Department of Planning and Environment

Nagindar Singh
Planning and Assessment Group
Department of Planning and Environment
4 Parramatta Square
12 Darcy Street PARRAMATTA NSW 2150

Your ref: MP08_0150-PA-46

File: DOC22/75316

23 February 2022

Dear Ms Singh

Bulli Seam Operations - Appin Mine LWs 709-711 and 905 Extraction Plan (MP08_0150-PA-46) – post approval assessment

I refer to your request received on 3 February 2022 seeking additional comments from the Environment, Energy and Science Group (EES) on the following documents submitted by the applicant:

- South32 cover letter
- Extraction Plan - Responses to agency submissions
- updated Groundwater Impact Assessment (SLR 2022).

As you are aware, EES previously provided detailed comments on the draft Extraction Plan to the applicant (South32) on 6 August 2021. EES subsequently reviewed the Extraction Plan dated October 2021 and provided comments to DPE Planning Assessment Group (DPE PAG) on 24 November 2021. In summary, EES did not support approval of the Extraction Plan until a statistically rigorous and quality controlled/quality assured water monitoring program was in place that addressed the failures of the current surface water and groundwater monitoring program.

EES has now reviewed the above documents and provides detailed comments and recommendations in Attachment A. As outlined in the attachment, EES's previous comments have not been adequately addressed. EES is concerned that the applicant's response is highly selective in the issues that have been addressed and that a statistically rigorous and quality controlled/quality assured water monitoring program is still not in place. EES therefore does not support approval of the Extraction Plan until each of the recommendations in Attachment A are met and the relevant information provided to EES.

Should you have any queries regarding this matter, please contact Marnie Stewart, Senior Project Officer - Planning on 9995 6868 or Marnie.stewart@environment.nsw.gov.au.

Yours sincerely

S. Harrison

Susan Harrison
Senior Team Leader Planning
Greater Sydney Branch
Biodiversity and Conservation

Attachment A – EES comments_Bulli Seam Operations - Appin Mine LWs 709-711 and 905 Extraction Plan (MP08_0150-PA-46) – post approval assessment

In reviewing the additional information, EES is concerned that the applicant's response is highly selective in the issues that have been addressed and that a statistically rigorous and quality controlled/quality assured water monitoring program is still not in place.

The updated Groundwater Impact Assessment (SLR 2022) does not contain:

- any BACI analyses to support interpretations of 'impact' or lack thereof,
- identify any monitoring sites for surface water, alluvial aquifers or groundwater directly above LW709-711 and LW905[1], and
- an improved groundwater model for the area which addresses the mismatch between modelled and observed groundwater levels.

A significant concern is the highly selective nature of the piezometers and data used in the groundwater assessment. Further monitoring bores exist in appropriate areas, but these bores are not mentioned, and the data has not been illustrated/provided[2]. As a result, the presentation of bore aquifer levels is often dominated by bores to the sides or well away from longwalls, with very few illustrations of the behaviour of bore aquifers directly above the longwalls. Most of these bores do not monitor the upper Hawkesbury sandstone or Wiannamatta shale layers – the most important aquifers likely to interact with the 3rd order streams of the areas (e.g. by providing baseflow).

It is also noted that the majority of bores close to the extraction area for LW709-711 and LW905 still do not have an appropriate baseline to assess change, with less than 12 months data for the 'new' bores[3] installed in 2021. None of these groundwater bores lie directly above LW709-711 and LW905[4] where the greatest impacts are likely to occur. At this point in time, EES considers that the applicant is ill-prepared to be able to assess the full extent of potential impacts of the extraction of LW709-711 and LW905 on surface and groundwater.

In response to EES concerns about the lack of any monitoring above the longwalls, the applicant states:

> *As stated previously in Table 7 of the Longwalls 709 to 711 and 905 Extraction Plan (EP), potential sites directly above the proposed longwalls would be located on private property. Installing pool water monitoring equipment or boreholes with piezometers is subject to landholder agreement.*

It is important to note that the Bulli Seam Operations (BSO) Project was approved by the Planning Assessment Commission on 22 December 2011. The applicant has drilled many exploration and

[1] Even though some groundwater monitoring bores do exist above the longwalls.
[2] Nor do many of these additional monitoring bores appear to have been used in the modelling.
[3] IMC state that it has established four groundwater monitoring boreholes in the Longwalls 709 to 711 and 905 Study Area:

- S2536 – single piezometer at a depth of 15.6 m in the alluvium, established 27 August 2021.
- S3536A – single piezometer at a depth of 136.6 m in the HBSS, established 27 July 2021.
- S2537 – single piezometer at a depth of 129.5 in the HBSS, established 5 July 2021.
- S2538 – single piezometer at a depth of 129.5 m in the HBSS, established 12 July 2021.

[4] Although as identified below, some bores above the longwalls do exist but have been selectively excluded from the groundwater assessment report. The majority of bores discussed in the Groundwater Assessment are to the sides of the longwall (in some cases up to ~1km away). The majority of these are not monitoring the Hawkesbury sandstone or Wiannamatta shale – the most important aquifers affecting 3rd order streams of the areas (e.g. providing baseflow).

monitoring boreholes on private property and has had over a decade to sort out appropriate surface and alluvial water monitoring sites for the development. Over the intervening time, EES (and its predecessors) has repeatedly identified the deficiencies in the surface water and groundwater monitoring programs. These deficiencies remain unaddressed as does the scientific rigour[5] of assessments based on the monitoring that does take place.

The applicant appears to primarily monitor and report on areas to the sides of the longwalls, rather than in areas where maximum subsidence and impacts are likely to occur. This approach to monitoring and reporting on the effects of longwall mining on surface water and groundwater aquifers is not supported.

Surface Water Monitoring

Longwalls 709 to 711 and 905 will directly undermine 3rd order sections of Navigation Creek, Navigation Creek Tributary 1 and Foot Onslow Creek. Geomorphically, these creeks appear to be a chain of ponds system, with a significant number of farm dams in both the Navigation and Foot Onslow Creek catchments. Where there are permanent (or near permanent pools) on these drainage lines they are poorly studied.

The upper most parts of Navigation Creek (1st and second order) will be undermined by the south-western end of LW711. LW711 then goes on to undermine approximately 800m of the third order section of Navigation Creek. In addition, LW 711 and 710B will undermine approximately 1km of the third order section of the Navigation Creek Tributary 1.

Approximately 300m of the 3rd order section of Foot Onslow Creek will be undermined by LW709 and the north-east corner of LW710B. A fault lies very close to the section of Foot Onslow Creek proposed to be directly undermined (MSEC 1117-06).

The maximum predicted subsidence effects on the third order creeks (i.e. Navigation, Foot Onslow and Harris) is 1400 mm vertical subsidence, comprising a predicted 550 mm upsidence and 800 mm total closure.

In relation to surface water flows, BSO Approval Condition 1, Schedule 3 stipulates that there should be *negligible diversion of flows or changes in the natural drainage behaviour of pools* in the Nepean River. In relation to other watercourses, there should be *no greater subsidence impact or environmental consequences than predicted in the Environmental Assessment and PPR.* The term "negligible" is defined within the Project Approval as "small and unimportant, such as not to be worth considering".

The BSO Surface Water Assessment stated that for Navigation Creek and Foot Onslow Creek:

> *The impacts on the headwaters of these creeks are expected to be limited to localised areas of iron staining and possibly cracking and enhanced leakage from farm dams. There may also be some changes to in-stream pools including the creation of additional pools at the northern end of the Project extent of longwall mining area at Appin West (Area 9), however is not expected to significantly alter the hydrology along the stream. Dilation fracturing could lead to reduction in pool levels and affect farm dams in areas of rock outcrop or where bedrock is covered by a thin mantle of alluvium.* (Gilbert and Associates 2009).

[5] For example, a proper BACI analysis of before, after, impact and reference site data.

