Strata Control Technology

HV COKING COAL PTY LTD

Integra Underground Mine:
Six-monthly Subsidence Report for Longwall16
June - November 2020

INT5184-3

Mining Research and Consulting Group

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TITLE Integra Underground Mine:
Six-monthly Subsidence
Report for Longwall 16
June – November 2020

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PREPARED BY Stephen Wilson

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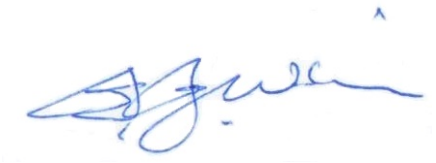

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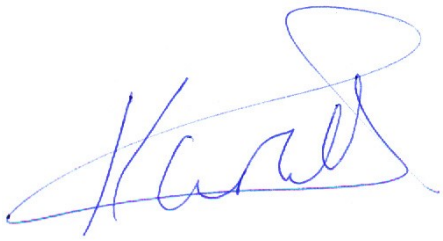

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SUMMARY

HV Coking Coal Pty Ltd (HVCC) operates the Integra Underground (IUG) mine under modified Project Approval 08_0101 for the Integra Underground Project. The approved Extraction Plan (EP) for Longwalls 15 and 16 in the Middle Liddell (ML) Seam, require HVCC to monitor and report subsidence impacts on a bi-monthly, six-monthly and annual basis. HVCC commissioned SCT Operations Pty Ltd (SCT) to review and analyse the subsidence monitoring conducted and prepare reports suitable for submission to the Department of Planning, Industry and Environment (DPIE) and the Resources Regulator. This report presents our review of the subsidence monitoring undertaken for the mining in Longwall 16 during the six-month period from the start of June to end of November 2020. Our review indicates:

- Subsidence impacts observed are considered compliant with the subsidence performance measures of the IUG Project Approval 08_0101, notwithstanding the input of other specialists.

- Subsidence effects and impacts observed are considered compliant with the performance indicators for subsidence performance measures required in management plans for the EP and IUG Project Approval conditions, although it should be recognised that assessment of compliance requires input from other specialists.

- No incidents relating to an increased risk to public safety from subsidence in the mining area have been reported.

Measured subsidence effects are less than the forecast values for primary subsidence parameters and significantly less than the maximum levels recommended as performance indicators in SCT Report INT4852 – "Subsidence Assessment for LW15 and LW16 Extraction Plan" (SCT 2018).

The nature and magnitudes of subsidence impacts are consistent with or less than those forecast in SCT (2018).

No significant subsidence impacts have been reported to any natural feature, built feature or infrastructure.

Subsidence effects measured along the Mt Owen Railway Line and at the Bettys Creek bridges are consistent with those predicted in the asset management plan for this infrastructure. The minor impacts experienced are being effectively monitored and managed to maintain these built features in a safe and serviceable condition. No subsidence impacts from Longwall 16 have been recorded at the Mt Owen - North Pit.

Monitoring of biodiversity and for stream health and channel stability of Bettys Creek indicates no subsidence impacts to these features.

Environmental monitoring results for surface water and groundwater that were above limits or outside of trigger levels for Trigger Action Response Plans (TARPs) recorded during the 3rd quarter of 2020 are not considered significant or related to IUG operations.

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1. INTRODUCTION

HV Coking Coal Pty Ltd (HVCC), a wholly owned subsidiary of Glencore Coal Pty Ltd (Glencore), operates the Integra Underground (IUG) mine near Camberwell, 12km northwest of Singleton in the Hunter Valley of NSW. Consent for the current longwall mining in the Middle Liddell (ML) Seam is provided by modified Project Approval 08_0101 (MOD8) for the Integra Underground Project. The approved Extraction Plan (EP) for Longwalls 15 and 16, require HVCC to monitor and report subsidence impacts on a bi-monthly, six-monthly and annual basis. HVCC commissioned SCT Operations Pty Ltd (SCT) to review and analyse the subsidence monitoring conducted and prepare reports suitable for submission to the Department of Planning, Industry and Environment (DPIE) and the Resources Regulator. This report presents our review of the subsidence monitoring undertaken for the mining in Longwall 16 during the six-month period from the start of June to the end of November 2020.

Our review is based on:

- Weekly and periodic inspections of the natural and man-made surface features by IUG personnel and other specialists.
- Subsidence monitoring reports by Mine Subsidence Engineering Consultants Pty Ltd (MSEC) and technical committee meeting minutes for the management of Mt Owen Railway Line, Bettys Creek bridges and associated infrastructure. These documents detail the daily and periodic inspections, monitoring surveys and maintenance for the management of subsidence impacts to this infrastructure and built features.
- Measurements of subsidence effects and observations of impacts from Longwall 16 to open cut surface mining operations as reported by the Senior Geotechnical Engineer at Mt Owen - North Pit.

