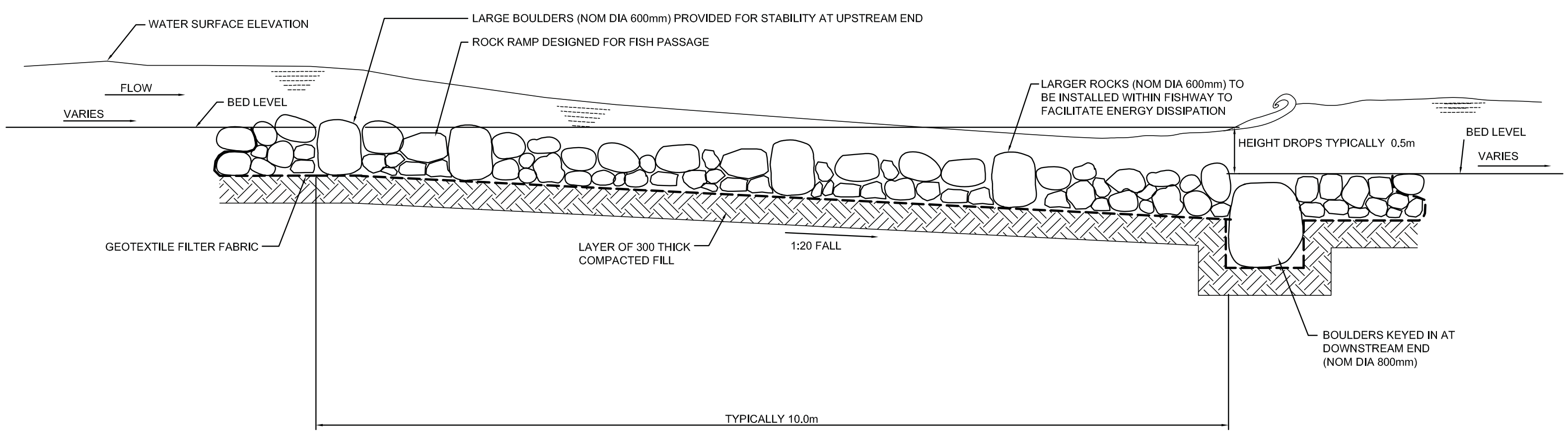
Wherever possible the use of large woody debris will be incorporated into the design of the pool and riffle structure. This will enable the development of a more natural design that will use materials that may be produced during the clearing of areas that are to be mined in OC4.

It is proposed that during the detail design phase of the creek design, the Department Primary Industries, which is part of the Department of Industry & Investment (*DII*) be liaised with to determine the limit of fish migration for Murragamba and 'Eastern' Creeks. Above this location, the riffle design may be modified to facilitate additional energy dissipation characteristics which are not feasible where the provision of fish passage is deemed necessary.

FIGURE 12



OPTION B: TYPICAL LONG SECTION OF A DROP STRUCTURE



OPTION A: TYPICAL LONG SECTION OF A ROCK RAMP

0 0.5 1 1.5 2 2.5m

1 : 25

LOCATION: W:_Infrastructure\Projects\301015\00746_Moolarben Mine EA Stage 2\11.0 Drawings\Drgs\CIVIL\Working\figure 12.dwg DATE & TIME: 4-Apr-11, 9:07:42 AM

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Fig 12 - Typical Rock Ramp & Drop Structure

MOOLARBEN COAL PROJECT - STAGE 2
TYPICAL ROCK RAMP AND DROP STRUCTURE

5.2.2 Vertical Drop Structures

An alternative to pool and riffle type structures is a vertical drop structure located within the river. **Figure 12** provides typical details of the drop structure. The drop height is limited to between 0.25 and 0.3m to ensure the feasibility of fish passage during flood events. Vertical drop structures may be used where the implementation of a riffle structure is not considered feasible.

5.2.3 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.

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 measures to protect against sub-aerial erosion of the top soil layer include the planting of stoloniferous and 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. 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.

A reduction in the longitudinal grade of the revised creeks, achieved by channel lengthening and the use of riffles will assist in reducing velocity and shear stress in the revised channel.

Mass gravity failure occurs where 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. 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 a number of techniques will 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 flow velocities 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. In this regard, it is proposed that a minimum of five years be targeted between the construction of a creek realignment and the instigation of regular flow to the channel.

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.

5.3 RIPARIAN CORRIDOR REHABILITATION

The overall vision for the post mining riparian corridor is one of "*maintain and improve*" the existing conditions of Murragamba and 'Eastern' Creeks. In order to meet this objective, an Ecological Impact Assessment (EIA) was prepared for Stage 2 Moolarben Coal Mine Environmental Assessment documentation to manage the impacts associated with open cut mining of the area. The EIA was prepared by *Ecovision*.

Ecovision has recommended a number of measures to ensure the post mining rehabilitation of the site achieves the stated objective. The measures include the specification of types and zones for revegetation, facilitating the development of ponded areas and replicating natural stream characteristics through the installation of wooded debris.

The following outlines details of the integration of each of these aspects with the creek design.

5.3.1 Provision of Permanent Water Sources

It will be necessary to incorporate into the creek design areas where water is retained in order to facilitate habitat development and food sources. To facilitate this, ponds will be installed at various locations along the creek.

The exact layout, including number and size of the pond areas will be determined during the detailed design stage and will require input from appropriately qualified ecologists.

A possible location for a ponded area is upstream of selected riffle structures, which have been described in **Section 5.2.1**. Details of the lining characteristics which are required to achieve water retention characteristics are discussed in **Section 5.4.1**.

Pond areas will also be incorporated into the post mining landform in a number of tributaries which flow the permanent creek diversion.

5.3.2 Habitat Generation

It is proposed that the channel be vegetated to create a similar habitat to that found in the well vegetated/forested areas of the existing Murragamba and 'Eastern' Creek channels. An example of an existing channel section which the revegetation plan will seek to replicate is pictured below in **Plate 1**.

Plate 1 Picture of Existing Creek Line Indicating Possible Revegetation for the Post Mining Creek Alignment

A conceptual section for the proposed revegetated creek channel is shown in **Figure 11**.

Planting on the realigned creek will increase the riparian species diversity above the current diversity, which has been depleted by former land use practices (*ie. cattle grazing*).

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 4**.

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Table 4 EXAMPLES OF VEGETATION SPECIES TO USED IN STREAM REHABILITATIONS WORKS

LOCATION	SPECIES
Lower Banks **(ie main channel zone)**	*Arundinella nepalensis* *Melaleuca thymifolia*
Mid Banks **(Floodplain overbank zone)**	*Melaleuca thymifolia (clayey soils)* *Leptospermum polygalifolium (sandy soils)* *Shorthair Plumegrass (Dichelachne micrantha)* *Lomandra confertifolia* *Kangaroo Grass (Themeda australis)* *Blakely's Redgum (Eucalyptus blakelyii)* *Rough-barked Apple (Angophora floribunda)*
Upper Banks **(Near Top of Bank- 100 year ARI channel)**	*Blakely's Redgum (Eucalyptus blakelyii) – clayey soils* *Yellow Box (Eucalyptus melliodora)* *Grey Box (Eucalyptus moluccana)* *Acacia spectablis/ polybotria (sandy soils)* *Acacia decora/ Daveisia genistifolia (clayey soils)* *Kangaroo Grass (Themeda australis)* *Rough-barked Apple (Angophora floribunda) – sandier soils*

A range of native grasses and trees are proposed for the in-channel bench and channel side-slopes (*refer* **Figure 11**). These will be supplemented with stoloniferous grasses where required. The potential for erosion along the in-channel terrace will be mitigated through the use of dense copse of deep-rooted tree species with soil binding characteristics. 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.

In addition, wooded debris is to be stockpiled throughout the life of the mine. The wooded debris will be installed within the reach of the creek to facilitate the development of appropriate habitat for aquatic species and to replicate natural stream conditions.

5.4 CONSTRUCTION METHODOLOGY

The proposed methodology to be employed in the construction of the permanent realignment of Murragamba and 'Eastern' Creeks is detailed in the following sections.

5.4.1 Proposed Construction Materials & Controls

Construction in Overburden Material

The majority of the permanent creek realignment is to be constructed in overburden material which will be placed during mining activities.

It will be necessary to compact the overburden material located along the main channel section of the diverted creeklines to prevent excessive loss of surface water into the overburden fill.

The exact level of compaction will be specified during the detailed design phase of the creek diversion project. The level of compaction will be sufficient to ensure the bed and banks of the main channel section present a significant barrier to the infiltration of water.

If necessary, remediation of the fill along the proposed main channel of the creek line may be undertaken to achieve the desired level of compaction. Alternatively, areas where the degree of compaction is not realised the compacted fill layer may be thickened locally to reduce infiltration.

The controlled compacted fill layer will be approximately 300mm thick (*refer* **Figure 11**) and will extend across the width of the main channel section. This may be compacted as a single layer. Alternatively, the fill may be compacted in two layers where this facilitates preferable compaction conditions. In addition, the moisture content of the soil may be modified to achieve optimum compaction for the particular soil characteristics encountered. The required thickness of the compacted fill layer will be confirmed during construction of the creek diversion.

The same compacted layer is proposed beneath the riffle structures.

The overburden fill will be shaped and excavated as required to form the overbank areas located to either side of the main channel (*refer* **Figure 11**). Some compaction of the overbank areas will occur during construction. However, these areas are only expected to convey creek flows on an irregular basis, during times of major flooding. Therefore, specified compaction control for the overbank areas is not warranted.

Construction of Permanent Water Sources

In locations where the permanent water sources are to be located (*refer* **Section 5.3**), it will be necessary to line the base of the channel with clay, which is to be stockpiled as part of mining operations. It is proposed that the clay liner be compacted to a level of high impermeability. The clay liner should be a minimum thickness of 300 millimetres.

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5.4.2 Targeted Material Retention

The majority of material excavated through the mining operations will be used as backfill material. However, certain materials have been identified as being of particular benefit to the rehabilitation of the permanent creek diversion. Therefore, these materials are to be retained from the mining operations for reuse as part of the rehabilitation works. Details of the soil types has been identified by Jammel (*2005*). The specific materials to be stockpiled and their intended use include:

- topsoil, which will assist in the revegetation of the creek bed;
- soil identified as having clay characteristics, which will be used to form permanent water sources. In addition, clay may be mixed with other material to achieve the required impermeability of the creek channel;
- stone for use in rock ramp riffles, drop structures and locations requiring erosion protection; and,
- wooded debris for placement within the stream to assist in replicating natural stream conditions.

If necessary, off-site sources will be utilised in the event of a shortfall of a key materials during the rehabilitation process.

5.4.3 Testing of Materials

It will be necessary to undertake sampling and analysis at periodic intervals of the overburden fill where the main channel of the creek alignment will be constructed. Collected samples will be analysed to determine whether the soil characteristics are sufficient to facilitate the degree of compaction which is required to achieve the permeability specified in **Section 5.4.1**.

Testing will be undertaken of the in situ compacted creek bed to confirm that the desired permeability has been achieved.

Standard testing of the compacted fill will be undertaken in accordance with the Australian Standard titled '*Guidelines on earthworks for commercial and residential developments' (AS 3798)*, and with reference to the procedures outlined in the Australian Standard titled '*Methods of testing soils for engineering purposes' (AS 1289)*.

Given the size and scope of the creek reconstruction works, it is proposed the "*Statistical Acceptance Criteria*" (*refer AS 3798*), which relates to control over variation in the degree of compaction be adopted.

The proposal to adopt the *Statistical Acceptance Criteria* reflects the fact there may be localised areas where the required compaction is unrealistic. However, it will ensure that an appropriate majority of the creek line meets or exceeds the functionality expected for the permanent creek diversion.

Detail of the performance criteria will be outlined during the detail design phase of the creek construction.

5.4.4 Protection During Construction & Rehabilitation

The staging of the creek diversion has been developed to allow the permanent creek diversion to be stabilised and rehabilitated over a minimum period of 5 years (*refer* **Section 6.1**). Additional time has been provided to particular stages as required by the staging of the creek diversion works.

The 5 year time frame will be achieved through the installation of a number of temporary dams upstream of the construction/rehabilitation of the permanent creek diversion. A pipe system, extending from the dam to downstream end of the length of creek being constructed or rehabilitated will discharge the necessary environmental flow.

There is provision for water to be released into the permanent creek diversion during the five year rehabilitation and consolidation period. This may be used where required for plant growth or to facilitate controlled testing of the rehabilitated creek diversion.

A time frame of 5 years is believed to allow sufficient time for the overburden fill beneath the creek line to consolidate and stabilise and for the bed, banks and flood terraces to be sufficiently revegetated.

The 5 year timeframe is intended to provide a general framework to rehabilitate the diverted creek line. Regular monitoring of the rehabilitation process will be undertaken and should the process be expedited, sections of the creek may become operational sooner than anticipated with necessary consultation.

5.5 HYDRAULIC ANALYSIS OF PROPOSED CREEK DIVERSIONS

5.5.1 Changes to HEC-RAS Flood Model

In order to assess the potential impact of the post-mining creek alignments (*refer* **Section 5.1.1**), the existing HEC-RAS model of Murragamba and 'Eastern' Creek (*refer* **Appendix A**) was modified to include the proposed changes. The modifications included:

- removal of all existing cross-sections located within the footprint of OC4, located downstream of the morphologically sound section of Murragamba Creek (*refer* **Figure 3**);
- 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.

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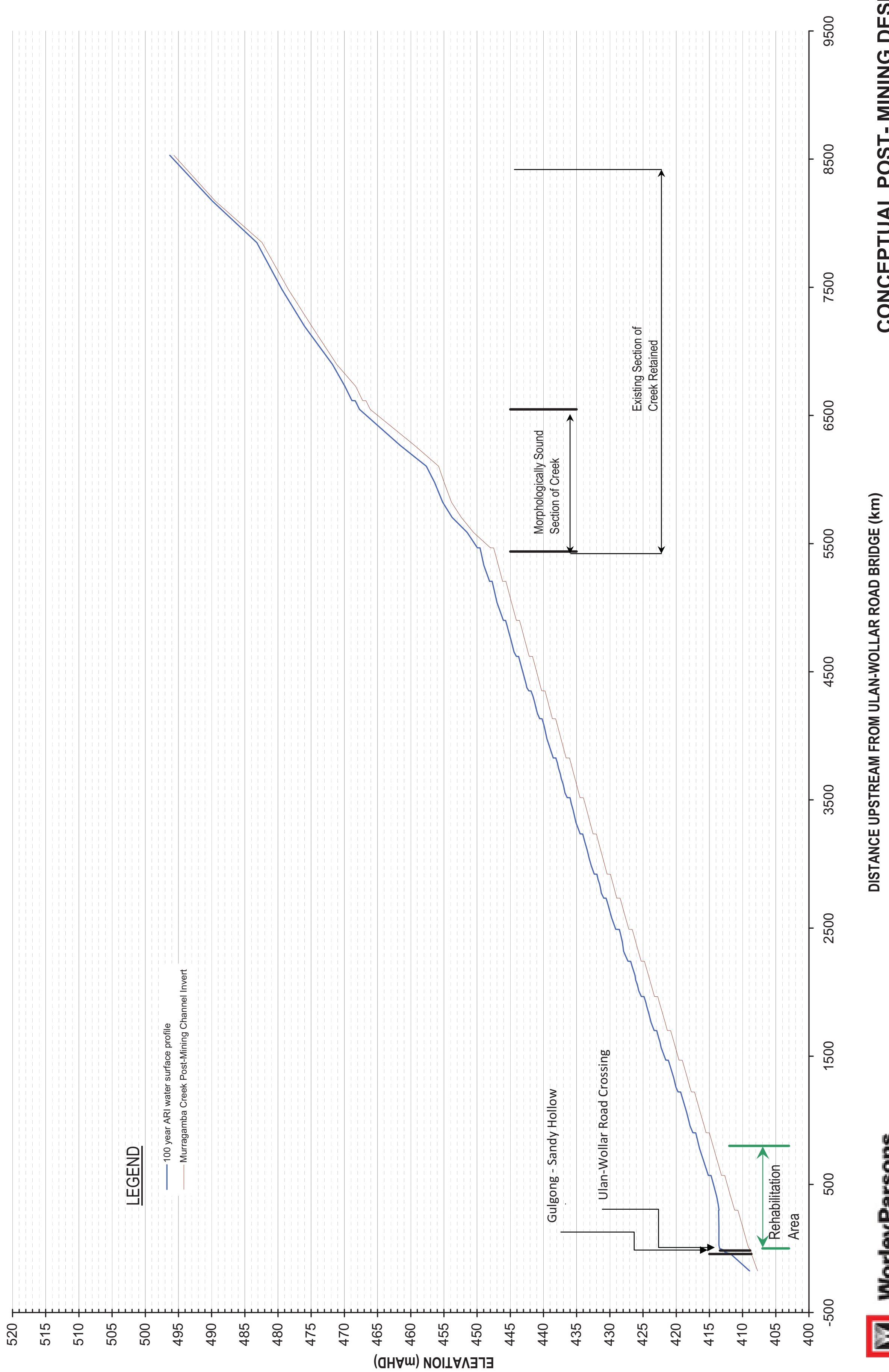
5.5.2 Results

Selected results from the analysis of the 100 year recurrence flood event have been extracted at approximately 200 metre intervals, the results are summarised in **Table 5** and **Table 5** and the predicted water surface profiles for each of the proposed creek alignments are presented in **Figures 13** and **14**. 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 15**. It shows that the peak 100 year recurrence flood is completely contained within the proposed post-mining creek corridors for Murragamba and 'Eastern' Creeks.

Table 5 and **Table 5** indicate 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 at 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 13



CONCEPTUAL POST- MINING DESIGN FLOODWATER SURFACE PROFILES FOR MURRAGAMBA CREEK

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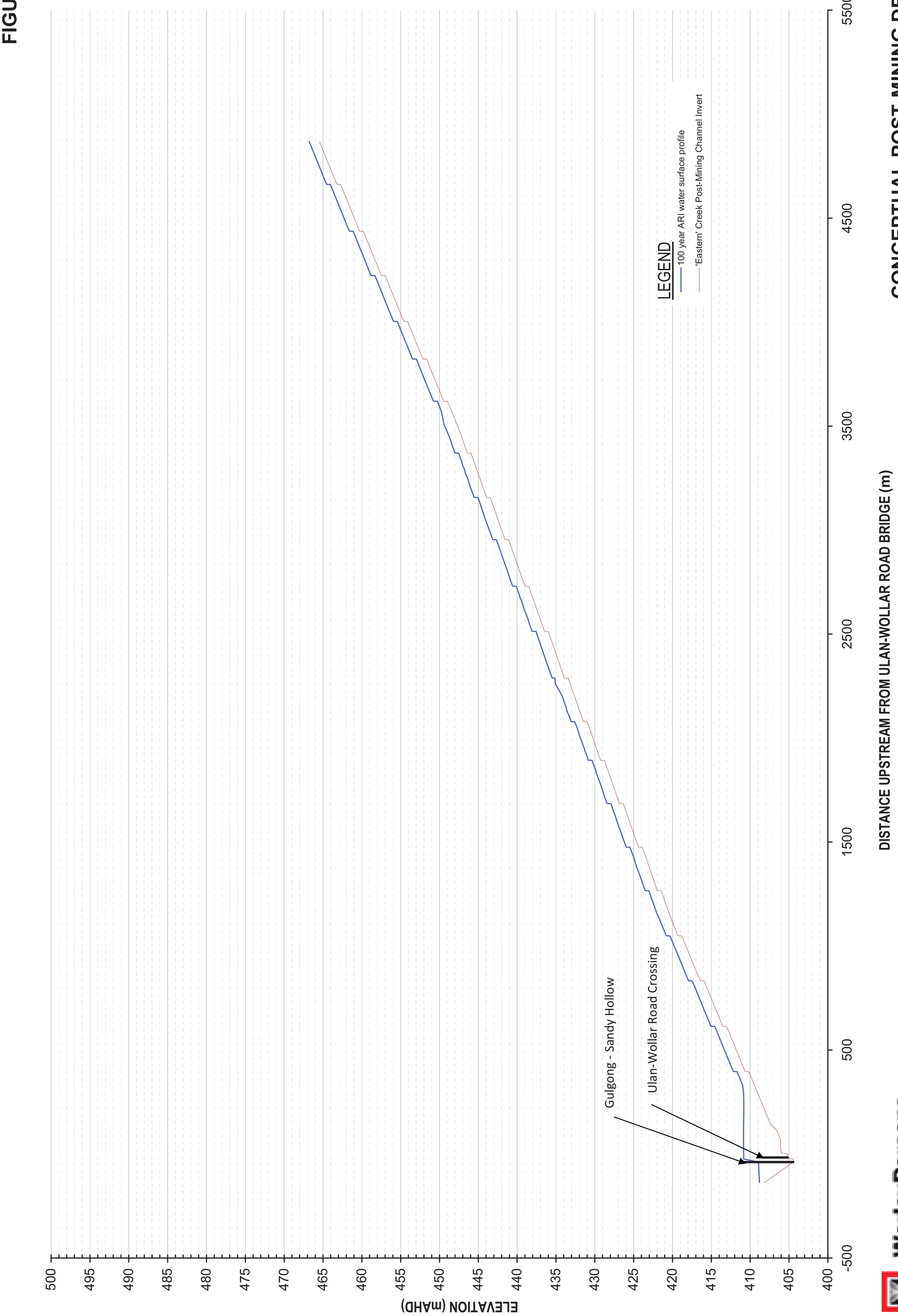
rp6173_01 - MCM Creek Concept Design
Fig 13 - Post WSP Murragamba

FIGURE 14



CONCEPTUAL POST-MINING DESIGN FLOODWATER SURFACE PROFILES FOR EASTERN CREEK

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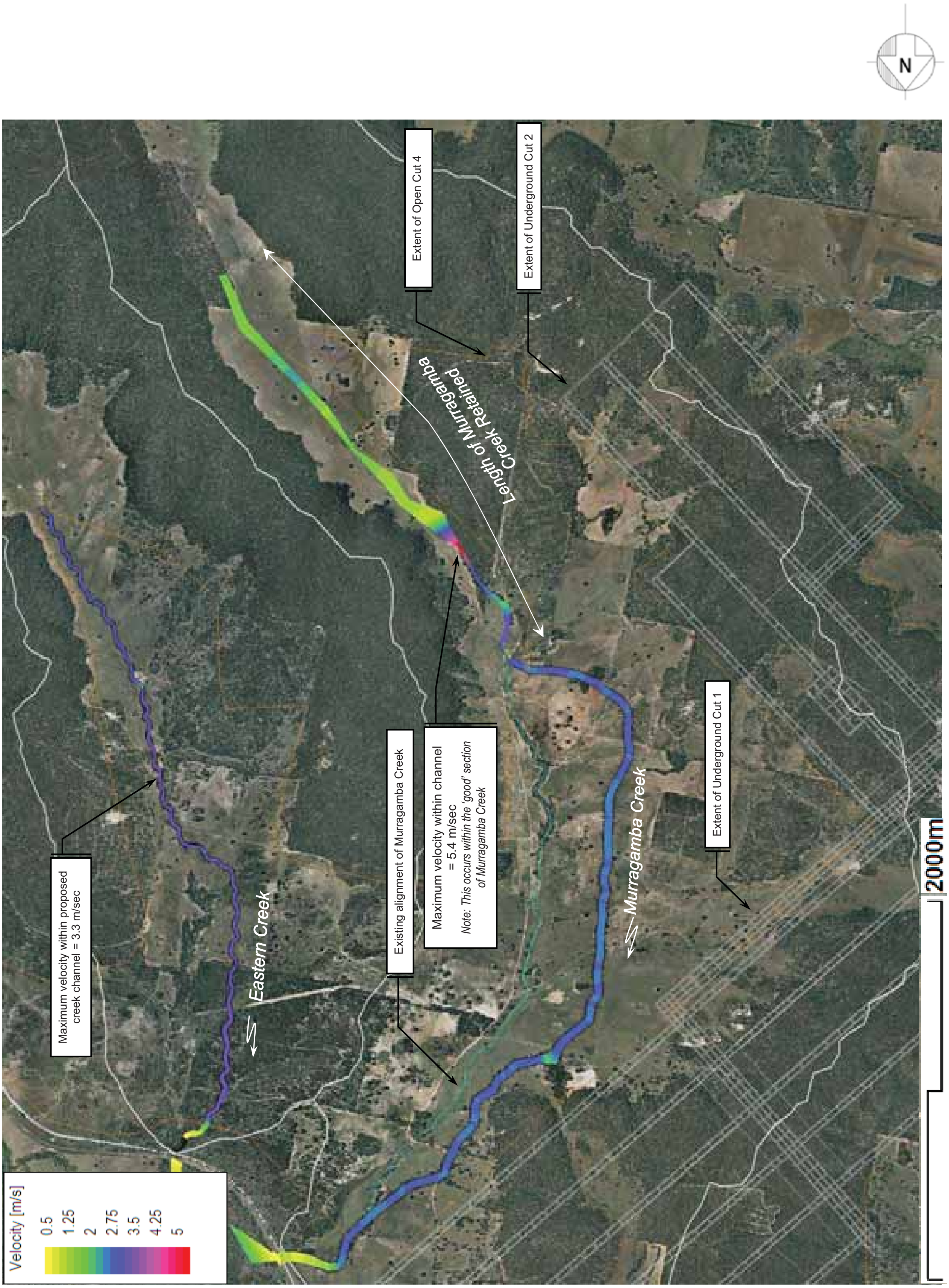
rp6173_01 - MCM Creek Concept Design
Fig 14 - Post WSP Eastern

FIGURE 15



100 YEAR RECURRENCE FLOOD EXTENTS FOR THE PROPOSED POST MINING CREEK ALIGNMENTS

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fig 18 – Proposed Flood Extent

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Concept Design For Proposed Diversions Of Murragamba & Eastern Creeks

Table 5 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
MORPHOLOGICALLY STABLE SECTION OF CREEK AND UPSTREAM RETAINED (*refer* Appendix A)					
85	5179.0	448.11	1.13	3.17	1.09
80	4723.2	444.9	1.05	2.76	1.05
75	4414.2	442.81	1.03	2.78	1.06
70	4229.5	441.3	0.99	2.8	1.06
65	4021.7	439.77	0.96	2.69	1.04
60	3674.6	437.45	1.06	2.81	0.84
55	3491.5	436.42	1.11	3.09	0.87
50	3139.5	433.73	0.99	2.7	1.04
45	2852.6	431.77	1	2.62	1.01
40	2677.0	430.38	1.03	2.81	1.05
35	2292.0	427.93	0.78	2.13	0.87
30	2067.2	426.09	0.99	2.61	0.99
25	1863.2	424.44	0.97	2.82	1.05
20	1581.9	422.43	1.05	2.79	1.03
15	1194.2	419.71	1.04	3.12	1.1
12	929.4	417.91	1	2.69	1.03
11	876.4	417.48	1.07	3.12	1.09
10	753.6	416.49	1.02	2.6	0.95
9	543.5	415.16	1.1	3.12	1.04
8	508.1	414.56	1.06	2.85	0.98
7	469.4	414.36	1.05	2.81	1.03
6	381.0	413.91	1.03	2.74	1.02
5	332.9	413.71	1	2.55	0.97
4	272.2	413.53	0.93	2.23	0.87
3	212.1	413.58	0.54	1.31	0.55
2	140.9	413.57	0.44	1.09	0.31
1	64.2	413.56	0.35	0.85	0.34
0	0.0	413.56	0.31	0.71	0.31

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Table 6 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	4869.1	466.9	1.22	2.65	1.2
130	4798.3	464.17	1.34	3.08	1.4
123	4598.2	461.24	1.4	3.12	1.37
117	4445.6	458.68	1.4	3.12	1.37
111	4200.2	456.23	1.37	3.11	1.4
105	4008.7	453.38	1.41	3.12	1.36
100	3819.4	450.69	1.32	3.12	1.43
95	3602	448.61	1.28	2.79	1.18
87	3415.1	446.29	1.51	3.35	1.29
83	3208.2	443.59	1.12	2.43	1.04
77	3021.6	441.24	1.47	3.35	1.4
69	2826.3	438.9	1.23	3.34	1.53
63	2607.2	436.56	1.12	2.56	1.15
59	2424.3	434.53	0.69	2.32	0.83
52	2213.5	431.69	1.33	3.35	1.5
46	2012.4	429.54	1.51	3.35	1.29
40	1823.7	427.23	1.34	2.94	1.19
34	1590.7	424.78	1.49	3.35	1.37
29	1393.5	422.47	1.44	3.34	1.44
24	1224.9	420.01	1.38	3.32	1.51
20	1022.1	417.96	1.24	3.32	1.53
15	804	415.95	1.3	3	1.38
9	593.4	413.26	1.38	3.32	1.51
5	430.6	411.51	1.01	2.38	1.14
0	205.4	410.82	0.54	1.3	0.58
-3	0	410.84	0.07	0.25	0.06
Road Culvert					

6. STAGING OF CREEK DIVERSION

The successful rehabilitation and realignment of Murragamba and 'Eastern' Creeks will require the development of a re-construction plan based on the proposed staging of the mine progression for Open Cut 4.

The schedule for the diversion and reconstruction of affected sections of Murragamba and 'Eastern' Creeks is detailed below.

6.1 DIVERSION STAGING OF MURRAGAMBA AND EASTERN CREEKS

Sections 6.1.1 to **6.1.5** describe the construction and establishment of the permanent creek diversion which will be installed progressively throughout the period of mining operations. The staging was developed based on integration of the mine pit progression with the proposed creek realignment works.

Figure 16 outlines an indicative timeline for the construction of the permanent diversion of Murragamba and 'Eastern' Creeks. Details are provided of the period when each stage of the creek realignment will be constructed. Subsequent to construction, an indicative timeframe of when the creek line is expected to become operational is also provided.

In addition, detail of the temporary structures which are required to facilitate the diversion of creek flows during construction and establishment, prior to operation of the reconstructed creek are provided (*refer* **Figure 16**).

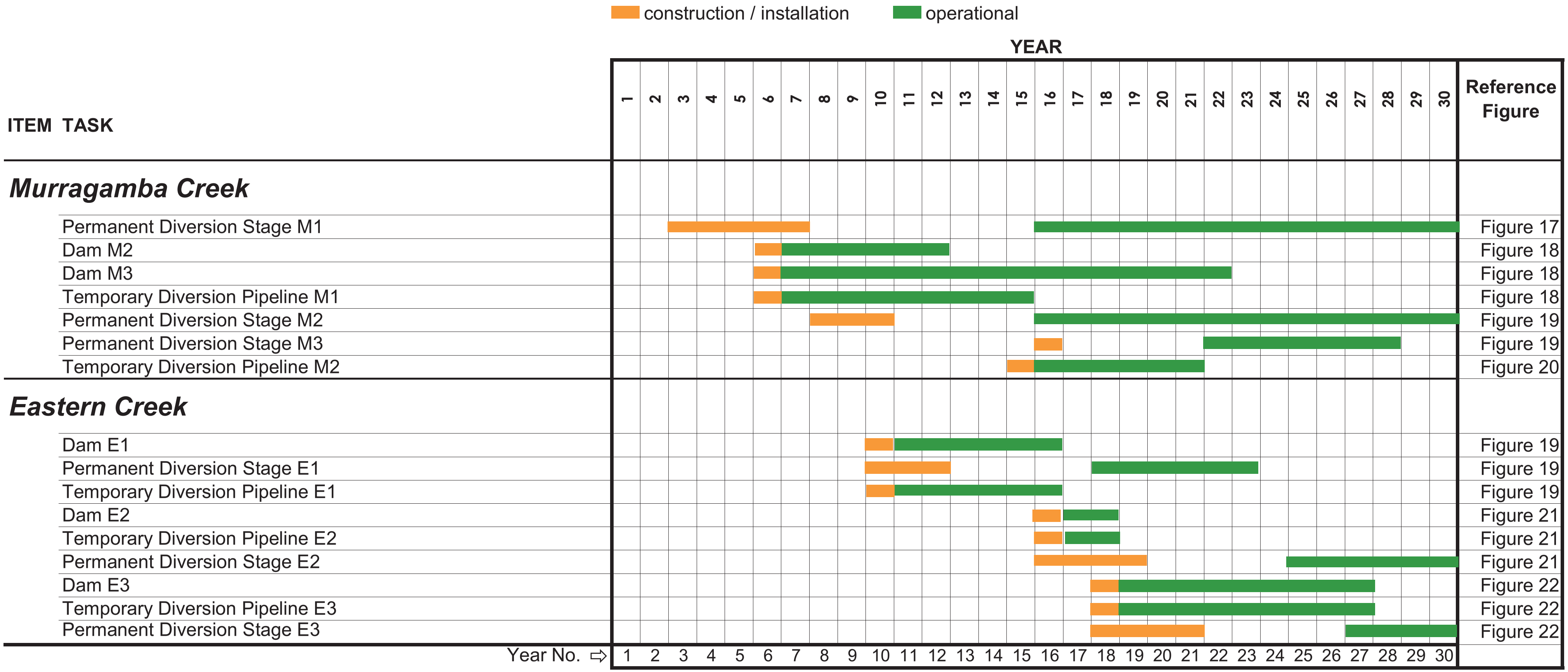
The staging of the proposed creek diversion works has been designed to be flexible, which will allow for potential deviations in the proposed mining sequence, should they arise.

Figures 17 to **22** outline the proposed creek diversion works at key intervals throughout the lifetime of the mine. The diversion works have been separated into stages on the basis of when one continuous reach is being constructed. The staging of the creek diversions have been labelled according to the creek name with the numerical identifier increasing in a downstream direction. For example, the most upstream section of the Murragamba Creek diversion is referred to as "Stage M1".

In developing the staging of the creek layout, a nominal time frame of 5 years has been adopted to allow sufficient time for the overburden fill to consolidate and the creek line to be revegetated and stabilised. That is, there will be sufficient time for a substantial ground cover to be developed across the base of the channel to ensure the potential for scour of the constructed channel is greatly reduced, prior to introducing flow (*refer* **Section 5.4.4**).

However, Moolarben Coal will undertake regular monitoring of the diverted creek line. Should rehabilitation of the diverted creek line be achieved in a timeframe shorter than 5 years, there is the opportunity for sections of the creek to become operational sooner than this 5 year timeframe, with necessary consultation.

MOORLARBEN COAL MINE CREEK CONCEPT DESIGN
PROPOSED STAGING OF DIVERSION WORKS



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rp6173_01 - MCM Concept Creek Design
fig 19 - Diversion Works Program

FIGURE 16

6.1.1 Years 1 to 6 inclusive

Mining is proposed to commence midway up the Murragamba Creek Valley as shown in **Figure 17**. The extent of mining proposed for Years 1 and 2 is shown in **Figure 17** and the extent of mining through the period of Years 3 to 6 is shown in **Figure 18**. Mining in Years 1 to 6 will progress south up the Murragamba Valley. The existing creek line will not be mined through until Year 7, which is shown for reference in **Figure 18**.

No temporary diversion works will be required until Year 7 of mining operations. Provided below is a description of the permanent and temporary diversion works required during this period of mining.

Permanent Diversion Works

The extent of mining proposed through years 1 to 6 coincides with a section of the realigned creek channel, identified as *'Permanent Diversion Stage M1'*. Construction of *Stage M1* will progress throughout Years 1 to 6 of mining, as placement and consolidation of overburden allows. The extent of *Stage M1* can be seen in **Figure 18**.

Temporary Diversion Works

Prior to excavating Murragamba Creek at Year 7, two dams will be constructed on Murragamba Creek during Year 6. The dams are identified as M2 and M3 and their location is shown on **Figure 18**. The dams will facilitate capture and diversion of Murragamba Creek flows from the upper catchment around the active pit.

Dam M2 is required to capture and divert run-off in the local catchment upstream of the pit, it will be removed due to mining at the beginning of Year 13. Dam M3 is required to manage run-off from the catchment upstream of the active pit and to control discharge through the rehabilitated creek. This dam will remain in place until the diverted creek channel is fully operational.

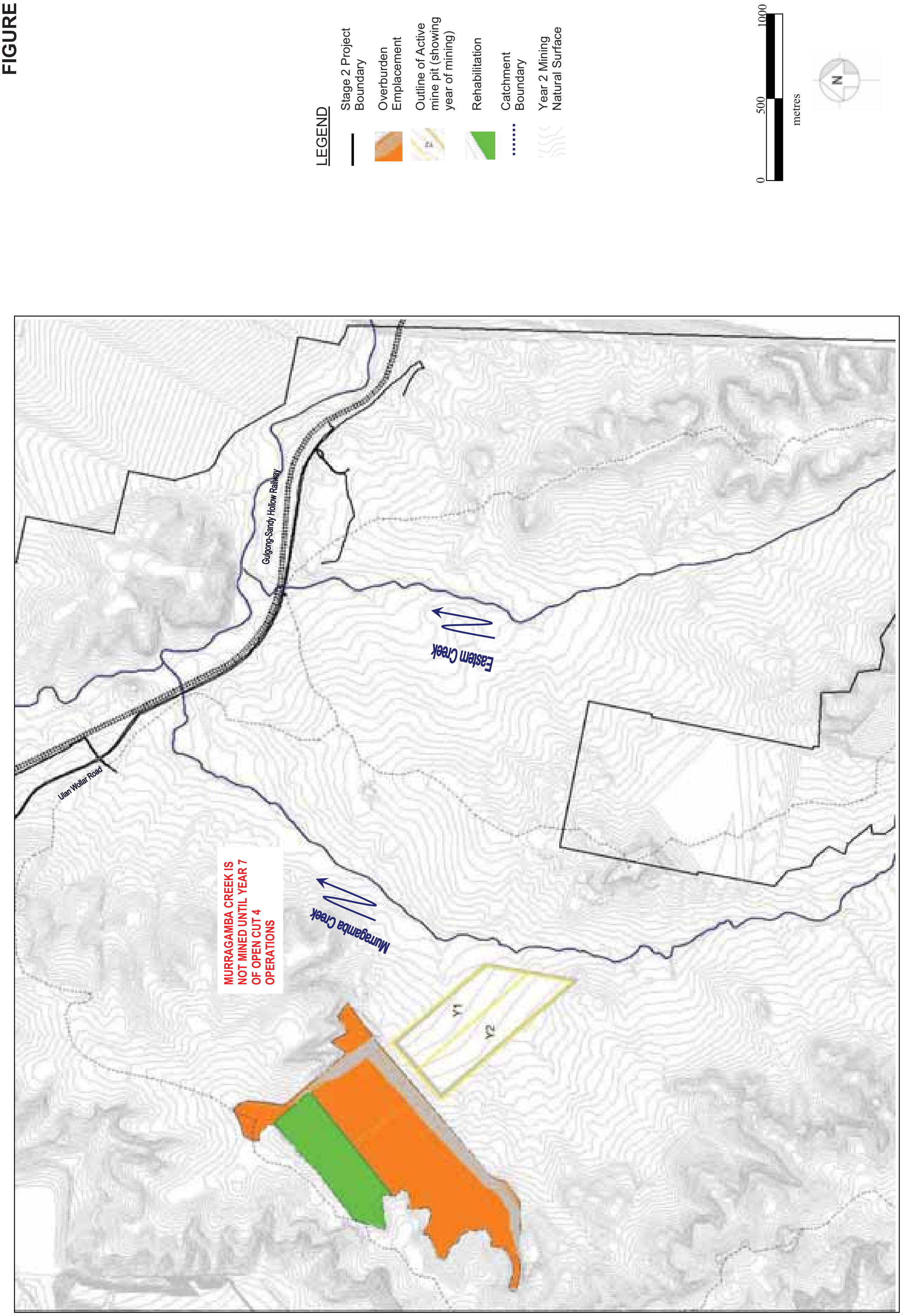
6.1.2 Years 7 to 12 inclusive

At the beginning of Year 7, mining will re-commence adjacent to the location where mining commenced in the Murragamba Creek Valley (*refer* **Figure 18**). It will progress north from this location (*refer* **Figure 19**).

From year 10 onwards, mining operations will progressively move eastward, out of the Murragamba Creek valley and into the 'Eastern' Creek valley. It is anticipated that during years 11 to 12 of mining operations, the downstream section of 'Eastern' creek will be mined.

The progression of the mine pit in year 7 to 12 can be seen in **Figure 19**.

FIGURE 17



MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 1 - 2
CREEK DIVERSION STAGING

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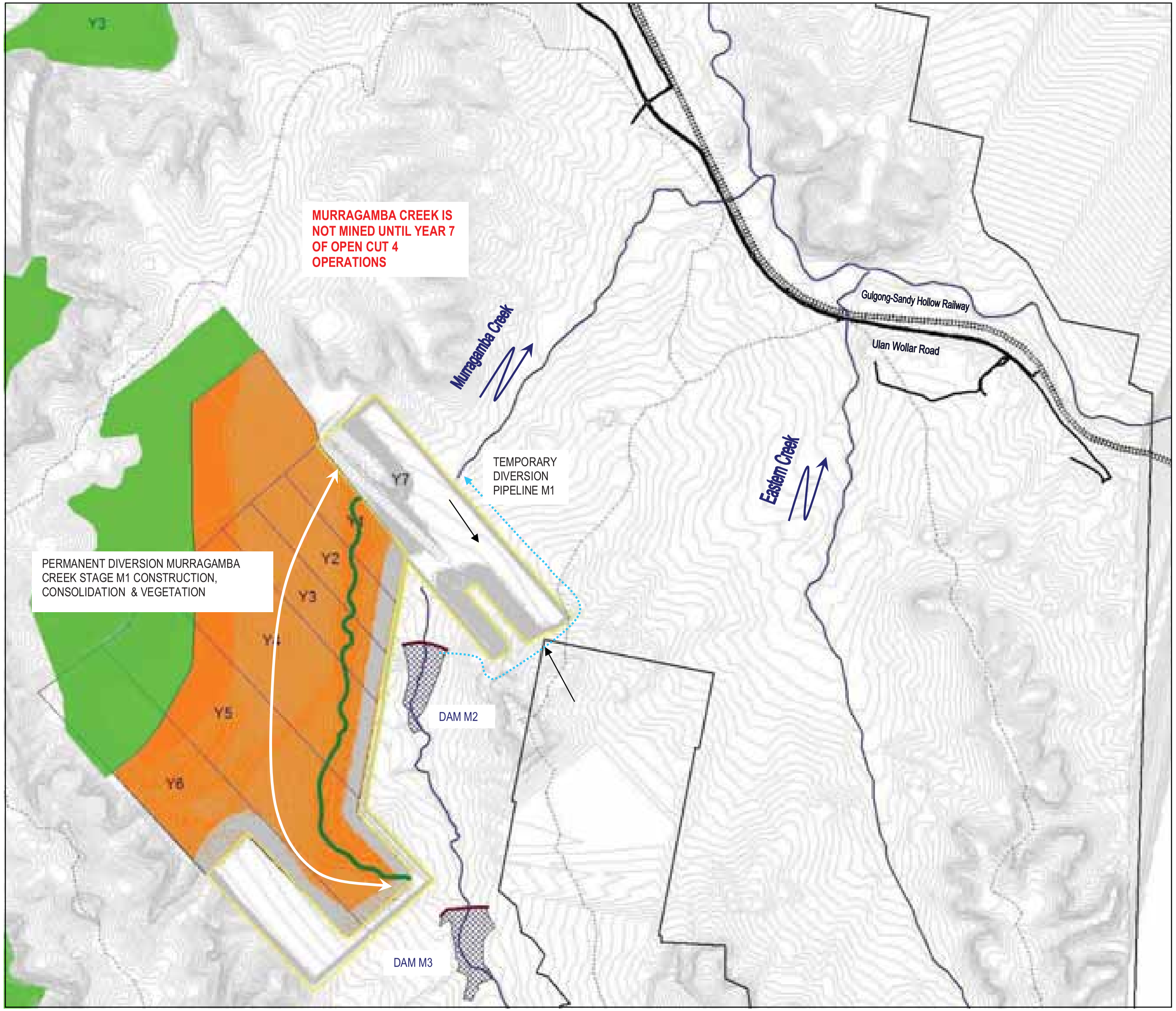
Moolarben Coal Project PPR Creek Diversion Concept
fg6173_05am110303-figA_Creek Diversion yrs 1-2.doc

FIGURE 18



LEGEND
- Stage 2 Project Boundary
- Overburden Emplacement
- Outline of active mine pit (showing year of mining)
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Temporary diversion pipeline/channel
- Permanent Creek Diversion
- Year 7 Mining Natural Surface

0 500 1000
metres

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Moolarben Coal Project PPR Creek Diversion Concept
fg6173_05am110303-fig17_Ck Diversion yrs 3-7.doc

MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 3 – 7
CREEK DIVERSION STAGING

The progression of the creek diversion during this period of mining is outlined in **Figures 19**. Permanent and temporary diversions proposed during this period are described in the following section.

Permanent Diversion Works

During this period Stage M2 of the Murragamba Creek permanent diversion will be constructed, as overburden emplacement and consolidation allows. Construction of Stage M2 will be complete around year 11. The alignment of Stage 2 is indicated in **Figure 19**. Dam M3 will be maintained throughout this period to ensure that flow through the creek from the upper Murragamba Catchment is diverted around the active pit and diverted creek channels undergoing rehabilitation.

Based on the 5 year timeframe adopted for construction, consolidation and revegetation, Stage M1 will become operational at the commencement of year 13. However, since it drains directly to Stage M2, which will still be undergoing rehabilitation, the two stages will become operational together in year 16. Nonetheless, during this period it is envisaged that run-off from the local catchment draining directly to the diverted channels will be conveyed by them.

In addition, the degraded southern 700 metres of Murragamba Creek will be rehabilitated to enhance the existing natural features of the creek and to provide bank protection to the existing channel. It is anticipated that rehabilitation works will mainly involve landscaping and replanting of native species (*refer* **Figure 19**).

Once mining is completed in the northern section of the 'Eastern' Creek valley a permanent creek alignment will be constructed in the rehabilitated area where overburden placement is located. The permanent creek alignment for ''Eastern' Creek will be located approximately 300m west of the existing creek alignment and is shown in **Figure 19**. This section of the permanent creek alignment is referred to as '*Permanent Diversion Stage E1*'.

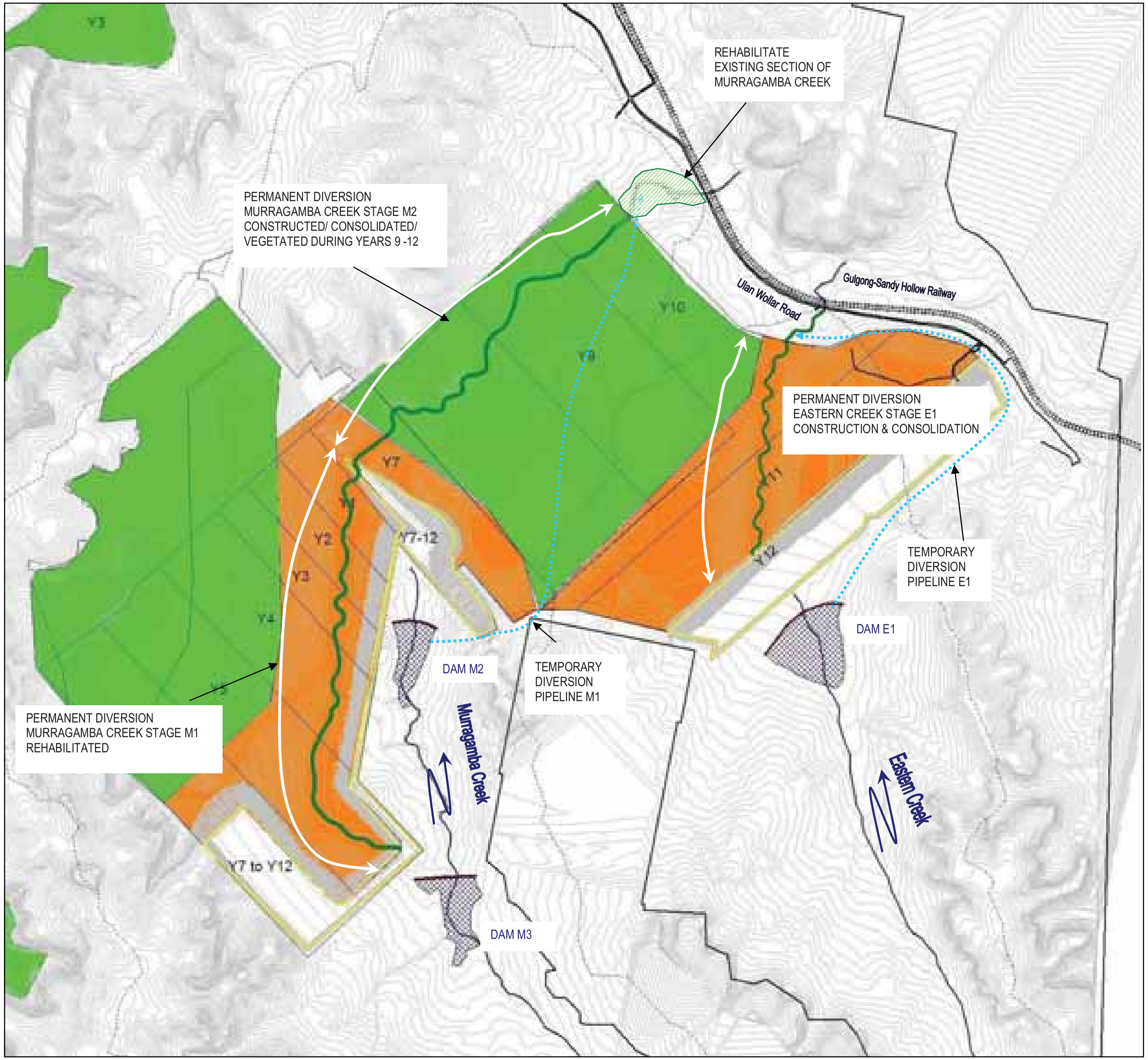
Temporary Diversion Works

To facilitate the delivery of environmental flow, '*Temporary Diversion Pipeline M1'*, will be installed to convey water stored from Dam M2 to the downstream end of the Murragamba Creek (*refer* **Figure 19**).

Near the commencement of mining in the 'Eastern' Creek valley it will be necessary to construct a temporary dam upstream of the projected Year 16 mine pit shell. Year 16 has been selected since only a small amount of mining will take place between Years 12 and 16 in 'Eastern' Creek, thus representing the most efficient location for the dam. The indicative location of the dam, identified as '*Dam E1'* is shown on **Figure 19**. The dam will prevent water entering the mine pit, together with the construction of any bunding upstream of the pit. The dam will remain operational until it is removed by mining operations at the beginning of Year 17.

FIGURE 19

DRAFT



LEGEND

- Stage 2 Project Boundary
- Overburden Emplacement
- Outline of active mine pit (showing year of mining)
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Temporary diversion pipeline/channel
- Permanent Creek Diversion
- Year 12 Mining Natural Surface

0 500 1000
metres

N

MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 8 – 12
CREEK DIVERSION STAGING

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fg6173_05am110303-fig19_Ck Diversion yrs 8-12.doc

In conjunction with *Dam E1*, it will be necessary to install '*Temporary Diversion Pipeline E1*' to divert environmental flows from the dam once the existing creek has been excavated by mining operations.

The pipeline will convey water that is stored in Dam E1 downstream of the *Stage E1* permanent diversion into the existing 'Eastern' Creek alignment (*refer* **Figure 19**). An indicative layout for the pipeline is included on **Figure 19**.

6.1.3 Years 13 to 16 inclusive

At the beginning of Year 13, mining will recommence in the Murragamba Creek Valley, adjacent to location of the active pit in Year 7. Mining will progress south up the valley, resulting in the removal of Dam M2 and a section of the existing Murragamba Creek. However, diversion infrastructure to capture and divert flow will already be in place.

From Year 16, the active pit will no longer affect the diverted creek line, maintaining a distance of at least one hundred metres between the active pit and the existing creek, which is to remain in place as part of the post mining landscape.

Throughout this period, Dam M3 will manage run-off from undisturbed catchments in the Murragamba Creek Valley. This will prevent run-off from entering the open cut pit and the Section of M2.

During this period, a small amount of mining will occur in the 'Eastern' Creek Valley, the extent of which can be seen in **Figure 20**.

Permanent Diversion Works

By this stage, it is anticipated that construction will be complete on the Permanent Diversion of Stages M1 and M2. However, for Years 13 to 15, flow in the diverted creek will be limited to run-off from the local catchment to ensure a sufficient rehabilitation period for Stage M2. During Year 16, construction will be completed for a small section of the Murragamba Creek *'Permanent Diversion Stage M3'* (*refer* **Figure 20**). The extent of the permanent creek diversion works during this period is outlined on **Figure 20**.

It is anticipated Stages M1 and M2 will become fully operational at the beginning of Year 16.

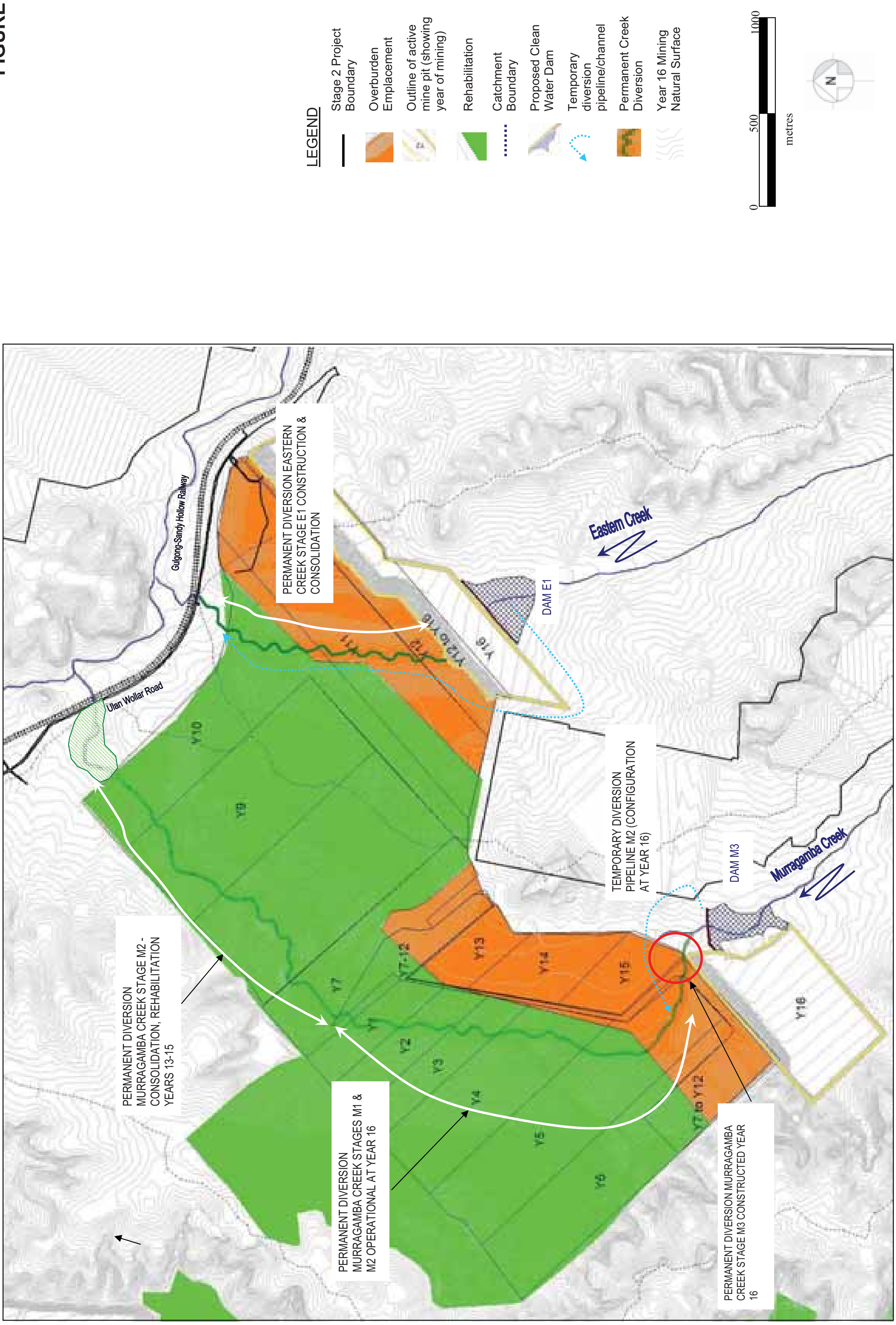
Rehabilitation of *'Permanent Diversion Stage E1'* will continue.

