



HV COKING COAL PTY LTD

Integra Underground Mine:
Six-monthly Subsidence Report for Longwalls 16 and 17
December 2020 – May 2021

INT5319-1

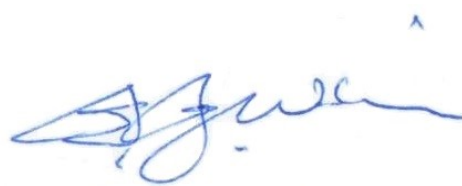
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TITLE Integra Underground Mine:
Six-monthly Subsidence
Report for Longwalls 16 and 17
December 2020 – May 2021

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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, and Longwalls 17-20 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 and Longwall 17 during the six-month period from the start of December 2020 to end of May 2021. 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 for Longwall 16 are less than the forecast values for primary subsidence parameters and significantly less than the maximum levels presented as performance indicators in SCT Report INT4852 – “Subsidence Assessment for LW15 and LW16 Extraction Plan” (SCT 2018).

To date, no measurements of subsidence effects from Longwall 17 have been undertaken and no impacts have been observed.

No significant subsidence impacts from Longwall 16 have been reported to any natural feature, built feature or infrastructure. The nature and magnitudes of subsidence impacts are consistent with expectations and less than the maxima presented in SCT (2018).

Subsidence effects measured along the Mt Owen Railway Line and at the Bettys Creek bridges are generally 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.

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 4th quarter of 2020 and 1st quarter of 2021 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 New South Wales. 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, and Longwalls 17-20, 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 and Longwall 17 during the six-month period from the start of December 2020 to the end of May 2021.

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.
- Observations from an inspection of the surface above and in the vicinity of Longwall 16 conducted by SCT on 20 May 2021.

This report is structured to provide:

- Conclusions and recommendations.
- Background with:
 - o Site description including mining geometry and timing, and details of surface features.
 - o Details of subsidence management and the subsidence monitoring program (SMP).
- Details of subsidence monitoring and measured subsidence effects relative to the forecasts of subsidence effects presented in SCT (2018) for Longwalls 15 and 16 and in SCT Report INT5106 – “Integra Underground Mine: Subsidence Assessment for LW17-20 Extraction Plan” (SCT 2021) for Longwall 17.
- Summary of subsidence impacts observed and comparisons to the forecasts in SCT (2018) and SCT (2021) with:

- o Reference to Trigger Action Response Plans (TARPs) within relevant management plans.
- o 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 and Longwall 17 during the December 2020 to May 2021 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_0101MOD8, 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 subsidence management plans for the EPs for Longwalls 15 and 16 and Longwalls 17-20 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.

The end of panel surveys of subsidence monitoring lines or points for Longwall 16 are yet to be completed. However, in the interim, the final ground survey of PH Line on the Mt Owen Railway Line provides an indication of measured subsidence effects along the railway corridor above Longwall 16.

Overall, subsidence behaviour is as expected and generally consistent with the low values predicted for the management of subsidence impacts in the asset management plan for this infrastructure.

The values for primary subsidence parameters are less than those forecast more generally for both the natural ground surface and areas of disturbed ground with waste rock fill or tailings material and much less than the values of subsidence effects presented in SCT (2018) as performance indicators for the Longwalls 15 and 16 EP.

To date, no measurements of subsidence effects from Longwall 17 have been undertaken and no impacts have been observed.

The nature and magnitudes of impacts from Longwall 16 are consistent with or less than those presented by SCT (2018) 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.

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

Annual and end of Longwall 16 monitoring of Bettys Creek for channel stability and stream health reported in June 2021 indicates no evidence of subsidence impacts from IUG operations.

Similarly, the 2021 biodiversity monitoring indicates there has been no evidence of subsidence from the 2020 observations.

