Mt Keith Satellite Statement 1087 Compliance Assessment Report

BHP Nickel West

29 March 2022

Contents

Document Amendment Record

Version	Page No.	Version Description	Key Changes	Date
1	-	Draft for Internal Review (BHP Nickel West HSEC)	-	22 March 2022
2	-	Draft for BHP Approval (BHP Nickel West HSEC)	-	29 March 2022
0	-	Final for BHP issue to EPA (BHP Nickel West HSEC)	-	29 March 2022

Endorsement

I have reviewed this Compliance Assessment Report prepared to meet the requirements of Condition 4-6 of the Statement 1087 approval for the Mt Keith Satellite Project, and accept that the information provided is an accurate account of the activities undertaken during the reporting period.

Michael Moscarda

A / General Manager Northern Operations

BHP Nickel West Pty Ltd

Executive Summary

BHP Billiton Nickel West Pty Ltd (BHP Nickel West) was granted environmental approval of the Mt Keith Satellite Project (the 'Project') in December 2018 by the Western Australian Minister for Environment in accordance with Section 45(5) of the Environmental Protection Act 1986 (WA).

Works on the Project commenced in February 2019, which to date have included the clearing and establishment of the initial operating areas (Haul Road, Mine Pits, Waste Rock Landform and Mine Ore Pad) and the commencement of productive mining of ore from both the Six Mile Well Mine Pit and the Goliath Mine Pit. Implementation of the Project is currently expected to continue until approximately 2030+.

Condition 4-6 of the Statement 1087 approval requires BHP Nickel West to submit an annual Compliance Assessment Report which outlines the status of implementation of the Project and compliance with the approval conditions. This Report outlines the implementation status and compliance for the Project covering the period of 28 December 2020 to 31 December 2021. BHP Nickel West was in compliance with all conditions of the Statement 1087 approval during the reporting period.

1. Introduction

The Mt Keith Satellite Project (the 'Project') is for a satellite mining operation as an extension to the existing Mt Keith Nickel Mine[1]. The Project comprises two Mine Pits, a Waste Rock Landform, Support Infrastructure and a Haul Road, requiring the clearing of up to 1,069 hectares (ha) of native vegetation within a Development Envelope of 1,265 ha, as identified by Figure 1 Project Area.

BHP Billiton Nickel West Pty Ltd (BHP Nickel West) referred the Project to the Environmental Protection Authority (EPA) in May 2017 in accordance with Section 38 of the *Environmental Protection Act 1986* (WA) (BHP Nickel West 2017). The EPA (2017) determined the Project required an environmental assessment, with the key assessment factors including 'Flora and Vegetation', 'Inland Waters', 'Social Surroundings' (Aboriginal Heritage) and 'Air Quality'. An 'Environmental Review' document (Environmental Impact Assessment) assessing the potential environmental effects of the Project was additionally prepared to assist the EPA assessment (BHP Nickel West 2018a).

The EPA (2018) assessment concluded the Project could be implemented subject to recommended conditions to ensure the potential environmental effects of the Project were appropriately managed. Following the advice of the EPA (2018), the Project was subsequently approved by the WA Minister for Environment (2018) through the Statement 1087 approval granted in accordance with Section 45(5) of the *Environmental Protection Act 1986* (WA).

Implementation of the Project commenced in February 2019, which to date has included the clearing and establishment of the initial operating areas (Haul Road, Mine Pits, Waste Rock Landform and Mine Ore Pad) and the continuation of productive ore mining from both the Six Mile Well Mine Pit and the Goliath Mine Pit.

Implementation of the Project is expected to occur over a period of 10+ years, with the cessation of mining (and the commencement of mine closure) estimated to occur from approximately 2030+.

2. Purpose and Scope

Condition 4-6 of the Statement 1087 approvals requires the submission of an annual Compliance Assessment Report (CAR) document, which outlines the status of implementation of the Project and compliance with the approval conditions.

This CAR outlines the implementation and compliance status of the Project for the period of 28 December 2020 to 31 December 2021, and aligns with the requirements of the approved Compliance Assessment Plan (BHP Nickel West 2020a) under Condition 4-1 of the Statement 1087 approval.

This CAR document is the third CAR document to be submitted for the Project under the Statement 1087 approval, following from the CAR documents submitted in 2020 and 2021 (BHP Nickel West 2020b and BHP Nickel West 2021c).