Temporary Diversion Works

Run-off will continue to be captured and diverted by Dam M3 and Dam E1 around the active pit and areas of the creek channels undergoing rehabilitation. As discussed previously, temporary diversion pipelines will facilitate conveyance of environmental flow.

'*Temporary Diversion Pipeline M2*' will be installed towards the end of Year 12 and will begin operation once the existing creek alignment is excavated by the mine. *Temporary Diversion*

FIGURE 20



MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 13 – 16
CREEK DIVERSION STAGING

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Pipeline E1 will continue to convey flow around the active mine pit. An indicative layout for the pipeline is provided in **Figure 20**.

6.1.4 Years 17 to 19 inclusive

During Years 17 to 18, mining will progress simultaneously along the Murragamba and 'Eastern' Creek valleys to the south. No additional excavation of the existing Murragamba Creek line will occur during this period (*refer* **Figure 21**). Mining the Murragamba Creek Valley will finish in Year 18.

Stages M1 and M2 of the permanent diversion will be operational during this period.

The excavation of the existing alignment of 'Eastern' Creek will continue towards the south. As this occurs, it will be necessary to relocate the temporary dam and diversion pipeline.

Permanent Diversion Works

Consolidation and rehabilitation of '*Permanent Diversion Stage M3*' will continue during this period. This section of the creek realignment is identified on **Figure 21**.

Based on the progression of the mining, it is anticipated that '*Permanent Diversion Stage E2'* will be constructed during Years 17 to 19 of the mining operations (*refer* **Figure 19**).

Temporary Diversion Works

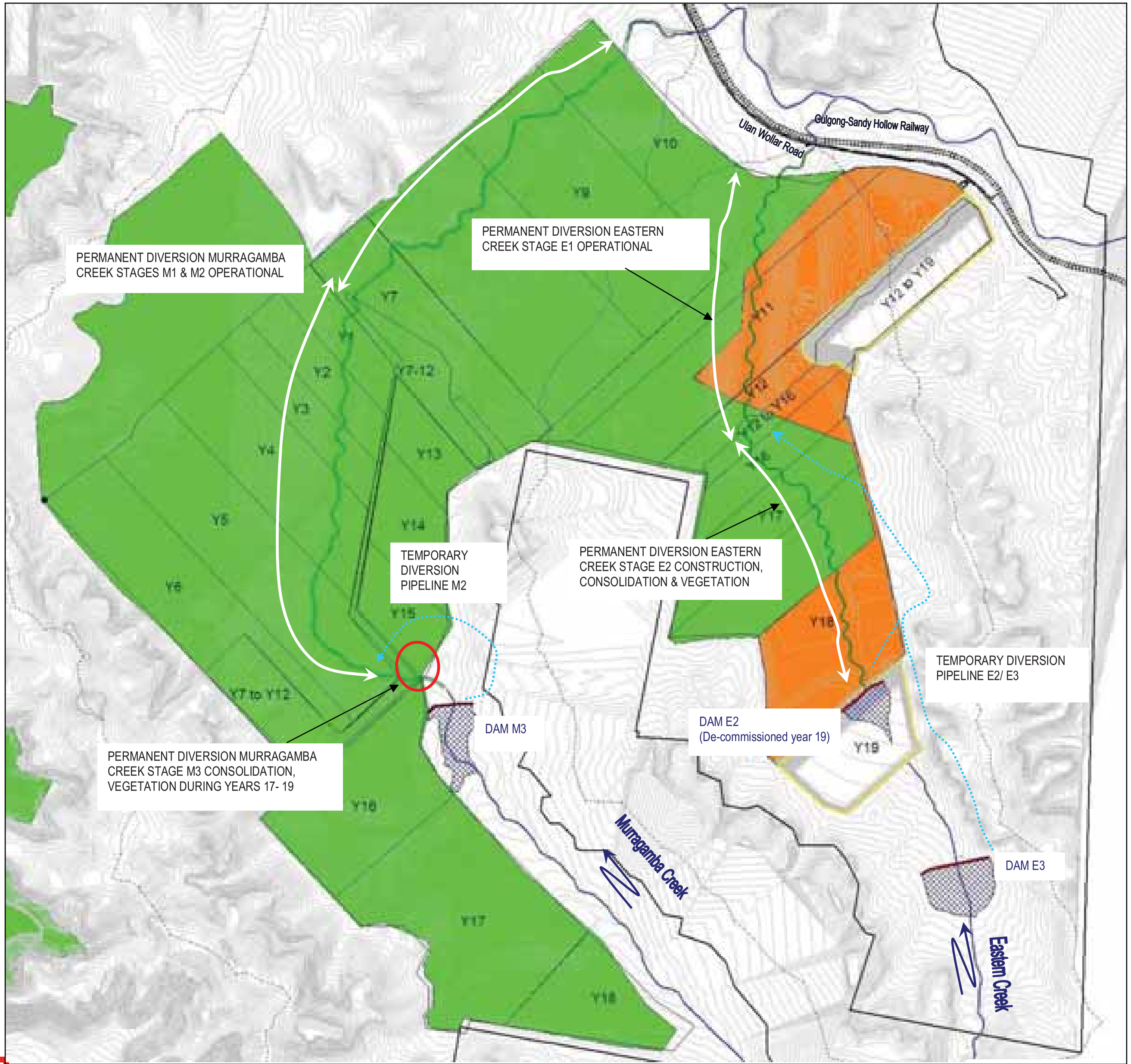
Dam M3, will continue to capture and divert flow from the Murragamba Creek catchment via '*Temporary diversion pipeline M2*' into Stage M1 of the permanent diversion (*refer* **Figure 21**).

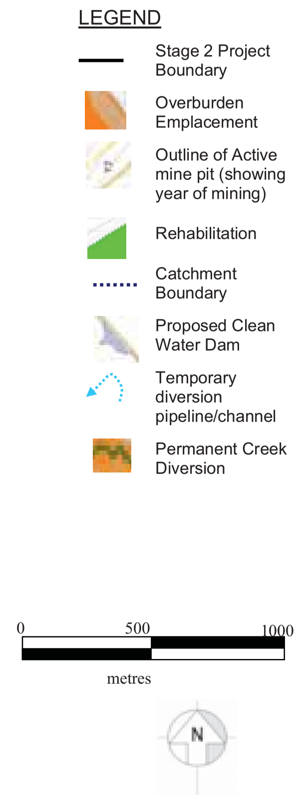
In the 'Eastern' Creek valley, the construction of the temporary creek works will progress in a similar fashion as to what occurred during Years 11 to 16. That is, a temporary dam structure will be constructed upstream of the Open Cut pit. The temporary dam structure will prevent surface water from entering the pit and can be used for environmental flows in ''Eastern' Creek.

Provision is made for the installation of two temporary dam structures, identified as *'Dam E2'* and '*Dam E3'*. It is proposed that Dam E2 be constructed upstream of the extent of the Year 18 mining pit shell (*refer* **Figure 21**). Similarly, Dam E3 is to be constructed at the upstream end of mining operations in the 'Eastern' creek valley. It is anticipated this dam will divert flow during Years 19 and 20 of mining operations.

'*Temporary Diversion Pipeline E2'* and '*Temporary Diversion Pipeline E3*' will be installed to convey environmental flow from Dam E2 and Dam E3 respectively downstream of the creek diversion works.

FIGURE 21





MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 17 – 19
CREEK DIVERSION STAGING

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6.1.5 Years 20 to 24 Inclusive

Permanent Diversion Works

The permanent diversion for 'Eastern' Creek will continue 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.

Following this, '*Permanent Diversion Stage E3'* will be constructed from Year 20 to Year 21. The extent of Stage E3 is outlined on **Figure 22**. It is anticipated that Stage E3 will be fully operational in Year 27.

Although mining operations are projected to finish at the end of Year 24, it is proposed that the lease relinquishment period be extended to allow for the sufficient rehabilitation and establishment of Stages E2 and E3.

Temporary Diversion Works

The yearly mine progression, anticipated dam locations and temporary pipeline layouts are outlined on **Figure 22**.

By Year 20, mining in Eastern' Creek valley will be completed. However the permanent realigned creek channel will not be allowed to carry uncontrolled creek flow until the 5 year period allowing for rehabilitation has elapsed. Therefore Dam E3 and Permanent Diversion E3 will remain in place until Year 27.

6.1.6 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 function as a catchment drainage system. 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.

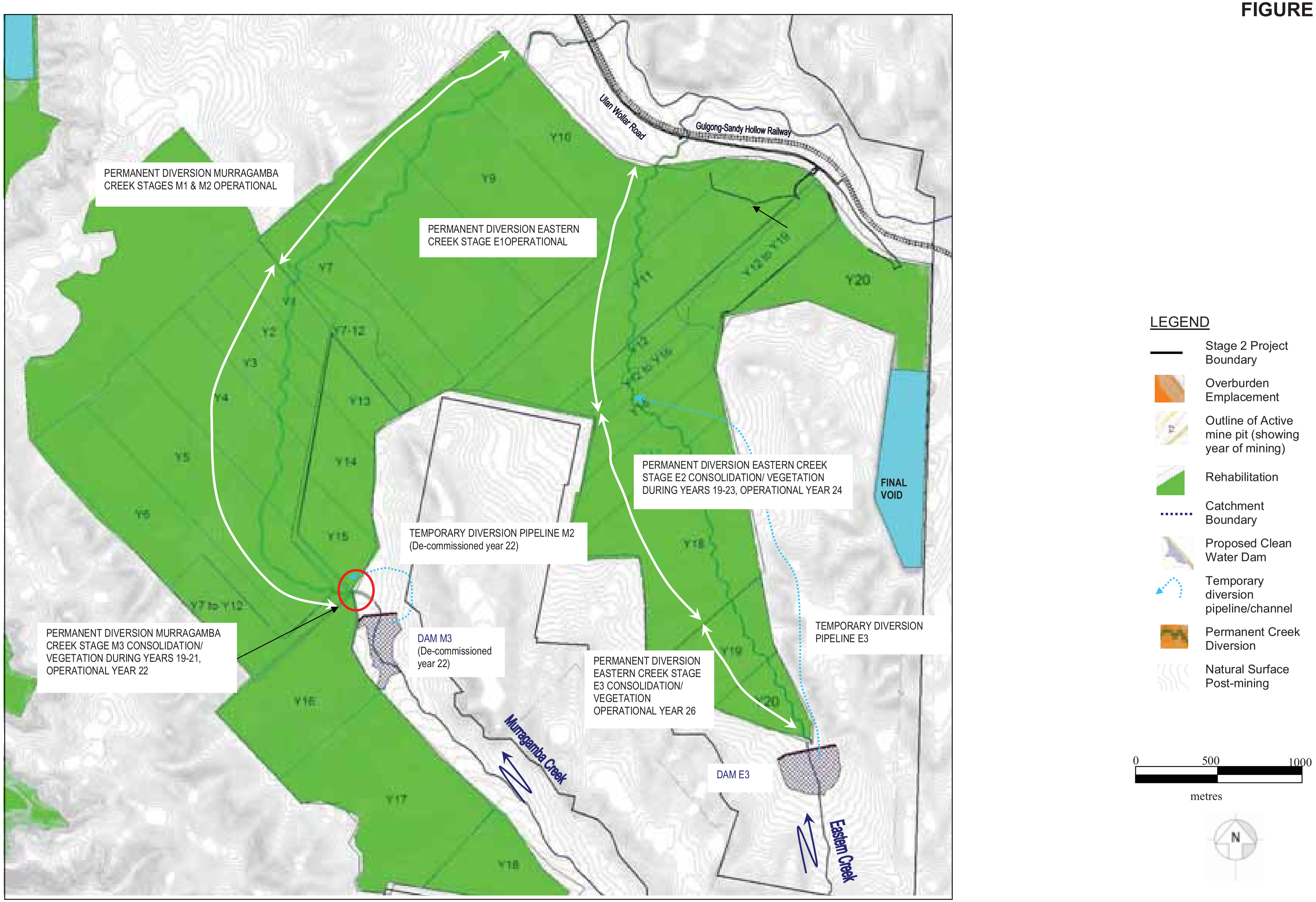
A comparison of the present and post mining alignment of the creeks has been outlined previously (*refer* **Figure 3**).

6.2 CLEAN SURFACE WATER MANAGEMENT

In addition to the permanent creek diversion works, it will be necessary to divert and contain surface runoff upstream of the open cut pit 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 OC4 will be diverted around the open cut pit. 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 and discharged into Murragamba and 'Eastern' Creeks.

FIGURE 22



MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 20 – 24
CREEK DIVERSION STAGING

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Concept Design For Proposed Diversions Of Murragamba & Eastern Creeks

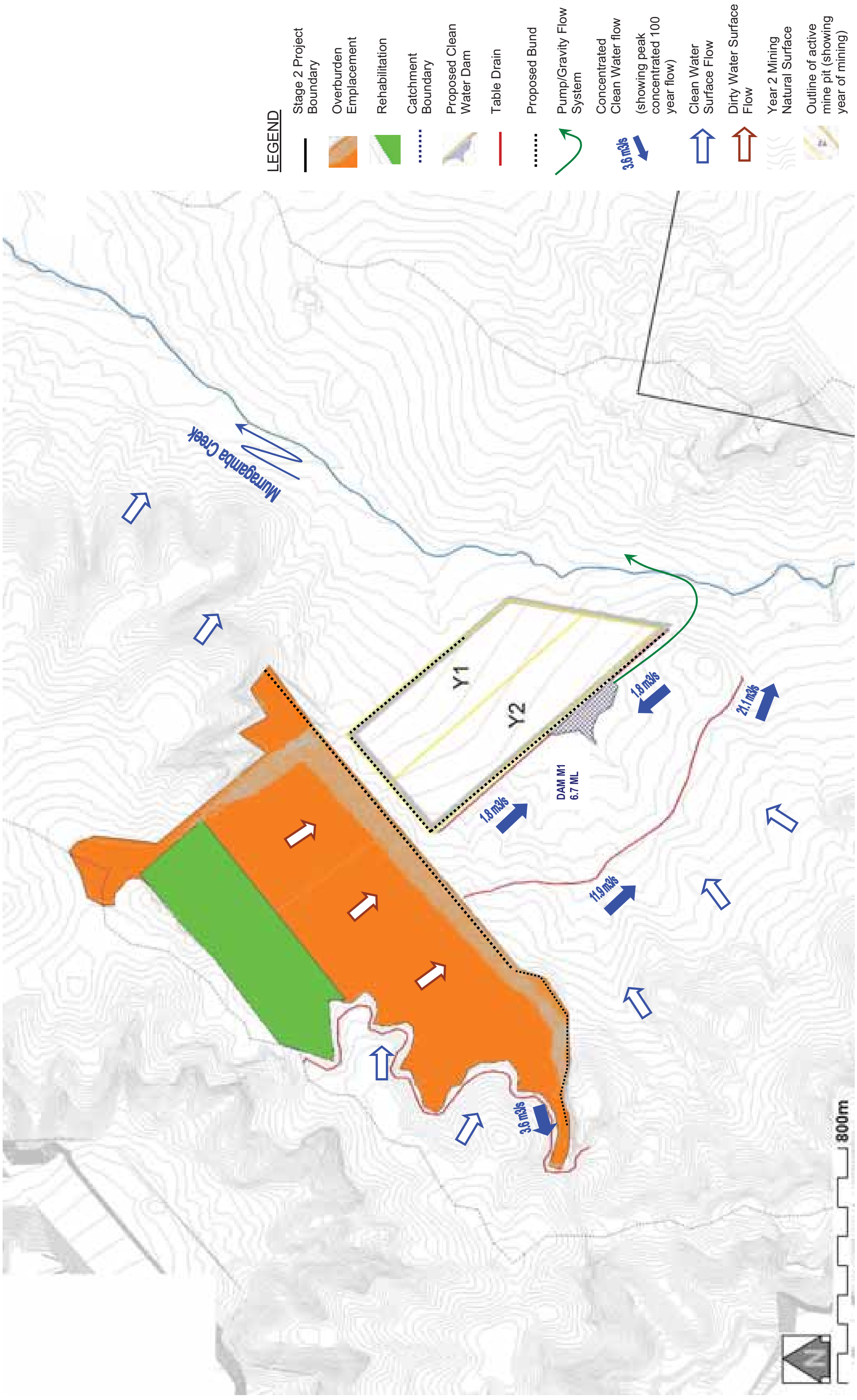
Clean water storage dams within the Murragamba and 'Eastern' Creeks catchments will be connected to allow transfer across the system.

The location of diversion drains and clean water storage dams has been conceptually developed for a number of key years of OC4. This can be observed in **Figures 23** to **28**. 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 23** to **28**. Each of these dams will be constructed as required by the mine pit progression plan and staging of the diversion works, and will 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. The requirement for discharge is discussed further in *Chapter 5* of the report titled *'Supplementary Surface Water Investigations Including Water Balance Modelling'* (*WorleyParsons, 2011*) (SSWI).

Indicative details of the clean water dams, including their size, location and purpose, is summarised in **Table 7** below. Actual sizing will be confirmed through detailed engineering design prior to the construction. Mine sediment and erosion control structures required for mine water are described in the *Surface Water Management* Strategy (*November, 2008*) Report. Sizing of sediment dams in mine areas has been updated in the SSWI (*2011*).

FIGURE 23



SURFACE WATER MANAGEMENT PLAN
YEARS 1-2

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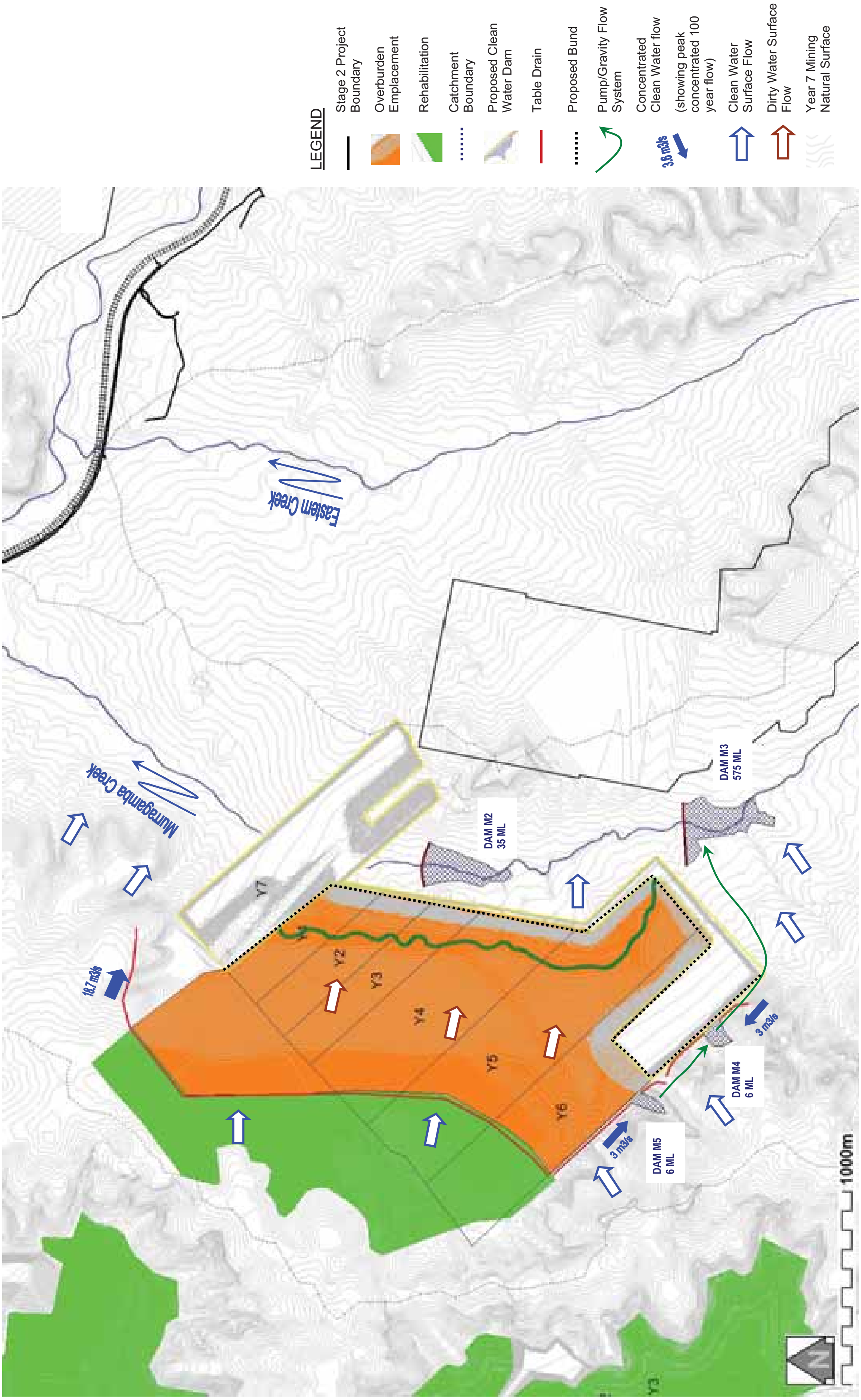
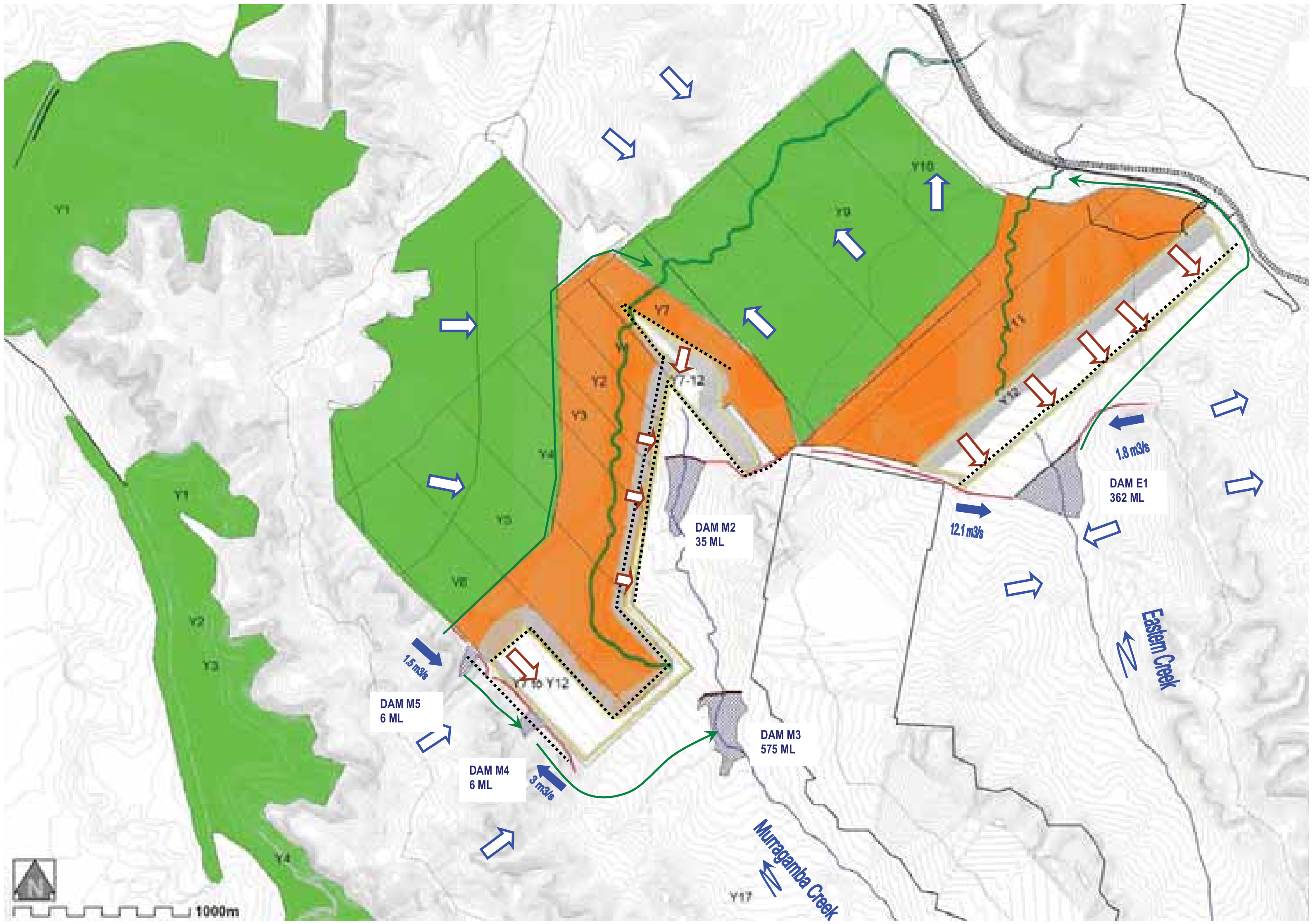
fg6173_05am110303-fig23_SWMS yrs 1-2.doc

FIGURE 24



SURFACE WATER MANAGEMENT PLAN
YEAR 7

FIGURE 25



LEGEND

- Stage 2 Project Boundary
- Overburden Emplacement
- Rehabilitation
- Catchment Boundary
- Proposed Clean Water Dam
- Table Drain
- Proposed Bund
- Pump/Gravity Flow System
- 3.6 m3/s Concentrated Clean Water flow
- Clean Water Surface Flow
- Dirty Water Surface Flow
- Contour of natural surface at mining year 12

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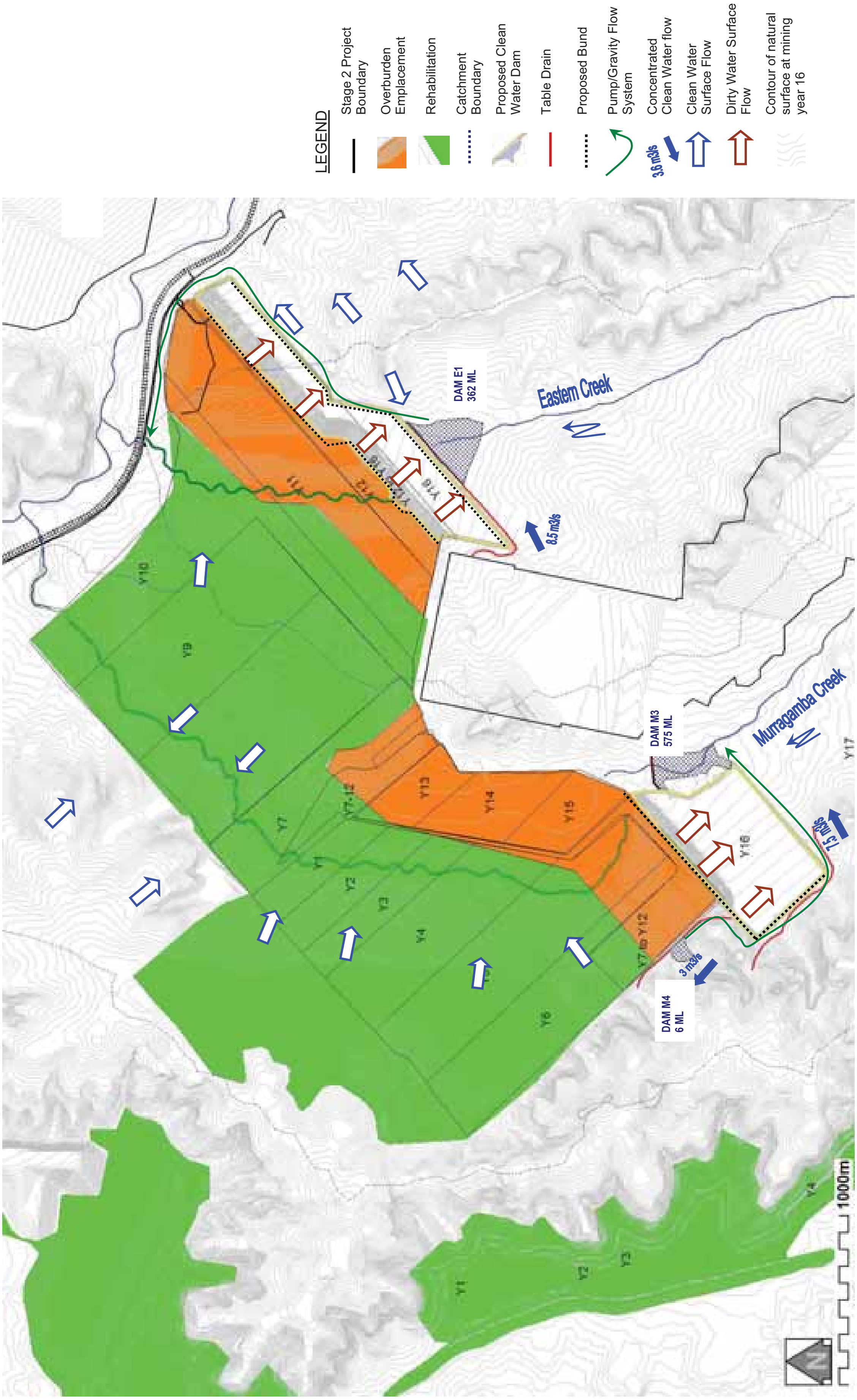
fg6173_05am110303-figB_Creek Diversion yrs 3-7.doc

MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 12
SURFACE WATER MANAGEMENT STRATEGY

FIGURE 26



MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 16
SURFACE WATER MANAGEMENT STRATEGY

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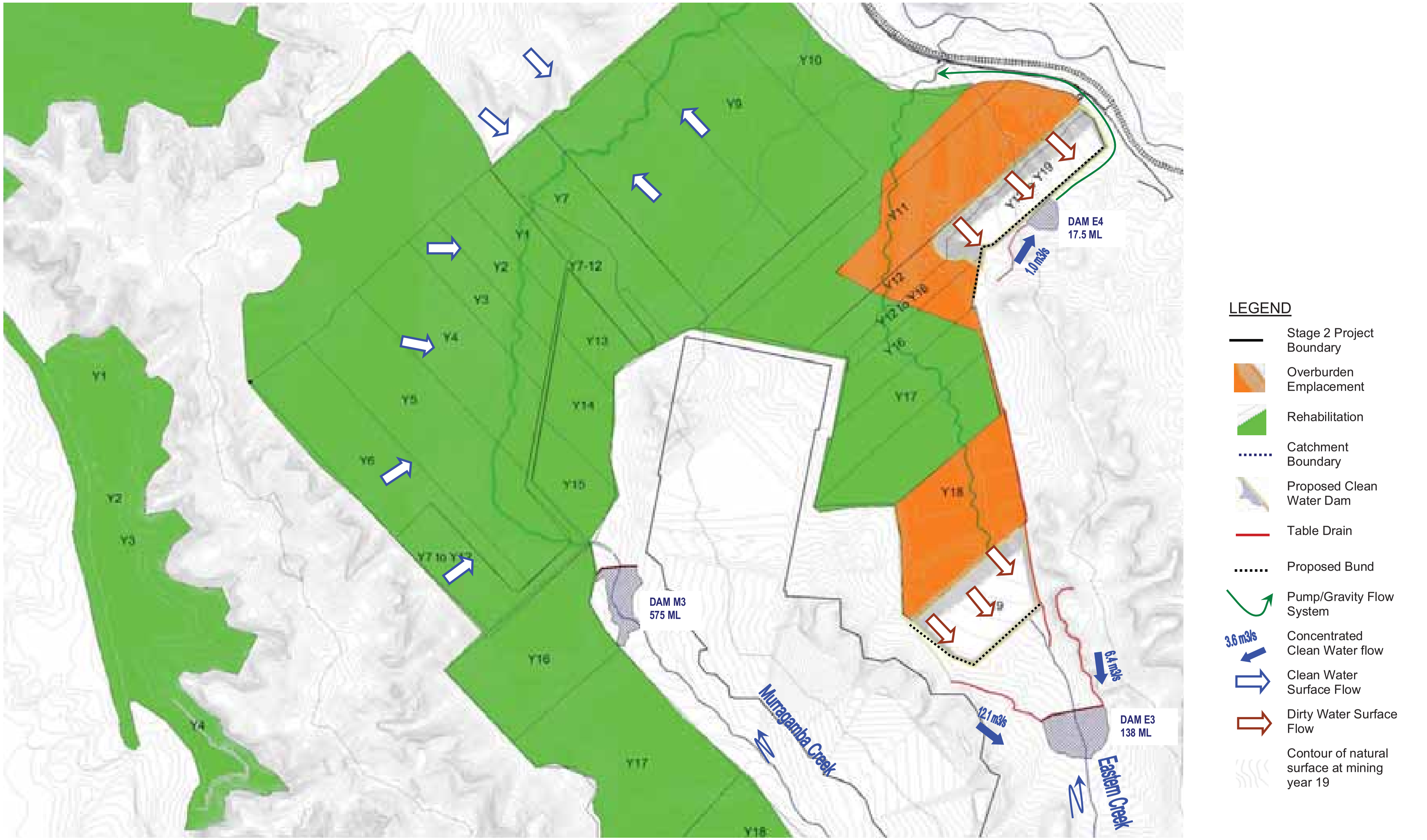
Moolarben Coal Project PPR Creek Diversion Concept
fg6173_05am110303-figB_Creek Diversion yrs 3-7.doc

FIGURE 27



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Moolarben Coal Project PPR Creek Diversion Concept
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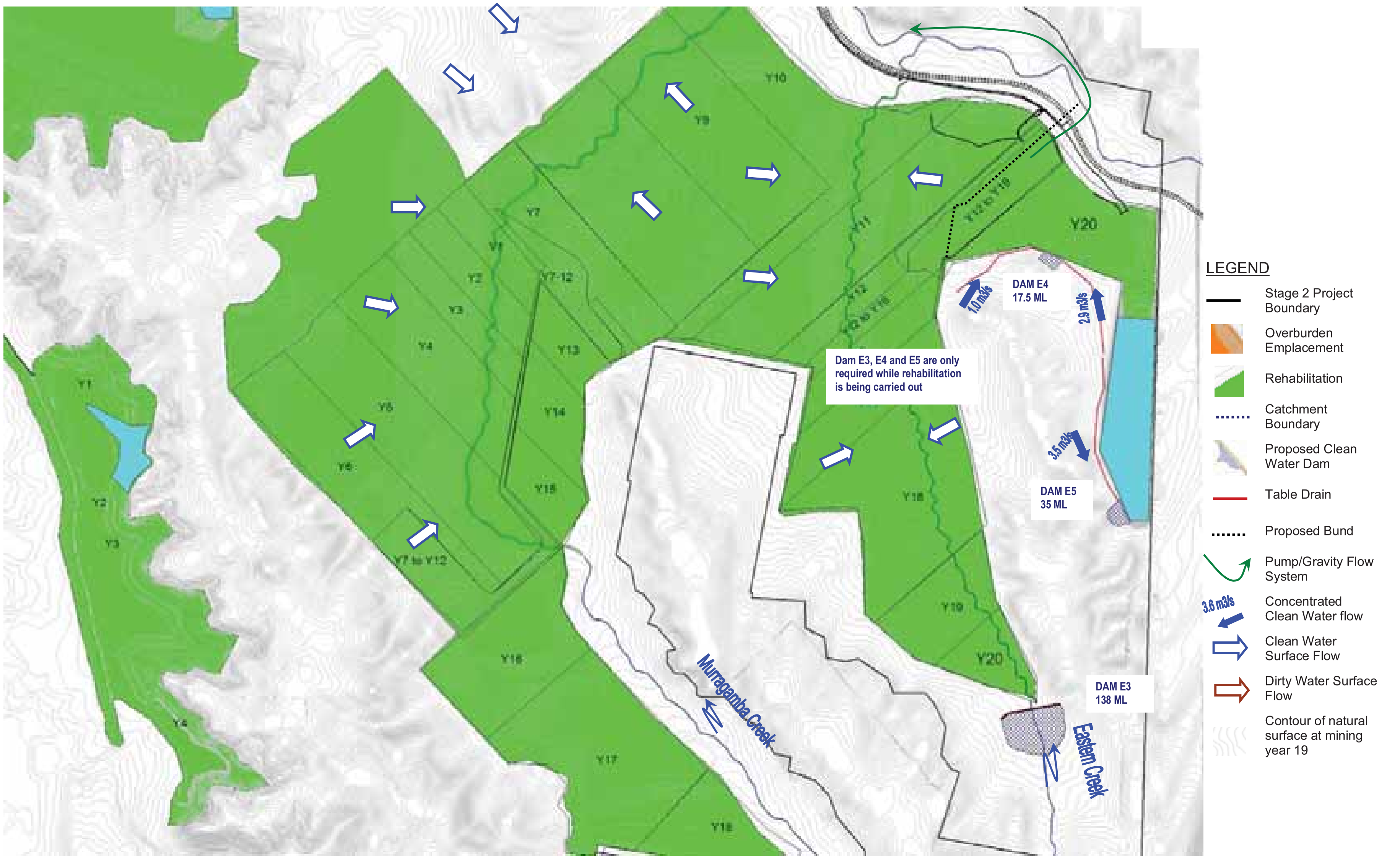
MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 19
SURFACE WATER MANAGEMENT STRATEGY

FIGURE 28



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MOOLARBEN COAL PROJECT – STAGE 2
MINING YEARS 24
SURFACE WATER MANAGEMENT STRATEGY

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Table 7 INDICATIVE SIZING OF CLEAN WATER DAMS

DAM NAME	LOCATION	PURPOSE	CAPACITY (ML)	REFERENCE FIGURE(s)
M1	South of Year 1 open cut pit	Store & Divert Clean Water	**7**	**23**
M2	On-stream storage south of Year 7 active pit	Store & Divert Clean Water	**35**	**18-19, 24-25**
M3	Downstream end of Morphologically stable section of Murragamba Creek	Store & Divert Clean Water Minimise discharge of flow to realigned channel during rehabilitation	**575**	**18-22, 24-28**
M4	West of Year 6 mining operations	Store & Divert Clean Water	**6**	**25,26**
M5	West of Year 6 mining operations	Store & Divert Clean Water	**6**	**25**
E1	'Eastern' Creek, Upstream of Year 19 mining operations	Store & Divert Clean Water Minimise discharge of flow to realigned channel during rehabilitation	**365**	**19 – 20,25-26**
E2	'Eastern' Creek, Upstream of Year 20 mining operations	Store & Divert Clean Water Minimise discharge of flow to realigned channel during rehabilitation	**280**	**21**
E3	'Eastern' Creek, Upstream of Year 22 mining operations	Store & Divert Clean Water Minimise discharge of flow to realigned channel during rehabilitation	**140**	**21-22,27-28**
E4	South of Year 19/20 mining operations	Store & Divert Clean Water	**18**	**28**
E5	South of Year 20 mining operations	Store & Divert Clean Water	**35**	**28**

6.2.1 Maintenance of Riparian Flows

The mine operations that will be undertaken as part of the Preferred 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 uses 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 riparian flows in the Wilpinjong creek system. This will be supplemented with water from Splitters Hollow Dam, (*an on-stream dam on Wilpinjong* Creek) where required.

The clean water diversion infrastructure as described in **Section 6.2** has been designed to ensure that no run-off from clean surface water areas on site will be retained for the purpose of mining. Rather, run-off from these areas will be discharged off-site as efficiently as possible. The framework for the discharge of riparian flow to Wilpinjong Creek is described in *Chapter 5* of the SSWI (*2011*).

6.2.2 Downstream Water Users

The proposed water management system has been designed to ensure that the water management needs of the Preferred 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 is discussed in more detail in **Section 6.3**. 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 in the long term. In the period immediately following mining there may be some slight reduction in surface water run-off from the two catchments, as discussed in **Section 6.3**.

6.2.3 Potential Impact on Flows to Wilpinjong Creek

The mining operations that are proposed as part of Stage 2 of the MCC have the potential to reduce flow from Murragamba and 'Eastern' Creeks 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 Project Boundary. This involved determining the predicted runoff from the

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Murragamba and 'Eastern' Creek catchments and comparing it to the expected runoff from the post-mining landscape.

The assessment of the potential reduction in streamflow is documented in the Surface Water Management Strategy.

6.3 PROPOSED POST- MINING LANDFORM

It will be necessary to rehabilitate the overburden areas of the open cut pit on a progressive basis. Rehabilitation will include shaping and contouring of the backfilled landform.

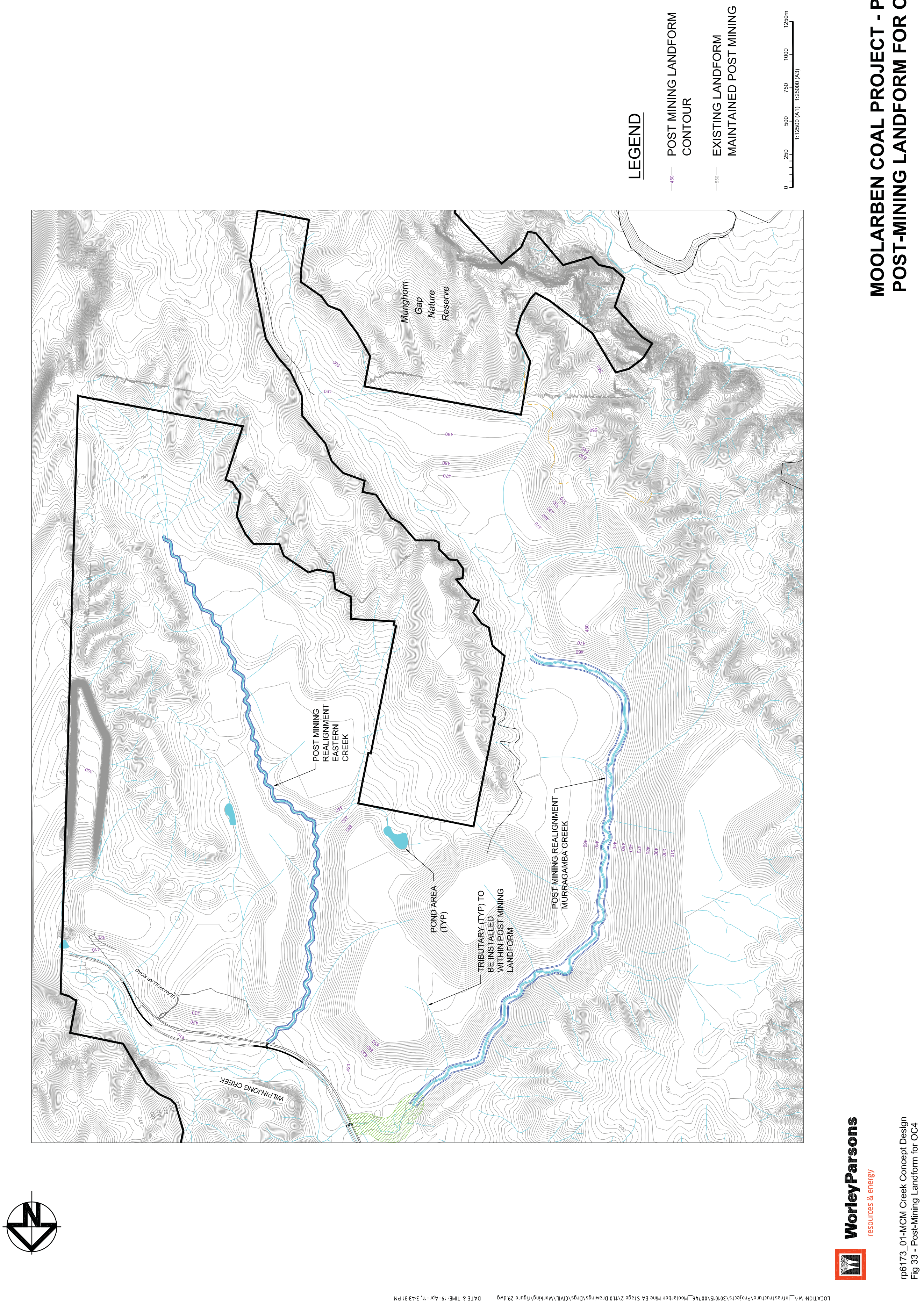
Contouring of the post-mining landform is necessary as it will allow the conveyance of surface water flows from the undisturbed upper reaches of the catchments down to the rehabilitated main channels of Murragamba and 'Eastern' Creeks. A conceptual post-mining landform has been prepared and is shown in **Figure 29**. Appropriate measures to manage erosion and sediment control, such as contour banks, will be incorporated into the post mining landform.

Figure 29 indicates that a series of ridges and drainage lines will be required to enable surface water flows to be concentrated and directed into both Murragamba and 'Eastern' Creeks. This will enable the flow of surface water over the rehabilitated area towards local drainage networks. Erosion and sediment control structures such as contour banks and sediment ponds will be included in the development of the final landform to reduce the risk of soil loss. Other energy dissipation structures will be included as deemed necessary.

The location of drainage lines has been designed to incorporate water storage areas required as part of the mine surface water management strategy (*i.e. sedimentation structures*) into the post-mining landform.

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

FIGURE 29



LEGEND
POST MINING LANDFORM CONTOUR
EXISTING LANDFORM MAINTAINED POST MINING
0 250 500 750 1000 1250m
1:12500 (A1) 1:25000 (A3)
Munghorn Gap Nature Reserve
POST MINING REALIGNMENT EASTERN CREEK
POND AREA (TYP)
TRIBUTARY (TYP) TO BE INSTALLED WITHIN POST MINING LANDFORM
POST MINING REALIGNMENT MURRAGAMBA CREEK
WILPINJONG CREEK
ULAN-WOLLAR ROAD
MOOLARBEN COAL PROJECT - PPR
POST-MINING LANDFORM FOR OC4
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rp6173_01-MCM Creek Concept Design
Fig 33 - Post-Mining Landform for OC4

7. MITIGATION & CONTINGENCY MEASURES

A number of different scenarios have been identified which have the potential to affect the performance of the permanent diversions of Murragamba and 'Eastern' Creeks. These scenarios included the following:

- Settlement of backfilled overburden and waste rock materials causing cracking of the bed and banks of the realigned creeks and subsequent loss of in-channel surface flows;
- Infiltration and loss of in-channel surface flows into backfilled overburden and waste rock materials caused by poorly prepared reconstructed creek beds;
- The occurrence of a major flood event during the period in which the creek diversion is being revegetated, stabilised and rehabilitated; and,
- Excessive erosion and sediment transport of the creek bed downstream of the Project Boundary.

The following describes measures which have been developed to reduce the impact of the potential impact scenarios identified above. A number of strategies will be implemented to achieve this as discussed in the following sections.

7.1 MONITORING OF THE PERMANENT CREEK REALIGNMENT

Each of the permanent creek realignments will be monitored on a periodic basis. Periodic monitoring will ensure the early detection of locations within the realigned creek where excessive consolidation, erosion or inhibited plant growth may be occurring. This will facilitate the application of appropriate remediation techniques.

In addition, it will be necessary to ensure that those locations within the creek channel that will function as ponded areas (*refer* **Section 5.3**), are adequately protected against surface fractures. Since the ponded areas are proposed to be clay lined, it is expected that any fracture zones which may develop will self anneal due to the properties of clay. However, monitoring of the creek lines will determine any non conformance within the creek lines and allow the implementation of appropriate contingency measures including remediation in consultation with relevant regulators.

7.2 REMEDIATION TECHNIQUES

The techniques employed to undertake remediation will depend on the particular conditions which arise during the rehabilitation of the creek line.

In the first instance, remediation may replicate aspects of the original design and rehabilitation proposal described previously in this report. This will include planting additional vegetation or undertaking further compaction of the creek bed to provide stability to the creek realignment and prevent the loss of surface flow.

Periodic monitoring of the creek will identify locations within the bed and banks where settlement has occurred leading to excessive infiltration. This may be localised settlement or settlement along a length of the diverted creek channel. The possible remediation options for this scenario include the following:

- Where local settlement of the channel has occurred, overburden material may be used to restore the channel to its intended functionality. If necessary, additional compaction and revegetation of the layer may be undertaken.
- Alternatively, it may be more effective to line the settled area with clay so that it forms a permanent water source. The viability of this procedure will depend on the size of the settlement and its context within the overall creek alignment.
- Where the settlement is likely to result in the formation of a scour hole, leading to erosion, selected rip-rap may be placed to protect the scour hole from further erosion.
- If a section of the channel undergoes settlement, an assessment will be made of the potential impact on the creek functionality. Extra overburden material will be compacted as necessary to prevent infiltration of surface water.

Where infiltration and excessive loss of surface flow is identified, the following is proposed:

- An inspection of the site will be undertaken and if necessary, a monitoring program instituted in consultaiton with the relevant authorities.
- The impact on riparian flows will be established and appropriate remedation techniques identified, as listed above.

In the unlikely event that remediation fails, the following steps will be taken for localised sections of creek:

- Any vegetation should be removed and stored in a suitable location, to be replanted following repatriation of the channel;
- The section of creek bed should be removed. The material should be re-confirmed that it is suitable for reuse as bed and bank material. If not it should be placed elsewhere and more suitable material provided.
- The creek channel should be reinstated and compacted as originally detailed. Following this, the area is required to be revegetated.

7.3 EROSION AND SEDIMENT CONTROL

At the downstream end of each reconstructed section of the creek channel, a sediment trap will be installed which will be maintained while the creek is being constructed and rehabilitated. This will allow for the capture and repatriation of the erosion of sediments while the creek channel is still being established.

In locations where excessive erosion occurs within the reconstructed creek channel, rock rip-rap or other suitable material will be used to provide protection to the creek bed and banks. The rip-rap will be placed as required to stabilise the eroded stream. In addition, rock and gravel may be used to anchor finer bed sediments and prevent erosion.

7.4 FLOODING OF THE PERMANENT CREEK DIVERSION

Temporary dams will be installed at the upstream end of the creek diversions (*refer* **Section 6.2**). The primary purpose of these dams is to capture and store clean water, to be released in order to meet riparian flow requirements. However, some provision for the capture and storage of flood water is proposed to retard the peak of the hydrograph and volume of floodwater entering the rehabilitated creek. The exact quantity of flood storage will vary depending on the size of the catchment draining to the dam and the quantity of rainfall which has fallen and been stored in period prior to the flood event.

In addition, inspection of the revised creek alignment will be undertaken following a flood event. As a general guideline, inspection will be undertaken following a flood event equivalent to the 1 year ARI flood (i.e. near bank full flow of the main channel section). Observation of a particular flood event will be required to assess if an inspection of the reinstated creek line is necessary.

In the event that a flood occurs which causes damage to the reconstructed creek prior to mine closure, remediation of the creek will be undertaken in accordance with the remediation measures outlined in **Section 7.2**.

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8. CONCLUSION

The Preferred Project will involve an extension to mining operations proposed as part of Stage 1, which was approved by the Minister for Planning on 6 September 2007. The extension involves two new underground mines (*Underground No's 1 and 2*) and a new open cut mine (*OC4*). The underground mines that are proposed as part of Preferred Project will be located below the sandstone ridges that form the catchment divide between Moolarben and Murragamba Creeks. OC4 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 Project Boundary. Due to their location within the proposed mining footprint for OC4, extensive sections of both streams will be mined for resource extraction. As a result, sections of both streams will need to be diverted. New sections of channel will need to be constructed where diversions of the stream are required during the mining operation.

Investigations undertaken for this report and the *Surface Water Management Strategy* (*2008*) have established that most of the lengths of both Murragamba and 'Eastern' Creeks within the OC4 footprint are either significantly altered or severely eroded. This observed erosion is due to prior unsustainable land management practices including wholesale clearing of the valley floor, and extended periods of overgrazing followed by intense rainfall events.

A section of Murragamba Creek has been retained due to it being morphologically stable, since the channel is formed in bedrock. Also, it consists of a steeper grade which is beneficial to the stability of the overall creek diversion design. In addition it contains beneficial ecological and archaeological characteristics. The section upstream from here will also be retained.

However, the remainder of Murragamba Creek downstream of the morphologically stable section of creek and 'Eastern' Creek are proposed to be mined as part of the Preferred Project. Hence, it is considered that stream geomorphology does not present as an impediment to mining of most of the lengths of both creeks. In addition, flood characteristics for the existing creeks indicate that flood flows are retained in-bank for most design events.

The ephemeral creeks 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 creeks is considered feasible and can occur with minimal impact on downstream river systems. A concept design has been developed, to outline and detail the realignment and describe the features necessary to implement the design.

The particular features of the concept design which has been developed include:

- preservation of a morphologically significant section of the central reach of Murragamba Creek. Preservation of this section will also assist in minimising the potential for head cuts and bed scour in adjacent sections of the realigned creek channel;
- design of a morphologically stable post-mining system of creek channels linked to an active adjoining floodplain;
- mimicking natural creek features such as meanders in the creek realignment. This will provide stability for the creek diversion by reducing the longitudinal grade of the post alignment creek in comparison to the existing system and the associated flow velocity;
- 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 riparian and in-stream habitat along the realigned creeks;
- compaction of the bed to reduce infiltration loss;
- use of clay lining in places to enable the development of pools which provide wildlife habitat through retention of water; and,
- maintenance of riparian flows.

The implementation of these features will ensure that the post-mining creek channels for both Murragamba Creek and 'Eastern' Creek are morphologically stable and will not impact negatively on downstream river systems. In addition, the proposed design has been developed to improve on the existing creek conditions.

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Concept Design For Proposed Diversions Of Murragamba & Eastern Creeks

Appendix A – ASSESSMENT OF EXISTING FLOOD CHARACTERISTICS

Appendix A contains information extracted from Chapter 5 of WorleyParsons report titled, 'Moolarben Coal Project EA2, Surface Water Management Strategy' (2008), which documents the existing condition of Murragamba and 'Eastern' Creeks. The existing conditions provided background information in developing the concept design of the proposed diversion of Murragamba and 'Eastern' Creeks. For this reason it has been reproduced in this concept design report as a reference. Where necessary, the information has been updated to reflect the current proposal.

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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 A1**). 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 1**). The steeper sections of the catchment are generally densely vegetated and uncleared, although the valley walls are typically defined by rocky outcrops.

Plate 1 View looking at section of upper Murragamba Creek Valley showing extent of sparsely vegetated floodplain lands

As shown in **Plate 1**, 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 2**).

Land use across the catchment has been predominately low density grazing in the past. 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 drainage channels extend across the lower-lying sections of the catchment and drain to Murragamba Creek and 'Eastern' Creek.

Plate 2 View looking downstream along the lower reaches of Eastern Creek south of the Ulan-Wollar Road crossing

2. STREAM CHARACTERISTICS

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 23.9 km^2.

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 3**). 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. This also marks a change of grade between the steeper channel grade encountered upstream of this section of the creek and the gentler grade encountered downstream.

Plate 3 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.

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Several roads and unsealed tracks 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 land owned by Moolarben Coal Mine.
- 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.

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 1013 ha and is located immediately east of the Murragamba Creek valley (*refer* **Figure A1**).