Environmental monitoring of surface water and groundwater, during the 4th quarter of 2020 and 1st quarter of 2021, show some results above limits or outside of trigger levels for TARPs. These results were investigated independently as required and the monitoring results are not considered to be significant and 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. This figure is a copy of Figure 4 from SCT (2018) amended to show the completed mining in Longwall 14 and the mining in Longwalls 15, 16 and 17, during the bi-monthly reporting periods, up to the end of May 2021. The assessment area (EP Area) and 0.5 Depth zones for Longwalls 17-20 from SCT (2021) have also been added to this figure. Subsidence monitoring lines and points for Longwall 16 are also shown.

During the six-month period for December 2020 to May 2021, Longwall 16 mined from CH725m to the finish line of the panel at CH0m, and Longwall 17 mined from the start line at approximately CH1677 to CH1524m. The total distance mined by these two longwalls during this reporting period was 878m. The void width for both panels is nominally 257m.

At the completion of mining in Longwall 16, the total void, including the 9m wide installation roadway, was approximately 1747m long and 257m wide.

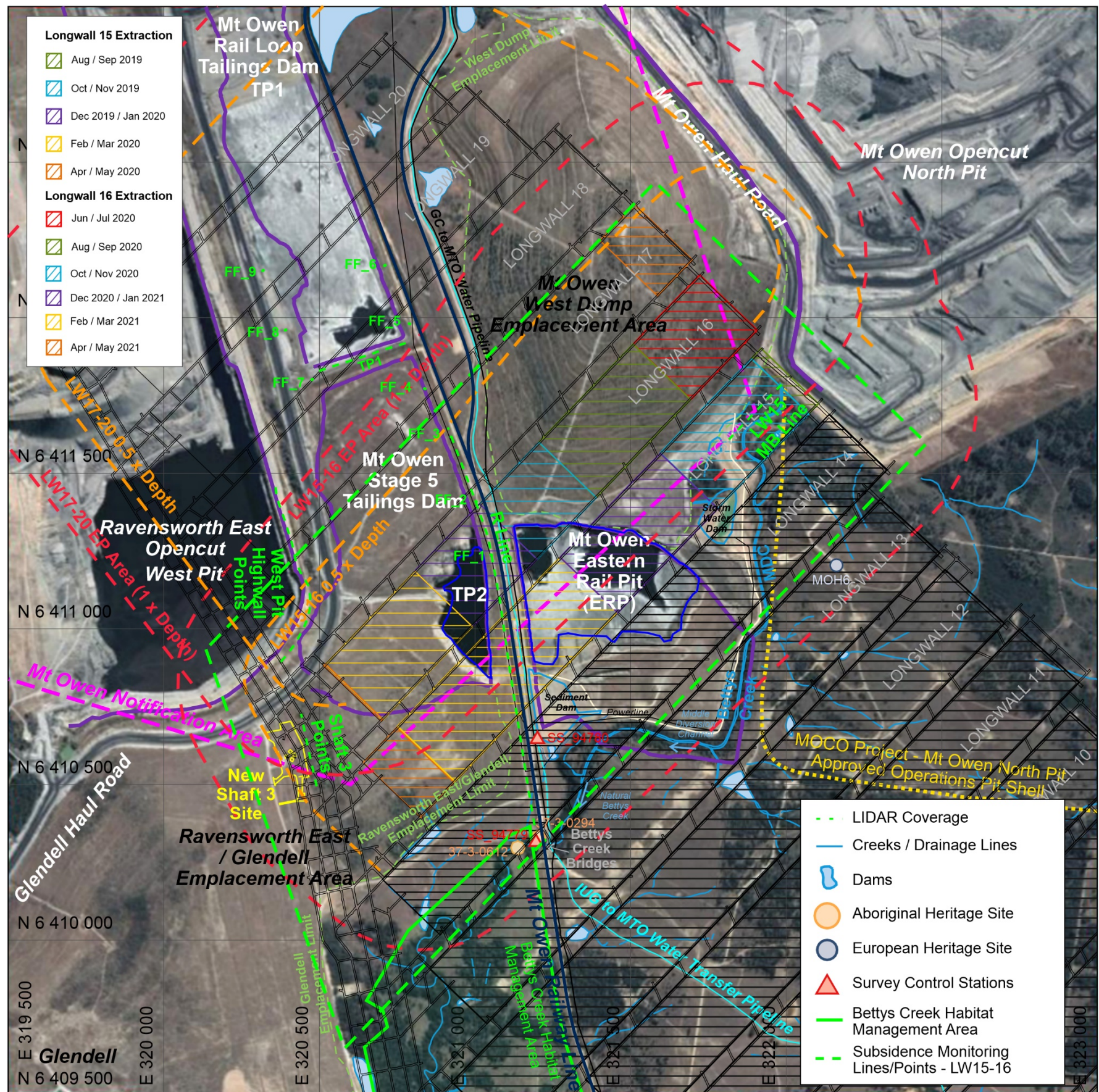


Figure 1: Locations of surface features, subsidence monitoring lines/points and Bi-monthly mining areas.

The overburden depth for the section of Longwall 16 mined during this reporting period ranges from 475m to 450m. The overburden thickness above the face line of Longwall 16 at the start of December 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). The total overburden thickness above the finish line of Longwall 16 is approximately 450m. This 450m includes 420m of solid strata below the base of the Mt Owen Stage 5 Tailing Dam (also known as TP2) and the 30m of fill material that is emplaced in TP2 to about 15m above the natural ground level at this location.

The surface above and in the vicinity of Longwall 16 and Longwall 17 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 and in the vicinity of Longwall 16 and Longwall 17 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 above Longwall 15 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 TP2 are located above Longwall 16. Sections of the rehabilitated Mt Owen West Dump and Ravensworth East/Glendell emplacement areas are located above Longwall 16 and the area to be mined by Longwall 17. A small section of haul road for the Mt Owen – North Pit is adjacent to the start line of Longwall 17.