[1] Note: The Mt Keith Nickel Mine commenced operations in 1993. The existing components of the Mt Keith Nickel Mine do not form part of the approved Project, and accordingly, are not addressed within this CAR document.

3. Project and Status

BHP Nickel West commenced implementation of the Project in February 2019. To date, implementation of the Project has included:

- Clearing and establishment of the initial operating areas (Haul Road, Mine Pits, Waste Rock Landform and Run of Mine Pad); and
- Continuation of productive mining of ore from both the Six Mile Well Mine Pit and commencement of mining from the Goliath Mine Pit.
- Ore supplied from the Project is now the primary product processed at the Mt Keith Nickel Mine.

Implementation of the Project is expected to occur over a period of 10+ years, with the cessation of mining (and the commencement of mine closure) estimated to occur from approximately 2030+.

4. Statement of Compliance

A completed Audit Table (consistent with the approved Compliance Assessment Plan (BHP Nickel West 2020a)) is provided below to outline compliance with the conditions of the Statement 1087 approval. The Audit Table verifies that BHP Nickel West was in compliance with all conditions of the Statement 1087 approval during the reporting period. Refer to Table 1 Mt Keith Satellite Operations Audit Table.

A completed and signed Statement of Compliance form (prepared using the DWER (2018) form *'PAF2 - Statement of Compliance – 2018'*) is provided at Appendix 1.

AUDIT TABLE
Mt Keith Satellite Project, Statement No.1087

• Phases that apply in this table = Pre-Construction, Construction, Operation, Decommissioning, Overall (several phases).
• This audit table is a summary and timetable of conditions and commitments applying to this project. Refer to the Minister's Statement for full detail/precise wording of individual elements.
• Code prefixes: M = Implementation condition; P = Proponent's commitment; N = Procedure.
• Compliance status: C = Compliant, CLD = Completed, NC = Non-compliant, NR = Not required at this stage. Please note terms NA = Not Audited and VR = Verification Required are only for EPA use. IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the *Post Assessment Guideline for Preparing an Audit Table*.

Table 1: Mt Keith Satellite Operation Audit Table (28 December 2020 to 31 December 2021).

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
1087:M1.1	**Proposal Implementation**	When implementing the proposal, the proponent shall not exceed the authorised extent of the proposal as defined in Table 2 of Schedule 1, unless amendments to the proposal and the authorised extent of the proposal have been approved under the EP Act.	Implement the Project in accordance with criteria outlined in Schedule 1.	Compliance Assessment Reports.	Overall	For the life of the Proposal.	COMPLIANT	Table 2 of Schedule 1 of the Statement 1087 approval, as amended by Attachment 1 to the Statement 1087 approval under s45C in September 2020, authorises the clearing of up to 1,069 hectares (ha) of native vegetation within a 1,265 ha Development Envelope. As of 31st December 2021, a total of 805.3 ha of native vegetation has been cleared within the Development Envelope; being within the total 1,069 ha authorised limit. No clearing of native vegetation beyond the Development Envelope has been undertaken for the Project. The area of native vegetation clearing undertaken to date, and the extent of the approved Development Envelope, is identified at Figure 2. Table 2 of Schedule 1 of the Statement 1087 approval authorises groundwater abstraction (mine pit dewatering) of up to 0.4 gigalitres (GL) per year (y) using bores and pit sumps. A total of 0.206 GL (206,173 kilolitres (kL)) of groundwater was abstracted between 1st January 2021 and 31st December 2021; being within the 0.4 GL/y authorised limit. Groundwater abstractions records to verify the mine pit dewatering volumes from each bore/sump is provided in Appendix 2.
1087:M2.1	**Contact Details**	The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.	Notify the CEO of any change in proponent details.	Written notification to the CEO of any change in proponent details.	Overall	Within 28 days of such change.	NOT REQUIRED	No change to the Proponent name, physical address or postal address has occurred during the reporting period, and accordingly, no notification to the DWER CEO has been required.
1087:M3.1	**Time Limit for Proposal Implementation**	The proponent shall not commence implementation of the proposal after five (5) years from the date on this Statement, and any commencement, prior to this date, must be substantial.	Notify the CEO advising proposal has not commenced implementation.	Written notification to the CEO.	Overall	After 28 December 2023.	COMPLETED	Implementation of the Project commenced in February 2019 with the construction and operation of the Project. Implementation of the Project is considered to be 'substantial'. Compliance with Condition 3-1 is now completed.
1087:M3.2	**Time Limit for Proposal Implementation**	Any commencement of implementation of the proposal, on or before five (5) years from the date of this Statement, must be demonstrated as substantial by providing the CEO with written evidence, on or before the expiration of five (5) years from the date of this Statement.	N/A.	Compliance Assessment Reports.	Overall	Within 5 years from the date of Statement 1087, being on or before 28 December 2023.	COMPLETED	Implementation of the Project commenced in February 2019 with the construction and operation of the Project. Implementation of the Project is considered to be 'substantial'. Written evidence demonstrating compliance was confirmed in the DWER Compliance Audit Report in May 2020. Compliance with Condition 3-2 is now completed.
1087:M4.1	**Compliance Reporting**	The proponent shall prepare, and maintain a Compliance Assessment Plan which is submitted to the CEO at least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.	Submit Compliance Assessment Plan to the CEO.	Compliance Assessment Plan (this document).	Pre-construction	At least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the	COMPLIANT	A Compliance Assessment Plan (CAP) document (BHP Nickel West 2019a) was initially submitted to the DWER CEO in September 2019, with the DWER CEO granting initial approval of the CAP document in October 2019. The current version of the CAP document (Revision 2, BHP Nickel West 2020a) was approved by the DWER CEO in October 2020 (DWER 2020b).