This report is structured to provide:

- Conclusions and recommendations.
- Background with:
    - Site description including mining geometry and timing, and details of surface features.
    - Details of subsidence management and the subsidence monitoring program (SMP).
- Details of subsidence monitoring and measured subsidence effects.
- Summary of subsidence impacts observed with:
    - Reference to Trigger Action Response Plans (TARPs) within relevant management plans.
    - Any actions or proposed actions resulting from the relevant TARP.

- Assessment of compliance with subsidence performance measures and performance indicators contained in the modified IUG Project Approval and relevant subsidence management plans.

2. CONCLUSIONS AND RECOMMENDATIONS

Our review of the subsidence monitoring data from mining in Longwall 16 during the June to November 2020 six-monthly reporting period indicates that the subsidence impacts observed are considered to be compliant with the performance measures outlined in Table 10 of Section 17 in Schedule 3 (Environmental Performance Measures) of the IUG PA08_0101 MOD8, notwithstanding the input of other specialists.

Our review also indicates that the subsidence effects and impacts observed are considered to be compliant with the performance indicators for subsidence performance measures required in management plans for the Longwalls 15 and 16 EP and IUG PA08_0101MOD8 conditions, although it is recognised that assessment of compliance requires input from other specialists.

No incidents relating to an increased risk to public safety from subsidence in the mining area were reported.

Measured subsidence effects are less than the forecast values for primary subsidence parameters and significantly less than the maximum levels recommended as performance indicators in SCT (2018).

Measurements of subsidence effects along the Mt Owen Railway Line corridor, and elsewhere over the mining area, are generally consistent with the values for the primary subsidence parameters, predicted in the asset management plan for this infrastructure, much less than the maximum levels forecast for subsidence effects and impact assessment and significantly less than the values recommended as performance indicators for subsidence effects in SCT (2018).

The nature and magnitudes of impacts are consistent with or less than those presented by SCT (2018) in the subsidence assessment for the Longwalls 15 and 16 EP.

No significant subsidence impacts to any natural or man-made feature on the surface above, or in the vicinity of, the area mined by Longwall 16 have been observed during the reporting period.

Minor impacts to the Mt Owen Railway Line and associated infrastructure are being effectively monitored and managed to maintain these built features in a safe and serviceable condition to avoid operating restrictions.

No significant impacts from Longwall 16 have been recorded at Mt Owen – North Pit operations.

Subsidence impacts from Longwall 16 are limited to minor cracking of the ground surface. Features on the landform such as minor ponding in contour drains, minor holes from settlement of fill material and areas of erosion have been reported. Areas of erosion, slumping and settlement of excavated areas for gas drainage installations have also been recorded. However, these features are unlikely to be directly related to subsidence from longwall mining.

Annual and end of panel monitoring of Bettys Creek for channel stability and stream health indicates no evidence of subsidence impacts from IUG operations.

Similarly, biodiversity monitoring indicates there has been no evidence of subsidence from the 2019 observations.

Environmental monitoring of surface water and groundwater, during the 3rd quarter of 2020, show some results above limits or outside of trigger levels for TARPs in relevant IUG Management Plans. These results were investigated independently as required by the relevant TARP. The investigations concluded that the monitoring results are not considered to be significant and are not due to influences from activities or operations undertaken by IUG.

3. BACKGROUND

3.1 Site Description

Figure 1 shows the longwall mining areas, superimposed onto a Google Earth image of the surface from August 2018 (the Mt Owen - North Pit has not extended over the extracted longwall panels since this time). This figure is a copy of Figure 4 from SCT (2018) amended to show the completed mining in Longwall14 and the mining in Longwalls 15 and 16, during the bi-monthly reporting periods, up to the end of November 2020. Subsidence monitoring lines and points, and the shortened panel starting position of Longwall 16 are also shown.

Longwall 16 commended secondary extraction on 9 June 2020. This longwall starting mining below the eastern slope of the rehabilitated West Dump approximately 120m short of the location approved by MOD8 to PA08_0101 (SCT 2017) and included in SCT (2018). The panel was shortened due to in-seam geotechnical and practical constraints. This actual start line position increased the offset distance between the mining of Longwall 16 underground at IUG and the surface operations at Mt Owen – North Pit reducing the potential for interactions.

During the six-month period for June to November 2020, Longwall 16 mined from the revised start line at CH1738m to CH725m, a total distance of 1013m.

At the end of November 2020, the total void created by Longwall 16, including the 9m wide installation roadway, was approximately 1022m long and 257m wide.