'Eastern' Creek is a small intermittent watercourse that drains through the eastern section of the area designated for Open Cut No. 4 (*refer* **Figure A1**). 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 4**), 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 5**).

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

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Plate 4 View looking upstream along steep and scoured central section of Eastern Creek

Plate 5 View looking downstream along lower reaches of 'Eastern' Creek

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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. These characteristics have been used to guide design of the reconstructed creek.

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 A1**.

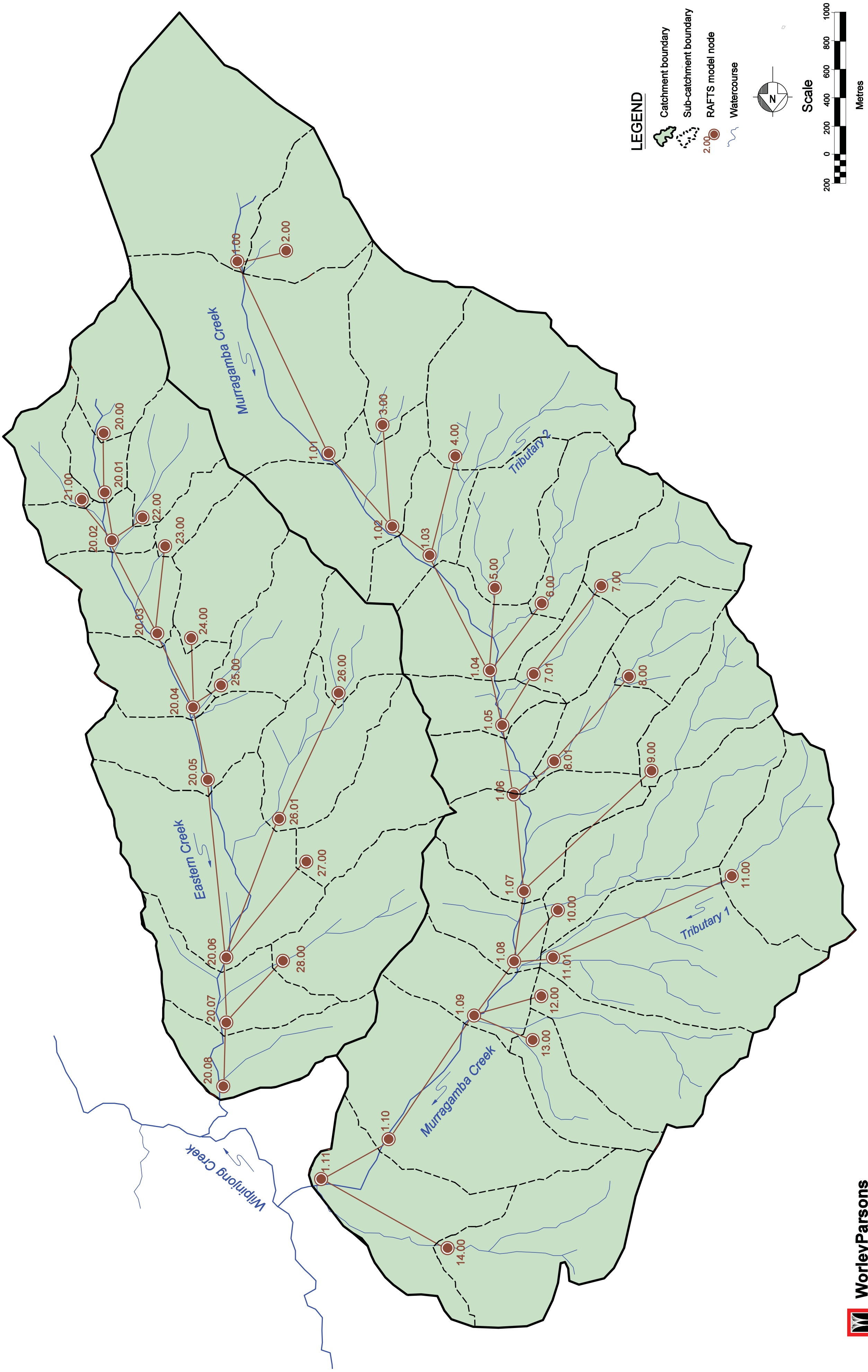
The location of each sub-catchment outlet was based on consideration of the local topography, the Open Cut No. 4 pit extent, the potential alignment for creek channel diversion, and the probable extent of the hydraulic model that was to be used to simulate flood characteristics along the watercourses.

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 B**.

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 A1**.

FIGURE A1



NODE AND LINK ARRANGEMENT FOR RAFTS HYDROLOGIC MODEL

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figA1-rafts_layout.dgn

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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.

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 nearest stream gauging station within the Wilpinjong Creek catchment is Gauge No. 210082 which is located along Wollar Creek near its confluence with Wilpinjong Creek. The gauge only records streamflows from upstream of Wollar Creek. Therefore, streamflows recorded at this gauge do not define flow yield from the Murragamba and Eastern Creek catchments.

Furthermore, the stream gauge only provides monthly stream flow readings.

Hence, there is no continuous stream flow information available to reliably calibrate the hydrologic model.

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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*).

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 1**. Peak discharges are listed at key locations along both Murragamba and Eastern Creeks.

It should be noted that the peak discharges listed in **Table 1** 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 1** 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 1** 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 38 m^3/s, or 40% of the 100 year recurrence flood flow.

Table 1 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.

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Table 1 PEAK DESIGN FLOWS FOR EXISTING CATCHMENT CONDITIONS

DESCRIPTION OF LOCATION	RAFTS MODEL NODE NUMBER (*refer* Figure A1)	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**

3.4 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.

3.5 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 A2**. Plots of each cross-section are also enclosed within **Appendix C**.

Ground surface contours for the Stage 2 area were also provided by Pegasus Technical and are also shown in **Figure A2**. 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

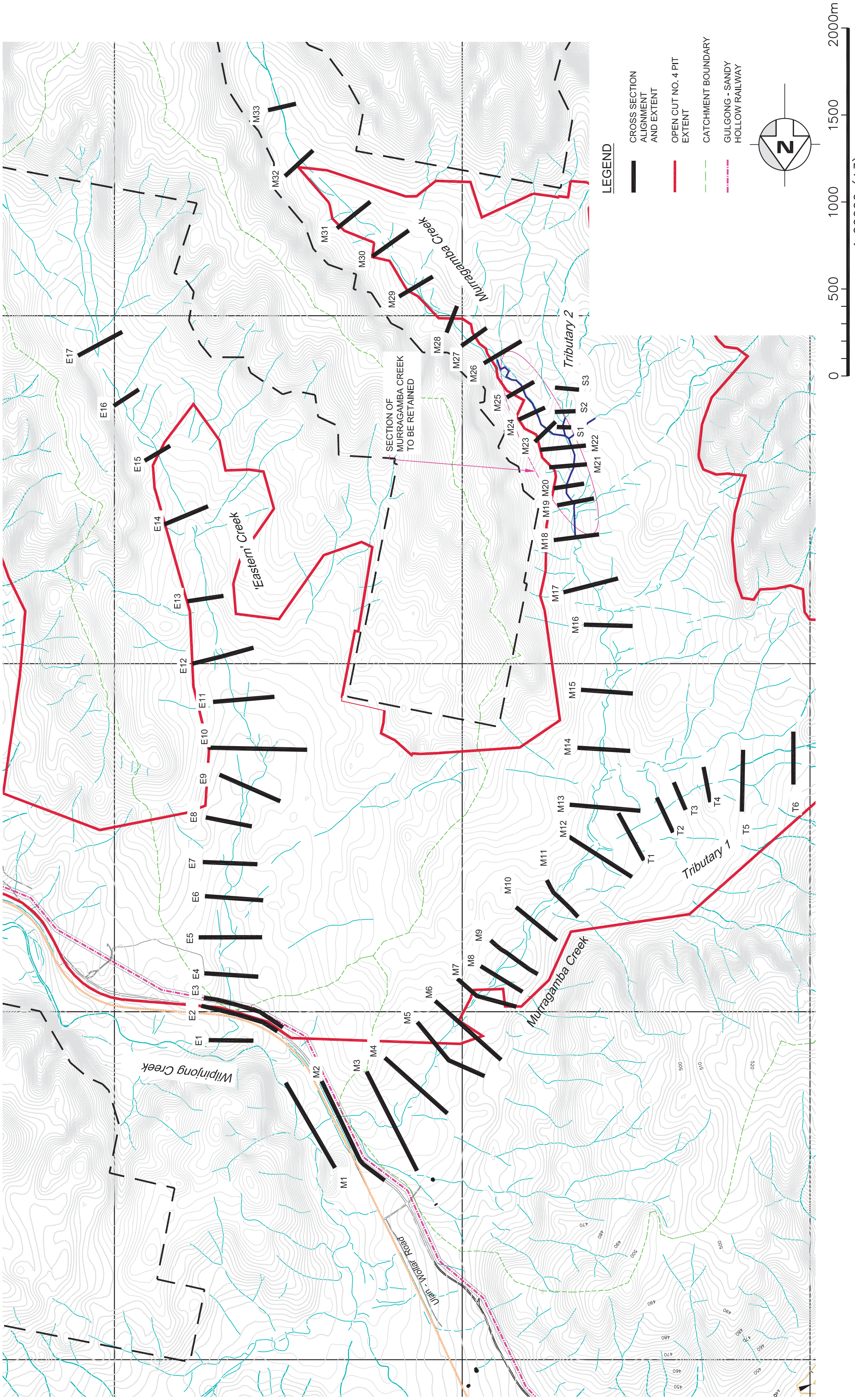
Boundary Conditions

Murragamba Creek

Boundary conditions for the Murragamba Creek flood model were based on the peak discharges determined from the RAFTS hydrologic model (*refer* **Table 1**). 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 A1** and **A2**).

As mentioned in **Section 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.

FIGURE A2



LOCATIONS AND EXTENT OF CREEK CROSS SECTIONS

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rp6173_01_MCM CREEK CONCEPT DESIGN
Fig A2 – CREEK CROSS SECTIONS

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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 A2**). 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 A2**). 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 D**. Waterway areas and approach embankment details at all crossings were incorporated into the HEC-RAS model.

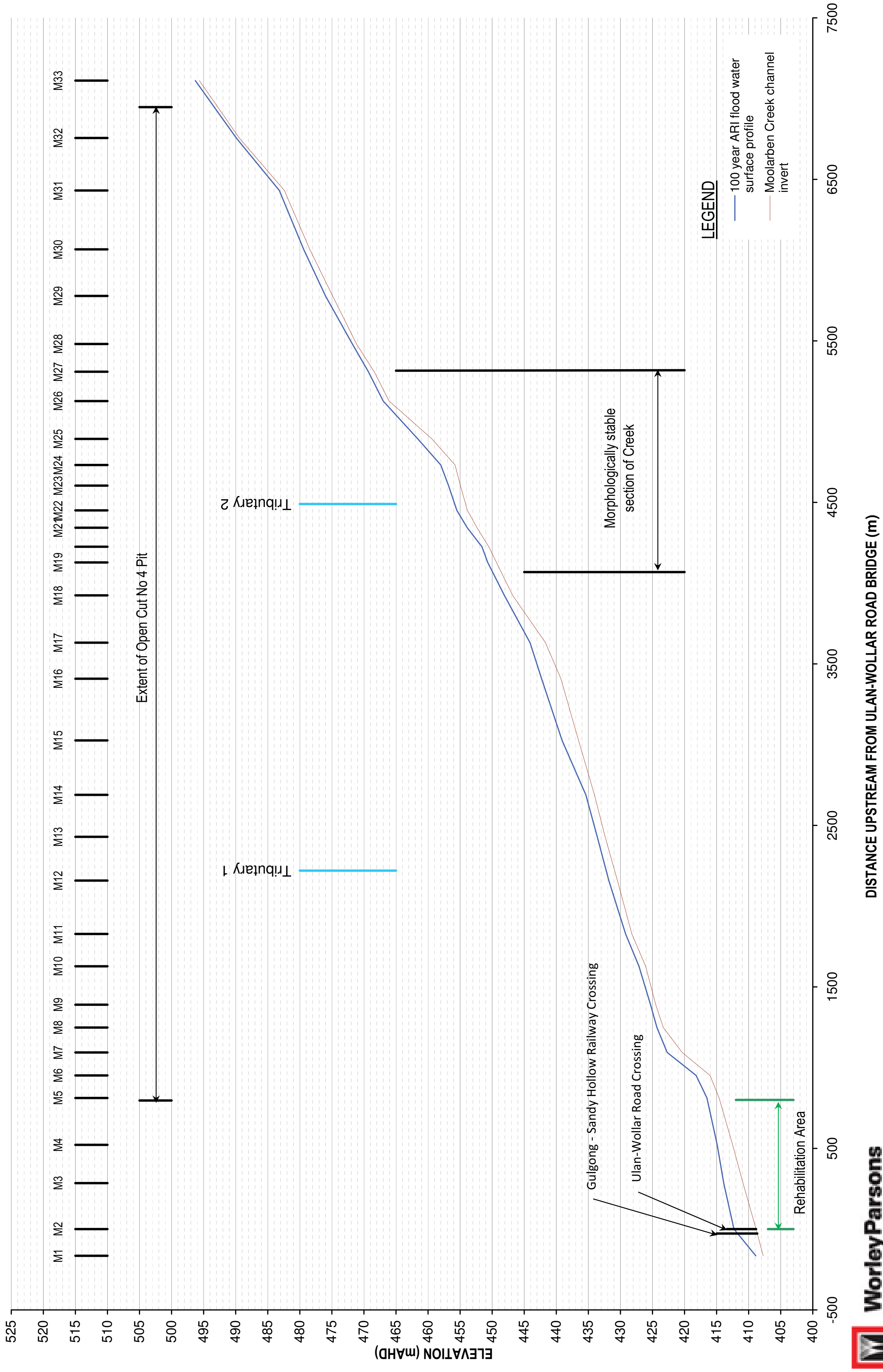
3.6 FLOOD CHARACTERISTICS FOR EXISTING CONDITIONS

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 **Table 2** and **Table 3**, for Murragamba and 'Eastern' Creeks, respectively.

Design water surface profiles for the 100 year recurrence flood are presented in **Figures A3** and **A4** 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 A3



PREDICTED DESIGN 100 YEAR ARI FLOODWATER SURFACE PROFILE FOR MURRAGAMBA CREEK

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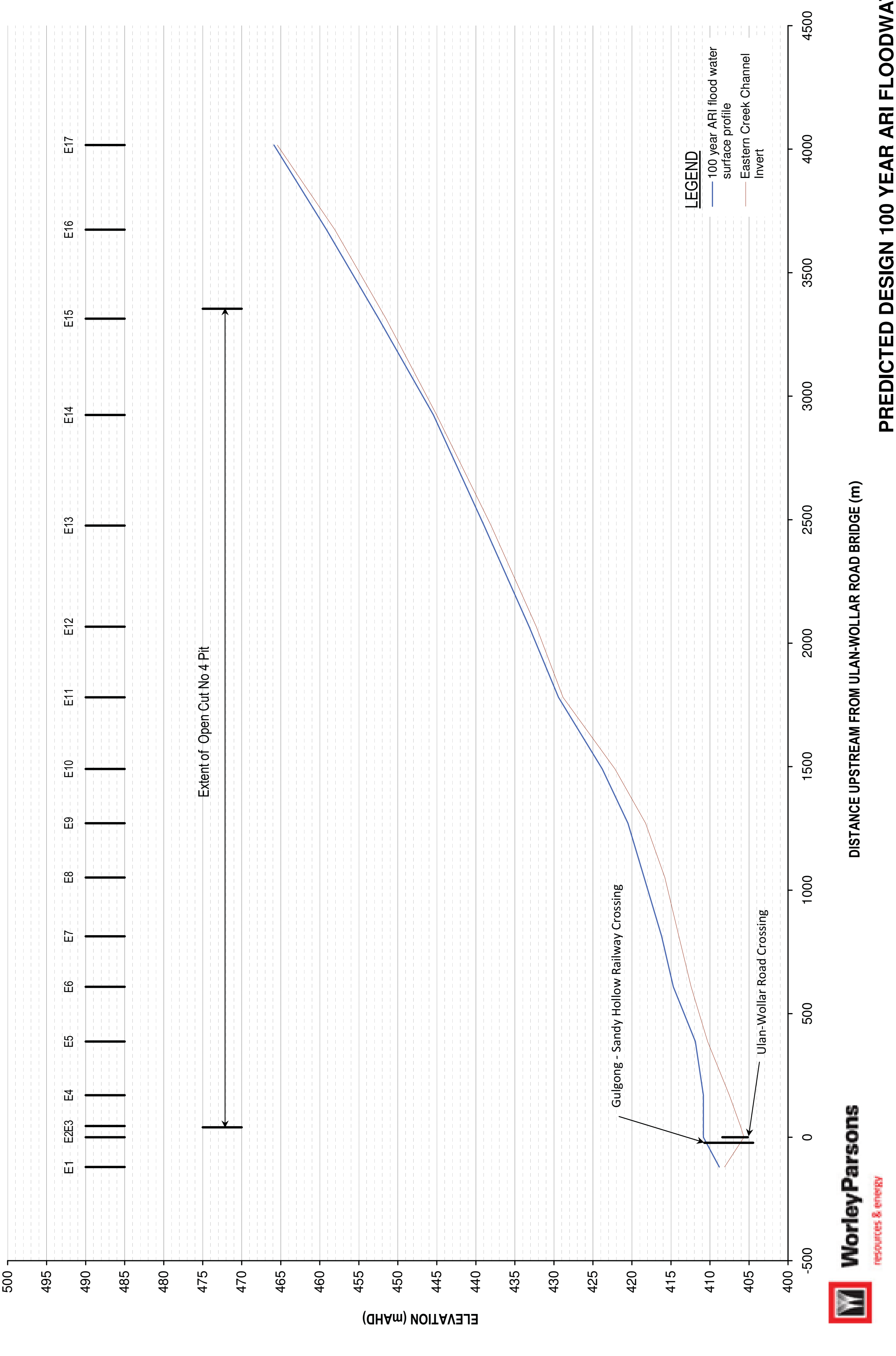
FIGURE A4



PREDICTED DESIGN 100 YEAR ARI FLOODWATER SURFACE PROFILE FOR EASTERN CREEK

rp6173_01 - MCM Creek Concept Design
figA4 - Eastern Existing WSP

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Table 2 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

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Table 3 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

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4. 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 **Table 2** and **Table 3** 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 2** *for cross-sections M3 to M7*).

The results listed in **Table 2** 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 high velocity is a function of the steeper channel slope encountered in this location of the creek.

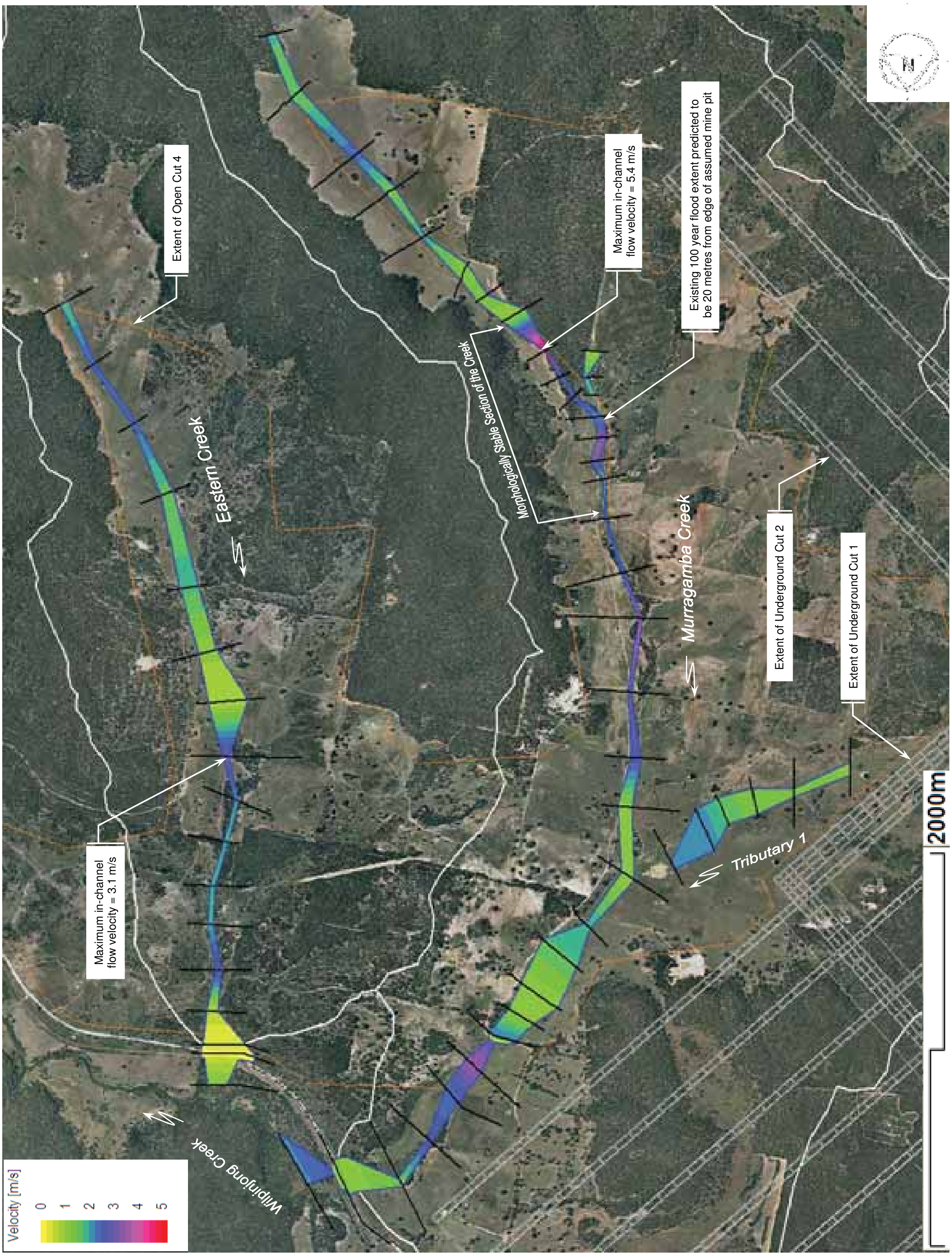
The proposed realignment of Murragamba Creek aims to retain the morphologically stable section of the creek as it is hydraulically stable due to the presence of bedrock along the channel base. With this in mind, it will be necessary to ensure that care is taken not to disturb this section of the creek and thereby ensure that the existing hydraulic conditions in this 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 A5**. 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 A3** and **A4**, 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 the body of the main report. 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 A3** and **A5**.

FIGURE A5



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

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rp6173_01 - MCM Creek Concept Design
fig A5 – Existing 100yr Flood Extent.doc

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As shown in **Figure A5**, 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.

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.

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Appendix B – ADOPTED RAFTS MODEL SUB-CATCHMENT PARAMETERS

APPENDIX B **RAFTS SUBCATCHMENT DATA**

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CATCHMENT SPECIFIC DATA

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

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

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LINK AND LAG SPECIFIC DATA

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**

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**

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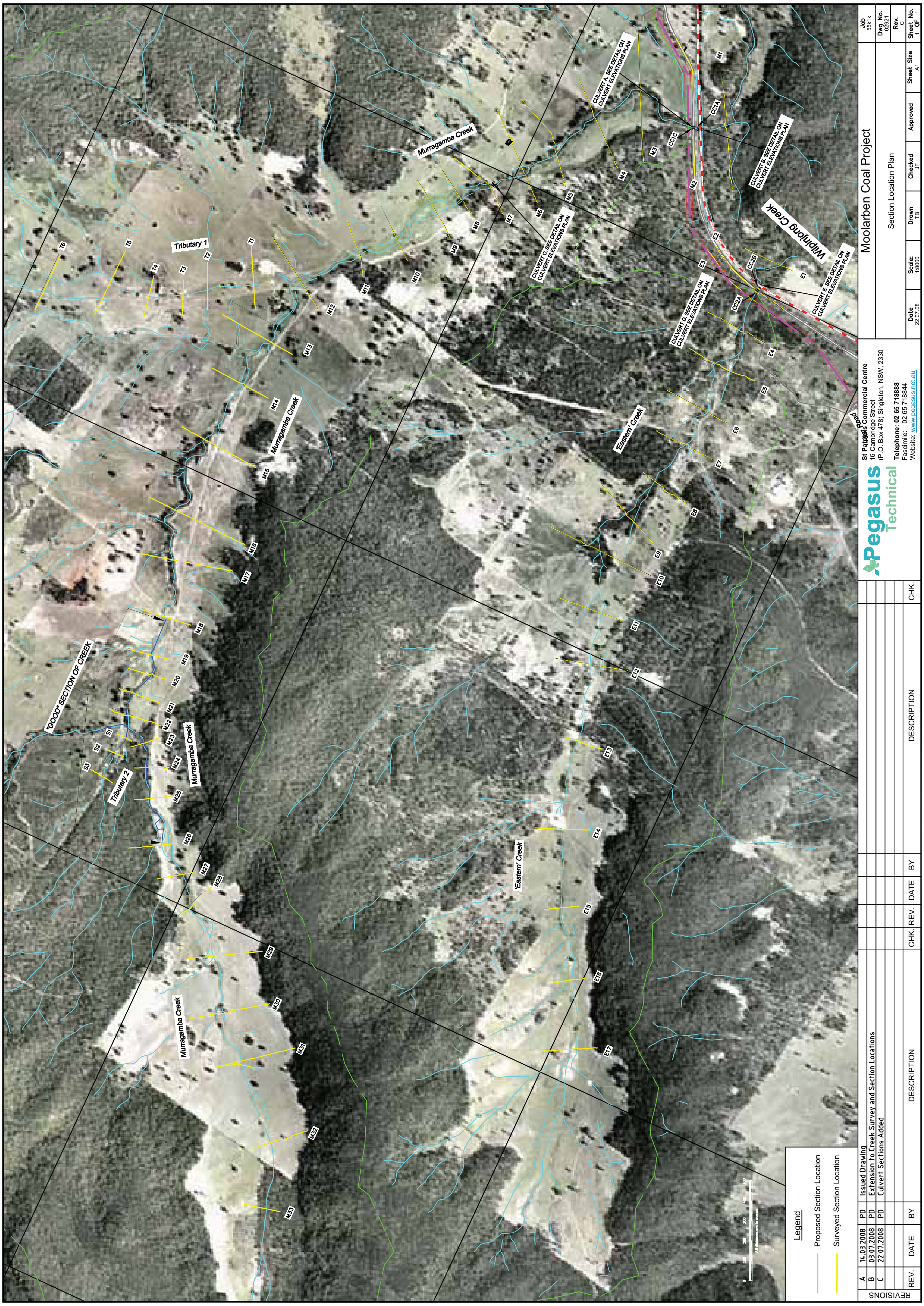
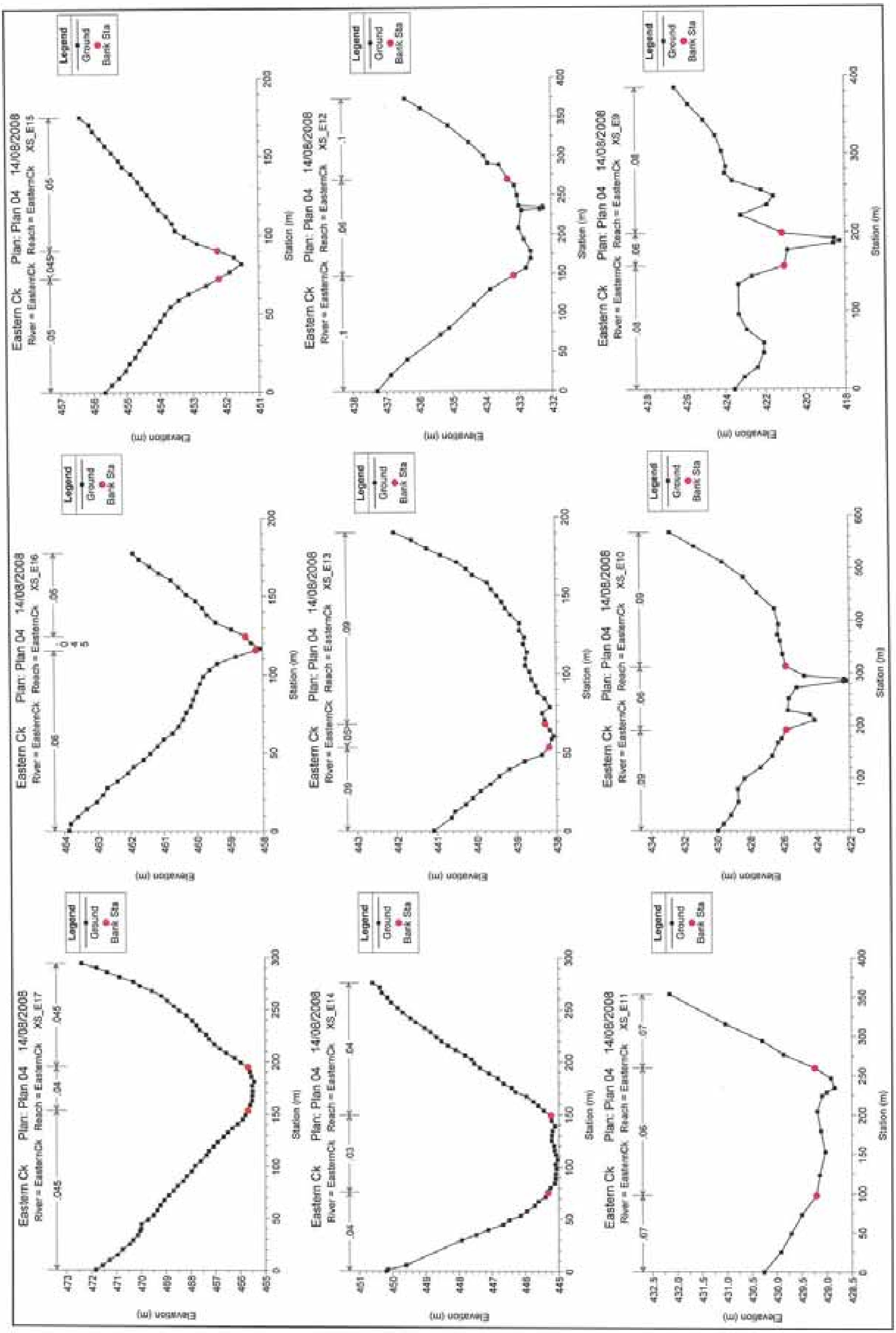
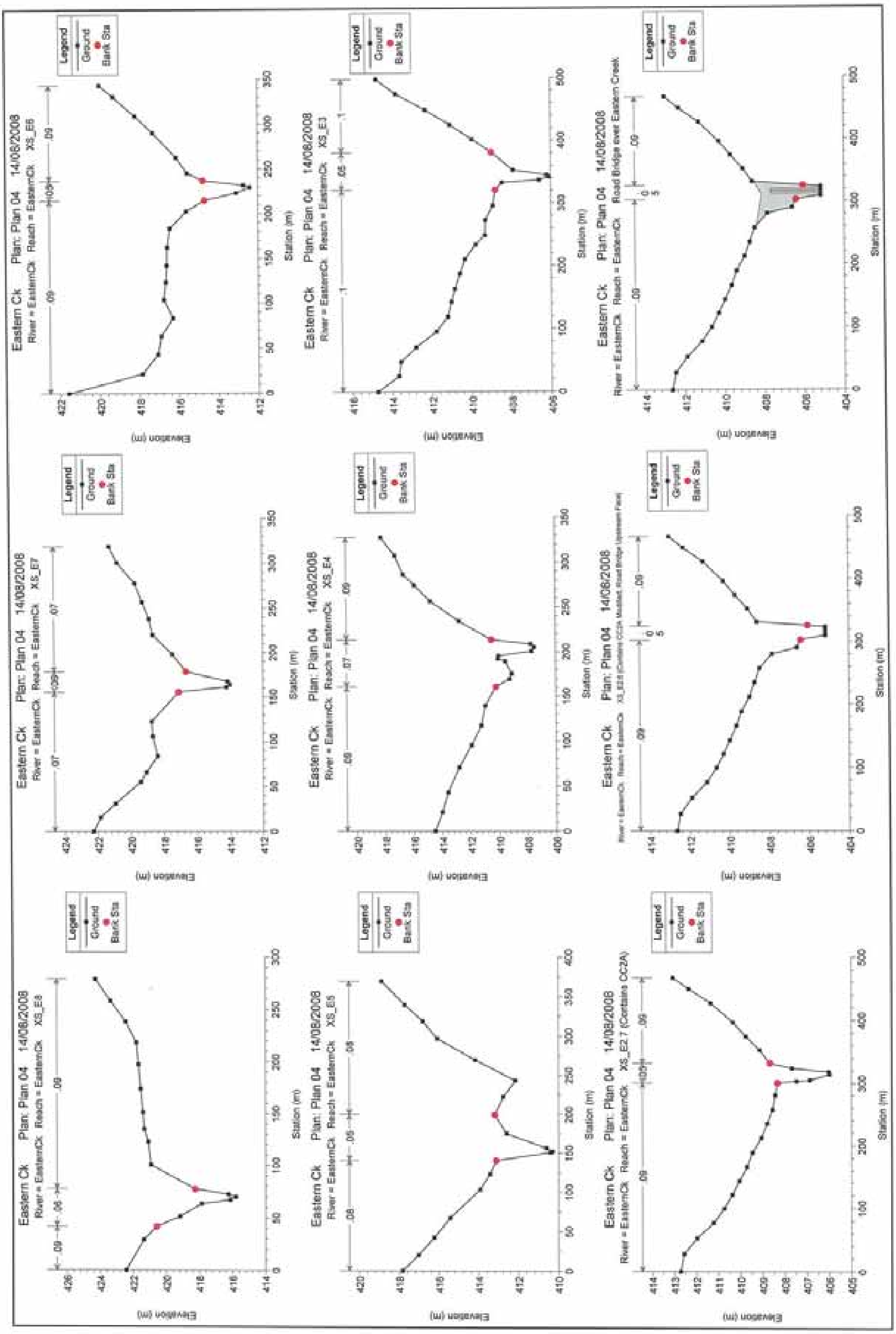
Appendix C – SURVEYED CROSS-SECTIONS OF MURRAGAMBA AND 'EASTERN' CREEKS


Moolarben Coal Project
Section Location Plan
Pegasus Technical
St Patricks Commercial Centre
16 Cambridge Street
(P.O. Box 478) Singleton, NSW, 2330
Telephone: 02 65 718888
Fascimile: 02 65 718844
Website: www.pegasus.net.au
Legend
Proposed Section Location
Surveyed Section Location
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.
Murragamba Creek
'Eastern' Creek
Wilpinjong Creek
Tributary 1
Tributary 2
"GOOD" SECTION OF CREEK


Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E17
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E16
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E15
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E14
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E13
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E12
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E11
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E10
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E9
Station (m)
Elevation (m)
Legend
Ground
Bank Sta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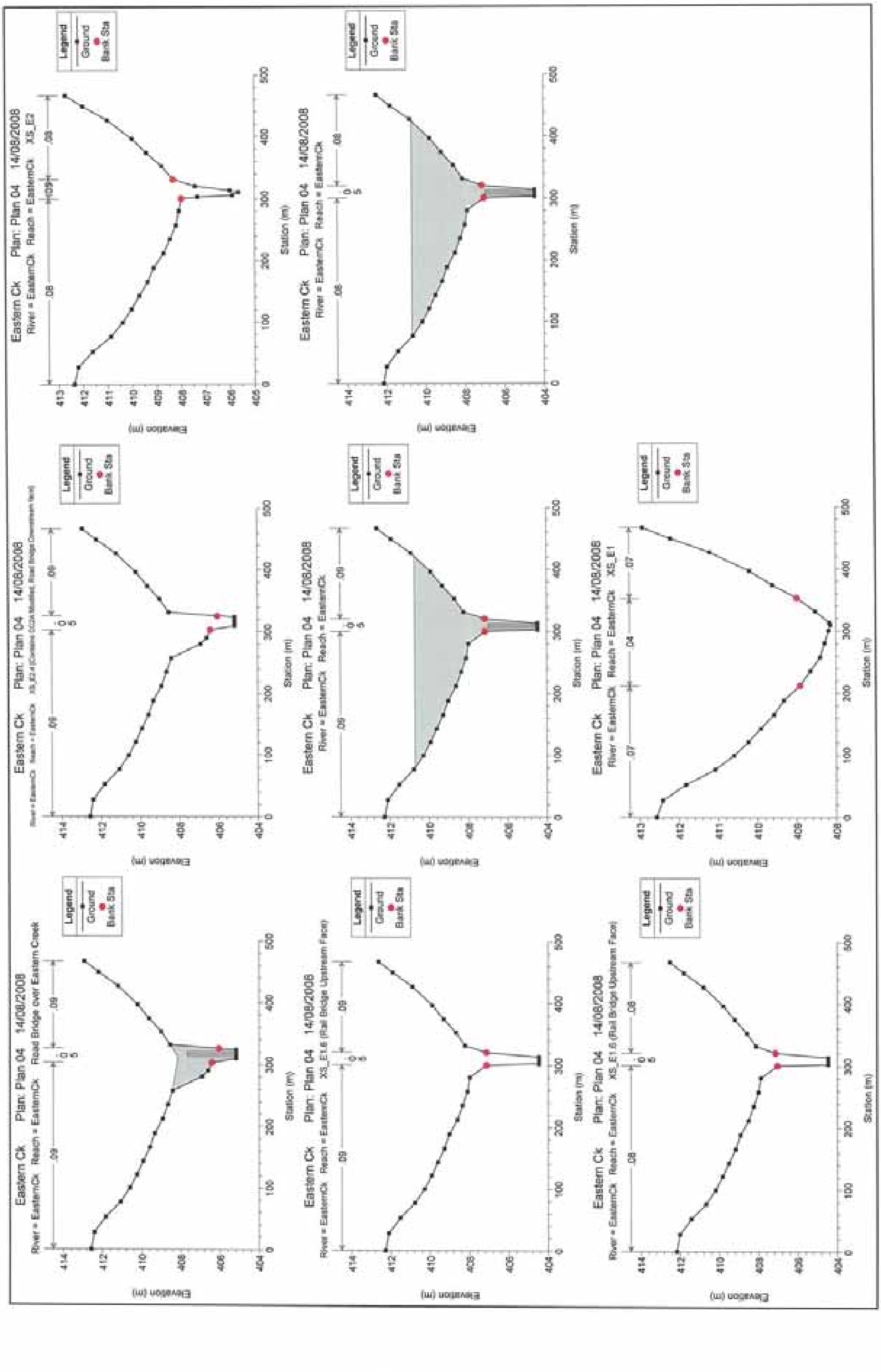
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E7
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E6
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E5
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E4
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E3
Eastern Ck Plan: Plan 04 14/08/2008
Road Bridge over Eastern Creek
Legend
Ground
Bank Sta
Station (m)
Elevation (m)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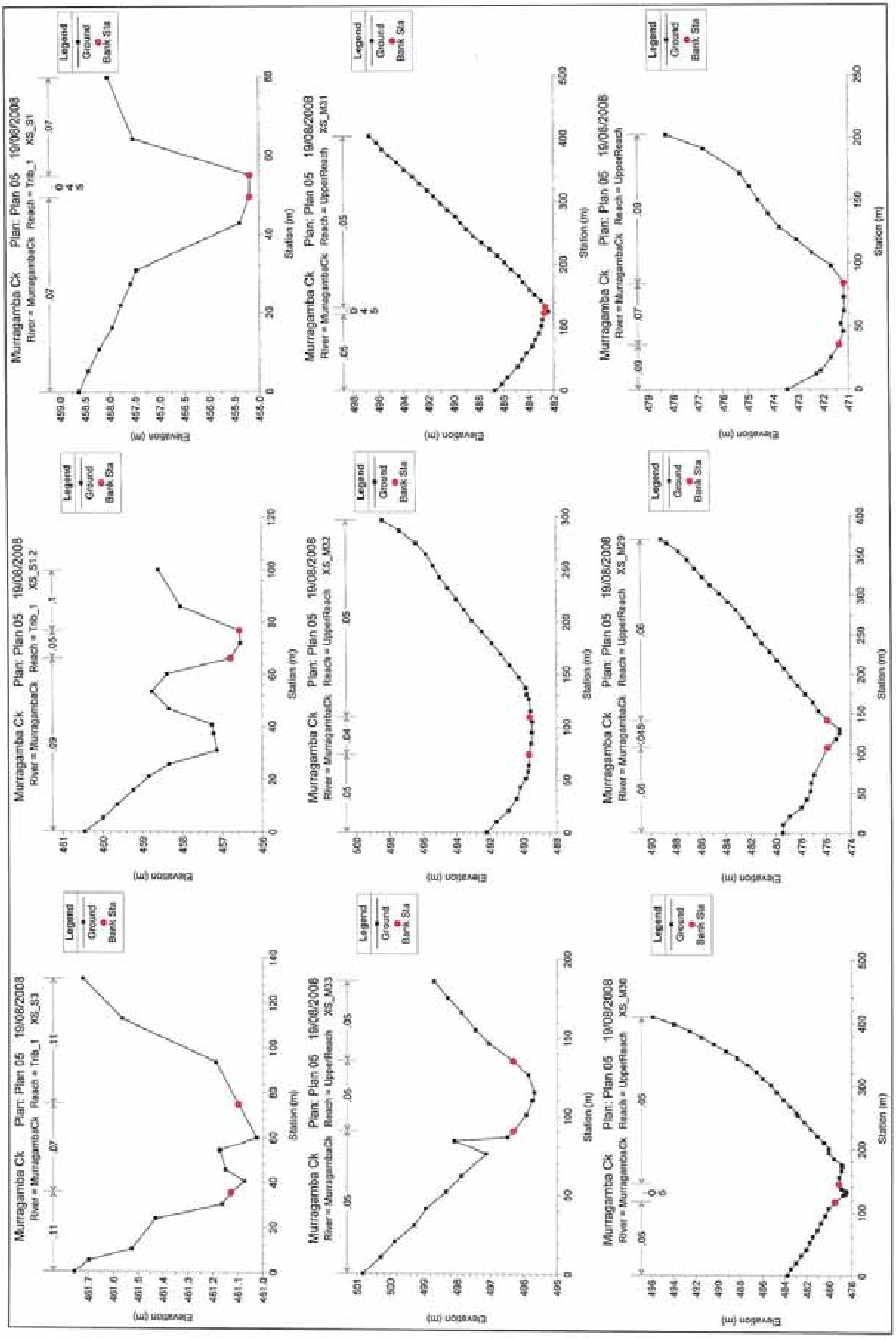
River = EasternCk Reach = EasternCk XS_E2
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E1
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk Road Bridge over Eastern Creek
Eastern Ck Plan: Plan 04 14/08/2008
River = EasternCk Reach = EasternCk XS_E1.6 (Rail Bridge Upstream Face)
Legend
Ground
Bank Sta
Station (m)
Elevation (m)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Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_1 XS_S3
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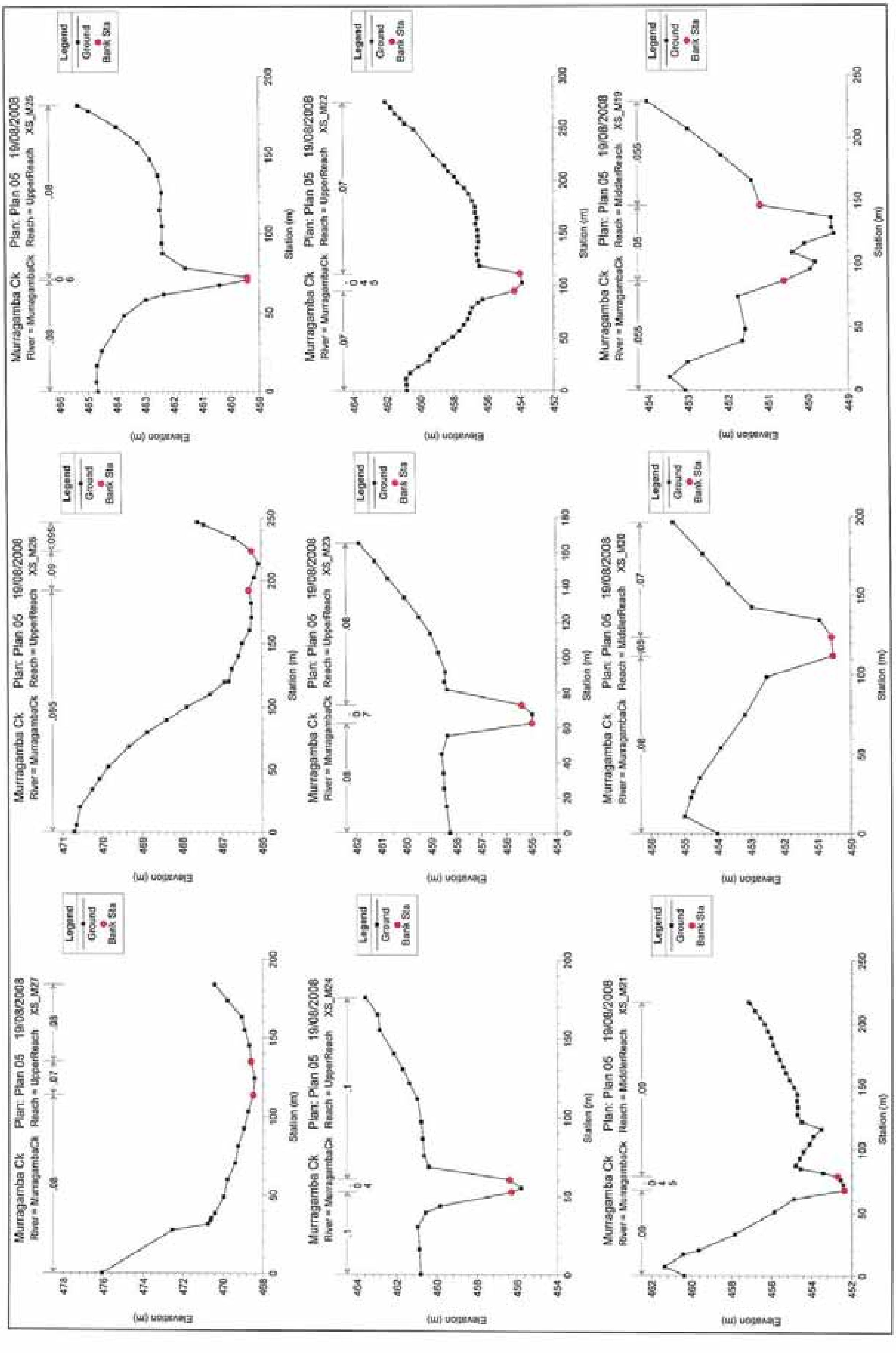
Legend
Ground
Bank Sta
Station (m)
Elevation (m)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Murragamba Ck Plan: Plan 05 19/08/2008
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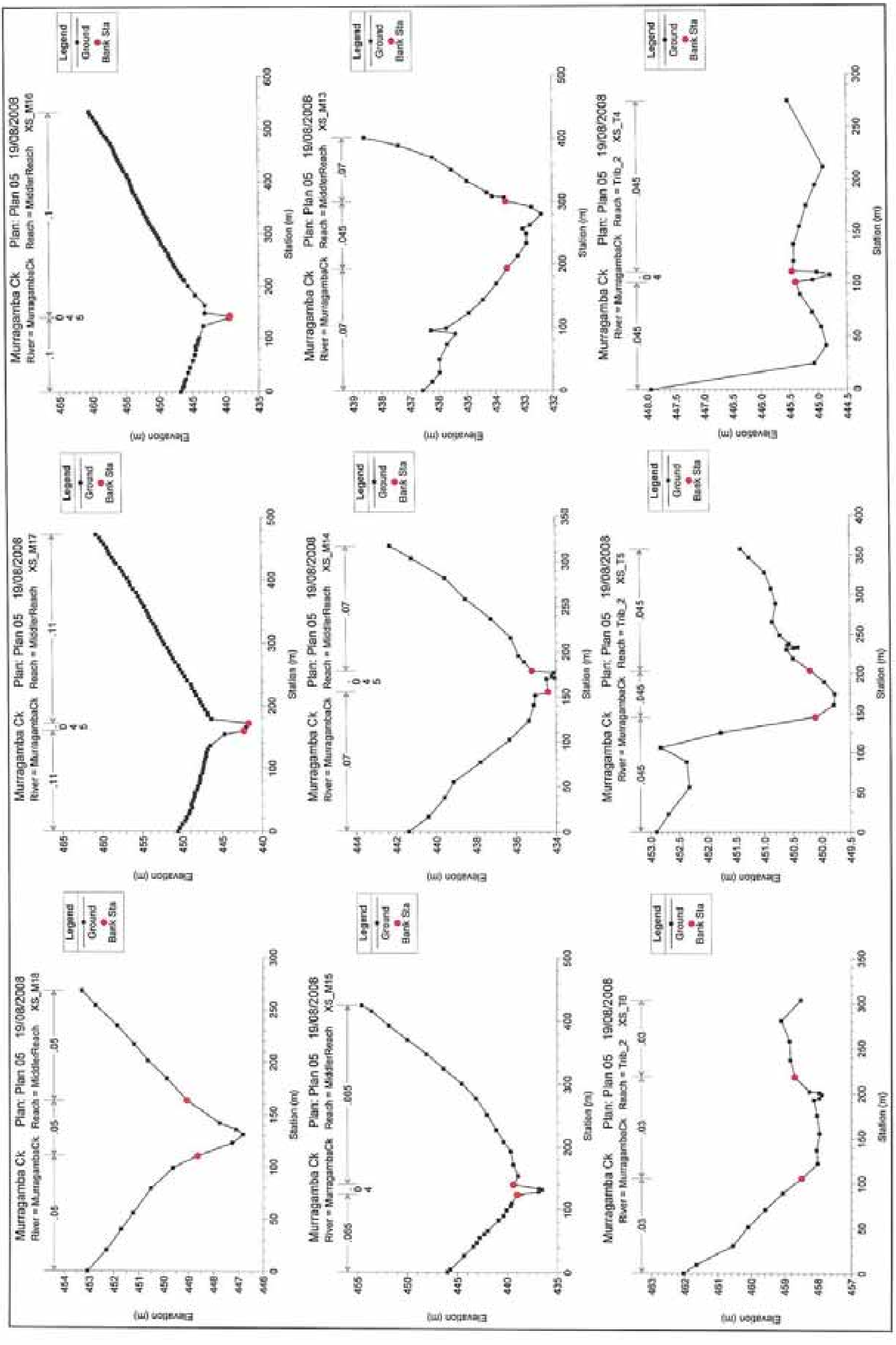
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = UpperReach XS_M22
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddleReach XS_M21
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddleReach XS_M20
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddleReach XS_M19
Legend
Ground
Bank Sta
Station (m)
Elevation (m)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Murragamba Ck Plan: Plan 05 19/08/2008
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Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddleReach XS_M18
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddleReach XS_M13
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = MiddleReach XS_M14
Murragamba Ck Plan: Plan 05 19/08/2008
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River = MurragambaCk Reach = Trib_2 XS_T4
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = Trib_2 XS_T5
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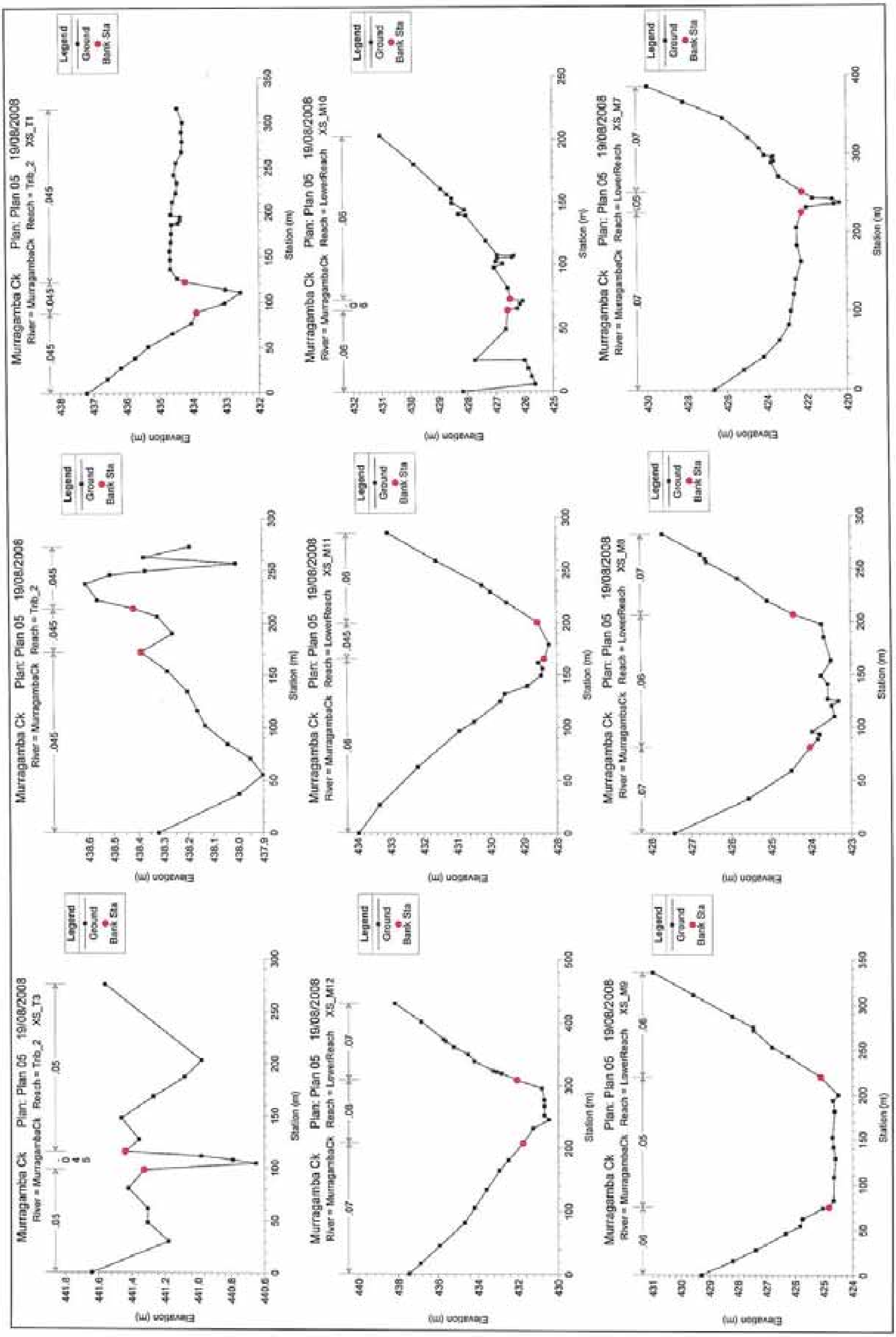
River = MurragambaCk Reach = Trib_2 XS_T6
Station (m)
Elevation (m)
Legend
Ground
Bank Sta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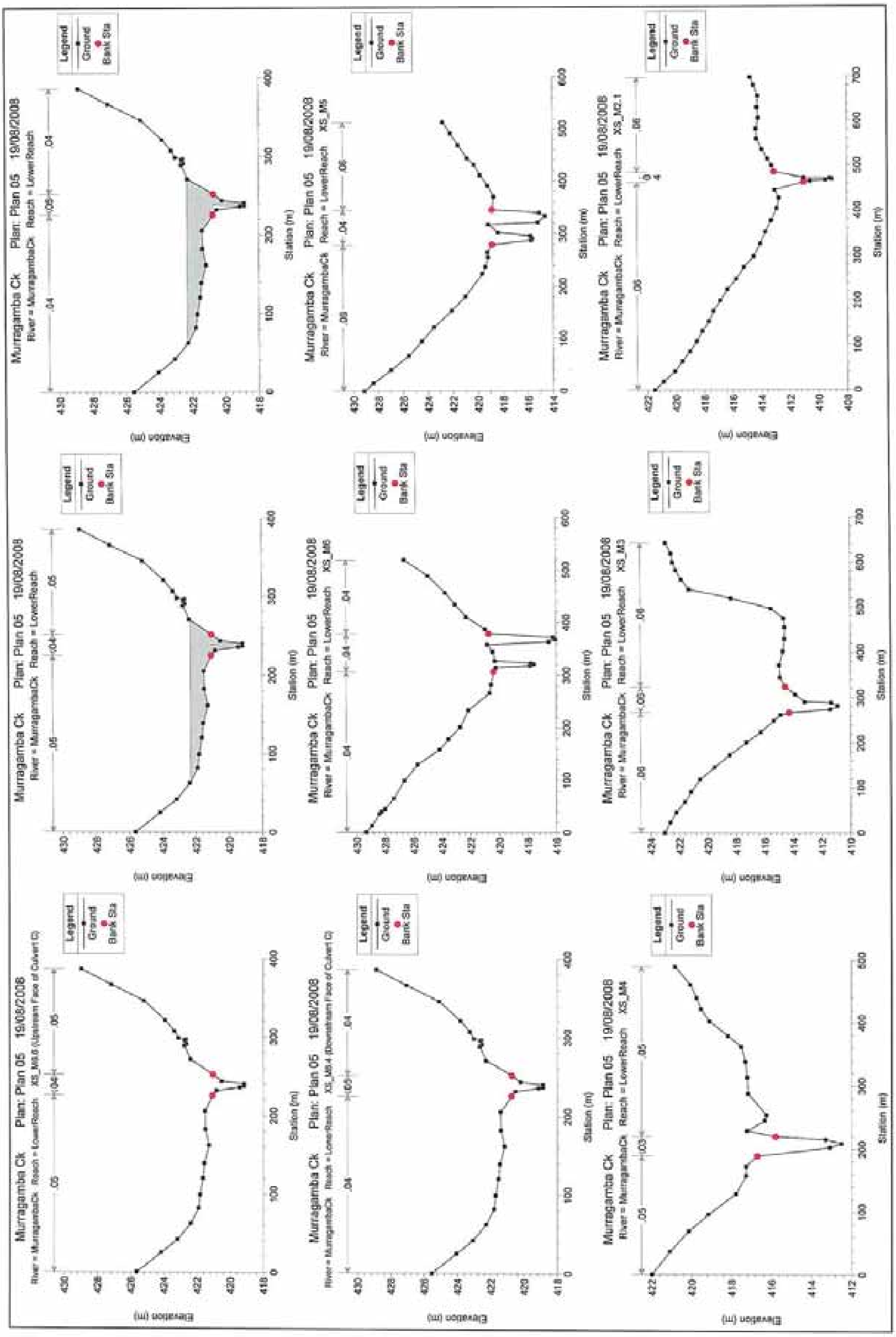
River = MurragambaCk Reach = Trib_2 XS_T3
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M12
Murragamba Ck Plan: Plan 05 19/08/2008
River = MurragambaCk Reach = LowerReach XS_M9
Legend
Ground
Bank Sta
Elevation (m)
Station (m)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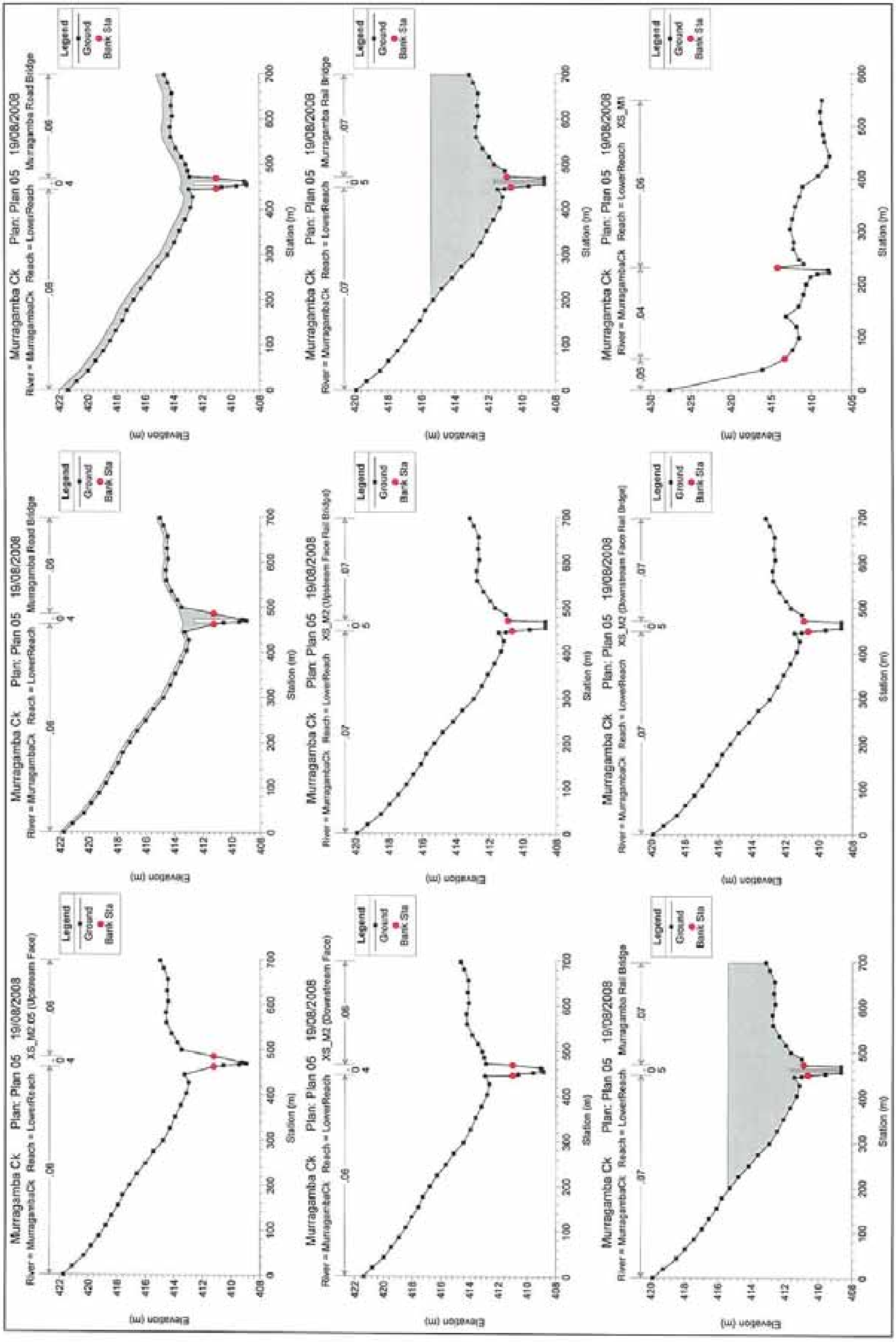
River = MurragambaCk Reach = LowerReach XS_M4
River = MurragambaCk Reach = LowerReach XS_M3
River = MurragambaCk Reach = LowerReach XS_M2.1
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


