METROPOLITAN COAL LONGWALLS 305-307

LAND MANAGEMENT PLAN

Peabody

METROPOLITAN COAL

LONGWALLS 305-307

LAND MANAGEMENT PLAN

ME-TSE-MNP-0079

Revision Status Register

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1 INTRODUCTION

Metropolitan Coal is a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody). Metropolitan Coal was granted approval for the Metropolitan Coal Project (the Project) under section 75J of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* (EP&A Act) on 22 June 2009. A copy of the Project Approval is available on the Peabody website (http://www.peabodyenergy.com).

The Project comprises the continuation, upgrade and extension of underground coal mining operations (Longwalls 20-27 and Longwalls 301-317) and surface facilities at the Metropolitan Coal Mine (Figure 1). Longwalls 305-307 are situated to the west of Longwalls 301-304, and define the next mining sub-domain within the Project underground mining area (Figures 1 and 2). Longwall 308 on will be subject to future Extraction Plans.

1.1 PURPOSE AND SCOPE

In accordance with Condition 6, Schedule 3 of the Project Approval, this Land Management Plan (LMP) has been prepared as a component of the Metropolitan Coal Longwall 305-307 Extraction Plan to manage the potential environmental consequences of the Extraction Plan on cliffs and overhangs, steep slopes and land in general.

The relationship of this LMP to the Metropolitan Coal Environmental Management Structure and to the Metropolitan Coal Longwalls 305-307 Extraction Plan is shown on Figure 3.

This LMP includes post-mining monitoring and management of cliffs and overhangs, steep slopes and land in general for Longwalls 20-22, 23-27, 301-303 and 304, subject to the previously approved Metropolitan Coal Longwall 304 LMP. Consistent with the recommended approach in the NSW Department of Planning & Environment (DP&E) and NSW Division of Resources and Energy (DRE) (2015) *Guidelines for the Preparation of Extraction Plans*, the Metropolitan Coal Longwall 304 LMP will be superseded by this document following the completion of Longwall 304.

In accordance with Condition 6, Schedule 3 of the Project Approval, this LMP has been prepared by Metropolitan Coal with assistance from Resource Strategies and Mine Subsidence Engineering Consultants (MSEC).

1.2 STRUCTURE OF THE LAND MANAGEMENT PLAN

The remainder of this LMP is structured as follows:

Section 2: Describes the review and update of this LMP.

Section 3: Outlines the statutory requirements applicable to this LMP.

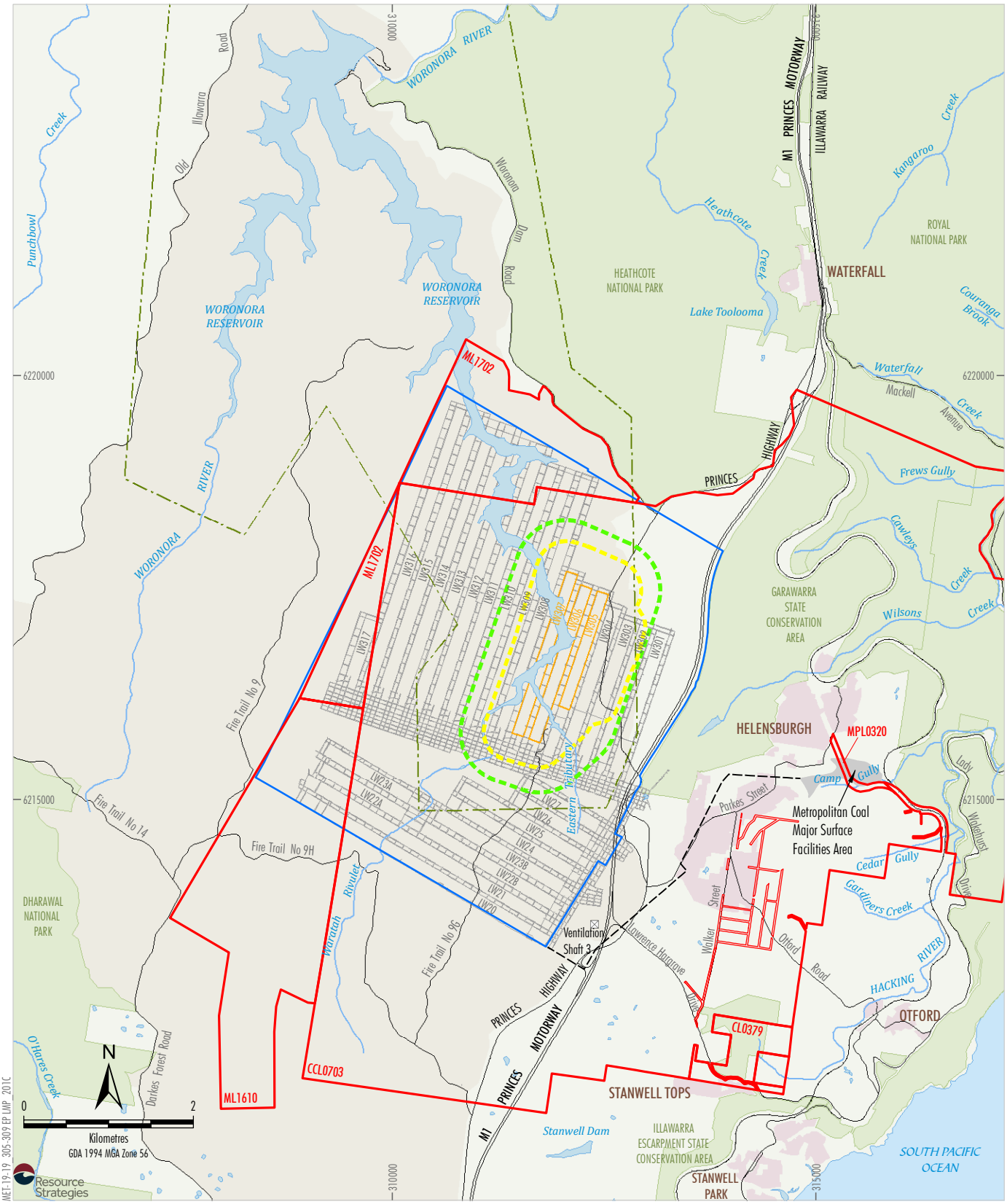
Section 4: Provides a revised assessment of the potential subsidence impacts and environmental consequences for Longwalls 305-307.

Section 5: Details the performance measures and indicators that will be used to assess the Project.

Section 6: Provides the detailed baseline data.

Section 7: Describes the monitoring program and Trigger Action Response Plan (TARP) for cliffs and overhangs, steep slopes and land in general.

Section 8: Describes the management measures that will be implemented.



LEGEND

- Mining Lease Boundary
- Woronora Special Area
- Railway
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Longwalls 305-307 Secondary Extraction
- Longwalls 305-307 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 305-307 Secondary Extraction
- Woronora Notification Area
- Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2019); MSEC (2019)

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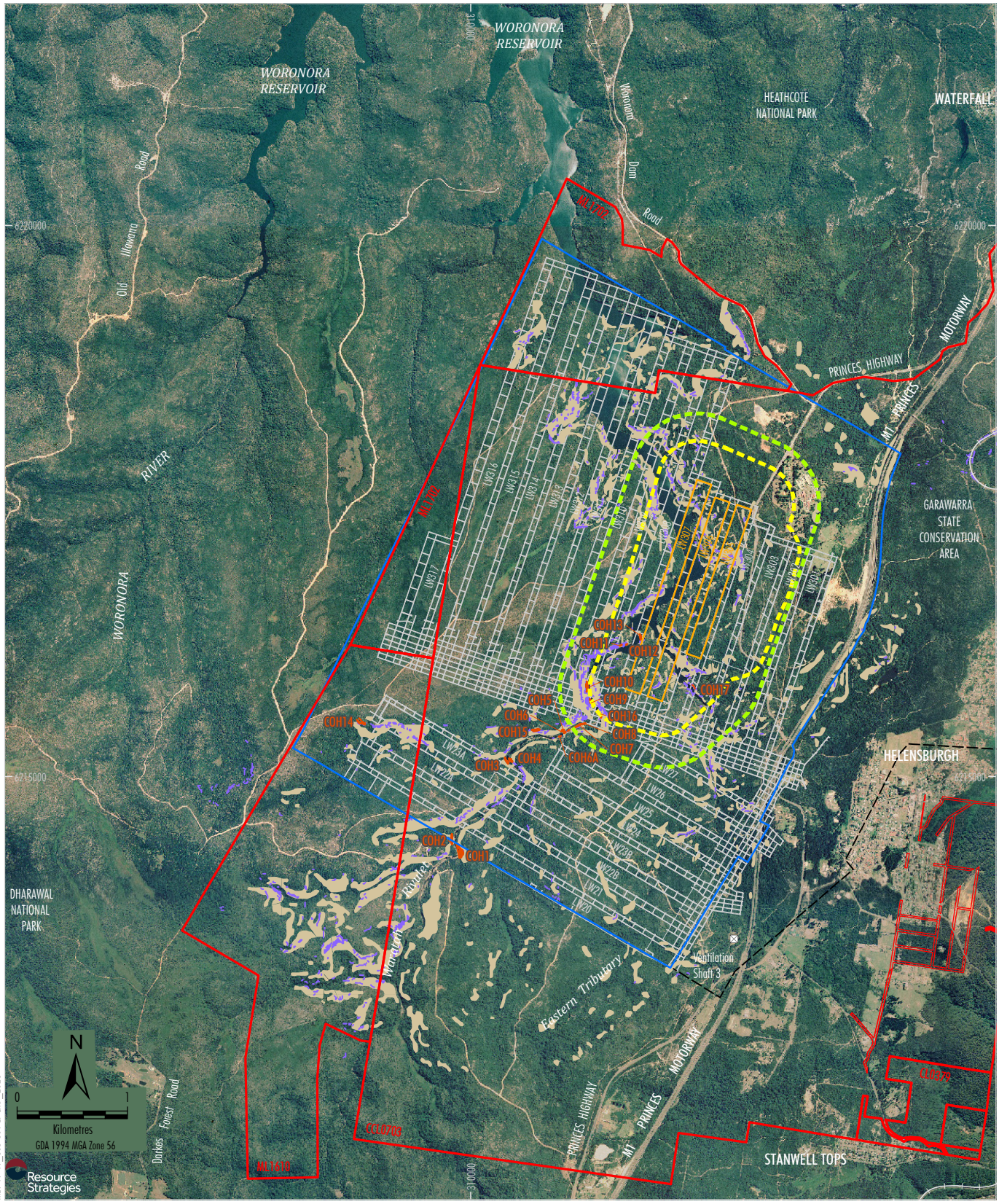
Longwalls 305-307 and Project Underground Mining Area

Figure 1



LEGEND

- Mining Lease Boundary
- Railway
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Longwalls 305-307 Secondary Extraction
- Longwalls 305-307 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 305-307 Secondary Extraction
- Existing Underground Access Drive (Main Drift)
- Cliffs and Overhangs
- Steep Slopes (Project Approval)
- Steep Slopes (Project Environmental Assessment)

Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2019); MSEC (2008; 2018; 2019)

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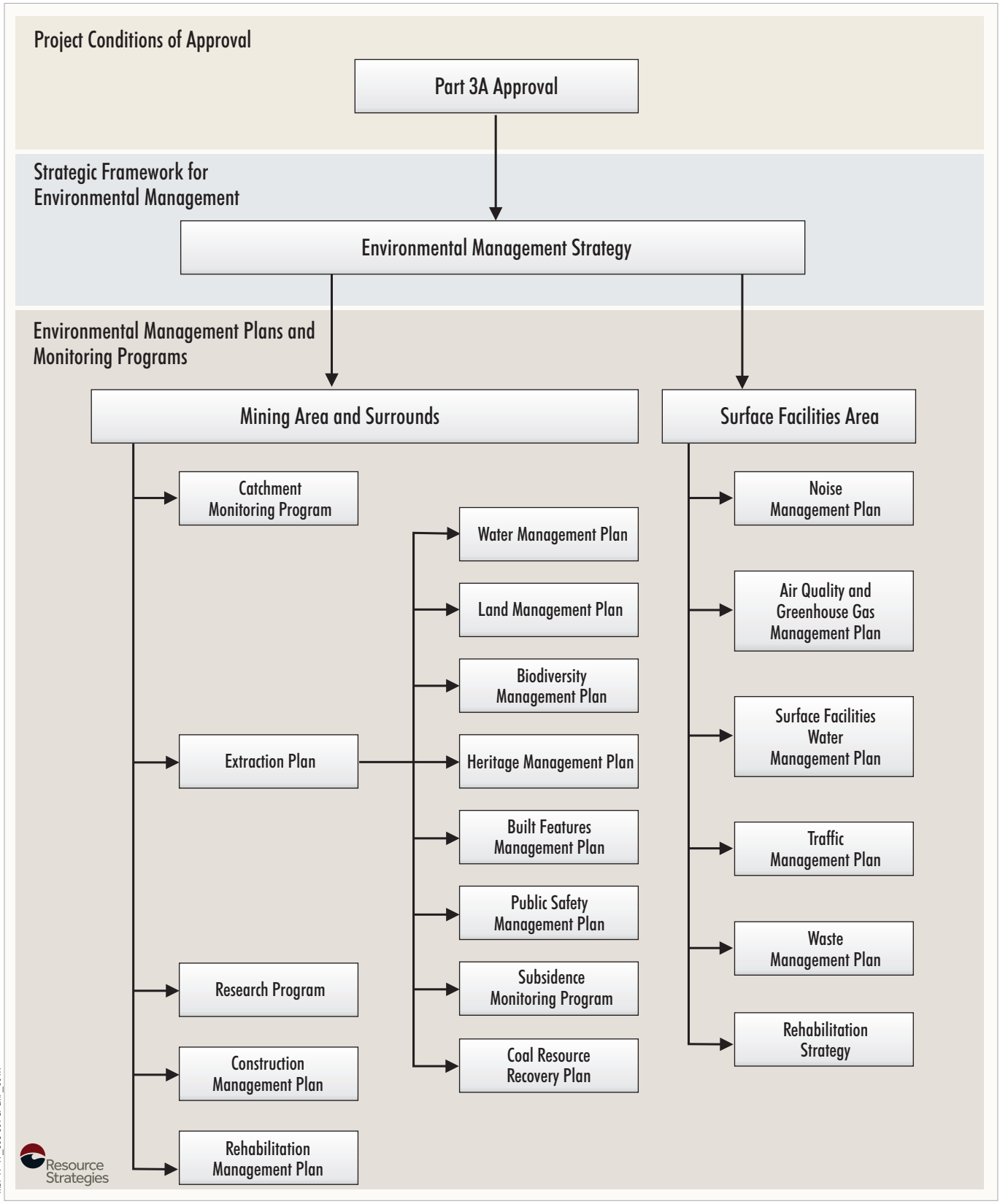
Cliffs and Overhangs, Steep Slopes and Land in General within the Project Underground Mining Area and Surrounds

Figure 2



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Environmental Management Structure

Figure 3

Section 9: Provides a Contingency Plan to manage any unpredicted impacts and their consequences.

Section 10: Describes the program to collect baseline data for future Extraction Plans.

Section 11: Describes the annual review and improvement of environmental performance.

Section 12: Outlines the management and reporting of incidents.

Section 13: Outlines the management and reporting of complaints.

Section 14: Outlines the management and reporting of non-compliances with statutory requirements.

Section 15: Lists the references cited in this LMP.

2 LAND MANAGEMENT PLAN REVIEW AND UPDATE

In accordance with Condition 4, Schedule 7 of the Project Approval, this LMP will be reviewed within three months of the submission of:

- an audit under Condition 8, Schedule 7;
- an incident report under Condition 6, Schedule 7;
- an annual review under Condition 3, Schedule 7; and

if necessary, revised to the satisfaction of the Director-General (now Secretary) of the Department of Planning, Industry and Environment (DPIE) to ensure this LMP is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

This LMP will also be reviewed within three months of approval of any Project modification and if necessary, revised to the satisfaction of the DPIE.

The revision status of this LMP is indicated on the title page of each copy. The distribution register for controlled copies of this LMP is described in Section 2.1.

2.1 DISTRIBUTION REGISTER

In accordance with Condition 10, Schedule 7 of the Project Approval 'Access to Information', Metropolitan Coal will make this LMP publicly available on the Peabody website. A hard copy of this LMP will also be maintained at the Metropolitan Coal Mine.

Metropolitan Coal recognises that various regulators have different distribution requirements, both in relation to whom documents should be sent and in what format.

An Environmental Management Plan and Monitoring Program Distribution Register has been established in consultation with the relevant agencies and infrastructure owners that indicates:

- to whom the Metropolitan Coal plans and programs, such as this LMP, will be distributed;
- the format (i.e. electronic or hard copy) of distribution; and
- the format of revision notification.

Metropolitan Coal will make the Distribution Register publicly available on the Peabody website.

Metropolitan Coal will be responsible for maintaining the Distribution Register and for ensuring that the notification of revisions is sent by email or post as appropriate.

In addition, Metropolitan Coal employees with local computer network access will be able to view the controlled electronic version of this LMP on the Metropolitan Coal local area network. Metropolitan Coal will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on Metropolitan Coal's computer system and the Peabody website.

3 STATUTORY REQUIREMENTS

Metropolitan Coal's statutory obligations are contained in:

(i) the conditions of the Project Approval;

(ii) relevant licences and permits, including conditions attached to mining leases; and

(iii) other relevant legislation.

These are described below.

3.1 ENVIRONMENTAL PLANNING & ASSESSMENT ACT APPROVAL

Condition 6(f), Schedule 3 of the Project Approval requires the preparation of a LMP as a component of Extraction Plan(s) for second workings. Condition 6(f), Schedule 3 states:

> ***SECOND WORKINGS***
>
> ***Extraction Plan***
>
> *6. The Proponent shall prepare and implement an Extraction Plan for all second workings in the mining area to the satisfaction of the Director-General. This plan must:*
>
> *…*
>
> *(f) include a:*
>
> *…*
>
> - *Land Management Plan, which has been prepared in consultation with the SCA*[1]*, to manage the potential environmental consequences of the Extraction Plan on cliffs, overhangs, steep slopes and land in general;*

In addition, Condition 2, Schedule 7 and Condition 7, Schedule 3 of the Project Approval outline management plan requirements that are applicable to the preparation of this LMP. Table 1 indicates where each component of the conditions is addressed within this LMP.

[1] The Sydney Catchment Authority (SCA) is now WaterNSW.

Table 1
Management Plan Requirements

Project Approval Condition	LMP Section
Condition 2, Schedule 7	
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;	Section 6
b) a description of:	
• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 3
• any relevant limits or performance measures/criteria;	Section 5
• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 5
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Sections 5, 7, 8 and 9
d) a program to monitor and report on the:	Sections 7, 8 and 11
• 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;	Section 9
f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Sections 7 and 11
g) a protocol for managing and reporting any;	
• incidents;	Section 12
• complaints;	Section 13
• non-compliances with statutory requirements; and	Section 14
• exceedances of the impact assessment criteria and/or performance criteria; and	Section 9
h) a protocol for periodic review of the plan.	Sections 2 and 11
Condition 7, Schedule 3	
7. In addition to the standard requirements for management plans (see condition 2 of schedule 7), the Proponent shall ensure that the management plans required under condition 6(f) above include:	
a) a program to collect sufficient baseline data for future Extraction Plans;	Section 10
b) a revised assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval;	Section 4
c) a detailed description of the measures that would be implemented to remediate predicted impacts; and	Section 8
d) a contingency plan that expressly provides for adaptive management.	Section 9

3.2 LICENCES, PERMITS AND LEASES

In addition to the Project Approval, all activities at or in association with the Metropolitan Coal Mine will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending issue:

- The conditions of mining leases issued by the NSW Division of Resources and Geoscience (DRG) (now the Resources Regulator), under the NSW *Mining Act, 1992* (e.g. Consolidated Coal Lease [CCL] 703, Mining Lease [ML] 1610, ML 1702, Coal Lease [CL] 379 and Mining Purpose Lease 320).
- The *Metropolitan Coal Mining Operations Plan 1 October 2012 to 30 September 2019* approved by the DRG.
- The conditions of Environment Protection Licence No. 767 issued by the NSW Environment Protection Authority under the NSW *Protection of the Environment Operations Act, 1997*. Revision of the EPL will be required prior to the commencement of Metropolitan Coal activities that differ from those currently licensed.
- The prescribed conditions of specific surface access leases within CCL 703 for the installation of surface facilities as required.
- Water Access Licences (WALs) issued by the NSW Department of Industry – Water (now DPIE-Water) under the NSW *Water Management Act, 2000,* including WAL 36475 under the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* and WAL 25410 under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011.*
- Mining and workplace health and safety related approvals granted by the NSW Resources Regulator and WorkCover NSW.
- Supplementary approvals obtained from WaterNSW for surface activities within the Woronora Special Area (e.g. fire road maintenance activities).

3.3 OTHER LEGISLATION

Metropolitan Coal will conduct the Project consistent with the Project Approval and any other legislation that is applicable to an approved Part 3A Project under the EP&A Act.

The following Acts may be applicable to the conduct of the Project (Helensburgh Coal Pty Ltd [HCPL], 2008)[2]:

- *Biodiversity Conservation Act, 2016;*
- *Biosecurity Act, 2015;*
- *Contaminated Land Management Act, 1997;*
- *Crown Land Management Act, 2016;*
- *Dams Safety Act, 2015;*
- *Dangerous Goods (Road and Rail Transport) Act, 2008;*
- *Energy and Utilities Administration Act, 1987;*
- *Fisheries Management Act, 1994;*

[2] The list of potentially applicable Acts has been updated to reflect changes to the Acts that were in force at the time of submission of the Metropolitan Coal Project Environmental Assessment (Project EA) (HCPL, 2008).

- *Mining Act, 1992;*
- *Protection of the Environment Operations Act, 1997;*
- *Rail Safety (Adoption of National Law) Act, 2012;*
- *Roads Act, 1993;*
- *Water Act, 1912;*
- *Water Management Act, 2000;*
- *Water NSW Act, 2014;*
- *Work Health and Safety Act, 2011;* and
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

Relevant licences or approvals required under these Acts will be obtained as required.