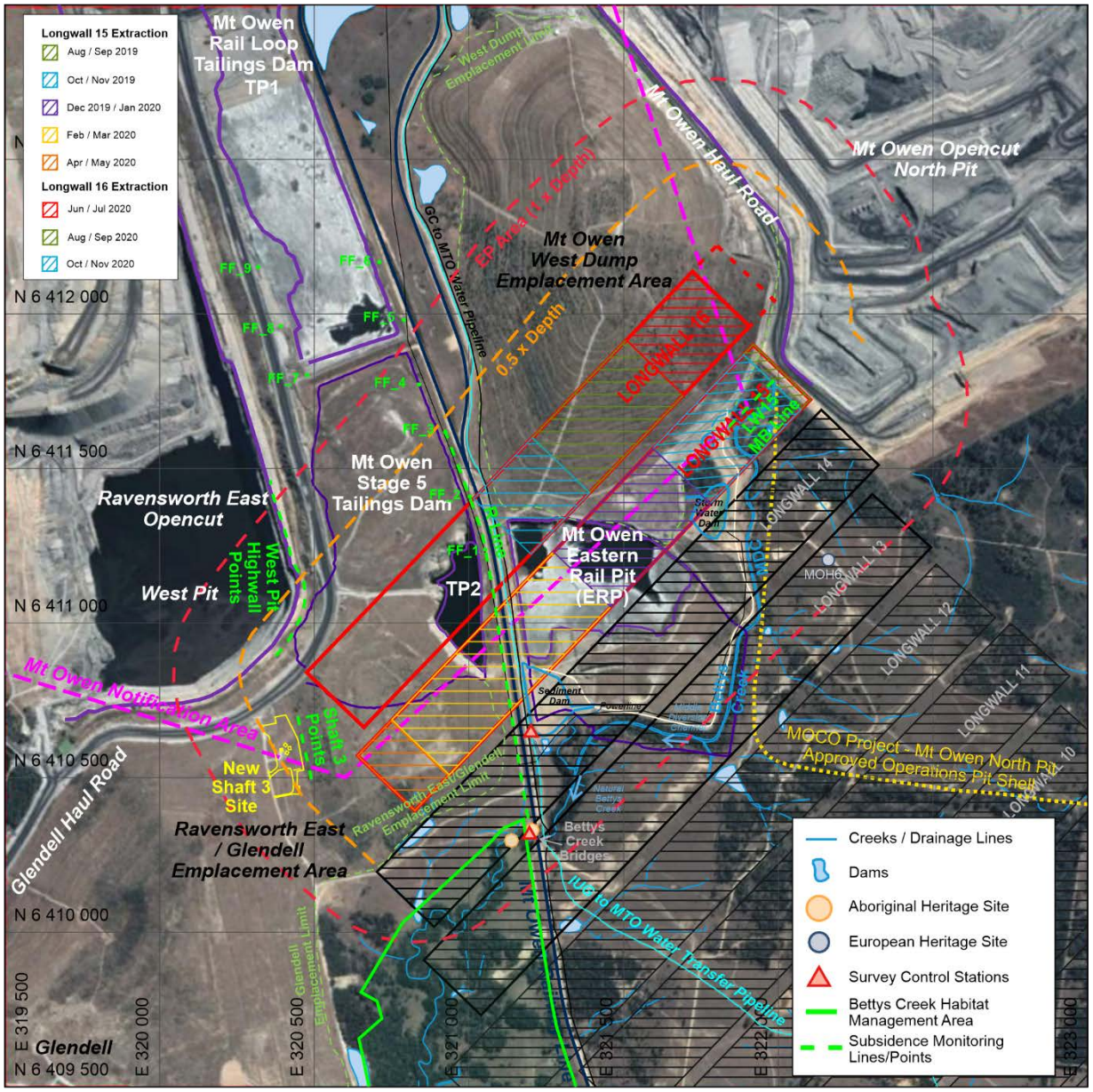

Figure 1: Locations of surface features, subsidence monitoring lines/points and Bi-monthly mining areas.

The overburden depth for the section of Longwall 16 mined to the end of November 2020 ranges from 540m to 445m. The total overburden thickness at the start line of Longwall 16 varies from 520-540m. This total includes 10-40m of waste rock fill material on the West Dump emplaced above the natural ground level at this location. The overburden thickness above the face line of Longwall 16 at the end of November 2020 varies from 445m to 475m. The depth to the ML Seam is 475m in areas of natural ground along the Mt Owen Railway Line corridor and 445m below the base of the section of the Eastern Rail Pit (ERP) above the face line.

The surface above and in the vicinity of Longwall 15 is owned entirely by Glencore and its subsidiary companies. The areas in the north, east and west have been significantly modified by surface mining activities associated with the Mt Owen Complex (MOC) open cut mines (Glendell, Ravensworth East and Mt Owen), all owned by Glencore. The surface areas are used by Glencore for surface and underground mining activities. Access to the surface areas, other than along the publicly accessible section of Forest Road further to the south, is controlled by Glencore.

The surface above Longwalls 15 and 16 comprises areas modified by surface mining and items of mining related infrastructure. Natural features are limited to small sections of native and planted vegetation adjacent to the remaining upper reaches of the Bettys Creek middle diversion channel (MDC), small farm dams and the natural ground surface along the Mt Owen Railway Line corridor.