MSEC (2009) stated:

> *Fracturing could therefore develop along the creeks and tributaries due to the mining of the proposed LW709 to LW711 and LW905. Fracturing will predominately occur where the creeks and tributaries are located directly above the mining area. Impacts can also occur outside the mining area, with minor and isolated fracturing occurring at distances up to approximately 400 m outside the longwalls, as previously observed at Appin Colliery and elsewhere in the Southern Coalfield. Based on the experience of mining beneath ephemeral creeks and tributaries in the Southern Coalfield, it is likely that some fracturing will occur along the streams within the Study Area, particularly those located directly above or adjacent to the mining area. Some standing pools could experience a reduction or loss of water holding capacity.*

Figure 1 (Figure 4 of SLR 2022) illustrates the surface water monitoring for the area. There are no monitoring sites identified in the 3rd order sections of Navigation Creek, Navigation Creek Tributary 1 and Foot Onslow Creek (let alone above any of the longwalls - LW709-711 and LW905).

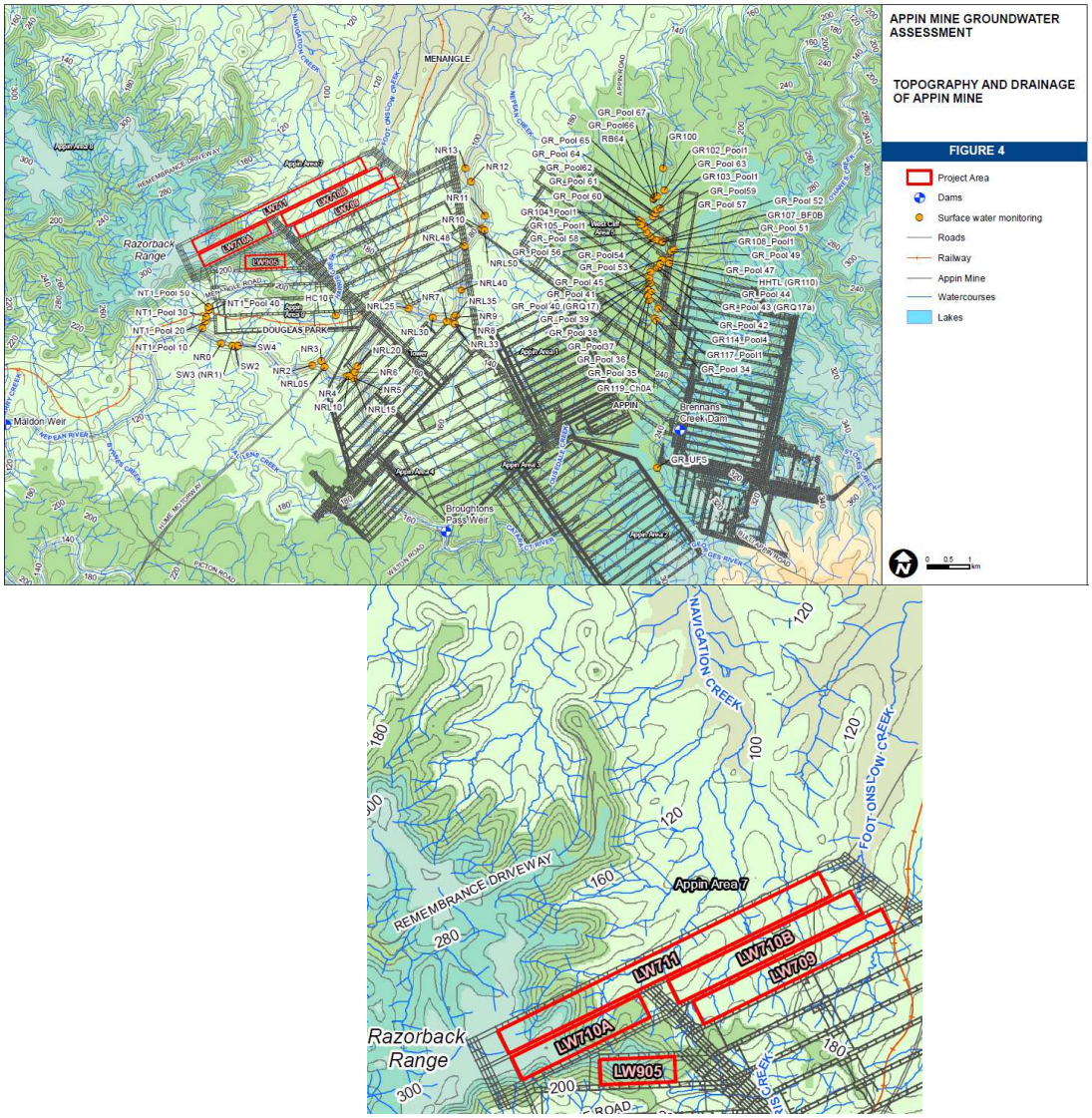


Figure 1. Surface water monitoring for the LW709 to LW711 and LW905 area. Source SLR 2022 Figure 4.

EES recommendation

Prior to approval of the LW709-711 and LW905 Extraction Plan a statistically rigorous, quality assured monitoring program is established for surface pool levels in the undermined 3rd order sections of Navigation Creek, Navigation Creek Tributary 1 and Foot Onslow Creek.

Alluvial monitoring

Only one alluvial bore appears to be monitored over the whole of the mining domain (Figure 2). According to the applicant this is:

> *S2536 – single piezometer at a depth of 15.6 m in the alluvium, established 27 August 2021.*
>
> and
>
> *IMC has installed a piezometer in the alluvium at a depth of ~16 m within the Longwalls 709 to 711 and 905 Study Area to monitor groundwater levels. Borehole S2536 shows the location of this monitoring site which is also near Navigation Creek. The Water Management Plan (WMP) has been updated to include this information.*

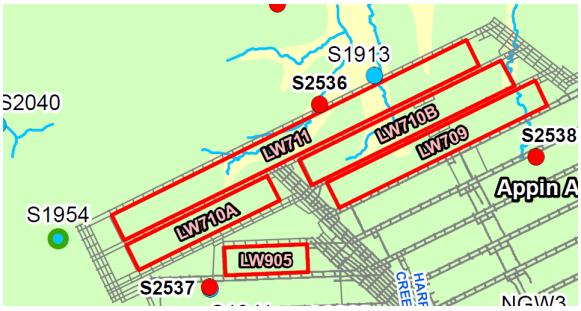


Figure 2 Alluvial water monitoring (S2536 only) for the LW709 to LW711 and LW905 area. Source SLR 2022.

According to the updated Groundwater Assessment (SLR 2022), "*S2536 does not have surveyed coordinates".*

Given that there is only one (1) alluvial monitoring bore, its coordinates have not been surveyed and it is cited to be '*near Navigation Creek'* rather than *'in Navigation Creek'*, EES considers that an inadequate monitoring program for alluvial aquifers occurs in the LW709-711 and LW905 mining domain. S2536 currently has an extremely short period of baseline monitoring (~6 months) and the results from this monitoring have not been supplied/illustrated anywhere in the documentation to support the Extraction Plan.

EES recommendation

1. Prior to approval of the LW709-711 and LW905 Extraction Plan a statistically rigorous, quality assured monitoring program is established for alluvial aquifers in the undermined 3rd order sections of Navigation Creek, Navigation Creek Tributary 1 and Foot Onslow Creek.
2. The raw data and surveyed coordinates for S2436 are forwarded to EES.

Groundwater Monitoring

The applicant's response to the groundwater monitoring issues raised by EES is:

> *SLR has reassessed **all groundwater data available from the monitoring bores** and included the latest data for the bores in the data set as shown in Section 3.2 of the Groundwater Impact Assessment (SLR 2022).*

Figure 3 below (Figure 9 of SLR 2022) purports to illustrates the groundwater monitoring for the area.

