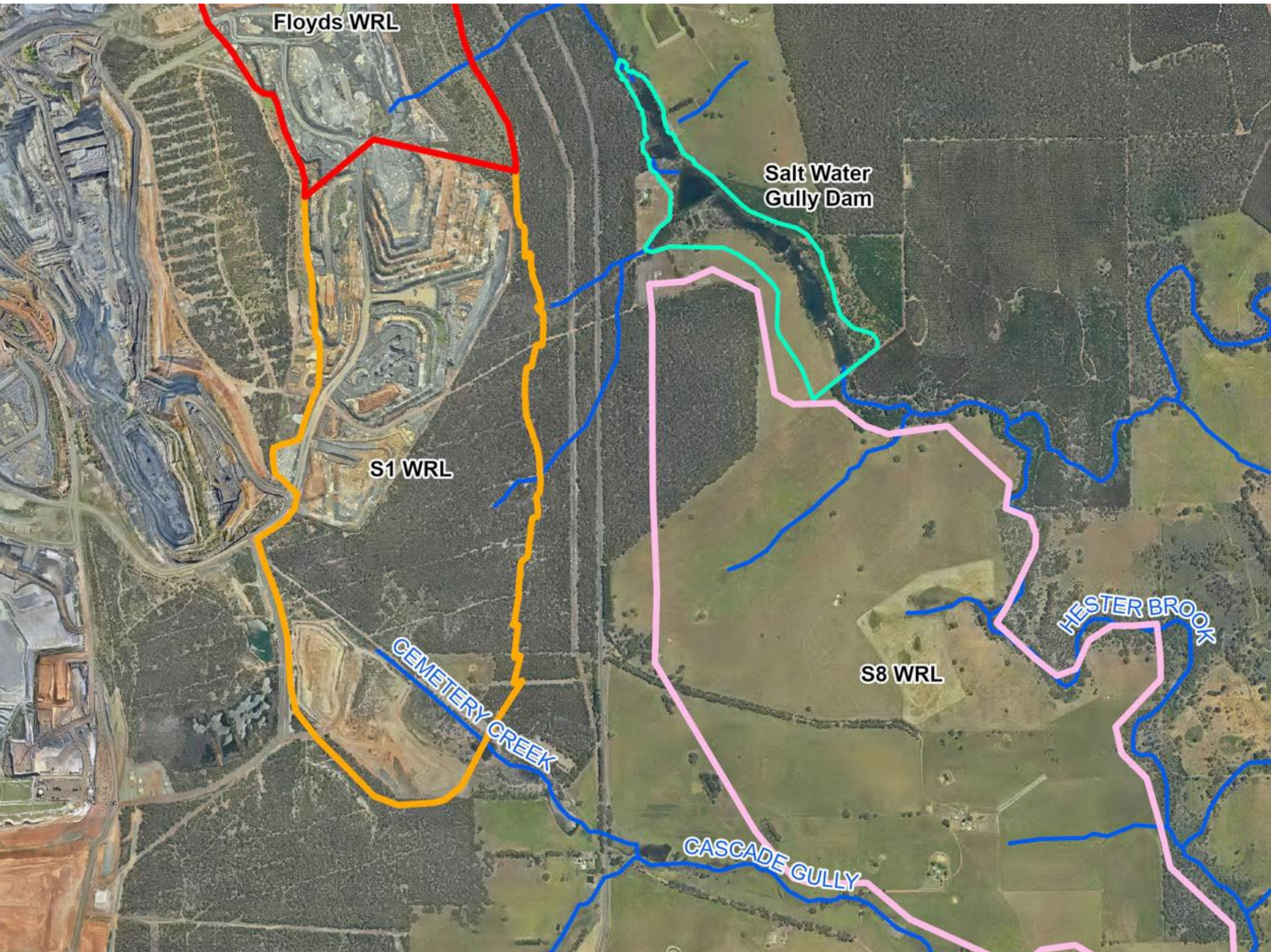
Eastern Catchments Hydrology Study

Groundwater Modelling

Talison Lithium Pty Ltd

04 December 2023

→ **The Power of Commitment**



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The Power of Commitment

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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was engaged by Talison Lithium Pty Ltd (Talison) to undertake the Eastern Catchment Hydrology Study (the Study) which entails the hydrological and hydrogeological assessments of proposed new facilities on the mine site and subsequent preliminary assessment of the environmental and human health risks arising from these activities. These facilities are:

– Construction and operation of a new water dam within the mine water supply network, namely Saltwater Gully (SWG) Dam.
– Establishment of the new SWG Waste Rock Landform (WRL).
– Reuse of all or part of Tailings Storage Facility #1 (TSF1) following removal of existing material for reprocessing, either for tailings or water rock deposition.

A plan of the proposed facilities is provided in **Figure 1.1**.

The purpose of this Study is to assess the potential impacts that the proposed facilities, in addition to the existing baseline activities, may have on the beneficial use of the surface water and groundwater receiving environments, during operations and closure. In doing so, the Study will support the environmental approvals application.

The Study deliverables are:

– Data Review and Gap Analysis (GHD, 2023a).
– Conceptual Site Model (GHD, 2023b).
– Water Resources Monitoring Plan (GHD, 2023c).
– Groundwater Modelling (this report).
– Surface Water and Mass Balance Modelling (GHD, 2023d).
– Preliminary Risk Assessment (GHD, 2023e).

This report documents the groundwater modelling and fate and transport of key Contaminants of Potential Concern (CoPCs) emanating from the proposed new facilities on the mine site.

1.2 Study Area

A site wide groundwater model has already been configured and calibrated for the Greenbushes mine site (GHD, 2023f). The model domain was extended to accommodate the potential groundwater impact areas downgradient of the proposed new facilities (i.e., to the southeast). The groundwater model domain also matches the surface water model domain in this area. A plan of the groundwater model domain is provided in **Figure 1.2**.

1.3 Purpose of this Report

The purpose of this report is to present the understanding of groundwater flow and solute transport in and around the mine site, the potential impacts that the historical WRLs and TSFs have had on the chemistry of the groundwater in the Hester Brook catchment (i.e., current baseline), and the potential future impacts that SWG WRL, SWG Dam and the reuse of TSF1 may have on the groundwater chemistry. The understanding of potential impacts is presented in a hydrogeological conceptual model (GHD, 2023c) based on the following inputs:

– Local and regional hydrogeology.
– Potential interaction between the surface water and groundwater.
– Groundwater flow within water-bearing basement rock.
– Solute transport, including adsorption, within the aquifer and discharges to surface water (site drainage and natural waterways).
– Beneficial use of the groundwater.

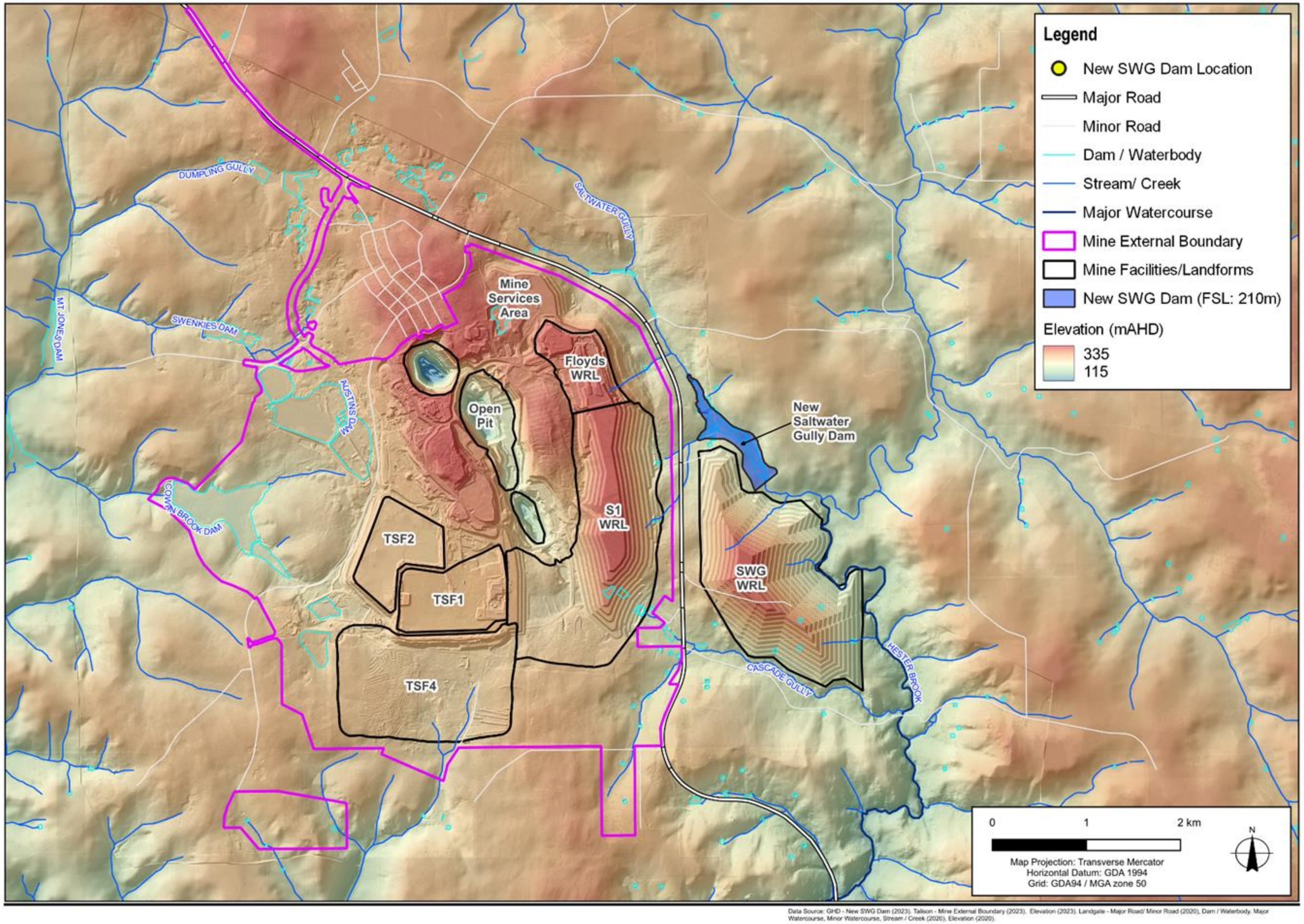
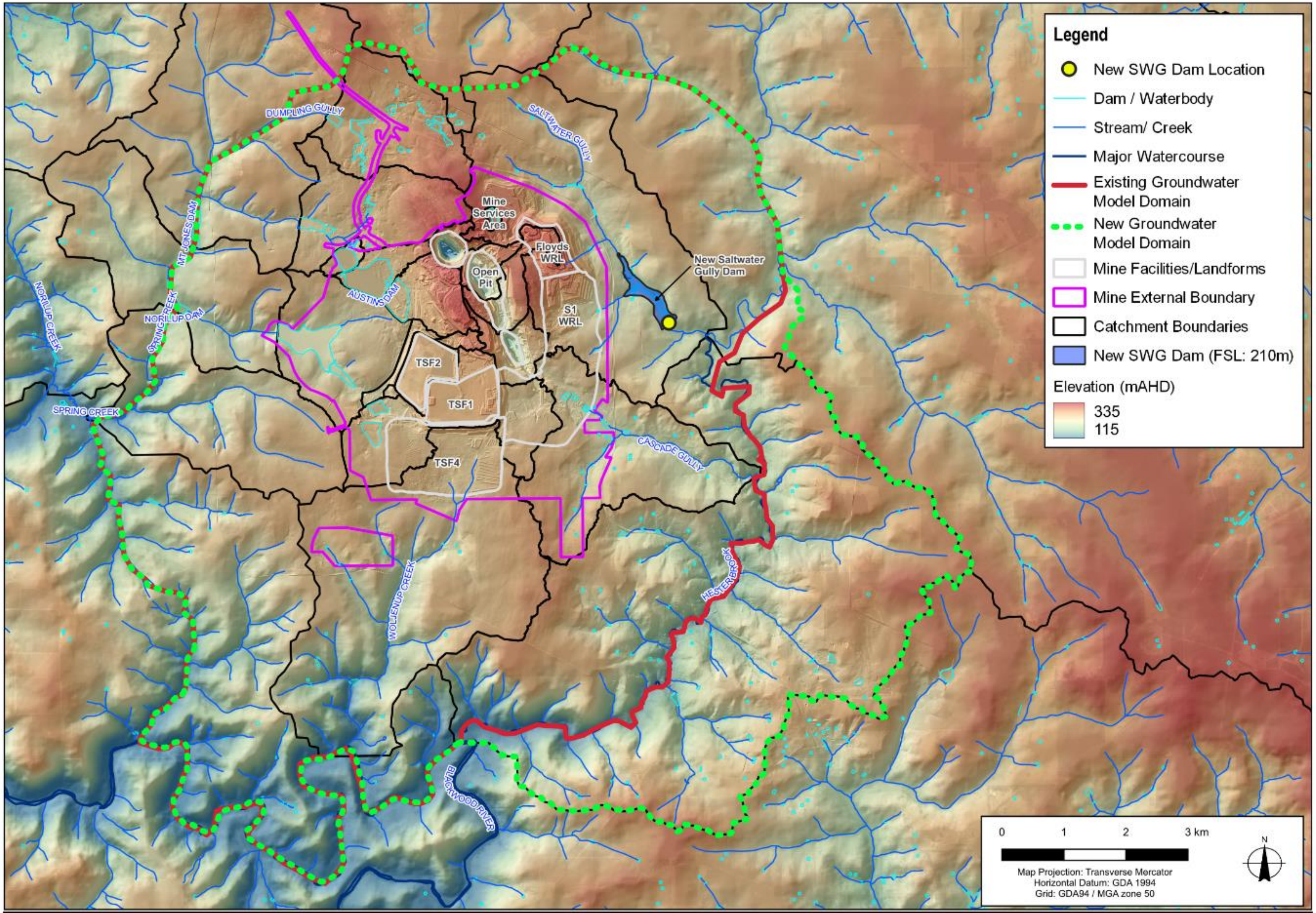


Figure 1.1: Plan of the Proposed Facilities



Data Source: GHD - New SWG Dam (2023). Mine Facilities/ Landform (2022), Catchment Boundaries (2023), Existing/ New Groundwater Model Domain (2023). Talison - Mine External Boundary (2023), Elevation (2023). Landgate - Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020), Elevation (2020).

Figure 1.2: Groundwater Model Domain

This report should be considered an addendum to *TSF4 Seepage Assessment: Groundwater Model Update and Site Assessment* (GHD, 2023f), which should be read in conjunction with this report. This report only documents the modification of the numerical groundwater flow and solute transport model detailed in the *TSF4 Seepage Assessment: Groundwater Model Update and Site Assessment* for application to this Study.

1.4 Scope and Limitations

1.4.1 General Limitations

This report has been prepared by GHD for Talison and may only be used and relied on by Talison for the purpose agreed between GHD and Talison as set out in **Section 1.3** of this report.

GHD otherwise disclaims responsibility to any person other than Talison arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer **Section 1.5** of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has prepared this report on the basis of information provided by Talison and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.4.2 Groundwater Model Limitations

Numerical groundwater models are a mathematical representation of complex real-world systems. The physical domain of interest, comprising layers of rocks and sediments, is discretised into a number of cells and the parameters that control the movement of groundwater and solutes through these layers is prescribed to each cell. Inputs that vary over time are discretised into a limited number of stress periods and time steps. The governing groundwater flow and solute transport equations are solved by the code to compute hydraulic head, concentrations, and fluxes into and out of each cell. This mathematical representation of a natural physical system, using a finite number of cells, is a necessary simplification that is inherent in all numerical modelling. The degree of simplification is influenced by factors including the availability of data, scale of the model, intended model use and computational demand of modelling techniques.

As with all models, the level of uncertainty is larger in parts of the model where observations are not available to constrain the model parameters or benchmark the performance of the model. Site-specific data are available for parameters such as horizontal hydraulic conductivity of the upper weathered materials, but uncertainty remains in areas where data is currently absent or limited, such as the physical and chemical properties of the tailings and the chemical properties of the underlying sediments and rock. As additional data become available over time, the model can be periodically updated and the level of confidence in model's outputs would increase accordingly.

An important limitation of the modelling and associated conclusions of this report are based on observation data from a very limited period of time. For this model, as is typical for most mine simulations, in the order of decades of water level and mine progression data are available for calibration, but the model needs to run for hundreds of years post-closure until quasi-steady-state conditions are achieved. As such, the data are only representative of current climatic conditions, and the system may behave differently beyond those conditions experienced in the limited observation data set. This may have important implications for the effectiveness of the remedial system as modelled in this study under significantly different long-term climatic conditions. However, the limited fluctuation in groundwater levels in response to seasonal rainfall variations suggests that climate variability impact would not be significant, compared to other impacts such as mine dewatering.

1.5 Assumptions

This report is based on the assumptions that the previously used hydraulic and geochemical properties (GHD, 2020) (GHD, 2023g), and the current TSF and WRL designs are representative of future site conditions. Site-specific adsorption isotherms based on adsorption testing have been used in solute transport modelling and are assumed to be appropriate given the relatively low concentrations of key solutes present in the leachate and decant.

2. Model Background

2.1 Objectives of the Modelling

The objectives of the modelling are to predict the collective seepage from:

- Tailings Storage Facilities (TSF1, TSF2 and TSF4).
- Waste Rock Landforms (Floyds, S1, and SWG WRLs).
- The proposed SWG Dam.

and assess the flow rate and chemistry of groundwater discharging to surface water bodies in the Study Area.

Two development scenarios were modelled to assess the impacts on groundwater of constructing the above facilities, these being:

- **Base Case:** Groundwater impacts of mine site facilities as they currently exist.
- **Impact Case:** Groundwater impacts of existing mine site facilities plus proposed facilities.

Comparison of the modelling results from these scenarios provides an indication of the incremental impacts resulting from the proposed facilities.

The term “seepage” herein relates to impacted waters which migrate from the facilities into the underlying strata, and which seeps in the direction of groundwater flow. The impacted seepage waters may contain elevated CoPCs, primarily metals, which are derived from leaching from the facilities (waste rock or tailings), and/or from slurry waters used during tailings deposition. For this model, arsenic and lithium were modelled as being representative of strongly and weakly attenuated CoPCs, the adsorption characteristics of which can be used to reliably infer the distribution of other CoPCs.

The groundwater modelling accommodates the objectives via the following:

- Modelling the seepage inputs into the underlying strata.
- Attenuation of CoPCs within the underlying strata.
- Migration of the seepage with groundwater flow (rates and volumes).
- Discharge locations of any residual seepage impacts (e.g., creeks, dams, rivers).
- Predictive estimates of CoPCs concentrations and loads to the receiving environments.

The report is aimed at a preliminary level study and as such does not include detailed assessment of model sensitivity or uncertainty. The modified model was not formally re-calibrated, other than checking the level of calibration of the extended model, while retaining the previous model parameters.

2.2 Scope of Modelling Works

The scope of the modelling work reported on herein comprised:

- Review changes to TSF and WRL design and any new aquifer hydraulic or geochemical properties obtained since previous modelling stages.
- Activate cells to the eastern edge of the Hester Brook catchment, as far as the existing model grid shell allowed, to move the external model boundary further from the edge of SWG WRL, while maintaining a natural hydrogeological boundary condition as far as practicable.
- Modify the model materials and internal boundary conditions (flow and transport) to reflect changes in TSF and WRL designs.
- Modify surface drainage to restrict drain cells to mapped streamlines and include drainage to simulate former dredge ponds to the east of TSF1, to better reflect site conditions.
- Modify the open pit dewatering simulation to use progressively deepening Drain (DRN) cells rather than the previously used Lake (LAK) cells, to enable better control of active mining water levels.

– Run the groundwater flow and solute transport modelling for historical (pre-2023) conditions then continuing the model to simulate ongoing mining operations to post-closure, to determine the extent of contaminant plumes and predict inflows to the various drainage systems over time.

2.3 Model Development History

The history of modelling at the site is detailed in the *TSF4 Seepage Assessment: Groundwater Model Update and Site Assessment* (GHD, 2023f) which should be read in conjunction with this report. An initial single layer MODFLOW NWT and MT3D-USGS model was constructed and calibrated as Stage 1 by GHD (2019) and used to assess pit inflows. This was then expanded by GHD (2020) into a 3-layer model to assess post-closure pit lake levels. The model was further modified by GHD (2023f) to laterally refine the model grid around the mine pit and TSFs and vertically refine the model into 11 layers, to allow inclusion of the various weathering zones (saprolites, saprock and alluvial sands), TSF features (liners and tailings) and WRLs. This model has been further modified, as noted in **Sections 2.2** and **3**.

3. Model Construction and Calibration

3.1 Model Grid

The Stage 3 model activated area was extended to the east, within the limits of the existing grid shell, to increase the distance from the edge of SWG WRL and the model edge, and to take in more of the Hester Brook catchment. The grid frame, cells and activation areas are shown in **Figure 3.1**.

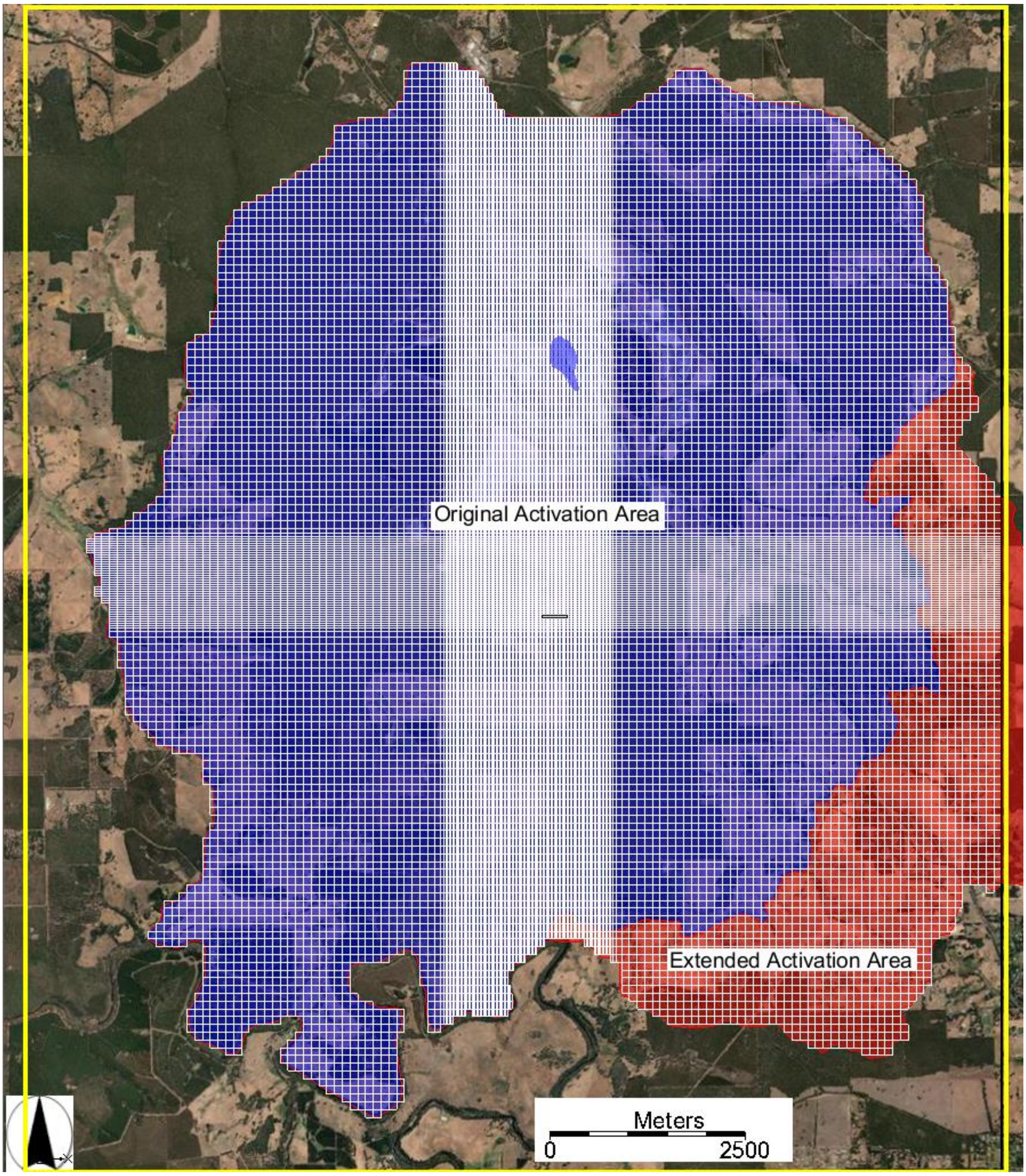


Figure 3.1: Model Activation Areas[1]

[1] Blue - Original activated cells
Red – New activated cells
Yellow – Model extent
White - Grid cells

3.2 Model Layers

The model comprises 11 layers with variable thicknesses, elevations, and properties to reflect the infrastructure and underlying geology. The layers represent the features and lithologies detailed in **Table 1**, which have a constant thickness with their base configured relative to the pre-mine surface elevation. Further details of the model construction and calibration are provided by GHD (2023f).

Table 1: Layer Tops and Bottoms Relative to pre-TSF4 Surface[2]

Layer	Depth From (m)	Depth to (m)	Thickness (m)	Dominant lithologies
1[3]	0	1	1	Tailings beach, tailings interior, waste rock, TSF embankments, embankment clay core, and palaeochannel sands
2	1	1.6	0.6	TSF liner, pallid saprolite, palaeochannel sands.
3[4]	1.6	10	8.4	Pallid saprolite, palaeochannel sands
4	10	18	8	Non-pallid saprolite
5	18	20	2	Saprock
6	20	40	20	"U" Upper fractured bedrock"
7	40	60	20	"M" Middle fractured bedrock
8	60	100	40	As above
9	100	180	80	As above
10	180	-100 mAHD	>1 Variable	As above
11	-100 mAHD	-200 mAHD	100	"L" Lower fractured bedrock

3.3 Model Boundary Conditions

The boundary conditions remained the same as the Stage 3 model (GHD, 2023f), with the following exceptions:

- The extended eastern boundary was set as drain cells along drainage lines and no-flow lines where the boundary followed surface water catchment divides or the grid limit along the eastern edge.
- Drain cells were set along drainage lines and a drain polygon was set over the dredge ponds to the east of TSF1. Drain elevations were set at the 2020 LIDAR-based DEM where available, or the Landgate 5 m DEM.
- A General Head Boundary (GHB) polygon was set at the proposed full supply level of SWG Dam (see **Figure 3.2**), with inter-polygon boundaries based on the four existing dam embankments in the gully. For the base case, the GHB elevations were set at the existing embankment elevations indicated by the site orthophoto (200 m AHD, 205 m AHD, 206 m AHD, and 208 m AHD). For the impact case, the GHB elevations increased to 210 m AHD on 01/01/2024 (assumed date of completion of SWG Dam). The GHB conductance was set at 0.03 $m^2/d/m^2$ and a constant source concentration of 0.025 mg/L for arsenic and 1 mg/L for lithium was assumed (based on historical monitoring).
- Recharge concentrations and rates from the WRLs, including the Mine Services Area (MSA) embankment, which is constructed from waste rock (see **Figure 3.2**), were modelled as follows:
  - Recharge concentrations were initially set to be the same as the regional recharge of 0.0056 mg/L of arsenic and 0.0246 mg/L of lithium, which were based on the average background concentrations in groundwater from wells outside likely impacted areas.
  - Concentrations were increased after commencement of deposition in the WRLs to 0.056 mg/L of arsenic and 0.166 mg/L of lithium based on the results of waste rock leachate testing (GHD, 2023h). Commencement of deposition was assumed to be 01/01/1980 for Floyds WRL and MSA, 01/01/2026 for S1 WRL and 01/01/2032 for SWG WRL.

[2] Data provided for post pit conditions. Key layers were removed within the opencut.
[3] Layer 1 has a base 1 m below pre-mine surface and a top that varies over time as tailings and waste rock are deposited. Pallid saprolite makes up the rest of Layer 1 outside the various tailings and embankment areas.
[4] Sand paleochannel in Layer 3 is assumed to be removed from beneath TSF4.

- Transient monthly recharge rates were used for the base case prior to 2023, which were based on calibrated rates from previous pit lake and inflow models as a percentage of rainfall. Post 2023 recharge rates were constant based on the average percentage of rainfall for the period 1980 to 2022 (GHD, 2023f).
- Recharge rates for the impact case were maintained at the base case rate (i.e., no landform design or capping allowed for).

– To enable better control of active mining water levels, the open pit dewatering was simulated using progressively deepening drain cells rather than the lake cells used in the Stage 3 model (GHD, 2023f). The drain cells were turned off on 01/01/2040 (assumed date of site closure).

– The GHB was turned off for the western half of TSF4 as a separate test, although this is irrelevant for the eastern catchment area which are the focus of this report.

3.4 Calibration

The model was not recalibrated. The pre-2023 flow calibration model (*Talison_2023NWT_002*) gave a scaled Root Mean Square (RMS) residual of 15.8% (GHD, 2023f). While this is higher than the typically accepted value pf 10% (Barnett, et al., 2012), it is of less concern for this model as it is dominated by bores around the TSFs, with little data in the Eastern Catchments Area.

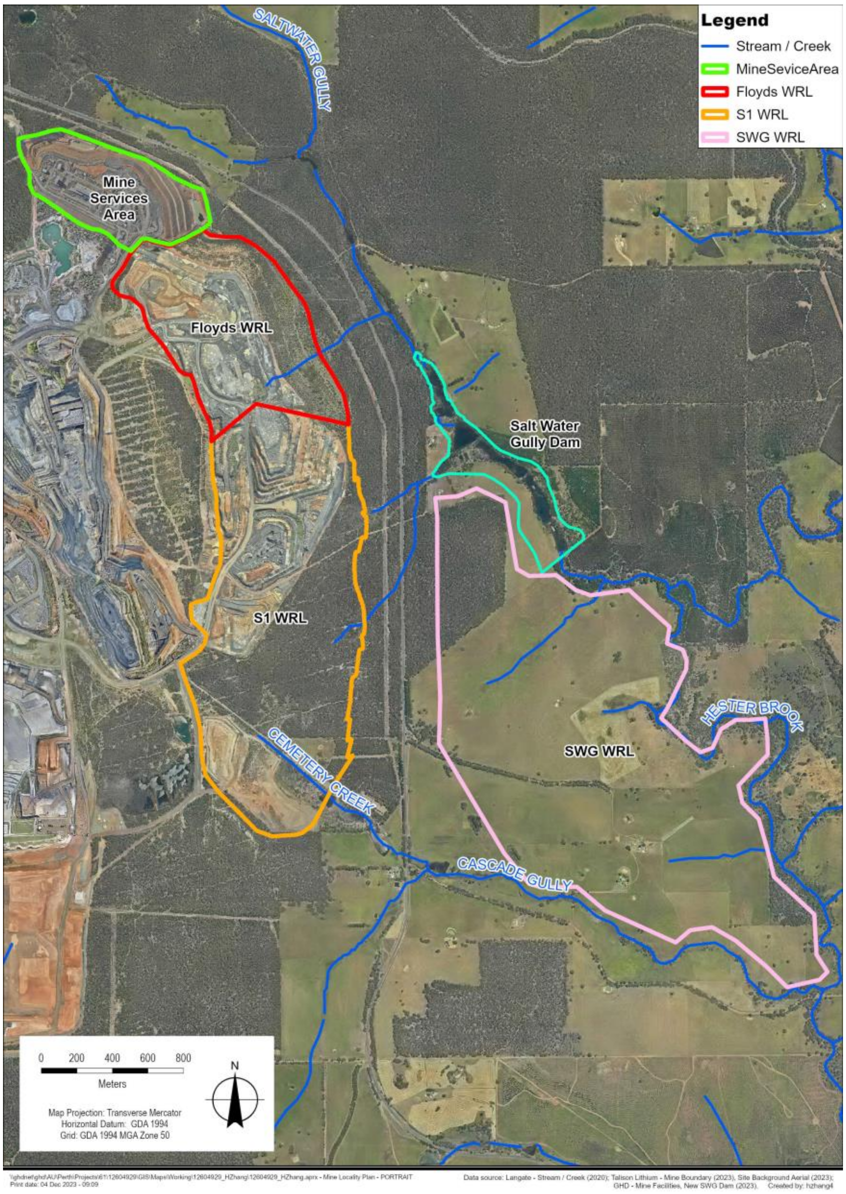


Figure 3.2: Extents of Saltwater Gully Dam General Head Boundary and WRL Recharge Zones

4. Predictive Modelling

4.1 Modelling Approach

4.1.1 Base Case Model

The base case model (*Talison_2023NWT_16ZTA*) was configured to include the flow and transport sources of the existing TSFs, the existing Floyds WRL, and the MSA embankment. The model used the historical modelling up to 2023 (*Talison_2023NWT_02*) as a starting point, and then ran to 2913, which was the final transport step that achieved convergence with satisfactory mass balance errors.

4.1.2 Impact Case Model

The impact case model (*Talison_2023NWT_015ZA1*) was the same as the base case model with the reuse of TSF1, establishment of SWG WRL, and construction of SWG Dam configured in the model run. The model ran to completion in the year 3000.

4.2 Water Quality Guidelines

Water Quality Guidelines (WQGs) were derived for the downstream beneficial uses for the *TSF4 Seepage Assessment* (GHD, 2023i) and have been adopted to assess the fate and transport modelling of the key CoPCs. A summary of the WQGs for arsenic and lithium (the key CoPCs modelled) is provided in **Table 2**.