Murragamba Ck
Plan: Plan 05
19/08/2008
Legend
Ground
Bank Sta
Station (m)
Elevation (m)

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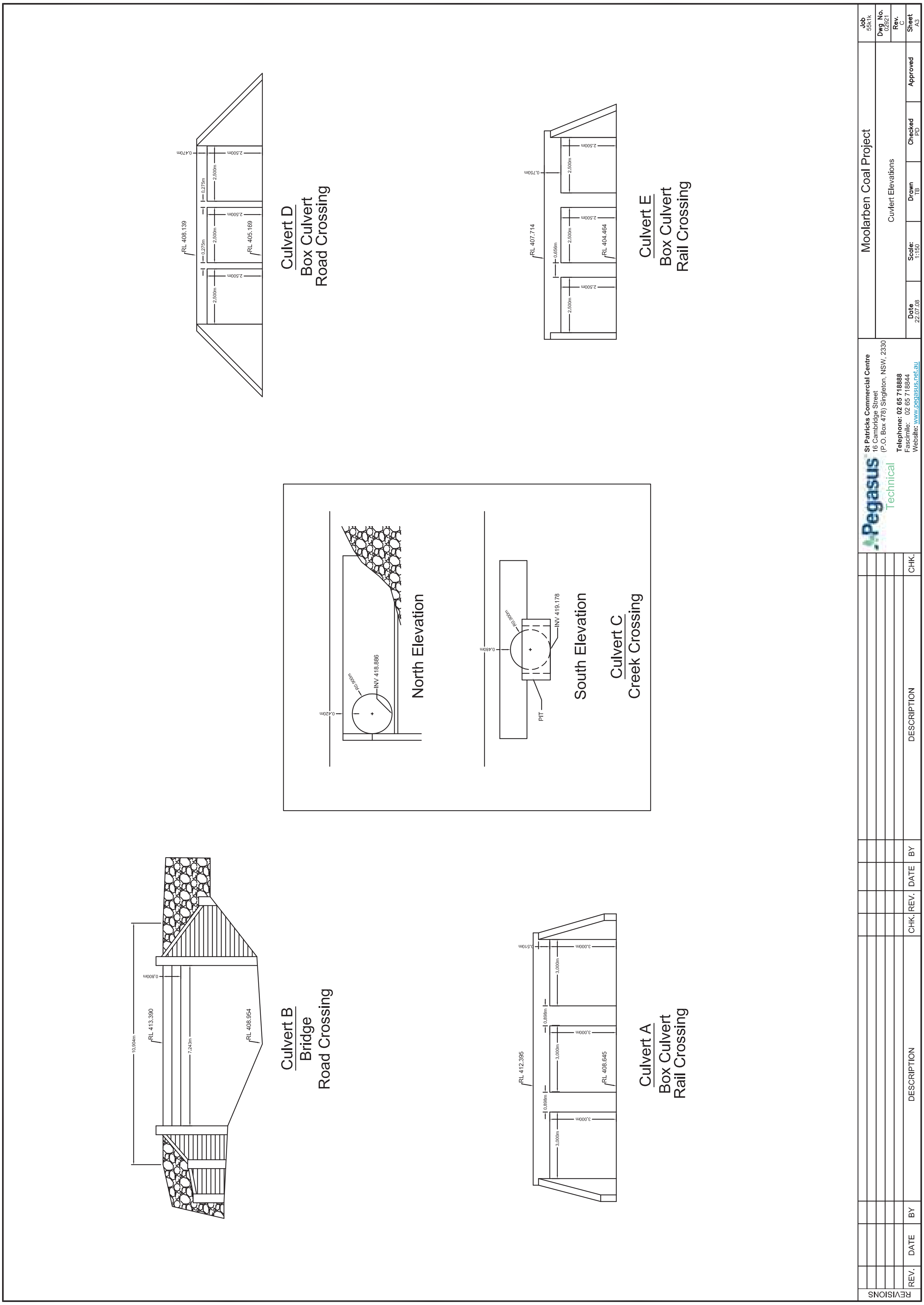
Appendix D – DETAILS OF BRIDGE CROSSINGS OF MURRAGAMBA AND 'EASTERN' CREEKS


Culvert D
Box Culvert
Road Crossing
RL 408.139
RL 405.169
Culvert E
Box Culvert
Rail Crossing
RL 407.714
RL 404.464
North Elevation
INV 418.886
South Elevation
INV 419.178
PIT
Culvert C
Creek Crossing
Culvert B
Bridge
Road Crossing
RL 413.390
RL 408.954
Culvert A
Box Culvert
Rail Crossing
RL 412.395
RL 408.645
Moolarben Coal Project
Culvert Elevations
Job 5541k
Dwg No. 02921
Rev. C
Sheet A3
Date 22.07.08
Scale: 1:150
Drawn TB
Checked PD
Approved
Pegasus Technical
St Patricks Commercial Centre
16 Cambridge Street
(P.O. Box 478) Singleton, NSW, 2330
Telephone: 02 65 718888
Fascimile: 02 65 718844
Website: www.pegasus.net.au
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DATE
BY
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MOOLARBEN COAL MINES PTY LTD

MOOLARBEN COAL PROJECT STAGE2 PPR
Concept Design For Proposed Diversions Of Murragamba & Eastern Creeks

Appendix E – HEC-RAS MODEL OUTPUT FOR EXISTING CONDITIONS

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Upper	M33	5 year	7.8		0.1		495.7	496.08	496.0	496.13	0.0		0.9		8.5	33.99	0.58
Upper	M33	20 year	14.0		0.1		495.7	496.19	496.1	496.25	0.0		1.1		12.4	38.99	0.64
Upper	M33	100 year	23.6	0.05	0.1	0.00	495.7	496.32	496.2	496.41	0.0	0.1	1.3	0.0	17.9	45.03	0.67
Upper	M33	200 year	28.7	0.05	0.1	0.05	495.7	496.36	496.3	496.47	0.0	0.2	1.5	0.2	19.5	46.42	0.71
Upper	M33	PMF	189.0	0.05	0.1	0.05	495.7	497.11	497.1	497.63	0.0	2.1	3.3	1.5	61.3	62.32	0.96
Upper	M32	5 year	7.8	0.05	0.0	0.05	489.5	489.67	489.7	489.74	0.0	0.2	1.2	0.6	7.6	65.94	0.93
Upper	M32	20 year	14.0	0.05	0.0	0.05	489.5	489.74	489.7	489.82	0.0	0.5	1.4	0.8	12.1	73.53	0.93
Upper	M32	100 year	23.6	0.05	0.0	0.05	489.5	489.81	489.8	489.92	0.0	0.7	1.7	0.9	17.6	83	0.97
Upper	M32	200 year	28.7	0.05	0.0	0.05	489.5	489.85	489.9	489.97	0.0	0.8	1.7	1.0	21.0	86.78	0.94
Upper	M32	PMF	189.0	0.05	0.0	0.05	489.5	490.43	490.4	490.77	0.0	1.7	3.1	1.9	81.2	120.1	1.03
Upper	M31	5 year	7.8	0.05	0.0	0.05	482.4	482.99		483.05	0.0	0.5	1.2	0.6	9.1	43.48	0.58
Upper	M31	20 year	14.0	0.05	0.0	0.05	482.4	483.11		483.18	0.0	0.6	1.4	0.7	15.0	52.67	0.59
Upper	M31	100 year	23.6	0.05	0.0	0.05	482.4	483.21		483.30	0.0	0.9	1.7	0.9	20.2	58	0.68
Upper	M31	200 year	28.7	0.05	0.0	0.05	482.4	483.25		483.36	0.0	1.0	1.9	1.0	22.7	60.08	0.72
Upper	M31	PMF	189.0	0.05	0.0	0.05	482.4	484.10		484.35	0.0	1.9	3.1	1.7	93.5	103.38	0.78
Upper	M30	5 year	7.8		0.1	0.05	478.4	479.01	479.0	479.09	0.0		1.4	0.8	6.3	34.27	0.89
Upper	M30	20 year	14.0		0.1	0.05	478.4	479.09	479.1	479.21	0.0		1.6	1.1	9.7	43.17	0.97
Upper	M30	100 year	23.6		0.1	0.05	478.4	479.23	479.2	479.33	0.0		1.6	1.1	17.3	59.72	0.82
Upper	M30	200 year	28.7		0.1	0.05	478.4	479.28	479.2	479.39	0.0		1.6	1.2	20.4	61.2	0.79
Upper	M30	PMF	189.0	0.05	0.1	0.05	478.4	479.95	480.0	480.36	0.0	1.2	3.1	2.6	68.0	83.59	0.98
Upper	M29	5 year	7.8		0.0		474.9	475.51	475.3	475.55	0.0		0.8		9.6	24.38	0.41
Upper	M29	20 year	14.0		0.0		474.9	475.66	475.4	475.72	0.0		1.0		13.5	28.22	0.48
Upper	M29	100 year	23.6		0.0		474.9	475.81	475.6	475.90	0.0		1.3		18.1	32.09	0.56
Upper	M29	200 year	28.7	0.06	0.0	0.00	474.9	475.88	475.7	475.98	0.0	0.1	1.4	0.0	20.4	34.13	0.58
Upper	M29	PMF	189.0	0.06	0.0	0.06	474.9	477.17	476.8	477.41	0.0	0.9	2.4	0.8	106.7	103.83	0.56
Upper	M28	5 year	20.7	0.09	0.1	0.09	471.2	471.57	471.5	471.63	0.0	0.4	1.1	0.6	20.4	66.6	0.58
Upper	M28	20 year	33.1	0.09	0.1	0.09	471.2	471.70	471.6	471.77	0.0	0.5	1.3	0.7	28.9	73.73	0.59
Upper	M28	100 year	52.6	0.09	0.1	0.09	471.2	471.86	471.7	471.96	0.0	0.6	1.4	0.8	41.9	80.2	0.57
Upper	M28	200 year	62.3	0.09	0.1	0.09	471.2	471.93	471.7	472.04	0.0	0.7	1.5	0.8	47.5	82.84	0.57
Upper	M28	PMF	482.0	0.09	0.1	0.09	471.2	473.29		473.71	0.0	1.8	3.3	1.8	186.9	120.81	0.73

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Upper	M27	5 year	20.7	0.08	0.1	0.08	468.4	469.05	468.9	469.09	0.0	0.6	1.0	0.5	27.3	74.69	0.43
Upper	M27	20 year	33.1	0.08	0.1	0.08	468.4	469.18	469.0	469.23	0.0	0.7	1.2	0.7	37.2	81.47	0.46
Upper	M27	100 year	52.6	0.08	0.1	0.08	468.4	469.32	469.1	469.39	0.0	0.8	1.5	0.9	49.4	92.14	0.51
Upper	M27	200 year	62.3	0.08	0.1	0.08	468.4	469.38	469.2	469.47	0.0	0.8	1.6	1.0	55.6	97.7	0.52
Upper	M27	PMF	482.0	0.08	0.1	0.08	468.4	470.83		471.06	0.0	1.7	2.8	1.9	244.6	152.52	0.57
Upper	M26	5 year	20.7	0.10	0.1	0.10	466.1	466.62	466.5	466.65	0.0	0.6	0.8	0.4	30.4	95.28	0.40
Upper	M26	20 year	33.1	0.10	0.1	0.10	466.1	466.75	466.5	466.78	0.0	0.7	0.9	0.5	43.3	105.37	0.40
Upper	M26	100 year	52.6	0.10	0.1	0.10	466.1	466.93	466.6	466.97	0.0	0.7	1.0	0.6	63.7	117.95	0.38
Upper	M26	200 year	62.3	0.10	0.1	0.10	466.1	467.00	466.7	467.04	0.0	0.8	1.1	0.7	71.9	120.63	0.38
Upper	M26	PMF	482.0	0.10	0.1	0.10	466.1	468.33	467.6	468.52	0.0	1.7	2.3	1.6	261.2	156.48	0.49
Upper	M25	5 year	20.7	0.08	0.1	0.08	459.4	460.85	460.9	461.28	0.0	1.8	3.8	1.7	8.8	10.36	1.02
Upper	M25	20 year	33.1	0.08	0.1	0.08	459.4	461.20	461.2	461.72	0.0	2.1	4.4	2.0	12.8	12.35	1.04
Upper	M25	100 year	52.6	0.08	0.1	0.08	459.4	461.57	461.6	462.25	0.0	2.4	5.2	2.3	17.7	14.41	1.12
Upper	M25	200 year	62.3	0.08	0.1	0.08	459.4	461.80	461.8	462.50	0.0	2.5	5.4	2.1	21.4	17.72	1.11
Upper	M25	PMF	482.0	0.08	0.1	0.08	459.4	464.03	463.8	464.49	0.0	2.1	6.4	2.3	198.3	128.28	0.95
Upper	M24	5 year	20.7	0.10	0.0	0.10	455.8	457.23		457.45	0.0	0.5	2.1	0.4	11.2	12.03	0.63
Upper	M24	20 year	33.1	0.10	0.0	0.10	455.8	457.57		457.89	0.0	0.6	2.6	0.5	15.5	13.52	0.68
Upper	M24	100 year	52.6	0.10	0.0	0.10	455.8	457.97		458.44	0.0	0.7	3.2	0.7	21.3	15.31	0.73
Upper	M24	200 year	62.3	0.10	0.0	0.10	455.8	458.14		458.68	0.0	0.8	3.4	0.7	23.9	16.04	0.76
Upper	M24	PMF	482.0	0.10	0.0	0.10	455.8	462.32	462.3	463.23	0.0	1.0	5.5	0.8	275.3	143.4	0.70
Upper	M23	5 year	20.7	0.08	0.1	0.08	455.0	456.05		456.22	0.0	1.0	1.9	0.8	12.1	14.64	0.60
Upper	M23	20 year	33.1	0.08	0.1	0.08	455.0	456.31		456.56	0.0	1.2	2.3	1.0	16.0	15.93	0.66
Upper	M23	100 year	52.6	0.08	0.1	0.08	455.0	456.66		457.00	0.0	1.5	2.7	1.3	21.8	17.66	0.69
Upper	M23	200 year	62.3	0.08	0.1	0.08	455.0	456.81		457.19	0.0	1.6	2.9	1.4	24.7	18.45	0.70
Upper	M23	PMF	482.0	0.08	0.1	0.08	455.0	459.22	458.3	460.51	0.0	2.1	6.4	2.0	143.3	117.57	1.00
Upper	M22	5 year	20.7	0.07	0.0	0.07	453.9	454.89	454.6	454.98	0.0	0.4	1.4	0.5	16.3	21.48	0.47
Upper	M22	20 year	33.1	0.07	0.0	0.07	453.9	455.18		455.30	0.0	0.5	1.6	0.6	22.9	23.61	0.48
Upper	M22	100 year	52.6	0.07	0.0	0.07	453.9	455.51		455.69	0.0	0.7	2.0	0.8	31.2	26.07	0.51
Upper	M22	200 year	62.3	0.07	0.0	0.07	453.9	455.64		455.85	0.0	0.7	2.1	0.8	34.5	27.01	0.53
Upper	M22	PMF	482.0	0.07	0.0	0.07	453.9	457.83		458.46	0.0	1.3	4.5	1.3	216.5	147.11	0.73

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Trib_2	S3	5 year	4.7	0.11	0.1	0.11	461.0	461.21	461.2	461.25	0.1	0.4	0.9	0.4	6.1	65.72	0.88
Trib_2	S3	20 year	8.6	0.11	0.1	0.11	461.0	461.27	461.3	461.32	0.1	0.5	1.1	0.5	9.9	70.04	0.82
Trib_2	S3	100 year	14.3	0.11	0.1	0.11	461.0	461.32	461.3	461.39	0.1	0.6	1.3	0.6	13.5	73.83	0.89
Trib_2	S3	200 year	17.2	0.11	0.1	0.11	461.0	461.33	461.3	461.42	0.1	0.7	1.5	0.7	14.3	74.62	1.00
Trib_2	S3	PMF	114.4	0.11	0.1	0.11	461.0	461.82	461.8	462.05	0.1	1.0	2.6	1.2	65.7	130.82	0.97
Trib_2	S2	5 year	4.7	0.09	0.1	0.10	456.5	456.94	456.9	457.02	0.0	0.3	1.3	0.4	3.9	13.5	0.73
Trib_2	S2	20 year	8.6	0.09	0.1	0.10	456.5	457.06	457.0	457.20	0.0	0.4	1.7	0.6	5.7	14.75	0.81
Trib_2	S2	100 year	14.3	0.09	0.1	0.10	456.5	457.23	457.2	457.42	0.0	0.4	2.0	0.7	8.8	25.18	0.81
Trib_2	S2	200 year	17.2	0.09	0.1	0.10	456.5	457.32	457.3	457.51	0.0	0.4	2.1	0.7	11.1	28.36	0.78
Trib_2	S2	PMF	114.4	0.09	0.1	0.10	456.5	458.65		458.98	0.0	1.0	3.2	0.8	71.4	73.74	0.72
Trib_2	S1	5 year	4.7	0.07	0.0	0.07	455.2	455.61	455.5	455.67	0.0	0.6	1.3	0.5	5.1	15.21	0.62
Trib_2	S1	20 year	8.6	0.07	0.0	0.07	455.2	455.80	455.6	455.88	0.0	0.8	1.5	0.6	8.0	17	0.62
Trib_2	S1	100 year	14.3	0.07	0.0	0.07	455.2	455.97	455.8	456.09	0.0	1.0	1.9	0.8	11.1	18.71	0.67
Trib_2	S1	200 year	17.2	0.07	0.0	0.07	455.2	456.03	455.9	456.17	0.0	1.1	2.1	0.8	12.2	19.25	0.72
Trib_2	S1	PMF	114.4	0.07	0.0	0.07	455.2	457.97		458.24	0.0	1.2	3.3	0.9	73.7	62.3	0.63
Middle	M21	5 year	24.0	0.09	0.0	0.09	452.4	453.25	453.2	453.60	0.0	0.9	2.7	0.7	10.1	15.47	0.97
Middle	M21	20 year	38.6	0.09	0.0	0.09	452.4	453.52	453.5	453.99	0.0	1.0	3.1	0.8	14.4	17.26	0.98
Middle	M21	100 year	60.3	0.09	0.0	0.09	452.4	453.89	453.9	454.44	0.0	1.1	3.5	0.8	22.6	27.01	0.94
Middle	M21	200 year	70.5	0.09	0.0	0.09	452.4	454.05	454.1	454.62	0.0	1.1	3.6	0.8	27.6	33.88	0.90
Middle	M21	PMF	555.0	0.09	0.0	0.09	452.4	456.42	456.4	457.17	0.0	1.4	5.6	1.5	259.1	155.46	0.90
Middle	M20	5 year	24.0	0.08	0.1	0.07	450.5	451.20	451.2	451.39	0.0	0.9	2.2	1.2	14.2	28.14	0.87
Middle	M20	20 year	38.6	0.08	0.1	0.07	450.5	451.36	451.3	451.64	0.0	1.1	2.7	1.5	18.9	29.85	0.95
Middle	M20	100 year	60.3	0.08	0.1	0.07	450.5	451.55	451.6	451.95	0.0	1.3	3.3	1.9	24.7	31.84	1.04
Middle	M20	200 year	70.5	0.08	0.1	0.07	450.5	451.65	451.7	452.08	0.0	1.4	3.4	2.0	27.8	32.87	1.04
Middle	M20	PMF	555.0	0.08	0.1	0.07	450.5	454.24	454.2	455.06	0.0	1.7	5.6	2.2	203.4	130.81	0.93
Middle	M19	5 year	24.0		0.1		449.3	450.32	450.0	450.37	0.0		1.0		24.9	49.2	0.43
Middle	M19	20 year	38.6		0.1		449.3	450.51		450.57	0.0		1.1		34.7	54.83	0.45
Middle	M19	100 year	60.3	0.06	0.1		449.3	450.72		450.80	0.0	0.2	1.3		46.5	58.44	0.46
Middle	M19	200 year	70.5	0.06	0.1		449.3	450.80		450.90	0.0	0.3	1.4		51.4	59.78	0.47
Middle	M19	PMF	555.0	0.06	0.1	0.06	449.3	452.23		452.75	0.0	1.4	3.4	1.4	200.0	156.64	0.73

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Middle	M18	5 year	26.3		0.1		446.8	447.69	447.7	447.95	0.0		2.3		11.7	22.45	1.00
Middle	M18	20 year	42.3		0.1		446.8	447.91	447.9	448.22	0.0		2.5		17.0	27.48	1.01
Middle	M18	100 year	66.0		0.1		446.8	448.16	448.2	448.52	0.0		2.7		24.6	33.67	1.00
Middle	M18	200 year	77.3		0.1		446.8	448.25	448.3	448.64	0.0		2.8		28.0	36.08	1.00
Middle	M18	PMF	561.0	0.05	0.1	0.05	446.8	450.63		451.10	0.0	1.4	3.2	1.4	207.8	126.83	0.62
Middle	M17	5 year	26.3	0.11	0.0	0.11	441.7	443.06	442.8	443.26	0.0	0.4	2.0	0.5	14.7	15.5	0.62
Middle	M17	20 year	42.3	0.11	0.0	0.11	441.7	443.48		443.74	0.0	0.5	2.3	0.6	21.6	17.13	0.60
Middle	M17	100 year	66.0	0.11	0.0	0.11	441.7	444.01		444.33	0.0	0.6	2.6	0.6	31.2	19.2	0.58
Middle	M17	200 year	77.3	0.11	0.0	0.11	441.7	444.23		444.58	0.0	0.6	2.7	0.7	35.5	20.04	0.58
Middle	M17	PMF	561.0	0.11	0.0	0.11	441.7	448.26	448.3	449.32	0.0	0.8	5.4	0.8	276.8	154.63	0.69
Middle	M16	5 year	26.3	0.10	0.0	0.10	439.3	441.17	440.9	441.52	0.0	0.8	3.0	0.7	15.2	13.22	0.70
Middle	M16	20 year	42.3	0.10	0.0	0.10	439.3	441.67	441.3	442.12	0.0	1.0	3.5	0.9	22.5	15.9	0.73
Middle	M16	100 year	66.0	0.10	0.0	0.10	439.3	442.20		442.79	0.0	1.1	4.2	1.0	31.6	18.73	0.79
Middle	M16	200 year	77.3	0.10	0.0	0.10	439.3	442.43		443.06	0.0	1.2	4.4	1.1	36.1	20	0.79
Middle	M16	PMF	561.0	0.10	0.0	0.10	439.3	445.74	445.7	446.54	0.0	1.3	7.1	1.4	321.8	172.33	0.89
Middle	M15	5 year	26.3		0.0		436.5	438.16	437.9	438.41	0.0		2.2		11.7	11.23	0.70
Middle	M15	20 year	42.3		0.0		436.5	438.52	438.3	438.87	0.0		2.6		16.1	12.88	0.75
Middle	M15	100 year	66.0		0.0	0.07	436.5	438.98	438.7	439.42	0.0		2.9	0.2	22.6	19.59	0.76
Middle	M15	200 year	77.3	0.07	0.0	0.07	436.5	439.11	438.9	439.61	0.0	0.2	3.2	0.3	25.9	31.18	0.80
Middle	M15	PMF	561.0	0.07	0.0	0.07	436.5	441.07	441.1	441.79	0.0	1.6	5.1	1.7	223.0	146.4	0.86
Middle	M14	5 year	26.3	0.07	0.0		434.1	435.00		435.15	0.0	0.7	1.8		15.8	26.71	0.70
Middle	M14	20 year	42.3	0.07	0.0		434.1	435.20	435.0	435.41	0.0	0.5	2.1		22.9	44.74	0.74
Middle	M14	100 year	66.0	0.07	0.0	0.07	434.1	435.36	435.4	435.68	0.0	0.7	2.6	0.3	31.6	59.87	0.84
Middle	M14	200 year	77.3	0.07	0.0	0.07	434.1	435.45	435.5	435.78	0.0	0.8	2.7	0.4	36.9	64.04	0.84
Middle	M14	PMF	561.0	0.07	0.0	0.07	434.1	437.01	437.0	437.73	0.0	2.0	4.8	1.6	202.4	141.7	0.95
Middle	M13	5 year	29.5		0.0		432.4	433.25	433.0	433.28	0.0		0.9		34.7	86.28	0.43
Middle	M13	20 year	47.4		0.0		432.4	433.38	433.1	433.43	0.0		1.0		46.9	94.54	0.46
Middle	M13	100 year	73.8	0.00	0.0		432.4	433.59	433.3	433.65	0.0	0.0	1.1		67.5	107.05	0.44
Middle	M13	200 year	86.3	0.07	0.0	0.07	432.4	433.65	433.3	433.72	0.0	0.1	1.2	0.1	74.9	115.47	0.44
Middle	M13	PMF	720.0	0.07	0.0	0.07	432.4	435.64		435.83	0.0	0.8	2.1	0.7	450.0	268.28	0.41

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Trib_1	T6	5 year	3.9		0.0		457.9	458.07	458.1	458.10	0.0		0.8		4.9	72.07	0.97
Trib_1	T6	20 year	7.3		0.0		457.9	458.10	458.1	458.15	0.0		1.0		7.5	80.16	1.02
Trib_1	T6	100 year	11.9		0.0		457.9	458.14	458.1	458.20	0.0		1.1		10.5	83.91	1.02
Trib_1	T6	200 year	14.1		0.0		457.9	458.15	458.2	458.23	0.0		1.2		11.8	84.5	1.02
Trib_1	T6	PMF	62.3		0.0		457.9	458.40	458.4	458.57	0.0		1.9		33.7	98.55	1.01
Trib_1	T5	5 year	3.9		0.0		449.8	449.96	449.9	449.99	0.0		0.8		4.9	38.32	0.71
Trib_1	T5	20 year	7.3		0.0		449.8	450.01	450.0	450.07	0.0		1.0		7.2	44.23	0.80
Trib_1	T5	100 year	11.9		0.0		449.8	450.07	450.1	450.15	0.0		1.2		9.9	50.22	0.86
Trib_1	T5	200 year	14.1		0.0		449.8	450.10	450.1	450.18	0.0		1.2		11.4	53.27	0.85
Trib_1	T5	PMF	62.3	0.05	0.0	0.05	449.8	450.41	450.4	450.62	0.0	0.9	2.1	0.7	31.3	74.09	0.93
Trib_1	T4	5 year	3.9	0.05	0.0	0.05	444.8	445.01	445.0	445.05	0.0	0.8	1.0	0.6	5.3	67.07	0.96
Trib_1	T4	20 year	7.3	0.05	0.0	0.05	444.8	445.06	445.1	445.10	0.0	0.8	1.1	0.7	9.1	87.14	0.91
Trib_1	T4	100 year	11.9	0.05	0.0	0.05	444.8	445.11	445.1	445.15	0.0	0.9	1.2	0.7	13.3	102.61	0.90
Trib_1	T4	200 year	14.1	0.05	0.0	0.05	444.8	445.12	445.1	445.17	0.0	1.0	1.3	0.8	14.8	107.03	0.93
Trib_1	T4	PMF	62.3	0.05	0.0	0.05	444.8	445.32	445.3	445.44	0.0	1.6	2.0	1.3	42.0	175.9	1.10
Trib_1	T3	5 year	3.9		0.0	0.05	440.7	441.08	441.1	441.14	0.0		1.2	0.4	4.4	41.78	0.76
Trib_1	T3	20 year	7.3		0.0	0.05	440.7	441.15	441.2	441.22	0.0		1.4	0.6	7.7	57.6	0.82
Trib_1	T3	100 year	11.9	0.05	0.0	0.05	440.7	441.21	441.2	441.29	0.0	0.2	1.5	0.7	11.6	78.54	0.86
Trib_1	T3	200 year	14.1	0.05	0.0	0.05	440.7	441.24	441.2	441.31	0.0	0.3	1.5	0.8	13.9	90.87	0.84
Trib_1	T3	PMF	62.3	0.05	0.0	0.05	440.7	441.49	441.5	441.57	0.0	0.8	1.8	1.0	59.2	257.69	0.81
Trib_1	T2	5 year	3.9	0.05		0.05	438.3	438.08	438.0	438.10	0.0	0.6		0.3	6.7	67.61	0.00
Trib_1	T2	20 year	7.3	0.05		0.05	438.3	438.13	438.1	438.16	0.0	0.7		0.4	10.7	86.12	0.00
Trib_1	T2	100 year	11.9	0.05		0.05	438.3	438.19	438.1	438.22	0.0	0.7		0.6	16.2	119.26	0.00
Trib_1	T2	200 year	14.1	0.05		0.05	438.3	438.21	438.2	438.24	0.0	0.8		0.6	18.6	130.73	0.00
Trib_1	T2	PMF	62.3	0.05	0.0	0.05	438.3	438.35	438.4	438.46	0.0	1.5	0.5	1.1	43.5	218.42	0.76
Trib_1	T1	5 year	3.9		0.0		432.6	432.97	433.0	433.08	0.0		1.5		2.7	12.95	1.01
Trib_1	T1	20 year	7.3		0.0		432.6	433.08	433.1	433.23	0.0		1.7		4.4	15.9	1.02
Trib_1	T1	100 year	11.9		0.0		432.6	433.20	433.2	433.38	0.0		1.9		6.3	18.15	1.01
Trib_1	T1	200 year	14.1		0.0		432.6	433.25	433.3	433.44	0.0		2.0		7.2	19.08	1.01
Trib_1	T1	PMF	62.3	0.05	0.0	0.05	432.6	435.20		435.21	0.0	0.2	0.4	0.2	234.0	261.9	0.09

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Lower	M12	5 year	36.2		0.1		430.5	431.37	431.0	431.41	0.0		0.9		42.4	75.15	0.36
Lower	M12	20 year	57.4		0.1		430.5	431.62	431.2	431.66	0.0		0.9		62.7	89.21	0.35
Lower	M12	100 year	88.1	0.07	0.1		430.5	431.80	431.3	431.86	0.0	0.1	1.1		80.4	99.49	0.39
Lower	M12	200 year	102.5	0.07	0.1		430.5	431.88	431.4	431.95	0.0	0.2	1.2		88.4	103.17	0.39
Lower	M12	PMF	1024.0	0.07	0.1	0.07	430.5	434.23		434.53	0.0	1.1	2.6	1.1	475.9	236.2	0.47
Lower	M11	5 year	36.2	0.06	0.0	0.06	428.2	428.91	428.8	429.00	0.0	0.8	1.5	0.5	30.0	68.07	0.62
Lower	M11	20 year	57.4	0.06	0.0	0.06	428.2	429.01	428.9	429.16	0.0	1.1	1.9	0.7	36.9	71.29	0.74
Lower	M11	100 year	88.1	0.06	0.0	0.06	428.2	429.24	429.1	429.41	0.0	1.2	2.0	0.8	54.1	78.75	0.69
Lower	M11	200 year	102.5	0.06	0.0	0.06	428.2	429.32	429.1	429.50	0.0	1.3	2.1	0.9	60.5	81.35	0.69
Lower	M11	PMF	1024.0	0.06	0.0	0.06	428.2	431.46		432.14	0.0	2.4	4.7	2.2	337.2	174.76	0.84
Lower	M10	5 year	36.2	0.06	0.1	0.06	426.1	426.67	426.5	426.80	0.0	1.7	1.2	0.5	24.1	59.54	0.56
Lower	M10	20 year	57.4	0.06	0.1	0.06	426.1	426.96	426.7	427.06	0.0	1.5	1.3	0.7	44.4	82.51	0.49
Lower	M10	100 year	88.1	0.06	0.1	0.06	426.1	427.09	426.9	427.24	0.0	1.8	1.7	0.9	56.1	95.49	0.59
Lower	M10	200 year	102.5	0.06	0.1	0.06	426.1	427.16	427.0	427.31	0.0	1.9	1.8	1.0	62.7	99.11	0.60
Lower	M10	PMF	1024.0	0.06	0.1	0.06	426.1	428.92		429.54	0.0	3.7	4.2	2.9	301.7	161	0.82
Lower	M9	5 year	36.2	0.06	0.1		424.5	425.03	424.8	425.06	0.0	0.2	0.7		52.8	143.34	0.36
Lower	M9	20 year	57.4	0.06	0.1		424.5	425.08	424.9	425.13	0.0	0.3	1.0		60.3	145.89	0.47
Lower	M9	100 year	88.1	0.06	0.1	0.06	424.5	425.25	425.0	425.31	0.0	0.4	1.1	0.2	84.9	152.39	0.44
Lower	M9	200 year	102.5	0.06	0.1	0.06	424.5	425.31	425.0	425.37	0.0	0.4	1.1	0.3	93.5	154.49	0.44
Lower	M9	PMF	1024.0	0.06	0.1	0.06	424.5	427.11		427.42	0.0	1.3	2.6	1.2	440.5	229.72	0.53
Lower	M8	5 year	36.2		0.1		423.3	423.95	423.8	424.00	0.0		1.0		37.6	115.8	0.54
Lower	M8	20 year	57.4	0.07	0.1		423.3	424.21	423.9	424.25	0.0	0.2	0.8		69.9	131.79	0.35
Lower	M8	100 year	88.1	0.07	0.1		423.3	424.29	424.0	424.35	0.0	0.3	1.1		80.6	136.61	0.44
Lower	M8	200 year	102.5	0.07	0.1		423.3	424.35	424.1	424.42	0.0	0.4	1.2		89.2	140.36	0.45
Lower	M8	PMF	1024.0	0.07	0.1	0.07	423.3	426.08		426.46	0.0	1.6	2.9	1.2	406.9	223.16	0.59
Lower	M7	5 year	36.2	0.07	0.1	0.07	420.4	422.42		422.53	0.0	0.2	1.5	0.2	27.2	69.29	0.50
Lower	M7	20 year	57.4	0.07	0.1	0.07	420.4	422.33	422.3	422.69	0.0	0.2	2.7	0.3	22.1	45.24	0.94
Lower	M7	100 year	88.1	0.07	0.1	0.07	420.4	422.69	422.7	422.92	0.0	0.6	2.3	0.6	58.4	146.55	0.69
Lower	M7	200 year	102.5	0.07	0.1	0.07	420.4	422.75	422.8	422.99	0.0	0.7	2.4	0.6	67.7	155.25	0.70
Lower	M7	PMF	1024.0	0.07	0.1	0.07	420.4	424.09	424.1	424.74	0.0	2.5	5.2	1.7	353.5	254.44	1.03

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Lower	M6.6	5 year	36.2	0.05	0.0	0.05	419.2	422.49	420.7	422.49	0.0	0.1	0.3	0.1	219.5	217.45	0.06
Lower	M6.6	20 year	57.4	0.05	0.0	0.05	419.2	422.57	421.1	422.57	0.0	0.2	0.4	0.1	236.8	223.19	0.09
Lower	M6.6	100 year	88.1	0.05	0.0	0.05	419.2	422.68	421.5	422.69	0.0	0.3	0.6	0.2	261.3	235.62	0.12
Lower	M6.6	200 year	102.5	0.05	0.0	0.05	419.2	422.74	421.7	422.75	0.0	0.3	0.6	0.2	276.4	244.11	0.13
Lower	M6.6	PMF	1024.0	0.05	0.0	0.05	419.2	424.12	423.1	424.28	0.0	1.5	2.6	1.1	649.5	299.5	0.42
Lower	M6.4	5 year	36.2		0.1		418.9	420.42	420.4	420.85	0.0		2.9		12.6	15.24	1.01
Lower	M6.4	20 year	57.4	0.04	0.1	0.04	418.9	420.81	420.8	421.20	0.0	0.4	2.8	0.5	20.9	29.37	0.99
Lower	M6.4	100 year	88.1	0.04	0.1	0.04	418.9	421.13	421.1	421.54	0.0	1.1	2.9	1.2	32.4	42.95	0.88
Lower	M6.4	200 year	102.5	0.04	0.1	0.04	418.9	421.30	421.3	421.66	0.0	1.1	2.8	1.3	41.8	73.48	0.79
Lower	M6.4	PMF	1024.0	0.04	0.1	0.04	418.9	423.35		423.61	0.0	2.2	2.7	1.6	468.6	272.89	0.47
Lower	M6	5 year	36.2		0.0		416.0	417.39	417.4	417.89	0.0		3.2		11.5	11.26	1.00
Lower	M6	20 year	57.4		0.0		416.0	417.85	417.9	418.38	0.0		3.2		17.9	17.26	1.01
Lower	M6	100 year	88.1		0.0		416.0	418.23	418.2	418.87	0.0		3.5		24.9	19.64	1.00
Lower	M6	200 year	102.5		0.0		416.0	418.39	418.4	419.07	0.0		3.7		28.0	20.6	1.00
Lower	M6	PMF	1024.0	0.04	0.0	0.04	416.0	421.86	421.9	422.71	0.0	2.5	4.4	1.8	271.5	163.05	0.88
Lower	M5	5 year	36.2		0.0		414.6	415.98		416.10	0.0		1.6		23.0	28.81	0.56
Lower	M5	20 year	57.4		0.0		414.6	416.15	415.9	416.36	0.0		2.0		28.2	30.22	0.67
Lower	M5	100 year	88.1		0.0		414.6	416.46		416.74	0.0		2.3		37.9	32.7	0.69
Lower	M5	200 year	102.5		0.0		414.6	416.61		416.90	0.0		2.4		42.9	33.91	0.68
Lower	M5	PMF	1024.0	0.06	0.0	0.06	414.6	419.85	419.9	420.79	0.0	1.0	4.5	1.2	293.1	197.24	0.81
Lower	M4	5 year	36.2		0.0		412.5	413.84	413.8	414.19	0.0		2.6		13.9	16.35	0.90
Lower	M4	20 year	57.4		0.0		412.5	414.35		414.67	0.0		2.5		23.0	19.17	0.73
Lower	M4	100 year	88.1		0.0		412.5	414.83		415.20	0.0		2.7		32.9	21.84	0.70
Lower	M4	200 year	102.5		0.0		412.5	415.00		415.40	0.0		2.8		36.6	22.77	0.70
Lower	M4	PMF	1024.0	0.05	0.0	0.05	412.5	418.45	418.5	419.23	0.0	1.1	4.8	1.3	430.2	273.16	0.73
Lower	M3	5 year	36.2		0.1		410.9	413.05		413.11	0.0		1.1		32.2	20.26	0.28
Lower	M3	20 year	57.4		0.1		410.9	413.47		413.56	0.0		1.4		42.0	28.44	0.36
Lower	M3	100 year	88.1		0.1		410.9	413.88		414.01	0.0		1.6		56.2	39.97	0.42
Lower	M3	200 year	102.5		0.1		410.9	414.01		414.15	0.0		1.7		61.4	43.16	0.45
Lower	M3	PMF	1024.0	0.06	0.1	0.06	410.9	416.76		416.93	0.0	1.0	2.2	1.4	621.9	293.54	0.36

Table E1: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
Lower	M2.1	5 year	36.2	0.06	0.0		409.0	411.04	411.0	411.60	0.0	0.2	3.3		11.0	10.17	1.00
Lower	M2.1	20 year	57.4	0.06	0.0		409.0	412.03		412.28	0.0	0.8	2.3		28.3	25.03	0.60
Lower	M2.1	100 year	88.1	0.06	0.0	0.06	409.0	413.25		413.34	0.0	0.4	1.5	0.1	92.2	120.4	0.32
Lower	M2.1	200 year	102.5	0.06	0.0	0.06	409.0	413.57		413.63	0.0	0.4	1.3	0.2	136.5	157.63	0.27
Lower	M2.1	PMF	1024.0	0.06	0.0	0.06	409.0	416.59		416.64	0.0	0.7	1.7	0.7	1279.2	483.72	0.23
Lower	M2.05	5 year	36.2		0.0		409.0	411.25	410.5	411.34	0.0		1.4		26.3	22.82	0.41
Lower	M2.05	20 year	57.4	0.06	0.0	0.06	409.0	412.15	410.9	412.22	0.0	0.3	1.2	0.3	52.9	36.22	0.26
Lower	M2.05	100 year	88.1	0.06	0.0	0.06	409.0	413.28	411.2	413.33	0.0	0.3	1.1	0.3	111.5	102.97	0.19
Lower	M2.05	200 year	102.5	0.06	0.0	0.06	409.0	413.57	411.4	413.63	0.0	0.2	1.1	0.3	145.8	129.26	0.19
Lower	M2.05	PMF	1024.0	0.06	0.0	0.06	409.0	416.55	415.1	416.63	0.0	0.7	2.0	0.7	1188.2	470.51	0.26
Lower	M2	5 year	37.9		0.0		408.9	410.67		410.81	0.0		1.7		22.6	19.14	0.49
Lower	M2	20 year	59.7	0.06	0.0	0.06	408.9	411.38		411.50	0.0	0.2	1.6	0.2	38.3	23.62	0.39
Lower	M2	100 year	92.2	0.06	0.0	0.06	408.9	412.30		412.42	0.0	0.3	1.6	0.4	61.2	25.81	0.31
Lower	M2	200 year	108.0	0.06	0.0	0.06	408.9	412.72		412.84	0.0	0.2	1.6	0.4	73.1	45.59	0.28
Lower	M2	PMF	1191.0	0.06	0.0	0.06	408.9	416.54		416.62	0.0	0.7	2.1	0.8	1320.2	486.15	0.26
Lower	M1.6	5 year	37.9	0.07	0.1		408.7	410.71	409.5	410.76	0.0	0.1	1.0		37.7	23.51	0.25
Lower	M1.6	20 year	59.7	0.07	0.1	0.07	408.7	411.41	409.8	411.47	0.0	0.2	1.0	0.2	71.9	97.96	0.22
Lower	M1.6	100 year	92.2	0.07	0.1	0.07	408.7	412.36	410.2	412.39	0.0	0.2	0.8	0.2	213.5	205.37	0.14
Lower	M1.6	200 year	108.0	0.07	0.1	0.07	408.7	412.79	410.3	412.81	0.0	0.2	0.7	0.1	327.5	365.87	0.12
Lower	M1.6	PMF	1191.0	0.07	0.1	0.07	408.7	416.58	413.4	416.60	0.0	0.5	1.1	0.6	2119.8	568.65	0.13
Lower	M1.4	5 year	37.9		0.1		408.7	409.99	409.5	410.14	0.0		1.7		22.2	19.92	0.52
Lower	M1.4	20 year	59.7		0.1		408.7	410.29		410.51	0.0		2.1		28.3	21.27	0.58
Lower	M1.4	100 year	92.2		0.1		408.7	410.61		410.96	0.0		2.6		35.5	22.75	0.66
Lower	M1.4	200 year	108.0	0.07	0.1		408.7	410.73	410.3	411.14	0.0	0.2	2.8		38.2	23.7	0.70
Lower	M1.4	PMF	1191.0	0.07	0.1	0.07	408.7	413.38	413.4	413.94	0.0	1.7	4.9	1.4	561.8	415.82	0.75
Lower	M1	5 year	37.9		0.0	0.06	407.7	408.55	408.4	408.62	0.0		1.8	1.0	36.0	79.95	0.70
Lower	M1	20 year	59.7		0.0	0.06	407.7	408.72	408.5	408.81	0.0		2.0	1.1	51.5	105.38	0.72
Lower	M1	100 year	92.2		0.0	0.06	407.7	408.93	408.7	409.02	0.0		2.2	1.1	79.0	148.06	0.74
Lower	M1	200 year	108.0		0.0	0.06	407.7	408.99	408.8	409.09	0.0		2.2	1.1	87.5	149.25	0.74
Lower	M1	PMF	1191.0		0.0	0.06	407.7	410.94	410.3	411.35	0.0		2.3	2.9	421.8	212.47	0.77

Table E2: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	E17	5 year	8.6	0.05	0.0	0.05	465.5	465.72	465.7	465.80	0.0	0.2	1.3	0.2	6.8	43	1.01
1	E17	20 year	13.9	0.05	0.0	0.05	465.5	465.78	465.8	465.89	0.0	0.5	1.5	0.5	9.6	46.35	0.99
1	E17	100 year	22.3	0.05	0.0	0.05	465.5	465.87	465.9	466.01	0.0	0.7	1.7	0.7	13.7	50.73	0.97
1	E17	200 year	26.2	0.05	0.0	0.05	465.5	465.90	465.9	466.06	0.0	0.7	1.8	0.7	15.5	52.45	0.96
1	E17	PMF	168.0	0.05	0.0	0.05	465.5	466.63	466.6	467.05	0.0	1.7	3.1	1.6	63.2	79.68	0.95
1	E16	5 year	8.6	0.06	0.0	0.06	458.1	458.82	458.7	458.94	0.0	0.9	1.6	0.5	6.3	16.12	0.71
1	E16	20 year	13.9	0.06	0.0	0.06	458.1	458.96	458.9	459.13	0.0	1.0	2.0	0.7	8.8	18.66	0.76
1	E16	100 year	22.3	0.06	0.0	0.06	458.1	459.12	459.1	459.36	0.0	1.2	2.4	0.9	11.9	21.42	0.85
1	E16	200 year	26.2	0.06	0.0	0.06	458.1	459.18	459.1	459.45	0.0	1.3	2.6	1.0	13.2	22.44	0.88
1	E16	PMF	168.0	0.06	0.0	0.06	458.1	460.51	460.5	460.95	0.0	1.4	4.0	1.6	79.9	87.35	0.86
1	E15	5 year	8.6		0.0		451.5	452.09	452.1	452.25	0.0		1.8		4.8	15.12	1.01
1	E15	20 year	13.9	0.05	0.0		451.5	452.22	452.2	452.42	0.0	0.2	2.0		7.0	17.99	1.01
1	E15	100 year	22.3	0.05	0.0	0.05	451.5	452.38	452.4	452.64	0.0	0.6	2.3	0.5	10.1	20.99	0.98
1	E15	200 year	26.2	0.05	0.0	0.05	451.5	452.44	452.4	452.72	0.0	0.7	2.4	0.6	11.5	22.23	0.96
1	E15	PMF	168.0	0.05	0.0	0.05	451.5	453.76	453.8	454.33	0.0	1.7	3.7	1.4	59.7	59.62	0.86
1	E14	5 year	15.0	0.04	0.0	0.04	445.0	445.32	445.3	445.39	0.0	0.1	1.1	0.4	13.5	75.86	0.84
1	E14	20 year	24.3	0.04	0.0	0.04	445.0	445.37	445.4	445.47	0.0	0.3	1.4	0.5	17.6	79.79	0.92
1	E14	100 year	37.7	0.04	0.0	0.04	445.0	445.44	445.4	445.58	0.0	0.5	1.7	0.7	22.8	83.05	0.99
1	E14	200 year	44.6	0.04	0.0	0.04	445.0	445.47	445.5	445.63	0.0	0.6	1.8	0.7	25.7	84.74	0.99
1	E14	PMF	305.0	0.04	0.0	0.04	445.0	446.27	446.3	446.74	0.0	1.5	3.2	1.5	108.6	119.1	0.96
1	E13	5 year	15.0	0.09	0.1	0.09	438.1	438.57	438.5	438.67	0.0	0.6	1.7	0.6	13.9	48.23	0.82
1	E13	20 year	24.3	0.09	0.1	0.09	438.1	438.71	438.6	438.83	0.0	0.7	1.9	0.7	21.4	57.96	0.79
1	E13	100 year	37.7	0.09	0.1	0.09	438.1	438.88	438.8	439.01	0.0	0.8	2.1	0.7	33.6	83.05	0.77
1	E13	200 year	44.6	0.09	0.1	0.09	438.1	438.95	438.8	439.09	0.0	0.8	2.1	0.7	39.6	90.73	0.76
1	E13	PMF	305.0	0.09	0.1	0.09	438.1	439.98	439.8	440.33	0.0	1.3	3.9	1.6	158.6	137.96	0.92
1	E12	5 year	15.0		0.0		432.5	433.21	433.1	433.31	0.0		1.4		10.8	23.37	0.65
1	E12	20 year	24.3		0.0		432.5	433.37	433.2	433.51	0.0		1.6		14.9	27.08	0.70
1	E12	100 year	37.7	0.07	0.0	0.07	432.5	433.54	433.4	433.72	0.0	0.1	1.9	0.1	19.7	37.33	0.76
1	E12	200 year	44.6	0.07	0.0	0.07	432.5	433.60	433.5	433.81	0.0	0.2	2.1	0.2	22.3	49.4	0.79
1	E12	PMF	305.0	0.07	0.0	0.07	432.5	434.62	434.6	435.06	0.0	1.2	3.6	1.1	156.3	180.57	0.87