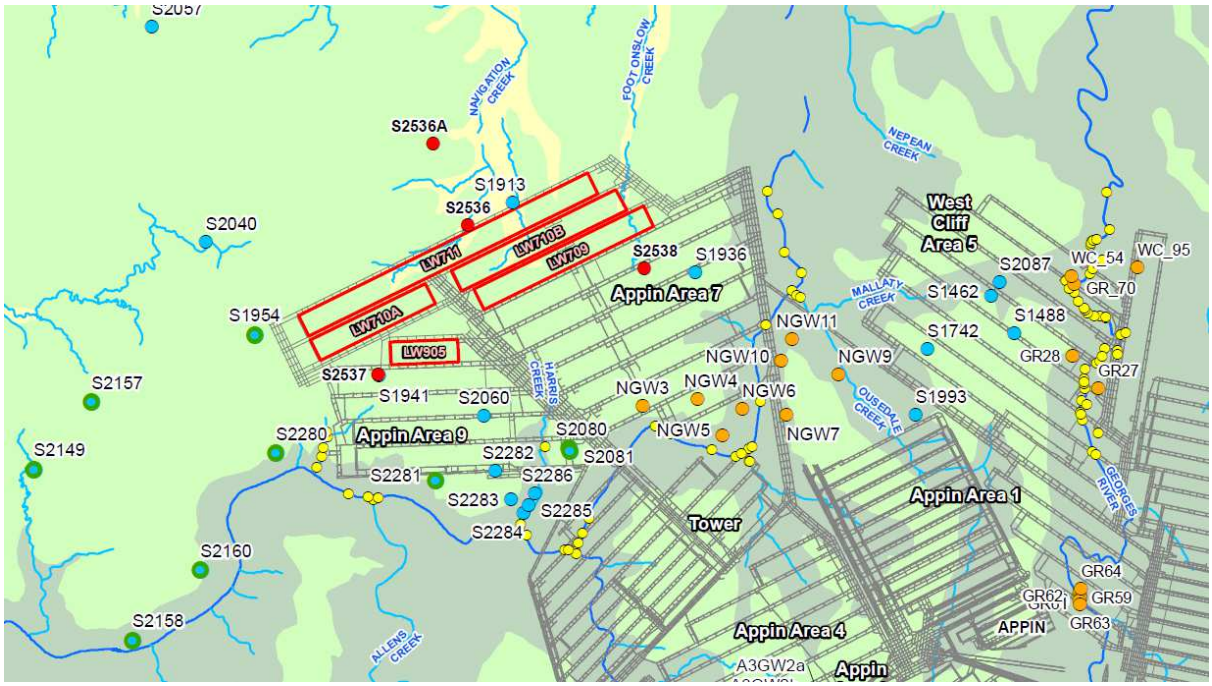


Figure 3 Groundwater monitoring for the LW709 to LW711 and LW905 area. Source SLR 2022 Figure 9.

The most significant issue from Figure 3 is that it appears[6] there are no groundwater monitoring bores directly above LW709-711 and LW905. Review of End of Panel reports and Annual Reports as well as later figures in SLR (2022; e.g. Figure 45), however, identify a number of piezometers above the longwalls (Figures 4 and 5), many of which have not been included/discussed in detail in the Groundwater Impact Assessment (SLR 2022) report.

[6] But as is discussed further below, there are yet other groundwater bores that have been selectively excluded from the Updated Groundwater Assessment (and potentially in the calibration and validation of the groundwater model).

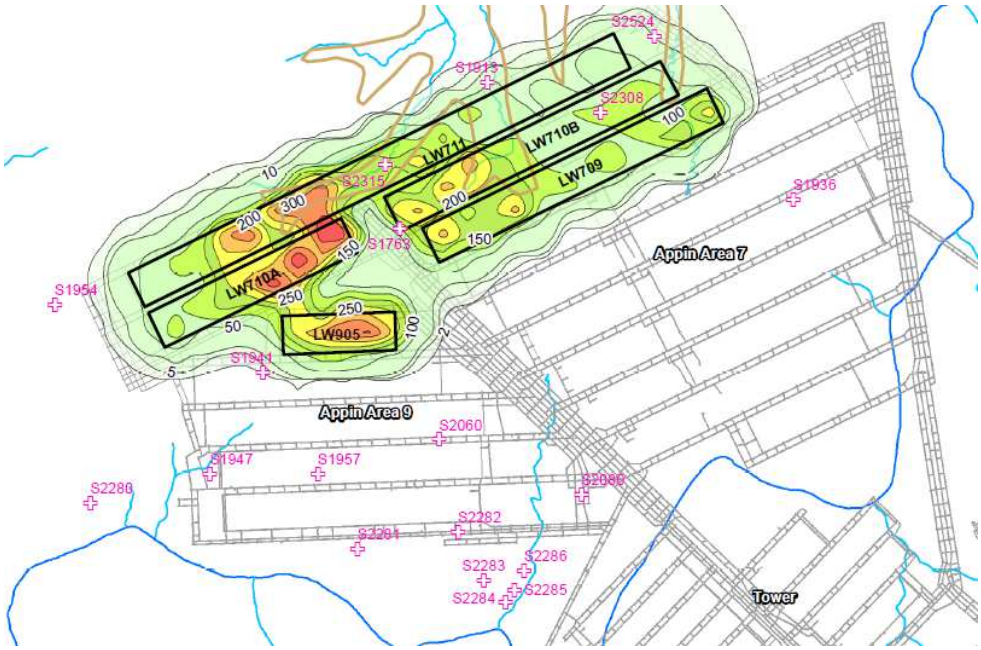


Figure 4 Groundwater monitoring for the LW709 to LW711 and LW905 area. Source SLR 2022 Figure 45.

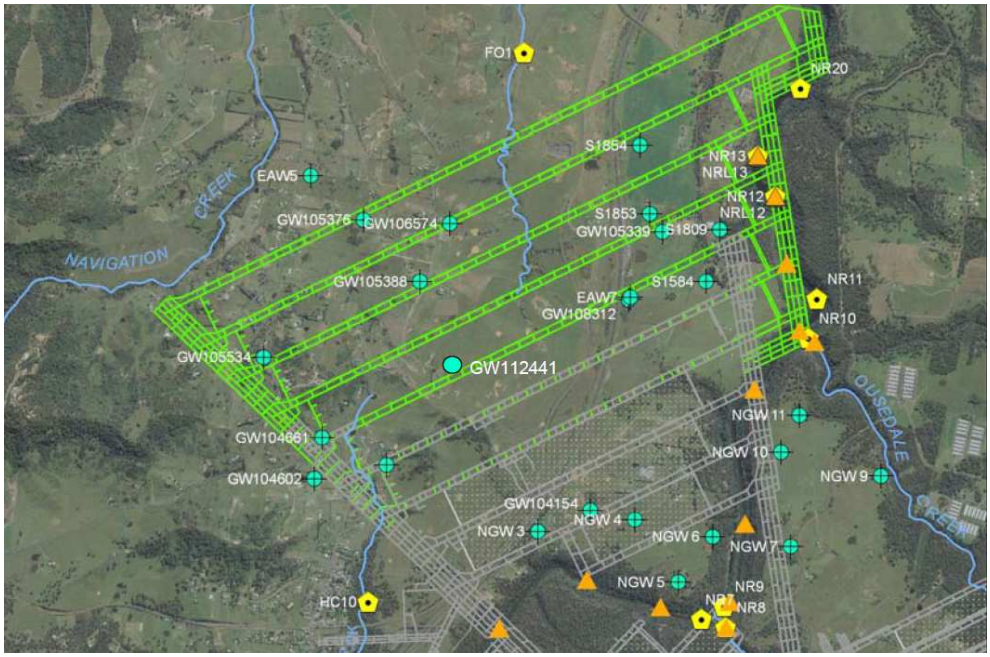


Figure 5 Groundwater monitoring for the Appin 700 area. Source Geoterra 2018.

In particular, the Groundwater Impact Assessment (SLR 2022) provides no or very limited information or data on S1763, S2315, S2524, S1947, S1957, S2060, S1864, S1853, S1584, S1809, S1854. It is difficult to find any information on S1864, S1853, S1584, S1809 and S1854, despite them being listed as monitoring bores in end of panel reports.

