

***ADDENDUM REPORT:***

***MAJOR PROJECT ASSESSMENT  
Russell Vale Colliery Underground  
Expansion Project (MP 09\_0013)***



Section 75I of the  
*Environmental Planning and Assessment Act 1979*  
November 2015

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## EXECUTIVE SUMMARY

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This Addendum Report (AR) for the Russell Vale Colliery Underground Expansion Project (the UEP) has been produced by the Department of Planning and Environment (the Department) for consideration by the Planning Assessment Commission (the Commission).

This AR focuses on the residual matters identified in the Commission's *Russell Vale Colliery – Underground Expansion Project - Review Report* dated 2 April 2015, responses to that report by the proponent Wollongong Coal Pty Ltd (Wollongong Coal) and additional information received from technical specialists and key Government agencies since the Commission's review.

The Commission's report made 15 recommendations regarding additional work and assessment that it considered should be carried out prior to a determination being made. These were in relation to:

- establishment of an Independent Risk Assessment Panel to oversee an Integrated Risk Assessment, particularly focusing on links between subsidence and impacts of the proposal;
- re-running the existing groundwater model;
- establishment of a network of piezometers within and around the upland swamps;
- consideration of any additional Government policy developed regarding swamp-related triggers for offsets and mitigation measures under the *"Policy Framework for Biodiversity Offsets for Threatened Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence"*;
- revision of the existing economic assessment to reflect the current economic climate and an independent analysis of the revised assessment;
- further consideration of the noise impacts of the project, including justification for any deviations from the existing noise limits and clarification on the outcomes and applicability of the noise audit;
- assessment of PM<sub>2.5</sub> dust emissions from the project and strengthening of the monitoring and reporting systems for air quality;
- further justification for the proposed flood mitigation measures for Bellambi Creek;
- negotiations with Wollongong City Council (Council) and Road & Maritime Services in relation to road maintenance contributions;
- consideration of further limiting the hours of truck movements and options to reduce the noise impacts to residents along Bellambi Lane; and
- demonstration that the pit-top infrastructure and facilities can handle the additional volume of coal without unacceptable impacts for local residents.

The Department considered the Commission's recommendations and then required Wollongong Coal to undertake additional work and assessment to satisfy these recommendations, including the:

- establishing the Independent Risk Assessment Panel and completion of an Integrated Risk Assessment;
- implementing extensive additional technical studies, including re-running the groundwater model;
- expanding the existing network of piezometers in and around the upland swamps;
- preparing a revised *Economic Assessment*, including an updated Cost Benefit Analysis which calculates the benefits of the project using the latest projected coal prices and foreign exchange rates;
- completing an independent analysis of the economic costs and benefits of the UEP as presented in the revised *Economic Assessment*;
- assessing the potential noise reductions associated with noise mitigation measures recommended by the Environment Protection Authority and analysing the costs of implementing the noise controls;
- assessing the predicted PM<sub>2.5</sub> dust emissions associated with the UEP;
- revising the *Bellambi Creek Flood Study* to incorporate a range of measures to reduce clean runoff entering the stockpile area, whilst ensuring that all site runoff is released in a controlled way to Bellambi Gully Creek;
- preparing an additional noise assessment to analyse the noise control efficacy of constructing a noise barrier around the site; and
- preparing a *Materials Handling Assessment* to assess the ability of the proposed infrastructure to handle an increase in production from 1 million tonnes per annum (Mtpa) to 3 Mtpa.

In addition, the Department has amended and strengthened its recommended conditions to require:

- the approach to offsetting for upland swamps to fully reflect the *Policy Framework for Biodiversity Offsets for Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence*, which is expected to be finalised shortly;
- continuing investigation and implementation of any additional reasonable and feasible noise and air quality mitigation measures; and
- implementing on-site flood mitigation measures for Bellambi Creek within 12 months.

The Department is satisfied that the project would provide economic and social benefits for the Illawarra region and for NSW as a whole. These benefits include:

- direct employment of 300 people during mining operations;
- direct employment of an additional 100 people during construction of surface facilities;
- estimated indirect employment of up to 800 people in the local and regional area;
- a total of \$85 million in capital investment (\$18 million during construction and \$67 million during operations); and
- \$23 million to the State of NSW in royalties.

The Department is satisfied that its recommended conditions, which incorporate a number of changes as recommended by the Commission, are based on contemporary policy and reflect current best-practice for the management of underground coal mines in NSW, and are equitable and enforceable.

Following its consideration of the Commission's Report and Wollongong Coal's response, and the changes made to the recommended conditions, the Department is satisfied that the project is, on balance, in the public interest, and recommends that it be approved, subject to the recommended conditions of approval.



## 1.0 INTRODUCTION

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### 1.1 Background

This Addendum Report (AR) has been produced for the consideration of the Planning Assessment Commission (the Commission).

The AR supplements the Secretary's *Preliminary Assessment Report* (PAR, December 2014) for the Russell Vale Colliery Underground Expansion Project (MP 09\_0013) (the UEP), which provides a detailed assessment of the key issues in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and remains part of the Secretary's environmental assessment report for the project.

This AR considers the:

- recommendations made in the Commission's *Russell Vale Colliery – Underground Expansion Project - Review Report* (2 April 2015);
- additional information since received from Wollongong Coal Pty Limited (Wollongong Coal) and its technical specialists; and
- further advice received from key Government agencies.

### 1.2 Project Overview

Wollongong Coal is seeking approval to extend its existing approved underground mining operations, to allow it to extract coal for an additional 5 years. The UEP would involve:

- continued mining operations to extract 4.7 million tonnes (Mt) of run-of-mine (ROM) coal from the Wongawilli Seam in the Wonga East domain from a total of eight longwalls (Longwalls 1, 2, 3, the remaining length of Longwall 6<sup>1</sup>, and Longwalls 7, 9, 10 and 11);
- upgrade of and continued operation of the pit-top area, support facilities and utilities;
- continued minimal processing (sizing and screening) of up to 3 Mt per annum (Mtpa) of ROM coal at the pit-top area;
- continued exploration activities, environmental monitoring and maintenance of access to the existing underground workings and surface infrastructure within exploration and mining tenements in the Wonga West domain;
- continued transport of ROM coal from the mine by road to the Port Kembla Coal Terminal (PKCT) for export; and
- disposal of coal rejects adjacent to the mine site and rehabilitation of the site.

The proposal would also consolidate the mining operations associated with the mine's existing Preliminary Works Project (PWP) approval, into one integrated project approval.

The major components of the UEP are depicted in **Figures 1 and 2**.

### 1.3 Overview of Commission's Review Findings

The Commission's Review Report concluded that:

*"At this stage, the Commission does not have sufficient information or confidence to determine the merits of the proposal sufficient for a determination for approval. It may be possible for the proposal, or a modified proposal to be approved if all the additional information identified in this Review report provides a greater level of confidence for the protection of the water quality and quantity in the Sydney Catchment Area and satisfies all the other issues identified in this review."*

The Commission made 15 recommendations regarding additional work and assessment that it considered should be carried out prior to a determination being made. These were in relation to:

- establishment of an Independent Risk Assessment Panel (IRAP) to oversee an Integrated Risk Assessment (IRA), particularly focusing on links between subsidence and impacts of the proposal;
- re-running the existing groundwater model;
- establishment of a network of piezometers within and around the upland swamps;

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<sup>1</sup> Total length of LW6 is 1,120 metres (m), but only 340 m has been extracted to date.  
NSW Government  
Department of Planning & Environment

- consideration of any additional Government policy developed regarding swamp-related triggers for offsets and mitigation measures under the “Policy Framework for Biodiversity Offsets for Threatened Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence”;
- revision of the existing economic assessment to reflect the current economic climate and an independent analysis of the revised assessment;
- further consideration of the noise impacts of the project, including justification for any deviations from the existing noise limits and clarification on the outcomes and applicability of the noise audit;
- assessment of PM<sub>2.5</sub> dust emissions from the project and strengthening of the monitoring and reporting systems for air quality;
- further justification for the proposed flood mitigation measures for Bellambi Creek;
- negotiations with Wollongong City Council (Council) and Road & Maritime Services in relation to road maintenance contributions;
- consideration of further limiting the hours of truck movements and options to reduce the noise impacts to residents along Bellambi Lane; and
- demonstration that the pit-top infrastructure and facilities can handle the additional volume of coal without unacceptable impacts for local residents.



**Figure 1: Russell Vale Colliery Pit-top Surface Facilities**

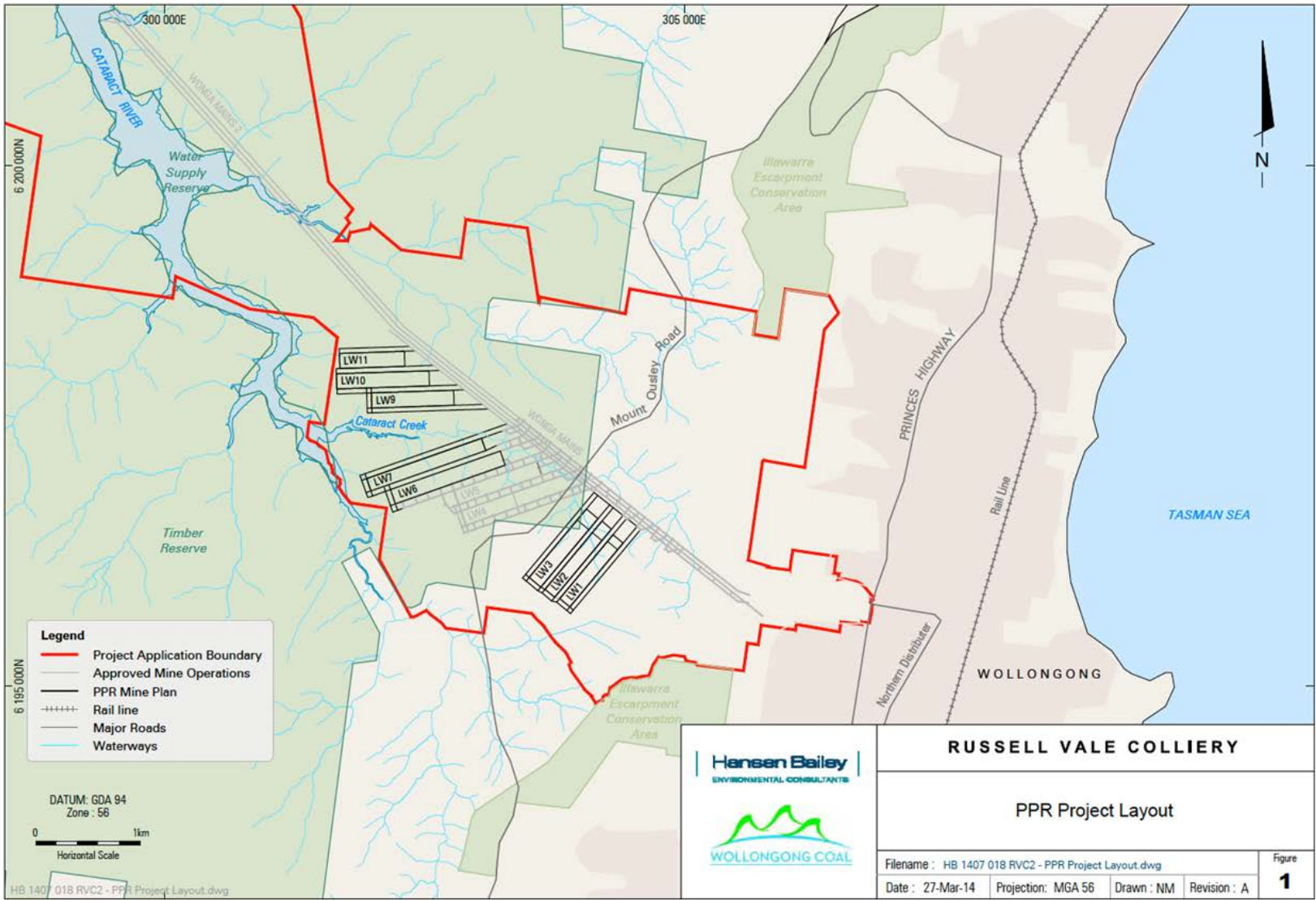


Figure 2: Preferred Project Longwall Layout



## 1.4 Chronology of Events

A chronology of the key events relevant to this AR in the time since the Department's referral of its PAR to the Commission to consider as part of its merit review of the UEP is presented in **Table 1**.

**Table 1: Chronology of Events**

<b>Date</b>	<b>Event</b>
9 December 2014	Secretary's Preliminary Assessment Report referred to Commission
9 January 2015	Wollongong Coal submits a revised <i>Bellambi Creek Flood Study</i> , prepared by Cardno (NSW/ACT) Pty Ltd (Cardno) to the Department and Commission ( <b>Appendix A</b> )
3 February 2015	Commission holds public hearings
19 February 2015	Wollongong Coal submits document titled <i>Response to Public Hearing</i> , prepared by Hansen Bailey, to the Commission
2 April 2015	Commission finalises its review and refers its <i>Review Report</i> to the Department ( <b>Appendix B</b> )
5 June 2015	Department approves the members of Wollongong Coal's Independent Risk Assessment Panel (IRAP)
19 June 2015	Wollongong Coal, in consultation with key agencies, finalises the IRAP's Terms of Reference ( <b>Appendix C</b> )
23 July 2015	Wollongong Coal submits <i>Response to Planning Assessment Commission Review Report – Part 1 (Part 1 Response)</i> , prepared by Hansen Bailey, including a response to the economic, noise, air quality and flooding issues raised by the Commission ( <b>Appendix D</b> )
14 August 2015	Wollongong Coal submits draft <i>Risk Assessment Report</i> and a draft <i>Risk Register</i> which were prepared by Broadleaf Capital International Pty Ltd (Broadleaf)
19 August 2015	Wollongong Coal submits draft <i>Independent Risk Assessment Panel – Risk Assessment Supporting Technical Information</i> , prepared by Hansen Bailey, including updated surface and groundwater modelling and assessments, and specialist studies regarding the suitability of the protective barrier between the proposed mining and Cataract Reservoir
20 August 2015	Department distributes the above information to agencies for comment
20 August 2015	Environment Protection Authority (EPA) submits a letter to the Department commenting on Wollongong Coal's response to the Commission's Recommendations 7-10 related to noise and particulate emissions ( <b>Appendix E</b> )
2 September 2015	Department engaged the Centre for International Economics (CIE) to undertake an independent analysis of the project's economic costs and benefits
7 September 2015	Department provides Wollongong Coal with review comments on the draft Integrated Risk Assessment (IRA) process and draft documentation, including comments received from other agencies ( <b>Appendix F</b> )
10 September 2015	Dams Safety Committee (DSC) confirms to Wollongong Coal and the Department that it is satisfied with the company's approach to developing effective closure and contingency plans ( <b>Appendix G</b> )
28 September 2015	Wollongong Coal submits <i>Response to Planning Assessment Commission Review Report – Part 2</i> , prepared by Hansen Bailey, including the final IRA and a response to the Commission's upland swamp recommendations ( <b>Appendix H</b> )
7 October 2015	Department distributes the above information to agencies for final comment
14 October 2015	CIE submits its independent economic analysis of the project titled <i>Review of CBA for Russell Vale Extension</i> ( <b>Appendix I</b> )
8-22 October 2015	Department receives final comments from agencies on the IRA and supporting information ( <b>Appendix J</b> )
23 October	Minister asked the Commission to carry out a second review of the project (with public hearings) and to report back within 5 weeks of receiving this report ( <b>Appendix K</b> )

## 2.0 INTEGRATED RISK ASSESSMENT AND PANEL

### **Commission Recommendation 1**

*The establishment of a risk assessment panel, constituted by an independent Chair, WaterNSW, the Dams Safety Committee, the Division of Resources and Energy and the proponent to oversee an integrated risk assessment, particularly focusing on links between subsidence and water (both groundwater and surface water) impacts of the proposal. This risk assessment, including associated work rerunning the groundwater modelling as recommended by Dr Mackie; and addressing the issues raised by the relevant agencies and experts (as highlighted by this report), needs to be completed before the application can be determined.*

## 2.1 Risk Assessment Methodology

In addressing this recommendation, the Department and other affected agencies initially met and agreed that it was inappropriate for government agency representatives to constitute an independent panel which could be considered to be advocating for or otherwise endorsing proposals by a mining company. Instead, it was agreed that the IRAP should consist of an independent Chair and independent specialists in groundwater, surface water, upland swamps and subsidence. The Department engaged in extensive discussions with Wollongong Coal over a suitable membership, including a proposal to include additional subsidence expertise on the panel. On 15 June 2015, the Department approved the structure and membership for the IRAP. As a result, the approved IRAP comprised:

- *Chairperson* - Ismet Canbulat, Professor of Rock Mechanics at UNSW;
- *Subsidence* - Arthur Waddington, Managing Director (Mine Subsidence Engineering Consultants);
- *Groundwater* - Andrea Madden, Principal Hydrogeologist (WSP – Parsons Brinkerhoff);
- *Surface Water* - Steve Perrens, Principal (Advisian, formerly Evans & Peck); and
- *Upland Swamps* - David Robertson, Director (Cumberland Ecology).

The scope of the risk assessment proposed to be considered by the IRAP and thereby satisfy the Commission's request was first drafted by Wollongong Coal, and then discussed with the Department and other key agencies. Following extensive review by the Department and other agencies, the scope was then stipulated in an approved Terms of Reference (ToR) for the IRAP on 19 June 2015 (see **Appendix C**). In summary, the ToR require Wollongong Coal to:

- constitute an IRAP to conduct an ongoing assessment of the risks to Cataract Reservoir, groundwater, surface water and upland swamps during the extraction of longwalls associated with the project;
- develop a risk assessment methodology;
- utilise the latest available data to identify and assess the risks related to the extraction of the project longwalls;
- engage experts to assist and/or review the Risk Assessment Report and any other specialist studies;
- consult with regulatory authorities and WaterNSW during the process; and
- implement advice from the IRAP during the Extraction Plan and post-approval stages of the project.

Wollongong Coal then engaged a risk assessment specialist, Dr Dale Cooper from Broadleaf Capital International Pty Ltd (Broadleaf), to facilitate risk assessment workshops, which were held during July and August 2015. During this process, a risk assessment methodology was agreed and an Integrated Risk Assessment (IRA) was conducted. The IRAP made a number of recommendations for the provision of additional technical information.

A draft *Integrated Risk Assessment* (IRA), including a *Risk Register*, was subsequently prepared by Broadleaf and distributed to the IRAP and affected agencies on 14 August 2015. The technical information requested by the IRAP was included in a draft document titled *Independent Risk Assessment Panel – Risk Assessment Supporting Technical Information* (the *Technical Information report*), which was prepared by Hansen Bailey and submitted to the Department on 19 August 2015 and then to agencies. This document included the following additional specialist studies:

- *Review of Barrier to Protect Stored Waters of Cataract Reservoir*, SCT Operations Pty Ltd (SCT), 12 August 2015 (Appendix B of the *Technical Information report*);
- *Assessment of Corrimal Fault and Dyke 8 at Russell Vale East as Risks to the Stored Waters of Cataract Reservoir*, SCT, 19 August 2015 (Appendix D of the *Technical Information report*);
- *Russell Vale Colliery Underground Expansion Project, Russell Vale East, Revised Groundwater Assessment*, Geoterra Pty Ltd and GES Pty Ltd, 18 August 2015 (Appendix E of the *Technical Information report*); and
- *Russell Vale Colliery Underground Expansion Project – Surface Water Modelling: Response to Planning Assessment Commission*, WRM Water & Environment Pty Ltd (WRM), 19 August 2015 (Appendix F of the *Technical Information report*).

On 7 September 2015, the Department provided formal review comments to Wollongong Coal on the IRA process and the draft IRA and the *Technical Information report*, including comments received from the Dams Safety Committee (DSC), Office of Environment & Heritage (OEH), WaterNSW and subsequently the Division of Resources & Energy (DRE) of the Department of Industry. A copy of these comments is provided at **Appendix F**.

## 2.2 Final Integrated Risk Assessment (IRA)

On 28 September 2015, Wollongong Coal submitted a document titled *Response to Planning Assessment Commission Review Report – Part 2* (Hansen Bailey). This document includes the final IRA, which reports the outcomes of the risk assessment, provides the final versions of the technical information requested by the IRAP and responds to the issues raised by agencies. Copies of the final IRA and associated *Risk Register* are provided in Appendix A and B of Appendix A of the Part 2 response, respectively. A copy of the Part 2 response is provided at **Appendix H** of this AR.

The final IRA includes the same four technical studies as the *Technical Information report*, but now numbered as Appendices D, F, H and I, respectively. The *Groundwater Assessment* and the *Surface Water Modelling* were also revised to specifically address residual issues raised by agencies.

In addition, in response to a further request from the IRAP, the Part 2 document also includes the following reports:

- *Response to Residual Matters from the Independent Risk Assessment Panel Comments*, 12 September 2015, SCT (Appendix G of the Part 2 response). This letter report addresses issues in relation to the:
  - reliability of the mine plan in the Bulli Seam at the start of LW7;
  - clarification of closure movements on Cataract Creek;
  - uncertainty of subsidence predictions;
  - effectiveness of underground seals at the Colliery; and
  - potential for horizontal shears to influence mine flow; and
- *Underground Expansion Project, Independent Risk Assessment – Addendum Report*, 23 September 2015, Biosis Pty Ltd (Appendix J of the Part 2 response). This addendum report responds to IRAP questions relating to upland swamps and provides an impact assessment for two additional swamps (CCUS24 and CRUS6) identified during recent aerial surveys.

## 2.3 Outcomes of the IRA

As requested by the IRAP, the final IRA provides a summary and discussion of the predicted risks of impact of the UEP on water resources and upland swamps, which was informed by the technical studies prepared by the relevant specialists. In summary, the IRA:

- identifies 110 individual risks across the three groups of longwall panels (ie LWs 1-3, 6-7 and 9-11), the great majority of which (107 of 110) were assessed as having either 'low' or 'very low' consequences;
- did not identify any 'extreme risks' that may result from the UEP;
- identifies two 'high' risks, both of which relate to potential impacts to swamps;
- identifies a total of 29 'medium' risks, the majority of which (28) were assessed as having 'low' or 'very low' consequences (and all of which relate to water quantity and quality) and one which relates to impacts to a swamp.

A more detailed analysis of the findings of the IRA is provided throughout Section 3 of this report.

## 2.4 Agency Comments on the IRA

On 7 October 2015, the Department distributed the final IRA and supporting information to agencies for final comment. The Department and the IRAP also completed comprehensive reviews of the final documentation.

Importantly, the IRAP has indicated that it is satisfied with the IRA process and additional information provided and concluded that:

*"the risk assessment has been conducted by appropriately qualified experts in the fields of mine subsidence engineering, groundwater, surface water and ecology. It is understood that the WCL experts worked on the project together for a considerable period of time, which provided them the experience and the knowledge required to conduct the 'integrated' risk assessment, which aims to ensure that the risks associated with underground mining on the quantity and quality of groundwater and surface water as well as upland swamps have been assessed and appropriate controls are identified.*

*Following an extensive review of the risk assessment and the relevant documentation, it is the opinion of the IRAP that the risk assessment is 'integrated' and has been based upon an approach that is sufficiently detailed and at an appropriate level to evaluate the risks to the swamps, streams, groundwater and the waters of Cataract Reservoir."* (see Appendix B to the IRA).

Similarly, the Department, the Division of Resource & Energy (DRE), the Environment Protection Authority (EPA) and the Dams Safety Committee (DSC) are satisfied with the risk assessment process and findings.

A summary and discussion of the review comments from the Department, the IRAP and the residual issues from relevant agencies is provided in Section 3 of this report. Copies of all comments are provided at **Appendix J**.

## 2.5 Ongoing Role of the IRAP

WaterNSW indicated its strong support for an ongoing role of the IRAP during the operational stages of the UEP, and considered that this should be a conditional requirement. Wollongong Coal also contemplated an ongoing role for the panel (see Figure 1 of the Part 2 Response at **Appendix H**).

The Department agrees that an independent panel should continue to provide expert advice to Wollongong Coal, the Department and relevant agencies on the environmental consequences of mining associated with the UEP. Specifically, the Department believes that the role of the panel should be to provide timely, accurate and focussed advice regarding the:

- collection of relevant data to predict and monitor the potential subsidence impacts and environmental consequences of longwall mining;
- achievement of performance measures in respect of swamps, land and biodiversity, including avoidance of impacts where reasonable and feasible, rather than relying on remediation and offsets;
- preparation, revision and implementation of Extraction Plans, particularly their Swamp Monitoring Program, Biodiversity Management Plan and Land Management Plan components;
- implementation of the swamp and groundwater monitoring programs and adaptive management regime throughout the life of the project; and
- calculation of swamp offset liabilities and verification of calculated swamp offset liabilities.

The Department has recommended a condition requiring the establishment of an Independent Monitoring Panel for the project (see condition 12 of Schedule 3). The panel is to be appointed by the Department, funded by Wollongong Coal and comprise suitably qualified experts in the fields of mining subsidence, groundwater and upland swamps.

The Department notes that a requirement for a similar panel was included in the recent approval for the Springvale Mine Extension Project.

## 3.0 SUPPLEMENTARY ASSESSMENT

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### 3.1 Subsidence Impacts on Stored Waters

#### 3.1.1 Findings of the IRA

The final IRA provides a summary and discussion of the predicted risks of impact of the UEP on water resources, which was informed by the technical studies prepared by the relevant specialists. In relation to subsidence and water resources, the IRA identified a total of 29 'medium' risks, the majority of which (28) were assessed as having 'low' or 'very low' consequences. These include risks to water quantity and quality, such as:

- groundwater depressurisation leading to seepage from Cataract Reservoir;
- reduced baseflow to streams due to depressurisation of the regional aquifer;
- fracturing of deeper strata leading to increased groundwater flowing into the mine; and
- surface cracking leading to redirection of surface flow to groundwater system.

Most of these risks are considered to be unavoidable consequences of underground mining (and likely to occur), but are not considered to be significant in magnitude of impact (ie volumes of water involved). The 'medium' level of risk is therefore attributed to a high likelihood of occurrence but is not a reflection of the severity of impact.

#### 3.1.2 Connectivity with Cataract Reservoir

In response to a request from the IRAP, Wollongong Coal engaged SCT to produce a report titled *Review of Barrier to Protect Stored Waters of Cataract Reservoir* (12 August 2015, Appendix D of the



IRA), which provides a comprehensive discussion of the background to the selection of the proposed width of the protective barrier between proposed mining and Cataract Reservoir and its suitability.

As discussed in the Department's PAR (p. 22-23), the mining layout proposed for the UEP incorporates a protective barrier to the full supply level (FSL) of Cataract Reservoir which was based on 0.7 times depth (35° angle of draw) or a 203 m horizontal distance. There is also a vertical barrier of about 300 m between the stored waters and the mining horizon along most of this barrier.

SCT indicates that the 0.7 times depth barrier was used because it is consistent with historical norms that have existed since prior to the formation of the DSC and is about 50 m more than the offset recommended by Reynolds (1977) based on the findings of a Commission of Inquiry into coal mining under or in the vicinity of stored waters in the Nepean, Avon, Cordeaux, Cataract, and Woronora Reservoirs in NSW. SCT concludes that *"a review of the historical prescriptive guidelines indicates that this barrier is likely to be conservative and ensure that the stored waters of Cataract Reservoir are fully protected"*.

The Department and DSC accept the justification for the selection of the proposed width of the protective barrier between the mining and Cataract Reservoir. However, as discussed below, both agencies recognise that geological structures have the potential to compromise the effectiveness of the barrier.

### 3.1.3 Corrimal Fault and Dyke 8

In response to a request from the IRAP, Wollongong Coal also engaged SCT to prepare a report titled *Assessment of Corrimal Fault and Dyke 8 at Russell Vale East as Risks to the Stored Waters of Cataract Reservoir* (19 August, 2015, Appendix F of the IRA). The report presents all the available information, including mining records in three seams dating back to the 1880s, to assess the potential for the Corrimal Fault and/or Dyke 8 to provide flow pathways between the stored waters of Cataract Reservoir and the mining horizons.

SCT's additional research in relation to the Corrimal Fault indicates that:

- the fault tapers to become insignificant with less than 1 m throw at seam level which is 540 m from the edge of the Reservoir at an overburden depth of greater than 300 m;
- the fault has not been found to be hydraulically conductive or water-bearing at any of the numerous intersections in all three seams, including the most recent intersection where the fault was mined through in Longwall 6; and
- proposed mining does not have potential to enhance connection between the seam and the Reservoir along the projected alignment of the fault.

SCT's additional research in relation to Dyke 8 indicates that:

- it passes below the Reservoir and is intersected by the mine workings;
- there has been no history of inflow through this dyke at numerous intersections in all three seams; and
- the lateral offset of the proposed longwall goafs from the Reservoir along the alignment of the dyke is sufficiently large (1.7 km) for there to be no credible risk to the stored waters of Cataract Reservoir.

SCT concludes that:

*"The additional research undertaken as part of this assessment has increased the understanding of the characteristics of the Corrimal Fault and Dyke 8 but this understanding has not changed the original interpretation that proposed mining does not present a credible pathway for inflow from Cataract Reservoir through either the Corrimal Fault or Dyke 8" (p. ii).*

It is noted that the IRA determined that the risks of these geological structures providing flow pathways between the stored waters of Cataract Reservoir and the mine workings are 'low'. The Department and DRE are satisfied with this finding.

The DSC has reviewed the additional information produced by SCT and indicates that it would:

*"have no difficulty in approving extraction of longwall 7 if the Corrimal Fault is absent, or can be demonstrated to be terminating at longwall 7. Even if the Corrimal Fault is demonstrably present in LW7, DSC has no concerns with extraction of the Eastern 2/3 of LW7, but may insist on a leaving a hydraulic barrier of solid coal against the fault for protection against ingress." (see Appendix G).*

In its submission on the final IRA, WaterNSW requested the following commitments made by Wollongong Coal in relation to geological structures be included in the recommended conditions:

- if required by the DSC, the panel length of Longwall 7 would be truncated if the Corrimal Fault is intersected during the development of the gateroads for Longwall 7;
- undertake inspections of the Bulli Seam workings overlying Longwall 7 to confirm the accuracy of the record tracings (subject to ability to safely access these workings); and
- drill exploration boreholes to confirm the accuracy of the record tracings for the Bulli Seam workings overlying Longwall 7.

The Department accepts this adaptive management approach, particularly the role of the DSC, and believes that additional inspections and exploration would further inform this process. The Department has recommended a condition to give it effect (see condition 11 of Schedule 3).

### **3.1.4 Subsidence Impact Performance Measures**

In its submission in the final IRA, WaterNSW included recommended subsidence impact performance measures and monitoring triggers for water resources, swamps, biodiversity, cliffs and steep slopes (see **Appendix J**).

The Department confirms that the recommended approval includes subsidence impact performance measures which are considered to be adequate to protect water resources, swamps, biodiversity, cliffs and steep slopes. The conceptual monitoring triggers proposed by WaterNSW are generally seen as useful. However, such triggers would normally be developed and included in future Extraction Plans. The Department supports careful review of these proposed triggers, in consultation with WaterNSW and other key agencies, during the preparation of future Extraction Plans.

### **3.1.5 Extraction Plan**

In its submission in the final IRA, WaterNSW also requested that the Department require a Trigger Action Response Plan (TARP) as part of the Extraction Plan. The Department confirms that the existing conditions of approval require the Extraction Plan to include a Trigger Action Response Plan (condition 10(o) of Schedule 3).

### **3.1.6 Contingency and Closure Planning**

The DSC requires the preparation of a Mine Closure and Contingency Plan prior to any mining within a Notification Area. Wollongong Coal submitted a copy of its *Mine Closure and Contingency Plan for the Underground Expansion Project* to DSC's Mining Subcommittee on 26 August 2015. The plan contains closure and contingency measures that would be implemented in the unlikely event that a hydraulic connection is made between the Cataract Reservoir and the mine workings.

WaterNSW requested that the Department not recommend approval of the project unless it is satisfied that the project's Mine Closure and Contingency Plan contains feasible closure and contingency measures. Correspondence received by the Department from the DSC indicates that it is:

*"satisfied with the approaches WCL have taken to address issues with respect to the development of effective contingency and closure plans.*

*DSC staff are confident that WCL have demonstrated that in the unlikely event of a connection to the Mine developing, that water from the outflow could be contained for an extended period (up to 10 years) in the workings that currently exist underground and would therefore have ample time to install effective seals where required."* (see **Appendix G**).

The Department notes that WaterNSW has recently provided additional comments on Wollongong Coal's *Mine Closure and Contingency Plan*. The Department is satisfied that these can be addressed in conjunction with the Extraction Plan process (ie post-approval). WaterNSW has accepted that these matters can be adequately addressed after determination, and has requested that the *Mine Closure and Contingency Plan* is updated, in consultation with WaterNSW and to the satisfaction of the DSC.

## **3.2 Subsidence Impacts on Watercourses**

### **3.2.1 Surface Water Modelling**

Wollongong Coal engaged WRM to revise the *Surface Water Model* undertaken for the project (Appendix I of the IRA). The revised model uses recent flow monitoring data from an expanded surface water monitoring network to refine its previous estimates of streamflow losses associated with the UEP.

The Department notes that the WRM modelling presents ‘worst case’ scenarios of streamflow loss by removing all subsidence-affected tributary streamflow within, and upstream of, the aerial extent of the proposed underground workings. The model was prepared to specifically investigate the impact that worst case losses would have on Cataract Reservoir yield. The model therefore assumes both *total* diversion of all surface rainfall and flow and *no* downstream re-emergence of diverted flow. WRM concludes that, even with these very conservative assumptions, losses would average approximately 7.3 ML/d, which is within the range previously assumed and a negligible impact on the overall water storage of Cataract Reservoir.

WRM acknowledges that the surface water model is highly conservative and that the “*likelihood of losing all streamflow to the underground workings via subsidence cracking is very improbable*”. The Department agrees, and maintains its previous position that this type of modelling provides coarse estimates for comparative purposes, rather than firm predictions. The Department accepts that the model presents useful comparative data to demonstrate that even total loss of baseflow and streamflow would have negligible impacts on the water stored within Cataract Reservoir, but presents results that are highly unlikely to eventuate in reality. WRM’s predictions should therefore be used with caution in relation to both streamflow losses and baseflow losses.

### 3.2.2 Baseflow Predictions

The GeoTerra/GES *Groundwater Assessment* presents predictions of the UEP’s likely baseflow impacts. This assessment predicts a maximum of 0.041 ML/day (14.9 ML/year) transfer of stream flow from the stream beds in the vicinity of the UEP to the underlying strata in the Cataract Creek, Cataract River and Bellambi Creek catchments at the end of the proposed mining. The great majority of this very low level of loss would occur in Cataract Creek. The great majority of the loss in Cataract Creek is predicted to take place during extraction of Longwalls 9 to 11, because:

- only the Bulli Seam has been extracted adjacent to this stream reach, so there is greater potential for additional incremental strata depressurisation leading to baseflow losses following extraction of the underlying Wongawilli Seam; and
- Longwalls 9 to 11 are located in the downstream reach of the creek, which has a much greater catchment area to generate baseflow volumes.

Predicted baseflow losses associated with extraction of Longwalls 1 to 3 and also Longwalls 6 to 7 are very low because a significant degree of strata depressurisation has already occurred in these areas due to the extraction of both the Bulli and Balgownie Seams. Furthermore, the Longwall 1 to 3 area is in the headwaters of Cataract Creek’s catchment, meaning that there is significantly less catchment area from which baseflow volume can be derived.

It should also be noted that not all of the 14.9 ML/year water volume is ‘lost’ as flow into the reservoir, as a portion of it would migrate to the reservoir via lower elevation, down-gradient, groundwater seeps into the lower catchments and reservoir. It is beyond the capacity of the groundwater or surface water models to specify how much of the 14.9 ML/year would enter the reservoir via groundwater seepage following their initial transfer from the stream bed into underlying strata.

The IRA determined that the risks associated with depressurisation of the regional groundwater system are ‘medium’, because mining is certain to result in groundwater depressurisation (high likelihood rating), but the effect of depressurisation on stream flows is predicted to be negligible (low consequence rating).

### 3.2.3 Conflicting Estimates of Baseflow Loss

The Department of Primary Industries (DPI Water) and WaterNSW questioned the significant differences in predictions in baseflow and stream flow losses presented in the *Groundwater Assessment* undertaken by GeoTerra/GES (Appendix H of the IRA) and the *Surface Water Modelling* undertaken by WRM (Appendix I of the IRA).

As indicated above, the GeoTerra/GES model predicts a baseflow loss of approximately 0.041 ML/day, while the WRM model predicts a loss of approximately 7.3 ML/day. It should be recognised that the two models have been prepared for very different purposes. The WRM model relates to the very highly unlikely, potential worst case impact where all surface runoff catchments upstream of and overlying the proposed secondary extraction areas are cracked and *all* affected catchment runoff is diverted into these cracks and no infiltrated runoff later emerges as groundwater seeps. This model was prepared to illustrate that, even under unrealistically conservative assumptions, the worst case baseflow losses would have negligible impact on the water storage of Cataract Reservoir.

The mechanism assessed by the GeoTerra/GES groundwater model is the regional depressurisation of aquifers following mine subsidence, with associated groundwater level reductions, and as a result, reduction in groundwater baseflow from surficial aquifers to the streams and the reservoir. The Department considers that the *Groundwater Assessment's* predictions of baseflow and stream flow losses are a much more accurate reflection of potential actual impacts than those in the *Surface Water Modelling*, and that they should be adopted for assessment purposes. The *Groundwater Assessment* uses the latest available data from the mine's piezometer network, has been peer reviewed and been endorsed as 'fit for purpose'.

DPI Water indicated that, if the surface water take proves to be a significant volume in comparison with groundwater make, it may not be possible to authorise this take under the relevant licensing provisions of the *Water Management Act 2000*. GeoTerra/GES predicts that the maximum loss of stream baseflow that would require licensing is 14.9 ML/year, which is a small fraction of the predicted maximum groundwater inflow of 1,066 ML/year. It is therefore considered that this surface water take is licensable under the *Water Management Act 2000* within the Upper Nepean and Upstream Warragamba Water Source. Wollongong Coal has confirmed that it has commenced negotiations to source a licensed allocation.

WaterNSW continues to express its dissatisfaction with the surface and groundwater modelling, particularly in respect of predicted baseflow losses (see **Section 3.2.6** below).

### **3.2.4 Conceptual Water Balance**

WaterNSW sought further explanation of the conceptual water balance figure shown in the IRA (see Figure 10 of the IRA). The Department has confirmed that this figure was sourced from Wollongong Coal's presentation to the Commission during the public hearings for the project's first merit review. SCT has confirmed that this figure estimates rainfall (derived from local average annual rainfall data), drinking water usage and environmental flows (obtained from recent WaterNSW annual reports) and predictions of mine inflow capture (obtained from the *Groundwater Assessment*).

### **3.2.5 Iron Oxide Staining**

In its submission in the final IRA, DPI Water recommended that, in recognition of the 'medium' risk classification in the IRA in respect of iron oxide staining, a review of the proposed water quality performance measures and the monitoring program be undertaken. As stated in the Department's PAR, GeoTerra/GES predicts that the UEP may result in some localised iron hydroxide precipitation if the groundwater is exposed to freshly-fractured rock surfaces. However, it is important to note that stored water quality in the region has not been adversely affected by previous mining and that many aquifers in the Southern Coalfields contain dissolved iron and that consequently many groundwater seeps display iron staining. Wollongong Coal confirmed that recent water quality monitoring data indicates that extraction of Longwalls 4 & 5 did not affect the water quality of Cataract Creek.

The Department accepts the results of the IRA and that the project may result in some iron oxide staining of the beds of watercourses. However, this iron staining is likely to be localised and would have negligible effect on the overall water quality of Cataract Creek and more particularly Cataract Reservoir. A subsidence performance measure requiring not-greater-than-negligible iron staining in Cataract Creek is already included in the project approval. To further satisfy DPI Water's recommendation, the Department has included a specific requirement for the proposed surface water monitoring program to address both dissolved iron and filterable iron oxides/hydroxides.

### **3.2.6 Surface Water Monitoring**

In its final submissions in response to the IRA dated 2 November 2015 and 6 November 2015, WaterNSW requested that the conditions of approval include requirements for:

- limits on total baseflow loss from all streams of 0.05 ML/day;
- revised surface and groundwater modelling to specify detailed predictions for surface water losses for 3 years after commencement of mining, when mining is completed (ie 5 – 6 years), and 50, 100 and 200 years following completion of mining; and
- a surface and groundwater monitoring program to confirm that losses of surface water and baseflow adequately align with predictions;

The Department confirms that the existing conditions of approval require the Extraction Plan to include a Water Management Plan which is required to include a program to validate the surface water and groundwater models for the project, and compare monitoring results with baseline data and modelled predictions (condition 10(h) of Schedule 3). All surface water impacts of the project are required to be accounted for through water licensing.

However, it is Department's view is that the additional long-term modelling as proposed by WaterNSW would serve no useful purpose. Firstly, the Geoterra/GES modelling already includes the Upper Hawkesbury Sandstone and the overlying regolith. From this modelling it has derived clear estimates for predicted baseflow losses to surface streams both during and after mining. These losses are predicted to be very low. Secondly, WRM's model considered surface flow losses as an extreme worst-case scenario, and demonstrated that even extreme losses would be low. Thirdly, the Department considers that good baseline monitoring and impact monitoring would be more accurate than any predictive modelling. The Department also questions whether accurate, longterm predictive modelling can be accomplished unless it is well-informed by accurate data from impact monitoring.

The Department also considers that there is no policy basis for restricting baseflow losses to an arbitrary (and exceedingly low) limit. Instead, the policy framework for dealing with baseflow losses across the State (including all mining operations and all water catchment areas) is one of licensing water take under the *Water Management Act 2000*. In alignment with the advice of DPI-Water, the Department considers that Wollongong Coal should obtain all necessary water licences for water take by the project, including baseflow losses as monitored.

### 3.3 Subsidence Impacts on Groundwater

#### 3.3.1 Groundwater Assessment and Modelling

In response to the Commission's Recommendation 1, Wollongong Coal engaged GeoTerra Pty Ltd (GeoTerra) and Groundwater Exploration Services (GES) to prepare a revised *Groundwater Assessment* (Appendix H of the IRA). The revised assessment uses the latest available data, including data collected from an expanded piezometer network and recent monitoring following the extraction of the first 340 m of Longwall 6, to provide an updated understanding of the local groundwater system and predicted mine-water inflow dynamics.

The Department considers that the revised assessment addresses the groundwater-related issues raised in the Commission's *Review Report* (see Appendix A of the *Groundwater Assessment*). It is noted that a peer review of the *Groundwater Assessment*, undertaken by Dr Noel Merrick of HydroSimulations (see Appendix F of the *Groundwater Assessment*), concludes that:

*"the Russell Vale Groundwater Model has been developed competently and is "fit for purpose" for addressing the potential environmental impacts from the proposed underground mining operations and for estimating indicative dewatering rates.*

*The uncertainty in modeling predictions was assessed thoroughly in the PPR groundwater assessment by analyzing the outputs of 31 models with parameterisations based on the statistical distribution of packer test permeabilities. Additional investigation of mine inflow uncertainty has been made in the current report for changes in effective recharge due to land surface disturbance.*

*Due to the substantial depressurization that has been caused by earlier mining at the subject mine, and at neighbouring historical mines, the additional effects of mining the Wongawilli Seam with eight more longwall panels are considered marginal".*

#### 3.3.2 Groundwater Management Plan

WaterNSW requested that the recommended conditions of approval include a requirement for the preparation of a Groundwater Management Plan. The Department agrees, and notes that its standard conditions of approval for underground coal mines require the preparation of such a plan. Accordingly, the recommended conditions of approval for the UEP require the Extraction Plan to include a Water Management Plan, which involves preparation of a groundwater monitoring program (condition 10(h) of Schedule 3). As requested by WaterNSW, this requirement aligns with that for the recently approved Springvale Coal Mine Extension Project.

### 3.4 Subsidence Impacts on Upland Swamps

#### **Commission Recommendation 2**

*The establishment of a network of piezometers within and surrounding the upland swamps, the establishment of this network should be guided by the relevant authorities (ie Office of Environment & Heritage, WaterNSW, the Dams Safety Committee and the Department of Planning & Environment). This network will collect additional baseline data and monitor the impacts to the swamps, through changes to the groundwater supporting the swamps, from the mining. This monitoring data should be made available to the independent risk assessment panel.*

**Commission Recommendation 3**

*Any more definitive policy developed regarding triggers for offsets and mitigation measures under the “Policy Framework for Biodiversity Offsets for Threatened Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence” should be made available for consideration by the independent risk assessment panel (see Recommendation 1).*

**Commission Recommendation 4**

*Any potential offset policy should address key elements including:*

- a. the potential delayed onset of subsidence and associated hydrogeological and ecological impacts to swamps;*
- b. potential ecological and structural tipping points; and*
- c. mechanisms to adequately secure offset sites (with consideration of the current land tenure and exploration licence and mining lease tenements of the proposed offset site; and the need for site specific offset management plans).*

**3.4.1 Findings of the IRA in Relation to Swamps**

The final IRA provides a summary and discussion of the predicted risks of impact of the UEP on upland swamps, which was informed by the technical studies prepared by the relevant specialists. In relation to swamps, the IRA:

- identified two ‘high’ risks (BS1113 and BS1213), both of which relate to potential impacts to swamp CCUS4. This swamp is assessed as being at high risk of environmental impacts due to fracturing of the bedrock beneath the swamp and/or fracturing of the controlling rockbar at the base of the swamp; and
- identified that the only ‘medium’ risk that is assessed as having ‘moderate’ consequences relates to swamp BCUS4, which is assessed as being at a ‘medium’ risk of environmental impacts due to subsidence-induced tilting.

**3.4.2 Consequence Categories for Swamps**

In its submission on the final IRA, OEH considered that the risk assessment for upland swamps uses assumptions that lead to an under-estimation of the project’s consequences. OEH questioned several of the consequence categories for swamps used in the risk matrix, as well as the area of assumed impact within swamps. OEH considers that predicted swamp impacts need to be supported by evidence and that a more precautionary approach to the risk assessment should have been taken.

The Department acknowledges OEH’s concerns and accepts that there is uncertainty in predicting subsidence and environmental outcomes for upland swamps. However, the Department considers it unlikely that this issue can be resolved through further technical work or analysis and that there is a need to accept there could be some variability in predicting impacts on swamps. Indeed, the draft Swamp Offsets Policy provides for such variations as a matter of course. Therefore, the Department considers that it would be unreasonable to hold Wollongong Coal strictly liable for precise impacts on swamps. However, it is vital that there is strict monitoring of the impacts on swamps and an obligation to offset all such impacts. If offsets cannot be obtained, then Wollongong Coal would have to adapt the mine plan to avoid greater than negligible impacts on swamps.

To ensure there is a consistent approach to managing both uncertainty and impacts, the Department proposes that the project approval be revised to:

- strengthen monitoring conditions, requiring expansion of the existing network of piezometers in and around the upland swamps (see Section 3.4.4); and
- reflect the draft *Policy Framework for Biodiversity Offsets for Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence* (see Section 3.4.5)

**3.4.3 Swamp Avoidance**

In its submission on the final IRA, Wollongong City Council (Council) reiterated its previous requests that the proposed extension of Longwall 6 should be deleted in order to minimise impacts on upland swamp CCUS4. The Department accepts that the current mine plan for the UEP would result in impacts to some upland swamps, particularly CCUS4. The Department believes that the impacts of the UEP need to be carefully weighed against its social and economic benefits and that residual impacts should be addressed in a clear and consistent manner.

The Department accepts that Wollongong Coal has employed all feasible and reasonable measures to avoid swamp impacts during the development of the mine plan, and has avoided mining under several large swamps near the proposed longwalls. It also accepts that some impacts on swamps are an unavoidable consequence of longwall mining, and that these impacts should be carefully weighed against the social and economic benefits of the project, and offset if they are greater than negligible.

The Department's proposed approach to offsetting impacts to upland swamps (including CCUS4) is consistent with the Government's current draft Swamp Offsets Policy (see Section 3.4.5).

#### **3.4.4 Upland Swamp Monitoring**

Wollongong Coal has confirmed that it has already installed a total of 23 shallow groundwater piezometers within and around upland swamps in the vicinity of the UEP. A location figure and a full list of the swamps within which piezometers have been installed, including the installation date, intake depth and closest proximate longwall is provided in Section 2.2 of Wollongong Coal's Part 2 response (see **Appendix H**). Wollongong Coal has also confirmed that extensive consultation has been undertaken with key agencies, including OEH, DRE, WaterNSW and the Commonwealth Department of Environment, in relation to the design and installation of the existing swamp piezometer monitoring network (see Table 3 of **Appendix H**).

In addition, Wollongong Coal has committed to installing an additional 30 shallow groundwater piezometers in all upland swamps located within 400 m of the longwalls. If feasible, this would include installation of open standpipes or shallow groundwater piezometers around upland swamps CCUS1 and CRUS3 to assess the inflow to these upland swamps from surrounding surficial and shallow groundwater aquifers. Wollongong Coal has confirmed that installation would be subject to further consultation with key agencies and would be described in future Extraction Plans. This commitment is included in Wollongong Coal's revised Statement of Commitments (SoC) at Appendix 3 of **Appendix K** (Commitment No. 38).

The Department considers that the existing and proposed network of piezometers within and around upland swamps would be more than sufficient to determine if the performance measures and other conditions of approval are being met and would provide valuable information on the magnitude of any mining-related impacts to swamps.

WaterNSW requested that the Department include a condition of approval requiring all new piezometers to be installed within 3 months of the date of an approval. While the Department agrees with WaterNSW that the additional piezometers should be installed as soon as practicable, it does not think this can be achieved within 3 months, particularly if the installation of these piezometers is to be informed by the advice of the proposed Independent Monitoring Panel.

The Department has therefore recommended a condition requiring piezometers to be installed as soon as practicable after approval, to the satisfaction of the Secretary.

The Department notes that all future installation of piezometers would be subject to further consultation with key agencies and would be described in future Extraction Plans. The Department has also recommended a condition requiring all raw piezometer and other monitoring data to be made available to the Department, OEH and an independent monitoring panel, on request.

#### **3.4.5 Draft Swamp Offset Policy**

In May 2015, OEH released for public consultation the draft *Policy Framework for Biodiversity Offsets for Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence* (draft Swamp Offset Policy). Since that time, extensive consultation between the Department and OEH over the development of the draft Swamp Offset Policy has taken place, and the policy is expected to be finalised in the next few months.

The current draft policy framework outlines a clear and consistent approach to identifying subsidence-related impacts to upland swamps and calculating and securing offsets for swamps impacted by longwall mining subsidence, and would operate as an addendum to OEH's 2014 *NSW Biodiversity Offsets Policy for Major Projects* (Offsets Policy).

The Department has recommended that the draft project approval is revised to reflect the current draft Swamp Offset Policy and the recent conditions applied to the Springvale Extension Project. Consequently, the Department recommends that the subsidence impact performance measure of 'negligible environmental consequences' continue to apply to 2 of the swamps (CRUS1 and CCUS1),



as well as to the additional 2 nearby swamps recently identified in aerial surveys (CRUS6 and CCUS24) (see condition 1 of Schedule 3).

Wollongong Coal should be held strictly liable for causing not greater than negligible environmental consequences to these swamps, and should be subject to compliance action if there are any exceedances of this performance measure. In the unlikely event of any such exceedances occurring, Wollongong Coal should also be required to offset any resulting impacts in accordance with the draft Swamp Offsets Policy (or the final policy once it is made).

The Department has recommended a condition which requires a Swamp Offset Bond of \$500,000<sup>2</sup> for the first swamp to be undermined (ie CCUS4) (see condition 4 of Schedule 3). This is in recognition of the fact that Wollongong Coal may not be able to purchase relevant offset sites or biodiversity credits, or arrange for supplementary measures to be carried out, before it commences mining of Longwall 6, which may impact this swamp. The bond therefore provides a safeguard in the event that swamp CCUS4 is impacted by mining operations, and gives Wollongong Coal time to demonstrate that it can satisfy the maximum predicted offset liability for all other potentially-affected swamps.

There are 7 other upland swamps which may be impacted by mining operations at Russell Vale (CCUS2, CCUS5, CCUS10, CCUS11, CCUS12, BCUS4 and BCUS11). Recommended conditions have been revised to require Wollongong Coal to have suitable offsets in place prior to carrying out any longwall extraction under these swamps and to offset any impacts on these swamps that cause greater than 'negligible environmental consequences' (see condition 5 of Schedule 3).

Due to the uncertainties in predicting impacts on swamps, and OEH's concerns that the IRAP may have underestimated these impacts, the Department considers it would be unreasonable to hold Wollongong Coal strictly liable if greater than negligible environmental consequences result in any of these swamps. Instead, the requirements of the draft Swamp Offset Policy should apply.

As discussed in Section 2.5, recommended conditions include a requirement to establish an Independent Monitoring Panel (see condition 12 of Schedule 3). The panel would be required to consider monitoring data for at least 12 months after mining ceases within 400 m of a swamp (or within the 20 millimetre (mm) subsidence contour, whichever is greater), to determine whether a greater than negligible environmental consequence has occurred, and whether an offset should therefore be realised.

If monitoring demonstrates that greater than negligible change to the shallow groundwater regime occurs and that impact has stabilised for a period of 12 months, then the Wollongong Coal must meet the full calculated value of the offset for that swamp equivalent to that impact within six months of the completion of the review by the independent monitoring panel.

If the independent panel assesses that the monitoring data demonstrates that a predicted groundwater impact has not occurred within 12 months of completion of all mining within 400 m of a swamp, or has occurred in only part of that swamp, then the full offset associated with the swamp, or part of that offset, may be deducted from the UEP's overall 'maximum predicted offset liability'.

Conversely, where the independent panel concludes that monitoring demonstrates that mining has impacted the shallow groundwater regime to a greater degree than was predicted and that impact has stabilised for a period of 12 months, then an offset equivalent to that impact must be identified and secured within six months of the completion of the 12 month monitoring review.

The recommended conditions have been revised to require the preparation of the Swamp Monitoring Program as part of the Extraction Plan (see condition 10(j) of Schedule 3). This program requires both primary (groundwater) and secondary (terrestrial and aquatic flora and fauna, soil and peat, stability, erosion) monitoring of swamps to inform the adaptive management process, as recommended by the Commission. The Swamp Monitoring Program requires consideration of a minimum of 2 years of baseline data for swamp hydrology and swamp vegetation. Swamp monitoring must fully satisfy Before After Control Impact (BACI) design principles.

WaterNSW requested that any offsets required for impacts to upland swamps are located within the local catchment where the swamps are located. Wollongong Coal has committed to ensuring land-

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<sup>2</sup> This figure has been determined based on a comparative analysis of the proportional area and vegetation complexity of the first swamp to be undermined at Russell Vale compared with the first two swamps to be undermined at Springvale Mine (Sunnyside and Carne West).

based offsets are located within the local catchment, where possible (see Commitment No. 40 at Appendix 3 of **Appendix K**). The Department accepts that this may not be possible, and notes that the draft Swamp Offset Policy does not place any such restriction on the provision of offsets. Instead, it takes a broader perspective and requires the impact to be offset within the range or distribution of the relevant endangered ecological community or swamp community.

### 3.5 Socio Economic

#### **Commission Recommendation 5**

*The proponent's economic assessment, in particular the estimated costs and benefits, should be updated to reflect the current economic climate.*

#### **Commission Recommendation 6**

*The final assessment and determination of the project should be informed by an independent analysis of the economic costs and benefits of the project, including any additional information/updated economic assessment provided by the Applicant. The independent analysis should be managed by the Department of Planning & Environment.*

In response to the Commission's recommendation, Wollongong Coal engaged Gillespie Economics to undertake a revised *Economic Assessment*, which was included as Appendix A of the company's *Part 1 Response* to the Commission's review (see **Appendix D**). The revised assessment included an updated Cost Benefit Analysis (CBA), which calculated the benefits of the project using the latest projected coal prices and foreign exchange rates.

The Department commissioned the Centre for International Economics (CIE) to undertake an independent analysis of the economic costs and benefits of the UEP as presented by Gillespie (see **Appendix I**).

Specifically, Gillespie adopted export prices of US\$84 per tonne for coking coal and US\$61 per tonne for thermal coal, and an AUD/USD exchange rate forecast of 0.73. In line with its earlier CBA for the UEP, Gillespie assumed an average annual production rate of 934,000 tonnes and that the coal produced would be sold into the export market on a 52.6% coking coal and 28.6% thermal coal basis.

In the revised CBA, Gillespie took a 'minimum threshold value' approach and focused on quantifying the royalty payments to the State, excluding other known but difficult-to-quantify benefits, such as company tax payments to the Commonwealth. CIE supported this approach. Using this approach, Gillespie calculated that the project would, under the current economic climate, generate \$323 million in revenue for Wollongong Coal and \$23 million in royalties to the State. These figures are lower than the original figures presented in the social and economic assessment provided in the Preferred Project Report (PPR), which estimated \$400 million in revenue to Wollongong Coal and \$34 million in royalties to the State.

Gillespie also undertook a sensitivity analysis of the revised figures at discount rates of 4%, 7% and 10% for a number of variables. This analysis indicated that the value of royalties is most sensitive to either a change in production levels or a change in the USD price for coal. A 20% decrease in production or USD price would reduce royalties to \$18.6 million. A 20% increase in coal prices would increase the royalties to \$27.9 million.

Gillespie states that, for the project to be questionable from an economic efficiency perspective, the incremental residential environmental, social and cultural impacts of the project (after mitigation, offsetting and compensation) would need to exceed \$23 million.

The revised CBA noted that no 'material' impacts are considered likely in relation to air quality, traffic and transport, Aboriginal cultural heritage and historic heritage. The revised CBA also noted that noise impacts, surface water impacts, groundwater impacts, visual amenity impacts, upland swamp impacts and infrastructure impacts associated with the project would be mitigated, compensated for or offset, and therefore the costs associated with this would form part of the capital or operating costs of the project. Subsequently, the only impacts that would remain unmitigated and uncompensated for would be greenhouse gas emissions. Gillespie estimated the cost of the greenhouse gas emissions would be in the order of \$0.15 M (present value).

In summary, the revised CBA estimates the project would have net social benefits to Australia of a minimum of \$23 M minus the cost of greenhouse emissions (\$0.15 M) and hence is considered desirable and justified from an economic efficiency perspective. CIE indicated that these estimates are reasonable.

In terms of the costing of environment impacts, CIE notes that the Gillespie analysis assumes that the majority of the environmental impacts would be mitigated or offsets would be purchased to compensate for any impact. CIE notes that implementing mitigation or purchasing offsets would reduce the financial profitability of the UEP and not impact on royalty payments accruing to the State government.

In its merit review, the Commission noted that Wollongong Coal had used available information reported by WaterNSW to calculate the value of the catchment areas proposed to be impacted. The Commission considered that WaterNSW's view on these figures should be sought and considered in any subsequent updating of the analysis of this issue. In response to this, CIE consulted with WaterNSW and reviewed Gillespie's estimate of \$235,000 in net present value terms for the loss of stream baseflow as a result of the project. CIE considered the maximum predicted loss of stream baseflow of 15 ML/year (as included in the *Groundwater Assessment*) and suggested a high-end estimate of \$430,000 in net present value terms could be assumed for the purposes of the CBA. As recommended conditions would ensure that the costs associated with purchasing licences for this loss of stream baseflow would be borne by Wollongong Coal, the Department is satisfied that the difference in these values would not impact on the outcome of the CBA.

CIE also estimated that additional monitoring costs of around \$62,000 in present value terms could be incurred by WaterNSW and should be reflected in the CBA. The Department notes this cost of the project but considers it also would have little bearing on the overall socio-economic outcome, given the magnitude of other variables, such as the export coal price.

In summary, the Department considers that the project would result in an unequivocal socio-economic benefit to the region and the State through:

- the employment it would provide (both directly and indirectly);
- its significant capital investment (and resultant flow-on effects within the region); and
- an estimated \$23 million to the State of NSW in royalties.

### 3.6 Noise

#### **Commission Recommendation 7**

*The Commission recommends that further consideration of the noise impacts of the project needs to be provided including consideration of further noise mitigation measures as recommended by the EPA. Detailed justification should be provided for any deviations from the existing noise limits in current planning approval. Also clarification should be provided on the outcomes and applicability of the noise audit required in the 2011 approval.*

#### **3.6.1 Existing and Predicted Noise Levels**

As discussed in the Department's PAR (Section 6.7.1), Wollongong Coal engaged Wilkinson Murray to prepare a revised *Noise Assessment* for the UEP in accordance with applicable guidelines (see Appendix F of the PAR). The *Noise Assessment* provides a comparison of the existing noise levels against the predicted noise levels associated with the UEP. These have been summarised in **Table 2** below.