4 REVISED ASSESSMENT OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

4.1 LONGWALLS 305-307 EXTRACTION LAYOUT

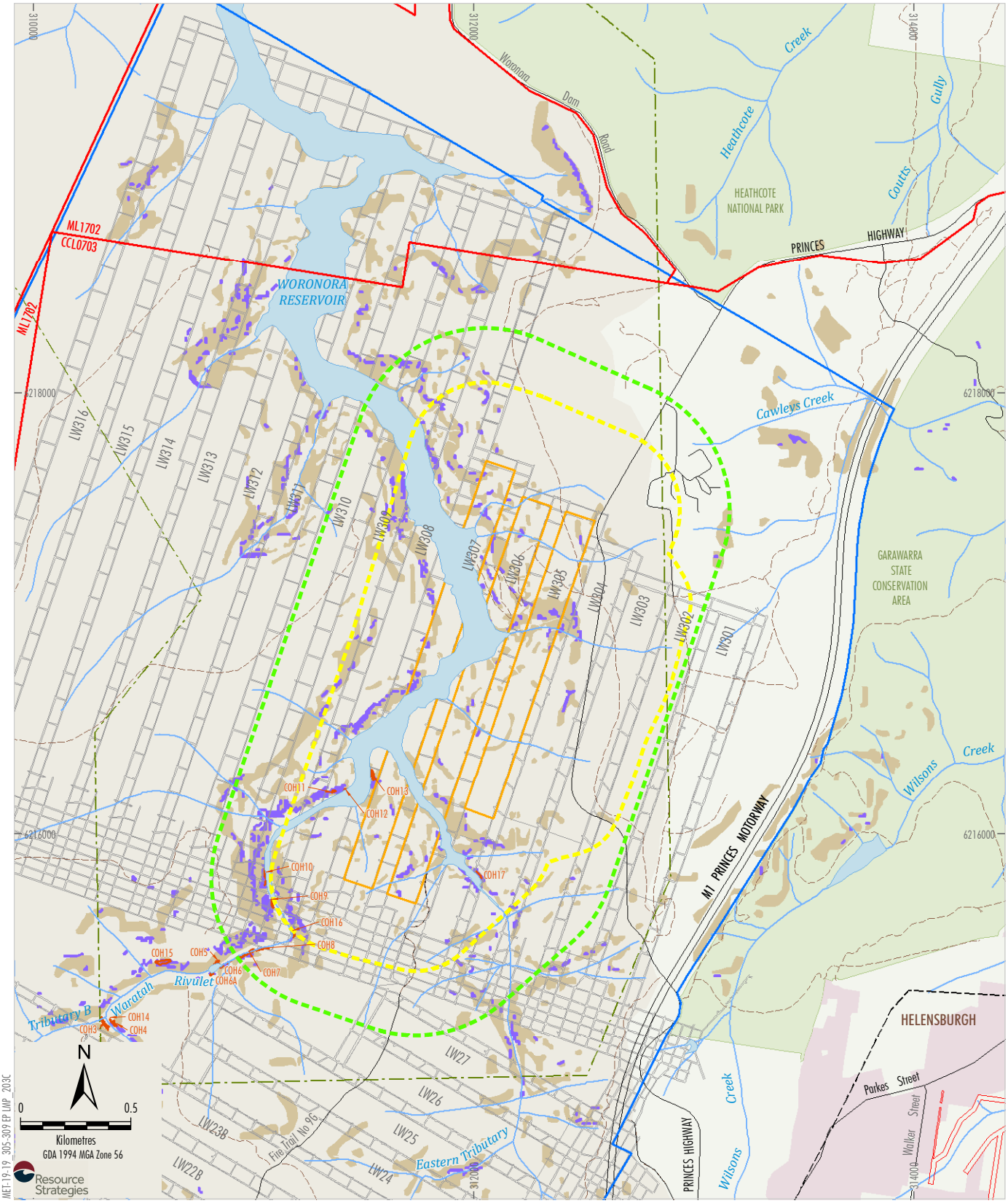
Longwalls 305-307 and the area of land within 600 metres (m) of Longwalls 305-307 secondary extraction are shown on Figures 1, 2 and 4. Longwall extraction will occur from north to south. The Longwall 305 layout includes a 138 m panel width (void), a 45 m tailgate pillar width and a 70 m maingate pillar width. The longwall layout of Longwalls 306 and 307 includes 138 m panel widths (void) and 70 m pillars (solid) consistent with the PPL.

The provisional extraction schedule for Longwalls 305-307 is provided in Table 2.

Table 2
Provisional Extraction Schedule

Longwall	Estimated Start Date	Estimated Duration	Estimated Completion Date
Longwall 305	April 2020	8 Months	November 2020
Longwall 306	June 2021	11 Months	April 2022
Longwall 307	May 2022	8 Months	December 2022

The total cumulative predicted subsidence effects, subsidence impacts and/or environmental consequences at the completion of the Project are considered in the Metropolitan Coal Project Environmental Assessment (Project EA) (HCPL, 2008) and the Preferred Project Report (HCPL, 2009), and the cumulative subsidence effects, subsidence impacts and environmental consequences will be assessed in future Extraction Plans.



LEGEND

- Mining Lease Boundary
- Woronora Special Area
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Longwalls 305-307 Secondary Extraction
- Longwalls 305-307 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 305-307 Secondary Extraction
- Woronora Notification Area
- Existing Underground Access Drive (Main Drift)
- Road
- Vehicular Track
- Streams
- Cliffs and Overhangs
- Steep Slopes (Project Approval)
- Steep Slopes (Project Environmental Assessment)

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2019); MSEC (2008; 2018; 2019)

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Cliffs and Overhangs, Steep Slopes and Land in General within 600 m of Longwalls 305-307 and Surrounds

Figure 4

4.2 RELEVANT INFORMATION OBTAINED SINCE PROJECT APPROVAL

Visual inspections of cliffs and overhangs were conducted monthly when mining of Longwalls 20-22 and/or Longwalls 23-27 was within 400 m of sites COH1, COH2, COH3, COH4, COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH14, COH15 and COH16 (Figure 2) and following the completion of each longwall to record evidence of subsidence impacts. A vertical tension crack (approximately 50 millimetres [mm] wide and 15 m long) on the cliff face and a small rock fall (approximately 1.5 m long, 0.5 m wide and 0.5 m^3) were recorded at site COH2 (Figure 2) in December 2013 during the mining of Longwall 22 (Metropolitan Coal, 2014). No additional subsidence impacts at the abovementioned cliff or overhang sites were recorded following the completion of Longwall 27 (Metropolitan Coal, 2017).

An additional cliff and overhang site (COH17) was identified below the full supply level on the Eastern Tributary arm of the Woronora Reservoir in August 2018. A visual inspection of site COH17 was conducted following the completion of Longwall 303 to record evidence of subsidence impacts. No subsidence impacts were recorded.

Visual inspections for subsidence impacts on COH17 will also be conducted for Longwall 304. Longwall 304 had only recently commenced at the time of LMP development.

Observations of steep slopes and land in general have been conducted by Metropolitan Coal and its contractors as part of routine works conducted in the catchment. In February 2012 during the mining of Longwall 21, a surface tension crack was recorded on Fire Trail 9C adjacent to Longwall 20, approximately 10 m long with a maximum width of 20 mm (Metropolitan Coal, 2011). In February 2017 a surface tension crack was recorded on a rock platform located over Longwall 25 in the vicinity of Aboriginal heritage site FRC 301 approximately 10 mm wide and 25 m long (Metropolitan Coal, 2017).

In September 2011 during the mining of Longwall 21, a rock ledge was recorded to have collapsed on the Unnamed Tributary/Tributary D, located to the south of Longwalls 20-22 (Metropolitan Coal, 2012). In July 2015 during the mining of Longwall 24, a rock ledge collapse was recorded on Tributary B (Metropolitan Coal, 2016). In February 2017 rock fall from the underside of a sandstone boulder overhang, approximately 60 cm wide and 80 cm in length, was recorded in the vicinity of Aboriginal heritage site FRC 285 located over Longwall 22B (Metropolitan Coal, 2017).

The potential for impacts on public safety, as well as the potential environmental consequences of the observed subsidence impacts were assessed. None of the recorded subsidence impacts were considered to represent a safety or environmental hazard and no management measures were considered necessary.

The recorded subsidence impacts are consistent with the potential subsidence impacts described in the Project EA and Preferred Project Report.

4.3 ENVIRONMENTAL RISK ASSESSMENT

An Environmental Risk Assessment (ERA) was conducted for four of the key component plans of the Metropolitan Coal Longwalls 305-307 Extraction Plan[3] *viz.* Water Management Plan, Biodiversity Management Plan, Heritage Management Plan and this LMP to give appropriate consideration to risk assessment and risk management in accordance with the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*.

[3] Risk assessments have been undertaken separately in relation to the Metropolitan Coal Longwalls 305-307 Built Features Management Plan and the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan, and are reported in their respective documents.

The suitably qualified and experienced experts endorsed by the Secretary of the DPIE for the preparation of the Metropolitan Coal Longwalls 305-307 Extraction Plan participated in the ERA[4]. The ERA process involved the key steps described below.

Review of Relevant Documentation and Risk Identification

In preparation for the ERA workshop, the ERA participants reviewed a number of documents relevant to the risk assessment. This included (but was not limited to):

- The 2008 *Environmental Risk Analysis* (SP Solutions, 2008) conducted for the Project EA (Appendix O of the Project EA).
- The Preferred Project Report (HCPL, 2009). During the NSW Government's assessment phase of the Project EA, and in recognition of concerns raised by key stakeholders during the formal Planning Assessment Commission assessment process, HCPL considered it appropriate to reduce the proposed extent of the original Project longwall mining area (i.e. Longwalls 20-44). This reduction in the extent of longwall mining resulted in a significant reduction to the extent of potential subsidence effects to the Waratah Rivulet and the Eastern Tributary and a reduction in the consequential potential environmental impacts.
- The Longwalls 304 Environmental Risk Assessment Report (Operational Risk Mentoring, 2019a) (which included consideration of the Longwalls 301-303 Environmental Risk Assessment Report).
- Figures showing the Longwalls 305-307 layout in relation to key surface features.
- Subsidence predictions for Longwalls 305-307(including subsidence contours, Eastern Tributary, Waratah Rivulet, Woronora Reservoir, other streams, cliff sites, upland swamps and Aboriginal heritage sites).

The participants were asked to identify any additional (specific) issues/risks and/or changes to previously assessed levels of risk in preparation for the ERA workshop.

ERA Workshop

The ERA workshop for Longwalls 305-307 was conducted on 16 July 2019, with some participants attending via video conferencing and others attending in person at the Metropolitan Coal Mine. The ERA workshop was facilitated by an independent specialist, Dr Peter Standish of Operational Risk Mentoring and conducted in accordance with AS/NZS ISO 31000: *2009 Risk Management – Principles and Guidelines.*

The general consensus of the workshop participants was the additional (specific) issues/risks identified for Longwalls 305-307 were broadly assessed and ranked as part of the 2008 Environmental Risk Analysis, Longwalls 301-303 ERA and/or Longwall 304 ERA. However, additional (specific) issues were identified by the workshop participants relevant to Longwalls 305-307. Each of the issues/risks were explained systematically by the relevant workshop participants and each carefully reviewed.

[4] Participants included Mr Peter DeBono (Mine Subsidence Engineering Consultants, Subsidence and Land), Dr Noel Merrick (SLR Consulting, Groundwater), Mr Lindsay Gilbert (Hydro Engineering & Consulting, Surface Water), Associate Professor Barry Noller (The University of Queensland, Surface Water Quality), Dr David Goldney (Cenwest Environmental Services, Fauna), Ms Elizabeth Norris (Ecoplanning, Flora), Mr Jon Degotardi (Metropolitan Coal), Mr Stephen Love (Metropolitan Coal), Mr Shane Kornek (Metropolitan Coal), Ms Stacey Gromadzki (Resource Strategies), Mr Joe Flanagan (Resource Strategies) and Mr Sam Webber (Resource Strategies). Mr Jamie Reeves (Niche Environment and Heritage, Heritage) contributed to the risk assessment external to the workshop.

Loss scenarios for the key potential environmental issues were identified for upland swamps, the Eastern Tributary, Waratah Rivulet and the Woronora Reservoir. The risk rankings are within the "low" range and consequently the potential outcomes can be integrated into the existing management systems for effective review and monitoring.

ERA Report Review

All ERA participants were asked to review the draft Longwalls 305-307 ERA report that was prepared to summarise the outcomes of the risk assessment. Participants' comments were incorporated into the final Operational Risk Mentoring (2019b) report.

This LMP has been prepared to provide for effective management of the identified subsidence risks.

4.4 CLIFFS AND OVERHANGS

Consistent with the Project Approval, cliffs are defined as a continuous rock face, including overhangs, having a minimum height of 10 m and a slope of greater than 66 degrees (º). The location of cliffs within the Project underground mining area (Figure 2) was determined by MSEC (2008) from site inspections and from 1 m surface contours of the area. Overhangs associated with cliffs and/or considered sensitive to potential mine subsidence movements (due to their location relative to the Waratah Rivulet) were also identified within the Project underground mining area (Figure 2).

An additional cliff and overhang site (COH17) was identified below the full supply level on the Eastern Tributary arm of the Woronora Reservoir in August 2018 (Figure 4).

Five cliffs are located within the Longwalls 305-307 35° angle of draw and/or predicted 20 mm subsidence contour (sites COH11, COH12, COH13, COH16 and COH17) and four cliffs (COH7, COH8, COH9 and COH10) are outside the Longwalls 305-307 35° angle of draw and/or predicted 20 mm subsidence contour and within 600 m of Longwalls 305-307. None of the cliffs are located directly above Longwalls 305-307.

4.4.1 Revised Subsidence Predictions

The subsidence predictions for Longwalls 305-307 in relation to cliff sites within the 35° and/or predicted 20 mm subsidence contour have been prepared by MSEC (2019). Table 3 compares the predicted subsidence parameter for the Longwalls 305-307 Extraction Plan with those for the Preferred Project Layout (at the completion of Longwall 307).

The cliffs located outside of the Longwalls 305-307 35° angle of draw and/or predicted 20 mm subsidence contour and within 600 m of Longwalls 305-307 are not expected to experience any measurable vertical subsidence resulting from the extraction of Longwalls 305-307. The cliffs are located along the alignment of streams and will not experience predicted valley closures which act across the alignments of the streams.

The maximum predicted vertical subsidence for the cliffs based on the Extraction Plan Layout is less than the maxima predicted based on the Preferred Project Layout at four sites and the same as the Preferred Project Layout at one site (COH16, <20 mm) (Table 3). The maximum predicted tilt for the cliffs based on the Extraction Plan Layout is less than or the same as the maxima predicted based on the Preferred Project Layout (Table 3).

The maximum predicted hogging curvature and sagging curvature based on the Extraction Plan Layout are less than or the same as the maxima predicted based on the Preferred Project Layout, with the exception of hogging curvature at Cliff COH13, which is slightly higher (Table 3). Whilst hogging curvature increases at COH13 as a result of the Extraction Plan Layout, the maximum predicted conventional hogging curvature for cliffs, based on the Extraction Plan Layout (0.02 1/kilometres [km^{-1}]), is the same as the maxima based on the Preferred Project Layout after Longwall 307 (MSEC, 2019).

Table 3
Revised Subsidence Predictions for Cliffs and Overhangs

Cliff Site	Maximum Predicted Total Conventional Subsidence (mm)[1]		Maximum Predicted Total Conventional Tilt (mm/m)[2]		Maximum Predicted Total Conventional Hogging Curvature (km^{-1})[3]		Maximum Predicted Total Conventional Sagging Curvature (km^{-1})[3]	
	PPL	EPL	PPL	EPL	PPL	EPL	PPL	EPL
COH11	70	40	1.0	< 0.5	0.01	< 0.01	< 0.01	< 0.01
COH12	125	40	1.5	< 0.5	0.02	< 0.01	< 0.01	< 0.01
COH13	300	90	2.0	1.0	0.01	0.02	0.02	< 0.01
COH16	< 20	< 20	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01
COH17	475	125	0.5	< 0.5	0.01	< 0.01	0.03	< 0.01

Source: after MSEC (2019).

1 Subsidence refers to vertical displacements of the ground.

2 Tilt is the change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the distance between those points.

3 Curvature is the second derivative of subsidence, the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by average length of those sections.

PPL = After completion of Longwall 307 of the Preferred Project Layout.

EPL = After completion of Longwall 307 of the Extraction Plan Layout.

mm/m= millimetres per metre

4.4.2 Revised Assessment of Potential Subsidence Impacts and Environmental Consequences

The potential for impacts on the cliffs and overhangs, based on the Extraction Plan Layout, are similar to those based on the Preferred Project Layout. Based on comparisons with other mines in the Southern Coalfield where cliff lines have been undermined, the lengths of potential cliff instabilities are expected to be less than 3 percent (%) of the lengths of these cliffs (MSEC, 2019). Although isolated rock falls have been observed over solid coal outside the extracted goaf areas of longwall mining in the Southern Coalfield, there have been no recorded cliff instabilities outside the extracted goaf areas of longwall mining in the Southern Coalfield. It is possible that isolated rock falls could occur as a result of the extraction of the proposed longwalls. It is not expected, however, that any large cliff instabilities would occur outside the longwall footprints as a result of the extraction of the longwalls (MSEC, 2019).

4.5 STEEP SLOPES

Consistent with the Project Approval, steep slopes are defined as an area of land having a natural gradient of between 33º and 66º. In the Project EA subsidence assessment (Appendix A of the Project EA) MSEC (2008) defined steep slopes as an area of land having a natural gradient of between 18º and 63º. The steep slopes were identified from surface level contours generated from 1 m contours of the area. Both definitions of steep slopes are shown on Figures 2 and 4.

Steep slopes have been identified to highlight areas where existing ground slopes may be marginally stable. However, no significant slope failures have been observed in the Southern Coalfield as a result of longwall mining. Steep slopes within 600 m of Longwalls 305-307 secondary extraction are shown on Figure 4.

The surface soils generally consist of soils derived from Hawkesbury Sandstone, in varying stages of weathering and fracturing. The majority of the slopes are stabilised, to some extent, by trees and other natural vegetation.

4.5.1 Revised Subsidence Predictions

A summary of the maximum predicted values of incremental conventional subsidence, tilt and curvature due the extraction of each of Longwalls 305, 306 and 307, is provided in Table 4.

Table 4
Maximum Predicted Incremental Conventional Subsidence, Tilt and Curvature Resulting from the Extraction of Longwalls 305, 306 and 307

Longwall	Maximum Predicted Incremental Conventional			
	Subsidence[1] (mm)	Tilt[2] (mm/m)	Hogging Curvature[3] (km^{-1})	Sagging Curvature[3] (km^{-1})
Due to LW305	525	4	0.05	0.10
Due to LW306	300	2	0.04	0.07
Due to LW307	275	2	0.04	0.07

Source: after MSEC (2019).

1 Subsidence refers to vertical displacements of the ground.

2 Tilt is the change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the distance between those points.

3 Curvature is the second derivative of subsidence, the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by average length of those sections.

A comparison of the maximum predicted total subsidence parameters resulting from the extraction of Longwalls 305-307 (i.e. the Extraction Plan Layout), with those based on the Preferred Project Layout after Longwall 307, are provided in Table 5. The values are the maxima anywhere within the Longwalls 305-307 35° angle of draw and/or predicted 20 mm subsidence contour (Figure 4) (MSEC, 2019). The maximum predicted total subsidence, hogging curvature and sagging curvature based on the Extraction Plan Layout are the same or less than the maxima based on the Preferred Project Layout (Table 5). The maximum predicted tilt for the Extraction Plan Layout is higher than that for the Preferred Project Layout (Table 4) (MSEC, 2019).

Table 5
Comparison of Maximum Predicted Total Conventional Subsidence Parameters based on the Preferred Project Layout and the Extraction Plan Layout

Layout	Maximum Predicted Total Conventional			
	Subsidence (mm)	Tilt (mm/m)	Hogging Curvature (km^{-1})	Sagging Curvature (km^{-1})
Preferred Project Layout (LW307)	1250	3.0	0.06	0.10
Extraction Plan Layout	1100	4.5	0.06	0.09

Source: after MSEC (2019).

4.5.2 Revised Assessment of Potential Subsidence Impacts and Environmental Consequences

The steep slopes could experience the full range of predicted subsidence movements, as summarised in Table 4 and Table 5. The maximum predicted subsidence parameters for the steep slopes, based on the Extraction Plan Layout, are similar to the maxima based on the Preferred Project Layout, as summarised in Table 5 (MSEC, 2019).

The maximum predicted subsidence parameters for the steep slopes based on the Extraction Plan Layout are similar to the maxima based on the Preferred Project Layout. The potential impacts on steep slopes, based on the Extraction Plan Layout, are the same as those assessed based on the Preferred Project Layout, as described in the Project EA and Preferred Project Report, specifically, the potential for ground surface cracking. The size and extent of surface cracking at the steep slopes is expected to be similar to that observed during the extraction of earlier longwalls at Metropolitan Coal (MSEC, 2019).

Potential environmental consequences of surface cracking, such as the formation of areas capable of trapping some ground dwelling fauna and impacts on Aboriginal heritage sites, are the subject of other Metropolitan Coal management plans such as the Metropolitan Coal Longwalls 305-307 Biodiversity Management Plan and Longwalls 305-307 Heritage Management Plan (Figure 3). A protocol is outlined in Sections 8 and 9 that ensures the potential environmental consequences of recorded subsidence impacts are assessed as a component of the LMP monitoring program and that this LMP initiates and links actions with other plans where appropriate.

Another potential consequence of surface cracking is the potential for impacts on public safety. Public safety will be addressed in the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan (Figure 3).

4.6 LAND IN GENERAL

Land in general refers to the general landscape other than cliffs and steep slopes. There are rock ledges, also called rock outcrops and minor cliffs, which occur within 600 m of Longwalls 305-307 (MSEC, 2019).

Land in general includes other land features such as fire trails and vehicular tracks, however excludes surface features such as streams and upland swamps which are addressed in other Metropolitan Coal management plans and programs. Unsealed vehicular tracks and fire trails are located throughout the Project underground mining area and above Longwalls 305-307 (Figure 4).

4.6.1 Revised Subsidence Predictions

Land in general could experience the full range of predicted subsidence movements, as summarised in Table 4 and Table 5. The maximum predicted subsidence parameters for land in general, based on the Extraction Plan Layout, are similar to the maxima based on the Preferred Project Layout, as summarised in Table 5 (MSEC, 2019).

4.6.2 Revised Assessment of Potential Subsidence Impacts and Environmental Consequences

As described in Section 4.6.1, land in general could experience the full range of predicted subsidence movements, as summarised in Table 4 and Table 5.

The potential impacts on land in general, based on the Extraction Plan Layout, are similar to those assessed based on the Preferred Project Layout, as described in the Project EA and Preferred Project Report, specifically, the fracturing of sandstone (including surface tension cracking) and subsequent rock falls (particularly where rock ledges are marginally stable).

Fire trails and vehicular tracks could experience surface cracking during the mining period, particularly where the trails/tracks are located near the tops of existing slopes or at the bottom of valleys.

In relation to potential environmental consequences, the aesthetics of the landscape could be altered by rock falls, while surface cracking has the potential to form areas capable of trapping some ground dwelling fauna. Rock falls and/or surface cracking also have potential to impact surface water quality and Aboriginal heritage sites. A protocol is outlined in Sections 8 and 9 that ensures the potential environmental consequences of recorded subsidence impacts are assessed as a component of the LMP monitoring program and that this LMP initiates and links actions with other plans where appropriate.

Another potential consequence of rock falls and surface cracking is the potential for impacts on public safety. Public safety is addressed in the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan (Figure 3).

5 PERFORMANCE MEASURES AND INDICATORS

5.1 CLIFFS AND OVERHANGS

The Project Approval requires Metropolitan Coal not to exceed the subsidence impact performance measures outlined in Table 1 of Condition 1, Schedule 3. The subsidence impact performance measure specified in Table 1 of Condition 1, Schedule 3 in relation to land is:

> *Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall.*

This performance measure is based on the results of the Project EA subsidence assessment (MSEC, 2008). Most of the mining-induced cliff falls have been observed where the depth of cover to mining was shallow, as in the Western Coalfield, and few cliff falls or rock falls have been observed where the depth of cover is more than 400 m, as is generally the case in the Southern Coalfield (MSEC, 2008). Based on comparisons against other mines where cliff lines have been undermined in the Southern Coalfield, the length of potential cliff instabilities are expected to be less than 3% of the lengths of these cliffs.

Minor rock falls have been observed to occur naturally at locations where there has been no mining and this is a reminder that cliffs and rock overhangs are landforms that are part of a naturally occurring erosion/weathering cycle and they are often only marginally stable (*ibid*.). This highlights that caution is required when inspecting the surface near these natural features and when proposing any surface management plans near or around cliffs and overhangs during and immediately after mining (MSEC, 2008).