For S2308[7], which lies directly above LW710B, the Illawarra Coal Annual Review FY2018 stated:

> ***Borehole Appin West S2308 with eight piezometers installed is located approximately 940 m from LW707.*** *No water head changes that could be associated with longwall extraction were recorded. The top Hawkesbury sandstone piezometer installed 70 m below ground level has recorded some 20 m water head increase during longwall extraction.*

EES also previously identified issues with the reliability and consistency of groundwater data for S2308, for example:

> *Reference to one of these (S2308) suggests that water levels in the HBSS at 70m have potentially risen by 40m, without any explanation or validation.*

The Groundwater Impact Assessment (SLR 2022) now states:

*In the bore S2308, located within Longwall 710, most of the sensors except the first sensor depth at 70 mbgl in HBSS show decline in groundwater levels (**Figure 13**). The measured data for the sensor at 70 mbgl has recorded a significant increase in groundwater levels in recent years (approximately 50 m) and appear erroneous. Therefore, the data from this sensor is not considered in this groundwater assessment and model calibration.*

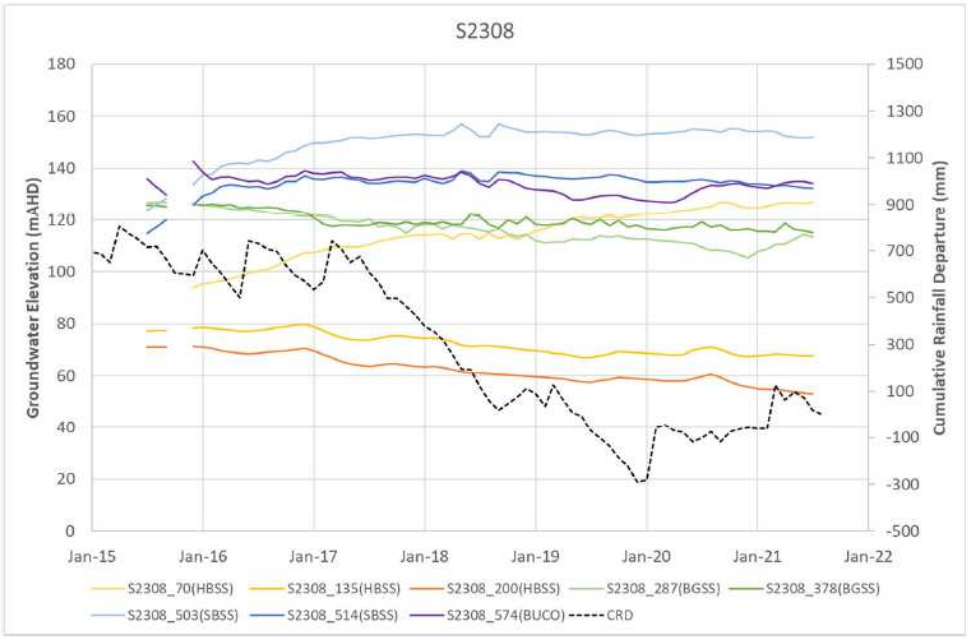


Figure 13 Hydrograph – S2308

It appears that the Hawkesbury sandstone aquifers in S2308 have potentially been directly affected by mining, with declines of ~10m (135m and 200m sensors), but there is no statistically rigorous assessment of the data (i.e. there is no BACI design assessment).

[7] It is noted that Figure 9 of SLR 2022 still does not identify S2308 lying above LW710B.

The closest groundwater monitoring bores (identified in SLR 2022 Figure 9) to LW709-711 and LW905 are S1913, S1954, S2537 and S2538.

- S1954 - is approximately 650m southwest of the end of LW711 and according to HGEO (2021) was established in 2008. There is a period of 3.5 years where there was no data and no explanation has been provided for this (see Appendix 1). S1954 does not overly any longwalls but appears to have experienced some small declines in the Hawkesbury sandstone aquifer levels as a result of mining (HGEO 2021).

- S1913 is located on the northern edge of LW711 near the Navigation Creek Tributary 1. According to HGEO (2021), S1913 is located 2.6 km north of Longwall 903. It has three sensors in the Hawkesbury Sandstone at 65 m, 137 m and 194 m depth. During Longwall 903, groundwater pressures at the upper two Hawkesbury Sandstone sensors remained relatively stable, and pressures at the 194 m sensor showed a declining trend. Pressures at the upper two Hawkesbury Sandstone sensors were above the level of the Nepean River during Longwall 903. Pressures at the 194 m sensor have been below the level of the Nepean River since prior to the commencement of mining in AA9. Pressures at the 194 m sensor have declined by 14.3 m since the commencement of mining in AA9, more than the predicted maximum reduction of 10 m.

- S2537 and S2538 have only recently been installed and no details are provided in the Groundwater Impact Assessment (SLR 2022).

As another example of an inadequately supported conclusion, the Groundwater Impact Assessment (SLR 2022) states:

> "*The hydrograph for the bore S1941 (Figure 12), located within Longwall 904, shows decline in groundwater levels at sensor depth 201 mbgl during Feb. 2020 and Aug. 2020 which is likely response to the registered bore GW100673 located approximately 950 m west of S1941 and 1,000 m southeast of S1954 extracting water from HBSS.*"

In the End of Panel report for LW903, HGEO (2021) identify the decline in the S1941 201 mbgl sensor as being ~17m[8].

It should be noted that bore GW100673 (almost a kilometre away from S1941) was drilled to 104m bgl so it is located ~100m above the strata of the sensor suggested to be measuring at 201m bgl. No scientific evidence is provided to support the subjective and unverified opinion that groundwater pumping in bore GW100673 caused a 17m decline in an aquifer 100m lower than where the pumping took place. The credibility of this conclusion is challenged by EES.

Further details on individual bores are provided in Appendix A.

The groundwater modelling section also suggests that any groundwater depressurisations in the area are largely due to other interventions (quarries and groundwater bores) rather than the longwall mining:

The findings are:

- *There is a 2 m depressurisation contour surrounding Menangle Quarry in the Alluvium (Model Layer 1) and no additional depressurisation due to Appin Mine.*

[8] Roughly equivalent to the height of a 5-story building

- *Up to 40 m depressurisation is predicted to at least 2,000 m away from Appin Mine in the Wianamatta Group around the registered bores.*
- *For the Upper HBSS there is 20 m predicted depressurisation around the central of Longwalls 710 and 711 surrounding the registered bores caused by the water supply extraction. The predicted 10 m depressurisation is extending from Longwalls 709 to 711 and 905 footprints to 6,000 m to the north and 700 m to the south caused by the cumulative extraction from the registered bores.*
- *Similar to the predicted depressurisation in the Upper HBSS, the Lower HBSS (Model Layer 5) is predicted to experience significant depressurisation (up to 100 m), located around the registered bores caused by the water supply extraction.*

No science is presented to support the conclusion that all/the majority of modelled aquifer depressurisations in the area are primarily due to groundwater extraction[9] (rather than longwall mining). The majority of bores in the area are stock or basic water use bores (rather than bores used for extensive agricultural irrigation). Groundwater monitoring near Thirlmere Lakes to the south of the longwalls suggests that while groundwater extraction can affect water levels, the drawdown is much lower than the levels (10-40m) suggested by SLR (2022) and such declines are temporary, with the aquifer levels returning to pre-pumping levels once groundwater extraction ceases.

The scientific evidence and causal attribution of sustained water level declines solely due to groundwater extraction or quarrying in the area is lacking.

EES recommendations

1. Prior to approval of the LW709-711 and LW905 Extraction Plan a statistically rigorous, quality assured monitoring program is established for groundwater monitoring in the area.
2. A proper BACI analysis is conducted on all (not a selective subset of) groundwater monitoring bores to assess the putative impacts of mining on groundwater levels.
3. The raw data and surveyed coordinates for all groundwater monitoring bores are forwarded to EES.
4. Scientific evidence be provided to support the currently unsupported contention that groundwater extraction from landholder bores leads to a sustained decline of 10-40m in aquifer levels independent of mining.