**Table 2: Predicted Noise Levels and Recommended Noise Criteria**

Receiver Id	Time Period	Noise Level Leq(15 minute) dB(A)	
		Existing	Predicted Level
R1	Day	51	51
	Evening	54	53
	Night	45	43
R2	Day	54	54
	Evening	56	53
	Night	47	44
R3	Day	53	53
	Evening	55	53
	Night	46	44

R4	Day	51	51
	Evening	55	53
	Night	45	43
R5	Day	52	52
	Evening	55	53
	Night	43	41
R6	Day	51	51
	Evening	56	53
	Night	43	41
R7	Day	52	52
	Evening	56	53
	Night	44	44
R8	Day	51	51
	Evening	56	53
	Night	46	46
R9	Day	44	43
	Evening	47	46
	Night	42	43
R10	Day	42	42
	Evening	45	44
	Night	42	43
R11	Day	40	40
	Evening	43	43
	Night	40	40
R12	Day	42	42
	Evening	43	42
	Night	40	39
R13	Day	45	45
	Evening	46	46
	Night	42	42
R14	Day	44	44
	Evening	46	46
	Night	42	40

**Table 2** shows that the predicted noise levels under the UEP are either the same as, or less than, those currently being experienced in the vicinity of the pit top operations. The only exception to this is at one receiver location (Receiver 9), which is predicted to experience a 1 dB(A) increase in existing noise levels under the UEP. The Department notes that this increase would not be noticeable and, given conditions the Department has developed that restrict surface activities during the sensitive night-time period, it is considered that Receiver 9 would actually experience a decrease on existing noise levels.

The Department notes that maintaining the existing restrictions on the Wollongong Coal's operations effectively means that the only surface activity that can occur during the sensitive night-time period is the running of coal onto the stockpile. Details regarding the noise mitigation measures already implemented and restrictions on equipment and transfer of material to the surface during night-time operations are provided in Section 3.6.2 below.

### 3.6.2 Best Practice Noise Mitigation Measures

A number of noise surveys of the previous and existing operations at the Russell Vale pit top site have been undertaken in order to identify noise mitigation measures that could be implemented to reduce noise to residents living in the vicinity of the site.

In accordance with the existing PWP project approval, the previous owner of Russell Vale Colliery (Gujarat NRE Coking Coal Ltd) engaged Pacific Environmental Limited (PEL) to undertake a noise audit, which was conducted on-site between 1 October and 21 December 2012.

In addition, in response to the EPA's recommendations to the Commission (letter dated 13 March 2015), Wollongong Coal engaged Wilkinson Murray to assess the potential noise reductions associated with a range of additional noise mitigation measures and engaged Hatch to provide an analysis of the costs of implementing these noise controls. Copies of the noise assessment and costing report are included at Appendices B and C, respectively, of Wollongong Coal's *Part 1 Response* (see **Appendix D**).

The EPA has reviewed the additional noise and costing reports and has indicated that Wollongong Coal has undertaken a 'reasonable and feasible' assessment of the noise control recommendations and costs (see **Appendix E**).

A summary of both the recommendations of the 2012 noise audit and the mitigation measures suggested by the EPA in 2015 is provided in the first column of **Table 3** below. The continuing applicability, outcome and status of these are provided in the second column of the table.

**Table 3: Noise Audit and EPA Mitigation Measures – Applicability, Outcome and Status**

<b>Conclusion / Recommendation</b>	<b>Applicability / Outcome / Status</b>
<b>Noise Audit (2012)</b>	
Restrict heavy truck activities on the project site outside day and evening periods to achieve the project approval's noise limits.	Wollongong Coal has confirmed that this is undertaken where possible; however infrequent night deliveries do take place for oversized loads. These movements require RMS/police approval. The Department notes that the recommended UEP project approval includes a condition which specifically prohibits the operation of dozers or front end loaders during the night-time period (see condition 2(b) of Schedule 4).
Schedule 3, condition 14(a) of the project approval to be modified to state ' <i>the existing Bulli Conveyor is decommissioned when the Wonga Mains driveway is complete</i> '.	This requirement was included in the PWP project approval via Mod 1 in December 2012. Wollongong Coal has confirmed that the Bulli Conveyor is currently decommissioned, but may be required to be re-commissioned at a later date. The Wonga Mains driveway would not be complete for several years. The Department has recommended that this condition be included in the UEP approval (see condition 2(f) of Schedule 4).
Any large scale construction activity include a noise management plan in accordance with the EPA's <i>Interim Construction Noise Guidelines</i>	Wollongong Coal has agreed to implement this recommendation (see Commitment 33 at Appendix 3 of <b>Appendix K</b> ).
Retrofit existing mobile plant with non-tonal reversing alarms (quacking alarms).	Wollongong Coal has confirmed that all heavy equipment that remains on-site in the stockpile area has had non-tonal reversing alarms fitted. Wollongong Coal has committed to ensuring that any new machinery brought onto site would have non-tonal reversing alarms fitted (see Commitment 34 at Appendix 3 of <b>Appendix K</b> ).
Implement real time monitoring program	Complete and being implemented.
When possible, coordinate quarterly attended noise surveys with high levels of site activity. Quarterly attended noise survey should include 1/3 octave band measurement	Wollongong Coal has confirmed that short-term attended noise monitoring is being undertaken at 8 locations in the vicinity of the pit-top site on a quarterly basis. The Department confirms that the details of this monitoring are included in the approved Noise Management Plan required under the PWP approval (condition 3 of Schedule 4), and would be updated as part of the UEP.
Retrofit CAT988 loader and the D11 dozer with noise mitigation	Wollongong Coal has confirmed that the CAT988 loader and D11 dozer are no longer on-site and has committed to ensure that any new loaders and dozers would be fitted with noise attenuation prior to use (see Commitment 35 at Appendix 3 of <b>Appendix K</b> ).
Based on noise source levels of mitigated dozer and front end loaders, quarterly compliance measurements and operational modelling predictions; determine additional administrative controls required to achieve medium term intrusive noise limits of the project approval.	No longer applicable. See above.
<b>EPA (2015)</b>	
Conveyor runner bearing design	Wilkinson Murray has confirmed that RV1 has poly rollers installed; RC1 and RC3 conveyors are not yet installed; and RC4 has steel rollers. Wollongong Coal has committed to fit all surface conveyors with poly rollers prior to the commencement of coal extraction (see Commitment 32 at Appendix 3 of <b>Appendix K</b> ).

	In accordance with the EPA's request, the Department has also recommended a condition requiring conveyors RC1 and RC3 to be fitted with polymer rollers prior to coal extraction.
Replacement of metal clips used to join conveyors with vulcanised joints	Wilkinson Murray has confirmed that all surface belts are vulcanised.
Use of noise barriers on site boundaries and around identified noisy equipment	Discussed in detail below.
Maintaining a volume of coal in bins so that coal is not dumped into an empty bin	Wollongong Coal has committed to ensuring that a volume of coal remains in the bins at all times (see Commitment 32 at Appendix 3 of <b>Appendix K</b> ).
Minimising dump height from mobile plant	Wilkinson Murray considered that an automotive tripper system may provide some noise reduction benefit and recommended that this be further evaluated. Wollongong Coal has agreed to undertake trials into the potential noise reductions associated with tripper heights and locations (see Commitment No. 32 at Appendix 3 of <b>Appendix K</b> ). In accordance with the EPA's request, the Department has also include a condition requiring the trials to be completed to the satisfaction of the EPA within 6 months of the commencement of operations at the pit top site.
Noise dampening material in coal bins/deflection plates	Wilkinson Murray considered that this measure is not practicable because coal typically wears the dampening material away. Wilkinson Murray believes that alternative measures, such as maintaining a volume of coal in the bins, are more effective. Wilkinson Murray also notes that the bins contribute a low level of noise to the closest residences, therefore mitigating these items would not result in a noticeable reduction in noise levels at the receivers.
Noise cladding on conveyor winder houses and conveyor rope rollers	Belt drivers have cladding on the walls.
Enclosed motor rooms, etc	Wilkinson Murray confirmed that the RC1 drive is within the sizer building; however the RC3 and RC4 drives are not enclosed. Wilkinson Murray considered that the RC3 and RC4 drives contribute low levels of noise to the closest residential receivers and enclosing these items would not result in a reduction of noise at the receivers.
Different load-out operations	Wilkinson Murray confirmed that, with the proposed UEP upgrades in place, the majority of coal would be loaded from the truck loading bins. This would ensure the use of a front-end loader is limited to times when the conveyor/bin is unserviceable or during longwall change-outs.

Wilkinson Murray confirms that the majority of the EPA's recommended noise mitigation measures have already been implemented on-site. The measures that have not been implemented have been assessed as having limited acoustic benefit (ie enclosing motor rooms and attenuating the D11 dozer, which does not operate at night) or else are considered impractical when compared with more beneficial alternative measures (ie noise dampening material in coal bins).

### 3.6.3 Potential Noise Barrier

Wilkinson Murray undertook more detailed modelling to assess the noise control efficacy of constructing noise barriers around the site boundaries. Modelling indicates that some acoustic benefit may be achieved by constructing a 280 m barrier of 6 m height along part of the site's northeastern boundary. Hatch has estimated that the cost of constructing such a barrier would be \$1.08 million for a concrete structure or \$445 K for a steel panel system.

Wilkinson Murray indicates that the barrier may provide benefit to some single-storey receivers adjacent to the barrier during day and evening operations, but that its effectiveness would reduce as distance from the barrier increases, and the barrier would provide a negligible reduction in noise impacts at night.

Council believes the noise barrier should be constructed (see **Appendix F**). However, the Department maintains its long-held position that the topography in the vicinity of the pit-top site is not conducive to a noise barrier being an effective noise management technique. Furthermore, such a barrier would result in significant visual impacts on nearby receivers, which have generally not raised noise as an issue in the past.

Wollongong Coal also considers that the limited benefits of the barrier do not outweigh the costs of its construction. Nonetheless, the company has committed to undertake further real time *in-situ* noise monitoring to verify the results of Wilkinson Murray's modelling, as requested by the EPA. Wollongong Coal also committed to discussing the results with the affected residents, who may not wish to have a 6 m noise wall directly behind their houses, presenting the findings to the EPA for its final position on whether the noise barrier should be constructed. The Department supports this proposal and has recommended a condition requiring this work to be submitted to the EPA within 6 months of the commencement of operations at the pit top site. If it is decided that there would be some benefit in constructing the barrier, then Wollongong Coal would be required to seek planning approval for its construction and the community in the surrounding area would be given an opportunity to comment on the merits of the proposal before any final decision is made.

### 3.6.4 Proposed Noise Limits

The noise limits in the current planning approval (ie the PWP approval) were based on information contained in the *Acoustic Assessment* prepared by Environmental Resource Management (ERM) (October, 2010) for the *NRE No. 1 Colliery Preliminary Works Project Environmental Assessment* (see Annex J of that EA).

As identified by the Department in its PAR (p. 47) and re-confirmed by Wilkinson Murray (see **Appendix D**), the assumptions and methodology used in ERM's noise assessment were seriously flawed and failed to deliver realistic or practical outcomes for a number of reasons, including the:

- incorrect assumption that adverse meteorological conditions were not a feature of the area;
- predictions based on data from an inappropriate weather station;
- use of sound power levels lower than that actually produced by key equipment; and
- omission of items of noise plant and equipment in the noise model.

The combined result of the assumptions and methodology used in the ERM noise assessment was to:

- significantly underestimate the noise being generated by the Russell Vale pit-top site during periods when it operated to capacity; and
- derive noise criteria which are unrealistically low.

Wilkinson Murray subsequently undertook a revised *Noise Assessment* (2014), which incorporated long-term data logging to provide a more accurate estimate of background noise levels. The revised assessment developed a noise prediction model based on more appropriate weather data, including that collected on-site, and examined the historical context of the mine in terms of noise levels generated over the last 35 years. This *Noise Assessment* was included in Appendix F of the UEP EA and was considered by the Department's noise specialist to be "*representative of the existing and future operational activities under the UEP*" (p. 47 of the PAR).

During June 2015, Wilkinson Murray undertook additional noise measurements at the pit-top site to verify noise levels of activities and equipment following implementation of recently installed mitigation measures (see Appendix B of **Appendix D**). The results were consistent with those set out in the *Noise Assessment* (2014).

The EPA has accepted that the noise criteria for the UEP proposed by the Department approximately correspond to the worst case levels modelled by Wilkinson Murray and that "*the modelled levels include all reasonable and feasible noise treatments and are conservatively generated under full scale production of 3 Mt/y*" (p. 2 of **Appendix E**). As discussed in the Department's PAR (p. 49), the predicted noise levels would exceed the PSNLs at certain locations, even following the implementation of all reasonable and feasible noise mitigation measures.

However, the NSW Government's *Voluntary Land Acquisition and Mitigation Policy* (November 2014) specifically states that a consent authority cannot grant voluntary mitigation and acquisition rights to reduce operational noise impacts of a development for:

*"existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through*



*site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997”.*

Russell Vale’s pit-top operations clearly fit into this category. In such cases, the *NSW Industrial Noise Policy (INP)* states that “*decisions of this nature will be determined on a case-by-case basis, taking into account various factors, for example, feasible and reasonable mitigation works, the absolute level of noise and existing measures of community impact including complaints.*”

The EPA and the Department accept that all reasonable and feasible noise mitigation measures have been adopted, and that any additional improvements associated with the operation of the tripper and noise barriers would be investigated and, if considered beneficial, implemented.

For the reasons detailed in the PAR (Section 6.7.1), the Department believes that it is reasonable to limit noise from the Russell Vale pit top site to levels that do not exceed the Acceptable Amenity Criteria for the area. In line with current EPA practice, where the predicted level is below the nominal amenity criterion, the Department has set criteria to the predicted level.

As discussed in detail in the Department PAR (p.49), the predicted noise levels represent worst-case scenarios that would only occur less than 10% of the time. Although the predicted noise levels mostly exceed the PSNLs, in no case would the predicted levels exceed the Acceptable Amenity Criteria. Furthermore, stringent operational restrictions recommended in the draft project approval would mean that the operations would be quieter during the most sensitive time-periods.

The Department maintains that the previously recommended noise criteria for the UEP are appropriate and that the recommended conditions would require Wollongong Coal to continue to investigate and implement any additional reasonable and feasible noise reduction measures.

### **3.6.5 Recommended Noise Conditions**

The Department maintains that the existing proposed noise criteria and operating conditions remain applicable to the UEP. In accordance with a request from the EPA, the Department has recommended additional conditions, which require Wollongong Coal to:

- fit polymer rollers to conveyors RC1 and RC3 prior to the commencement of coal extraction;
- conduct trials to minimise the height of falling on the stockpile with tripper automation within 12 months of the commencement of operations; and
- undertake further investigations in relation to a noise barrier within 6 months of the commencement of operations at the pit top site, including:
  - conducting real time *in-situ* noise monitoring to verify the results of the modelling and assess the need for a noise barrier;
  - discuss the results with the affected residents to determine their views on the construction of a noise barrier; and
  - present the findings to the EPA for its final position on whether the noise barrier should be constructed.

The Department has recommended that these measures be implemented within the specific timeframes to the satisfaction of the EPA.

## **3.7 Air Quality**

### **Commission Recommendation 8**

*The PM<sub>2.5</sub> emissions from the proposal need to be assessed prior to any determination of the application.*

### **Commission Recommendation 9**

*Consideration of best practice standards needs to be provided to demonstrate that air emissions would be minimised and to justify the proposed increase in coal handling capacity.*

### **Commission Recommendation 10**

*The mine’s existing monitoring and reporting systems should be strengthened to clearly demonstrate compliance with current conditions, environmental standards and reporting goals (ie for PM<sub>2.5</sub> emissions).*

### 3.7.1 Existing and Predicted Air Quality

As discussed in the Department's PAR (Section 6.7.3), Wollongong Coal engaged ERM to prepare an *Air Quality Assessment* for the UEP in accordance with applicable guidelines (see Annex I of the UEP EA). The air quality assessment predicted that dust emissions generated by the UEP would comply with all relevant dust criteria at privately owned residences in the vicinity of the pit top site. Similarly, the cumulative impact assessment predicts that the cumulative dust levels would remain in compliance with all relevant criteria.

The only exception to this is in relation to short-term (24-hour) *cumulative* impacts. The modelling predicts that the PM<sub>10</sub> 24-hour criterion is exceeded on one occasion over the year when emissions are considered in conjunction with existing background concentrations. This exceedance is considered to be infrequent and would only occur rarely under worst case meteorological conditions.

### 3.7.2 Best Practice Air Mitigation Measures

As indicated in the Department's PAR (p. 53), Wollongong Coal has implemented a range of air quality mitigation measures associated with the existing mining operations. These measures include:

- decommissioning the Balgownie belt and bins and the Bulli decline belt;
- constructing a new stackout conveyer and tripper system;
- covering coal conveyors to the stockpile area;
- installing an automatically controlled stockpile spray system;
- using mobile water trucks;
- installing new truck washing facilities used by all trucks prior to departure from site;
- covering all loads prior to leaving the site;
- sealing pit-top truck haulage roads and parking areas;
- using a bobcat mounted road sweeper on all sealed areas;
- using fixed water sprays on surface and underground coal conveyors; and
- operating a comprehensive air quality management system, including 9 dust deposition gauges and two real-time high volumes air samplers.

In response to a Pollution Reduction Program imposed by the EPA on the site's Environment Protection Licence, Wollongong Coal engaged PAE Holmes in October 2012 to undertake a site-specific best management practice review and report aimed at further reducing emissions of particulate matter at the site. This report recommended that the following additional measures be implemented to reduce dust emissions:

- a new truck loading facility;
- secondary sizer building;
- upgrade of the fleet of trucks from 34 to 44 tonne;
- two new conveyors with enclosures; and
- underground reclaim.

In addition, the PAE Holmes report identified the following measures to potentially achieve further reductions in dust levels:

- vegetation windbreaks protecting stockpiles;
- use of chemical wetting agents on haul roads and stockpiles;
- sealing of haul roads; and
- water sprays on the moving tipper.

Wollongong Coal has confirmed that the:

- new truck loader facility and the secondary sizer building would be constructed during the first stages of the UEP and would be completed by the end of 2016.
- truck fleet upgrade would be phased in progressively over a 24 month period following approval of the UEP; and
- two new conveyors and underground reclaim operations would only be needed once production rates reach around 2.7 Mtpa (ie approximately 2 to 3 years after commencement of operations under the UEP).

In its response to the Commission's *Review Report*, Wollongong Coal committed to trialling chemical wetting agents on haul roads and stockpiles, sealing the haul roads through the stockpile area and installing water sprays on the tipper (see Commitment 26 at Appendix 3 of **Appendix K**).

To ensure these additional air quality mitigation measures are implemented, and in accordance with the EPA's recent recommendations (see **Appendix E**), the Department has included operating conditions requiring these measures to be implemented within these timeframes (see condition 5(b) of Schedule 4).

PEL conducted a further evaluation of these measures and their applicability at the Russell Vale site (see Appendix D of **Appendix D**). PEL states that:

*“vegetative windbreaks can reduce dust during high wind conditions (by intercepting dust with leaves and branches, and reducing wind speed as it passes through the vegetation). However, as with other dust management measures, it is more effective to control the source (ie avoid the dust emissions) rather than control the emissions after release.”*

The Department agrees with this evaluation and considers that ‘source-based’ mitigation measures are more effective. The Department considers that the implementation of these measures, in conjunction with best practice particulate matter control, would allow the pit-top facilities to operate within relevant dust criteria, despite the proposed increase in coal handling capacity.

### 3.7.3 **PM<sub>2.5</sub> Emissions**

In response to the Commission's recommendation, Wollongong Coal engaged Pacific Environmental Limited (PEL) to undertake an air quality assessment for the UEP for PM<sub>2.5</sub> emissions. A copy of the assessment is included at Appendix D of Wollongong Coal's *Part 1 Response* (see **Appendix D**).

PEL's atmospheric dispersion modelling was based on the approach taken by ERM in its original air quality assessment undertaken for the UEP for total suspended particulate (TSP) and PM<sub>10</sub> emissions, which was in accordance with the EPA's *Approved Methods for Modelling and Assessment of Air Pollutants in NSW*. The EPA has reviewed PEL's air quality assessment and modelling for PM<sub>2.5</sub> emissions and is satisfied that it has been undertaken in accordance with the approved methods (see **Appendix E**).

Wollongong Coal currently measures PM<sub>2.5</sub> concentrations using two Tapered Electronic Oscillating Microbalances (TEOMs) located at the Russell Vale site. Measured PM<sub>2.5</sub> concentrations were adopted as the background PM<sub>2.5</sub> concentrations for purposes of the cumulative assessment.

Since the EPA does not have criteria for PM<sub>2.5</sub>, the predicted PM<sub>2.5</sub> emissions were assessed against the *National Environment Protection Measure for Ambient Air Quality* (NEPM, May 2003 version). The assessment predicts that PM<sub>2.5</sub> dust emissions generated under the UEP would comply with the NEPM criteria at all privately-owned residences in the vicinity of the pit-top site. Similarly, the cumulative impact assessment predicts that the cumulative PM<sub>2.5</sub> levels would remain in compliance with the criteria.

### 3.7.4 **Air Quality Monitoring and Reporting**

Wollongong Coal currently maintains two TEOM monitors at the northern and southern boundaries of the Russell Vale site to continuously monitor PM<sub>10</sub> and PM<sub>2.5</sub>. Wollongong Coal has confirmed that data is transferred to a cloud-based environmental management software (EnviroSuite) that provides real-time alerts to mine operators when short-term PM concentrations exceed trigger levels. The trigger levels are short-term (typically 1-hour) values that are set to alert the mine of the potential for exceedance of 24-hour criteria before the event, in order that pre-emptive mitigation measures can be applied.

Wollongong Coal currently produces quarterly reports that reference the EPA's air quality criteria for PM<sub>10</sub>, however does not report the PM<sub>2.5</sub> data. In accordance with the Commission's recommendations, Wollongong Coal has provided a commitment to report:

- annual average and 24 hour average PM<sub>10</sub> criteria;
- annual average and 24 hour average PM<sub>2.5</sub> criteria; and
- adaptive management and ongoing improvements implemented to reduce dust emissions throughout the reporting period.

This commitment is specified in Wollongong Coal's revised SoC at Appendix 3 of the Project Approval at **Appendix K** (Commitment No. 27).

### 3.7.5 Recommended Air Quality Conditions

The Department maintains that the existing proposed air quality criteria and operating conditions remain applicable to the UEP. In accordance with a request from the EPA, the Department has recommended additional conditions, which require Wollongong Coal to:

- implement the following mitigation measures by 31 December 2016:
  - new truck loading facility; and
  - secondary sizer building;
- upgrade the fleet of trucks from 34 to 44 tonne progressively over 24 months from the date of the approval;
- implement the following mitigation measures prior to quarterly production rates reaching the equivalent of 2.7 million tonnes per annum:
  - two new conveyors with enclosures;
  - underground reclaim;
- implement the following mitigation measures within one year of the commencement of mining operations:
  - trial the use of chemical wetting agents on haul roads and stockpiles;
  - seal the haul roads through the stockpile area; and
  - install water sprays on the moving tipper(s).

### 3.8 Flooding/Bellambi Creek

#### **Commission Recommendation 11**

*Any new approval should retain the existing requirement to realign Bellambi Creek or a full justification why this is no longer necessary to provide protection to the creek downstream from the pit-top surface area.*

The existing SoC for the PWP project approval requires Wollongong Coal to complete the Bellambi Gully realignment works by December 2014. These works were originally committed to by the then owner of the mine (Gujarat NRE Coking Coal Ltd) in order to protect against any repetition of a major pollution incident during the 1998 floods. The incident involved the Bellambi Gully Creek overtopping the constructed underground culvert beneath the Russell Vale pit-top site, and consequently scouring a significant quantity of coal from the mine's ROM stockpile, which in turn was transported off the site, affecting a number of residences and the downstream creekline.

However, Wollongong Coal did not proceed with the construction of the realignment. In response to a draft Order from the Department requiring implementation of the works, Wollongong Coal indicated that the original undertaking as presented in the EA for the PWP was made on the basis of incomplete and incorrect information regarding the cause of the overtopping incident. Wollongong Coal subsequently committed to preparing a detailed flood mitigation study to assess the flood risks and determine the most appropriate flood mitigation option for the surface infrastructure and stockpile areas at the pit-top site.

As described in detail in the Department's PAR (p. 51-52), the *Bellambi Creek Flood Study*, was subsequently undertaken by Cardno (NSW/ACT) Pty Ltd (Cardno) in August 2014. However, the study was not considered by the Department to contain sufficient information to support the alternative flood mitigation measures proposed. In particular, the Department raised concerns that the study did not:

- assess any residual risk of the coal stockpile being eroded or scoured;
- address what size of flood is likely to lead to overland flows (ie the point at which the capacity of the pipe network is exceeded); and
- provide a comparative analysis between its recommended approach and the re-establishment of the original creek alignment previously proposed (and still required under existing conditions of the PWP approval).

Council also completed a review of the flood study and requested that it be revised to use a standard modelling approach which assesses the 100 year ARI, adopts appropriate tailwater levels and applies a 100% blockage criterion for all stormwater pipes less than 6 m in diameter.

Consequently, Cardno prepared a revised *Bellambi Creek Flood Study* that was submitted to the Department and Council in January 2015 (**Appendix A**). In addition, Cardno prepared a report titled *Bellambi Gully Flooding Approach* (23 July 2015), which provides a comparison of the originally proposed creek realignment approach with the alternative mitigation measures presented by Cardno

(see Appendix F of **Appendix D**). The revised flood study includes a review of all past flood studies, a topographic survey and a digital terrain model, identification of peak flows (5, 10 and 100 year ARI), a flood model based on three scenarios and recommended flood mitigation measures.

The study indicates that runoff originating from the Illawarra Escarpment flows down the Escarpment's heavily vegetated, steep slopes to the Russell Vale site in the foothills, where it enters the Bellambi Gully Creek. Some reaches of the watercourse are conveyed by pipes and constructed channels within the site. The total catchment area is 427 ha and the total creek length is 4.3 km.

Cardno modelled three blockage scenarios to assess flooding throughout the site. The models represented 100 year ARI events where the current stormwater pipes are completely blocked, 20% blocked and fully operational. Results indicated that flooding within the site is significant under all three scenarios. In all scenarios, while overland flows are mainly contained within the stockpile area, they also overtop the access road and continue as sheet flow towards and onto Bellambi Lane.

The study recommends a range of mitigation measures to reduce clean runoff entering the stockpile area, while conveying all site runoff in a controlled way to Bellambi Gully Creek (ie preventing flooding of Bellambi Lane). In summary, these measures include:

- upgrading the stockpile area access road and installing a 6m span culvert to convey the site runoff across the access road, into a proposed grass-lined swale before discharging into Bellambi Creek;
- implementing a debris control structure at the 1800 mm diameter pipe and M3 culvert opening to reduce probability of blockage within the system due to debris from the upstream catchment;
- formalising the swale in the vicinity of the existing 600 mm clean water inlet;
- upgrading the existing 600 mm diameter clean water pipe to an 825 mm diameter pipe;
- maintenance works immediately upstream and downstream of the existing debris control structures within Bellambi Gully Creek to minimise the potential for blockage of the system and
- installing culverts across the access road along the northern boundary of the site to direct flows from catchment M8 directly towards Bellambi Gully Creek, in order to reduce clean water runoff conveyed into the stockpile area.

Cardno states that the proposed culvert and swale structure would be adequate to convey the 100 year ARI flows and eliminate the flooding on Bellambi Lane, even if the existing pipes are 20% blocked. Cardno notes that the proposed flood mitigation approach assumes sufficient treatment of runoff water within the stockpile area prior to discharge through the licenced discharge point and into the upgraded system. As part of the UEP, Wollongong Coal proposed to construct a dry sedimentation basin with a 6 ML capacity to treat runoff water from the pit-top area prior to discharge into Bellambi Creek. Cardno recommended that the proposed sedimentation design be reviewed after adoption of the proposed flood mitigation measures to ensure adequate treatment capacity for dirty runoff water. DPI Water also requested that the water quality impacts downstream of the proposed Bellambi Creek flood mitigation works be further considered during the detailed design of the works.

The Department has reviewed the two Cardno reports and is satisfied that they adequately address previous concerns, and that the proposed flood mitigation works would reduce clean runoff entering the stockpile area, while conveying all site runoff in a controlled way to Bellambi Creek. Council has also confirmed that it is satisfied with the proposed flood mitigation measures.

The Department has recommended a condition requiring the flood mitigation measures proposed by Cardno to be implemented on-site within 12 months of the date of any approval (see condition 11 of Schedule 4). The Department also notes that dirty water discharges from the site are regulated by the EPA under the site's EPL. The Department is satisfied that the existing water performance measure requiring dams to be designed, installed and maintained in accordance with the series *"Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries"* is otherwise sufficient to ensure the treatment of runoff water within the stockpile area prior to discharge.

### 3.9 Traffic

#### **Commission Recommendation 12**

*The proponent should negotiate with Council and Roads & Maritime Services regarding maintenance contributions to mitigate impacts from the increase in truck movements along the haulage route.*

#### **Commission Recommendation 13**

*Consideration should be given to further limiting the hours of truck movements.*

**Commission Recommendation 14**

*Proponent should investigate and cost a number of options to reduce the noise impacts to the most effected residents along Bellambi Lane, particularly those near the intersections with the Princes Highway and the Northern Distributor. Options to be considered by the proponent, should include, but not be limited to:*

- a. construction of a coal truck parking area (for trucks to wait prior to the commencement of haulage hours) within the mine boundary;*
- b. construction of a noise barrier near the intersections of Bellambi Lane/Princes Highway and Bellambi Lane/Northern Distributor; and*
- c. use of pavement modifications along Bellambi Lane, to reduce truck/trailer banging.*

**Commission Recommendation 15**

*No increase in the currently approved maximum rate of extraction should be approved without clear demonstration that facilities can handle the additional volume without unacceptable impacts for local residents.*

**3.9.1 Road Maintenance Contributions**

The existing and proposed haulage route from the pit-top site to PKCT runs along Bellambi Lane to Memorial Drive / M1 Princes Motorway, Masters Road, Springhill Road and Port Kembla Road.

Although Bellambi Lane is a former arterial road (formerly part of the Princes Highway), it was transferred to Council following the construction of the Northern Distributor. Bellambi Lane is now a local road which is managed and maintained by Council.

While the Department concluded in the PAR that a maintenance contribution was not necessary, given the existing high standard of the road surface, which reflects its prior use as an arterial road, and the UEP's relatively short (5 year) project life, it accepts that Wollongong Coal would cause some wear and tear to the road and should therefore contribute towards any future road maintenance costs. Wollongong Coal has advised that it is negotiating with Council in relation to providing an annual maintenance contribution for Bellambi Lane (see Commitment No. 48 at Appendix 3 of **Appendix K**). The Department has included a condition requiring agreement with Council to be reached within 6 months of approval, and referral to the Secretary if agreement cannot be reached.

With regard to the remainder of the fixed haul route to PKCT which follows roads under RMS (rather than Council) control, the Department considers the maintenance of these roads should continue to be funded by State and Commonwealth governments under the usual arrangements. The Department notes that the RMS, in its submission on the PPR dated 28 May 2015, stated that it did not consider that the proposed increase in traffic would have a significant impact on the operation and performance of the main road network and raised no objections in principle to the application.

**3.9.2 Restrictions on Truck Movements**

Under the PWP approval, Wollongong Coal is currently approved to transport coal from the colliery during the following time periods:

- 7 am to 10 pm on weekdays; and
- 8 am to 6 pm on weekends and public holidays.

The Department has recommended a condition requiring these coal transport restrictions to continue to apply to the UEP (see condition 14 of Schedule 4).

Under the UEP, coal trucks from the pit-top site would continue to initially travel along Bellambi Lane before joining Memorial Drive. As discussed in the Department's PAR (p. 50), Bellambi Lane is a four-lane road that has a long history as a coal transport corridor to the Northern Distributor (now Memorial Drive). The nearest residences to the north are in Keerong Avenue as the northern side of the road is a disused rail corridor (which previously serviced the mine). The south side of Bellambi Lane is zoned light industrial land and as such the isolated residences located in this zone do not have noise criteria assigned to them under the Road Noise Policy.

From 1992 until 2009, Bellambi Lane formed part of State Highway 1 (the Princes Highway) with correspondingly high levels of road traffic noise experienced on both the southern side of Bellambi Lane and the rear of residences on Keerong Avenue to the north. Following the extension of the Northern Distributor, there was a considerable reduction in traffic volumes on Bellambi Lane.

The proposal to increase transport of coal from a current level of 1 Mtpa to 3 Mtpa would require an increase in the number of truck movements from 22 to 34 per hour. The Road Noise Policy sets noise criteria for two periods – 7 am to 10 pm and 10 pm to 7 am. Trucking from Russell Vale on Bellambi Lane would only take place during the first of these periods. The proposed increase in trucks during these hours has been estimated to increase the current road traffic noise levels by up to 1.7 dB(A). This is considered negligible, particularly within the historical context of noise levels generated on Bellambi Lane until 2009, which were much higher than future predictions. The Department notes there would be no night-time trucking (apart from the odd over-sized vehicle) and that the project would remain fully in compliance with criteria in the Road Noise Policy.

Once trucks leave Bellambi Lane they travel on high traffic volume roads to PKCT. The impact of increased truck volumes on these roads is insignificant and does not trigger the need for any further consideration of noise.

Given these considerations, the Department does not believe that additional restrictions on truck movements from the colliery are warranted.

### **3.9.3 Additional Noise Mitigation along Bellambi Lane**

The Department confirms that the existing UEP proposes the construction of a coal truck parking area in the northeastern portion of the pit-top area. The precise location of the parking area is shown in Figure 3 of Wollongong Coal's *Part 1 Response* (see **Appendix D**). Wollongong Coal has confirmed that this area is intended to be used for truck parking outside of haulage hours.

Wollongong Coal engaged Wilkinson Murray to undertake an additional noise assessment of the noise control efficacy of constructing a barrier around the site (see Appendix B of **Appendix D**). The assessment concludes that, for the majority of the site, including near the intersection of Bellambi Lane and Princes Highway, a 6 m high acoustic boundary would provide limited and barely discernible reductions in noise.

As discussed above, the increase in traffic noise levels along Bellambi Lane without any noise barriers is predicted to be 1.7 dB(A). The Department agrees with Wollongong Coal's noise consultant that this increase is minor and likely to be barely perceptible. Therefore, the Department does not believe that the construction of a noise barrier at the intersections along Bellambi Lane would provide noise benefits to residents, and may well introduce a visually unattractive element in the streetscape.

Wollongong Coal has confirmed that the majority of the pavement along Bellambi Road has previously been upgraded. As discussed above, Wollongong Coal has committed to negotiating with Council in relation to providing an annual maintenance contribution for Bellambi Lane, which could be used to upgrade the short length of the road which has not been upgraded.

### **3.9.4 Infrastructure Capacity**

In response to the Commission's recommendation, Wollongong Coal engaged Hatch to undertake a *Materials Handling Assessment* for the UEP (see Appendix F of **Appendix D**). The assessment considers the ability of the proposed infrastructure to handle an increase in production from 1 Mtpa to 3 Mtpa. Hatch used an event simulation model which was run on an annual basis over the proposed production period, and considered the capacity of the primary and secondary sizers, stockpiles, conveyors and surge and weight bins. Hatch concludes that:

*"The proposed material handling equipment system capacity has been assessed and we confirm that proposed materials handling infrastructure has the system capacity to handle 3 Mtpa".*

The Department confirms that the air quality, noise and traffic assessments undertaken for the UEP have all modelled an operational scenario with an annual coal production rate of 3 Mtpa. The Department is satisfied that the additional mitigation measures required under the recommended project approval would ensure that the UEP would comply with applicable criteria and standards, despite the proposed increase in coal handling capacity.

## **4.0 RESIDUAL MATTERS**

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### **4.1 Statutory Considerations**

While the provisions of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) do not strictly apply to the UEP (because it is a transitional Part 3A project), consistent with previous practice, the Department has considered the provisions of

the Mining SEPP in its assessment of the merits of the proposal, as summarised under the headings below.

#### **4.1.1 Compatibility with Other Land Uses (Clause 12)**

The Department's assessment has considered the potential impacts of the project on other land uses in the locality, particularly on the catchment of the Cataract Reservoir and on upland swamps. This assessment has been undertaken in consideration of the public benefits of the project and the surrounding land uses, and measures to avoid or minimise any land use incompatibility.

The Department's assessment indicates there would be some minimal residual impacts on a small number of privately-owned residences, but that it is not likely to result in unacceptable impacts to surrounding land uses in general. The Department is satisfied that the residual impacts are able to be minimised, mitigated or compensated for to achieve acceptable environmental and amenity outcomes.

#### **4.1.2 Voluntary Land Acquisition and Mitigation Policy (Clause 12A)**

The Department's assessment has considered the NSW Government's *Voluntary Land Acquisition and Mitigation Policy* (December 2014), and notes that a consent authority cannot grant voluntary mitigation and acquisition rights to reduce operational noise impacts for existing developments with legacy noise issues, such as Russell Vale. Therefore, as discussed in response to Recommendation 7, decisions in relation to acquisition and mitigation have been reached by careful consideration of the feasible and reasonable mitigation measures, the absolute level of noise and existing measures of community impact including complaints.

The EPA and the Department accept that all reasonable and feasible noise mitigation measures have been adopted, and that any additional improvements associated with the operation of the tripper would be investigated and, if considered beneficial, implemented.

#### **4.1.3 Compatibility with Mining, Petroleum and Extractive Industries (Clause 13)**

The Department is satisfied that the project has been designed in a manner that is compatible with, and would not adversely affect, adjacent current or future mining-related activities.

#### **3.1.4 Natural Resource Management and Environmental Management (Clause 14)**

The Department has recommended a number of conditions aimed at ensuring that the project is undertaken in an environmentally responsible manner, including but not limited to conditions in relation to water resources, threatened species and biodiversity, and greenhouse gas emissions. All offsets in relation to swamps have been designed to reflect the draft Swamp Offsets Policy.

#### **4.1.5 Resource Recovery (Clause 15)**

The Department has considered resource recovery in its assessment of the project, and is satisfied that the project can be carried out in an efficient manner. The Department has recommended conditions requiring Wollongong Coal to implement reasonable and feasible measures to minimise waste and maximise the salvage and re-use of resources within the disturbance area (including vegetative and soil resources).

#### **4.1.6 Transport (Clause 16)**

The Department notes that the maximum number of truck movements per hour as a result of the project would increase from 22 (for a production rate of 1 Mtpa) to 34 (for a production rate of 3 Mtpa). The Department has consulted with the applicable roads authorities in relation to the project, and taken these submissions into consideration in its assessment of the project.

The Department notes that the colliery has used the proposed haul route for many years, and that there is no alternative road route to PKCT that would reduce the impact of the road transport of coal on residences. Conditions have been recommended to require Wollongong Coal to implement a traffic management plan to minimise traffic impacts on residential areas along Bellambi Land and implement a code of conduct for its drivers.

#### **4.1.7 Rehabilitation (Clause 17)**

The Department has recommended a number of conditions aimed at ensuring the rehabilitation of land affected by the existing or proposed development at Russell Vale. These include requirements on Wollongong Coal to prepare and implement a Rehabilitation Management Plan, to effectively manage waste, and to meet a number of rehabilitation objectives including ensuring that the mine site as a whole is safe, stable and non-polluting, and to ensure public



#### 4.1.8 Significance of the Resource (Clause 12AA)(Repealed)

Clause 12AA of the Mining SEPP previously required the significance of the resource to be the consent authority's (ie the Commission's) 'principal consideration' under Part 3 of the Mining SEPP. However, this provision was repealed on 2 September 2015.

The Department has considered the draft *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) Amendment (Significance of Resource) 2015*, which effected this repeal, and its explanation of intended effect. The Department is satisfied that the repeal of clause 12AA has no material bearing on the outcomes of the Department's assessment of the project or the conclusions reached regarding its net overall social and economic benefits.

The Department is satisfied that the project is able to be managed in a manner that is generally consistent with the aims, objectives, and provisions of the Mining SEPP, following the repeal of clause 12AA, and that the project is in the public interest.

## 5.0 RECOMMENDED CONDITIONS

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Appropriate revisions have been made to the draft conditions of consent to reflect the Commission's recommendations and the Department's further assessment (see **Appendix L**).

## 6.0 CONCLUSION

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In April 2015, the Commission completed its merit review of the Russell Vale Colliery UEP and concluded that it did not have sufficient information or confidence to determine the merits of the proposal in order to determine it. Consequently, the Commission made 15 recommendations regarding additional work and assessment to be carried out prior to a determination being considered.

The Department has carefully considered the Commission's recommendations. The Department has largely accepted the Commission's recommendations and has accordingly required Wollongong Coal to undertake additional assessment, including the:

- establishment of an IRAP and completion of an IRA;
- implementation of extensive additional technical studies, including re-running the groundwater model;
- proposed expansion of the existing network of piezometers within and around the upland swamps;
- preparation of a revised *Economic Assessment*, including an updated CBA which calculates the benefits of the project using the latest projected coal prices and foreign exchange rates;
- completion of an independent analysis of the economic costs and benefits of the UEP as presented in the revised *Economic Assessment*;
- assessment of the potential noise reductions associated with noise mitigation measures recommended by the EPA and an analysis of the costs of implementing potential noise controls;
- assessment of the predicted PM<sub>2.5</sub> dust emissions associated with the UEP;
- revision of the *Bellambi Creek Flood Study to recommend* a range of mitigation measures to reduce clean runoff entering the stockpile area, while conveying all site runoff in a controlled way to Bellambi Gully Creek;
- preparation of an additional noise assessment to analyse the noise control efficacy of constructing a barrier around the site; and
- preparation of a *Materials Handling Assessment* to assess the ability of the proposed infrastructure to handle an increase in production from 1 Mtpa to 3 Mtpa.

In addition, the Department has amended and strengthened its recommended conditions to require:

- the approach to offsetting for upland swamps to fully reflect the agreed *Policy Framework for Biodiversity Offsets for Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence*, which is expected to be finalised shortly;
- continued investigation and implementation of any additional reasonable and feasible noise and air quality mitigation measures; and
- flood mitigation measures for Bellambi Creek to be implemented on-site within 12 months.

The Department considers the additional assessment addresses the Commission's recommendations and provides greater confidence in the previous predictions made in relation to the impacts of the UEP on swamps, underground and surface waters, and the risks to stored waters in Cataract Reservoir.

With the proposed amendments, the Department considers that its recommended conditions provide a comprehensive, strict, and precautionary approach to ensuring that the project can comply with relevant criteria and standards, and ensure that the predicted residual impacts can be effectively minimised, mitigated and/or compensated for. The Department considers that these conditions reflect current best practice for the regulation of underground mining projects in NSW, and would therefore protect the local environment and the amenity of the local community and promote the orderly development of the region's important natural resources.

The Department also recognises that the project would provide significant economic and social benefits for the Illawarra region and for NSW as a whole. These benefits include the:

- direct employment of 300 people during mining operations;
- direct employment of an additional 100 people during construction;
- indirect employment, estimated to be up to 800 people in the local and regional area;
- \$85 million in capital investment during construction (\$18 million) and operation (\$67 million); and
- \$23 million to the State of NSW in royalties.

The Department has carefully weighed the impacts of the project against its social and economic benefits. On balance, the Department is satisfied that the project's benefits substantially outweigh its residual costs, that it is in the public interest and should be approved, subject to strict conditions of consent.

## 7.0 RECOMMENDATION

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On 23 October 2015, the Minister for Planning requested the Commission to carry out a second review of the project (with public hearings) and to report back within 5 weeks of receiving this report. The Minister's Terms of Reference for the review are attached (see **Appendix K**).

It is therefore **RECOMMENDED** that the Commission, as requested by the Minister for Planning:

- **consider** the findings of this report;
- **consider** the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) Amendment (Significance of Resource) 2015* (Mining SEPP Amendment);
- **hold a public hearing** on matters relating to the Mining SEPP Amendment;
- **consider any submissions** made on matters relating to the Mining SEPP Amendment; and
- **provide a review report** on matters relating to the Mining SEPP Amendment and any residual matters within 5 weeks of receiving this report.



Howard Reed  
**Director**  
**Resource Assessments**

10.11.15



David Kitto  
**Executive Director**  
**Resource Assessments & Business Systems**

## **APPENDIX A: BELLAMBI CREEK FLOOD STUDY**

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## **APPENDIX B: COMMISSION'S MERIT REVIEW REPORT**

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## **APPENDIX C: TERMS OF REFERENCE FOR THE INDEPENDENT RISK ASSESSMENT PANEL**

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## **APPENDIX D: WOLLONONG COAL'S RESPONSE TO THE COMMISSION'S REVIEW REPORT (PART 1)**

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## **APPENDIX E: EPA'S RESPONSE TO WOLLONGONG COAL'S RESPONSE (PART 1)**

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## **APPENDIX F: AGENCY RESPONSES TO WOLLONGONG COAL'S DRAFT IRA AND SUPPORTING TECHNICAL INFORMATION**

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## **APPENDIX G: DSC RESPONSE TO WOLLONGONG COAL**

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## **APPENDIX H: WOLLONGONG COAL'S RESPONSE TO THE COMMISSION'S REVIEW REPORT (PART 2)**

# **APPENDIX I: CIE'S INDEPENDENT ECONOMIC ANALYSIS**

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## **APPENDIX J: FINAL AGENCY COMMENTS ON THE IRA**

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## **APPENDIX K: TERMS OF REFERENCE FOR THE SECOND REVIEW BY THE COMMISSION**

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## **APPENDIX L: DRAFT INSTRUMENT OF APPROVAL**

# Wollongong Coal Limited

## Bellambi Gully Flood Study

NA82014089 – Ver 06



Prepared for  
Wollongong Coal Limited

January 2015



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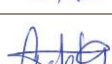

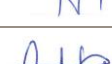

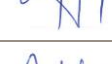
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Appendix G	PROPOSED MITIGATION STRUCTURES

# 1 Introduction

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## 1.1 Background

Wollongong Coal Limited (WCL) has engaged Cardno (NSW/ACT) Pty Ltd to undertake a flood study for Bellambi Gully to determine the existing flood conditions at the Russell Vale Colliery site and recommend potential flood mitigation measures.

A hydrological assessment of the site was previously carried out in 2009 by BECA. The main outcome of the study suggests that stormwater conveyance through the site may be improved through diversion of flows from Bellambi Gully around coal stockpile areas. Maintenance measures were also recommended as methods to improve the conveyance of the existing channel and minimise the likelihood of failure.

This study aims to present alternative mitigation measures for WCL to undertake in order to reduce flooding impacts downstream of the site, particularly those associated with coal stockpile washouts as a result of flooding.

### 1.1.1 Site Description

The Russell Vale Colliery site is located within the Southern Coalfields Region of NSW. The site is approximately 8 km north of Wollongong and 70 km south of Sydney and lies within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region.

The Russell Vale Colliery site is located on the lower slopes and foothills of the Illawarra Escarpment. The vicinity surrounding the site to the north, south and east is mainly comprised of residential properties of Russell Vale, Bellambi and Corrimal respectively. The Russell Vale golf course is situated to the north of the site. The west and east of the site is directly bounded by the Woronora Plateau and Princes Highway respectively.

The site study area includes the Illawarra Escarpment and extends towards the Bellambi Creek approximately 250m west of the Princes Highway.

### 1.1.2 Bellambi Gully

The total Bellambi Gully catchment area is 427 ha and the total creek length is 4.3km. Runoff originating from the Illawarra Escarpment flows down the heavily vegetated steep slopes of the escarpment to the Russell Vale Colliery site at the foothills, where it enters the Bellambi Gully watercourse. Some reaches of the watercourse are conveyed by pipes and constructed channels within the site.

The main Bellambi Gully watercourse within the site connects to an 1800 mm diameter clean-water pipeline (approx. 660 m in length) before discharging into Bellambi Creek. Another 600 mm diameter pipe collects a fraction of the upstream stormwater runoff and also connects to the 1800 mm diameter clean-water pipeline. The site stormwater captured by the pipe bypasses the main stockpile area, and discharges to the licensed discharge point (LDP2) into Bellambi Creek approximately 250 m to the west of the Princes Highway.

Bellambi Creek flows underneath the Princes Highway via a 2.4 m W x 1.5 m H box culvert. Flows are conveyed via a number of culvert structures under roads and rail ultimately discharging at Bellambi Beach. The length of the creek from the colliery discharge point to the ocean outfall is approximately 3 km.

## **1.2 Scope of Work**

The scope of work consists of the following:

- > Review existing flood studies relevant to the catchment;
- > Compile and review topographic survey and ALS information of the study area and develop a Digital Terrain Model (DTM);
- > Identify sub-catchments and peak flows derived in previous flood studies (5, 10 and 100 year ARI from BECA 2009);
- > Develop a 1D flood model (configure parameters, baseline conditions and incorporate existing culvert structures) and simulate to establish existing conditions;
- > Identify key areas to be addressed based on flood modelling results;
- > Identify opportunities for flood mitigation such as vegetation management, channel / culvert upgrades etc. with consideration of site constraints; and
- > Incorporate alternative flood mitigation measures and quantify improvements to flooding/ conveyance.

## 2 Available Data

---

### 2.1 Previous Studies

#### 2.1.1 Combined Catchments of Whartons, Collins and Farrahars Creeks, Bellambi Gully and Bellambi Lake Flood Study (Lyall & Associates Consulting Water Engineers, 2011)

The flood study combines the Whartons, Collins and Farrahars Creeks catchment area along with the Bellambi Gully and Bellambi Lake catchments. The flood study is referred to as the Combined FS in this report.

The study was undertaken to assess and define the flood behaviour within the study area under current conditions. The information obtained from the assessment forms the basis of the Floodplain Risk Management Plan for the study area.

The flood behaviour was assessed using hydrological and hydraulic computer modelling. Sensitivity analyses were also carried out to verify the parameters adopted and assumptions made in the development of the hydraulic model. The flood information obtained from the analysis was presented in terms of flows, levels and velocities ranges between the 5 to 500 year Average Recurrence Interval (ARI) storm events including the Probable Maximum Flood (PMF).

#### 2.1.2 Water Management Report No.1 Colliery Russell Vale (BECA, 2010)

A Water Management Report for the operation of Wollongong Coal Limited (previously known as Gujarat NRE), No.1 Colliery at Russell Vale was prepared by BECA in 2010. The information presented in the report includes the current and future water management at the Russell Vale and Shaft No. 4 sites, water balance for the Russell Vale site, the collection and treatment of mine water and dirty storm water, the quantity and quality of water discharged to Bellambi Gully as well as the impacts in terms of water quality discharged to Bellambi Gully.

The report recommends further investigation of water treatment and reuse on site, including the management of solids from the water treatment plant site and also recommends improving the stormwater conveyance across the site to reduce the risk of failure to the current system.

#### 2.1.3 Gujarat NRE Stormwater Hydrology Review (BECA, 2009)

A hydrological investigation of the clean stormwater system at the Russell Vale mine site was undertaken by BECA. The stormwater system on site was deemed inadequate following the 1998 flood event which resulted in large quantities of runoff diverting through the existing coal stockpile originating from the steep escarpment slopes.

The objective of the assessment was to review the existing stormwater system, identify inefficiencies in the system and propose measures and potential upgrades to the current system to reduce the likelihood of future failures.

The proposed measures include the maintenance and upgrade of existing diversion channels and flowpaths, the construction of open channels and diversion drains around the proposed stockpile area, and the maintenance and implementation of scour protection devices in areas susceptible to erosion. Some of the recommended measures suggested have since been undertaken on site.

The hydrological investigation report produced from this assessment was included in the appendix of the Water Management Report (BECA, 2010).

## **2.2 Survey**

### **2.2.1 Detailed Site Survey**

A detailed site survey was undertaken in 2010 by Wollongong Coal Limited (WCL) and provided in **Appendix A**. The survey includes the escarpment to the west and extends towards Princes Highway to the east of the WCL Russell Vale Colliery site.

### **2.2.2 Aerial Laser Survey (ALS) Data**

The ALS data tile W3066194 collected by AAM between May 2005 and October 2006 was used to define catchment boundaries and to represent the existing surface beyond the extent of the detailed site survey.

An updated laser survey of the site, collected in May 2014 was used to better define the current site topography specifically through the stockpile area. This survey was used to model the existing site conditions in the hydraulic analysis.

## 3 Hydrological Data

### 3.1 Sub-Catchment Topology

Sub-catchments delineated from the previous study by BECA (2009) were based on the proposed scenario catchments (**Appendix A**). As such, peak flows derived from the previous study were re-assessed and delineated based on the detailed site survey and ALS data to represent the existing conditions on site. Stormwater runoff from the north western sub-catchments discharges towards the north while the remaining sub-catchments discharge towards the stormwater systems. The stormwater systems are separated into the dirty water (DW) and clean water (CW) systems.

The two stormwater systems are as follows:

1. DW – runoff primarily from the stockpile area and along the conveyor portal are directed to the dirty water stormwater system to be treated before discharging into Bellambi Creek.
2. CW – runoff through the southern extent of the site flows through the natural Bellambi Gully watercourse before connecting to the 1800 mm diameter main stormwater pipeline. Runoff generated through the centre and along the northern access road falls towards the stockpile area where it enters a 600 mm diameter pipe. The pipe then connects to the 1800mm diameter main stormwater pipeline. The main stormwater pipeline is 660 m long and conveys the upstream runoff towards the Bellambi Creek licensed discharge point (LDP2), approximately 250 m upstream of Princes Highway.

### 3.2 Design Storms

Peak flows presented in the BECA report were used as a basis for this assessment (review of these flows is beyond the scope of this assessment). Peak flows of the upstream catchments entering the multiple discharge points downstream were determined, and are presented in **Table 3-1**.

**Table 3-1 Peak Flows**

Catchments (BECA)	Area (ha)	Discharge Location	Adopted Peak Flows (m <sup>3</sup> /s)		
			5 year ARI	10 year ARI	100 year ARI
U1	10.69	CW	2.83	3.58	6.39
U2	9.76	CW	2.5	3.13	5.66
U3	8.63	North	2.21	2.77	5
U4	0.5	North	0.226	0.274	0.459
U5	0.4	North	0.189	0.237	0.367
M1	6.12	DW & CW	1.89	2.28	3.92
M2	1.28	North	0.528	0.625	0.995
M3	3.31	CW	0.734	0.923	1.73
M4	0.43	CW	0.149	0.181	0.3
M5	3.34	CW	0.874	1.1	1.98
M6	1.36	CW	0.368	0.47	0.818
M7	1.73	DW	0.654	0.778	1.29
M8	1.78	CW	0.473	0.615	1.09
L1	4.84	CW	0.738	0.951	1.94
L2	12.07	DW	2.84	3.52	6.51



## 4 Hydraulic Analysis

### 4.1 Selection of Hydraulic Model

#### 4.1.1 Model Parameters

A HECRAS 1D steady-state hydraulic model was developed for the site, using ALS data and detailed site survey. Runoff generated from the site is conveyed beneath the stockpile area before discharging into Bellambi Creek. As such, the upstream model boundary was established within the stockpile area and extends towards the Bellambi Creek discharge. A plan view of the model is presented in **Appendix B**.

The Manning's *n* roughness values along the channel were adopted from the Combined FS report (Lyll & Associates, 2011) and are presented in **Table 4-1**.

**Table 4-1 Manning's 'n' Roughness Values**

Surface Type (Combine FS)	Surface Type (Cardno)	Manning's 'n' Value
Asphalt, river bed or pillowcrete	Roads, stockpile area, creek bed	0.02
Grass or lawns	Grassed areas	0.045
Dense vegetation	Dense vegetated areas	0.135

Building structures within the modelling extents were represented as obstructions. Tailwater levels were adopted from the Collins Creek Flood Study (Lyll & Associates, 2011) and taken immediately downstream of the discharge location within Bellambi Creek. Tailwater levels for the modelled storm events are presented in **Table 4-2**.

**Table 4-2 Downstream Tailwater Levels (Bellambi Creek Discharge)**

Storm Event	Tailwater Levels
5 year ARI	30 m AHD
10 year ARI	30 m AHD
100 year ARI	30 m AHD

#### 4.1.2 Modelling Approach

Three main pipes located within the stockpile area were identified to receive the DW and CW flows from the upslope catchments. **Table 4-3** presents the pipe capacities, the total flows and the corresponding contributing catchments for the DW and CW pipes in the 5, 10 and 100 year ARI storm events.

The full capacities for the pipes (no blockage assumed) were determined using the Manning's Equation. Flows in excess of the pipe's capacity were modelled as overland flows at the pipe inlets in the 1d hydraulic model.

The 450 mm DW pipe underneath the stockpile area was formerly designed to receive the first flush flow from catchment M1 as well as stormwater flows from catchments L1 and L2. However, based on the information presented in the report by BECA (2009), the maximum flow rate of the DW first flush pipe in catchment M1 is 0.02 m<sup>3</sup>/s, which is lower than the 5 year ARI catchment flows. Hence, it was assumed that all the designed flows from M1 bypasses the first flush system and are completely captured by the CW system.

The report also states that flows from catchment M7 should be considered "dirty". Based on the topographical data, it has been confirmed that flows from M7 are currently directed to the 450 mm DW pipe.

Flows from catchments M5, M6 and M8 as well as flows within the north extent of catchments M1 and M3 are directed towards the 600mm CW pipe. The main 1800 mm CW pipe receives flows from the 600 mm CW pipe as well as catchments M4, U1, U2 and the remaining flows within the south extents of catchments M1 and M3.

**Table 4-3 Steady State Flows**

Pipe Type	Contributing Catchments	Pipe Capacity (m <sup>3</sup> /s)	Peak Flow Rate (m <sup>3</sup> /s)		
			5 year ARI	10 year ARI	100 year ARI
450 mm DW	M7, L1 and L2.	0.817	4.23	5.25	9.74
600 mm CW	North of M1 and M3. M5, M6 and M8.	1.63	3.03	3.79	6.71
1800 mm CW	M1, M3, M4, M5, M6, M8, U1 and U2.	24.9	9.82	12.28	21.89

Based on the values presented in **Table 4-3**, it can be seen that the 450 mm DW and 600 mm CW pipes do not have sufficient capacity to convey flows exceeding and including the 5 year ARI event. Runoff is generated from the excess flows, causing coal stockpile washout in all modelled scenarios (see **Section 4.1.3** for details of scenarios).

However, the 1800 mm CW pipe has adequate capacity to receive the upstream catchment flows including flows from the 600 mm CW pipe.

#### 4.1.3 Model Scenarios

The model was established based on the three scenarios presented in **Table 4-4**.

**Table 4-4 Model Scenarios**

Scenario	Details
1	This model is based on the event where the stormwater systems are completely blocked, i.e. catchment flows are entirely conveyed as overland flows.
2	A conservative model is established as the second scenario where a 20% blockage was applied to the receiving stormwater pipes (i.e. CW and DW systems within the stockpile area). Flows exceeding the capacity of the pipes were modelled as overland flows.
3	The third modelled scenario is based on the event where the stormwater systems are fully functional i.e. CW and DW pipes are flowing full. Flows exceeding the capacity of the pipes were modelled as overland flows.

## 4.2 Modelling Results

Results generated indicate that flooding within the site is significant, and is mainly contained within the stockpile area in all modelled scenarios. Flooding within the site remains significant in the third modelled scenario (i.e. unblocked) although the majority of flows are captured within the stormwater pipes.

Runoff from the stockpile area overtops the access road near the settling ponds and continues as sheet flow downstream towards Bellambi Lane in all modelled scenarios. Overtopping flows conveyed along Bellambi Lane have the potential to convey coal stockpile washouts downstream. Flood modelling results are included in **Appendix B** while the flood extents maps for the modelled scenarios are presented in **Appendix C.p**

## 5 Flood Mitigation

### 5.1 Proposed Flood Mitigation Measures

Based on the flood assessment results and information gathered from the site inspection, flooding caused by site runoff can be alleviated by optimising the existing structures in addition to implementing upgrades on site.

The key flooding issues identified and the corresponding proposed mitigation measures are presented as follows. The locations of the proposed mitigations are presented in **Appendix D** (refer numbers 1-5).

