# Kestrel Management Plan

## Subsidence Management Plan: ML70481

Status: Active

Revision: 1.1 (15.12.2022)

Business Owner: Environment

## Contents

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## Abbreviations

| | |
|---|---|
| ACARP | Australian Coal Association Research Program |
| DSDILGP | Department of State Development, Infrastructure, Local Government and Planning |
| EA | Environmental Authority |
| GDP | Ground Disturbance Permit |
| Kestrel Mine | Kestrel Coal Mine |
| Kestrel Coal Resources | Kestrel Coal Resources Pty Ltd |
| LiDAR | Light detection and ranging |
| ML | Mining Lease |
| RIDA | Regional Interests Development Approval |
| SCL | Strategic Cropping Land |
| SCP | Soil Conservation Plan |
| SMP | Subsidence Management Plan |

# 1 Purpose

This Subsidence Management Plan (SMP) has been drafted to address subsidence related risks that may be associated with longwall mining operations within Kestrel Mine, and more specifically, with the upcoming mining areas within ML 70481. This SMP outlines the relevant risks and mitigation measures to be implemented.

## 1.1 Background

The Kestrel Coal Mine (Kestrel Mine) is located in the Bowen Basin, approximately 51 km northeast of Emerald in central Queensland, Australia – refer (Figure 1).

Currently, within the 400-series panels, coal extraction and production occurs at depths of 300–450 m, with production rates of 8–10 Mt run of mine coal per year. The current approved life of mine includes mining of a further series of longwall panels, referred to as the 500 series, which extends into ML70481 at depths of between 360 m and 470 m. Typical mining seam thickness ranges between 2.5–3.1 m with the longwall minimum extraction height being 2.6 m.

Mining operations up to and including the 400 series longwall panels have occurred on ML1978, ML70301, ML70302, and ML70330. In 2016, ML70481 was granted to enable operation of the 500 series longwall panels. A Strategic Cropping Land (SCL) protection decision (SCLRD2012/000090) was issued for ML70481; one of the first issued under the new SCL regulatory environment. In March 2016, the SCL protection decision was transitioned to a RIDA under Section 53 of the *Regional Planning Interests Act 2014*, referred to as RPI16/002/Rio Tinto - Kestrel Extension #4 Coal Project (RPI16/002).

The area of trigger-mapped SCL within ML70481 is shown in Figure 2. Kestrel holds all of the freehold titles for all surface properties associated with the Mining Leases (MLs) with the exception of a parcel of State-owned land (lot 8 on TT424), which lies within a watercourse reserve not mapped as SCL trigger land on ML70481. Kestrel manages agricultural lessees carrying out pastoral activities across all freehold lands not utilised for mining activities