Groundwater Model

The applicant has not appropriately discussed nor addressed the EES recommendation that:

> *An improved groundwater model for the area which addresses the mismatch between modelled and observed groundwater levels.*

Whilst Figure 38 of the Groundwater Impact Assessment (SLR 2022) suggests a good agreement between model predictions and groundwater levels in the coal seam at ~500m for 3 bores, it is a highly selective presentation of results. It does not appropriately discuss the poor level of calibration of model results to the upper layers (Hawkesbury Sandstone, Alluvium), nor does it adequately address uncertainty in the model results. According to the revised Groundwater Assessment (SLR 2022), the RMS error calculated for the calibrated model is 27.5 m. If this is taken as a measure of the standard deviation(σ) of the data, then predicted levels potentially come

[9] Or Menangle Quarry. The model has not been rigorously calibrated or validated to confirm this.

with an approximate error of +/-30m (1 X σ) or +/-60m (2 X σ). This is not considered a particularly accurate model estimation for aquifer levels[10] in the LW709-711 and LW905 mining domain.

Evidence for the mismatch between modelled and observed data can also be seen in SLR (2022) Appendix D. Reference to Appendix D shows a large number of model results which demonstrate a very poor level of agreement between calibrated and observed data, and as identified earlier, the majority of data presented are for bores to the sides or well away from longwall mining.

The presentation of observed and modelled data is quite selective and is not considered to be a comprehensive and objective assessment of all groundwater data in the area. As a result, EES's original recommendation about the need for an improved groundwater model remains. Additional recommendations are made regarding the completeness of groundwater assessments, and model calibration and validation.

EES recommendations

1. An improved groundwater model for the area which addresses the mismatch between modelled and observed groundwater levels.
2. Model calibration and observed data be provided for all bore monitoring data in the area (including all bores directly above longwalls), not a selective subset of the monitoring data.
3. Scientific evidence be provided that validates a model-inferred, sustained decline of 10-40m in aquifer levels due to groundwater extraction from landholder bores in the area.

References

Geoterra (2018). Appin Colliery Longwall 707 End Of Panel Surface Water and Groundwater Monitoring Report Sth32_707 R1B 11 October 2018

Gilbert and Associates (2009). Bulli Seam Operations Surface Water Assessment Prepared for: Illawarra Coal Holdings Pty Ltd Sep-09 J0810-1.rg1a-6-8-09.doc

HGEO (2021). South32 Appin Mine Area 9 Longwall 903 End of Panel surface water and groundwater monitoring review HGEO Pty Ltd August 2021 Project number: J21520 Report: D21147

MSEC (2009). Illawarra Coal Bulli Seam Operations Subsidence Assessment Report On The Prediction Of Subsidence Parameters And The Assessment Of Mine Subsidence Impacts On Natural Features And Surface Infrastructure Resulting From The Bulli Seam Operations In Support Of The Part 3a Application Mine Subsidence Engineering Consultants Report Number MSEC404 Revision D

SLR (2022). Appin Mine Extraction Plan Groundwater Impact Assessment Prepared for: South 32 - Illawarra Metallurgical Coal SLR Ref: 665.10015-R01 Version No: -v7.0 February 2022

[10] Especially for the alluvium which is very poorly monitored.

Appendix 1. Groundwater Bore Summary

- S2308 - which lies directly above LW710B. The Illawarra Coal Annual Review FY2018 states:

  Borehole Appin West S2308 with eight piezometers installed is located approximately 940 m from LW707. No water head changes that could be associated with longwall extraction were recorded. The top Hawkesbury sandstone piezometer installed 70 m below ground level has recorded some 20 m water head increase during longwall extraction.

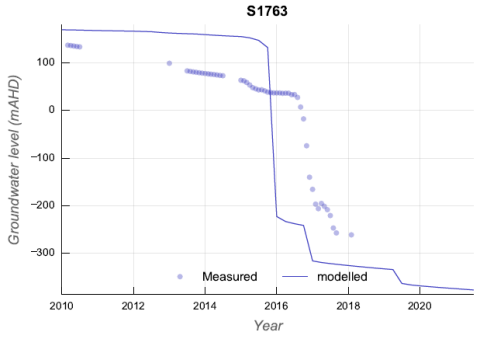
  EES also previously identified issues with the reliability and consistency of groundwater data, for example:

  Reference to one of these (S2308) suggests that water levels in the HBSS at 70m have potentially risen by 40m, without any explanation or validation.

  SLR (2022) states:

  *In the bore S2308, located within Longwall 710, most of the sensors except the first sensor depth at 70 mbgl in HBSS show decline in groundwater levels (**Figure 13**). The measured data for the sensor at 70 mbgl has recorded a significant increase in groundwater levels in recent years (approximately 50 m) and appear erroneous. Therefore, the data from this sensor is not considered in this groundwater assessment and model calibration.*

- S1763 – which lies in-between LW710A and LW710B. This bore is not discussed in any detail in SLR (2022) and appears to only be monitoring the coal seam which has already been depressurised (see SLR 2022 Appendix D). Note the poor agreement between modelled and observed data, with observed groundwater depressurisation occurring 12 months later than predicted. No recent data is illustrated.



- S2315 - which lies directly above LW711. Figure 9 of SLR 2022 does not identify bore S2315, however it does appear in SLR (2022) Figure 45.

  The Illawarra Coal Annual Review FY2018 stated:

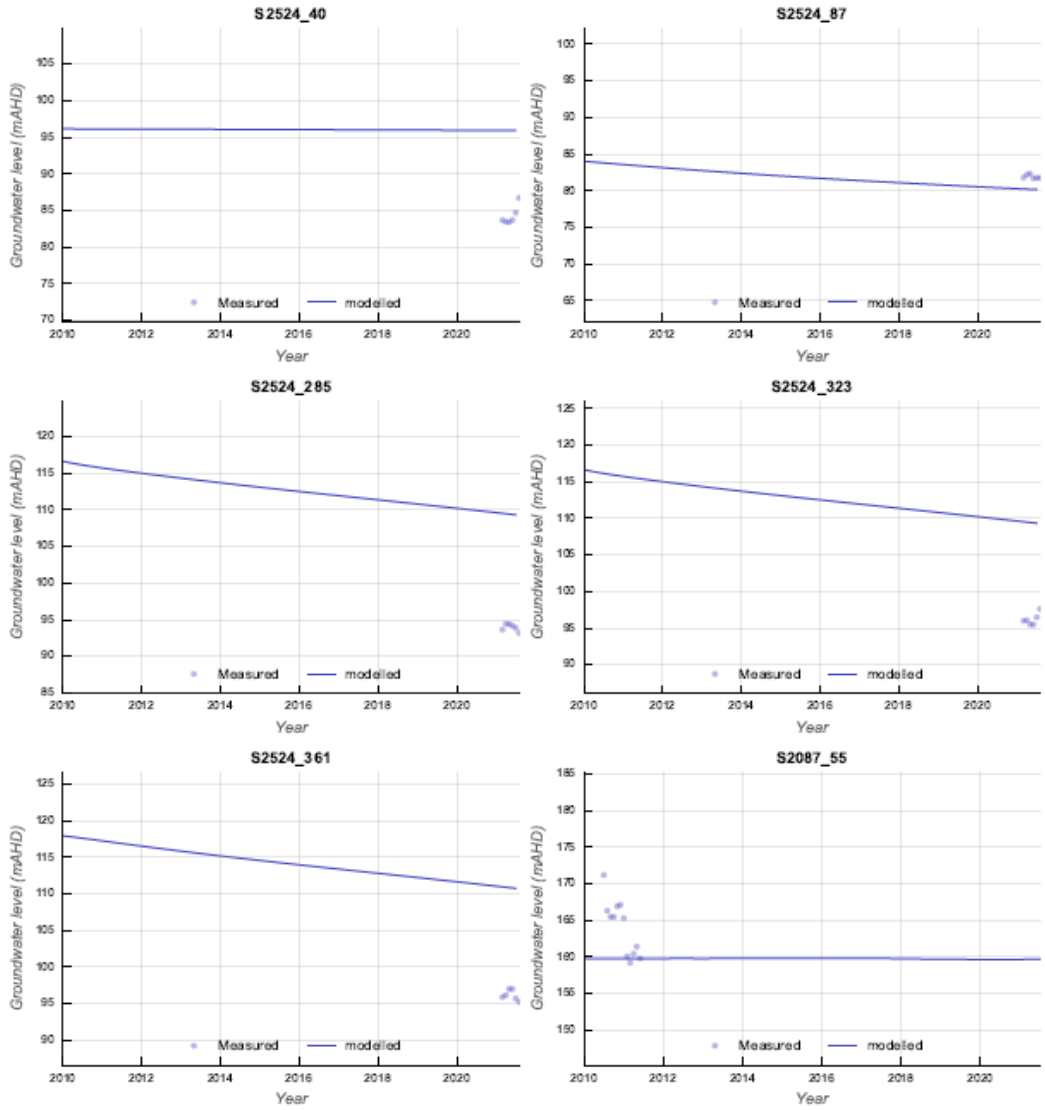
  Borehole Appin West S2315 is located 990 m from the longwall, it has nine piezometers installed. During Longwall 707 extraction, three piezometers recorded water head recession. These were Hawkesbury Sandstone piezometers installed at depths of 144 m and 224.5 m and Bulli Coal seam instrument installed at 576.4 m. Water head decline in the Bulli Seam can be attributed to the longwall extraction, however drops recorded in Hawkesbury are unlikely a result of mining, as the Bulgo Sandstone piezometers did not record any notable change and

the top Hawkesbury piezometer located 65 m below ground level recorded water head increase of some 15 m.