Table E2: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	E11	5 year	15.0	0.07	0.0	0.07	429.0	429.19	429.2	429.29	0.0	0.5	1.4	0.5	11.5	63.14	0.99
1	E11	20 year	24.3	0.07	0.0	0.07	429.0	429.27	429.3	429.39	0.0	0.6	1.6	0.6	16.1	66.15	0.99
1	E11	100 year	37.7	0.07	0.0	0.07	429.0	429.35	429.4	429.52	0.0	0.7	1.9	0.7	22.1	69.84	0.99
1	E11	200 year	44.6	0.07	0.0	0.07	429.0	429.39	429.4	429.58	0.0	0.7	2.0	0.7	25.0	71.56	0.99
1	E11	PMF	305.0	0.07	0.0	0.07	429.0	430.21	430.2	430.49	0.0	0.9	2.9	0.9	193.6	311.95	0.83
1	E10	5 year	15.0	0.07	0.0	0.07	422.0	422.39	422.3	422.46	0.0	0.4	1.2	0.4	14.3	42.73	0.60
1	E10	20 year	24.3	0.07	0.0	0.07	422.0	422.49	422.4	422.60	0.0	0.5	1.5	0.5	18.8	46.03	0.68
1	E10	100 year	37.7	0.07	0.0	0.07	422.0	422.63	422.5	422.78	0.0	0.6	1.8	0.6	25.3	50.47	0.71
1	E10	200 year	44.6	0.07	0.0	0.07	422.0	422.70	422.6	422.86	0.0	0.7	1.9	0.7	28.9	52.7	0.72
1	E10	PMF	305.0	0.07	0.0	0.07	422.0	423.84	423.8	424.49	0.0	1.5	4.1	1.5	109.9	89.7	0.96
1	E9	5 year	15.0		0.0		418.9	419.49	419.5	419.77	0.0		2.3		6.4	11.62	1.01
1	E9	20 year	24.3		0.0		418.9	419.79	419.7	420.09	0.0		2.4		10.0	12.42	0.87
1	E9	100 year	37.7	0.07	0.0	0.07	418.9	420.11	420.0	420.47	0.0	0.2	2.7	0.2	14.4	17.96	0.82
1	E9	200 year	44.6	0.07	0.0	0.07	418.9	420.24	420.1	420.63	0.0	0.4	2.8	0.3	17.0	23.47	0.81
1	E9	PMF	305.0	0.07	0.0	0.07	418.9	422.71		422.98	0.0	1.0	3.1	0.9	209.6	132.31	0.52
1	E8	5 year	23.1	0.07	0.0	0.07	417.0	418.67		418.77	0.0	0.3	1.5	0.3	21.4	31.09	0.38
1	E8	20 year	36.2	0.07	0.0	0.07	417.0	418.95		419.09	0.0	0.4	1.8	0.4	31.5	40.41	0.42
1	E8	100 year	54.3	0.07	0.0	0.07	417.0	419.24		419.41	0.0	0.6	2.1	0.6	44.6	49.96	0.46
1	E8	200 year	63.2	0.07	0.0	0.07	417.0	419.36		419.54	0.0	0.6	2.2	0.6	50.8	53.9	0.47
1	E8	PMF	504.0	0.07	0.0	0.07	417.0	421.50		421.98	0.0	1.6	4.7	1.3	259.2	148.73	0.71
1	E7	5 year	23.1		0.0		417.0	417.37	417.4	417.56	0.0		1.9		12.2	33.12	1.00
1	E7	20 year	36.2		0.0		417.0	417.50	417.5	417.75	0.0		2.2		16.4	33.5	1.00
1	E7	100 year	54.3		0.0		417.0	417.66	417.7	417.98	0.0		2.5		21.7	33.97	1.00
1	E7	200 year	63.2		0.0		417.0	417.72	417.7	418.08	0.0		2.6		24.0	34.17	1.01
1	E7	PMF	504.0	0.07	0.0	0.07	417.0	419.65	419.7	420.36	0.0	1.1	4.2	1.1	195.9	161.99	0.83
1	E6	5 year	23.1		0.0		413.0	413.76	413.7	413.92	0.0		1.8		12.9	23.13	0.76
1	E6	20 year	36.2		0.0		413.0	413.98	413.8	414.17	0.0		2.0		18.4	26.64	0.76
1	E6	100 year	54.3	0.07	0.0	0.07	413.0	414.20	414.0	414.45	0.0	0.3	2.2	0.3	25.0	34.18	0.75
1	E6	200 year	63.2	0.07	0.0	0.07	413.0	414.29	414.1	414.56	0.0	0.4	2.3	0.4	28.3	37.48	0.75
1	E6	PMF	504.0	0.07	0.0	0.07	413.0	416.19	416.2	417.13	0.0	1.3	4.9	1.5	166.7	115.86	0.91

Table E2: HEC-RAS MODELLING RESULTS FOR EXISTING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	E5	5 year	23.1		0.0		411.0	411.70	411.5	411.84	0.0		1.7		13.8	20.4	0.65
1	E5	20 year	36.2		0.0		411.0	411.90	411.7	412.11	0.0		2.0		17.9	20.8	0.70
1	E5	100 year	54.3	0.07	0.0	0.07	411.0	412.12	411.9	412.41	0.0	0.2	2.4	0.2	23.2	33.67	0.74
1	E5	200 year	63.2	0.07	0.0	0.07	411.0	412.21	412.0	412.54	0.0	0.3	2.6	0.3	26.7	43.5	0.76
1	E5	PMF	504.0	0.07	0.0	0.07	411.0	413.85	413.9	414.53	0.0	1.3	4.7	1.8	200.1	136.09	0.89
1	E4	5 year	23.1		0.0		408.5	408.98	409.0	409.21	0.0		2.2		10.7	22.95	1.01
1	E4	20 year	36.2		0.0		408.5	409.14	409.1	409.46	0.0		2.5		14.5	23.28	1.01
1	E4	100 year	54.3		0.0		408.5	409.34	409.3	409.75	0.0		2.8		19.2	23.68	1.01
1	E4	200 year	63.2		0.0		408.5	409.43	409.4	409.88	0.0		3.0		21.3	23.85	1.01
1	E4	PMF	504.0	0.07	0.0	0.07	408.5	411.67		412.18	0.0	1.5	4.0	1.3	220.6	120.67	0.71
1	E3	5 year	23.1		0.0		406.6	407.47		407.56	0.0		1.4		17.1	20.48	0.47
1	E3	20 year	36.2	0.07	0.0		406.6	407.71		407.84	0.0	0.1	1.6		22.5	28.53	0.51
1	E3	100 year	54.3	0.07	0.0		406.6	407.98		408.16	0.0	0.3	1.9		33.0	48.51	0.53
1	E3	200 year	63.2	0.07	0.0	0.07	406.6	408.10		408.28	0.0	0.4	2.0	0.1	38.9	53.66	0.53
1	E3	PMF	504.0	0.07	0.0	0.07	406.6	409.78	409.8	410.60	0.0	1.6	4.9	1.3	184.2	118.62	0.88
1	E2	5 year	26.2		0.0		406.5	407.14	407.0	407.31	0.0		1.8		14.6	23.28	0.73
1	E2	20 year	41.3		0.0		406.5	407.34	407.2	407.58	0.0		2.1		19.3	23.69	0.76
1	E2	100 year	61.7	0.07	0.0	0.07	406.5	407.57	407.4	407.89	0.0	0.2	2.5	0.2	25.2	35.89	0.78
1	E2	200 year	71.7	0.07	0.0	0.07	406.5	407.66	407.5	408.02	0.0	0.3	2.6	0.3	29.2	51.19	0.80
1	E2	PMF	565.0	0.07	0.0	0.07	406.5	409.26	409.3	409.85	0.0	1.3	4.5	1.5	265.6	225.14	0.87

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Appendix F – HEC-RAS MODEL OUTPUT FOR THE POST-MINING CREEK ALIGNMENTS

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	85	1 year	11.1		0.0		446.2	446.85	446.9	447.10	0.0		2.2		5.0	9.99	1.01
1	85	5 year	36.2		0.0		446.2	447.46	447.5	447.88	0.0		2.9		12.6	14.87	1.00
1	85	100 year	88.1	0.05	0.0	0.05	446.2	448.11	448.1	448.54	0.0	1.1	3.2	1.1	37.2	44.25	0.84
1	85	200 year	77.3	0.05	0.0	0.05	446.2	448.03	448.0	448.43	0.0	1.0	3.0	1.0	33.8	43.64	0.82
1	85	PMF	561.3	0.05	0.0	0.05	446.2	450.43		451.09	0.0	2.1	4.7	1.9	199.6	92.8	0.77
1	84.5	1 year	11.1		0.0		445.7	446.53		446.66	0.0		1.6		6.9	11.44	0.66
1	84.5	5 year	36.2	0.05	0.0	0.05	445.7	447.15	447.0	447.41	0.0	0.3	2.3	0.3	17.6	40.67	0.74
1	84.5	100 year	88.1	0.05	0.0	0.05	445.7	447.72		448.05	0.0	1.1	2.8	1.0	42.2	45.12	0.72
1	84.5	200 year	77.3	0.05	0.0	0.05	445.7	447.62		447.94	0.0	1.0	2.7	1.0	38.0	44.39	0.72
1	84.5	PMF	561.3	0.05	0.0	0.05	445.7	450.65		450.99	0.0	1.7	3.4	1.6	266.8	92.8	0.52
1	84	1 year	11.1		0.0		444.8	445.83		445.91	0.0		1.3		8.8	12.67	0.49
1	84	5 year	36.2	0.05	0.0	0.05	444.8	446.49		446.64	0.0	0.5	1.8	0.5	25.6	42.1	0.52
1	84	100 year	88.1	0.05	0.0	0.05	444.8	446.99		447.25	0.0	1.0	2.5	1.0	47.5	45.96	0.63
1	84	200 year	77.3	0.05	0.0	0.05	444.8	446.89		447.14	0.0	0.9	2.4	0.9	42.9	45.19	0.62
1	84	PMF	561.3	0.05	0.0	0.05	444.8	450.51	447.8	450.72	0.0	1.4	2.7	1.4	332.4	92.74	0.38
1	83	1 year	11.1		0.0		444.1	444.78	444.8	445.03	0.0		2.2		5.0	10	1.01
1	83	5 year	36.2		0.0		444.1	445.39	445.4	445.81	0.0		2.9		12.6	14.87	1.00
1	83	100 year	88.1	0.05	0.0	0.05	444.1	446.04	446.0	446.47	0.0	1.1	3.2	1.1	37.2	44.16	0.84
1	83	200 year	77.3	0.05	0.0	0.05	444.1	445.96	446.0	446.36	0.0	1.0	3.0	1.0	33.7	43.55	0.82
1	83	PMF	561.3	0.05	0.0	0.05	444.1	447.12	447.1	450.04	0.0	4.2	9.0	4.1	89.1	52.49	1.80
1	82.5	1 year	11.1		0.0		443.6	444.51		444.62	0.0		1.5		7.4	11.8	0.60
1	82.5	5 year	36.2	0.05	0.0	0.05	443.6	445.15		445.36	0.0	0.4	2.1	0.4	20.4	41.1	0.65
1	82.5	100 year	88.1	0.05	0.0	0.05	443.6	445.69		446.00	0.0	1.1	2.7	1.0	43.7	45.29	0.69
1	82.5	200 year	77.3	0.05	0.0	0.05	443.6	445.59		445.89	0.0	1.0	2.6	1.0	39.5	44.56	0.69
1	82.5	PMF	561.3	0.05	0.0	0.05	443.6	448.37		448.77	0.0	1.7	3.8	1.7	246.6	92.71	0.58
1	82	1 year	11.1		0.0		443.4	444.27		444.38	0.0		1.5		7.4	11.8	0.60
1	82	5 year	36.2	0.05	0.0	0.05	443.4	444.91		445.12	0.0	0.4	2.1	0.4	20.4	41.18	0.65
1	82	100 year	88.1	0.05	0.0	0.05	443.4	445.45		445.76	0.0	1.1	2.7	1.0	43.8	45.37	0.69
1	82	200 year	77.3	0.05	0.0	0.05	443.4	445.36		445.65	0.0	1.0	2.6	0.9	39.6	44.64	0.69
1	82	PMF	561.3	0.05	0.0	0.05	443.4	448.30		448.65	0.0	1.7	3.5	1.6	262.2	92.78	0.53

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	81	1 year	11.1		0.0		443.1	444.03		444.15	0.0		1.5		7.5	11.81	0.60
1	81	5 year	36.2	0.05	0.0	0.05	443.1	444.67		444.89	0.0	0.4	2.1	0.4	20.4	41.18	0.65
1	81	100 year	88.1	0.05	0.0	0.05	443.1	445.21		445.52	0.0	1.1	2.8	1.0	43.5	45.32	0.70
1	81	200 year	77.3	0.05	0.0	0.05	443.1	445.12		445.41	0.0	1.0	2.6	1.0	39.3	44.6	0.69
1	81	PMF	561.3	0.05	0.0	0.05	443.1	448.24		448.54	0.0	1.6	3.3	1.5	278.4	92.78	0.49
1	80	1 year	11.1		0.0		442.8	443.73		443.84	0.0		1.5		7.4	11.81	0.60
1	80	5 year	36.2	0.05	0.0	0.05	442.8	444.37		444.58	0.0	0.4	2.1	0.4	20.3	41.38	0.65
1	80	100 year	88.1	0.05	0.0	0.05	442.8	444.90		445.22	0.0	1.1	2.8	1.1	43.4	45.51	0.70
1	80	200 year	77.3	0.05	0.0	0.05	442.8	444.81		445.11	0.0	1.0	2.7	1.0	39.3	44.8	0.69
1	80	PMF	561.3	0.05	0.0	0.05	442.8	448.18		448.43	0.0	1.5	3.0	1.5	302.2	93.01	0.44
1	79	1 year	11.1		0.0		442.5	443.40		443.51	0.0		1.5		7.6	11.88	0.59
1	79	5 year	36.2	0.05	0.0	0.05	442.5	444.05		444.26	0.0	0.4	2.0	0.4	21.1	41.33	0.63
1	79	100 year	88.1	0.05	0.0	0.05	442.5	444.57		444.88	0.0	1.0	2.8	1.1	43.3	45.31	0.70
1	79	200 year	77.3	0.05	0.0	0.05	442.5	444.48		444.77	0.0	0.9	2.7	1.0	39.2	44.6	0.69
1	79	PMF	561.3	0.05	0.0	0.05	442.5	448.13		448.34	0.0	1.3	2.8	1.4	328.0	92.8	0.39
1	78	1 year	11.1		0.0		442.3	443.25		443.36	0.0		1.4		7.7	11.99	0.57
1	78	5 year	36.2	0.05	0.0	0.05	442.3	443.94		444.11	0.0	0.5	1.9	0.4	23.2	42.68	0.58
1	78	100 year	88.1	0.05	0.0	0.05	442.3	444.43		444.72	0.0	1.0	2.7	1.0	45.4	46.55	0.67
1	78	200 year	77.3	0.05	0.0	0.05	442.3	444.34		444.61	0.0	1.0	2.6	0.9	41.2	45.84	0.66
1	78	PMF	561.3	0.05	0.0	0.05	442.3	448.12	445.4	448.31	0.0	1.3	2.6	1.3	346.5	93.8	0.36
1	77	1 year	11.1		0.0		442.2	442.83	442.8	443.09	0.0		2.2		5.0	9.99	1.01
1	77	5 year	36.2		0.0		442.2	443.44	443.4	443.87	0.0		2.9		12.6	14.87	1.00
1	77	100 year	88.1	0.05	0.0	0.05	442.2	444.09	444.1	444.52	0.0	1.1	3.2	1.1	37.5	44.86	0.84
1	77	200 year	77.3	0.05	0.0	0.05	442.2	444.02	444.0	444.41	0.0	1.0	3.0	1.0	34.0	44.26	0.82
1	77	PMF	561.3	0.05	0.0	0.05	442.2	445.19	445.2	447.97	0.0	4.2	8.8	3.9	91.4	53.38	1.76
1	76.5	1 year	11.1		0.0		441.7	442.56		442.67	0.0		1.5		7.5	11.81	0.60
1	76.5	5 year	36.2	0.05	0.0	0.05	441.7	443.20		443.42	0.0	0.4	2.1	0.4	20.5	41.82	0.65
1	76.5	100 year	88.1	0.05	0.0	0.05	441.7	443.74		444.05	0.0	1.1	2.7	1.0	44.0	45.97	0.69
1	76.5	200 year	77.3	0.05	0.0	0.05	441.7	443.64		443.94	0.0	1.0	2.6	0.9	39.7	45.24	0.69
1	76.5	PMF	561.3	0.05	0.0	0.05	441.7	446.43		446.83	0.0	1.8	3.7	1.6	249.8	93.42	0.57

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	76	1 year	11.1		0.0		441.1	442.01		442.13	0.0		1.5		7.4	11.8	0.60
1	76	5 year	36.2	0.05	0.0	0.05	441.1	442.65		442.87	0.0	0.4	2.1	0.4	20.3	41.18	0.65
1	76	100 year	88.1	0.05	0.0	0.05	441.1	443.19		443.50	0.0	1.1	2.8	1.0	43.5	45.34	0.70
1	76	200 year	77.3	0.05	0.0	0.05	441.1	443.10		443.39	0.0	1.0	2.7	1.0	39.3	44.62	0.69
1	76	PMF	561.3	0.05	0.0	0.05	441.1	446.29		446.58	0.0	1.6	3.2	1.5	285.4	92.8	0.47
1	75	1 year	11.1		0.0		440.7	441.64		441.75	0.0		1.5		7.5	11.81	0.60
1	75	5 year	36.2	0.05	0.0	0.05	440.7	442.28		442.50	0.0	0.4	2.1	0.4	20.5	41.24	0.65
1	75	100 year	88.1	0.05	0.0	0.05	440.7	442.81		443.13	0.0	1.0	2.8	1.1	43.1	45.3	0.70
1	75	200 year	77.3	0.05	0.0	0.05	440.7	442.72		443.02	0.0	1.0	2.7	1.0	39.0	44.59	0.70
1	75	PMF	561.3	0.05	0.0	0.05	440.7	446.23		446.46	0.0	1.4	2.9	1.4	314.5	92.83	0.41
1	74	1 year	11.1		0.0		440.5	441.46		441.57	0.0		1.5		7.5	11.84	0.59
1	74	5 year	36.2	0.05	0.0	0.05	440.5	442.12		442.32	0.0	0.4	2.0	0.4	21.2	41.85	0.63
1	74	100 year	88.1	0.05	0.0	0.05	440.5	442.63		442.94	0.0	1.1	2.8	1.0	43.6	45.82	0.70
1	74	200 year	77.3	0.05	0.0	0.05	440.5	442.54		442.83	0.0	1.0	2.7	1.0	39.5	45.11	0.69
1	74	PMF	561.3	0.05	0.0	0.05	440.5	446.21		446.42	0.0	1.4	2.7	1.3	331.7	93.32	0.38
1	73	1 year	11.1		0.0		440.4	441.32		441.43	0.0		1.5		7.6	11.89	0.59
1	73	5 year	36.2	0.05	0.0	0.05	440.4	442.01	441.7	442.19	0.0	0.4	2.0	0.4	22.5	41.6	0.59
1	73	100 year	88.1	0.05	0.0	0.05	440.4	442.50		442.80	0.0	1.1	2.7	1.0	43.9	45.4	0.69
1	73	200 year	77.3	0.05	0.0	0.05	440.4	442.41		442.69	0.0	1.0	2.6	0.9	39.8	44.7	0.68
1	73	PMF	561.3	0.05	0.0	0.05	440.4	446.19	443.5	446.39	0.0	1.4	2.6	1.3	341.3	92.8	0.37
1	72	1 year	11.1		0.0		440.3	440.95	441.0	441.20	0.0		2.2		5.0	10	1.01
1	72	5 year	36.2		0.0		440.3	441.56	441.6	441.98	0.0		2.9		12.6	14.87	1.00
1	72	100 year	88.1	0.05	0.0	0.05	440.3	442.21	442.2	442.63	0.0	1.1	3.2	1.1	37.6	45.11	0.84
1	72	200 year	77.3	0.05	0.0	0.05	440.3	442.13	442.1	442.52	0.0	1.0	3.0	1.0	34.1	44.51	0.82
1	72	PMF	561.3	0.05	0.0	0.05	440.3	443.30	443.3	446.06	0.0	4.0	8.8	4.1	91.7	53.62	1.75
1	71.5	1 year	11.1		0.0		439.8	440.67		440.79	0.0		1.5		7.4	11.8	0.60
1	71.5	5 year	36.2	0.05	0.0	0.05	439.8	441.31		441.53	0.0	0.4	2.1	0.4	20.5	42.07	0.65
1	71.5	100 year	88.1	0.05	0.0	0.05	439.8	441.86		442.16	0.0	1.0	2.7	1.1	44.4	46.26	0.69
1	71.5	200 year	77.3	0.05	0.0	0.05	439.8	441.76		442.05	0.0	0.9	2.6	1.0	40.1	45.55	0.68
1	71.5	PMF	561.3	0.05	0.0	0.05	439.8	444.23		444.75	0.0	1.9	4.2	1.9	220.7	93.68	0.68

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	71	1 year	11.1		0.0		439.6	440.47		440.58	0.0		1.5		7.4	11.81	0.60
1	71	5 year	36.2	0.05	0.0	0.05	439.6	441.10		441.32	0.0	0.4	2.1	0.4	20.2	42.46	0.66
1	71	100 year	88.1	0.05	0.0	0.05	439.6	441.57		441.92	0.0	1.0	2.9	1.1	41.1	46.12	0.76
1	71	200 year	77.3	0.05	0.0	0.05	439.6	441.49		441.82	0.0	0.9	2.8	1.0	37.4	45.5	0.74
1	71	PMF	561.3	0.05	0.0	0.05	439.6	444.13		444.59	0.0	1.6	4.0	1.9	233.0	94.14	0.63
1	70	1 year	11.1		0.0		439.3	440.20		440.31	0.0		1.5		7.5	11.83	0.60
1	70	5 year	36.2	0.05	0.0	0.05	439.3	440.83		441.04	0.0	0.4	2.1	0.4	20.9	46.86	0.65
1	70	100 year	88.1	0.05	0.0	0.05	439.3	441.30		441.62	0.0	1.0	2.8	1.1	44.2	50.68	0.72
1	70	200 year	77.3	0.05	0.0	0.05	439.3	441.22		441.52	0.0	0.9	2.7	1.0	40.0	50.02	0.71
1	70	PMF	561.3	0.05	0.0	0.05	439.3	444.11		444.43	0.0	1.5	3.4	1.7	272.9	98.9	0.52
1	69	1 year	11.1		0.0		439.1	440.02		440.13	0.0		1.5		7.5	11.87	0.59
1	69	5 year	36.2	0.05	0.0	0.05	439.1	440.65		440.86	0.0	0.4	2.1	0.4	21.5	48.57	0.64
1	69	100 year	88.1	0.05	0.0	0.05	439.1	441.14		441.43	0.0	1.0	2.7	1.0	46.0	52.46	0.70
1	69	200 year	77.3	0.05	0.0	0.05	439.1	441.05		441.33	0.0	0.9	2.6	0.9	41.6	51.77	0.69
1	69	PMF	561.3	0.05	0.0	0.05	439.1	444.09		444.36	0.0	1.5	3.1	1.6	294.3	100.55	0.47
1	68	1 year	11.1		0.0		438.9	439.81		439.91	0.0		1.4		7.9	12.1	0.56
1	68	5 year	36.2	0.05	0.0	0.05	438.9	440.49		440.65	0.0	0.5	1.9	0.4	24.9	47.78	0.56
1	68	100 year	88.1	0.05	0.0	0.05	438.9	440.92		441.21	0.0	1.0	2.7	0.8	46.1	51.2	0.69
1	68	200 year	77.3	0.05	0.0	0.05	438.9	440.83		441.11	0.0	1.0	2.6	0.8	41.8	50.54	0.68
1	68	PMF	561.3	0.05	0.0	0.05	438.9	444.05	441.9	444.29	0.0	1.5	3.0	1.3	308.9	99.15	0.44
1	67	1 year	11.1		0.0		438.7	439.34	439.3	439.59	0.0		2.2		5.0	10	1.01
1	67	5 year	36.2		0.0		438.7	439.95	440.0	440.37	0.0		2.9		12.5	14.86	1.00
1	67	100 year	88.1	0.05	0.0	0.05	438.7	440.58	440.6	440.96	0.0	1.1	3.1	1.1	40.5	52.16	0.82
1	67	200 year	77.3	0.05	0.0	0.05	438.7	440.51	440.5	440.87	0.0	1.0	2.9	1.0	36.9	51.6	0.80
1	67	PMF	561.3	0.05	0.0	0.05	438.7	441.64	441.6	443.95	0.0	3.9	8.2	3.9	100.7	60.7	1.66
1	66.5	1 year	11.1		0.0		438.2	439.06		439.18	0.0		1.5		7.5	11.81	0.60
1	66.5	5 year	36.2	0.05	0.0	0.05	438.2	439.70		439.91	0.0	0.4	2.1	0.4	21.5	49.16	0.64
1	66.5	100 year	88.1	0.05	0.0	0.05	438.2	440.21		440.49	0.0	1.0	2.6	1.0	47.7	53.25	0.67
1	66.5	200 year	77.3	0.05	0.0	0.05	438.2	440.13		440.39	0.0	0.9	2.6	0.9	43.0	52.55	0.67
1	66.5	PMF	561.3	0.05	0.0	0.05	438.2	442.71		443.09	0.0	1.7	3.7	1.7	252.6	101.15	0.59

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	66	1 year	11.1		0.0		437.9	438.81		438.92	0.0		1.5		7.5	11.82	0.60
1	66	5 year	36.2	0.05	0.0	0.05	437.9	439.44		439.65	0.0	0.4	2.1	0.4	20.8	46.92	0.66
1	66	100 year	88.1	0.05	0.0	0.05	437.9	439.93		440.24	0.0	0.9	2.8	1.1	44.7	50.83	0.71
1	66	200 year	77.3	0.05	0.0	0.05	437.9	439.84		440.14	0.0	0.8	2.7	1.0	40.4	50.14	0.71
1	66	PMF	561.3	0.05	0.0	0.05	437.9	442.61		442.97	0.0	1.4	3.5	1.8	261.7	98.97	0.55
1	65	1 year	11.1		0.0		437.7	438.63		438.74	0.0		1.5		7.5	11.87	0.59
1	65	5 year	36.2	0.05	0.0	0.05	437.7	439.25	439.0	439.47	0.0	0.4	2.1	0.4	20.6	47.72	0.66
1	65	100 year	88.1	0.05	0.0	0.05	437.7	439.77		440.06	0.0	1.0	2.7	1.0	46.4	51.86	0.69
1	65	200 year	77.3	0.05	0.0	0.05	437.7	439.68		439.95	0.0	0.9	2.6	1.0	41.7	51.14	0.69
1	65	PMF	561.3	0.05	0.0	0.05	437.7	442.58		442.88	0.0	1.5	3.3	1.7	279.4	99.82	0.51
1	64	1 year	11.1		0.0		437.4	438.37		438.45	0.0		1.3		8.8	12.69	0.48
1	64	5 year	36.2	0.05	0.0	0.05	437.4	439.02		439.16	0.0	0.5	1.8	0.4	27.0	47.86	0.52
1	64	100 year	88.1	0.05	0.0	0.05	437.4	439.47		439.72	0.0	1.0	2.5	0.8	49.5	51.49	0.63
1	64	200 year	77.3	0.05	0.0	0.05	437.4	439.38		439.62	0.0	0.9	2.4	0.8	44.7	50.73	0.63
1	64	PMF	561.3	0.05	0.0	0.05	437.4	442.50	440.4	442.75	0.0	1.6	3.0	1.3	304.8	98.87	0.44
1	63	1 year	11.1		0.0		436.6	437.26	437.3	437.51	0.0		2.2		5.0	9.99	1.01
1	63	5 year	36.2		0.0		436.6	437.87	437.9	438.29	0.0		2.9		12.6	14.86	1.00
1	63	100 year	88.1	0.05	0.0	0.05	436.6	438.51	438.5	438.90	0.0	1.1	3.1	1.1	39.8	50.35	0.82
1	63	200 year	77.3	0.05	0.0	0.05	436.6	438.43	438.4	438.80	0.0	1.0	2.9	1.0	36.2	49.78	0.81
1	63	PMF	561.3	0.05	0.0	0.05	436.6	439.58	439.6	441.98	0.0	3.8	8.3	4.0	98.6	58.97	1.68
1	62.5	1 year	11.1		0.0		436.1	436.99		437.10	0.0		1.5		7.5	11.81	0.60
1	62.5	5 year	36.2	0.05	0.0	0.05	436.1	437.62		437.83	0.0	0.4	2.1	0.4	21.0	47.28	0.65
1	62.5	100 year	88.1	0.05	0.0	0.05	436.1	438.12		438.42	0.0	1.0	2.7	1.0	45.4	51.24	0.70
1	62.5	200 year	77.3	0.05	0.0	0.05	436.1	438.03		438.32	0.0	0.9	2.6	1.0	41.2	50.57	0.69
1	62.5	PMF	561.3	0.05	0.0	0.05	436.1	440.32		440.87	0.0	1.8	4.4	2.0	216.3	99.3	0.72
1	62	1 year	11.1		0.0		435.9	436.78		436.89	0.0		1.5		7.4	11.8	0.60
1	62	5 year	36.2	0.05	0.0	0.05	435.9	437.40		437.62	0.0	0.4	2.1	0.4	20.7	46.9	0.66
1	62	100 year	88.1	0.05	0.0	0.05	435.9	437.87		438.20	0.0	0.9	2.8	1.1	43.6	50.65	0.74
1	62	200 year	77.3	0.05	0.0	0.05	435.9	437.79		438.10	0.0	0.8	2.7	1.0	39.4	50	0.73
1	62	PMF	561.3	0.05	0.0	0.05	435.9	440.22		440.72	0.0	1.6	4.1	2.0	226.2	98.97	0.67

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	61	1 year	11.1		0.0		435.7	436.58		436.69	0.0		1.5		7.5	11.81	0.60
1	61	5 year	36.2	0.05	0.0	0.05	435.7	437.21		437.42	0.0	0.4	2.1	0.4	21.6	50.71	0.65
1	61	100 year	88.1	0.05	0.0	0.05	435.7	437.73		437.99	0.0	1.0	2.6	1.0	48.7	54.81	0.67
1	61	200 year	77.3	0.05	0.0	0.05	435.7	437.64		437.89	0.0	0.9	2.5	0.9	43.9	54.11	0.66
1	61	PMF	561.3	0.05	0.0	0.05	435.7	440.20		440.58	0.0	1.7	3.7	1.7	255.5	102.71	0.58
1	60	1 year	11.1		0.0		435.4	436.34		436.45	0.0		1.5		7.4	11.8	0.60
1	60	5 year	36.2	0.05	0.0	0.05	435.4	436.97		437.19	0.0	0.4	2.1	0.4	20.7	46.84	0.66
1	60	100 year	88.1	0.05	0.0	0.05	435.4	437.45		437.77	0.0	1.1	2.8	0.8	44.0	50.66	0.73
1	60	200 year	77.3	0.05	0.0	0.05	435.4	437.37		437.67	0.0	1.0	2.7	0.8	39.9	50	0.72
1	60	PMF	561.3	0.05	0.0	0.05	435.4	440.11		440.47	0.0	1.8	3.6	1.4	258.0	98.9	0.56
1	59	1 year	11.1		0.0		435.2	436.16		436.27	0.0		1.5		7.5	11.81	0.60
1	59	5 year	36.2	0.05	0.0	0.05	435.2	436.79		437.00	0.0	0.4	2.1	0.4	21.2	48.54	0.65
1	59	100 year	88.1	0.05	0.0	0.05	435.2	437.30		437.58	0.0	1.0	2.7	1.0	47.0	52.62	0.68
1	59	200 year	77.3	0.05	0.0	0.05	435.2	437.22		437.48	0.0	0.9	2.6	0.9	42.5	51.93	0.68
1	59	PMF	561.3	0.05	0.0	0.05	435.2	440.09		440.39	0.0	1.7	3.3	1.5	279.4	100.56	0.51
1	58	1 year	11.1		0.0		435.1	435.97		436.08	0.0		1.5		7.5	11.83	0.59
1	58	5 year	36.2	0.05	0.0	0.05	435.1	436.59		436.81	0.0	0.4	2.1	0.4	20.7	46.89	0.66
1	58	100 year	88.1	0.05	0.0	0.05	435.1	437.05		437.38	0.0	0.9	2.9	1.1	42.9	50.54	0.75
1	58	200 year	77.3	0.05	0.0	0.05	435.1	436.97		437.28	0.0	0.9	2.8	1.0	39.0	49.91	0.74
1	58	PMF	561.3	0.05	0.0	0.05	435.1	440.04		440.32	0.0	1.4	3.2	1.6	288.9	98.96	0.48
1	57	1 year	11.1		0.0		434.9	435.79		435.90	0.0		1.5		7.6	11.89	0.59
1	57	5 year	36.2	0.05	0.0	0.05	434.9	436.43		436.63	0.0	0.4	2.1	0.4	21.5	47.31	0.64
1	57	100 year	88.1	0.05	0.0	0.05	434.9	436.90		437.21	0.0	1.0	2.8	1.1	44.6	51.06	0.72
1	57	200 year	77.3	0.05	0.0	0.05	434.9	436.81		437.11	0.0	0.9	2.7	1.0	40.3	50.39	0.71
1	57	PMF	561.3	0.05	0.0	0.05	434.9	440.03		440.27	0.0	1.3	3.0	1.5	306.3	99.25	0.44
1	56	1 year	11.1		0.0		434.7	435.62		435.73	0.0		1.4		7.8	12.06	0.56
1	56	5 year	36.2	0.05	0.0	0.05	434.7	436.31	436.0	436.46	0.0	0.4	1.9	0.4	25.5	50.77	0.56
1	56	100 year	88.1	0.05	0.0	0.05	434.7	436.77		437.02	0.0	1.0	2.5	1.0	50.0	54.49	0.64
1	56	200 year	77.3	0.05	0.0	0.05	434.7	436.68		436.92	0.0	0.9	2.5	0.9	45.2	53.78	0.64
1	56	PMF	561.3	0.05	0.0	0.05	434.7	440.02	437.7	440.22	0.0	1.4	2.7	1.3	336.1	102.15	0.40

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	55	1 year	11.1		0.0		434.5	435.17	435.2	435.42	0.0		2.2		5.0	10	1.01
1	55	5 year	36.2		0.0		434.5	435.78	435.8	436.20	0.0		2.9		12.6	14.87	1.00
1	55	100 year	88.1	0.05	0.0	0.05	434.5	436.42	436.4	436.81	0.0	1.1	3.1	0.9	39.6	49.98	0.82
1	55	200 year	77.3	0.05	0.0	0.05	434.5	436.34	436.3	436.71	0.0	1.0	2.9	0.8	36.1	49.41	0.81
1	55	PMF	561.3	0.05	0.0	0.05	434.5	437.49	437.5	439.90	0.0	4.1	8.3	3.0	98.1	58.59	1.68
1	54.5	1 year	11.1		0.0		434.0	434.90		435.01	0.0		1.5		7.4	11.8	0.60
1	54.5	5 year	36.2	0.05	0.0	0.05	434.0	435.52		435.74	0.0	0.4	2.1	0.4	20.6	46.84	0.66
1	54.5	100 year	88.1	0.05	0.0	0.05	434.0	435.99		436.32	0.0	1.1	2.8	0.8	43.5	50.59	0.74
1	54.5	200 year	77.3	0.05	0.0	0.05	434.0	435.91		436.22	0.0	1.0	2.7	0.8	39.3	49.93	0.73
1	54.5	PMF	561.3	0.05	0.0	0.05	434.0	438.46		438.90	0.0	1.9	3.9	1.5	237.6	98.92	0.63
1	54	1 year	11.1		0.0		433.7	434.64		434.75	0.0		1.5		7.4	11.8	0.60
1	54	5 year	36.2	0.05	0.0	0.05	433.7	435.29	435.0	435.49	0.0	0.4	2.0	0.4	22.2	49.62	0.63
1	54	100 year	88.1	0.05	0.0	0.05	433.7	435.79		436.06	0.0	1.0	2.6	1.0	48.4	53.67	0.66
1	54	200 year	77.3	0.05	0.0	0.05	433.7	435.71		435.96	0.0	0.9	2.5	0.9	43.7	52.97	0.66
1	54	PMF	561.3	0.05	0.0	0.05	433.7	438.43		438.76	0.0	1.6	3.5	1.6	268.4	101.5	0.54
1	53	1 year	11.1		0.0		433.5	434.39		434.51	0.0		1.5		7.3	11.7	0.62
1	53	5 year	36.2	0.05	0.0	0.05	433.5	435.01	434.8	435.24	0.0	0.4	2.2	0.4	19.4	47.13	0.70
1	53	100 year	88.1	0.05	0.0	0.05	433.5	435.53		435.83	0.0	1.0	2.8	1.0	45.2	51.32	0.71
1	53	200 year	77.3	0.05	0.0	0.05	433.5	435.44		435.73	0.0	0.9	2.7	1.0	40.7	50.62	0.70
1	53	PMF	561.3	0.05	0.0	0.05	433.5	438.35		438.66	0.0	1.6	3.4	1.6	276.5	99.43	0.51
1	52	1 year	11.1		0.0		433.0	433.98		434.07	0.0		1.3		8.5	12.47	0.51
1	52	5 year	36.2	0.05	0.0	0.05	433.0	434.64		434.79	0.0	0.5	1.8	0.4	26.3	47.82	0.53
1	52	100 year	88.1	0.05	0.0	0.05	433.0	435.10		435.36	0.0	1.0	2.5	0.8	49.0	51.48	0.64
1	52	200 year	77.3	0.05	0.0	0.05	433.0	435.01		435.25	0.0	0.9	2.5	0.8	44.3	50.74	0.63
1	52	PMF	561.3	0.05	0.0	0.05	433.0	438.25	436.0	438.48	0.0	1.5	2.9	1.3	316.1	98.94	0.42
1	51	1 year	11.1		0.0		432.5	433.21	433.2	433.47	0.0		2.2		5.0	10	1.01
1	51	5 year	36.2		0.0		432.5	433.82	433.8	434.25	0.0		2.9		12.6	14.87	1.00
1	51	100 year	88.1	0.05	0.0	0.05	432.5	434.46	434.5	434.86	0.0	1.0	3.1	1.1	39.6	49.86	0.82
1	51	200 year	77.3	0.05	0.0	0.05	432.5	434.39	434.4	434.76	0.0	0.9	3.0	1.0	36.0	49.29	0.81
1	51	PMF	561.3	0.05	0.0	0.05	432.5	435.54	435.5	437.96	0.0	3.6	8.4	4.1	98.0	58.5	1.68

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	50.5	1 year	11.1		0.0		432.0	432.94		433.05	0.0		1.5		7.5	11.81	0.60
1	50.5	5 year	36.2	0.05	0.0	0.05	432.0	433.57		433.79	0.0	0.4	2.1	0.4	20.9	46.77	0.65
1	50.5	100 year	88.1	0.05	0.0	0.05	432.0	434.07		434.37	0.0	1.0	2.8	1.1	45.0	50.72	0.71
1	50.5	200 year	77.3	0.05	0.0	0.05	432.0	433.98		434.27	0.0	0.9	2.7	1.0	40.7	50.04	0.70
1	50.5	PMF	561.3	0.05	0.0	0.05	432.0	436.09		436.78	0.0	1.8	4.8	2.2	196.3	98.8	0.82
1	50	1 year	11.1		0.0		431.7	432.59		432.70	0.0		1.5		7.4	11.8	0.60
1	50	5 year	36.2	0.05	0.0	0.05	431.7	433.23		433.44	0.0	0.4	2.1	0.4	21.1	47.29	0.65
1	50	100 year	88.1	0.05	0.0	0.05	431.7	433.73		434.02	0.0	1.0	2.7	1.0	46.0	51.34	0.69
1	50	200 year	77.3	0.05	0.0	0.05	431.7	433.65		433.92	0.0	0.9	2.6	1.0	41.6	50.65	0.68
1	50	PMF	561.3	0.05	0.0	0.05	431.7	435.79		436.43	0.0	1.9	4.7	2.1	202.1	99.3	0.79
1	49	1 year	11.1		0.0		431.4	432.30		432.41	0.0		1.5		7.4	11.8	0.60
1	49	5 year	36.2	0.05	0.0	0.05	431.4	432.93		433.14	0.0	0.4	2.1	0.4	20.8	46.84	0.66
1	49	100 year	88.1	0.05	0.0	0.05	431.4	433.41		433.72	0.0	1.1	2.8	0.9	44.4	50.72	0.72
1	49	200 year	77.3	0.05	0.0	0.05	431.4	433.33		433.62	0.0	1.0	2.7	0.9	40.2	50.05	0.71
1	49	PMF	561.3	0.05	0.0	0.05	431.4	435.55		436.16	0.0	2.1	4.6	1.7	206.5	98.89	0.76
1	48	1 year	11.1		0.0		431.0	431.96		432.07	0.0		1.5		7.6	11.9	0.58
1	48	5 year	36.2	0.05	0.0	0.05	431.0	432.58		432.79	0.0	0.4	2.1	0.4	21.3	47.72	0.65
1	48	100 year	88.1	0.05	0.0	0.05	431.0	433.09		433.38	0.0	1.0	2.7	1.0	46.2	51.74	0.69
1	48	200 year	77.3	0.05	0.0	0.05	431.0	433.00		433.27	0.0	1.0	2.6	0.9	41.7	51.03	0.69
1	48	PMF	561.3	0.05	0.0	0.05	431.0	435.38		435.87	0.0	2.0	4.1	1.7	227.0	99.71	0.67
1	47	1 year	11.1		0.0		430.8	431.73		431.82	0.0		1.3		8.3	12.35	0.52
1	47	5 year	36.2	0.05	0.0	0.05	430.8	432.39	432.1	432.55	0.0	0.4	1.8	0.5	25.5	47.72	0.55
1	47	100 year	88.1	0.05	0.0	0.05	430.8	432.79		433.09	0.0	0.9	2.8	1.1	44.8	50.86	0.71
1	47	200 year	77.3	0.05	0.0	0.05	430.8	432.71		432.99	0.0	0.8	2.6	1.0	40.8	50.22	0.70
1	47	PMF	561.3	0.05	0.0	0.05	430.8	435.25		435.68	0.0	1.5	3.9	1.9	240.4	98.98	0.62
1	46	1 year	11.1		0.0		430.4	431.10	431.1	431.35	0.0		2.2		5.0	9.99	1.01
1	46	5 year	36.2		0.0		430.4	431.70	431.7	432.13	0.0		2.9		12.5	14.86	1.00
1	46	100 year	88.1	0.05	0.0	0.05	430.4	432.34	432.3	432.73	0.0	0.8	3.1	1.1	40.1	51.1	0.82
1	46	200 year	77.3	0.05	0.0	0.05	430.4	432.27	432.3	432.63	0.0	0.7	2.9	1.0	36.5	50.53	0.80
1	46	PMF	561.3	0.05	0.0	0.05	430.4	435.21		435.53	0.0	1.3	3.4	1.7	273.9	100.06	0.52

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	45.5	1 year	11.1		0.0		429.9	430.82		430.94	0.0		1.5		7.5	11.81	0.60
1	45.5	5 year	36.2	0.05	0.0	0.05	429.9	431.45		431.67	0.0	0.3	2.1	0.4	20.9	48	0.66
1	45.5	100 year	88.1	0.05	0.0	0.05	429.9	431.93		432.24	0.0	0.8	2.8	1.1	44.9	51.84	0.72
1	45.5	200 year	77.3	0.05	0.0	0.05	429.9	431.85		432.14	0.0	0.7	2.7	1.0	40.9	51.23	0.70
1	45.5	PMF	561.3	0.05	0.0	0.05	429.9	435.29		435.49	0.0	1.2	2.7	1.5	331.5	100.06	0.40
1	45	1 year	11.1		0.0		429.7	430.62		430.73	0.0		1.5		7.5	11.81	0.60
1	45	5 year	36.2	0.05	0.0	0.05	429.7	431.25		431.46	0.0	0.4	2.1	0.4	21.4	49.45	0.65
1	45	100 year	88.1	0.05	0.0	0.05	429.7	431.77		432.04	0.0	1.0	2.6	1.0	48.1	53.61	0.67
1	45	200 year	77.3	0.05	0.0	0.05	429.7	431.70		431.95	0.0	0.9	2.5	0.9	44.5	53.07	0.64
1	45	PMF	561.3	0.05	0.0	0.05	429.7	435.28		435.45	0.0	1.3	2.6	1.3	356.6	101.47	0.36
1	44	1 year	11.1		0.0		429.5	430.42		430.53	0.0		1.5		7.5	11.83	0.59
1	44	5 year	36.2	0.05	0.0	0.05	429.5	431.05		431.26	0.0	0.4	2.1	0.4	20.8	46.89	0.66
1	44	100 year	88.1	0.05	0.0	0.05	429.5	431.51		431.84	0.0	1.1	2.8	1.0	43.4	50.59	0.74
1	44	200 year	77.3	0.05	0.0	0.05	429.5	431.57		431.79	0.0	0.9	2.4	0.8	46.2	51.02	0.60
1	44	PMF	561.3	0.05	0.0	0.05	429.5	435.25		435.42	0.0	1.3	2.5	1.2	363.1	98.93	0.35
1	43	1 year	11.1		0.0		429.3	430.22		430.33	0.0		1.5		7.6	11.93	0.58
1	43	5 year	36.2	0.05	0.0	0.05	429.3	430.89		431.07	0.0	0.4	1.9	0.4	23.5	47.92	0.59
1	43	100 year	88.1	0.05	0.0	0.05	429.3	431.37		431.64	0.0	1.0	2.6	0.9	47.3	51.75	0.67
1	43	200 year	77.3	0.05	0.0	0.05	429.3	431.51		431.67	0.0	0.8	2.0	0.8	54.7	52.89	0.49
1	43	PMF	561.3	0.05	0.0	0.05	429.3	435.24		435.39	0.0	1.3	2.3	1.1	386.2	99.54	0.32
1	42	1 year	11.1		0.0		429.2	430.10		430.20	0.0		1.4		7.9	12.08	0.56
1	42	5 year	36.2	0.05	0.0	0.05	429.2	430.82	430.5	430.96	0.0	0.5	1.8	0.5	27.0	49.35	0.52
1	42	100 year	88.1	0.05	0.0	0.05	429.2	431.27		431.52	0.0	1.0	2.5	1.0	50.4	53.01	0.63
1	42	200 year	77.3	0.05	0.0	0.05	429.2	431.48		431.60	0.0	0.8	1.8	0.8	61.2	54.62	0.43
1	42	PMF	561.3	0.05	0.0	0.05	429.2	435.23		435.37	0.0	1.1	2.2	1.2	403.6	100.42	0.30
1	41	1 year	11.1		0.0		429.0	429.64	429.6	429.89	0.0		2.2		5.0	10	1.01
1	41	5 year	37.9		0.0		429.0	430.28	430.3	430.71	0.0		2.9		13.0	15.1	1.00
1	41	100 year	92.2	0.05	0.0	0.05	429.0	430.91	430.9	431.31	0.0	1.1	3.1	1.1	41.4	51.2	0.83
1	41	200 year	107.7	0.05	0.0	0.05	429.0	431.00	431.0	431.44	0.0	1.2	3.3	1.3	46.2	51.94	0.85
1	41	PMF	1191.3	0.05	0.0	0.05	429.0	433.91	433.9	435.18	0.0	3.1	6.8	3.4	289.0	99.95	1.03

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	40.5	1 year	11.1		0.0		428.5	429.35		429.47	0.0		1.5		7.2	11.65	0.62
1	40.5	5 year	37.9	0.05	0.0	0.05	428.5	430.06	429.8	430.25	0.0	0.5	2.0	0.5	23.8	48.38	0.61
1	40.5	100 year	92.2	0.05	0.0	0.05	428.5	430.57		430.84	0.0	1.0	2.6	1.0	49.8	52.5	0.66
1	40.5	200 year	107.7	0.05	0.0	0.05	428.5	430.68		430.98	0.0	1.1	2.8	1.2	55.8	53.41	0.67
1	40.5	PMF	1191.3	0.05	0.0	0.05	428.5	434.03		434.85	0.0	2.7	5.5	2.8	350.9	99.95	0.78
1	40	1 year	11.1		0.0		428.3	429.17		429.30	0.0		1.6		7.0	11.49	0.65
1	40	5 year	37.9	0.05	0.0	0.05	428.3	429.82	429.6	430.08	0.0	0.3	2.3	0.3	18.4	46.64	0.74
1	40	100 year	92.2	0.05	0.0	0.05	428.3	430.38		430.70	0.0	1.0	2.8	1.1	45.8	51.14	0.72
1	40	200 year	107.7	0.05	0.0	0.05	428.3	430.49		430.83	0.0	1.1	2.9	1.2	51.8	52.06	0.72
1	40	PMF	1191.3	0.05	0.0	0.05	428.3	433.80		434.71	0.0	2.8	5.8	2.9	335.9	99.65	0.82
1	39	1 year	11.1		0.0		427.6	428.60		428.69	0.0		1.3		8.3	12.39	0.52
1	39	5 year	37.9	0.05	0.0	0.05	427.6	429.30		429.46	0.0	0.4	1.9	0.4	25.9	47.86	0.55
1	39	100 year	92.2	0.05	0.0	0.05	427.6	429.72		430.03	0.0	1.0	2.8	1.0	46.9	51.26	0.70
1	39	200 year	107.7	0.05	0.0	0.05	427.6	429.83		430.16	0.0	1.2	2.9	1.1	52.5	52.12	0.71
1	39	PMF	1191.3	0.05	0.0	0.05	427.6	432.75	432.7	433.94	0.0	3.2	6.6	3.1	298.0	99.6	0.98
1	38	1 year	11.1		0.0		427.1	427.81	427.8	428.07	0.0		2.2		5.0	10	1.01
1	38	5 year	37.9		0.0		427.1	428.45	428.5	428.88	0.0		2.9		13.0	15.1	1.00
1	38	100 year	92.2	0.05	0.0	0.05	427.1	429.10	429.1	429.49	0.0	1.1	3.1	1.0	42.3	54.05	0.81
1	38	200 year	107.7	0.05	0.0	0.05	427.1	429.20	429.2	429.62	0.0	1.2	3.2	1.2	47.4	54.81	0.83
1	38	PMF	1191.3	0.05	0.0	0.05	427.1	432.08	432.1	433.31	0.0	3.3	6.7	3.0	293.8	103.44	1.02
1	37.5	1 year	11.1		0.0		426.6	427.53		427.64	0.0		1.5		7.3	11.7	0.61
1	37.5	5 year	37.9	0.05	0.0	0.05	426.6	428.19	428.0	428.42	0.0	0.4	2.2	0.3	20.4	50.72	0.69
1	37.5	100 year	92.2	0.05	0.0	0.05	426.6	428.56		429.00	0.0	1.1	3.2	1.1	40.2	53.74	0.86
1	37.5	200 year	107.7	0.05	0.0	0.05	426.6	428.70	428.7	429.12	0.0	1.2	3.2	1.2	47.4	54.81	0.83
1	37.5	PMF	1191.3	0.05	0.0	0.05	426.6	431.58	431.6	432.81	0.0	3.3	6.7	3.0	293.4	103.44	1.02
1	37	1 year	11.1		0.0		426.4	427.32		427.44	0.0		1.5		7.3	11.7	0.62
1	37	5 year	37.9	0.05	0.0	0.05	426.4	427.98	427.8	428.21	0.0	0.3	2.2	0.3	21.7	64.24	0.68
1	37	100 year	92.2	0.05	0.0	0.05	426.4	428.37	428.4	428.71	0.0	1.0	3.0	1.0	47.4	67.37	0.79
1	37	200 year	107.7	0.05	0.0	0.05	426.4	428.45	428.5	428.81	0.0	1.1	3.1	1.1	52.7	68	0.81
1	37	PMF	1191.3	0.05	0.0	0.05	426.4	431.79		432.44	0.0	2.4	5.0	2.7	390.2	117	0.73

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	36	1 year	11.1		0.0		426.1	426.96		427.07	0.0		1.5		7.3	11.7	0.62
1	36	5 year	37.9	0.05	0.0	0.05	426.1	427.59	427.4	427.83	0.0	0.3	2.2	0.3	22.9	89.51	0.69
1	36	100 year	92.2	0.05	0.0	0.05	426.1	428.07		428.25	0.0	0.8	2.3	0.9	66.3	93.3	0.61
1	36	200 year	107.7	0.05	0.0	0.05	426.1	428.19		428.37	0.0	0.8	2.3	0.9	78.0	94.3	0.58
1	36	PMF	1191.3	0.05	0.0	0.05	426.1	431.93		432.22	0.0	1.6	3.4	2.0	561.4	142.39	0.47
1	35	1 year	11.1		0.0		425.7	426.62		426.73	0.0		1.5		7.5	11.86	0.59
1	35	5 year	37.9	0.05	0.0	0.05	425.7	427.31		427.49	0.0	0.4	2.0	0.4	25.3	64.44	0.61
1	35	100 year	92.2	0.05	0.0	0.05	425.7	427.93		428.09	0.0	0.8	2.1	0.9	66.6	69.38	0.52
1	35	200 year	107.7	0.05	0.0	0.05	425.7	428.06		428.22	0.0	0.8	2.2	0.9	75.9	70.44	0.51
1	35	PMF	1191.3	0.05	0.0	0.05	425.7	431.68		432.13	0.0	2.0	4.2	2.3	460.6	116.74	0.57
1	34	1 year	11.1		0.0		425.5	426.48		426.58	0.0		1.4		7.9	12.1	0.56
1	34	5 year	37.9	0.05	0.0	0.05	425.5	427.19		427.37	0.0	0.4	1.9	0.4	24.2	44.91	0.58
1	34	100 year	92.2	0.05	0.0	0.05	425.5	427.66		427.97	0.0	1.0	2.8	1.1	46.0	48.64	0.69
1	34	200 year	107.7	0.05	0.0	0.05	425.5	427.77		428.10	0.0	1.1	2.9	1.2	51.4	49.52	0.71
1	34	PMF	1191.3	0.05	0.0	0.05	425.5	430.68	430.7	431.95	0.0	3.0	6.7	3.4	289.7	96.82	1.00
1	33	1 year	11.1		0.0		425.3	425.96	426.0	426.21	0.0		2.2		5.0	10	1.01
1	33	5 year	37.9		0.0		425.3	426.59	426.6	427.03	0.0		2.9		12.9	15.07	1.01
1	33	100 year	92.2	0.05	0.0	0.05	425.3	427.26	427.3	427.67	0.0	1.0	3.1	1.1	40.5	49.73	0.82
1	33	200 year	107.7	0.05	0.0	0.05	425.3	427.36	427.4	427.80	0.0	1.1	3.3	1.2	45.5	50.52	0.84
1	33	PMF	1191.3	0.05	0.0	0.05	425.3	430.34	430.3	431.61	0.0	2.9	6.7	3.4	289.4	99.03	1.01
1	32.5	1 year	11.1		0.0		424.8	425.67		425.79	0.0		1.5		7.3	11.71	0.61
1	32.5	5 year	37.9	0.05	0.0	0.05	424.8	426.35	426.1	426.57	0.0	0.4	2.2	0.4	20.6	46.42	0.67
1	32.5	100 year	92.2	0.05	0.0	0.05	424.8	426.84		427.18	0.0	1.0	2.9	1.1	44.7	50.4	0.73
1	32.5	200 year	107.7	0.05	0.0	0.05	424.8	426.95		427.31	0.0	1.1	3.0	1.2	50.2	51.26	0.75
1	32.5	PMF	1191.3	0.05	0.0	0.05	424.8	430.02		431.13	0.0	2.8	6.3	3.2	307.2	99.03	0.93
1	32	1 year	11.1		0.0		424.6	425.46		425.58	0.0		1.5		7.3	11.7	0.62
1	32	5 year	37.9	0.05	0.0	0.05	424.6	426.14		426.37	0.0	0.4	2.2	0.4	20.9	48.01	0.67
1	32	100 year	92.2	0.05	0.0	0.05	424.6	426.65		426.97	0.0	1.0	2.8	1.0	46.7	52.13	0.71
1	32	200 year	107.7	0.05	0.0	0.05	424.6	426.76		427.10	0.0	1.1	2.9	1.2	52.3	52.98	0.72
1	32	PMF	1191.3	0.05	0.0	0.05	424.6	429.84		430.88	0.0	3.0	6.2	3.1	316.4	100.6	0.90