A section of open void and capped portion of the ERP, a section of the Mt Owen Railway Line with associated infrastructure and parts of the open void and filled portion of the Mt Owen Stage 5 Tailing Dam (also known as TP2) are located above Longwalls 15 and 16. Sections of the rehabilitated Mt Owen West Dump and Ravensworth East/Glendell emplacement areas are located above the areas to be mined by Longwalls 15 and 16. Parts of the surface water management system including the eastern storm water dam for the West Dump (Dam4) and ERP sediment dam with associated pumping and power supply equipment are located above Longwall 15. Water supply and transfer pipelines, an 11kV overhead powerline, gas drainage boreholes and related equipment associated with IUG, are also located above, or cross the surface above Longwalls 15 and 16.

Other natural or built features within the EP Assessment Area for Longwalls 15 and 16, but generally above the area mined by Longwall 14, include natural dams (ponds), minor drainage lines, Aboriginal and historical (European) heritage sites, survey control stations, the natural section of Bettys Creek and adjacent floodplain, and an area of natural land set aside as the Bettys Creek Habitat Management Area (BCHMA). The rail and road bridges over Bettys Creek are positioned between Longwalls 13 and 14.

During the June to November 2020 reporting period, Longwall 16 mined below:

- A section of the eastern slope of the West Dump emplacement area.
- A new drainage channel/drop structure being constructed on the eastern slope of the West Dump.
- Part of the north western corner of the open void of the ERP. This part of the open void includes tailings and sections of the exposed northern and western highwalls.
- A small section of the Mt Owen Railway Line and associated infrastructure.
- Mining related infrastructure including water supply and water transfer pipelines and other pumping installations as part of the surface water management system for the MOC site.

- Gas drainage installations and equipment for IUG operations.
- Other minor built features such as access roads and four-wheel drive tracks.

3.2 Subsidence Management Context

The modified Project Approval for the Integra Underground Project (PA08_0101 MOD8) requires HVCC to prepare and implement an EP before secondary extraction of the approved longwall panels can commence. Major components of the EP are a subsidence monitoring program (SMP) and various subsidence management plans. Management plans for Built Features, Public Safety, Rehabilitation, Water, Biodiversity, Heritage and Land are required to manage any potential subsidence impacts and ensuing environment consequences and, to ensure public safety at the site. The management plans for Longwalls 13 and 14 were revised or updated for the Longwalls 15 and 16 EP.

Some of these mandatory management plans have been divided into sub-plans by IUG to effectively manage the specific natural and built surface features present in the vicinity of Longwalls 13-14 and Longwalls 15-16. The requirement for a revised Rehabilitation Plan in the EPs is addressed by the subsidence remediation provisions of the Land Management Plan and the overall site rehabilitation plan within the Mining Operations Plan (MOP) and Annual Review provisions of mining lease conditions.

The SMP approved for Longwalls 15 and 16 outlines the location, configuration of survey marks and type of surveying to be undertaken. The survey monitoring methodology, accuracies, purpose, installation standard and frequency of surveys are also listed.

The SMP details the monitoring type, responsibility and reporting requirements contained in the various management plans for the natural and man-made surface features.

These management plans include those for:

- Aboriginal heritage.
- Non-Aboriginal heritage (Historical Heritage).
- Built Features including MOC infrastructure such as:
    - Mt Owen Railway Line and Bettys Creek Bridges.
    - Other key infrastructure e.g.
    - Mt Owen - North Pit.
    - Ravensworth East - West Pit.
    - ERP

  - TP2.
  - Overburden Emplacement Areas.
  - Surface water management installations and equipment.

- Water (Surface Water, Groundwater, Erosion and Sediment Control), including Bettys Creek Diversion for Longwalls 15 and 16.
- Biodiversity.

The monitoring of other farming or mining related infrastructure is also included in the SMP.

4. SUBSIDENCE MONITORING

This section describes subsidence monitoring details and the subsidence effects measured.

4.1 Monitoring Details

As required by the SMP and various management plans under the EP for Longwalls 15 and 16, general weekly inspections of all surface features within the predicted active subsidence zone (or subsidence impact zone) are conducted by IUG personnel. These weekly inspections commenced in late May 2017 with the start of Longwall 13 following the period of care and maintenance. This "subsidence impact zone" is based on a distance equal to half overburden depth from the active longwall face position. For Longwalls 15 and 16, this distance is in the range of approximately 200-250m.

In addition to the weekly inspections required by the various asset, public safety and environmental management plans, monthly, quarterly, and other periodic inspections are required under the management plans for Water, Biodiversity and Aboriginal Heritage.

In contrast to the continuous, real-time environmental monitoring for such items as air, noise and water conducted by IUG and reported on a quarterly basis, much of the monitoring or measurement of subsidence effects and impacts is event based or recorded annually.