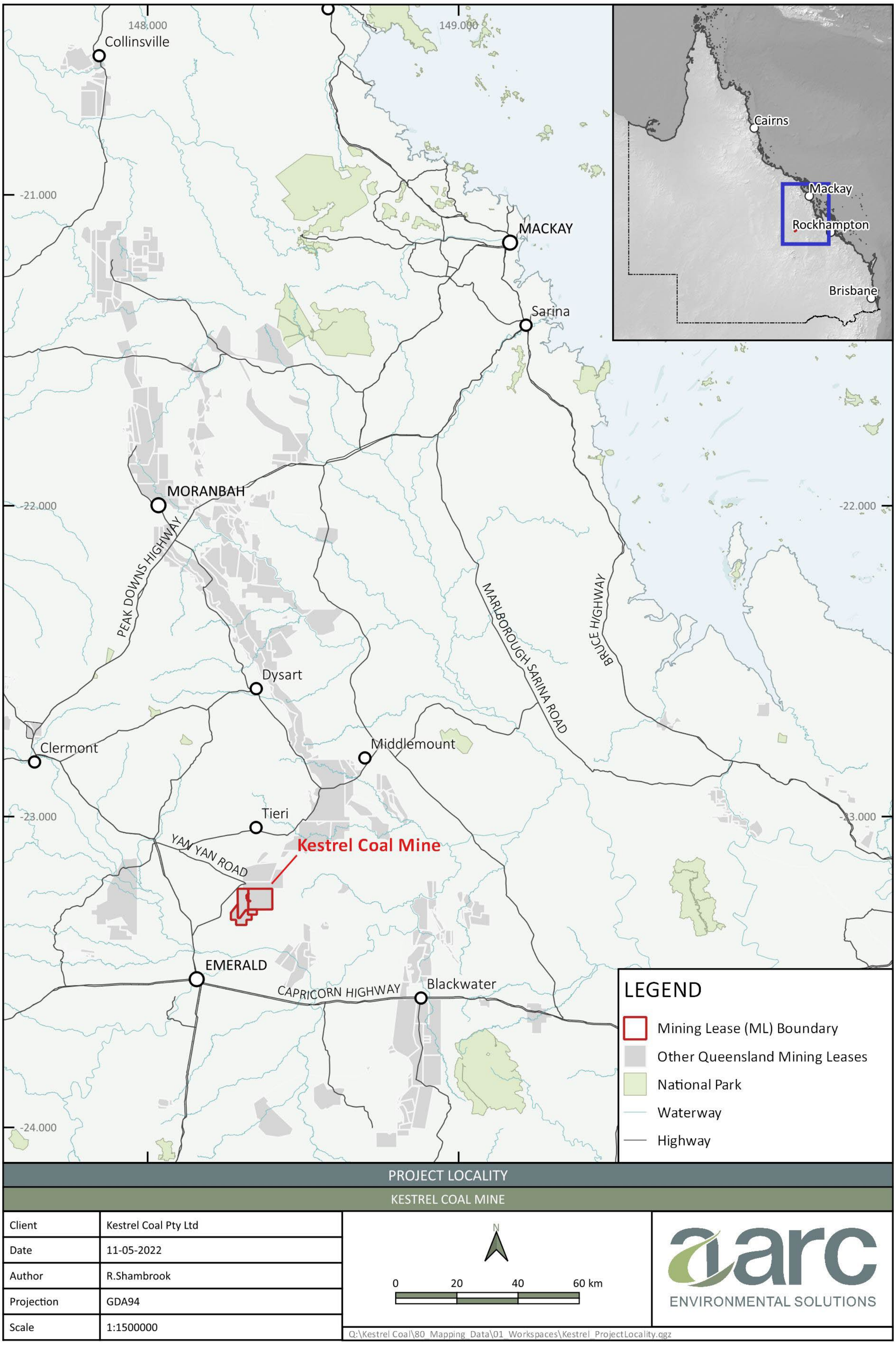


*Figure 1: Project location*

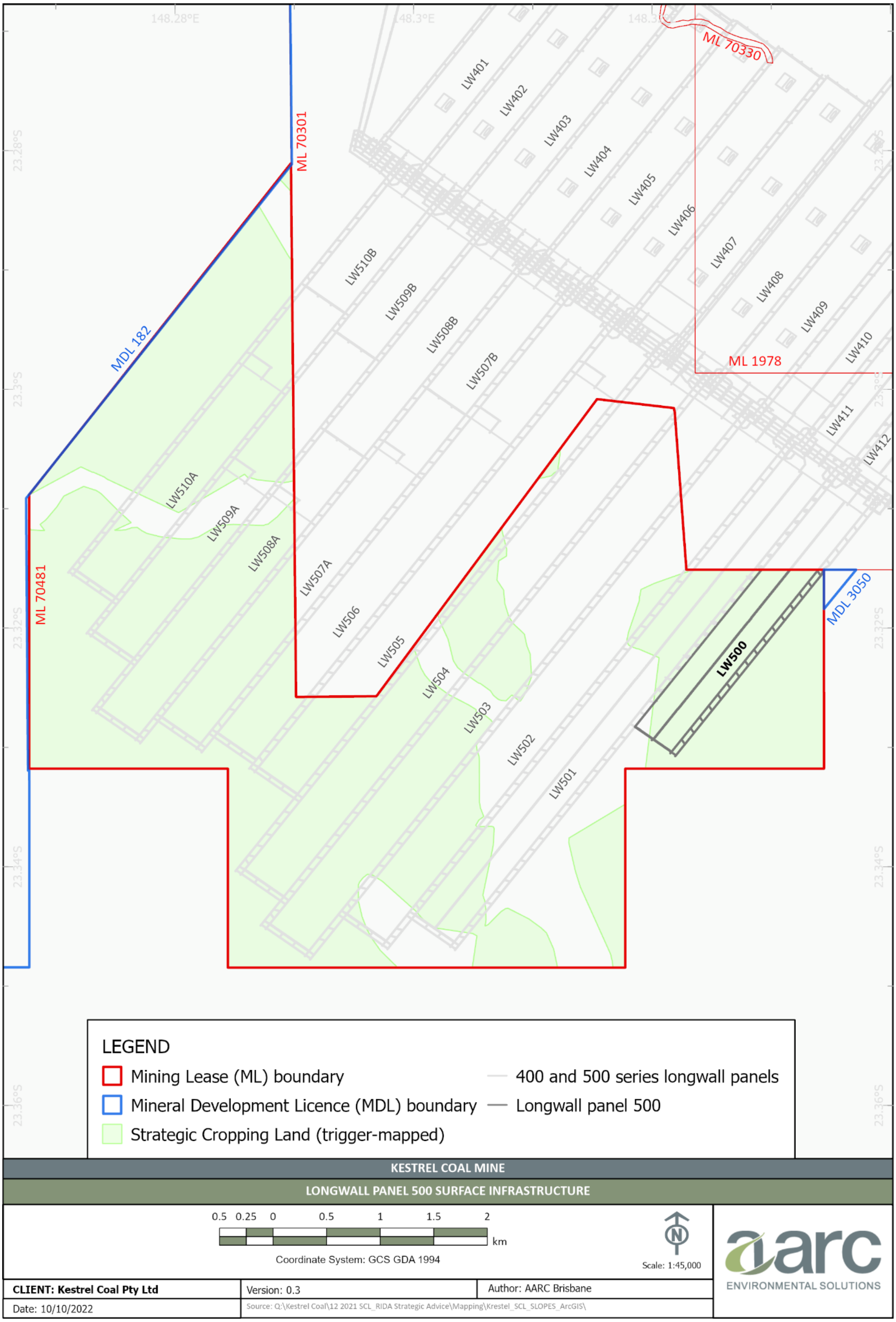


*Figure 2: 500 series mine plan showing LW500*

# 2 Scope

The scope of this SMP is to manage subsidence associated with the 500 series longwall panels within ML70481. While applicable to longwall panel mining operations within ML704851, the controls and mitigation measures have generally been applied across all previous longwall panel operations, Figure 2 shows the current layout of the 500 series longwall panels and the boundary of ML70481.

# 3 Baseline ground conditions

This Section outlines the existing environment prior to land disturbance in the areas of the Kestrel MLs. Including the soil types, landscapes and pre-disturbance land degradation.

## 3.1 Topography

Land on and surrounding ML 70481 is gently undulating with low to moderate relief. Slopes generally range from 1% to 3%, with small areas ranging up to 5%.

On slopes where cropping activities have occurred in the past, some contour banks remain.

## 3.2 Surface waters and watercourses

Kestrel sits within the Nogoa River catchment, a tributary of the Mackenzie River, which joins the Fitzroy River before flowing to the ocean near Rockhampton. The site is located in the upper and mid-reaches of the Crinum Creek catchment, which flows across ML70481 before flowing to the Nogoa River. Several other drainage lines are present as ephemeral flow creeks, including:

- Homestead Creek: the reaches which overlay the MLs (principally ML1978 and ML70301) consist of a wide shallow channel with ephemeral standing water. In some sections a bifurcated channel exists while its lower reaches approaching the Crinum Creek confluence becoming increasingly braided and indistinct with flows likely to follow multiple flow paths.
- Belcong Creek: flows from north-west to south-east across the site traversing ML70481 and ML70301. The upper reaches are characterised by an undulating channel with alternating scours and depositional features. Bank vegetation comprises grasses and scattered trees with little vegetation in the channel bed. Cattle tramping has been noted along the banks and may affect bank stability. The lower reach of Belcong Creek, upstream of the confluence with Crinum Creek, follows a meandering path with active bank erosion and bank retreat evident on the outside of most bends.
- Crinum Creek: flows from north to south meandering on the western boundary of ML1978, crossing ML70301 before its confluence with Belcong and Homestead Creeks and Liskeard Gully in ML70481. The riparian zone is forested but the floodplains are largely cleared of trees for agricultural purposes. While the channel banks are generally grassed and appear to be stable away from bends, the creek displays significant undercutting at some of its larger meanders.
- Liskeard Gully: traverses ML70301 and ML70481. Channel banks are covered with grass and the surrounding areas are forested. Closer to its confluence with Crinum Creek, Liskeard Gully comprises of an incised relatively straight channel.

Water quality results show significant variability in relation to flow rates, rainfall intensity, and runoff, demonstrating the ephemeral nature of the watercourses. Upstream land managers can also impact water quality through rainfall runoff and water releases during heavy rainfall periods.

## 3.3 Land use and land suitability

### 3.3.1 Land use

The *Central Highlands Regional Council Planning Scheme 2016* (CHRC 2016) includes Kestrel and the surrounding region within the Rural zone code which has as its purpose to:

- provide for rural uses including cropping, intensive horticulture, intensive animal industries, animal husbandry, animal keeping and other primary production activities;
- provide opportunities for non-rural uses that are compatible with agriculture, the environmental features, and landscape character of the rural area where the uses do not compromise the long-term use of the land for rural purposes; and
- protect or manage significant natural resources and processes to maintain the capacity for primary production.

Prior to mining, regional and local land use comprised grazing of native and improved pastures, and cropping. In the 1980s (prior to mining) and again in the early 2000s (post commencement of mining), the Gordon Downs property had been assessed by the then Soil Conservation Branch of the Queensland Department of Primary Industries, for the design and installation of erosion control structures appropriate to a cropping regime. A review of recent aerial photography confirms some of these structures remain in place today. In 1983 approximately 4% of ML70481 was subject to cropping activity, increasing in 1993 to approximately 13% and again in 2004 to approximately 21%. Since 2004, cropping activity has diminished such that there is not currently any cropping activity occurring in ML70481. The property is now predominantly used for grazing based on native and naturalised grasses, as well as the forage crop Leucaena (*Leucaena leucocephala*).

ML70481 is located on surface freehold lands owned by Kestrel, with both mining and pastoral activities being completed in the area.

### 3.3.2 Land suitability

Relevant land suitability assessments have been undertaken in 1996 and 2002 (summarised for the ML70481 area in MWH [2011]), and then again by Highlands Environmental in 2022.

Highlands Environmental (2022) notes that outside of the Emerald Irrigation Area, district cropping systems are opportunistic, and reliant on the timing and amount of rainfall, previous cropping history and fallow management for the accumulation of soil water. Dominant crops are summer sorghum and winter wheat and chickpeas. Rainfall is summer dominated but highly variable.

There is no Class 1 dryland cropping land in the study area. Three soil landscapes (1a, 2a and 3a) are suitable for summer and winter dryland cropping (refer Figure 3 and Figure 4).