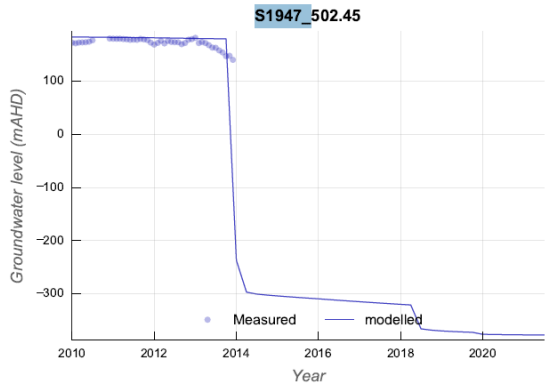
The updated Groundwater Assessment (SLR 2022) discusses S2135 and states:

*The depressurisation of the strata is observed across the historical and active mining areas as seen in bores S1936 and S2315 located in Area 7. All sensors at bore S1936 except the shallowest sensor (65 m) is no longer working since 2014 (**Figure 22**). This is likely due to the loggers being damaged or destroyed by mining. The hydrograph for S2315 (**Figure 23**) shows significant decline in groundwater levels in Bulli Coal Seam in response to the longwall mining. However, S2308 located 1.8 km to the west of S2315 has recorded stable groundwater level due to further distance from the current mining works (**Figure 13**).*

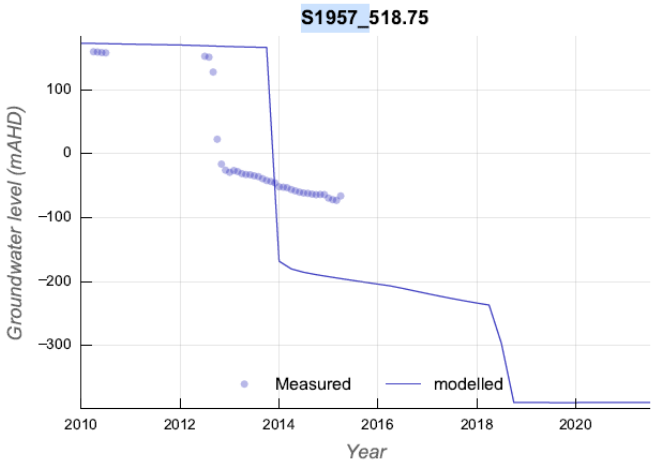
- S2524 – at the northern end of LW711. Data appears to exist from mid-2020 but this receives no discussion in the report. No recent data has been supplied/presented. Note the poor agreement between modelled and observed data, with observed groundwater often being 10-15m below model predictions.



- S1947 – lies at end LW902. No recent data has been supplied/presented.



- S1957 – lies above LW902. Note the poor agreement between modelled and observed data, with observed groundwater declining earlier than predicted and towards the end of 2015 being 100m above model predictions. No recent data has been supplied/presented.



- S2060 – lies above LW902. No recent data has been supplied/presented, but the declining trend in aquifer levels is obvious in Appendix D[11].

[11] Less so in Figure 25 of SLR (2022) which also indicates 'unreliable data'. No explanation is given for why it is considered 'unreliable' or why it is not potentially a 'real' mining impact.

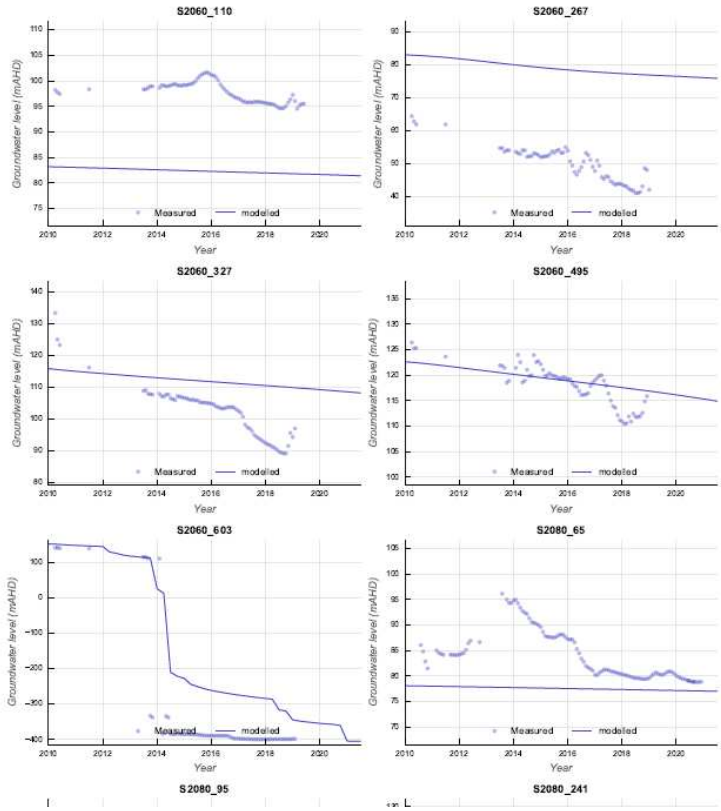


Figure 25 Hydrograph – S2060

- S1941 – lies above LW904. Note the poor agreement between modelled and observed data, with observed groundwater often being 10-50m below model predictions. This could quite conceivably be indicative of a longwall mining impact given S1941 lies directly above LW904.