#### 1. Raise stockpile area access road, install new culvert and formalize open channel

The location where the overflow occurs should be upgraded to prevent coal washout downstream. Flooding can be contained within the site by raising the stockpile area access road and installing a culvert. The access road should be constructed with a low point (sag) to allow for overtopping of flows in excess of the culvert capacity. The culvert would connect to the proposed grass-lined swale on the east side of the stockpile area access road before discharging into Bellambi Creek.

#### 2. Debris control structures at the 1800mm pipe inlet and the M3 Culvert

The probability of blockage of the 1800 mm pipe, and the M3 culvert (near the conveyor) can be reduced by implementing a Debris Control Structure (DCS) at the respective inlets. Additionally, rehabilitation and opening up of the M3 culvert will further reduce the probability of blockage of the M3 culvert. This would increase the efficiency of the stormwater systems and reduce occurrence of overflows from the natural Bellambi Gully watercourse into the stockpile area.

The efficiency of the DCS's can be improved by inclusion of a Debris Control Management Procedure (DCMP) in the existing Surface Water Management Plan. The DCMP would include measures to ensure the DCS is maintained regularly with additional maintenance both before predicted storms and after storm events.

#### 3. Formalisation of the 600 mm clean stormwater

The existing 600 mm clean stormwater pipe has a capacity of 1.6 m<sup>3</sup>/s (6% slope), which is not sufficient to convey the 100 year ARI catchment runoff (6.7 m<sup>3</sup>/s). However, the operation of the pipe inlet can be improved by formalising the swale in the vicinity of the inlet. The swale functions to capture the clean water (CW) flows from the upslope catchments (M5, M6, M8 and north of M1 and M3) and convey it towards the CW pipeline system. Formalisation of the swale will provide sufficient capacity to capture the CW flows and ensure CW does not overtop into the stockpile area.

A Manning's calculation confirms that upgrading to an 825 mm diameter pipe would convey flows up to the 100 year ARI storm, between the pipe inlet and the 1800 mm pipe. This can be considered as an additional measure, and would likely present challenges in implementation due to the coal stockpiles and existing structures.

#### 4. Maintenance to existing structures

It was observed in the site inspection that the existing debris control screens (trash racks) were fully blocked with rocks and boulders conveyed from the upstream creek banks.

Appropriate maintenance should be carried out immediately upstream and downstream of the existing debris control structures within the Bellambi Gully to avoid any blockage of the system. Blockage of these upstream culverts tends to lead to uncontrolled surface flows into the stockpile area.

## 5. Upgrade through roads

To decrease the amount of clean stormwater runoff entering the stockpile area, culverts may be installed across the access road along the northern boundary of the site to direct flows from the catchment M8 directly towards Bellambi Creek.

This option is considered as an alternative and can decrease runoff conveyed towards the existing 600 mm CW pipe, which has a limited capacity (as discussed in Option 3).

## 5.2 Discussion

It was proposed in the Stormwater Hydrology Review report (BECA, 2009) that the clean water system be diverted around the stockpile area through a proposed diversion channel. Implementation would require that diversion drains, land grading, bunds and road crests be constructed within the steep batters and access roads within the upstream catchments to ensure that all clean water flows be directed towards the proposed diversion channel. Reno mattresses and drop structures using gabion basket within catchments M1, M3, M5 and M6 were also proposed to improve the efficiency of the stormwater conveyance through the site. Implementation of the proposed measures would require annual inspections and ongoing maintenance to the existing and proposed structures. Geotechnical assessment would be required to determine the stability of the proposed channel realignment area prior to any detailed design works. Given the significant capital and maintenance costs associated with this approach, the potential for alternative approaches have been explored in this report.

Based on the assessments undertaken, it was demonstrated that the existing stormwater system is adequate for managing flows on site (except the capacity of the 600 mm CW pipe); on the condition that maintenance is undertaken regularly. The alternative measures explored in this report were focused on providing more effective structures through optimising the existing stormwater systems on site. Flood modelling was undertaken to confirm the validity of the alternative measures proposed and are discussed in **Section 5.3**. Factors to be considered when implementing the measures are discussed in the following sections.

### 5.2.1 Blockage

Mitigation Option 2 proposes the design and construction of debris control structures at the M3 culvert (near the conveyor) and the 1800 mm diameter culvert. According to Council's blockage policy, both culverts should be considered blocked for the 100 year ARI flood event. The implication of assuming these culverts as blocked is that clean water would be diverted from the existing watercourse, down the conveyor portal and through the coal stockpile before being discharged into Bellambi Creek (see **Table 4-3** for culvert capacity and 100 year ARI flows from contributing catchments). However, if the inlets are rehabilitated and an additional DCS constructed and maintained as part of a DCMP, it is considered likely that the culverts will remain relatively free of debris. As such, clean-water flows would avoid the coal stockpile area, reducing the potential for pollution of the downstream watercourse.

### 5.2.2 Water Quality

Water quality requirements are beyond the scope of this report. Notwithstanding, given the importance of runoff water quality leaving the site (and that water quality issues are somewhat connected to flooding issues in this case), this section has been compiled to provide a preliminary discussion of the potential water quality implications resulting from the proposed flood mitigation methodology.

A 6ML dry sediment basin near the proximity of the stockpile access road as proposed in Appendix C (Stormwater Hydrology Review) of the Water Management Report (BECA, 2010) is currently being assessed by Wollongong Coal Limited. The Stormwater Hydrology Review (BECA, 2009) advises that all existing and proposed dirty water from the site up to the 10 year ARI event should be directed into the dry sediment basin for treatment before discharging through the licensed discharge point (LDPs) at Bellambi Creek.

It is noted that some site discharge will still flow through the coal stockpiles even in the 20% blockage scenario. Based on the previous submission, the sizing and assessment of this basin has been based on hydrographs for the entire stockpile area and the requirement to contain all storms up to and including a 10 year ARI event. However, further investigations will be required to confirm that the basin size

will be adequate to treat excess flows not captured by the 20% blocked dirty and clean stormwater pipes within the stockpile area.

### **5.2.3 Earthworks**

The embankment upstream of the proposed culvert should be excavated to allow unrestricted conveyance towards the structure. Additionally, the embankment downstream of the culvert will have to be excavated for the construction of the swale. Further modelling and surface design should be undertaken in subsequent design phases. We also recommend detailed survey of the current site be undertaken prior to any design works.

## **5.3 Hydraulic Modelling of the Proposed Scenario**

Flood modelling was undertaken to confirm the validity of the alternative measures proposed. The proposed culvert and grass lined swale discussed for mitigation Option 1 (refer **Section 5.1**) was modelled using a HEC-RAS steady state hydraulic model, incorporating 100 year ARI flows provided in the BECA Stormwater Hydrology Review report (BECA, 2009).

Existing structures were modelled as per Council's DCP (2009). 25% blockage was applied to the proposed 6m span Reinforced Concrete Box Culvert (RCBC), while 100% blockage was applied to all culverts upstream. The proposed culvert would consist of (1x) 6000W x 1200H RCBC. The proposed access road slopes 3% towards the proposed low point, which is approximately 16 m west of Bellambi Lane. The proposed swale has been adequately sized to convey the 100 year ARI flow towards Bellambi Creek in the event where the upstream structures are fully blocked.

### **5.3.1 Modelling Results**

Results indicate that the 100 year ARI flows overtop the culvert and flow across the access road at the low point before discharging into the proposed swale downstream. This demonstrates that the proposed upgrades are effective in eliminating flooding on Bellambi Lane. However, it should be noted that although the model represents the worst case scenario for the site (i.e. assuming existing structures upstream are fully blocked), the suggested measures to maintain and upgrade the existing structures should nonetheless be carried out for optimum operations of the stormwater system.

The flood extents map is presented in **Appendix F** and a typical cross section detail of the proposed RCBC and swale is presented in **Appendix G**.

## 6 Conclusions

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The following can be concluded from the Bellambi Gully flood assessment:

1. Runoff generated within the site is currently conveyed under the stockpile area before discharging into Bellambi Creek.
2. Three scenarios were modelled to assess flooding throughout the site. The models represent events where the stormwater pipes are completely blocked, 20% blocked and fully operational.
3. Results indicate that flooding within the site is significant in all modelled scenarios; however overland flows are mainly contained within the stockpile area in all modelled storm events.
4. Modelling results indicate that overland flows currently overtop the access road and continue as sheet flow downstream towards Bellambi Lane in all modelled scenarios.
5. The proposed mitigation measures are aimed to reduce clean runoff entering the stockpile area, while conveying all site runoff in a controlled way to Bellambi Creek.
6. Mitigation measures suggested for the site are as follows:
  - Upgrading the stockpile area access road and installing a 6m span culvert to convey the site runoff across the access road, into a proposed grass-lined swale before discharging into Bellambi Creek.
  - Implementing a debris control structure at the 1800 mm diameter pipe and M3 culvert opening to reduce probability of blockage within the system due to debris from upstream catchment.
  - Formalising the swale in the vicinity of the existing 600 mm clean water inlet. This would provide increased temporary storage for stormwater which helps to manage peak flows from the upstream catchment and to ensure all the clean water runoff is captured before entering the stockpile area.
  - Upgrading the existing 600 mm diameter clean water pipe to an 825 mm diameter pipe should be considered although the other proposed mitigation measures does not rely on this upgrade (and was not modelled in the proposed scenario model).
  - Appropriate maintenance should be carried out immediately upstream and downstream of the existing debris control structures within the Bellambi Gully to minimise the potential for blockage of the system.
  - Culverts may be installed across the access road along the northern boundary of the site to direct flows from catchment M8 directly towards Bellambi Creek, in order to reduce clean water runoff conveyed into the stockpile area.
7. Flood mitigation measures presented in this report may provide an alternative to the measures presented in the Stormwater Hydrology Review (BECA, 2009), with the exception of water quality measures (e.g. sediment basin) which have not been considered in this report.
8. Further investigations should be undertaken to confirm that the dry sediment basin proposed in the Stormwater Hydrology Review (BECA, 2009) will be adequate to treat excess flows not captured by the 20% blocked dirty and clean stormwater pipes within the stockpile area before discharging into Bellambi Creek (design of treatment measures to achieve this is beyond the scope of this report).
9. 25% blockage was applied to the proposed 6 m RCBC, while 100% blockage was applied to all culverts upstream as per Council's blockage policy in the DCP (2009). The results demonstrate that the proposed road upgrade, 6m culvert and swale are adequate to convey the 100 year ARI flows.
10. Although the solution has been designed for a worst case scenario where existing structures upstream are fully blocked, the suggested measures should nonetheless be carried out to maintain and upgrade the existing structures for optimum operations on site.

11. Designs presented in this report are preliminary only. Detailed survey of the current site is required prior to any subsequent design works.

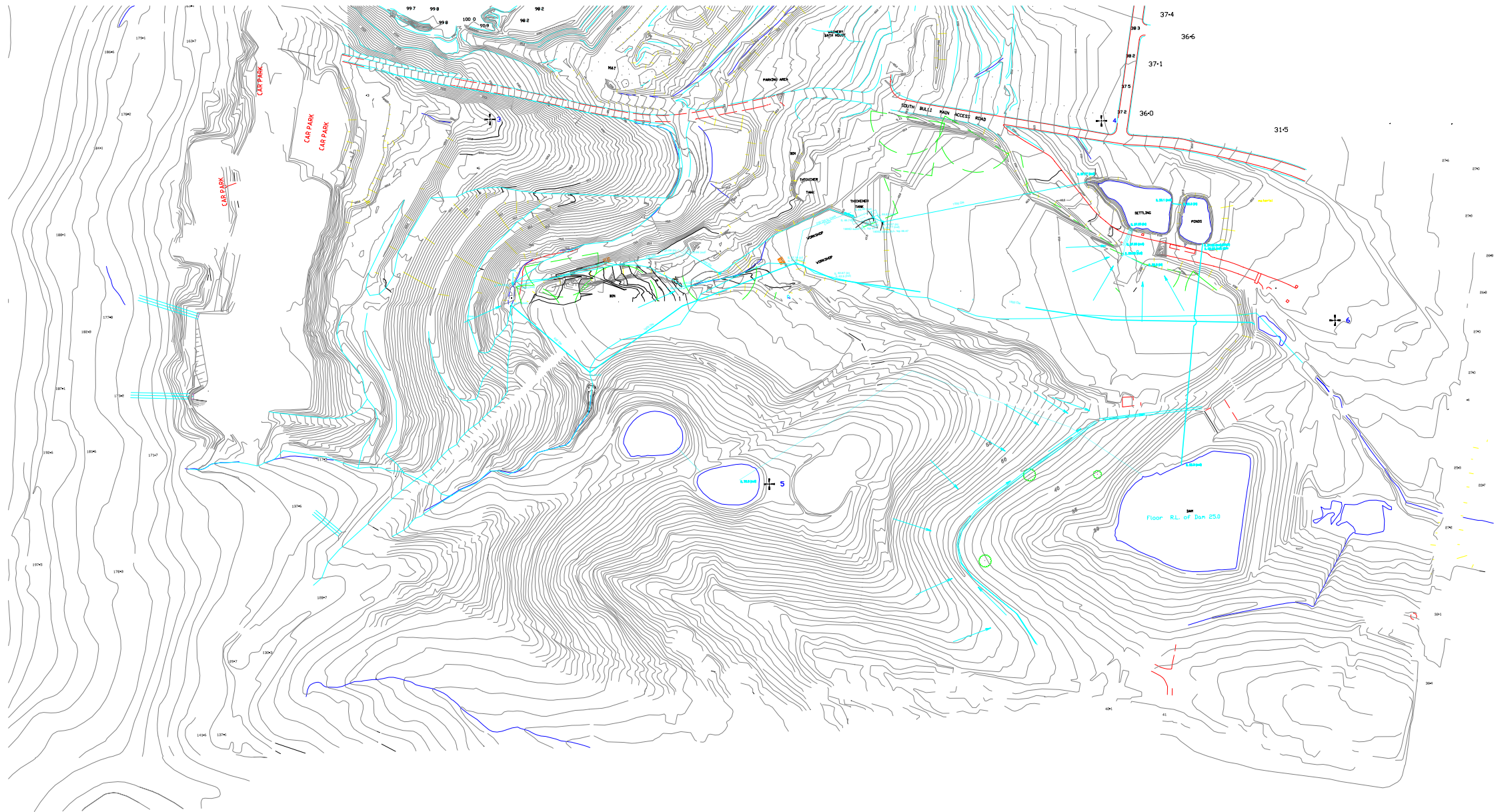


Bellambi Gully Flood Study

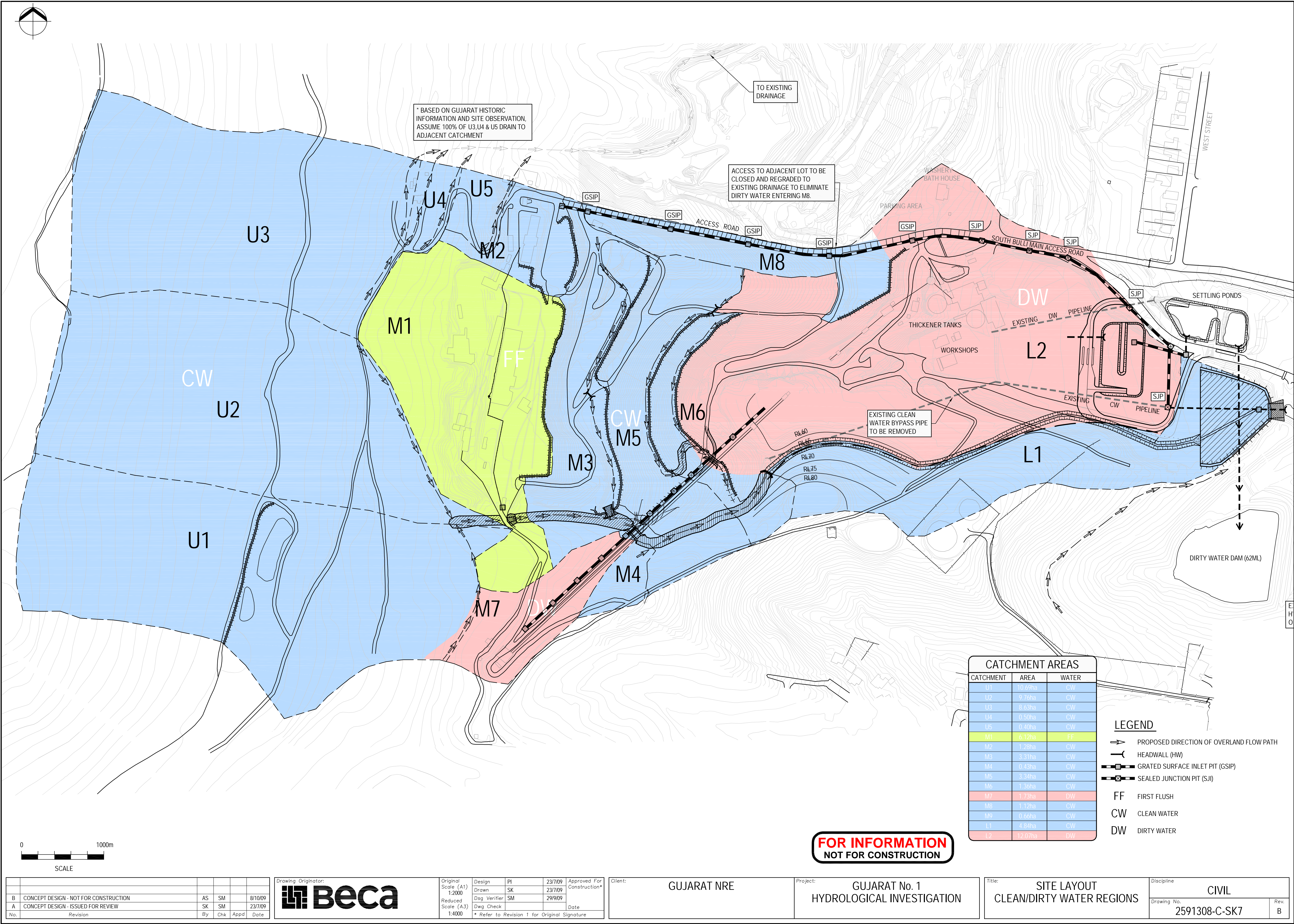
# APPENDIX A

## AVAILABLE INFORMATION

## Site Survey







CATCHMENT AREAS		
CATCHMENT	AREA	WATER
U1	10.69ha	CW
U2	9.76ha	CW
U3	8.63ha	CW
U4	0.50ha	CW
U5	0.40ha	CW
M1	6.12ha	FF
M2	1.28ha	CW
M3	3.31ha	CW
M4	0.43ha	CW
M5	3.34ha	CW
M6	1.36ha	CW
M7	1.73ha	DW
M8	1.12ha	CW
M9	0.66ha	CW
L1	4.84ha	CW
L2	12.07ha	DW

- LEGEND**
- PROPOSED DIRECTION OF OVERLAND FLOW PATH
  - ⊥ HEADWALL (HW)
  - ⊥ GRATED SURFACE INLET PIT (GSIP)
  - ⊥ SEALED JUNCTION PIT (SJP)
  - FF FIRST FLUSH
  - CW CLEAN WATER
  - DW DIRTY WATER

**FOR INFORMATION**  
**NOT FOR CONSTRUCTION**

B	CONCEPT DESIGN - NOT FOR CONSTRUCTION	AS	SM	8/10/09	
A	CONCEPT DESIGN - ISSUED FOR REVIEW	SK	SM	23/7/09	
No.	Revision	By	Chk	Appd	Date

Drawing Originator:  
**Beca**

Original Scale (A1)	Design	PI	23/7/09	Approved For Construction*
1:2000	Drawn	SK	23/7/09	
Reduced Scale (A3)	Dsg. Verifier	SM	29/9/09	Date
1:4000	Dwg Check			
* Refer to Revision 1 for Original Signature				

Client: GUJARAT NRE

Project: GUJARAT No. 1  
HYDROLOGICAL INVESTIGATION

Title: SITE LAYOUT  
CLEAN/DIRTY WATER REGIONS

Discipline	CIVIL
Drawing No.	2591308-C-SK7
Rev.	B



# APPENDIX B

## EXISTING HYDRAULIC FLOOD MODEL

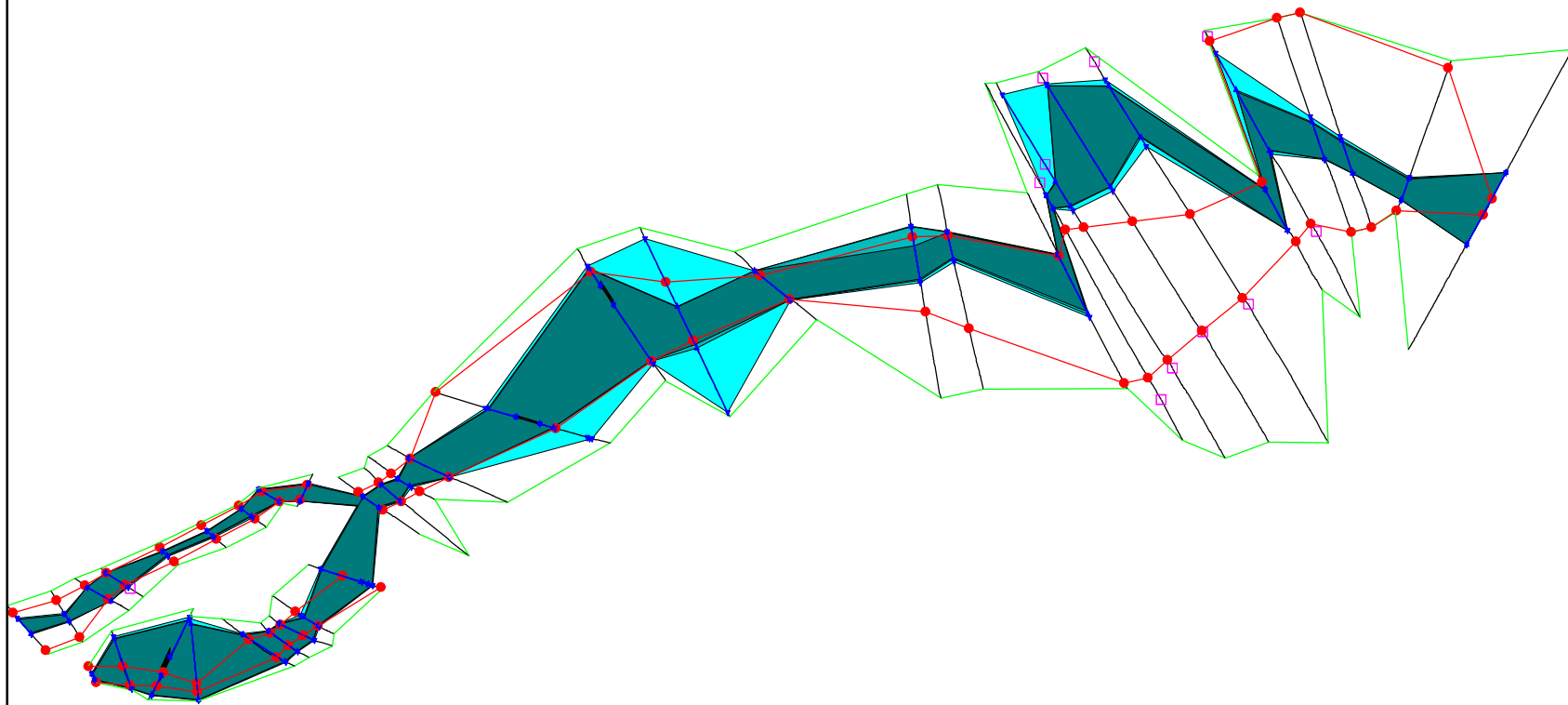
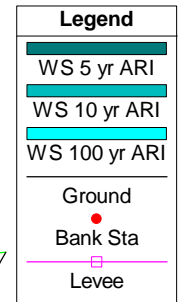
HECRAS Model View