## 3.4 Soils

### 3.4.1 Previous studies

Current soils knowledge is based on a number of soil surveys that have been undertaken across the various MLs as follows:

- 1993 (Emmerton): conducted a soils and land suitability assessment for dryland cropping in the Gordonstone West area (1:25,000 scale). Note that the prior name of Kestrel was the Gordonstone Mine;
- 1996 (Cannon): addressed soils and land suitability for the Gordonstone Mine, Gordonstone Extension and Gordonstone West Mines (1:25,000 scale);

- 2002 (MWH): conducted a pre-mining condition soil and land capability study of Gordon Downs; effectively covering ML 1978, ML70301, ML 70302, ML7030 and parts of ML70481 excluding the immediate area of existing surface infrastructure, and improving the mapping scale to 1:10,000; and
- 2011 (MWH): surveyed the remainder of ML70481 at 1:10,000 scale as part of the *Environmental Assessment Report Kestrel Extension #4 November 2012* (EMM 2012). This study also addressed land capability, land suitability and SCL aspects.
- 2022 (Highlands Environmental): Agricultural land evaluation on Mining Lease 70481, Gordon Downs, central Queensland. This study includes an agricultural land evaluation, land suitability assessment and SCL zonal criteria assessment and determination.

### 3.4.2 Soil types

The distribution of soil types within Kestrel includes soils formed on:

- alluvium (Quaternary Alluvium);
- Cainozoic Sediments;
- Tertiary Basalt;
- Colluvium (mainly basalt derived); and
- highly calcareous materials.

Specifically, the soils of ML70481 are shown in Figure 5 and summarised in Table 1. The various soils studies listed above should be referenced for further details on soils.

*Table 1: Soil landscapes of ML70481 (from Highlands Environmental 2022)*

| Land resource area | Agricultural management unit (Bourne and Tuck 1993b) | Soil landscape | | Occurrence in study area |
|---|---|---|---|---|
| Alluvial Plains | Adelong | 1a | Deep, uniform (>100 cm depth) clay soils on level alluvial plains. | Widespread, 525.7 ha |
| | Isaac | 1b | Deep (>100 cm depth) uniform sandy clay soils on levees and alluvial plains. | Minor, 16.3 ha |
| | College | 1c | Deep (>100 cm) clay soils with highly saline and sodic subsoils. | Minor, 24.3 ha |
| | Lascelles | 1d | Deep (>100 cm depth) duplex soils with sandy A horizons and poorly drained subsoils. | Minor, 17.4 ha |
| Undulating Downs | Orion | 2a | Deep clay soils (>60 cm depth) with surface stone on gently undulating plains and rises. | Widespread, 178.0 ha |
| | Jimbaroo | 2b | Shallow clay soils (<60 cm depth) with surface stone on undulating plains and rises. | Widespread, 279.1 ha |
| Undulating Scrub Plains | Picardy | 3a | Deep clay soils (>100 cm depth) on gently undulating plains and rises. | Widespread, 530.2 ha |
| | Springton | 3b | Deep (>100 cm depth) clay soils with calcareous subsoil on gently undulating plains and rises. | Minor, 9.8 ha |

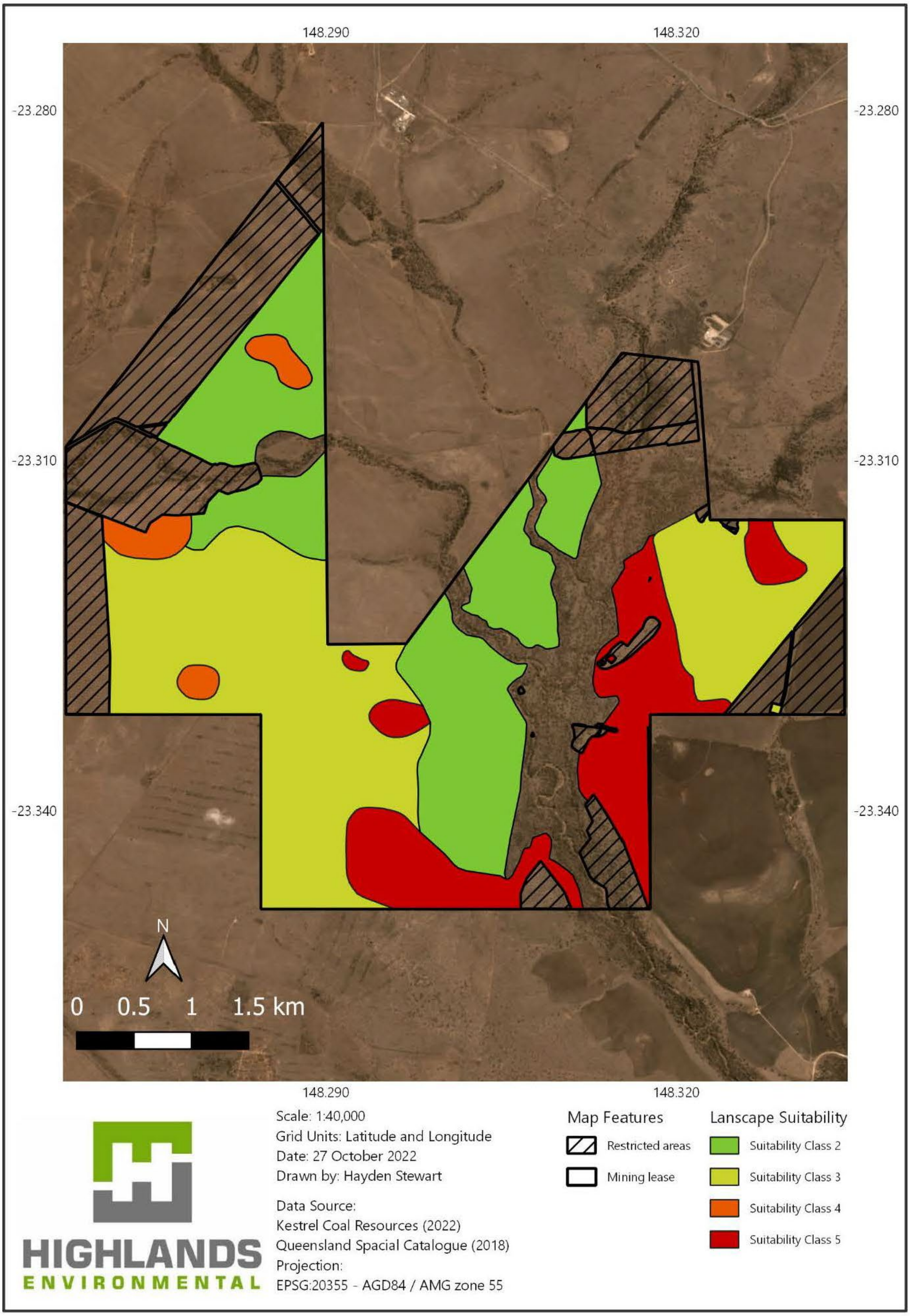


*Figure 3: Land suitability for dryland summer cropping (Highlands Environmental 2022)*