Table 2: Water Quality Guidelines (GHD, 2023i)

Contaminant	Water quality guideline (mg/L)				
	Agricultural use - Livestock	Agricultural use - Irrigation	Aquatic Environment	Potable use	Non-potable use
Sample type	Unfiltered	Unfiltered	Filtered	Unfiltered	Unfiltered
Arsenic	0.5	0.1	0.013 (as AsV) 0.024 (as AsIII)	0.01	0.2
Lithium	0.82	2.5	2.0	0.007	0.14

4.3 Plume Extents

4.3.1 Arsenic

The modelled arsenic plumes (contours of concentrations reflecting the various WQGs) in various layers are provided as follows:

- Plume extents in 2023 in layers 2, 3, and 5 in **Appendix A**.
- Plume extents in 2030 in layers 2, 3, and 5 in **Appendix B**.
- Plume extent in 2040 in layer 2 in **Appendix C**.
- Plume extent in 2070 in layer 2 in **Appendix D**.
- Plume extents in 2123 in layers 2 and 3 in **Appendix E**.
- Plume extents in 2913 in layers 2, 3, and 5 in **Appendix F**.

The base case modelling results indicate that:

– The current impact (2023) of the TSFs is confined to Layer 5 and above within the footprints of TSF1 and TSF2 and there is no impact from Floyds WRL and MSA (see **Appendix A**). The concentration contours of 0.010 mg/L and 0.013 mg/L within the plume indicate that the drinking water and aquatic environment WQGs, the most stringent of these guidelines, are exceeded.
– There is no noticeable migration of the plumes from TSF1 and TSF2 in Layer 2 by 2030, either horizontally or vertically (see **Appendix B**). By this date, seepage from Cell 1 of TSF4 is evident by the plumes forming in layers 2 and 3 within the footprint of the TSF. The impacts of seepage from TSF4 are discussed in more detail in the *TSF4 Seepage Assessment* (GHD, 2023f).
– The impact of Floyds WRL and MSA does not appear at the water table (Layer 2) until 2040, where emergence of a plume in Layer 2 is noted (see **Appendix C**), the concentrations of which exceed the drinking water and aquatic environment WQGs. There is no noticeable additional migration or intensification of the plumes from TSF1, TSF2, and TSF4 in Layer 2 by 2040.
– The plume emanating from Floyds WRL and MSA within layer 2 extends to cover most of the footprint of these facilities by 2070 (see **Appendix D**). The drinking water and aquatic environment WQGs remain the only guidelines exceeded. There is no noticeable additional migration or intensification of the plumes from TSF1, TSF2, and TSF4 in Layer 2 by 2070, the extents of which remain within the TSF footprints.
– There is no noticeable migration in extent or intensity of the plumes in Layer 2 emanating from the TSFs and from Floyds WRL and MSA by 2123 (see **Appendix E**). By this date, the plume from Floyds WRL and MSA has emerged in Layer 3.
– The plume in Layer 2 emanating from Floyds WRL and MSA has migrated ~200 m eastwards by 2913 (see **Appendix F**), but remains west of the highway, and the plumes emanating from TSF1 and TSF2 have expanded (but remain within the footprints of the respective TSFs), whilst that from Cell 1 of TSF4 has reduced notably. The plume from Floyds WRL and MSA has migrated into Layers 3 and 5 but remains within the footprint of the landforms. The drinking water and aquatic environment WQGs remain the only guidelines exceeded. The persistence of the plume is expected as the WRLs are assumed to be a constant source once deposited. Concentrations immediately down-gradient are expected to persist as even with capping, as they are at the "headwaters" of the groundwater catchment, there is no "upstream" recharge to dilute any leachate from the base of the WRLS. If capped, however, downstream dilution would be grater as there would be proportionally less contribution from the WRLs.

The impact case modelling results indicate the following incremental changes from the base case:

– The first indications of arsenic impact from S1 and SWG WRLs appear between 2040 and 2070 (see **Appendix D**), with the 0.01 mg/L (drinking water guideline) and 0.013 mg/L (aquatic environmental guideline) contours covering almost the full footprint of the two WRLs, including the headwaters of Saltwater Gully and some minor gullies leading into Hester Brook.
– By 2123 (see **Appendix E**) the 0.01 mg/L plume has extended in Layer 2 to much of Hester Brook between Saltwater Gully and Cascade Gully.
– By 2913, the extent of the plume in layer 2 (see **Appendix G**) has increased slightly and extends to almost the same extent in Layer 3. This plume diminished significantly by Layer 5.

4.3.2 Lithium

The modelled lithium plumes (contours of concentrations reflecting the various WQGs) in various layers are provided as follows:

– Plume extents in 2023 in layers 2, 3, and 5 in **Appendix G**.
– Plume extents in 2030 in layers 2, 3, and 5 in **Appendix H**.
– Plume extent in 2040 in layer 2 in **Appendix I**.
– Plume extent in 2070 in layer 2 in **Appendix J**.
– Plume extents in 2123 in layers 2 and 3 in **Appendix K**.
– Plume extents in 2913 in layers 2, 3, and 5 in **Appendix L**.

It should be noted that the background lithium concentrations exceed the drinking water guidelines (0.007 mg/L) across much of the mine site and the upper reaches of the receiving catchments, so it was not possible to depict these concentration contours.

The base case modelling results indicate that:

– The current impact (2023) of the TSFs is mostly confined within the landform footprints except for the eastern side of TSF1, where the plume extends ~200 m in Layer 2 into the area of historical dredge mining (concentration of 0.14 mg/L only representing the non-potable water guideline), and slightly further in Layer 3 (see **Appendix G**). The maximum concentration simulated is 5.0 mg/L, which exceeds all guidelines. There is no impact simulated from Floyds WRL and MSA in 2023.
– There is no noticeable migration or intensification of the plume from TSF2 by 2030, however, the plume from TSF1 migrates further eastwards towards Vultans Pit (see **Appendix H**). By this date, seepage from Cell 1 of TSF4 is evident by the plume forming in layers 2, 3, and 5 within the footprint of the TSF. There is no impact simulated from Floyds WRL and MSA in 2030, however, isolated outbreaks of concentrations above the non-potable water guideline are evident within the footprint of Floyds WRL and MSA and along Saltwater Gully.
– The impact of Floyds WRL and MSA at concentrations above the non-potable water guideline in Layer 2 expand across under these facilities by 2040 (see **Appendix I**). The plume from TSF1 migrates further eastwards towards the open pit by 2040. The isolated areas of concentrations above the non-potable water guideline along Saltwater Gully remain unchanged.
– The impact of Floyds WRL and MSA at concentrations above the non-potable water guideline in Layer 2 expand across most of the footprint of these facilities by 2070 (see **Appendix J**). The plume from TSF1 migrates again slightly further eastwards around the south of the open pit by 2070, but the isolated areas of concentrations above the non-potable water guideline along Saltwater Gully remain unchanged.
– The plume emanating from Floyds WRL and MSA within layer 2 extends across the footprint of these facilities by 2123 (see **Appendix K**). The non-potable water guideline remains the only guideline exceeded here. The plume from TSF1 above the guideline migrates beyond the open pit to the upper Cemetery Creek but is unlikely to discharge to the creek. All plumes have extended down to Layer 5 with concentrations exceeding the non-potable water guideline in these layers.
– The extent and intensity of the plume in Layer 2 emanating from Floyds WRL and MSA remains largely unchanged by 2913 (see **Appendix L**) due to the continuing release of leachate from the waste rock. The plumes emanating from TSF1 and TSF2 have reduced in intensity (i.e., concentrations reduce), due to the lower concentrations in long-term leachate, compared to tailings decant water. The plume to the east of TSF1 has reduced to within ~300 m of the TSF footprint. The plume from Floyds WRL and MSA has migrated into Layer 5 and extends as far as SWG Dam by 2913.

The impact case modelling results indicate the following incremental changes from the base case:

– The first indications of lithium impact from S1 WRL appears around 2030 as isolated pockets in Layer 2 (see **Appendix H**), and a similar pattern is observed from SWG WRL in 2040 (see **Appendix I**). By 2030, the isolated areas of concentrations above the drinking water guideline along Saltwater Gully seen in the base case have expanded with the construction of SWG Dam.
– By 2070, the plume represented by the 0.14 mg/L contour (non-potable water guideline) in Layer 2 expands to cover almost the full footprint of S1 and SWG WRLs, including the headwaters of Saltwater Gully and some minor gullies leading into Hester Brook (see **Appendix J**).
– By 2123, the 0.14 mg/L plume has extended in Layers 2 and 3 (see **Appendix K**) to much of Hester Brook between Saltwater Gully and Cascade Gully. Although the 0.14 mg/L contour from the WRLs merges with that from the TSFs by 2123, the 0.82 mg/L contour from TSF1 does not extend more than ~250 m to the east of TF1, as indicated by the 2123 contours.
– By 2913, the extent of the 0.14 mg/L plume in Layers 2 and 3 (see **Appendix L**) has increased slightly but has now extended beyond the S1 WRL footprint in Layer 5. Lithium concentrations below the WRLs did not exceed 0.82 mg/L (i.e., the stock watering guideline, which is the next most sensitive guideline after non-potable).

4.4 Groundwater Discharge to Surface

4.4.1 Arsenic

4.4.1.1 Overview

The solute mass flux and groundwater discharge to the various creek lines in the Eastern catchment were extracted from the model. As the model had a constant recharge rate after 2023, these represent the average annual values. The average concentration, derived from the sum of mass flux divided by the flow, expressed as mg/L is shown in **Figure 4.1**. The average arsenic concentration reaches 0.005 mg/L by 2177 and reaches 0.0056 mg/L by 2863. This is below the WQGs.

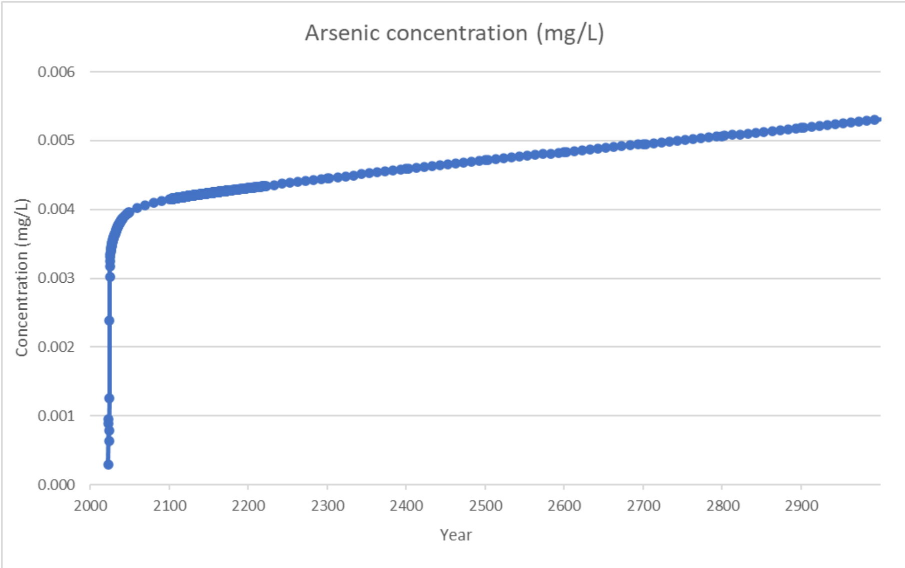


Figure 4.1: Average groundwater arsenic discharge concentration for the Eastern Catchments

Groundwater discharging to Saltwater Gully had the highest arsenic concentrations (see **Figure 4.2**), which rapidly rose to 0.23 mg/L by 2030 then gradually increased to 0.24 mg/L by the year 3000, due to continued release of leachate, which is above all the adopted WQGs other than for livestock use. These concentrations do not consider dilution by surface water flows or concentration by evapotranspiration, which are dealt with separately in surface water hydrology report (GHD, 2023d).

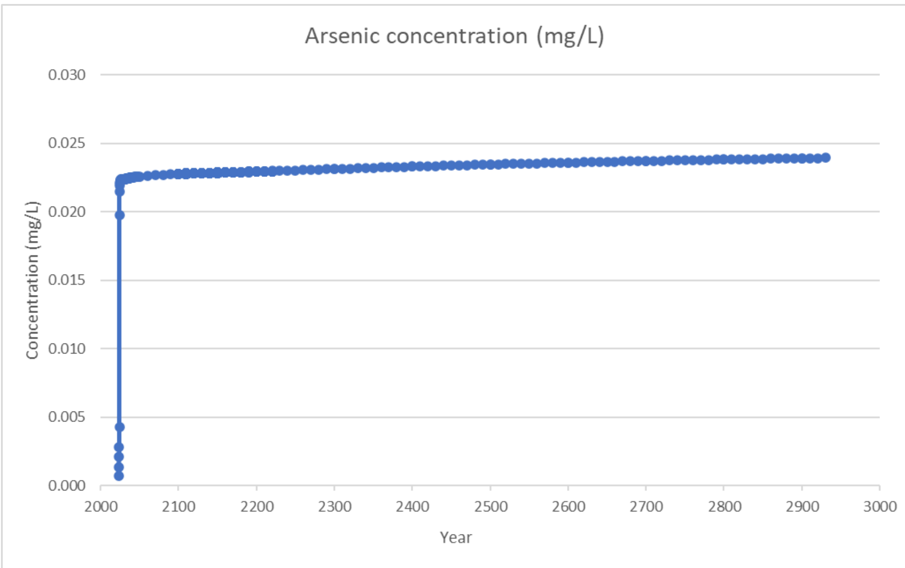


Figure 4.2: Average groundwater discharge arsenic concentration for the Saltwater Gully

4.4.1.2 Catchment Scale Groundwater Discharges

The surface water balance modelling (GHD, 2023d) requires estimates of the CoPC loads discharged to surface water for the catchment scale mass balances. To this end, time series of the groundwater discharges (flows and arsenic concentrations) to the creeks in the various surface water catchments (see **Figure 4.3**) were simulated and are presented in **Appendix M**.

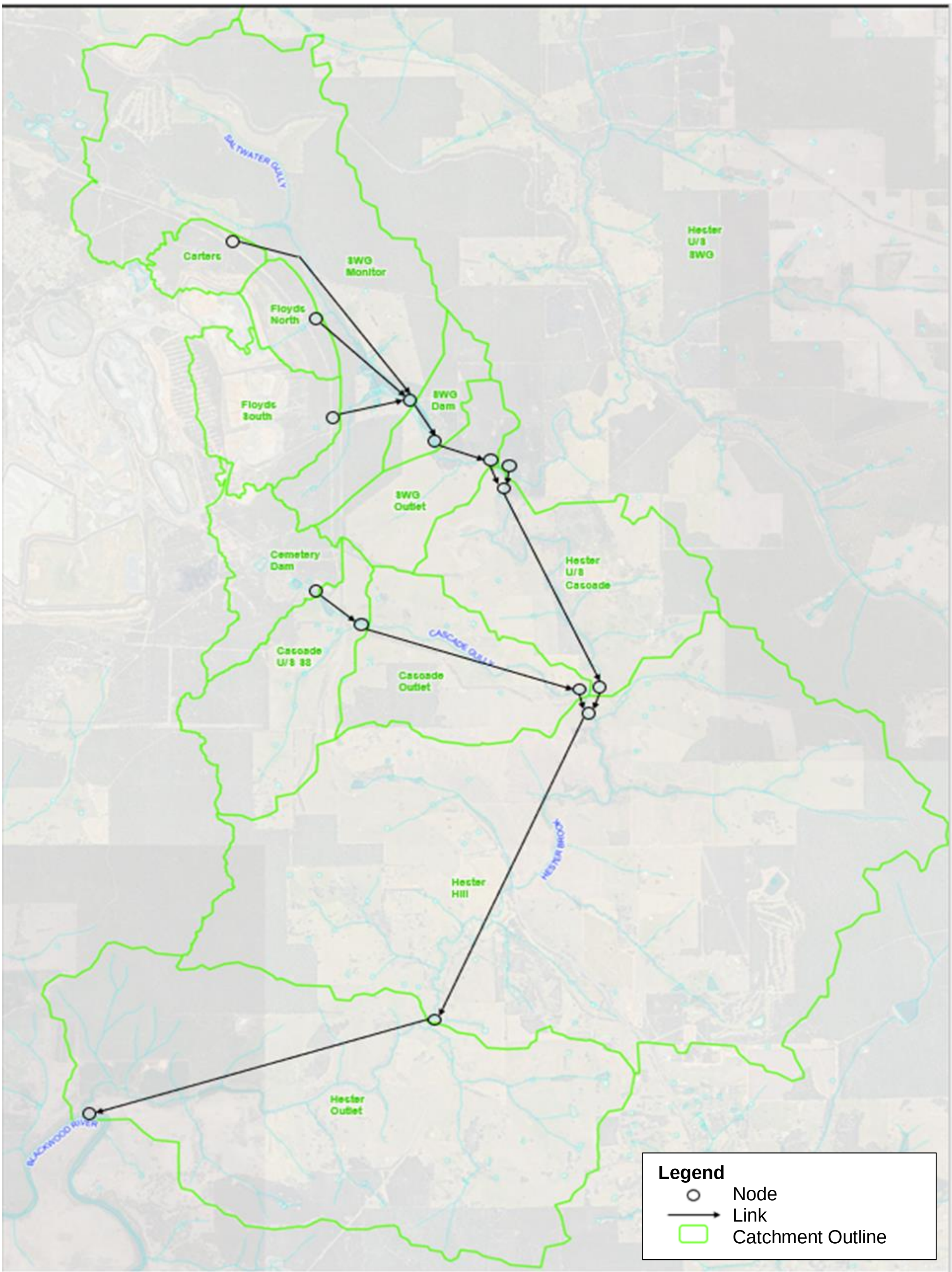


Figure 4.3: Surface Water Catchments for Groundwater Discharge Assessment

4.4.2 Lithium

4.4.2.1 Overview

The solute mass flux and groundwater discharge to the various creek lines in the Eastern catchment were extracted from the model. As the model had a constant recharge rate after 2023, these represent the average annual values. The average lithium concentration, derived from the sum of mass flux divided by the flow, expressed as mg/L is shown in **Figure 4.4**. The average lithium concentration reaches 0.18 mg/L by 2233 and stabilises at 0.19 mg/L by 2753. This is above the potable and non-potable guidelines but below the livestock, irrigation, and freshwater aquatic ecosystem guidelines.

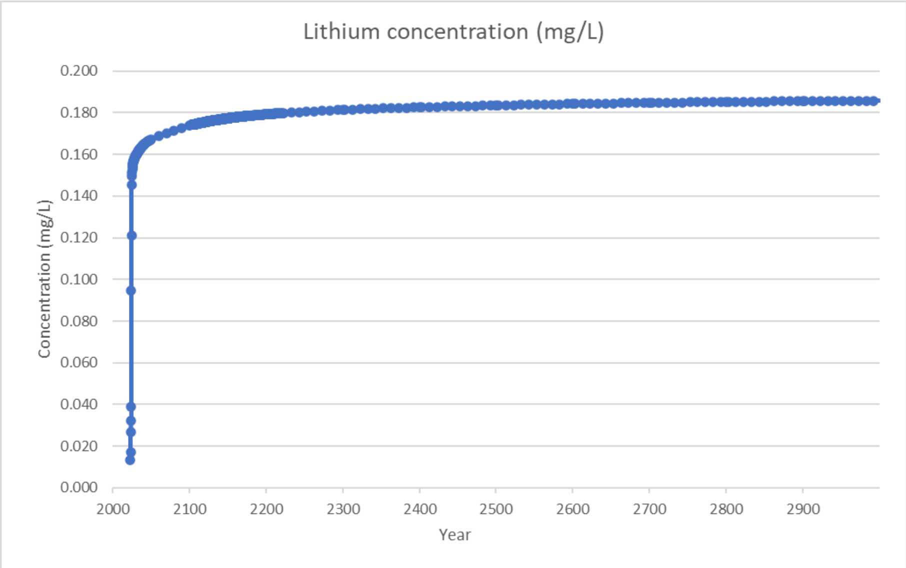


Figure 4.4: Average Groundwater Discharge Lithium Concentration for the Eastern Catchments

Groundwater discharging to Saltwater Gully Dam had the highest lithium concentrations (see **Figure 4.5**), which rapidly rose to 1.10 mg/L by 2025 then stabilised at 1.15 mg/L by the year 2070. This is above the potable, non-potable, and livestock guidelines, but below the irrigation and freshwater aquatic ecosystem guidelines. Again, these concentrations do not consider dilution by surface water flows or concentration by evapotranspiration, which are dealt with separately in surface water hydrology report (GHD, 2023d).

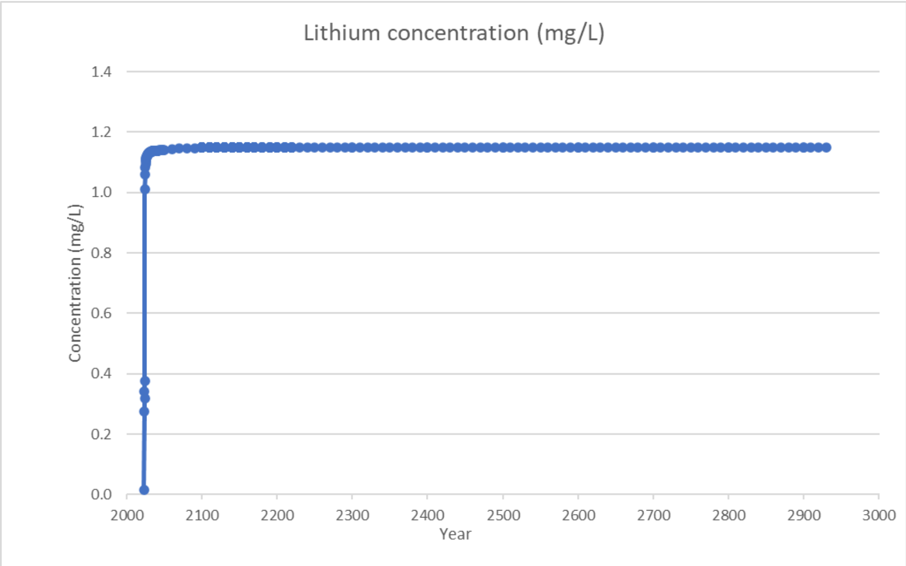


Figure 4.5: Average Groundwater Discharge Lithium Concentration to Saltwater Gully Dam

4.4.2.2 Catchment Scale Groundwater Discharges

The time series of the groundwater discharges (flows and lithium concentrations) to the creeks in the various surface water catchments (see **Figure 4.3**) were simulated and are presented in **Appendix N**.

4.5 Point Impacts

4.5.1 Selection of Points

The modelled changes in arsenic and lithium concentrations in the groundwater were assessed at three nominal sites within the Study Area, these being:

– Site 1: East of SWG Dam.
– Site 2: Within the footprint of SWG WRL.
– Site 3: South of TSF4 (within Woljenup Creek Catchment).

The location of these sites is shown in **Figure 4.6** and discussions on the changes in concentrations are provided in the following sections.

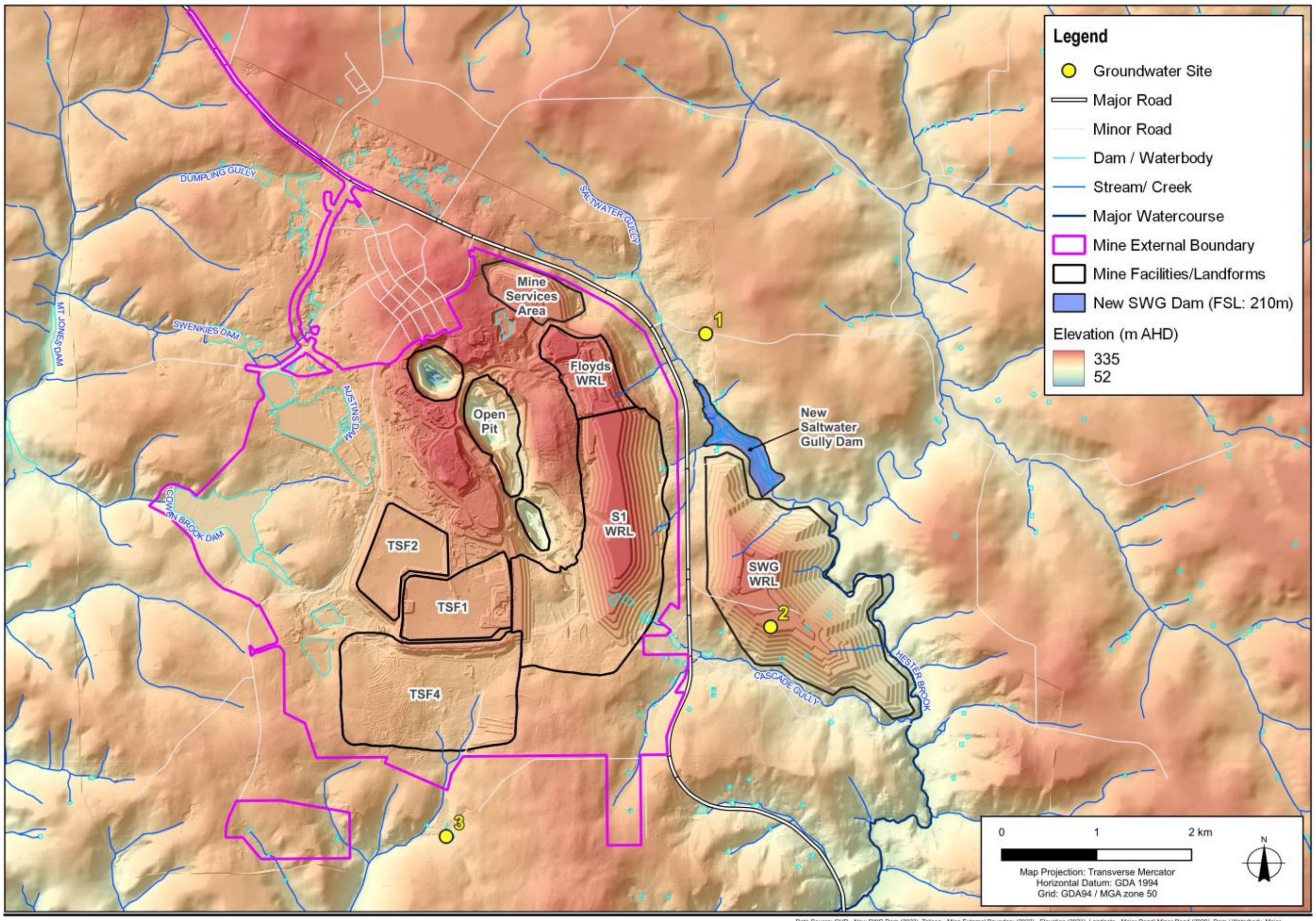


Figure 4.6: Point Impact Sites

4.5.2 Arsenic

The concentrations in arsenic over time in the uppermost saturated layer (Layer 2) were plotted for each of the three sites to assess the changes in concentrations in the groundwater.

4.5.2.1 Site 1

The modelled arsenic concentration at Site 1 is shown in **Figure 4.7**, and indicates the following:

– Concentrations increasing from ~0.00033 mg/L to ~0.00038 between 2023 and 2048, and then there is a rapid jump to ~0.00046 mg/L in 2049.
– Concentrations stabilise at ~0.0005 mg/L in ~2300, which is the steady recharge concentration.
– Arsenic concentrations always remain below all WQGs.
– The initial part of the curve is most likely an artefact of lower starting concentrations when importing the data form the pre-2023 model and does not reflect an actual change in concentration.

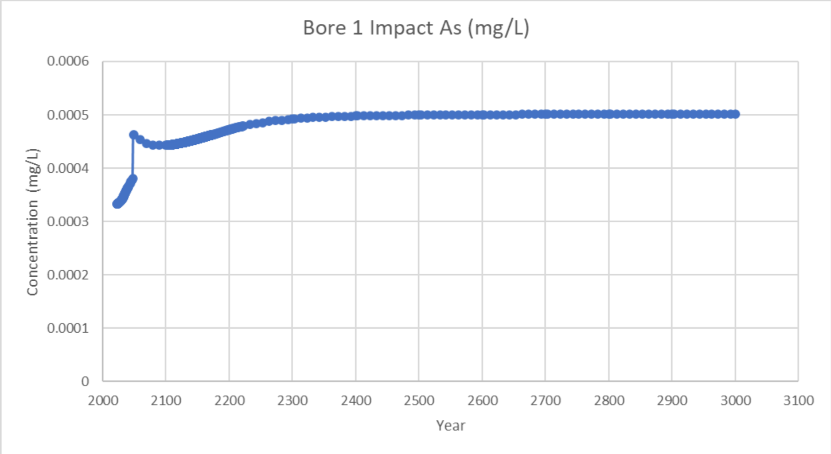


Figure 4.7: Modelled Arsenic Concentrations in Layer 2 at Site 1

4.5.2.2 Site 2

The modelled arsenic concentration at Site 2 is shown in **Figure 4.8**, and indicates the following:

– An initially steep increase from the baseline concentration of ~0.0005 mg/L to ~0.018 mg/L by 2100.
– A continuous increase in concentration, albeit at a lower rate, to reach ~0.034 mg/L by 3000 (noting that the recharge concentration from SWG WRL is 0.056 mg/L).
– Arsenic concentrations exceed the drinking water and aquatic environment guidelines in ~2050 and ~2075 respectively.

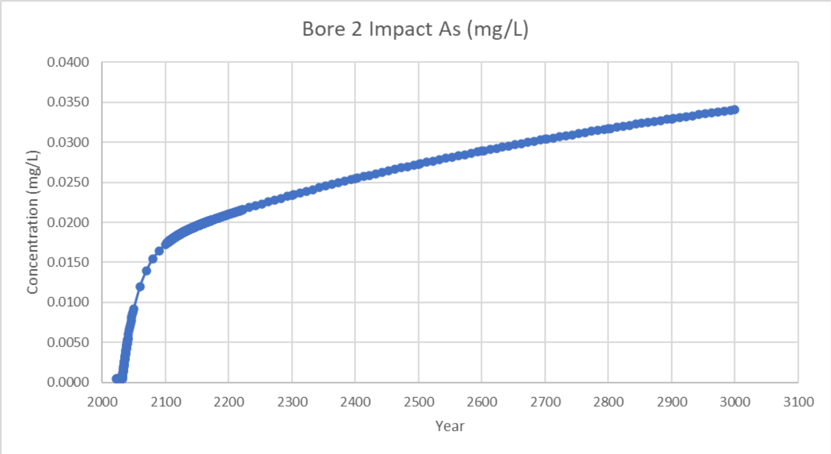


Figure 4.8: Modelled Arsenic Concentrations in Layer 2 at Site 2

4.5.2.3 Site 3

This site is outside the Study Area but has been included for the risk assessment. The modelled arsenic concentration at Site 3 is shown in **Figure 4.9**, and indicates the following:

– Initial decrease in concentrations from ~0.00055 mg/L to ~0.00053 mg/L in 2100.
– Gradual increase in concentrations to ~0.000545 mg/L in 3100.
– Arsenic concentrations always remain below all WQGs.
– The pattern of the concentrations is likely to be due to numerical dispersion and other model artifacts and does not indicate any impact from site operations. This variation is not significant and is only noticeable due to the very narrow range of plotted concentrations.

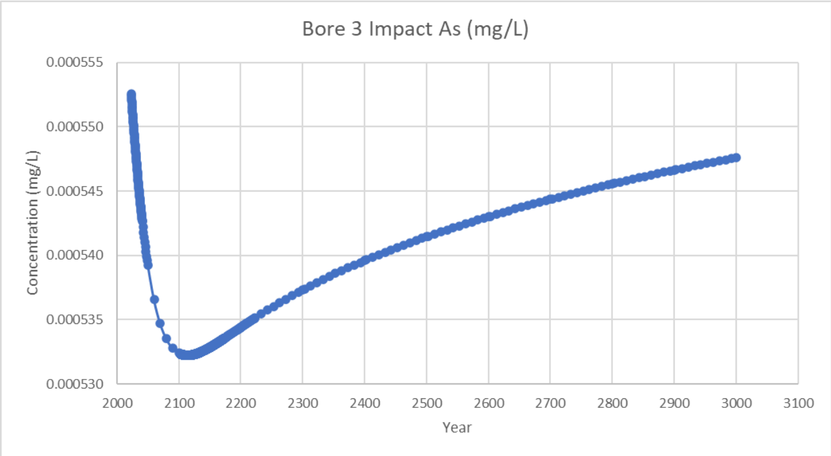


Figure 4.9: Modelled Arsenic Concentrations in Layer 2 at Site 3

4.5.3 Lithium

The concentrations in lithium over time in the uppermost saturated layer (Layer 2) were plotted for each of the three sites to assess the changes in concentrations in the groundwater.

4.5.3.1 Site 1

The modelled lithium concentration at Site 1 is shown in **Figure 4.10**, which indicates the following:

– The concentrations follow a similar but more pronounced pattern to those for arsenic (see **Section 4.5.2.1**).
– Concentrations stabilise at ~0.0246 mg/L in ~2300, which is the steady recharge concentration.
– Lithium concentrations always remain below all WQGs.
– The initial part of the curve is most likely an artefact of lower starting concentrations when importing the data form the pre-2023 model and does not reflect an actual change in concentration.

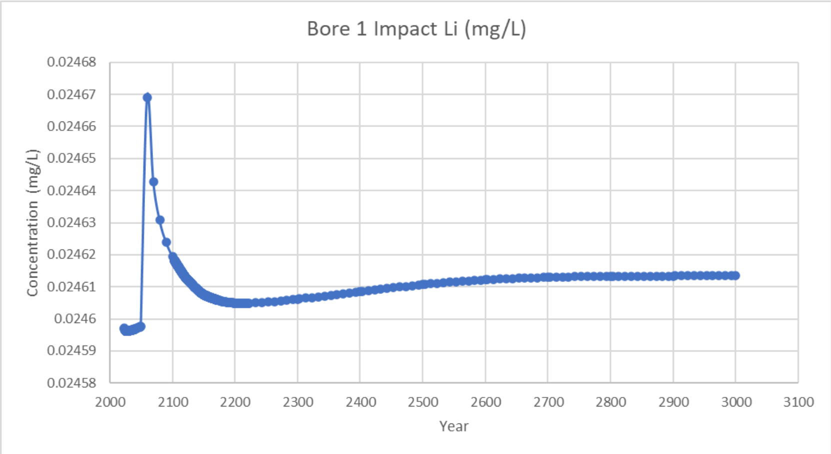


Figure 4.10: Modelled Lithium Concentrations in Layer 2 at Site 1

4.5.3.2 Site 2

The modelled lithium concentration at Site 2 is shown in **Figure 4.11**, and indicates the following:

– An initially steep increase from the baseline concentration of ~0.0246 mg/L to ~0.13 mg/L by 2100.
– The increase in concentrations reduces thereafter until it stabilises at ~0.16 mg/L by 2300.
– Lithium concentrations exceed the non-potable water guideline of 0.14 mg/L in ~2120.