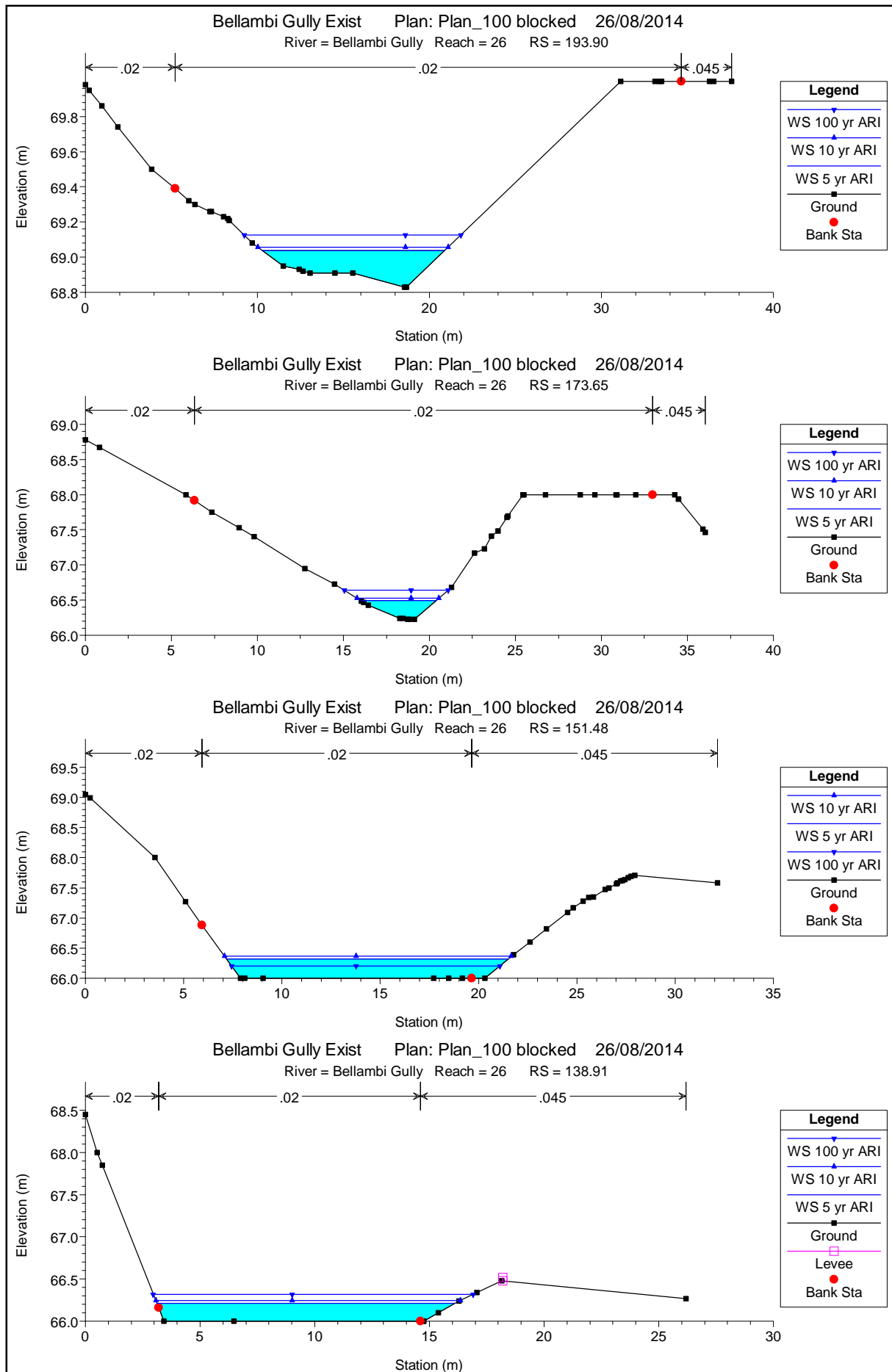


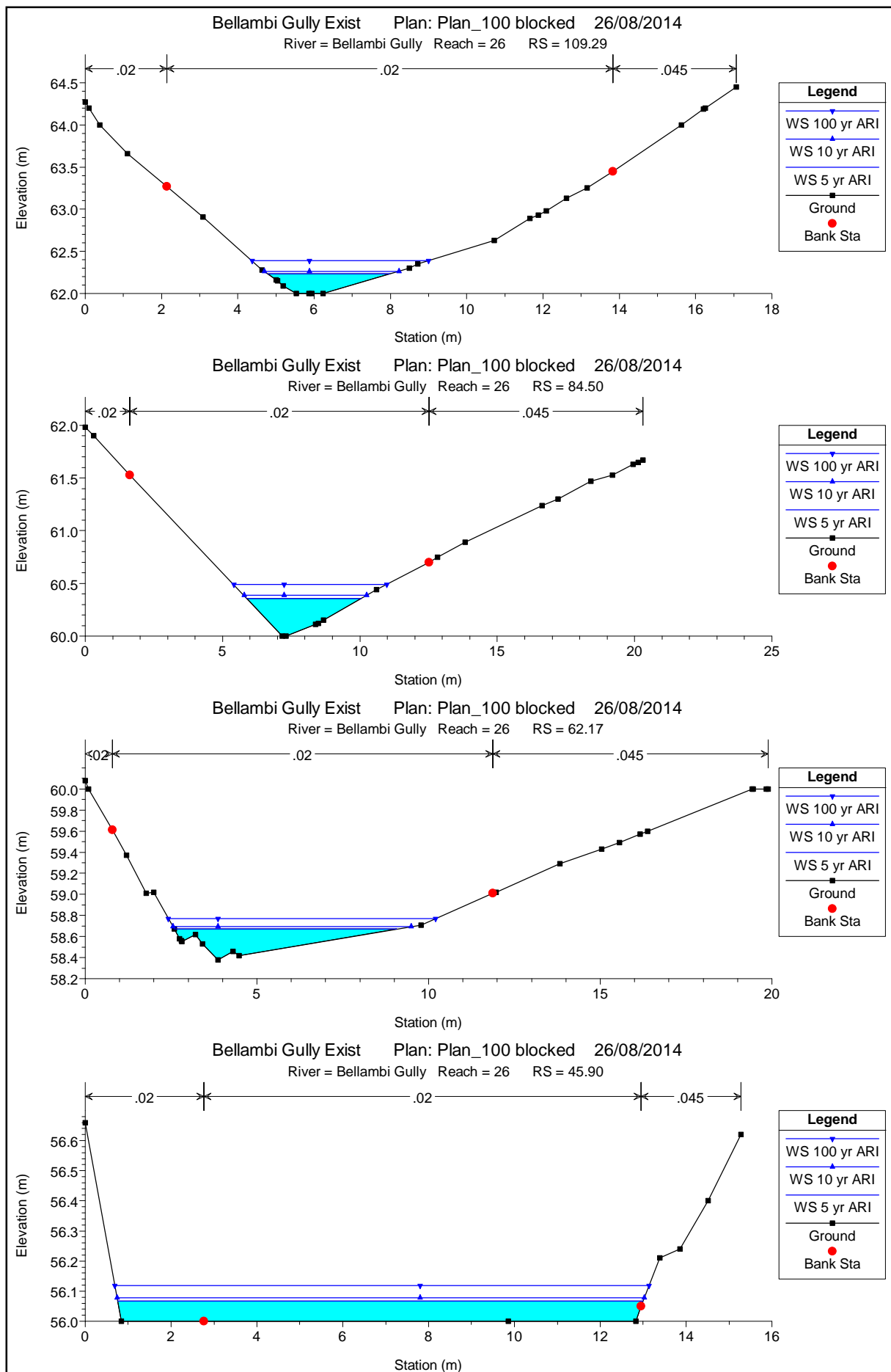
# Plan View Scenario 1

Bellambi Gully Exist    Plan: Plan\_100 blocked    26/08/2014

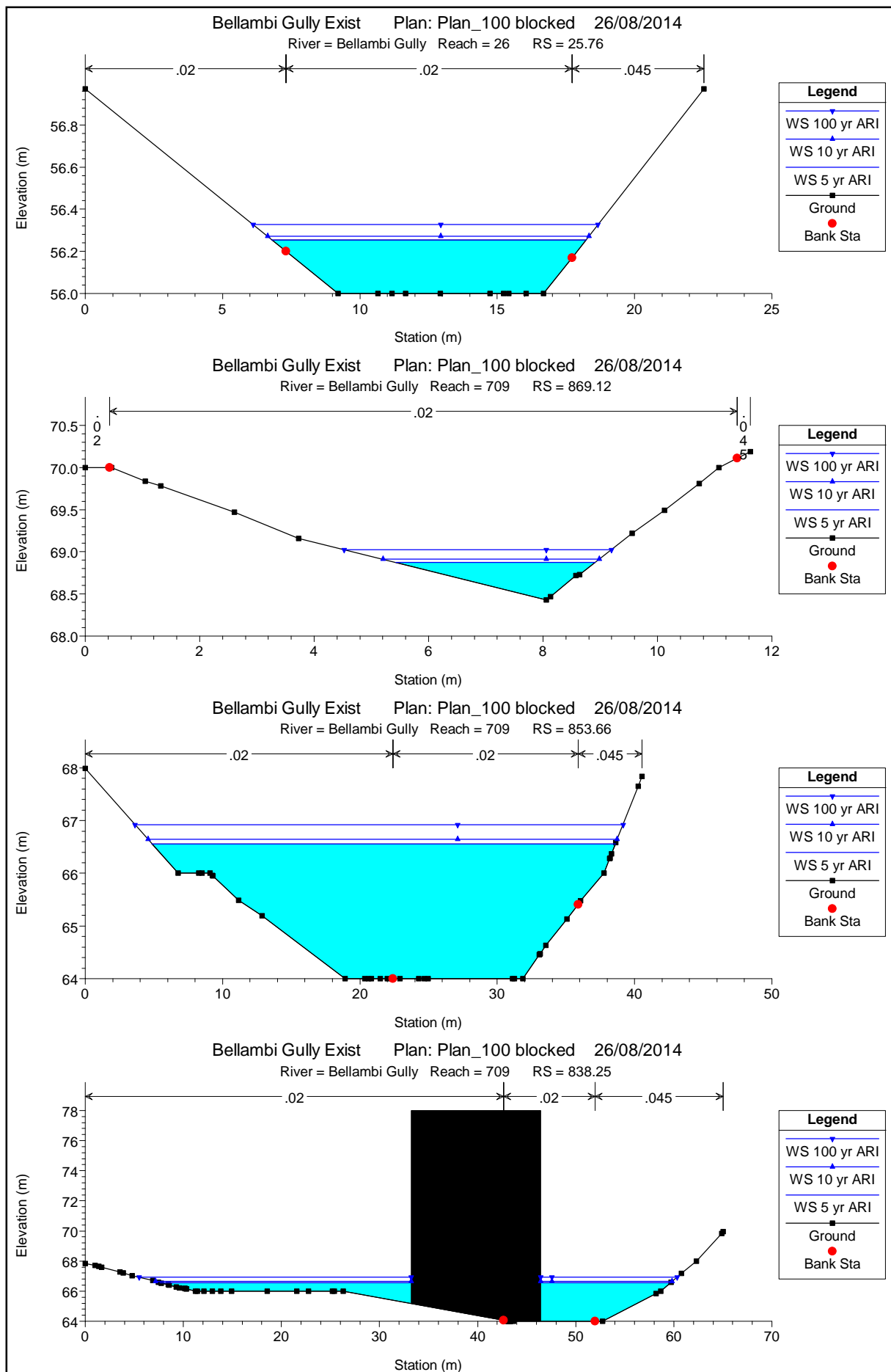


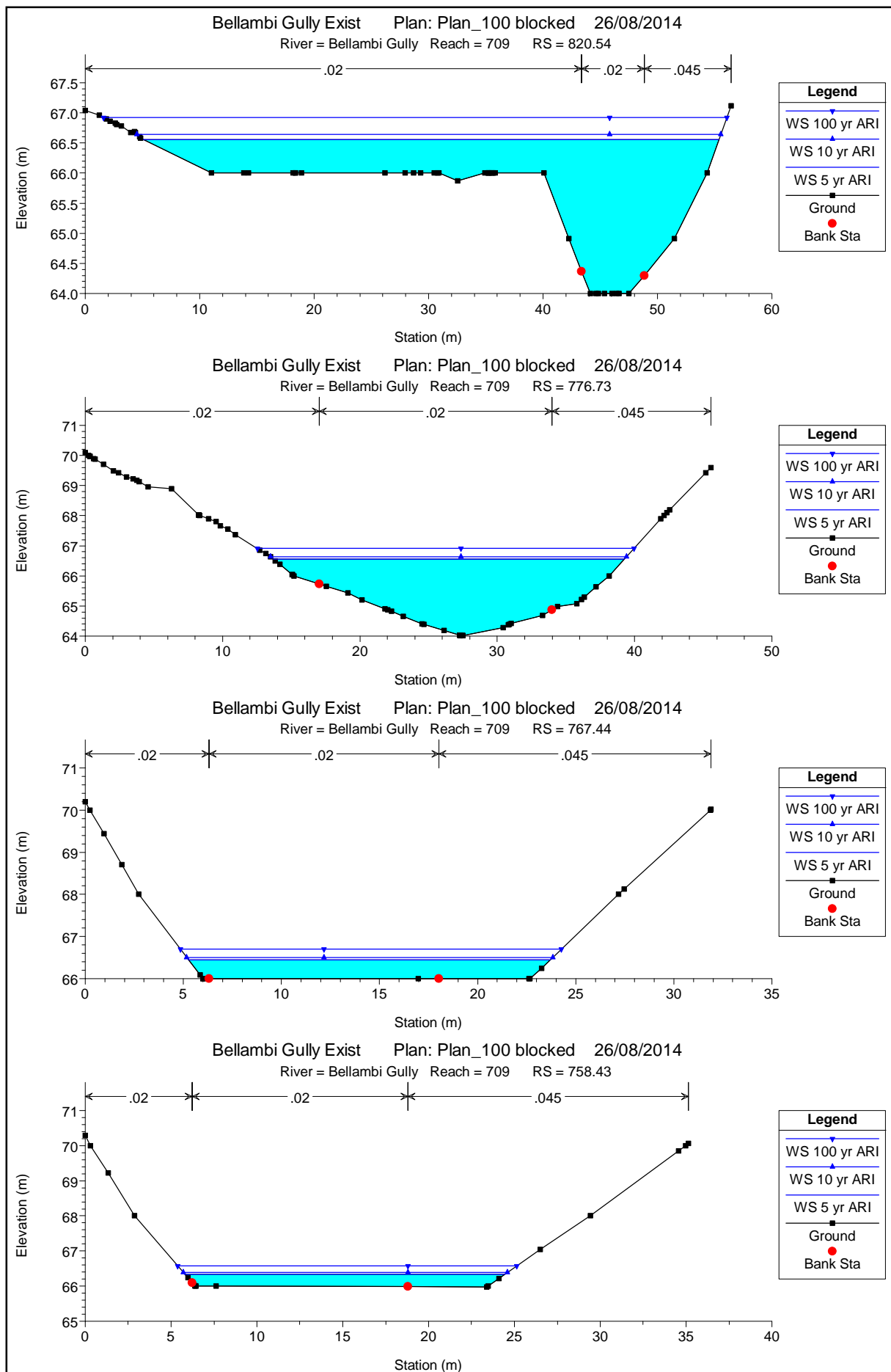
## Cross Sections

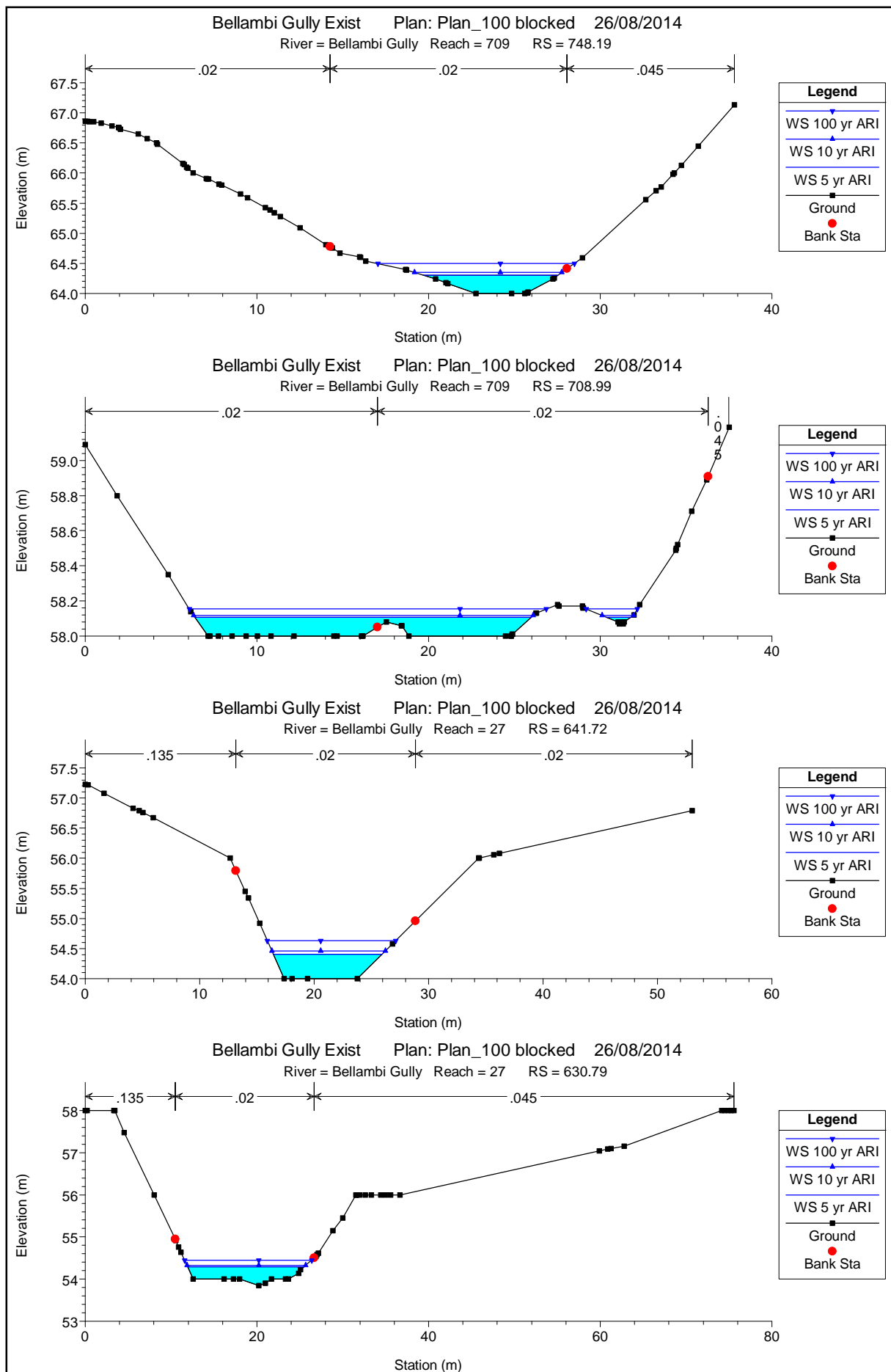


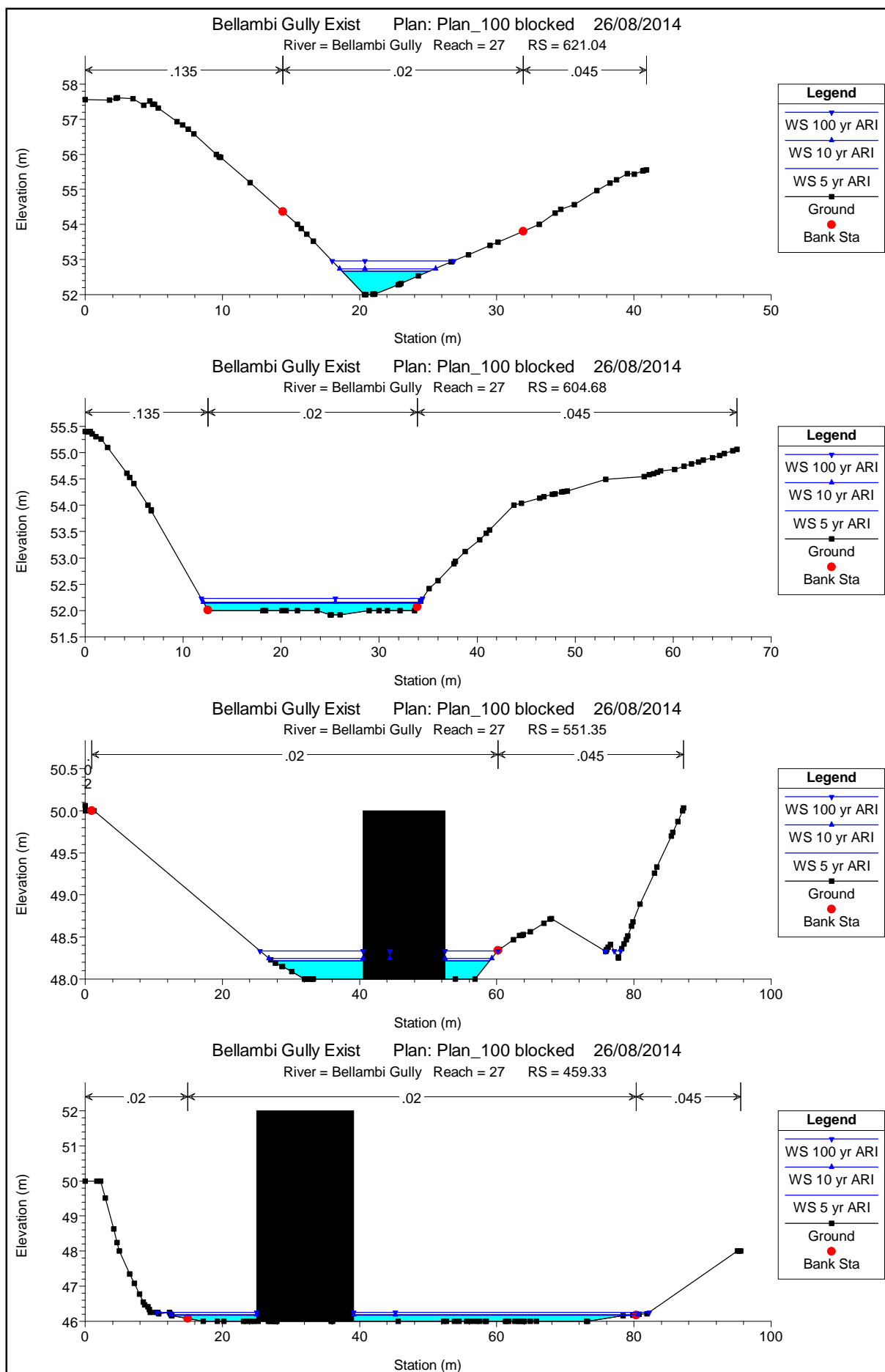


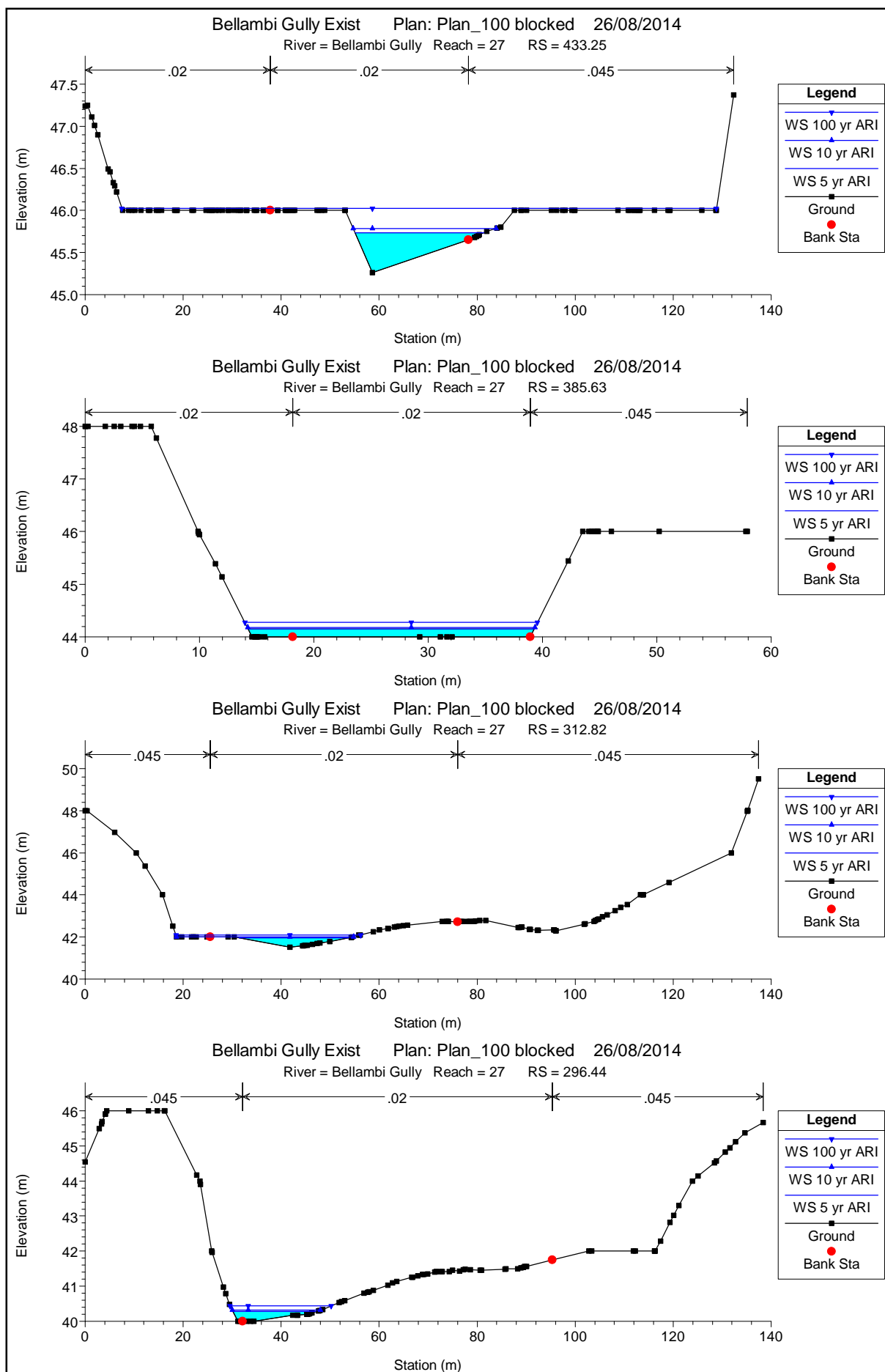


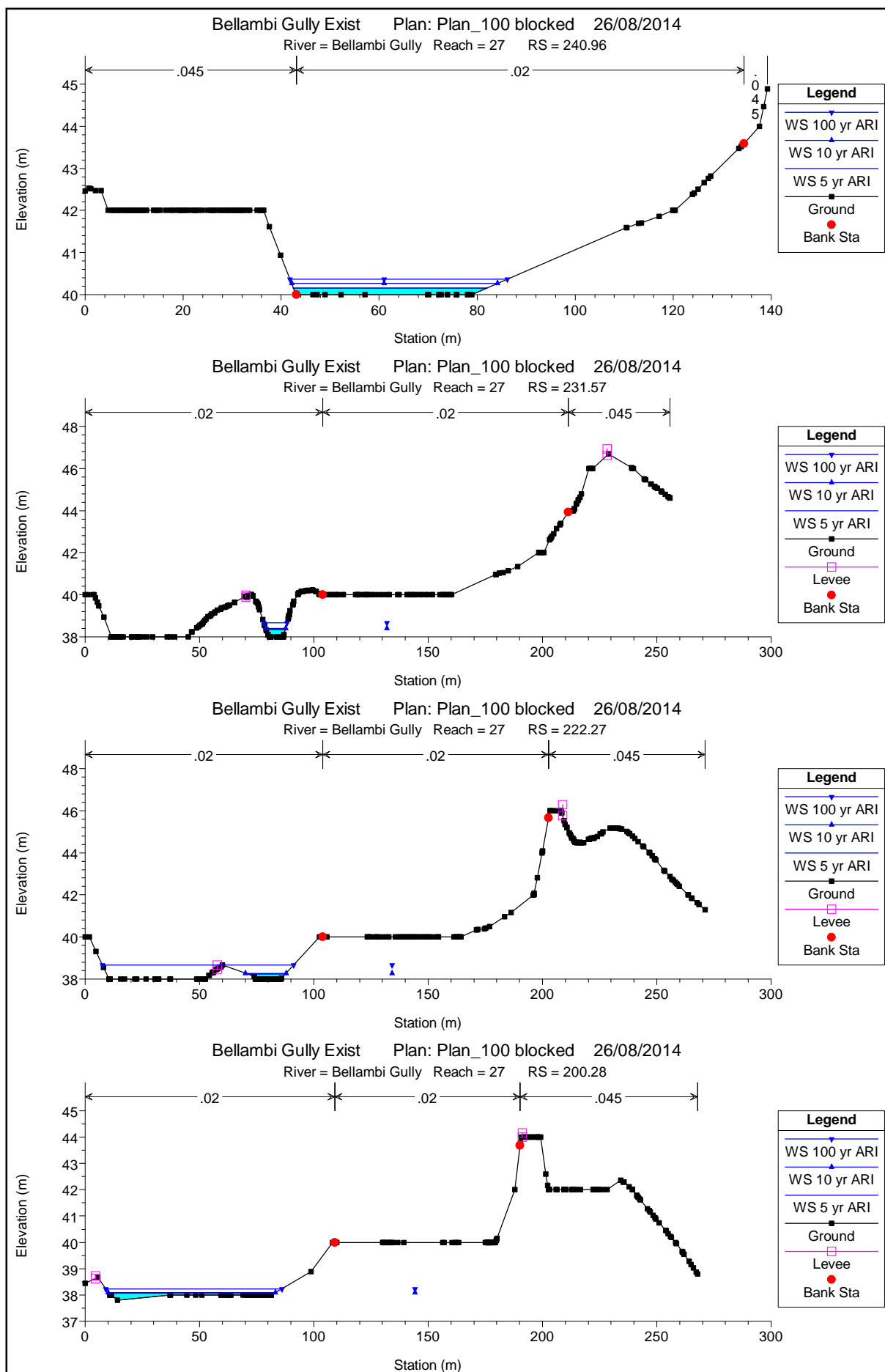


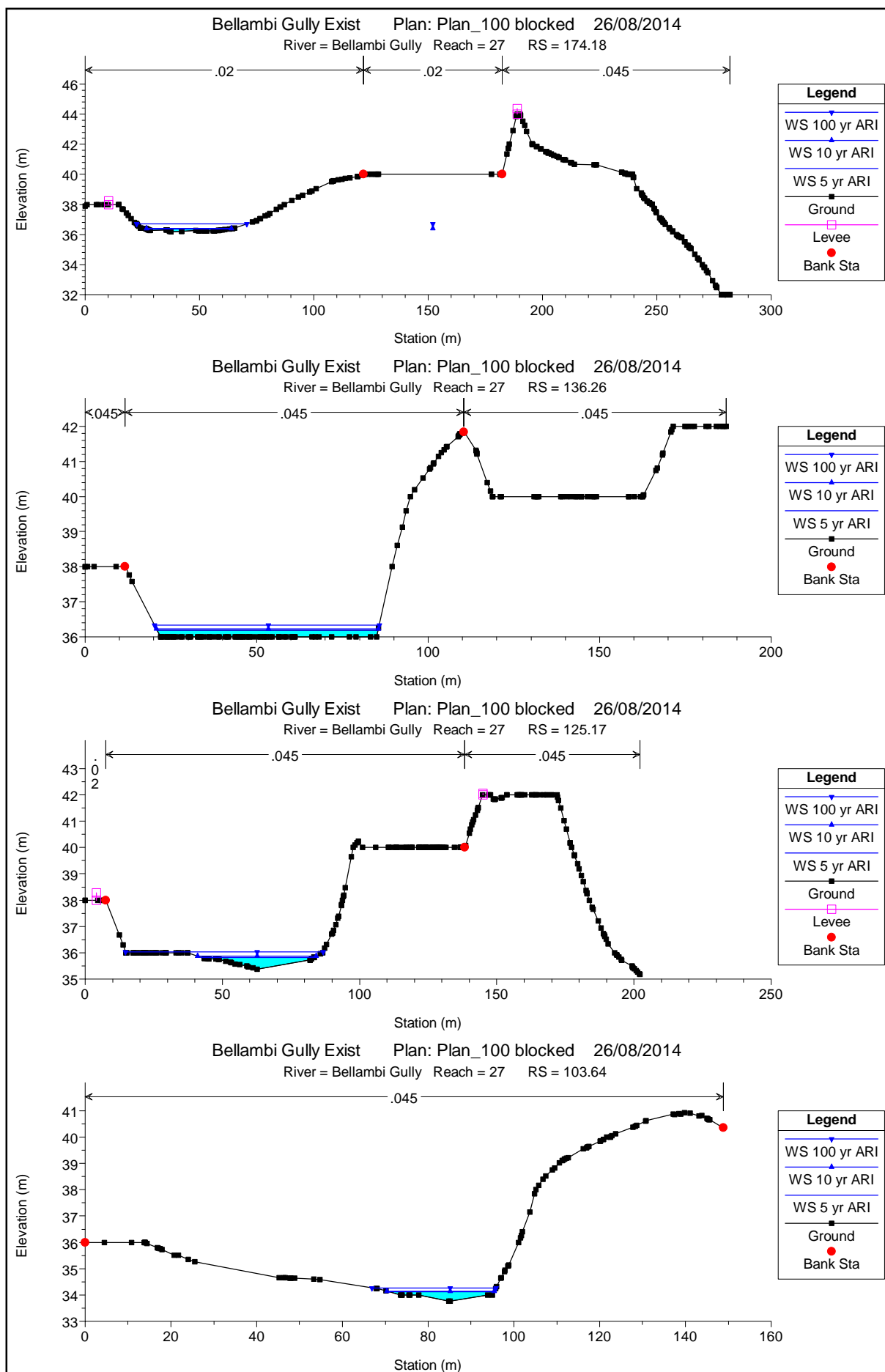


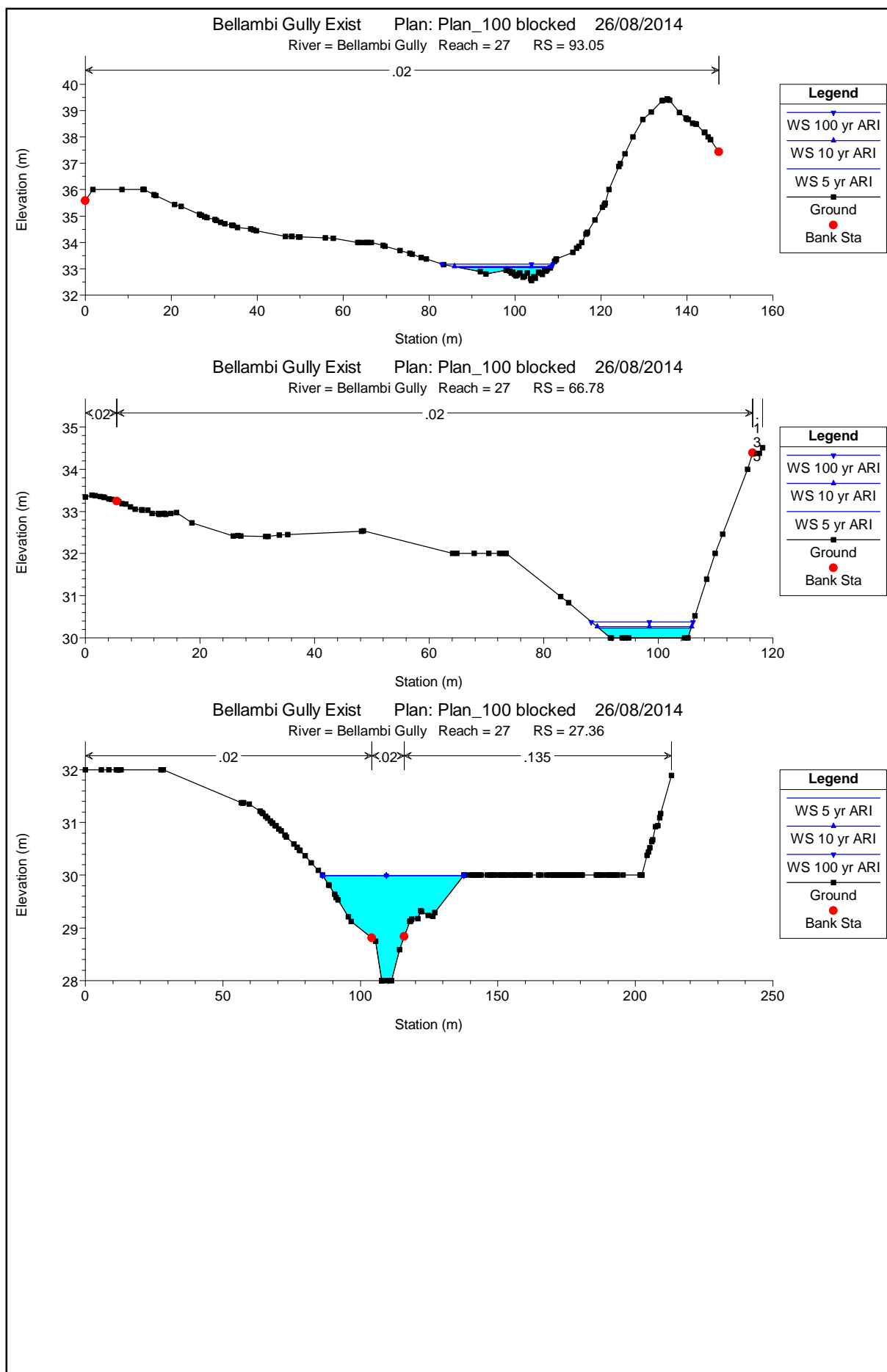














HEC-RAS Plan: 100block

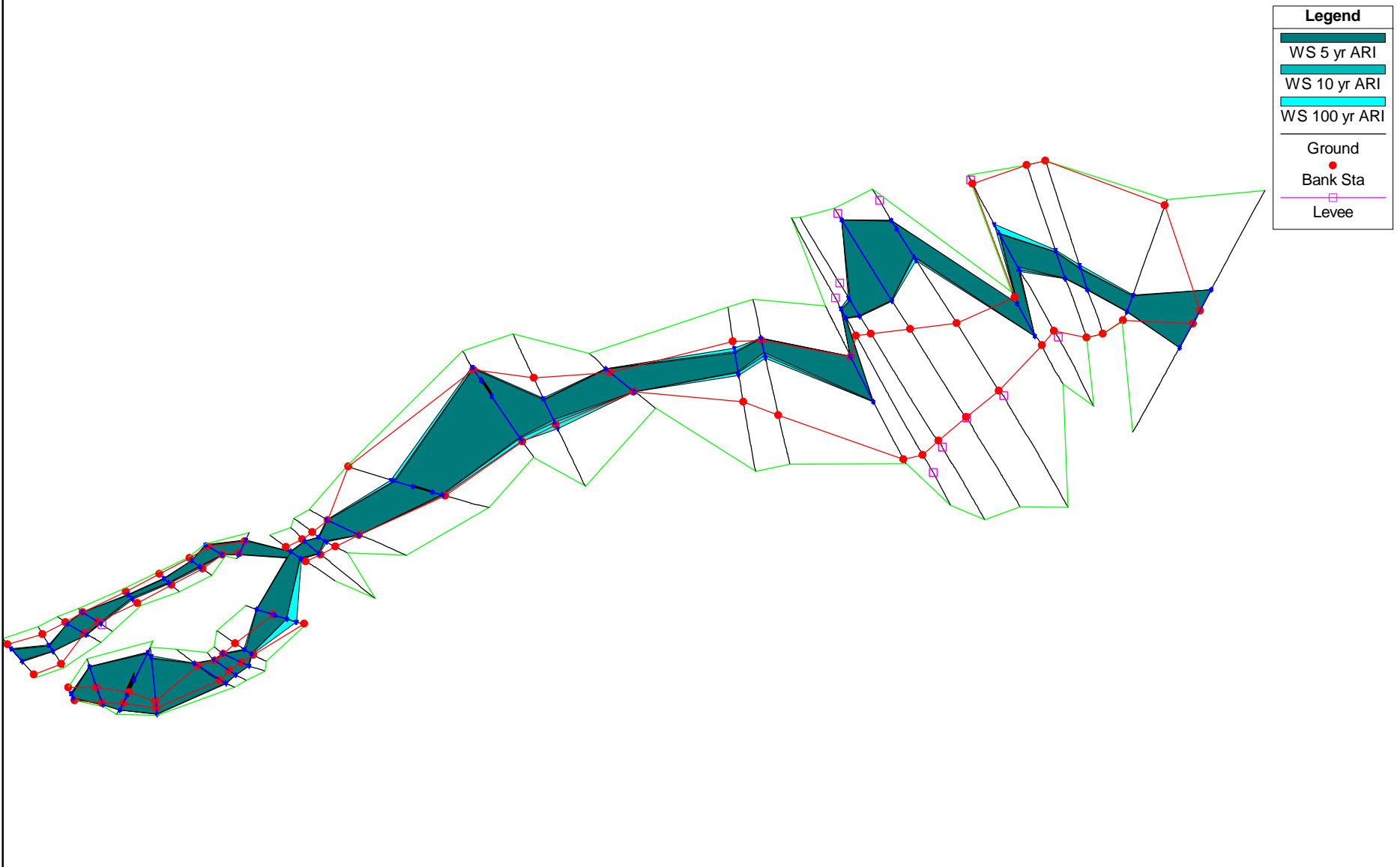
Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
26	193.90	5 yr ARI	3.58	68.83	69.04	69.14	69.43	0.050030	2.76	1.30	0.12
26	193.90	10 yr ARI	4.47	68.83	69.06	69.18	69.50	0.050062	2.96	1.51	0.14
26	193.90	100 yr ARI	8.45	68.83	69.13	69.31	69.80	0.050036	3.63	2.33	0.18
26	173.65	5 yr ARI	3.58	66.23	66.50	66.74	67.83	0.122719	5.12	0.70	0.16
26	173.65	10 yr ARI	4.47	66.23	66.53	66.79	67.95	0.112730	5.28	0.85	0.18
26	173.65	100 yr ARI	8.45	66.23	66.64	66.98	68.36	0.091113	5.80	1.46	0.24
26	151.48	5 yr ARI	3.58	66.00	66.32	66.20	66.36	0.001501	0.89	4.30	0.30
26	151.48	10 yr ARI	4.47	66.00	66.36	66.24	66.41	0.001543	0.97	4.91	0.34
26	151.48	100 yr ARI	8.45	66.00	66.21	66.36	66.75	0.037652	3.33	2.68	0.20
26	138.91	5 yr ARI	3.58	66.00	66.21	66.21	66.32	0.006889	1.46	2.57	0.20
26	138.91	10 yr ARI	4.47	66.00	66.25	66.25	66.37	0.006327	1.56	3.04	0.23
26	138.91	100 yr ARI	8.45	66.00	66.32	66.37	66.57	0.009500	2.26	4.02	0.29
26	109.29	5 yr ARI	3.58	62.00	62.23	62.56	65.38	0.339075	7.86	0.46	0.14
26	109.29	10 yr ARI	4.47	62.00	62.26	62.62	65.48	0.299590	7.95	0.56	0.16
26	109.29	100 yr ARI	8.45	62.00	62.39	62.82	65.54	0.177988	7.87	1.07	0.23
26	84.50	5 yr ARI	3.58	60.00	60.35	60.58	61.37	0.072849	4.46	0.80	0.19
26	84.50	10 yr ARI	4.47	60.00	60.39	60.64	61.55	0.075442	4.79	0.93	0.21
26	84.50	100 yr ARI	8.45	60.00	60.49	60.83	62.21	0.082851	5.81	1.45	0.26
26	62.17	5 yr ARI	3.58	58.38	58.67	58.85	59.49	0.092625	4.02	0.89	0.14
26	62.17	10 yr ARI	4.47	58.38	58.69	58.89	59.62	0.092361	4.26	1.05	0.15
26	62.17	100 yr ARI	8.45	58.38	58.77	59.05	60.17	0.091494	5.24	1.61	0.21
26	45.90	5 yr ARI	3.58	56.00	56.07	56.20	57.04	0.282651	4.39	0.82	0.07
26	45.90	10 yr ARI	4.47	56.00	56.08	56.24	57.21	0.270561	4.74	0.95	0.08
26	45.90	100 yr ARI	8.45	56.00	56.12	56.36	57.86	0.239159	5.89	1.45	0.12
26	25.76	5 yr ARI	3.58	56.00	56.25	56.26	56.37	0.006557	1.51	2.41	0.21
26	25.76	10 yr ARI	4.47	56.00	56.27	56.30	56.43	0.008015	1.75	2.60	0.22
26	25.76	100 yr ARI	8.45	56.00	56.33	56.44	56.69	0.014217	2.67	3.28	0.26
709	869.12	5 yr ARI	3.03	68.43	68.87	69.09	69.67	0.050055	3.96	0.76	0.22
709	869.12	10 yr ARI	3.79	68.43	68.91	69.15	69.81	0.050059	4.19	0.90	0.24
709	869.12	100 yr ARI	6.71	68.43	69.03	69.33	70.22	0.050076	4.84	1.39	0.30
709	853.66	5 yr ARI	3.03	64.00	66.56	64.17	66.56	0.000000	0.06	59.84	1.77
709	853.66	10 yr ARI	3.79	64.00	66.64	64.20	66.64	0.000001	0.07	62.71	1.84
709	853.66	100 yr ARI	6.71	64.00	66.92	64.29	66.92	0.000001	0.11	72.46	2.04
709	838.25	5 yr ARI	3.03	64.00	66.56		66.56	0.000002	0.11	41.83	1.08
709	838.25	10 yr ARI	3.79	64.00	66.64		66.64	0.000003	0.13	45.13	1.15
709	838.25	100 yr ARI	6.71	64.00	66.92		66.92	0.000005	0.18	56.44	1.36
709	820.54	5 yr ARI	3.03	64.00	66.56		66.56	0.000002	0.12	44.97	0.89
709	820.54	10 yr ARI	3.79	64.00	66.64		66.64	0.000002	0.14	49.25	0.97
709	820.54	100 yr ARI	6.71	64.00	66.92		66.92	0.000004	0.19	64.00	1.18
709	776.73	5 yr ARI	9.82	64.01	66.56		66.56	0.000014	0.29	39.23	1.53
709	776.73	10 yr ARI	12.28	64.01	66.64		66.64	0.000019	0.34	41.36	1.59
709	776.73	100 yr ARI	21.89	64.01	66.91		66.92	0.000038	0.53	48.60	1.77
709	767.44	5 yr ARI	9.82	66.00	66.44		66.55	0.002807	1.54	7.80	0.42
709	767.44	10 yr ARI	12.28	66.00	66.51		66.63	0.002826	1.69	8.95	0.48
709	767.44	100 yr ARI	21.89	66.00	66.70	66.59	66.90	0.002994	2.16	12.65	0.65
709	758.43	5 yr ARI	9.82	65.99	66.34	66.34	66.50	0.006423	1.95	6.11	0.33
709	758.43	10 yr ARI	12.28	65.99	66.39	66.39	66.58	0.006175	2.10	7.10	0.38
709	758.43	100 yr ARI	21.89	65.99	66.57	66.57	66.85	0.005296	2.52	10.70	0.54
709	748.19	5 yr ARI	9.82	64.00	64.30	64.63	66.16	0.119464	6.04	1.62	0.21
709	748.19	10 yr ARI	12.28	64.00	64.35	64.69	66.26	0.104834	6.13	2.00	0.23
709	748.19	100 yr ARI	21.89	64.00	64.50	64.90	66.54	0.076054	6.34	3.47	0.30
709	708.99	5 yr ARI	9.82	58.00	58.11	58.29	59.53	0.268377	4.72	1.88	0.09
709	708.99	10 yr ARI	12.28	58.00	58.12	58.33	59.92	0.305430	5.29	2.09	0.10
709	708.99	100 yr ARI	21.89	58.00	58.15	58.46	61.08	0.354168	6.64	2.93	0.12
27	641.72	5 yr ARI	14.05	54.00	54.41	54.68	55.36	0.031874	4.32	3.25	0.34
27	641.72	10 yr ARI	17.53	54.00	54.46	54.77	55.56	0.032028	4.65	3.77	0.38
27	641.72	100 yr ARI	31.63	54.00	54.63	55.07	56.28	0.033713	5.69	5.56	0.50
27	630.79	5 yr ARI	14.05	53.85	54.29	54.48	54.95	0.027276	3.59	3.91	0.29
27	630.79	10 yr ARI	17.53	53.85	54.33	54.56	55.14	0.029695	3.99	4.39	0.32

HEC-RAS Plan: 100block (Continued)

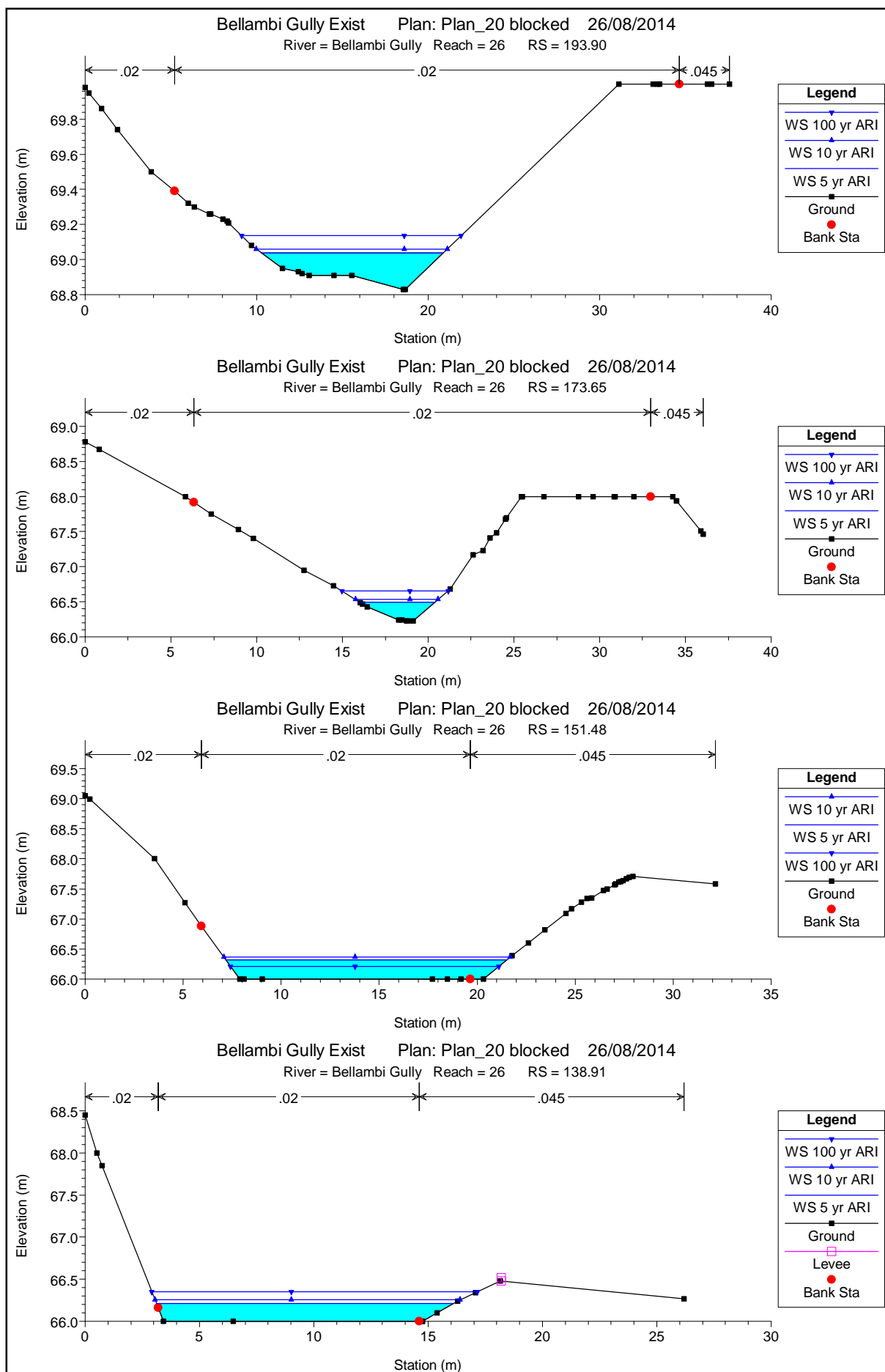
Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
27	630.79	100 yr ARI	31.63	53.85	54.44	54.81	55.81	0.035410	5.18	6.10	0.41
27	621.04	5 yr ARI	14.05	52.00	52.67	53.09	54.46	0.055056	5.94	2.37	0.37
27	621.04	10 yr ARI	17.53	52.00	52.74	53.20	54.65	0.051478	6.12	2.86	0.41
27	621.04	100 yr ARI	31.63	52.00	52.97	53.54	55.33	0.045848	6.81	4.65	0.52
27	604.68	5 yr ARI	14.05	51.92	52.14	52.34	53.08	0.089622	4.29	3.31	0.15
27	604.68	10 yr ARI	17.53	51.92	52.16	52.40	53.31	0.094391	4.76	3.73	0.17
27	604.68	100 yr ARI	31.63	51.92	52.23	52.59	54.12	0.099065	6.11	5.28	0.23
27	551.35	5 yr ARI	14.05	48.00	48.22	48.41	49.02	0.064310	3.97	3.54	0.18
27	551.35	10 yr ARI	17.53	48.00	48.25	48.47	49.16	0.063276	4.25	4.13	0.20
27	551.35	100 yr ARI	31.63	48.00	48.34	48.66	49.72	0.065685	5.21	6.11	0.26
27	459.33	5 yr ARI	14.05	46.00	46.17	46.21	46.33	0.014913	1.76	8.04	0.15
27	459.33	10 yr ARI	17.53	46.00	46.19	46.24	46.38	0.015576	1.94	9.12	0.17
27	459.33	100 yr ARI	31.63	46.00	46.26	46.35	46.58	0.017619	2.54	12.71	0.22
27	433.25	5 yr ARI	14.05	45.26	45.73	45.80	45.98	0.011090	2.21	6.46	0.25
27	433.25	10 yr ARI	17.53	45.26	45.79	45.86	46.06	0.009665	2.30	7.93	0.27
27	433.25	100 yr ARI	31.63	45.26	46.03	46.10	46.26	0.008004	2.18	18.02	0.15
27	385.63	5 yr ARI	14.05	44.00	44.15	44.32	44.86	0.067873	3.74	3.80	0.15
27	385.63	10 yr ARI	17.53	44.00	44.18	44.37	45.02	0.068241	4.09	4.34	0.17
27	385.63	100 yr ARI	31.63	44.00	44.27	44.55	45.39	0.050179	4.72	6.83	0.27
27	312.82	5 yr ARI	14.05	41.52	41.96	42.08	42.32	0.019629	2.67	5.26	0.24
27	312.82	10 yr ARI	17.53	41.52	42.01	42.12	42.37	0.020406	2.65	6.71	0.19
27	312.82	100 yr ARI	31.63	41.52	42.09	42.28	42.70	0.025233	3.49	9.58	0.25
27	296.44	5 yr ARI	14.05	40.00	40.28	40.53	41.58	0.118659	5.21	2.90	0.17
27	296.44	10 yr ARI	17.53	40.00	40.31	40.59	41.64	0.097690	5.26	3.59	0.20
27	296.44	100 yr ARI	31.63	40.00	40.44	40.80	41.98	0.066082	5.64	6.04	0.29
27	240.96	5 yr ARI	14.05	40.00	40.16	40.24	40.44	0.027760	2.37	5.96	0.15
27	240.96	10 yr ARI	17.53	40.00	40.27	40.28	40.41	0.007522	1.71	10.33	0.25
27	240.96	100 yr ARI	31.63	40.00	40.37	40.41	40.61	0.008041	2.17	14.76	0.33
27	231.57	5 yr ARI	14.05	40.00	38.36	38.70	39.79	0.054696		2.65	0.31
27	231.57	10 yr ARI	17.53	40.00	38.41	38.80	40.04	0.053014		3.10	0.35
27	231.57	100 yr ARI	31.63	40.00	38.67	39.14	40.28	0.028599		5.64	0.55
27	222.27	5 yr ARI	14.05	40.00	38.25	38.47	39.12	0.058698		3.40	0.20
27	222.27	10 yr ARI	17.53	40.00	38.28	38.54	39.36	0.066834		3.80	0.21
27	222.27	100 yr ARI	31.63	40.00	38.67	38.67	38.70	0.000452		45.14	0.54
27	200.28	5 yr ARI	14.05	40.00	38.09	38.12	38.22	0.018636		8.58	0.12
27	200.28	10 yr ARI	17.53	40.00	38.10	38.15	38.28	0.022554		9.26	0.13
27	200.28	100 yr ARI	31.63	40.00	38.24	38.24	38.37	0.006184		19.87	0.26
27	174.18	5 yr ARI	14.05	40.00	36.36	36.51	37.12	0.125273		3.65	0.10
27	174.18	10 yr ARI	17.53	40.00	36.39	36.55	37.13	0.094497		4.59	0.12
27	174.18	100 yr ARI	31.63	40.00	36.71	36.67	36.86	0.003901		18.92	0.39
27	136.26	5 yr ARI	14.05	36.00	36.19	36.17	36.26	0.024550	1.15	12.23	0.19
27	136.26	10 yr ARI	17.53	36.00	36.22	36.20	36.30	0.022992	1.23	14.27	0.22
27	136.26	100 yr ARI	31.63	36.00	36.33		36.44	0.019476	1.47	21.48	0.33
27	125.17	5 yr ARI	14.05	35.38	35.82	35.82	35.94	0.034400	1.52	9.24	0.22
27	125.17	10 yr ARI	17.53	35.38	35.87	35.87	36.00	0.032223	1.60	10.96	0.25
27	125.17	100 yr ARI	31.63	35.38	36.03	36.03	36.17	0.031228	1.63	19.35	0.27
27	103.64	5 yr ARI	14.05	33.76	34.12	34.26	34.59	0.175939	3.07	4.58	0.19
27	103.64	10 yr ARI	17.53	33.76	34.15	34.31	34.70	0.174752	3.30	5.31	0.21
27	103.64	100 yr ARI	31.63	33.76	34.27	34.48	34.96	0.141328	3.70	8.55	0.30
27	93.05	5 yr ARI	14.05	32.56	33.05	33.22	33.69	0.048622	3.56	3.95	0.19
27	93.05	10 yr ARI	17.53	32.56	33.08	33.27	33.81	0.047865	3.79	4.62	0.21
27	93.05	100 yr ARI	31.63	32.56	33.18	33.45	34.17	0.043482	4.41	7.18	0.28
27	66.78	5 yr ARI	14.05	30.00	30.23	30.45	31.09	0.053602	4.11	3.42	0.21
27	66.78	10 yr ARI	17.53	30.00	30.26	30.51	31.26	0.052531	4.42	3.96	0.24
27	66.78	100 yr ARI	31.63	30.00	30.38	30.74	31.81	0.048655	5.31	5.96	0.34
27	27.36	5 yr ARI	14.05	28.00	30.00	28.86	30.01	0.000054	0.51	44.69	0.87
27	27.36	10 yr ARI	17.53	28.00	30.00	28.96	30.02	0.000085	0.64	44.69	0.87
27	27.36	100 yr ARI	31.63	28.00	30.00	29.26	30.05	0.000276	1.15	44.69	0.87

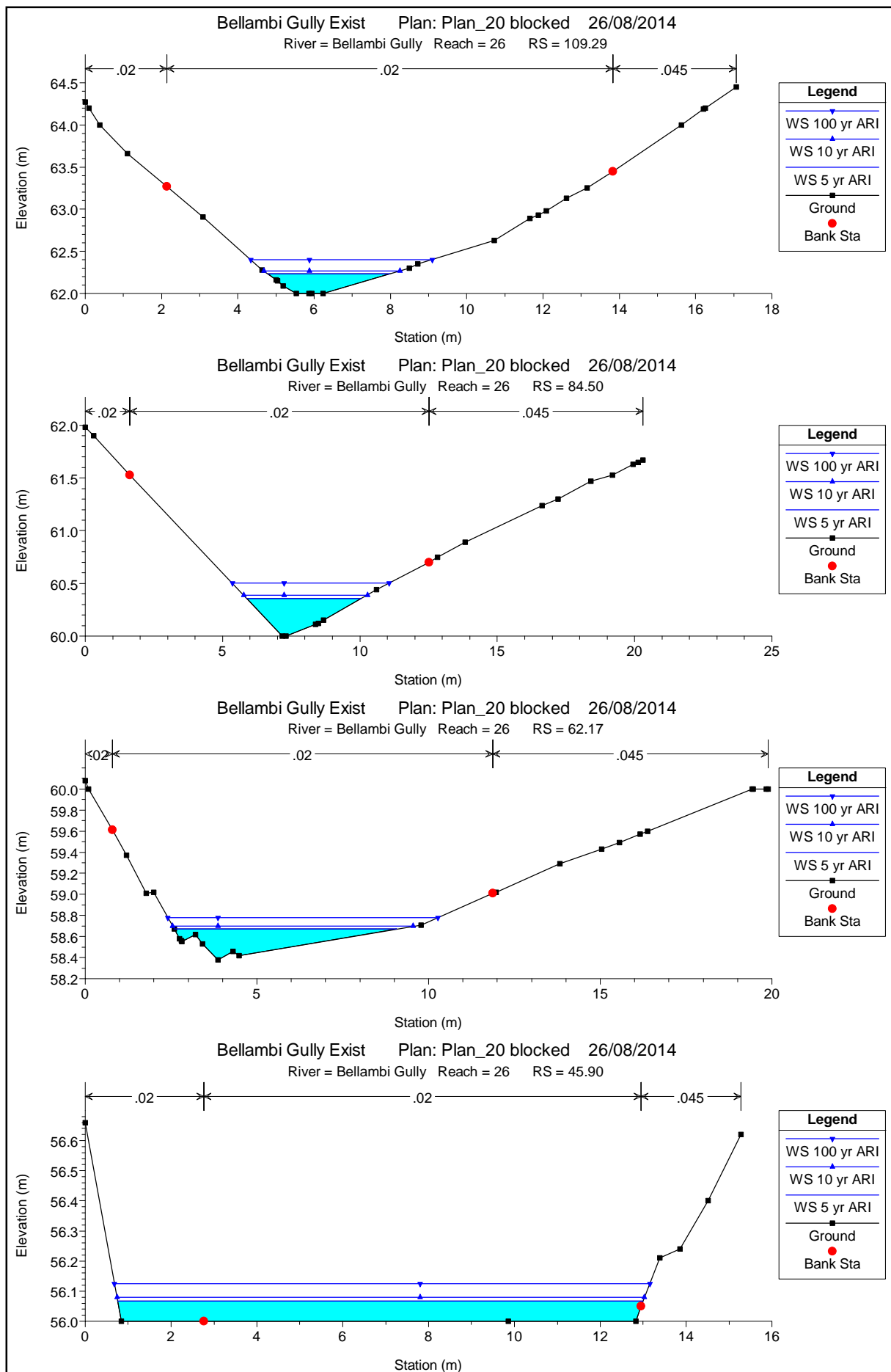
## Plan View Scenario 2

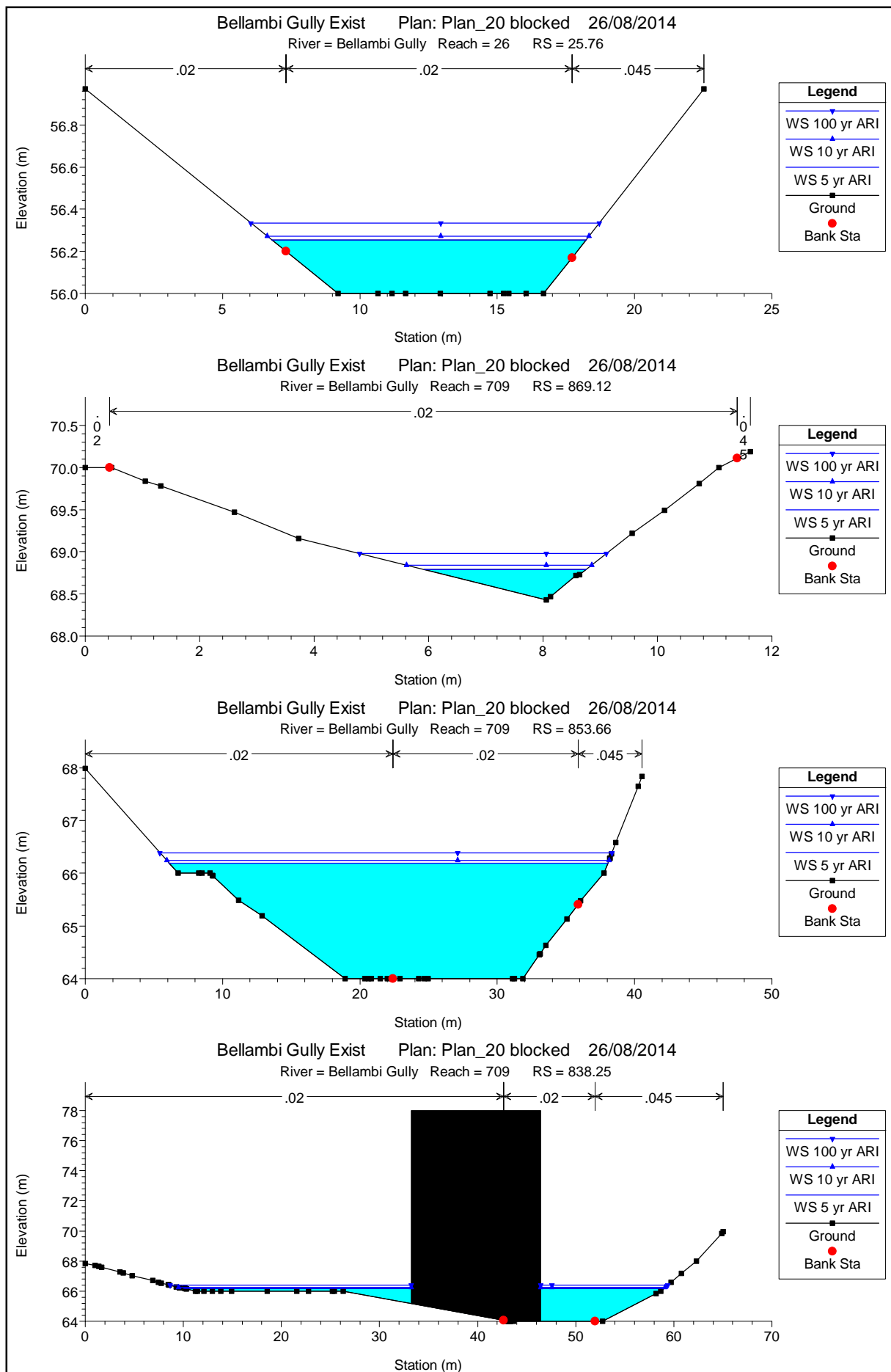
Bellambi Gully Exist    Plan: Plan\_20 blocked    26/08/2014

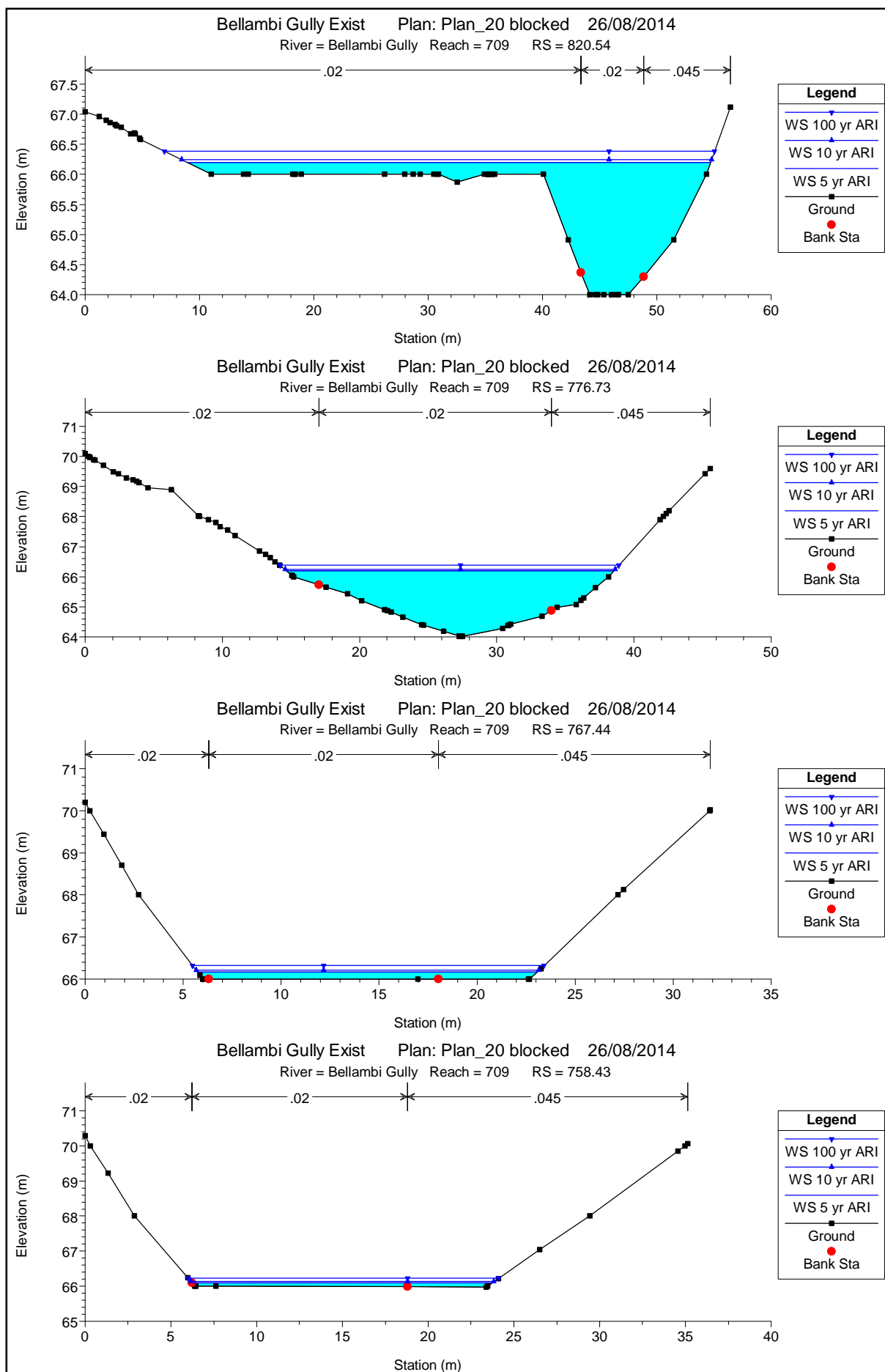


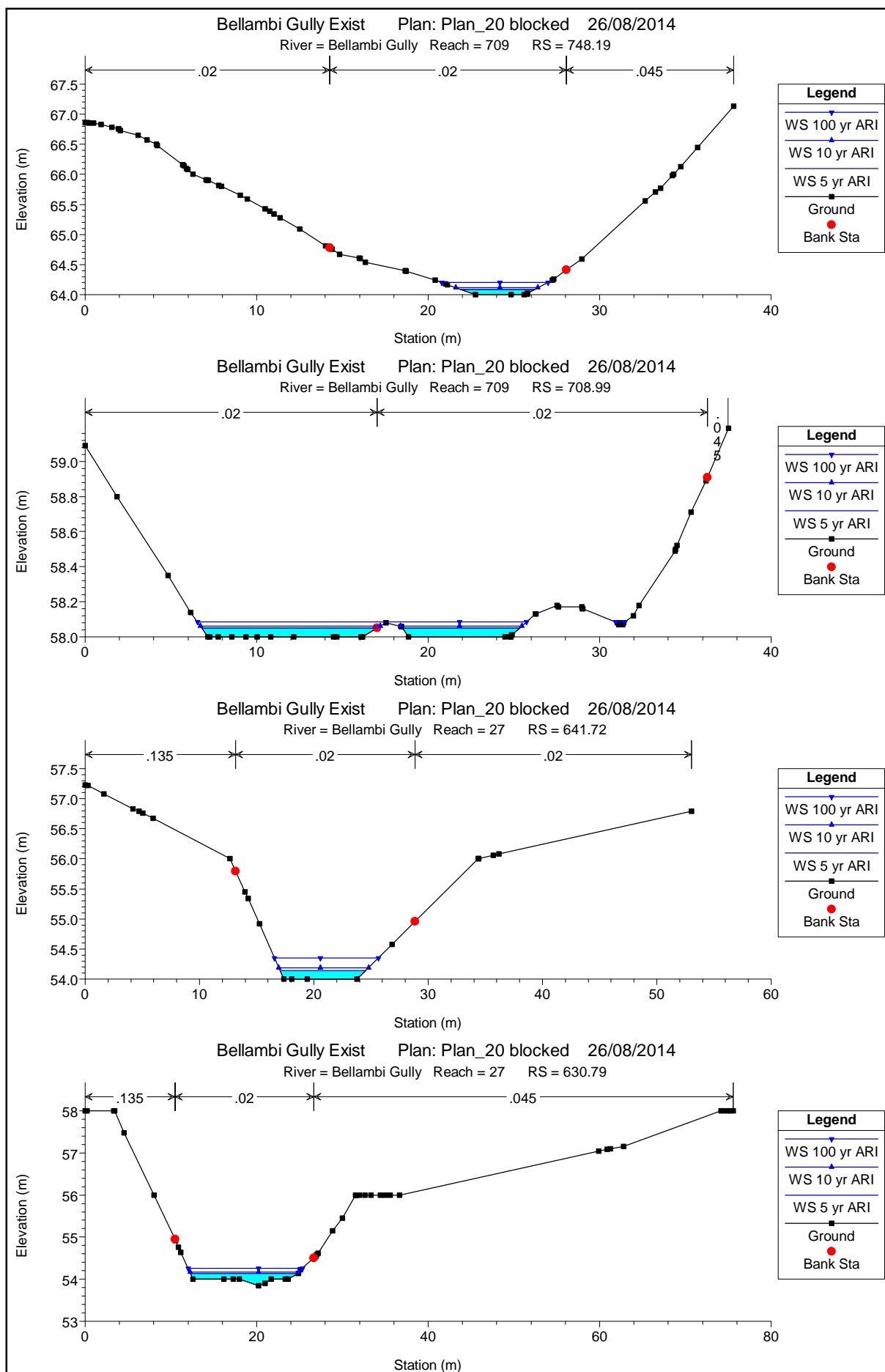
## Cross Sections



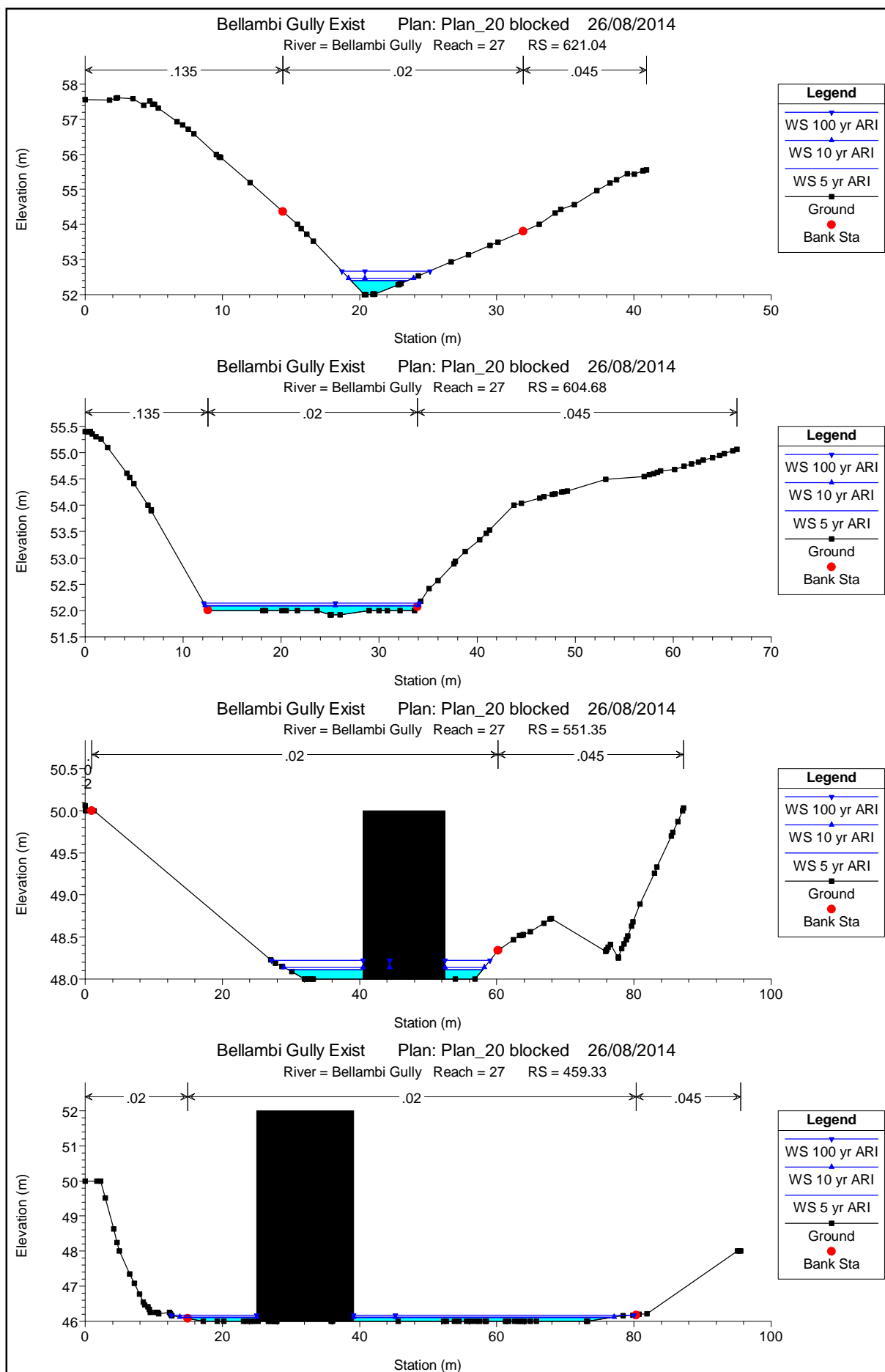


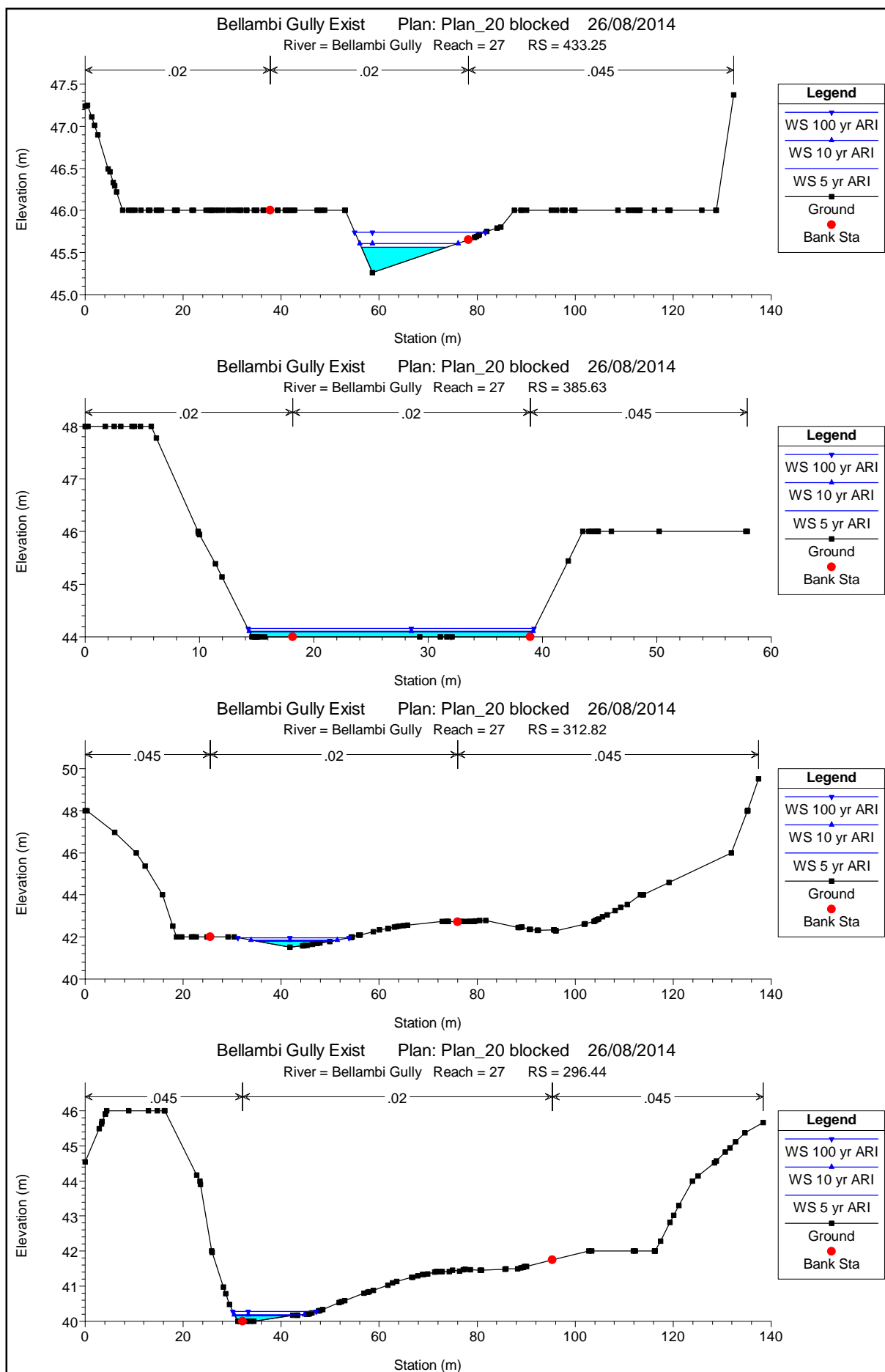


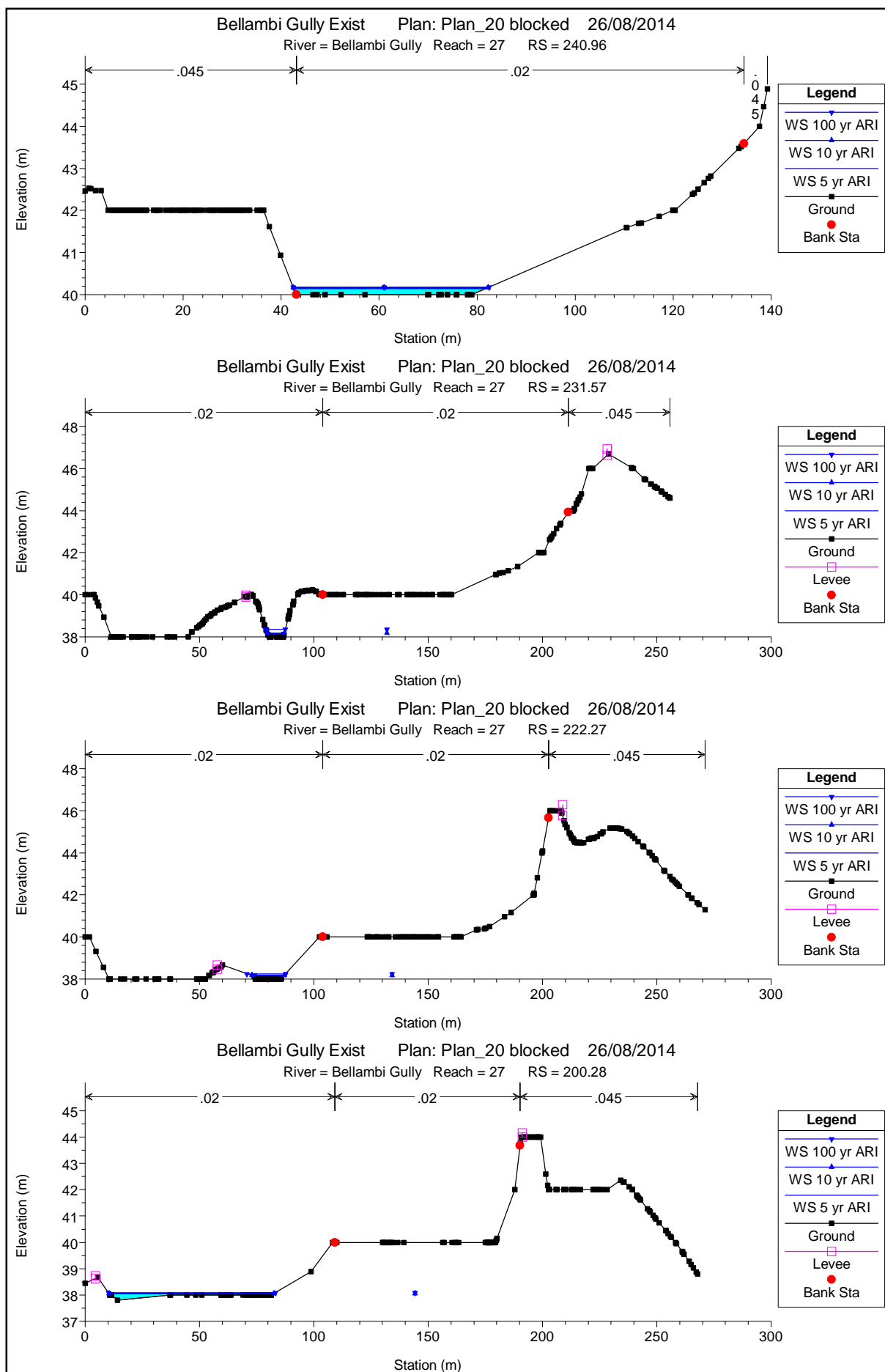


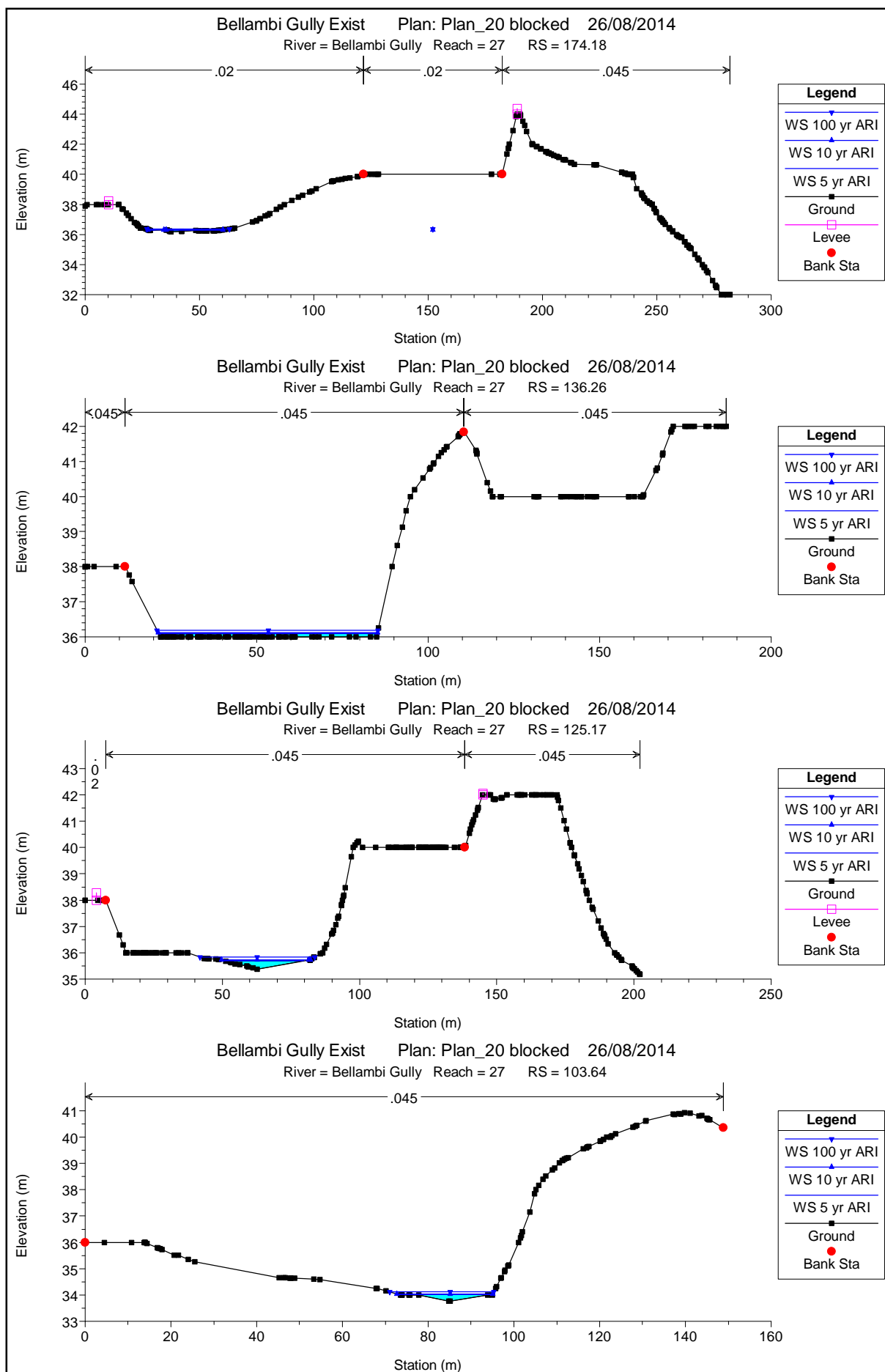


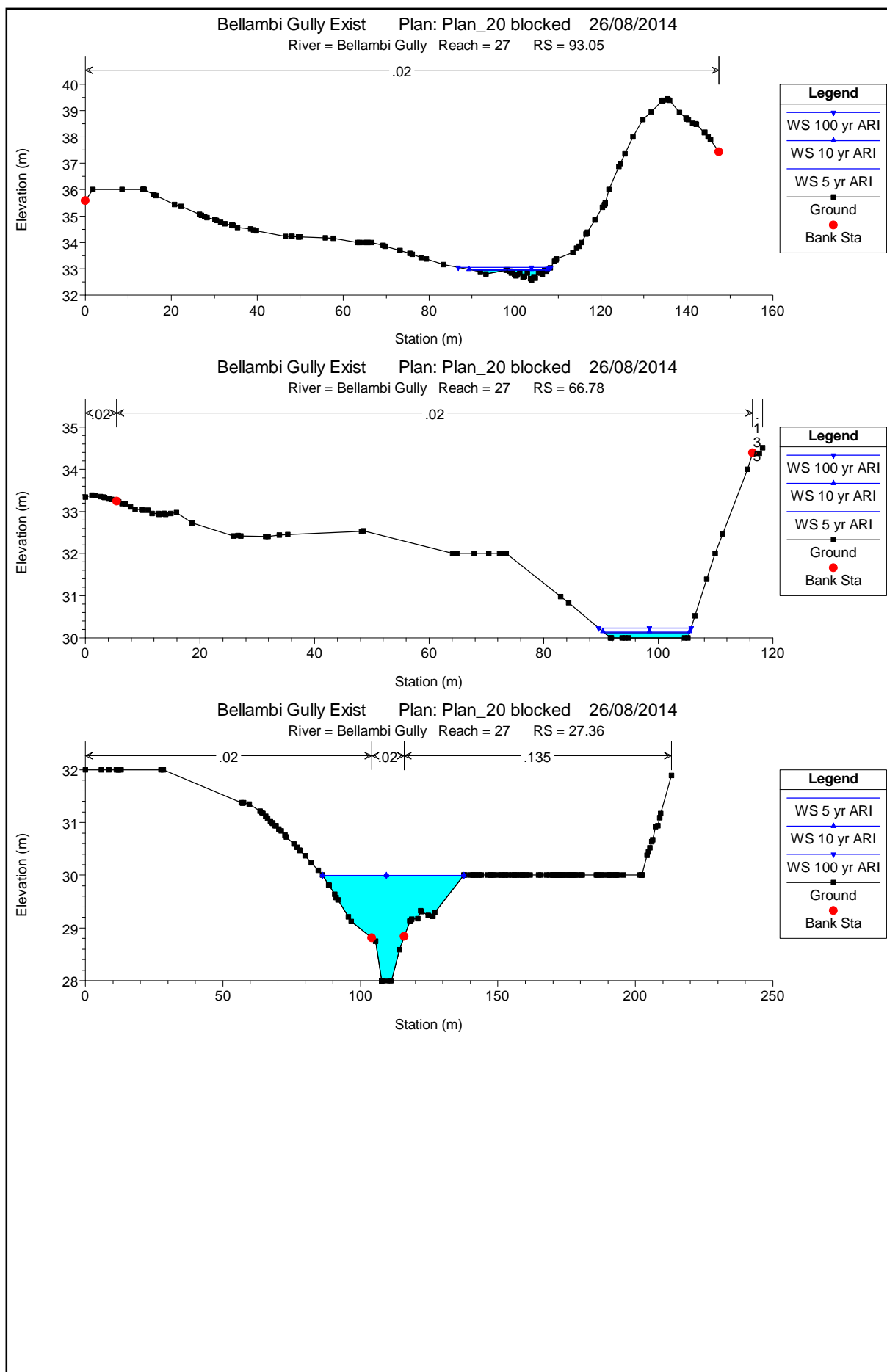












HEC-RAS Plan: 20block

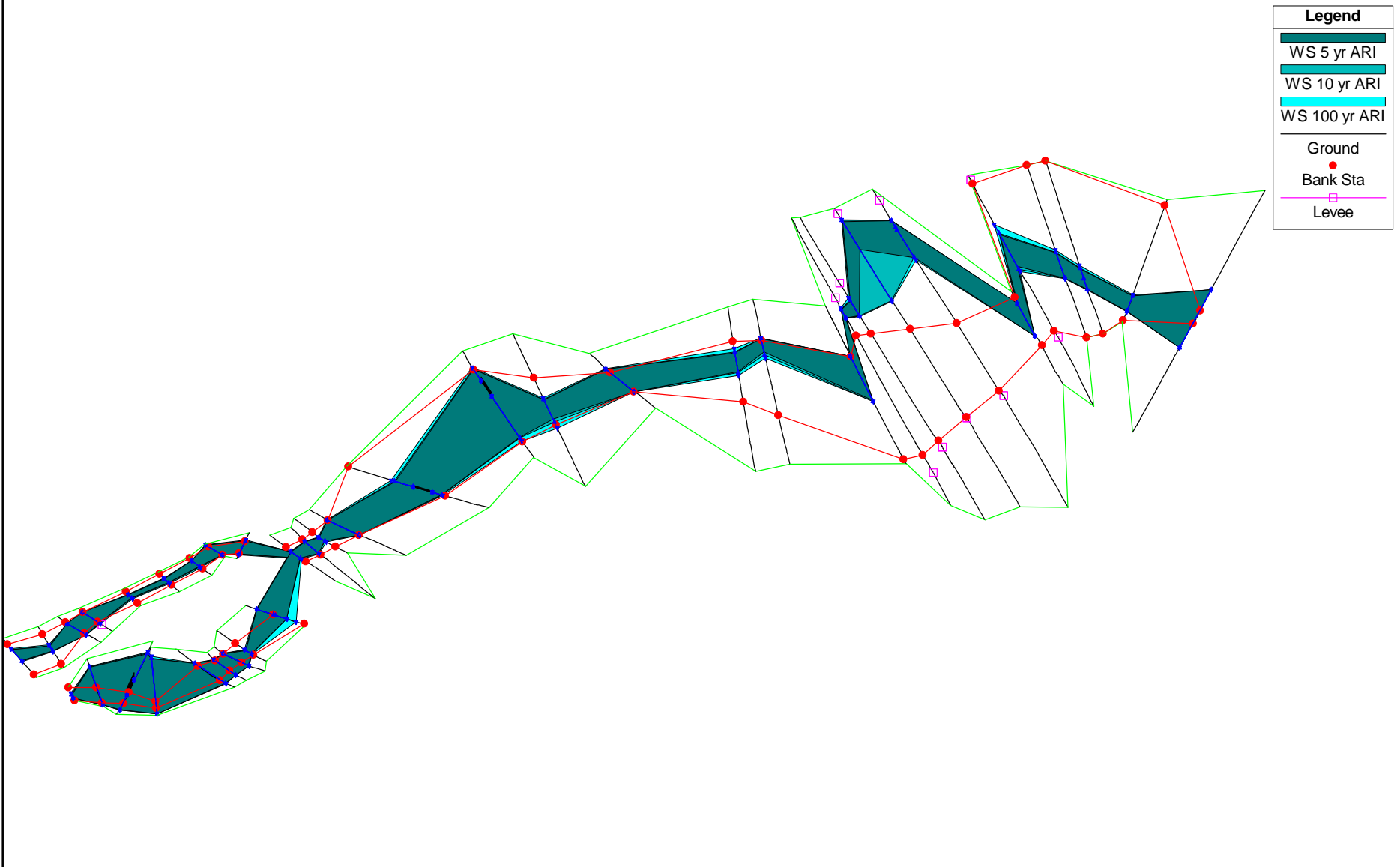
Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
26	193.90	5 yr ARI	3.58	68.83	69.04	69.14	69.43	0.050030	2.76	1.30	0.12
26	193.90	10 yr ARI	4.60	68.83	69.06	69.18	69.52	0.050066	2.99	1.54	0.14
26	193.90	100 yr ARI	9.09	68.83	69.14	69.32	69.84	0.050041	3.71	2.45	0.19
26	173.65	5 yr ARI	3.58	66.23	66.50	66.74	67.83	0.122719	5.12	0.70	0.16
26	173.65	10 yr ARI	4.60	66.23	66.53	66.80	67.96	0.111586	5.30	0.87	0.18
26	173.65	100 yr ARI	9.09	66.23	66.66	67.00	68.41	0.089055	5.87	1.55	0.25
26	151.48	5 yr ARI	3.58	66.00	66.32	66.20	66.36	0.001501	0.89	4.30	0.30
26	151.48	10 yr ARI	4.60	66.00	66.37	66.24	66.42	0.001555	0.99	4.99	0.34
26	151.48	100 yr ARI	9.09	66.00	66.21	66.38	66.80	0.038499	3.44	2.78	0.20
26	138.91	5 yr ARI	3.58	66.00	66.21	66.21	66.32	0.006889	1.46	2.57	0.20
26	138.91	10 yr ARI	4.60	66.00	66.25	66.25	66.37	0.006126	1.56	3.13	0.23
26	138.91	100 yr ARI	9.09	66.00	66.35	66.39	66.59	0.007947	2.20	4.47	0.31
26	109.29	5 yr ARI	3.58	62.00	62.23	62.56	65.38	0.339075	7.86	0.46	0.14
26	109.29	10 yr ARI	4.60	62.00	62.27	62.63	65.51	0.295906	7.97	0.58	0.16
26	109.29	100 yr ARI	9.09	62.00	62.40	62.84	65.65	0.176263	7.99	1.14	0.24
26	84.50	5 yr ARI	3.58	60.00	60.35	60.58	61.37	0.072849	4.46	0.80	0.19
26	84.50	10 yr ARI	4.60	60.00	60.39	60.65	61.58	0.075821	4.83	0.95	0.21
26	84.50	100 yr ARI	9.09	60.00	60.50	60.86	62.30	0.083950	5.95	1.53	0.27
26	62.17	5 yr ARI	3.58	58.38	58.67	58.85	59.49	0.092625	4.02	0.89	0.14
26	62.17	10 yr ARI	4.60	58.38	58.70	58.90	59.64	0.092428	4.30	1.07	0.15
26	62.17	100 yr ARI	9.09	58.38	58.78	59.07	60.25	0.091302	5.36	1.69	0.22
26	45.90	5 yr ARI	3.58	56.00	56.07	56.20	57.04	0.282651	4.39	0.82	0.07
26	45.90	10 yr ARI	4.60	56.00	56.08	56.24	57.24	0.268676	4.78	0.97	0.08
26	45.90	100 yr ARI	9.09	56.00	56.12	56.38	57.96	0.235598	6.04	1.52	0.12
26	25.76	5 yr ARI	3.58	56.00	56.25	56.26	56.37	0.006557	1.51	2.41	0.21
26	25.76	10 yr ARI	4.60	56.00	56.27	56.30	56.43	0.008378	1.79	2.61	0.22
26	25.76	100 yr ARI	9.09	56.00	56.33	56.46	56.73	0.015097	2.80	3.37	0.27
709	869.12	5 yr ARI	1.72	68.43	68.79	68.95	69.39	0.050041	3.43	0.50	0.18
709	869.12	10 yr ARI	2.48	68.43	68.84	69.03	69.56	0.050044	3.77	0.66	0.20
709	869.12	100 yr ARI	5.41	68.43	68.98	69.25	70.05	0.050064	4.59	1.18	0.27
709	853.66	5 yr ARI	1.72	64.00	66.20	64.12	66.20	0.000000	0.04	47.86	1.50
709	853.66	10 yr ARI	2.48	64.00	66.24	64.15	66.24	0.000001	0.06	49.38	1.53
709	853.66	100 yr ARI	5.41	64.00	66.39	64.26	66.39	0.000002	0.12	54.09	1.64
709	838.25	5 yr ARI	1.72	64.00	66.20		66.20	0.000002	0.10	28.20	0.79
709	838.25	10 yr ARI	2.48	64.00	66.24		66.24	0.000004	0.13	29.91	0.82
709	838.25	100 yr ARI	5.41	64.00	66.39		66.39	0.000012	0.25	35.20	0.94
709	820.54	5 yr ARI	1.72	64.00	66.19		66.20	0.000002	0.11	27.47	0.60
709	820.54	10 yr ARI	2.48	64.00	66.24		66.24	0.000003	0.15	29.64	0.64
709	820.54	100 yr ARI	5.41	64.00	66.39		66.39	0.000010	0.27	36.39	0.76
709	776.73	5 yr ARI	1.72	64.01	66.19		66.20	0.000001	0.06	30.34	1.27
709	776.73	10 yr ARI	2.48	64.01	66.24		66.24	0.000002	0.09	31.47	1.31
709	776.73	100 yr ARI	5.41	64.01	66.39		66.39	0.000006	0.17	34.96	1.41
709	767.44	5 yr ARI	1.72	66.00	66.17		66.19	0.002145	0.71	2.90	0.17
709	767.44	10 yr ARI	2.48	66.00	66.21		66.24	0.002280	0.84	3.56	0.20
709	767.44	100 yr ARI	5.41	66.00	66.32		66.38	0.002639	1.20	5.50	0.31
709	758.43	5 yr ARI	1.72	65.99	66.10	66.10	66.15	0.010115	1.11	1.85	0.11
709	758.43	10 yr ARI	2.48	65.99	66.13	66.13	66.20	0.009045	1.24	2.38	0.13
709	758.43	100 yr ARI	5.41	65.99	66.22	66.22	66.34	0.007387	1.60	4.06	0.22
709	748.19	5 yr ARI	1.72	64.00	64.09	64.26	65.69	0.430529	5.61	0.31	0.07
709	748.19	10 yr ARI	2.48	64.00	64.11	64.31	65.77	0.319950	5.70	0.44	0.09
709	748.19	100 yr ARI	5.41	64.00	64.20	64.47	65.96	0.176676	5.88	0.92	0.15
709	708.99	5 yr ARI	1.72	58.00	58.05	58.11	58.28	0.102314	2.10	0.82	0.05
709	708.99	10 yr ARI	2.48	58.00	58.06	58.14	58.39	0.119898	2.47	0.98	0.06
709	708.99	100 yr ARI	5.41	58.00	58.08	58.21	58.82	0.185242	3.44	1.43	0.07
27	641.72	5 yr ARI	5.30	54.00	54.14	54.38	55.60	0.171448	5.35	0.99	0.13
27	641.72	10 yr ARI	7.08	54.00	54.19	54.45	55.61	0.118479	5.28	1.34	0.17
27	641.72	100 yr ARI	14.50	54.00	54.35	54.69	55.82	0.058963	5.37	2.70	0.30
27	630.79	5 yr ARI	5.30	53.85	54.14	54.25	54.52	0.037012	2.75	1.93	0.15
27	630.79	10 yr ARI	7.08	53.85	54.17	54.30	54.65	0.037720	3.09	2.29	0.18