Monitoring of some surface features is not initiated until the features or infrastructure are within the predicted subsidence impact zone or monitored based on distance from the active longwall face. As an example, the asset management plan for the Mt Owen Railway Line, Bettys Creek bridges and associated infrastructure start periodic survey monitoring once a longwall is "500m from first rail contact".

Details of reports for the continuous or periodic inspections, monitoring and actions carried out to manage subsidence impacts to the Mt Owen Railway Line, Bettys Creek bridges and associated infrastructure, are included in bi-monthly subsidence reports and summarised in Section 5 of this report.

Inspections of the Bettys Creek MDC are planned before and after mining and after a stream flow event. This stream flow is defined as a "bank full" flow. No rainfall events of this magnitude have occurred during the six-month reporting period.

Surveying of the various subsidence monitoring lines, points and LIDAR surveys of the surface, described in the SMP, are planned to be conducted, as a minimum, before and after the mining of each longwall panel. The end of panel subsidence monitoring report for Longwall 15 was finalised in September 2020. No surveys for the mining in Longwall 16 were conducted during this reporting period consistent with the SMP for Longwalls 15 and 16.

Monitoring by other specialists includes channel stability and stream health monitoring of the Bettys Creek middle diversion and Biodiversity monitoring. The stability and stream health monitoring is required by the IUG Water Management Plan and Bettys Creek Diversion Asset Management Plan (BCDAMP). Biodiversity monitoring is required by the IUG Biodiversity Management Plan for Longwalls 13-20. The reporting of this monitoring is required on an annual basis and also triggered by the completion of each longwall panel.

The Mt Owen Railway and Bettys Creek Bridges Asset Management Plan includes engineering works to mitigate the expected subsidence effects, continuous, real-time and periodic monitoring, and regular inspections overseen by a technical committee of specialists. The monitoring covers ground movements for the railway and bridges, track and bridge geometry and rail stress measurements. Maintenance and testing activities to mitigate or remediate subsidence impacts are planned and implemented by the technical committee as required through regular and ongoing communications.

The longwall action plans within this asset management plan includes weekly visual inspections for the entire period of longwall mining, extensive survey measurements and continuous, real-time monitoring of the rail and bridges structure during the period of active subsidence and beyond.

In addition to the baseline ground survey when the Longwall 16 face line was 500m from first rail contact, weekly engineering surveys have been undertaken during this reporting period starting when the face line was 100m from first rail contact.

Monitoring of subsidence effects and potential impacts from interactions between Longwalls 14-16 and the North Pit by Mt Owen operations (MTO) continued during this reporting period consistent with recommendation for subsidence monitoring contained in SCT (2017) and SCT (2018) for MOD8 to PA08_101 (Longwalls 15-20) and the Longwalls 15 and 16 EP, respectively.

A summary of the radar scanning measurements and visual inspections used to monitor ground, slope and highwall movements during mining of the first 500m of Longwall 16 was reported by the Senior Geotechnical Engineer for the North Pit in August 2020.

4.2 Subsidence Effects

The results for surveys of subsidence monitoring lines or points for Longwall 15 conducted in the previous reporting period were finalised in September 2020. These surveys were undertaken consistent with the SMP for Longwalls 15 and 16.

SCT (2020) presents the results for Longwall 15 from monitoring lines are marks. These include R Line and MB15 Line, and arrays of marks around the perimeter of the West Pit highwall and Shaft 3 site boundary as well as far-field effects marks established above and adjacent to Longwalls 15 and 16. The lines and marks were installed to measure subsidence effects from the mining in each and both panels. The position of the lines/points are shown in Figure 1.

The observed subsidence behaviour is consistent with expectations and subsidence effects are less than forecast in the Longwalls 15 and 16 EP for both the natural ground surface and areas of disturbed ground with waste rock fill or tailings material.

Maximum vertical subsidence measured over Longwall 15 is 0.73m, tilt is approximately 10mm/m and strains are 3mm/m in tension and 7mm/m in compression. This compares to forecast maximum values of 1.5m for vertical subsidence, 14mm/m for tilt and 7mm/m and 10mm/m for tensile and compressive strain, respectively.

Results from ground surveys for Longwall 16 of the Mt Owen Railway Line and Betty Creek bridges conducted on 24 November 2020, indicates subsidence effects for ground movements, rail geometries and rail status to date have been of a low magnitude. Incremental vertical subsidence over Longwall 16 was 40mm and additional vertical subsidence at the bridges was 10mm.

In general, the subsidence effects measured from mining Longwall 16 at this stage are consistent with expectation and those predicted in the asset management plan for this infrastructure, and much less than those forecast more generally for these built features in SCT (2018).

A report for the monitoring of highwall stability at Mt Owen – North Pit during the first 500m of mining in Longwall 16 was published in late August 2020.