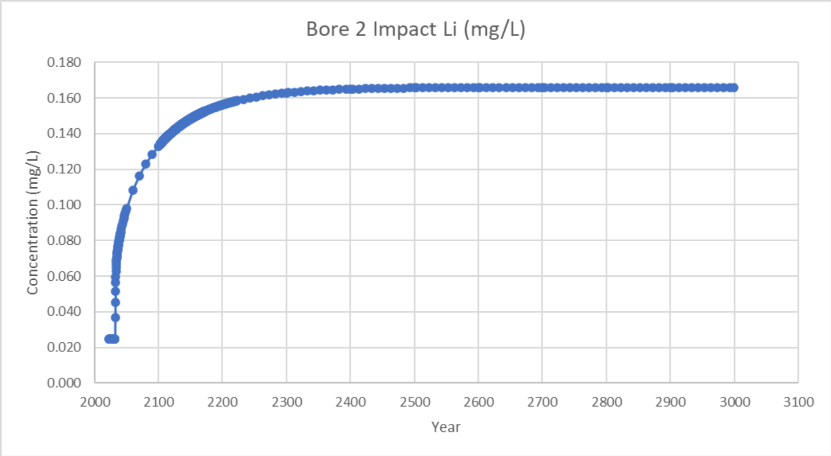


Figure 4.11: Modelled Lithium Concentrations in Layer 2 at Site 2

4.5.3.3 Site 3

The modelled lithium concentration at Site 3 is shown in **Figure 4.12**, and indicates the following:

– Initial decrease in concentrations from ~0.02463 mg/L to ~0.02461 mg/L in 2100.
– The reduction in concentrations reduces thereafter until it stabilises at ~0.02460 mg/L by 2200.
– Lithium concentrations always remain below all WQGs.
– As for the arsenic concentrations, this pattern is likely to be due to numerical dispersion and other model artifacts and does not indicate any impact from site operations, and is only noticeable due to the very narrow range of plotted concentrations.

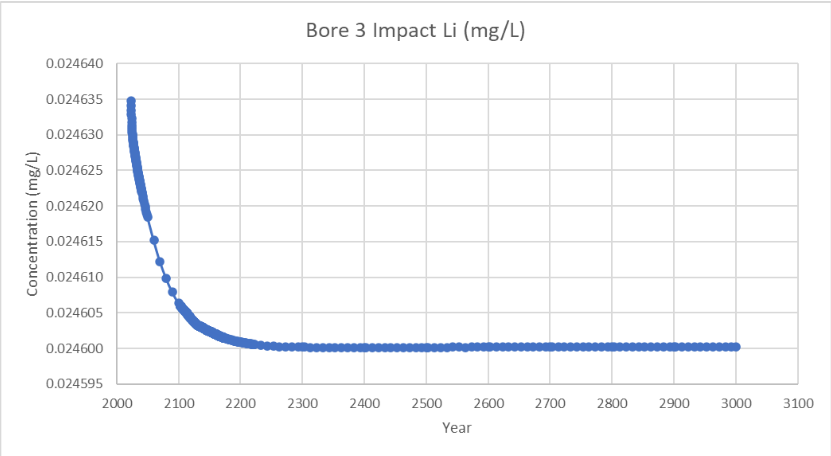


Figure 4.12: Modelled Lithium Concentrations in Layer 2 at Site 3

5. Conclusions from Modelling

Modelling indicates that the arsenic and lithium plumes from the existing and proposed WRLs and TSF are generally constrained close to or within the TSF or WRL footprints. There is some localised spreading around the SWG Dam due to infiltration of stored water with elevated arsenic and lithium.

Overall, the eastern catchment groundwater discharge to surface drainage shows an increase in arsenic concentrations from an assumed baseline of 0.0005 mg/L, up to around 0.005 mg/L (see **Figure 4.1**). Saltwater Gully, immediately adjacent to SWG WRL, had the highest arsenic concentrations, which rapidly rose to 0.23 mg/L by 2030 then gradually increased to 0.24 mg/L by the year 3000 (see **Figure 4.2**), which is above all the adopted WQGs other than for livestock use. Of the three areas of potential groundwater use, only the one within the SWG WRL footprint showed a notable increase in arsenic (see **Figure 4.7**, **Figure 4.8**, and **Figure 4.9**)

The average groundwater discharge lithium concentration to the Eastern Catchment creeks reaches 0.18 mg/L by 2233 and stabilises at 0.19 mg/L by 2753 (see **Figure 4.4**). This is above the drinking water and non-potable guidelines but below the livestock, irrigation, and freshwater aquatic ecosystem guidelines. Groundwater discharging to SWG Dam had the highest lithium concentrations, which rapidly rose to 1.10 mg/L by 2025 then stabilised at 1.15 mg/L by the year 2070 (see **Figure 4.5**). This is above the drinking water, non-potable, and livestock guidelines but below the irrigation and freshwater aquatic ecosystem guidelines. Of the three possible groundwater use sites assessed, only the site within the SWG WRL footprint showed a significant increase in lithium concentrations (see **Figure 4.10**, **Figure 4.11**, and **Figure 4.12**).

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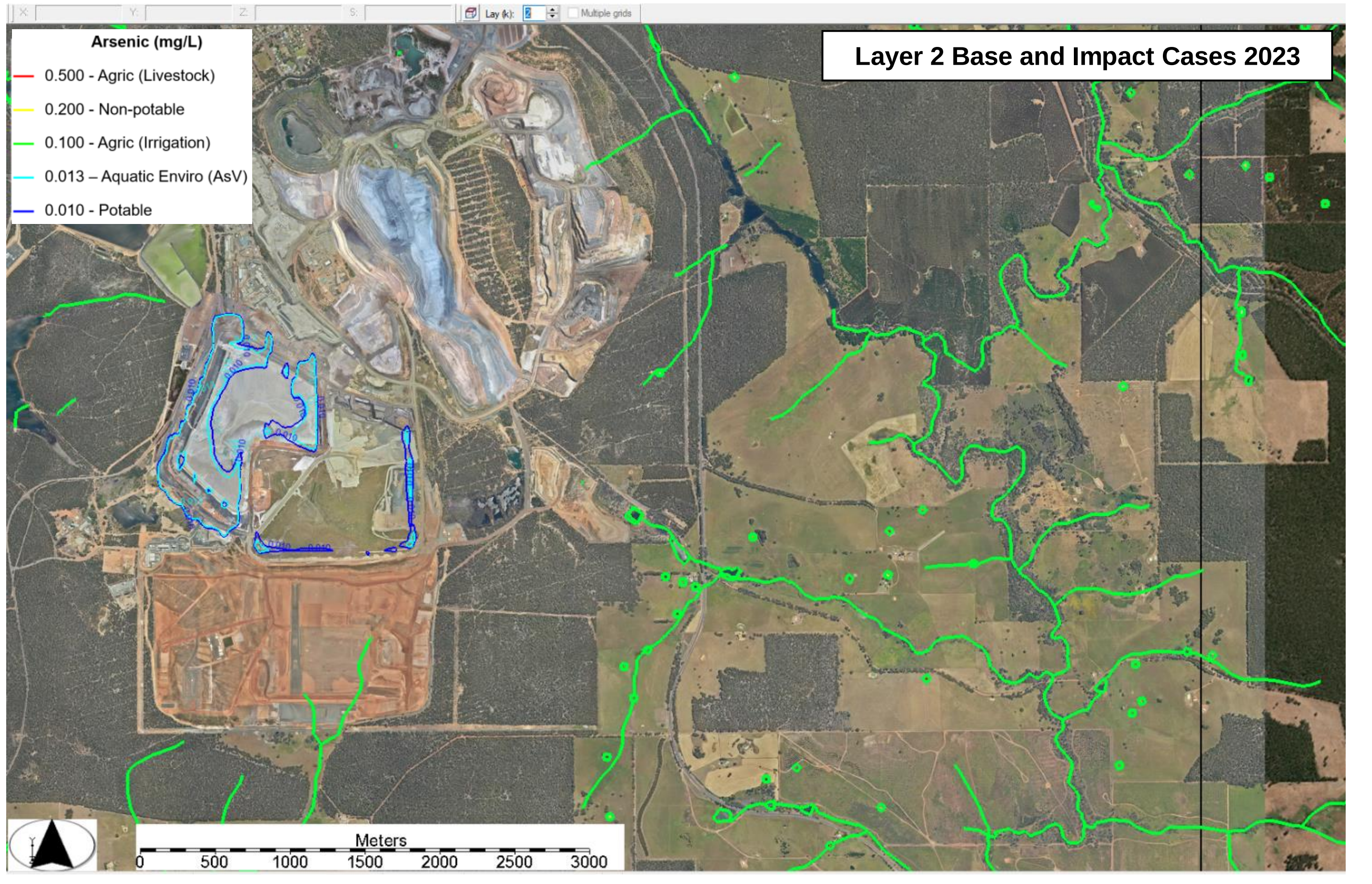
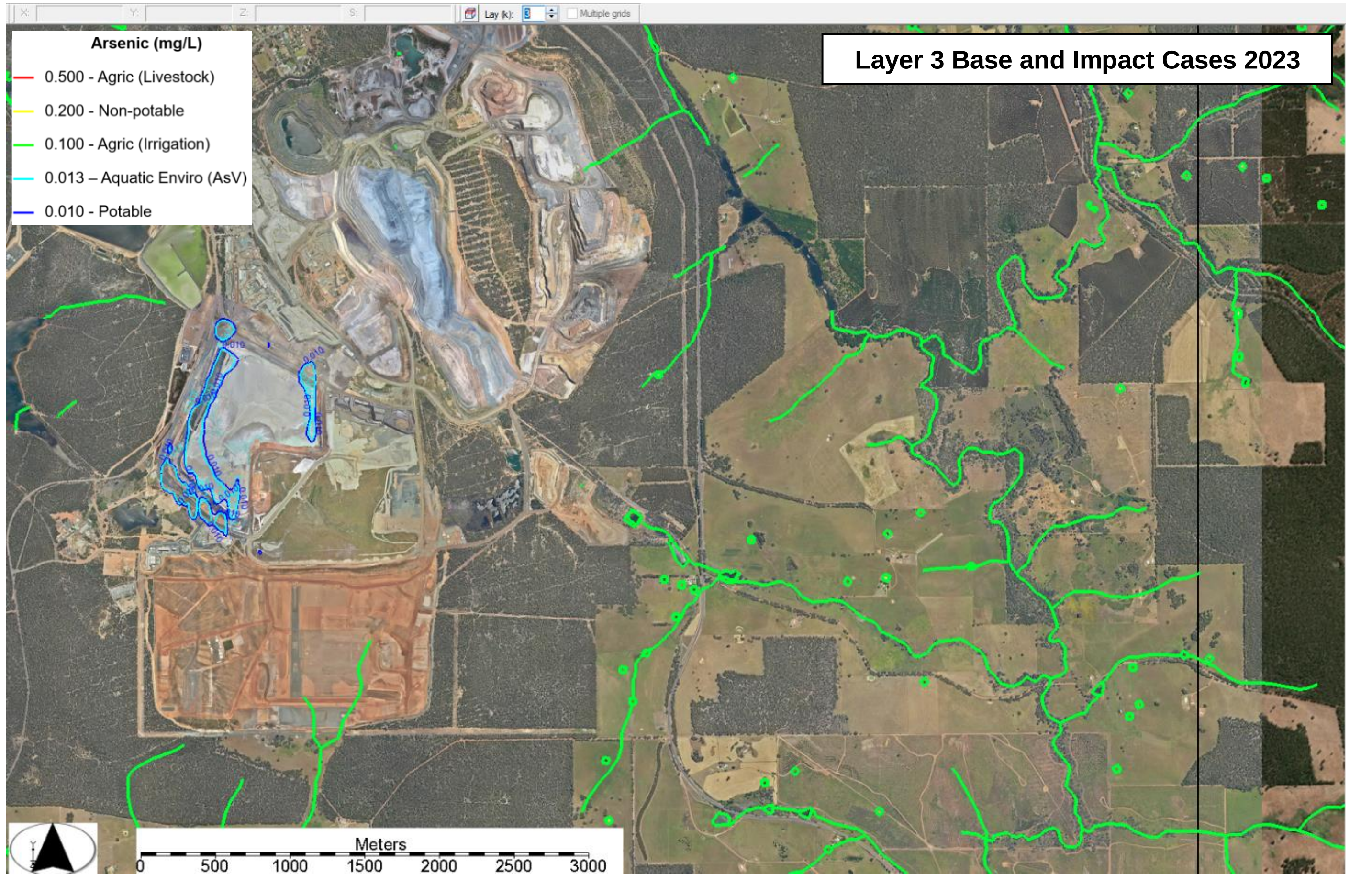
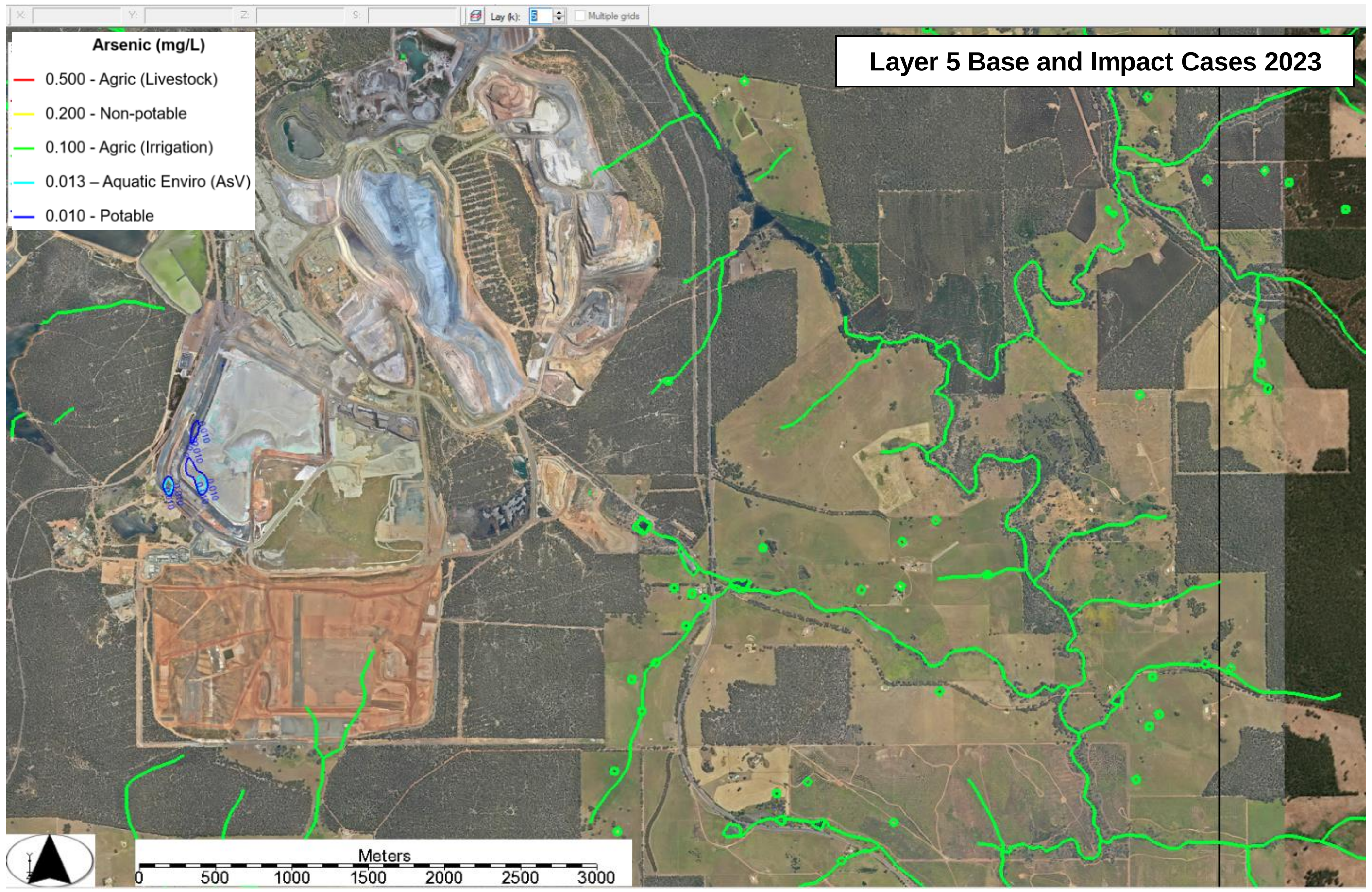
Appendices

Appendix A

Modelled Arsenic Plumes in 2023

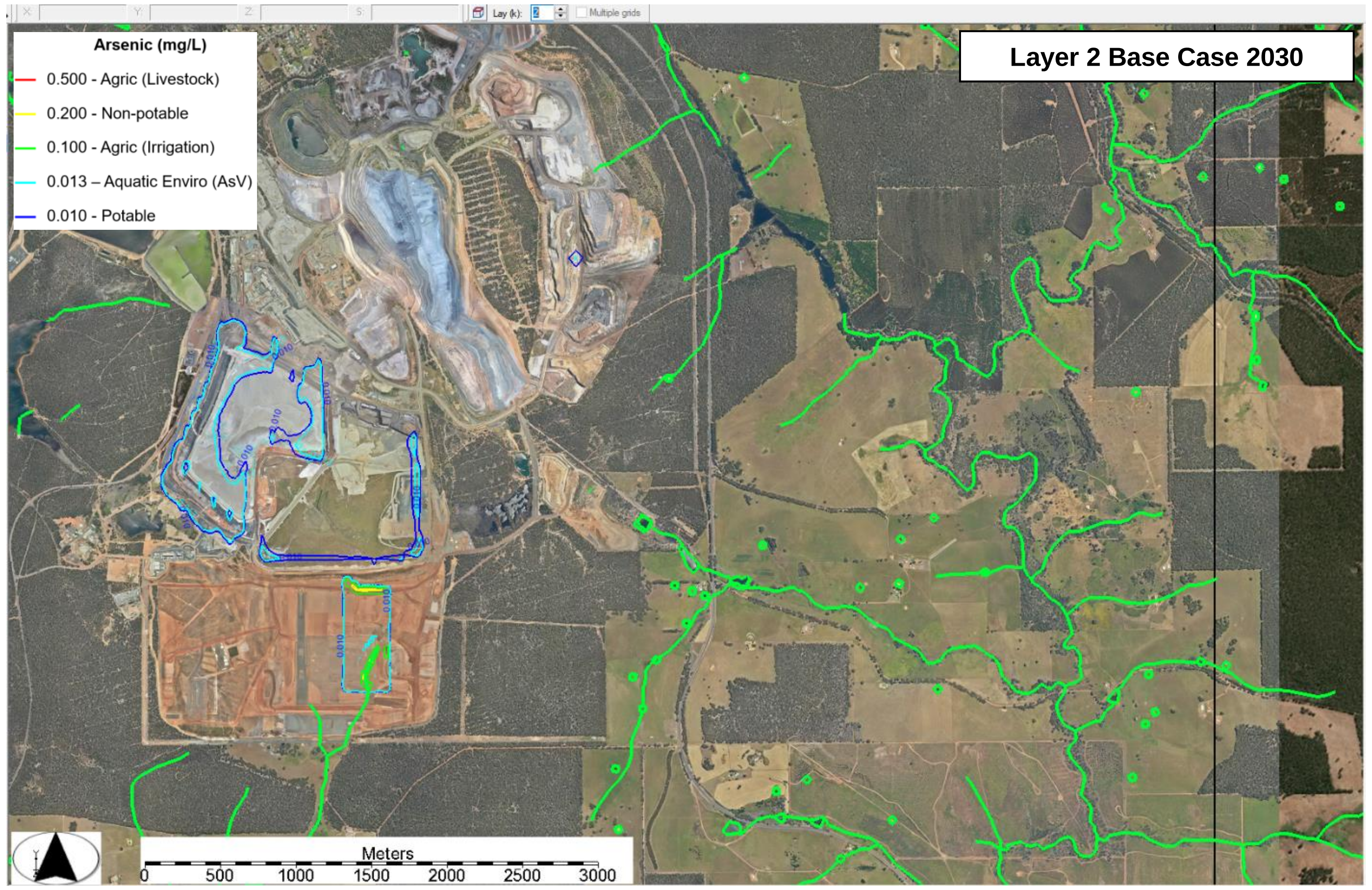

Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 2 Base and Impact Cases 2023
Meters
0
500
1000
1500
2000
2500
3000


Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 3 Base and Impact Cases 2023
Meters
0
500
1000
1500
2000
2500
3000


Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 5 Base and Impact Cases 2023
Meters
0
500
1000
1500
2000
2500
3000

Appendix B

Modelled Arsenic Plumes in 2030


Layer 2 Base Case 2030
Arsenic (mg/L)
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0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
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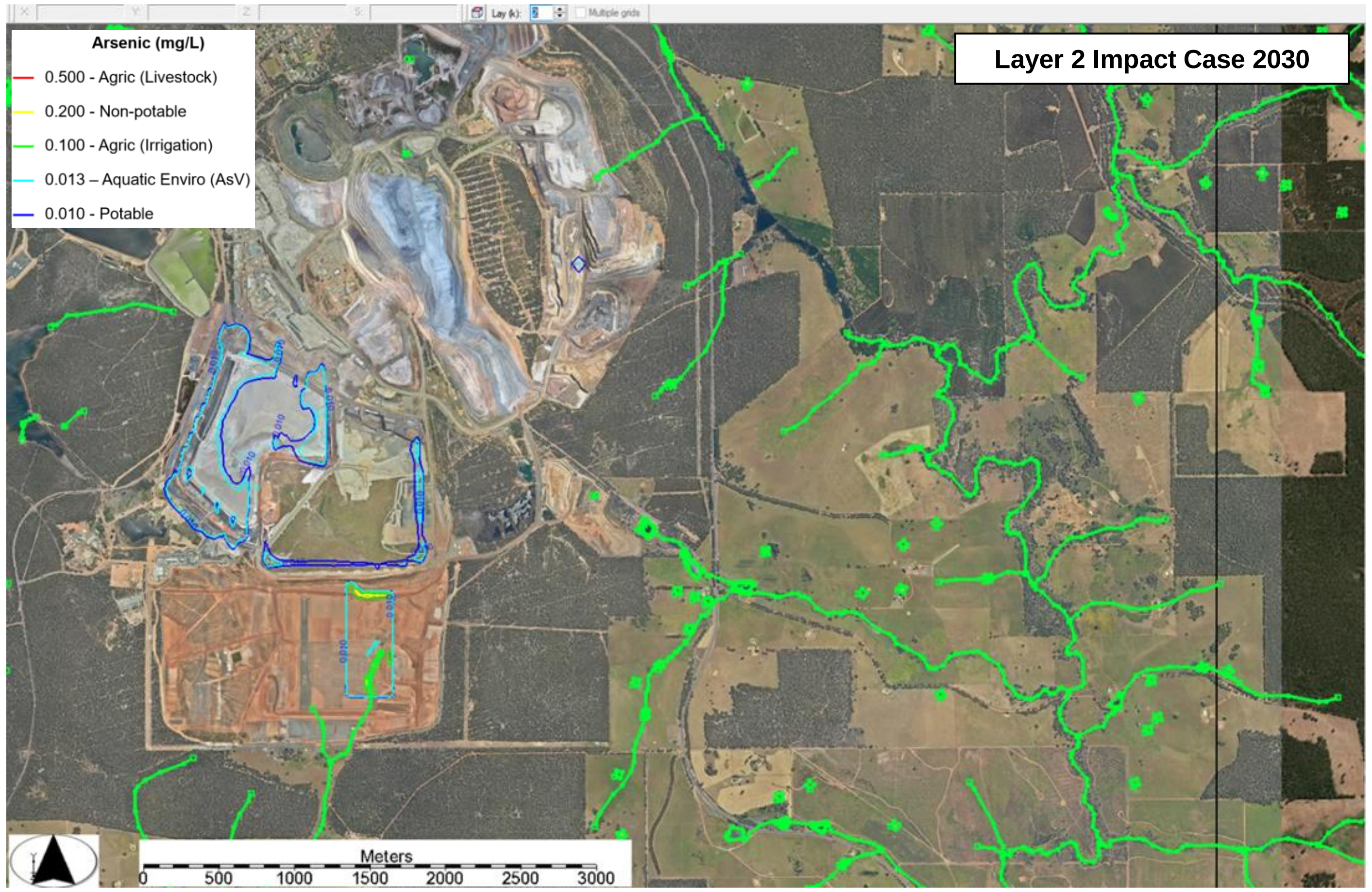
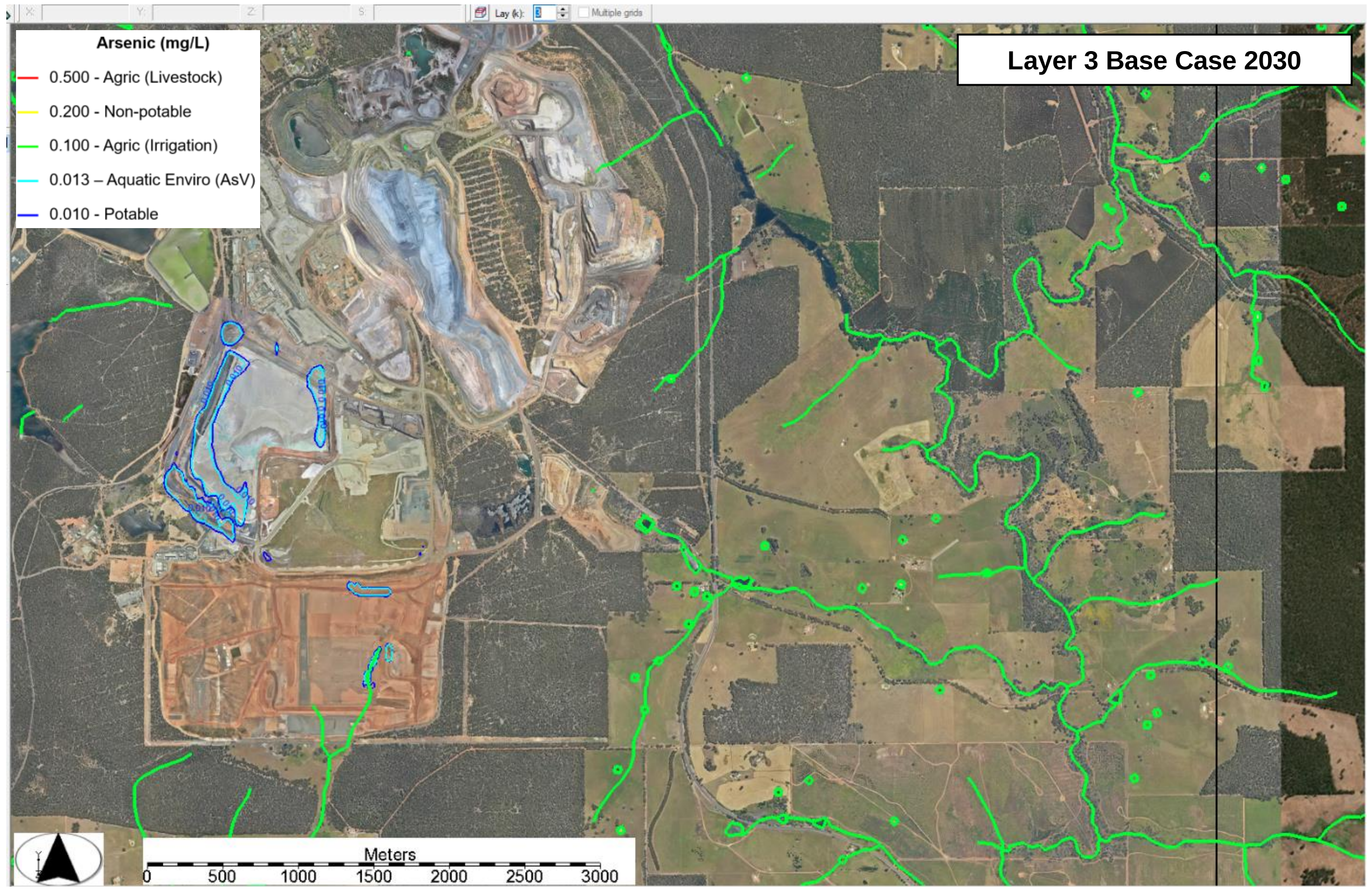
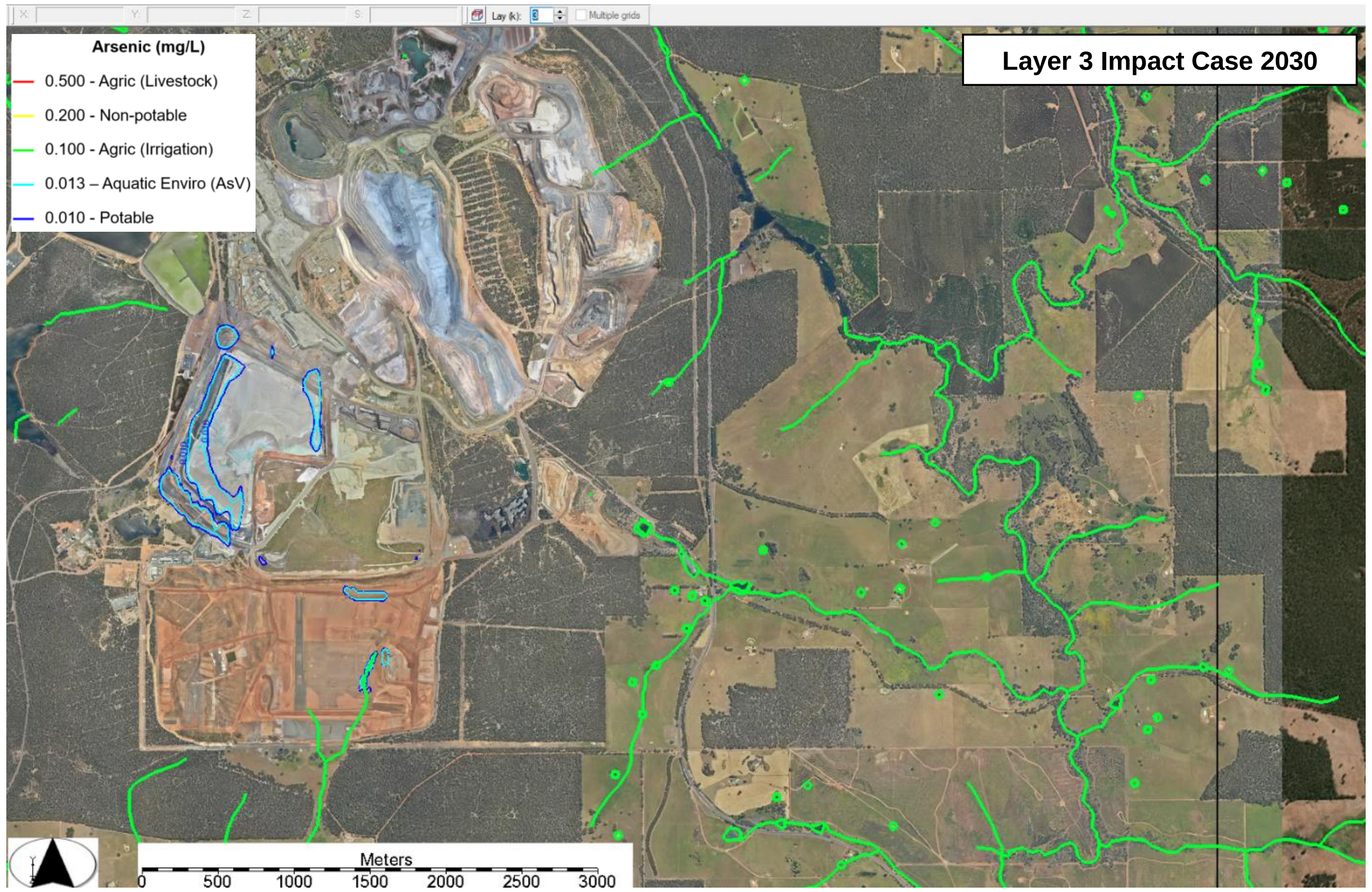