## HEC-RAS Plan: 20block (Continued)

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
27	630.79	100 yr ARI	14.50	53.85	54.26	54.49	55.12	0.039578	4.09	3.54	0.27
27	621.04	5 yr ARI	5.30	52.00	52.40	52.72	53.90	0.083871	5.41	0.98	0.23
27	621.04	10 yr ARI	7.08	52.00	52.47	52.81	54.05	0.074143	5.57	1.27	0.27
27	621.04	100 yr ARI	14.50	52.00	52.67	53.11	54.55	0.057382	6.08	2.39	0.37
27	604.68	5 yr ARI	5.30	51.92	52.09	52.17	52.42	0.058724	2.56	2.08	0.10
27	604.68	10 yr ARI	7.08	51.92	52.10	52.21	52.56	0.067605	3.00	2.38	0.11
27	604.68	100 yr ARI	14.50	51.92	52.14	52.35	53.11	0.091387	4.37	3.35	0.15
27	551.35	5 yr ARI	5.30	48.00	48.11	48.23	48.63	0.086963	3.18	1.67	0.10
27	551.35	10 yr ARI	7.08	48.00	48.14	48.28	48.72	0.076743	3.36	2.10	0.12
27	551.35	100 yr ARI	14.50	48.00	48.22	48.42	49.03	0.063627	4.00	3.63	0.18
27	459.33	5 yr ARI	5.30	46.00	46.10	46.11	46.17	0.011831	1.15	4.63	0.10
27	459.33	10 yr ARI	7.08	46.00	46.12	46.14	46.21	0.012630	1.31	5.43	0.11
27	459.33	100 yr ARI	14.50	46.00	46.17	46.22	46.34	0.015071	1.79	8.18	0.15
27	433.25	5 yr ARI	5.30	45.26	45.56	45.63	45.77	0.020119	2.01	2.64	0.15
27	433.25	10 yr ARI	7.08	45.26	45.61	45.67	45.82	0.017003	2.03	3.49	0.17
27	433.25	100 yr ARI	14.50	45.26	45.74	45.81	45.99	0.010850	2.23	6.65	0.25
27	385.63	5 yr ARI	5.30	44.00	44.10	44.17	44.36	0.047300	2.27	2.35	0.09
27	385.63	10 yr ARI	7.08	44.00	44.11	44.20	44.47	0.053817	2.65	2.69	0.11
27	385.63	100 yr ARI	14.50	44.00	44.16	44.33	44.88	0.068267	3.80	3.86	0.15
27	312.82	5 yr ARI	5.30	41.52	41.81	41.89	42.05	0.022389	2.16	2.45	0.16
27	312.82	10 yr ARI	7.08	41.52	41.85	41.94	42.12	0.020901	2.28	3.11	0.18
27	312.82	100 yr ARI	14.50	41.52	41.97	42.09	42.34	0.019680	2.69	5.38	0.24
27	296.44	5 yr ARI	5.30	40.00	40.17	40.33	41.18	0.178800	4.63	1.25	0.11
27	296.44	10 yr ARI	7.08	40.00	40.19	40.38	41.28	0.183063	4.78	1.60	0.11
27	296.44	100 yr ARI	14.50	40.00	40.28	40.54	41.59	0.116120	5.23	2.98	0.17
27	240.96	5 yr ARI	5.30	40.00	40.14	40.13	40.19	0.005797	1.01	5.29	0.14
27	240.96	10 yr ARI	7.08	40.00	40.17	40.17	40.23	0.005382	1.10	6.49	0.16
27	240.96	100 yr ARI	14.50	40.00	40.18	40.25	40.41	0.019383	2.15	6.80	0.17
27	231.57	5 yr ARI	5.30	40.00	38.14	38.39	39.73	0.188640		0.95	0.13
27	231.57	10 yr ARI	7.08	40.00	38.18	38.46	39.85	0.146789		1.23	0.16
27	231.57	100 yr ARI	14.50	40.00	38.36	38.72	39.85	0.056404		2.68	0.31
27	222.27	5 yr ARI	5.30	40.00	38.15	38.27	38.61	0.053661		1.76	0.13
27	222.27	10 yr ARI	7.08	40.00	38.17	38.32	38.76	0.060023		2.08	0.15
27	222.27	100 yr ARI	14.50	40.00	38.26	38.48	39.17	0.060834		3.43	0.20
27	200.28	5 yr ARI	5.30	40.00	38.05	38.05	38.09	0.008308		6.06	0.08
27	200.28	10 yr ARI	7.08	40.00	38.06	38.07	38.12	0.011087		6.62	0.09
27	200.28	100 yr ARI	14.50	40.00	38.09	38.12	38.23	0.019257		8.66	0.12
27	174.18	5 yr ARI	5.30	40.00	36.29	36.39	37.31	0.436637		1.19	0.05
27	174.18	10 yr ARI	7.08	40.00	36.31	36.42	37.20	0.294531		1.69	0.05
27	174.18	100 yr ARI	14.50	40.00	36.37	36.51	37.12	0.119257		3.78	0.10
27	136.26	5 yr ARI	5.30	36.00	36.10	36.09	36.14	0.031770	0.84	6.28	0.10
27	136.26	10 yr ARI	7.08	36.00	36.12	36.11	36.16	0.027507	0.91	7.81	0.12
27	136.26	100 yr ARI	14.50	36.00	36.19	36.17	36.26	0.025537	1.18	12.32	0.19
27	125.17	5 yr ARI	5.30	35.38	35.69	35.69	35.76	0.036826	1.21	4.37	0.15
27	125.17	10 yr ARI	7.08	35.38	35.72	35.72	35.81	0.036059	1.30	5.45	0.17
27	125.17	100 yr ARI	14.50	35.38	35.84	35.84	35.95	0.031962	1.50	9.68	0.23
27	103.64	5 yr ARI	5.30	33.76	34.02	34.10	34.29	0.214165	2.30	2.31	0.11
27	103.64	10 yr ARI	7.08	33.76	34.04	34.13	34.36	0.203872	2.52	2.81	0.13
27	103.64	100 yr ARI	14.50	33.76	34.11	34.26	34.63	0.191088	3.18	4.55	0.19
27	93.05	5 yr ARI	5.30	32.56	32.94	33.06	33.31	0.050775	2.69	1.97	0.12
27	93.05	10 yr ARI	7.08	32.56	32.97	33.09	33.40	0.050237	2.91	2.43	0.13
27	93.05	100 yr ARI	14.50	32.56	33.05	33.22	33.71	0.048446	3.59	4.04	0.19
27	66.78	5 yr ARI	5.30	30.00	30.13	30.24	30.57	0.058172	2.94	1.80	0.12
27	66.78	10 yr ARI	7.08	30.00	30.15	30.29	30.69	0.057089	3.26	2.17	0.14
27	66.78	100 yr ARI	14.50	30.00	30.24	30.46	31.11	0.053451	4.15	3.49	0.22
27	27.36	5 yr ARI	5.30	28.00	30.00	28.49	30.00	0.000008	0.19	44.69	0.87
27	27.36	10 yr ARI	7.08	28.00	30.00	28.58	30.00	0.000014	0.26	44.69	0.87
27	27.36	100 yr ARI	14.50	28.00	30.00	28.87	30.01	0.000058	0.53	44.69	0.87

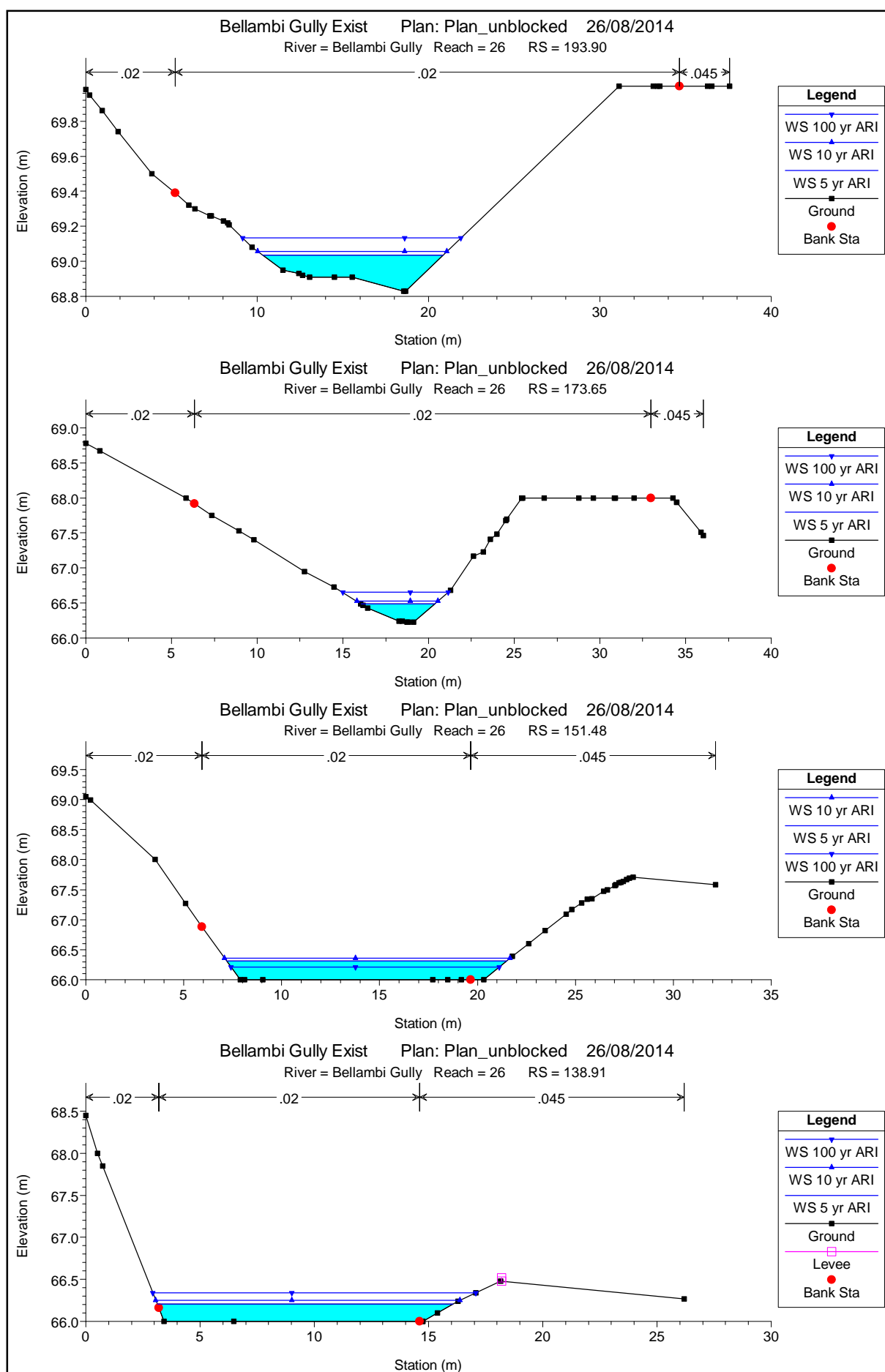
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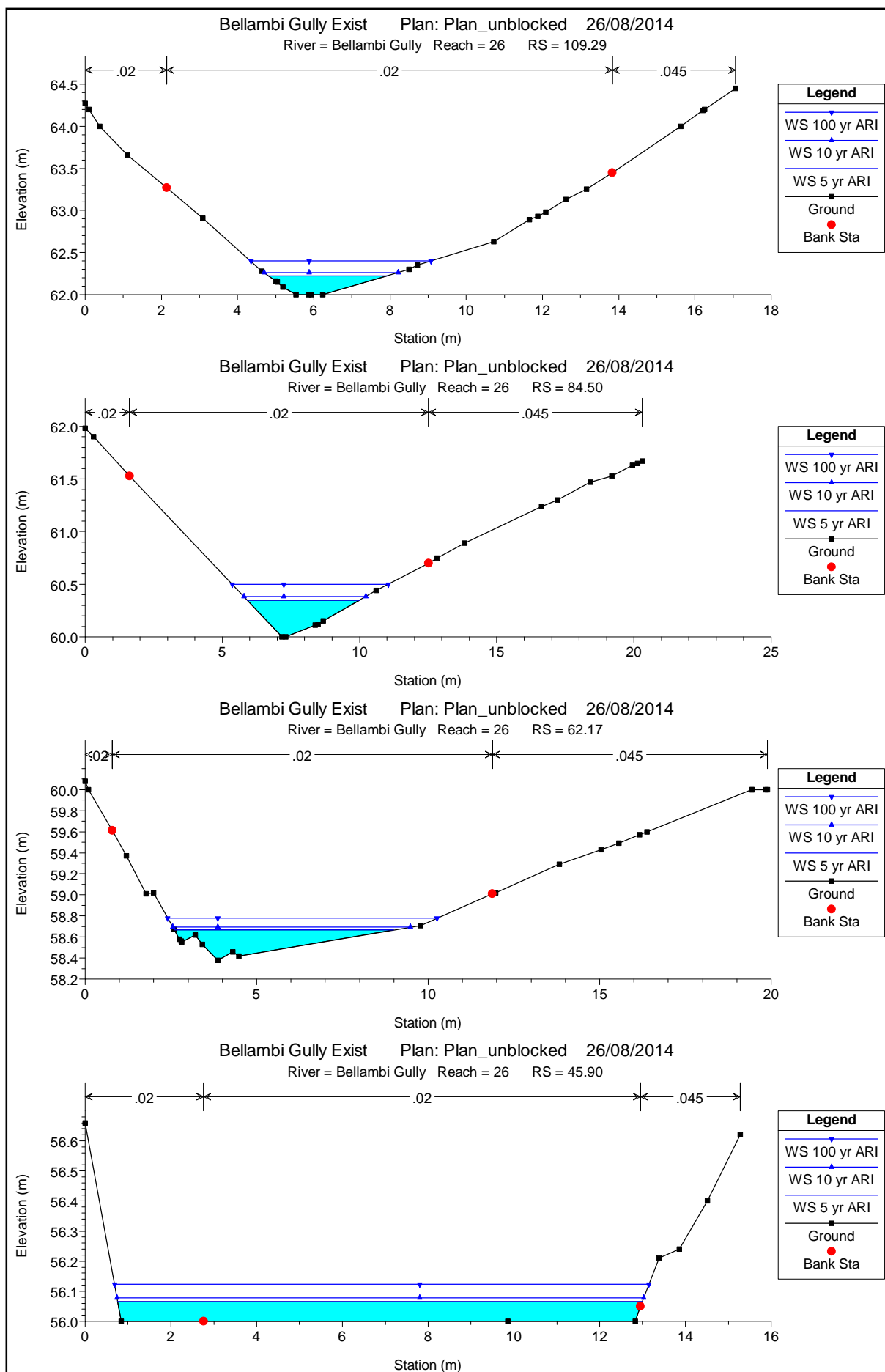
Bellambi Gully Exist Plan: Plan\_unblocked 26/08/2014

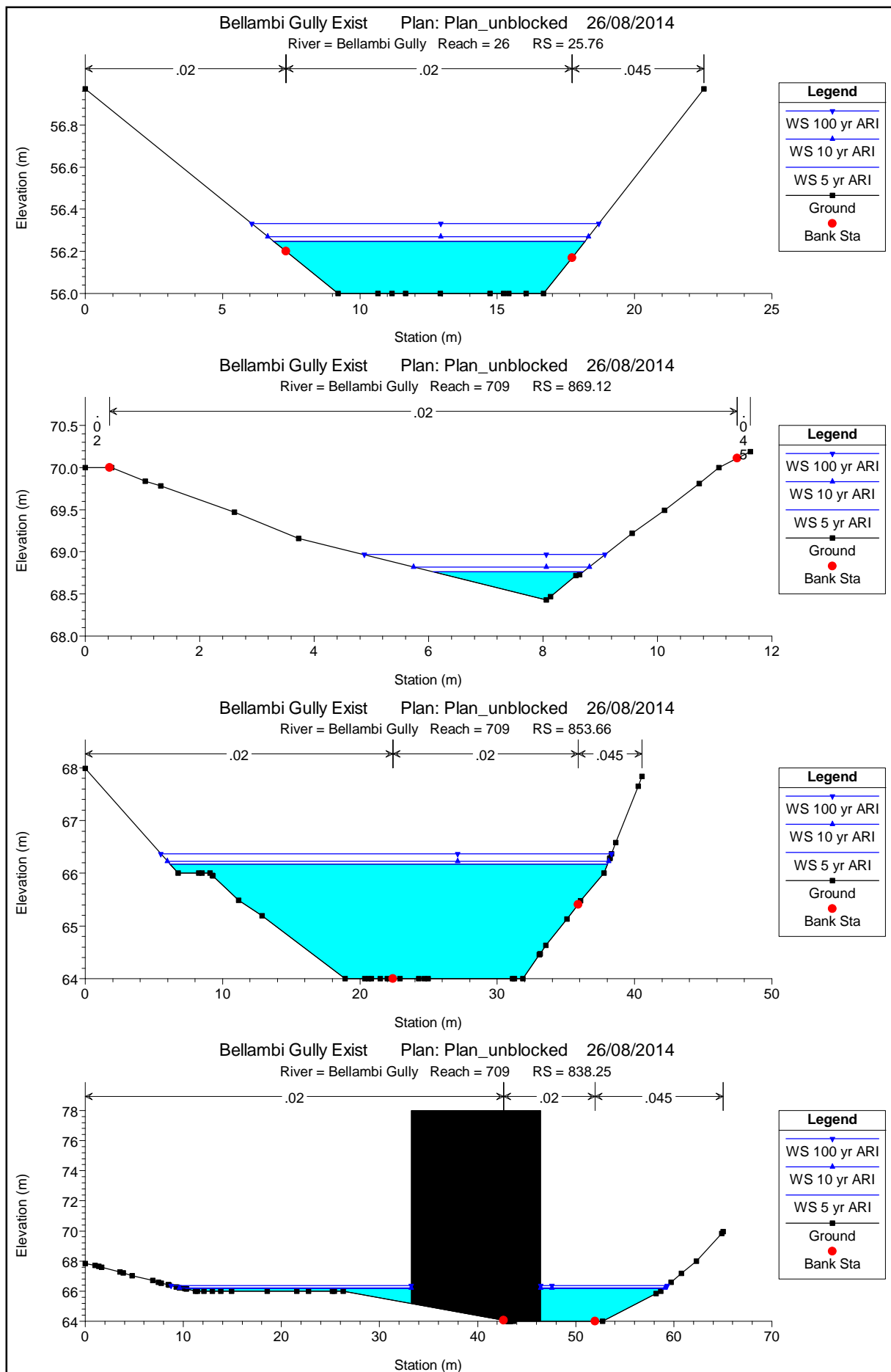


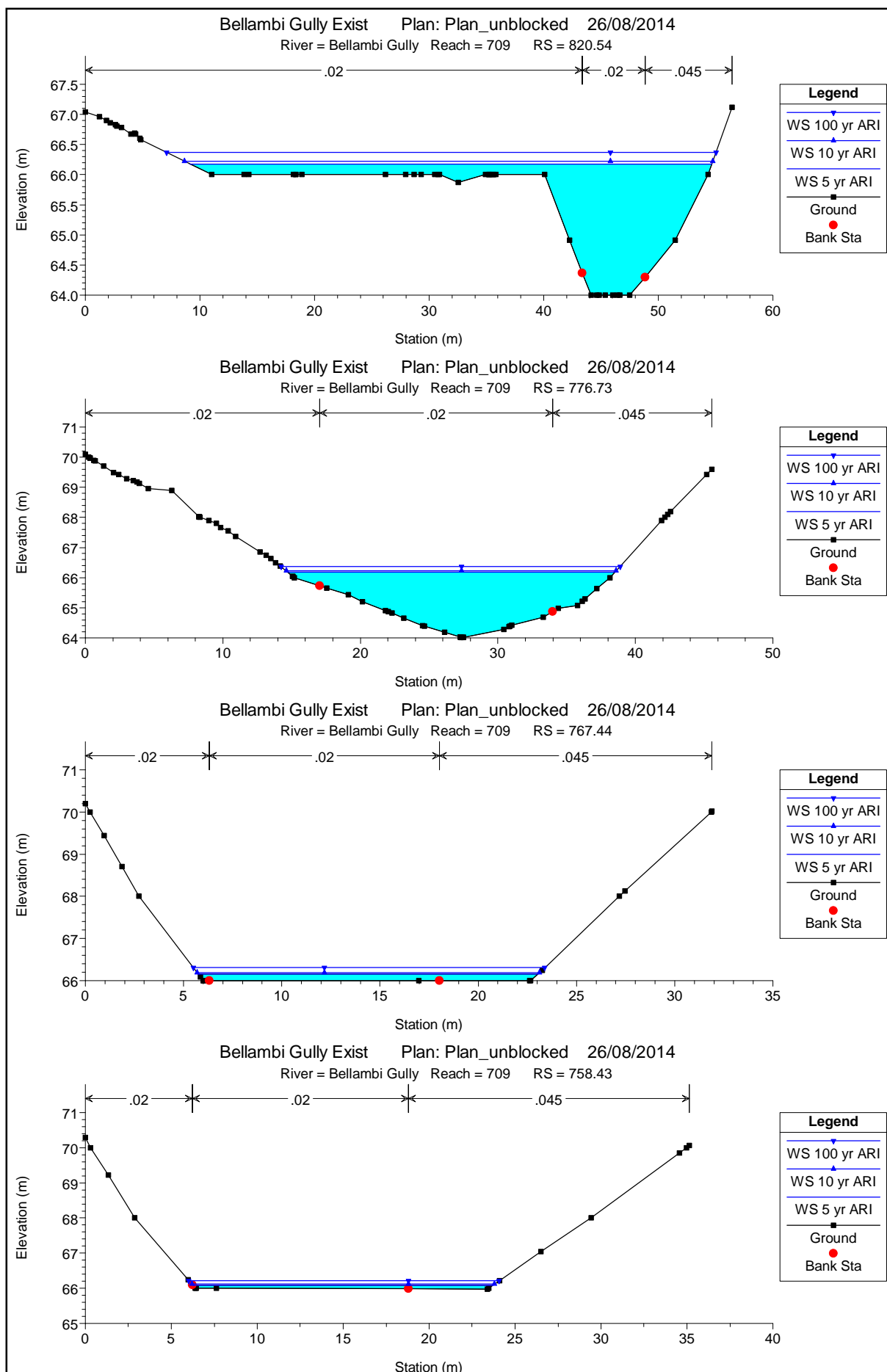


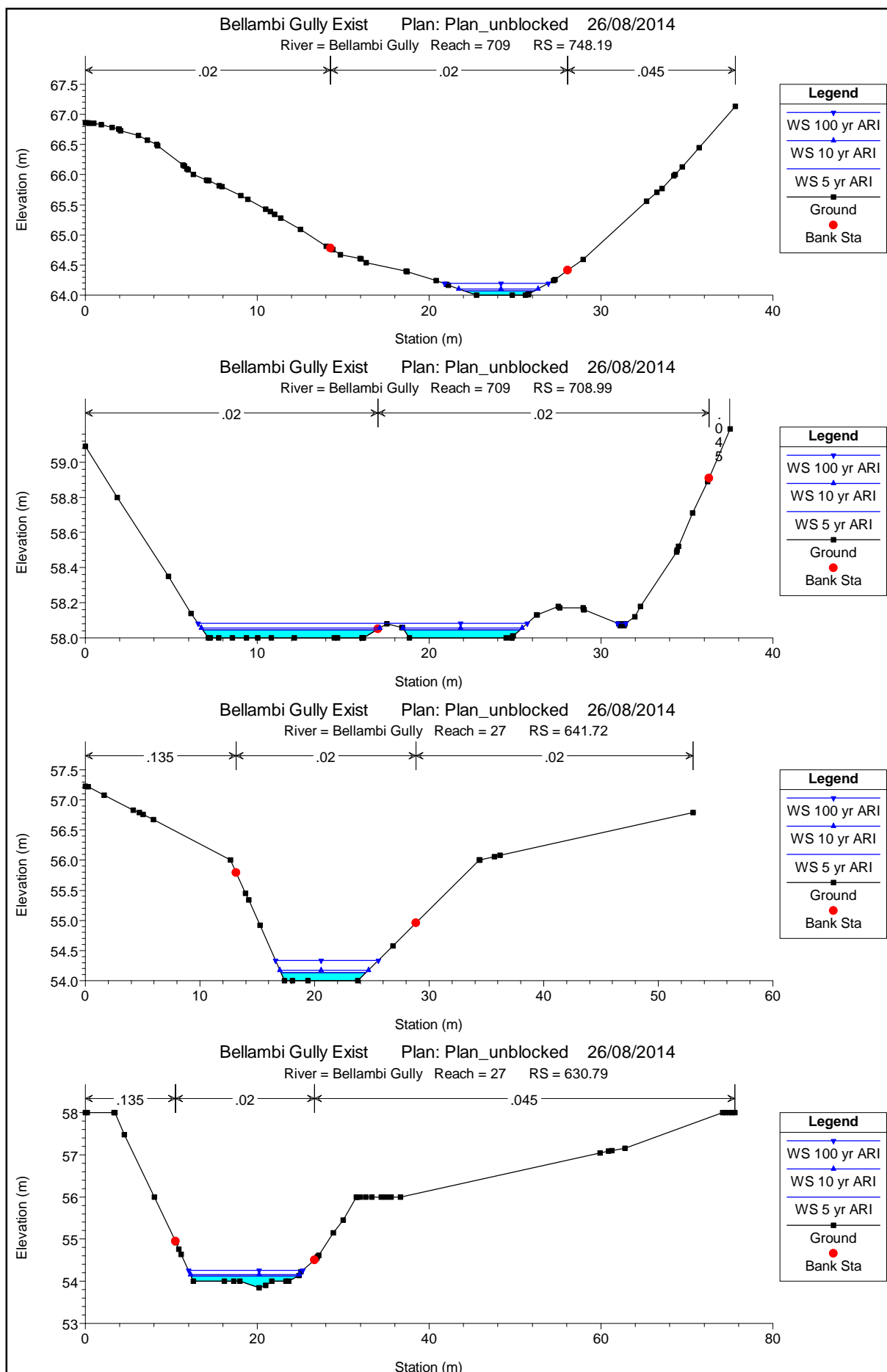
## Cross Sections

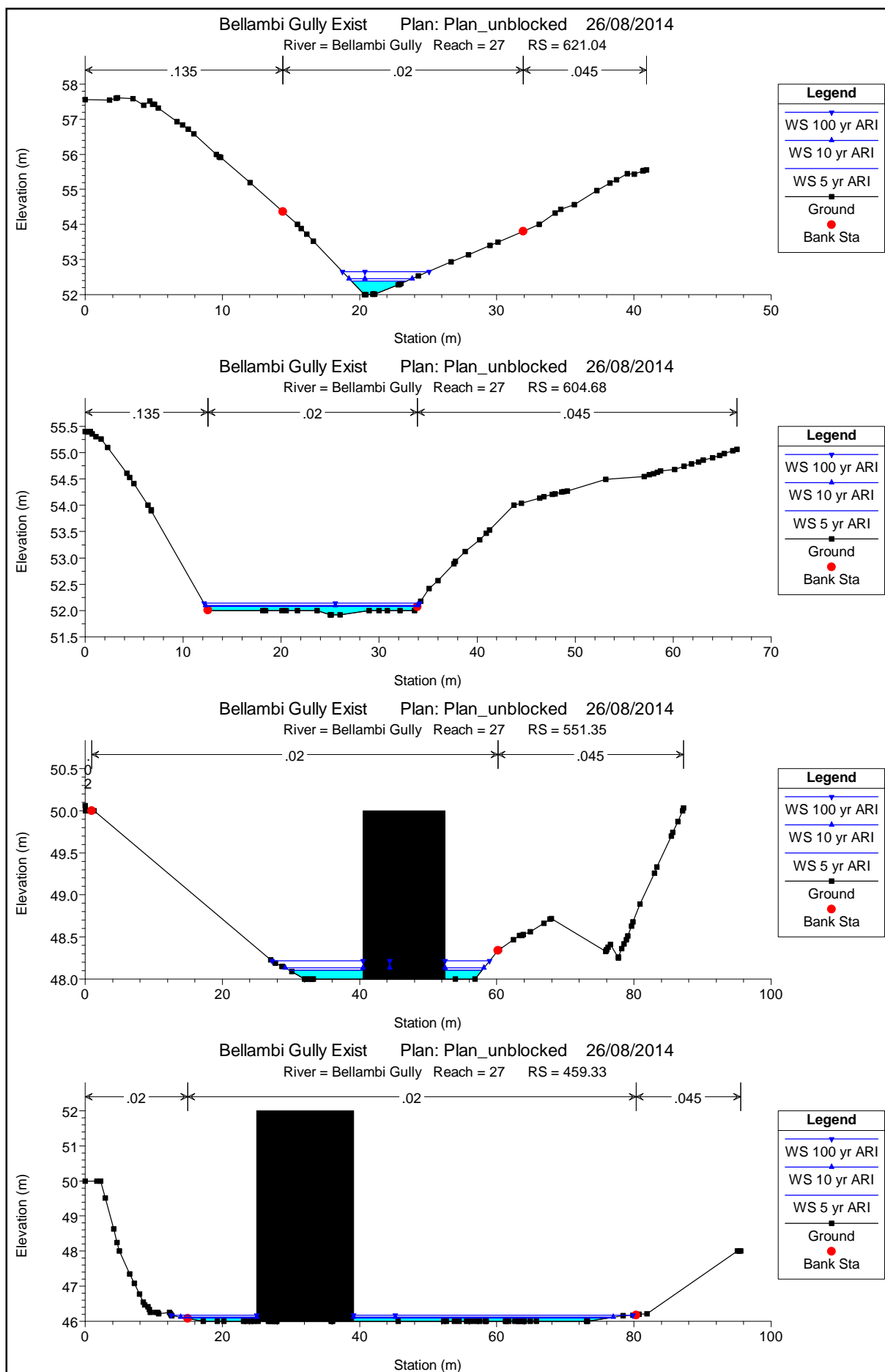


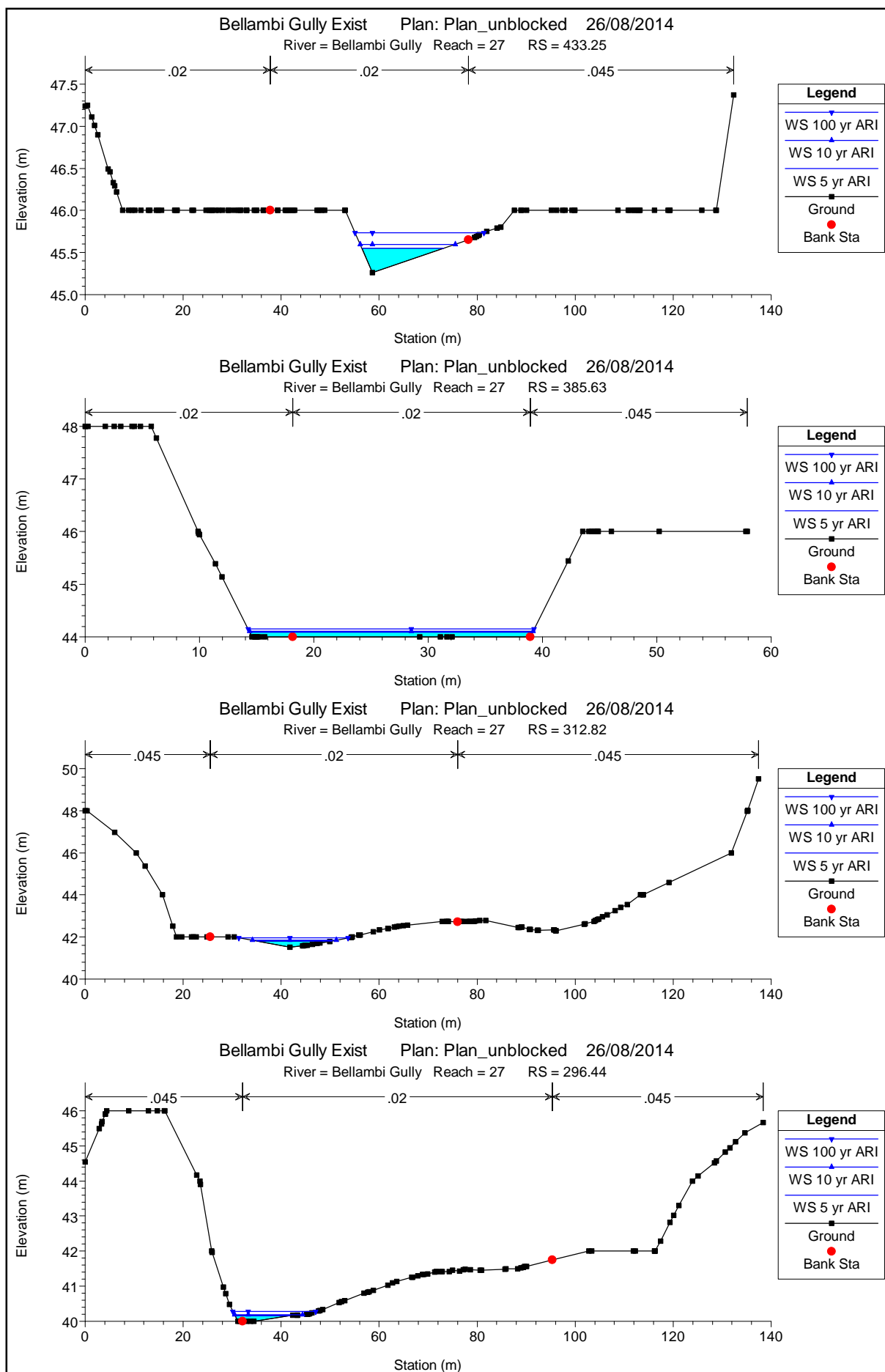


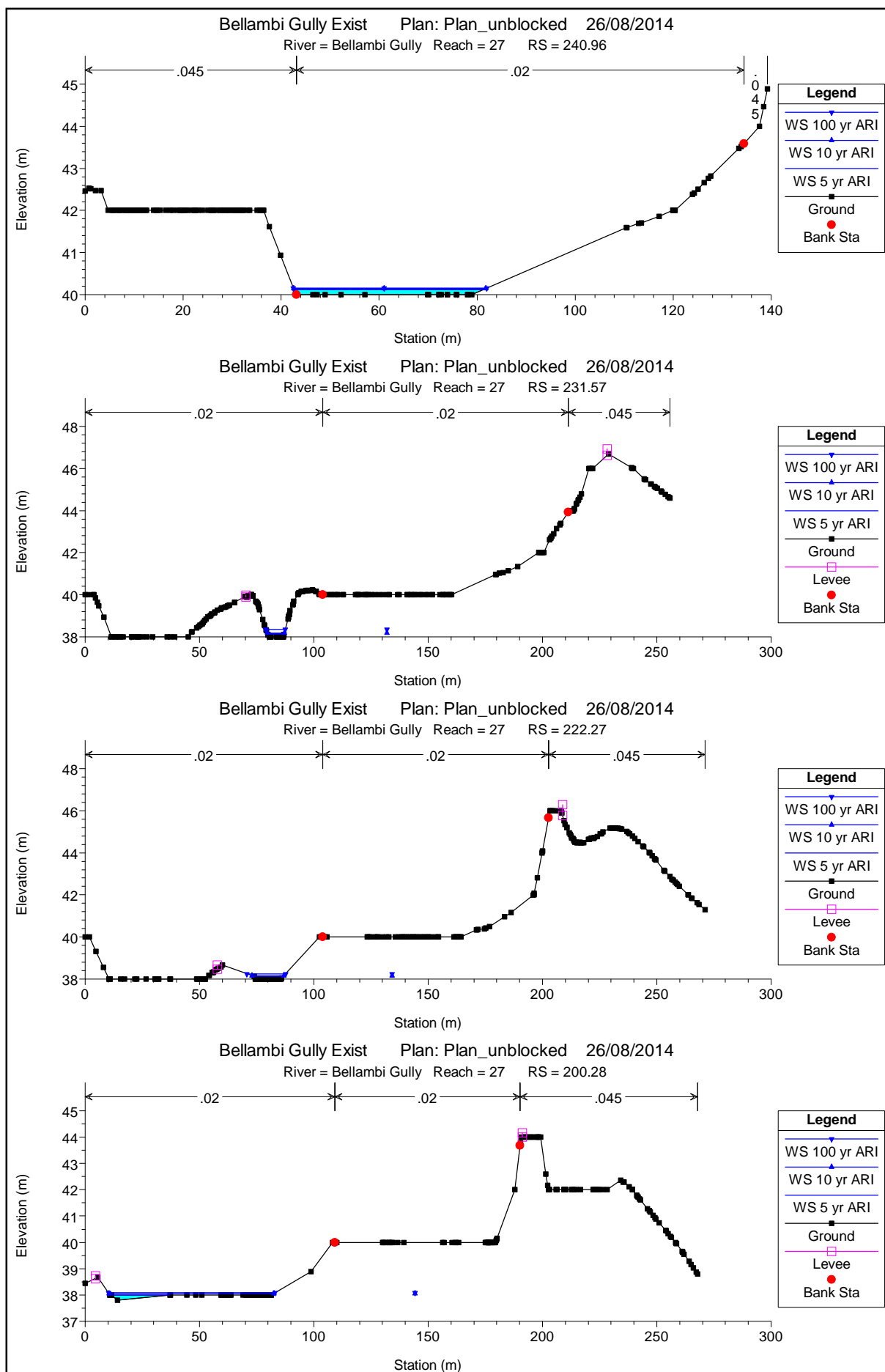




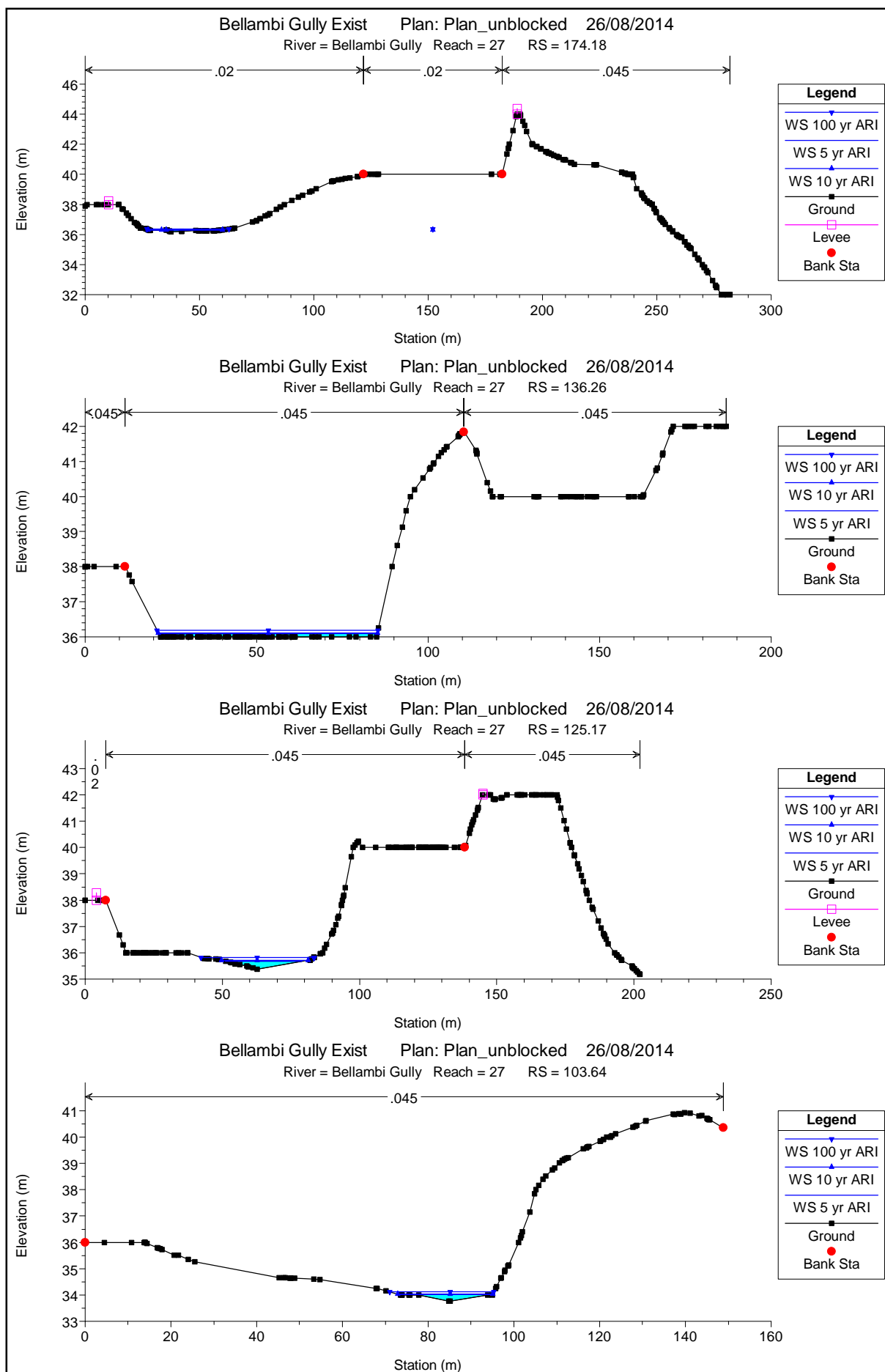


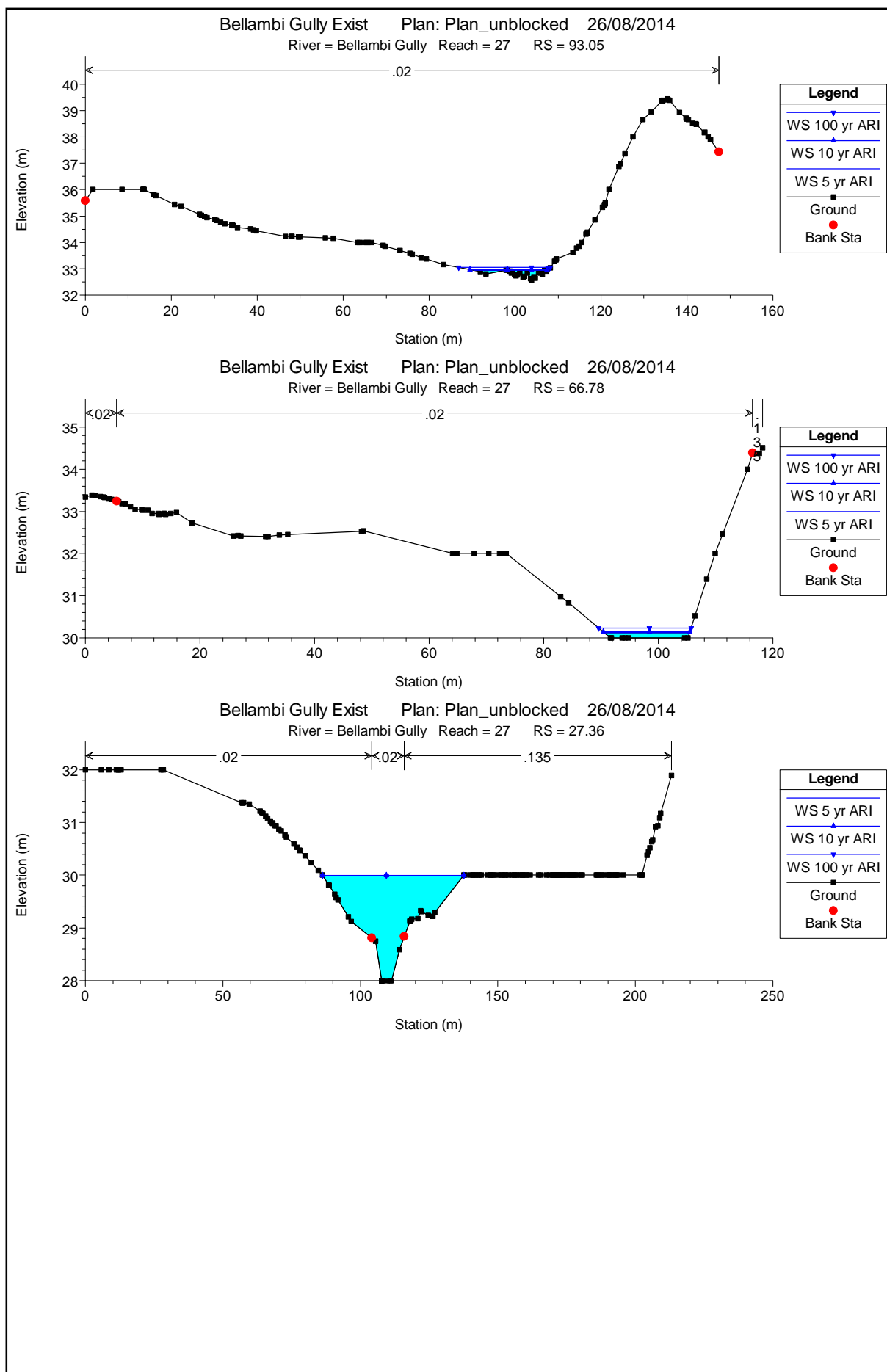












HEC-RAS Plan: unblock

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
26	193.90	5 yr ARI	3.42	68.83	69.03	69.14	69.41	0.050026	2.72	1.26	0.12
26	193.90	10 yr ARI	4.43	68.83	69.06	69.18	69.50	0.050066	2.95	1.50	0.14
26	193.90	100 yr ARI	8.92	68.83	69.13	69.32	69.83	0.050039	3.69	2.42	0.19
26	173.65	5 yr ARI	3.42	66.23	66.49	66.73	67.80	0.124755	5.08	0.67	0.16
26	173.65	10 yr ARI	4.43	66.23	66.53	66.79	67.94	0.113084	5.27	0.84	0.18
26	173.65	100 yr ARI	8.92	66.23	66.65	66.99	68.40	0.089580	5.85	1.52	0.25
26	151.48	5 yr ARI	3.42	66.00	66.31	66.19	66.35	0.001488	0.87	4.19	0.29
26	151.48	10 yr ARI	4.43	66.00	66.36	66.23	66.41	0.001558	0.97	4.87	0.33
26	151.48	100 yr ARI	8.92	66.00	66.21	66.37	66.79	0.038292	3.41	2.76	0.20
26	138.91	5 yr ARI	3.42	66.00	66.20	66.20	66.31	0.007016	1.44	2.49	0.19
26	138.91	10 yr ARI	4.43	66.00	66.25	66.25	66.37	0.005991	1.52	3.08	0.23
26	138.91	100 yr ARI	8.92	66.00	66.34	66.39	66.59	0.008359	2.22	4.34	0.31
26	109.29	5 yr ARI	3.42	62.00	62.23	62.55	65.37	0.349035	7.85	0.44	0.14
26	109.29	10 yr ARI	4.43	62.00	62.26	62.62	65.50	0.304257	7.98	0.56	0.16
26	109.29	100 yr ARI	8.92	62.00	62.40	62.84	65.62	0.176648	7.95	1.12	0.24
26	84.50	5 yr ARI	3.42	60.00	60.35	60.57	61.33	0.072360	4.40	0.78	0.19
26	84.50	10 yr ARI	4.43	60.00	60.38	60.64	61.55	0.075484	4.78	0.93	0.21
26	84.50	100 yr ARI	8.92	60.00	60.50	60.85	62.28	0.083659	5.91	1.51	0.27
26	62.17	5 yr ARI	3.42	58.38	58.67	58.83	59.46	0.092117	3.96	0.86	0.14
26	62.17	10 yr ARI	4.43	58.38	58.69	58.89	59.61	0.092271	4.25	1.04	0.15
26	62.17	100 yr ARI	8.92	58.38	58.78	59.07	60.23	0.091352	5.33	1.67	0.21
26	45.90	5 yr ARI	3.42	56.00	56.07	56.20	57.01	0.285735	4.33	0.79	0.06
26	45.90	10 yr ARI	4.43	56.00	56.08	56.24	57.21	0.271267	4.72	0.94	0.08
26	45.90	100 yr ARI	8.92	56.00	56.12	56.38	57.93	0.236518	6.00	1.50	0.12
26	25.76	5 yr ARI	3.42	56.00	56.25	56.25	56.36	0.006542	1.48	2.34	0.21
26	25.76	10 yr ARI	4.43	56.00	56.27	56.29	56.42	0.007971	1.74	2.59	0.22
26	25.76	100 yr ARI	8.92	56.00	56.33	56.45	56.72	0.014866	2.76	3.35	0.26
709	869.12	5 yr ARI	1.40	68.43	68.76	68.91	69.30	0.050032	3.26	0.43	0.16
709	869.12	10 yr ARI	2.16	68.43	68.82	69.00	69.49	0.050041	3.64	0.59	0.19
709	869.12	100 yr ARI	5.08	68.43	68.97	69.23	70.00	0.050062	4.51	1.13	0.27
709	853.66	5 yr ARI	1.40	64.00	66.18	64.12	66.18	0.000000	0.03	47.23	1.48
709	853.66	10 yr ARI	2.16	64.00	66.22	64.14	66.22	0.000000	0.05	48.77	1.52
709	853.66	100 yr ARI	5.08	64.00	66.37	64.24	66.37	0.000002	0.11	53.61	1.63
709	838.25	5 yr ARI	1.40	64.00	66.18		66.18	0.000001	0.08	27.50	0.77
709	838.25	10 yr ARI	2.16	64.00	66.22		66.22	0.000003	0.12	29.22	0.81
709	838.25	100 yr ARI	5.08	64.00	66.37		66.37	0.000011	0.23	34.66	0.93
709	820.54	5 yr ARI	1.40	64.00	66.18		66.18	0.000001	0.09	26.57	0.58
709	820.54	10 yr ARI	2.16	64.00	66.22		66.22	0.000003	0.13	28.77	0.62
709	820.54	100 yr ARI	5.08	64.00	66.37		66.37	0.000009	0.26	35.71	0.74
709	776.73	5 yr ARI	1.40	64.01	66.18		66.18	0.000001	0.05	29.87	1.26
709	776.73	10 yr ARI	2.16	64.01	66.22		66.22	0.000001	0.08	31.01	1.29
709	776.73	100 yr ARI	5.08	64.01	66.37		66.37	0.000005	0.17	34.61	1.40
709	767.44	5 yr ARI	1.40	66.00	66.16		66.17	0.001921	0.63	2.65	0.15
709	767.44	10 yr ARI	2.16	66.00	66.19		66.22	0.002214	0.79	3.30	0.19
709	767.44	100 yr ARI	5.08	66.00	66.31		66.37	0.002609	1.16	5.30	0.30
709	758.43	5 yr ARI	1.40	65.99	66.08	66.08	66.13	0.013062	1.10	1.51	0.09
709	758.43	10 yr ARI	2.16	65.99	66.12	66.12	66.18	0.009437	1.19	2.16	0.12
709	758.43	100 yr ARI	5.08	65.99	66.21	66.21	66.32	0.007560	1.57	3.88	0.21
709	748.19	5 yr ARI	1.40	64.00	64.07	64.23	65.59	0.485661	5.46	0.26	0.06
709	748.19	10 yr ARI	2.16	64.00	64.10	64.29	65.73	0.355905	5.66	0.38	0.08
709	748.19	100 yr ARI	5.08	64.00	64.19	64.45	65.95	0.184210	5.87	0.87	0.14
709	708.99	5 yr ARI	1.40	58.00	58.05	58.09	58.23	0.095911	1.91	0.73	0.04
709	708.99	10 yr ARI	2.16	58.00	58.06	58.12	58.34	0.112844	2.33	0.91	0.05
709	708.99	100 yr ARI	5.08	58.00	58.08	58.20	58.77	0.178725	3.33	1.39	0.07
27	641.72	5 yr ARI	4.81	54.00	54.13	54.36	55.61	0.195907	5.39	0.89	0.12
27	641.72	10 yr ARI	6.59	54.00	54.18	54.43	55.61	0.131291	5.32	1.24	0.16
27	641.72	100 yr ARI	14.01	54.00	54.34	54.68	55.80	0.060685	5.36	2.61	0.29
27	630.79	5 yr ARI	4.81	53.85	54.13	54.23	54.49	0.036651	2.65	1.82	0.15
27	630.79	10 yr ARI	6.59	53.85	54.16	54.29	54.62	0.037734	3.01	2.19	0.17

HEC-RAS Plan: unblock (Continued)