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	31	1 year	11.1		0.0		424.2	425.08		425.20	0.0		1.5		7.3	11.71	0.61
1	31	5 year	37.9	0.05	0.0	0.05	424.2	425.75	425.5	425.98	0.0	0.4	2.2	0.3	20.5	48.28	0.68
1	31	100 year	92.2	0.05	0.0	0.05	424.2	426.20		426.57	0.0	1.1	3.0	0.8	43.2	51.91	0.78
1	31	200 year	107.7	0.05	0.0	0.05	424.2	426.30		426.69	0.0	1.2	3.1	0.9	48.6	52.74	0.79
1	31	PMF	1191.3	0.05	0.0	0.05	424.2	429.51		430.50	0.0	3.1	6.0	2.5	322.9	100.96	0.87
1	30	1 year	11.1		0.0		424.0	424.88		424.99	0.0		1.5		7.3	11.72	0.61
1	30	5 year	37.9	0.05	0.0	0.05	424.0	425.55	425.3	425.77	0.0	0.4	2.1	0.4	21.5	52.46	0.66
1	30	100 year	92.2	0.05	0.0	0.05	424.0	426.09		426.36	0.0	1.0	2.6	1.0	51.1	56.78	0.66
1	30	200 year	107.7	0.05	0.0	0.05	424.0	426.21		426.49	0.0	1.1	2.7	1.1	57.8	57.72	0.66
1	30	PMF	1191.3	0.05	0.0	0.05	424.0	429.55		430.30	0.0	2.7	5.3	2.7	364.3	105.04	0.76
1	29	1 year	11.1		0.0		423.8	424.69		424.80	0.0		1.5		7.4	11.77	0.60
1	29	5 year	37.9	0.05	0.0	0.05	423.8	425.35		425.58	0.0	0.4	2.1	0.4	20.9	47.34	0.67
1	29	100 year	92.2	0.05	0.0	0.05	423.8	425.85		426.18	0.0	0.9	2.8	1.1	45.5	51.33	0.72
1	29	200 year	107.7	0.05	0.0	0.05	423.8	425.96		426.31	0.0	1.0	3.0	1.2	51.3	52.22	0.73
1	29	PMF	1191.3	0.05	0.0	0.05	423.8	429.09		430.12	0.0	2.7	6.1	3.1	317.5	99.92	0.89
1	28	1 year	11.1		0.0		423.5	424.47		424.57	0.0		1.4		7.9	12.08	0.56
1	28	5 year	37.9	0.05	0.0	0.05	423.5	425.18		425.35	0.0	0.4	1.9	0.4	24.9	48.6	0.57
1	28	100 year	92.2	0.05	0.0	0.05	423.5	425.64		425.93	0.0	1.0	2.7	1.0	48.0	52.27	0.68
1	28	200 year	107.7	0.05	0.0	0.05	423.5	425.75		426.06	0.0	1.1	2.8	1.1	53.8	53.15	0.70
1	28	PMF	1191.3	0.05	0.0	0.05	423.5	428.87		429.86	0.0	2.9	6.0	3.0	323.4	100.53	0.87
1	27	1 year	11.1		0.0		423.3	423.96	424.0	424.22	0.0		2.2		5.0	10	1.01
1	27	5 year	37.9		0.0		423.3	424.60	424.6	425.03	0.0		2.9		12.9	15.06	1.01
1	27	100 year	92.2	0.05	0.0	0.05	423.3	425.26	425.3	425.67	0.0	1.1	3.1	1.0	41.0	50.79	0.82
1	27	200 year	107.7	0.05	0.0	0.05	423.3	425.36	425.4	425.80	0.0	1.2	3.3	1.1	46.0	51.57	0.84
1	27	PMF	1191.3	0.05	0.0	0.05	423.3	428.31	428.3	429.58	0.0	3.4	6.7	2.9	290.3	100.11	1.01
1	26.5	1 year	11.1		0.0		422.8	423.68		423.79	0.0		1.5		7.3	11.7	0.62
1	26.5	5 year	37.9	0.05	0.0	0.05	422.8	424.35		424.58	0.0	0.4	2.2	0.4	20.7	47.49	0.67
1	26.5	100 year	92.2	0.05	0.0	0.05	422.8	424.85		425.18	0.0	1.1	2.9	1.0	45.3	51.46	0.73
1	26.5	200 year	107.7	0.05	0.0	0.05	422.8	424.95		425.31	0.0	1.2	3.0	1.1	50.8	52.31	0.74
1	26.5	PMF	1191.3	0.05	0.0	0.05	422.8	428.00		429.10	0.0	3.2	6.3	2.8	309.1	100.11	0.93

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	26	1 year	11.1		0.0		422.5	423.43		423.55	0.0		1.5		7.3	11.71	0.61
1	26	5 year	37.9	0.05	0.0	0.05	422.5	424.10	423.9	424.33	0.0	0.4	2.2	0.4	20.7	48.11	0.67
1	26	100 year	92.2	0.05	0.0	0.05	422.5	424.57		424.92	0.0	1.0	2.9	1.1	44.2	51.87	0.76
1	26	200 year	107.7	0.05	0.0	0.05	422.5	424.67		425.05	0.0	1.1	3.1	1.2	49.6	52.7	0.77
1	26	PMF	1191.3	0.05	0.0	0.05	422.5	427.77		428.83	0.0	2.9	6.2	3.1	312.9	100.74	0.92
1	25	1 year	11.1		0.0		422.4	423.27		423.38	0.0		1.5		7.3	11.71	0.61
1	25	5 year	37.9	0.05	0.0	0.05	422.4	423.95	423.7	424.17	0.0	0.4	2.1	0.4	21.3	48.67	0.66
1	25	100 year	92.2	0.05	0.0	0.05	422.4	424.44		424.76	0.0	1.0	2.8	1.1	46.1	52.58	0.72
1	25	200 year	107.7	0.05	0.0	0.05	422.4	424.54		424.89	0.0	1.1	3.0	1.2	51.7	53.44	0.73
1	25	PMF	1191.3	0.05	0.0	0.05	422.4	427.69		428.68	0.0	2.7	6.0	3.1	323.4	101.21	0.87
1	24	1 year	11.1		0.0		422.1	422.94		423.06	0.0		1.5		7.3	11.7	0.62
1	24	5 year	37.9	0.05	0.0	0.05	422.1	423.60	423.4	423.84	0.0	0.3	2.2	0.3	20.0	47.97	0.69
1	24	100 year	92.2	0.05	0.0	0.05	422.1	424.11		424.44	0.0	1.1	2.9	1.0	45.4	52.03	0.73
1	24	200 year	107.7	0.05	0.0	0.05	422.1	424.22		424.57	0.0	1.2	3.0	1.2	51.1	52.91	0.74
1	24	PMF	1191.3	0.05	0.0	0.05	422.1	427.37		428.37	0.0	3.0	6.1	3.0	321.2	100.72	0.88
1	23	1 year	11.1		0.0		421.7	422.63		422.73	0.0		1.4		8.1	12.23	0.54
1	23	5 year	37.9	0.05	0.0	0.05	421.7	423.33	423.0	423.50	0.0	0.4	1.9	0.4	25.2	47.88	0.57
1	23	100 year	92.2	0.05	0.0	0.05	421.7	423.78		424.08	0.0	1.1	2.7	0.9	47.2	51.44	0.69
1	23	200 year	107.7	0.05	0.0	0.05	421.7	423.89		424.21	0.0	1.2	2.9	1.0	52.9	52.3	0.70
1	23	PMF	1191.3	0.05	0.0	0.05	421.7	426.99		428.02	0.0	3.2	6.1	2.7	317.7	99.74	0.89
1	22	1 year	11.1		0.0		421.3	422.02	422.0	422.27	0.0		2.2		5.0	10	1.01
1	22	5 year	37.9		0.0		421.3	422.65	422.7	423.09	0.0		2.9		12.9	15.07	1.01
1	22	100 year	92.2	0.05	0.0	0.05	421.3	423.32	423.3	423.72	0.0	1.1	3.1	1.1	40.8	50.47	0.82
1	22	200 year	107.7	0.05	0.0	0.05	421.3	423.41	423.4	423.85	0.0	1.2	3.3	1.2	45.8	51.26	0.84
1	22	PMF	1191.3	0.05	0.0	0.05	421.3	426.38	426.4	427.65	0.0	3.2	6.8	3.2	290.4	99.79	1.01
1	21.5	1 year	11.1		0.0		420.8	421.73		421.85	0.0		1.5		7.3	11.71	0.61
1	21.5	5 year	37.9	0.05	0.0	0.05	420.8	422.40	422.2	422.63	0.0	0.4	2.2	0.4	20.7	47.18	0.67
1	21.5	100 year	92.2	0.05	0.0	0.05	420.8	422.92		423.24	0.0	1.0	2.8	1.0	46.0	51.3	0.71
1	21.5	200 year	107.7	0.05	0.0	0.05	420.8	423.03		423.37	0.0	1.2	2.9	1.1	52.0	52.21	0.72
1	21.5	PMF	1191.3	0.05	0.0	0.05	420.8	426.31		427.24	0.0	2.9	5.8	2.9	333.4	99.79	0.83

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	21	1 year	11.1		0.0		420.5	421.43		421.54	0.0		1.5		7.4	11.77	0.61
1	21	5 year	37.9	0.05	0.0	0.05	420.5	422.10		422.32	0.0	0.4	2.1	0.4	21.0	47.51	0.66
1	21	100 year	92.2	0.05	0.0	0.05	420.5	422.64		422.94	0.0	1.0	2.7	1.0	47.9	51.83	0.68
1	21	200 year	107.7	0.05	0.0	0.05	420.5	422.76		423.07	0.0	1.1	2.8	1.1	54.1	52.78	0.69
1	21	PMF	1191.3	0.05	0.0	0.05	420.5	426.06		426.94	0.0	2.8	5.7	2.8	341.0	100.07	0.81
1	20	1 year	11.1		0.0		420.3	421.26		421.37	0.0		1.5		7.6	11.91	0.58
1	20	5 year	37.9	0.05	0.0	0.05	420.3	421.93		422.14	0.0	0.4	2.1	0.4	21.6	46.34	0.65
1	20	100 year	92.2	0.05	0.0	0.05	420.3	422.43		422.75	0.0	1.1	2.8	1.0	45.9	50.36	0.71
1	20	200 year	107.7	0.05	0.0	0.05	420.3	422.55		422.89	0.0	1.2	2.9	1.1	51.7	51.29	0.72
1	20	PMF	1191.3	0.05	0.0	0.05	420.3	425.76		426.75	0.0	3.0	6.0	2.9	323.7	98.78	0.86
1	19	1 year	11.1		0.0		420.1	421.10		421.19	0.0		1.3		8.4	12.43	0.51
1	19	5 year	37.9	0.05	0.0	0.05	420.1	421.80	421.4	421.95	0.0	0.5	1.8	0.4	26.2	48.19	0.54
1	19	100 year	92.2	0.05	0.0	0.05	420.1	422.26		422.53	0.0	1.0	2.6	1.0	49.4	51.9	0.66
1	19	200 year	107.7	0.05	0.0	0.05	420.1	422.37		422.67	0.0	1.1	2.8	1.1	55.5	52.83	0.67
1	19	PMF	1191.3	0.05	0.0	0.05	420.1	425.60		426.51	0.0	2.9	5.8	2.8	335.2	99.88	0.83
1	18	1 year	11.1		0.0		419.6	420.26	420.3	420.51	0.0		2.2		5.0	10	1.01
1	18	5 year	37.9		0.0		419.6	420.89	420.9	421.33	0.0		2.9		12.9	15.07	1.01
1	18	100 year	92.2	0.05	0.0	0.05	419.6	421.56	421.6	421.97	0.0	1.1	3.1	1.0	40.8	50.43	0.82
1	18	200 year	107.7	0.05	0.0	0.05	419.6	421.66	421.7	422.10	0.0	1.2	3.3	1.2	45.8	51.21	0.84
1	18	PMF	1191.3	0.05	0.0	0.05	419.6	424.62	424.6	425.89	0.0	3.4	6.7	3.0	290.0	99.74	1.01
1	17.5	1 year	11.1		0.0		419.1	419.97		420.09	0.0		1.5		7.3	11.71	0.61
1	17.5	5 year	37.9	0.05	0.0	0.05	419.1	420.66	420.4	420.88	0.0	0.4	2.1	0.4	21.4	47.25	0.65
1	17.5	100 year	92.2	0.05	0.0	0.05	419.1	421.17		421.48	0.0	1.1	2.8	1.0	46.7	51.36	0.70
1	17.5	200 year	107.7	0.05	0.0	0.05	419.1	421.29		421.62	0.0	1.2	2.9	1.1	52.5	52.25	0.71
1	17.5	PMF	1191.3	0.05	0.0	0.05	419.1	424.44		425.44	0.0	3.1	6.0	2.8	322.2	99.74	0.87
1	17	1 year	11.1		0.0		418.3	419.23		419.35	0.0		1.5		7.3	11.69	0.62
1	17	5 year	37.9	0.05	0.0	0.05	418.3	419.88	419.7	420.13	0.0	0.3	2.2	0.3	19.8	47.16	0.70
1	17	100 year	92.2	0.05	0.0	0.05	418.3	420.38		420.73	0.0	1.0	2.9	1.1	44.4	51.15	0.75
1	17	200 year	107.7	0.05	0.0	0.05	418.3	420.49		420.86	0.0	1.2	3.0	1.2	50.0	52.02	0.76
1	17	PMF	1191.3	0.05	0.0	0.05	418.3	423.64		424.68	0.0	2.9	6.1	3.0	316.8	99.92	0.90

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	16	1 year	11.1		0.0		417.9	418.86		418.97	0.0		1.4		7.7	11.99	0.57
1	16	5 year	37.9	0.05	0.0	0.05	417.9	419.58		419.75	0.0	0.4	1.9	0.4	24.8	50.37	0.58
1	16	100 year	92.2	0.05	0.0	0.05	417.9	420.04		420.32	0.0	1.0	2.7	1.0	49.1	54.1	0.68
1	16	200 year	107.7	0.05	0.0	0.05	417.9	420.15		420.46	0.0	1.1	2.8	1.1	55.2	54.99	0.69
1	16	PMF	1191.3	0.05	0.0	0.05	417.9	423.39		424.26	0.0	2.7	5.7	2.9	342.3	102.38	0.81
1	15	1 year	11.1		0.0		417.7	418.41	418.4	418.66	0.0		2.2		5.0	10	1.01
1	15	5 year	37.9		0.0		417.7	419.04	419.0	419.48	0.0		2.9		12.9	15.07	1.01
1	15	100 year	92.2	0.05	0.0	0.05	417.7	419.71	419.7	420.12	0.0	1.0	3.1	1.1	40.8	50.4	0.82
1	15	200 year	107.7	0.05	0.0	0.05	417.7	419.81	419.8	420.25	0.0	1.2	3.3	1.2	45.8	51.18	0.84
1	15	PMF	1191.3	0.05	0.0	0.05	417.7	422.77	422.8	424.04	0.0	3.0	6.8	3.4	289.7	99.71	1.01
1	14.5	1 year	11.1		0.0		417.2	418.12		418.24	0.0		1.5		7.3	11.71	0.61
1	14.5	5 year	37.9	0.05	0.0	0.05	417.2	418.80	418.5	419.03	0.0	0.4	2.1	0.4	21.0	47.15	0.66
1	14.5	100 year	92.2	0.05	0.0	0.05	417.2	419.33		419.64	0.0	1.0	2.7	1.0	47.2	51.41	0.69
1	14.5	200 year	107.7	0.05	0.0	0.05	417.2	419.45		419.77	0.0	1.1	2.9	1.2	53.1	52.32	0.70
1	14.5	PMF	1191.3	0.05	0.0	0.05	417.2	422.63		423.60	0.0	2.7	5.9	3.0	326.2	99.71	0.86
1	14	1 year	11.1		0.0		416.4	417.26		417.37	0.0		1.5		7.3	11.7	0.62
1	14	5 year	37.9	0.05	0.0	0.05	416.4	417.92	417.7	418.16	0.0	0.4	2.2	0.4	20.4	47.03	0.68
1	14	100 year	92.2	0.05	0.0	0.05	416.4	418.41		418.75	0.0	1.1	2.9	1.0	44.1	50.9	0.75
1	14	200 year	107.7	0.05	0.0	0.05	416.4	418.51		418.89	0.0	1.2	3.1	1.1	49.6	51.76	0.76
1	14	PMF	1191.3	0.05	0.0	0.05	416.4	421.66		422.70	0.0	3.2	6.2	2.7	315.2	99.69	0.90
1	13	1 year	11.1		0.0		416.0	416.92		417.03	0.0		1.5		7.5	11.83	0.60
1	13	5 year	37.9	0.05	0.0	0.05	416.0	417.59		417.81	0.0	0.4	2.1	0.4	21.7	48.97	0.65
1	13	100 year	92.2	0.05	0.0	0.05	416.0	418.09		418.40	0.0	1.0	2.8	1.0	47.3	52.98	0.70
1	13	200 year	107.7	0.05	0.0	0.05	416.0	418.20		418.53	0.0	1.2	2.9	1.1	53.3	53.89	0.71
1	13	PMF	1191.3	0.05	0.0	0.05	416.0	421.44		422.35	0.0	3.0	5.8	2.7	335.7	101.45	0.83
1	12	1 year	11.1		0.0		415.8	416.74		416.84	0.0		1.4		8.0	12.16	0.55
1	12	5 year	37.9	0.05	0.0	0.05	415.8	417.45	417.1	417.62	0.0	0.4	1.9	0.4	25.1	47.93	0.57
1	12	100 year	92.2	0.05	0.0	0.05	415.8	417.91		418.20	0.0	1.0	2.7	1.0	48.1	51.62	0.68
1	12	200 year	107.7	0.05	0.0	0.05	415.8	418.02		418.33	0.0	1.1	2.8	1.1	53.9	52.52	0.69
1	12	PMF	1191.3	0.05	0.0	0.05	415.8	421.16		422.15	0.0	2.9	6.0	3.0	323.7	99.81	0.87

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	11	1 year	11.1		0.0		415.5	416.18	416.2	416.43	0.0		2.2		5.0	10	1.01
1	11	5 year	37.9		0.0		415.5	416.81	416.8	417.25	0.0		2.9		12.9	15.07	1.01
1	11	100 year	92.2	0.05	0.0	0.05	415.5	417.48	417.5	417.88	0.0	1.1	3.1	1.1	40.9	50.56	0.82
1	11	200 year	107.7	0.05	0.0	0.05	415.5	417.58	417.6	418.01	0.0	1.2	3.3	1.2	45.9	51.35	0.84
1	11	PMF	1191.3	0.05	0.0	0.05	415.5	420.54	420.5	421.80	0.0	3.1	6.7	3.3	290.9	99.88	1.01
1	10.5	1 year	11.1		0.0		415.0	415.86		415.99	0.0		1.6		6.9	11.42	0.66
1	10.5	5 year	37.9	0.05	0.0	0.05	415.0	416.50	416.3	416.78	0.0	0.3	2.4	0.3	17.8	46.77	0.75
1	10.5	100 year	92.2	0.05	0.0	0.05	415.0	417.05		417.39	0.0	1.0	2.9	1.1	44.7	51.17	0.74
1	10.5	200 year	107.7	0.05	0.0	0.05	415.0	417.17		417.53	0.0	1.1	3.0	1.2	50.6	52.08	0.74
1	10.5	PMF	1191.3	0.05	0.0	0.05	415.0	420.42		421.38	0.0	2.8	5.9	3.0	328.7	99.88	0.85
1	10	1 year	11.1		0.0		414.3	415.35	415.0	415.43	0.0		1.3		8.8	12.69	0.48
1	10	5 year	37.9	0.05	0.0	0.05	414.3	416.04	415.7	416.19	0.0	0.5	1.8	0.4	27.1	48.17	0.53
1	10	100 year	92.2	0.05	0.0	0.05	414.3	416.49		416.76	0.0	1.0	2.6	1.0	49.8	51.8	0.65
1	10	200 year	107.7	0.05	0.0	0.05	414.3	416.61		416.90	0.0	1.1	2.7	1.0	56.1	52.76	0.66
1	10	PMF	1191.3	0.05	0.0	0.05	414.3	419.87		420.76	0.0	2.9	5.7	2.6	339.8	99.7	0.81
1	9	1 year	11.1		0.0		413.2	413.87	413.9	414.12	0.0		2.2		5.0	10	1.01
1	9	5 year	37.9		0.0		413.2	414.50	414.5	414.94	0.0		2.9		12.9	15.06	1.01
1	9	100 year	92.2	0.05	0.0	0.05	413.2	415.16	415.2	415.57	0.0	1.1	3.1	1.0	41.0	50.77	0.82
1	9	200 year	107.7	0.05	0.0	0.05	413.2	415.26	415.3	415.70	0.0	1.2	3.3	1.2	46.0	51.56	0.84
1	9	PMF	1191.3	0.05	0.0	0.05	413.2	418.22	418.2	419.48	0.0	3.4	6.7	3.0	290.3	100.09	1.01
1	8.5	1 year	11.1		0.0		412.7	413.58		413.70	0.0		1.5		7.3	11.7	0.62
1	8.5	5 year	37.9	0.05	0.0	0.05	412.7	414.25	414.0	414.48	0.0	0.4	2.2	0.4	20.7	47.47	0.67
1	8.5	100 year	92.2	0.05	0.0	0.05	412.7	414.75		415.08	0.0	1.1	2.8	1.0	45.4	51.46	0.73
1	8.5	200 year	107.7	0.05	0.0	0.05	412.7	414.86		415.21	0.0	1.2	3.0	1.1	51.0	52.33	0.74
1	8.5	PMF	1191.3	0.05	0.0	0.05	412.7	418.05		419.04	0.0	3.1	6.0	2.8	323.9	100.09	0.87
1	8	1 year	11.1		0.0		412.5	413.39		413.51	0.0		1.5		7.3	11.7	0.62
1	8	5 year	37.9	0.05	0.0	0.05	412.5	414.06	413.8	414.29	0.0	0.4	2.2	0.4	20.7	47.56	0.67
1	8	100 year	92.2	0.05	0.0	0.05	412.5	414.56		414.89	0.0	1.1	2.9	1.0	45.2	51.52	0.73
1	8	200 year	107.7	0.05	0.0	0.05	412.5	414.67		415.02	0.0	1.2	3.0	1.1	50.9	52.39	0.74
1	8	PMF	1191.3	0.05	0.0	0.05	412.5	417.89		418.86	0.0	3.1	5.9	2.7	326.6	100.18	0.86

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	7	1 year	11.1		0.0		412.3	413.18		413.30	0.0		1.5		7.3	11.69	0.62
1	7	5 year	37.9	0.05	0.0	0.05	412.3	413.85	413.6	414.08	0.0	0.4	2.2	0.4	20.7	47.19	0.67
1	7	100 year	92.2	0.05	0.0	0.05	412.3	414.36		414.69	0.0	1.1	2.8	1.0	45.9	51.29	0.72
1	7	200 year	107.7	0.05	0.0	0.05	412.3	414.48		414.82	0.0	1.2	2.9	1.1	51.6	52.18	0.73
1	7	PMF	1191.3	0.05	0.0	0.05	412.3	417.73		418.67	0.0	2.9	5.9	2.8	330.8	99.81	0.84
1	6	1 year	11.1		0.0		411.8	412.71		412.82	0.0		1.5		7.4	11.8	0.60
1	6	5 year	37.9	0.05	0.0	0.05	411.8	413.38		413.60	0.0	0.4	2.1	0.4	21.1	47.17	0.66
1	6	100 year	92.2	0.05	0.0	0.05	411.8	413.91		414.21	0.0	1.0	2.7	1.0	47.1	51.39	0.69
1	6	200 year	107.7	0.05	0.0	0.05	411.8	414.08		414.37	0.0	1.1	2.7	1.1	55.8	52.73	0.66
1	6	PMF	1191.3	0.05	0.0	0.05	411.8	417.32		418.22	0.0	2.9	5.7	2.8	337.0	99.71	0.82
1	5	1 year	11.1		0.0		411.5	412.50		412.60	0.0		1.4		8.1	12.23	0.54
1	5	5 year	37.9	0.05	0.0	0.05	411.5	413.21	412.9	413.37	0.0	0.4	1.9	0.4	25.5	48.38	0.56
1	5	100 year	92.2	0.05	0.0	0.05	411.5	413.71		413.97	0.0	1.0	2.6	1.0	51.0	52.43	0.63
1	5	200 year	107.7	0.05	0.0	0.05	411.5	413.93		414.16	0.0	1.0	2.5	1.0	62.6	54.16	0.57
1	5	PMF	1191.3	0.05	0.0	0.05	411.5	417.12		417.97	0.0	2.8	5.6	2.7	345.9	100.19	0.79
1	4	1 year	11.1		0.0		411.2	411.89	411.9	412.14	0.0		2.2		5.0	10	1.01
1	4	5 year	37.9		0.0		411.2	412.53	412.5	412.96	0.0		2.9		13.0	15.1	1.00
1	4	100 year	92.2	0.05	0.0	0.05	411.2	413.53		413.73	0.0	0.9	2.2	0.9	58.8	53.28	0.53
1	4	200 year	107.7	0.05	0.0	0.05	411.2	413.80		413.97	0.0	1.0	2.1	0.9	73.3	55.41	0.47
1	4	PMF	1191.3	0.05	0.0	0.05	411.2	416.82		417.67	0.0	2.9	5.6	2.6	347.7	99.83	0.78
1	3.5	1 year	11.1		0.0		410.7	411.60		411.72	0.0		1.5		7.3	11.71	0.61
1	3.5	5 year	37.9	0.05	0.0	0.05	410.7	412.28	412.0	412.50	0.0	0.4	2.2	0.4	20.7	47.21	0.67
1	3.5	100 year	92.2	0.05	0.0	0.05	410.7	413.61		413.69	0.0	0.7	1.5	0.6	91.0	57.91	0.30
1	3.5	200 year	107.7	0.05	0.0	0.05	410.7	413.86		413.94	0.0	0.7	1.5	0.6	105.5	61.32	0.30
1	3.5	PMF	1191.3	0.05	0.0	0.05	410.7	417.01		417.58	0.0	2.4	4.6	2.3	416.6	99.83	0.61
1	3	1 year	11.1		0.0		410.4	411.28		411.40	0.0		1.5		7.3	11.69	0.62
1	3	5 year	37.9	0.05	0.0	0.05	410.4	412.06		412.22	0.0	0.4	1.9	0.4	25.8	47.98	0.55
1	3	100 year	92.2	0.05	0.0	0.05	410.4	413.58		413.64	0.0	0.5	1.3	0.6	108.3	70.06	0.26
1	3	200 year	107.7	0.05	0.0	0.05	410.4	413.83		413.89	0.0	0.5	1.4	0.5	130.3	99.73	0.27
1	3	PMF	1191.3	0.05	0.0	0.05	410.4	416.91		417.42	0.0	2.3	4.3	2.3	438.4	99.73	0.56

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	2	1 year	11.1		0.0		410.0	410.93		411.03	0.0		1.4		7.7	11.97	0.57
1	2	5 year	37.9	0.05	0.0	0.05	410.0	411.99		412.06	0.0	0.5	1.3	0.4	41.6	50.55	0.33
1	2	100 year	92.2	0.05	0.0	0.05	410.0	413.57		413.61	0.0	0.4	1.1	0.3	143.2	99.73	0.20
1	2	200 year	107.7	0.05	0.0	0.05	410.0	413.82		413.86	0.0	0.5	1.1	0.4	168.4	99.73	0.19
1	2	PMF	1191.3	0.05	0.0	0.05	410.0	416.82		417.26	0.0	2.2	4.0	2.0	468.2	99.73	0.51
1	1	1 year	11.1		0.0		409.6	410.75		410.80	0.0		1.0		10.8	13.89	0.37
1	1	5 year	37.9	0.05	0.0	0.05	409.6	411.97		412.00	0.0	0.4	0.9	0.4	62.3	53.69	0.20
1	1	100 year	92.2	0.05	0.0	0.05	409.6	413.56		413.58	0.0	0.4	0.9	0.3	184.4	99.7	0.15
1	1	200 year	107.7	0.05	0.0	0.05	409.6	413.81		413.84	0.0	0.4	0.9	0.4	209.5	99.7	0.14
1	1	PMF	1191.3	0.05	0.0	0.05	409.6	416.75		417.13	0.0	2.0	3.8	2.0	502.7	99.7	0.46
1	0	1 year	11.1	0.05	0.0	0.05	409.2	410.70		410.72	0.0	0.0	0.7	0.0	16.1	46.3	0.24
1	0	5 year	37.9	0.05	0.0	0.05	409.2	411.96		411.98	0.0	0.3	0.7	0.3	81.1	56.42	0.14
1	0	100 year	92.2	0.05	0.0	0.05	409.2	413.56		413.57	0.0	0.3	0.7	0.3	219.1	99.7	0.12
1	0	200 year	107.7	0.05	0.0	0.05	409.2	413.81		413.82	0.0	0.3	0.7	0.3	244.2	99.7	0.12
1	0	PMF	1191.3	0.05	0.0	0.05	409.2	416.70		417.03	0.0	1.9	3.5	1.9	532.4	99.7	0.43
1	-1	1 year	11.1		0.0		409.0	410.54		410.68	0.0		1.6		6.9	6.72	0.51
1	-1	5 year	37.9	0.05	0.0		409.0	411.72		411.90	0.0	0.6	1.9		21.4	20.43	0.53
1	-1	100 year	92.2	0.05	0.0	0.05	409.0	413.46		413.52	0.0	0.4	1.3	0.2	120.4	145.31	0.26
1	-1	200 year	107.7	0.05	0.0	0.05	409.0	413.73		413.78	0.0	0.4	1.2	0.2	163.2	176.09	0.23
1	-1	PMF	1191.3	0.05	0.0	0.05	409.0	416.64		416.70	0.0	0.8	1.9	0.8	1303.9	486.21	0.25
1	-2	1 year	11.1		0.0		409.0	410.61	409.9	410.64	0.0		0.8		13.9	16.08	0.27
1	-2	5 year	37.9	0.06	0.0	0.06	409.0	411.81	410.6	411.86	0.0	0.2	1.0	0.2	41.6	31.24	0.23
1	-2	100 year	92.2	0.06	0.0	0.06	409.0	413.47	411.3	413.52	0.0	0.2	1.0	0.3	133.0	117.48	0.18
1	-2	200 year	107.7	0.06	0.0	0.06	409.0	413.73	411.4	413.77	0.0	0.2	1.1	0.3	166.9	147.11	0.18
1	-2	PMF	1191.3	0.06	0.0	0.06	409.0	416.59	415.2	416.69	0.0	0.8	2.3	0.8	1205.5	471.89	0.29
1	-3	1 year	11.1		0.0		408.9	410.57		410.58	0.0		0.5		20.7	18.32	0.16
1	-3	5 year	37.9	0.06	0.0	0.06	408.9	411.53		411.57	0.0	0.1	0.9	0.2	42.0	23.99	0.21
1	-3	100 year	92.2	0.06	0.0	0.06	408.9	412.66		412.75	0.0	0.2	1.4	0.4	70.6	32.46	0.25
1	-3	200 year	107.7	0.06	0.0	0.06	408.9	413.08		413.17	0.0	0.2	1.4	0.2	100.9	109.36	0.23
1	-3	PMF	1191.3	0.06	0.0	0.06	408.9	416.57		416.65	0.0	0.7	2.1	0.8	1336.7	487.81	0.26

TABLE F1: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - MURRAGAMBA CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
1	-4	1 year	11.1		0.1		408.7	410.57	409.1	410.58	0.0		0.3		34.6	22.56	0.08
1	-4	5 year	37.9	0.07	0.1	0.07	408.7	411.55	409.5	411.56	0.0	0.1	0.6	0.1	85.7	110.6	0.12
1	-4	100 year	92.2	0.07	0.1	0.07	408.7	412.71	410.2	412.72	0.0	0.2	0.6	0.2	298.8	337.15	0.11
1	-4	200 year	107.7	0.07	0.1	0.07	408.7	413.13	410.3	413.14	0.0	0.2	0.5	0.1	460.6	407	0.09
1	-4	PMF	1191.3	0.07	0.1	0.07	408.7	416.61	413.4	416.63	0.0	0.5	1.1	0.6	2138.2	570.51	0.13
1	-5	1 year	11.1		0.5		408.7	410.54		410.55	0.0		0.3		33.9	22.42	0.09
1	-5	5 year	37.9	0.07	0.5	0.07	408.7	411.37		411.39	0.0	0.7	0.5	1.0	67.9	91.63	0.10
1	-5	100 year	92.2	0.07	0.5	0.07	408.7	411.78		411.83	0.0	1.1	0.5	1.3	114.5	135.84	0.10
1	-5	200 year	107.7	0.07	0.5	0.07	408.7	411.86		411.91	0.0	1.2	0.5	1.3	125.0	144.64	0.10
1	-5	PMF	1191.3	0.07	0.5	0.07	408.7	413.67	413.1	413.86	0.0	2.1	0.6	1.8	683.4	426.93	0.09
1	-6	1 year	11.1		0.0	0.06	407.7	408.21	408.1	408.25	0.0		1.3	0.7	14.0	48.97	0.66
1	-6	5 year	37.9		0.0	0.06	407.7	408.55	408.4	408.62	0.0		1.8	1.0	36.0	79.92	0.70
1	-6	100 year	92.2		0.0	0.06	407.7	408.93	408.7	409.02	0.0		2.2	1.1	79.0	148.06	0.74
1	-6	200 year	107.7		0.0	0.06	407.7	408.99	408.8	409.09	0.0		2.2	1.1	87.3	149.22	0.74
1	-6	PMF	1191.3		0.0	0.06	407.7	410.94	410.3	411.35	0.0		2.3	2.9	421.9	212.49	0.77

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	137	1 year	4.3		0.0		465.5	466.06		466.19	0.0		1.6		2.7	6.9	0.81
1	137	5 year	15.0	0.05	0.0	0.05	465.5	466.40	466.4	466.62	0.0	0.9	2.3	0.8	8.9	21.04	0.86
1	137	100 year	37.7	0.05	0.0	0.05	465.5	466.77	466.8	467.13	0.0	1.4	3.1	1.4	17.4	24.76	0.95
1	137	200 year	44.6	0.05	0.0	0.05	465.5	466.87	466.9	467.25	0.0	1.5	3.3	1.5	19.8	25.7	0.96
1	137	PMF	305.4	0.05	0.0	0.05	465.5	468.45	468.5	469.28	0.0	2.8	5.6	2.8	90.0	48.03	1.07
1	136	1 year	4.3		0.0		465.1	465.72		465.85	0.0		1.6		2.7	6.91	0.80
1	136	5 year	15.0	0.05	0.0	0.05	465.1	466.06	466.1	466.28	0.0	0.9	2.3	0.8	9.0	21.45	0.86
1	136	100 year	37.7	0.05	0.0	0.05	465.1	466.43	466.4	466.78	0.0	1.4	3.1	1.4	17.5	25.12	0.95
1	136	200 year	44.6	0.05	0.0	0.05	465.1	466.51	466.5	466.90	0.0	1.5	3.3	1.5	19.8	26	0.97
1	136	PMF	305.4	0.05	0.0	0.05	465.1	468.10	468.1	468.92	0.0	2.8	5.6	2.7	90.2	48.46	1.08
1	135	1 year	4.3		0.0		464.9	465.52		465.65	0.0		1.6		2.7	6.91	0.80
1	135	5 year	15.0	0.05	0.0	0.05	464.9	465.86	465.9	466.08	0.0	0.9	2.3	0.8	8.9	21.11	0.86
1	135	100 year	37.7	0.05	0.0	0.05	464.9	466.23	466.2	466.59	0.0	1.4	3.1	1.4	17.4	24.82	0.95
1	135	200 year	44.6	0.05	0.0	0.05	464.9	466.33	466.3	466.71	0.0	1.5	3.3	1.5	19.8	25.75	0.96
1	135	PMF	305.4	0.05	0.0	0.05	464.9	467.91	467.9	468.74	0.0	2.8	5.6	2.7	89.9	48.1	1.08
1	134	1 year	4.3		0.0		464.6	465.19		465.32	0.0		1.6		2.7	6.9	0.81
1	134	5 year	15.0	0.05	0.0	0.05	464.6	465.53	465.5	465.75	0.0	0.8	2.3	0.9	8.9	21.01	0.86
1	134	100 year	37.7	0.05	0.0	0.05	464.6	465.90	465.9	466.26	0.0	1.3	3.1	1.4	17.4	24.73	0.95
1	134	200 year	44.6	0.05	0.0	0.05	464.6	465.99	466.0	466.38	0.0	1.4	3.3	1.6	19.6	25.63	0.97
1	134	PMF	305.4	0.05	0.0	0.05	464.6	467.58	467.6	468.41	0.0	2.7	5.6	2.9	89.7	48	1.08
1	133	1 year	4.3		0.0		464.4	464.97		465.09	0.0		1.6		2.8	6.96	0.79
1	133	5 year	15.0	0.05	0.0	0.05	464.4	465.30	465.3	465.52	0.0	0.8	2.3	0.9	8.9	21.02	0.86
1	133	100 year	37.7	0.05	0.0	0.05	464.4	465.68	465.7	466.03	0.0	1.4	3.1	1.4	17.5	24.8	0.94
1	133	200 year	44.6	0.05	0.0	0.05	464.4	465.77	465.8	466.15	0.0	1.5	3.3	1.5	19.9	25.72	0.95
1	133	PMF	305.4	0.05	0.0	0.05	464.4	467.35	467.4	468.18	0.0	2.7	5.6	2.8	89.9	48.01	1.08
1	132	1 year	4.3		0.0		463.7	464.32	464.3	464.45	0.0		1.6		2.7	6.84	0.83
1	132	5 year	15.0	0.05	0.0	0.05	463.7	464.67	464.7	464.89	0.0	0.9	2.3	0.8	8.9	21.01	0.86
1	132	100 year	37.7	0.05	0.0	0.05	463.7	465.04	465.0	465.40	0.0	1.4	3.1	1.4	17.4	24.74	0.95
1	132	200 year	44.6	0.05	0.0	0.05	463.7	465.13	465.1	465.52	0.0	1.5	3.3	1.5	19.6	25.63	0.97
1	132	PMF	305.4	0.05	0.0	0.05	463.7	466.72	466.7	467.55	0.0	2.8	5.6	2.7	89.9	48	1.07

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	131	1 year	4.3		0.0		463.4	464.08		464.18	0.0		1.5		3.0	7.19	0.72
1	131	5 year	15.0	0.05	0.0	0.05	463.4	464.37		464.60	0.0	0.9	2.3	0.9	8.7	20.99	0.88
1	131	100 year	37.7	0.05	0.0	0.05	463.4	464.77		465.11	0.0	1.4	3.0	1.4	17.9	24.97	0.92
1	131	200 year	44.6	0.05	0.0	0.05	463.4	464.86		465.23	0.0	1.5	3.2	1.5	20.1	25.85	0.94
1	131	PMF	305.4	0.05	0.0	0.05	463.4	466.43	466.4	467.26	0.0	2.8	5.6	2.8	90.0	48.04	1.07
1	130	1 year	4.3		0.0		463.2	463.77	463.8	463.95	0.0		1.9		2.3	6.37	1.01
1	130	5 year	15.0	0.05	0.0	0.05	463.2	464.17	464.2	464.39	0.0	0.8	2.3	0.9	8.9	21.11	0.86
1	130	100 year	37.7	0.05	0.0	0.05	463.2	464.54	464.5	464.90	0.0	1.4	3.1	1.4	17.4	24.82	0.95
1	130	200 year	44.6	0.05	0.0	0.05	463.2	464.64	464.6	465.02	0.0	1.4	3.3	1.5	19.8	25.75	0.96
1	130	PMF	305.4	0.05	0.0	0.05	463.2	466.22	466.2	467.05	0.0	2.7	5.6	2.8	89.9	48.1	1.08
1	129.5	1 year	4.3		0.0		462.7	463.34		463.46	0.0		1.6		2.7	6.91	0.80
1	129.5	5 year	15.0	0.05	0.0	0.05	462.7	463.67	463.7	463.89	0.0	0.8	2.3	0.9	8.9	21.11	0.86
1	129.5	100 year	37.7	0.05	0.0	0.05	462.7	464.04	464.0	464.40	0.0	1.4	3.1	1.4	17.4	24.82	0.95
1	129.5	200 year	44.6	0.05	0.0	0.05	462.7	464.14	464.1	464.52	0.0	1.4	3.3	1.5	19.8	25.75	0.96
1	129.5	PMF	305.4	0.05	0.0	0.05	462.7	465.72	465.7	466.55	0.0	2.7	5.6	2.8	89.9	48.1	1.08
1	129	1 year	4.3		0.0		462.5	463.09		463.22	0.0		1.6		2.7	6.91	0.80
1	129	5 year	15.0	0.05	0.0	0.05	462.5	463.43	463.4	463.64	0.0	0.8	2.3	0.9	8.9	21.15	0.86
1	129	100 year	37.7	0.05	0.0	0.05	462.5	463.80	463.8	464.15	0.0	1.3	3.1	1.4	17.4	24.85	0.95
1	129	200 year	44.6	0.05	0.0	0.05	462.5	463.89	463.9	464.27	0.0	1.4	3.3	1.6	19.7	25.74	0.97
1	129	PMF	305.4	0.05	0.0	0.05	462.5	465.47	465.5	466.30	0.0	2.6	5.6	2.9	89.8	48.14	1.08
1	128	1 year	4.3		0.0		462.3	462.90		463.03	0.0		1.6		2.7	6.92	0.80
1	128	5 year	15.0	0.05	0.0	0.05	462.3	463.24	463.2	463.46	0.0	0.7	2.3	0.9	8.9	21.04	0.86
1	128	100 year	37.7	0.05	0.0	0.05	462.3	463.61	463.6	463.96	0.0	1.2	3.1	1.5	17.4	24.78	0.95
1	128	200 year	44.6	0.05	0.0	0.05	462.3	463.70	463.7	464.09	0.0	1.3	3.3	1.6	19.7	25.66	0.96
1	128	PMF	305.4	0.05	0.0	0.05	462.3	465.29	465.3	466.12	0.0	2.6	5.6	2.9	89.9	48.03	1.07
1	127	1 year	4.3		0.0		461.5	462.12		462.25	0.0		1.6		2.7	6.9	0.80
1	127	5 year	15.0	0.05	0.0	0.05	461.5	462.46	462.5	462.68	0.0	0.9	2.3	0.8	8.9	21.04	0.86
1	127	100 year	37.7	0.05	0.0	0.05	461.5	462.83	462.8	463.19	0.0	1.4	3.1	1.3	17.4	24.76	0.95
1	127	200 year	44.6	0.05	0.0	0.05	461.5	462.93	462.9	463.31	0.0	1.6	3.3	1.4	19.7	25.69	0.96
1	127	PMF	305.4	0.05	0.0	0.05	461.5	464.51	464.5	465.34	0.0	2.9	5.6	2.6	89.9	48.03	1.07

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	126	1 year	4.3		0.0		461.3	461.92		462.05	0.0		1.6		2.8	6.95	0.79
1	126	5 year	15.0	0.05	0.0	0.05	461.3	462.26	462.3	462.48	0.0	0.9	2.3	0.8	8.9	21.02	0.86
1	126	100 year	37.7	0.05	0.0	0.05	461.3	462.63	462.6	462.98	0.0	1.4	3.1	1.3	17.4	24.75	0.95
1	126	200 year	44.6	0.05	0.0	0.05	461.3	462.72	462.7	463.11	0.0	1.5	3.3	1.4	19.7	25.64	0.97
1	126	PMF	305.4	0.05	0.0	0.05	461.3	464.30	464.3	465.14	0.0	2.8	5.6	2.7	89.7	48.01	1.08
1	125	1 year	4.3		0.0		461.0	461.62	461.6	461.76	0.0		1.6		2.7	6.84	0.82
1	125	5 year	15.0	0.05	0.0	0.05	461.0	461.97	462.0	462.19	0.0	0.8	2.3	0.9	8.9	21.07	0.86
1	125	100 year	37.7	0.05	0.0	0.05	461.0	462.34	462.3	462.69	0.0	1.2	3.1	1.5	17.4	24.78	0.95
1	125	200 year	44.6	0.05	0.0	0.05	461.0	462.43	462.4	462.82	0.0	1.3	3.3	1.6	19.6	25.68	0.97
1	125	PMF	305.4	0.05	0.0	0.05	461.0	464.02	464.0	464.85	0.0	2.6	5.6	2.9	89.8	48.06	1.07
1	124	1 year	4.3	0.05	0.0	0.05	460.8	461.43	461.3	461.53	0.0	0.1	1.4	0.1	3.2	18.14	0.69
1	124	5 year	15.0	0.05	0.0	0.05	460.8	461.72	461.7	461.94	0.0	0.8	2.3	0.9	8.9	21.06	0.86
1	124	100 year	37.7	0.05	0.0	0.05	460.8	462.09	462.1	462.44	0.0	1.3	3.1	1.4	17.5	24.82	0.95
1	124	200 year	44.6	0.05	0.0	0.05	460.8	462.18	462.2	462.57	0.0	1.4	3.3	1.6	19.7	25.7	0.96
1	124	PMF	305.4	0.05	0.0	0.05	460.8	463.77	463.8	464.60	0.0	2.6	5.6	2.9	90.0	48.05	1.07
1	123	1 year	4.3		0.0		460.3	460.83	460.8	461.02	0.0		1.9		2.3	6.36	1.01
1	123	5 year	15.0	0.05	0.0	0.05	460.3	461.24	461.2	461.46	0.0	0.9	2.3	0.8	8.9	21.03	0.86
1	123	100 year	37.7	0.05	0.0	0.05	460.3	461.61	461.6	461.97	0.0	1.4	3.1	1.4	17.4	24.75	0.95
1	123	200 year	44.6	0.05	0.0	0.05	460.3	461.71	461.7	462.09	0.0	1.5	3.3	1.5	19.8	25.69	0.96
1	123	PMF	305.4	0.05	0.0	0.05	460.3	463.29	463.3	464.12	0.0	2.8	5.6	2.8	89.7	48.02	1.08
1	122.5	1 year	4.3		0.0		459.8	460.40		460.53	0.0		1.6		2.7	6.9	0.80
1	122.5	5 year	15.0	0.05	0.0	0.05	459.8	460.74	460.7	460.96	0.0	0.9	2.3	0.8	8.9	21.03	0.86
1	122.5	100 year	37.7	0.05	0.0	0.05	459.8	461.11	461.1	461.47	0.0	1.4	3.1	1.4	17.4	24.76	0.95
1	122.5	200 year	44.6	0.05	0.0	0.05	459.8	461.20	461.2	461.59	0.0	1.5	3.3	1.5	19.8	25.69	0.96
1	122.5	PMF	305.4	0.05	0.0	0.05	459.8	462.79	462.8	463.62	0.0	2.8	5.6	2.8	89.8	48.02	1.08
1	122	1 year	4.3		0.0		459.6	460.20		460.33	0.0		1.6		2.7	6.91	0.80
1	122	5 year	15.0	0.05	0.0	0.05	459.6	460.54	460.5	460.76	0.0	0.9	2.3	0.8	8.9	21.1	0.86
1	122	100 year	37.7	0.05	0.0	0.05	459.6	460.91	460.9	461.26	0.0	1.4	3.1	1.3	17.4	24.82	0.95
1	122	200 year	44.6	0.05	0.0	0.05	459.6	461.00	461.0	461.39	0.0	1.6	3.3	1.4	19.8	25.74	0.96
1	122	PMF	305.4	0.05	0.0	0.05	459.6	462.59	462.6	463.42	0.0	2.9	5.6	2.6	90.0	48.09	1.07

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	121	1 year	4.3		0.0		459.2	459.85		459.98	0.0		1.6		2.7	6.91	0.80
1	121	5 year	15.0	0.05	0.0	0.05	459.2	460.19	460.2	460.40	0.0	0.8	2.3	0.9	8.9	21.11	0.86
1	121	100 year	37.7	0.05	0.0	0.05	459.2	460.56	460.6	460.91	0.0	1.4	3.1	1.4	17.4	24.82	0.95
1	121	200 year	44.6	0.05	0.0	0.05	459.2	460.65	460.7	461.03	0.0	1.5	3.3	1.5	19.7	25.71	0.97
1	121	PMF	305.4	0.05	0.0	0.05	459.2	462.24	462.2	463.06	0.0	2.7	5.6	2.8	90.1	48.1	1.07
1	120	1 year	4.3		0.0		459.0	459.62		459.75	0.0		1.6		2.7	6.91	0.80
1	120	5 year	15.0	0.05	0.0	0.05	459.0	459.96	460.0	460.18	0.0	0.8	2.3	0.9	8.9	21.1	0.86
1	120	100 year	37.7	0.05	0.0	0.05	459.0	460.33	460.3	460.68	0.0	1.3	3.1	1.4	17.4	24.81	0.95
1	120	200 year	44.6	0.05	0.0	0.05	459.0	460.42	460.4	460.81	0.0	1.4	3.3	1.5	19.8	25.74	0.96
1	120	PMF	305.4	0.05	0.0	0.05	459.0	462.00	462.0	462.84	0.0	2.7	5.6	2.9	89.8	48.09	1.08
1	119	1 year	4.3		0.0		458.8	459.45		459.57	0.0		1.6		2.8	6.97	0.78
1	119	5 year	15.0	0.05	0.0	0.05	458.8	459.76		460.00	0.0	0.8	2.4	0.9	8.5	20.86	0.90
1	119	100 year	37.7	0.05	0.0	0.05	458.8	460.15	460.2	460.50	0.0	1.3	3.1	1.4	17.4	24.74	0.95
1	119	200 year	44.6	0.05	0.0	0.05	458.8	460.24	460.2	460.63	0.0	1.4	3.3	1.5	19.7	25.67	0.96
1	119	PMF	305.4	0.05	0.0	0.05	458.8	461.82	461.8	462.66	0.0	2.7	5.6	2.9	89.7	48	1.08
1	118	1 year	4.3		0.0		458.3	458.90	458.8	459.03	0.0		1.6		2.7	6.82	0.83
1	118	5 year	15.0	0.05	0.0	0.05	458.3	459.25	459.3	459.47	0.0	0.9	2.3	0.8	8.9	21.09	0.86
1	118	100 year	37.7	0.05	0.0	0.05	458.3	459.62	459.6	459.97	0.0	1.4	3.1	1.3	17.4	24.8	0.95
1	118	200 year	44.6	0.05	0.0	0.05	458.3	459.71	459.7	460.10	0.0	1.6	3.3	1.4	19.7	25.69	0.97
1	118	PMF	305.4	0.05	0.0	0.05	458.3	461.30	461.3	462.13	0.0	2.9	5.6	2.6	89.9	48.08	1.07
1	117	1 year	4.3	0.05	0.0	0.05	458.0	458.69	458.6	458.79	0.0	0.1	1.4	0.1	3.2	18.11	0.69
1	117	5 year	15.0	0.05	0.0	0.05	458.0	458.98	459.0	459.20	0.0	0.9	2.3	0.8	8.9	21.03	0.86
1	117	100 year	37.7	0.05	0.0	0.05	458.0	459.36	459.4	459.71	0.0	1.4	3.1	1.4	17.5	24.8	0.95
1	117	200 year	44.6	0.05	0.0	0.05	458.0	459.45	459.5	459.83	0.0	1.5	3.3	1.5	19.7	25.67	0.96
1	117	PMF	305.4	0.05	0.0	0.05	458.0	461.03	461.0	461.87	0.0	2.8	5.6	2.7	90.0	48.02	1.07
1	116	1 year	4.3		0.0		457.5	458.03	458.0	458.21	0.0		1.9		2.3	6.37	1.01
1	116	5 year	15.0	0.05	0.0	0.05	457.5	458.44	458.4	458.65	0.0	0.8	2.3	0.9	8.9	21.01	0.86
1	116	100 year	37.7	0.05	0.0	0.05	457.5	458.81	458.8	459.16	0.0	1.3	3.1	1.4	17.4	24.73	0.95
1	116	200 year	44.6	0.05	0.0	0.05	457.5	458.90	458.9	459.28	0.0	1.4	3.3	1.6	19.7	25.66	0.96
1	116	PMF	305.4	0.05	0.0	0.05	457.5	460.48	460.5	461.32	0.0	2.6	5.6	2.9	89.6	47.99	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	115.5	1 year	4.3		0.0		457.0	457.60		457.72	0.0		1.6		2.7	6.9	0.80
1	115.5	5 year	15.0	0.05	0.0	0.05	457.0	457.94	457.9	458.15	0.0	0.8	2.3	0.9	8.9	21	0.86
1	115.5	100 year	37.7	0.05	0.0	0.05	457.0	458.31	458.3	458.66	0.0	1.3	3.1	1.4	17.4	24.73	0.95
1	115.5	200 year	44.6	0.05	0.0	0.05	457.0	458.40	458.4	458.78	0.0	1.4	3.3	1.6	19.7	25.66	0.96
1	115.5	PMF	305.4	0.05	0.0	0.05	457.0	459.98	460.0	460.82	0.0	2.6	5.6	2.9	89.8	47.99	1.07
1	115	1 year	4.3		0.0		456.4	457.01		457.14	0.0		1.6		2.7	6.9	0.81
1	115	5 year	15.0	0.05	0.0	0.05	456.4	457.35	457.4	457.57	0.0	0.9	2.3	0.8	8.9	21.26	0.86
1	115	100 year	37.7	0.05	0.0	0.05	456.4	457.72	457.7	458.07	0.0	1.4	3.1	1.3	17.5	24.95	0.95
1	115	200 year	44.6	0.05	0.0	0.05	456.4	457.81	457.8	458.19	0.0	1.5	3.3	1.4	19.8	25.88	0.96
1	115	PMF	305.4	0.05	0.0	0.05	456.4	459.39	459.4	460.22	0.0	2.8	5.6	2.7	89.8	48.26	1.08
1	114	1 year	4.3		0.0		456.1	456.72		456.85	0.0		1.6		2.7	6.91	0.80
1	114	5 year	15.0	0.05	0.0	0.05	456.1	457.06	457.1	457.28	0.0	0.9	2.3	0.8	8.9	21.03	0.86
1	114	100 year	37.7	0.05	0.0	0.05	456.1	457.44	457.4	457.79	0.0	1.4	3.1	1.3	17.5	24.79	0.95
1	114	200 year	44.6	0.05	0.0	0.05	456.1	457.52	457.5	457.91	0.0	1.5	3.3	1.4	19.7	25.67	0.96
1	114	PMF	305.4	0.05	0.0	0.05	456.1	459.11	459.1	459.94	0.0	2.8	5.6	2.7	90.0	48.02	1.07
1	113	1 year	4.3		0.0		455.8	456.36		456.49	0.0		1.6		2.7	6.9	0.81
1	113	5 year	15.0	0.05	0.0	0.05	455.8	456.70	456.7	456.92	0.0	0.8	2.3	0.9	8.9	21.02	0.86
1	113	100 year	37.7	0.05	0.0	0.05	455.8	457.07	457.1	457.43	0.0	1.4	3.1	1.4	17.4	24.75	0.95
1	113	200 year	44.6	0.05	0.0	0.05	455.8	457.17	457.2	457.55	0.0	1.4	3.3	1.5	19.8	25.68	0.96
1	113	PMF	305.4	0.05	0.0	0.05	455.8	458.75	458.8	459.58	0.0	2.7	5.6	2.8	90.0	48.01	1.07
1	112	1 year	4.3		0.0		455.4	456.06		456.19	0.0		1.6		2.8	6.95	0.79
1	112	5 year	15.0	0.05	0.0	0.05	455.4	456.40	456.4	456.61	0.0	0.8	2.3	0.9	8.9	21.06	0.86
1	112	100 year	37.7	0.05	0.0	0.05	455.4	456.77	456.8	457.12	0.0	1.3	3.1	1.4	17.4	24.78	0.95
1	112	200 year	44.6	0.05	0.0	0.05	455.4	456.86	456.9	457.24	0.0	1.4	3.3	1.5	19.7	25.67	0.97
1	112	PMF	305.4	0.05	0.0	0.05	455.4	458.45	458.5	459.28	0.0	2.7	5.6	2.8	90.1	48.05	1.07
1	111	1 year	4.3		0.0		455.3	455.86	455.8	456.00	0.0		1.6		2.7	6.83	0.83
1	111	5 year	15.0	0.05	0.0	0.05	455.3	456.19		456.43	0.0	0.9	2.4	0.9	8.7	21.27	0.90
1	111	100 year	37.7	0.05	0.0	0.05	455.3	456.58		456.93	0.0	1.4	3.1	1.4	17.7	25.17	0.94
1	111	200 year	44.6	0.05	0.0	0.05	455.3	456.68	456.7	457.05	0.0	1.5	3.2	1.5	20.1	26.08	0.95
1	111	PMF	305.4	0.05	0.0	0.05	455.3	458.25	458.3	459.07	0.0	2.8	5.6	2.8	90.2	48.41	1.07