Layer 2 Impact Case 2030
Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 3 Base Case 2030
Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 3 Impact Case 2030
Arsenic (mg/L)
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0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
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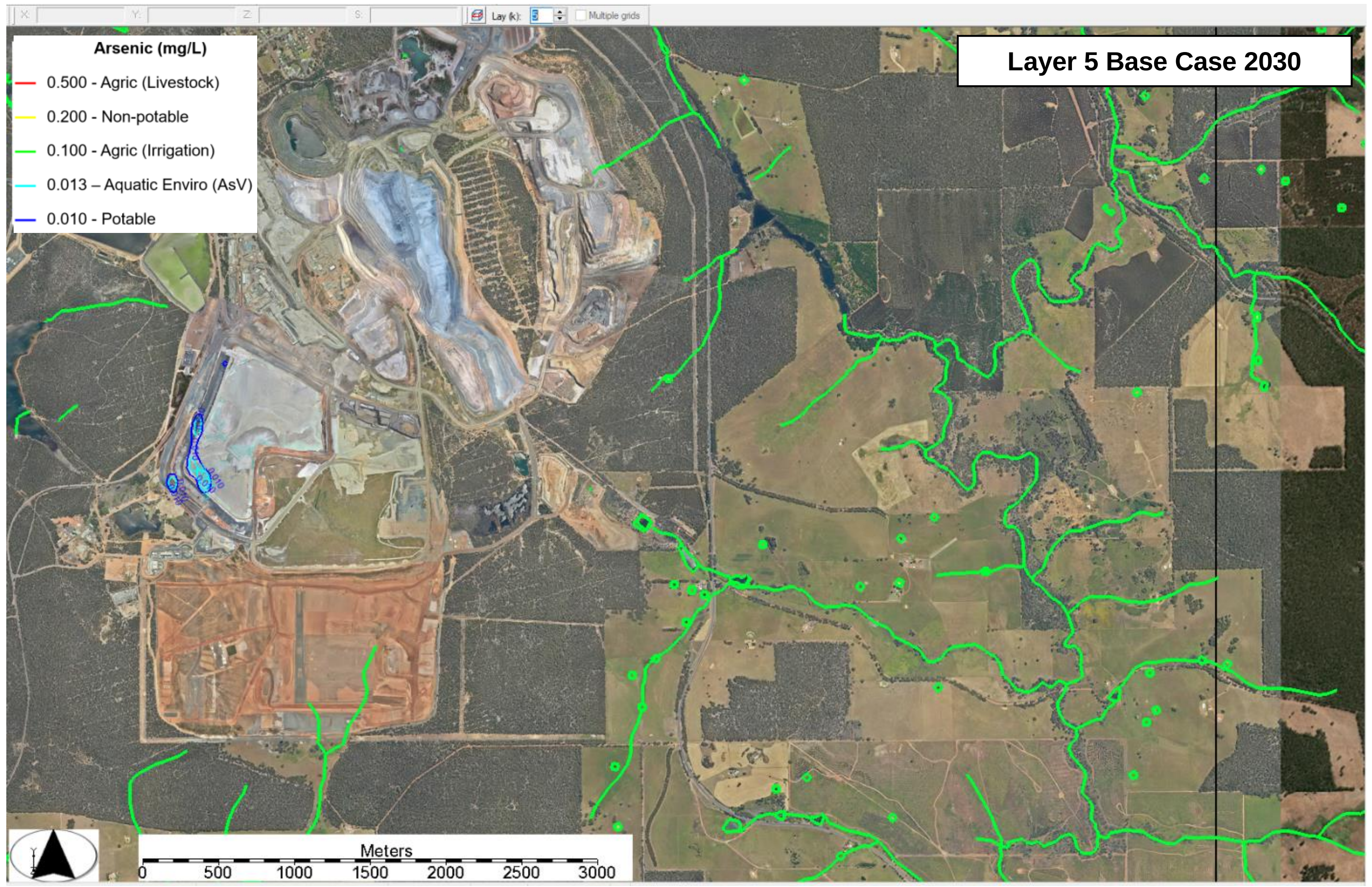
Arsenic (mg/L)
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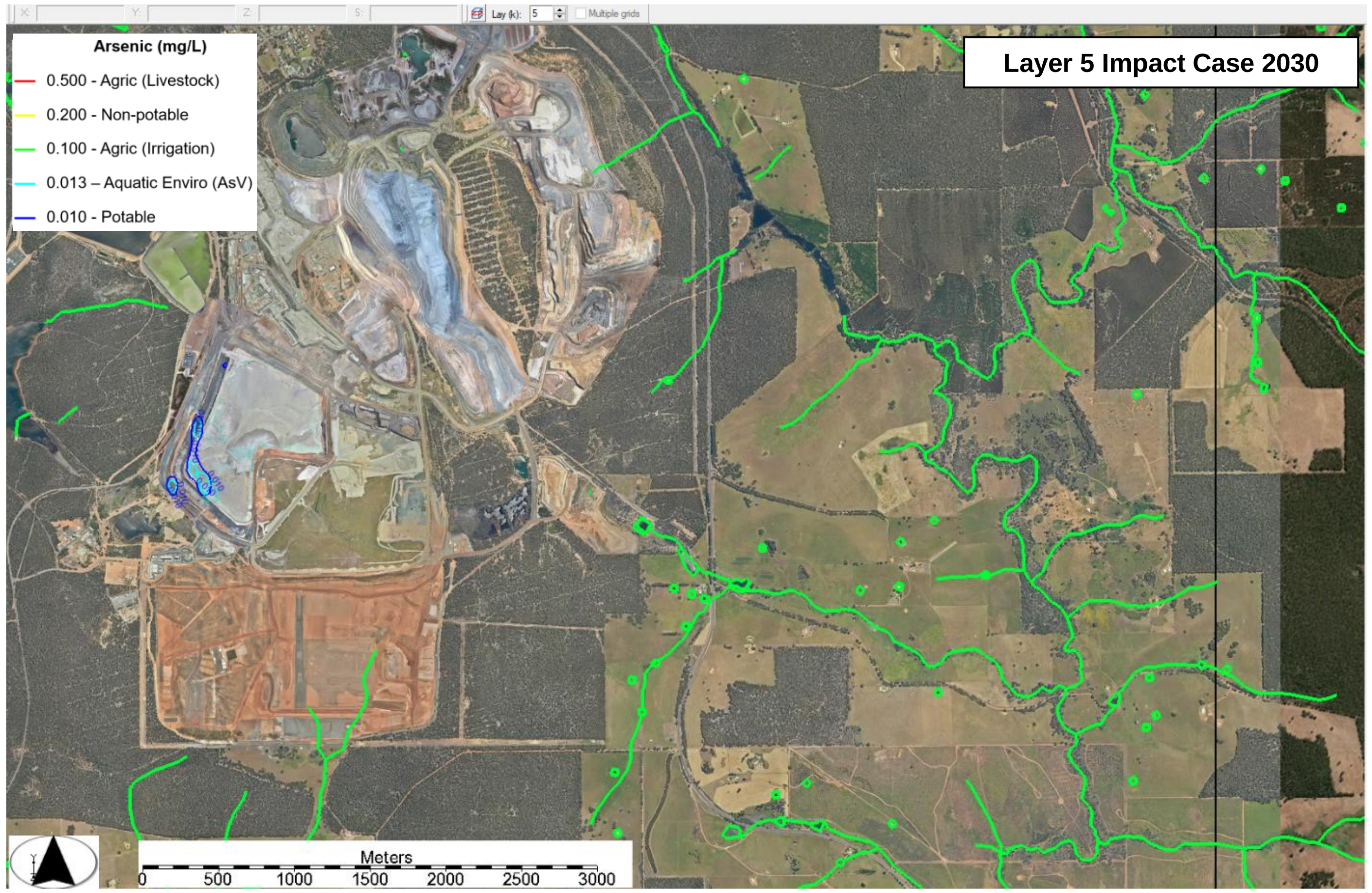
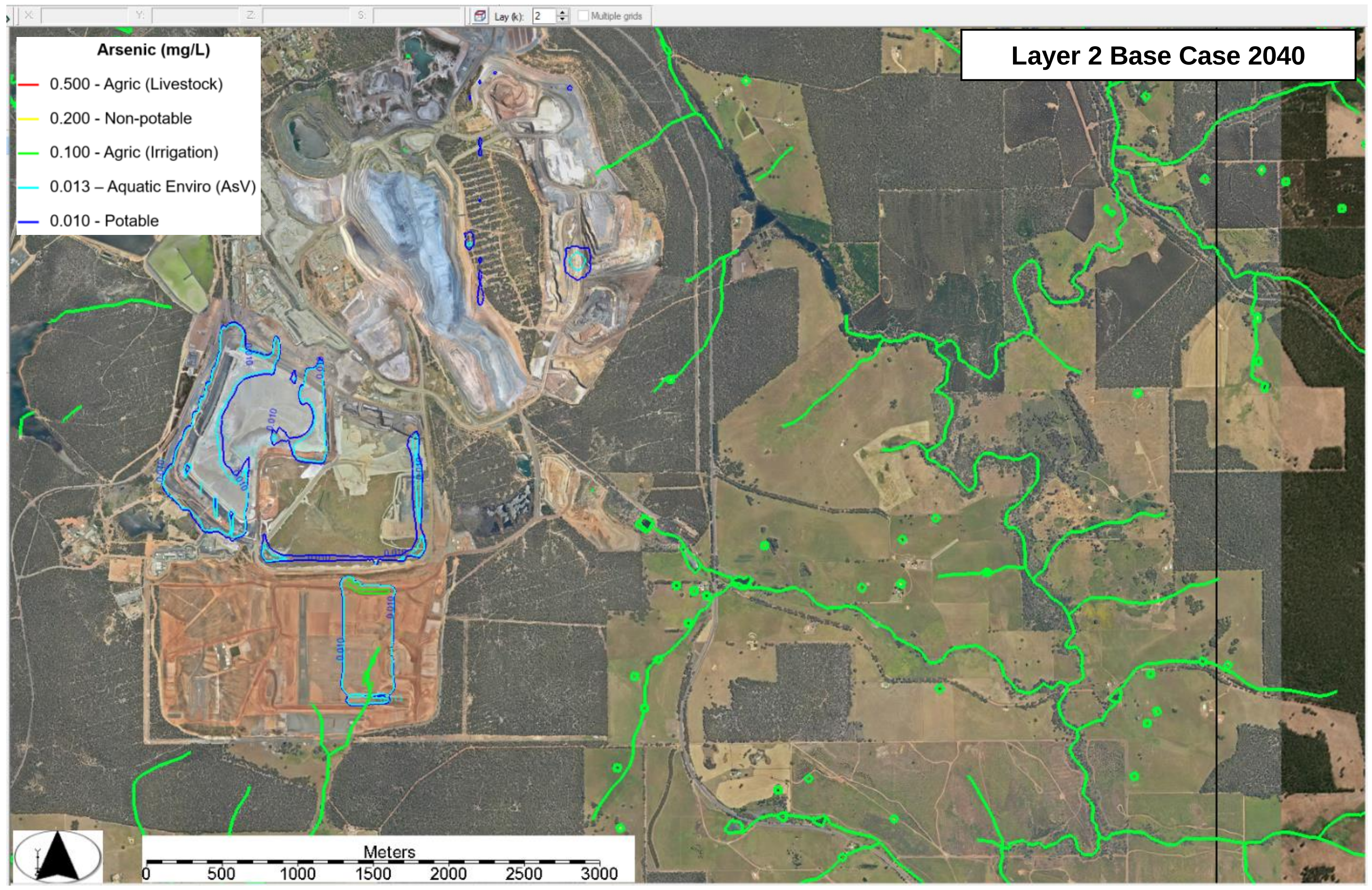
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 5 Base Case 2030
Meters
0 500 1000 1500 2000 2500 3000


Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 5 Impact Case 2030
Meters
0 500 1000 1500 2000 2500 3000

Appendix C

Modelled Arsenic Plumes in 2040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Arsenic (mg/L)
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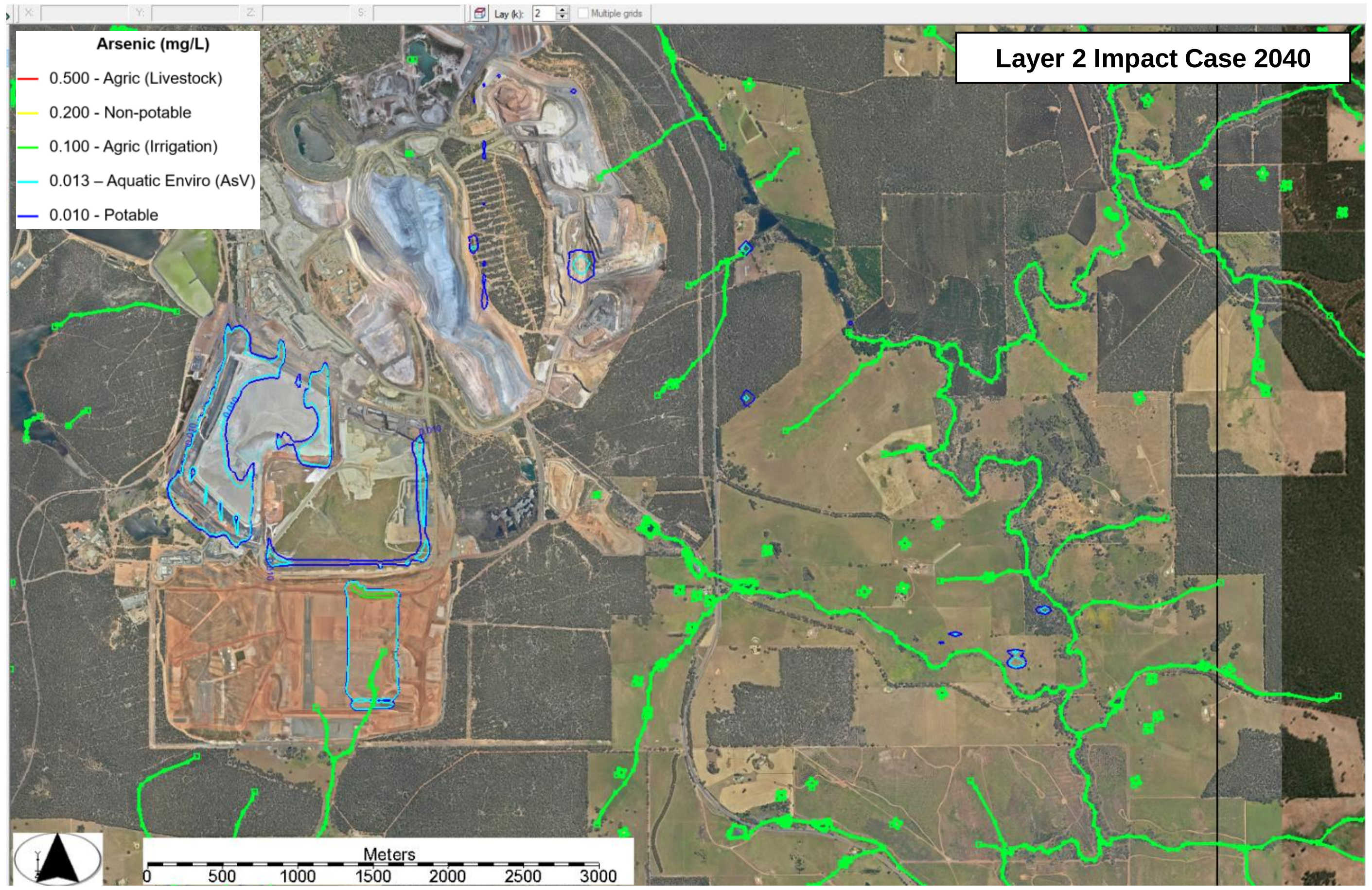
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0
500
1000
1500
2000
2500
3000


Layer 2 Impact Case 2040
Arsenic (mg/L)
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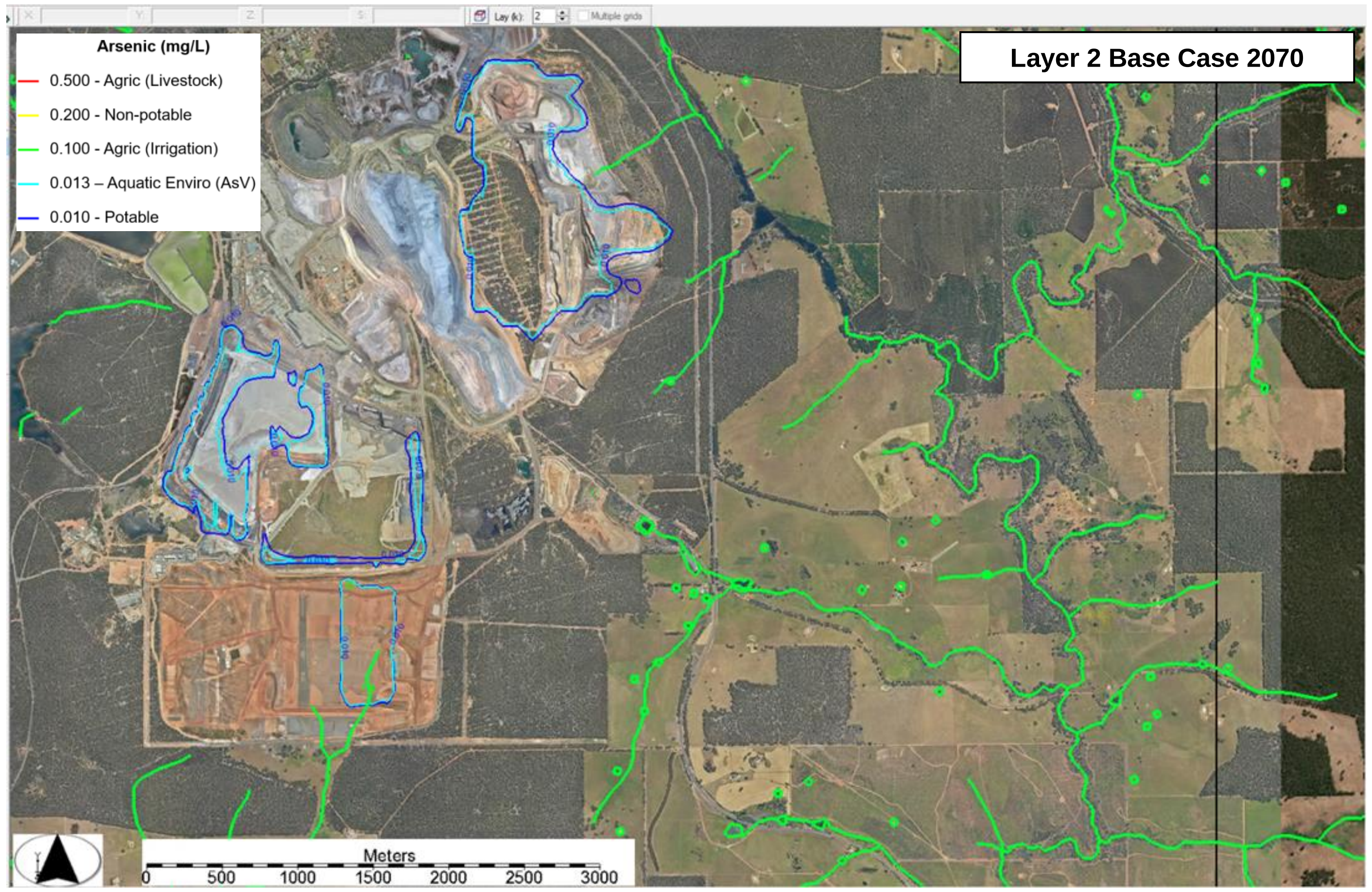
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0
500
1000
1500
2000
2500
3000

Appendix D

Modelled Arsenic Plumes in 2070



Arsenic (mg/L)
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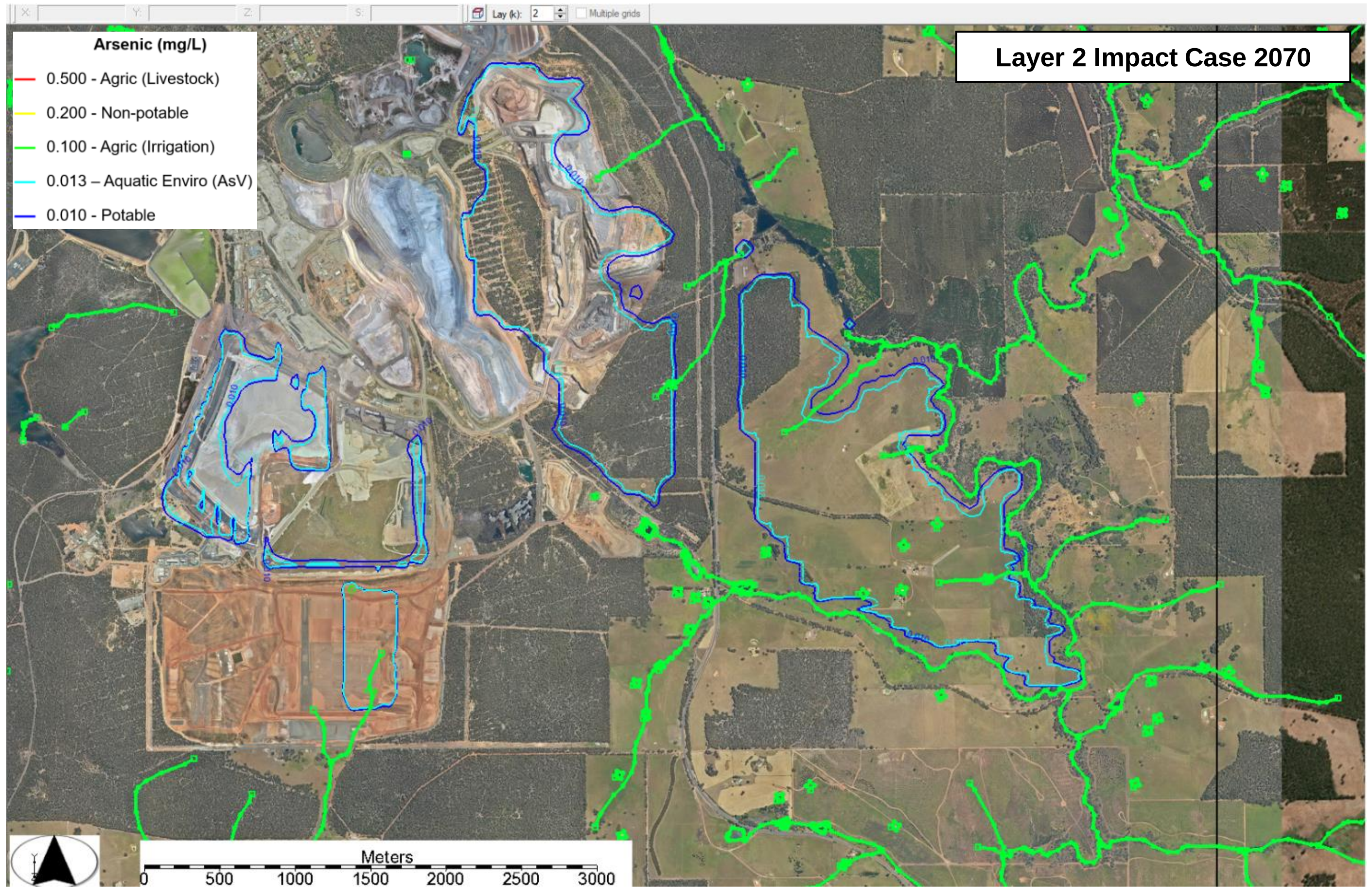
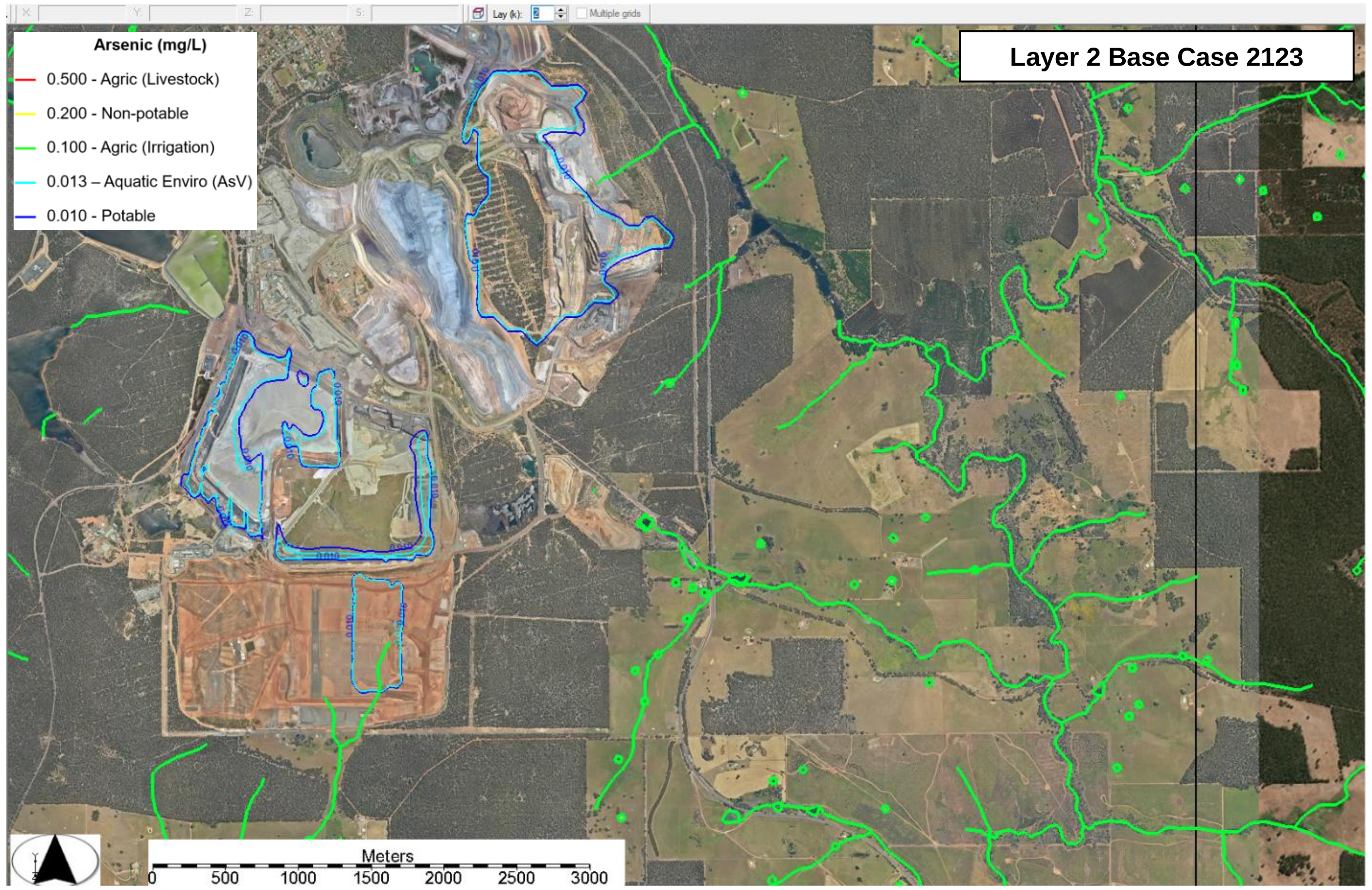
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 2 Base Case 2070
Meters
0 500 1000 1500 2000 2500 3000



Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 2 Impact Case 2070
Meters
0 500 1000 1500 2000 2500 3000

Appendix E

Modelled Arsenic Plumes in 2123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Arsenic (mg/L)
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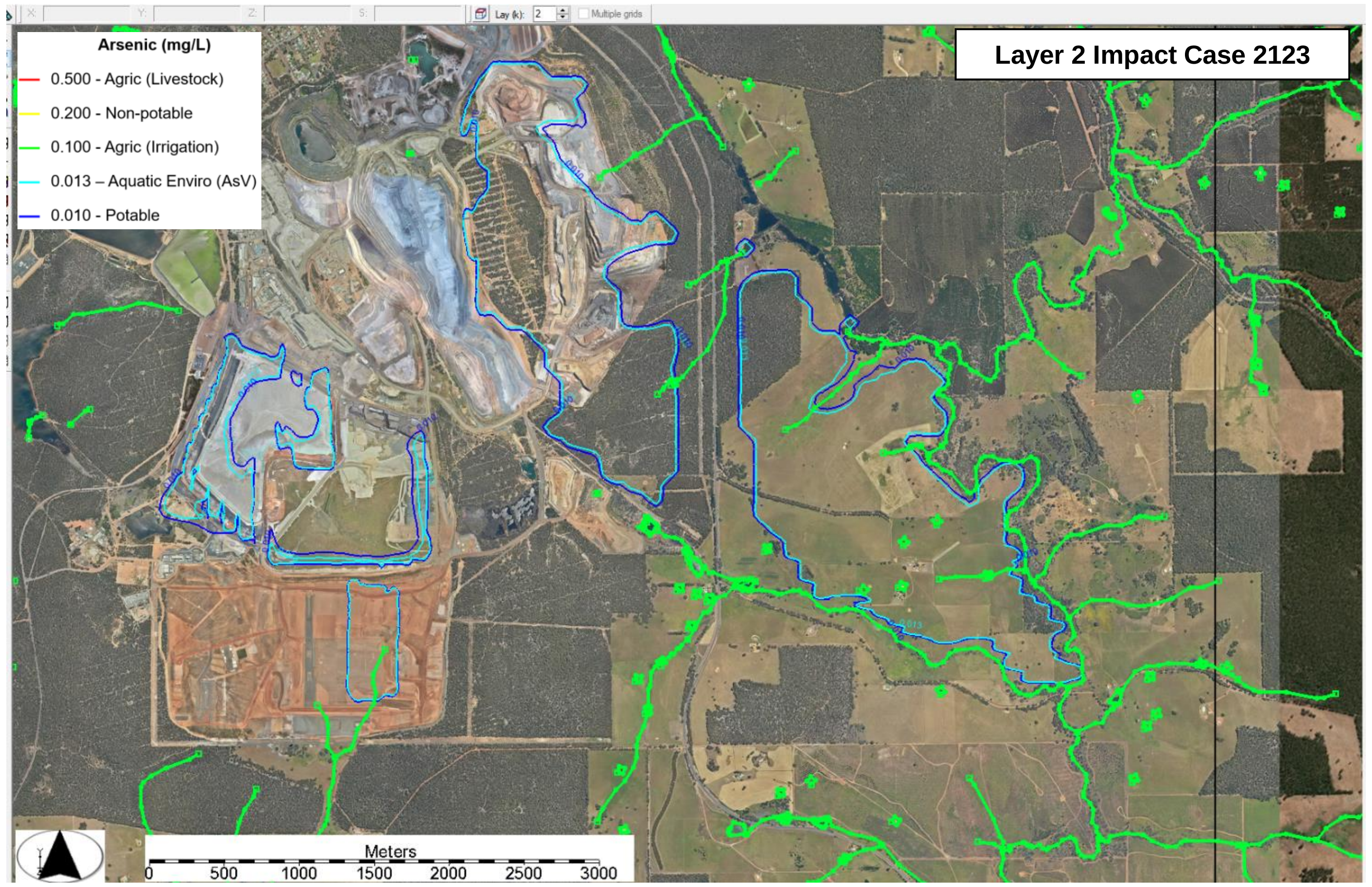
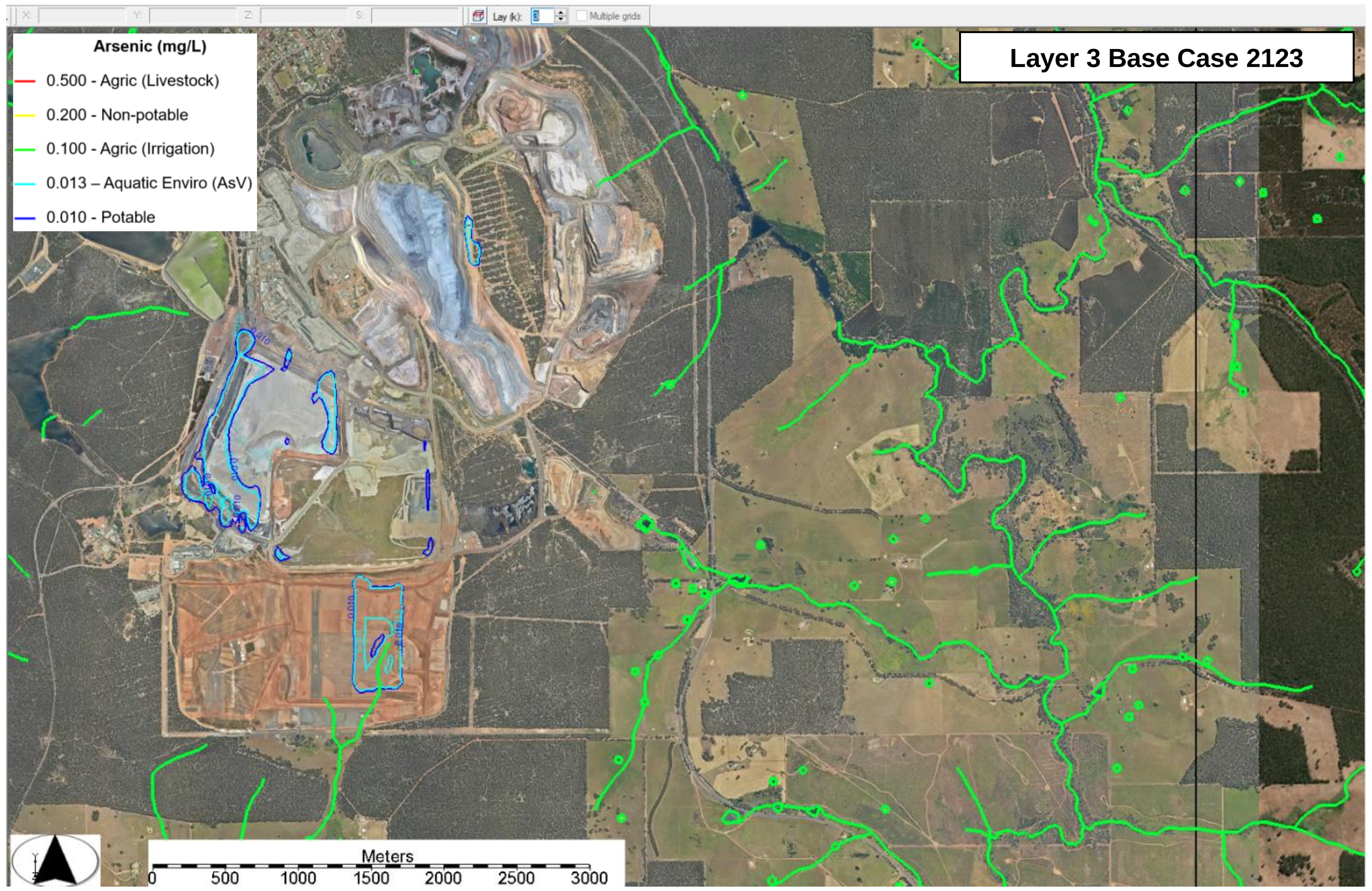
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 2 Impact Case 2123
Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 3 Base Case 2123
Arsenic (mg/L)
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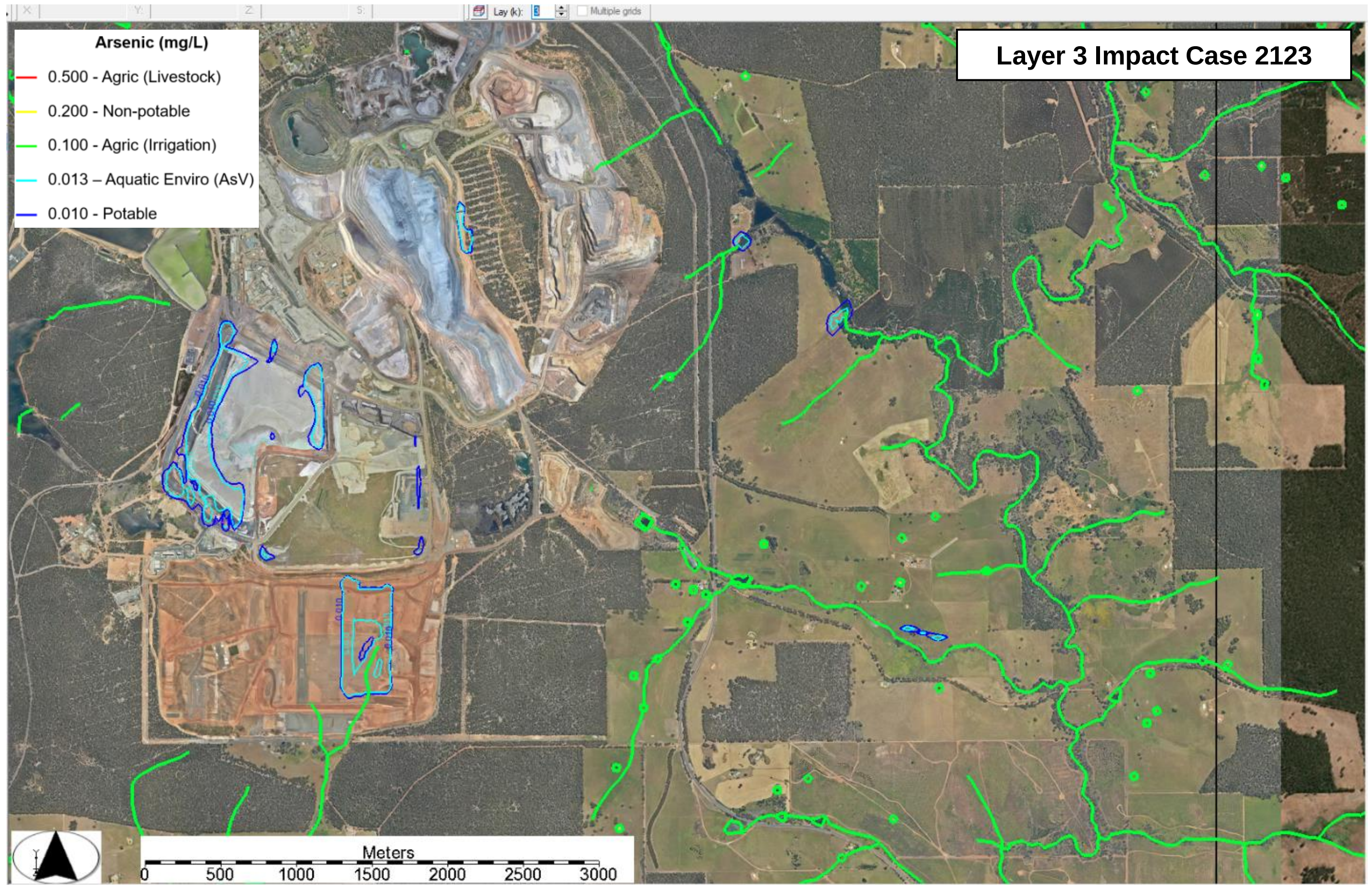
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 3 Impact Case 2123
Arsenic (mg/L)
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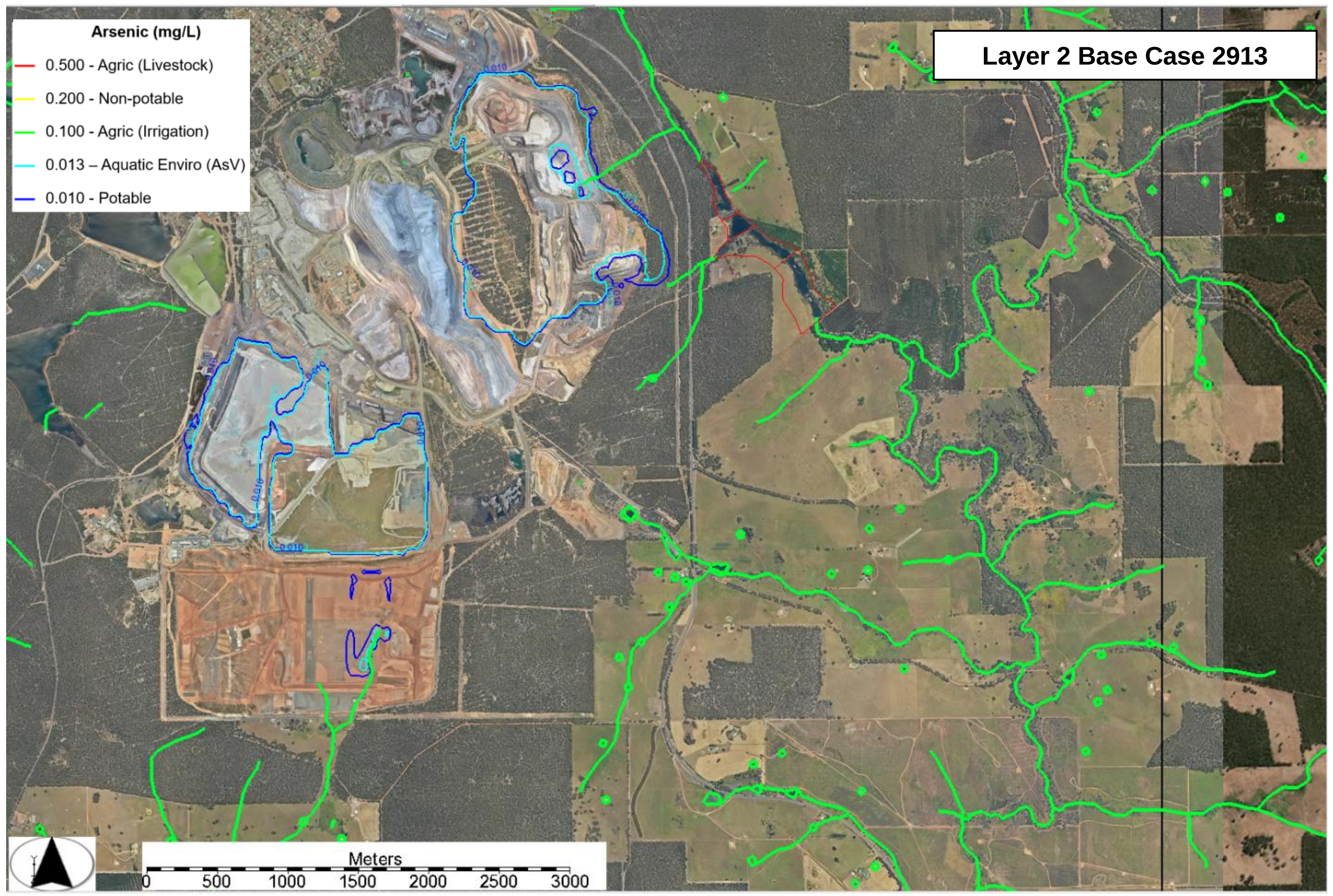
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Meters
0 500 1000 1500 2000 2500 3000