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
27	630.79	100 yr ARI	14.01	53.85	54.26	54.48	55.09	0.039707	4.05	3.46	0.26
27	621.04	5 yr ARI	4.81	52.00	52.38	52.69	53.85	0.087769	5.36	0.90	0.22
27	621.04	10 yr ARI	6.59	52.00	52.45	52.79	54.01	0.076318	5.53	1.19	0.26
27	621.04	100 yr ARI	14.01	52.00	52.66	53.09	54.52	0.058029	6.05	2.32	0.37
27	604.68	5 yr ARI	4.81	51.92	52.08	52.16	52.38	0.055159	2.41	2.00	0.09
27	604.68	10 yr ARI	6.59	51.92	52.10	52.20	52.52	0.064594	2.87	2.31	0.11
27	604.68	100 yr ARI	14.01	51.92	52.14	52.34	53.08	0.090517	4.29	3.29	0.15
27	551.35	5 yr ARI	4.81	48.00	48.11	48.22	48.61	0.092437	3.13	1.53	0.09
27	551.35	10 yr ARI	6.59	48.00	48.13	48.27	48.70	0.079565	3.32	1.98	0.12
27	551.35	100 yr ARI	14.01	48.00	48.22	48.41	49.01	0.063880	3.96	3.54	0.18
27	459.33	5 yr ARI	4.81	46.00	46.10	46.11	46.16	0.011510	1.10	4.39	0.09
27	459.33	10 yr ARI	6.59	46.00	46.12	46.13	46.20	0.012458	1.27	5.22	0.11
27	459.33	100 yr ARI	14.01	46.00	46.17	46.21	46.33	0.014932	1.76	8.02	0.15
27	433.25	5 yr ARI	4.81	45.26	45.55	45.61	45.75	0.021091	2.00	2.41	0.14
27	433.25	10 yr ARI	6.59	45.26	45.60	45.66	45.80	0.017580	2.02	3.27	0.17
27	433.25	100 yr ARI	14.01	45.26	45.73	45.80	45.98	0.011105	2.21	6.45	0.25
27	385.63	5 yr ARI	4.81	44.00	44.09	44.16	44.33	0.045342	2.16	2.24	0.09
27	385.63	10 yr ARI	6.59	44.00	44.11	44.19	44.44	0.052556	2.56	2.59	0.10
27	385.63	100 yr ARI	14.01	44.00	44.15	44.32	44.86	0.067870	3.74	3.79	0.15
27	312.82	5 yr ARI	4.81	41.52	41.80	41.88	42.03	0.022984	2.12	2.27	0.15
27	312.82	10 yr ARI	6.59	41.52	41.84	41.93	42.10	0.021131	2.24	2.94	0.17
27	312.82	100 yr ARI	14.01	41.52	41.96	42.08	42.32	0.019622	2.67	5.25	0.24
27	296.44	5 yr ARI	4.81	40.00	40.16	40.32	41.14	0.183366	4.55	1.15	0.10
27	296.44	10 yr ARI	6.59	40.00	40.19	40.36	41.25	0.186988	4.73	1.50	0.11
27	296.44	100 yr ARI	14.01	40.00	40.27	40.53	41.58	0.118899	5.21	2.89	0.17
27	240.96	5 yr ARI	4.81	40.00	40.12	40.12	40.18	0.007994	1.07	4.51	0.12
27	240.96	10 yr ARI	6.59	40.00	40.15	40.15	40.22	0.007971	1.21	5.49	0.14
27	240.96	100 yr ARI	14.01	40.00	40.16	40.24	40.45	0.028918	2.40	5.88	0.15
27	231.57	5 yr ARI	4.81	40.00	38.13	38.37	39.71	0.208884		0.86	0.12
27	231.57	10 yr ARI	6.59	40.00	38.17	38.45	39.78	0.150244		1.17	0.16
27	231.57	100 yr ARI	14.01	40.00	38.36	38.70	39.78	0.054503		2.65	0.31
27	222.27	5 yr ARI	4.81	40.00	38.14	38.25	38.57	0.051850		1.66	0.13
27	222.27	10 yr ARI	6.59	40.00	38.16	38.31	38.71	0.056651		2.02	0.14
27	222.27	100 yr ARI	14.01	40.00	38.25	38.47	39.12	0.058484		3.40	0.20
27	200.28	5 yr ARI	4.81	40.00	38.00	38.04	38.21	0.038634		2.37	0.09
27	200.28	10 yr ARI	6.59	40.00	38.06	38.06	38.11	0.010414		6.45	0.09
27	200.28	100 yr ARI	14.01	40.00	38.09	38.12	38.22	0.018578		8.57	0.12
27	174.18	5 yr ARI	4.81	40.00	36.32	36.38	36.61	0.100700		1.99	0.06
27	174.18	10 yr ARI	6.59	40.00	36.30	36.41	37.22	0.324145		1.55	0.05
27	174.18	100 yr ARI	14.01	40.00	36.36	36.51	37.12	0.125849		3.63	0.10
27	136.26	5 yr ARI	4.81	36.00	36.09	36.09	36.13	0.033032	0.82	5.85	0.09
27	136.26	10 yr ARI	6.59	36.00	36.11	36.10	36.16	0.031175	0.92	7.20	0.11
27	136.26	100 yr ARI	14.01	36.00	36.19	36.17	36.26	0.024786	1.15	12.17	0.19
27	125.17	5 yr ARI	4.81	35.38	35.68	35.68	35.75	0.035713	1.17	4.12	0.15
27	125.17	10 yr ARI	6.59	35.38	35.72	35.72	35.80	0.033435	1.24	5.32	0.17
27	125.17	100 yr ARI	14.01	35.38	35.83	35.83	35.94	0.034098	1.51	9.25	0.22
27	103.64	5 yr ARI	4.81	33.76	34.01	34.08	34.27	0.230352	2.27	2.12	0.10
27	103.64	10 yr ARI	6.59	33.76	34.03	34.12	34.37	0.237968	2.57	2.56	0.12
27	103.64	100 yr ARI	14.01	33.76	34.12	34.26	34.60	0.178161	3.08	4.56	0.19
27	93.05	5 yr ARI	4.81	32.56	32.94	33.04	33.28	0.049739	2.60	1.85	0.11
27	93.05	10 yr ARI	6.59	32.56	32.97	33.08	33.37	0.049349	2.83	2.33	0.13
27	93.05	100 yr ARI	14.01	32.56	33.05	33.22	33.69	0.048616	3.55	3.94	0.18
27	66.78	5 yr ARI	4.81	30.00	30.12	30.23	30.53	0.059605	2.86	1.68	0.11
27	66.78	10 yr ARI	6.59	30.00	30.14	30.28	30.66	0.058243	3.19	2.06	0.14
27	66.78	100 yr ARI	14.01	30.00	30.23	30.45	31.09	0.053628	4.11	3.41	0.21
27	27.36	5 yr ARI	4.81	28.00	30.00	28.47	30.00	0.000006	0.18	44.69	0.87
27	27.36	10 yr ARI	6.59	28.00	30.00	28.56	30.00	0.000012	0.24	44.69	0.87
27	27.36	100 yr ARI	14.01	28.00	30.00	28.86	30.01	0.000054	0.51	44.69	0.87

# APPENDIX C

## EXISTING SCENARIO FLOOD MAPS









## Scenario 2 (20% blocked pipes)

BELLAMBI GULLY FLOOD STUDY

1:2,500 Scale at A3

Metres  
0 40 80 120 160



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)  
Date: 2014-06-27  
Coordinate System: GDA 1994 MGA Zone 56  
Project: 82014089-01  
Map: G1002\_Scenario2\_20perc.mxd 02  
Aerial imagery supplied by nearmap (July 2013)







# APPENDIX D

## PROPOSED MITIGATION MEASURES





## Proposed Flood Mitigation

BELLAMBI GULLY FLOOD STUDY

1:3,000 Scale at A3

Metres  
0 50 100 150 200



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)  
Date: 2014-07-01  
Coordinate System: GDA 1994 MGA Zone 56  
Project: 82014089-01  
Map: G1004\_ProposedFloodMitigation.mxd 02  
Aerial Imagery supplied by nearmap (July 2013)



Bellambi Gully Flood Study

# APPENDIX E

## PROPOSED SCENARIO HYDRAULIC MODEL




HECRAS Model View

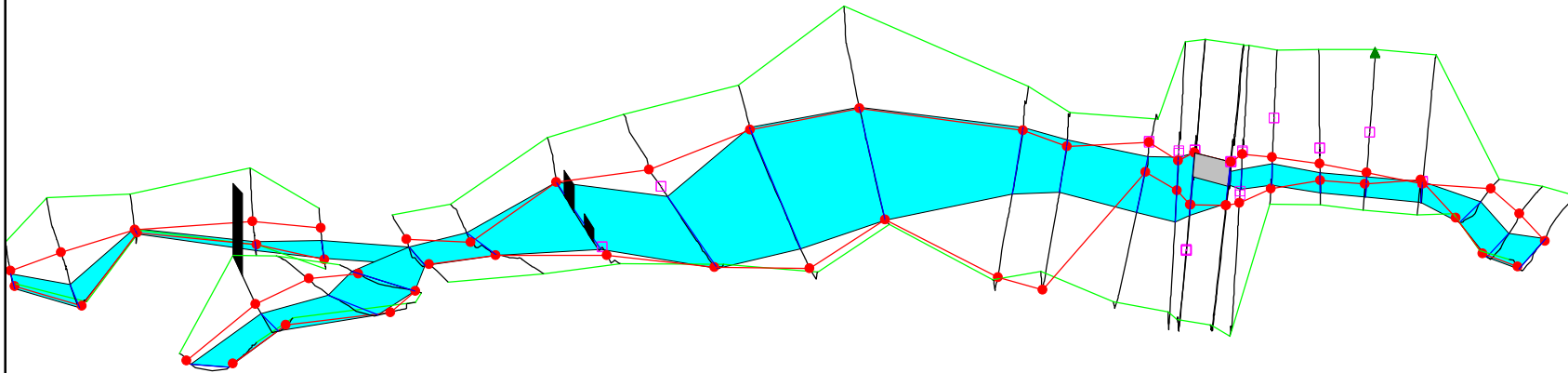


# Plan View

U:\FY14\089\_Bellambi Gully Flood Study\D

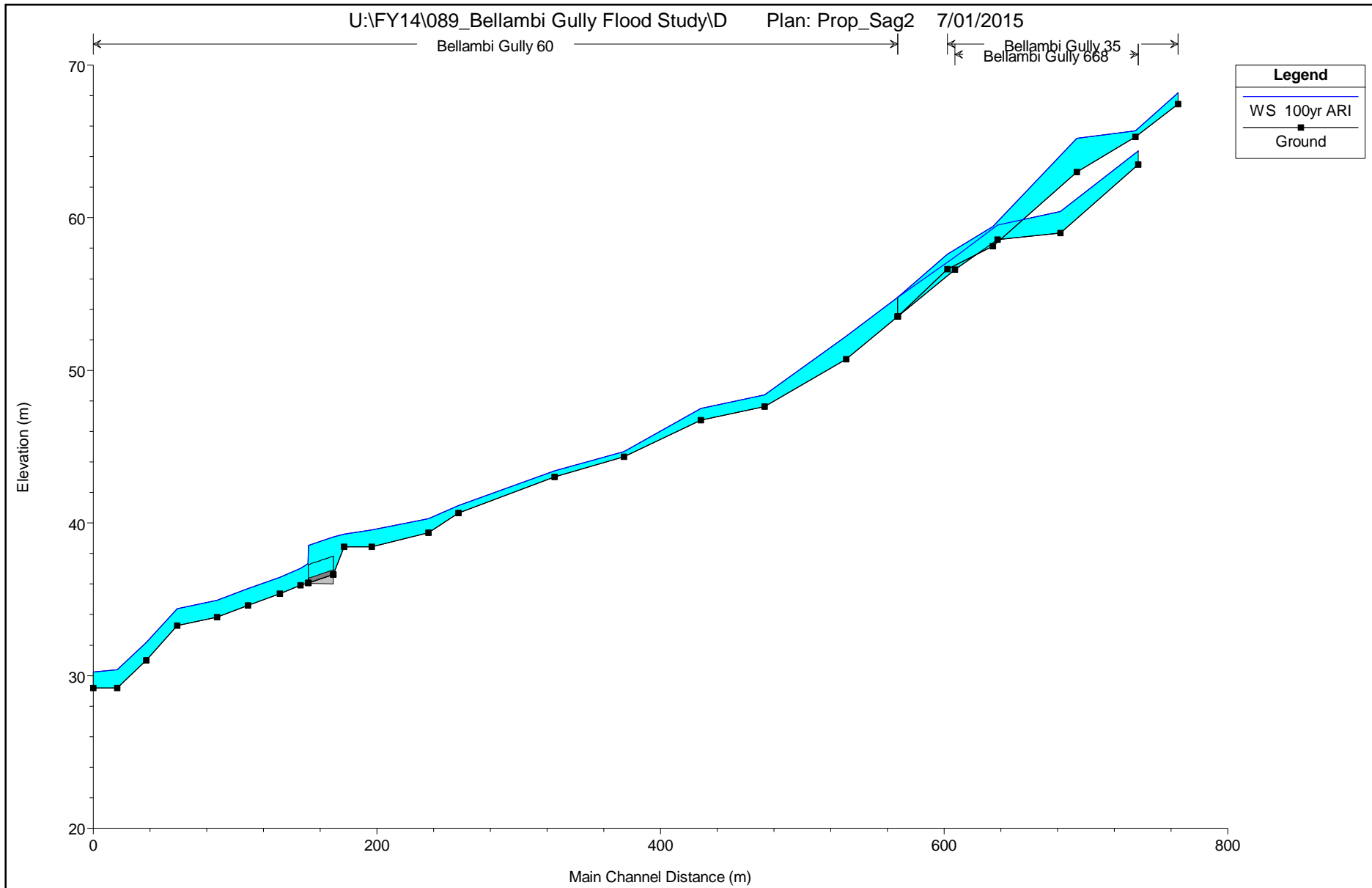
Plan: Prop\_Sag2 7/01/2015

Legend	
	WS 100yr ARI
<hr/>	
	Ground
	Bank Sta
	Levee
	Ineff

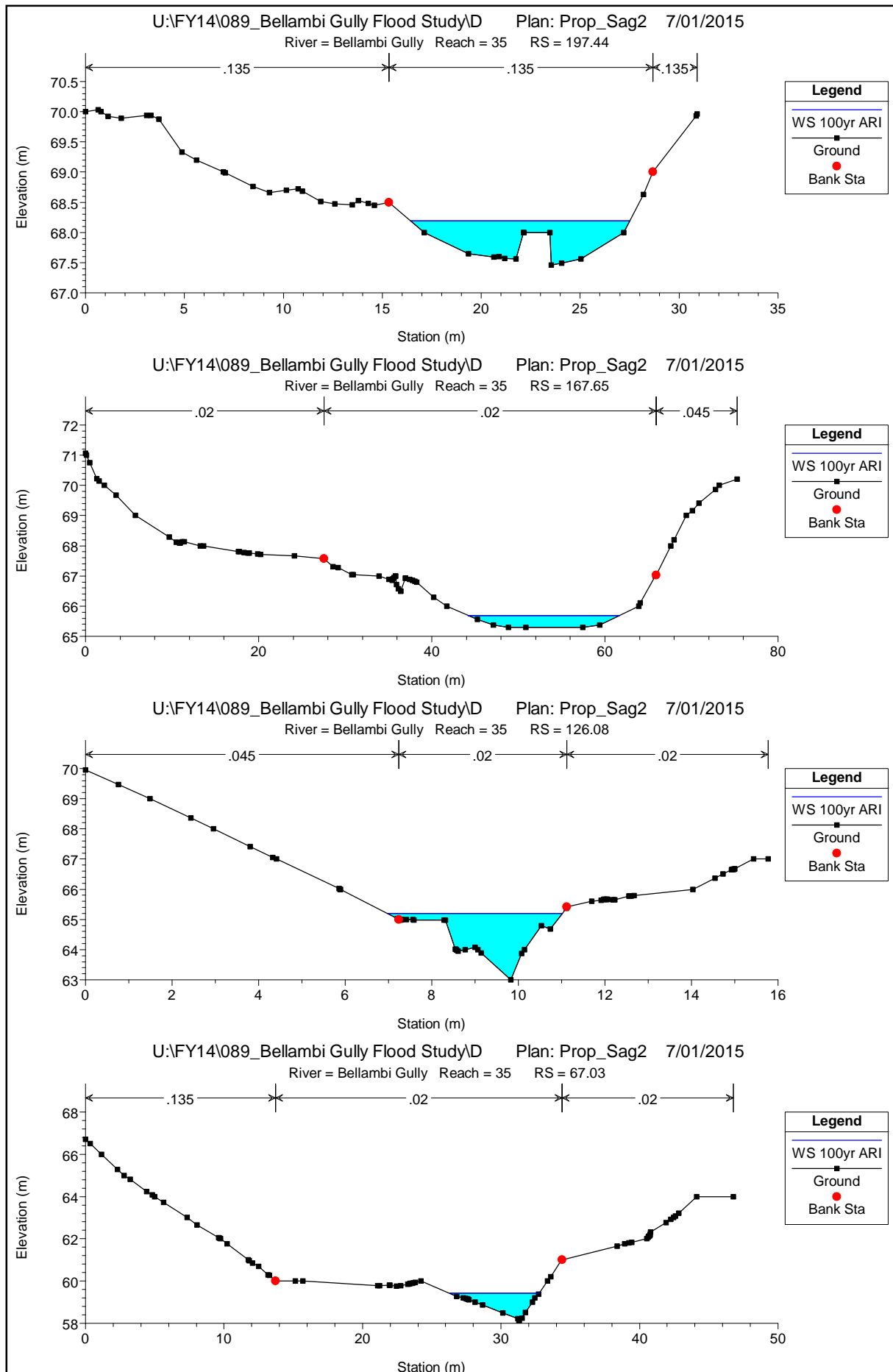


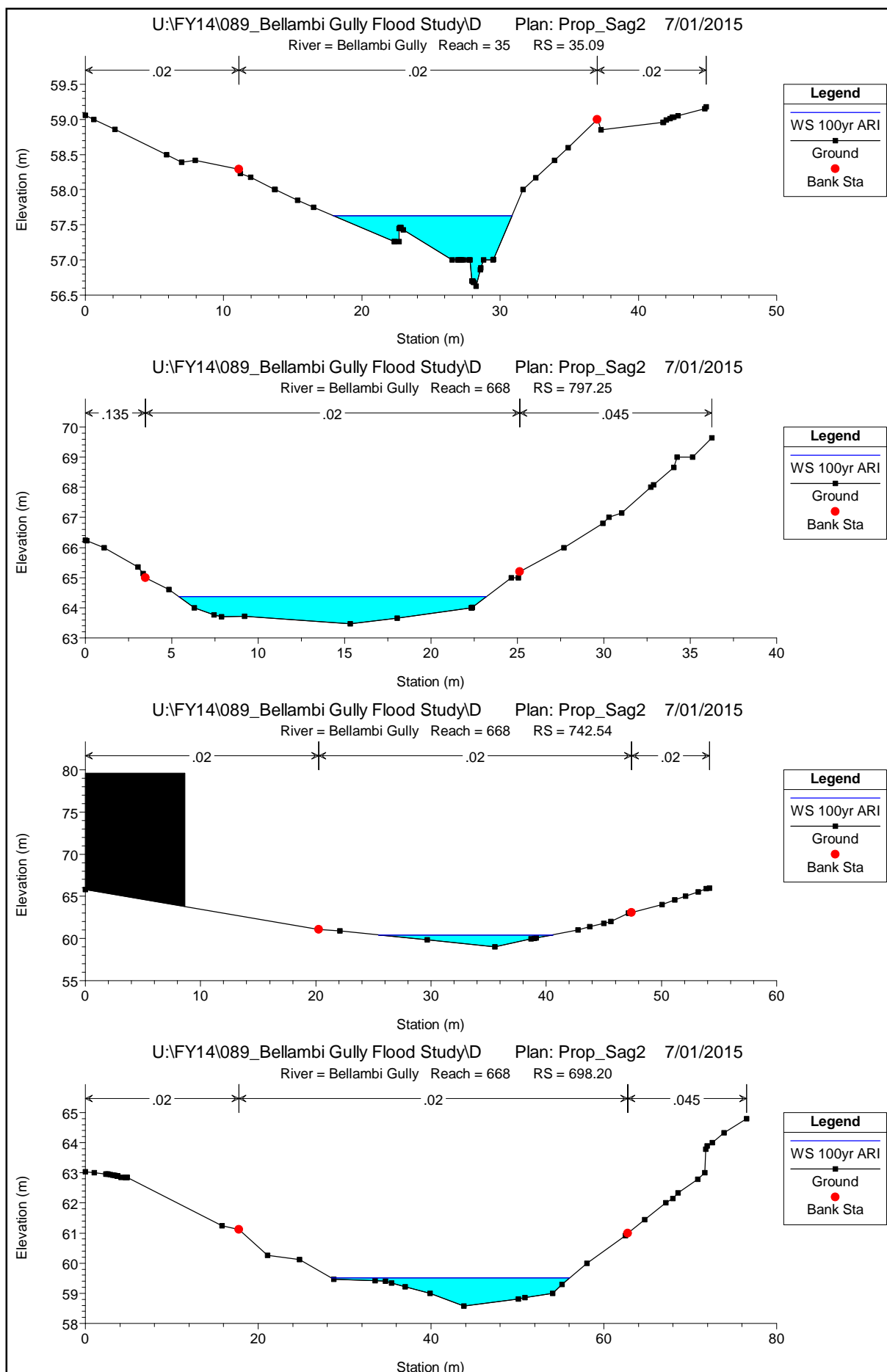


# Long Section View

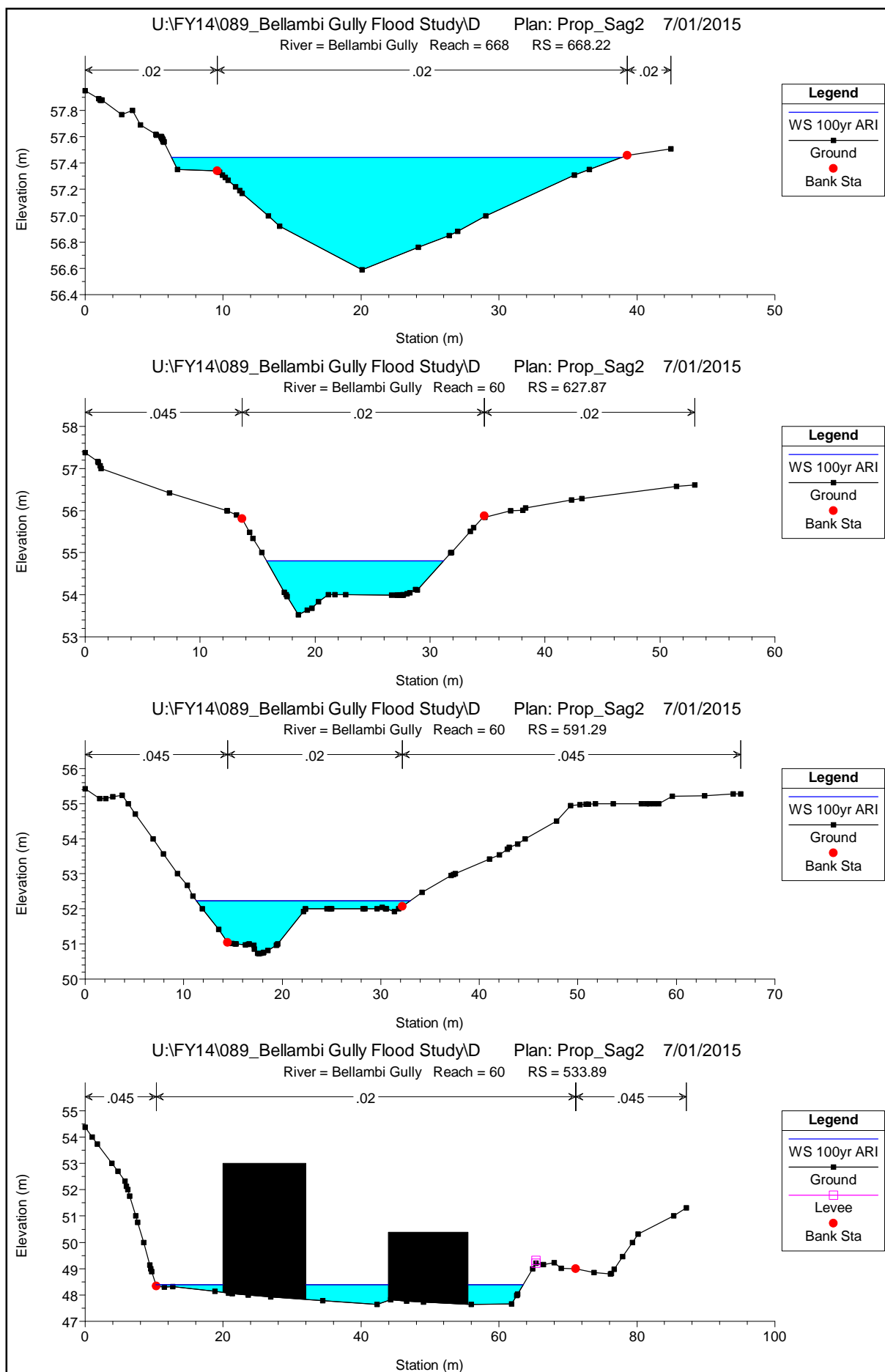


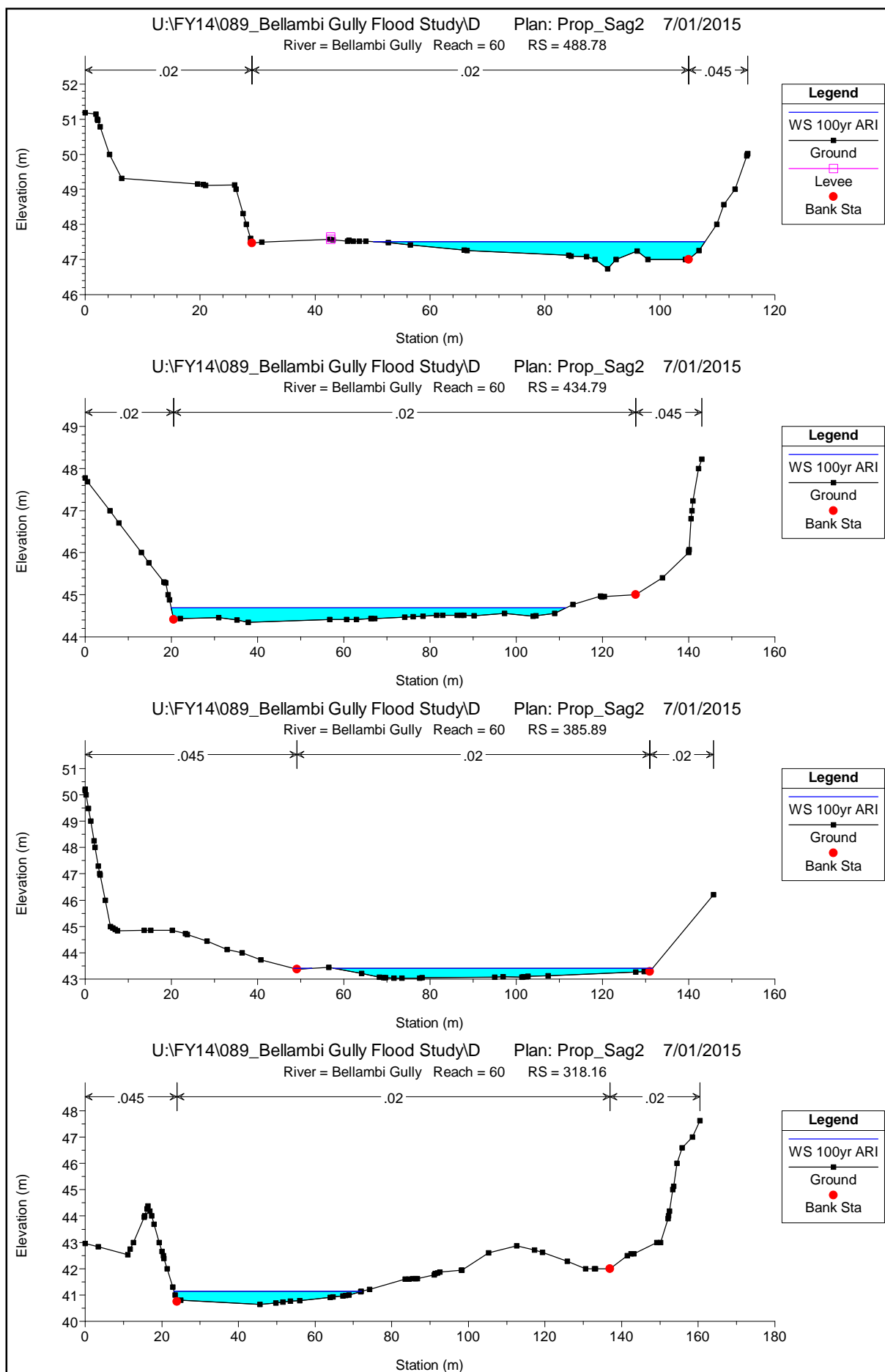
## Cross Sections

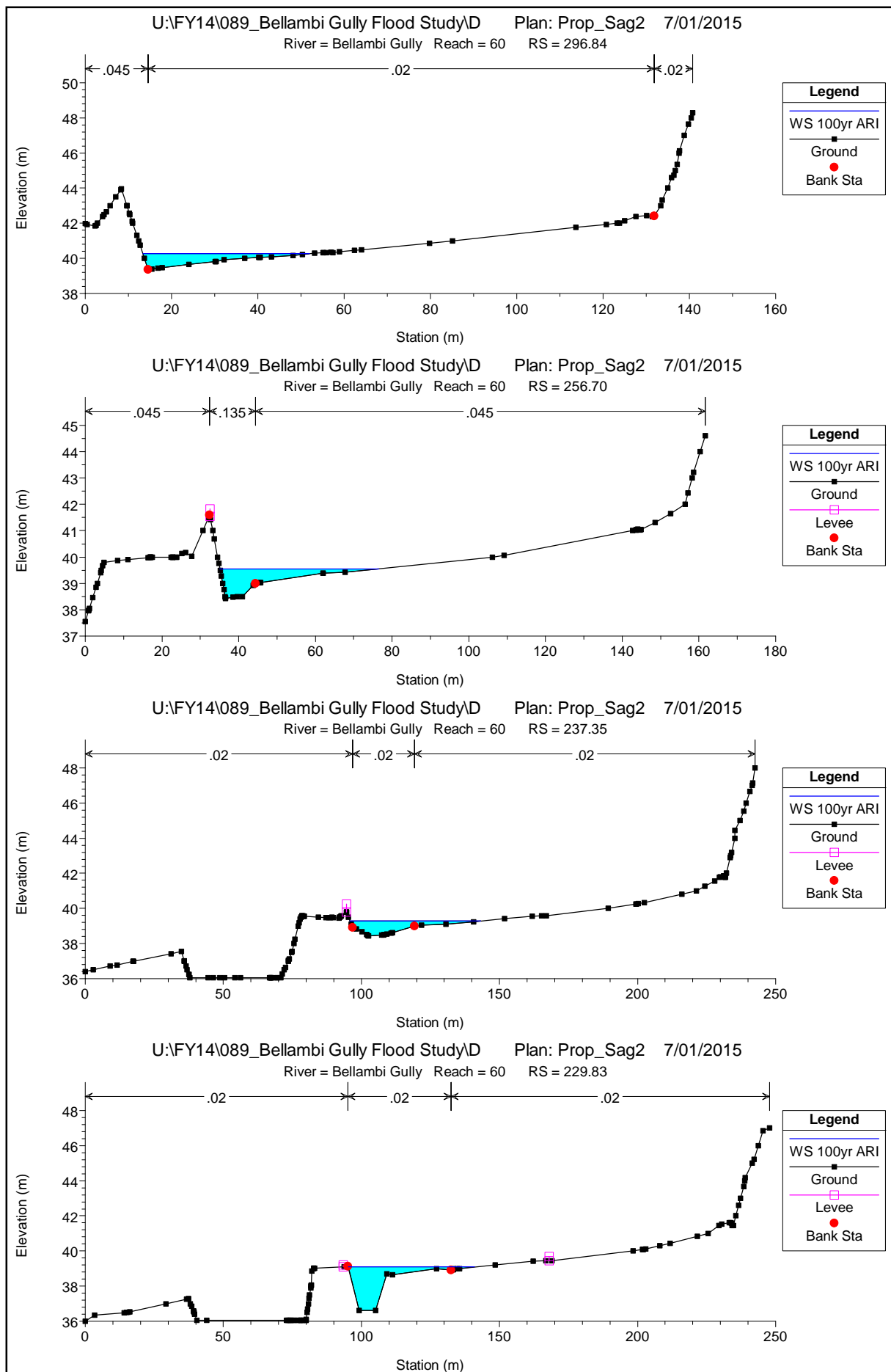


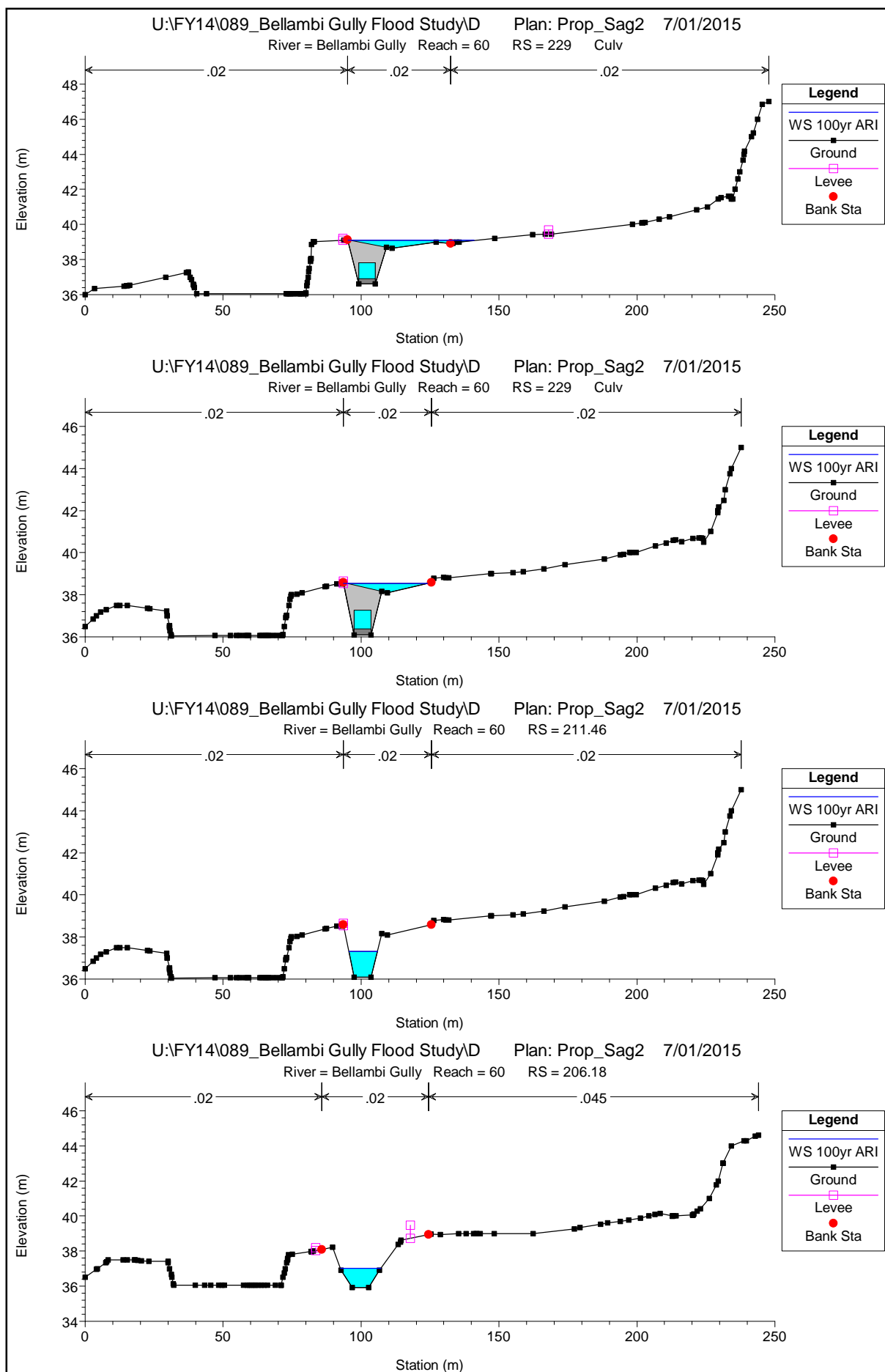


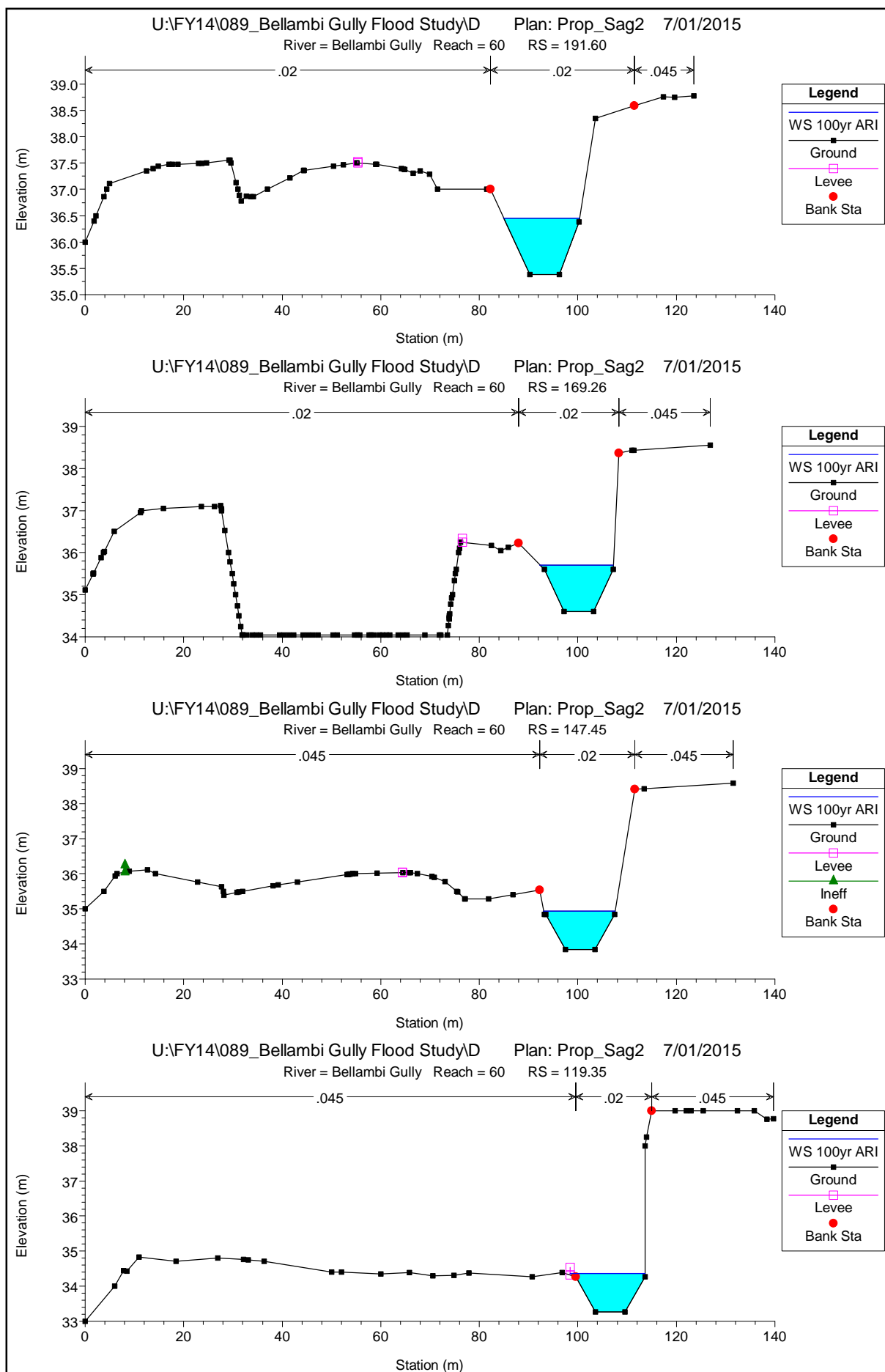


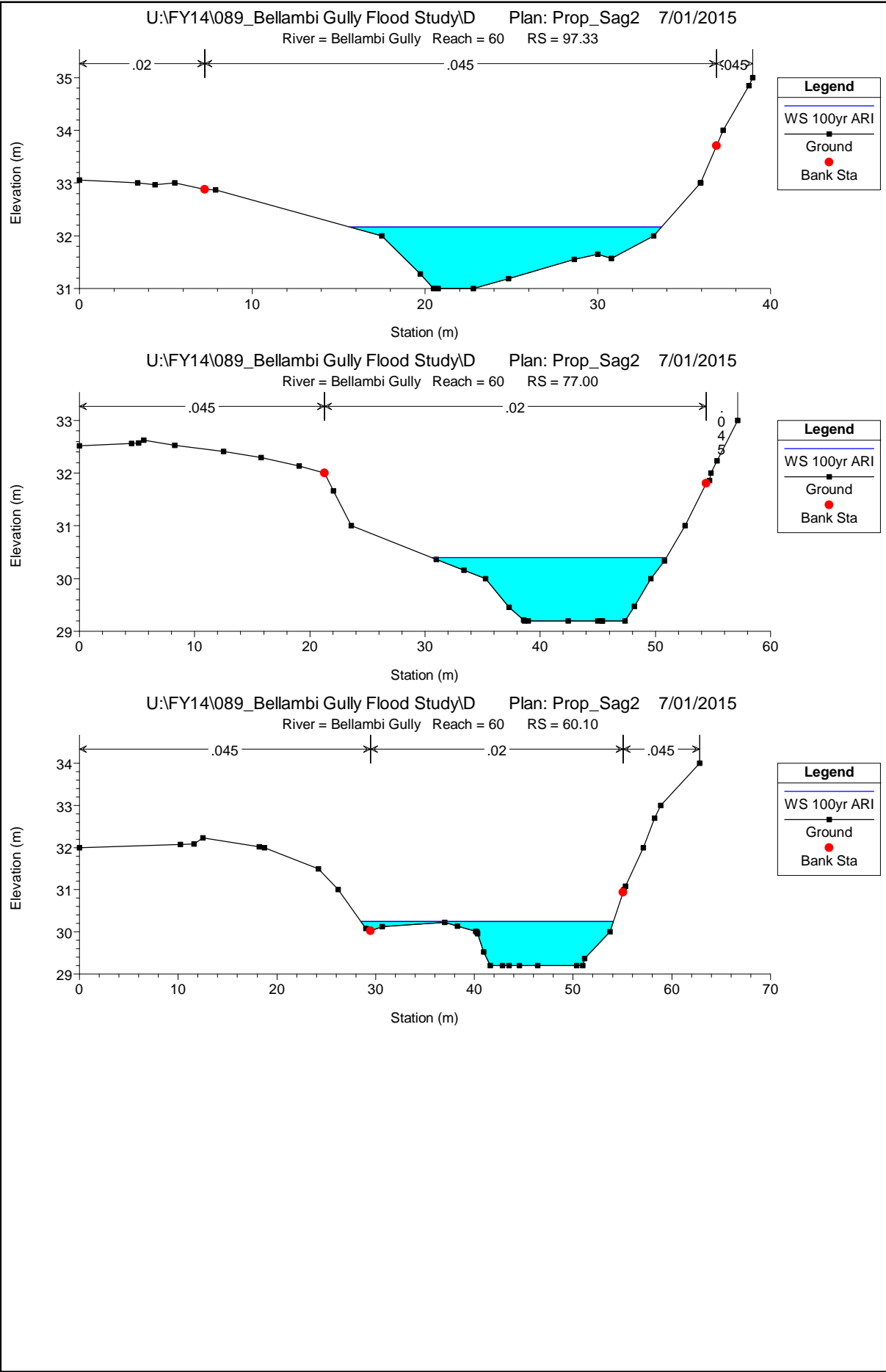












## Results Table

HEC-RAS Plan: Prop\_sag2 Profile: 100yr ARI

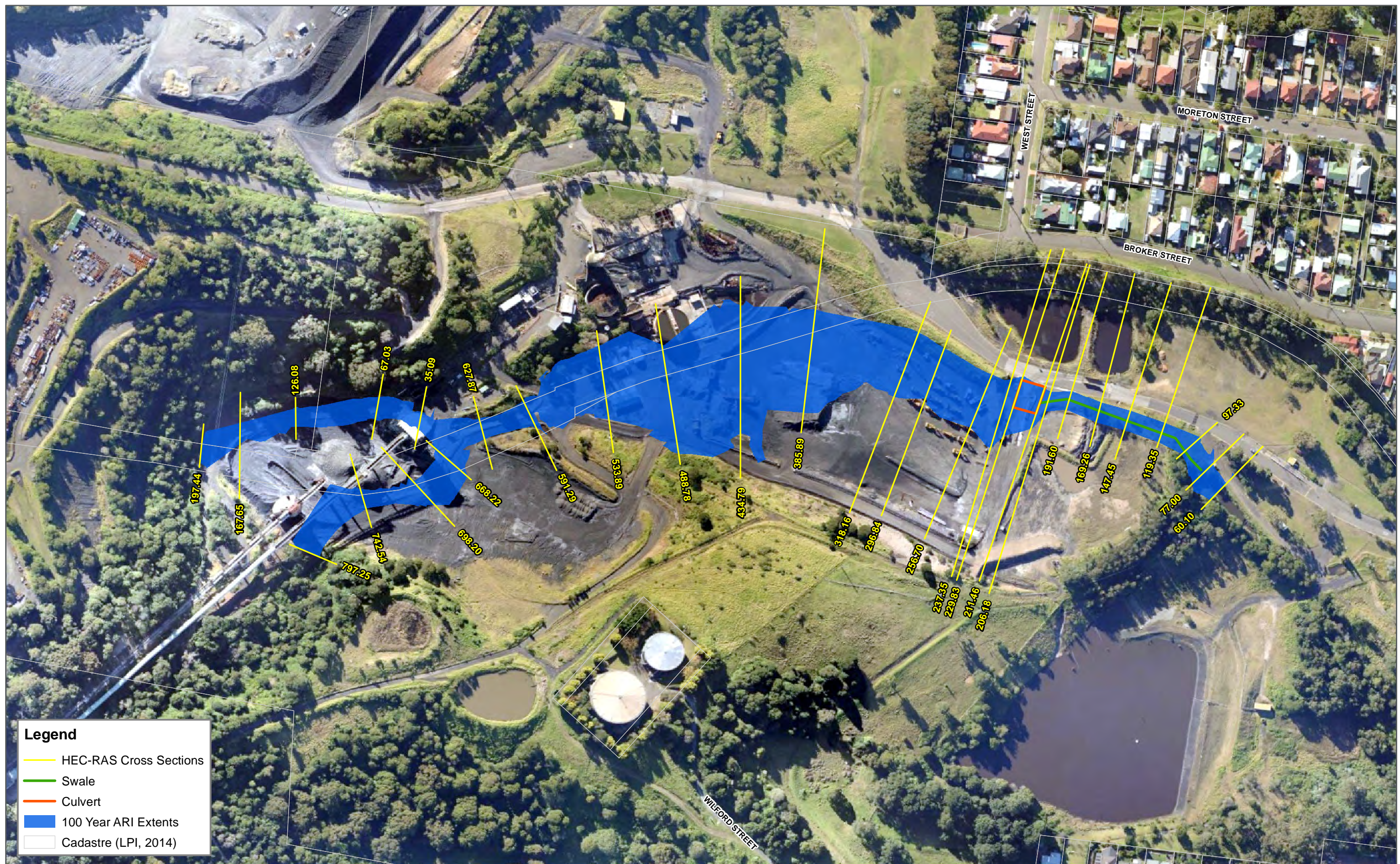
Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Hydr Depth (m)
35	197.44	100yr ARI	9.74	67.46	68.19	68.19	68.41	0.270153	2.07	4.70	0.42
35	167.65	100yr ARI	9.74	65.29	65.69	65.69	65.85	0.005791	1.76	5.52	0.32
35	126.08	100yr ARI	9.74	63.00	65.20	65.20	65.64	0.008790	2.93	3.35	0.83
35	67.03	100yr ARI	9.74	58.14	59.42	59.42	59.73	0.005463	2.48	3.92	0.61
35	35.09	100yr ARI	9.74	56.63	57.63	57.63	57.83	0.005917	1.96	4.96	0.38
668	797.25	100yr ARI	28.60	63.47	64.37	64.37	64.69	0.004705	2.52	11.35	0.64
668	742.54	100yr ARI	28.60	59.00	60.43	60.43	60.79	0.004660	2.67	10.70	0.71
668	698.20	100yr ARI	28.60	58.57	59.51	59.51	59.76	0.005331	2.20	12.98	0.47
668	668.22	100yr ARI	28.60	56.59	57.44	57.44	57.67	0.004954	2.10	13.82	0.42
60	627.87	100yr ARI	31.63	53.52	54.80	54.80	55.19	0.004619	2.75	11.52	0.75
60	591.29	100yr ARI	31.63	50.72	52.24	52.24	52.57	0.005330	2.65	13.09	0.60
60	533.89	100yr ARI	31.63	47.64	48.38	48.38	48.63	0.005597	2.20	14.40	0.48
60	488.78	100yr ARI	31.63	46.73	47.51	47.51	47.66	0.005638	1.76	18.44	0.32
60	434.79	100yr ARI	31.63	44.35	44.69	44.69	44.80	0.006344	1.50	21.11	0.23
60	385.89	100yr ARI	31.63	43.03	43.41	43.41	43.54	0.006205	1.59	19.88	0.25
60	318.16	100yr ARI	31.63	40.64	41.14	41.14	41.32	0.005680	1.87	17.01	0.35
60	296.84	100yr ARI	31.63	39.35	40.28	40.28	40.49	0.005609	2.05	15.75	0.41
60	256.70	100yr ARI	31.63	38.43	39.55	39.55	39.76	0.067705	1.73	16.02	0.39
60	237.35	100yr ARI	31.63	38.43	39.28	39.28	39.48	0.003253	2.07	17.61	0.37
60	229.83	100yr ARI	31.63	36.62	39.09	37.87	39.14	0.000532	1.01	31.93	0.70
60	229		Culvert								
60	211.46	100yr ARI	31.63	36.08	37.32	37.32	37.81	0.004282	3.10	10.20	0.98
60	206.18	100yr ARI	31.63	35.92	37.02	37.02	37.41	0.004339	2.76	11.48	0.78
60	191.60	100yr ARI	31.63	35.38	36.46	36.46	36.83	0.004417	2.72	11.62	0.75
60	169.26	100yr ARI	31.63	34.60	35.71	35.71	36.09	0.004319	2.73	11.58	0.77
60	147.45	100yr ARI	31.63	33.84	34.94	34.94	35.33	0.004426	2.78	11.37	0.78
60	119.35	100yr ARI	31.63	33.27	34.37	34.37	34.76	0.004218	2.78	11.45	0.75
60	97.33	100yr ARI	31.63	31.00	32.17	32.17	32.51	0.023347	2.59	12.21	0.68
60	77.00	100yr ARI	31.63	29.20	30.40		30.59	0.002085	1.94	16.27	0.80
60	60.10	100yr ARI	31.63	29.20	30.24	30.24	30.53	0.005061	2.35	13.58	0.53

Bellambi Gully Flood Study

# APPENDIX F

## PROPOSED SCENARIO FLOOD MAP

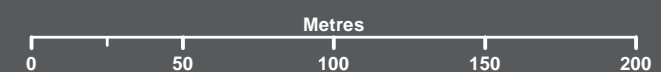




## Proposed Scenario

BELLAMBI GULLY FLOOD STUDY

1:2,500 Scale at A3

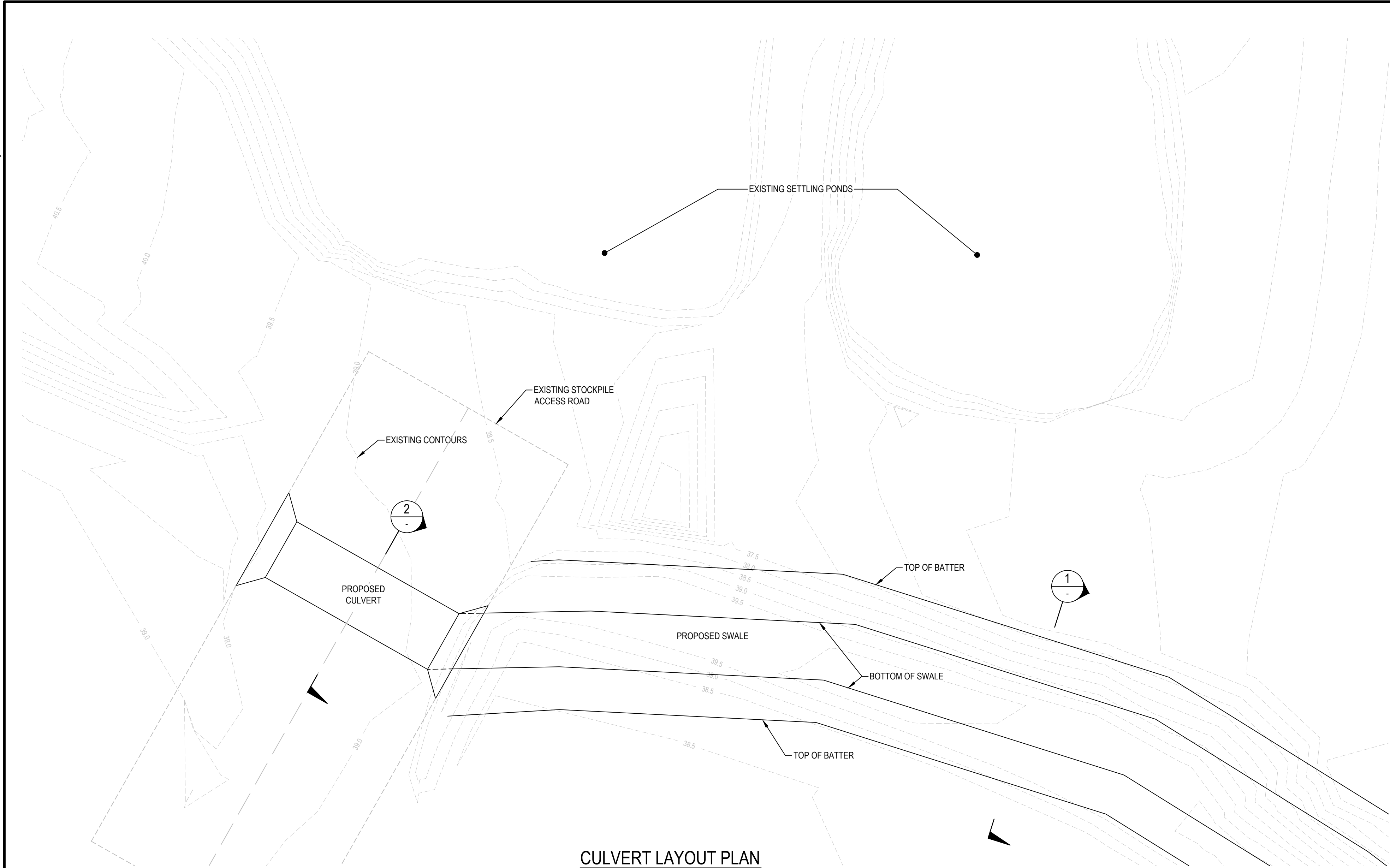


Map Produced by Cardno NSW/ACT Pty Ltd (WOL)  
Date: 2015-01-07  
Coordinate System: GDA 1994 MGA Zone 56  
Project: 82014089-01  
Map: G1005\_ProposedScenario.mxd 04  
Aerial imagery supplied by Nearmap (July, 2013).

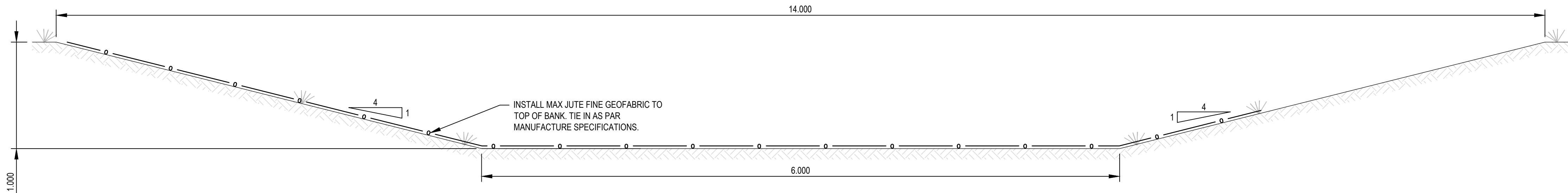


# APPENDIX G

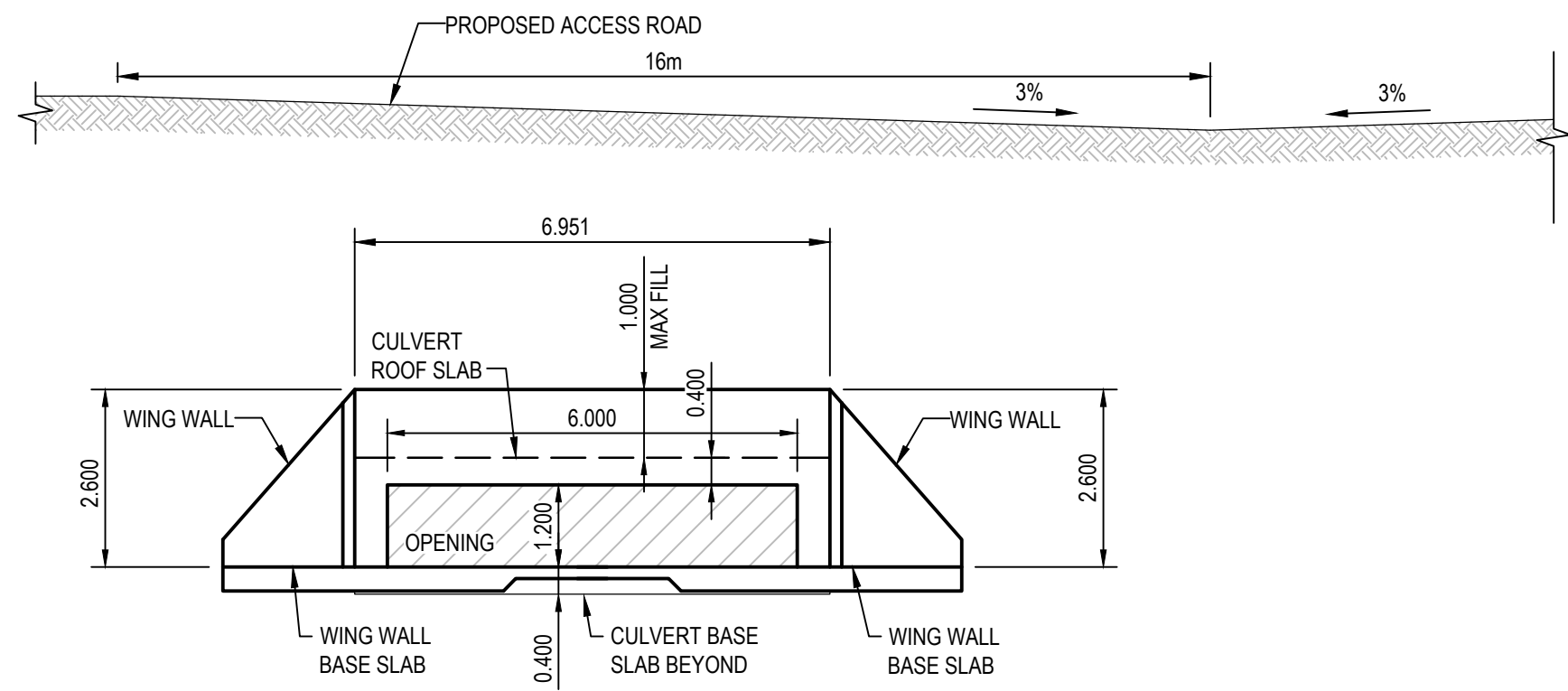
## PROPOSED MITIGATION STRUCTURES



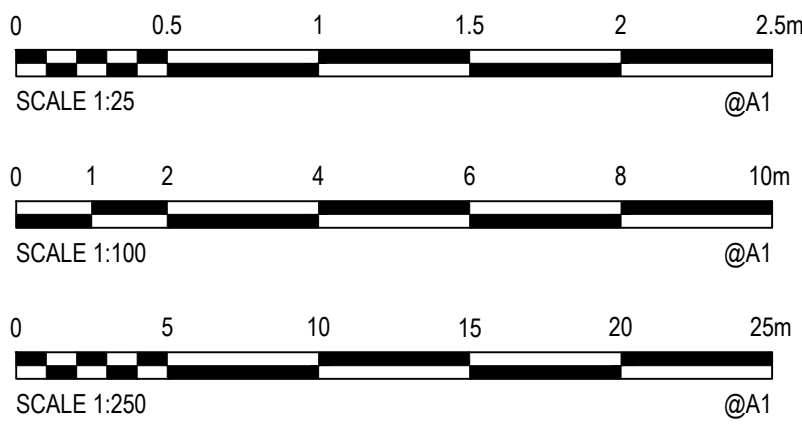
CULVERT LAYOUT PLAN  
SCALE 1:250



SECTION 1  
SCALE 1:25



SECTION 2  
SCALE 1:100



Rev.	Date	Description	Des.	Verif.	Appd.
2	7/01/2015	MINOR AMENDMENTS AS PER COUNCIL COMMENTS	BAH	SBR	ODJ
1	24/11/2014	ISSUED FOR APPROVAL	AMW	SBR	ODJ

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Shaping the Future  
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Web: www.cardno.com.au

Drawn	AMW	Date	24/11/2014
Checked	FK	Date	24/11/2014
Designed	AMW	Date	24/11/2014
Verified	SBR	Date	24/11/2014
Approved	ODJ	Date	24/11/2014

Client **WOLLONGONG COAL LIMITED**  
Project **BELLAMBI GULLY FLOOD STUDY**  
Title **PROPOSED CULVERT AND SWALE SECTIONS AND DETAILS**

Status				<div>FOR APPROVAL</div> <div>NOT TO BE USED FOR CONSTRUCTION PURPOSES</div>	
DATUM		Scale	Size		
AHD		AS SHOWN	A1		
Drawing Number			Revision		
82014089-01-C1000			2		

## David Clarkson

---

**From:** Ron Zwicker <RZwicker@wollongong.nsw.gov.au>  
**Sent:** Monday, 16 February 2015 8:45 AM  
**To:** David Clarkson  
**Cc:** Sara Wilson (Sara.Wilson@planning.nsw.gov.au); Howard.Reed@planning.nsw.gov.au  
**Subject:** FW: TRIM: FW: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Hi Dave

Please see comments from Sasho – The revised January 2015 Flood Study has addressed Council’s previous comments.