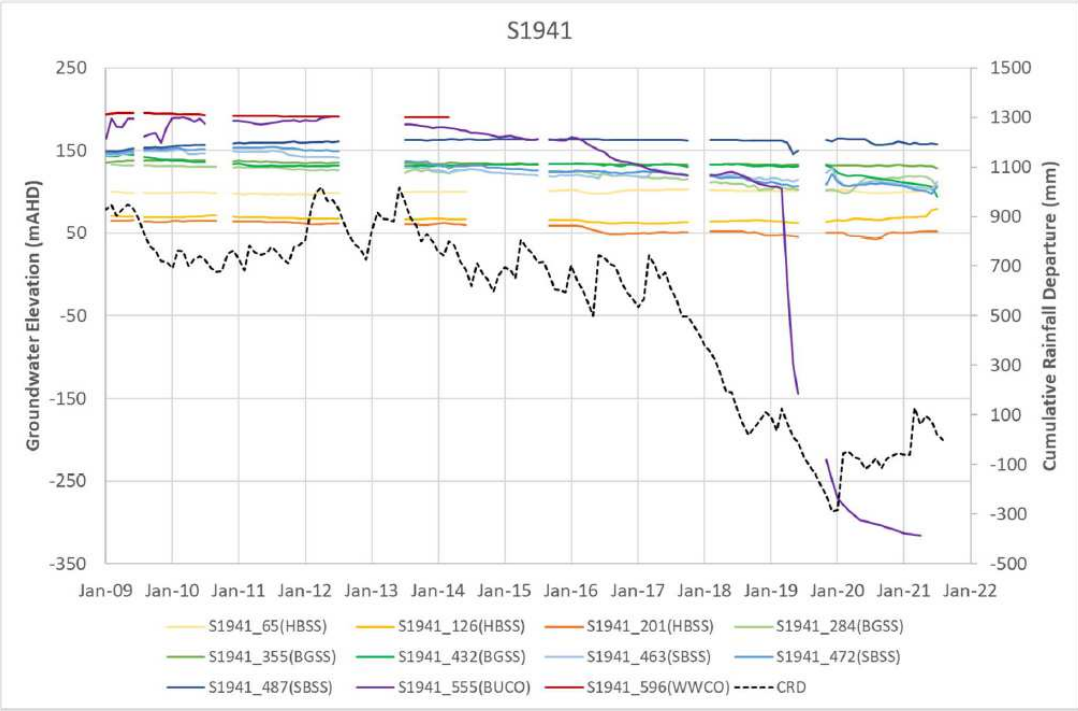
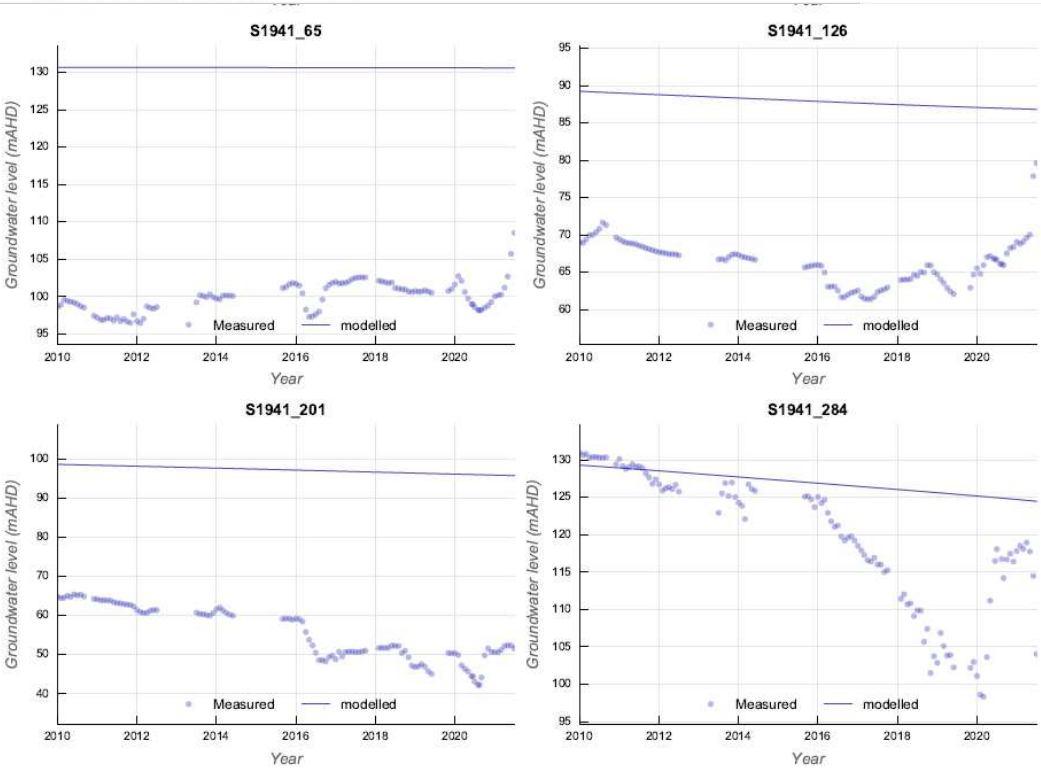


Figure 24 Hydrograph - S1941



Other groundwater trends are not appropriately discussed. For example:

- S1936 – above LW706

In regard to S1936 it is stated:

*The depressurisation of the strata is observed across the historical and active mining areas as seen in bores S1936 and S2315 located in Area 7. All sensors at bore S1936 except the shallowest sensor (65 m) is no longer working since 2014 (**Figure 22**). This is likely due to the loggers being damaged or destroyed by mining.*

This summary does not identify that the 65m Hawkesbury sandstone sensor indicates water levels have declined by ~7m since monitoring began.