Appendix F

Modelled Arsenic Plumes in 2913


Arsenic (mg/L)
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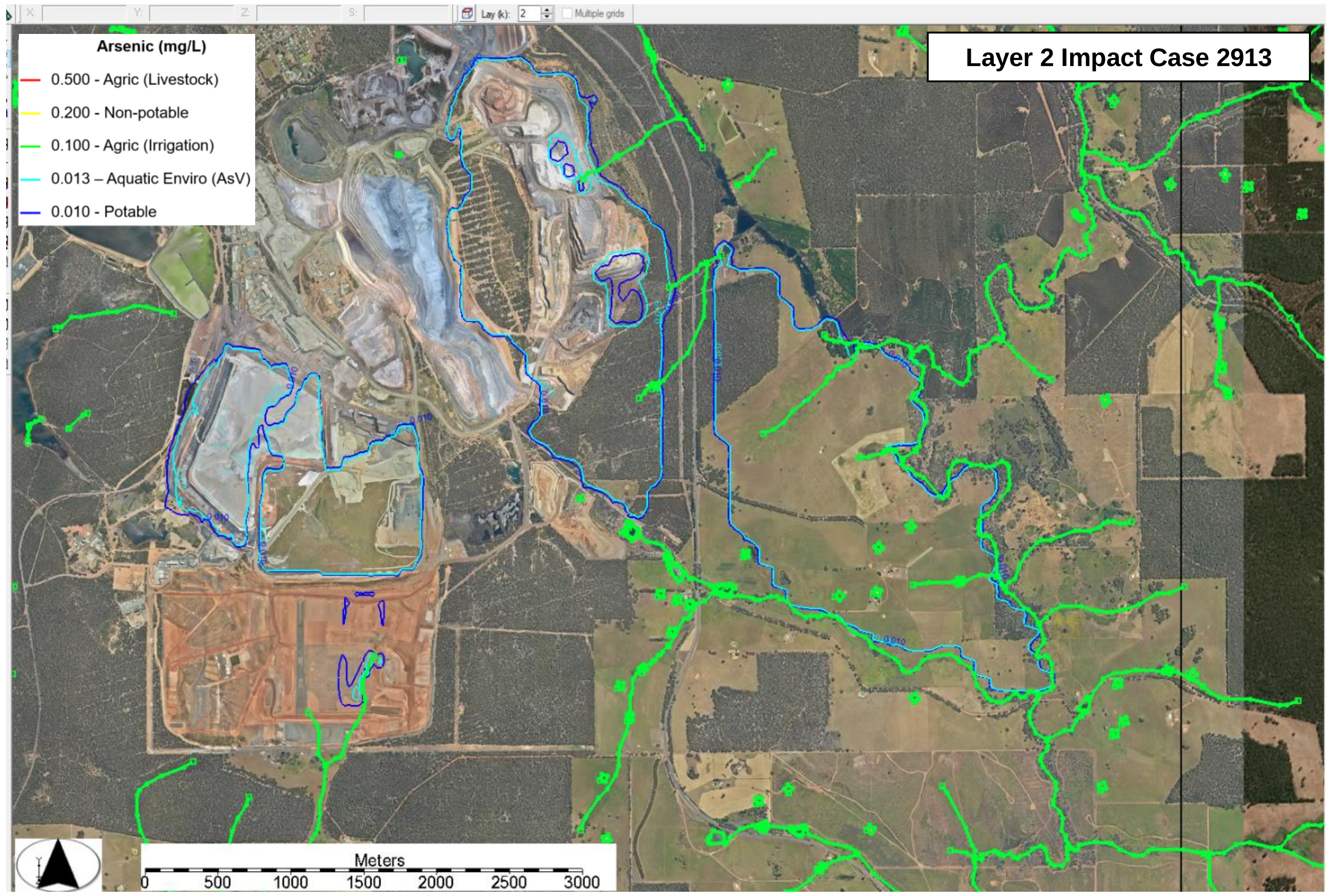
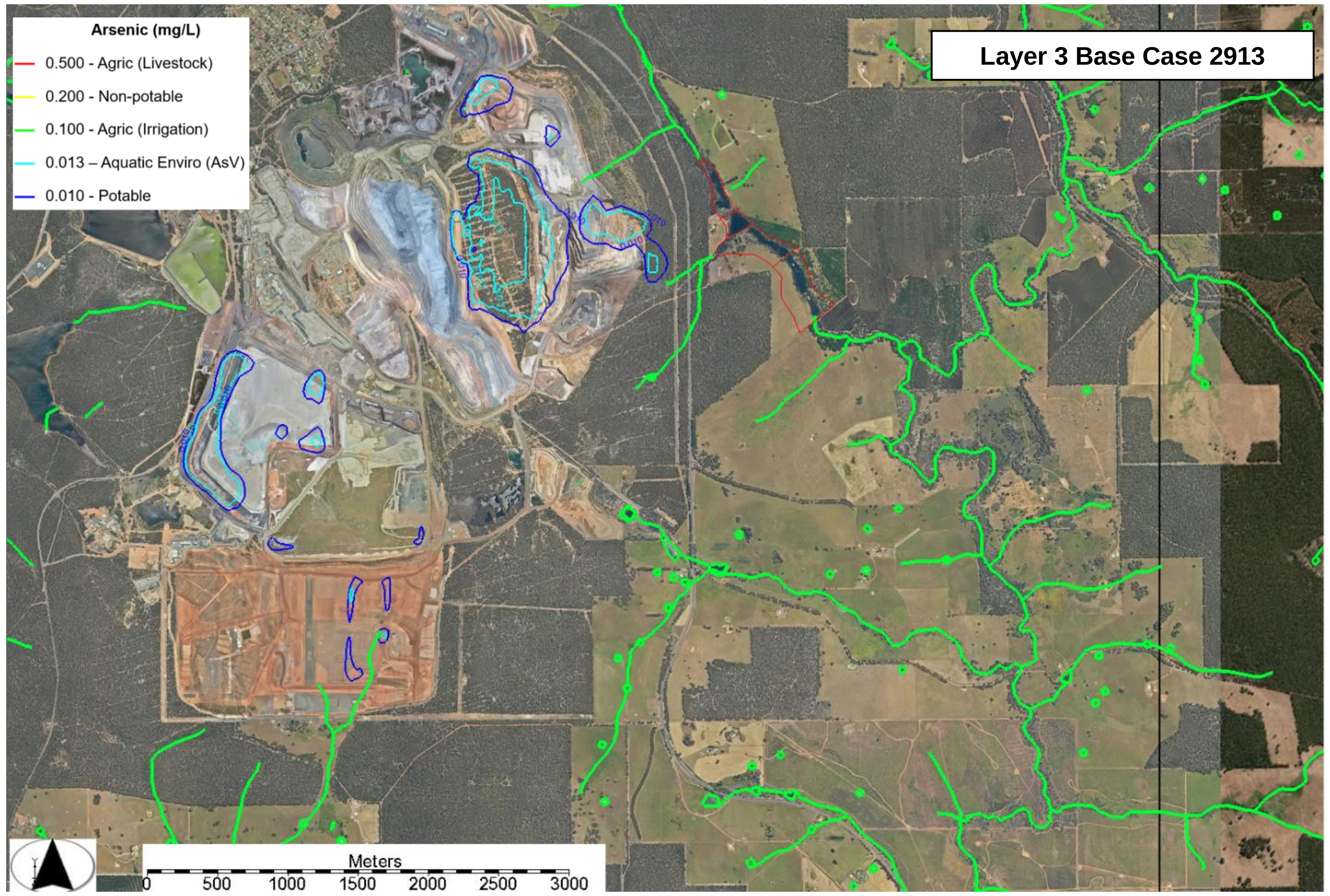
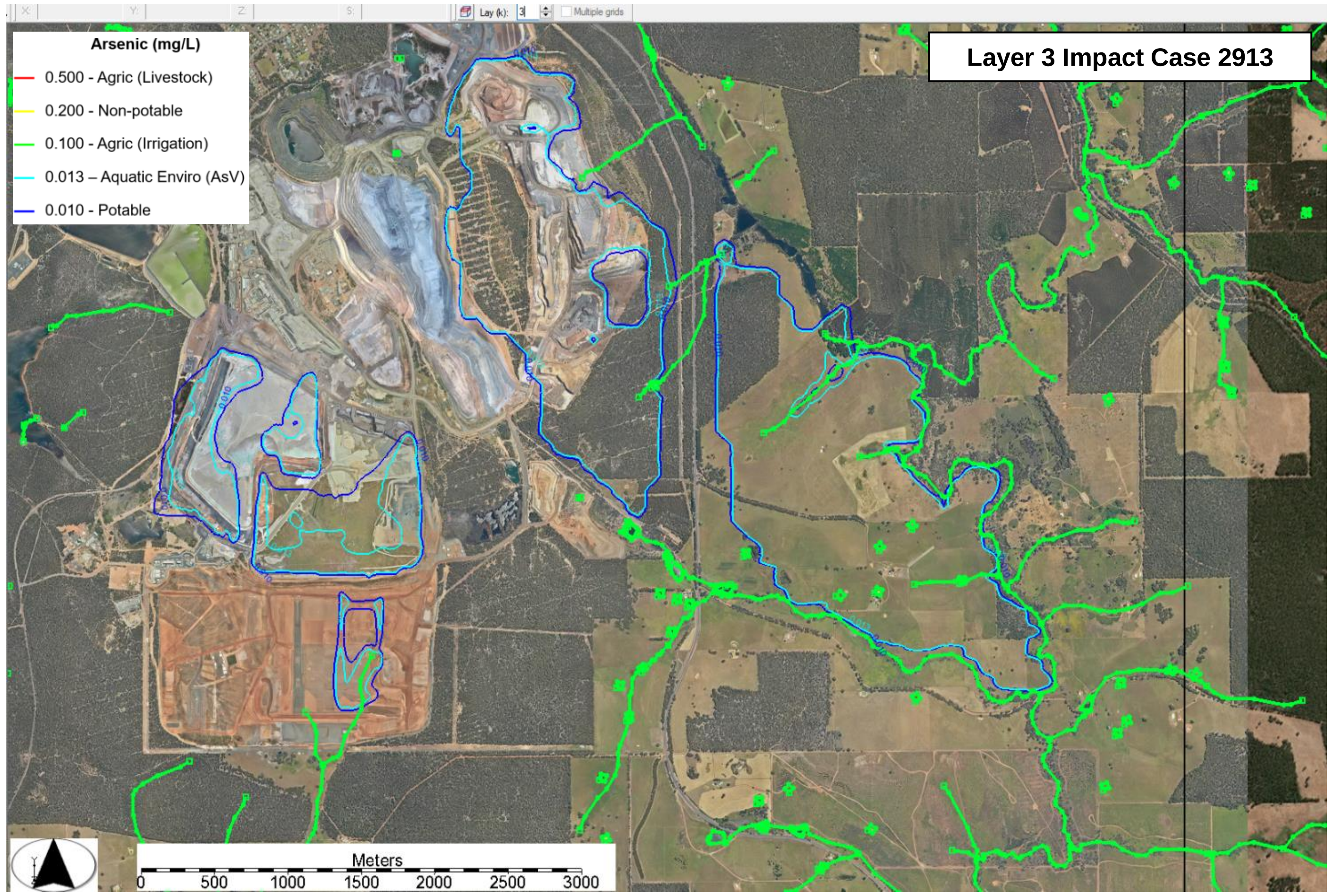
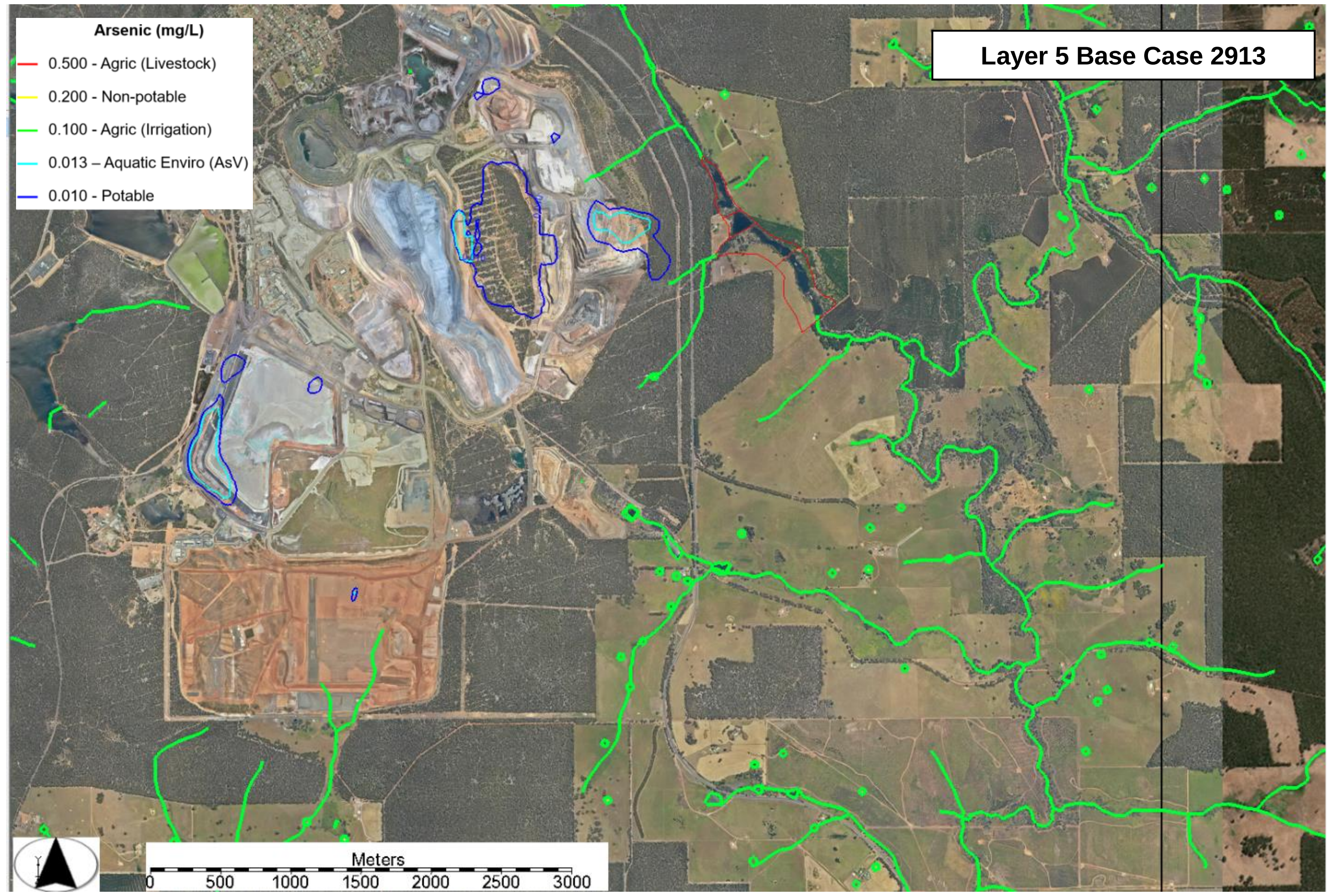
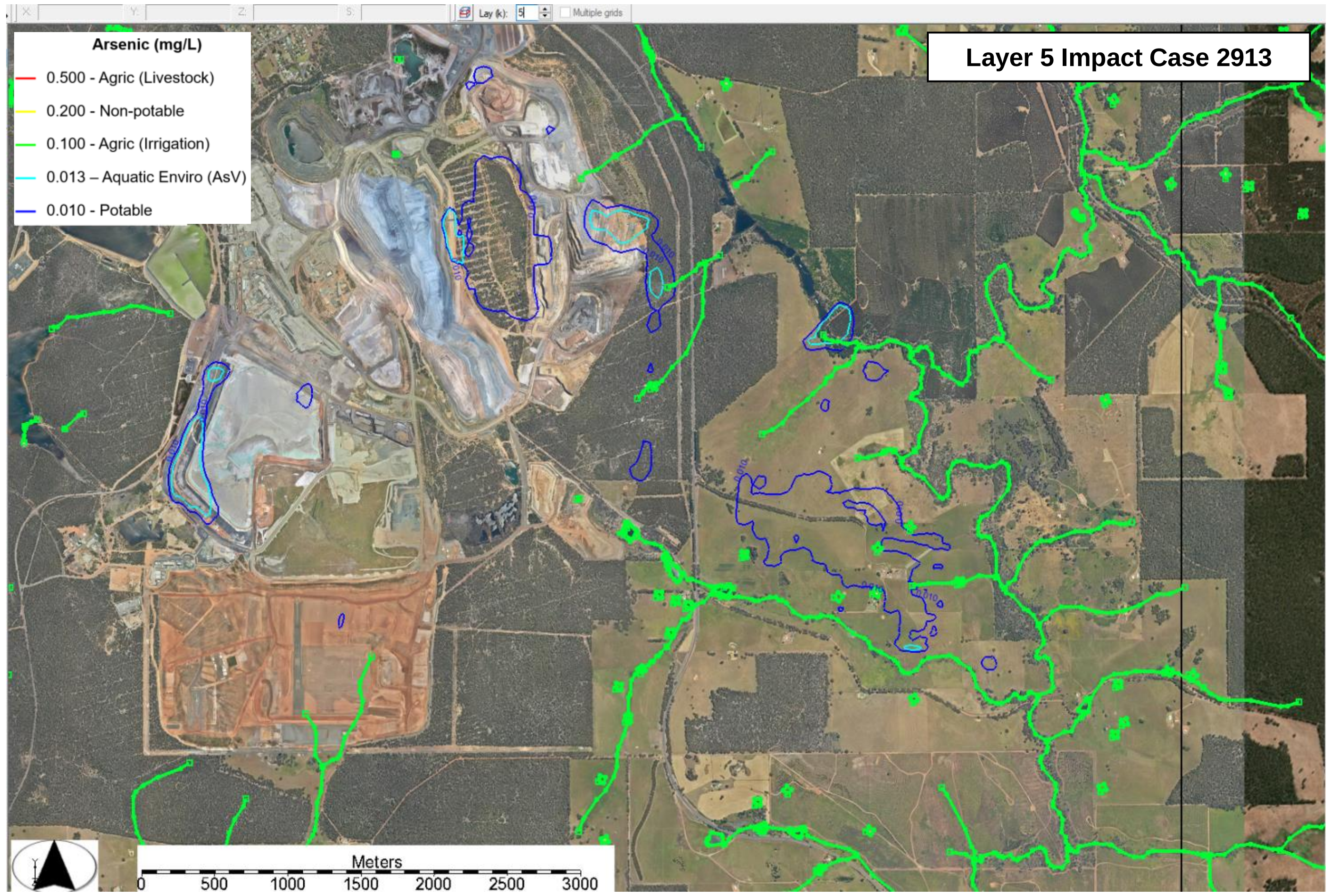
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 2 Base Case 2913
Meters
0 500 1000 1500 2000 2500 3000


Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 2 Impact Case 2913
Meters
0 500 1000 1500 2000 2500 3000


Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 3 Base Case 2913
Meters
0 500 1000 1500 2000 2500 3000

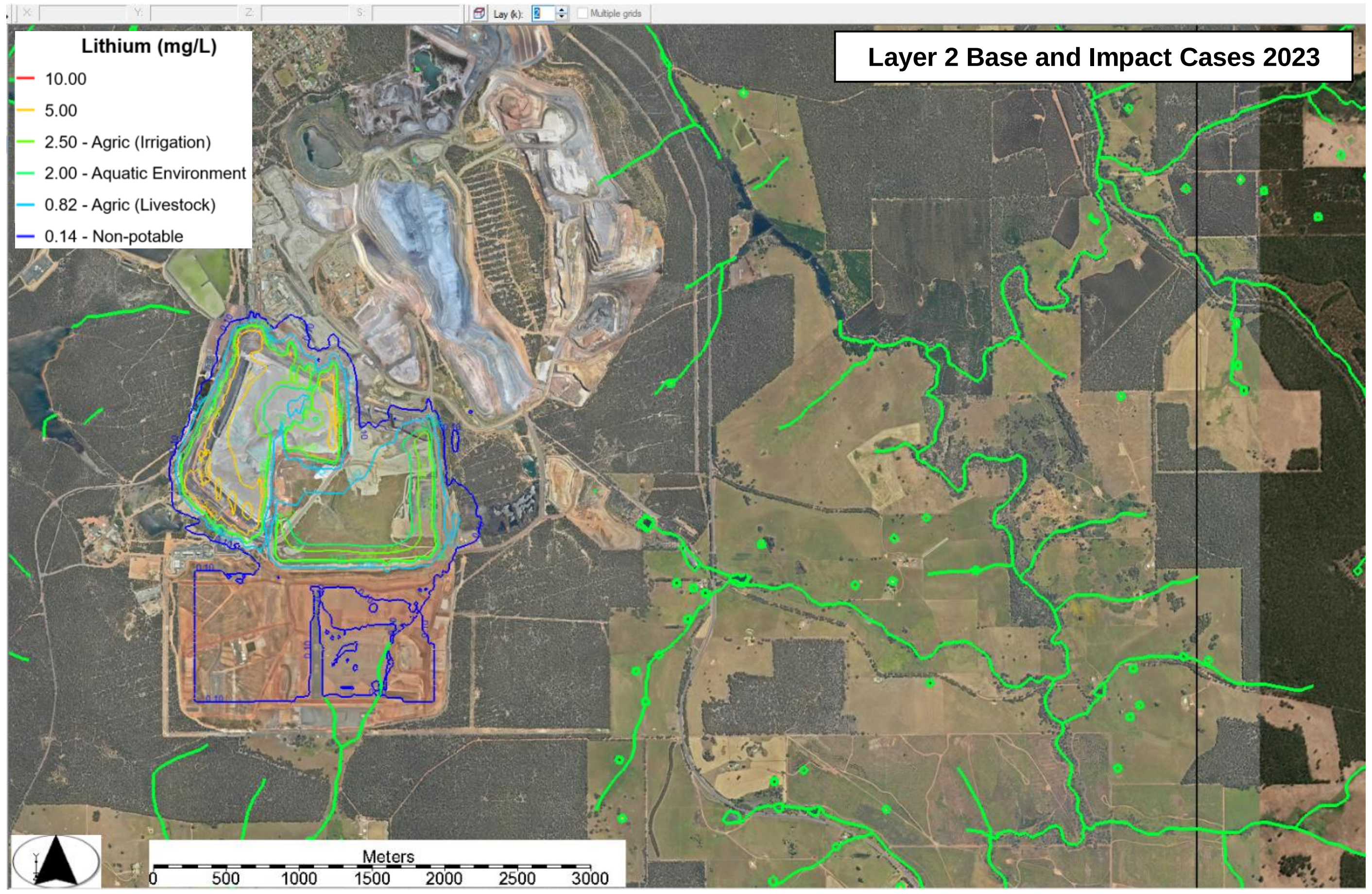

Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 3 Impact Case 2913
Meters
0 500 1000 1500 2000 2500 3000

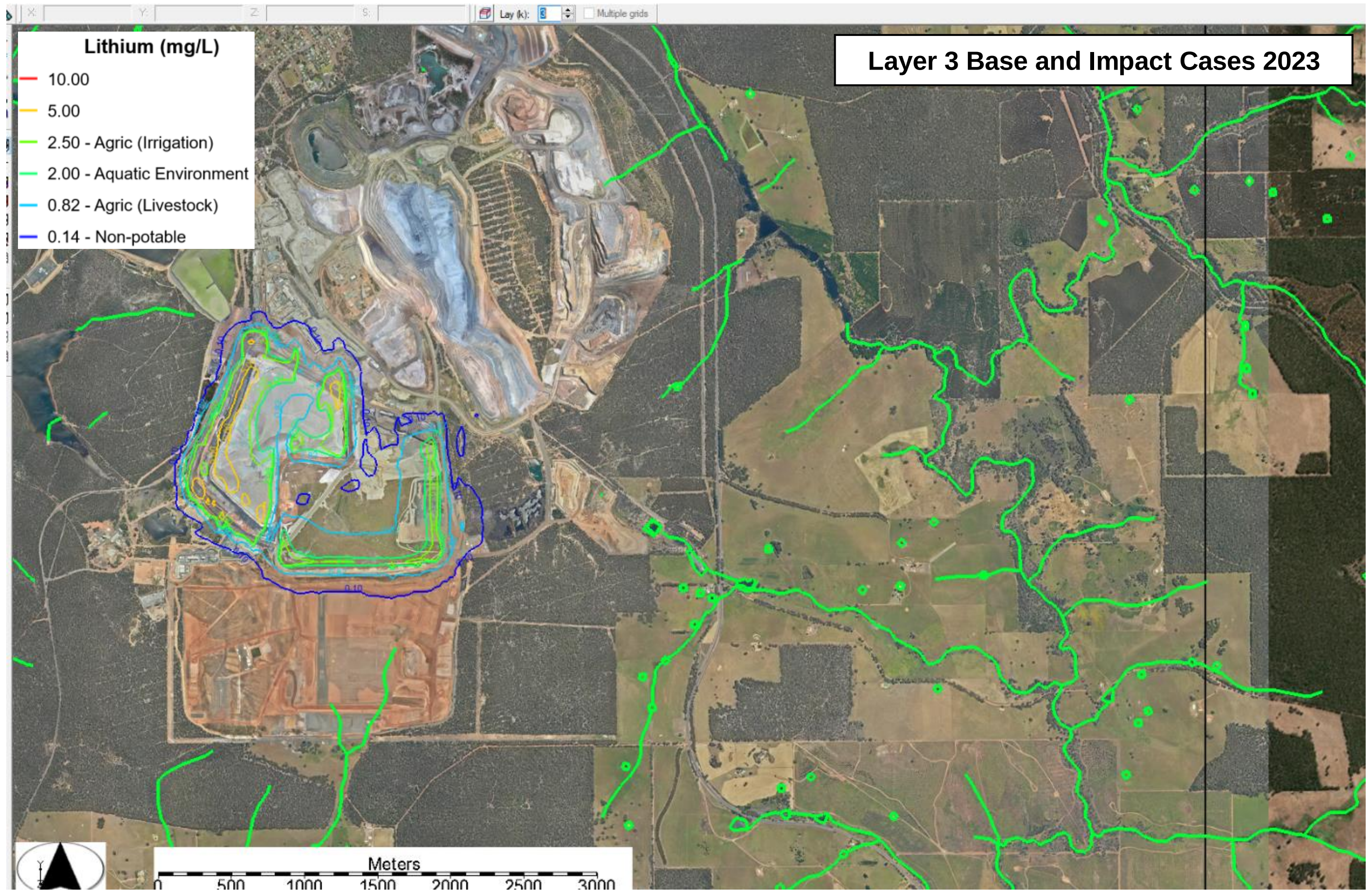

Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 5 Base Case 2913
Meters
0
500
1000
1500
2000
2500
3000