Consistent with the Project EA subsidence assessment (MSEC, 2008), cliff instabilities (cliffs within the mining area that experience mining-induced rock fall) are considered to result in freshly exposed surfaces dissimilar to natural weathering processes. They are represented by the exposure of a fresh face of rock and debris scattered around the base of the cliff or overhang.

Metropolitan Coal will assess the Project against the following performance indicator:

> *Cliff sites COH11, COH12, COH13, COH16 and/or COH17 experience cliff instabilities that do not require management measures to be implemented.*

Section 7 describes the monitoring and TARP that will be used to assess the Project against the performance indicator.

Table 6 shows the length of cliffs and associated overhangs within the Project underground mining area. Figure 2 shows the location of the cliffs and associated overhangs in the Project underground mining area. Table 6 indicates the total length of cliffs and associated overhangs identified within the Project underground mining area is approximately 924 m.

Table 6
Length of Cliffs and Overhangs within the Project Underground Mining Area

Site	Approximate Overall Length (m)*
COH1	143
COH2	95
COH3	55
COH4	19
COH5	12
COH6	20
COH6A	10
COH7	85
COH8	30
COH9	35
COH10	100
COH11	20
COH12	30
COH13	40
COH14	45
COH15	70
COH16	35
COH17	80
Total Length	924

* Detailed baseline mapping of cliffs and overhangs COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH15 and COH16 was undertaken for the Longwalls 23-27 Extraction Plan and the lengths of the cliffs estimated for the Project EA were updated. This table has been updated to be consistent with the approximate lengths of the cliffs recorded by the detailed baseline mapping at the time of the Longwalls 23-27 Extraction Plan (rather than the Project EA estimate). The detailed baseline mapping of all cliff and overhang sites is provided in Appendix 1.

A Land Management Plan – Subsidence Impact Register has been used to progressively monitor the total length of cliffs and associated overhangs that experience cliff instabilities. At the completion of Longwall 303, one cliff site (COH2) located over Longwall 20 has been recorded with cliff instabilities, approximately 1.5 m in length (Appendix 2).

5.2 STEEP SLOPES AND LAND IN GENERAL

The potential for the fracturing of sandstone (including surface tension cracking) and subsequent rock falls (particularly where rock ledges are marginally stable) has been identified, similar to that observed during the extraction of previous longwalls at Metropolitan Coal.

Metropolitan Coal will assess the Project against the following performance indicator:

> *Steep slopes and land in general do not experience sandstone fracturing/cracking or rock falls that require management measures to be implemented.*

Section 7 describes the monitoring and TARP that will be used to assess the Project against this performance indicator.

6 BASELINE DATA

6.1 CLIFFS AND OVERHANGS

As described in Section 4.4, cliffs are defined as a continuous rock face, including overhangs, having a minimum height of 10 m and a slope of greater than 66º. The location of cliffs within the Project underground mining area (Figure 2) was determined by MSEC (2008) from site inspections and from 1 m surface contours of the area. Overhangs associated with cliffs and/or considered sensitive to potential mine subsidence movements (due to their location relative to the Waratah Rivulet) were also identified within the Project underground mining area (Figure 2).

Site inspections of cliffs and overhangs within 600 m of Longwalls 20-27 secondary extraction (namely sites COH1, COH2, COH3, COH4, COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH14, COH15 and COH16) (Figure 4) were conducted by MSEC prior to the commencement of Longwalls 20-22 and/or Longwalls 23-27. Site inspections of cliff and overhang sites COH11, COH12, COH13 and COH17 (Figure 4) were conducted by MSEC prior to the commencement of Longwall 303. The baseline characteristics of each cliff and overhang were recorded. The data obtained includes:

- photographic records of each cliff and overhang;
- sketches of overhangs;
- mapping of the approximate location of the cliff/overhang face and the rear extent of the overhang/undercut; and
- mapping of the location of the cliff or overhang relative to the Waratah Rivulet (where relevant).

The detailed baseline information for each site containing a cliff and/or overhangs is provided in Appendix 1.

The extent of weathering was observed to vary from well weathered rock faces to relatively freshly exposed rock surfaces where weathering was not advanced and vegetation cover had not established.

Jointing is considered ubiquitous within the Hawkesbury Sandstone and cliff lines have developed in association with the conjugate joint sets present. Differential weathering has exposed the sub-horizontal layers at varying rates, reflecting the natural variation in rock strength through the profile. In places the differential weathering has resulted in overhangs, essentially reflecting the erosion of weaker layers below more competent strata units that can span varying distances.

Table 6 in Section 5.1 shows the length of cliffs and associated overhangs within the Project underground mining area.

6.2 STEEP SLOPES AND LAND IN GENERAL

A series of en-echelon rock ledges occur on the steep slopes and other land, as well as other rock formations such as boulders and rock pavements. Natural cracks along exposed rock ledges are common and migration of leaf litter and establishment of vegetation within these zones is common. Freshly exposed cracks attributable to mining would be readily apparent, at least in areas of no soil cover.

No surface tension cracks as a result of previous mining had been observed within the 35º angle of draw and/or predicted 20 mm subsidence contour of Longwalls 305-307 at the time of LMP preparation.

7 MONITORING

The monitoring program described in Sections 7.1 and 7.2 will be conducted during the mining of Longwalls 305-307.

The TARP that will be used to assess the environmental performance of the Project is provided in Section 7.3.

7.1 SUBSIDENCE PARAMETERS

Subsidence parameters will be measured in accordance with the Metropolitan Coal Longwalls 305-307 Subsidence Monitoring Program (Figure 3).

In summary, surveys will be conducted to measure subsidence movements in three dimensions using a total station survey instrument. Subsidence movements will be measured along subsidence lines that have been positioned across the general landscape.

7.2 SUBSIDENCE IMPACTS

7.2.1 Cliffs and Overhangs

Following the completion of Longwall 27 extraction, cliff sites COH1, COH2, COH3, COH4, COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH14, COH15 and COH16 were inspected to record any additional subsidence impacts (e.g. cliff instabilities and cracking) to those previously recorded. The visual inspections did not record any additional subsidence impacts.

Cliff site COH17 was inspected for subsidence impacts following the completion of Longwall 303. The visual inspection did not record any subsidence impacts.

Visual inspections for subsidence impacts on cliff site COH17 will be conducted monthly when Longwall 304 extraction is within 400 m of the site and at the completion of Longwall 304.

Visual inspections for subsidence impacts for Longwalls 305-307 will be conducted at sites COH11, COH12, COH13, COH16 and COH17:

- prior to the commencement of Longwall 305 extraction;
- monthly at cliff site(s) located within 400 m of longwall extraction; and
- within three months of the completion of Longwall 305, Longwall 306 and Longwall 307.

Additional visual observations of subsidence impacts will be conducted during routine works and sampling by Metropolitan Coal and its contractors.

In the event subsidence impacts are identified, the following details will be noted and/or photographed:

- the date of the inspection;
- the location of longwall extraction (i.e. the longwall chainage);
- the location of the cliff instability (i.e. freshly exposed rock face and debris scattered around the base of the cliff or overhang) relative to the cliff face or overhang;
- the nature and extent of the cliff instability (including an estimate of volume);
- the length of the cliff instability;
- other relevant aspects such as water seepage (which can indicate weaknesses in the rock);
- whether any actions are required (for example, implementation of appropriate safety controls, review of public safety etc.); and
- any other relevant information.

The information obtained will be recorded in the Land Management Plan – Subsidence Impact Register and Land Management Plan – Subsidence Impact Register Assessment Form (Appendix 2) and reported in accordance with the Project Approval conditions.

The information obtained will be used to assess the potential environmental consequences of the subsidence impact. Specific details that will be noted and/or photographed to assess the potential environmental consequences of the subsidence impact include:

- the nature and extent of impacts on the aesthetic values of the land feature;
- any areas of erosion or sedimentation arising from mining activities;
- the co-ordinates of the subsidence impact to assess impacts on known Aboriginal heritage sites;
- nature and extent of impacts on potential flora and fauna habitats;
- evidence of impacts on terrestrial fauna (e.g. observed fauna mortality); and
- any impacts on the serviceability of fire trails/vehicular tracks and/or stream crossings.

Metropolitan Coal will document the assessment of potential environmental consequences in the Land Management Plan – Subsidence Impact Register Assessment Form (Appendix 2).

The information recorded will be used to assess the Project against the following performance indicator in accordance with the TARP (Section 7.3):

> *Cliff sites COH11, COH12, COH13, COH16 and/or COH17 experience cliff instabilities that do not require management measures to be implemented.*

The information recorded will also be used to assess the Project against the following performance measure in accordance with the TARP (Section 7.3):

> *Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall.*

7.2.2 Steep Slopes and Land in General

Visual inspections for subsidence impacts on steep slopes and land in general within 600 m of Longwalls 20-27 and Longwalls 301-307 extraction will be conducted by Metropolitan Coal and its contractors during catchment visits, sampling and routine works conducted in the catchment.

In the event subsidence impacts are identified within 600 m of Longwalls 20-27 and Longwalls 301-304 (that were not previously recorded during the mining of Longwalls 20-27 or Longwalls 301-304), or within 600 m of Longwalls 305-307, the following details will be noted and/or photographed:

- the location, approximate dimensions (length, width and depth), and orientation of surface tension cracks;
- the location of the surface tension crack in relation to fire trails or vehicular tracks;
- the location and approximate dimensions of rock falls (e.g. rock ledges);
- whether any actions are required (for example, implementation of appropriate safety controls, review of public safety etc.); and
- any other relevant information.

The date of the observation, details of the observer and the location of longwall extraction will also be documented.

The information obtained will be recorded in the Land Management Plan – Subsidence Impact Register and Land Management Plan – Subsidence Impact Register Assessment Form (Appendix 2) and reported in accordance with the Project Approval conditions.

The information obtained will be used to assess the potential environmental consequences of the subsidence impact. Specific details that will be noted and/or photographed to assess the potential environmental consequences of the subsidence impact include:

- the nature and extent of impacts on the aesthetic values of the land feature;
- any areas of erosion or sedimentation arising from mining activities;
- the co-ordinates of the subsidence impact to assess impacts on known Aboriginal heritage sites;
- nature and extent of impacts on potential flora and fauna habitats;

- evidence of impacts on terrestrial fauna (e.g. observed fauna mortality); and
- any impacts on the serviceability of fire trails/vehicular tracks and/or stream crossings.

Metropolitan Coal will document the assessment of potential environmental consequences in the Land Management Plan – Subsidence Impact Register Assessment Form (Appendix 2).

The information recorded will be used to assess the Project against the following performance indicator in accordance with the TARP (Section 7.3):

> *Steep slopes and land in general do not experience sandstone fracturing/cracking or rock falls that require management measures to be implemented.*

7.3 TRIGGER ACTION RESPONSE PLAN

The TARP for cliffs and overhangs, steep slopes and land in general is detailed in Table 7.

If monitoring indicates a land performance indicator has been exceeded, appropriate management measures will be considered and implemented in consultation with the relevant landholder (Section 8).

Table 7
Trigger Action Response Plan – Cliffs and Overhangs, Steep Slopes and Land in General

Performance Measure	Performance Indicator	Monitoring Sites	Parameters	Analysis Methodology	Frequency/ Sample Size	Error Types	Baseline	Significance Levels/Triggers/Action/Response		
Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall[1]	*Cliff sites COH11, COH12, COH13, COH16 and/or COH17 experience cliff instabilities that do not require management measures to be implemented.*	Cliff sites COH11, COH12, COH13, COH16 and COH17.	Cliff instabilities.	Visual inspection.	• Prior to the commencement of LW305 extraction. • Monthly at cliff site(s) located within 400 m of longwall extraction. • Within three months of the completion of Longwall 305, Longwall 306 and Longwall 307.	Assessment of mining versus natural causes.	• Photographic record of cliff and overhang sites provided in Appendix 1. • Cliff sites in variable condition, and subject to natural processes (e.g. erosion and weathering) • Subsidence impacts recorded at Site COH2. No management measures required.	Level 1	No subsidence impacts (i.e. cliff instabilities) recorded.	Continue monitoring. Six monthly reporting.
								Level 2	Subsidence impacts (i.e. cliff instabilities) recorded, however, do not require management measures to be implemented.	Record subsidence impacts in the Land Management Plan – Subsidence Impact Register and Land Management Plan – Subsidence Impact Register Assessment Form. Assess whether the impact is considered to be a safety hazard and the potential environmental consequences of the subsidence impact and document assessment in Land Management Plan – Subsidence Impact Register Assessment Form. Six monthly reporting.
								Level 3	Subsidence impacts (i.e. cliff instabilities) recorded, and require management measures to be implemented.	Record subsidence impacts in the Land Management Plan – Subsidence Impact Register and Land Management Plan – Subsidence Impact Register Assessment Form. In the event the subsidence impacts are deemed to present a safety hazard (i.e. regardless of the nature or extent of the subsidence impact), actions will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan. Assess the potential environmental consequences of the subsidence impact and document assessment in Land Management Plan – Subsidence Impact Register Assessment Form. Consult with landholder and DPIE in relation to proposed management measures.

[1] Visual inspections of the cliff and overhang sites COH1, COH2, COH3, COH4, COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH14, COH15 and COH16 were conducted monthly when mining of Longwalls 20-22 and/or Longwalls 23-27 were within 400 m of the sites and following the completion of each longwall to record evidence of subsidence impacts. Visual inspections of the cliffs and overhangs following the completion of Longwall 27 did not identify any additional subsidence impacts to those recorded during the mining of Longwalls 20-27. Visual inspection of cliff site COH17 was conducted at the completion of Longwall 303 and no subsidence impacts were recorded. Visual inspection of cliff site COH17 will also be conducted for Longwall 304.

Table 7 (Continued)
Trigger Action Response Plan – Cliffs and Overhangs, Steep Slopes and Land in General

Performance Measure	Performance Indicator	Monitoring Sites	Parameters	Analysis Methodology	Frequency/ Sample Size	Error Types	Baseline	Significance Levels/Triggers/Action/Response		
-	*Steep slopes and land in general experience sandstone fracturing/cracking and rock falls that do not require management measures to be implemented.*	Steep slopes and land in general within 600 m of Longwalls (LW) 20-27 and LW301-307.	Sandstone fracturing/cracking and rock falls.	Visual inspection. The Land Management Plan – Subsidence Impact Register and Assessment Form will be used to monitor subsidence impacts and determine management measure requirements.	Visual inspections as part of routine works conducted in the catchment.	Assessment of mining versus natural causes.	• Some surface tension cracks on steep slopes and land in general within 600 m of LW20-27. • No surface tension cracks recorded as a result of previous mining within 600 m of LW301-304 at the time of LMP development. • Two rock ledges (on streams) have collapsed within 600 m of LW20-27. • Rock fall from the underside of a sandstone boulder overhang within 600 m of LW20-27. • No rock ledge collapses recorded as a result of mining of LW301-304 at the time of LMP development. • No rock ledge collapses recorded as a result of previous mining within 600 m of LW305-307 at the time of LMP development.	Level 1	No subsidence impacts (i.e. sandstone fracturing/cracking and rock falls) recorded on steep slopes or land in general not previously recorded within 600 m of LW20-27 or LW301-307 (after LW305 commencement).	Continue monitoring. Six monthly reporting.
								Level 2	Subsidence impacts (i.e. sandstone fracturing/cracking and rock falls) on steep slopes or land in general recorded within 600 m of LW20-27 or LW301-307 (after LW305 commencement) additional to those previously recorded, however do not require management measures to be implemented.	Record subsidence impacts in the Land Management Plan – Subsidence Impact Register and Land Management Plan – Subsidence Impact Register Assessment Form. Six monthly reporting.
								Level 3	Subsidence impacts (i.e. sandstone fracturing/cracking and rock falls) on steep slopes or land in general recorded within 600 m of LW20-27 or LW301-307 (after LW305 commencement) additional to those previously recorded and require management measures to be implemented.	Record subsidence impacts in the Land Management Plan – Subsidence Impact Register and Land Management Plan – Subsidence Impact Register Assessment Form. In the event the subsidence impacts are deemed to present a safety hazard (i.e. regardless of the nature or extent of the subsidence impact), actions will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan. Assess the potential environmental consequences of the subsidence impact and document assessment in Land Management Plan – Subsidence Impact Register Assessment Form. Consult with landholder and DPIE in relation to proposed management measures.

8 MANAGEMENT MEASURES

Potential management measures that will be considered to mitigate/remediate environmental consequences are provided in Tables 8 and 9. The implementation of management measures will be considered with regard to the specific circumstances of the subsidence impact (e.g. the location, nature and extent of the impact) and the assessment of environmental consequences. The implementation of management measures will be related to the scale of impact and the ability to, and value in, undertaking mitigation measures on a case by case basis. This means that management measures will be considered and may be implemented prior to the land performance measure being exceeded. Management measures will be implemented, as appropriate, to comply with the relevant statutory requirements and the subsidence impact performance measure.

Metropolitan Coal will assess the potential environmental consequences of the recorded subsidence impact on known Aboriginal heritage sites, and where appropriate, implement measures in accordance with the Metropolitan Coal Longwalls 305-307 Heritage Management Plan.

In the event the subsidence impacts are deemed to present a safety hazard (i.e. regardless of the nature or extent of the subsidence impact), actions will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan.

Where significant subsidence impacts on fire trails or vehicular tracks are detected (e.g. those that affect the serviceability of the fire trails or vehicular tracks) or at any time Metropolitan Coal or the landholder considers that the integrity of the fire trails or vehicular tracks may be compromised, the following management measures will be implemented. Where significant cracks are detected, the cracks will be repaired as soon as practicable in consultation with the landholder. This may include the use of earthmoving equipment if considered the most appropriate means of repair. Appropriate sedimentation controls will be implemented during repair works.

The implementation of any stabilisation techniques or measures to improve the aesthetic value of the feature will be conducted in consultation with the landholder. Appropriate erosion and sediment control techniques will be implemented as required. As described in Table 9, the landholder will be consulted in the event Metropolitan Coal proposes to in-fill any surface tension cracks.

Follow-up inspections will be conducted to assess the effectiveness of implemented management measures and the requirement for any additional management measures. Management measures will be reported in the Annual Review (Section 11).

Table 8
Potential Management Measures – Cliffs and Overhangs

Environmental Consequence	Potential Management Measures	
	Measure	**Description**
Impacts on aesthetic values	Stabilisation techniques	• Installation of artificial rock support (e.g. rock bolts, cable bolts). • Installation of standing supports (e.g. timber props, sandbags). • Scaling/dislodgement/removal of remaining loose rock.
	Improvement of appearance	• Application (i.e. spraying) of product to enhance the weathered appearance of the cliff face (e.g. milk to enhance bacterial activity and darkening of exposed rock appearance). • Planting of endemic native vegetation at the base of the cliff face/overhang.
Impacts on surface water quality	Stabilisation techniques	• Installation of artificial rock support (e.g. rock bolts, cable bolts). • Installation of standing supports (e.g. timber props, sandbags). • Scaling/dislodgement/removal of remaining loose rock.
	Erosion and sediment control techniques	• Implementation of erosion and sediment control measures, such as: - Installation of sediment fences downslope of erosion areas. - Stabilisation of erosion areas using rock or other appropriate materials. - Other erosion and sediment control measures consistent with relevant guidelines.
Impacts on flora, fauna, and/or their habitats	Stabilisation techniques	• Installation of artificial rock support (e.g. rock bolts, cable bolts). • Installation of standing supports (e.g. timber props, sandbags). • Scaling/dislodgement/removal of remaining loose rock.
	Erosion and sediment control techniques	• Implementation of erosion and sediment control measures, such as: - Installation of sediment fences downslope of erosion areas. - Stabilisation of erosion areas using rock or other appropriate materials. - Other erosion and sediment control measures consistent with relevant guidelines.
Aboriginal heritage	Stabilisation techniques, salvage of artefacts	• Aboriginal heritage management measures will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Heritage Management Plan, such as: - Establishing an artificial support between the roof and floor, known as standing supports. - Installation of an artificial dripline to divert increased moisture flow away from an art panel. - Artificial reinforcement to improve the structural integrity of a feature.
Safety hazard	Site access control, signage, stabilisation techniques	• Measures to address safety hazards will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan, such as: - Signage to warn persons accessing the area of safety hazard. - Construction of barriers to restrict access to unsafe areas. - Road works to maintain road safety.

Table 9
Potential Management Measures – Steep Slopes and Land in General

Environmental Consequence	Potential Management Measures	
	Measure	**Description**
Impacts on surface water quality	Erosion and sediment control techniques	• Implementation of erosion and sediment control measures, such as: - Installation of sediment fences downslope of erosion areas. - Stabilisation of erosion areas using rock or other appropriate materials. - Other erosion and sediment control measures consistent with relevant guidelines.
Impacts on flora, fauna, and/or their habitats	Erosion and sediment control techniques	• Implementation of erosion and sediment control measures, such as: - Installation of sediment fences downslope of erosion areas. - Stabilisation of erosion areas using rock or other appropriate materials. - Other erosion and sediment control measures consistent with relevant guidelines.
	Remediation of surface tension crack	• Permanent filling of the surface tension crack. The nature and extent of the in-fill material (e.g. sand) determined in consultation with the landholder. Methods of in-filling may include manual application or use of small machinery (e.g. bob cat).
Aboriginal heritage	Salvage of artefacts, aesthetic repair	• Aboriginal heritage management measures will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Heritage Management Plan, such as: - Establishing an artificial support between the roof and floor, known as standing supports. - Installation of an artificial dripline to divert increased moisture flow away from an art panel. - Artificial reinforcement to improve the structural integrity of a feature.
Safety hazard	Site access control, signage, stabilisation techniques	• Measures to address safety hazards will be implemented in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan, such as: - Signage to warn persons accessing the area of safety hazard. - Construction of barriers to restrict access to unsafe areas. - Road works to maintain road safety.

9 CONTINGENCY PLAN

In the event the subsidence impacts observed exceed the land performance measure detailed in Section 5 of this LMP, Metropolitan Coal will implement the following Contingency Plan:

- The observation will be reported to the Technical Services Manager and/or the Environment & Community Superintendent within 24 hours.
- The observation will be recorded in the Land Management Plan - Subsidence Impact Register (Appendix 2).
- Metropolitan Coal will report any exceedance of the land performance measure to the DPIE and WaterNSW as soon as practicable after Metropolitan Coal becomes aware of the exceedance.
- Metropolitan Coal will assess public safety and where appropriate implement safety measures in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan.
- Metropolitan Coal will assess impacts on known Aboriginal heritage sites and where appropriate implement measures in accordance with the Metropolitan Coal Longwalls 305-307 Heritage Management Plan.
- Metropolitan Coal will assess the impacts on the aesthetic values of the land feature.
- Metropolitan Coal will assess the environmental consequences of the subsidence impacts, in consultation with relevant specialists and WaterNSW, including:
  - a review of potential impacts on surface water quality in accordance with the Metropolitan Coal Longwalls 305-307 Water Management Plan; and
  - a review of potential impacts on flora, fauna, and their habitats in accordance with the Metropolitan Coal Longwalls 305-307 Biodiversity Management Plan.

  This will include an assessment of the environmental consequences and how they compare to the assessment of environmental consequences in the Project EA and Preferred Project Report.
- Metropolitan Coal will conduct an investigation to evaluate the potential contributing factors in consultation with WaterNSW. The investigation will:
  - include the re-survey of relevant subsidence monitoring lines;
  - compare and critically analyse measured versus predicted subsidence parameters;
  - review measured subsidence parameters against the observed impact; and
  - review the subsidence monitoring program and update the program where appropriate.
- Metropolitan Coal will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists and relevant agencies including WaterNSW, as necessary. For example:
  - proposed contingency measures;
  - a program to review the effectiveness of the contingency measures; and
  - consideration of adaptive management under circumstances where a water resource or watercourse performance measure detailed in Table 1 of the Project Approval has been exceeded.