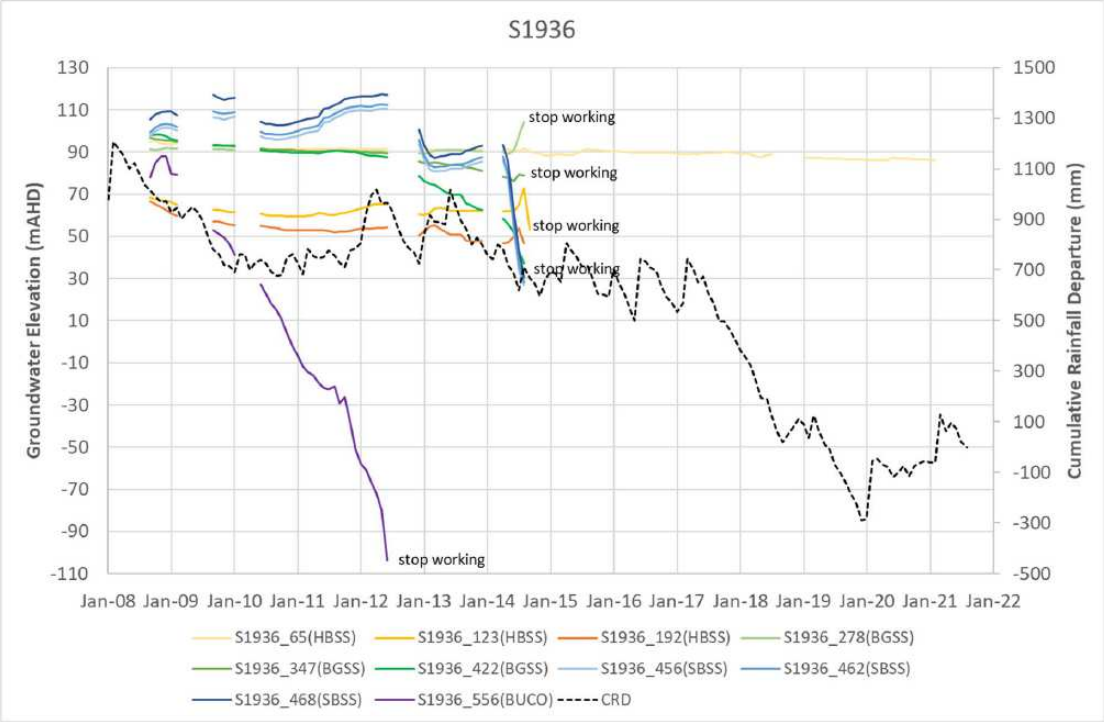
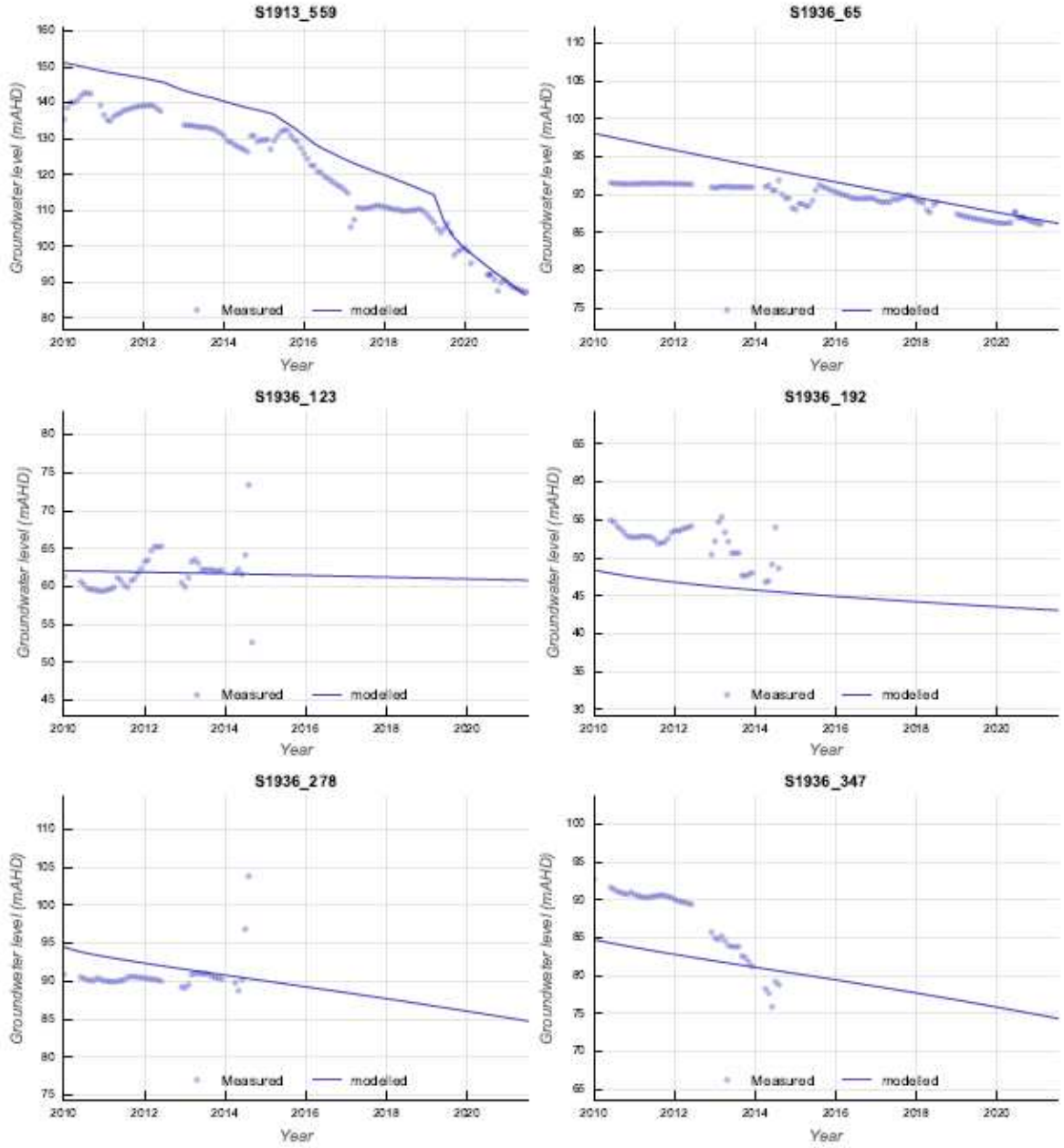
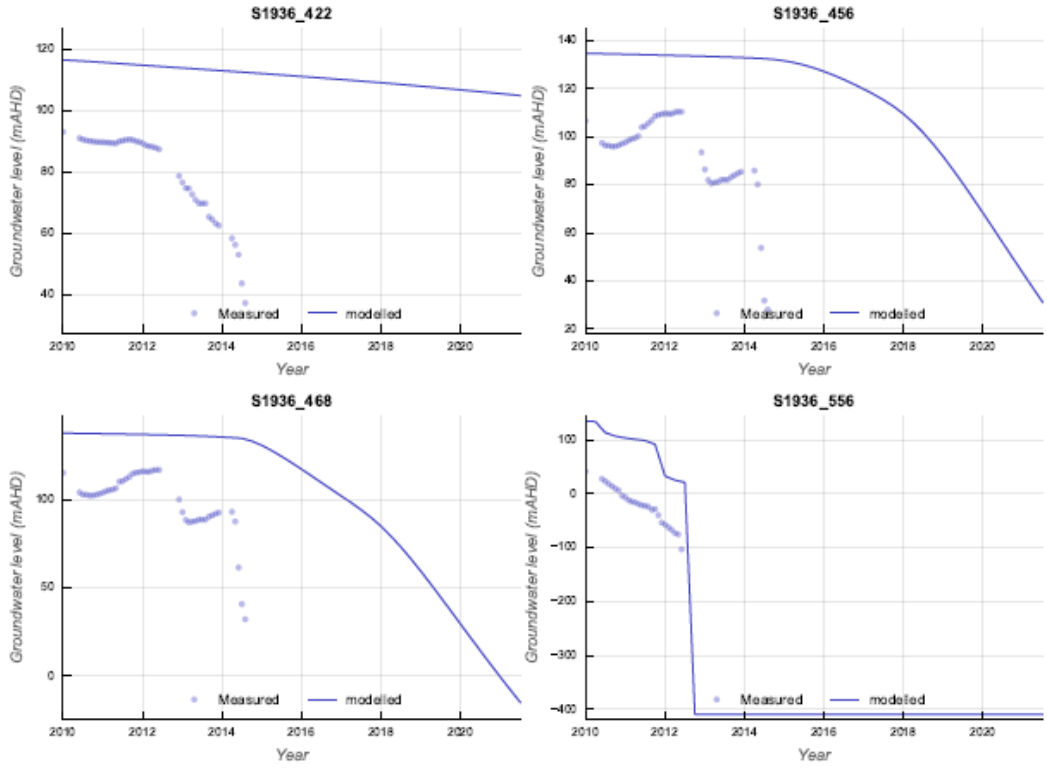
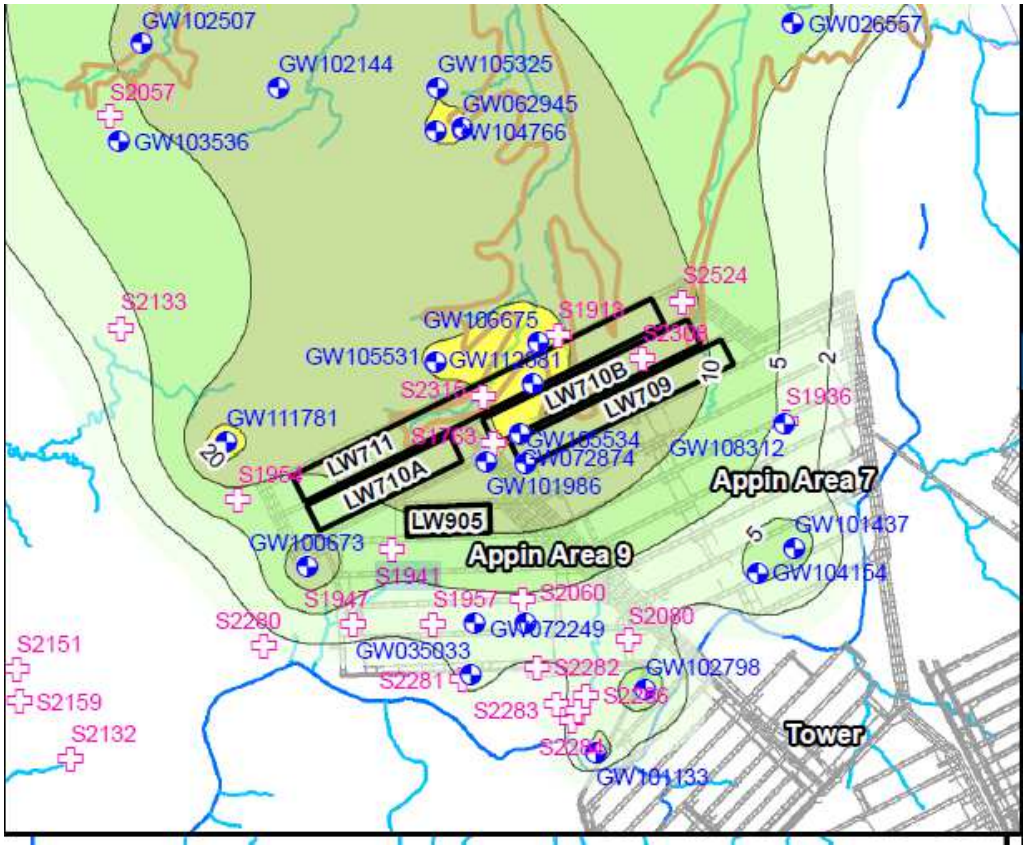


Figure 22 Hydrograph - S1936


S1913_559
S1936_65
S1936_123
S1936_192
S1936_278
S1936_347
Groundwater level (mAHD)
Year
Measured
modelled





End of Submission