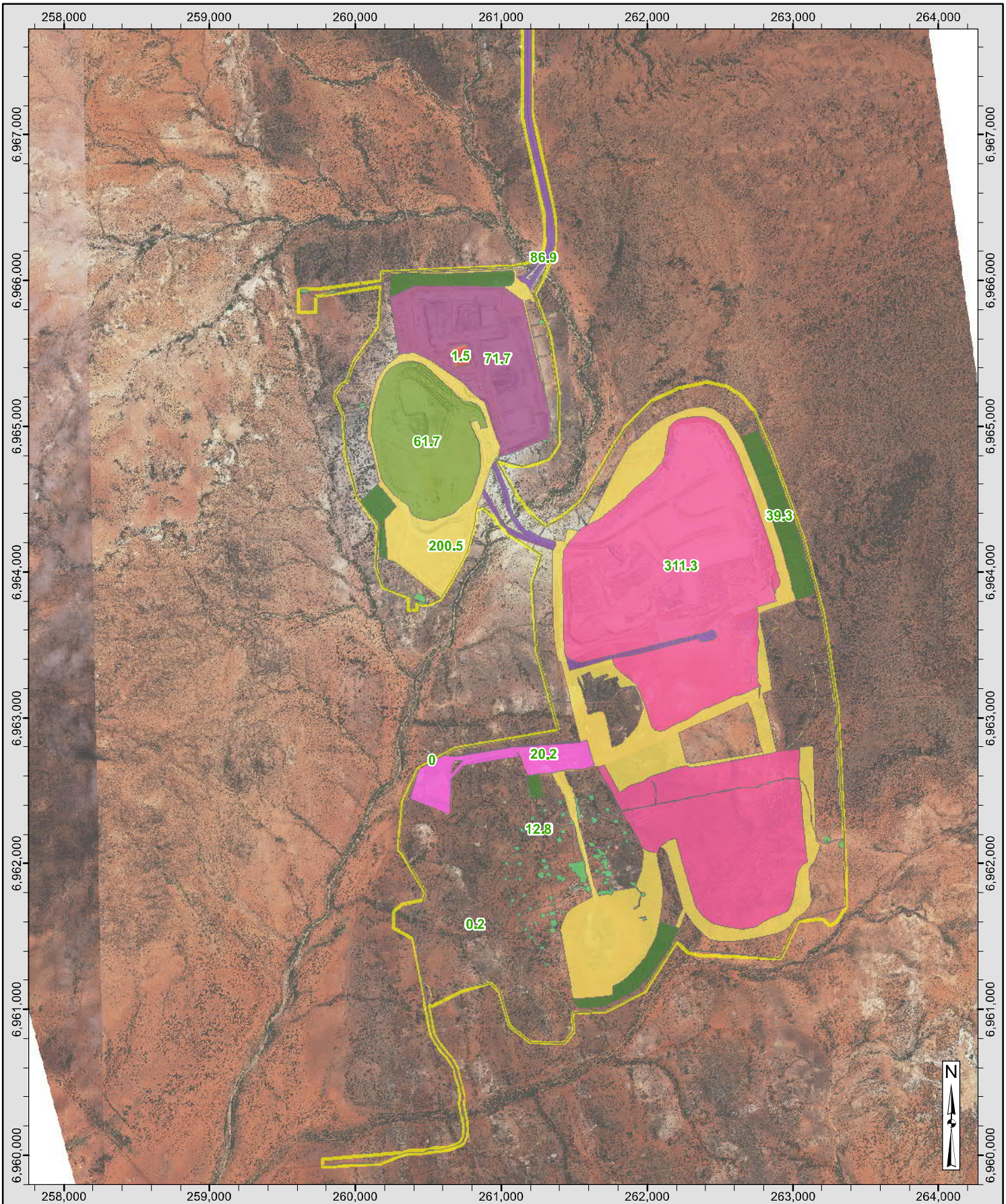
AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
						proposal, whichever is sooner.		BHP Nickel West will continue to review and maintain the CAP document, as required from time to time, to ensure ongoing compliance with Condition 4-1.
1087:M4.2	**Compliance Reporting**	The Compliance Assessment Plan shall indicate: (1) the frequency of compliance reporting; (2) the approach and timing of compliance assessments; (3) the retention of compliance assessments; (4) the method of reporting of potential non-compliances and corrective actions taken; (5) the table of contents of Compliance Assessment Reports; and (6) public availability of Compliance Assessment Reports.	Submit Compliance Assessment Plan to the CEO.	Compliance Assessment Plan (this document).	Pre-construction	At least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.	COMPLIANT	A Compliance Assessment Plan (CAP) document (BHP Nickel West 2019a) was initially submitted to the DWER CEO in September 2019, with the DWER CEO granting initial approval of the CAP document in October 2019. The current version of the CAP document (Revision 2, BHP Nickel West 2020a) was approved by the DWER CEO in October 2020 (DWER 2020b). In accordance with Condition 4-2, the approved CAP document identifies: • frequency of compliance reporting; • approach and timing of compliance assessments; • retention of compliance assessments; • method of reporting of potential non-compliances and corrective actions taken; • table of contents of Compliance Assessment Reports; and • public availability of Compliance Assessment Reports. BHP Nickel West remains in compliance with the requirements of Condition 4-2.