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 Longwall 16 and Longwall 17.

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 December 2020 to May 2021 reporting period, Longwall 16 mined below:

- Part of the north-western corner of the open void of the ERP.
- A section of the Mt Owen Railway Line and associated infrastructure.
- The causeway of natural ground between the ERP and TP2 (on which the Mt Owen Railway Line and other infrastructure is located).
- A section of the open void, with water lodgement, and filled area of TP2.
- Part of the Ravensworth East/Glendell emplacement area
- Mining related infrastructure including 11kV overhead powerline, water supply and water transfer pipelines, and other surface water management equipment.
- Gas drainage installations and equipment.
- Other minor built features such as access roads and four-wheel drive tracks.

Longwall 17 mined below:

- Part of the West Dump with contour drains and access tracks.
- Gas drainage installations and associated equipment.
- A section of the drop structure/drainage channel on the eastern slope of the West Dump.

Other built features in proximity to the areas mined in this reporting period include:

- Glendell haul road and Ravensworth East – West Pit, adjacent to the finish line of Longwall 16.
- A small section of Mt Owen – North Pit haul road, adjacent to the start line of Longwall 17.

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 prepared in consultation with relevant government agencies. Management plans for Built Features, Public Safety, Rehabilitation, Water, Biodiversity, Land and Heritage are required to manage any potential subsidence impacts and ensuing environment consequences and, to ensure public safety at the site.

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 15 and 16, and Longwalls 17-20. 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:
 - o Mt Owen Railway Line and Bettys Creek Bridges.
 - o Mt Owen train loading and items in the Mine Infrastructure Area.
 - o Other key infrastructure e.g.
 - Mt Owen - North Pit.
 - Ravensworth East - West Pit.
 - Glendell haul road.
 - ERP.
 - TP2.
 - TP1 (Mt Owen Rail Loop Tailings Dam).
 - Overburden Emplacement Areas.
 - Powerlines and water pipelines
 - 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.