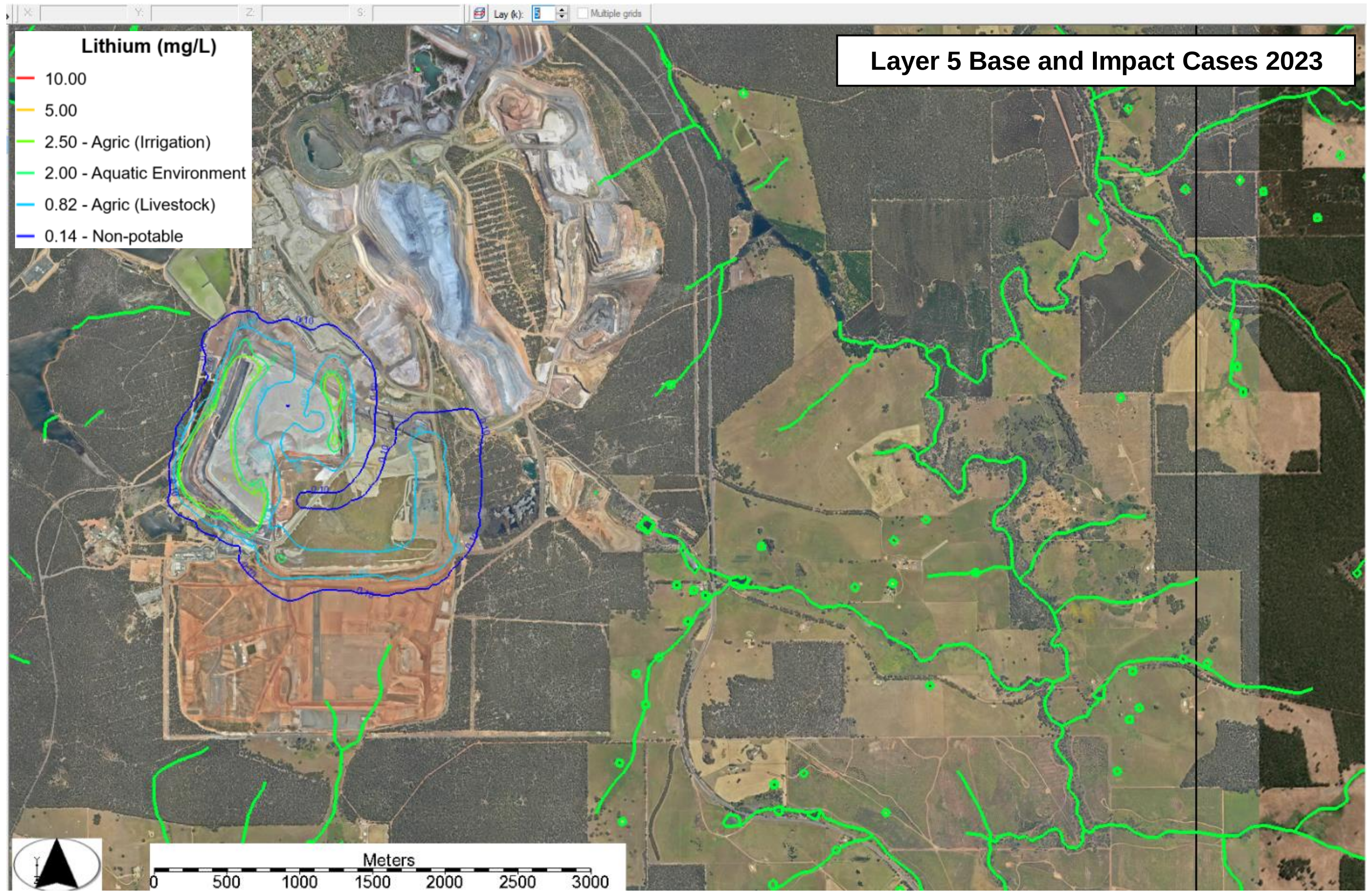

Arsenic (mg/L)
0.500 - Agric (Livestock)
0.200 - Non-potable
0.100 - Agric (Irrigation)
0.013 – Aquatic Enviro (AsV)
0.010 - Potable
Layer 5 Impact Case 2913
Meters
0
500
1000
1500
2000
2500
3000

Appendix G

Modelled Lithium Plumes in 2023

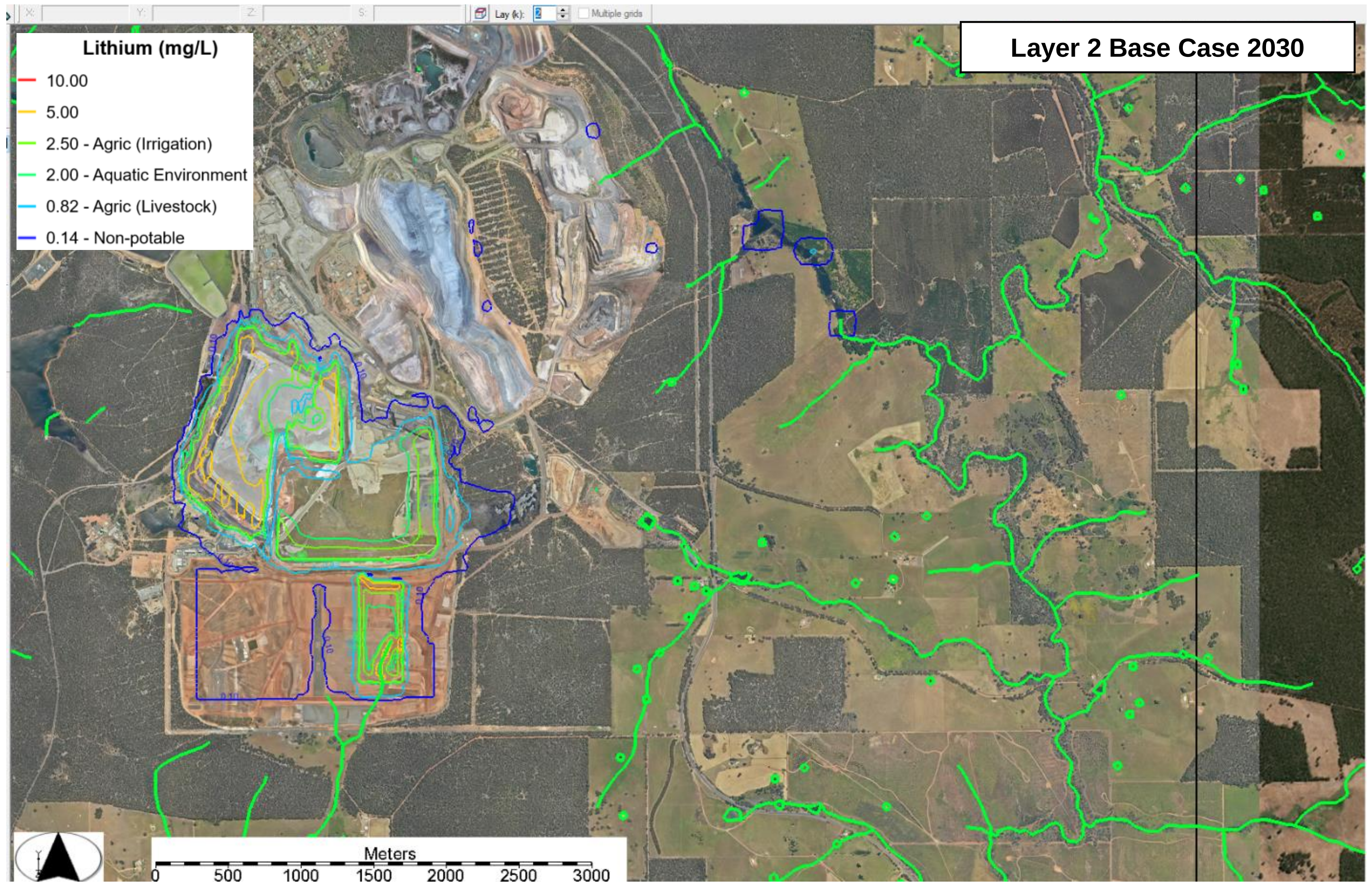

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Base and Impact Cases 2023
Meters
0
500
1000
1500
2000
2500
3000

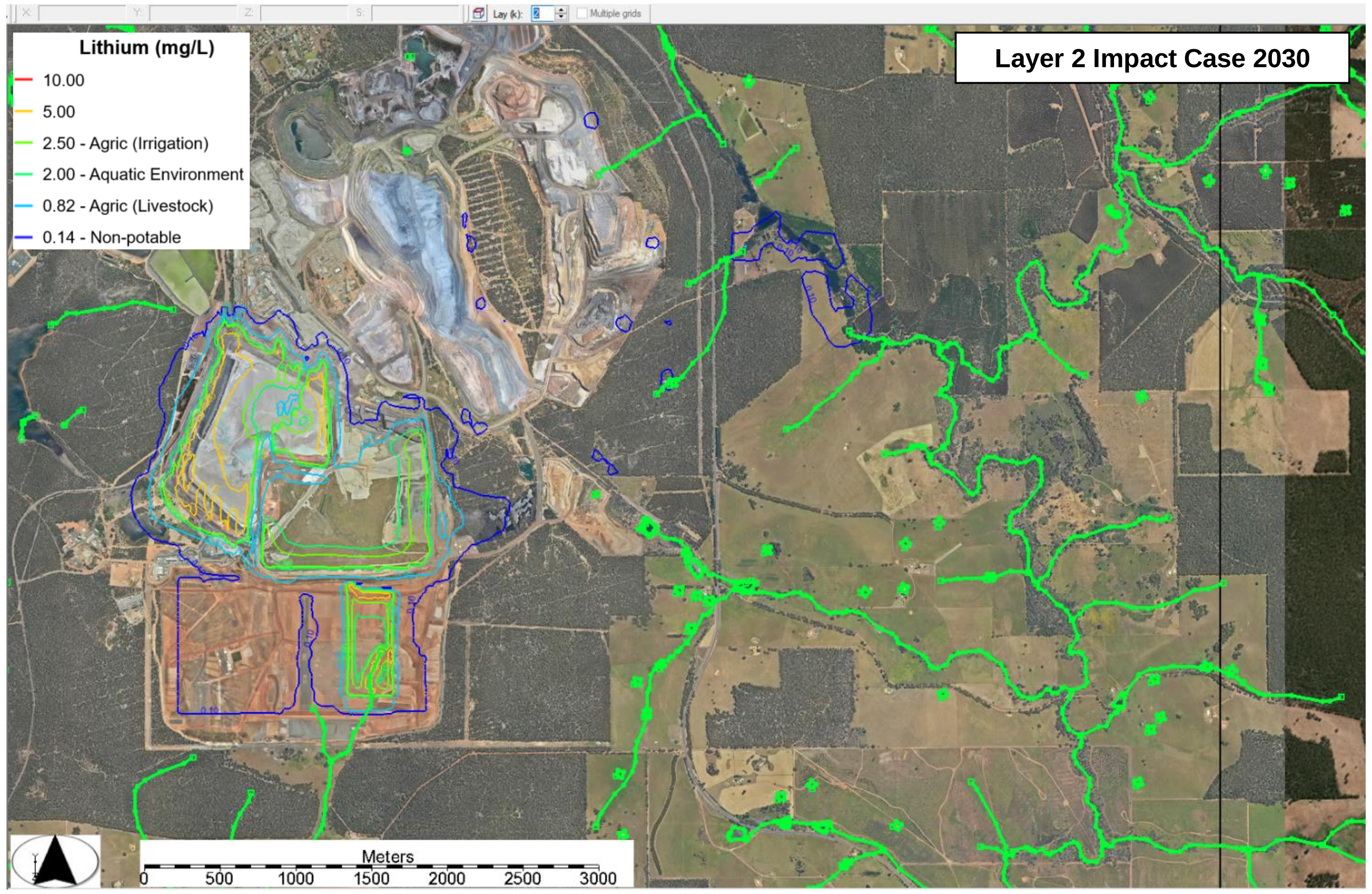

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 3 Base and Impact Cases 2023
Meters
0
500
1000
1500
2000
2500
3000

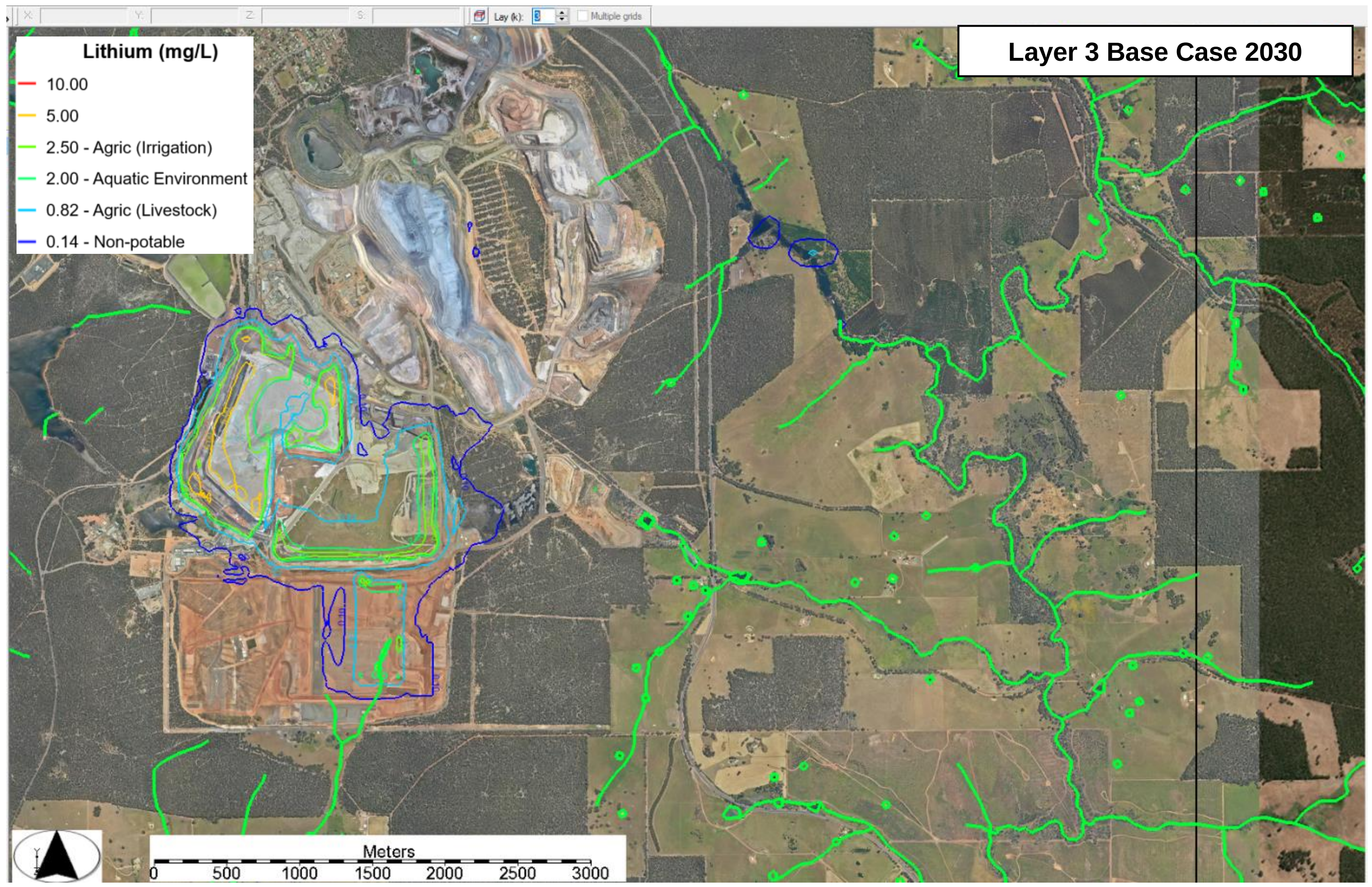

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 5 Base and Impact Cases 2023
Meters
0
500
1000
1500
2000
2500
3000

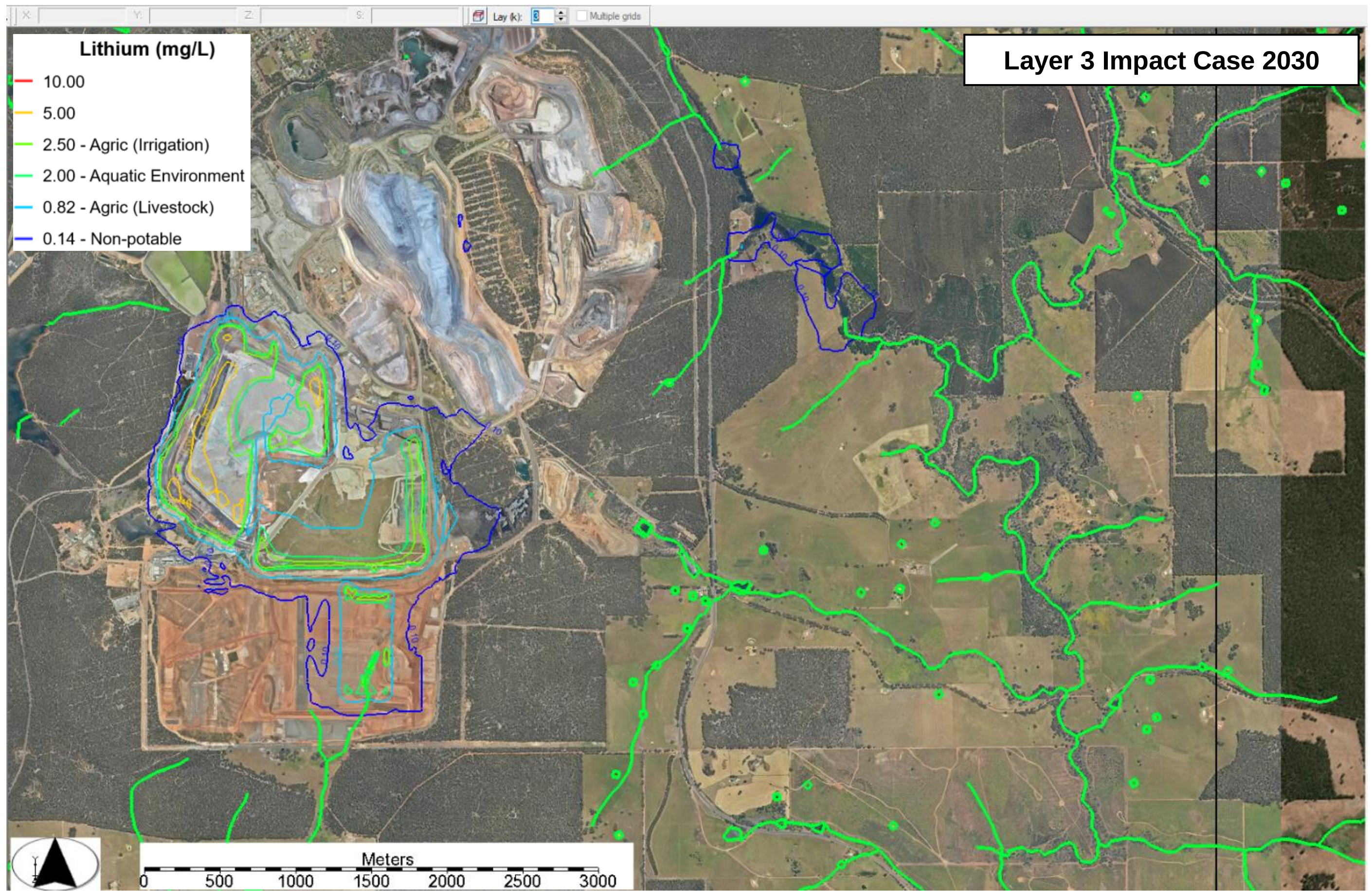
Appendix H

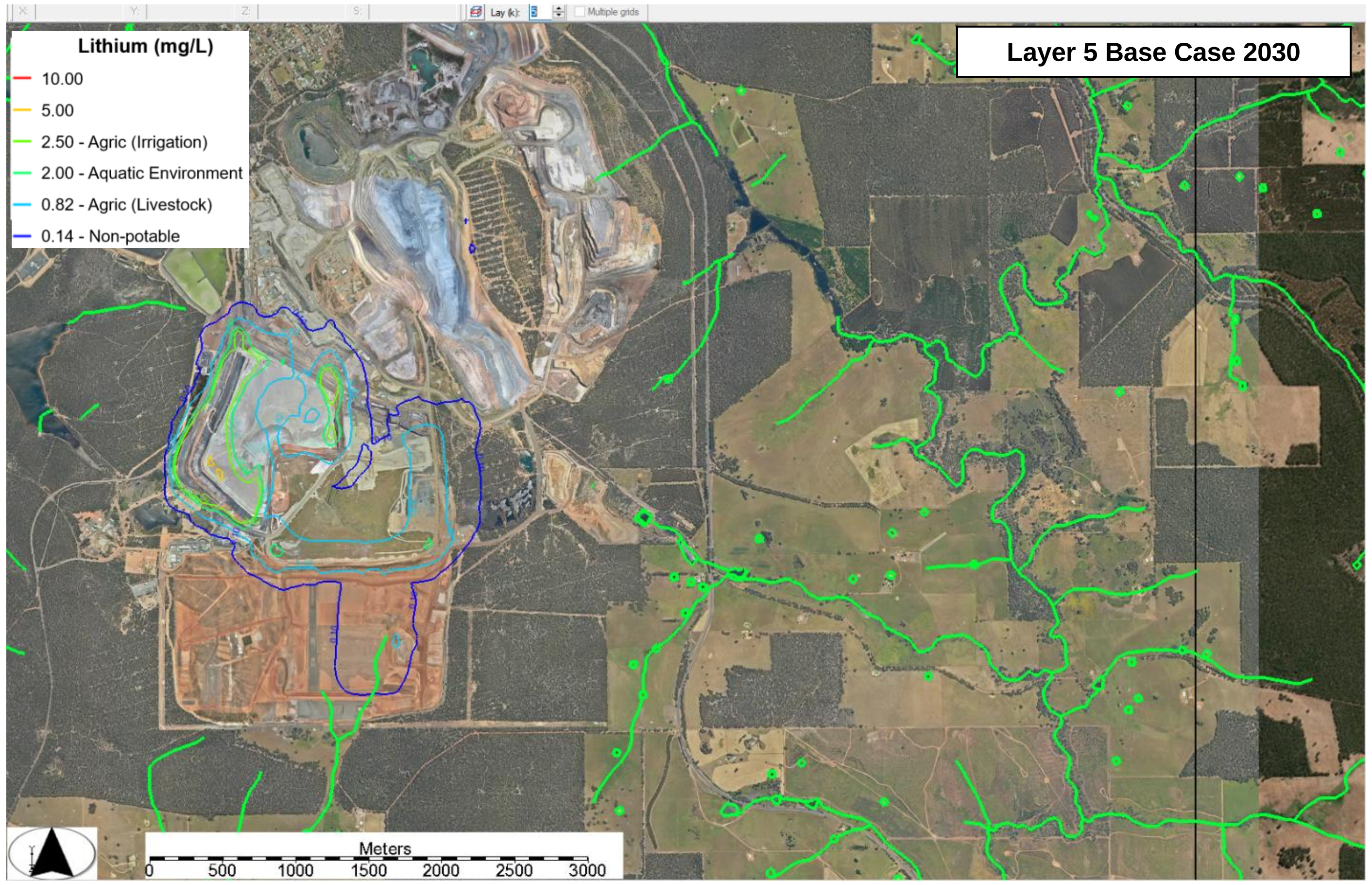
Modelled Lithium Plumes in 2030

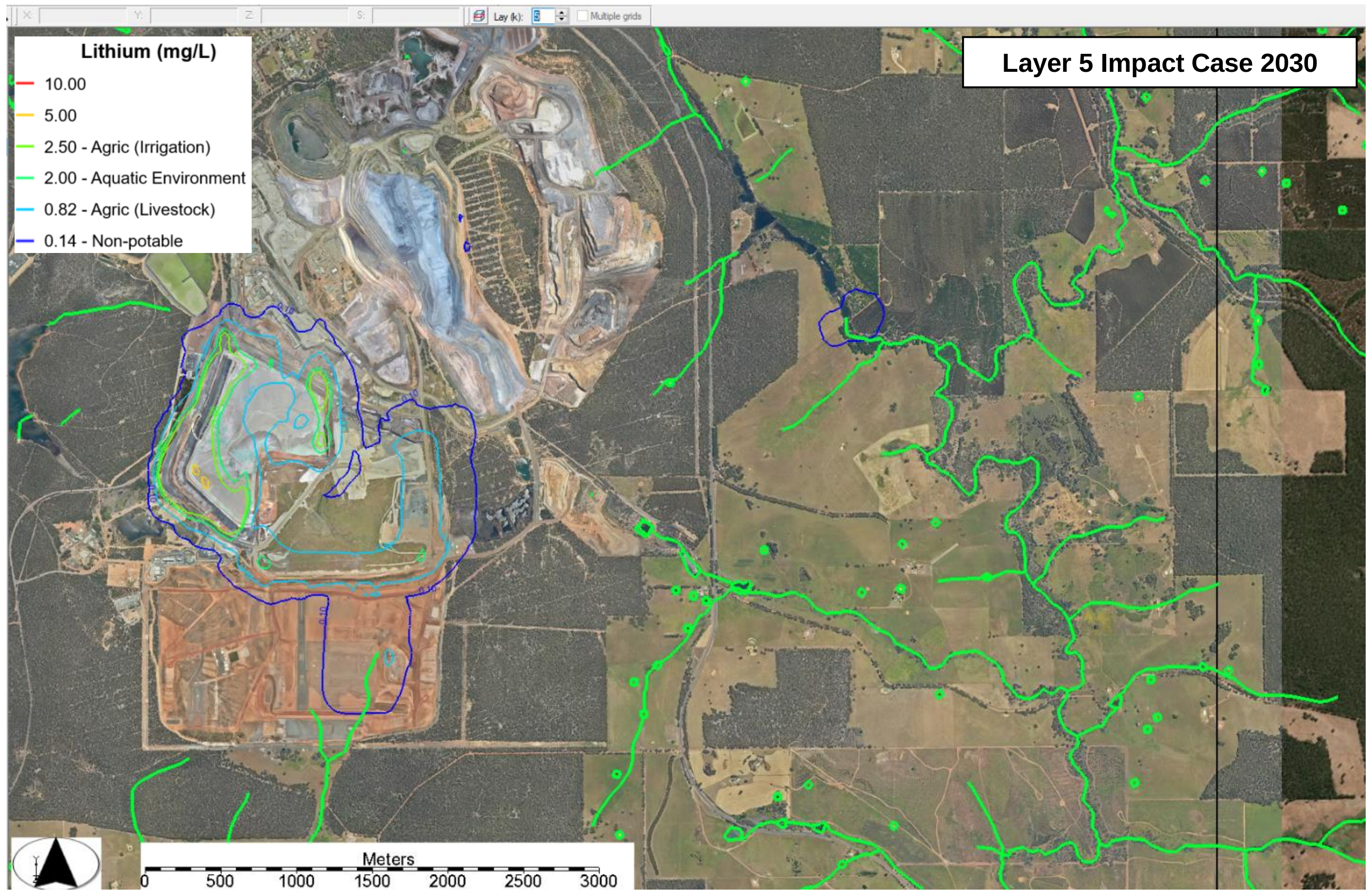

Layer 2 Base Case 2030
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 2 Impact Case 2030
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0 500 1000 1500 2000 2500 3000


Layer 3 Base Case 2030
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0 500 1000 1500 2000 2500 3000

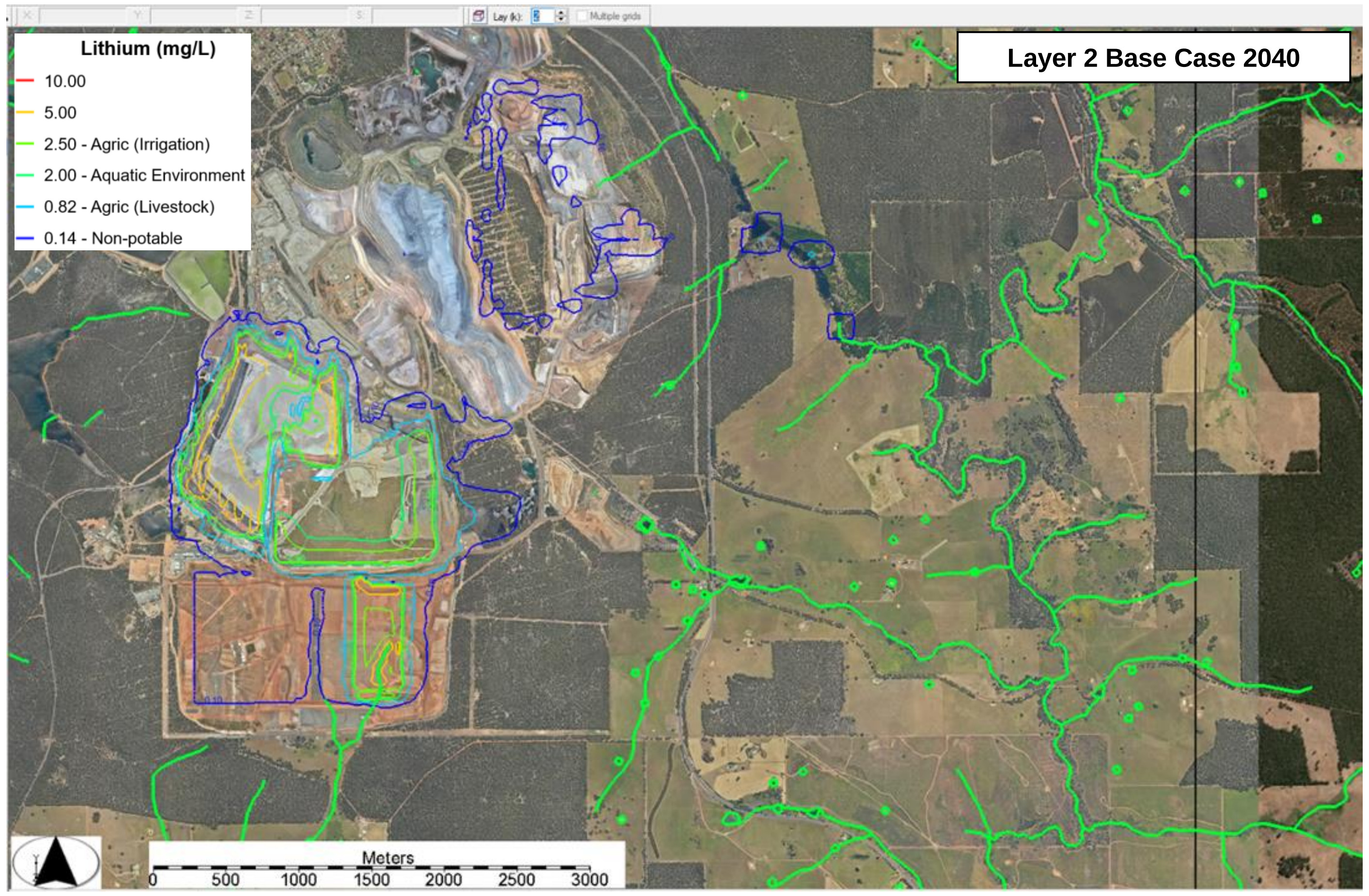

Layer 3 Impact Case 2030
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0 500 1000 1500 2000 2500 3000

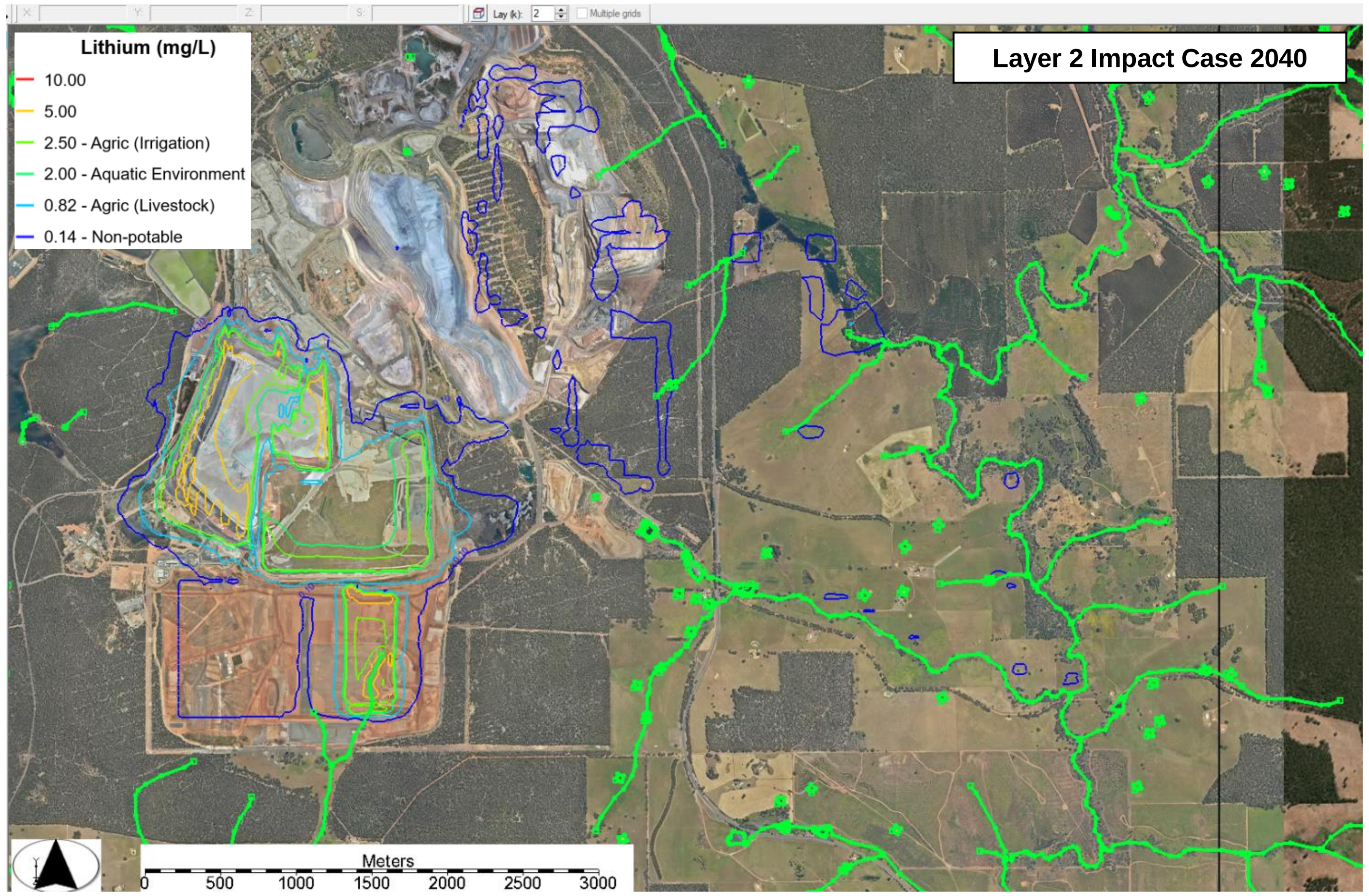

Layer 5 Base Case 2030
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0
500
1000
1500
2000
2500
3000