Therefore, Council requests that the revised January 2015 Flood Study form part of the conditions of any consent granted for the Russell Vale Colliery Underground Expansion Project. This advice was also communicated to the PAC Commissioners when Council met the PAC recently.

Regards

Ron Zwicker  
Special Projects Manager  
Wollongong City Council  
Locked Bag 8821  
WOLLONGONG DC NSW 2500  
Ph. (02) 4227 7639  
Email: [rzwicker@wollongong.nsw.gov.au](mailto:rzwicker@wollongong.nsw.gov.au)

---

**From:** Sasho Srbinovski [mailto:SSrbinovski@wollongong.nsw.gov.au]  
**Sent:** Thursday, 29 January 2015 3:50 PM  
**Subject:** RE: TRIM: FW: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Hi Ron

The revised Bellambi Gully Flood Study by Cardno dated January 2015 submitted in support of alternative flood mitigation measures on the Russellvale Colliery site has been assessed against Chapters E13/E14 of the Wollongong DCP 2009 and previous stormwater comments dated 17 December 2014.

It is considered that the previous flooding comments raised have now been addressed. In particular, the flood modelling has now considered all culverts <6m in diagonal as 100% blocked and (proposed) culverts >6m in diagonal as 25% blocked btm up. This has resulted in a proposed culvert 6m wide x 1.2m high under access road with low point in access road to direct overflows into proposed swale designed to carry the 100 year flows from the site.

The following condition is recommended with respect to the proposed flood mitigation works on the site:

The proposed flood mitigation works for the site should be undertaken in accordance with the measures put forward within the Bellambi Gully Flood Study report 001 version 06 by Cardno dated January 2015.

regards

Sasho Srbinovski | Senior Stormwater Development Engineer | Wollongong City Council  
T: 02 4227 7111| F: 02 4227 7048 | E: [ssrbinovski@wollongong.nsw.gov.au](mailto:ssrbinovski@wollongong.nsw.gov.au)  
41 Burelli Street, Wollongong NSW 2500

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---

**From:** Ron Zwicker  
**Sent:** Tuesday, 27 January 2015 10:23 AM  
**To:** Sasho Srbinovski  
**Subject:** TRIM: FW: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Sasho

Please see revised flood study.

Cheers

Ron

---

**From:** Dianne Munro [<mailto:DMunro@hansenbailey.com.au>]  
**Sent:** Tuesday, 27 January 2015 9:46 AM  
**To:** Ron Zwicker

**Cc:** Howard Reed; Sara Wilson; David Clarkson; Andrew Wu

**Subject:** RE: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

---

A file has been sent to you via the [YouSendIt](#) File Delivery Service.

Download the file - [Report 001 V06 Bellambi Gully Flood Study \(Amendments Highlighted\).pdf](#)

Your file will expire after 14 days or 500 downloads.

---

Hi Ron, find attached updated flood study as forwarded by Dave Clarkson on 14 January.

Please let us know if you require anything further.

Regards,  
Dianne.

**Dianne Munro**

*Principal*

*MEnvLaw BSc*

**HANSEN BAILEY**

Tel: (02) 6575 2003

Fax: (02) 6575 2001

Mobile: 0428 772 566

Email: [dmunro@hansenbailey.com.au](mailto:dmunro@hansenbailey.com.au)

---

**From:** David Clarkson [<mailto:dclarkson@wcl.net.au>]

**Sent:** Wednesday, January 14, 2015 10:38 AM

**To:** [rzwicker@wollongong.nsw.gov.au](mailto:rzwicker@wollongong.nsw.gov.au)

**Cc:** Dianne Munro; Howard Reed; Sara Wilson

**Subject:** Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Hi Ron,

Please find attached a revised Bellambi Gully flood study to incorporate Council's requests in your email below.

The revised report adopts Council blockage policy upstream of the 6m culvert, and increases the sag over the culvert to convey 100 year ARI flows overtopping the road in this scenario. Amended sections have been highlighted for reference.

The revised modelling does not affect the conclusion or recommendations.

We look forward to your early approval of the attached report.

Cheers

**Dave Clarkson**

Group Environment Manager



☎ Mob: 0458 059 564

✉ Email: [dclarkson@wcl.net.au](mailto:dclarkson@wcl.net.au)

**From:** Ron Zwicker <[RZwicker@wollongong.nsw.gov.au](mailto:RZwicker@wollongong.nsw.gov.au)>

**Date:** 18 December 2014 9:27:41 am AEST

**To:** "David Clarkson ([dclarkson@wcl.net.au](mailto:dclarkson@wcl.net.au))" <[dclarkson@wcl.net.au](mailto:dclarkson@wcl.net.au)>, "Owen de Jong ([owen.dejong@cardno.com.au](mailto:owen.dejong@cardno.com.au)) ([owen.dejong@cardno.com.au](mailto:owen.dejong@cardno.com.au))" <[owen.dejong@cardno.com.au](mailto:owen.dejong@cardno.com.au)>

**Cc:** Sasho Srbinovski <[ssrbinovski@wollongong.nsw.gov.au](mailto:ssrbinovski@wollongong.nsw.gov.au)>, "Sara Wilson ([Sara.Wilson@planning.nsw.gov.au](mailto:Sara.Wilson@planning.nsw.gov.au))" <[Sara.Wilson@planning.nsw.gov.au](mailto:Sara.Wilson@planning.nsw.gov.au)>, "[Howard.Reed@planning.nsw.gov.au](mailto:Howard.Reed@planning.nsw.gov.au)" <[Howard.Reed@planning.nsw.gov.au](mailto:Howard.Reed@planning.nsw.gov.au)>

**Subject: FW: review of Bellambi Gully Flood Study for Russell Vale Colliery Site**

Hi Dave / Owen

Please see Sasho's comments regarding the revised Bellambi Gully Flood Study.

Regards

Ron Zwicker

Special Projects Manager

Wollongong City Council

Locked Bag 8821

WOLLONGONG DC NSW 2500

Ph. (02) 4227 7639

Email: [rzwicker@wollongong.nsw.gov.au](mailto:rzwicker@wollongong.nsw.gov.au)

---

**From:** Sasho Srbinovski  
**Sent:** Thursday, 18 December 2014 9:50 AM  
**To:** Ron Zwicker  
**Subject:** review of Bellambi Gully Flood Study for Russell Vale Colliery Site

Hi Ron

Please find my comments below.

*The Bellambi Gully Flood Study by Cardno dated November 2014 submitted in support of alternative flood mitigation measures on the Russellvale Colliery site has been assessed against Chapters E13/E14 of the Wollongong DCP 2009 and previous stormwater comments dated 22 September 2014. The following comments are made:*

*The proposed mitigation option within the current (November 2014) flood study by Cardno for the subject site has assumed a portion of the contributing stormwater flows at the site will be catered for within the existing stormwater pipes, which is considered unrealistic in light of the flood impacts experienced both on site and downstream in 1998.*

*Whilst the proposal to implement debris control structures across existing inlets together with management procedures has merit, these measures are not considered as 'failsafe' and therefore unlikely to prevent a recurrence of the flood impacts experienced in this area in 1998.*

*In order to address the concerns raised above, the proposed mitigation option for the site should be based on the Wollongong Council 'policy based' conduit blockage criteria. This approach adopts 100% blockage of all stormwater pipes having less than 6m diagonal opening and 25% bottom up blockage for stormwater pipes having greater than 6m diagonal opening. This would result in a culvert design of greater than 6m in diagonal located at the stockpile access road to cater for the contributing stormwater flows arriving on the site for a 100 year ARI event or greater. The proposed swale alongside the stockpile access road should also be designed to cater for the contributing 100 year ARI flows or greater to ensure these flows are conveyed to the licensed discharge point at Bellambi Creek.*

*The proposed flood mitigation measures for the site should be accurately reflected within Appendix E of the updated study.*

*Final dimensions of the proposed culvert and swale including calculations demonstrating the capacity of each in line with the abovementioned conduit blockage policy should be included within the study for further assessment.*

regards

Sasho Srbinovski | Senior Stormwater Development Engineer | Wollongong City Council  
T: 02 4227 7111 | F: 02 4227 7048 | E: [ssrbinovski@wollongong.nsw.gov.au](mailto:ssrbinovski@wollongong.nsw.gov.au)  
41 Burelli Street, Wollongong NSW 2500



---

**From:** Ron Zwicker  
**Sent:** Tuesday, 25 November 2014 3:29 PM  
**To:** Owen de Jong; Sasho Srbinovski  
**Cc:** David Clarkson ([dclarkson@wcl.net.au](mailto:dclarkson@wcl.net.au)); Shaza Raini; Wollongong Document Control  
**Subject:** RE: Bellambi Gully Flood Study (82014089-01)

Hi Owen

Thanks for the revised flood study.

The revised flood study will be reviewed and we will provide appropriate feedback within the next 2 weeks.

In light of this, I agree that the meeting this week is no longer necessary.

Can you also ask Wollongong Coal to formally lodge the revised flood study with the NSW Department of Planning & Environment since the Department will also need to be involved in any decision making concerning this revised flood study.

Regards

Ron Zwicker  
Special Projects Manager  
Wollongong City Council  
Locked Bag 8821  
WOLLONGONG DC NSW 2500  
Ph. (02) 4227 7639  
Email: [rzwicker@wollongong.nsw.gov.au](mailto:rzwicker@wollongong.nsw.gov.au)

---

**From:** Owen de Jong [<mailto:owen.dejong@cardno.com.au>]  
**Sent:** Tuesday, 25 November 2014 2:59 PM  
**To:** Ron Zwicker; Sasho Srbinovski  
**Cc:** David Clarkson ([dclarkson@wcl.net.au](mailto:dclarkson@wcl.net.au)); Shaza Raini; Wollongong Document Control  
**Subject:** Bellambi Gully Flood Study (82014089-01)

Ron / Sasho,

Please find attached the updated Bellambi Gully flood study for your consideration, which has been revised following the outcomes of our recent meeting.

With regards to the culvert sizing, we reviewed sizing of the 6m RCBC designed for the Ridge (as discussed), and found that 1.2m H was adopted following liaison / agreement with Council. On this basis we've adopted 1.2m H for this site also.

Happy to meet on Thursday to discuss (if necessary), otherwise if any further clarity is required please don't hesitate to contact me.

Regards,

**Owen de Jong**

SENIOR WATER ENGINEER - MIEAUST CPENG  
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# WOLLONGONG COAL LIMITED

## Operating Procedures for the Russell Vale Colliery – Independent Risk Assessment Panel

### Purpose

In its review report, the NSW Planning Assessment Commission (PAC) made the following recommendations:

*'The establishment of a risk assessment panel, constituted by an independent chair, Water NSW, the Dams Safety Committee, the Division of Resources and Energy and the proponent to oversee an integrated risk assessment, particularly focusing on links between subsidence and water (both groundwater and surface water) impacts of the proposal. This risk assessment, including associated work rerunning the groundwater modelling as recommended by Dr Mackie; and addressing the issues raised by the relevant agencies and experts (as highlighted in this report), needs to be completed before the application can be determined.'*

In accordance with recommendations made by the PAC, and prior to longwall extraction beyond the approved 365m section of LW6 in the Russell Vale East area, WCL will constitute an Independent Risk Assessment Panel (IRAP) to conduct an ongoing assessment of risks to Cataract Reservoir, groundwater, surface water and Upland Swamps during the extraction of LWs 1, 2, 3, 6, 7, 9, 10 and 11.

The IRAP will have an Independent Chair, approved by the Department of Planning and Environment (DP&E), to ensure that the objectives of the IRAP are achieved. This proposed Operating Procedure documents the following for endorsement by the parties:

1. Objectives of the IRAP;
2. IRAP Process
3. Structure and membership of the IRAP; and
4. Financial arrangements.

### 1. Objectives of the IRAP

The objective of the IRAP is to give full effect to Recommendation 1 of the PAC Russell Vale Colliery Underground Expansion Project (UEP) Review Report.

### 2. IRAP Process

#### ***a. Project Approval Process***

- Assist in the development and approval of an appropriate risk assessment methodology;

- Utilise latest available data to identify and assess the risks related to the extraction of longwalls in the Russell Vale East area. At a minimum, this must include consideration of potential risks associated with the following mining activities:
  - Longwall 1 – groundwater systems, Cataract Creek;
  - Longwall 2 – groundwater systems, swamp CCUS2, Cataract Creek;
  - Longwall 3 – groundwater systems, swamps CCUS1 & CCUS2, Cataract Creek;
  - Longwall 6 (*365m to completion*) – Cataract Reservoir, Dyke D8, groundwater systems, swamp CCUS4, Cataract Creek, Cataract River;
  - Longwall 7 – Cataract Reservoir, Corrimal Fault, Dyke D8, groundwater systems, swamps CCUS4 & CCUS5, Cataract Creek, Cataract River;
  - Longwall 9 – Cataract Reservoir, Dyke D8, groundwater systems, swamps CCUS10, CCUS11, CCUS12 and CCUS24, Cataract Creek;
  - Longwall 10 – Cataract Reservoir, Dyke D8, groundwater systems, swamps CCUS12, BCUS4 and BCUS11; and
  - Longwall 11 – Cataract Reservoir, Dyke D8, groundwater systems, swamp CRUS6.
- Engage suitable experts to assist with and/or review the Risk Assessment Report and any other studies undertaken by WCL and its specialists; and
- Consultation with appropriate regulatory authorities and WaterNSW (as required) during its consideration of the risk assessment methodology and Risk Assessment Report.

#### ***b. Extraction Plan Process***

- Based on latest available data, review the risk assessment for the following longwall and make recommendations to WCL for revisions of the existing Extraction Plan; and
- Review the draft Extraction Plan (to be prepared by WCL) and provide recommendations prior to submission of the plan for approval by DP&E.

#### ***c. Post Approval Process***

- Based on latest available data and risk assessment outcomes, provide ongoing advice to WCL in consideration of findings from monitoring conducted during and following mining; and
- Advise on appropriate mitigation or remediation measures (by engaging suitable experts where necessary) to address any Extraction Plan triggers or exceedances of Performance Measures.

### **3. Structure and Membership of the IRAP**

The **IRAP** will be comprised of:

- Independent Expert (IE) groundwater, surface water, upland swamp and subsidence specialists, as approved by DP&E, to provide advice and guidance on identifying and managing key risks;

- An Independent Chair.
- WCL representatives and specialists would attend meetings at the request of the IRAP to provide advice, as required.

The IRAP will consist of the following members as approved by DP&E.

<b><u>WCL IRAP</u></b>	
<b>Chairperson</b>	Ismet Canbulat (Professor of Rock Mechanics UNSW); and
<b>IE Subsidence</b>	Arthur Waddington – Managing Director (Mine Subsidence Engineering Consultants)
<b>IE Groundwater</b>	Andrea Madden – Principal Hydrogeologist (WSP – Parsons Brinkerhoff)
<b>IE Surface Water</b>	Steve Perrens – Principal (Advisian, formerly Evans & Peck)
<b>IE Upland Swamps</b>	David Robertson – Director (Cumberland Ecology)

#### **4. Financial Arrangements**

WCL agrees to fund the reasonable costs of:

- The Independent Experts and Chair;
- any monitoring, investigatory or other preparatory work agreed to by WCL and the IRAP, or required by DP&E in liaison with the IRAP Independent Chair, to improve data for use in risk assessment, management and/or review of the Extraction Plan in relation to Cataract Reservoir, groundwater, surface water and upland swamps; and
- engagement of independent specialists, as required; and
- any other work required to further critical works associated with the implementation of Extraction Plans.

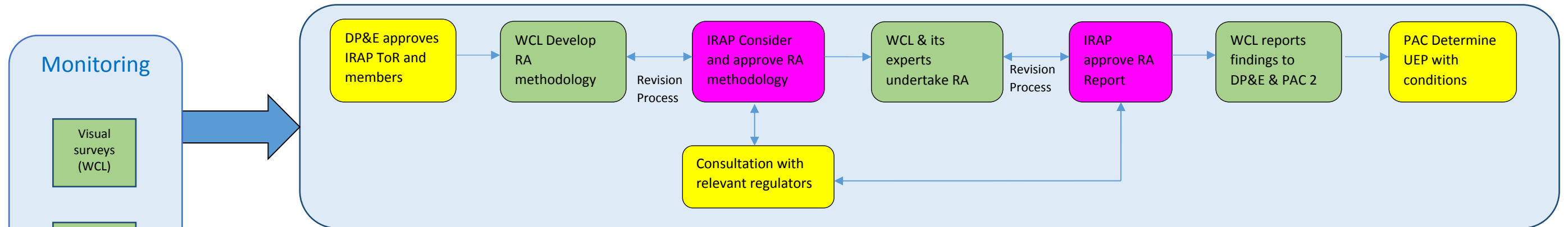
#### **5 Endorsements**

Signed and dated in agreement on behalf of:

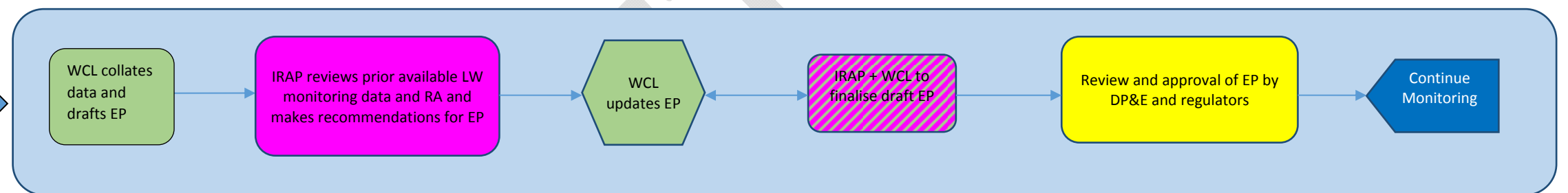
Wollongong Coal Limited

Rhys Brett  
Business Development Manager

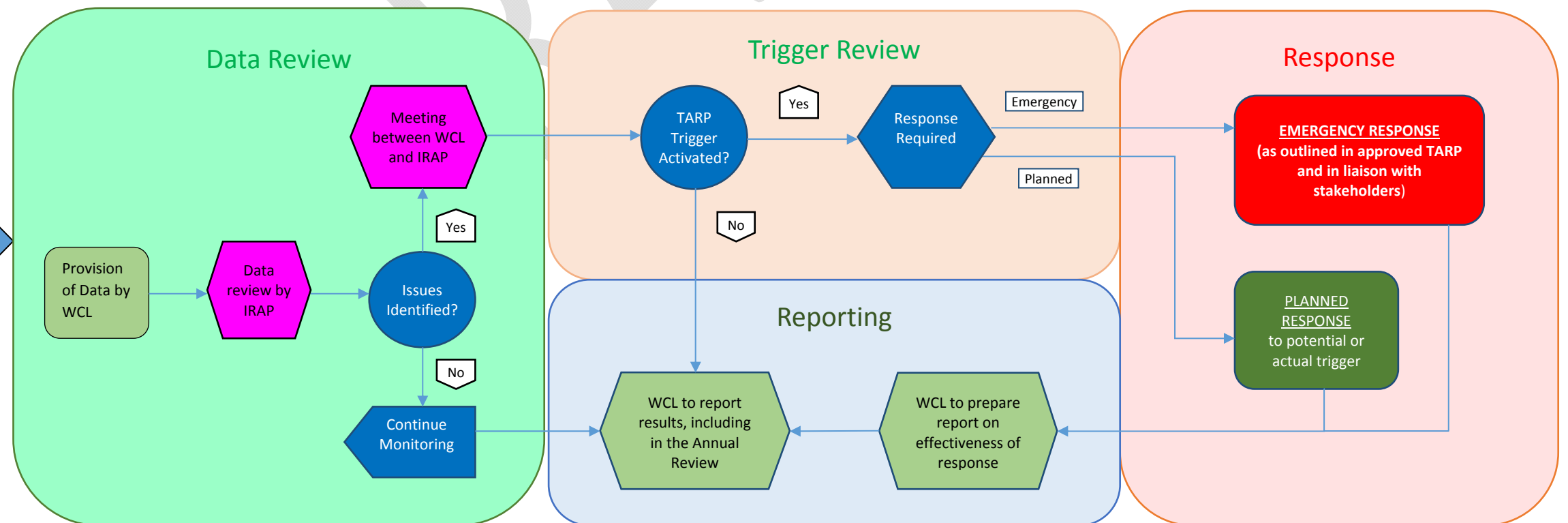
## Project Approval Process



## Extraction Plan Process



## Post-Approval Process





**REPORT**

# Review of CBA for Russell Vale extension



*Prepared for  
NSW Department Planning and Environment  
October 2015*

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## *Overview of project*

### *About the mine*

The Proponent (Wollongong Coal Limited) has sought an extension of the underground mine at Russell Vale Colliery. The Project is seeking to mine 4.7 million tonnes of coal over a period of up to 5 years, from the Wongawilli Seam, under a protected part of Sydney's drinking water catchment. Coal would be extracted through the existing pit top at Russell Vale, as an increased rate of up to 3 million tonnes per year. The mine has an approval (granted in 2011) to extract up to 1 million tonnes of coal a year for 3 years (to October 2014). The approval has been modified 3 times and will currently expire on 31 December 2015.

The Project is expected to maintain coal production from the Southern coalfield and the utilisation of the Port Kembla Coal Terminal.

### *The PAC review*

In April 2015 the Planning Assessment Commission (PAC) released its review of the Project. The PAC made a number of recommendations around the following topic areas water/subsidence, upland swamps, socio-economic, noise, air, flooding at Bellambi Creek and traffic. A large number of the recommendations related to the need for further analysis to better understand the potential extent of impacts and whether impacts can be mitigated.

### *The CIE's review*

The PAC's review report raised a number of issues regarding the socio-economic component including:

The proponent's economic assessment, in particular the estimated costs and benefits should be updated to reflect the current economic climate.

The final assessment and determination of the project should be informed by an independent analysis of the economic costs and benefits of the project, including any additional information/updated economic assessment provided by the Applicant. The independent analysis should be managed by the Department of Planning and Environment.<sup>1</sup>

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<sup>1</sup> Planning Assessment Commission (2015), *Review Report on Russell Vale Underground Expansion Project*, p.iv.

The Proponent has prepared a response to the PAC's recommendations prepared by Hansen Bailey Environmental Consultants in a report dated July 2015. This included a revised Cost Benefit Analysis (CBA) prepared by Gillespie Economics.

NSW Department of Planning and Environment (the Department) has sought advice from the CIE on the revised economic modelling conducted by Gillespie Economics in 2015.<sup>2</sup>

For the purpose of this analysis we have focused on the revisions to the CBA undertaken by the Proponent as presented in the Gillespie Economics 2015 report.<sup>3</sup> The Gillespie report also presents revised modelling of potential economic impacts as present in chapter 3 (Regional Economic Impact Assessment). We have focused on the CBA conducted given that this is the primary tool to evaluate whether the project will deliver net benefits to society.

In reviewing the revised CBA conducting this review we have considered the recommendations of the PAC in regards the potential environmental impacts of the mine and the extent to which these have been incorporated into the revised CBA.

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<sup>2</sup> Gillespie Economics (2015), Russell Vale Colliery Underground Expansion Project Economic Assessment, June, prepared for Hansen Bailey.

<sup>3</sup> The CIE has previously reviewed, for NSW Planning, the economic analysis conducted by Gillespie Economics. The CIE report formed part of the Department's advice to the PAC.

## *Findings*

### *Overall approach*

The economic analysis seeks to quantify those impacts (on the benefits and costs side) that are material and can be readily quantified. On the benefits side, the revised analysis focuses on the royalty payments as the key source of benefits although recognising that there are other unquantified benefits. From this perspective the revised analysis presents a ‘minimum threshold value’

against which the relative value of the residual environmental, social and cultural impacts from the Project, to Australia, after mitigation, offset and compensation, would need to be valued.

The revised analysis notes that

No material impacts are considered likely in relation to air quality, traffic and transport, Aboriginal cultural heritage and historic heritage. Noise impacts, surface water impacts, groundwater impacts, visual amenity, upland swamp impacts and infrastructure impacts will be mitigated, compensated for or offset, with these costs forming part of the costs of the capital or operating costs of the Project.

The impacts arising from greenhouse gas emissions would remain unmitigated and are estimated at \$0.15 million in present value terms. These impacts can be compared against the ‘minimum threshold value’ which are estimated at \$23 million in present value terms (discussed below). Given this, Gillespie Economics estimates that the net benefits to the community from the Project to be at greater than \$22 million in present value terms.

The overall approach provides a pragmatic basis on which to estimate the net benefits of the Project. It recognises that there may be other benefits where there is greater uncertainty (and debate) regarding the quantum. Therefore, these other benefits are excluded from the analysis and instead it focuses on the quantification of royalty payments (which are expected to be the dominant benefits category). We consider further below the estimated quantum of royalty payments and the potential environmental impacts.

- **The ‘minimum threshold value’ approach used by Gillespie Economics is a reasonable basis on which to frame the economic analysis.**

### *Royalty payments*

The key benefits attributed to the Project are associated with the royalty payments from coal production. The proponent estimates royalty payments of \$23 million (in present value terms) over a 5 year period.



In its original analysis the Project was expected to generate \$29 million (in present value terms) worth of royalties to NSW.<sup>4</sup> This assumed a future price over the next 5 years of \$150 per tonne for coking coal and \$90 per tonne for thermal coal. It assumed a royalty rate of 7.2 per cent (assuming underground mine with extraction taking place at depths shallower than 400 metres).

In its revised analysis (July 2015), Gillespie Economics estimates coal royalties of \$23 million (in present value terms). This is based on

...average annual ROM production of 934,000 tonnes, 52.6% coking coal and 28.6% thermal coal, WCL adjusted coal prices based on Energy & Metals Consensus forecasts (August 2014) i.e. average of USD84/tonne for coking coal and USD61/tonne for thermal coal, and an AUD/USD exchange rate forecast of 0.73 based on NAB (2015).<sup>5</sup>

In Australian dollar terms, the coal prices assumed equates to around AUD\$115 per tonne for coking coal and AUD\$84 per tonne for thermal coal. The reduction in estimated royalties, compared to the original analysis, reflects the reduction in the market price for coal exports.

In its earlier advice, dated December 2014, the NSW Division of Resources and Energy within NSW Trade and Investment estimated royalties of \$26 million (in present value terms) under the following assumptions:

- export thermal coal price of A\$82 to A\$108 per tonne of coal
- export price of A\$105 to A\$125 per tonne of semi-soft coking coal
- allowable deductions of \$1.50 per tonne.

The key uncertainty in the royalty calculation is likely to be the world coal export price. In its more recent assessment in regards to the proposed Springvale mine extension, for example, the Division has used

.... the current low short term coal prices and medium to long term export thermal prices in the range of \$A97 to \$117 per tonne.<sup>6</sup>

Independent data from the Australian Government's Department of Industry provides another point of comparison. In regards to thermal coal, it indicates that

Benchmark prices for the Japanese Fiscal Year 2015 (JFY, April 2015 to March 2016) settled at US\$67.80.....Benchmark prices for JFY 2016 are forecast to settle at 9 per cent lower at around US\$62 a tonne, underpinned by continued oversupply and an assumed depreciation of the Australian dollar.<sup>7</sup>

<sup>4</sup> Gillespie Economics (2015), *Russell Vale Colliery Underground Expansion Project Economic Assessment*, February.

<sup>5</sup> Footnote 4, Gillespie Economics 2015.

<sup>6</sup> NSW Trade and Investment, Letter to Department of Planning and Environment, dated 10 March 2015.

<sup>7</sup> Australian Department of Industry, (2015) *Resources and Energy Quarterly*, June 2015, p.28.

This equates to around US\$61 per tonne, in real terms.<sup>8</sup> Based on the current exchange rate (as at 4 September 2015) of AUD 0.70 per US dollar, forecast prices in 2015/16 would be around A\$87 per tonne for export thermal coal.<sup>9</sup>

In regards to coking coal, the Australian Government's Department of Industry, noted that

Mettallurgical coal spot prices declined substantially in the first half of 2015, reflecting surplus supply, lower demand and lower production costs that reduced the price required for operations to remain viable. ....For 2015 as a whole, contract prices are forecast to average around US\$104 a tonne, 17 per cent lower than 2014.....In 2016, high quality coking coal contract prices are forecast to average US\$103 a tonne.<sup>10</sup>

If the coal produced from Russell Vale is high quality hard coking coal this equates to a future export price of around AUD\$148 per tonne.

Using assumptions of A\$87 per tonne for export thermal coal and A\$148 per tonne for hard coking coal, this generates royalties equivalent to around \$28 million in present value terms.<sup>11</sup> While coal export prices are low, in US dollar terms, this has been 'countered' by the lower exchange rate.

- **Based on current forecasts it is reasonable to assume that royalties of A\$23 million (in present value terms) would be a lower-bound estimate.**

## *Environmental impacts*

The Commission noted that

....at this stage the Commission does not have sufficient information or confidence to anticipate a determination for approval without additional risk mitigation strategies being developed and implemented. The Commission has provided recommendations outlining additional assessment work to be provided to enable determination of the proposed mine expansion. (p.ii)

The Commission did not provide recommendations in regards to the assumptions presented in the economic analysis regarding the potential impacts of greenhouse gas emissions.

The Gillespie Economics 2015 report notes that the majority of potential impacts are either negligible or are mitigated/offset with the costs of these actions resulting in additional operating and capital expenditure which lowers the profitability of the mine (with no direct impact on royalties unless the mine profitability impacts on production).

<sup>8</sup> Australian Department of Industry, (2015) *Resources and Energy Quarterly*, June 2015, Figure 4.2.

<sup>9</sup> <http://www.rba.gov.au/statistics/frequency/exchange-rates.html>

<sup>10</sup> Australian Department of Industry, (2015) *Resources and Energy Quarterly*, June 2015, p.24.

<sup>11</sup> Even if the quality of the coal was close to semi-soft coking coal, rather than high quality hard coking coal, this would generate royalties around \$19 million in present value terms.

To the extent that the revised analysis presented in the Gillespie Economics 2015 report has dealt with the Commission's concerns then these impacts are already accounted for in the additional risk management strategies adopted.

- **The Gillespie Economics analysis assumes that the majority of potential environmental impacts may be mitigated or equivalent offsets purchased.**

Potential issues raised by the Commission and the responses are noted below.

### ***Surface water.***

#### ***Commission's recommendation***

In regards to surface water impacts, the PAC noted that

Advice from Water NSW and the Commonwealth's Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development have both identified significant risks with respect to the proponent's modelling of the predicted impacts.....

At this stage, the Commission does not have sufficient information or confidence to determine the merits of the proposal sufficient for a determination for approval. It may be possible for the proposal, or a modified proposal to be approved if all the additional information identified in this Review report provides a greater level of confidence for the protection of the water quality and quantity in the Sydney Catchment Area and satisfies all the other issues identified in this review. The Commission has recommended that a risk management panel oversee any additional assessment.

#### ***Review of revised economic assessment***

The economic assessment recognises that there is a risk associated with a reduction in raw water supply due to groundwater depressurisation estimated at 8.66 ML/year. To the extent that this reduction in water supply impacts the water yield there is an economic cost. The revised Gillespie Economics report notes that,

Assuming an opportunity cost of water of \$2,000 per ML per year and water loss occurring in perpetuity, these impacts equate to \$235,000 (present value at 7% discount rate). These surface water costs would form part of the capital and operating costs of the Project.

There are a number of issues that need to be considered:

- the analysis focuses on impacts on water quantity and, therefore, assumes that any impact on water quality is immaterial for the purposes of the CBA.
- the analysis assumes that the annual loss in yield extends into perpetuity and not just be in the life of the mine. If the loss only occurred in each year over a 10 year period from the commencement of the Project then the value of the impact would fall to around \$122 000 in present value terms (compared to \$235 000).
- the maximum predicted loss of stream baseflow within the Sydney Basin Nepean Groundwater Source, as a result of the proposed mining, is 15 ML/year (as estimated in the revised Groundwater Assessment, GeoTerra, 18 August 2015). If this estimate was utilised the value of the lost yield is around \$430 000 in present value terms (based on the approach presented in Gillespie Economics).

- The assumed opportunity cost of water of \$2,000 per ML appears high compared to the estimated of under \$500 per ML derived utilising Sydney's 2010 Metropolitan Water Plan. Using this alternative figure would result in impacts of around \$62 000 in present value terms.

Based on the above, a high end estimate of \$430 000 in present value terms can be assumed for the purposes of estimating the net benefits expected from the Project.

The revised economic assessment assumes that where these actions to compensate for lost yield are undertaken by the Proponent then this would form part of the capital and operating costs of the firm. For example, if the costs were incurred by the Proponent to prevent groundwater depressurisation then these would form part of the Proponent's cost base. Similarly, if there were irrigation licences available to mitigate the lost yield and which were purchased by the Proponent then this would also form part of the cost base.

However, where the costs are incurred by third parties (such as Water NSW, Sydney Water Corporation or Sydney Desalination Plant Pty Ltd) these costs would not form part of the costs incurred by the Proponent (unless, perhaps, there were agreements in place for the Proponent to make payments to the third party).

Water NSW has advised that it will incur additional monitoring costs to monitor the compliance of the mine, estimated at \$30 000 per annum.<sup>12</sup> Assuming that these costs are incurred in each year over the 5 year life of the project then this would result in an additional cost of \$62 000 in present value terms.

- **It is estimated that the additional monitoring costs to Water NSW (that should be reflected in the CBA) will be around \$62 000 in present value terms.**
- **If the additional mitigation costs noted above were incurred by a third party then the estimated impact (of \$430 000 at a high end) would need to be deducted from royalties to generate the net benefits to community from the Project. The Department should satisfy itself that any costs incurred to mitigate water quality impacts are costs incurred by the proponent and, if not, that the CBA results are adjusted for any third party costs.**

## *Noise impacts*

### *Commission's recommendation*

The PAC made the following recommendation with regard to noise impacts

That further consideration of the noise impacts of the project needs to be provided including consideration of further noise mitigation measures as recommended by the EPA. Detailed justification should be provided for any deviations from the existing noise limits in current planning approval. Also clarification should be provided on the outcomes and applicability of the noise audit required in the 2011 approval.

<sup>12</sup> Based on 0.2 FTE at \$150,000 per annum, as advised by NSW Water (personal correspondence 9 September 2015).

WCL's response to the PAC's review report noted Wilkinson Murray (the consultant who conducted noise modelling for the Project) considered each of the additional noise mitigation measures recommended by the Environment Protection Authority (EPA) and assessed the potential reductions in noise levels that these measures could produce.<sup>13</sup> Table 4-1 of Appendix B of WCL's response outlines Wilkinson Murray's findings, noting that 6 out of 9 measures were reasonable and hence were adopted in the revised noise model.<sup>14</sup>

### *Review of revised economic assessment*

The revised economic assessment does not mention the PAC's recommendation regarding noise impacts, nor WCL's response to the recommendation. However, it does note that:

Predicted noise levels exceed the criteria at 12 receiver locations. The exceedances are in the magnitude of 2-5 dBA. This potentially gives rise to management liabilities but not acquisition liabilities in accordance with the new Land Acquisition Policy (DP&E, 2015). These noise management costs would form part of the capital and operating costs of the Project. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable.

- **According to the economic assessment, the cost of management liabilities due to noise impacts will be included in the proponent's capital and/or operating costs which are not considered in the minimum threshold value framework adopted for the economic assessment. The Department should satisfy itself that these actions undertaken as part of the Project and there are no material unmitigated impacts that arise (as assumed in the economic assessment).**

### *Air quality*

#### *Commission's recommendation*

The PAC made three recommendations with regard to air quality impacts. Each recommendation is outlined below with the proponent's respective response.

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<sup>13</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pg. 4.

<sup>14</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pages 8-12.



*PAC recommendation 8: The PM<sub>2.5</sub> emissions from the proposal need to be assessed prior to any determination of the application.*

The proponent noted that an assessment of PM<sub>2.5</sub> emissions was undertaken and the modelling results indicate that all sensitive receivers are predicted to experience PM<sub>2.5</sub> concentrations within the criteria.<sup>15</sup>

It is not clear whether the assessment of PM<sub>2.5</sub> emissions undertaken has been reviewed by the PAC.

*PAC recommendation 9: Consideration of best practice standards needs to be provided to demonstrate that air emissions would be minimised and to justify the proposed increase in coal handling capacity.*

The proponent noted evaluation of best practice dust management at Russell Vale Colliery was undertaken by PAEHolmes in 2012. The evaluation by PAEHolmes identified components of the Project that represent best practice dust management and recommended four additional best practice measures which were potentially achievable. Hansen Bailey noted that Wollongong Coal Limited (WCL) will investigate two of the four additional best practice measures identified by PAEHolmes.<sup>16</sup>

It is not clear whether WCL will adopt additional best practice management measures.

*PAC recommendation 10. The mine's existing monitoring and reporting systems should be strengthened to clearly demonstrate compliance with current conditions, environmental standards and reporting goals (i.e. for PM<sub>2.5</sub> emissions).*

Hansen Bailey noted that WCL currently produces quarterly reports that reference the EPA's air quality criteria for PM<sub>10</sub> and logs and evaluates concentrations of the PM<sub>2.5</sub> size fraction for internal environmental management purposes. In accordance with the PAC's recommendation, WCL will include the results of PM<sub>2.5</sub> monitoring in future reporting and publish it on its website.<sup>17</sup>

#### *Review of revised economic assessment*

The revised economic assessment notes that 'no significant air quality impacts are predicted' and hence 'no material impact therefore arises that would be included in the BCA'.<sup>18</sup>

■ **This conclusion is consistent with the findings in WCL's response to PAC's review. However it is not clear if additional best practice management measures will be**

<sup>15</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pg. 9.

<sup>16</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pg. 11.

<sup>17</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pg. 12.

<sup>18</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Appendix A.

adopted by WCL as a result of the PAC's recommendations and whether the cost of these has been included in the economic assessment. . The Department should satisfy itself that additional best practice management actions will be undertaken as part of the Project and there are no material unmitigated impacts that arise (as assumed in the economic assessment).

## ***Traffic***

### ***Commission's recommendation***

The PAC made four recommendations with regard to traffic impacts. Each recommendation is outlined below with the proponent's respective response.

*PAC recommendation 12. The Proponent should negotiate with Council and Roads & Maritime Services regarding maintenance contributions to mitigate impacts from the increase in truck movements along the haulage route.*

Hansen Bailey noted that WCL has commenced consultation with Wollongong City Council regarding reasonable financial contribution to the maintenance of Bellambi Lane.<sup>19</sup>

*PAC recommendation 13. Consideration should be given to further limiting the hours of truck movements.*

The Proponent stated that the proposed project does not involve any change from currently approved trucking hours for Russell Vale Colliery to undertake coal transportation.

*PAC recommendation 14. Proponent should investigate and cost a number of options to reduce the noise impacts to the most effected residents along Bellambi Lane, particularly those near the intersections with the Princes Highway and the Northern Distributor. Options to be considered by the proponent, should include, but not be limited to:*

- construction of a coal truck parking area (for trucks to wait prior to the commencement of haulage hours) within the mine boundary;
- construction of a noise barrier near the intersections of Bellambi Lane / Princes Highway and Bellambi Lane / Northern Distributor; and
- use of pavement modifications along Bellambi Lane to reduce truck / trailer banging.

In response to recommendation 14, the proponent noted:

- that a parking area for haul trucks is proposed as a component of the Project and is illustrated in the Environmental Assessments conducted in 2013.
- the construction of a barrier at the Bellambi Lane / Northern Distributor intersection is considered by the Proponent to provide no benefit

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<sup>19</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pg. 13.

- Roads and Maritime Services (RMS) has previously upgraded pavement along Bellambi Lane excluding a section that was unable to be upgraded due to objections from local residents regarding property access during these works. If required, WCL will make a contribution to RMS for upgrading of the pavement along this part of the road.

*PAC recommendation 15. No increase in the currently approved maximum rate of extraction should be approved without clear demonstration that facilities can handle the additional volume without unacceptable impacts for local residents.*

The proposed project will increase coal production from 1 Mtpa to 3 Mtpa. With regard to the PAC's recommendation, the proponent noted:

- Hatch assessed the ability of the proposed infrastructure to handle the increase in coal production from 1 Mtpa to 3 Mtpa and determined that the infrastructure has sufficient capacity to handle up to 3 Mtpa.
- Air quality assessments undertaken for the Project were modelled based on an operational scenario with an annual coal production rate of 3 Mtpa and with results within required criteria (except for an exceedance of the cumulative 24-hour average PM<sub>10</sub> concentrations on one day).
- Noise assessments conducted, based on coal production of 3 Mtpa, found the Project is predicted to result in lower noise levels at private receivers relative to what is currently experienced due to additional mitigation measures that WCL advises can be implemented.<sup>20</sup>

#### *Review of revised economic assessment*

The revised economic assessment concludes that:

The road traffic assessment did not identify any significant issues from a road traffic performance or safety perspective. Consequently, there are no material economic effects for inclusion in the BCA.<sup>21</sup>

The revised economic assessment does not discuss any of the PAC's recommendations, nor does it quantify any costs or benefits associated with the recommendations.

The PAC's recommendations may increase the proponent's capital and/or operating costs due to:

- maintenance contributions to local council
- increased operating costs if trucking hours are restricted
- cost to construct barrier at the Bellambi Lane/Northern Distributor
- **The economic assessment does not incorporate the proponent's capital or operating costs (including changes resulting from the PAC's recommendations).**

<sup>20</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Pages 16-17.

<sup>21</sup> Hansen Bailey, 2015, *Russell Vale Colliery: Response to Planning Assessment Commission Review Report*. Prepared for Wollongong Coal Limited: July 2015, Appendix A: Economic Assessment

**The Department should satisfy itself that these actions are undertaken and there are no material unmitigated impacts that arise, consistent with the assumptions in the economic analysis.**

## **Conclusions**

The estimated net production benefits from the Project arise from the royalties stream generated. While there is significant uncertainty regarding the future price of coal (in Australian dollar terms) it is reasonable to expect royalties to be above \$23 million in present value terms, once deductions have been incorporated. Additional benefits arising from company tax are also likely, however, these have not been quantified and included in the analysis. Therefore, the royalty stream should be interpreted as the *minimum* net production benefits that can be expected.

On the cost side, the additional cost to Water NSW of ongoing monitoring is estimated at around \$62 000 in present value terms which would slightly reduce the net benefits from the Project.

There are also a number of areas where impacts are expected to be immaterial or can be readily mitigated. To the extent that this holds, then it would reduce the financial profitability of the Project. The Department should, however, satisfy itself that such mitigation actions are undertaken to ensure that there are no third party impacts that would need to be incorporated into the economic assessment.

If, for example, the costs associated with the lost surface water quantity was incurred by a third party then it would reduce the net benefits expected from royalties by up to \$430 000 in present value terms. Under this scenario the benefits from the Project would still deliver net benefits to the community in excess of \$22.5 million in present value terms.

Any potential impacts associated with greenhouse gas emissions would need to be greater than this for the Project to generate net costs to the community. Using Gillespie Economic's estimate the greenhouse gas emissions are valued at \$0.15 million in present value terms. This would mean that the Project still generates a net benefit to the community.







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# Project Approval

## Section 75J of the *Environmental Planning and Assessment Act 1979*

As delegate for the Minister for Planning, the Planning Assessment Commission approves the project application referred to in Schedule 1, subject to the conditions in Schedules 2 to 6.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

Member of the Commission	Member of the Commission
Sydney	2015
<hr/>	
<b>Project Application:</b>	<b>SCHEDULE 1</b> 09_0013
<b>Proponent:</b>	Wollongong Coal Limited
<b>Approval Authority:</b>	Minister for Planning
<b>Land:</b>	See Appendix 1
<b>Project:</b>	Russell Vale Colliery Underground Expansion Project
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## DEFINITIONS

Adaptive management	Adaptive management includes monitoring subsidence effects and impacts and, based on the results, modifying the mine plan as mining proceeds to ensure that the effects, impacts and/or associated environmental consequences remain within the predicted and/or designated ranges and in compliance with the conditions of this approval
Annual Review	The review required by condition 11 of Schedule 6
Approval	This Project Approval
Approved Mine Plan	The mine plan depicted in the figure in Appendix 2
BCA	Building Code of Australia
Built features	Includes any building or work erected or constructed on land, and includes dwellings and infrastructure such as any formed road, street, path, walk, or driveway; and any pipeline, water, sewer, telephone, gas or other service main
CCC	Community Consultative Committee
Conditions of this approval	Conditions contained in Schedules 2 to 6 inclusive
Construction	The demolition of buildings or works, carrying out of works and erection of buildings covered by this approval
Council	Wollongong City Council
Day	The period from 7 am to 6 pm on Monday to Saturday, and 8 am to 6 pm on Sundays and Public Holidays
Department	Department of Planning and Environment
DPI	Department of Primary Industries
DPI-Water	Department of Primary Industries – Water
DRE	Division of Resources and Energy within the Department of Industry
DSC	Dams Safety Committee
EA	Environmental Assessment prepared for NRE No. 1 Colliery Underground Expansion Project entitled <i>NRE No. 1 Colliery Project Application (09_0013) Environmental Assessment</i> (dated February 2013) including the Preferred Project Report and associated Response to Submissions (dated September 2013), the Residual Matters Report (dated June 2014) and the following additional information: <ul style="list-style-type: none"> <li>- <i>Bellambi Gully Flood Study</i> (25 November 2014) undertaken by Cardno Pty Ltd;</li> <li>- letter report from Wollongong Coal Ltd (26 September 2014) to the Department providing additional information in relation to total groundwater inflow; and</li> <li>- <i>Noise Impact Assessment</i> (September 2014) undertaken by Wilkinson Murray Pty Ltd.</li> </ul>
Environmental consequences	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; adverse water quality impacts; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding.
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPL	Environment Protection Licence issued under the <i>Protection of the Environment Operations Act 1997</i>
Evening	The period from 6 pm to 10 pm
Feasible	Feasible relates to engineering considerations and what is practical to build or to implement
First workings	Extraction of coal from bord and pillar workings and development of main headings, longwall gate roads, related cut throughs and the like
Incident	A set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in this approval
INP	<i>NSW Industrial Noise Policy</i> (NSW EPA, 2000)
Land	As defined in the EP&A Act, except where the term is used in the noise and air quality conditions in Schedule 4 of this project approval where it is defined to mean the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Material harm to the environment	Harm to the environment is material if it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial
Mining operations	Extraction, processing, handling and storage of coal on the site
Minister	Minister for Planning, or delegate
Mitigation	Activities associated with reducing the impacts of the project prior to or during those impacts occurring

MSB	Mine Subsidence Board
Negligible	Small and unimportant, such as to be not worth considering
Night	The period from 10 pm to 7 am, Monday to Saturday, 10 pm to 8 am on Sundays and Public Holidays
OEH	Office of Environment and Heritage
PKCT	Port Kembla Coal Terminal
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Privately-owned land	Land that is not owned by a public agency, or a mining company (or its subsidiary)
Project	Russell Vale Colliery Underground Expansion Project as described in the EA
Proponent	Wollongong Coal or any other person or persons who rely on this approval to carry out the project that is subject to this approval
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Reasonable costs	The costs agreed between the Department and the Proponent for obtaining independent experts to review the adequacy of any aspects of the extraction plan, or where such costs cannot be agreed, the costs determined by a dispute resolution process
ROM coal	Run-of-mine coal
RMS	Roads and Maritime Services
Safe, serviceable & repairable	Safe means no danger to users who are present, serviceable means available for its intended use, and repairable means damaged components can be repaired economically
Second workings	Extraction of coal from longwall panels, mini-wall panels or pillar extraction
Secretary	Secretary of the Department, or nominee
Site	Land to which the project approval applies (see Appendix 1)
Statement of Commitments	The commitments by Wollongong Coal set out in Appendix 3
Subsidence	The totality of subsidence effects and impacts and their associated environmental consequences
Subsidence effects	Deformation of the ground mass due to mining, including all mining-induced ground movements, including both vertical and horizontal displacement, tilt, strain and curvature
Subsidence impacts	Physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs
Surface facilities site	The Russell Vale site; all ventilation shaft sites; sites used for gas drainage or for other mining purposes infrastructure; and any other site subject to existing or proposed surface disturbance associated with the project
Wollongong Coal	Wollongong Coal Limited



## **SCHEDULE 2 ADMINISTRATIVE CONDITIONS**

### **OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT**

1. In addition to meeting the specific performance criteria established under this approval, the Proponent shall implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation, or rehabilitation of the project.

### **TERMS OF APPROVAL**

2. The Proponent shall carry out the project:
  - (a) generally in accordance with the EA;
  - (b) in accordance with the project layout plans and the Statement of Commitments; and
  - (c) in accordance with the conditions of this approval.

*Notes:*

- *The project layout plans are shown in Appendix 2.*
- *The Proponent's Statement of Commitments is shown in Appendix 3.*

3. If there is any inconsistency between the above documents, the more recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.
4. The Proponent shall comply with any reasonable requirement/s of the Secretary arising from the Department's assessment of:
  - (a) any strategies, plans, programs, reviews, audits, reports or correspondence that are submitted in accordance with this approval;
  - (b) any reviews, reports or audits undertaken or commissioned by the Department regarding compliance with this approval; and
  - (c) the implementation of any actions or measures contained in these documents.

### **LIMITS ON APPROVAL**

#### **Mining Operations**

5. The Proponent may carry out mining operations on the site until 31 December 2021.

*Note: Under this Approval, the Proponent is required to rehabilitate the site to the satisfaction of DRE. Consequently this approval will continue to apply in all other respects other than the right to conduct mining operations until the site has been rehabilitated to a satisfactory standard.*

#### **Coal Extraction**

6. The Proponent shall not extract more than 3 million tonnes of ROM coal from the site per calendar year.

#### **Hours of Operation**

7. The Proponent may undertake mining operations 24 hours a day, 7 days a week.

### **COMMENCEMENT OF DEVELOPMENT UNDER THIS APPROVAL**

8. The Proponent:
  - (a) shall notify the Secretary in writing of the proposed date of commencement of development under this approval; and
  - (b) may only commence development under this approval once the Secretary has agreed in writing that all prerequisites to the commencement of that development have been met.

### **SURRENDER OF EXISTING PROJECT APPROVAL**

9. By 31 December 2016, or as otherwise agreed by the Secretary, the Proponent shall surrender the existing project approval for the site in accordance with Section 104A of the EP&A Act.

Prior to the surrender of the existing project approval, the conditions of this approval shall prevail to the extent of any inconsistency with the conditions of the existing project approval.

## **STRUCTURAL ADEQUACY**

10. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

*Notes:*

- *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for the proposed building works; and*
- *Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.*

## **DEMOLITION**

11. The Proponent shall ensure that all demolition work is carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures*, or its latest version.

## **PROTECTION OF PUBLIC INFRASTRUCTURE**

12. Unless the Proponent and the applicable authority agree otherwise, the Proponent shall:
- (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the project; and
  - (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the project.

*Note: This condition does not apply to any damage to public infrastructure subject to compensation payable under the Mine Subsidence Compensation Act 1961, or to damage to roads caused as a result of general road usage.*

## **OPERATION OF PLANT AND EQUIPMENT**

13. The Proponent shall ensure that all plant and equipment used on site is:
- (a) maintained in a proper and efficient condition; and
  - (b) operated in a proper and efficient manner.

## **CONTRIBUTIONS TO COUNCIL**

14. Within 6 months of the date of this approval, the Proponent shall reach agreement with Council on the annual contribution to be paid to Council for the maintenance of Bellambi Lane. Should agreement not be reached within that timeframe, the matter may be referred to the Secretary by either party for resolution. The Secretary's decision in regard to contributions shall be final.

### SCHEDULE 3 ENVIRONMENTAL CONDITIONS – UNDERGROUND MINING

#### SUBSIDENCE

#### Performance Measures – Natural and Heritage Features

- The Proponent shall ensure that the project does not cause any exceedance of the performance measures in Table 1, to the satisfaction of the Secretary.

Table 1: Subsidence Impact Performance Measures

<b>Water resources</b>	
Cataract Creek Cataract River	Negligible environmental consequences including: <ul style="list-style-type: none"> <li><i>negligible</i> diversion of flows or changes in the natural drainage behaviour of pools;</li> <li><i>negligible</i> gas releases and iron staining;</li> <li><i>negligible</i> increase in water cloudiness;</li> <li><i>negligible</i> increase in bank erosion;</li> <li><i>negligible</i> increase in sediment load; and</li> <li><i>negligible</i> reduction in the volume of water reporting to the reservoir.</li> </ul>
Cataract Reservoir	Negligible leakage from the reservoir and negligible reduction in the water quality of the reservoir.
Other watercourses	No greater subsidence impact or environmental consequences than predicted in the EA.
<b>Swamps</b>	
Upland Swamps CRUS1, CCUS1, CRUS6 and CCUS24	Negligible environmental consequences including: <ul style="list-style-type: none"> <li><i>negligible</i> change to the shallow groundwater regime when compared with control swamps;</li> <li><i>negligible</i> erosion of the surface of the swamp;</li> <li><i>negligible</i> change in the size of the swamp;</li> <li><i>negligible</i> change in the ecosystem functionality of the swamp;</li> <li><i>negligible</i> change to the composition or distribution of species within the swamp; and</li> <li><i>negligible</i> change to the structural integrity of the bedrock base or any controlling rockbar/s of the swamp.</li> </ul>
<b>Land</b>	
Cliffs	No greater subsidence impacts or environmental consequences than predicted in the EA.
<b>Biodiversity</b>	
Threatened species, populations or their habitats and endangered ecological communities (except Upland Swamps CCUS2, CCUS4, CCUS5, CCUS10, CCUS11, CCUS12, BCUS4 and BCUS11)	Negligible environmental consequences.
<b>Heritage Features</b>	
Aboriginal heritage sites 52-2-0083, 52-2-0233, 52-2-0310, 52-2-0311, 52-2-0312, 52-2-0313, 52-2-0314, 52-2-0317, 52-2-0319, 52-2-0322, 52-2-0323, Wonga East 4 and Wonga East 5	Negligible impact or environmental consequences.
Aboriginal heritage sites 52-2-0099, 52-2-0229, 52-2-0603, 52-2-3939, 52-2-3940, 52-2-3941, 52-2-0320 and 52-3-0325.	No greater subsidence impact or environmental consequences than predicted in the EA.
Historic heritage sites	Negligible impact or environmental consequences.

**Notes:**

- The Proponent will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this approval (see eg condition 10 below).
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.
- The requirements of this condition only apply to the impacts and consequences of mining operations, construction or demolition undertaken following the date of this approval.

2. The Proponent must assess and manage project-related risks to ensure that there are no exceedances of the performance measures in Table 1. Any exceedance of these performance measures constitutes a breach of this approval and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation, notwithstanding actions taken pursuant to paragraphs (a)-(c) or condition 3 below. Where any exceedance of these performance measures has occurred, the Proponent must, at the earliest opportunity:
- (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
  - (b) consider all reasonable and feasible options for remediation and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
  - (c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

### Offsets

3. If the Proponent exceeds the performance measures in Table 1 and the Secretary determines that:
- (a) it is not reasonable or feasible to remediate the impact or environmental consequence; or
  - (b) remediation measures implemented by the Proponent have failed to satisfactorily remediate the impact or environmental consequence;
- then the Proponent shall provide a suitable offset to compensate for the impact or environmental consequence, to the satisfaction of the Secretary.

The offset must give priority to like-for-like physical environmental offsets, but may also consider payment into any NSW Offset Fund established by OEH, or funding or implementation of supplementary measures such as:

- actions outlines in threatened species recovery programs;
- actions that contribute to threat abatement programs;
- biodiversity research and survey programs; and/or
- rehabilitating degraded habitat.

*Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence.*

### Swamp Offset Bond for First Swamp Undermined

4. Prior to the re-commencement of second workings in Longwall 6, unless otherwise agreed by the Secretary, the Proponent shall lodge a Swamp Offset Bond of \$500,000 with the Department.

If, after 12 months of completion of all mining under this approval within 400 metres of swamp CCUS4, monitoring demonstrates that no greater than 'negligible environmental consequences' have resulted to the swamp from mining under this approval, to the satisfaction of the Secretary, then the Secretary will release the Bond.

If monitoring demonstrates that greater than 'negligible environmental consequences' have resulted to swamp CCUS4 from mining under this approval, and that these consequences have stabilised for a period of at least 12 months, then the Proponent must offset the environmental consequences to that swamp to the satisfaction of the Secretary within any period specified by the Secretary.

The offset liability will be set by the Secretary in consultation with OEH, following consideration of:

- (a) the estimated liability using the Framework for Biodiversity Assessment in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
- (b) advice from the Independent Expert Panel that will be established by the Secretary for the project.

Once the Proponent has offset the environmental consequences to the satisfaction of the Secretary, the Bond will be returned to the Proponent.

*Note: Alternative funding arrangements, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate, can be used as part of the Swamp Offset Bond. A bank guarantee can be lodged in place of a cash bond.*

### Swamp Offsets for all other Upland swamps

5. Prior to the commencement of mining operations under an approved Extraction Plan which are predicted to cause greater than negligible environmental consequences to any of Upland Swamps CCUS2, CCUS5, CCUS10, CCUS11, CCUS12, BCUS4 or BCUS11, the Proponent shall demonstrate that it can satisfy the maximum predicted offset liability for the total area of swamp(s) predicted to be impacted under that Extraction Plan.

If, after 12 months of completion of all mining under this approval within 400 metres of any of these swamps, monitoring demonstrates that no greater than 'negligible environmental consequences' have resulted to the swamp from mining under this approval, to the satisfaction of the Secretary, then the Proponent will not be required to

secure the offset or retire the credits relating to that swamp.

If monitoring demonstrates that greater than 'negligible environmental consequences' have resulted to any of these swamps from mining under this approval, and that these consequences have stabilised for a period of at least 12 months, then the Proponent must offset the environmental consequences to that swamp to the satisfaction of the Secretary within any period specified by the Secretary.

The offset liability will be set by the Secretary in consultation with OEH, following consideration of:

- (a) the estimated liability using the Framework for Biodiversity Assessment in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
- (b) advice from the Independent Expert Panel that will be established by the Secretary for the development.

*Note: Alternative funding arrangements, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate, can be used as part of the Swamp Offset.*

- 6. As part of each Extraction Plan for mining within 400 metres of the swamps subject to condition 5 above, the Proponent must:
  - (a) calculate the maximum predicted offset liability for any environmental consequences on these swamps that may result from the proposed mining using the Framework for Biodiversity Assessment in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
  - (b) demonstrate that it has suitable arrangements in place to deal with these liabilities quickly in the event that offsets are required.

#### Performance Measures – Built Features

- 7. The Proponent shall ensure that the project does not cause any exceedances of the performance measures in Table 2, to the satisfaction of the Secretary.