  Contingency measures will be developed in consideration of the specific circumstances of the cliff instability (e.g. the location, nature and extent of the impact) and the assessment of environmental consequences in consultation with WaterNSW. Potential contingency measures include management measures described in Tables 8 and 9.

The proposed course of action will consider the nature and extent/scale of all recorded cliff falls. It may, for example, be more appropriate to remediate previous cliff fall areas as opposed to the specific cliff fall that initiated the implementation of the Contingency Plan.

- Metropolitan Coal will submit the proposed course of action to the DPIE for approval.
- Metropolitan Coal will implement the approved course of action to the satisfaction of the DPIE.
- In accordance with Condition 6, Schedule 6 of the Project Approval, Metropolitan Coal will provide a suitable offset to compensate for the impact to the satisfaction of the Secretary of the DPIE if either the contingency measures implemented by Metropolitan Coal have failed to remediate the impact or the Secretary determines that it is not reasonable or feasible to remediate the impact.

A Contingency Plan Check List has been developed and is provided in Appendix 3.

10 FUTURE EXTRACTION PLANS

In accordance with Condition 7, Schedule 3 of the Project Approval, Metropolitan Coal will collect baseline data for the next Extraction Plan (i.e. Longwalls 308 on).

A number of cliff and overhang sites (Figures 2 and 4) have been identified by MSEC (2008) adjacent to the Waratah Rivulet and Woronora Reservoir in the vicinity of, or to the south of, Longwalls 308-310.

The detailed baseline information for all cliff and overhang sites identified to date (i.e. COH1, COH2, COH3, COH4, COH5, COH6, COH6A, COH7, COH8, COH9, COH10, COH11, COH12, COH13, COH14, COH15, COH16, and COH17) is included in Appendix 1.

Baseline data obtained for these cliff sites includes:

- photographic records of each cliff and overhang;
- sketches of overhangs; and
- mapping of the approximate location of the cliff/overhang face and the rear extent of the overhang/undercut.

Baseline data collection for the next Extraction Plan will also include a description of steep slopes and land in general and a description of the recorded subsidence impacts (i.e. where mining of Longwall 304 or Longwalls 305-307 has resulted in subsidence impacts overlying the next Extraction Plan longwall layout [if any] at the time of Extraction Plan preparation).

Consideration of the environmental performance and management measures of this LMP will also inform the appropriate type and frequency of monitoring of the land features relevant to the next Extraction Plan.

11 ANNUAL REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

In accordance with Condition 3, Schedule 7 of the Project Approval, Metropolitan Coal will conduct an Annual Review of the environmental performance of the Project by the end of March each year.

The Annual Review will specifically address the environmental performance of the LMP and will:

- describe the works that were carried out in the past calendar year, and the works that are proposed to be carried out over the next calendar year;
- include a comprehensive review of the monitoring results and complaints records of the Project over the past year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the Project EA, Preferred Project Report and Extraction Plan;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the Project;
- identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the Project.

As described in Section 2, this LMP will be reviewed within three months of the submission of an Annual Review, and revised where appropriate.

12 INCIDENTS

An incident is defined as 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 the Project Approval.

The reporting of incidents will be conducted in accordance with Condition 6, Schedule 7 of the Project Approval. Metropolitan Coal will notify the Secretary of the DPIE and any other relevant agencies of any incident associated with the Project as soon as practicable after Metropolitan Coal becomes aware of the incident. Within seven days of the date of the incident, Metropolitan Coal will provide the Secretary and any relevant agencies with a detailed report on the incident.

13 COMPLAINTS

A protocol for the managing and reporting of complaints has been developed as a component of Metropolitan Coal's Environmental Management Strategy and is described below.

The Environment & Community Superintendent is responsible for maintaining a system for recording complaints.

Metropolitan Coal will maintain public signage advertising the telephone number on which environmental complaints can be made. The Environment & Community Superintendent is responsible for ensuring that the currency and effectiveness of the service is maintained. Notifications of complaints received are to be provided as quickly as practicable to the Environment & Community Superintendent.

Complaints and enquiries do not have to be received via the telephone line and may be received in any other form. Any complaint or enquiry relating to environmental management or performance is to be relayed to the Environment & Community Superintendent as soon as practicable. All employees are responsible for ensuring the prompt relaying of complaints. All complaints will be recorded in a complaints register.

For each complaint, the following information will be recorded in the complaints register:

- date and time of complaint;
- method by which the complaint was made;
- personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- nature of the complaint;
- the action(s) taken by Metropolitan Coal in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken by Metropolitan Coal, the reason why no action was taken.

The Environment & Community Superintendent is responsible for ensuring that all complaints are appropriately investigated, actioned and that information is fed back to the complainant, unless requested to the contrary.

In accordance with Condition 10, Schedule 7 of the Project Approval, the complaints register will be made publicly available on the Peabody website and updated on a monthly basis. A summary of complaints received and actions taken will be presented to the Community Consultative Committee as part of the operational performance review.

14 NON-COMPLIANCES WITH STATUTORY REQUIREMENTS

A protocol for the managing and reporting of non-compliances with statutory requirements has been developed as a component of Metropolitan Coal's Environmental Management Strategy and is described below.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed at or in association with the Metropolitan Coal Mine, and will be developed through promotion of Metropolitan Coal ownership under the direction of the General Manager.

The Technical Services Manager and/or Environment & Community Superintendent will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required, and areas of actual or potential non-compliance.

As described in Section 12, Metropolitan Coal will notify the Secretary of the DPIE and any other relevant agencies of any incident associated with Metropolitan Coal as soon as practicable after Metropolitan Coal becomes aware of the incident. Within seven days of the date of the incident, Metropolitan Coal will provide the Secretary of the DPIE and any relevant agencies with a detailed report on the incident.

A review of Metropolitan Coal's compliance with all conditions of the Project Approval, mining leases and all other approvals and licences will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on the Peabody website.

Additionally, in accordance with Condition 8, Schedule 7 of the Project Approval, an independent environmental audit was undertaken by the end of December 2011, and is undertaken a minimum of once every three years thereafter. A copy of the audit report will be submitted to the Secretary of the DPIE and made publicly available on the Peabody website. The independent audit will be undertaken by an appropriately qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DPIE.

15 REFERENCES

Department of Planning and Environment and NSW Trade & Investment – Division of Resources and Energy (2015) *Guidelines for the Preparation of Extraction Plans Required under Conditions of Development Consents, Project Approvals and Mining Lease Conditions for Underground Coal Mining.* Version 5. Draft.

Helensburgh Coal Pty Ltd (2008) *Metropolitan Coal Project Environmental Assessment*.

Helensburgh Coal Pty Ltd (2009) *Metropolitan Coal Project Preferred Project Report.*

Metropolitan Coal Pty Ltd (2011) *Metropolitan Coal 2011 Annual Review.*

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Metropolitan Coal Pty Ltd (2014) *Metropolitan Coal 2013 Annual Review and Annual Environmental Management Report.*

Metropolitan Coal Pty Ltd (2016) *Metropolitan Coal 2015 Annual Review.*

Metropolitan Coal Pty Ltd (2017) *Metropolitan Coal Six Monthly Report, 1 January to 30 June 2017.*

Mine Subsidence Engineering Consultants (2008) *Metropolitan Colliery Longwalls 20-44 Subsidence Assessment Report (MSEC Report MSEC285 Revision C, August 2008*), Appendix A in HCPL (2008) *Metropolitan Coal Project Environmental Assessment.*

Mine Subsidence Engineering Consultants (2019) *Metropolitan Mine – Longwalls 305-307 Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan (MSEC Report MSEC1057).*

Operational Risk Mentoring (2019a) *Metropolitan Coal Longwall 304 Environmental Risk Assessment Report.*

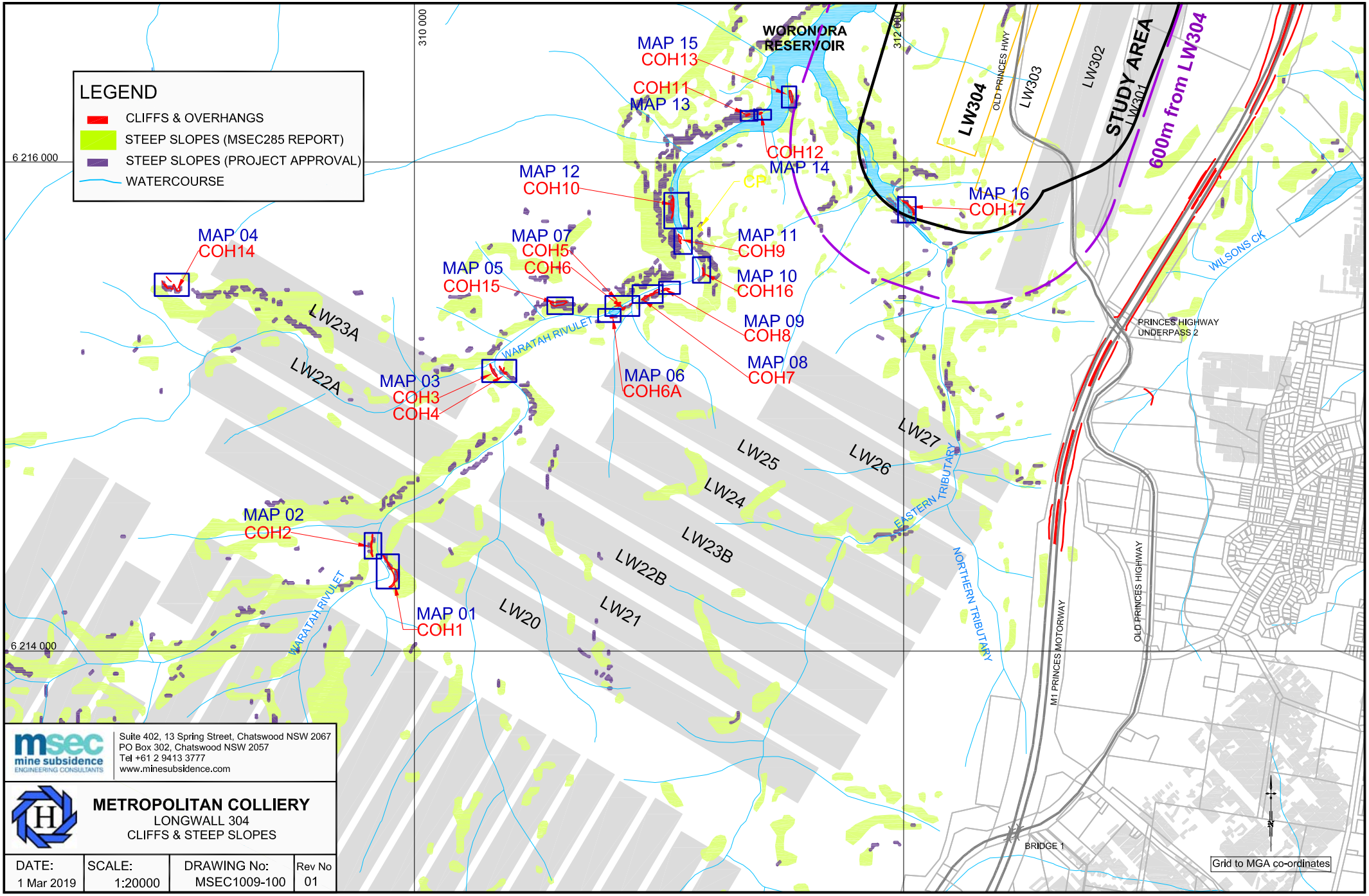
Operational Risk Mentoring (2019b) *Metropolitan Coal Longwalls 305-307 Environmental Risk Assessment Report.*

SP Solutions (2008) *Metropolitan Coal Project Environmental Risk Analysis*. Appendix O in the HCPL (2008) *Metropolitan Coal Project Environmental Assessment*.

APPENDIX 1

BASELINE MAPPING AND PHOTOGRAPHS – CLIFFS AND OVERHANGS

I:\Projects\Metropolitan\MSEC1009 - LW304 Extraction Plan\AutoCAD\MSEC1009-100 Cliffs & Steep Slopes.dwg



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METROPOLITAN COLLIERY
LONGWALL 304
CLIFFS & STEEP SLOPES

DATE:	SCALE:	DRAWING No:	Rev No
1 Mar 2019	1:20000	MSEC1009-100	01

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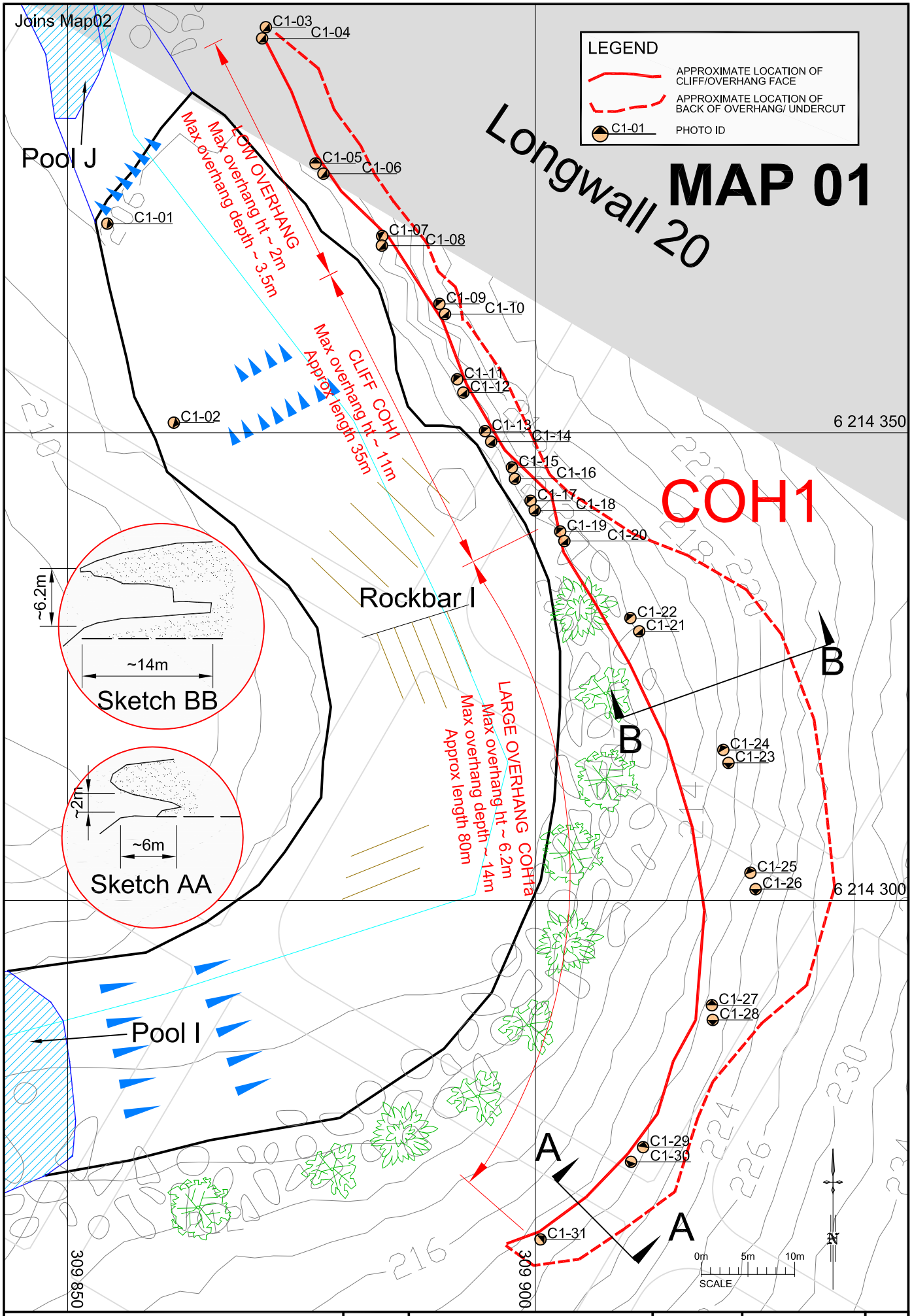

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LONGWALLS 23-27
CLIFF No. COH1

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map01	01

Site COH1 Photographic Record

Photo C1-01 View from opposite bank at the western end

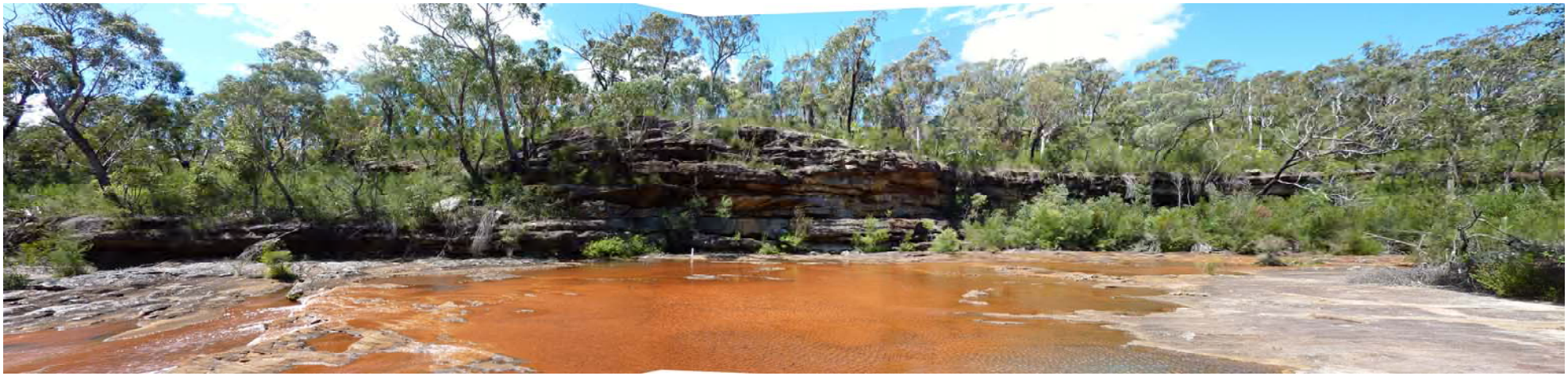

Photo C1-02 View from opposite bank

Photo C1-03 North west end of low overhang (~2m high, ~3.5m deep)