Layer 5 Impact Case 2030
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0
500
1000
1500
2000
2500
3000

Appendix I

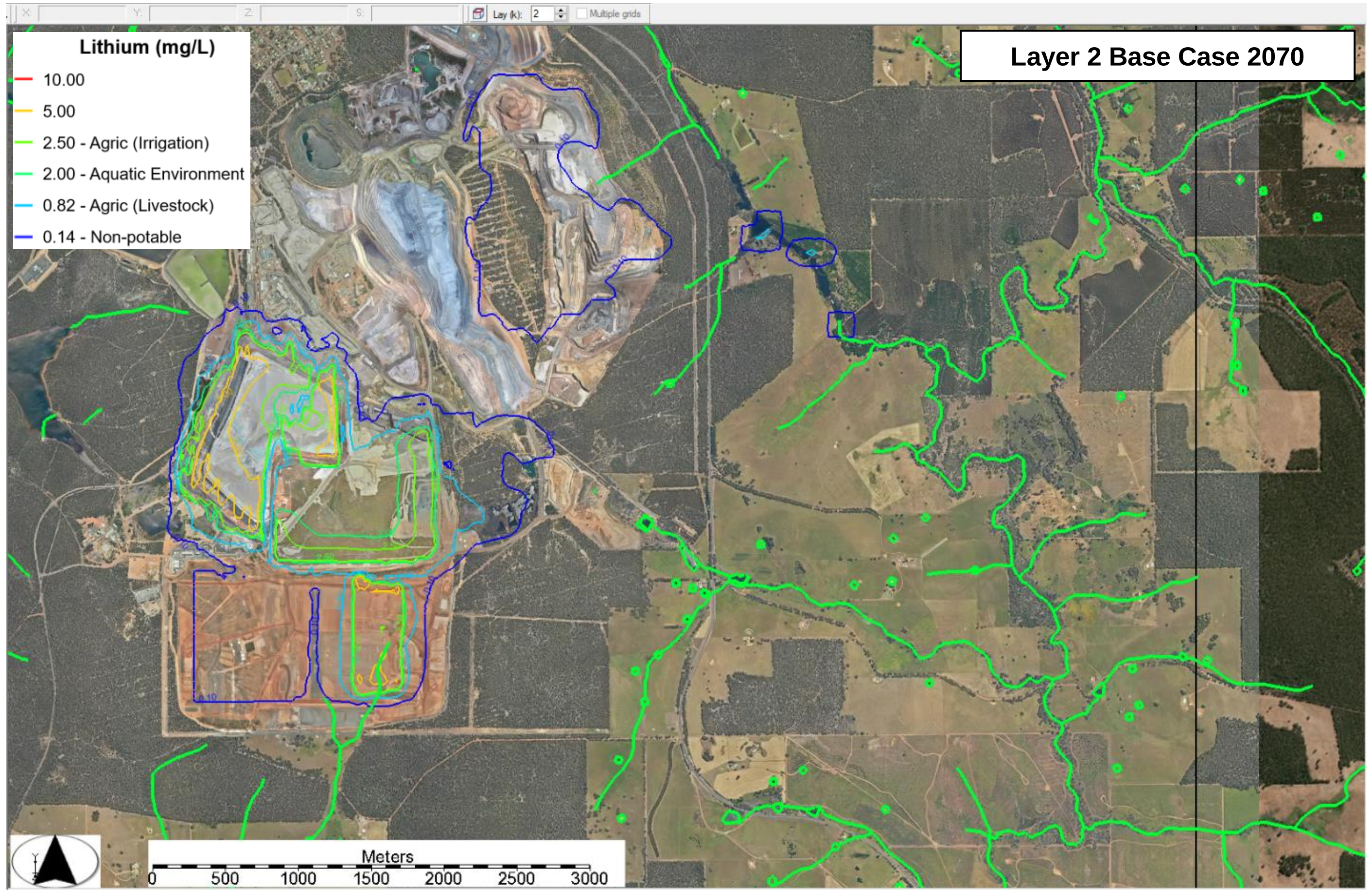
Modelled Lithium Plumes in 2040

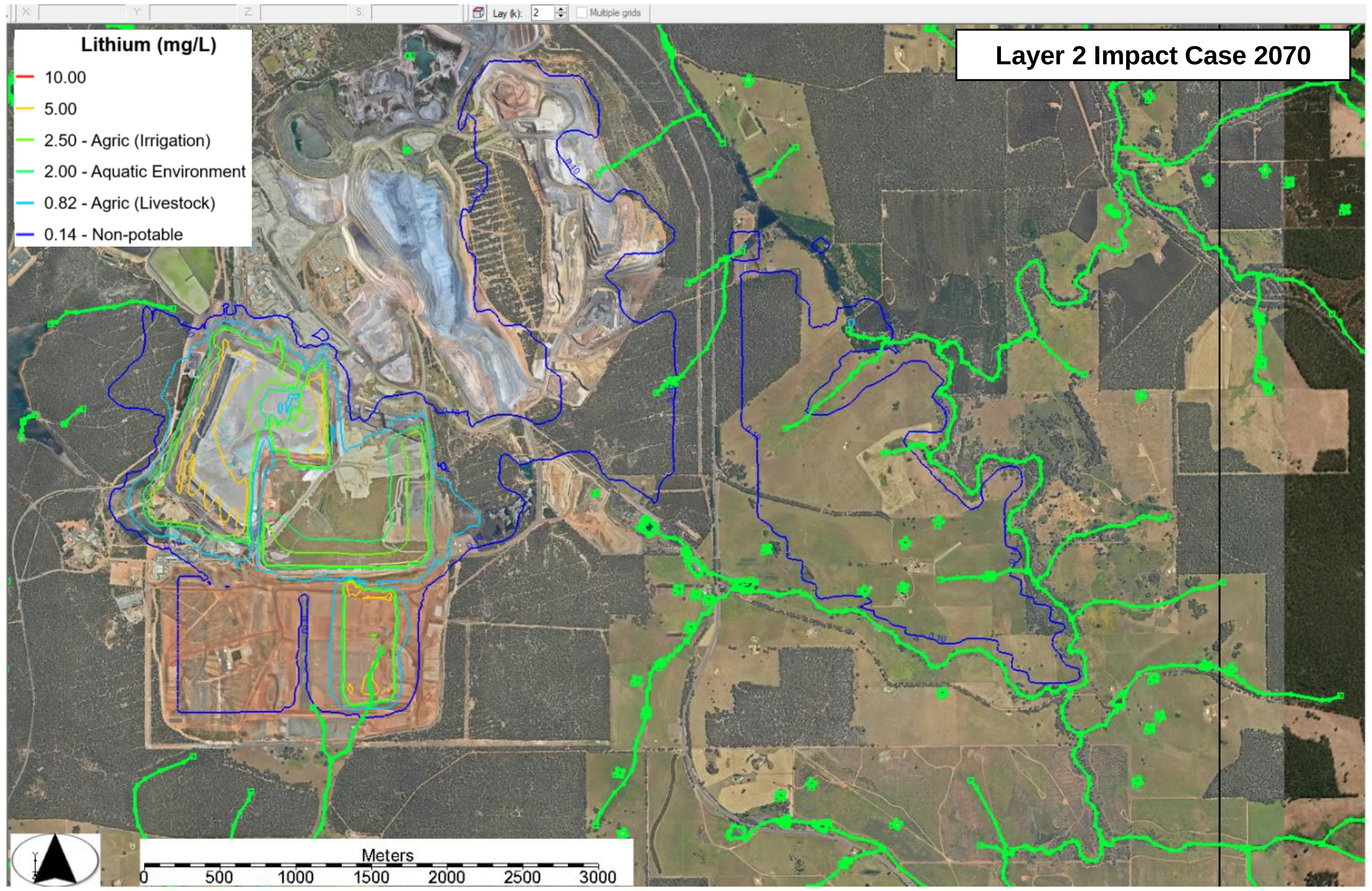

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Base Case 2040
Meters
0 500 1000 1500 2000 2500 3000


Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Impact Case 2040
Meters
0 500 1000 1500 2000 2500 3000

Appendix J

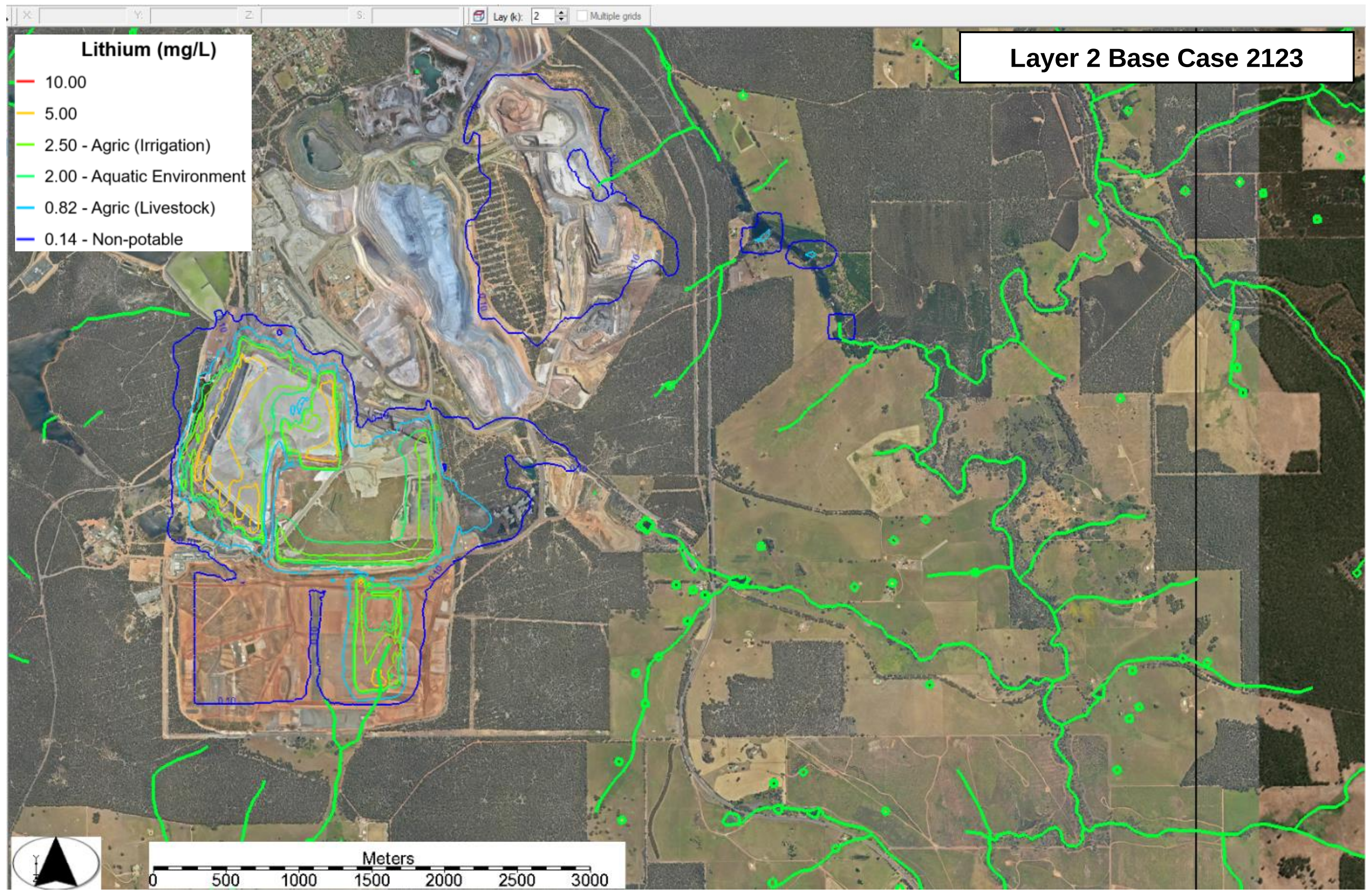
Modelled Lithium Plumes in 2070

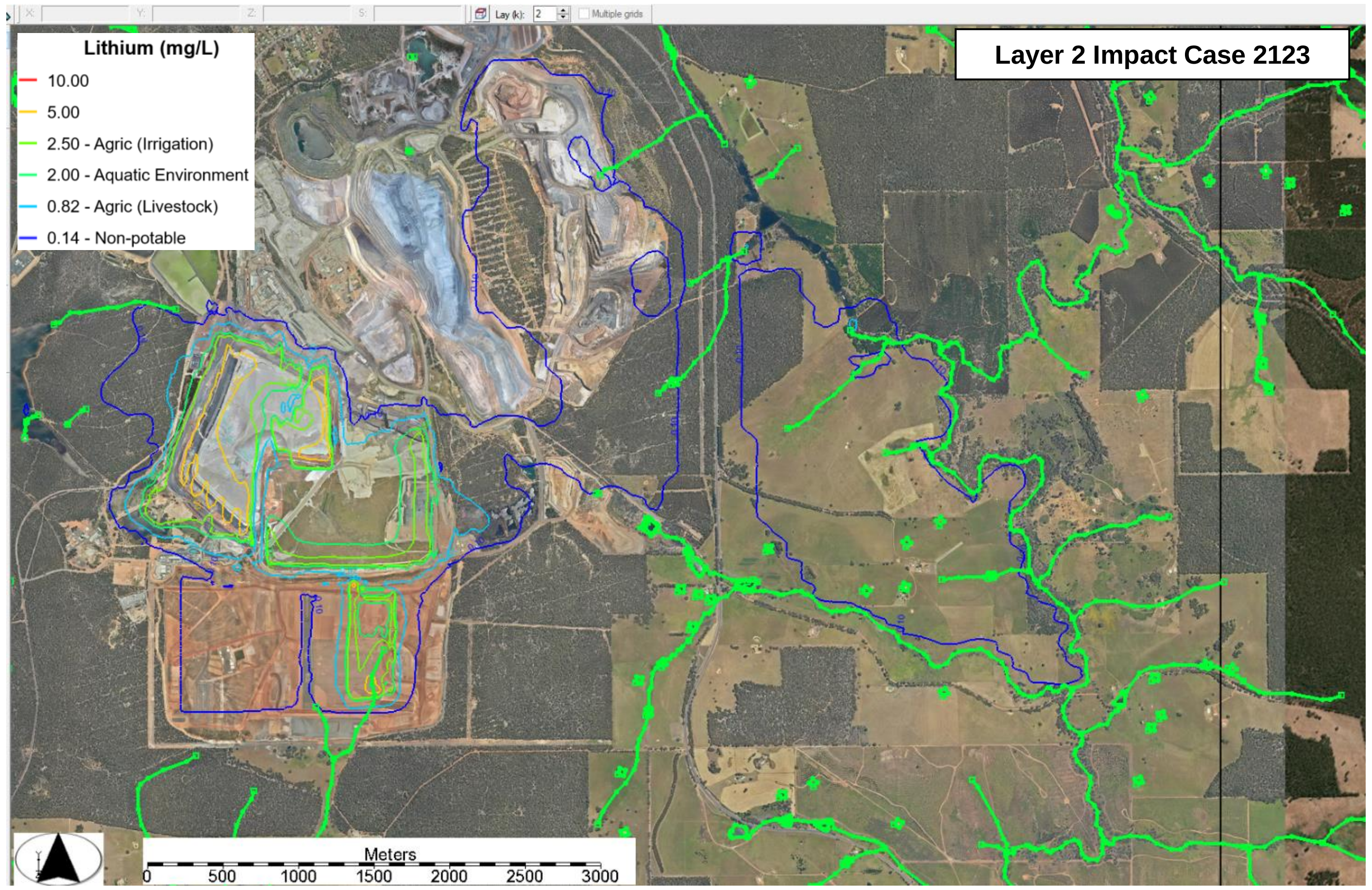

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Base Case 2070
Meters
0 500 1000 1500 2000 2500 3000

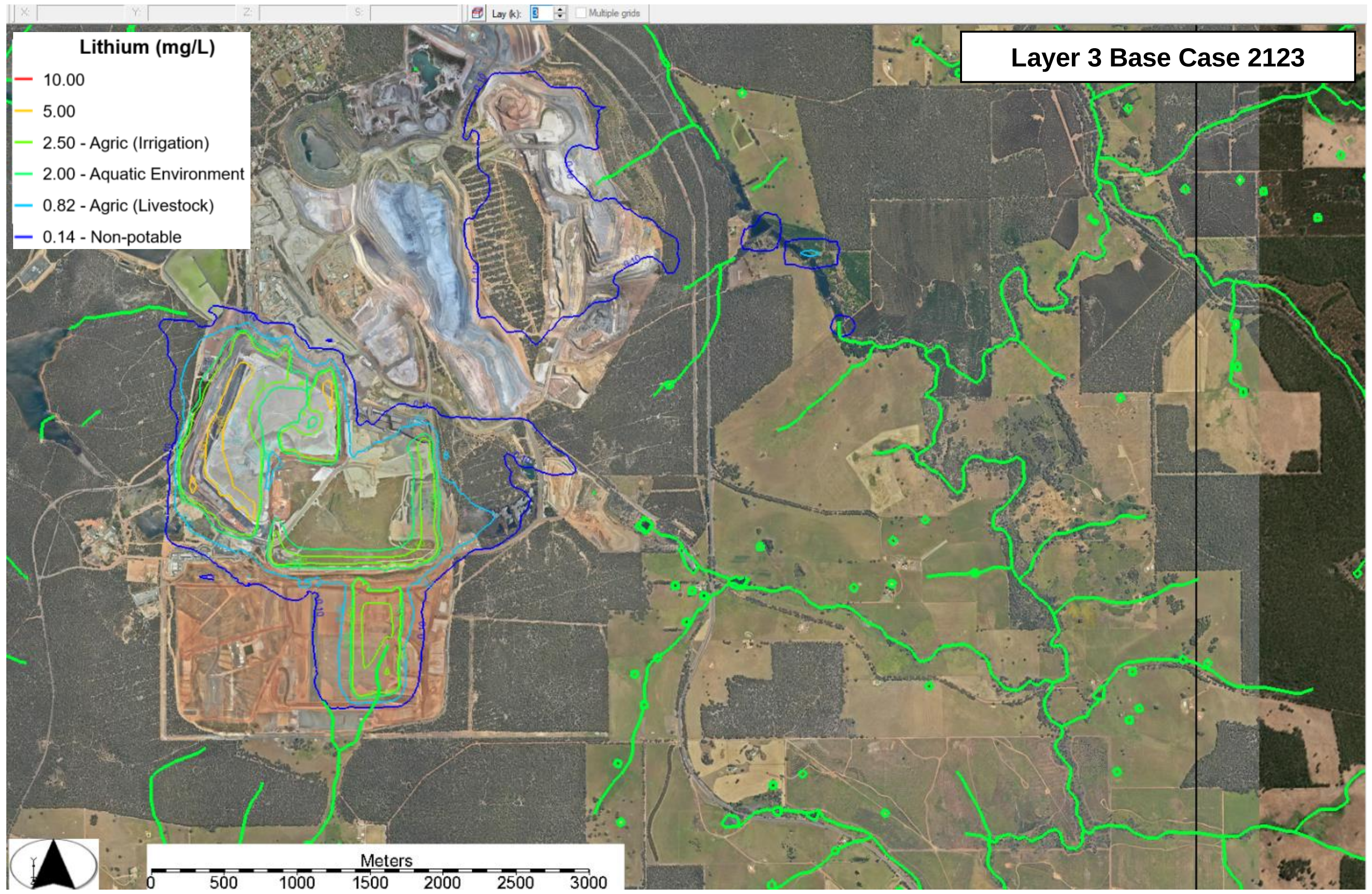

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Impact Case 2070
Meters
0 500 1000 1500 2000 2500 3000

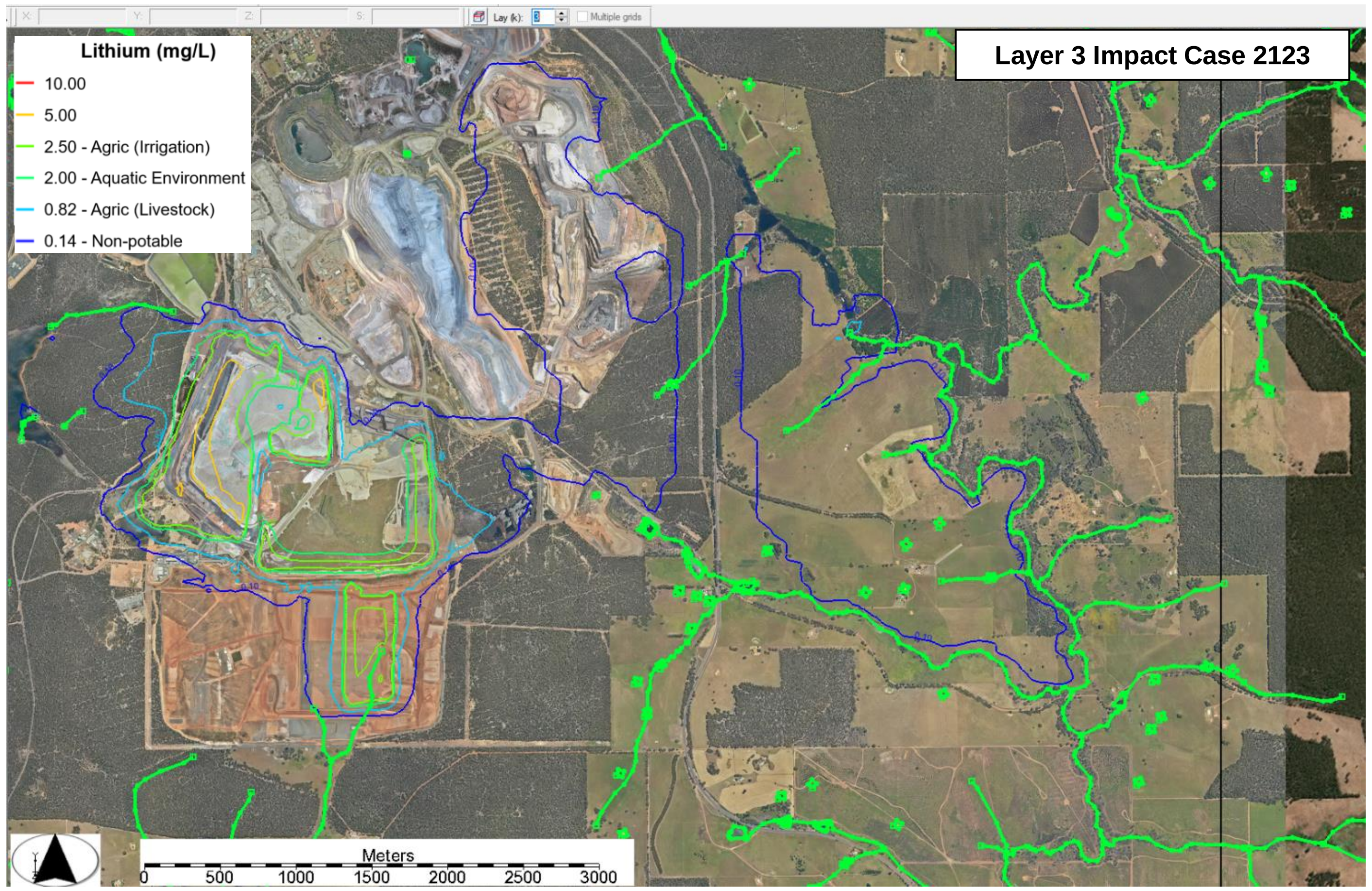
Appendix K

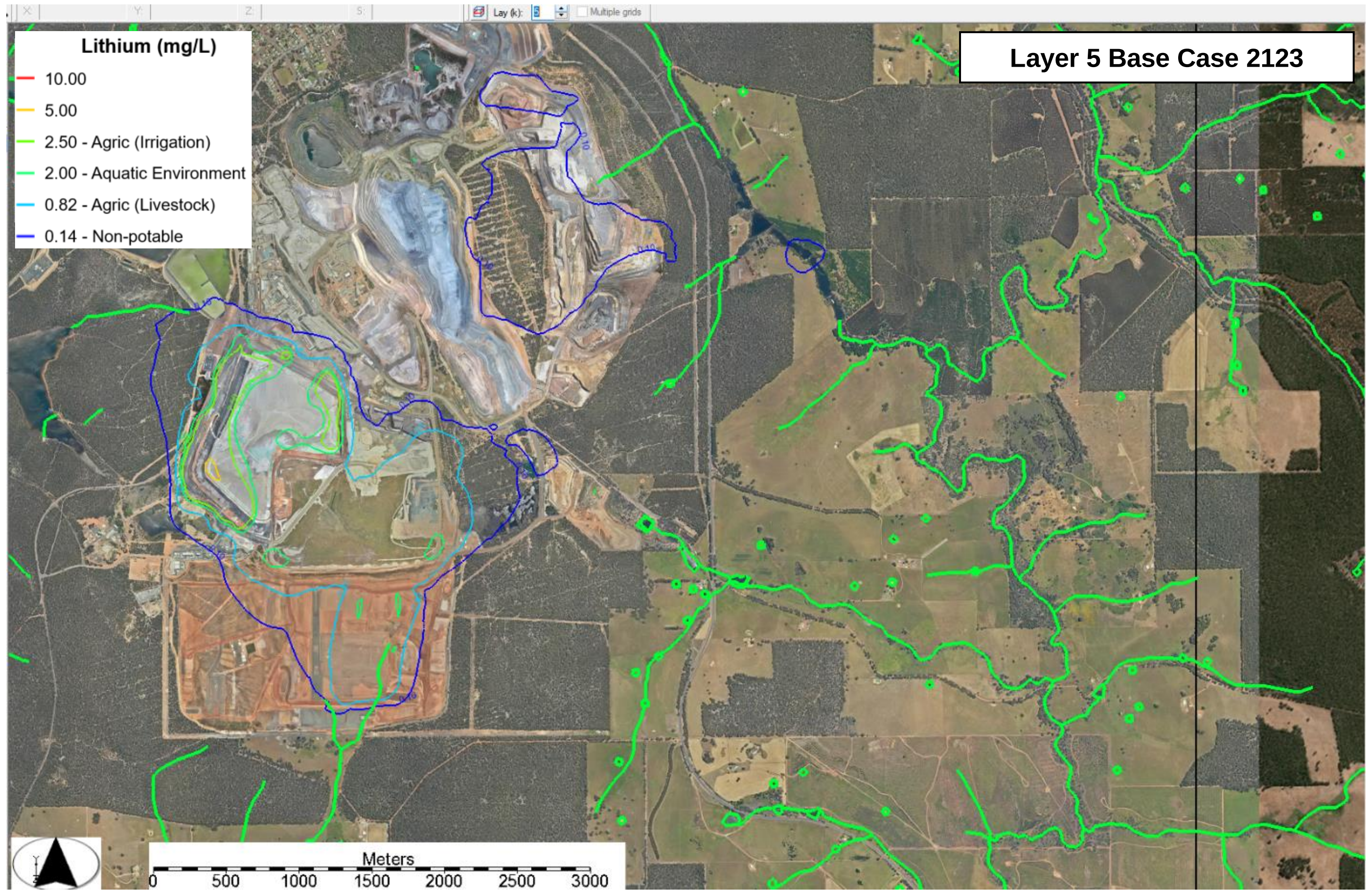
Modelled Lithium Plumes in 2123

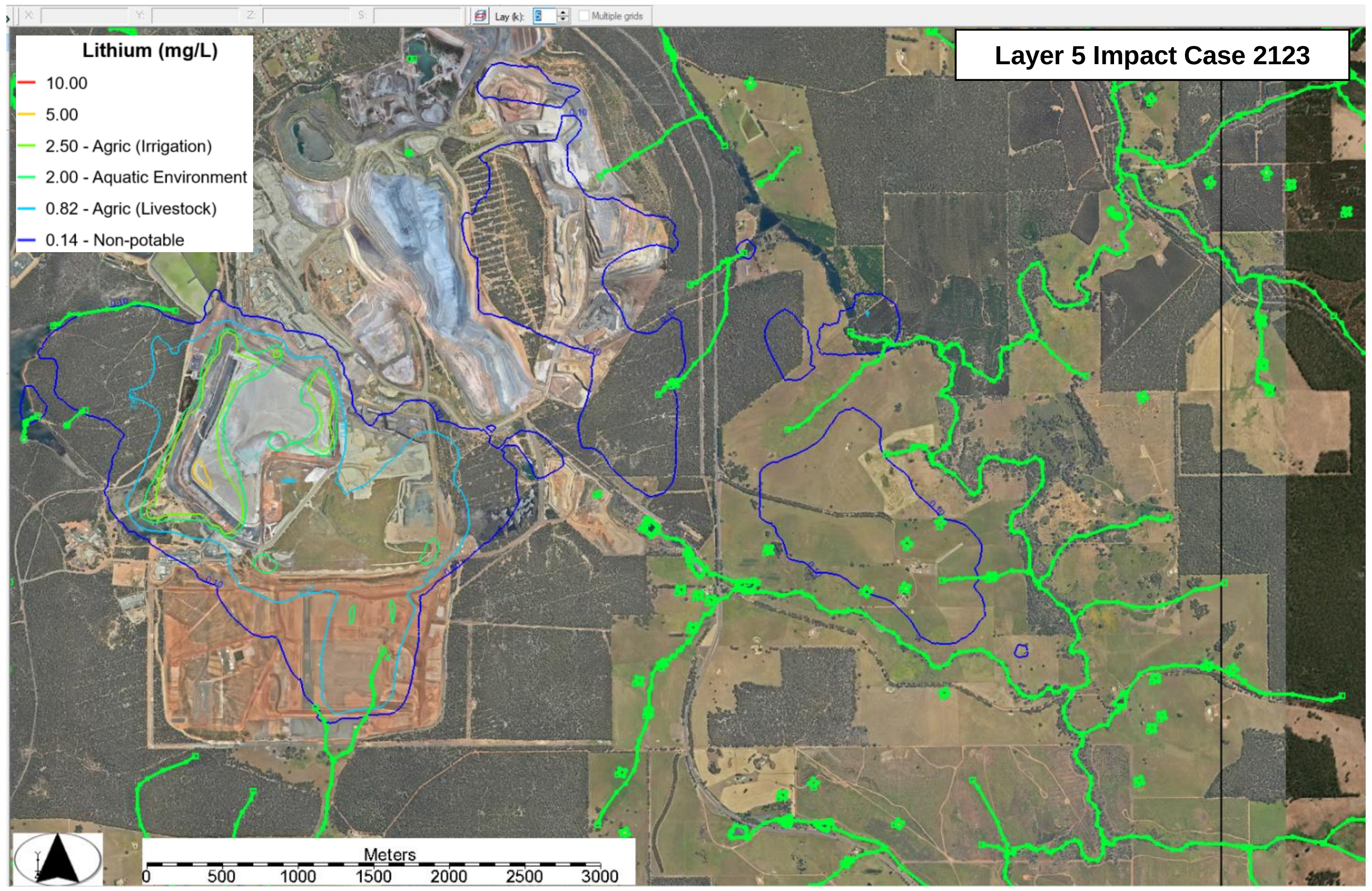

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Base Case 2123
Meters
0
500
1000
1500
2000
2500
3000


Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 2 Impact Case 2123
Meters
0
500
1000
1500
2000
2500
3000


Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 3 Base Case 2123
Meters
0
500
1000
1500
2000
2500
3000