Management plans for the EP overlap with the overall IUG Project Approval requirements for Water, Biodiversity, Heritage and Rehabilitation management plans relating to subsidence impacts and consequences.

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, and Longwalls 17-20, 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, and Longwalls 17-20 this distance is in the range of approximately 200-300m.

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 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 surveys of subsidence monitoring lines or points for Longwall 16, are yet to be completed. No measurements of subsidence effects from Longwall 17 have been undertaken to date.

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 (WMP) 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 (Mt Owen Railway Infrastructure 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 approximately 500m from first rail contact, weekly engineering surveys have been undertaken during this reporting period until the face line more than was 250m past last rail contact. Surveys then continued at fortnightly intervals with a final survey after the completion of mining in Longwall 16.

4.2 Subsidence Effects

Analysis of the surveys of subsidence monitoring lines or points for Longwall 16, required by the SMP for Longwalls 15 and 16, are yet to be completed by SCT. These surveys include the additional survey monitoring required by Dams Safety NSW along the southern edge of the Mt Owen Rail Loop Tailings Dam (TP1) as a prescribed/declared dam. The position of the lines/points are shown in Figure 1.

However, in the interim, the final engineering survey of PH Line on the Mt Owen Railway Line provides an indication of measured subsidence effects along the railway corridor above Longwall 16.

MSEC report 1127-R25 for the survey on 26 April 2021 details maximum incremental movements of 719mm for vertical subsidence, 1.1mm/m for tensile strain and 1.4mm/m for compressive strain. The results for vertical displacement and tensile strain are slightly higher than predicted but within the order of accuracy of the prediction method. Overall, subsidence behaviour is as expected and generally consistent with the low values predicted for the management of subsidence impacts to this infrastructure.

Cumulative subsidence above Longwall 16 is currently 0.8m. Cumulative subsidence over Longwall 15 has increased by approximately 0.3m to 1.1m after the mining of Longwall 16. The increase in vertical subsidence over the previous panel is consistent with expectation for the subcritical mining geometry at IUG. Maximum cumulative strains are approximately 2mm/m in tension and 3mm/m in compression.

All these values for primary subsidence parameters are less than those forecast more generally for both the natural ground surface and areas of disturbed ground with waste rock fill or tailings material and much less than the values of subsidence effects presented in SCT (2018) as performance indicators for the Longwalls 15 and 16 EP.

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 and Longwall 17 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 impacts have been observed from the mining in Longwall 17 to date. The impacts expected from the mining in this panel are presented in SCT (2021).

No significant subsidence impacts from underground longwall mining were reported on or at:

- Part of the north-western corner of the open void of the ERP.
- A section of the Mt Owen Railway Line and associated infrastructure.
- The causeway of natural ground between the ERP and TP2.
- A section of the open void, with water lodgement, and filled area of TP2.
- Part of the Ravensworth East/Glendell emplacement area.
- Mining related infrastructure including 11kV overhead powerline, water supply and water transfer pipelines, and other surface water management equipment.

- Gas drainage installations and equipment.
- Other minor built features such as access roads and four-wheel drive tracks.
- Glendell haul road and Ravensworth East – West Pit.
- Part of the West Dump with contour drains and access tracks.
- Gas drainage installations and associated equipment.
- A section of the drop structure/drainage channel on the eastern slope of the West Dump.
- Mt Owen – North Pit haul road.

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

The subsidence related impacts observed relate to:

- A minor crack in a gas drainage pad located on the causeway of natural ground the ERP and TP2 excavations.
- A minor crack observed in fill material emplaced in TP2.
- Minor subsidence impacts to the Mt Owen Railway Line and associated infrastructure requiring minor maintenance activities.

The minor crack in the hard surface of the gas drainage pad on the causeway is shown in Figure 2. This tensile crack is within expectations presented in SCT (2018) for minor spreading or stretching of the embankment and causeway below the Mt Owen Railway Line due to the surface profile providing capacity for the ground to dilate and move towards the free faces of the surface excavations. Weekly inspections since this feature was first observed indicate no increase in crack width or length but some infilling following recent rainfall events.