Photo C1-04 Low overhang

Photo C1-05 Low overhang

Photo C1-06 Low overhang

Photo C1-07 Face of low overhang

Photo C1-08 Northern end of cliff

Photo C1-09 Cliff ~9m high, Overhang ~6m high and ~4m deep

Photo C1-10 Cliff ~9m high, Overhang ~6m high and ~4m deep

Photo C1-11 Cliff ~9m high, Overhang ~6m high and ~4m deep

Photo C1-12 Cliff ~9m high, overhang ~6m high and ~4m deep

Photo C1-13 Overhang ~5m high, ~3m deep with additional 2m undercut

Photo C1-14 Overhang ~5m high, ~3m deep with additional 2m undercut

Photo C1-15 Southern end of cliff

Photo C1-16 Southern end of cliff

Photo C1-17 Southern end of cliff/Northern end of large overhang

Photo C1-18 Northern end of large overhang

Photo C1-19 Large overhang looking north

Photo C1-20 Large overhang looking south

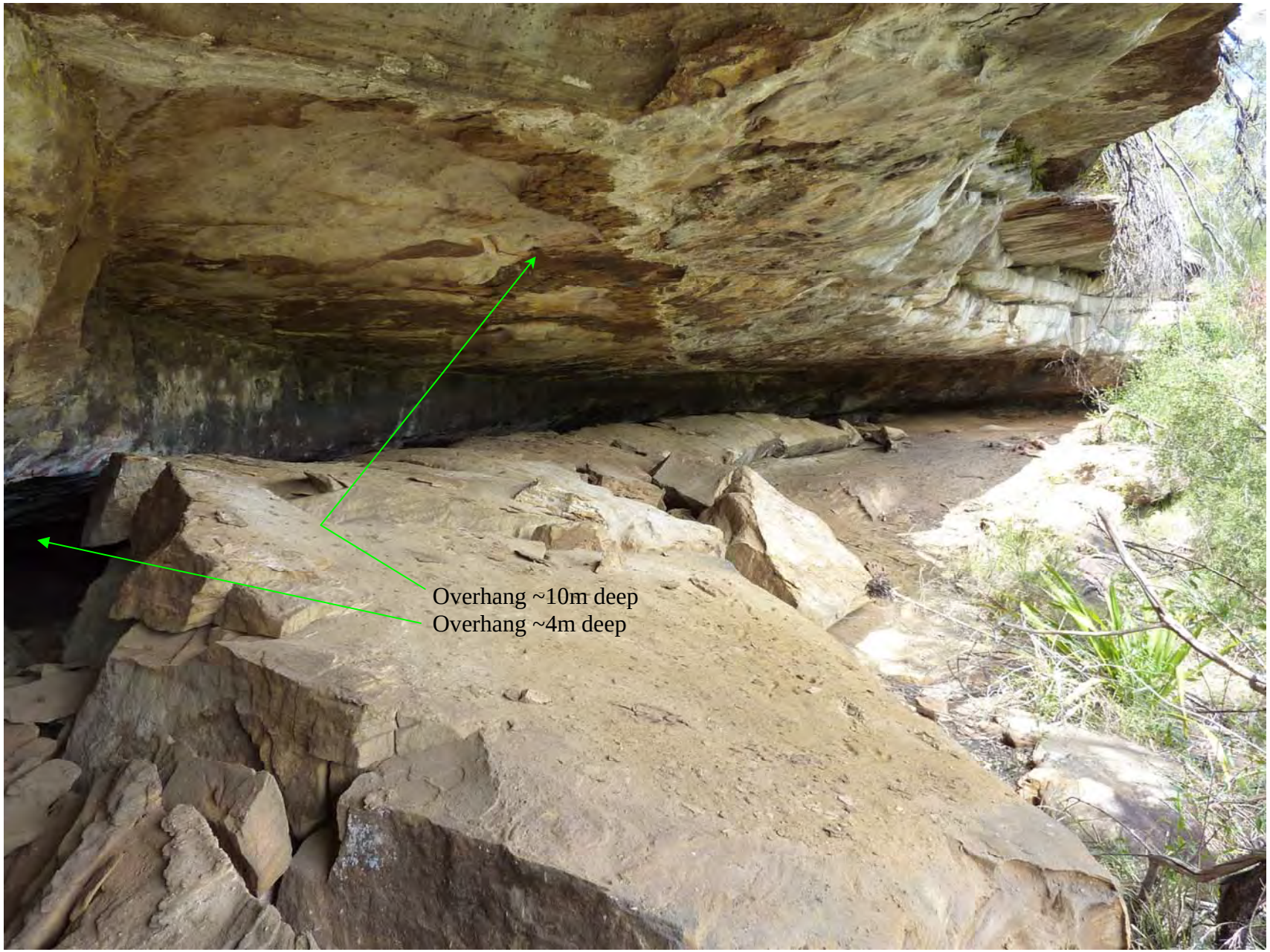

Photo C1-21 Overhang height ~6m,total overhang depth ~14m

Photo C1-22 Large overhang looking north

Photo C1-23 Large overhang looking south

Photo C1-24 Large overhang looking north

Photo C1-25 Large overhang looking north

Photo C1-26 Large overhang looking south

Photo C1-27 Large overhang looking north

Photo C1-28 Large overhang looking south

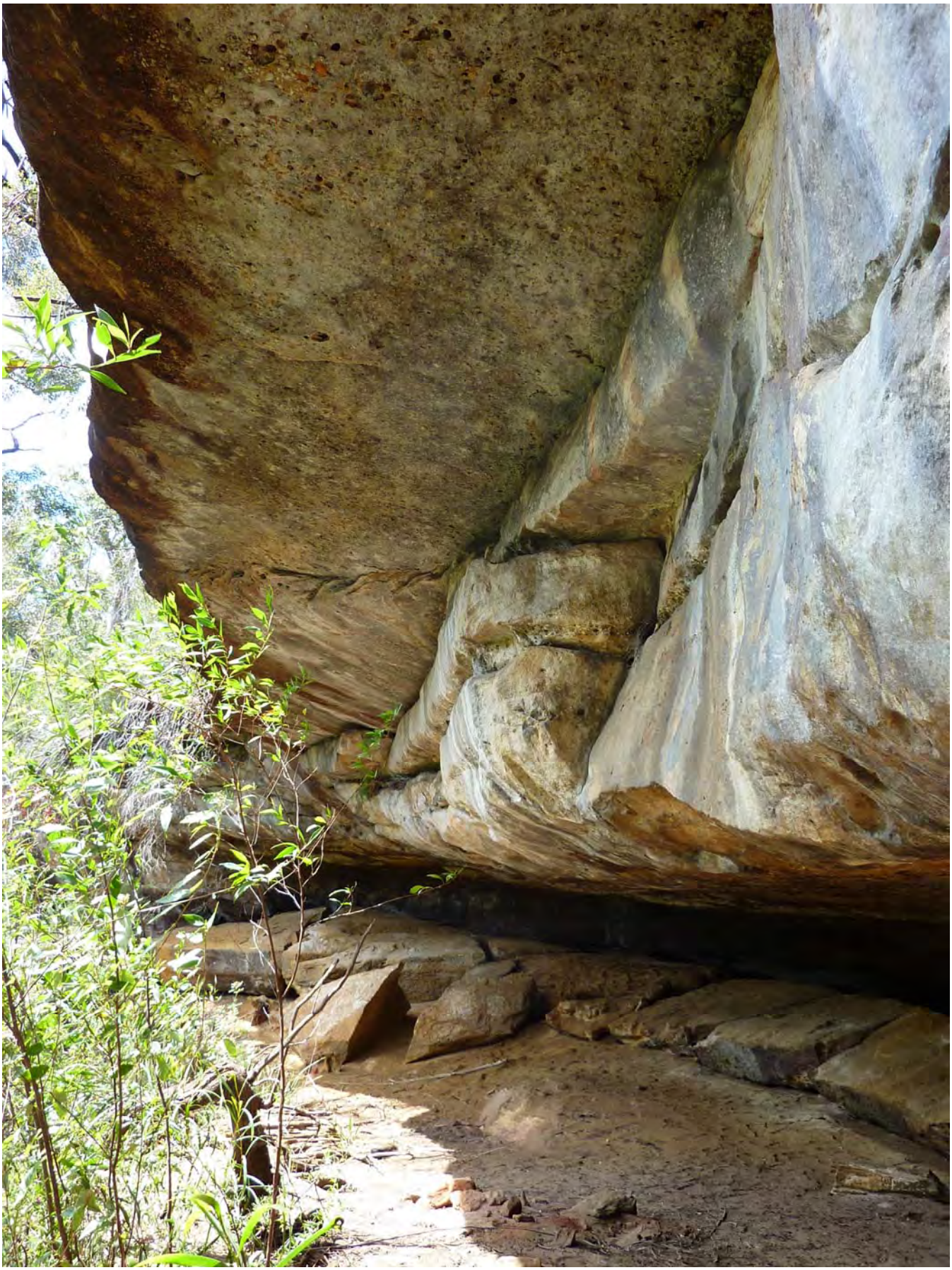

Photo C1-29 Large overhang looking north

Photo C1-30 Southern end of overhang, height ~2m, depth ~6m

Photo C1-31 Southern end of overhang, height ~2m, depth ~6m

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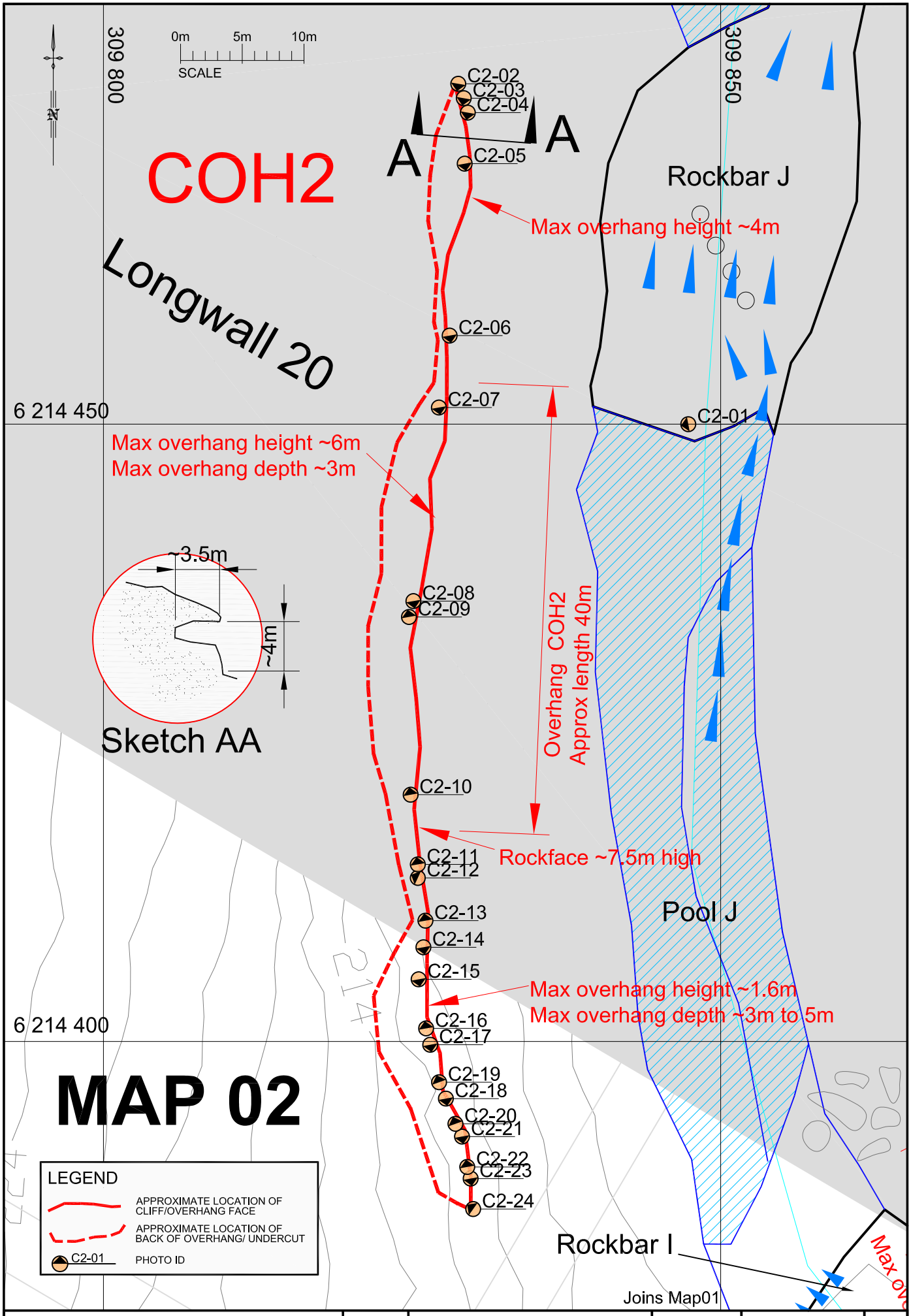

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LONGWALLS 23-27
CLIFF No. COH2

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map02	01

Site COH2 Photographic Record

Photo C2-01 Photo from centre of Waratah Rivulet at north end of Pool J

Photo C2-02 Northern end of overhang, height ~4m, depth ~3.5m

Photo C2-03 Northern end of overhang, height ~4m, depth ~3.5m

Photo C2-04 Underside of overhang, height ~4m, depth ~3.5m

Photo C2-05 Beneath overhang looking south

Photo C2-06 Northern end of main overhang

Photo C2-07 Looking south, overhang height ~6m, depth ~3m

Photo C2-08 Looking south, overhang height ~6m, depth ~3m

Photo C2-09 Looking north, overhang height ~6m, depth ~3m

Photo C2-10 Southern end of main overhang

Photo C2-11 Rock ledge between overhangs, ~7.5m high

Photo C2-12 Overhang, height ~1.5m, depth ~3m

Photo C2-13 Outside face of overhang

Photo C2-14 Overhang, height ~1.5m, depth ~3m

Photo C2-15 Overhang, height ~1.5m, depth ~3m

Photo C2-16 Overhang, height ~1.5m, depth ~3m

Photo C2-17 Overhang, height ~1.5m, depth ~3m

Photo C2-18 Overhang, height ~1.5m, depth ~5m

Photo C2-19 Overhang, height ~1.5m, depth ~5m

Photo C2-20 Between overhangs

Photo C2-21 Between overhangs

Photo C2-22 Overhang, height ~2.2m, depth ~6m

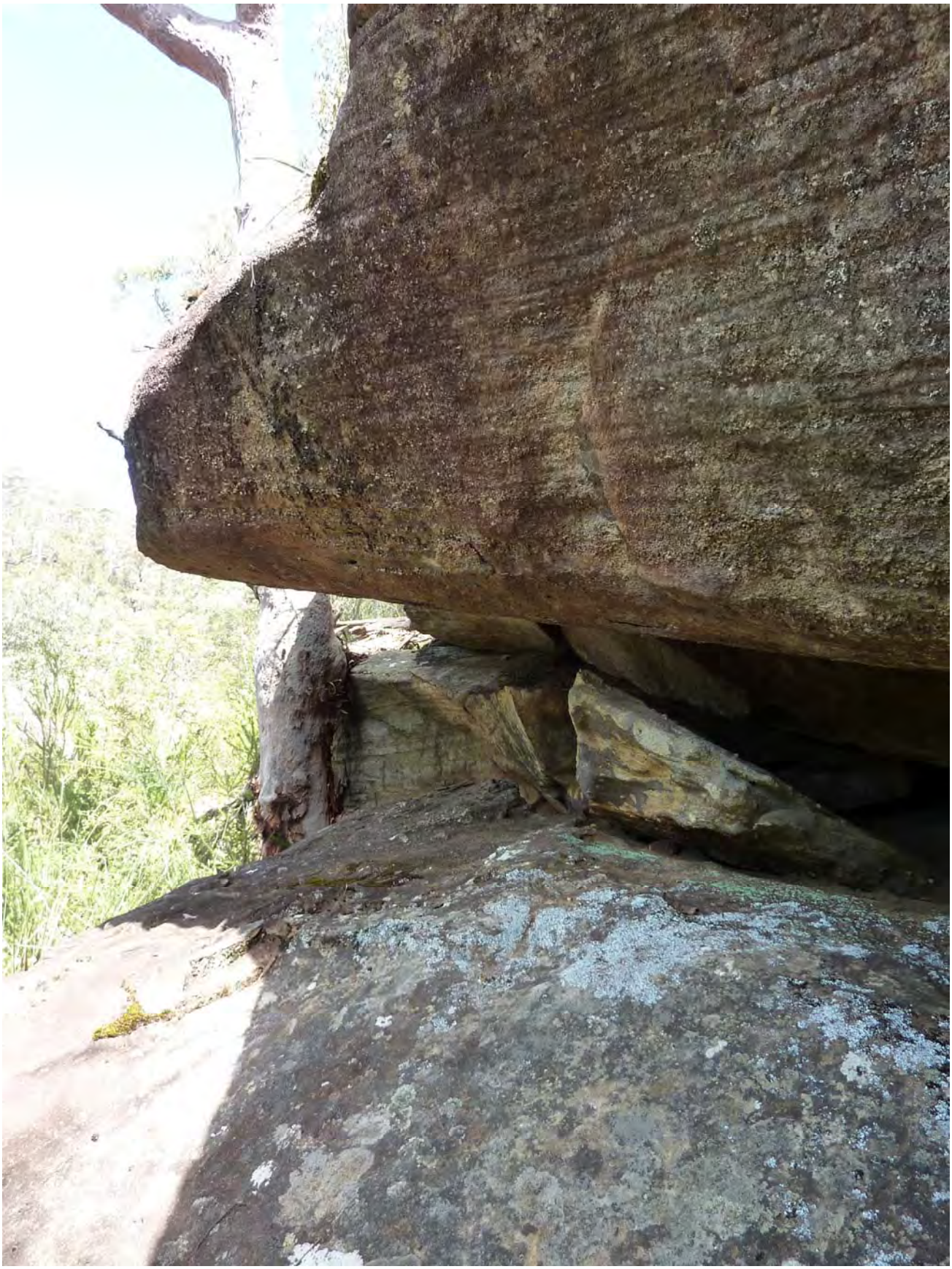

Photo C2-23 Overhang, height ~2.2m, depth ~6m, looking at southern end

Photo C2-24 Overhang, height ~2.2m, depth ~6m

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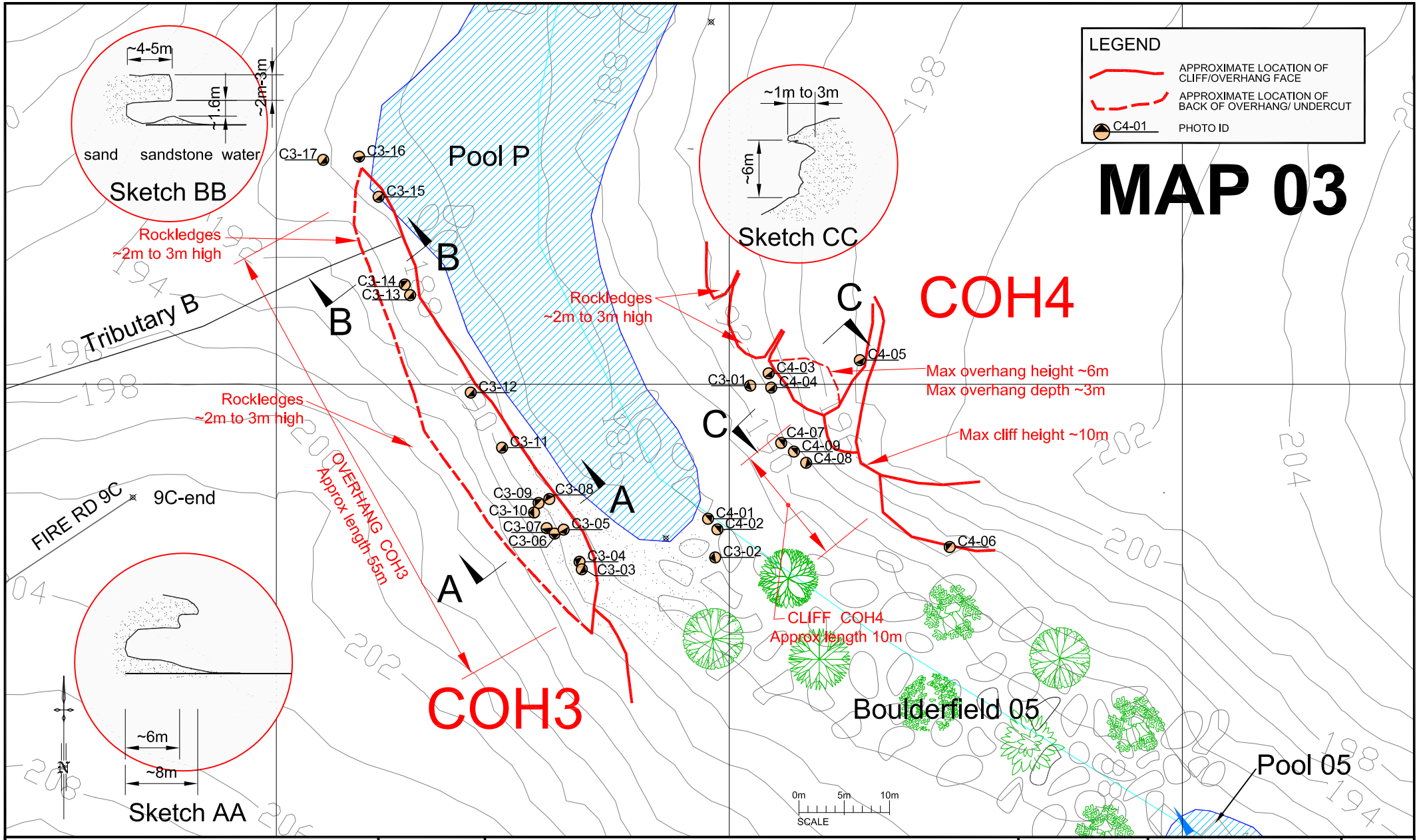

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Site COH3 Photographic Record

Photo C3-01 View from opposite bank

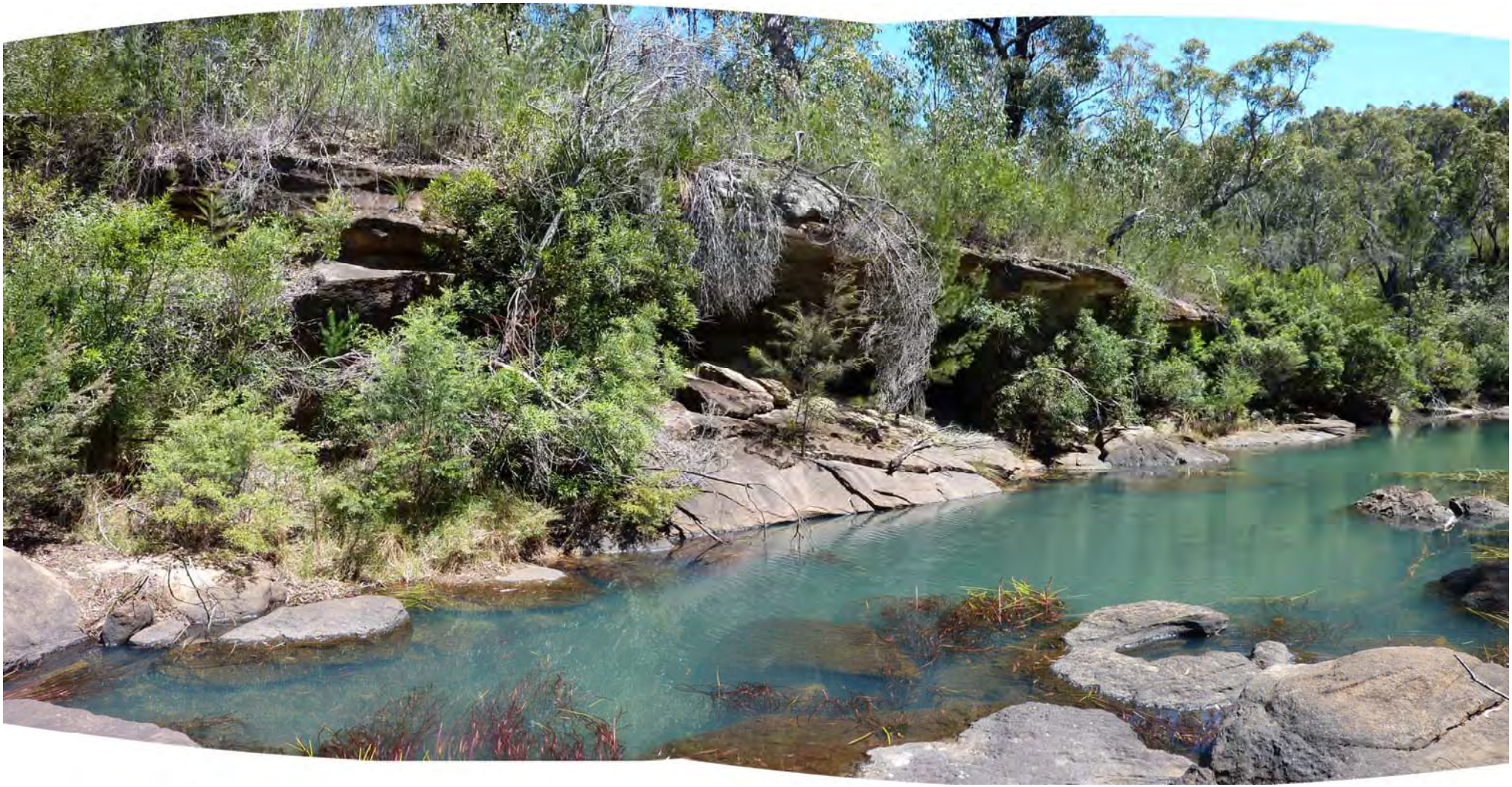

Photo C3-02 View from centre of Waratah Rivulet

Photo C3-03 Southeast end of overhang, height ~3m to ~5m, depth ~7m

Photo C3-04 Southeast end of overhang, height ~3m to ~5m, depth ~7m

Photo C3-05 Below overhang looking south east

Photo C3-06 Below overhang looking south east

Photo C3-07 Below overhang looking south east

Photo C3-08 Below overhang looking north west

Photo C3-09 Below overhang looking north west

Photo C3-10 Below overhang looking west

Photo C3-11 Below overhang looking south east

Photo C3-12 Below overhang looking south east

Photo C3-13 Below overhang looking south east

Photo C3-14 Below overhang looking north west, height ~1.6m, depth ~4m to ~5m

Photo C3-15 North west end of overhang looking south east

Photo C3-16 North west end of overhang, tributary flows over top of overhang

Photo C3-17 Above the north west end of the overhang

Site COH4 Photographic Record

Photo C4-01 View from Waratah Rivulet

Photo C4-02 View from Waratah Rivulet

Photo C4-03 Overhang, height ~6m, depth ~3m

Photo C4-04 Overhang, height ~6m, depth ~3m

Photo C4-05 Overhang depth ~1m, height ~10m

Photo C4-06 South eastern corner of COH4

Photo C4-07 Overhang, height ~6m, depth ~3m

Photo C4-08 Overhang depth ~1m, height ~10m

Photo C4-09 Overhang, height ~6m, depth ~3m

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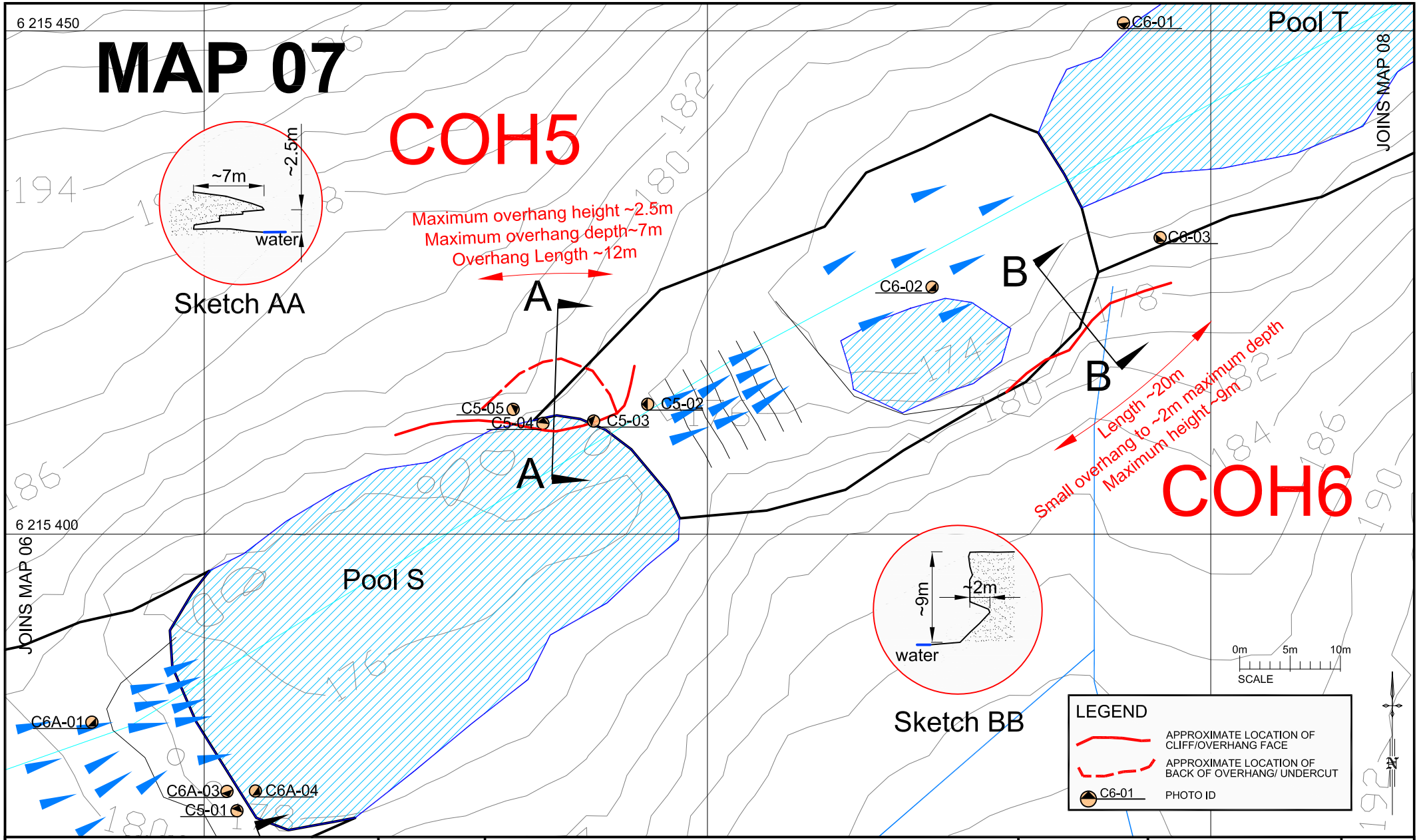