The report by the Senior Geotechnical Engineer for Mt Owen - North Pit operations presents a summary and interpretations of the radar measurements for ground movement at the western highwall adjacent to the start lines of Longwalls 15 and 16. The report indicates the maximum total horizontal movements during the period of monitoring the active longwall mining was 85mm (65±20mm) in a direction towards to the open North Pit excavation.

5. SUBSIDENCE IMPACTS OBSERVED

The subsidence monitoring data indicates there have been no significant subsidence impacts to surface features above, or in the vicinity of, the area mined by Longwall 16 during the six-month reporting period.

No incidents relating to an increased risk to public safety from subsidence in the mining area were reported.

The nature and magnitude of impacts are consistent with or less than those presented by SCT (2018) in the subsidence assessment for the Longwalls 15 and 16 EP.

No significant subsidence impacts from underground mining in Longwall 16 were reported on or at:

- The West Dump emplacement area.
- The drainage channel/drop structure on the eastern slope of the West Dump.
- The ERP.
- The Mt Owen Railway Line and associated infrastructure.
- Mining related infrastructure including water supply and water transfer pipelines and other pumping installations.
- Gas drainage installations and equipment.
- Other minor built features such as access roads and four-wheel drive tracks.

Minor subsidence impacts have been reported during mining in Longwall 16 to date, generally in the form of cracking of the ground surface and ongoing movements along the Mt Owen Railway Line. These impacts are less than and consistent with expectations presented in SCT (2018).

The main subsidence related impacts observed relate to:

- A minor crack observed in fill material on the south eastern slope of the West Dump above the centre of Longwall 16.
- Minor subsidence impacts to the Mt Owen Railway Line recorded early in this reporting period requiring minor maintenance activities.

The minor crack was located in the centre of the panel above the longwall face position at the time in an area where the maximum transient stretching (tensile strain) of the ground would be expected with the passage of the longwall. The fill material on the West Dump is approximately 5-10m thick at this location. The crack is about 2m long and 50mm wide and does not appear to be out of character with the surrounding landform. The crack was monitored for the following six-week period with only minor changes, mainly from erosion after heavy rainfall, recorded. This feature is consistent with expectations presented in SCT (2018) and less than the maximum impacts forecast.

The minor subsidence impacts to the Mt Owen Railway Line requiring minor adjustments are not directly related to Longwall16 but from Longwall 15 and previous panels. The impacts and actions are consistent with the provisions of the asset management for this infrastructure. These ongoing impacts are less than and consistent with expectations presented in SCT (2018). No significant impacts from Longwall 16 have been recorded. No trigger action response plan (TARP) triggers have been activated.

Features on the landform of the West Dump above Longwall16 such as minor ponding in contour drains after rainfall, minor holes from settlement of fill material and areas of erosion have been reported. Areas of erosion, slumping and settlement of excavated areas for gas drainage installations have also been recorded. However, these features are unlikely to be related to subsidence from longwall mining.

Monitoring of the middle diversion channel and natural section of Bettys Creek for channel stability and stream health by other specialists is required on an annual basis and also triggered by the completion of each longwall panel. The annual reporting for 2020 and end of Longwall 15 was completed in July 2020 by SLR Consulting Australia Pty Ltd (SLR 2020a).

The results of the June 2020 (SLR 2020a) Bettys Creek middle diversion channel stability and stream health monitoring indicates that the majority of monitoring points have experienced no apparent change from what was observed during the October 2019 assessment. The minor changes observed are possibly the result of small subjective differences brought about by a change of assessor for this round of monitoring rather than the result of a significant change to the creek stability at these locations. No evidence has been observed to indicate that impacts to the diversion have occurred, as a result of Integra underground operations (including subsidence impacts).

Changes in the type of erosion were noted following large storm events however, it is assessed that this erosion is not a result of IUG operations.

Biodiversity monitoring after Longwall 15 was conducted by SLR and reported in September 2020. The BMP monitors the potential impacts of subsidence on sensitive ecological features. The monitoring program targets areas predicted to be affected by subsidence impacts and is primarily designed to detect changes in vegetation and/or habitat condition.

SLR (2020b) indicates there has been no evidence of subsidence from the 2019 observations for the reference sites over Longwalls 13 and 14 and the control sites located outside the predicted subsidence zone.

Advice from the Senior Geotechnical Engineer at the Mt Owen - North Pit indicates the low-magnitude subsidence effects measured during the first 500m of Longwall 16 have not resulted in any perceptible impacts to the haul road, benches, other surfaces and to slope stability of the highwall.

6. ASSESSMENT OF COMPLIANCE

This section discusses compliance with the subsidence performance measures of the Integra Underground Project Approval (IUG PA08_0101 MOD8) and performance indicators within the various management plans required by the EP for Longwalls 15 and 16.

6.1 Subsidence Performance Measures

Our review of the subsidence monitoring data provided by IUG, for the mining in Longwall 16 during the June to November 2020 reporting period, indicates that the subsidence impacts observed are considered to be compliant with the subsidence performance measures outlined in Table 10 of Section 17 in Schedule 3 (Environmental Performance Measures) of the IUG PA08_0101 MOD8, notwithstanding the input of other specialists.