The minor crack in the fill material emplaced in TP2 is shown in Figure 3. The crack is small in magnitude and extent, located on the steeper slope down to the standing water level in TP2. The crack is about 20mm wide, was not continuous, extending for only a few metres and likely to be exacerbated by the nature of the surface material and topography.

Ongoing visual inspections of other minor cracks above Longwall 16 recorded in the previous six-monthly reporting period indicate no additional subsidence effects or impacts at these locations.



Figure 2: Surface crack at gas drainage pad on causeway.



Figure 3: Minor crack observed in fill material of TP2 above Longwall 16.

Areas of erosion reported mainly in fill material on emplacement areas are likely to be the result of recent rainfall and not related to subsidence. Other areas of cracking on recently constructed access tracks outside the longwall footprint and over Longwall 15, are not considered to be related to subsidence movements from the mining of Longwall 16.

Monitoring and management of subsidence impacts to the Mt Owen Railway Line, Bettys Creek bridges and associated infrastructure was conducted during the reporting period consistent with the asset management plan for this infrastructure.

Results from the ground surveys for the Mt Owen Railway Line and Betty Creek bridges, indicates subsidence behaviour consistent with expectation and subsidence effects for ground movements, rail geometries and rail status generally consistent with the predictions by MSEC. There have not been any significant impacts.

Generally, only low level (blue) trigger action response plan (TARP) triggers were activated by subsidence effects with responses effectively managed by the Technical Committee.

A range of triggers were activated during an extended period of high summer temperatures and during maintenance activities. However, either no trains were operating at these times, or the rails were cooled to reduce stress before haulage operations resumed. Responses to the triggers were effectively managed by the Technical Committee consistent with the asset management plan for this infrastructure.

In addition to the alarm responses, the Technical Committee has continued to oversee ongoing preventative maintenance activities to successfully mitigate subsidence impacts and maintain this infrastructure in a safe and serviceable condition.

Biodiversity monitoring consistent with the BMP was conducted by SLR Consulting Australia Pty Ltd (SLR) and reported in June 2021 (SLR 2021a) after the mining of Longwall 16 was complete. 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 (2021a) indicates there has been no evidence of subsidence from the 2020 observations for the reference sites over Longwalls 13 and 14 and the control sites located outside the predicted subsidence zone.

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 field work for 2021 and end of Longwall 16 was completed in May 2021 with a report by SLR issued in June 2021.

The results of the May 2021 Bettys Creek middle diversion channel stability and stream health monitoring (SLR 2021b) indicate the monitoring points have experienced no apparent change from what was observed during the June 2020 assessment. The monitoring identified that some sections of the diversion are currently eroding and are vulnerable to further erosion with areas of significant previous erosion. No evidence has been observed to indicate that impacts to the diversion have occurred as a result of Integra Underground operations (including subsidence impacts). No additional erosion points were identified during the May 2021 assessment. The condition of riparian vegetation remained stable amongst the majority of monitoring sites. Comparison of recent and historical aerial photographs and LIDAR surveys indicates that no significant lateral shifts or contours of the diversion have occurred.

GeoTerra Pty Ltd were commissioned by IUG *“to report on comparisons between predicted and observed groundwater system changes that occurred during the extraction of Longwalls 15 and 16 within the 2020 reporting period”*.

GeoTerra (2021) indicates that where groundwater levels were outside limits or groundwater quality triggers were reached that these values were within the historic range of monitoring data and are not definitively due to extraction of Longwalls 15 and 16. The summary of the predicted and observed effects on the groundwater systems due to extraction and subsidence impacts from Longwalls 15 and 16 indicates that impacts are generally less than predicted in 2005 and 2006. However, the piezometric surface is lower and has not recovered as predicted but it is noted that the recent drought period and surface mining operations (ERP excavation and reduced flows in Bettys Creek from Mt Owen - North Pit reducing catchment) are influencing water levels in the coal measures strata in the vicinity of Longwalls 14-16.