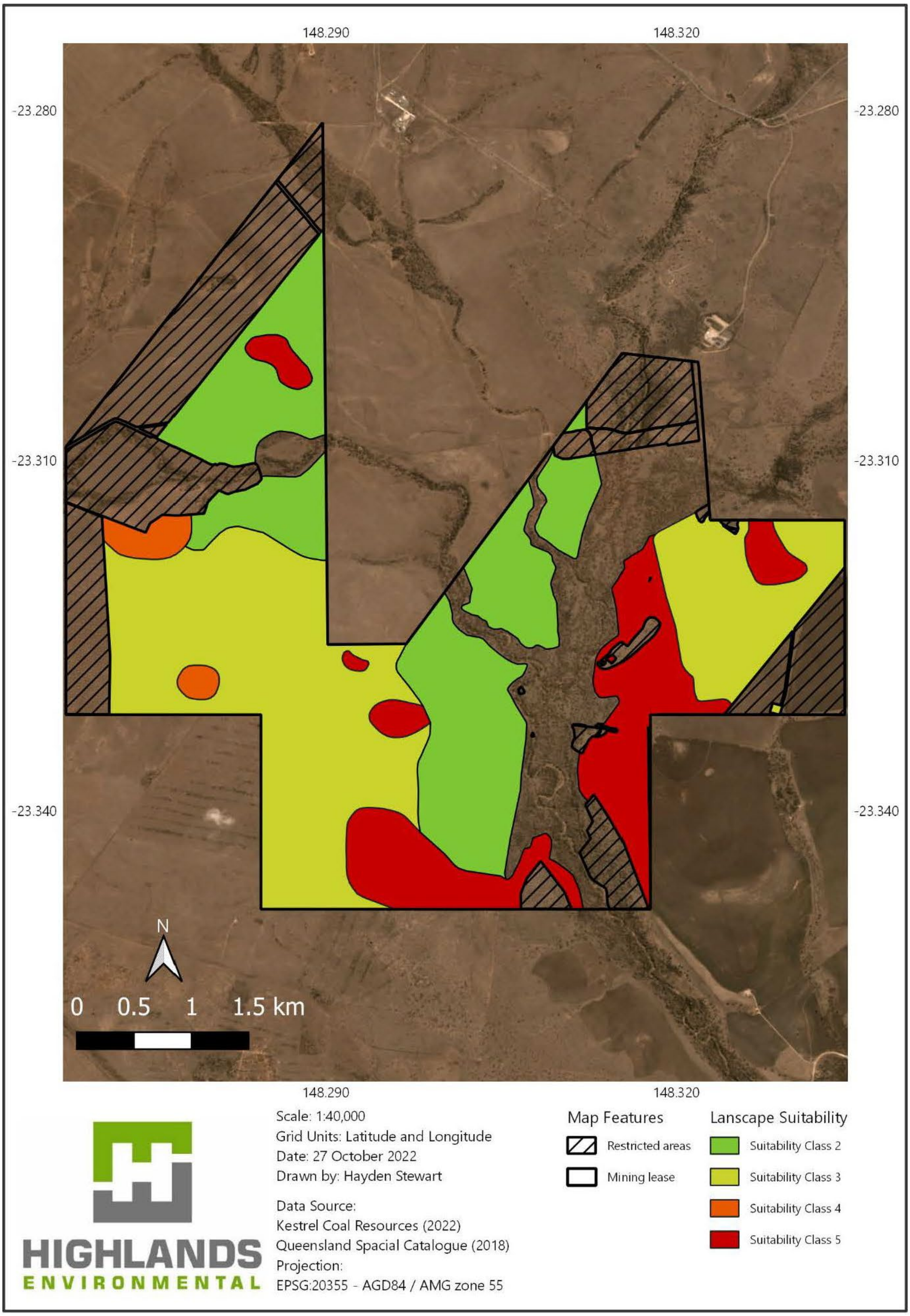


*Figure 4: Land suitability for dryland winter cropping (Highlands Environmental 2022)*

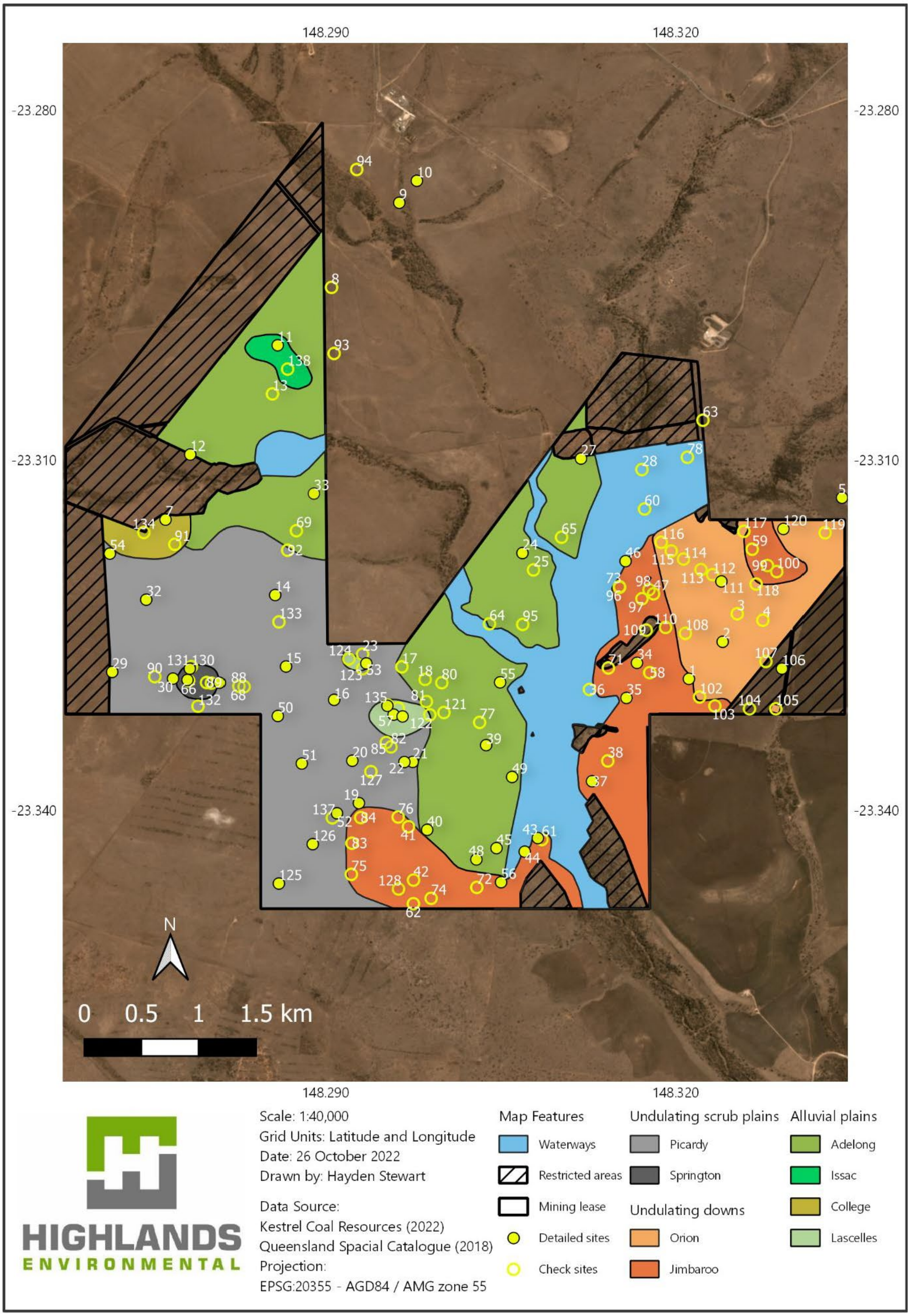


*Figure 5: Soils of ML70481 (Highlands Environmental 2022)*

# 4 Impacts from land disturbance activities

## 4.1 Longwall panel subsidence impacts

Within the 500 series panels, metallurgical coal is extracted from the German Creek Seam via longwall retreat mining methods. Depth of cover ranges from approximately 220 m in longwall panel LW510a up to 470 m in the central part of longwall panel LW500. Typical mining seam thickness ranges between 2.3–3.1 m with the longwall minimum extraction height being 2.4 m. Development mining activities commenced in November 2021 with longwall extraction planned to commence in mid-2023.

The principal land disturbance impact associated with underground mining activities at Kestrel is subsidence arising as longwall panels progressively extract the coal seam. The extent of subsidence impacts is defined by the underground mining footprint and the angle of draw to the surface. Subsidence predictions have been undertaken for all Kestrel longwall panel series out to completion of the 500 series and have been updated as and when mine planning changes occur. Subsidence monitoring of prior longwall panels is used to verify the relative accuracy of subsidence predictions as well as informing subsequent subsidence predictions. Data referred to in this SMP is taken from the most recent update for panels LW500 to LW510 (MSEC 2022).