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	110	1 year	4.3	0.05	0.0	0.05	455.0	455.65	455.5	455.75	0.0	0.1	1.4	0.1	3.1	18.14	0.70
1	110	5 year	15.0	0.05	0.0	0.05	455.0	455.94	455.9	456.16	0.0	0.9	2.3	0.8	8.9	21.09	0.86
1	110	100 year	37.7	0.05	0.0	0.05	455.0	456.31	456.3	456.67	0.0	1.4	3.1	1.3	17.4	24.8	0.95
1	110	200 year	44.6	0.05	0.0	0.05	455.0	456.40	456.4	456.79	0.0	1.6	3.3	1.4	19.7	25.69	0.97
1	110	PMF	305.4	0.05	0.0	0.05	455.0	457.99	458.0	458.82	0.0	2.9	5.6	2.7	89.9	48.08	1.07
1	109	1 year	4.3		0.0		454.6	455.15	455.2	455.33	0.0		1.9		2.3	6.36	1.01
1	109	5 year	15.0	0.05	0.0	0.05	454.6	455.55	455.6	455.77	0.0	0.9	2.3	0.8	8.9	21.19	0.86
1	109	100 year	37.7	0.05	0.0	0.05	454.6	455.92	455.9	456.27	0.0	1.4	3.1	1.3	17.4	24.88	0.95
1	109	200 year	44.6	0.05	0.0	0.05	454.6	456.01	456.0	456.40	0.0	1.6	3.3	1.4	19.7	25.77	0.97
1	109	PMF	305.4	0.05	0.0	0.05	454.6	457.59	457.6	458.43	0.0	2.9	5.6	2.6	89.9	48.18	1.08
1	108.5	1 year	4.3		0.0		454.1	454.71		454.84	0.0		1.6		2.7	6.91	0.80
1	108.5	5 year	15.0	0.05	0.0	0.05	454.1	455.05	455.1	455.27	0.0	0.9	2.3	0.8	8.9	21.19	0.86
1	108.5	100 year	37.7	0.05	0.0	0.05	454.1	455.42	455.4	455.77	0.0	1.4	3.1	1.3	17.4	24.88	0.95
1	108.5	200 year	44.6	0.05	0.0	0.05	454.1	455.51	455.5	455.90	0.0	1.6	3.3	1.4	19.8	25.81	0.96
1	108.5	PMF	305.4	0.05	0.0	0.05	454.1	457.09	457.1	457.93	0.0	2.9	5.6	2.6	89.9	48.18	1.08
1	108	1 year	4.3		0.0		454.0	454.56		454.69	0.0		1.6		2.7	6.89	0.81
1	108	5 year	15.0	0.05	0.0	0.05	454.0	454.90	454.9	455.12	0.0	0.9	2.3	0.8	8.9	21.02	0.86
1	108	100 year	37.7	0.05	0.0	0.05	454.0	455.28	455.3	455.63	0.0	1.4	3.1	1.4	17.4	24.75	0.95
1	108	200 year	44.6	0.05	0.0	0.05	454.0	455.37	455.4	455.75	0.0	1.5	3.3	1.5	19.7	25.64	0.97
1	108	PMF	305.4	0.05	0.0	0.05	454.0	456.95	457.0	457.79	0.0	2.8	5.6	2.7	90.0	48.01	1.07
1	107	1 year	4.3		0.0		453.7	454.35		454.47	0.0		1.5		2.9	7.06	0.76
1	107	5 year	15.0	0.05	0.0	0.05	453.7	454.67	454.7	454.89	0.0	0.8	2.3	0.9	8.9	21.14	0.86
1	107	100 year	37.7	0.05	0.0	0.05	453.7	455.04	455.0	455.39	0.0	1.3	3.1	1.4	17.4	24.84	0.95
1	107	200 year	44.6	0.05	0.0	0.05	453.7	455.13	455.1	455.52	0.0	1.4	3.3	1.5	19.7	25.74	0.97
1	107	PMF	305.4	0.05	0.0	0.05	453.7	456.72	456.7	457.55	0.0	2.7	5.6	2.8	90.1	48.13	1.07
1	106	1 year	4.3		0.0		453.3	453.93	453.9	454.08	0.0		1.7		2.5	6.67	0.88
1	106	5 year	15.0	0.05	0.0	0.05	453.3	454.29	454.3	454.51	0.0	0.8	2.3	0.9	8.9	21.27	0.86
1	106	100 year	37.7	0.05	0.0	0.05	453.3	454.67	454.7	455.01	0.0	1.3	3.1	1.4	17.6	25.01	0.94
1	106	200 year	44.6	0.05	0.0	0.05	453.3	454.75	454.8	455.14	0.0	1.4	3.3	1.5	19.8	25.88	0.96
1	106	PMF	305.4	0.05	0.0	0.05	453.3	456.33	456.3	457.16	0.0	2.7	5.6	2.9	89.8	48.27	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	105	1 year	4.3	0.05	0.0	0.05	452.4	453.05	453.0	453.16	0.0	0.0	1.4	0.0	3.0	18.03	0.71
1	105	5 year	15.0	0.05	0.0	0.05	452.4	453.35	453.4	453.57	0.0	0.9	2.3	0.8	8.9	21.02	0.86
1	105	100 year	37.7	0.05	0.0	0.05	452.4	453.73	453.7	454.08	0.0	1.4	3.1	1.4	17.4	24.74	0.95
1	105	200 year	44.6	0.05	0.0	0.05	452.4	453.82	453.8	454.20	0.0	1.5	3.3	1.5	19.8	25.68	0.96
1	105	PMF	305.4	0.05	0.0	0.05	452.4	455.41	455.4	456.24	0.0	2.8	5.6	2.7	90.0	48.01	1.07
1	104	1 year	4.3		0.0		452.2	452.70	452.7	452.88	0.0		1.9		2.3	6.37	1.01
1	104	5 year	15.0	0.05	0.0	0.05	452.2	453.10	453.1	453.32	0.0	0.9	2.3	0.8	8.9	21.02	0.86
1	104	100 year	37.7	0.05	0.0	0.05	452.2	453.47	453.5	453.83	0.0	1.4	3.1	1.4	17.4	24.75	0.95
1	104	200 year	44.6	0.05	0.0	0.05	452.2	453.56	453.6	453.95	0.0	1.5	3.3	1.5	19.7	25.64	0.97
1	104	PMF	305.4	0.05	0.0	0.05	452.2	455.15	455.2	455.98	0.0	2.8	5.6	2.7	90.0	48.01	1.07
1	103.5	1 year	4.3		0.0		451.7	452.27		452.39	0.0		1.6		2.8	6.94	0.79
1	103.5	5 year	15.0	0.05	0.0	0.05	451.7	452.59		452.82	0.0	0.9	2.4	0.9	8.6	20.9	0.89
1	103.5	100 year	37.7	0.05	0.0	0.05	451.7	452.97	453.0	453.33	0.0	1.4	3.1	1.4	17.4	24.75	0.95
1	103.5	200 year	44.6	0.05	0.0	0.05	451.7	453.06	453.1	453.45	0.0	1.5	3.3	1.5	19.6	25.64	0.97
1	103.5	PMF	305.4	0.05	0.0	0.05	451.7	454.65	454.7	455.48	0.0	2.8	5.6	2.7	90.0	48.01	1.07
1	103	1 year	4.3		0.0		451.2	451.80		451.94	0.0		1.6		2.7	6.86	0.82
1	103	5 year	15.0	0.05	0.0	0.05	451.2	452.14		452.37	0.0	0.8	2.3	0.9	8.7	21.14	0.88
1	103	100 year	37.7	0.05	0.0	0.05	451.2	452.52	452.5	452.87	0.0	1.3	3.1	1.4	17.4	24.92	0.95
1	103	200 year	44.6	0.05	0.0	0.05	451.2	452.61	452.6	452.99	0.0	1.4	3.3	1.5	19.7	25.81	0.97
1	103	PMF	305.4	0.05	0.0	0.05	451.2	454.19	454.2	455.02	0.0	2.7	5.6	2.8	90.0	48.22	1.07
1	102	1 year	4.3		0.0		450.6	451.18		451.30	0.0		1.5		2.8	7	0.77
1	102	5 year	15.0	0.05	0.0	0.05	450.6	451.49		451.72	0.0	0.9	2.3	0.8	8.7	21.06	0.89
1	102	100 year	37.7	0.05	0.0	0.05	450.6	451.89		452.23	0.0	1.4	3.0	1.3	17.9	25.04	0.93
1	102	200 year	44.6	0.05	0.0	0.05	450.6	451.98	452.0	452.35	0.0	1.5	3.2	1.4	20.1	25.93	0.94
1	102	PMF	305.4	0.05	0.0	0.05	450.6	453.55	453.6	454.38	0.0	2.8	5.6	2.7	90.0	48.16	1.07
1	101	1 year	4.3		0.0		450.1	450.70	450.7	450.84	0.0		1.7		2.6	6.78	0.85
1	101	5 year	15.0	0.05	0.0	0.05	450.1	451.05	451.1	451.27	0.0	0.8	2.3	0.9	8.9	21.03	0.86
1	101	100 year	37.7	0.05	0.0	0.05	450.1	451.43	451.4	451.78	0.0	1.3	3.1	1.4	17.4	24.75	0.95
1	101	200 year	44.6	0.05	0.0	0.05	450.1	451.52	451.5	451.90	0.0	1.4	3.3	1.5	19.8	25.69	0.96
1	101	PMF	305.4	0.05	0.0	0.05	450.1	453.11	453.1	453.94	0.0	2.7	5.6	2.8	90.1	48.02	1.07

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	100	1 year	4.3	0.05	0.0	0.05	449.7	450.36	450.3	450.47	0.0	0.0	1.4	0.0	3.0	18.01	0.71
1	100	5 year	15.0	0.05	0.0	0.05	449.7	450.66	450.7	450.88	0.0	0.8	2.3	0.9	8.9	21	0.86
1	100	100 year	37.7	0.05	0.0	0.05	449.7	451.04	451.0	451.39	0.0	1.3	3.1	1.4	17.4	24.73	0.95
1	100	200 year	44.6	0.05	0.0	0.05	449.7	451.13	451.1	451.51	0.0	1.4	3.3	1.5	19.7	25.67	0.96
1	100	PMF	305.4	0.05	0.0	0.05	449.7	452.72	452.7	453.55	0.0	2.7	5.6	2.8	90.0	47.99	1.07
1	99	1 year	4.3		0.0		449.5	450.00	450.0	450.18	0.0		1.9		2.3	6.37	1.01
1	99	5 year	15.0	0.05	0.0	0.05	449.5	450.41	450.4	450.62	0.0	0.9	2.3	0.8	8.9	21.27	0.86
1	99	100 year	37.7	0.05	0.0	0.05	449.5	450.77	450.8	451.13	0.0	1.5	3.1	1.3	17.4	24.96	0.95
1	99	200 year	44.6	0.05	0.0	0.05	449.5	450.87	450.9	451.25	0.0	1.6	3.3	1.3	19.8	25.89	0.96
1	99	PMF	305.4	0.05	0.0	0.05	449.5	452.45	452.5	453.28	0.0	2.9	5.6	2.6	90.1	48.27	1.07
1	98.5	1 year	4.3		0.0		449.0	449.56	449.5	449.69	0.0		1.6		2.7	6.83	0.83
1	98.5	5 year	15.0	0.05	0.0	0.05	449.0	449.91	449.9	450.12	0.0	0.9	2.3	0.8	8.9	21.27	0.86
1	98.5	100 year	37.7	0.05	0.0	0.05	449.0	450.27	450.3	450.63	0.0	1.5	3.1	1.3	17.4	24.96	0.95
1	98.5	200 year	44.6	0.05	0.0	0.05	449.0	450.37	450.4	450.75	0.0	1.6	3.3	1.3	19.8	25.88	0.96
1	98.5	PMF	305.4	0.05	0.0	0.05	449.0	452.34		452.88	0.0	2.4	4.6	2.2	108.8	48.27	0.82
1	98	1 year	4.3		0.0		448.7	449.31	449.2	449.41	0.0		1.5		3.0	7.2	0.72
1	98	5 year	15.0	0.05	0.0	0.05	448.7	449.61	449.6	449.83	0.0	0.9	2.3	0.8	8.9	21.12	0.86
1	98	100 year	37.7	0.05	0.0	0.05	448.7	449.98	450.0	450.33	0.0	1.4	3.1	1.4	17.4	24.83	0.95
1	98	200 year	44.6	0.05	0.0	0.05	448.7	450.07	450.1	450.46	0.0	1.5	3.3	1.5	19.8	25.76	0.96
1	98	PMF	305.4	0.05	0.0	0.05	448.7	452.29		452.73	0.0	2.2	4.1	2.1	120.6	48.11	0.71
1	97	1 year	4.3		0.0		448.4	448.99	449.0	449.17	0.0		1.9		2.3	6.36	1.01
1	97	5 year	15.0	0.05	0.0	0.05	448.4	449.40	449.4	449.62	0.0	0.9	2.3	0.8	8.9	21.02	0.86
1	97	100 year	37.7	0.05	0.0	0.05	448.4	449.77	449.8	450.12	0.0	1.4	3.1	1.4	17.4	24.75	0.95
1	97	200 year	44.6	0.05	0.0	0.05	448.4	449.86	449.9	450.25	0.0	1.5	3.3	1.5	19.8	25.68	0.96
1	97	PMF	305.4	0.05	0.0	0.05	448.4	452.27		452.64	0.0	2.0	3.8	2.0	129.3	48.01	0.64
1	96	1 year	4.3	0.05	0.0	0.05	447.7	448.45		448.52	0.0	0.2	1.2	0.2	4.1	18.72	0.57
1	96	5 year	15.0	0.05	0.0	0.05	447.7	448.89		448.99	0.0	0.7	1.6	0.7	13.4	23.18	0.52
1	96	100 year	37.7	0.05	0.0	0.05	447.7	449.41		449.57	0.0	0.9	2.2	0.9	26.7	32.06	0.58
1	96	200 year	44.6	0.05	0.0	0.05	447.7	449.49		449.72	0.0	0.9	2.6	0.8	29.9	47.94	0.68
1	96	PMF	305.4	0.05	0.0	0.05	447.7	452.22		452.45	0.0	1.6	3.0	1.6	161.3	48.12	0.47

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	95	1 year	7.0	0.05	0.0	0.05	447.4	448.15	448.1	448.29	0.0	0.1	1.7	0.1	4.3	19.38	0.75
1	95	5 year	23.1	0.05	0.0	0.05	447.4	448.56		448.79	0.0	0.9	2.4	0.9	13.2	23.97	0.79
1	95	100 year	54.3	0.05	0.0	0.05	447.4	449.03		449.37	0.0	1.4	3.0	1.3	25.8	29.27	0.83
1	95	200 year	63.2	0.05	0.0	0.05	447.4	449.14		449.50	0.0	1.5	3.2	1.3	29.0	30.47	0.83
1	95	PMF	504.0	0.05	0.0	0.05	447.4	451.41		452.27	0.0	3.0	5.7	2.8	143.6	53.3	0.93
1	94	1 year	7.0		0.0		447.0	447.73	447.7	447.89	0.0		1.7		4.0	8.41	0.79
1	94	5 year	23.1	0.05	0.0	0.05	447.0	448.13	448.1	448.41	0.0	1.0	2.6	0.8	11.8	22.3	0.88
1	94	100 year	54.3	0.05	0.0	0.05	447.0	448.57	448.6	449.00	0.0	1.5	3.4	1.3	22.9	27.29	0.93
1	94	200 year	63.2	0.05	0.0	0.05	447.0	448.67	448.7	449.13	0.0	1.6	3.5	1.4	25.7	28.43	0.94
1	94	PMF	504.0	0.05	0.0	0.05	447.0	450.80	450.8	451.91	0.0	3.3	6.4	3.0	128.1	52.02	1.08
1	93	1 year	7.0	0.05	0.0	0.05	446.7	447.53	447.4	447.65	0.0	0.2	1.5	0.2	4.9	18.51	0.67
1	93	5 year	23.1	0.05	0.0	0.05	446.7	447.90		448.15	0.0	0.9	2.4	0.9	12.5	22.63	0.82
1	93	100 year	54.3	0.05	0.0	0.05	446.7	448.35		448.74	0.0	1.4	3.2	1.3	24.0	27.72	0.88
1	93	200 year	63.2	0.05	0.0	0.05	446.7	448.45		448.88	0.0	1.5	3.4	1.4	26.8	28.85	0.90
1	93	PMF	504.0	0.05	0.0	0.05	446.7	450.56	450.5	451.65	0.0	3.2	6.3	3.1	129.5	52.01	1.07
1	92	1 year	7.0		0.0		446.4	447.08	447.1	447.30	0.0		2.1		3.4	7.73	1.01
1	92	5 year	23.1	0.05	0.0	0.05	446.4	447.56	447.6	447.84	0.0	0.9	2.6	0.9	11.8	22.29	0.88
1	92	100 year	54.3	0.05	0.0	0.05	446.4	448.01	448.0	448.43	0.0	1.4	3.4	1.5	22.9	27.28	0.93
1	92	200 year	63.2	0.05	0.0	0.05	446.4	448.11	448.1	448.57	0.0	1.5	3.5	1.6	25.7	28.43	0.94
1	92	PMF	504.0	0.05	0.0	0.05	446.4	450.23	450.2	451.34	0.0	3.2	6.4	3.2	128.3	52	1.08
1	91.5	1 year	7.0	0.05	0.0	0.05	445.9	446.68	446.6	446.82	0.0	0.0	1.7	0.0	4.1	18.01	0.77
1	91.5	5 year	23.1	0.05	0.0	0.05	445.9	447.07		447.34	0.0	0.9	2.5	0.9	12.1	22.4	0.86
1	91.5	100 year	54.3	0.05	0.0	0.05	445.9	447.52		447.93	0.0	1.4	3.3	1.4	23.3	27.45	0.91
1	91.5	200 year	63.2	0.05	0.0	0.05	445.9	447.62		448.07	0.0	1.5	3.5	1.5	26.1	28.57	0.93
1	91.5	PMF	504.0	0.05	0.0	0.05	445.9	449.74	449.7	450.84	0.0	3.2	6.4	3.2	128.8	52	1.07
1	91	1 year	7.0	0.05	0.0	0.05	445.7	446.49	446.4	446.63	0.0	0.0	1.7	0.0	4.1	18.01	0.77
1	91	5 year	23.1	0.05	0.0	0.05	445.7	446.88		447.15	0.0	0.9	2.5	0.9	12.2	22.47	0.85
1	91	100 year	54.3	0.05	0.0	0.05	445.7	447.33		447.74	0.0	1.4	3.3	1.4	23.2	27.4	0.92
1	91	200 year	63.2	0.05	0.0	0.05	445.7	447.42		447.88	0.0	1.5	3.5	1.5	25.9	28.5	0.93
1	91	PMF	504.0	0.05	0.0	0.05	445.7	449.58	449.5	450.65	0.0	3.1	6.3	3.2	130.1	52	1.06

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	90	1 year	7.0	0.05	0.0	0.05	445.6	446.30	446.2	446.45	0.0	0.0	1.7	0.0	4.2	17.96	0.77
1	90	5 year	23.1	0.05	0.0	0.05	445.6	446.69		446.97	0.0	0.9	2.6	0.9	11.9	22.26	0.87
1	90	100 year	54.3	0.05	0.0	0.05	445.6	447.13		447.56	0.0	1.4	3.4	1.5	22.9	27.25	0.93
1	90	200 year	63.2	0.05	0.0	0.05	445.6	447.23	447.2	447.69	0.0	1.5	3.5	1.6	25.7	28.38	0.94
1	90	PMF	504.0	0.05	0.0	0.05	445.6	449.44	449.4	450.47	0.0	3.1	6.2	3.1	132.3	51.94	1.04
1	89	1 year	7.0	0.05	0.0	0.05	445.4	446.10	446.0	446.24	0.0	0.0	1.7	0.0	4.1	18.22	0.77
1	89	5 year	23.1	0.05	0.0	0.05	445.4	446.51		446.76	0.0	0.9	2.4	0.9	12.7	22.86	0.81
1	89	100 year	54.3	0.05	0.0	0.05	445.4	446.98		447.35	0.0	1.4	3.2	1.4	24.6	28.1	0.86
1	89	200 year	63.2	0.05	0.0	0.05	445.4	447.09		447.49	0.0	1.5	3.3	1.4	27.6	29.29	0.87
1	89	PMF	504.0	0.05	0.0	0.05	445.4	449.35	449.1	450.28	0.0	3.0	5.9	3.0	139.1	52.21	0.97
1	88	1 year	7.0	0.05	0.0	0.05	445.2	445.96	445.9	446.11	0.0	0.0	1.7	0.0	4.2	18	0.77
1	88	5 year	23.1	0.05	0.0	0.05	445.2	446.34	446.3	446.63	0.0	1.0	2.6	0.9	11.8	22.27	0.88
1	88	100 year	54.3	0.05	0.0	0.05	445.2	446.79	446.8	447.22	0.0	1.5	3.4	1.3	22.9	27.27	0.93
1	88	200 year	63.2	0.05	0.0	0.05	445.2	446.89	446.9	447.35	0.0	1.6	3.5	1.4	25.7	28.4	0.94
1	88	PMF	504.0	0.05	0.0	0.05	445.2	449.02	449.0	450.13	0.0	3.3	6.4	3.1	128.2	51.98	1.08
1	87	1 year	7.0	0.05	0.0	0.05	445.1	445.83	445.7	445.97	0.0	0.1	1.7	0.1	4.3	18.11	0.75
1	87	5 year	23.1	0.05	0.0	0.05	445.1	446.23		446.48	0.0	1.0	2.4	0.8	12.5	22.63	0.82
1	87	100 year	54.3	0.05	0.0	0.05	445.1	446.69		447.08	0.0	1.5	3.2	1.2	24.1	27.78	0.88
1	87	200 year	63.2	0.05	0.0	0.05	445.1	446.78		447.21	0.0	1.6	3.4	1.3	26.7	28.81	0.90
1	87	PMF	504.0	0.05	0.0	0.05	445.1	448.88	448.9	449.98	0.0	3.3	6.4	3.0	128.7	52.02	1.08
1	86	1 year	7.0		0.0		444.8	445.52		445.68	0.0		1.8		4.0	8.35	0.81
1	86	5 year	23.1	0.05	0.0	0.05	444.8	445.93		446.21	0.0	0.9	2.6	1.0	11.9	22.31	0.87
1	86	100 year	54.3	0.05	0.0	0.05	444.8	446.37		446.80	0.0	1.4	3.4	1.5	22.8	27.26	0.94
1	86	200 year	63.2	0.05	0.0	0.05	444.8	446.47	446.5	446.93	0.0	1.5	3.5	1.6	25.7	28.43	0.94
1	86	PMF	504.0	0.05	0.0	0.05	444.8	448.59	448.6	449.70	0.0	3.1	6.4	3.2	128.1	52.01	1.08
1	85	1 year	7.0	0.05	0.0	0.05	444.5	445.27		445.39	0.0	0.2	1.5	0.2	5.1	18.65	0.65
1	85	5 year	23.1	0.05	0.0	0.05	444.5	445.63		445.89	0.0	0.9	2.5	0.9	12.4	22.64	0.83
1	85	100 year	54.3	0.05	0.0	0.05	444.5	446.08		446.48	0.0	1.4	3.3	1.4	23.7	27.64	0.90
1	85	200 year	63.2	0.05	0.0	0.05	444.5	446.18		446.61	0.0	1.5	3.4	1.5	26.4	28.75	0.91
1	85	PMF	504.0	0.05	0.0	0.05	444.5	448.27	448.3	449.38	0.0	3.1	6.4	3.2	128.3	52.07	1.08

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	84	1 year	7.0		0.0		444.0	444.60	444.6	444.82	0.0		2.1		3.3	7.73	1.01
1	84	5 year	23.1	0.05	0.0	0.05	444.0	445.08	445.1	445.36	0.0	1.0	2.6	0.9	11.8	22.29	0.88
1	84	100 year	54.3	0.05	0.0	0.05	444.0	445.53	445.5	445.96	0.0	1.5	3.4	1.4	22.9	27.29	0.93
1	84	200 year	63.2	0.05	0.0	0.05	444.0	445.63	445.6	446.09	0.0	1.6	3.5	1.5	25.7	28.43	0.94
1	84	PMF	504.0	0.05	0.0	0.05	444.0	447.75	447.8	448.86	0.0	3.2	6.4	3.2	128.2	52.01	1.08
1	83.5	1 year	7.0	0.05	0.0	0.05	443.5	444.20	444.1	444.35	0.0	0.0	1.7	0.0	4.2	18.03	0.77
1	83.5	5 year	23.1	0.05	0.0	0.05	443.5	444.58		444.86	0.0	1.0	2.6	0.9	11.9	22.31	0.87
1	83.5	100 year	54.3	0.05	0.0	0.05	443.5	445.03		445.46	0.0	1.5	3.3	1.4	23.0	27.33	0.93
1	83.5	200 year	63.2	0.05	0.0	0.05	443.5	445.14		445.59	0.0	1.6	3.5	1.5	25.8	28.48	0.94
1	83.5	PMF	504.0	0.05	0.0	0.05	443.5	447.27	447.3	448.36	0.0	3.2	6.3	3.1	129.0	52.01	1.07
1	83	1 year	7.0	0.05	0.0	0.05	442.4	443.16	443.1	443.31	0.0	0.0	1.7	0.0	4.2	18.02	0.77
1	83	5 year	23.1	0.05	0.0	0.05	442.4	443.58		443.83	0.0	0.9	2.4	0.9	12.6	22.65	0.82
1	83	100 year	54.3	0.05	0.0	0.05	442.4	444.03		444.42	0.0	1.4	3.2	1.3	24.0	27.75	0.88
1	83	200 year	63.2	0.05	0.0	0.05	442.4	444.13		444.55	0.0	1.5	3.4	1.4	26.8	28.86	0.89
1	83	PMF	504.0	0.05	0.0	0.05	442.4	446.25	446.2	447.32	0.0	3.2	6.3	3.1	130.1	52.01	1.06
1	82	1 year	7.0	0.00	0.0	0.00	441.9	442.66	442.6	442.80	0.0	0.0	1.7	0.0	4.1	18.03	0.77
1	82	5 year	23.1	0.05	0.0	0.05	441.9	443.04	443.0	443.32	0.0	1.0	2.6	0.9	11.9	22.32	0.88
1	82	100 year	54.3	0.05	0.0	0.05	441.9	443.48	443.5	443.91	0.0	1.5	3.4	1.3	22.9	27.3	0.93
1	82	200 year	63.2	0.05	0.0	0.05	441.9	443.58	443.6	444.04	0.0	1.6	3.5	1.4	25.7	28.44	0.94
1	82	PMF	504.0	0.05	0.0	0.05	441.9	445.71	445.7	446.82	0.0	3.3	6.4	3.1	128.1	52.03	1.08
1	81	1 year	7.0	0.05	0.0	0.05	441.7	442.52	442.4	442.64	0.0	0.2	1.6	0.2	4.7	18.5	0.70
1	81	5 year	23.1	0.05	0.0	0.05	441.7	442.89		443.15	0.0	0.9	2.5	0.9	12.4	22.66	0.84
1	81	100 year	54.3	0.05	0.0	0.05	441.7	443.33		443.74	0.0	1.5	3.3	1.3	23.5	27.62	0.91
1	81	200 year	63.2	0.05	0.0	0.05	441.7	443.43		443.87	0.0	1.6	3.5	1.4	26.2	28.7	0.92
1	81	PMF	504.0	0.05	0.0	0.05	441.7	445.53	445.5	446.64	0.0	3.3	6.4	3.1	128.3	52.14	1.08
1	80	1 year	7.0		0.0		441.6	442.23	442.2	442.45	0.0		2.1		3.4	7.73	1.01
1	80	5 year	23.1	0.05	0.0	0.05	441.6	442.71	442.7	442.99	0.0	0.9	2.6	0.9	11.9	22.44	0.88
1	80	100 year	54.3	0.05	0.0	0.05	441.6	443.15	443.2	443.58	0.0	1.5	3.4	1.4	22.9	27.42	0.93
1	80	200 year	63.2	0.05	0.0	0.05	441.6	443.25	443.3	443.71	0.0	1.6	3.5	1.5	25.8	28.55	0.94
1	80	PMF	504.0	0.05	0.0	0.05	441.6	445.37	445.4	446.48	0.0	3.2	6.4	3.2	128.3	52.17	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	79.5	1 year	7.0	0.00	0.0	0.00	441.1	441.83	441.7	441.97	0.0	0.0	1.7	0.0	4.1	18.17	0.77
1	79.5	5 year	23.1	0.05	0.0	0.05	441.1	442.23		442.49	0.0	0.9	2.5	0.9	12.4	22.69	0.83
1	79.5	100 year	54.3	0.05	0.0	0.05	441.1	442.68		443.08	0.0	1.4	3.3	1.4	23.6	27.69	0.90
1	79.5	200 year	63.2	0.05	0.0	0.05	441.1	442.78		443.21	0.0	1.5	3.4	1.5	26.4	28.81	0.91
1	79.5	PMF	504.0	0.05	0.0	0.05	441.1	444.91	444.9	445.98	0.0	3.2	6.3	3.1	130.1	52.17	1.06
1	79	1 year	7.0	0.05	0.0	0.05	440.9	441.62	441.5	441.77	0.0	0.0	1.7	0.0	4.2	18	0.77
1	79	5 year	23.1	0.05	0.0	0.05	440.9	442.00	442.0	442.29	0.0	0.9	2.6	1.0	11.8	22.26	0.88
1	79	100 year	54.3	0.05	0.0	0.05	440.9	442.45	442.5	442.88	0.0	1.4	3.4	1.5	22.9	27.26	0.93
1	79	200 year	63.2	0.05	0.0	0.05	440.9	442.55	442.6	443.01	0.0	1.5	3.5	1.6	25.7	28.4	0.94
1	79	PMF	504.0	0.05	0.0	0.05	440.9	444.67	444.7	445.79	0.0	3.1	6.4	3.3	128.0	51.97	1.08
1	78	1 year	7.0	0.05	0.0	0.05	440.4	441.12	441.0	441.26	0.0	0.0	1.7	0.0	4.2	18.03	0.77
1	78	5 year	23.1	0.05	0.0	0.05	440.4	441.52		441.78	0.0	0.8	2.5	1.0	12.2	22.49	0.84
1	78	100 year	54.3	0.05	0.0	0.05	440.4	441.95		442.37	0.0	1.2	3.3	1.5	23.0	27.33	0.92
1	78	200 year	63.2	0.05	0.0	0.05	440.4	442.05		442.50	0.0	1.3	3.5	1.6	25.7	28.43	0.94
1	78	PMF	504.0	0.05	0.0	0.05	440.4	444.16	444.2	445.28	0.0	3.0	6.4	3.3	127.9	52.01	1.08
1	77	1 year	7.0	0.00	0.0	0.00	440.2	440.92	440.8	441.06	0.0	0.0	1.7	0.0	4.1	18.18	0.77
1	77	5 year	23.1	0.05	0.0	0.05	440.2	441.30	441.3	441.58	0.0	1.0	2.6	0.9	11.9	22.46	0.87
1	77	100 year	54.3	0.05	0.0	0.05	440.2	441.74	441.7	442.17	0.0	1.5	3.4	1.4	23.0	27.43	0.93
1	77	200 year	63.2	0.05	0.0	0.05	440.2	441.84	441.8	442.30	0.0	1.6	3.5	1.5	25.8	28.56	0.94
1	77	PMF	504.0	0.05	0.0	0.05	440.2	443.96	444.0	445.07	0.0	3.2	6.4	3.1	128.3	52.18	1.08
1	76	1 year	7.0	0.05	0.0	0.05	439.8	440.59	440.5	440.73	0.0	0.1	1.7	0.1	4.2	18.52	0.76
1	76	5 year	23.1	0.05	0.0	0.05	439.8	441.00		441.24	0.0	0.9	2.4	0.9	12.8	23.13	0.81
1	76	100 year	54.3	0.05	0.0	0.05	439.8	441.43		441.83	0.0	1.4	3.2	1.4	23.9	27.99	0.89
1	76	200 year	63.2	0.05	0.0	0.05	439.8	441.53		441.96	0.0	1.5	3.4	1.4	26.7	29.1	0.90
1	76	PMF	504.0	0.05	0.0	0.05	439.8	443.72	443.6	444.73	0.0	3.1	6.1	3.0	133.9	52.45	1.02
1	75	1 year	7.0		0.0		439.6	440.30	440.2	440.45	0.0		1.7		4.1	8.43	0.79
1	75	5 year	23.1	0.05	0.0	0.05	439.6	440.68		440.97	0.0	0.8	2.6	1.0	11.7	22.35	0.89
1	75	100 year	54.3	0.05	0.0	0.05	439.6	441.13	441.1	441.55	0.0	1.2	3.3	1.5	22.9	27.4	0.93
1	75	200 year	63.2	0.05	0.0	0.05	439.6	441.23	441.2	441.69	0.0	1.3	3.5	1.6	25.7	28.53	0.94
1	75	PMF	504.0	0.05	0.0	0.05	439.6	443.34	443.3	444.46	0.0	3.0	6.4	3.3	127.8	52.17	1.09

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	74	1 year	7.0	0.05	0.0	0.05	439.3	440.11	440.0	440.23	0.0	0.2	1.5	0.2	5.0	18.56	0.67
1	74	5 year	23.1	0.05	0.0	0.05	439.3	440.48		440.73	0.0	0.9	2.5	0.9	12.4	22.64	0.83
1	74	100 year	54.3	0.05	0.0	0.05	439.3	440.92		441.32	0.0	1.4	3.3	1.4	23.7	27.65	0.90
1	74	200 year	63.2	0.05	0.0	0.05	439.3	441.02		441.46	0.0	1.5	3.4	1.5	26.5	28.76	0.91
1	74	PMF	504.0	0.05	0.0	0.05	439.3	443.13	443.1	444.23	0.0	3.1	6.3	3.2	129.0	52.06	1.07
1	73	1 year	7.0		0.0		439.0	439.65	439.7	439.87	0.0		2.1		3.4	7.73	1.01
1	73	5 year	23.1	0.05	0.0	0.05	439.0	440.13	440.1	440.41	0.0	1.0	2.6	0.9	11.8	22.29	0.88
1	73	100 year	54.3	0.05	0.0	0.05	439.0	440.58	440.6	441.00	0.0	1.5	3.4	1.3	22.9	27.28	0.93
1	73	200 year	63.2	0.05	0.0	0.05	439.0	440.68	440.7	441.14	0.0	1.6	3.5	1.4	25.7	28.42	0.94
1	73	PMF	504.0	0.05	0.0	0.05	439.0	442.80	442.8	443.91	0.0	3.3	6.4	3.1	128.2	52	1.08
1	72.5	1 year	7.0	0.05	0.0	0.05	438.5	439.25	439.2	439.39	0.0	0.0	1.7	0.0	4.1	18.01	0.77
1	72.5	5 year	23.1	0.05	0.0	0.05	438.5	439.63	439.6	439.91	0.0	1.0	2.5	0.9	11.9	22.32	0.87
1	72.5	100 year	54.3	0.05	0.0	0.05	438.5	440.08	440.1	440.50	0.0	1.5	3.4	1.3	22.9	27.28	0.93
1	72.5	200 year	63.2	0.05	0.0	0.05	438.5	440.18	440.2	440.64	0.0	1.6	3.5	1.4	25.7	28.42	0.94
1	72.5	PMF	504.0	0.05	0.0	0.05	438.5	442.30	442.3	443.41	0.0	3.3	6.4	3.1	128.2	52	1.08
1	72	1 year	7.0	0.05	0.0	0.00	438.4	439.13	439.0	439.27	0.0	0.0	1.7	0.0	4.1	18.01	0.77
1	72	5 year	23.1	0.05	0.0	0.05	438.4	439.53		439.79	0.0	0.9	2.5	0.9	12.4	22.57	0.83
1	72	100 year	54.3	0.05	0.0	0.05	438.4	439.98		440.38	0.0	1.5	3.2	1.3	23.7	27.62	0.89
1	72	200 year	63.2	0.05	0.0	0.05	438.4	440.08		440.52	0.0	1.6	3.4	1.4	26.5	28.73	0.91
1	72	PMF	504.0	0.05	0.0	0.05	438.4	442.20	442.2	443.29	0.0	3.2	6.3	3.1	129.3	52	1.07
1	71	1 year	7.0	0.05	0.0	0.05	438.1	438.87	438.8	439.01	0.0	0.0	1.7	0.0	4.2	18.03	0.77
1	71	5 year	23.1	0.05	0.0	0.05	438.1	439.25	439.3	439.53	0.0	1.0	2.5	0.9	11.9	22.33	0.87
1	71	100 year	54.3	0.05	0.0	0.05	438.1	439.70	439.7	440.12	0.0	1.5	3.4	1.3	22.9	27.28	0.93
1	71	200 year	63.2	0.05	0.0	0.05	438.1	439.80	439.8	440.25	0.0	1.6	3.5	1.4	25.7	28.42	0.94
1	71	PMF	504.0	0.05	0.0	0.05	438.1	441.95	441.9	443.03	0.0	3.2	6.3	3.0	129.8	52.01	1.06
1	70	1 year	7.0	0.05	0.0	0.05	438.0	438.77	438.7	438.91	0.0	0.0	1.7	0.0	4.2	18.3	0.77
1	70	5 year	23.1	0.05	0.0	0.05	438.0	439.18		439.43	0.0	0.9	2.4	0.9	12.7	22.92	0.81
1	70	100 year	54.3	0.05	0.0	0.05	438.0	439.63		440.01	0.0	1.4	3.2	1.3	24.1	27.94	0.88
1	70	200 year	63.2	0.05	0.0	0.05	438.0	439.73		440.15	0.0	1.5	3.4	1.4	27.0	29.08	0.89
1	70	PMF	504.0	0.05	0.0	0.05	438.0	441.92	441.8	442.92	0.0	3.1	6.1	3.0	134.3	52.28	1.02

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	69	1 year	7.0	0.05	0.0	0.05	437.8	438.56	438.5	438.70	0.0	0.0	1.7	0.0	4.2	18.04	0.77
1	69	5 year	23.1	0.05	0.0	0.05	437.8	438.94	438.9	439.22	0.0	0.8	2.6	1.0	11.8	22.3	0.88
1	69	100 year	54.3	0.05	0.0	0.05	437.8	439.38	439.4	439.81	0.0	1.2	3.3	1.5	22.9	27.28	0.93
1	69	200 year	63.2	0.05	0.0	0.05	437.8	439.48	439.5	439.94	0.0	1.3	3.5	1.6	25.7	28.42	0.94
1	69	PMF	504.0	0.05	0.0	0.05	437.8	441.60	441.6	442.72	0.0	3.0	6.4	3.3	127.9	52.02	1.08
1	68	1 year	7.0	0.05	0.0	0.05	437.5	438.24	438.2	438.39	0.0	0.0	1.7	0.0	4.2	18.14	0.77
1	68	5 year	23.1	0.05	0.0	0.05	437.5	438.65		438.90	0.0	0.9	2.4	0.9	12.6	22.74	0.82
1	68	100 year	54.3	0.05	0.0	0.05	437.5	439.11		439.50	0.0	1.4	3.2	1.4	24.2	27.9	0.87
1	68	200 year	63.2	0.05	0.0	0.05	437.5	439.21		439.63	0.0	1.5	3.4	1.5	27.0	28.98	0.89
1	68	PMF	504.0	0.05	0.0	0.05	437.5	441.35	441.3	442.40	0.0	3.1	6.2	3.1	131.6	52.12	1.05
1	67	1 year	7.0		0.0		437.0	437.79	437.7	437.93	0.0		1.7		4.1	8.49	0.77
1	67	5 year	23.1	0.05	0.0	0.05	437.0	438.17	438.2	438.45	0.0	1.0	2.6	0.9	11.9	22.31	0.88
1	67	100 year	54.3	0.05	0.0	0.05	437.0	438.61		439.04	0.0	1.5	3.4	1.4	22.8	27.25	0.94
1	67	200 year	63.2	0.05	0.0	0.05	437.0	438.72	438.7	439.18	0.0	1.6	3.5	1.5	25.7	28.44	0.94
1	67	PMF	504.0	0.05	0.0	0.05	437.0	440.84	440.8	441.95	0.0	3.3	6.4	3.1	128.2	52.02	1.08
1	66	1 year	7.0	0.05	0.0	0.05	436.9	437.67	437.5	437.78	0.0	0.2	1.5	0.2	5.0	18.63	0.66
1	66	5 year	23.1	0.05	0.0	0.05	436.9	438.03		438.28	0.0	0.9	2.5	0.9	12.4	22.67	0.83
1	66	100 year	54.3	0.05	0.0	0.05	436.9	438.47		438.87	0.0	1.5	3.3	1.3	23.6	27.64	0.90
1	66	200 year	63.2	0.05	0.0	0.05	436.9	438.57		439.00	0.0	1.6	3.4	1.4	26.4	28.75	0.91
1	66	PMF	504.0	0.05	0.0	0.05	436.9	440.67	440.7	441.78	0.0	3.3	6.4	3.1	128.2	52.1	1.08
1	65	1 year	7.0		0.0		436.5	437.15	437.2	437.37	0.0		2.1		3.3	7.73	1.01
1	65	5 year	23.1	0.05	0.0	0.05	436.5	437.62	437.6	437.91	0.0	0.9	2.6	1.0	11.8	22.31	0.88
1	65	100 year	54.3	0.05	0.0	0.05	436.5	438.07	438.1	438.50	0.0	1.4	3.4	1.5	22.9	27.3	0.93
1	65	200 year	63.2	0.05	0.0	0.05	436.5	438.17	438.2	438.63	0.0	1.4	3.5	1.6	25.7	28.44	0.94
1	65	PMF	504.0	0.05	0.0	0.05	436.5	440.29	440.3	441.40	0.0	3.1	6.4	3.3	128.1	52.02	1.08
1	64.5	1 year	7.0	0.05	0.0	0.05	436.0	436.74	436.7	436.89	0.0	0.0	1.7	0.0	4.1	18.03	0.77
1	64.5	5 year	23.1	0.05	0.0	0.05	436.0	437.12		437.41	0.0	0.9	2.6	1.0	11.7	22.24	0.89
1	64.5	100 year	54.3	0.05	0.0	0.05	436.0	437.57	437.6	438.00	0.0	1.4	3.4	1.5	22.9	27.3	0.93
1	64.5	200 year	63.2	0.05	0.0	0.05	436.0	437.67	437.7	438.13	0.0	1.4	3.5	1.6	25.7	28.43	0.94
1	64.5	PMF	504.0	0.05	0.0	0.05	436.0	439.80	439.8	440.90	0.0	3.1	6.4	3.3	128.2	52.02	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	64	1 year	7.0	0.05	0.0	0.05	435.8	436.60	436.5	436.74	0.0	0.0	1.7	0.0	4.2	18.04	0.77
1	64	5 year	23.1	0.05	0.0	0.05	435.8	436.99		437.26	0.0	0.9	2.5	1.0	12.1	22.43	0.85
1	64	100 year	54.3	0.05	0.0	0.05	435.8	437.43		437.85	0.0	1.3	3.3	1.5	23.2	27.43	0.91
1	64	200 year	63.2	0.05	0.0	0.05	435.8	437.53		437.98	0.0	1.4	3.5	1.6	26.0	28.54	0.93
1	64	PMF	504.0	0.05	0.0	0.05	435.8	439.65	439.7	440.76	0.0	3.1	6.4	3.3	128.2	52.01	1.08
1	63	1 year	7.0	0.00	0.0	0.00	435.4	436.10	436.0	436.25	0.0	0.0	1.7	0.0	4.1	18.14	0.77
1	63	5 year	23.1	0.05	0.0	0.05	435.4	436.50		436.77	0.0	0.9	2.5	0.9	12.1	22.54	0.85
1	63	100 year	54.3	0.05	0.0	0.05	435.4	436.94		437.36	0.0	1.4	3.3	1.5	23.2	27.48	0.92
1	63	200 year	63.2	0.05	0.0	0.05	435.4	437.04		437.49	0.0	1.5	3.5	1.5	26.0	28.61	0.93
1	63	PMF	504.0	0.05	0.0	0.05	435.4	439.18	439.2	440.26	0.0	3.1	6.3	3.2	129.9	52.14	1.06
1	62	1 year	7.0	0.05	0.0	0.05	434.9	435.69	435.6	435.84	0.0	0.0	1.7	0.0	4.2	18.32	0.77
1	62	5 year	23.1	0.05	0.0	0.05	434.9	436.09		436.35	0.0	0.9	2.5	0.9	12.3	22.75	0.84
1	62	100 year	54.3	0.05	0.0	0.05	434.9	436.54		436.94	0.0	1.4	3.2	1.4	23.9	27.87	0.89
1	62	200 year	63.2	0.05	0.0	0.05	434.9	436.65		437.07	0.0	1.5	3.4	1.5	26.7	29	0.90
1	62	PMF	504.0	0.05	0.0	0.05	434.9	438.90	438.7	439.85	0.0	3.0	6.0	3.0	137.1	52.3	0.99
1	61	1 year	7.0	0.05	0.0	0.05	434.8	435.58	435.4	435.69	0.0	0.2	1.5	0.2	5.2	18.66	0.64
1	61	5 year	23.1	0.05	0.0	0.05	434.8	435.93		436.19	0.0	0.9	2.5	0.9	12.4	22.58	0.83
1	61	100 year	54.3	0.05	0.0	0.05	434.8	436.38		436.78	0.0	1.5	3.3	1.3	23.5	27.56	0.90
1	61	200 year	63.2	0.05	0.0	0.05	434.8	436.47		436.91	0.0	1.6	3.4	1.4	26.3	28.65	0.92
1	61	PMF	504.0	0.05	0.0	0.05	434.8	438.58	438.6	439.69	0.0	3.3	6.4	3.1	128.3	52.03	1.08
1	60	1 year	7.0		0.0		433.9	434.57	434.6	434.79	0.0		2.1		3.3	7.73	1.01
1	60	5 year	23.1	0.05	0.0	0.05	433.9	435.05	435.1	435.33	0.0	0.8	2.6	1.0	11.8	22.28	0.88
1	60	100 year	54.3	0.05	0.0	0.05	433.9	435.50	435.5	435.92	0.0	1.2	3.3	1.5	22.9	27.26	0.93
1	60	200 year	63.2	0.05	0.0	0.05	433.9	435.60	435.6	436.05	0.0	1.3	3.5	1.6	25.7	28.4	0.94
1	60	PMF	504.0	0.05	0.0	0.05	433.9	437.72	437.7	438.83	0.0	3.0	6.4	3.3	128.0	52	1.08
1	59.5	1 year	7.0	0.00	0.0	0.00	433.4	434.17	434.1	434.31	0.0	0.0	1.7	0.0	4.1	18	0.77
1	59.5	5 year	23.1	0.05	0.0	0.05	433.4	434.56		434.83	0.0	0.8	2.5	1.0	11.9	22.33	0.87
1	59.5	100 year	54.3	0.05	0.0	0.05	433.4	435.13		435.45	0.0	1.1	2.9	1.4	26.7	28.79	0.77
1	59.5	200 year	63.2	0.05	0.0	0.05	433.4	435.31		435.61	0.0	1.1	2.9	1.4	32.1	30.83	0.72
1	59.5	PMF	504.0	0.05	0.0	0.05	433.4	437.98		438.60	0.0	2.4	4.8	2.6	167.5	52	0.74