Environmental monitoring of surface water and groundwater, during the 4th quarter of 2020 and 1st quarter of 2021, 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 were within historical variations are not considered to be significant and are not due to influences from activities or operations undertaken by IUG.

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, and Longwalls 17-20.

6.1 Subsidence Performance Measures

Our review of the subsidence monitoring data provided by IUG, for the mining in Longwall 16 and Longwall 17 during the December 2020 to May 2021 reporting period, indicates that the subsidence impacts observed are considered to be compliant with the subsidence performance measures outlined in Table 10 of Condition 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 and Longwall 17 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 and Longwall 17 December 2020 – May 2021
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 and LW17. 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 and LW17. 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 and Longwall 17 December 2020 – May 2021
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 and LW17. 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 and LW17. 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 and LW17. Compliant based on no greater subsidence effects for natural ground compared to IUG Project EA. Land 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 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 and Longwall 17 during the December 2020 to May 2021 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 are generally consistent with the values for the primary subsidence parameters predicted to manage subsidence impacts 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 parameters in SCT (2018).

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

Table 2: Primary Subsidence Parameters for Conventional Subsidence Behaviour 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

The values of performance indicators recommended in SCT (2021) for Longwalls 17-20 are 20% in excess of the parameters detailed in Table 3 below.

Table 3: Primary Subsidence Parameters for Conventional Subsidence Behaviour for the mining of Longwalls 17-20

Longwall	Maximum Subsidence (m)	Maximum Tilt (mm/m)	Maximum Tensile Strain (mm/m)	Maximum Compressive Strain (mm/m)
Natural/Undisturbed Ground (e.g. Rail Loop Corridor)				
LW17	2.0	14	7	10
LW18	2.0	14	7	10
LW19	2.0	14	7	10
LW20	1.5	14	7	10
Areas of Waste Rock Emplacement (e.g. TP1, TP2, ERP, West Pit, West Dump)				
LW17	2.5	14	14	20
LW18	2.5	14	14	20
LW19	2.5	14	14	20
LW20	2.5	14	14	20

Table 4 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 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 reached.

Table 4: Performance Indicators from Longwalls 15 and 16 Management Plans

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 December 2020 – May 2021
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	Periodic and continuous monitoring, inspections, maintenance and actions managed by Technical Committee. Actions in response to monitoring and TARP triggers. No significant impacts observed from mining in LW16. Compliant based on maintaining safety, serviceability and repairability.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 December 2020 – May 2021
Management Plan or Feature	Indicator	Monitoring details
Mt Owen Key Features Asset Management Plan for LW15 and 16 Water Pipelines Powerlines Mt Owen – North Pit Ravensthorpe East – West Pit Glendell Haul Road Eastern Rail Pit (ERP). Ravensthorpe 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 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.
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 and 16.
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.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 December 2020 – May 2021
Management Plan or Feature	Indicator	Monitoring details
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, annual reports by specialists 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, annual reports by specialists and no significant impacts observed from mining LW16.
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.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 16 December 2020 – May 2021
Management Plan or Feature	Indicator	Monitoring details
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.

Table 5 details the performance indicators contained in the various management plans and programs of the Longwalls 17-20 EP. The status of compliance expected for the mining in Longwall 17 during the six-month reporting period is based on the observed subsidence effects and impacts.