Maximum vertical subsidence over the 500-series longwall panels is predicted to range from between 1.6–2.3 m mid-panel to 0.1–0.3 m over longwall inter-panel pillars. Longwall panel widths are either 396 m (LW500) or 424 m. Maximum slopes arising from subsidence typically occur within 100–150 m of the panel edge. As a conservative comparison, measured maximum slopes from the adjacent 400 series panels are approximately 1.5–2% (or approximately 1°).

The slopes and troughs formed as a result of subsidence are subtle and not easily distinguishable from the surrounding topography, as the range of movement associated with subsidence is well within the range of natural elevation variation. In other words, the topography of subsided areas is not inconsistent with the surrounding un-subsided topography (i.e. gently rolling country with low relief).

Potential land impacts associated with subsidence include localised changes in slope, surface tensile cracking, and changed drainage systems including, in some areas, localised ponding. Where waterways traverse subsidence areas, localised longitudinal slope increases and waterway re-alignment may occur. These impacts are discussed in the following subsections.

Timing of subsidence at Kestrel is well understood from subsidence monitoring undertaken across the prior series longwall footprints. Monitoring indicates that at mining rates of 80–100 m per week, the majority of the subsidence on the surface occurs about 300 m behind the mining face with minor residual subsidence (subsoil settlement) of approximately 20–30 mm thereafter. At these rates of longwall retreat, 97% of maximum subsidence is achieved between four and six weeks of the longwall face retreating past any given point on the surface.

### 4.1.1 Subsidence-induced erosion impacts

Erosion impacting both land and/or watercourses is a potential outcome from subsidence-induced increases in slope. Site experience and subsidence monitoring observations to date reinforce the current understanding that the soil types located within the MLs, being high shrink-swell clays throughout their profile, are resilient to movement and, at the low slopes present in ML70481 and under the current grazing land use, have demonstrated low rates of erosion given their low erodibilities and calculated rates of soil loss.

Despite the favourable inherent characteristics of the soils, increases in localised erosion rates occurring post-disturbance is still a risk that requires monitoring and that may, in some cases require remediation. Certain surface landforms, and particularly those more prone to erosion naturally, for example watercourses and steeper slopes, may require additional attention. Management measures are outlined in Section 5

While the whole of the subsidence impacted area will be observed and monitored during and after longwall panel progress, the slopes predicted to increase to greater than 3% (refer Figure 7) will be a specific focus of monitoring efforts.

### 4.1.2 Subsidence-induced hydrological impacts

Kestrel is located in the upper to mid reaches of the Crinum Creek catchment and is drained by a number of small ephemeral gullies and tributaries of Crinum, Belcong and Homestead Creeks. Gilbert and Associates have been undertaking regular stream condition surveys across the whole of the Kestrel ML areas using an Index of Diversion Condition method since 2003 which provides an historic record of watercourse condition pre-mining and impact post-subsidence. It should be noted that watercourses and riparian zones are not mapped as SCL.

The observed impacts to overland flow and watercourses arising from subsidence related to earlier longwall panels have included:

- Localised re-direction of overland flow and changes to minor drainage paths, disruption to remnant contour banks, localised changes to runoff patterns and creation of surface ponding areas.
- Changes to flood prone areas in the flood plains of major drainage lines (e.g. Crinum Creek).
- Changes to the longitudinal slopes of watercourses. Where watercourses lie generally perpendicular to the panel direction, potential exists for ponding to occur immediately upstream of an inter-panel pillar, with increased potential for scouring immediately downstream of an inter-panel pillar due to localised increases in slope. This can have subsequent impacts on the sediment transport regime and geomorphological stability of these watercourses; in turn affecting the movement of bed/bank sediment and the stability of the creek channel. It should be noted though that the overall longitudinal slope of the watercourse will not change.

Minor depressions may occur in areas of flatter topography and which are isolated from the mainstream channels during low flows. These depressions may retain localised rainfall runoff and form ponds following rainfall events. These ponded areas may partially waterlog soils during summer events of high rainfall, but this is less likely during the rest of the year when rainfall is typically low.

Predictions of subsidence changes on the existing topography provide an indication of the locations of areas where ponding may occur. For ML70481, minor ponding is predicted to occur above up to five of the longwall panels, while one larger area of ponding (up to approximately 48 ha) may occur above longwall 510 (AARC 2022). Figure 8 indicates the inferred extent of these ponded areas. It should be noted that all of the predicted areas of ponding occur on the Grey or Black Vertosols formed on alluviums located within the floodplain of Belcong Creek and Crinum Creek. The specific location of ponded areas, soil drainage characteristics, and depth of ponding are factors influencing the duration and extent of ponding. In some cases, ponding may constitute a permanent impact on SCL. Proposed management measures to mitigate any impacts are outlined in Section 5.

While changes to local drainage patterns are anticipated, they are predicted to be both limited and minor re-alignment of first order drainage lines.

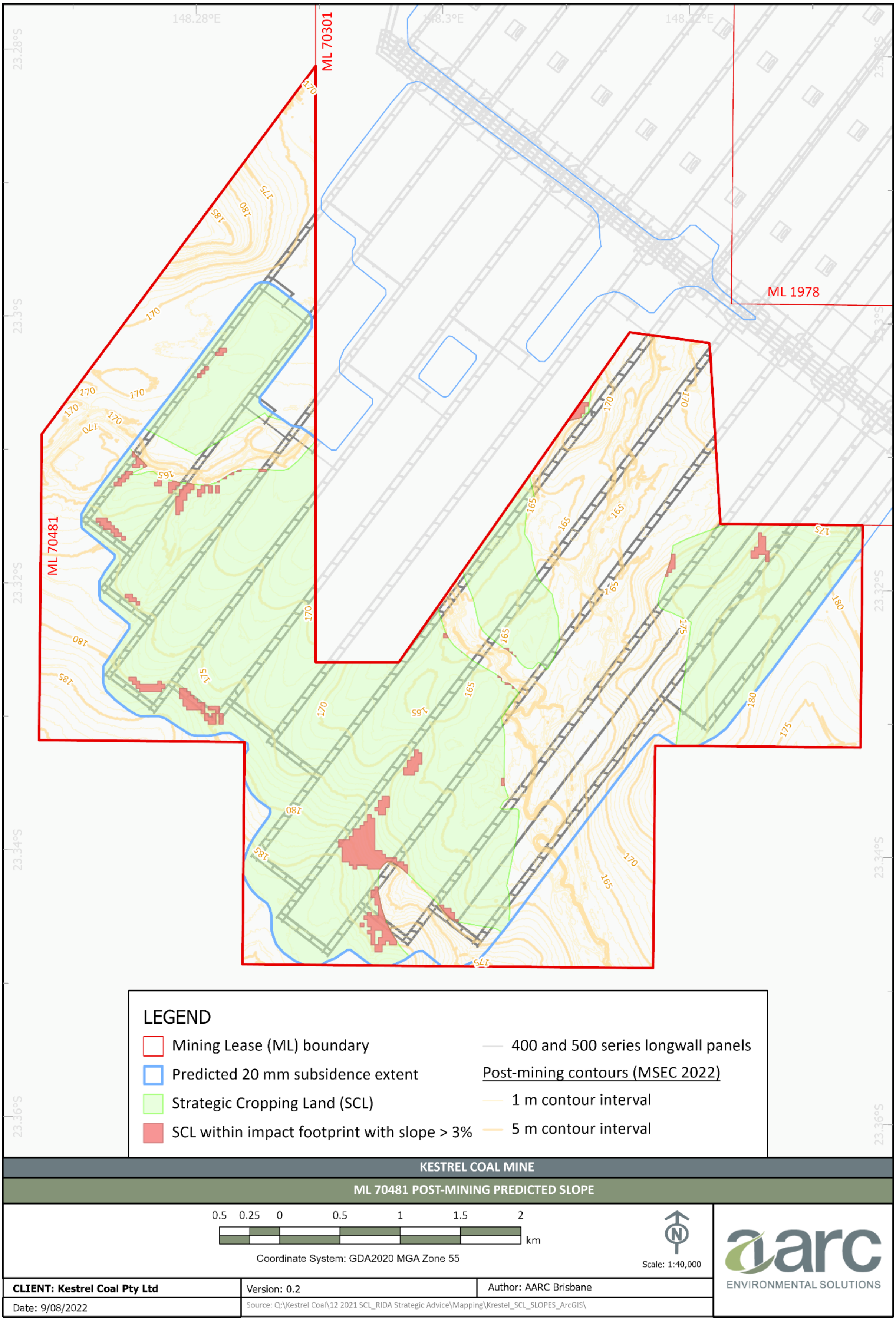


*Figure 6: Inferred slopes >3% post-mining (MSEC [2022] predicted subsidence DEM)*