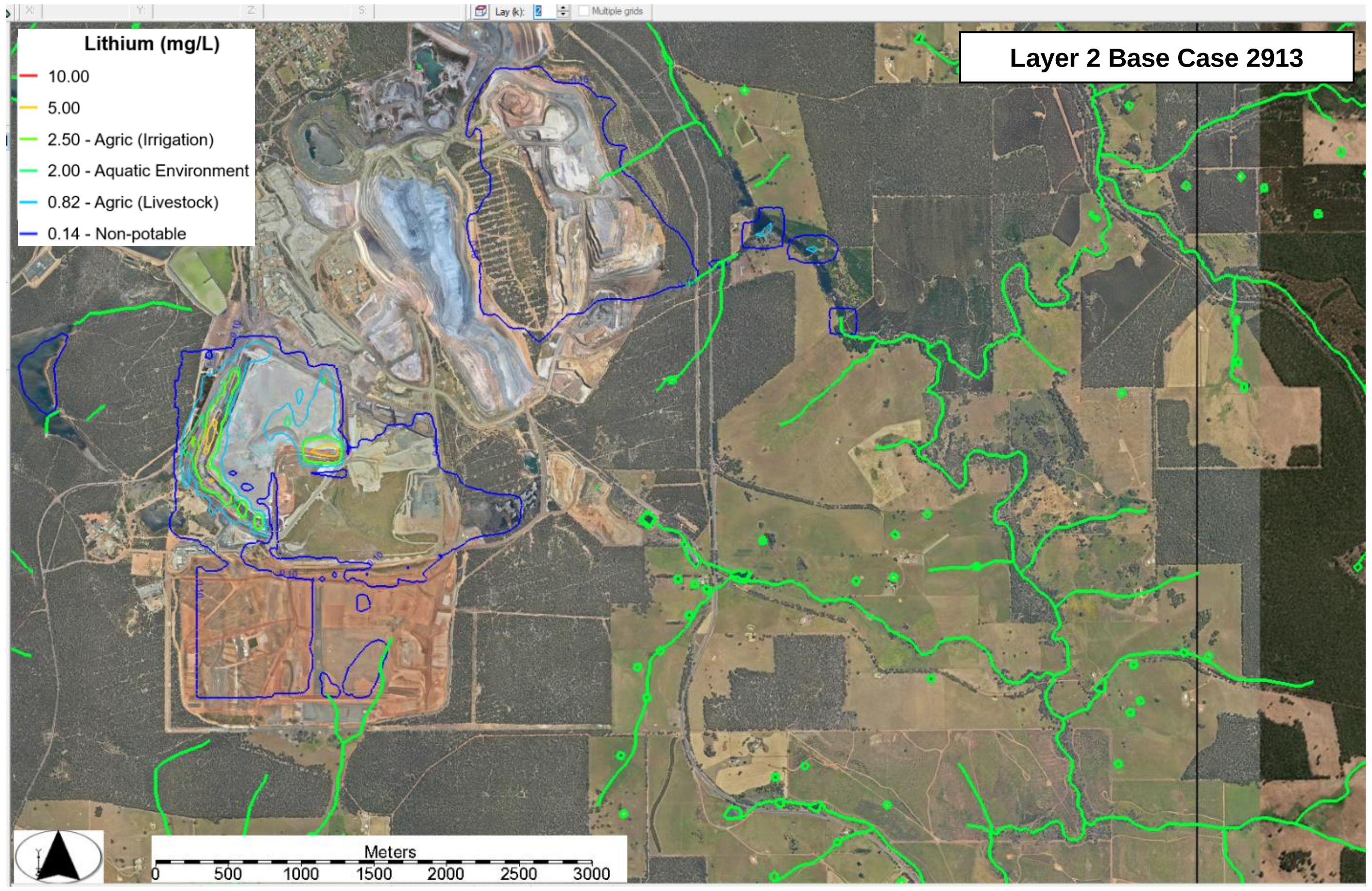

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 3 Impact Case 2123
Meters
0
500
1000
1500
2000
2500
3000

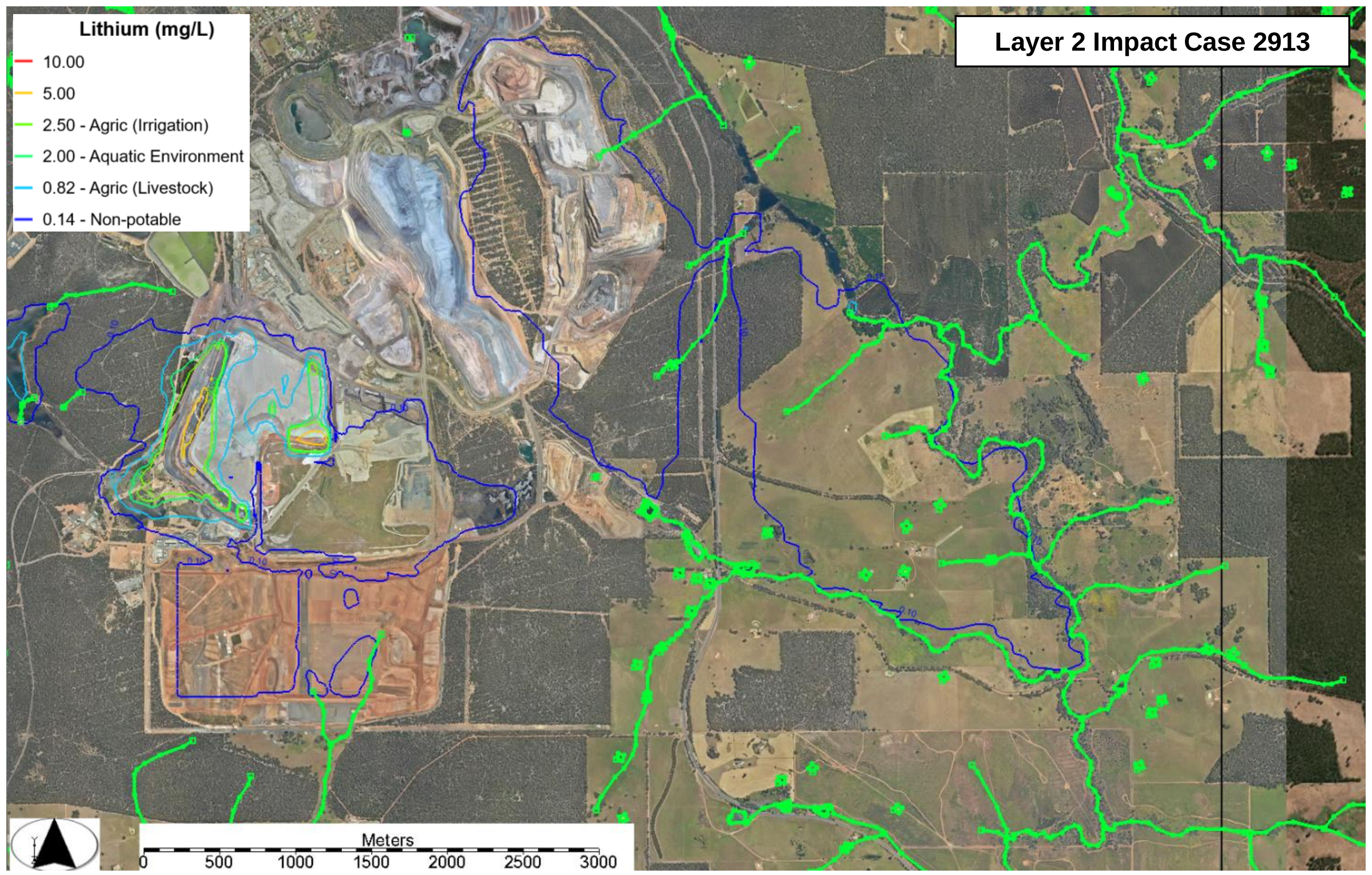

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 5 Base Case 2123
Meters
0 500 1000 1500 2000 2500 3000

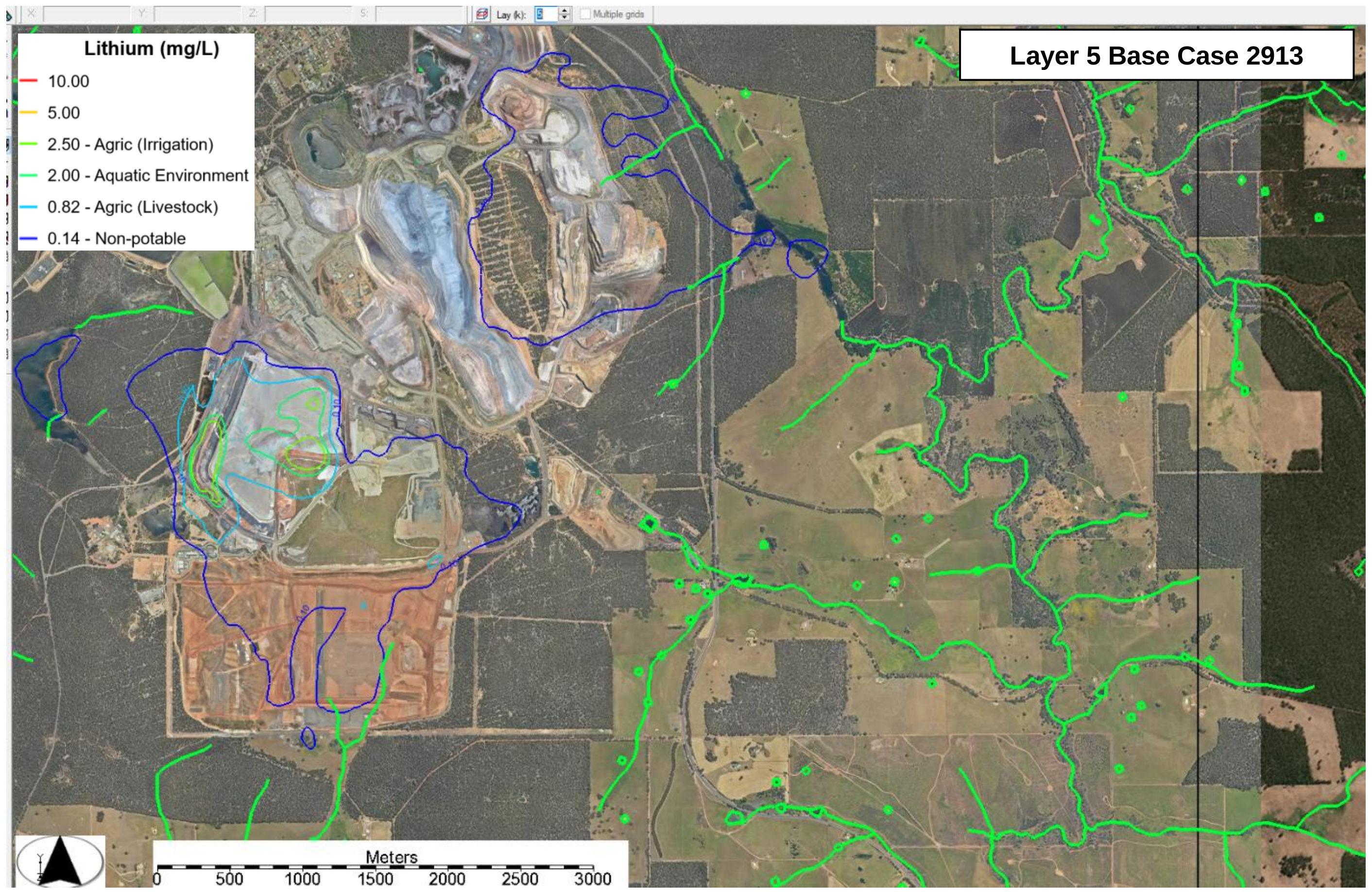

Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Layer 5 Impact Case 2123
Meters
0 500 1000 1500 2000 2500 3000

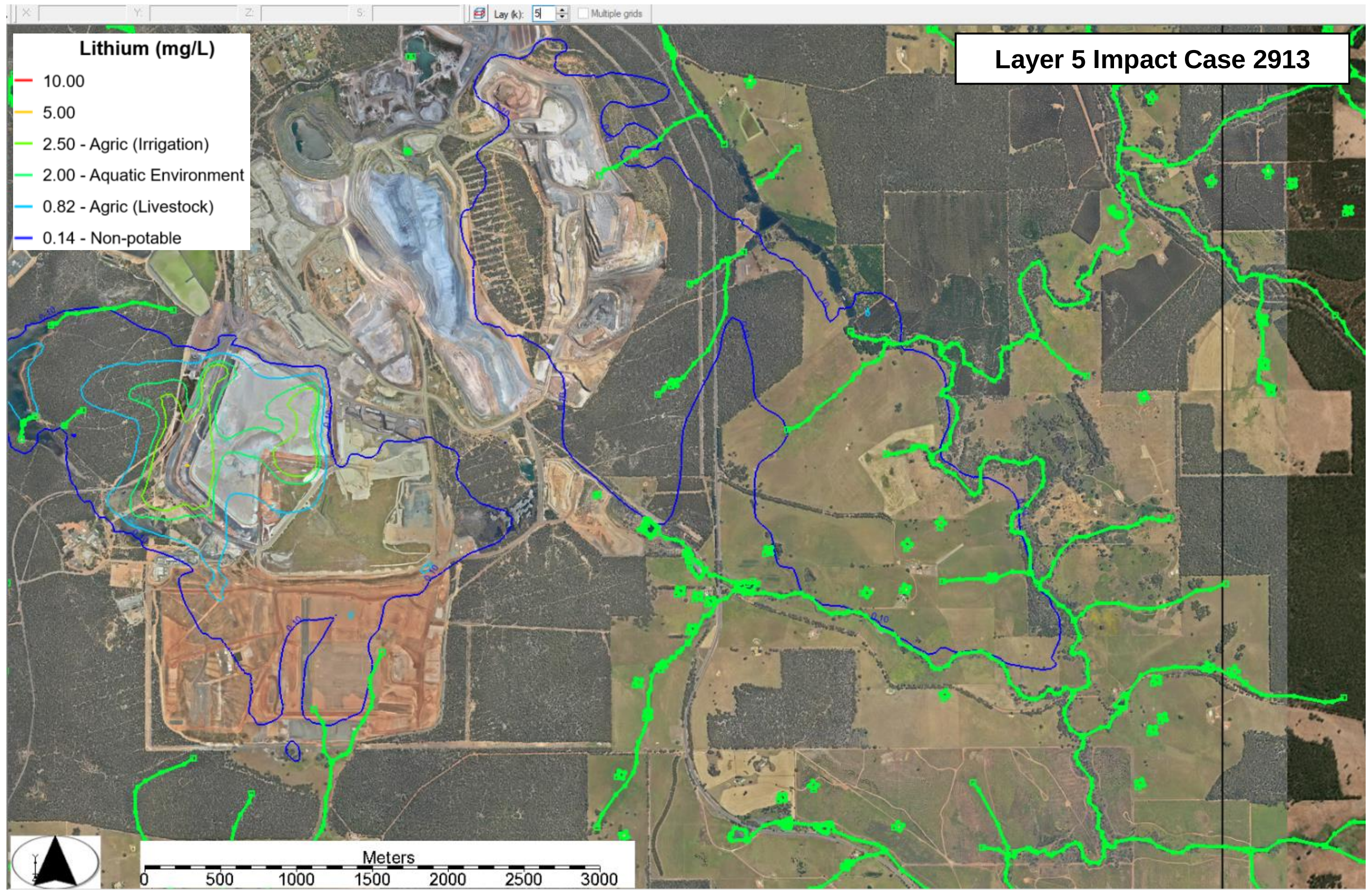
Appendix L

Modelled Lithium Plumes in 2913


Layer 2 Base Case 2913
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0
500
1000
1500
2000
2500
3000

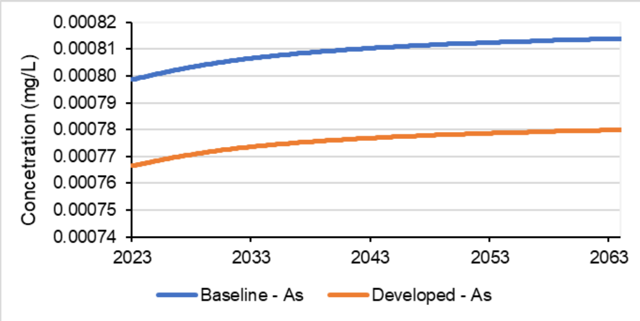

Layer 2 Impact Case 2913
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0
500
1000
1500
2000
2500
3000


Layer 5 Base Case 2913
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0
500
1000
1500
2000
2500
3000

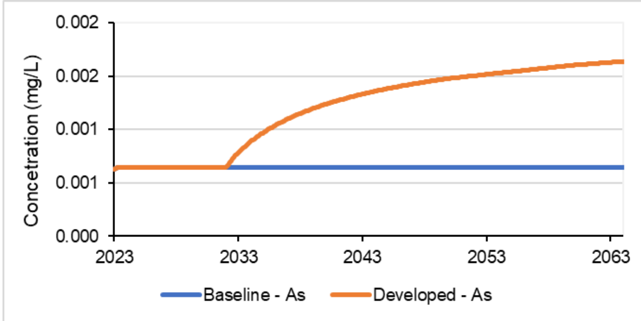

Layer 5 Impact Case 2913
Lithium (mg/L)
10.00
5.00
2.50 - Agric (Irrigation)
2.00 - Aquatic Environment
0.82 - Agric (Livestock)
0.14 - Non-potable
Meters
0
500
1000
1500
2000
2500
3000

Appendix M

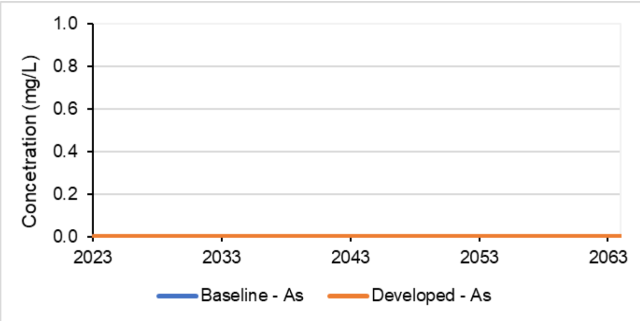
Modelled Groundwater Discharges and Arsenic Concentrations to Surface Water



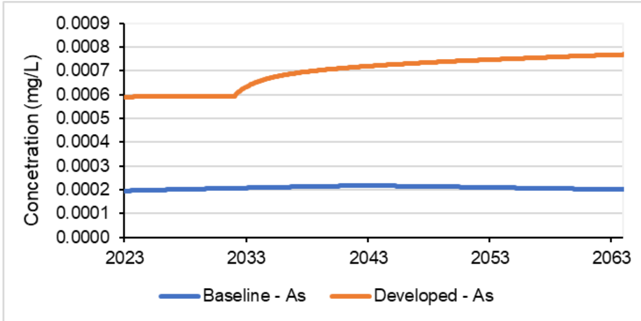
Hester Brook Catchment at Hester Hill



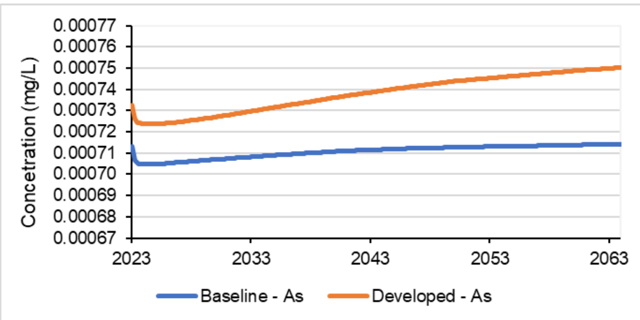
Hester Brook Catchment Upstream of Cascades Gully Confluence



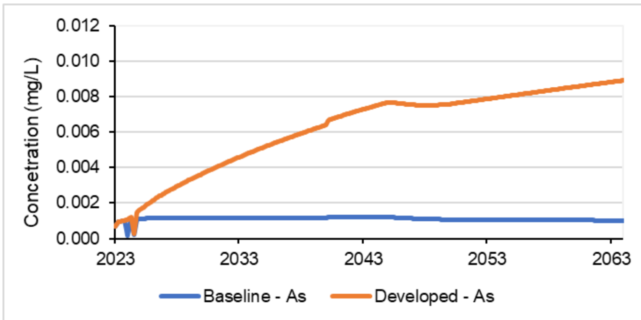
Hester Brook Catchment Upstream of Saltwater Gully Confluence



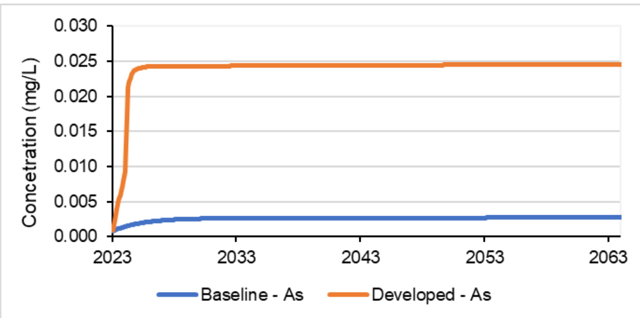
Cascades Gully Catchment at Hester Brook Confluence



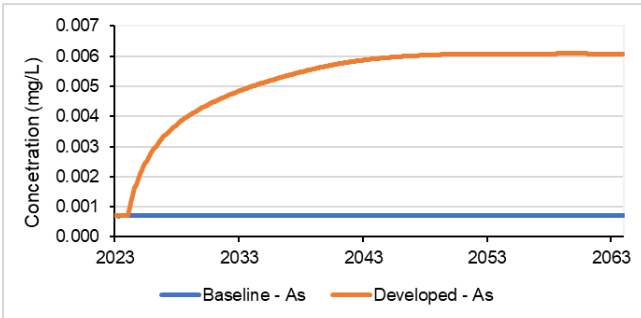
Cascades Gully Catchment Upstream of SWG WRL



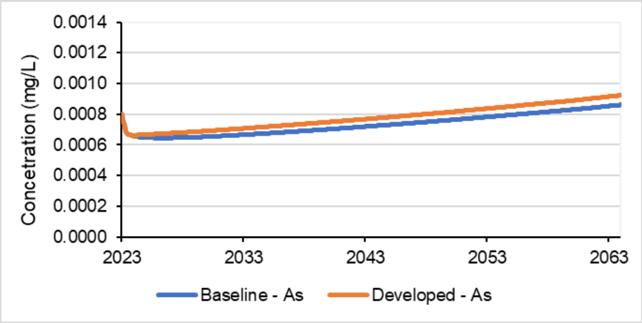
Cemetery Dam Catchment



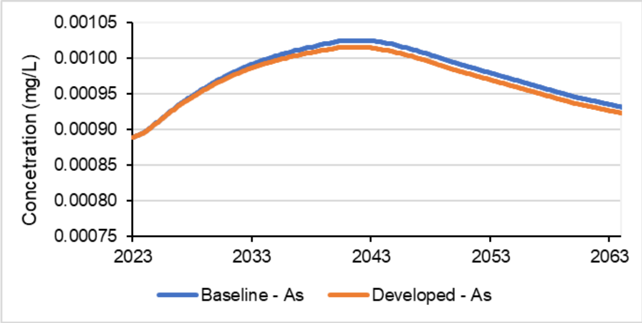
Saltwater Gully Catchment at SWG Dam



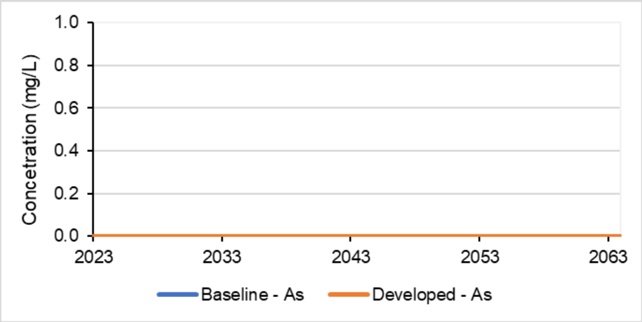
Saltwater Gully Catchment at Monitoring Site



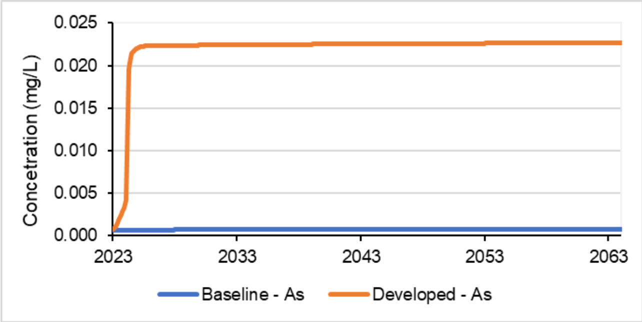
Floyds South Catchment



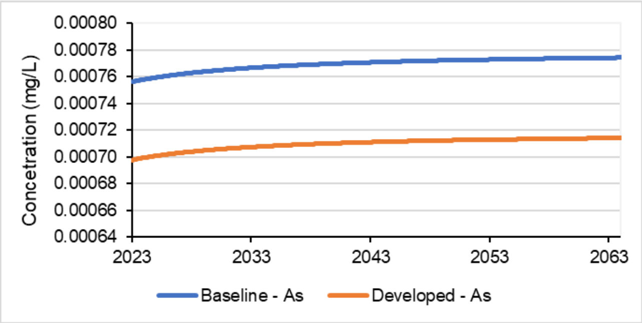
Floyds North Catchment



Carters Catchment



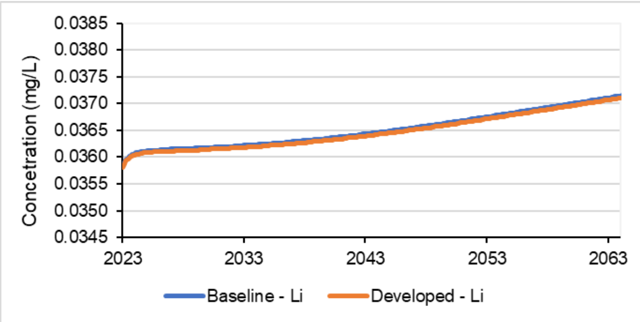
Saltwater Gully Catchment at Hester Brook Confluence



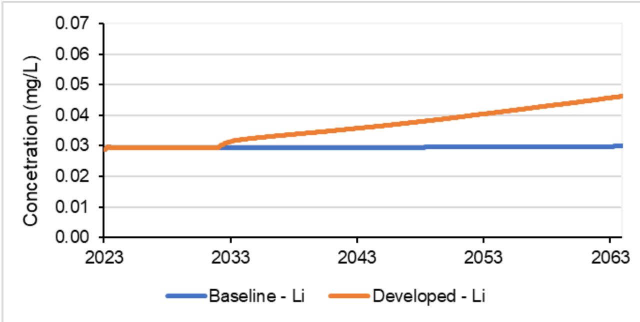
Hester Brook Catchment at Outlet

Appendix N

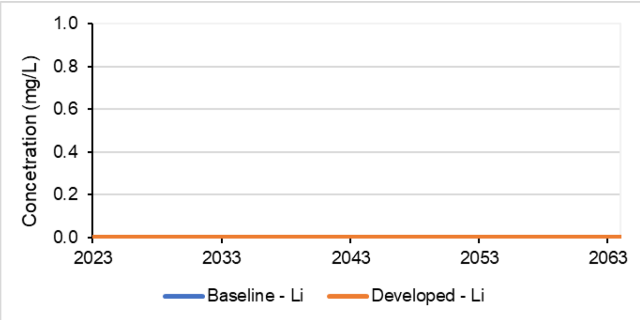
Modelled Groundwater Discharges and Lithium Concentrations to Surface Water



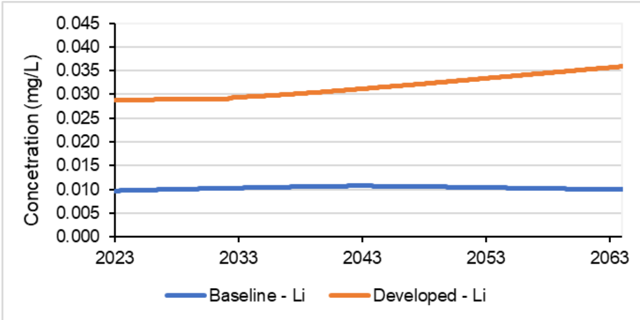
Hester Brook Catchment at Hester Hill



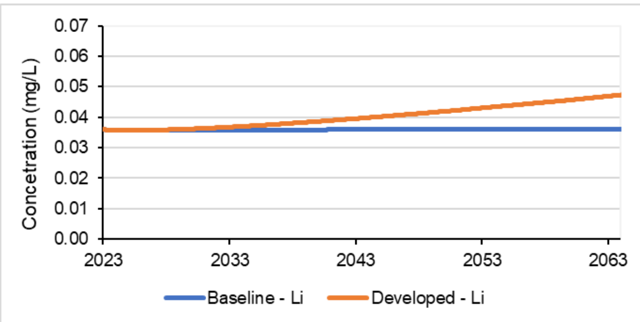
Hester Brook Catchment Upstream of Cascades Gully Confluence



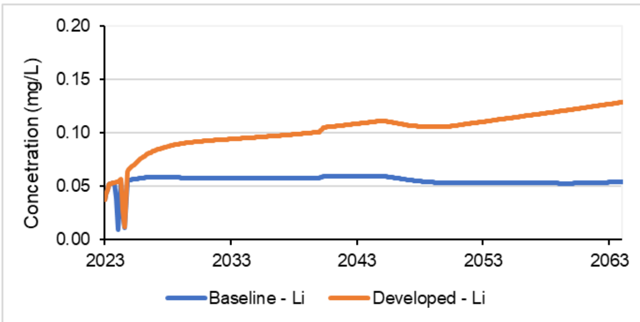
Hester Brook Catchment Upstream of Saltwater Gully Confluence



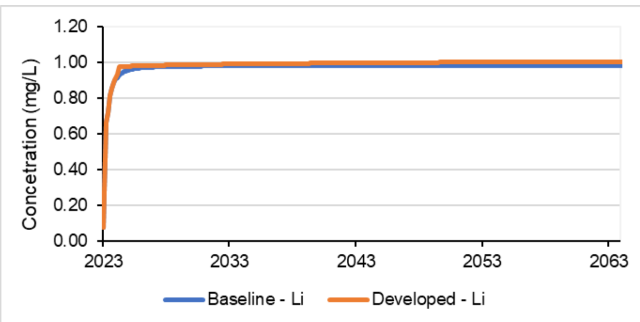
Cascades Gully Catchment at Hester Brook Confluence



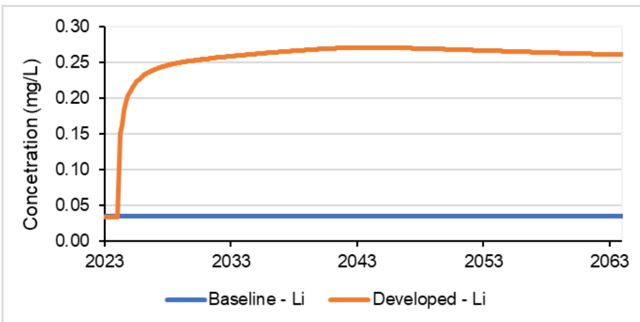
Cascades Gully Catchment Upstream of SWG WRL



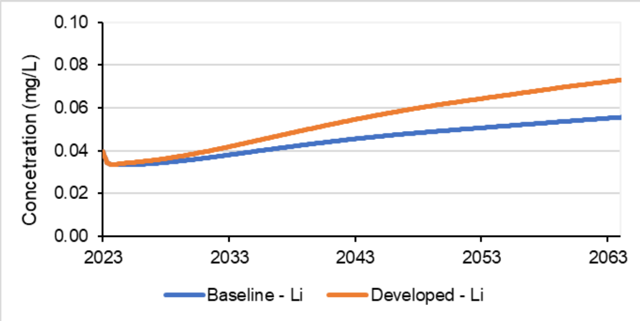
Cemetery Dam Catchment



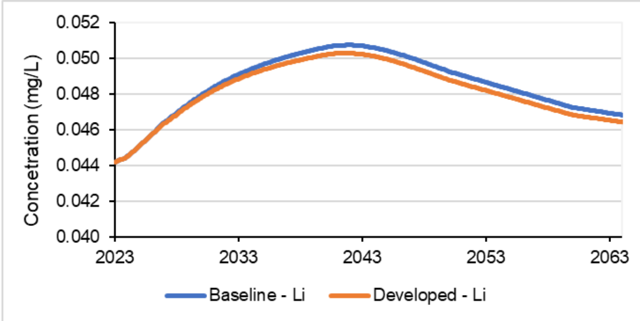
Saltwater Gully Catchment at SWG Dam



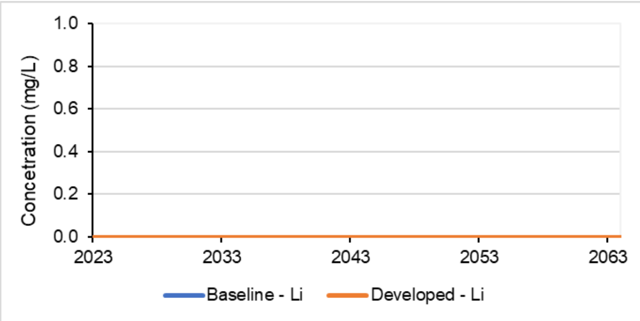
Saltwater Gully Catchment at Monitoring Site



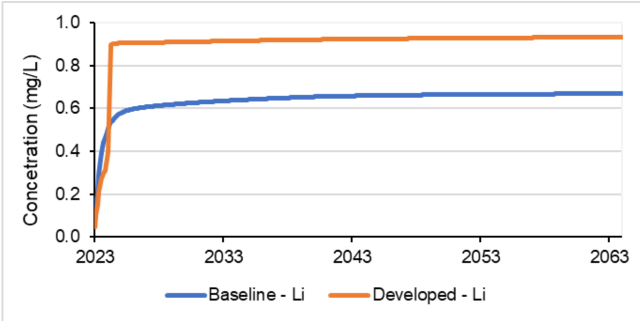
Floyds South Catchment



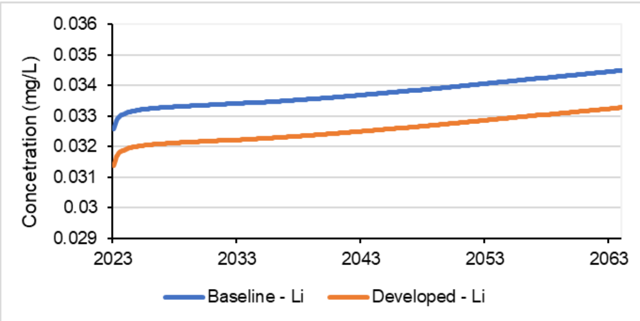
Floyds North Catchment



Carters Catchment



Saltwater Gully Catchment at Hester Brook Confluence



Hester Brook Catchment at Outlet

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The Power of Commitment