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LONGWALLS 23-27

CLIFF Nos. COH5 & CHO6

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map07	01

Site COH5 Photographic Record

Photo C5-01 View from Upstream end of Pool S Looking Downstream

Photo C5-02 View of Overhang Looking Upstream

Photo C5-03 Overhang, height ~2.5m, depth ~7m, Looking Upstream

Photo C5-04 Overhang, height ~2.5m, depth ~7m, Looking North

Photo C5-05 Overhang, height ~2.5m, depth ~7m, Looking Downstream

Site COH6 Photographic Record

Photo C6-01 View Looking Upstream

Photo C6-02 View Looking Downstream

Photo C6-03 View Looking Upstream

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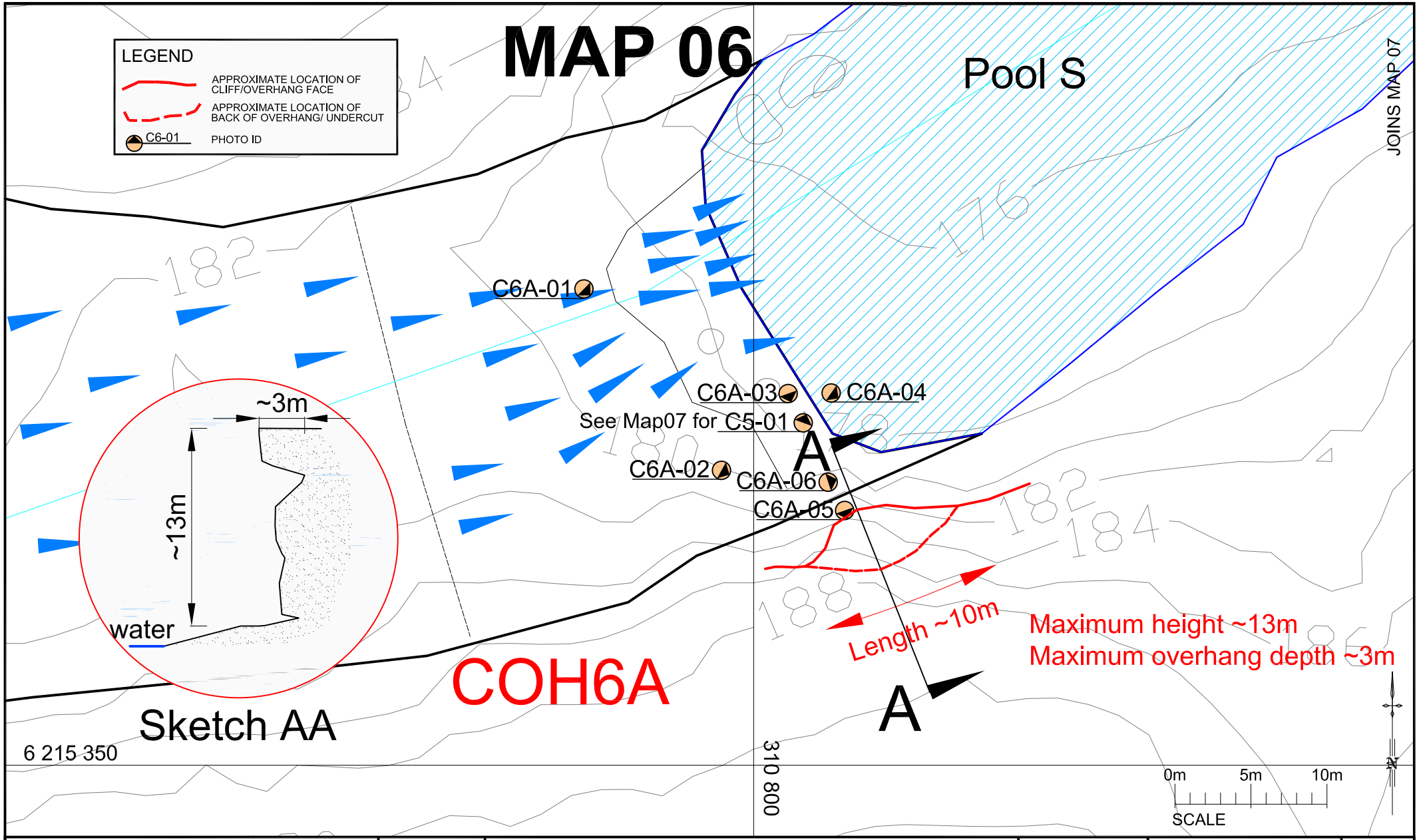

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Site COH6A Photographic Record

Photo C6A-01 View Looking South East

Photo C6A-02 Cliff, Maximum Height ~13m, Overhang Depth ~3m

Photo C6A-03 Cliff, Maximum Height ~13m, Overhang Depth ~3m

Photo C6A-04 Cliff, Maximum Height ~13m, Overhang Depth ~3m

Photo C6A-05 Cliff, Maximum Height ~13m, Overhang Depth ~3m

Photo C6A-06 Seepage Downstream from Cliff

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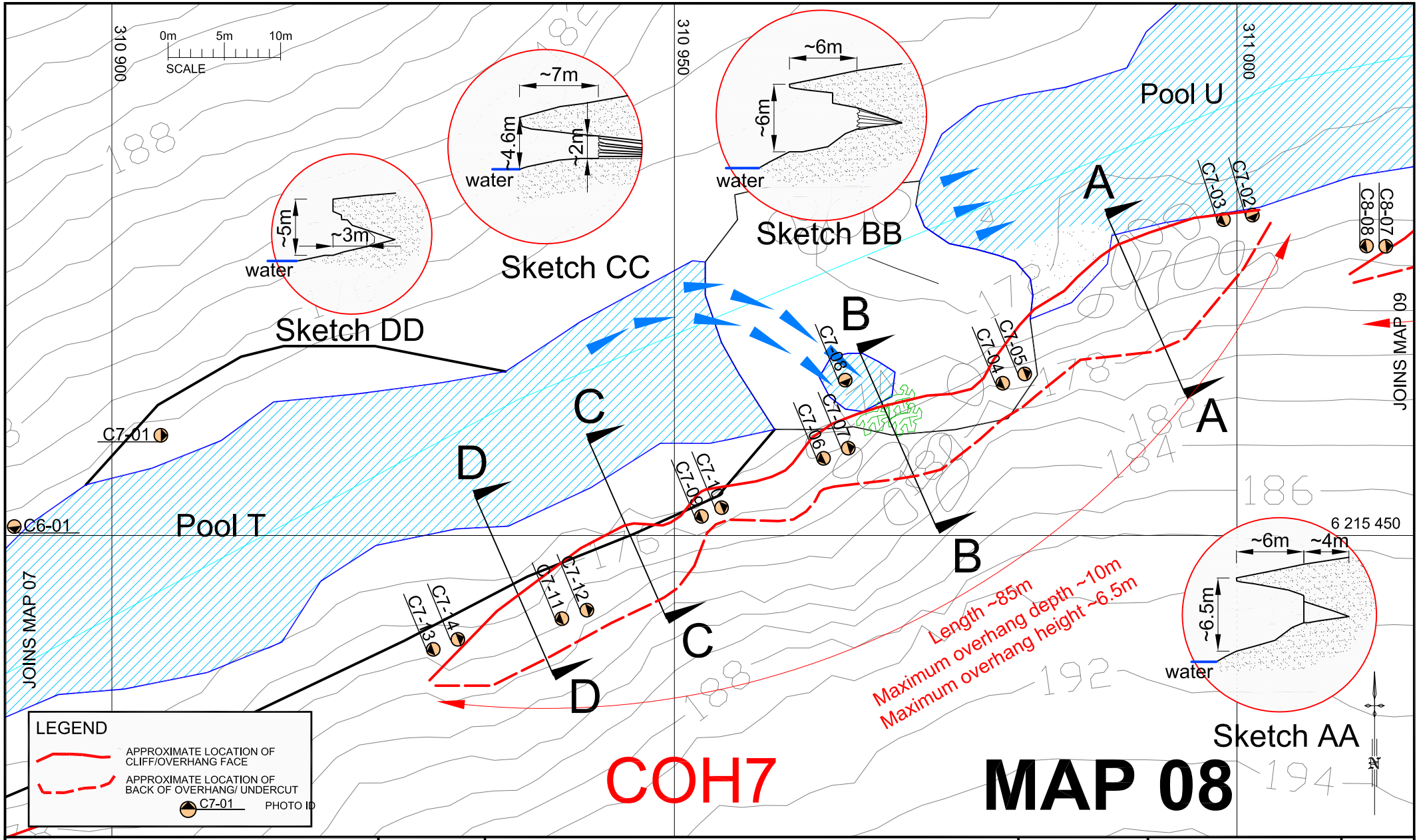

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Site COH7 Photographic Record

Photo C7-01 View Looking Downstream

Photo C7-02 Eastern End Looking South East

Photo C7-03 Eastern End Looking Upstream

Photo C7-04 Overhang, Looking Upstream

Photo C7-05 Overhang depth ~10, Looking Downstream

Photo C7-06 Overhang, Looking Upstream

Photo C7-07 Overhang Looking Downstream

Photo C7-08 Cross Bedded Strata at Back of Overhang

Photo C7-09 Overhang Looking Upstream

Photo C7-10 Overhang ~7m Depth

Photo C7-11 Overhang ~ 3m Depth

Photo C7-12 Overhang ~7m Depth

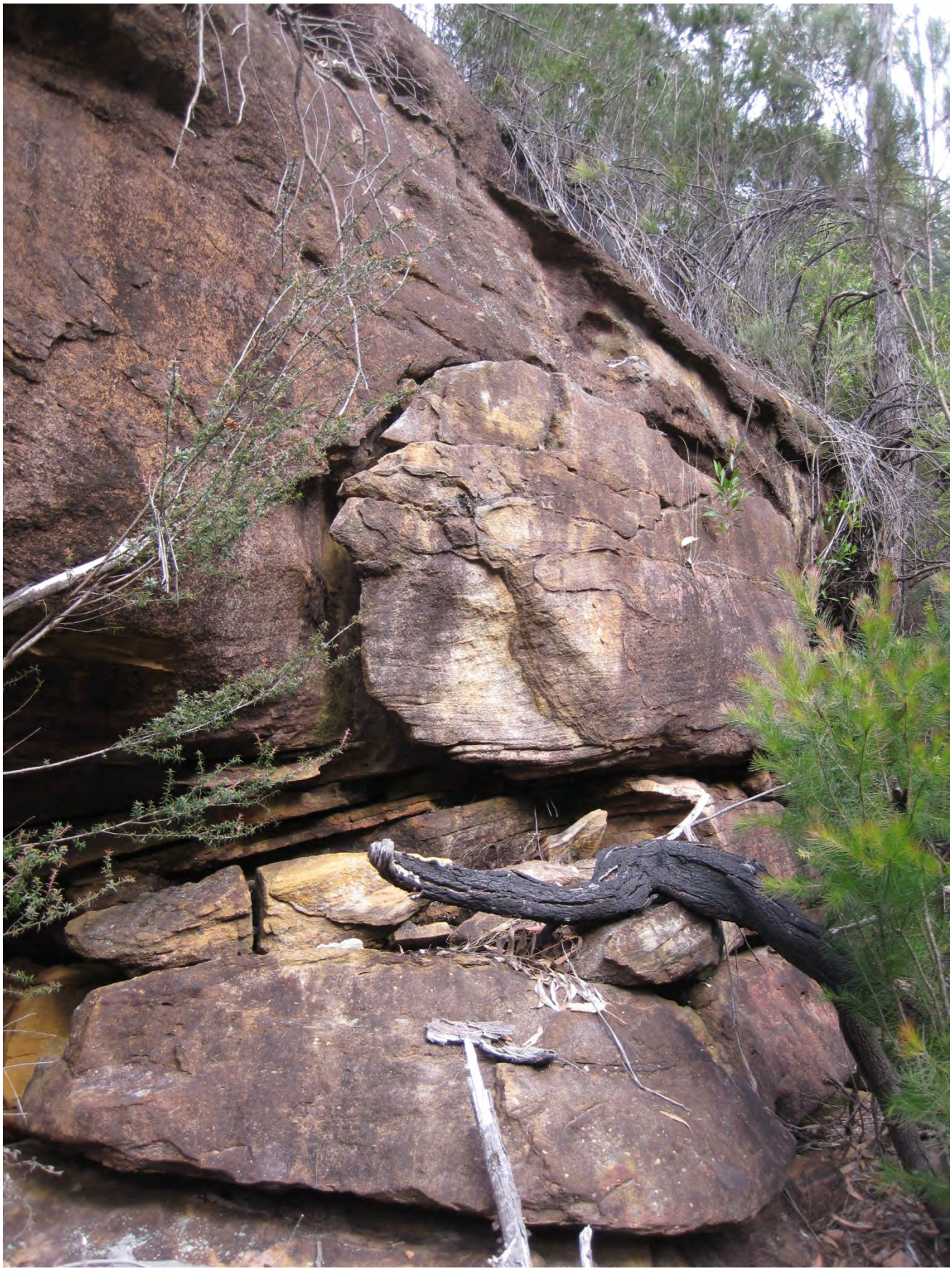

Photo C7-13 Western End of Overhang Looking Upstream

Photo C7-14 Western End of Overhang Looking Downstream

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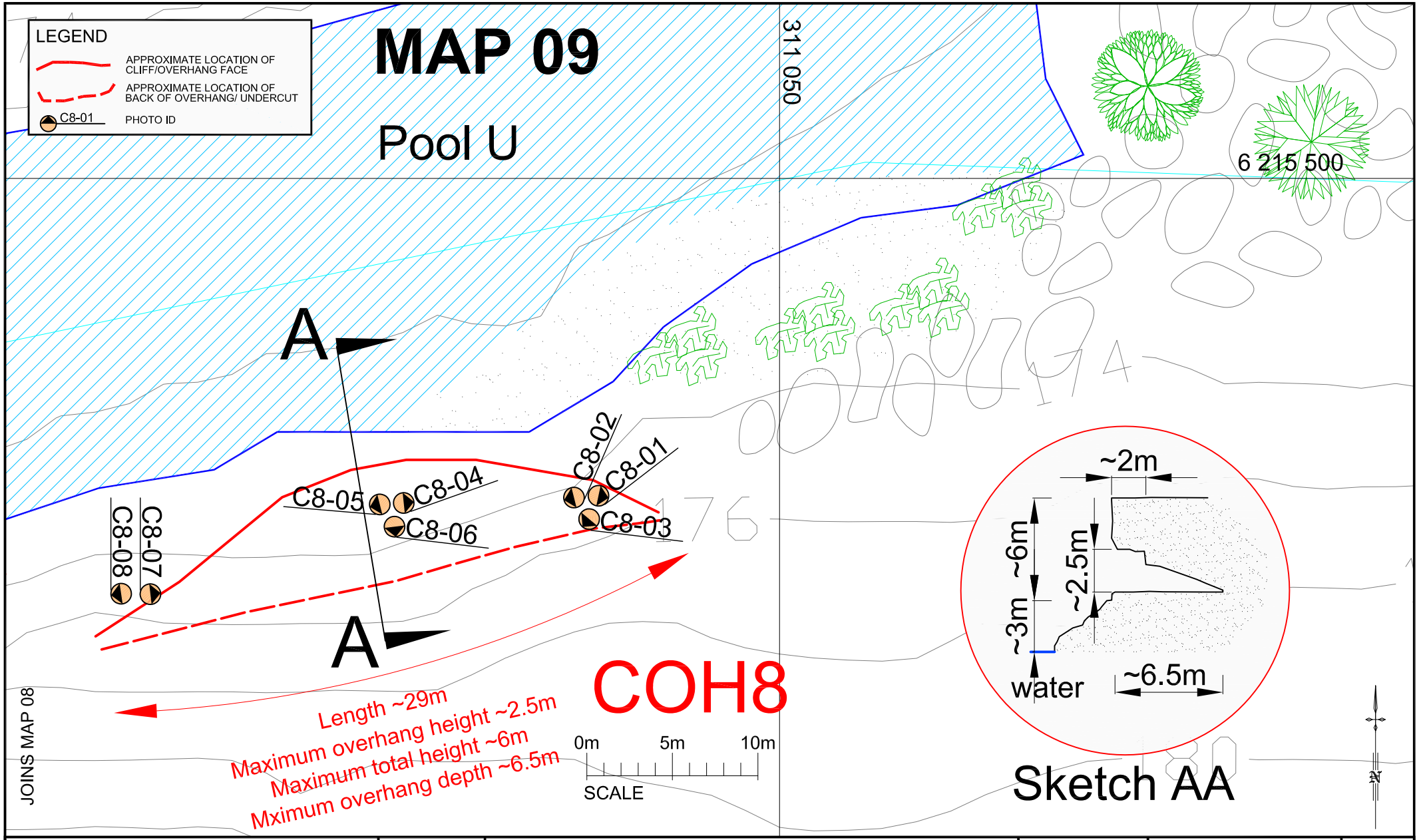

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METROPOLITAN COLLIERY
LONGWALLS 23-27

CLIFF No. COH8

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map09	01

Site COH8 Photographic Record

Photo C4-01 Eastern End Looking Downstream

Photo C4-02 Eastern End Looking Upstream

Photo C4-03 Eastern End Looking Upstream

Photo C4-04 Overhang, ~6.5m, Looking Downstream

Photo C4-05 Overhang, ~6.5m, Looking Upstream

Photo C4-06 Back of Overhang

Photo C4-07 Western End Looking Downstream

Photo C4-09 Western End Looking Upstream

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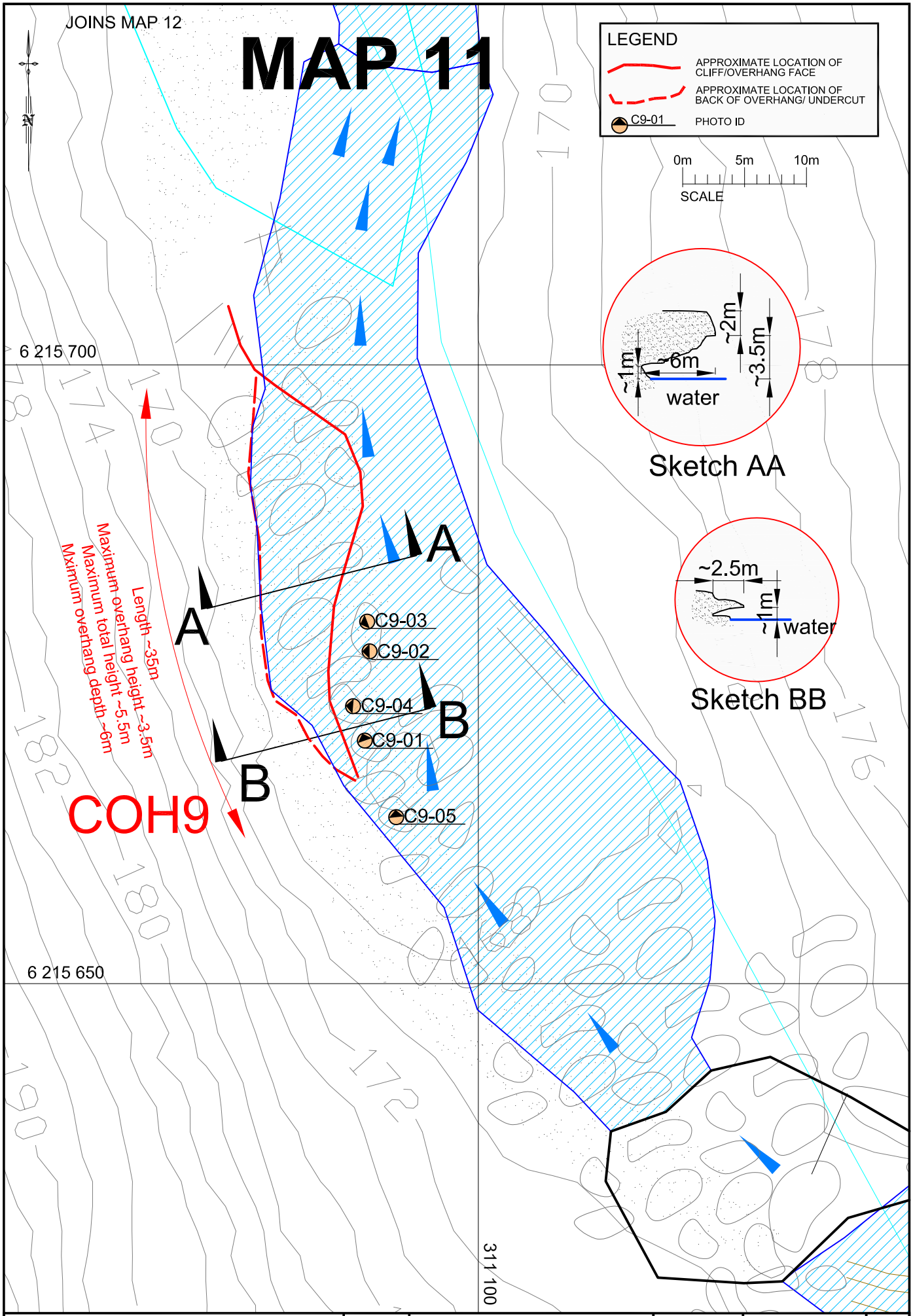

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Site COH9 Photographic Record