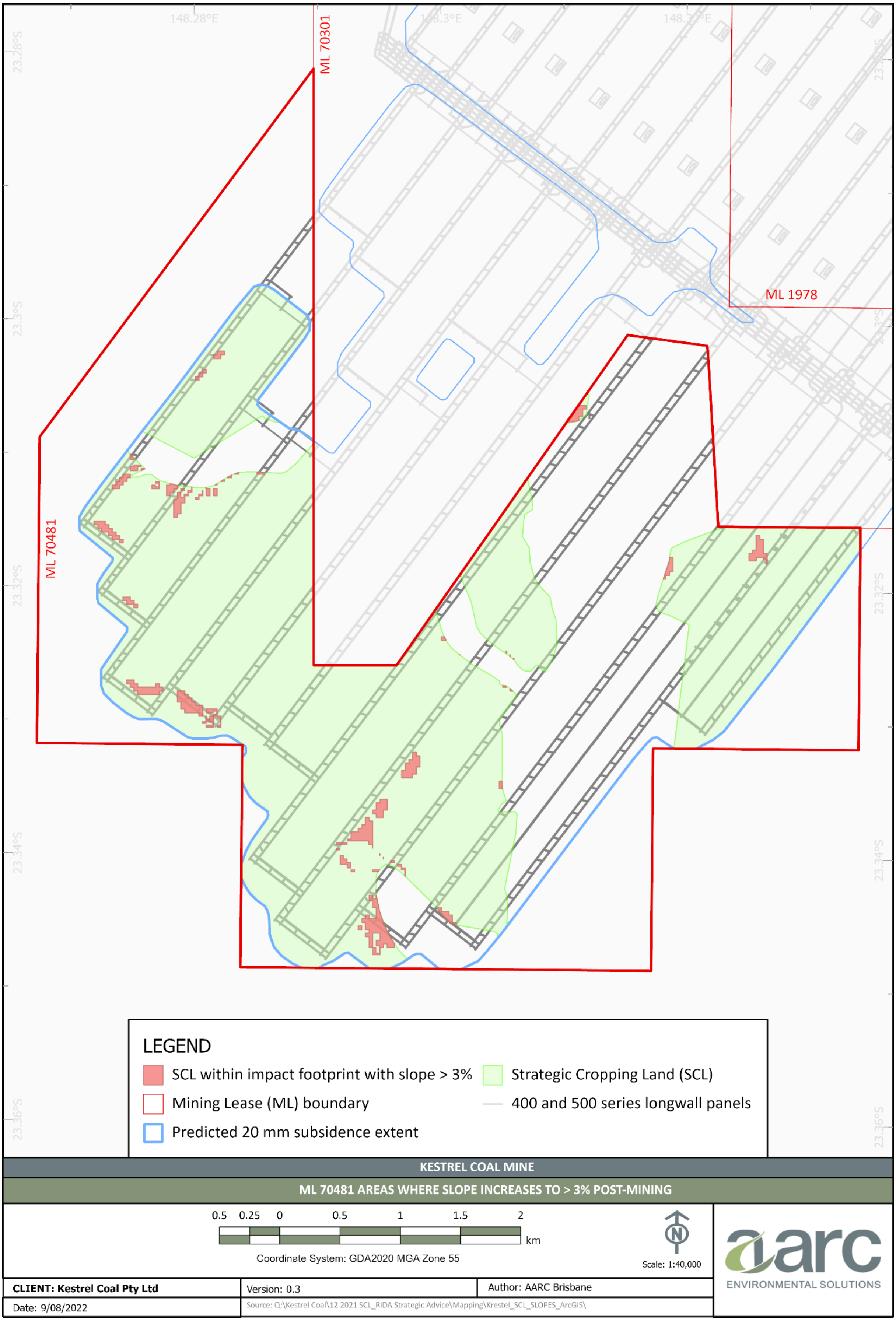


*Figure 7: Inferred subsidence-induced slope changes to greater than 3%*

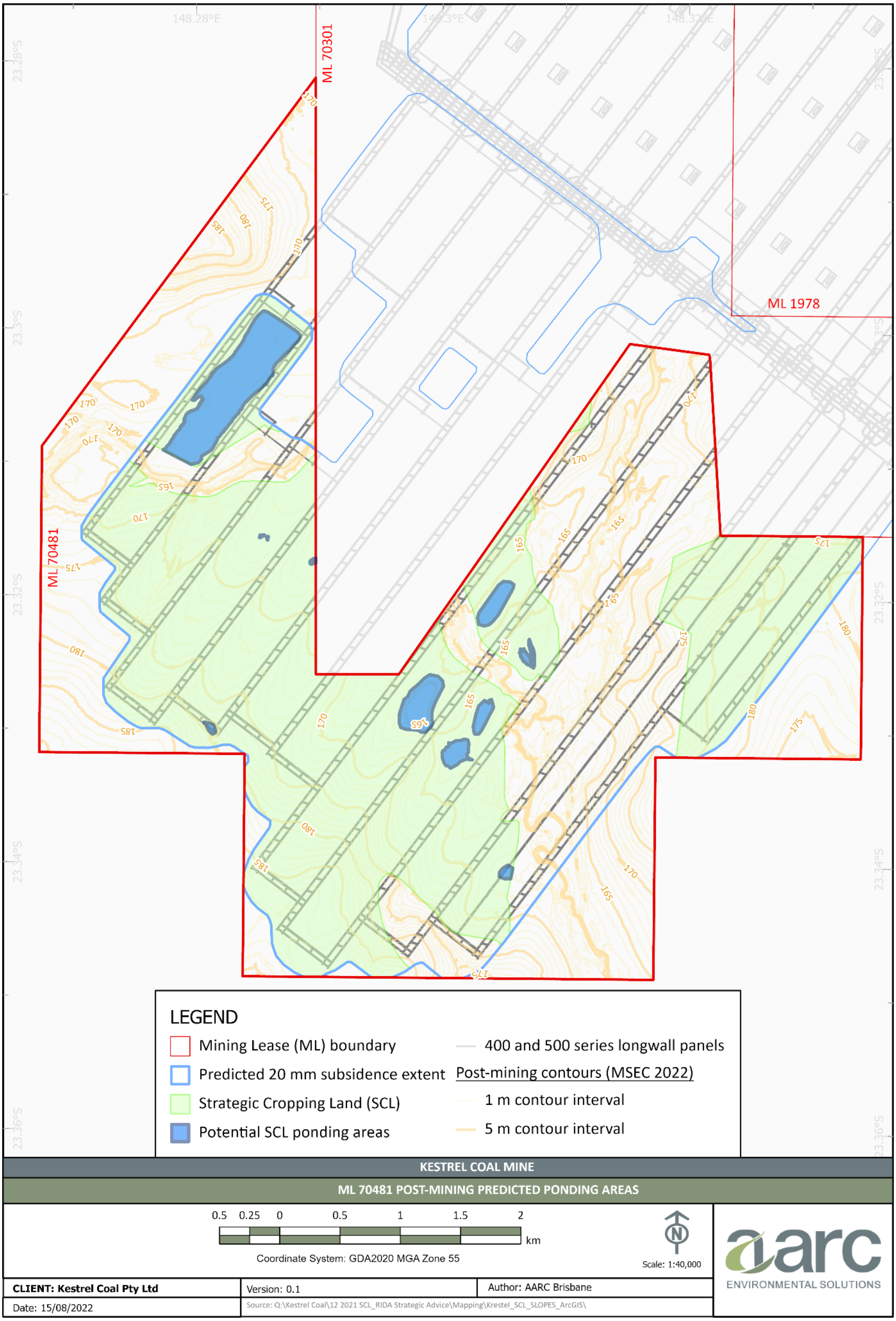


*Figure 8: Inferred ponding subsequent to subsidence*

### 4.1.3 Subsidence-induced surface cracking

Surface tension cracks may occur as a result of longwall panel subsidence. Observations have demonstrated that, in many cases, tension cracks open as a function of the longwall panel face passing, closing up again as the panel progresses. Tension cracks are more likely to remain along the line of the inter-panel pillars and at the ends of each longwall panel. For earlier Kestrel panel series, tension cracks have been observed over the 300-series longwall panels in areas with Vertosols. These areas were monitored and observed to either self-heal, or were able to be rehabilitated by cross ripping with scarifiers.

The majority of the Kestrel MLs are dominated by Vertosols which are characterised as expansive soils with a high shrink-swell potential that change volume with changes in soil water content. The nature of these expansive cracking clays is such that, typically over one to two seasons, natural soil movement will compensate for any subsidence-induced cracking, resulting in no measurable impact on the soil. The cracking clay soils naturally open, crack and shrink when dry, with the cracks then closing when wet as part of the soils inherent characteristics of pedoturbation. Thus, though cracks may result when subsidence first occurs, this natural characteristic of pedoturbation has been observed to lead to crack closure over one or two seasonal wetting and drying cycles.

Over 90% by area of the soils contained within ML70481 are Vertosols having a low risk of long-term impact from subsidence-induced surface cracking. The remainder will be subject to management measures as described in Section 5.

# 5 Subsidence management

## 5.1 General measures

The following general management measures relevant to subsidence related impacts will be utilised, as applicable, for ML70481:

- Subsidence prediction assessments will continue to be undertaken, at a minimum in advance of each new panel series and updated as required to align with mine planning changes or where monitoring identifies a variation from predicted subsidence behaviour.
- Pre- and post-subsidence survey monitoring (via light detection and ranging (LiDAR) or other methods) will continue to be undertaken to assess and validate subsidence predictions.
- In areas where subsidence movements are predicted to result in moderate or high risk of instability to the bed and banks of a watercourse, stock are to be excluded from the immediate bed, bank and overbank areas, as recommended by Gilbert & Associates (2012). Fencing is to be installed as required to enable effective stock management to occur.
- Agricultural activities will be managed in consultation with the lessee as required in advance of subsidence occurring to ensure that a high level of pasture cover exists, such that erosion potential is minimised.
- Any agricultural/soil erosion control infrastructure in the path of subsidence will be removed or, if required to be retained, subject to observation and monitoring to identify any potential soil erosion or drainage risk.

## 5.2 Restoration/rehabilitation measures

Rehabilitation and restoration of subsided land at Kestrel is undertaken where subsidence-induced geomorphological changes in the landform result in erosion, ponding or cracking that are unacceptable in extent or effect. Technical studies and experience to date have demonstrated that the majority of subsided land at Kestrel does not require extensive rehabilitation works to be undertaken i.e. where earthworks of significant scale is required. Where active rehabilitation is required, the objective is the return of the land to its pre-mining agricultural capability as required by the relevant conditions of the RIDA and Environmental Authority (EA).