Table 5: Performance Indicators from Longwalls 17–20 Management Plans

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 17 December 2020 – May 2021
Management Plan and/or Feature	Indicator	Monitoring details
Built Features (BFMP)		
Mt Owen Railway Infrastructure Longwalls 17 to 20 Asset Management Plan Train loading infrastructure at Mine Infrastructure Area	- No indicators - LW17-20 Action Plans - TARPs based on risk levels	Periodic and continuous monitoring, inspections, maintenance and actions managed by Technical Committee. Actions in response to monitoring and TARP triggers. No impacts observed from mining in LW17. Compliant based on maintaining safety, serviceability and repairability.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 17 December 2020 – May 2021
Management Plan and/or Feature	Indicator	Monitoring details
Mt Owen Glendell Operations Key Features Longwalls 17 to 20 Asset Management Plan Water Pipelines Powerlines Mt Owen – North Pit (highwall and haul road) Ravensworth East – West Pit (highwall) Glendell Haul Road Eastern Rail Pit (ERP) Mt Owen Rail loop Tailings Dam (TP1) Mt Owen Stage 5/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 less and more than a 20% increase of the forecast subsidence effects and impacts expected	Daily and weekly visual inspections. 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 impacts observed from mining in LW17. Compliant based on above.
Survey control stations	Not applicable	Compliant based on BFMP.
Access Roads Dams and Fences	- No indicators - TARPs	Compliant based on warning signs, weekly inspections and timely remediation of any impacts. No impacts observed from mining in LW17.
Surface Drainage	No indicators	Weekly Inspections during mining. No impacts observed from mining in LW17. Compliant based on above.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 17 December 2020 – May 2021
Management Plan and/or Feature	Indicator	Monitoring details
Mining infrastructure: Gas Drainage Ventilation Shaft 3 and associated infrastructure	- No indicators - TARPs in Ventilation Control Plan	Weekly Inspections during mining. Monitoring as per Ventilation Control Plan. No impacts observed from mining in LW17. Compliant based on above.
Public Safety		
Longwalls 17 to 20 Public Safety Management Plan (PSMP)	- No indicators - TARPs	Weekly surface inspections and remediation. No public safety incidents from mining in LW17 reported. Compliant with performance measures based on above.
Ponding and general subsidence remediation Mt Owen active mining areas Mt Owen Rail Line and associated infrastructure Roads and tracks Sediment dams Fences		Weekly inspections. No impacts observed from mining in LW17. No public safety incidents from mining in LW17 reported. Compliant based on warning signs, controlling access, weekly inspections and timely remediation of impacts.
Biodiversity		
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 LW17.
Land		
Longwalls 17 to 20 Land Management Plan	- Subsidence monitoring and inspections - Assessment of impacts - Effective remediation (landform is generally free draining) - TARPs	Subsidence monitoring as SMP. Weekly inspections as per PSMP. Monitoring as per WMP. Compliant based on weekly inspections by IUG Personnel and no impacts observed from mining LW17.

Performance Indicators		Status of compliance with Subsidence Performance Measures from mining in Longwall 17 December 2020 – May 2021
Management Plan and/or Feature	Indicator	Monitoring details
Heritage		
Aboriginal Heritage Management Plan	- No indicators - TARPs	No sites in active subsidence zone for LW17 during reporting period. Compliant based on, weekly inspections by IUG Personnel and no impacts observed from mining in LW17.
Historical Heritage Management Plan (HHMP)	- No indicators - TARPs	No sites in active subsidence zone for LW17 during reporting period. Compliant based on, weekly inspections by IUG Personnel and no impacts observed from mining in LW17.

Key risk control measures identified during risk assessments and included in the various management plans to manage subsidence impacts are not included in Table 4 and Table 5 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 4 and Table 5. 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 2021 “Integra Underground Mine: Subsidence Assessment for LW17-20 Extraction Plan” SCT Report INT5106 – 2 February 2021.

SLR 2021a “Longwalls 13-16 Biodiversity Monitoring 2021” SLR Consulting Australia Pty Ltd, SLR Ref: 630.12088-R05-v1.0 – 3 June 2021.

SLR 2021b “Bettys Creek Stream Health and Stability Report May 2021” SLR Consulting Australia Pty Ltd, SLR Ref: 630.12766-R01-v1.0 – Draft 16 June 2021.