Photo C9-01 View Looking Downstream

Photo C9-02 View Looking West

Photo C9-03 Back of Overhang

Photo C9-04 Back of Overhang

Photo C9-05 View Looking Downstream

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MAP 12

COH10

311 050

311 100

6 215 850

6 215 800

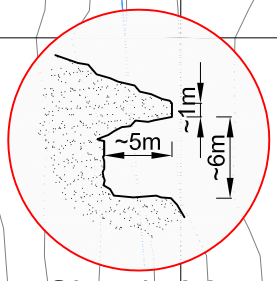
6 215 750

C10-03
C10-04
C10-06
C10-05
C10-07
C10-08
C10-09
C10-10
C10-11
C10-12
C10-14
C10-13
C10-15
C10-16
C10-17
C10-02
C10-01

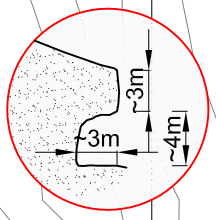
A
A

B
B

Length ~100m
Maximum overhang height ~6m
Maximum total height ~7m
Maximum overhang depth ~5m



Sketch AA



Sketch BB

JOINS MAP 11

LEGEND

APPROXIMATE LOCATION OF CLIFF/OVERHANG FACE

APPROXIMATE LOCATION OF BACK OF OVERHANG/ UNDERCUT

C10-01 PHOTO ID

N

0m 5m 10m
SCALE

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METROPOLITAN COLLIERY
LONGWALLS 23-27
CLIFF No. COH10

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map12	01

Site COH10 Photographic Record

Photo C10-01 View Looking Downstream

Photo C10-02 View Looking Downstream

Photo C10-03 View from Northern End Looking Upstream

Photo C10-04 Back of Overhang

Photo C10-05 Overhang ~5m Maximum Depth

Photo C10-06 Overhang ~5m Maximum Depth

Photo C10-07 Overhang ~5m Maximum Depth

Photo C10-08 View Looking Upstream

Photo C10-09 View Looking Upstream

Photo C10-10 Overhang Looking Downstream

Photo C10-11 View Looking Upstream

Photo C10-12 View Looking Downstream

Photo C10-13 View Looking Upstream

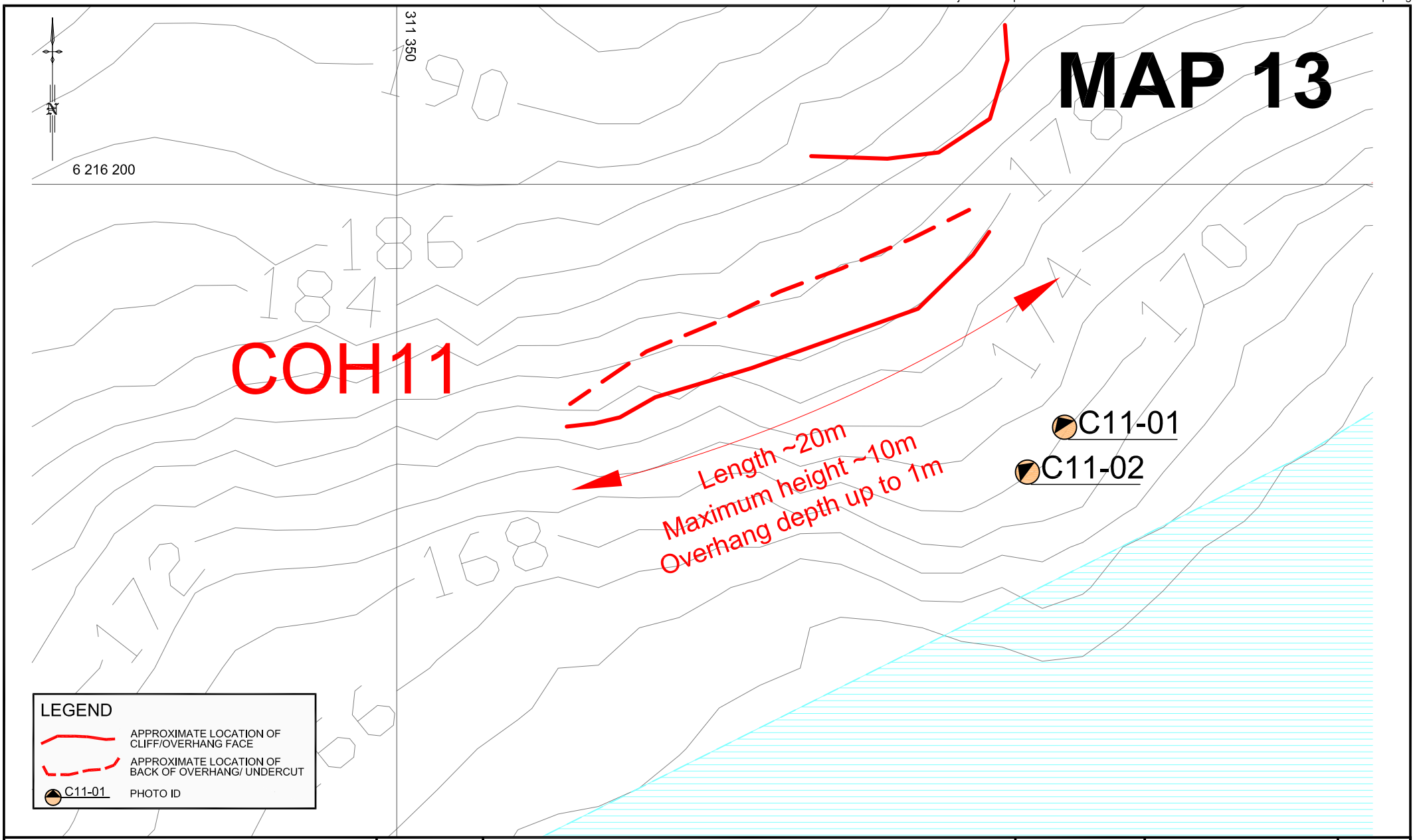
Photo C10-14 View Looking Downstream

Photo C10-15 Overhang ~3m Maximum Depth

Photo C10-16 Overhang ~3m Maximum Depth

Photo C10-17 View Looking North West

MAP 13



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HELENSBURGH COAL
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LONGWALL 304

CLIFF No. COH11

DATE:	DRAWING No:	Rev No
1 Mar 2019	MSEC1009 - Map13	01

Site COH11 Photographic Record

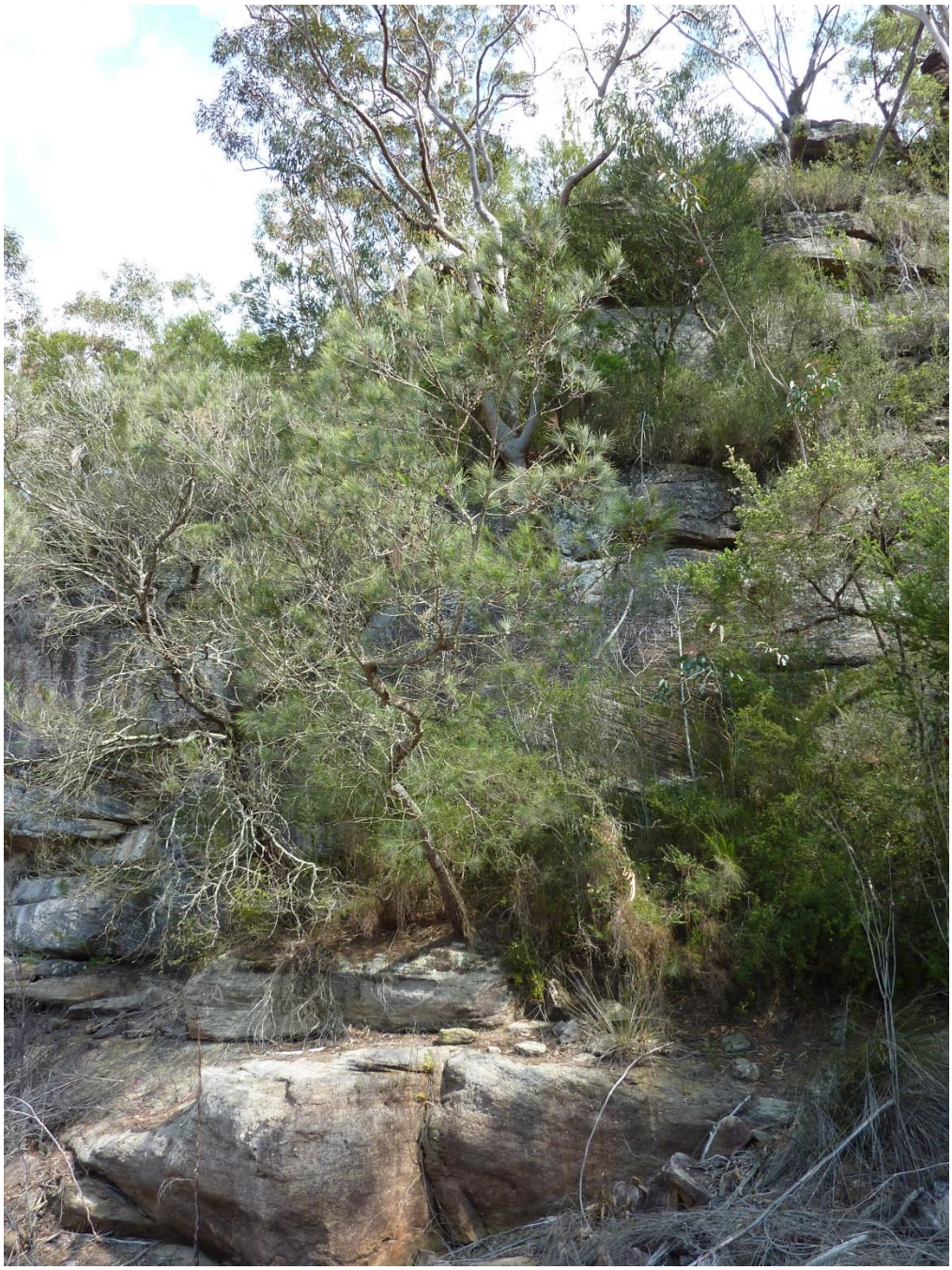

Photo C11-01 Western End Looking North West

Photo C11-02 Eastern End Looking North West

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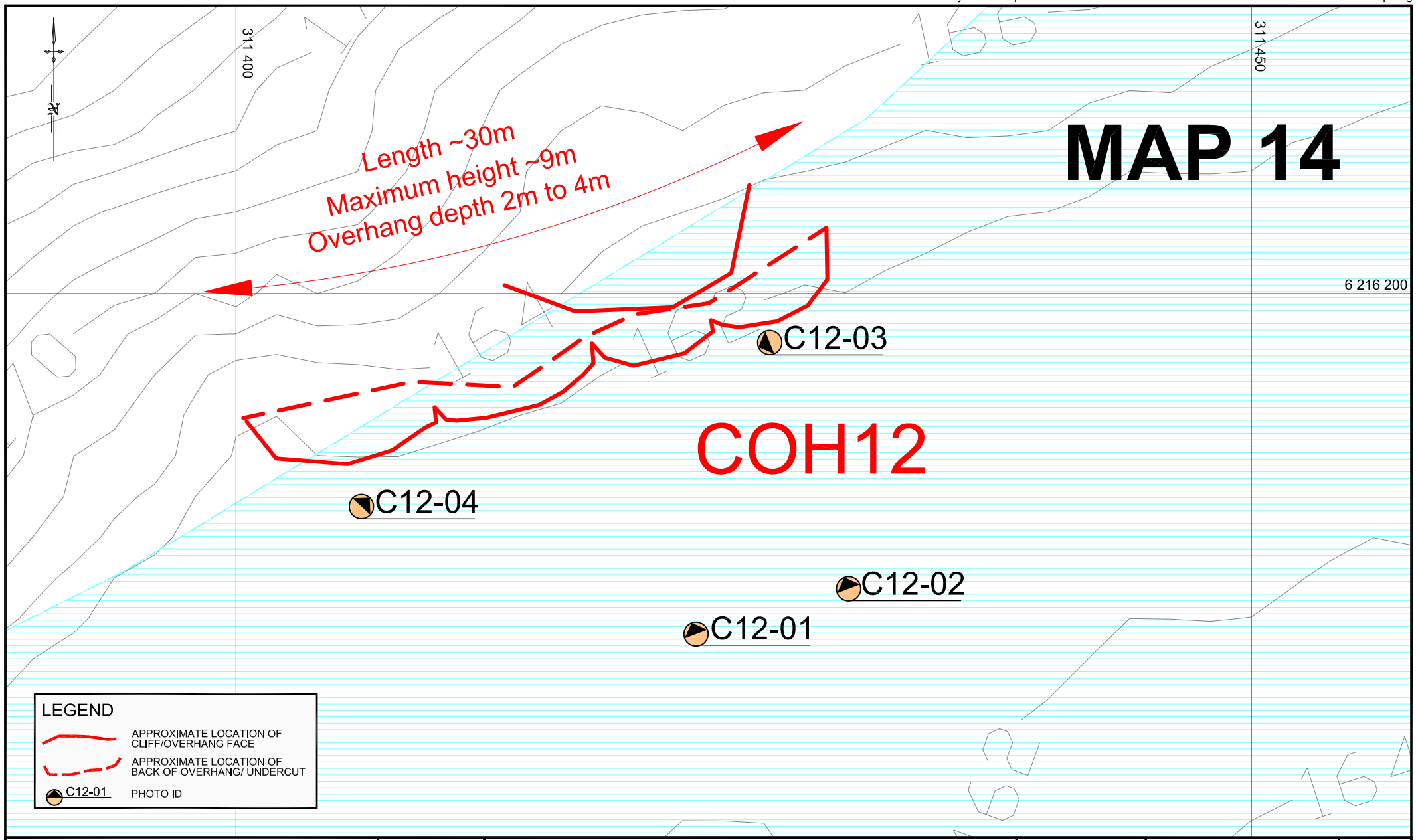

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LONGWALL 304

CLIFF No. COH12

DATE:	DRAWING No:	Rev No
1 Mar 2019	MSEC1009 - Map14	01

Site COH12 Photographic Record

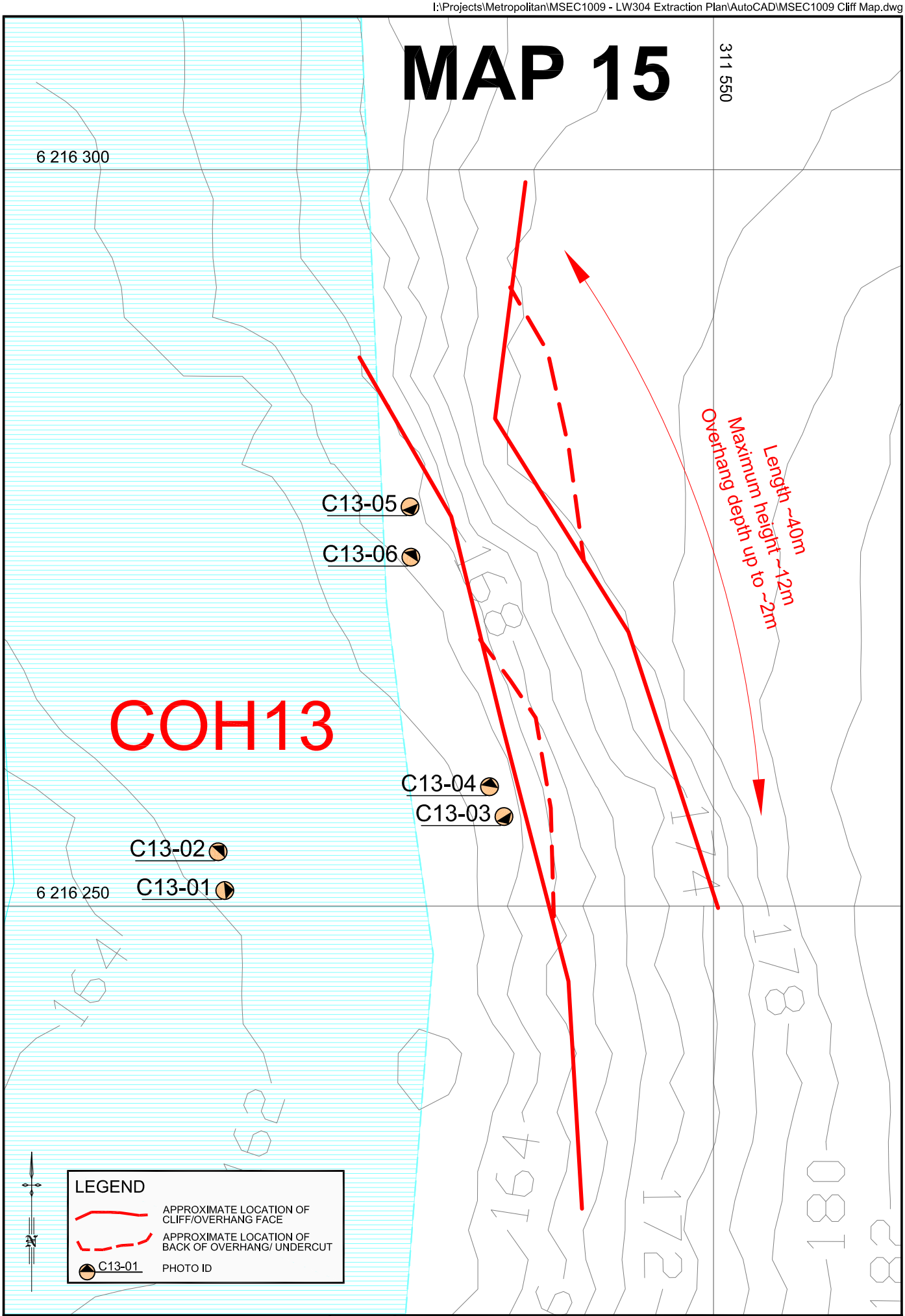
Photo C12-01 View Looking North West

Photo C12-02 View Looking North West

Photo C12-03 View Looking Downstream

Photo C12-04 View Looking Upstream

MAP 15



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HELENSBURGH COAL
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LONGWALL304
CLIFF No. CHO13

DATE:	DRAWING No:	Rev No
1 Mar 2019	MSEC1009 - Map15	01

Site COH13 Photographic Record

Photo C13-01 View Looking East

Photo C13-02 View Looking North East

Photo C13-03 South End Looking Upstream

Photo C13-04 South End Looking Downstream

Photo C13-05 North End Looking Upstream

Photo C13-06 North End Looking Downstream

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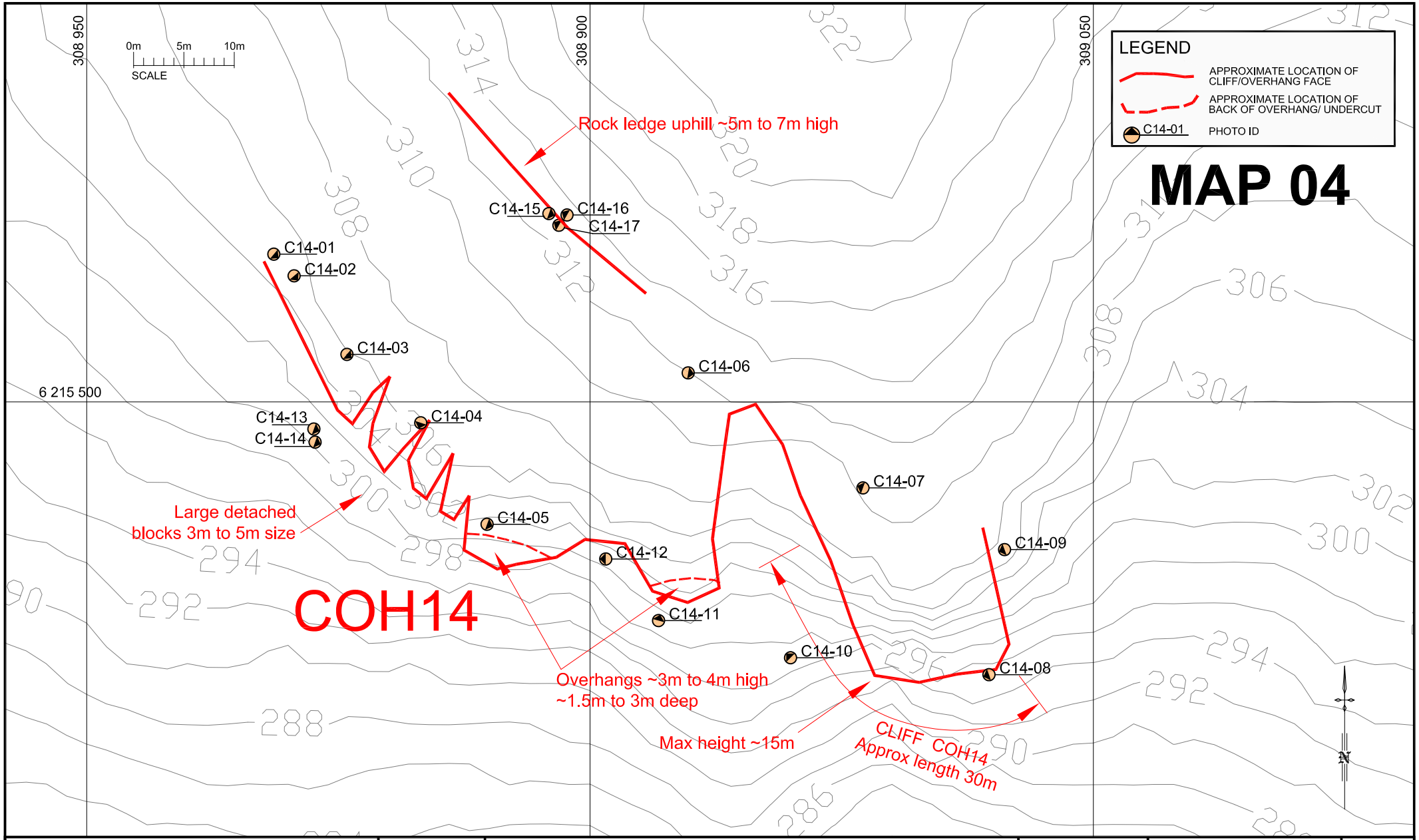

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Site COH14 Photographic Record