Table 1 summarises the subsidence performance measures outlined in Table 10 of IUG PA08_0101 MOD8, and the status of compliance expected for the mining in Longwall 16 during the six-month reporting period.

Table 1: Subsidence Performance Measures for PA08_0101 MOD8

Subsidence Performance Measures		Status of compliance from mining in Longwall 16 June – November 2020
Water		
Glennies Creek alluvial aquifer	Negligible impacts	Compliant based on aquifer remote from mining area – no subsidence effects or impacts expected. (Other specialists to assess impacts to water).
Natural watercourses on site	No greater environmental consequences than predicted in the IUG Project EA	No impacts observed from mining in LW16. Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA. (Other specialists to assess impacts to water).
Mt Owen Bettys Creek Diversions	No greater environmental consequences than predicted in the IUG Project EA, unless the owner agrees in writing	No significant impacts observed from mining in LW16. Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA. (Other specialists to assess impacts to water).
Underground Project Creek Diversions	Remain hydraulically and geomorphologically stable	Not applicable - not built as yet.

Subsidence Performance Measures		Status of compliance from mining in Longwall 16 June – November 2020
Other water storages and drainage lines	No greater environmental consequences than predicted in the IUG Project EA	No significant impacts observed from mining in LW16. Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA. (Other specialists to assess impacts to water).
Biodiversity		
Threatened species, populations, habitat, or ecological communities	Negligible impacts	No impacts observed from mining in LW16. Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA. (Other specialists to assess impacts to biodiversity).
Built Features		
All built features (except those fully covered by an operative contractual arrangement with another mine owner or other owner of the relevant built feature)	Safe, serviceable, and repairable unless the owner agrees otherwise in writing, including: • serviceability should be maintained wherever practicable. • loss of serviceability must be fully compensated; and • damage must be fully repaired or replaced, or else compensated.	Minor impacts observed from mining in LW16. Compliant based on built features remaining safe, serviceable, and repairable under common ownership (Glencore). Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA.
Public Safety		
Public Safety	No additional risk due to mining	No incidents reported from mining in LW16. Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA. Land largely owned and controlled by Glencore and is not easily accessible by the public.

There are no specific subsidence related performance measures for heritage items or general land management in the environmental performance conditions of the modified IUG Project Approval 08_0101 MOD8, but there are requirements for Land and Heritage Management Plans.

The IUG management plans for both Aboriginal and historic heritage include measures to protect sites from the impacts of subsidence in accordance with the Underground Project Approval requirement to satisfy the IUG Project EA commitments.

Details of Land and Heritage management plans are included in the following section.

6.2 Performance Indicators

Our review of the subsidence monitoring data provided, for the mining in Longwall 16 during the June to November 2020 reporting period, indicates that the subsidence effects and impacts observed are considered to be compliant with the performance indicators and subsidence performance measures for the EP required under the IUG Project Approval. However, assessment of compliance requires input from other specialists. SCT understands this will be provided as part of the Annual Review.

Measurements of subsidence effects along the Mt Owen Railway Line corridor and elsewhere are generally consistent with the values for the primary subsidence parameters predicted in the asset management plan for this infrastructure, much less than the maximum levels forecast for subsidence effects and impact assessment more generally and significantly less than the values recommended as performance indicators for subsidence effects in SCT (2018).

The performance indicator values recommended in SCT (2018) for Longwalls 15 and 16 are 20% in excess of the parameters detailed in Table 2 below.

Table 2: Primary Conventional Subsidence Parameters for the mining of Longwalls 15 and 16 only

Panel	Maximum Subsidence (m)	Maximum Tilt (mm/m)	Maximum Tensile Strain (mm/m)	Maximum Compressive Strain (mm/m)
Natural/Undisturbed Ground (e.g. Rail Corridor and Loop)				
LW15	2.0	14	7	10
LW16	1.5	14	7	10
Areas of Waste Rock Emplacement (e.g. TP2, ERP, West Dump)				
LW15	2.5	14	14	20
LW16	2.0	14	14	20

Table 3 details the performance indicators contained in the various management plans and programs of the Longwalls 15 and 16 EP. The status of compliance expected for the mining in Longwall 16 during the six-month reporting period of June to November 2020 is based on the measured and observed subsidence effects and impacts. Monitoring depicted as "not triggered" represents monitoring not conducted in the period as the approved trigger level for this monitoring has not been activated.