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	59	1 year	7.0	0.05	0.0	0.05	433.2	433.91	433.8	434.06	0.0	0.0	1.7	0.0	4.2	18.33	0.77
1	59	5 year	23.1	0.05	0.0	0.05	433.2	434.48		434.63	0.0	0.7	1.9	0.8	16.3	24.68	0.60
1	59	100 year	54.3	0.05	0.0	0.05	433.2	435.09		435.29	0.0	1.0	2.4	1.1	33.5	31.51	0.59
1	59	200 year	63.2	0.05	0.0	0.05	433.2	435.22		435.48	0.0	0.9	2.7	1.0	38.0	43.85	0.64
1	59	PMF	504.0	0.05	0.0	0.05	433.2	437.95		438.48	0.0	2.3	4.5	2.4	180.5	52.31	0.67
1	58	1 year	7.0	0.05	0.0	0.05	432.7	433.42	433.3	433.56	0.0	0.0	1.7	0.0	4.2	18.14	0.77
1	58	5 year	23.1	0.05	0.0	0.05	432.7	433.81		434.08	0.0	1.0	2.5	0.9	12.1	22.5	0.86
1	58	100 year	54.3	0.05	0.0	0.05	432.7	434.26		434.67	0.0	1.5	3.3	1.4	23.3	27.53	0.92
1	58	200 year	63.2	0.05	0.0	0.05	432.7	434.36		434.80	0.0	1.6	3.5	1.5	26.1	28.65	0.93
1	58	PMF	504.0	0.05	0.0	0.05	432.7	436.48	436.5	437.57	0.0	3.2	6.3	3.1	129.2	52.12	1.07
1	57	1 year	7.0	0.05	0.0	0.00	432.4	433.19	433.1	433.34	0.0	0.0	1.7	0.0	4.1	18.12	0.77
1	57	5 year	23.1	0.05	0.0	0.05	432.4	433.60		433.86	0.0	0.9	2.4	0.9	12.5	22.7	0.82
1	57	100 year	54.3	0.05	0.0	0.05	432.4	434.05		434.45	0.0	1.4	3.2	1.4	23.8	27.74	0.89
1	57	200 year	63.2	0.05	0.0	0.05	432.4	434.15		434.58	0.0	1.5	3.4	1.5	26.6	28.85	0.90
1	57	PMF	504.0	0.05	0.0	0.05	432.4	436.26	436.2	437.35	0.0	3.2	6.3	3.2	129.3	52.11	1.07
1	56	1 year	7.0	0.05	0.0	0.05	432.1	432.89	432.8	433.03	0.0	0.1	1.7	0.1	4.2	18.13	0.76
1	56	5 year	23.1	0.05	0.0	0.05	432.1	433.27	433.3	433.55	0.0	0.9	2.6	1.0	11.9	22.37	0.88
1	56	100 year	54.3	0.05	0.0	0.05	432.1	433.71	433.7	434.14	0.0	1.3	3.4	1.5	22.9	27.35	0.93
1	56	200 year	63.2	0.05	0.0	0.05	432.1	433.81	433.8	434.27	0.0	1.4	3.5	1.6	25.7	28.48	0.94
1	56	PMF	504.0	0.05	0.0	0.05	432.1	435.96	435.9	437.04	0.0	3.0	6.3	3.3	129.4	52.09	1.07
1	55	1 year	7.0		0.0		432.0	432.69	432.6	432.84	0.0		1.7		4.0	8.42	0.79
1	55	5 year	23.1	0.05	0.0	0.05	432.0	433.10		433.35	0.0	0.9	2.5	0.9	12.5	23.18	0.83
1	55	100 year	54.3	0.05	0.0	0.05	432.0	433.58		433.94	0.0	1.3	3.1	1.4	24.9	28.53	0.85
1	55	200 year	63.2	0.05	0.0	0.05	432.0	433.68		434.07	0.0	1.4	3.3	1.5	28.0	29.71	0.86
1	55	PMF	504.0	0.05	0.0	0.05	432.0	435.90	435.7	436.84	0.0	3.0	5.9	3.0	137.9	52.69	0.98
1	54	1 year	7.0	0.05	0.0	0.05	431.7	432.46	432.3	432.58	0.0	0.2	1.6	0.2	4.8	18.43	0.68
1	54	5 year	23.1	0.05	0.0	0.05	431.7	432.82		433.08	0.0	1.0	2.5	0.9	12.2	22.45	0.85
1	54	100 year	54.3	0.05	0.0	0.05	431.7	433.25		433.68	0.0	1.5	3.3	1.4	22.9	27.31	0.93
1	54	200 year	63.2	0.05	0.0	0.05	431.7	433.35		433.81	0.0	1.6	3.5	1.4	25.8	28.44	0.94
1	54	PMF	504.0	0.05	0.0	0.05	431.7	435.48	435.5	436.58	0.0	3.3	6.4	3.1	128.2	52.01	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	53	1 year	7.0		0.0		431.5	432.12	432.1	432.34	0.0		2.1		3.3	7.73	1.01
1	53	5 year	23.1	0.05	0.0	0.05	431.5	432.60	432.6	432.88	0.0	0.9	2.6	0.9	11.9	22.31	0.88
1	53	100 year	54.3	0.05	0.0	0.05	431.5	433.05	433.1	433.47	0.0	1.4	3.4	1.4	22.9	27.3	0.93
1	53	200 year	63.2	0.05	0.0	0.05	431.5	433.15	433.2	433.61	0.0	1.5	3.5	1.5	25.7	28.44	0.94
1	53	PMF	504.0	0.05	0.0	0.05	431.5	435.27	435.3	436.38	0.0	3.2	6.4	3.2	128.3	52.02	1.08
1	52.5	1 year	7.0		0.0		431.0	431.72	431.6	431.86	0.0		1.7		4.1	8.5	0.77
1	52.5	5 year	23.1	0.05	0.0	0.05	431.0	432.13		432.38	0.0	0.9	2.5	0.9	12.5	22.62	0.82
1	52.5	100 year	54.3	0.05	0.0	0.05	431.0	432.58		432.97	0.0	1.4	3.2	1.4	23.8	27.66	0.89
1	52.5	200 year	63.2	0.05	0.0	0.05	431.0	432.67		433.11	0.0	1.5	3.4	1.5	26.5	28.73	0.91
1	52.5	PMF	504.0	0.05	0.0	0.05	431.0	434.79	434.8	435.88	0.0	3.2	6.3	3.2	129.1	52.02	1.07
1	52	1 year	7.0	0.05	0.0	0.05	430.6	431.39	431.3	431.53	0.0	0.0	1.7	0.0	4.2	18.09	0.77
1	52	5 year	23.1	0.05	0.0	0.05	430.6	431.77	431.8	432.05	0.0	0.9	2.6	1.0	11.9	22.35	0.88
1	52	100 year	54.3	0.05	0.0	0.05	430.6	432.21	432.2	432.64	0.0	1.3	3.4	1.5	22.9	27.33	0.93
1	52	200 year	63.2	0.05	0.0	0.05	430.6	432.31	432.3	432.77	0.0	1.4	3.5	1.6	25.7	28.47	0.94
1	52	PMF	504.0	0.05	0.0	0.05	430.6	434.43	434.4	435.54	0.0	3.1	6.4	3.3	127.9	52.07	1.09
1	51	1 year	7.0	0.05	0.0	0.05	430.3	431.09	431.0	431.23	0.0	0.0	1.7	0.0	4.1	18.03	0.77
1	51	5 year	23.1	0.05	0.0	0.05	430.3	431.51		431.76	0.0	0.9	2.4	0.9	12.8	22.77	0.80
1	51	100 year	54.3	0.05	0.0	0.05	430.3	431.95		432.35	0.0	1.4	3.2	1.4	23.7	27.64	0.89
1	51	200 year	63.2	0.05	0.0	0.05	430.3	432.05		432.48	0.0	1.5	3.4	1.5	26.6	28.76	0.91
1	51	PMF	504.0	0.05	0.0	0.05	430.3	434.16	434.1	435.25	0.0	3.1	6.3	3.2	129.4	52.02	1.07
1	50	1 year	7.0	0.05	0.0	0.05	429.8	430.57	430.5	430.71	0.0	0.0	1.7	0.0	4.2	18.11	0.77
1	50	5 year	23.1	0.05	0.0	0.05	429.8	430.93		431.23	0.0	1.0	2.6	0.8	11.6	22.22	0.90
1	50	100 year	54.3	0.05	0.0	0.05	429.8	431.39	431.4	431.82	0.0	1.5	3.3	1.3	22.9	27.34	0.93
1	50	200 year	63.2	0.05	0.0	0.05	429.8	431.49	431.5	431.95	0.0	1.6	3.5	1.3	25.7	28.48	0.94
1	50	PMF	504.0	0.05	0.0	0.05	429.8	433.61	433.6	434.72	0.0	3.3	6.4	3.0	128.2	52.09	1.08
1	49	1 year	7.0		0.0		429.7	430.41	430.3	430.55	0.0		1.7		4.1	8.45	0.79
1	49	5 year	23.1	0.05	0.0	0.05	429.7	430.82		431.08	0.0	1.0	2.5	0.8	12.3	22.49	0.84
1	49	100 year	54.3	0.05	0.0	0.05	429.7	431.25		431.67	0.0	1.5	3.3	1.2	23.2	27.4	0.91
1	49	200 year	63.2	0.05	0.0	0.05	429.7	431.35		431.80	0.0	1.6	3.5	1.3	26.0	28.5	0.93
1	49	PMF	504.0	0.05	0.0	0.05	429.7	433.46	433.5	434.58	0.0	3.3	6.4	3.0	127.8	51.97	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	48	1 year	7.0	0.05	0.0	0.05	429.4	430.16	430.0	430.29	0.0	0.2	1.6	0.2	4.6	18.34	0.71
1	48	5 year	23.1	0.05	0.0	0.05	429.4	430.51	430.5	430.79	0.0	0.8	2.6	1.0	11.9	22.32	0.87
1	48	100 year	54.3	0.05	0.0	0.05	429.4	430.96	431.0	431.38	0.0	1.2	3.3	1.5	22.9	27.3	0.93
1	48	200 year	63.2	0.05	0.0	0.05	429.4	431.06	431.1	431.52	0.0	1.3	3.5	1.6	25.7	28.43	0.94
1	48	PMF	504.0	0.05	0.0	0.05	429.4	433.18	433.2	434.29	0.0	3.0	6.4	3.3	127.9	52.04	1.08
1	47	1 year	7.0		0.0		429.3	429.91	429.9	430.13	0.0		2.1		3.4	7.73	1.01
1	47	5 year	23.1	0.05	0.0	0.05	429.3	430.39	430.4	430.67	0.0	0.8	2.6	1.0	11.9	22.4	0.87
1	47	100 year	54.3	0.05	0.0	0.05	429.3	430.83	430.8	431.26	0.0	1.2	3.3	1.5	22.9	27.36	0.93
1	47	200 year	63.2	0.05	0.0	0.05	429.3	430.93	430.9	431.39	0.0	1.3	3.5	1.6	25.7	28.5	0.94
1	47	PMF	504.0	0.05	0.0	0.05	429.3	433.05	433.1	434.16	0.0	3.0	6.4	3.3	128.1	52.12	1.08
1	46.5	1 year	7.0	0.05	0.0	0.05	428.8	429.51	429.4	429.65	0.0	0.0	1.7	0.0	4.2	18.14	0.77
1	46.5	5 year	23.1	0.05	0.0	0.05	428.8	429.91		430.17	0.0	0.8	2.4	1.0	12.5	22.71	0.82
1	46.5	100 year	54.3	0.05	0.0	0.05	428.8	430.37		430.76	0.0	1.2	3.2	1.5	23.9	27.76	0.89
1	46.5	200 year	63.2	0.05	0.0	0.05	428.8	430.47		430.89	0.0	1.3	3.4	1.6	26.7	28.88	0.90
1	46.5	PMF	504.0	0.05	0.0	0.05	428.8	432.59	432.6	433.66	0.0	3.0	6.3	3.3	130.2	52.12	1.06
1	46	1 year	7.0	0.05	0.0	0.05	428.3	429.08	429.0	429.22	0.0	0.0	1.7	0.0	4.2	18.05	0.77
1	46	5 year	23.1	0.05	0.0	0.05	428.3	429.46	429.5	429.74	0.0	1.0	2.6	0.9	11.8	22.3	0.88
1	46	100 year	54.3	0.05	0.0	0.05	428.3	429.90	429.9	430.33	0.0	1.5	3.4	1.3	22.9	27.29	0.93
1	46	200 year	63.2	0.05	0.0	0.05	428.3	430.01	430.0	430.46	0.0	1.6	3.5	1.4	25.7	28.43	0.94
1	46	PMF	504.0	0.05	0.0	0.05	428.3	432.13	432.1	433.24	0.0	3.3	6.4	3.0	128.0	52.02	1.08
1	45	1 year	7.0		0.0		428.2	428.90	428.8	429.05	0.0		1.7		4.1	8.49	0.77
1	45	5 year	23.1	0.05	0.0	0.05	428.2	429.31		429.57	0.0	0.9	2.5	0.9	12.4	22.6	0.83
1	45	100 year	54.3	0.05	0.0	0.05	428.2	429.77		430.16	0.0	1.4	3.2	1.3	24.1	27.81	0.88
1	45	200 year	63.2	0.05	0.0	0.05	428.2	429.87		430.29	0.0	1.5	3.4	1.4	26.9	28.92	0.89
1	45	PMF	504.0	0.05	0.0	0.05	428.2	432.02	432.0	433.07	0.0	3.2	6.2	3.1	131.8	52.06	1.04
1	44	1 year	7.0	0.05	0.0	0.05	427.8	428.58	428.5	428.72	0.0	0.1	1.7	0.1	4.3	18.12	0.75
1	44	5 year	23.1	0.05	0.0	0.05	427.8	428.96		429.24	0.0	0.9	2.5	1.0	12.0	22.4	0.86
1	44	100 year	54.3	0.05	0.0	0.05	427.8	429.40		429.83	0.0	1.3	3.4	1.5	22.9	27.28	0.93
1	44	200 year	63.2	0.05	0.0	0.05	427.8	429.50	429.5	429.96	0.0	1.4	3.5	1.6	25.7	28.44	0.94
1	44	PMF	504.0	0.05	0.0	0.05	427.8	431.62	431.6	432.73	0.0	3.1	6.4	3.3	128.1	52.03	1.08

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	43	1 year	7.0		0.0		427.5	428.23		428.38	0.0		1.7		4.0	8.38	0.80
1	43	5 year	23.1	0.05	0.0	0.05	427.5	428.63		428.91	0.0	0.9	2.5	1.0	12.0	22.38	0.87
1	43	100 year	54.3	0.05	0.0	0.05	427.5	429.08		429.50	0.0	1.4	3.3	1.5	23.1	27.4	0.92
1	43	200 year	63.2	0.05	0.0	0.05	427.5	429.18		429.63	0.0	1.5	3.5	1.6	26.0	28.53	0.93
1	43	PMF	504.0	0.05	0.0	0.05	427.5	431.32	431.3	432.40	0.0	3.1	6.3	3.2	129.5	52.03	1.07
1	42	1 year	7.0	0.05	0.0	0.05	427.2	428.00	427.9	428.11	0.0	0.2	1.5	0.2	5.0	18.63	0.66
1	42	5 year	23.1	0.05	0.0	0.05	427.2	428.36		428.62	0.0	0.9	2.4	0.9	12.6	22.72	0.82
1	42	100 year	54.3	0.05	0.0	0.05	427.2	428.82		429.21	0.0	1.4	3.2	1.4	24.1	27.82	0.88
1	42	200 year	63.2	0.05	0.0	0.05	427.2	428.92		429.34	0.0	1.5	3.4	1.5	26.9	28.96	0.89
1	42	PMF	504.0	0.05	0.0	0.05	427.2	431.08	431.0	432.11	0.0	3.1	6.2	3.1	132.5	52.1	1.03
1	41	1 year	7.0		0.0		426.8	427.48	427.5	427.70	0.0		2.1		3.3	7.73	1.01
1	41	5 year	23.1	0.05	0.0	0.05	426.8	427.96	428.0	428.24	0.0	1.0	2.6	0.9	11.8	22.28	0.88
1	41	100 year	54.3	0.05	0.0	0.05	426.8	428.41	428.4	428.83	0.0	1.5	3.4	1.4	22.9	27.28	0.93
1	41	200 year	63.2	0.05	0.0	0.05	426.8	428.51	428.5	428.97	0.0	1.6	3.5	1.5	25.7	28.42	0.94
1	41	PMF	504.0	0.05	0.0	0.05	426.8	430.63	430.6	431.74	0.0	3.2	6.4	3.2	127.9	51.99	1.09
1	40.5	1 year	7.0	0.05	0.0	0.05	426.3	427.08	427.0	427.22	0.0	0.0	1.7	0.0	4.1	18	0.77
1	40.5	5 year	23.1	0.05	0.0	0.05	426.3	427.46		427.74	0.0	0.9	2.5	0.9	11.9	22.33	0.87
1	40.5	100 year	54.3	0.05	0.0	0.05	426.3	427.90		428.33	0.0	1.5	3.4	1.4	22.8	27.26	0.94
1	40.5	200 year	63.2	0.05	0.0	0.05	426.3	428.01	428.0	428.47	0.0	1.6	3.5	1.5	25.7	28.42	0.94
1	40.5	PMF	504.0	0.05	0.0	0.05	426.3	430.13	430.1	431.24	0.0	3.2	6.4	3.2	128.3	51.99	1.08
1	40	1 year	7.0	0.05	0.0	0.05	426.1	426.85	426.8	427.00	0.0	0.0	1.7	0.0	4.2	18.03	0.77
1	40	5 year	23.1	0.05	0.0	0.05	426.1	427.25		427.51	0.0	1.0	2.5	0.9	12.2	22.49	0.84
1	40	100 year	54.3	0.05	0.0	0.05	426.1	427.71		428.11	0.0	1.5	3.3	1.3	23.7	27.6	0.89
1	40	200 year	63.2	0.05	0.0	0.05	426.1	427.81		428.24	0.0	1.6	3.4	1.4	26.5	28.72	0.91
1	40	PMF	504.0	0.05	0.0	0.05	426.1	429.92	429.9	431.01	0.0	3.3	6.4	3.1	128.8	52.01	1.08
1	39	1 year	7.0		0.0		425.7	426.49	426.4	426.63	0.0		1.7		4.1	8.5	0.77
1	39	5 year	23.1	0.05	0.0	0.05	425.7	426.88		427.15	0.0	0.9	2.5	1.0	12.0	22.39	0.86
1	39	100 year	54.3	0.05	0.0	0.05	425.7	427.31	427.3	427.74	0.0	1.3	3.4	1.5	22.9	27.29	0.93
1	39	200 year	63.2	0.05	0.0	0.05	425.7	427.42	427.4	427.87	0.0	1.4	3.5	1.6	25.7	28.43	0.94
1	39	PMF	504.0	0.05	0.0	0.05	425.7	429.54	429.5	430.65	0.0	3.1	6.4	3.3	128.2	52.01	1.08

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	38	1 year	7.0	0.05	0.0	0.05	425.5	426.25	426.2	426.39	0.0	0.1	1.7	0.1	4.2	18.07	0.76
1	38	5 year	23.1	0.05	0.0	0.05	425.5	426.63	426.6	426.91	0.0	0.9	2.6	1.0	11.8	22.3	0.88
1	38	100 year	54.3	0.05	0.0	0.05	425.5	427.08	427.1	427.50	0.0	1.4	3.4	1.5	22.9	27.29	0.93
1	38	200 year	63.2	0.05	0.0	0.05	425.5	427.18	427.2	427.64	0.0	1.4	3.5	1.6	25.7	28.43	0.94
1	38	PMF	504.0	0.05	0.0	0.05	425.5	429.29	429.3	430.41	0.0	3.1	6.4	3.3	127.7	52.01	1.09
1	37	1 year	7.0		0.0		425.3	426.03		426.18	0.0		1.7		4.0	8.39	0.80
1	37	5 year	23.1	0.05	0.0	0.05	425.3	426.44		426.71	0.0	0.9	2.5	1.0	12.1	22.53	0.85
1	37	100 year	54.3	0.05	0.0	0.05	425.3	426.89		427.30	0.0	1.4	3.3	1.5	23.4	27.59	0.91
1	37	200 year	63.2	0.05	0.0	0.05	425.3	426.99		427.43	0.0	1.4	3.5	1.6	26.2	28.71	0.92
1	37	PMF	504.0	0.05	0.0	0.05	425.3	429.10	429.1	430.20	0.0	3.1	6.4	3.2	128.8	52.13	1.08
1	36	1 year	7.0	0.05	0.0	0.05	425.0	425.83		425.95	0.0	0.2	1.5	0.2	5.1	18.75	0.65
1	36	5 year	23.1	0.05	0.0	0.05	425.0	426.18		426.44	0.0	1.0	2.5	0.8	12.3	22.62	0.84
1	36	100 year	54.3	0.05	0.0	0.05	425.0	426.62		427.03	0.0	1.5	3.3	1.3	23.2	27.52	0.92
1	36	200 year	63.2	0.05	0.0	0.05	425.0	426.71		427.16	0.0	1.6	3.5	1.4	25.9	28.6	0.93
1	36	PMF	504.0	0.05	0.0	0.05	425.0	428.83	428.8	429.93	0.0	3.3	6.4	3.0	128.3	52.15	1.08
1	35	1 year	7.0		0.0		424.4	425.05	425.1	425.27	0.0		2.1		3.3	7.73	1.01
1	35	5 year	23.1	0.05	0.0	0.05	424.4	425.53	425.5	425.81	0.0	1.0	2.6	0.9	11.8	22.29	0.88
1	35	100 year	54.3	0.05	0.0	0.05	424.4	425.97	426.0	426.40	0.0	1.5	3.4	1.4	22.9	27.28	0.93
1	35	200 year	63.2	0.05	0.0	0.05	424.4	426.07	426.1	426.53	0.0	1.6	3.5	1.5	25.7	28.43	0.94
1	35	PMF	504.0	0.05	0.0	0.05	424.4	428.20	428.2	429.31	0.0	3.2	6.4	3.1	128.1	52	1.08
1	34.5	1 year	7.0		0.0		423.9	424.64	424.6	424.78	0.0		1.7		4.1	8.44	0.79
1	34.5	5 year	23.1	0.05	0.0	0.05	423.9	425.03	425.0	425.31	0.0	1.0	2.6	0.9	11.8	22.29	0.88
1	34.5	100 year	54.3	0.05	0.0	0.05	423.9	425.47	425.5	425.90	0.0	1.5	3.4	1.4	22.9	27.28	0.93
1	34.5	200 year	63.2	0.05	0.0	0.05	423.9	425.57	425.6	426.03	0.0	1.6	3.5	1.5	25.7	28.43	0.94
1	34.5	PMF	504.0	0.05	0.0	0.05	423.9	427.70	427.7	428.81	0.0	3.2	6.4	3.1	128.1	52	1.08
1	34	1 year	7.0	0.05	0.0	0.05	423.7	424.44	424.3	424.58	0.0	0.0	1.7	0.0	4.2	18.2	0.76
1	34	5 year	23.1	0.05	0.0	0.05	423.7	424.84		425.10	0.0	0.9	2.5	0.9	12.4	22.67	0.84
1	34	100 year	54.3	0.05	0.0	0.05	423.7	425.27		425.69	0.0	1.5	3.3	1.4	23.1	27.46	0.93
1	34	200 year	63.2	0.05	0.0	0.05	423.7	425.36	425.4	425.82	0.0	1.6	3.5	1.5	25.8	28.55	0.94
1	34	PMF	504.0	0.05	0.0	0.05	423.7	427.48	427.5	428.59	0.0	3.3	6.4	3.1	128.1	52.16	1.09

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	33	1 year	7.0		0.0		423.4	424.17	424.1	424.31	0.0		1.7		4.1	8.47	0.78
1	33	5 year	23.1	0.05	0.0	0.05	423.4	424.55		424.83	0.0	0.9	2.6	1.0	11.9	22.49	0.88
1	33	100 year	54.3	0.05	0.0	0.05	423.4	424.99	425.0	425.42	0.0	1.3	3.3	1.5	23.0	27.46	0.93
1	33	200 year	63.2	0.05	0.0	0.05	423.4	425.10	425.1	425.55	0.0	1.4	3.5	1.6	25.8	28.59	0.94
1	33	PMF	504.0	0.05	0.0	0.05	423.4	427.21	427.2	428.32	0.0	3.1	6.4	3.3	128.3	52.23	1.08
1	32	1 year	7.0	0.05	0.0	0.05	423.0	423.79	423.7	423.93	0.0	0.1	1.6	0.1	4.3	18.3	0.74
1	32	5 year	23.1	0.05	0.0	0.05	423.0	424.19		424.45	0.0	0.9	2.5	0.9	12.4	22.72	0.83
1	32	100 year	54.3	0.05	0.0	0.05	423.0	424.65		425.04	0.0	1.3	3.2	1.4	24.2	27.92	0.87
1	32	200 year	63.2	0.05	0.0	0.05	423.0	424.75		425.17	0.0	1.4	3.4	1.5	27.1	29.05	0.89
1	32	PMF	504.0	0.05	0.0	0.05	423.0	426.91	426.8	427.94	0.0	3.1	6.2	3.1	132.5	52.17	1.03
1	31	1 year	7.0		0.0		422.6	423.29		423.45	0.0		1.8		4.0	8.36	0.81
1	31	5 year	23.1	0.05	0.0	0.05	422.6	423.70		423.97	0.0	1.0	2.5	0.7	12.0	22.37	0.86
1	31	100 year	54.3	0.05	0.0	0.05	422.6	424.14	424.1	424.56	0.0	1.5	3.3	1.2	22.8	27.26	0.93
1	31	200 year	63.2	0.05	0.0	0.05	422.6	424.24	424.2	424.69	0.0	1.6	3.5	1.2	25.7	28.39	0.94
1	31	PMF	504.0	0.05	0.0	0.05	422.6	426.36	426.4	427.47	0.0	3.3	6.4	3.0	127.9	52	1.08
1	30	1 year	7.0	0.05	0.0	0.05	422.1	422.90	422.8	423.02	0.0	0.2	1.6	0.2	4.7	18.38	0.69
1	30	5 year	23.1	0.05	0.0	0.05	422.1	423.25	423.3	423.53	0.0	1.0	2.6	0.8	11.8	22.29	0.88
1	30	100 year	54.3	0.05	0.0	0.05	422.1	423.69	423.7	424.12	0.0	1.5	3.3	1.3	22.9	27.27	0.93
1	30	200 year	63.2	0.05	0.0	0.05	422.1	423.80	423.8	424.25	0.0	1.6	3.5	1.3	25.7	28.41	0.94
1	30	PMF	504.0	0.05	0.0	0.05	422.1	425.92	425.9	427.03	0.0	3.3	6.4	3.0	128.2	52	1.08
1	29	1 year	7.0		0.0		422.0	422.60	422.6	422.82	0.0		2.1		3.4	7.73	1.01
1	29	5 year	23.1	0.05	0.0	0.05	422.0	423.08	423.1	423.36	0.0	0.9	2.6	0.9	11.9	22.66	0.87
1	29	100 year	54.3	0.05	0.0	0.05	422.0	423.52	423.5	423.94	0.0	1.4	3.3	1.4	23.0	27.6	0.93
1	29	200 year	63.2	0.05	0.0	0.05	422.0	423.62	423.6	424.08	0.0	1.5	3.5	1.5	25.9	28.73	0.94
1	29	PMF	504.0	0.05	0.0	0.05	422.0	425.73	425.7	426.84	0.0	3.2	6.4	3.2	128.2	52.4	1.09
1	28.5	1 year	7.0		0.0		421.5	422.20	422.1	422.34	0.0		1.7		4.1	8.5	0.77
1	28.5	5 year	23.1	0.05	0.0	0.05	421.5	422.59		422.86	0.0	0.9	2.5	0.9	12.2	22.77	0.86
1	28.5	100 year	54.3	0.05	0.0	0.05	421.5	423.04		423.44	0.0	1.4	3.3	1.4	23.6	27.84	0.90
1	28.5	200 year	63.2	0.05	0.0	0.05	421.5	423.15		423.58	0.0	1.5	3.4	1.5	26.6	29.02	0.91
1	28.5	PMF	504.0	0.05	0.0	0.05	421.5	425.36	425.2	426.35	0.0	3.0	6.0	3.0	135.3	52.4	1.01

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	28	1 year	7.0	0.05	0.0	0.05	421.1	421.86	421.8	422.00	0.0	0.0	1.7	0.0	4.2	18.03	0.77
1	28	5 year	23.1	0.05	0.0	0.05	421.1	422.27		422.52	0.0	0.9	2.4	0.9	12.5	22.61	0.82
1	28	100 year	54.3	0.05	0.0	0.05	421.1	422.72		423.12	0.0	1.4	3.2	1.4	23.8	27.65	0.89
1	28	200 year	63.2	0.05	0.0	0.05	421.1	422.82		423.25	0.0	1.5	3.4	1.5	26.6	28.76	0.91
1	28	PMF	504.0	0.05	0.0	0.05	421.1	424.91	424.9	426.02	0.0	3.2	6.4	3.2	128.3	52.01	1.08
1	27	1 year	7.0	0.05	0.0	0.05	420.8	421.54	421.5	421.69	0.0	0.0	1.7	0.0	4.1	18.03	0.77
1	27	5 year	23.1	0.05	0.0	0.05	420.8	421.93	421.9	422.21	0.0	1.0	2.6	0.9	11.8	22.31	0.88
1	27	100 year	54.3	0.05	0.0	0.05	420.8	422.37	422.4	422.80	0.0	1.5	3.4	1.4	22.9	27.3	0.93
1	27	200 year	63.2	0.05	0.0	0.05	420.8	422.47	422.5	422.93	0.0	1.6	3.5	1.5	25.7	28.44	0.94
1	27	PMF	504.0	0.05	0.0	0.05	420.8	424.59	424.6	425.71	0.0	3.2	6.4	3.2	127.9	52.02	1.09
1	26	1 year	7.0	0.05	0.0	0.05	420.5	421.26	421.2	421.40	0.0	0.1	1.7	0.1	4.2	25.51	0.76
1	26	5 year	23.1	0.05	0.0	0.05	420.5	421.64		421.84	0.0	0.9	2.2	0.8	15.0	29.85	0.76
1	26	100 year	54.3	0.05	0.0	0.05	420.5	422.10		422.35	0.0	1.3	2.7	1.1	29.7	34.95	0.76
1	26	200 year	63.2	0.05	0.0	0.05	420.5	422.20		422.47	0.0	1.4	2.9	1.2	33.3	36.09	0.76
1	26	PMF	504.0	0.05	0.0	0.05	420.5	424.47		425.13	0.0	2.8	5.1	2.5	160.8	59.47	0.84
1	25	1 year	8.0	0.05	0.0	0.05	420.2	421.00	420.9	421.14	0.0	0.2	1.7	0.2	5.2	25.95	0.73
1	25	5 year	26.2	0.05	0.0	0.05	420.2	421.34	421.3	421.59	0.0	1.0	2.5	0.9	15.0	30.37	0.85
1	25	100 year	61.7	0.05	0.0	0.05	420.2	421.73	421.7	422.12	0.0	1.5	3.3	1.4	27.8	35.36	0.94
1	25	200 year	71.7	0.05	0.0	0.05	420.2	421.82	421.8	422.24	0.0	1.6	3.5	1.5	31.0	36.52	0.95
1	25	PMF	565.1	0.05	0.0	0.05	420.2	423.83	423.8	424.89	0.0	3.3	6.4	3.1	145.0	61.59	1.10
1	24	1 year	8.0		0.0		419.3	419.96	420.0	420.19	0.0		2.1		3.8	8.32	1.01
1	24	5 year	26.2	0.05	0.0	0.05	419.3	420.42	420.4	420.67	0.0	0.9	2.5	1.0	14.8	29.82	0.85
1	24	100 year	61.7	0.05	0.0	0.05	419.3	420.82	420.8	421.20	0.0	1.4	3.3	1.5	27.6	34.87	0.94
1	24	200 year	71.7	0.05	0.0	0.05	419.3	420.91	420.9	421.33	0.0	1.5	3.5	1.6	30.9	36.05	0.95
1	24	PMF	565.1	0.05	0.0	0.05	419.3	422.93	422.9	424.00	0.0	3.1	6.4	3.3	144.5	61	1.10
1	23.5	1 year	8.0		0.0		418.8	419.53		419.70	0.0		1.8		4.4	8.91	0.82
1	23.5	5 year	26.2	0.05	0.0	0.05	418.8	419.92	419.9	420.17	0.0	0.9	2.5	1.0	14.8	29.82	0.85
1	23.5	100 year	61.7	0.05	0.0	0.05	418.8	420.32	420.3	420.71	0.0	1.4	3.3	1.5	27.6	34.87	0.94
1	23.5	200 year	71.7	0.05	0.0	0.05	418.8	420.41	420.4	420.83	0.0	1.5	3.5	1.6	30.9	36.05	0.95
1	23.5	PMF	565.1	0.05	0.0	0.05	418.8	422.43	422.4	423.50	0.0	3.1	6.4	3.3	144.6	61	1.10

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	23	1 year	8.0		0.0		418.5	419.24	419.2	419.42	0.0		1.9		4.2	8.76	0.87
1	23	5 year	26.2	0.05	0.0	0.05	418.5	419.64	419.6	419.89	0.0	0.9	2.5	1.0	14.9	29.94	0.85
1	23	100 year	61.7	0.05	0.0	0.05	418.5	420.04	420.0	420.42	0.0	1.4	3.3	1.5	27.6	34.98	0.94
1	23	200 year	71.7	0.05	0.0	0.05	418.5	420.13	420.1	420.54	0.0	1.4	3.5	1.6	30.9	36.15	0.95
1	23	PMF	565.1	0.05	0.0	0.05	418.5	422.15	422.2	423.21	0.0	3.1	6.4	3.4	144.5	61.13	1.11
1	22	1 year	8.0	0.05	0.0	0.05	417.8	418.60	418.5	418.75	0.0	0.0	1.8	0.0	4.6	25.24	0.79
1	22	5 year	26.2	0.05	0.0	0.05	417.8	418.97	419.0	419.22	0.0	1.0	2.5	0.8	14.9	30.01	0.85
1	22	100 year	61.7	0.05	0.0	0.05	417.8	419.36	419.4	419.75	0.0	1.5	3.3	1.2	27.6	35.02	0.94
1	22	200 year	71.7	0.05	0.0	0.05	417.8	419.45	419.5	419.87	0.0	1.6	3.5	1.3	30.9	36.19	0.95
1	22	PMF	565.1	0.05	0.0	0.05	417.8	421.47	421.5	422.53	0.0	3.4	6.4	3.0	144.4	61.2	1.11
1	21	1 year	8.0		0.0		417.5	418.18	418.1	418.37	0.0		2.0		4.1	8.62	0.91
1	21	5 year	26.2	0.05	0.0	0.05	417.5	418.60	418.6	418.85	0.0	0.9	2.5	0.9	14.9	30.21	0.85
1	21	100 year	61.7	0.05	0.0	0.05	417.5	418.99	419.0	419.38	0.0	1.5	3.3	1.4	27.7	35.21	0.94
1	21	200 year	71.7	0.05	0.0	0.05	417.5	419.08	419.1	419.50	0.0	1.6	3.5	1.5	31.0	36.38	0.95
1	21	PMF	565.1	0.05	0.0	0.05	417.5	421.10	421.1	422.16	0.0	3.3	6.4	3.2	144.8	61.41	1.11
1	20	1 year	8.0	0.05	0.0	0.05	416.7	417.50	417.4	417.64	0.0	0.1	1.7	0.1	5.1	25.31	0.75
1	20	5 year	26.2	0.05	0.0	0.05	416.7	417.85	417.9	418.11	0.0	0.8	2.5	1.0	14.8	29.84	0.85
1	20	100 year	61.7	0.05	0.0	0.05	416.7	418.25	418.3	418.64	0.0	1.2	3.3	1.5	27.6	34.88	0.94
1	20	200 year	71.7	0.05	0.0	0.05	416.7	418.34	418.3	418.76	0.0	1.3	3.5	1.6	30.8	36.06	0.95
1	20	PMF	565.1	0.05	0.0	0.05	416.7	420.36	420.4	421.43	0.0	3.0	6.4	3.4	144.6	61.03	1.10
1	19	1 year	8.0		0.0		416.4	417.09	417.1	417.32	0.0		2.1		3.8	8.32	1.01
1	19	5 year	26.2	0.05	0.0	0.05	416.4	417.55	417.6	417.80	0.0	0.9	2.5	1.0	14.9	30.11	0.85
1	19	100 year	61.7	0.05	0.0	0.05	416.4	417.94	417.9	418.33	0.0	1.3	3.3	1.5	27.7	35.12	0.94
1	19	200 year	71.7	0.05	0.0	0.05	416.4	418.04	418.0	418.45	0.0	1.4	3.5	1.6	30.9	36.29	0.95
1	19	PMF	565.1	0.05	0.0	0.05	416.4	420.04	420.0	421.11	0.0	3.1	6.4	3.4	143.8	61.31	1.11
1	18.5	1 year	8.0		0.0		415.9	416.66		416.83	0.0		1.8		4.3	8.85	0.84
1	18.5	5 year	26.2	0.05	0.0	0.05	415.9	417.05	417.1	417.30	0.0	0.9	2.5	1.0	14.9	30.11	0.85
1	18.5	100 year	61.7	0.05	0.0	0.05	415.9	417.44	417.4	417.83	0.0	1.3	3.3	1.5	27.7	35.12	0.94
1	18.5	200 year	71.7	0.05	0.0	0.05	415.9	417.54	417.5	417.95	0.0	1.4	3.5	1.6	30.9	36.29	0.95
1	18.5	PMF	565.1	0.05	0.0	0.05	415.9	419.55	419.6	420.61	0.0	3.1	6.4	3.4	144.5	61.31	1.11

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	18	1 year	8.0		0.0		415.3	416.06		416.23	0.0		1.8		4.4	8.88	0.83
1	18	5 year	26.2	0.05	0.0	0.05	415.3	416.45	416.5	416.70	0.0	1.0	2.5	0.9	14.9	29.99	0.85
1	18	100 year	61.7	0.05	0.0	0.05	415.3	416.84	416.8	417.23	0.0	1.5	3.3	1.3	27.6	35.02	0.94
1	18	200 year	71.7	0.05	0.0	0.05	415.3	416.93	416.9	417.35	0.0	1.6	3.5	1.4	30.9	36.19	0.95
1	18	PMF	565.1	0.05	0.0	0.05	415.3	418.95	419.0	420.01	0.0	3.4	6.4	3.1	144.4	61.19	1.11
1	17	1 year	8.0		0.0		415.0	415.77	415.7	415.94	0.0		1.9		4.3	8.82	0.85
1	17	5 year	26.2	0.05	0.0	0.05	415.0	416.17	416.2	416.41	0.0	0.9	2.5	0.9	14.9	30.28	0.85
1	17	100 year	61.7	0.05	0.0	0.05	415.0	416.56	416.6	416.94	0.0	1.4	3.3	1.5	27.7	35.28	0.94
1	17	200 year	71.7	0.05	0.0	0.05	415.0	416.65	416.7	417.06	0.0	1.5	3.5	1.6	31.0	36.45	0.95
1	17	PMF	565.1	0.05	0.0	0.05	415.0	418.65	418.7	419.72	0.0	3.2	6.4	3.3	144.5	61.49	1.11
1	16	1 year	8.0		0.0		414.4	415.11		415.28	0.0		1.8		4.4	8.92	0.82
1	16	5 year	26.2	0.05	0.0	0.05	414.4	415.50	415.5	415.75	0.0	0.8	2.5	1.0	14.8	29.87	0.85
1	16	100 year	61.7	0.05	0.0	0.05	414.4	415.89	415.9	416.28	0.0	1.3	3.3	1.5	27.6	34.9	0.94
1	16	200 year	71.7	0.05	0.0	0.05	414.4	415.98	416.0	416.40	0.0	1.3	3.5	1.6	30.8	36.08	0.95
1	16	PMF	565.1	0.05	0.0	0.05	414.4	418.00	418.0	419.07	0.0	3.0	6.4	3.4	144.7	61.05	1.10
1	15	1 year	8.0		0.0		414.1	414.85	414.8	415.04	0.0		1.9		4.2	8.73	0.87
1	15	5 year	26.2	0.05	0.0	0.05	414.1	415.26	415.3	415.51	0.0	0.9	2.5	0.9	15.0	30.4	0.85
1	15	100 year	61.7	0.05	0.0	0.05	414.1	415.65	415.7	416.03	0.0	1.4	3.3	1.5	27.8	35.38	0.94
1	15	200 year	71.7	0.05	0.0	0.05	414.1	415.74	415.7	416.15	0.0	1.5	3.5	1.6	31.0	36.55	0.95
1	15	PMF	565.1	0.05	0.0	0.05	414.1	417.73	417.7	418.81	0.0	3.2	6.4	3.3	144.0	61.62	1.12
1	14	1 year	8.0	0.05	0.0	0.05	413.8	414.58	414.5	414.72	0.0	0.1	1.7	0.1	5.0	25.3	0.75
1	14	5 year	26.2	0.05	0.0	0.05	413.8	414.93	414.9	415.18	0.0	1.0	2.5	0.8	14.8	29.85	0.85
1	14	100 year	61.7	0.05	0.0	0.05	413.8	415.33	415.3	415.71	0.0	1.5	3.3	1.2	27.6	34.88	0.94
1	14	200 year	71.7	0.05	0.0	0.05	413.8	415.42	415.4	415.83	0.0	1.6	3.5	1.3	30.8	36.05	0.95
1	14	PMF	565.1	0.05	0.0	0.05	413.8	417.43	417.4	418.50	0.0	3.4	6.4	3.0	144.1	61.03	1.11
1	13	1 year	8.0		0.0		413.5	414.20	414.2	414.43	0.0		2.1		3.8	8.32	1.01
1	13	5 year	26.2	0.05	0.0	0.05	413.5	414.67	414.7	414.92	0.0	1.0	2.5	0.9	14.8	29.84	0.85
1	13	100 year	61.7	0.05	0.0	0.05	413.5	415.06	415.1	415.45	0.0	1.5	3.3	1.3	27.6	34.88	0.94
1	13	200 year	71.7	0.05	0.0	0.05	413.5	415.15	415.2	415.57	0.0	1.6	3.5	1.4	30.8	36.06	0.95
1	13	PMF	565.1	0.05	0.0	0.05	413.5	417.17	417.2	418.24	0.0	3.4	6.4	3.1	144.1	61.02	1.11

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	12.5	1 year	8.0		0.0		413.0	413.78		413.94	0.0		1.8		4.4	8.89	0.83
1	12.5	5 year	26.2	0.05	0.0	0.05	413.0	414.17	414.2	414.42	0.0	1.0	2.5	0.9	14.8	29.84	0.85
1	12.5	100 year	61.7	0.05	0.0	0.05	413.0	414.56	414.6	414.95	0.0	1.5	3.3	1.3	27.6	34.88	0.94
1	12.5	200 year	71.7	0.05	0.0	0.05	413.0	414.65	414.7	415.07	0.0	1.6	3.5	1.4	30.8	36.06	0.95
1	12.5	PMF	565.1	0.05	0.0	0.05	413.0	416.67	416.7	417.74	0.0	3.4	6.4	3.1	144.6	61.02	1.10
1	12	1 year	8.0		0.0		412.8	413.50	413.4	413.68	0.0		1.9		4.3	8.8	0.85
1	12	5 year	26.2	0.05	0.0	0.05	412.8	413.90	413.9	414.15	0.0	0.9	2.5	0.9	14.9	29.96	0.85
1	12	100 year	61.7	0.05	0.0	0.05	412.8	414.29	414.3	414.68	0.0	1.5	3.3	1.4	27.6	35	0.94
1	12	200 year	71.7	0.05	0.0	0.05	412.8	414.39	414.4	414.80	0.0	1.6	3.5	1.5	30.9	36.17	0.95
1	12	PMF	565.1	0.05	0.0	0.05	412.8	416.40	416.4	417.47	0.0	3.3	6.4	3.2	144.6	61.15	1.11
1	11	1 year	8.0	0.05	0.0	0.05	412.4	413.18	413.1	413.34	0.0	0.1	1.8	0.1	4.6	25.12	0.79
1	11	5 year	26.2	0.05	0.0	0.05	412.4	413.55	413.6	413.81	0.0	0.8	2.5	1.0	14.8	29.88	0.85
1	11	100 year	61.7	0.05	0.0	0.05	412.4	413.95	414.0	414.33	0.0	1.2	3.3	1.5	27.6	34.92	0.94
1	11	200 year	71.7	0.05	0.0	0.05	412.4	414.04	414.0	414.46	0.0	1.3	3.5	1.6	30.8	36.09	0.95
1	11	PMF	565.1	0.05	0.0	0.05	412.4	416.06	416.1	417.12	0.0	3.0	6.4	3.4	144.4	61.07	1.10
1	10	1 year	8.0		0.0		412.2	412.87	412.8	413.07	0.0		2.0		4.0	8.55	0.93
1	10	5 year	26.2	0.05	0.0	0.05	412.2	413.30	413.3	413.55	0.0	0.8	2.5	1.0	14.9	30	0.85
1	10	100 year	61.7	0.05	0.0	0.05	412.2	413.69	413.7	414.08	0.0	1.3	3.3	1.5	27.6	35.03	0.94
1	10	200 year	71.7	0.05	0.0	0.05	412.2	413.78	413.8	414.20	0.0	1.4	3.5	1.6	30.9	36.2	0.95
1	10	PMF	565.1	0.05	0.0	0.05	412.2	415.80	415.8	416.86	0.0	3.0	6.4	3.4	144.4	61.2	1.11
1	9	1 year	8.0	0.05	0.0	0.05	411.0	411.73	411.6	411.87	0.0	0.1	1.7	0.1	5.1	25.33	0.75
1	9	5 year	26.2	0.05	0.0	0.05	411.0	412.08	412.1	412.33	0.0	0.9	2.5	1.0	14.8	29.87	0.85
1	9	100 year	61.7	0.05	0.0	0.05	411.0	412.47	412.5	412.86	0.0	1.4	3.3	1.5	27.6	34.91	0.94
1	9	200 year	71.7	0.05	0.0	0.05	411.0	412.57	412.6	412.98	0.0	1.5	3.5	1.6	30.9	36.09	0.95
1	9	PMF	565.1	0.05	0.0	0.05	411.0	414.59	414.6	415.65	0.0	3.1	6.4	3.3	144.7	61.05	1.10
1	8	1 year	8.0		0.0		410.7	411.33	411.3	411.56	0.0		2.1		3.8	8.32	1.01
1	8	5 year	26.2	0.05	0.0	0.05	410.7	411.79	411.8	412.04	0.0	0.9	2.5	1.0	14.9	29.96	0.85
1	8	100 year	61.7	0.05	0.0	0.05	410.7	412.18	412.2	412.57	0.0	1.3	3.3	1.5	27.6	35	0.94
1	8	200 year	71.7	0.05	0.0	0.05	410.7	412.28	412.3	412.69	0.0	1.4	3.5	1.6	30.9	36.17	0.95
1	8	PMF	565.1	0.05	0.0	0.05	410.7	414.30	414.3	415.36	0.0	3.1	6.4	3.4	144.7	61.16	1.10

Eastern Post-Mining
HEC-RAS Results (Murra Extended).xls

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	7.5	1 year	8.0		0.0		410.2	410.90		411.07	0.0		1.8		4.4	8.88	0.83
1	7.5	5 year	26.2	0.05	0.0	0.05	410.2	411.29	411.3	411.54	0.0	0.9	2.5	1.0	14.9	29.97	0.85
1	7.5	100 year	61.7	0.05	0.0	0.05	410.2	411.69	411.7	412.07	0.0	1.3	3.3	1.5	27.6	35	0.94
1	7.5	200 year	71.7	0.05	0.0	0.05	410.2	411.78	411.8	412.19	0.0	1.4	3.5	1.6	30.9	36.17	0.95
1	7.5	PMF	565.1	0.05	0.0	0.05	410.2	413.80	413.8	414.86	0.0	3.1	6.4	3.4	144.6	61.16	1.10
1	7	1 year	8.0		0.0		409.5	410.20		410.38	0.0		1.9		4.3	8.84	0.84
1	7	5 year	26.2	0.05	0.0	0.05	409.5	410.60	410.6	410.84	0.0	1.0	2.5	0.9	15.0	30.5	0.85
1	7	100 year	61.7	0.05	0.0	0.05	409.5	410.98	411.0	411.37	0.0	1.5	3.3	1.4	27.8	35.48	0.94
1	7	200 year	71.7	0.05	0.0	0.05	409.5	411.07	411.1	411.49	0.0	1.6	3.5	1.5	30.8	36.53	0.96
1	7	PMF	565.1	0.05	0.0	0.05	409.5	413.08	413.1	414.14	0.0	3.4	6.4	3.1	144.6	61.73	1.11
1	6	1 year	8.0		0.0		409.1	409.83		409.99	0.0		1.8		4.4	8.93	0.82
1	6	5 year	26.2	0.05	0.0	0.05	409.1	410.21	410.2	410.46	0.0	0.9	2.5	0.9	14.9	29.96	0.85
1	6	100 year	61.7	0.05	0.0	0.05	409.1	410.86		411.07	0.0	1.2	2.5	1.2	37.1	38.29	0.65
1	6	200 year	71.7	0.05	0.0	0.05	409.1	410.91		411.17	0.0	1.3	2.8	1.3	38.8	38.86	0.72
1	6	PMF	565.1	0.05	0.0	0.05	409.1	412.72	412.7	413.78	0.0	3.3	6.4	3.2	144.9	61.15	1.10
1	5	1 year	8.0		0.0		408.8	409.51	409.5	409.69	0.0		1.9		4.2	8.75	0.87
1	5	5 year	26.2	0.05	0.0	0.05	408.8	409.92	409.9	410.17	0.0	0.9	2.5	1.0	15.0	29.92	0.85
1	5	100 year	61.7	0.05	0.0	0.05	408.8	410.82		410.97	0.0	0.8	2.1	0.9	47.3	47.95	0.51
1	5	200 year	71.7	0.05	0.0	0.05	408.8	410.84		411.04	0.0	0.9	2.5	1.1	48.3	51.66	0.59
1	5	PMF	565.1	0.05	0.0	0.05	408.8	412.42	412.4	413.49	0.0	3.1	6.4	3.4	144.6	61.04	1.10
1	4	1 year	8.0	0.05	0.0	0.05	408.1	408.82	408.7	408.97	0.0	0.1	1.8	0.1	4.6	25	0.79
1	4	5 year	26.2	0.05	0.0	0.05	408.1	409.51		409.59	0.0	0.6	1.6	0.7	25.0	33.85	0.45
1	4	100 year	61.7	0.05	0.0	0.05	408.1	410.84		410.88	0.0	0.5	1.1	0.6	92.4	60.94	0.23
1	4	200 year	71.7	0.05	0.0	0.05	408.1	410.88		410.92	0.0	0.5	1.3	0.6	94.3	60.94	0.26
1	4	PMF	565.1	0.05	0.0	0.05	408.1	411.75	411.7	412.77	0.0	3.0	6.2	3.3	147.4	60.94	1.07
1	3	1 year	8.0		0.0		407.8	408.48	408.5	408.69	0.0		2.0		4.0	8.55	0.93
1	3	5 year	26.2	0.05	0.0	0.05	407.8	409.51		409.55	0.0	0.5	1.1	0.5	35.0	37.77	0.30
1	3	100 year	61.7	0.05	0.0	0.05	407.8	410.84		410.87	0.0	0.4	0.9	0.5	110.0	61.41	0.18
1	3	200 year	71.7	0.05	0.0	0.05	407.8	410.88		410.91	0.0	0.5	1.1	0.5	111.9	61.41	0.20
1	3	PMF	565.1	0.05	0.0	0.05	407.8	411.75		412.54	0.0	2.9	5.5	2.9	165.8	61.41	0.91

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	2	1 year	8.0	0.05	0.0	0.05	407.4	408.53		408.56	0.0	0.3	0.7	0.3	15.3	30.02	0.25
1	2	5 year	26.2	0.05	0.0	0.05	407.4	409.50		409.52	0.0	0.4	0.9	0.3	51.1	60.99	0.21
1	2	100 year	61.7	0.05	0.0	0.05	407.4	410.84		410.86	0.0	0.4	0.8	0.4	133.2	60.99	0.14
1	2	200 year	71.7	0.05	0.0	0.05	407.4	410.87		410.89	0.0	0.5	0.9	0.4	135.2	60.99	0.15
1	2	PMF	565.1	0.05	0.0	0.05	407.4	411.65		412.29	0.0	2.7	5.0	2.5	182.5	60.99	0.79
1	1	1 year	8.0	0.05	0.0	0.05	406.6	408.55		408.55	0.0	0.1	0.3	0.1	44.4	40.93	0.07
1	1	5 year	26.2	0.05	0.0	0.05	406.6	409.51		409.51	0.0	0.2	0.4	0.2	101.6	61.57	0.08
1	1	100 year	61.7	0.05	0.0	0.05	406.6	410.85		410.85	0.0	0.3	0.5	0.3	184.1	61.57	0.09
1	1	200 year	71.7	0.05	0.0	0.05	406.6	410.88		410.89	0.0	0.3	0.6	0.3	186.1	61.57	0.10
1	1	PMF	565.1	0.05	0.0	0.05	406.6	411.78		412.13	0.0	2.1	3.7	2.0	241.4	61.57	0.53
1	0	1 year	8.0	0.05	0.0	0.05	406.1	408.55		408.55	0.0	0.1	0.2	0.1	71.8	61.11	0.04
1	0	5 year	26.2	0.05	0.0	0.05	406.1	409.51		409.51	0.0	0.2	0.3	0.2	130.6	61.11	0.06
1	0	100 year	61.7	0.05	0.0	0.05	406.1	410.85		410.85	0.0	0.2	0.5	0.3	212.4	61.11	0.07
1	0	200 year	71.7	0.05	0.0	0.05	406.1	410.88		410.89	0.0	0.3	0.5	0.3	214.4	61.11	0.08
1	0	PMF	565.1	0.05	0.0	0.05	406.1	411.75		412.04	0.0	1.8	3.3	1.9	267.8	61.11	0.46
1	-1	1 year	8.0		0.1		406.1	408.54		408.54	0.0		0.2		40.1	40.35	0.06
1	-1	5 year	26.2	0.10	0.1	0.10	406.1	409.50		409.50	0.0	0.1	0.3	0.0	128.3	149.96	0.07
1	-1	100 year	61.7	0.10	0.1	0.10	406.1	410.84		410.85	0.0	0.1	0.3	0.1	389.8	257.89	0.05
1	-1	200 year	71.7	0.10	0.1	0.10	406.1	410.87		410.88	0.0	0.1	0.3	0.1	398.0	262.19	0.06
1	-1	PMF	565.1	0.10	0.1	0.10	406.1	411.70		411.79	0.0	0.5	1.6	0.4	653.0	339.41	0.27
1	-2	1 year	8.0	0.09	0.1		406.0	408.54		408.54	0.0	0.0	0.2		50.5	69.86	0.04
1	-2	5 year	26.2	0.09	0.1	0.09	406.0	409.50		409.50	0.0	0.1	0.3	0.1	173.1	178.71	0.05
1	-2	100 year	61.7	0.09	0.1	0.09	406.0	410.84		410.84	0.0	0.1	0.3	0.1	512.0	316.49	0.04
1	-2	200 year	71.7	0.09	0.1	0.09	406.0	410.87		410.88	0.0	0.1	0.3	0.1	522.0	318.91	0.05
1	-2	PMF	565.1	0.09	0.1	0.09	406.0	411.70		411.76	0.0	0.5	1.6	0.5	809.9	373.3	0.24
1	-3	1 year	8.0	0.09	0.1	0.09	405.2	408.54	405.5	408.54	0.0	0.0	0.1	0.0	126.8	79.07	0.02
1	-3	5 year	26.2	0.09	0.1	0.09	405.2	409.50	405.8	409.50	0.0	0.1	0.2	0.0	257.1	187.76	0.03
1	-3	100 year	61.7	0.09	0.1	0.09	405.2	410.84	406.3	410.84	0.0	0.1	0.3	0.1	605.5	321.98	0.03
1	-3	200 year	71.7	0.09	0.1	0.09	405.2	410.87	406.4	410.88	0.0	0.1	0.3	0.1	615.7	324.41	0.04
1	-3	PMF	565.1	0.09	0.1	0.09	405.2	411.70	409.3	411.76	0.0	0.5	1.6	0.4	906.4	377.08	0.20

TABLE F2: HEC-RAS MODELLING RESULTS FOR POST-MINING CONDITIONS - EASTERN CREEK

REACH	MODEL CROSS-SECTION	PROFILE	Q Total	Mann Wtd Left	Mann Wtd Chnl	Mann Wtd Rght	Min Ch El	W.S. Elevation	Crit W.S.	E.G. Elevation	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Flow Area	Top Width	Froude # Channel
			(m3/s)				(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m/s)	(m/s)	(m2)	(m)	
1	-4	1 year	8.0	0.09	0.1	0.09	405.2	408.54		408.54	0.0	0.0	0.1	0.0	143.9	86.64	0.02
1	-4	5 year	26.2	0.09	0.1	0.09	405.2	409.50		409.50	0.0	0.1	0.2	0.0	282.7	197.4	0.03
1	-4	100 year	61.7	0.09	0.1	0.09	405.2	410.84		410.84	0.0	0.1	0.2	0.1	641.5	327.95	0.03
1	-4	200 year	71.7	0.09	0.1	0.09	405.2	410.87		410.87	0.0	0.1	0.3	0.1	651.0	330.17	0.04
1	-4	PMF	565.1	0.09	0.1	0.09	405.2	411.70		411.75	0.0	0.5	1.5	0.4	948.6	381.64	0.19
1	-5	1 year	8.0	0.08	0.1	0.08	405.7	408.54		408.54	0.0	0.0	0.1	0.0	74.6	113.49	0.04
1	-5	5 year	26.2	0.08	0.1	0.08	405.7	409.50		409.50	0.0	0.1	0.2	0.1	235.2	219.99	0.04
1	-5	100 year	61.7	0.08	0.1	0.08	405.7	410.84		410.84	0.0	0.1	0.2	0.1	619.4	343.41	0.03
1	-5	200 year	71.7	0.08	0.1	0.08	405.7	410.87		410.87	0.0	0.1	0.2	0.1	629.3	345.63	0.04
1	-5	PMF	565.1	0.08	0.1	0.08	405.7	411.71		411.74	0.0	0.5	1.3	0.4	939.9	393.89	0.18
1	-6	1 year	8.0	0.09	0.1	0.09	404.5	408.54	404.8	408.54	0.0	0.0	0.1	0.0	120.4	126.84	0.02
1	-6	5 year	26.2	0.09	0.1	0.09	404.5	409.50	405.3	409.50	0.0	0.0	0.2	0.0	291.5	230.54	0.03
1	-6	100 year	61.7	0.09	0.1	0.09	404.5	410.84	405.8	410.84	0.0	0.1	0.2	0.1	687.7	350.22	0.03
1	-6	200 year	71.7	0.09	0.1	0.09	404.5	410.87	406.0	410.87	0.0	0.1	0.3	0.1	697.8	352.03	0.04
1	-6	PMF	565.1	0.09	0.1	0.09	404.5	411.70	409.4	411.74	0.0	0.4	1.5	0.4	1008.3	399.56	0.18
1	-7	1 year	8.0	0.08	0.1	0.08	404.5	408.46		408.46	0.0	0.0	0.1	0.0	121.0	130.03	0.02
1	-7	5 year	26.2	0.08	0.1	0.08	404.5	408.67		408.68	0.0	0.1	0.3	0.1	151.2	152.56	0.05
1	-7	100 year	61.7	0.08	0.1	0.08	404.5	408.93		408.95	0.0	0.1	0.6	0.1	193.9	176.63	0.10
1	-7	200 year	71.7	0.08	0.1	0.08	404.5	408.99		409.01	0.0	0.2	0.7	0.1	204.6	184.1	0.11
1	-7	PMF	565.1	0.08	0.1	0.08	404.5	410.44		410.57	0.0	0.7	2.3	0.6	583.2	327.88	0.32
1	-8	1 year	8.0		0.0		408.1	408.43	408.4	408.46	0.0		0.7		11.1	71.41	0.59
1	-8	5 year	26.2		0.0		408.1	408.60	408.5	408.66	0.0		1.0		25.4	95.34	0.64
1	-8	100 year	61.7		0.0		408.1	408.80	408.7	408.89	0.0		1.3		46.7	121.65	0.68
1	-8	200 year	71.7		0.0		408.1	408.84	408.7	408.94	0.0		1.4		52.1	127.4	0.69
1	-8	PMF	565.1	0.07	0.0	0.07	408.1	409.77	409.7	410.20	0.0	0.8	3.0	0.8	215.9	227.42	0.83