Photo C14-01 Western end of COH14

Photo C14-02 Detached blocks at western end of COH14

Photo C14-03 Detached blocks at western end of COH14

Photo C14-04 Detached blocks at western end of COH14

Photo C14-05 Rock face ~8m high

Photo C14-06 Cliff ~10m to ~15m high

Photo C14-07 From top of cliff looking west

Photo C14-08 Looking at south east side of COH14

Photo C14-09 Western side of COH14

Photo C14-10 Overhang, height ~4m, depth ~1.5m to ~3m

Photo C14-11 Overhang, height ~4m, depth ~1.5m to ~3m

Photo C14-12 Looking west to overhang, height ~4m, depth ~1.5m to ~3m

Photo C14-13 Overhangs, height ~3m, depth ~1.5m to ~3m

Photo C14-14 Overhangs, height ~3m, depth ~1.5m to ~3m

Photo C14-15 Rock ledges uphill of COH14, height ~5m to ~7m

Photo C14-16 Rock ledges uphill of COH14, height ~5m to ~7m

Photo C14-17 Rock ledges uphill of COH14, height ~5m to ~7m

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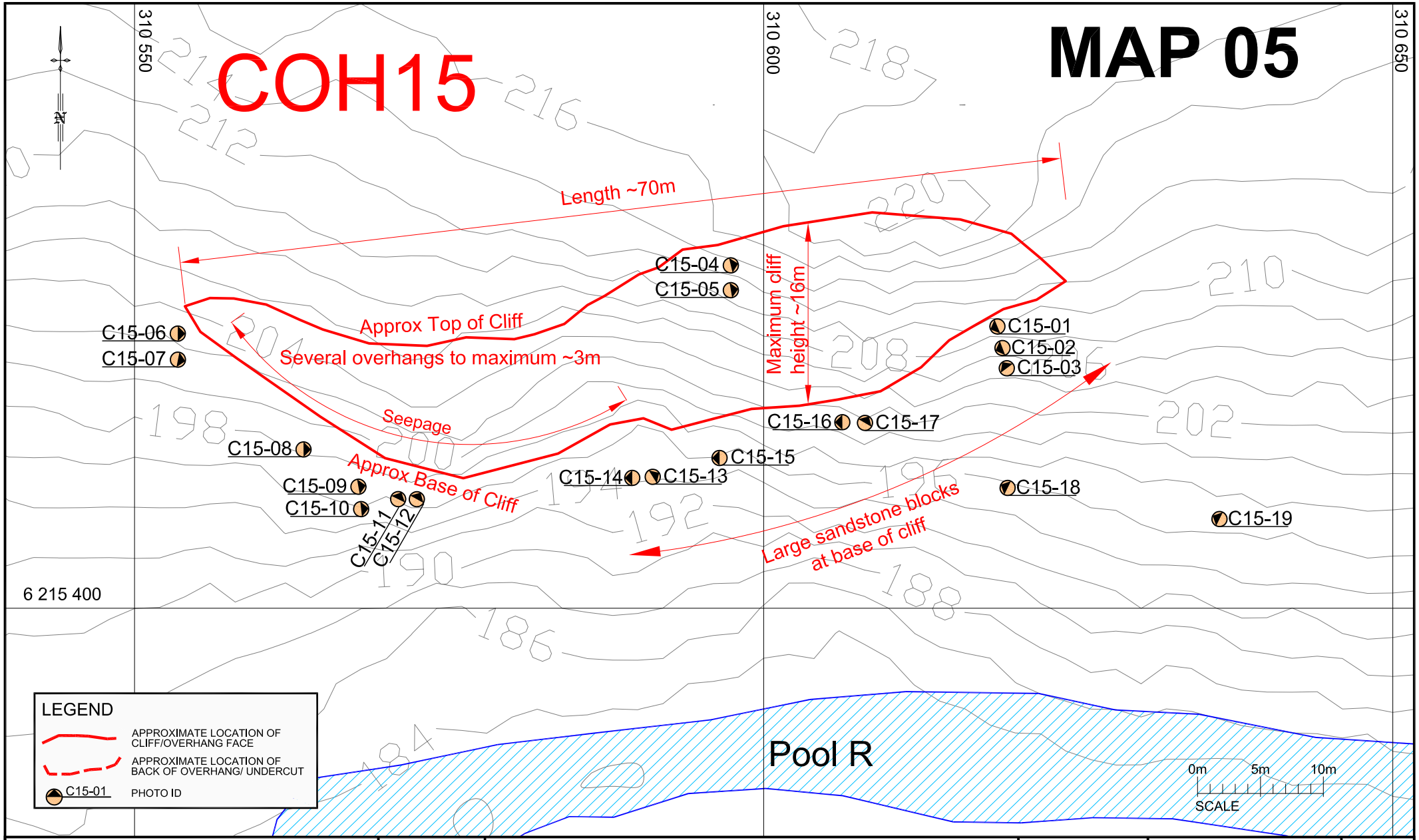

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LONGWALLS 23-27

CLIFF No. COH15

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map05	01

Site COH15 Photographic Record

Photo C15-01 Eastern End Looking Upstream

Photo C15-02 Eastern End Looking Upstream

Photo C15-03 Eastern End – Existing Fracture in Rock

Photo C15-04 Top of Cliff Looking East

Photo C15-05 Top of Cliff Looking East

Photo C15-06 Western End Looking Downstream

Photo C15-07 Western End Looking Downstream

Photo C15-08 View Looking Downstream

Photo C15-09 View Looking Downstream

Photo C15-10 View Looking Downstream

Photo C15-11 View of Overhang – Maximum ~3m depth

Photo C15-12 View of Overhang – Maximum ~3m depth

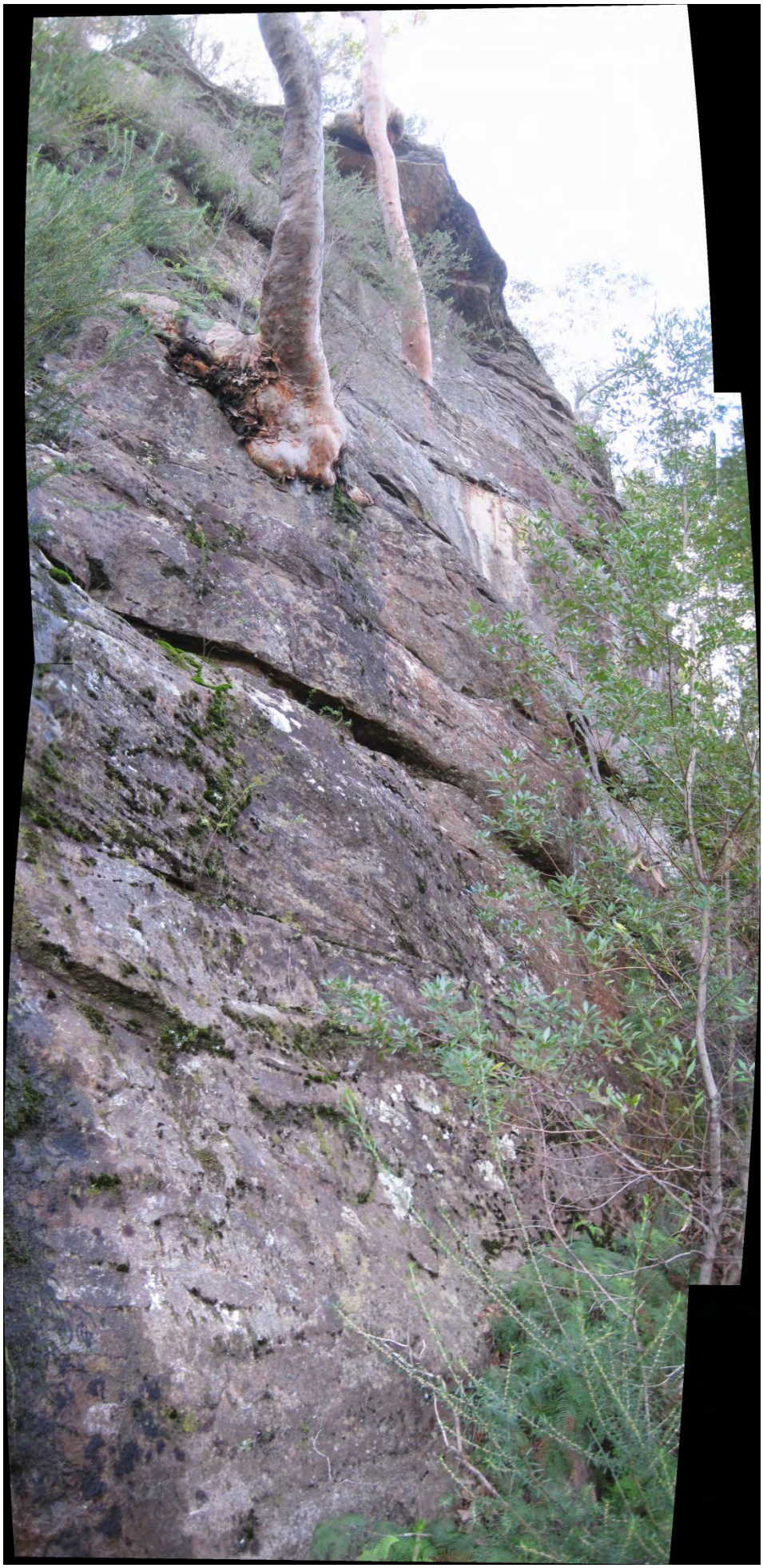


Photo C15-13 Cliff Maximum height ~16m

Photo C15-14 View Looking Upstream

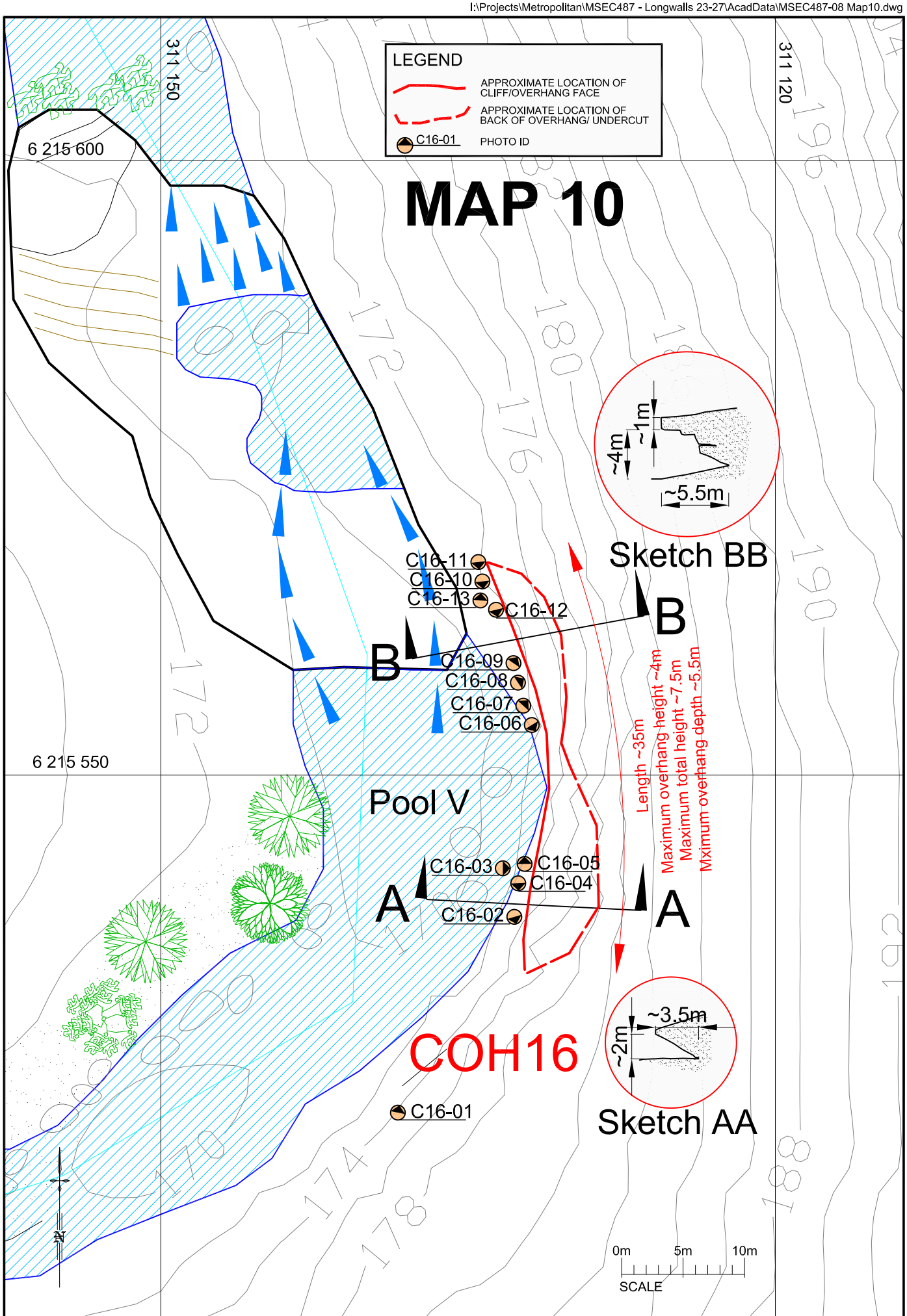
Photo C15-15 View Looking Upstream

Photo C15-16 View Looking Upstream

Photo C15-17 Cliff Face

Photo C15-18 View Looking Upstream

Photo C15-19 View Looking North West Towards Cliff



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HELENSBURGH COAL
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LONGWALLS 23-27
CLIFF No. COH16

DATE:	DRAWING No:	Rev No
23-July-2013	MSEC487-08 Map10	01

Site COH16 Photographic Record

Photo C16-01 View Looking Downstream

Photo C16-02 Southern End Looking Upstream

Photo C16-03 Southern End Back of Overhang

Photo C16-04 Overhang Looking Upstream

Photo C16-05 Overhang Looking Downstream

Photo C16-06 View Looking Upstream

Photo C16-07 Back of Overhang

Photo C16-08 View Looking Downstream

Photo C16-09 View Looking Downstream

Photo C16-10 Overhang Looking Upstream

Photo C16-11 Overhang Looking Upstream

Photo C16-12 View Looking Upstream

Photo C16-13 View Looking Downstream

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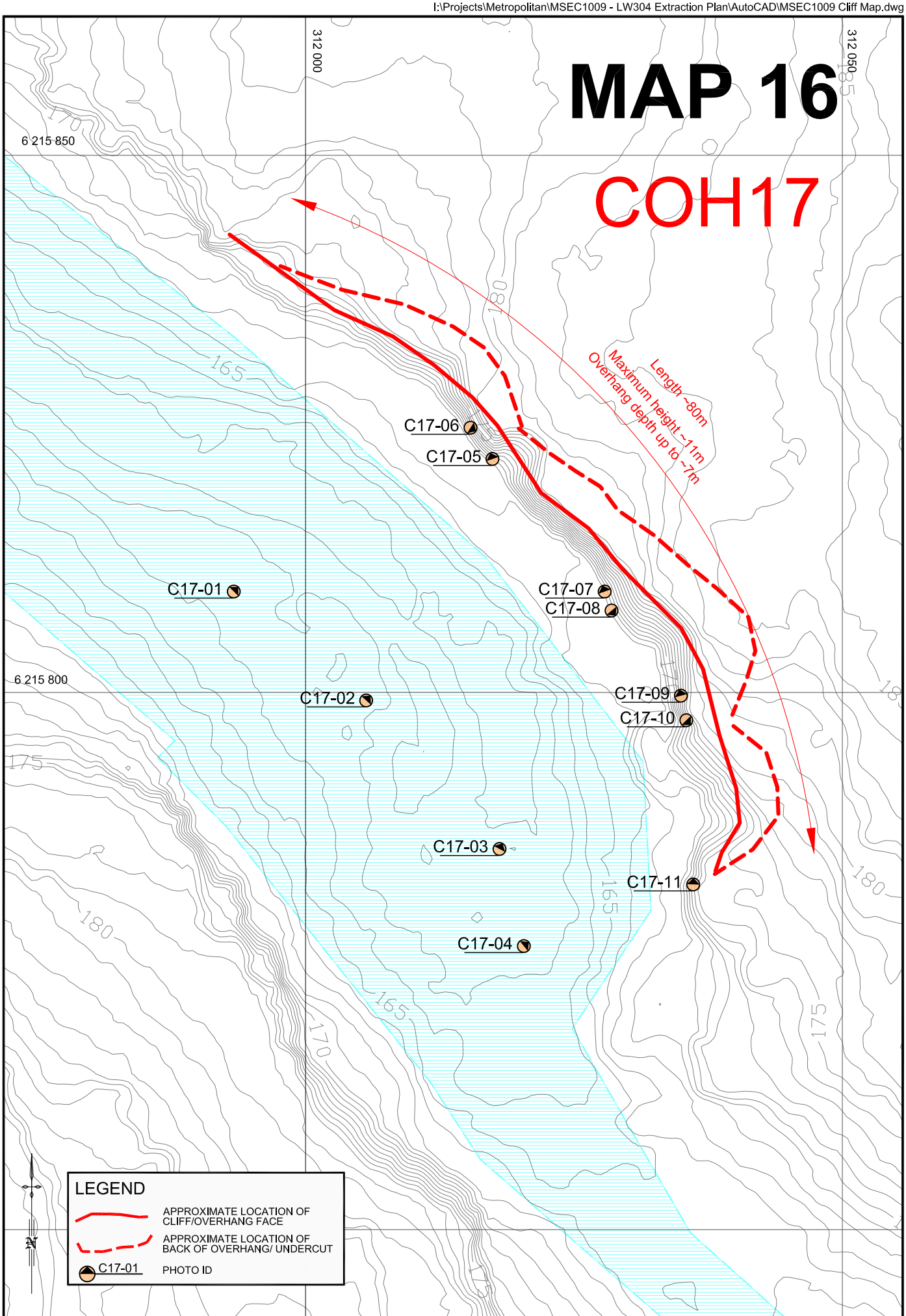

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METROPOLITAN COLLIERY
LONGWALL304
CLIFF No. CHO17

DATE:	DRAWING No:	Rev No
1 Mar 2019	MSEC1009 - Map16	01

Site COH17 Photographic Record

Photo C17-01 North West End Looking North East

Photo C17-02 Central Area Looking North East

Photo C17-03 South Eastern End Looking North East

Photo C17-04 South Eastern End Looking North East

Photo C17-05 View Looking Downstream

Photo C17-06 View Looking Upstream

Photo C17-07 View Looking Downstream

Photo C17-08 View Looking Upstream

Photo C17-09 View Looking Downstream

Photo C17-10 View Looking Upstream

Photo C17-11 View Looking Downstream

APPENDIX 2

LAND MANAGEMENT PLAN
SUBSIDENCE IMPACT REGISTER AND ASSESSMENT FORM

Land Management Plan – Subsidence Impact Register

Impact Register Number[1]	Land Feature[2]	General Impact Description[3]	Length of Recorded Cliff Instability[4]	Cumulative Length of Recorded Cliff Instability[5]	Does the Impact Exceed the Land Performance Measure? (Yes/No) [5]	Management or Contingency Measures Implemented? (Yes/No) [6]	Were Measures Effective? (Yes/No)[7]
1	Fire Road	Surface tension crack on Fire Road 9C situated adjacent to the ribline of Longwall 20 (between survey pegs C20 and C21). Approximately 10 m long, with maximum width of 20 mm.	N/A	N/A	N/A	No	N/A
2	Rock Ledge	Rock ledge collapse on the Unnamed Tributary.	N/A	N/A	N/A	No	N/A
3	Cliff	Vertical tension crack on the cliff face of site COH2 along with a small rock fall. Tension crack was 50 mm x 15 m and the rock fall was approximately 1.5 m long, 0.5 m wide and approximately 0.5 m^3. No water seepage was observed.	1.5 m	1.5 m	No	No	N/A
4	Rock Ledge	Rock ledge collapse at Pool TB-M on Tributary B.	N/A	N/A	N/A	No	N/A
5	Rock Ledge	Surface cracking and rock fall at a rock ledge located over Longwall 23B.	N/A	N/A	N/A	No	N/A
6	Rock platform	Surface cracking on rock platform.	N/A	N/A	N/A	No	N/A
7	Rock ledge	Rock fall from rock ledge.	N/A	N/A	N/A	No	N/A

Notes:

1: Fill out all details in the Subsidence Impact Register Assessment Form and record the register number here.

2: Land feature (e.g. cliff face, overhang, steep slope, ridgetop, fire road, etc.).

3: General impact description (e.g. cliff instability, surface tension crack, rock ledge collapse, etc.).

4: Length of recorded cliff instability (i.e. freshly exposed rock face evident and debris scattered around the base of the cliff or overhang).

5: If the cumulative length of cliff instabilities equals or exceeds 3% of the total length of cliffs (and associated overhangs) within the mining area, notify General Manager. If less than 3%, notify the Technical Services Manager or Environment & Community Superintendent of the cumulative length.

6: Indicate whether management or contingency measures were implemented (yes or no).

7: Indicate whether the implemented management or contingency measures were considered to be effective (yes or no).

Land Management Plan – Subsidence Impact Register Assessment Form

Date:

Observer (Name and position):

Register Number (ie. Number 1, 2, etc.):

Longwall Number and Chainage:

Location of Observed Impact:

(Examples: location of cliff instability in relation to the cliff face or overhang, location of surface tension crack in relation to fire trails, include GPS co-ordinates and a sketch)

Description of Observed Impact:

(Examples: nature and extent of cliff instability, length of cliff instability [i.e. freshly exposed rock face evident and debris scattered around the base of the cliff or overhang], other relevant aspects such as water seepage, approximate dimensions of surface tension cracks (length, width, depth), orientation of surface tension cracks, dimensions of rock falls (e.g. rock ledges that occur along the Waratah Rivulet), any other relevant information, attach photographs)

Description of Potential Environmental Consequences:

Examples:

- the nature and extent of impacts on the aesthetic values of the land feature;
- areas of erosion or sedimentation that have the potential to impact on surface water quality;
- the co-ordinates of the subsidence impact to assess impacts on known Aboriginal heritage sites;
- nature and extent of impacts on potential flora and fauna habitats;
- evidence of impacts on terrestrial fauna (e.g. observed fauna mortality);
- impacts on the serviceability of fire trails and/or stream crossings
- any other relevant information

Attach photographs

Description of Photographs:

Person Notified:	Environment & Community Superintendent	☐
	Technical Services Manager	☐
	General Manager	☐

Actions Required:	Management Measures	☐
	Contingency Plan Initiated	☐
	Incident Notification	☐
	Safety Measures/Public Safety Management Plan Requirements	☐

Management Measures Implemented:

Contingency Measures Implemented:

Effectiveness of Contingency or Management Measures:

APPENDIX 3

CONTINGENCY PLAN CHECK LIST

Contingency Plan Check List

Contingency Plan Component	Yes/No	Comment
Observation reported to the Technical Services Manager or the Environment & Community Superintendent (within 24 hours).		
Observation recorded in the Land Management Plan – Subsidence Impact Register.		
Reporting of any land performance measure exceedance to DPIE and WaterNSW (as soon as practicable after Metropolitan Coal becomes aware of the exceedance).		
Assessment of public safety and where appropriate implementation of safety measures in accordance with the Metropolitan Coal Longwalls 305-307 Public Safety Management Plan.		
Assessment of impacts on known Aboriginal heritage sites and where appropriate implementation of measures in accordance with the Metropolitan Coal Longwalls 305-307 Heritage Management Plan.		
Assessment of impacts on the aesthetic values of the land feature.		
Assessment of the environmental consequences in consultation with relevant specialists, including: • impacts on surface water quality in accordance with the Metropolitan Coal Longwalls 305-307 Water Management Plan; and • impacts on flora, fauna, and their habitats in accordance with the Metropolitan Coal Longwalls 305-307 Biodiversity Management Plan. Assessment to compare environmental consequences with assessment of environmental consequences in the EA.		
Conduct investigation to evaluate the potential contributing factors. Investigation to; • include the re-survey of relevant subsidence monitoring lines; • compare and critically analyse measured versus predicted subsidence parameters; • review measured subsidence parameters against the observed impact; and • review the Subsidence Monitoring Program and update the program where appropriate.		

Contingency Plan Check List (Continued)

Contingency Plan Component	Yes/No	Comment
Identification of appropriate course of action with respect to the identified impact(s) in consultation with specialists and relevant agencies. For example: • proposed contingency measures; • a program to review the effectiveness of the contingency measures; and • consideration of adaptive management under circumstances where a water resource or watercourse performance measure outlined in Table 1 of the Project Approval has been exceeded.		
Submission of the proposed course of action to the DPIE for approval.		
Implementation of the approved course of action to the satisfaction of the DPIE.		
Provision of a suitable offset - if either the contingency measures implemented by Metropolitan Coal have failed to remediate the impact or the Secretary determines that it is not reasonable or feasible to remediate the impact.		