Subsidence monitoring was undertaken at Kestrel in August 2008 as part of ACARP project C15013 (ACARP 2010), designed to quantify the impacts of mine subsidence on the production and quality of agricultural vegetated environments. Monitoring was undertaken above longwall panels 301 to 305, comparing pillars, transition areas and areas of maximum subsidence within the panels. The research program utilised a variety of traditional ground-based sampling techniques including biomass harvests and techniques, Leaf Area Index, pasture height, species composition and soil sampling along with proximal sensor data capture using a proximal crop reflectance sensor. Satellite imagery was also collected, and the high-resolution imagery used to monitor large areas of subsidence-affected areas and adjacent unmined land. A forage sorghum site and an improved pasture were monitored. The outcomes of the research concluded there was no significant variance between subsided and unmined areas with respect to soil physical and chemical characteristics.

Rehabilitation is planned and implemented in response to any observations of adverse impact(s) arising following the passage of a longwall panel or panels. Unless observations indicate that earlier intervention is required, land subject to subsidence is observed for a period of at least two wet seasons (typically 30–36 months) to ensure:

- that all expected settlement has occurred;
- that immediately adjacent areas will not be subject to further subsidence;
- that any potential for erosion impacts has had time to present; and
- that a practical package of aggregated works can be compiled for contract administration purposes.

The rehabilitation activities required will be contingent on soils, slopes, the land use of the impacted area, and the impact type i.e. erosion, excessive cracking or ponding. The following rehabilitation activities may be required either alone or sequentially as a component of a larger rehabilitation program:

### 5.2.1 Subsidence-induced erosion impacts

The following rehabilitation sequence will be utilised:

- Review and modify fencing as required to exclude stock from the area and/or manage grazing as appropriate in consultation with the agricultural lessee.
- Undertake amelioration works and/or earthworks as appropriate, (e.g. reprofiling, scarifying, topsoiling, etc.,).
- Revegetate the area as soon as practicable, using either traditional seeding methods or more intensive revegetation methods, as required.
- Monitor revegetation works and assess rehabilitation program success.
- Plan the re-introduction of cattle and future grazing activities with the agricultural lessee.

Some parts of the Kestrel property were historically subject to the construction of erosion control structures – predominantly contour banks – in areas where cropping activities were planned or carried out. Where these structures have been subject to subsidence their capacity to function as intended is in most cases compromised. The current land use for ML70481 areas (refer Section 3.3) is grazing and forage cropping, as is specified within the EA. At this point in time, there is no intention to revert to a cropping land use. As such, no erosion control structures are planned to be reinstated.

In the event that a cropping land use was to be implemented, recent regulatory changes have nominated new or expanded cropping or horticultural activities within the Fitzroy catchment as an environmentally relevant activity requiring an EA application to be submitted which will trigger an assessment of requirements for soil conservation measures and works.

### 5.2.2 Watercourse subsidence impacts

An adverse impact to watercourses is likely to be exhibited as creek bed or bank erosion and associated bank steepening or undercutting; initiated following panel passing. Within ML70481, the lower reach of Belcong Creek where it traverses the ML and prior to its confluence with Crinum Creek has the greatest risk of bed shallowing and steepening. Other watercourses traversing ML70481 will be subject to lesser shallowing and steepening as they cross inter-panel pillars.

Where monitoring identifies sequential pooling and scouring of streambeds due to increased variation in longitudinal bed slope, watercourse monitoring will be initiated to ensure that detailed monitoring of the impacted sections is occurring. It is considered most beneficial to carefully monitor the natural re-establishment of the watercourse bed and banks and only intervene with activities within the riparian zone if an area of pooling or scouring is observed to be on deteriorating trajectory. In this event, relevant expertise will be obtained to develop an appropriate rehabilitation strategy and program. Rehabilitation works may utilise one or more of:

- regrading of bed and banks to produce stable profiles;
- vegetation re-establishment on watercourse banks; and
- construction of rock armouring where high energy sections have resulted.