Table 3: Performance Indicators from Longwalls 15 and 16 Management Plans

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 June – November 2020
Management Plan or Feature	**Indicator**	**Monitoring details**
Built Features (BFMP)		
Mt Owen Railway and Bettys Creek Bridges LW15 and 16 Management Plan	• No indicators • LW15-16 Action Plans • TARPs based on risk levels	Compliant based on periodic and continuous monitoring, inspections and actions managed by Technical Committee. No TARP triggers activated. (Other specialists to assess impacts).
Mt Owen Key Features Asset Management Plan for LW15 and16 Water Pipelines Powerlines Mt Owen – North Pit Ravensworth East – West Pit Glendell Haul Road Eastern Rail Pit (ERP). Ravensworth East tailings dam (TP2) Overburden emplacement areas Sediment control dams Access roads and four-wheel drive tracks	• Indicators for quantitative and qualitative parameters based on a 20% increase of forecast subsidence effects and impacts. • TARPs based on subsidence effects and impacts expected	Daily and weekly visual inspections Continuous and periodic survey monitoring of North Pit highwall for first 500m of Longwall 16. Survey monitoring around the top edge of West Pit highwall - pre and post mining of each longwall panel. Daily/shift inspections of Glendell Haul Road during periods of active subsidence. Weekly inspections of total ERP void area during period of active subsidence and until longwall face is 500m past void edge for each longwall panel. Weekly inspections of total TP2 void area during period of active subsidence and/or until the end of each longwall panel. No significant impacts observed from mining in LW16. Compliant based on above.
Forest Road	• No indicators	No significant impacts observed from mining in LW16. No public safety incidents from mining in LW16 reported. Compliant based on warning signs, weekly inspections and timely remediation of any impacts.
Survey control stations	Not applicable	Compliant based on BFMP.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 June – November 2020
Management Plan or Feature	**Indicator**	**Monitoring details**
Farm infrastructure; Agricultural land Access Roads Dams and Fences	• No indicators • TARPs	Compliant based on warning signs, weekly inspections and timely remediation of any impacts. No significant impacts observed from mining in LW15.
Mining infrastructure: Gas Drainage	• No indicators • TARPs in Ventilation Control Plan	Weekly Inspections during mining. Monitoring as per Ventilation Control Plan. No significant impacts observed from mining in LW16.
Public Safety		
LW15 and LW16 Public Safety Management Plan (PSMP)	• No additional risk to public safety - no additional performance indicator included • TARPs	Weekly surface inspections and remediation. No public safety incidents from mining in LW16 reported. Compliant with performance measures based on above.
Ponding and general subsidence Mt Owen active mining area Mt Owen Railway Line/Bettys Creek bridges Roads and tracks Sediment dams		Weekly inspections. No significant impacts observed from mining in LW16. No public safety incidents from mining in LW16 reported. Compliant based on warning signs, controlling access, weekly inspections and timely remediation of impacts.
Biodiversity		
LW15 - 16 Biodiversity Management Plan	• No indicators • Detailed performance measures • TARPs	Monthly and annual inspections. Compliant based on weekly inspections by IUG personnel and no impacts observed from mining in LW16.
Land		
LW15 and LW16 Land Management Plan	• Subsidence monitoring and inspections • Assessment of impacts • Evidence of consultation • Effective remediation (landform is generally free draining) • TARPs	Weekly inspections as per PSMP. Monitoring as per BCDAMP – not triggered. Compliant based on weekly inspections by IUG Personnel and no significant impacts observed from mining LW16.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 June – November 2020
Management Plan or Feature	**Indicator**	**Monitoring details**
Heritage		
Aboriginal Heritage Management Plan	• No indicators • TARPs	No sites in active subsidence zone for LW16 during reporting period. Compliant based on, weekly inspections by IUG Personnel and no impacts observed from mining in LW16.
Historical Heritage Management Plan (HHMP)	• No indicators • TARPs	No sites in active subsidence zone for LW16 during reporting period. Compliant based on, weekly inspections by IUG Personnel and no impacts observed from mining in LW16.

Key risk control measures identified during risk assessments and included in the various management plans for management of subsidence impacts are not included in Table 2 or Table 3 as performance indicators or triggers for management actions.

Performance indicators for the environmental monitoring of surface water and groundwater parameters are also not included in Table 3. The results for the monitoring of these items are assessed and reported in other IUG environmental monitoring reports.

7. REFERENCES

SCT 2017 "Integra Underground Mine: Subsidence Assessment for Modification to PA08_0101" SCT Report INT4648 – 22 November 2017.

SCT 2018 "Integra Underground Mine: Subsidence Assessment for LW15 and LW16 Extraction Plan" SCT Report INT4852 – 24 December 2018.

SCT 2020 "Integra Underground Mine: Longwall 15 End of Panel Subsidence Report" SCT Report INT5047-8 – 28 September 2020.

SLR 2020a "Bettys Creek Stream Health and Stability Report June 2020" SLR Consulting Australia Pty Ltd, SLR Ref: 630.12766-R01-v1.0 – 3 July 2020

SLR 2020b "Longwalls 13-14 Biodiversity Monitoring 2020" SLR Consulting Australia Pty Ltd, SLR Ref: 630.12088-R04-v1.0 – 18 September 2020