*Table 2: Subsidence Impact Performance Measures*

<b>Built Features</b>	
Key public infrastructure: Mount Ousley Road; Picton Road Interchange; 330 and 132 kV power transmission lines and associated towers; and telecommunication infrastructure on Brokers Nose.	Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.
Access road to Vent Shaft No. 4, fire trails, other public infrastructure, other built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
<b>Public safety</b>	
Public Safety	No additional risk

Notes:

- 1) The Proponent will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in Built Features Management Plans or Public Safety Management Plan (see condition 10 below).
  - 2) Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.
  - 3) The requirements of this condition only apply to the impacts and consequences of mining operations undertaken following the date of this approval.
  - 4) Any breach of this condition is taken to be a breach of this approval, and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.
  - 5) Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes.
- 8. Any dispute between the Proponent and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 2 is to be settled by the Secretary, following consultation with the MSB and DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this approval.

#### First Workings

- 9. The Proponent may carry out first workings within the underground mining area, other than in accordance with an approved Extraction Plan, provided that DRE is satisfied that the first workings are designed to remain stable and non-subsiding in the long-term, except insofar as they may be impacted by approved second workings.

*Note: The intent of this condition is not to require an additional approval for first workings, but to ensure that first workings are built to geotechnical and engineering standards sufficient to ensure long term stability, with negligible resulting direct subsidence impacts.*

## Extraction Plan

10. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. Each extraction plan must:
  - (a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;
  - (b) be approved by the Secretary before the Proponent carries out any of the second workings covered by the plan;
  - (c) include detailed plans of existing and proposed first and second workings and any associated surface development;
  - (d) include detailed performance indicators for each of the performance measures in Tables 1 and 2;
  - (e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this approval;
  - (f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 1 and 2, and manage or remediate any impacts and/or environmental consequences;
  - (g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected infrastructure, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which:
    - addresses in appropriate detail all items of key public infrastructure, other public infrastructure and all classes of other built features;
    - has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;
    - recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and
    - in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner) and provides for annual auditing of compliance and effectiveness during extraction of longwalls which may impact the infrastructure;
  - (h) include a Water Management Plan, which has been prepared in consultation with WaterNSW and DPI-Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including:
    - detailed baseline data on:
      - surface water flows and quality in water bodies that could be affected by subsidence, including Cataract Creek, Cataract River and all major associated tributaries ;
      - groundwater levels, yield and quality in the region;
    - surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;
    - a surface water monitoring program to monitor and report on:
      - stream flows and water quality (including both dissolved iron and filterable iron oxides/hydroxides);
      - stream and riparian vegetation health;
      - channel and bank stability;
    - a groundwater monitoring program to monitor and report on:
      - groundwater inflows to the underground mining operations;
      - leakage from Cataract Reservoir;
      - the height of groundwater depressurisation in the area between Longwalls 6 and 7 and the Cataract Reservoir;
      - background changes in groundwater yield/quality against mine-induced changes;
      - permeability, hydraulic gradient, flow direction and connectivity of the deep and shallow groundwater aquifers;
      - impacts of the project on upland swamps and other groundwater dependent ecosystems;
    - a program to validate the surface water and groundwater models for the project, and compare monitoring results with modelled predictions; and
    - a plan to respond to any exceedances of the surface water and groundwater assessment criteria;
  - (i) include a Biodiversity Management Plan, which has been prepared in consultation with OEH, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats; endangered ecological communities; upland swamps and other groundwater dependent ecosystems;
  - (j) *Swamp Monitoring Program* which has been prepared in consultation with OEH, DPI-Water and WaterNSW, and which includes:



- measures to record the nature and condition of terrestrial and aquatic flora and fauna within all upland swamps;
  - measures to characterise soils or peat layers within the upland swamps to determine:
    - porosity;
    - a basis for relating water levels to rainfall and evapotranspiration; and
    - the presence, or absence, of clay materials at the interface with the underlying bedrock;
  - a program for monthly review of the water balance of all monitored swamps based on recorded rainfall, estimated evapotranspiration and recorded surface and shallow groundwater levels and outflow measurements;
  - detailed performance indicators for the relevant performance measures in Table 1, including performance indicators relating to surface and shallow groundwater levels and outflow measurements;
  - consideration of a minimum of 2 years of baseline data for swamp hydrology and swamp vegetation;
  - hydrological and vegetative monitoring which fully satisfies Before After Control Impact (BACI) design principles;
  - provision of raw piezometer and other monitoring data to the Department, OEH and the Independent Monitoring Panel, if requested; and
  - incorporation of any relevant findings from swamp research projects into the swamp monitoring program;
- (k) include a Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general;
- (l) include a Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders for both Aboriginal and historic heritage, to manage the potential environmental consequences of the proposed second workings on both Aboriginal and non-Aboriginal heritage items. This plan must reflect all requirements under condition 19 of Schedule 4;
- (m) include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure public safety in the mining area;
- (n) include a Subsidence Monitoring Program, which has been prepared in consultation with DRE, to:
- describe the on-going subsidence monitoring program;
  - provide data to assist with the management of the risks associated with subsidence;
  - validate the subsidence predictions;
  - analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and
  - inform the contingency plan and adaptive management process;
- (o) include Trigger Action Response Plans, or equivalent, to address potential subsidence impacts and environmental consequences that may result from mining subsidence;
- (p) include a Contingency Plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 1 and 2, or where any such exceedance appears likely;
- (q) include a Mine Workings Closure Plan, prepared in consultation with WaterNSW and the DSC, that effectively provides for the sealing and isolation of affected mine workings if there are unacceptable inflows to the mine from the Cataract Reservoir;
- (r) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 27 of Schedule 3; and
- (s) include a program to collect sufficient baseline data for future Extraction Plans.

*Notes:*

- *To identify the longwall mining domains referred to in this condition, see Appendix 2;*
- *Extraction of Longwall 6 may be undertaken under a Subsidence Management Plan or Extraction Plan which satisfies the conditions of MP 10\_0046 and was prepared prior to the date of this approval.*

## **Geological Structures**

11. The Proponent shall:

- (a) implement the following prior to the extraction of Longwall 7, to the satisfaction of the DSC:
- undertake inspections of the Bulli Seam workings overlying Longwall 7 to confirm the accuracy of the record tracings (subject to ability to safely access these workings); and
  - drill exploration boreholes to confirm the accuracy of the record tracings for the Bulli Seam workings overlying Longwall 7.
- (b) if required by the DSC, truncate the panel length of Longwall 7 if the Corrimall Fault is intersected during development of the gateroads for Longwall 7;

### **Independent Monitoring Panel**

12. An Independent Monitoring Panel for the project will be established by the Secretary, and be comprised of suitably qualified experts in the fields of mining subsidence and upland swamps. The role of the Panel is to provide timely, accurate and focussed advice to the Proponent and the Secretary regarding the:
- (a) collection of relevant data to predict and monitor the potential subsidence impacts and environmental consequences of second workings;
  - (b) achievement of performance measures in Table 1 in respect of Swamps, Land and Biodiversity, having regard to relevant performance indicators, including avoidance of impacts where reasonable and feasible, rather than relying on remediation and offsets;
  - (c) preparation, revision and implementation of Extraction Plans, particularly their Swamp Monitoring Program, Biodiversity Management Plan and Land Management Plan components;
  - (d) implementation of the swamp and groundwater monitoring programs (including the installation of piezometers) and adaptive management regime throughout the life of the project; and
  - (e) calculation of swamp offset liabilities and verification of calculated swamp offset liabilities under conditions 4 and 5 of Schedule 3.

### **Installation of Piezometers**

13. As soon as practicable following the date of this approval, the Proponent shall complete the installation of its network of piezometers to monitor shallow groundwater and upland swamps, to the satisfaction of the Secretary. This network must include:
- (a) installation of upslope and downslope piezometers in all upland swamps, in order to better understand the down-slope movement of shallow groundwater; and
  - (b) installation of flow monitoring points in all upland swamps.

### **PAYMENT OF REASONABLE COSTS**

14. The Proponent shall pay all reasonable costs incurred by the Department to:
- (a) engage suitably qualified, experienced and independent persons to review the adequacy of any aspect of an Extraction Plan; and
  - (b) establish and operate the Independent Monitoring Panel for the development.

## SCHEDULE 4 ENVIRONMENTAL CONDITIONS – GENERAL

### NOISE

#### Noise Criteria

1. The Proponent shall ensure that the noise generated by the project does not exceed the criteria in Table 3 at any residence on privately-owned land.

*Table 3: Noise Criteria dB(A)*

Location		Day	Evening	Night	
Area	Receiver Number	$L_{Aeq} (15 \text{ min})$	$L_{Aeq} (15 \text{ min})$	$L_{Aeq} (15 \text{ min})$	$L_{A1} (1 \text{ min})$
16 West Street, Russell Vale	R1	53	53	43	50
30 West Street, Russell Vale	R2	54	53	44	51
13 West Street, Russell Vale	R3	53	53	44	50
13 Broker Street, Russell Vale	R4	53	53	43	50
4 Broker Street, Russell Vale	R5	53	53	41	52
659 Princes Highway, Russell Vale	R6	53	53	41	52
34 Princes Highway, Corrimal	R7	53	53	44	52
95 Midgley Street, Corrimal	R8	53	53	46	52
109 Midgley Street, Corrimal	R9	46	46	43	48
6 Lyndon Street, Corrimal	R10	44	44	43	48
22 Lyndon Street, Corrimal	R11	43	43	40	48
46 Lyndon Street, Corrimal	R12	42	42	39	48
6 Taylor Place, Corrimal	R13	46	46	42	48
15 Taylor Place, Corrimal	R14	46	46	40	48
All other privately-owned land		63	53	48	52

*Note: To interpret the land referred to in Table 3 see the applicable figures in Appendix 4.*

Noise generated by the project is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy (as may be updated from time-to-time). Appendix 5 details the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Proponent has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.

#### Operating Conditions

2. The Proponent shall:
  - (a) implement best management practice to minimise the operational and coal transport noise generated by the project, including any restrictions on the loading and transport of coal described in conditions 14 to 16 below;
  - (b) implement the following measures to the satisfaction of the EPA:
    - fit polymer rollers to conveyors RC1 and RC3 prior to the commencement of coal extraction under this approval;
    - conduct trials to minimise the height of falling on the stockpile with tripper automation within 6 months of the commencement of operations at the pit top site under this approval; and
    - undertake further investigations in relation to an on-site noise barrier within 6 months of the commencement of operations at the pit top site, including:

- conduct real time *in-situ* noise monitoring to verify the results of the modelling and assess the need for a noise barrier;
  - discuss the results with the affected residents to determine their views on the construction of a noise barrier; and
  - present the findings to the EPA for its final position on whether the noise barrier should be constructed;
- (c) not operate dozers or front end loaders between the hours of 10 pm and 7 am Monday to Friday, or between the hours of 10 pm and 8 am on Saturdays, Sundays and Public Holidays. Start-up checks may be undertaken up to 30 minutes prior to operations, where this is undertaken in a designated area selected to minimise noise impacts;
- (d) ensure that delivery of known igneous dyke or sill material to surface stockpiles only occurs between the hours of 7 am and 6 pm;
- (e) ensure that seam floor and roof material and any unmapped igneous dyke or sill material delivered to surface stockpiles between the hours of 10 pm and 7 am comprises less than 10% of the ROM product by volume;
- (f) not operate Trippers 2 or 3 between the hours of 10 pm and 7 am, unless the Trippers are re-engineered to demonstrably achieve the criteria in Table 3;
- (g) ensure the existing Bulli Conveyor is only operated between 7 am and 6 pm and is decommissioned after completion of the driveage of the Wonga Mains;
- (h) only use noise-attenuated mobile fleet on the surface stockpile site;
- (i) operate a comprehensive noise management system that uses real-time noise monitoring data to guide day to day planning of mining operations and the implementation of both proactive and reactive noise mitigation measures to ensure compliance with the relevant conditions of this approval;
- (j) minimise the noise impacts of the project during meteorological conditions when the noise limits in this approval do not apply (see Appendix 5); and
- (k) carry out regular monitoring to determine whether the project is complying with the relevant conditions of this approval and, if necessary, adjust the scale of operations on site to meet the criteria in this approval.
- to the satisfaction of the Secretary.

*Note: During emergencies (see condition 15 below), the Proponent may exceed the restrictions in condition 2 above with the written approval of the Secretary.*

## **Noise Management Plan**

3. The Proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:
- (a) be prepared in consultation with EPA, and submitted to the Secretary for approval prior to the delivery of igneous dyke material to surface stockpiles;
  - (b) describe the noise mitigation measures that would be implemented to ensure compliance with the relevant conditions of this approval;
  - (c) outline procedures to manage responses to any complaints or issues raised by the owners of affected residences;
  - (d) describe the proposed noise management system in detail; and
  - (e) include a noise monitoring program that:
    - evaluates and reports on:
      - the effectiveness of the noise management system;
      - compliance against the noise criteria in this approval; and
      - compliance against the operating conditions in condition 2 above;
    - includes a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results over time (so the real-time noise monitoring program can be used as a better indicator of compliance with the noise criteria in this approval and trigger for further attended monitoring); and
    - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

## **AIR QUALITY**

### **Air Quality Criteria**

4. The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed, or contribute to exceedances of, the criteria listed in Tables 4, 5 or 6 at any residence on privately-owned land.

*Table 4: Long term impact assessment criteria for particulate matter*

<b>Pollutant</b>	<b>Averaging period</b>	<b><sup>d</sup> Criterion</b>
Total suspended particulate (TSP) matter	Annual	<sup>a</sup> 90 µg/m <sup>3</sup>
Particulate matter < 10 µm (PM <sub>10</sub> )	Annual	<sup>a</sup> 30 µg/m <sup>3</sup>

*Table 5: Short term impact assessment criterion for particulate matter*

<b>Pollutant</b>	<b>Averaging period</b>	<b><sup>d</sup> Criterion</b>
Particulate matter < 10 µm (PM <sub>10</sub> )	24 hour	<sup>a</sup> 50 µg/m <sup>3</sup>

*Table 6: Long term impact assessment criteria for deposited dust*

<b>Pollutant</b>	<b>Averaging period</b>	<b>Maximum increase in deposited dust level</b>	<b>Maximum total deposited dust level</b>
<sup>c</sup> Deposited dust	Annual	<sup>b</sup> 2 g/m <sup>2</sup> /month	<sup>a</sup> 4 g/m <sup>2</sup> /month

Notes to Tables 4-6:

<sup>a</sup> Total impact (i.e. incremental increase in concentrations due to the complex plus background concentrations due to all other sources);

<sup>b</sup> Incremental impact (i.e. incremental increase in concentrations due to the complex on its own);

<sup>c</sup> Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method; and

<sup>d</sup> Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents, illegal activities or any other activity agreed by the Secretary.

## Operating Conditions

5. The Proponent shall:
  - (a) implement all reasonable and feasible measures to minimise the:
    - odour, fume and dust emissions of the project; and
    - release of greenhouse gas emissions from the project;
  - (b) implement the following mitigation measures by 31 December 2016:
    - new truck loading facility;
    - secondary sizer building;
  - (c) upgrade of the fleet of coal transport trucks from 34 to 44 tonne capacity progressively over 24 months from the date of this approval;
  - (d) implement the following mitigation measures prior to quarterly production rates reaching the equivalent of 2.7 million tonnes per annum:
    - two new conveyors with enclosures;
    - underground reclaim;
  - (e) implement the following mitigation measures within 12 months of the commencement of mining operations:
    - trial the use of chemical wetting agents on haul roads and stockpiles;
    - seal the haul roads through the stockpile area;
    - install water sprays on the moving tipper(s);
  - (f) minimise any visible off-site air pollution generated by the project;
  - (g) minimise the surface disturbance of the site;
  - (h) operate a comprehensive air quality management system that uses a combination of predictive meteorological forecasting and real-time air quality monitoring data to guide the day to day planning of mining operations and the implementation of both proactive and reactive air quality mitigation measures to ensure compliance with the relevant conditions of this approval; and
  - (i) minimise the air quality impacts of the project during adverse meteorological conditions and extraordinary events (see Note d above under Table 6),

to the satisfaction of the Secretary.

## Air Quality & Greenhouse Gas Management Plan

6. The Proponent shall prepare and implement an Air Quality Management Plan for the project to the satisfaction of the Secretary. This plan must:
  - (a) be prepared in consultation with the EPA, and submitted to the Secretary within 6 months of the date of this approval, unless the Secretary agrees otherwise;
  - (b) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval;
  - (c) describe the measures that would be implemented to minimise the release of greenhouse gas emissions from the site;
  - (d) describe the air quality management system;

- (e) include an air quality monitoring program that:
- uses a combination of real-time and supplementary monitors to evaluate the performance of the project against the air quality criteria in this approval;
  - adequately supports the air quality management system;
  - evaluates and reports on the:
    - the effectiveness of the air quality management system;
    - compliance with the air quality criteria;
    - compliance with the operating conditions in condition 5 above; and
  - defines what constitutes an air quality incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents.

## Meteorological Monitoring

7. For the life of the project, the Proponent shall ensure that there is a meteorological station operating in the vicinity of the site that:
- (a) complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline; and
- (b) is capable of continuous real-time measurement of temperature lapse rate in accordance with the NSW Industrial Noise Policy, unless a suitable alternative is approved by the Secretary following consultation with the EPA.

## WATER

### Water Supply

8. The Proponent shall ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of operations on site to match its available water supply.

*Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Proponent is required to obtain the necessary water licences for the project.*

### Water Pollution

9. Unless an EPL authorises otherwise, the Proponent shall comply with section 120 of the POEO Act.

### Water Management Performance Measures

10. The Proponent shall comply with the performance measures in Table 7 to the satisfaction of the Secretary.

*Table 7: Water Management Performance Measures*

<b>Feature</b>	<b>Performance Measure</b>
Water Management – General	<ul style="list-style-type: none"> <li>• Minimise the use of clean water on site</li> <li>• Minimise the use of make-up water from external sources</li> </ul>
Construction and operation of infrastructure	<ul style="list-style-type: none"> <li>• Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads</li> <li>• Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land (DPI 2007)</i>, or its latest version</li> <li>• Design, install and maintain creek crossings generally in accordance with the Policy and Guidelines for <i>Fish Friendly Waterway Crossings</i> (NSW Fisheries, 2003) and <i>Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings</i> (NSW Fisheries 2003), or their latest versions</li> </ul>
Clean water diversion & storage infrastructure	<ul style="list-style-type: none"> <li>• Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site</li> </ul>
Sediment Dams	<ul style="list-style-type: none"> <li>• Design, install and maintain the dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries</li> </ul>
Mine water storages	<ul style="list-style-type: none"> <li>• Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site</li> <li>• New on-site storages (including tailings dams, mine infrastructure dams, groundwater storage and treatment dams) are suitably lined to comply with a permeability standard of <math>&lt; 1 \times 10^{-9}</math> m/s</li> </ul>
Chemical and hydrocarbon storage	<ul style="list-style-type: none"> <li>• Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards</li> </ul>



Aquatic and riparian ecosystems	<ul style="list-style-type: none"> <li>• Maintain or improve baseline channel stability</li> <li>• Develop site-specific water quality objectives in accordance with ANZECC 2000 and <i>Using the ANZECC Guidelines and Water Quality Objectives in NSW</i> procedures (DECC 2006), or its latest version</li> </ul>
Bellambi Gully Channel and Diversion	<ul style="list-style-type: none"> <li>• Design, install and maintain the main channel and culvert to convey the 100 year ARI flood or greater using Council's 'policy based' conduit blockage criteria</li> <li>• Design, install and maintain the swale alongside the stockpile access road to convey the 100 year ARI flood or greater</li> </ul>

### **Bellambi Gully Creek Works**

11. The Proponent shall implement each of the recommended mitigation measures detailed in Section 6 of the *Bellambi Gully Flood Study* (Cardno Pty Ltd, January 2012) within 12 months of the date of this approval, to the satisfaction of the Secretary.

### **Water Management Plan**

12. The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must:
- be prepared in consultation with DPI-Water and the EPA, by suitably qualified and experienced persons whose appointment has been approved by the Secretary;
  - be submitted to the Secretary for approval within 6 months of the date of this approval, unless the Secretary agrees otherwise;
  - include reference to the National Water Quality Management Strategy;
  - include detailed performance criteria and describes measure to ensure that the Proponent complies with the Water Management Performance Measures (see Table 7);
  - in addition to the standard requirements for management plans (see condition 2 of Schedule 6), this plan must include a:
    - Site Water Balance that:
      - includes details of:
        - sources and security of water supply, including contingency planning for future reporting periods;
        - water use and management on site;
        - reporting procedures, including the preparation of a site water balance for each calendar year;
      - describes the measures that would be implemented to minimise clean water use on site;
    - Surface Water Management Plan, that includes:
      - detailed baseline data on water flows and quality in the waterbodies that could be affected by the surface facilities associated with the project, including Bellambi Creek and Lizard Creek;
      - a detailed description of the water management systems on site, including the pit top and all shaft sites and associated facilities;
      - detailed plans, including design objectives and performance criteria;
      - detailed performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the project:
        - the water management system;
        - downstream surface water quality;
        - downstream flooding impacts; and
        - stream and riparian vegetation health for Bellambi Creek and Lizard Creek;
      - a program to monitor and report on:
        - the effectiveness of the water management system;
        - surface water flows and quality, stream and riparian vegetation health in the watercourses that could be affected by the surface facilities associated with the project;
        - the seepage/leachate from on-site water storages; and
        - downstream flooding impacts;
      - reporting procedures for the results of the monitoring program; and
      - a plan to respond to any exceedances of the performance criteria, and mitigate any adverse surface water impacts of the project.

## **TRANSPORT**

### **Monitoring of Coal Transport**

13. The Proponent shall:
- keep accurate records of the amount of coal transported from the site (on a daily basis);

- (b) make these records publicly available on its website at the end of each calendar quarter.

### **Road Transport Restrictions**

14. The Proponent shall only load coal or coal reject onto trucks, or transport it off site by road between 7 am to 10 pm, Monday to Friday and between 8 am to 6 pm on Saturdays, Sundays and public holidays.
15. During emergencies, the Proponent may exceed the restrictions in condition 14 above with the written approval of the Secretary.

*Note: The kind of circumstances which may constitute an emergency include major traffic disruptions on the transport route and major loading equipment failure or critical port need at PKCT.*

16. The Proponent shall ensure that any truck leaving the site:
- (a) does not carry dirt or mud onto public roads; and
  - (b) is free of material that may fall on the road and create a road safety hazard or public nuisance, to the satisfaction of the Secretary.

### **Traffic Management Plan**

17. The Proponent shall prepare and implement a Traffic Management Plan for the project to the satisfaction of the Secretary. This Plan must:
- (a) be prepared in consultation with RMS, EPA, Council and PKCT;
  - (b) be submitted for approval to the Secretary within 6 months of the date of this approval, unless the Secretary agrees otherwise;
  - (c) aim to minimise the traffic impacts of the project on the residential areas surrounding the surface facilities site, and in particular the residences located along Bellambi Lane;
  - (d) include a traffic management protocol, which must consider:
    - appropriate speed limits;
    - truck separation distances;
    - minimisation of compression braking and other noisy practices, especially on the approach to Port Kembla Road/Springhill Road traffic lights when entering or exiting PKCT;
    - reporting of vehicle faults; and
    - reporting of all traffic incidents; and
  - (e) include a Traffic Noise Management Strategy, which must consider, but is not limited to:
    - the selection and maintenance of vehicle fleets;
    - movement scheduling to reduce noise impacts during sensitive times of the day; and
    - procedures to minimise impacts at identified sensitive areas along the haulage routes; and
  - (f) include a drivers' code of conduct to minimise the impacts of project-related trucks on local residences and road users; and
  - (g) describe the measures that would be put in place to ensure compliance with the drivers' code of conduct.

## **HERITAGE**

### **Protection of Aboriginal Heritage Items**

18. Unless otherwise authorised under the *National Parks and Wildlife Act 1974*, the Proponent shall ensure that the project does not cause any direct or indirect impact on the identified Aboriginal heritage items located outside the approved disturbance area of the project.

*Note: Identified Aboriginal heritage items are listed in Appendix 6.*

### **Heritage Management Plan**

19. The Proponent shall prepare and implement a Heritage Management Plan for the project to the satisfaction of the Secretary. This Plan must:
- (a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;
  - (b) be prepared in consultation with OEH, Council, any relevant local historical organisations and Aboriginal stakeholders;
  - (c) be submitted to the Secretary for approval within 6 months of the date of this approval, unless the Secretary agrees otherwise;
  - (d) include a description of the measures that would be implemented for:
    - managing the discovery of human remains or previously unidentified heritage items on site; and
    - ensuring any workers on site receive suitable heritage inductions prior to carrying out any development on site, and that suitable records are kept of these inductions;
  - (e) include the following for the management of Aboriginal Heritage:

- a description of the measures that would be implemented for:
    - protecting, monitoring and/or managing (including any proposed archaeological investigations and/or salvage measures) the heritage items identified in Table 1;
    - managing the discovery of previously unidentified Aboriginal items on site;
    - conserving the sites outside the surface disturbance area (see Appendix 6), including measures that would be implemented to secure, analyse and record the sites at risk of subsidence;
    - maintaining and managing reasonable access for Aboriginal stakeholders to heritage items on site;
    - ongoing consultation with the Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage on site; and
  - a strategy for the storage of any heritage items salvaged on site, both during the project and in the long term;
- (f) include the following for the management of cultural heritage items:
- a description of the measures that would be implemented for:
    - protecting, monitoring and managing the heritage items identified in Appendix 7;
    - managing the discovery of previously unidentified cultural heritage items on site;
    - undertaking archival and photographic recording of the site, including the 1887 portal and all moveable heritage items; and
    - ensuring for the long-term storage of moveable heritage items.

## **VISUAL**

### **Visual and Lighting**

20. The Proponent shall:
- (a) implement all reasonable and feasible measures to minimise the visual and off-site lighting impacts of the project;
  - (b) ensure no fixed outdoor lights shine above the horizontal or above the building line or any illuminated structure;
  - (c) ensure that all external lighting associated with the project complies with *Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting*, or its latest version;
  - (d) take all practical measures to shield views of mining operations from users of public roads and privately-owned residences,
- to the satisfaction of the Secretary.

## **WASTE**

21. The Proponent shall:
- (a) implement all reasonable and feasible measures to minimise the waste generated by the project;
  - (b) ensure that the waste generated by the project is appropriately stored, handled and disposed of; and
  - (c) monitor and report on effectiveness of the waste minimisation and management measures each calendar year,
- to the satisfaction of the Secretary.

### **Underground Tailings Storage Trials**

22. The Proponent may conduct trials of underground emplacement and storage of coal tailings, subject to the prior approval of the Secretary.

## **BUSHFIRE MANAGEMENT**

23. The Proponent shall:
- (a) ensure that the project is suitably equipped to respond to any fires on site; and
  - (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the surrounding area.

## **PROJECT SURFACE INFRASTRUCTURE MANAGEMENT**

### **Service Boreholes Management Plan**

24. The Proponent shall prepare and implement a Service Boreholes Management Plan in respect of construction and use of future service boreholes (ie any service boreholes not subject to approval at the date of this instrument) to the satisfaction of the Secretary. This plan must be submitted to the Secretary for approval prior to the construction of any future service borehole and must include commitments regarding:
- (a) community consultation;
  - (b) landholder agreements;

- (c) assessment of noise, air quality, traffic, biodiversity, heritage, public safety and other impacts in accordance with approved methods;
- (d) avoidance of significant impacts and minimisation of impacts generally;
- (e) achievement of applicable standards and goals;
- (f) mitigation and/or compensation for significant noise, air quality and visual impacts; and
- (g) rehabilitation of disturbed sites.

## REHABILITATION

### Rehabilitation Objectives

25. The Proponent shall rehabilitate the site to the satisfaction of DRE. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EA, and comply with the objectives in Table 8.

*Table 8: Rehabilitation Objectives*

<b>Feature</b>	<b>Objective</b>
Mine site (as a whole)	<ul style="list-style-type: none"> <li>• Safe, stable &amp; non-polluting.</li> <li>• Final landforms to: <ul style="list-style-type: none"> <li>- use compatible with surrounding land uses;</li> <li>- be designed to minimise the visual impacts of the project;</li> <li>- be in keeping with the natural terrain features of the area; and</li> <li>- avoid straight run drainage drop structures.</li> </ul> </li> </ul>
Project surface infrastructure	<ul style="list-style-type: none"> <li>• To be decommissioned, and subject to the Heritage Management Plan, removed (unless DRE agrees otherwise).</li> </ul>
Portals and vent shafts	<ul style="list-style-type: none"> <li>• To be decommissioned and made safe and stable.</li> <li>• Retain habitat for threatened species (eg bats), where practicable</li> </ul>
Watercourses of 2 <sup>nd</sup> order or higher subject to subsidence impacts	<ul style="list-style-type: none"> <li>• Hydraulically and geomorphologically stable.</li> </ul>
Cliffs	<ul style="list-style-type: none"> <li>• No additional risk to public safety compared to prior to mining</li> </ul>
Other land affected by the project	<ul style="list-style-type: none"> <li>• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native plant species (unless the Secretary, NSW Trade &amp; Investment agrees otherwise).</li> </ul>
Built features damaged by mining operations	<ul style="list-style-type: none"> <li>• Repair to pre-mining condition or equivalent unless the: <ul style="list-style-type: none"> <li>- owner agrees otherwise; or</li> <li>- damage is fully restored, repaired or compensated for under the <i>Mine Subsidence Compensation Act 1961</i>.</li> </ul> </li> </ul>
Community	<ul style="list-style-type: none"> <li>• Ensure public safety.</li> <li>• Minimise the adverse socio-economic effects associated with mine closure.</li> </ul>

*Notes:*

- These rehabilitation objectives apply to all subsidence impacts and environmental consequences caused by mining taking place after the date of this approval; and to all project surface infrastructure part of the project, whether constructed prior to or following the date of this approval.
- Rehabilitation of subsidence impacts and environmental consequences caused by mining which took place prior to the date of this approval may be subject to the requirements of other approvals (eg an existing project approval, mining lease, or Subsidence Management Plan approval) or the Proponent's commitments.

### Progressive Rehabilitation

26. The Proponent shall rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies shall be employed when areas prone to dust generation cannot yet be permanently rehabilitated.

### Rehabilitation Management Plan

27. The Proponent shall prepare and implement a Rehabilitation Management Plan for the project to the satisfaction of DRE. This plan must:
- (a) be prepared in consultation with the Department, DPI-Water, OEH, Council and the CCC;
  - (b) be submitted to DRE for approval within 6 months of the commencement of development under this approval;
  - (c) be prepared in accordance with any relevant DRE guidelines;
  - (d) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary);

- (e) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval, and address all aspects of rehabilitation including mine closure, final landform, and final land use;
- (f) provide for detailed mine closure planning, including measures to minimise socio-economic effects due to mine closure, to be conducted prior to the site being placed on care and maintenance;
- (g) include interim rehabilitation where necessary to minimise the area exposed for dust generation;
- (h) include a program to monitor and report on the effectiveness of the measures, and progress against the detailed performance and completion criteria; and
- (i) build to the maximum extent practicable on the other management plans required under this approval.

## **SCHEDULE 5 ADDITIONAL PROCEDURES**

### **NOTIFICATION OF LANDOWNERS**

1. As soon as practicable after obtaining monitoring results showing:
  - (a) an exceedance of any relevant criteria in Schedule 4, the Proponent shall notify the affected landowners in writing of the exceedance, and provide regular monitoring results to these landowners until the project is again complying with the relevant criteria; and
  - (b) an exceedance of any relevant air quality criteria in Schedule 4, the Proponent shall send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (as may be updated from time to time) to the affected landowners and/or existing tenants of the land (including the tenants of any mine-owned land).

### **INDEPENDENT REVIEW**

2. If an owner of privately-owned land considers the project to be exceeding the relevant criteria in Schedule 4, then he/she may ask the Secretary in writing for an independent review of the impacts of the project on his/her land.

If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision the Proponent shall:

- (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Secretary, to:
  - consult with the landowner to determine his/her concerns;
  - conduct monitoring to determine whether the project is complying with the relevant criteria in Schedule 4;
  - if the project is not complying with these criteria then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
- (b) give the Secretary and landowner a copy of the independent review.



**SCHEDULE 6**  
**ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING**

**ENVIRONMENTAL MANAGEMENT**

**Environmental Management Strategy**

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Secretary. This strategy must:
  - (a) be submitted to the Secretary for approval within 6 months of the date of this approval, unless the Secretary agrees otherwise;
  - (b) provide the strategic framework for the environmental management of the project;
  - (c) identify the statutory approvals that apply to the project;
  - (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
  - (e) describe the procedures that would be implemented to:
    - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
    - receive, handle, respond to, and record complaints;
    - resolve any disputes that may arise during the course of the project;
    - respond to any non-compliance;
    - respond to emergencies; and
  - (f) include:
    - copies of any strategies, plans and programs approved under the conditions of this approval; and
    - a clear plan depicting all the monitoring required to be carried out under the conditions of this approval.

**Management Plan Requirements**

2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:
  - (a) detailed baseline data;
  - (b) a description of:
    - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
    - any relevant limits or performance measures/criteria;
    - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;
  - (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
  - (d) a program to monitor and report on the:
    - impacts and environmental performance of the project;
    - effectiveness of any management measures (see c above);
  - (e) a contingency plan to manage any unpredicted impacts and their consequences;
  - (f) a program to investigate and implement ways to improve the environmental performance of the project over time;
  - (g) a protocol for managing and reporting any:
    - incidents;
    - complaints;
    - non-compliances with statutory requirements; and
    - exceedances of the impact assessment criteria and/or performance measures; and
  - (h) a protocol for periodic review of the plan.

*Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*

**Application of Existing Management Plans**

3. Prior to the approval of management plans under this project approval, the Proponent shall manage development undertaken pursuant to this project approval in accordance with any equivalent or similar management plan/s required under approval MP10\_0046.

**Relationships between Management Plans**

4. The Water and Heritage Management Plans required by conditions 12 and 19 of Schedule 4, respectively, are to be prepared in respect of all parts of the project that are not covered by an Extraction Plan approved under condition 10 of Schedule 3. In particular, those management plans should address all areas subject to existing or proposed surface disturbance associated with the project.

## Revision of Strategies, Plans and Programs

5. Within 3 months of:
- the submission of an incident report under condition 9 below;
  - the submission of an annual review under condition 11 below;
  - the submission of an audit under condition 12 below; or
  - any modification to the conditions of this project approval (unless the conditions require otherwise),
- the Proponent shall review the strategies, plans, and programs required under this approval, to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted for the approval of the Secretary.

*Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.*

## Updating & Staging Strategies, Plans or Programs

6. To ensure that strategies, plans and programs required under this approval are updated on a regular basis, and that they incorporate any appropriate additional measures to improve the environmental performance of the project, the Proponent may at any time submit revised strategies, plans or programs for the approval of the Secretary. With the agreement of the Secretary, the Proponent may also submit any strategy, plan or program required by this approval on a staged basis.

With the agreement of the Secretary, the Proponent may prepare a revision of or a stage of a strategy, plan or program without undertaking consultation with all parties nominated under the applicable condition in this approval.

### Notes:

- *While any strategy, plan or program may be submitted on a staged basis, the Proponent will need to ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.*
- *If the submission of any strategy, plan or program is to be staged; then the relevant strategy, plan or program must clearly describe the specific stage/s of the project to which the strategy, plan or program applies; the relationship of this stage/s to any future stages; and the trigger for updating the strategy, plan or program.*

## Adaptive Management

7. The Proponent shall assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in Schedules 3 and 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this approval and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.

Where any exceedance of these criteria and/or performance measures has occurred, the Proponent must, at the earliest opportunity:

- take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
- implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

## Community Consultative Committee

8. The Proponent shall operate a Community Consultative Committee (CCC) for the project to the satisfaction of the Secretary. This CCC must be operated in accordance with the *Guidelines for Establishing and Operating Community Consultative Committees for Mining Developments* (Department of Planning, 2007), or its latest version or replacement.

### Notes:

- *The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Proponent complies with this approval;*
- *In accordance with the guideline, the Committee should be comprised of an independent chair and appropriate representation from the Proponent, Council, recognised environmental groups and the local community;*
- *The Department will accept the continued representation from existing CCC members.*

## REPORTING

### Incident Reporting

9. The Proponent shall immediately notify the Secretary and any other relevant agencies of any incident. Within 7 days of the date of the incident, the Proponent shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.

## Regular Reporting

10. The Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval, and to the satisfaction of the Secretary.

## ANNUAL REVIEW

11. By the end of March each year, unless the Secretary agrees otherwise, the Proponent shall review the environmental performance of the development to the satisfaction of the Secretary. This review must:
  - (a) describe the project (including any rehabilitation) that was carried out in the past calendar year, and the project that is proposed to be carried out over the current calendar year;
  - (b) include a comprehensive review of the monitoring results and complaints records of the project over the past calendar year, which includes a comparison of these results against the:
    - the relevant statutory requirements, limits or performance measures/criteria;
    - the monitoring results of previous years; and
    - the relevant predictions in the EIS;
  - (c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
  - (d) identify any trends in the monitoring data over the life of the project;
  - (e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
  - (f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

## INDEPENDENT ENVIRONMENTAL AUDIT

12. Within 1 year of the commencement of development under this approval, and every 3 years thereafter, unless the Secretary directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
  - (a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;
  - (b) include consultation with the relevant agencies;
  - (c) assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals);
  - (d) review the adequacy of strategies, plans or programs required under the abovementioned approvals; and
  - (e) recommend appropriate measures or actions to improve the environmental performance of the project, and/or any assessment, plan or program required under the abovementioned approvals.

*Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Secretary.*

13. Within 6 weeks of the completion of this audit, or as otherwise agreed by the Secretary, the Proponent shall submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report.

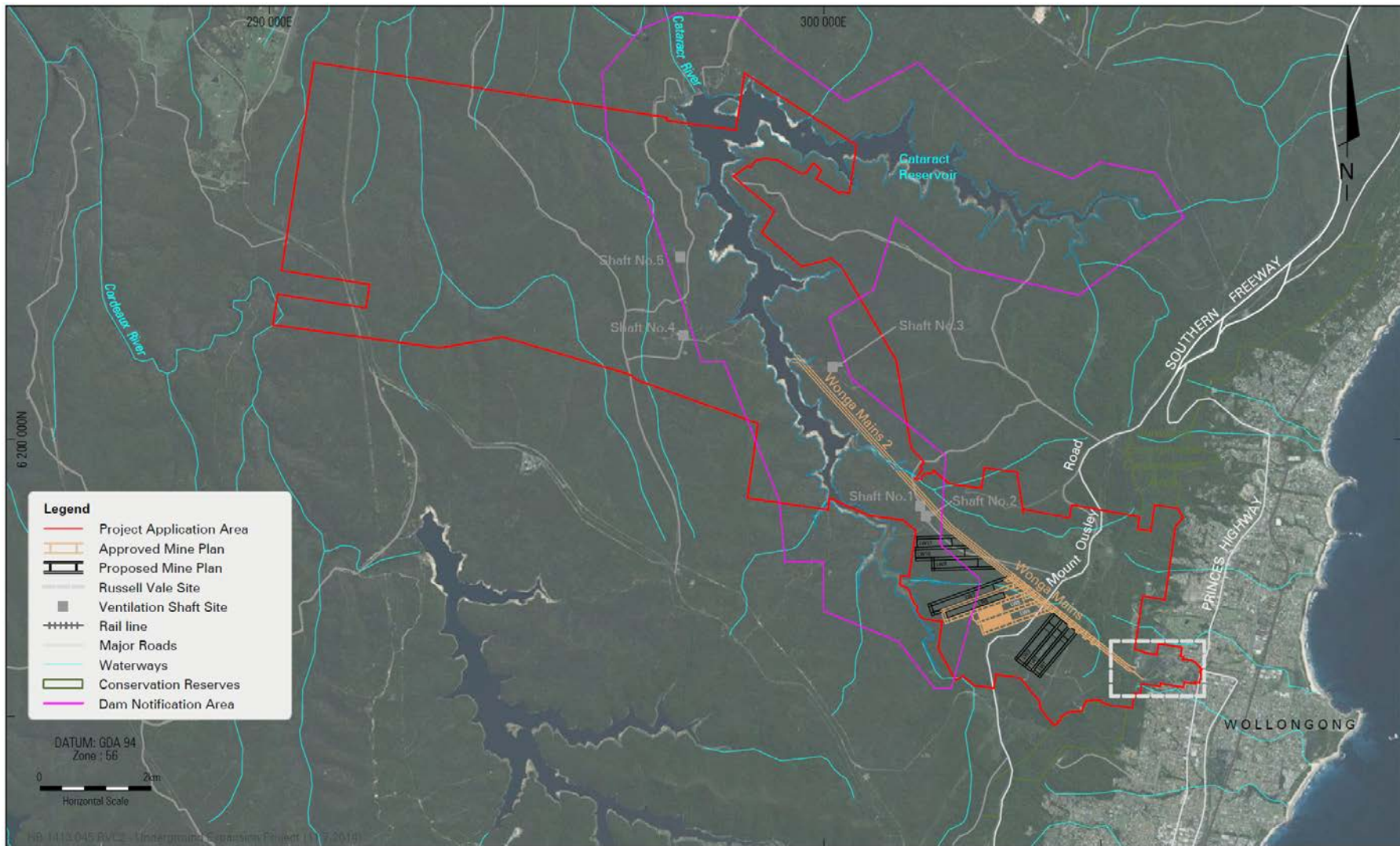
## ACCESS TO INFORMATION

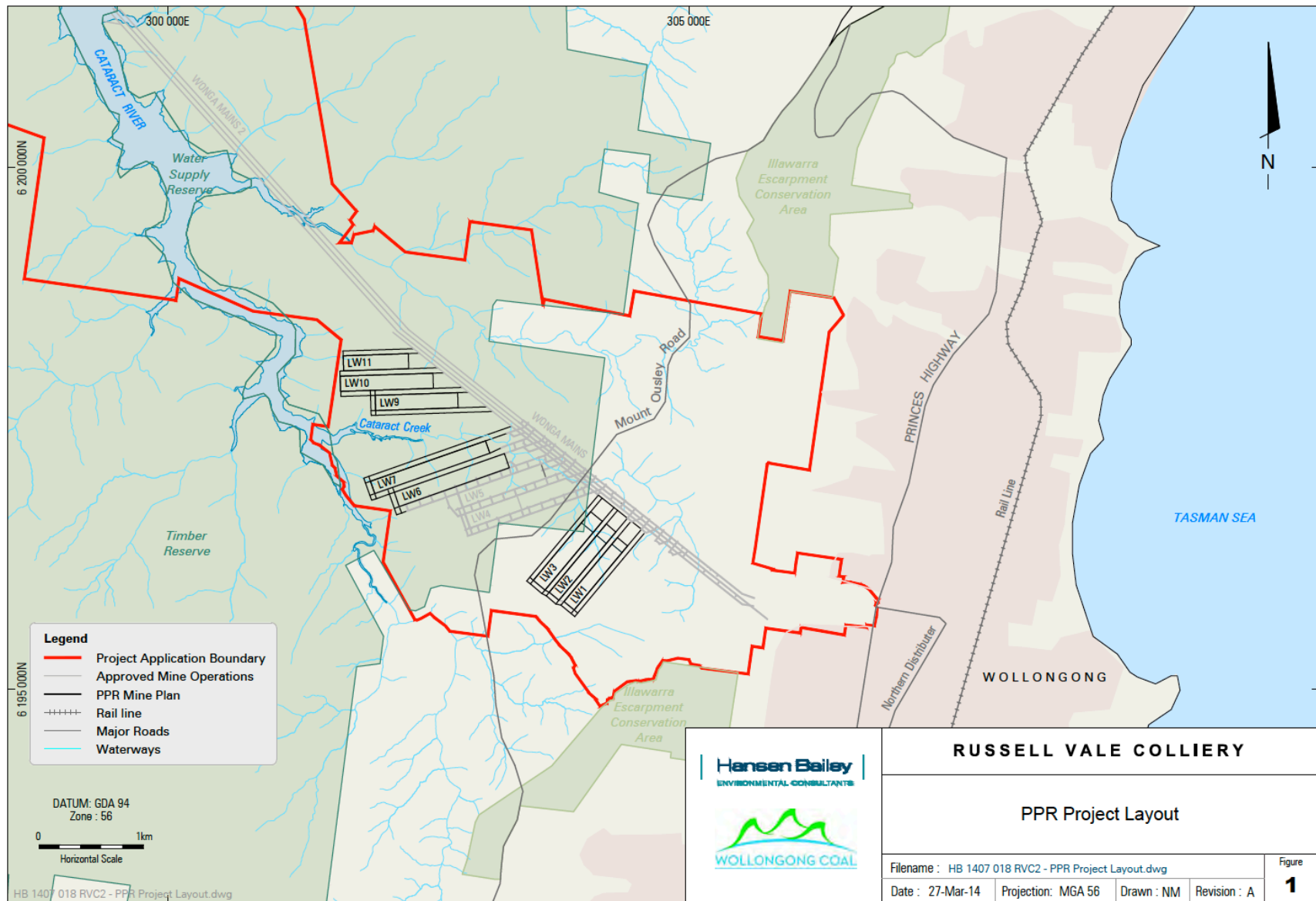
14. From the commencement of development under this approval, the Proponent shall:
  - (a) make copies of the following publicly available on its website:
    - the EA;
    - current statutory approvals for the project;
    - approved strategies, plans and programs required under the conditions of this approval;
    - a comprehensive summary of the monitoring results of the project, reported in accordance with the specifications in any conditions of this approval, or any approved plans and programs;
    - a complaints register, which is to be updated monthly;
    - minutes of CCC meetings;
    - the annual reviews of the project (for the last 5 years, if applicable);
    - any independent environmental audit of the project, and the Proponent's response to the recommendations in any audit;
    - any other matter required by the Secretary; and
  - (b) keep this information up-to-date, to the satisfaction of the Secretary.

## APPENDIX 1: SCHEDULE OF LAND

Property ID / Lot Number	DP Plan Number	Owner
Auto Consol 1833-110		Wollongong Coal Ltd
Auto Consol 1644-66		Wollongong Coal Ltd
Auto consol 5333-243 includes:		Wollongong Coal Ltd
Lot 3	DP 60975	Wollongong Coal Ltd
Lot 30 to 32	DP 751301	Wollongong Coal Ltd
Lot 63&68 -71	DP 751301	Wollongong Coal Ltd
Lot 1-2	DP 1046069	Wollongong Coal Ltd
Lot 1	DP 1046070	Wollongong Coal Ltd
Lot 130	DP 751301	Wollongong Coal Ltd
Lot 31	DP 1006012	Wollongong Coal Ltd
Lot 1	DP 630761	Wollongong Coal Ltd
Lot 1	DP 986675	Wollongong Coal Ltd
Lot 1	DP 986676	Wollongong Coal Ltd
Lot 1	DP 534522	Wollongong Coal Ltd
Lot 95 to 96	DP 4414	Wollongong Coal Ltd
Lot 97	DP 4414	The Council of the City of Wollongong
Lots 1 to 4	DP 225021	Wollongong Coal Ltd
Lot 34	DP 751301	Wollongong Coal Ltd
Lot 6	DP 793358	Wollongong Coal Ltd
Lot 66	DP 751301	Wollongong Coal Ltd
Lot 67	DP 751301	Wollongong Coal Ltd
Lot 1	DP 652833	Wollongong Coal Ltd
Lot 6001	DP 1077301	Wollongong Coal Ltd
Lot 1	DP 77407	Wollongong Coal Ltd
Lot 1	DP 1052074	Wollongong Coal Ltd
Lot 2	DP 1052074	Wollongong Coal Ltd
Lot 151	DP 667029	Wollongong Coal Ltd
Part Lot 6000	DP 1077301	Illawarra Land Pty Ltd
Lot 6500	DP 1083715	Illawarra Land Pty Ltd
Lot 6502	DP 1083715	Ronald Edward Devitt & Jane Wilson
Part Lot 6501	DP 1083715	Barbara Jean Williams
Lot 12	DP 736121	Integral Energy Australia
Lot 32	DP 1138149	Sydney Catchment Authority

## APPENDIX 2: PROJECT LAYOUT PLANS







# Pit Top Surface Facility



### APPENDIX 3: STATEMENT OF COMMITMENTS

Additional SoC's from the Response to PAC Report Parts 1 and 2 are shown in **bold**.

Ref	Commitment
<b>General</b>	
1.	WCL will conduct regular community consultation and provide updates to the community during operation of the UEP.
2.	WCL will regularly review and revise (if necessary) the existing Environmental Management System and its supporting management plans and procedures. This will be undertaken in consultation with relevant regulators.
3.	The existing Environmental Monitoring Program shall be revised and updated in consultation with relevant regulators in consideration of operations and impacts. The monitoring program will be included in Extraction Plans.
4.	WCL will provide regular and relevant training to all employees and contractors to ensure that environmental outcomes are achieved.
5.	WCL will continue to coordinate the Community Consultative Committee for the Russell Vale Colliery.
6.	All environmental management and monitoring outcomes will be reported in an Annual Review.
7.	<b>Consult with the IRAP (or equivalent expert panel) during the development of management plans (following approval of the Project).</b>
<b>Subsidence</b>	
8.	Establish a technical committee comprising representatives from Wollongong Coal, the power utility company and government regulators to monitor and manage potential impacts of mining on the power transmission towers.
9.	All secondary workings will be undertaken in accordance with approved Extraction Plans developed in consultation with relevant regulatory authorities and infrastructure owners.
10.	The Extraction Plan will include Trigger Action Response Plans (TARPs) to allow WCL to respond to impacts as they arise and to facilitate adaptive management over the life of the Project. TARPs will be developed for built features and natural features.
11.	The Extraction Plan will include a protocol for monitoring of subsidence effects. Monitoring will be conducted before, during and after secondary extraction.
12.	If necessary, adaptive management measures will be undertaken to reduce impacts on Cataract Creek and swamps of special significance. Adaptive management measures will be determined in consultation with relevant regulators.
13.	<b>If required by the DSC, the panel length of LW 7 will be truncated if the Corrimall Fault is intersected during the development of the gateroads for LW 7.</b>
14.	<b>Undertake inspections of the Bulli Seam workings overlying LW 7 to confirm the accuracy of the record tracings (subject to the ability to safely access these workings).</b>
15.	<b>Conduct drilling of underground exploration boreholes where necessary to confirm the accuracy of the record tracings for the Bulli Seam workings overlying LW 7.</b>
<b>Water</b>	
16.	WCL will revise the Water Management Plan (including a TARP and water monitoring program) in consultation with the relevant regulators.
17.	WCL will revise the existing water monitoring program in consultation with the relevant authorities. This will include monitoring of streams, swamps and groundwater systems.
18.	Monitoring of stream flows will be conducted to determine the potential for connectivity of surface water and groundwater systems.

Ref	Commitment
19.	To assess mine water make, WCL will continue to monitor volumes of water pumped into and out of the underground mine workings.
20.	WCL will continue to treat stormwater and mine water prior to discharge via LDP2. Treated water will continue to be discharged to Bellambi Creek in accordance with WCL's EPL.
21.	An Erosion and Sediment Control Plan will be implemented during construction activities at the Russell Vale Site.
22.	WCL will obtain and hold water licences as required.
23.	<b>Undertake detailed design of the dry sediment dam to ensure that there is sufficient treatment capacity.</b>
<b>Air Quality and Greenhouse Gas</b>	
24.	WCL will review and revise the existing Air Quality Management Plan in consultation with the relevant authorities. The Plan will include feasible and reasonable air quality controls.
25.	The existing air quality monitoring network will be reviewed.
26.	<b>Implement the following dust mitigation measures:</b> <ul style="list-style-type: none"> <li>• Trial the use of chemical wetting agents on unsealed roads and stockpiles, and report the results of the trial in the Annual Review;</li> <li>• Sealing of the proposed haul road circuit to and from the truck loading bins; and</li> <li>• Install water sprays on the tripper gantries.</li> </ul>
27.	<b>Regularly report on the:</b> <ul style="list-style-type: none"> <li>• Annual average and 24 hour average PM<sub>10</sub> criteria;</li> <li>• Annual average and 24 hour average PM<sub>2.5</sub> criteria; and</li> <li>• Adaptive management and ongoing improvements implemented to reduce dust emissions throughout the reporting period.</li> </ul>
<b>Acoustics</b>	
28.	WCL will review and revise the existing Noise Management Plan in consultation with the relevant authorities. The Plan will include feasible and reasonable noise controls.
29.	The environmental monitoring program will include continuous monitoring of operational noise, including attended monitoring of road traffic noise.
30.	Construction activities will be limited to between 7 am to 6 pm on weekdays and 8 am to 1 pm on Saturdays.
31.	The site noise model will be revised (in consultation with relevant regulators) once site specific sound power levels have been measured after construction and commissioning.
32.	<b>Implement the following noise mitigation measures:</b> <ul style="list-style-type: none"> <li>• Fitting surface conveyors with poly rollers (with the exception of high wear sections) prior to the commencement of coal extraction;</li> <li>• Maintain a volume of coal in bins at all times to minimise noise;</li> <li>• Undertake a trial to determine the efficiency of tripper automation to reduce noise produced by falling material; and</li> <li>• Undertake real time noise monitoring to confirm if any noise barriers (as shown on Figure 7-7 of the 'Response to Noise Issues Raised by the PAC' (Wilkinson Murray, July 2015) provide a net benefit to neighbours.</li> </ul>
33.	<b>Any large scale construction activity will include a noise management plan prepared in accordance with DECCW's Interim Construction Noise Guidelines.</b>
34.	<b>Any new machinery bought onto site will have non-tonal reverse alarms fitted.</b>
35.	<b>Any new loaders and dozers used on site will be fitted with noise attenuation prior to use on site.</b>
<b>Biodiversity</b>	

Ref	Commitment
36.	The existing Biodiversity Management Plan (BMP) will be reviewed and revised in consultation with the relevant authorities.
37.	Monitoring of the swamps will be undertaken in consultation with relevant regulators in accordance with the BMP.
38.	<b>WCL will install a number of additional shallow groundwater piezometers in all upland swamps within 400 m of the longwalls (secondary extraction). This will include the installation of approximately 30 additional shallow groundwater piezometers. Where feasible, this will include the installation of open standpipes or shallow groundwater piezometers around upland swamps CCUS1 and CRUS3 to assess the inflow to these upland swamps from surrounding surficial and shallow groundwater aquifers. Installation will be subject to further consultation and approval by relevant regulators.</b>
39.	<b>WCL will implement offsets for impacts to swamps in accordance with the final Swamp Offset Policy (with precedent given to conditions of Project Approval).</b>
40.	<b>Where offsets for impacts to swamps are required, WCL will endeavour to preferentially locate offsets within the local catchment the swamps were located.</b>
<b>Heritage</b>	
41.	A Heritage Management Plan (HMP) will be developed in consultation with the relevant authorities and Aboriginal stakeholders. The Plan will include management strategies for identified Aboriginal items.
42.	Photographic recordings of the existing site will be conducted prior to the proposed infrastructure upgrades. Moveable items of heritage significance will be documented, collated and catalogued. All recording work will be conducted to Heritage Archival Recording standards.
<b>Visual and Lighting</b>	
43.	Colour treatments for surface facilities will minimise visual contrast with the surrounding environment.
44.	Lighting will be directed away from nearby residences through the use of directional lightning and shielding.
<b>Waste</b>	
45.	The existing Waste Management System will be reviewed and revised (if necessary) to promote waste avoidance and resource recovery.
<b>Hazards &amp; Roads</b>	
46.	To protect public safety, WCL will continue to manage public access to the site using boundary fences, warning signs, surveillance and security personnel.
47.	A driver code of conduct will be enforced to avoid risks to public safety arising from coal transportation including complying with the 60 km/hr speed limit along Bellambi Lane.
48.	<b>Consult with Wollongong City Council regarding WCL's contribution to the maintenance of Bellambi Lane.</b>
<b>Rehabilitation and Mine Closure</b>	
49.	A Mine Closure Plan will be developed in consultation with the relevant authorities. The mine closure strategy will consider previous land uses, land zonings and potential uses for the existing infrastructure at the site.
50.	Areas that are no longer required for operations will be progressively rehabilitated.



#### APPENDIX 4: RECEIVER LOCATION PLAN



## **APPENDIX 5 NOISE COMPLIANCE ASSESSMENT**

### **Applicable Meteorological Conditions**

1. The noise criteria in Table 3 of Schedule 4 are to apply under all meteorological conditions except the following:
  - (a) wind speeds greater than 3 m/s at 10 metres above ground level; or
  - (b) stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level; or
  - (c) stability category G temperature inversion conditions.

### **Determination of Meteorological Conditions**

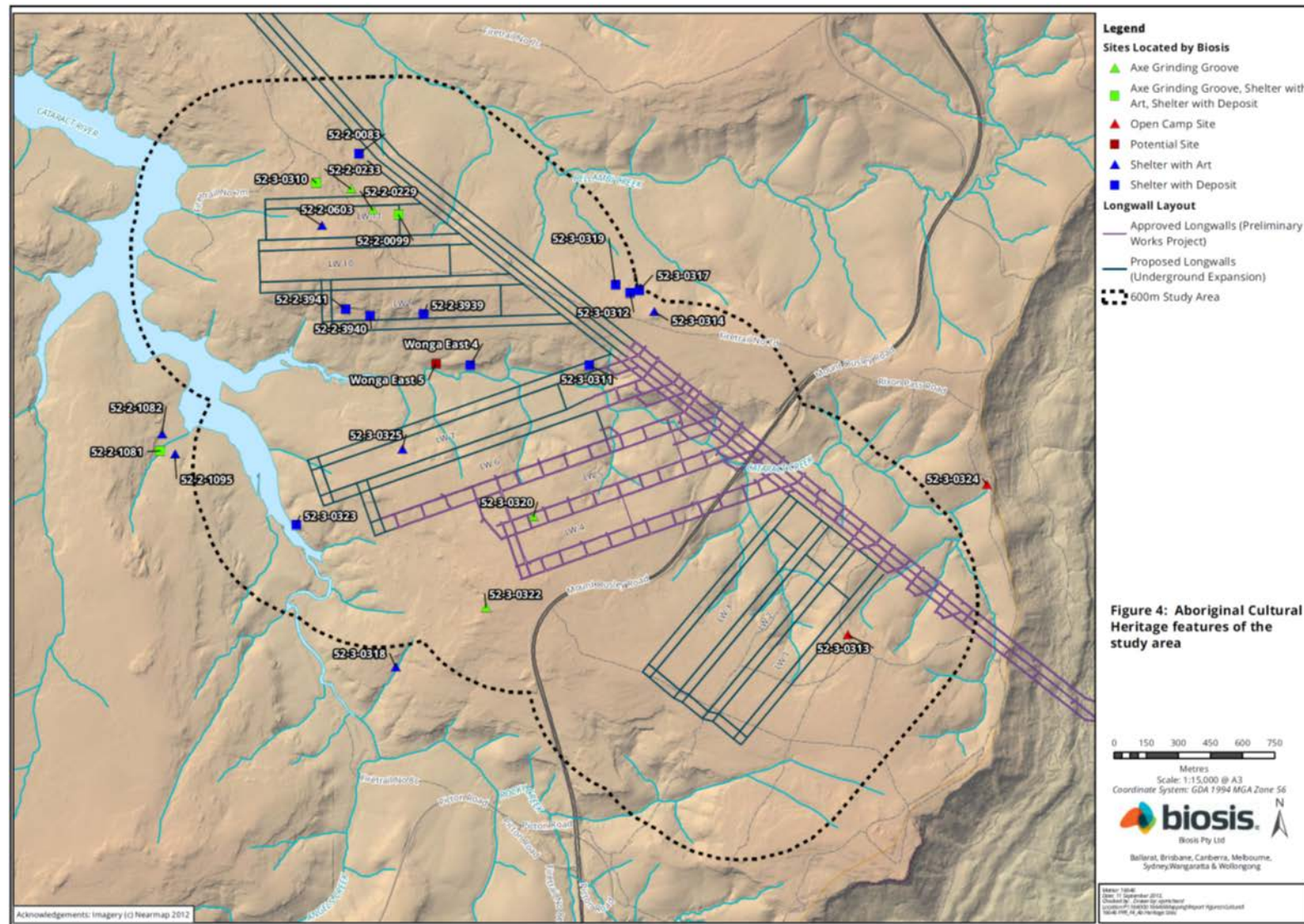
2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located on the site.

### **Compliance Monitoring**

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.
4. This monitoring must be carried out at least 4 times a year, unless the Secretary directs otherwise.
5. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
  - (a) monitoring locations for the collection of representative noise data;
  - (b) meteorological conditions during which collection of noise data is not appropriate;
  - (c) equipment used to collect noise data, and conformance with Australian Standards relevant to such equipment; and
  - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.



## APPENDIX 6: ABORIGINAL HERITAGE SITES



## APPENDIX 7: CULTURAL HERITAGE SITES