### 5.2.3 Subsidence-induced cracking

Where surface cracking is identified, these areas will be observed and monitored to ensure they self-heal. Minor cracks are not expected to require remediation and will resolve through geomorphological processes over time. However, where minor surface cracks do not resolve within three wet seasons, the area will be scarified or ripped to fill minor cracks, control erosion and assist revegetation. Larger or persistent cracks that are identified as requiring remediation will be rehabilitated through removal of topsoil, backfilling, re-spreading of topsoil, and revegetation. Livestock may need to be excluded from areas undergoing active subsidence.

### 5.2.4 Subsidence-induced ponding impacts

Figure 8 provides an indication of the predicted locations of ponding. The following rehabilitation measures will be implemented with a scale appropriate to the severity of observed ponding:

- An assessment will be undertaken to determine the extent, depth, duration and frequency of ponding. In some cases it may be possible to drain ponded areas to existing watercourses either by reprofiling or regrading of the modified topography. In some cases shallow ephemeral pools may serve a useful ecological and/or agricultural (e.g. stock watering) function and a decision is made to retain the pond.
- for larger semi-permanent or permanent pools which degrade ecological and/or agricultural use, drainage works will be undertaken to either mitigate or eliminate ponding and pasture/vegetation cover re-established as required.

# 6 Monitoring and maintenance

## 6.1 Landform change

Condition G6 of the Kestrel Environmental Authority requires an annual inspection of subsidence across the 500 panels by a suitably experienced person between 1 April and 1 November to assess structural, geotechnical and hydraulic adequacy of the panel and works relating to this SMP.

Historically, Kestrel has undertaken subsidence assessments and reporting as required under ML and/or EA conditions since the commencement of mining. Subsidence reports have been prepared over the years to outline the areas of Kestrel impacted by longwall subsidence, results of any subsidence monitoring and impacts on groundwater resources.

Impacts on slope are identified by ground survey traverses and more recently using remote LiDAR sensing technology which provides high accuracy topographic survey enabling landform changes to be tracked over time, including creek slope, width and depth.

## 6.2 Hillslope erosion and ponding

Identification of active erosion, instances of ponding and tension cracking is based on observations of subsided areas for a period of at least two wet seasons (typically 30–36 months) following the passage of a longwall face. Where subsidence-induced erosion is observed to have initiated, and assessed to be deteriorating, more detailed erosion surveys will be undertaken using a standard transect methodology, and a mitigation plan developed. To date, more detailed monitoring specifically for erosion has not been required for any of the previous longwall panel series at Kestrel, and is not anticipated for the 500 series panels within ML70481.

Rainfall records will be maintained and inspections of ponded areas may occur following significant rainfall events that coincide with identified potential for hillslope erosion or ponding impacts.

Observations will also include monitoring of areas where active rehabilitation works have been undertaken including maintenance of a photographic record.

## 6.3 Watercourses

Kestrel has maintained a regular stream condition survey program since the early 2000s, which provides a detailed assessment of all watercourses crossing the MLs. The monitoring program is based on the Index of Diversion Condition as outlined in ACARP Project Report C9068 for categorising stream diversion condition. The technique used categorises, or scores, the condition of the watercourse before and after subsidence, and can also be used to assess the effectiveness of natural or engineered remedial measures to enhance post subsidence stability and condition. Kestrel intends to maintain this program of monitoring.

Kestrel also collects flow data from established gauging stations in the region to allow analysis and assessment where this is required.

## 6.4 Land evaluation

### 6.4.1 Land capability and suitability

For Kestrel, land capability exists as a key completion criterion within the EA (Condition G12 and Table G1). Condition G14 requires an independent land capability class assessment to be completed to determine if the capability class rating proportions of Table G1 have been achieved post-rehabilitation. It is likely that, as part of the development of a Progressive Rehabilitation and Closure Plan for Kestrel, as required under the *Environmental Protection Act 1994*, that there may be a review of completion criteria and it is likely that the current land capability criteria will be replaced with land suitability criteria.

Once milestone criteria are established through the Progressive Rehabilitation and Closure Plan process, and at some point in time prior to ML surrender, Kestrel will undertake a land suitability assessment of ML70481 using a methodology appropriate to meet the finalised milestone criteria.

# 7 Reporting and review

Results of any surface water monitoring, the effectiveness of established water management structures, sediment control devices and the particulars of any remedial measures undertaken in instances where uncontrolled erosion or heavy sediment deposition occurred will be reported as part of the Receiving Environment Monitoring Program.

## 7.1 Review

This SMP will be reviewed and updated at least every three years to reflect changes in environmental requirements or in operational practices. The review will include an assessment of the effectiveness of subsidence management practices. The measures will be considered effective if:

- impacts associated with subsidence are being demonstrated to have been mitigated; and
- the lands within ML70481 can be demonstrated to be able to meet their pre-mining productive capacity.

Progressive amendments will be made to this SMP through Kestrel's continuous improvement process.

# 8 Administration

## 8.1 Incident and complaint management

Kestrel's established incident management process will be utilised for any incidents or non-compliances related to erosion and sediment control. This procedure outlines:

- managing any related complaints;
- the process to resolve any disputes with lessees, property owners, landowners or other persons;
- the process to respond to any non-compliances with the EA and ML70481 RIDA;
- the process to respond to any related incidents or emergencies.

In accordance with Schedule 3(b) of the RIDA, any incident, or serious non-compliance with the Soil Conservation Plan (SCP) (including the receipt of monitoring results demonstrating serious non-compliance) will be reported in writing to the Chief Executive (of the Department administering the *Regional Planning Interests Act 2014*) within 10 business days. The information to be reported to the DSDILGP includes:

- details of the nature of the incident or serious non-compliance;
- results and interpretation of any samples taken and analysed;
- the outcome of actions taken to rectify the incident, and the associated impacts;
- and details of the actions proposed to prevent a recurrence of the incident or serious non-compliance.

# 9 Accountabilities

The following accountabilities have been identified for this SMP:

| Role | Accountability |
|---|---|
| General Manager & SSE | • Ensure compliance with the requirements of this SMP<br>• Provide the required resources and systems to ensure that Managers, Supervisors, Employees Contractors and Visitors are aware of their responsibilities under this SMP<br>• this SMP is to be implemented in all applicable areas of ML70481<br>• Training for personnel to meet requirements of this SMP |
| Area Managers | • Familiarity with requirements of this SMP<br>• Maintain working knowledge of GDP procedure and system<br>• Maintain working knowledge of SMP requirements |
| Technical Services Manager | • Ensure that all works and activities under their control or influence are conducted in accordance with the requirements of this SMP |
| Superintendent Environment | • Maintain familiarity with this SMP<br>• Responsibility for correct operation and maintenance of GDP procedure and system, including review and sign-off of GDPs<br>• Knowledge of and accountability for implementation of SMP Plan requirements<br>• Maintain this SMP within the Site Document Register<br>• Initiate review of this SMP at intervals not exceeding 3 years<br>• Communication of the requirements of this SMP to relevant personnel. |
| Environment Team | • Maintain familiarity with this SMP and its operation<br>• Initiate rehabilitation and monitoring requirements of this SMP<br>• Maintain regular monitoring of works being undertaken within the jurisdiction of this SMP |
| General workforce (employees and contractors) | • Familiarisation with requirements of this SMP and management through GDP process and obligations<br>• Ensure all persons are competent to perform the tasks they are assigned. |
| Supervisors | • Have familiarity with the requirements of this SMP sufficient to identify Plan application and to report non-compliances |

# 10 References

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MSEC 2022, 500 series longwall layout adjustment, report prepared for Kestrel Coal Resources by Mine Subsidence Engineering Consultants (MSEC), Chatswood, NSW.

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