1087:M4.3	**Compliance Reporting**	After receiving notice in writing from the CEO that the Compliance Assessment Plan satisfies the requirements of condition 4-2 the proponent shall assess compliance with conditions in accordance with the Compliance Assessment Plan required by condition 4-1.	Implementation of Compliance Assessment Plan.	Notice in writing from the CEO and Compliance Assessment Reports.	Overall	Ongoing as per requirements of CAP.	COMPLIANT	This Compliance Assessment Report (CAR) document submitted to DWER in 2021 provides an assessment of compliance with the conditions of the Statement 1087 approval consistent with the approved CAP document. Annual submission of this CAR document ensures that BHP Nickel West remains in compliance with the requirements of Condition 4-2.
1087:M4.4	**Compliance Reporting**	The proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 4-1 and shall make those reports available when requested by the CEO.	Retain records in accordance with Compliance Assessment Plan.	Written response to request by CEO.	Overall	When requested by CEO.	COMPLIANT	Submitted CAR documents will be retained by BHP Nickel West for the duration of the Project in accordance with standard document control practices, as outlined within the approved CAP document. No requests were received from the DWER CEO during the reporting period to make additional copies of the submitted CAR documents available.
1087:M4.5	**Compliance Reporting**	The proponent shall advise the CEO of any potential non-compliance within seven (7) days of that non-compliance being known.	Notification of the CEO via an email to compliance@dwer.wa.gov.au which will include any corrective actions taken to address the potential non-compliance.	Written correspondence to CEO.	Overall	Within 7 days of the potential non-compliance being known.	COMPLIANT	Nil potential non-compliance items were identified, or required reporting to DWER, during the reporting period. BHP Nickel West has not been required to provide advice to the DWER CEO of any potential non-compliance during the reporting period.
1087:M4.6.1	**Compliance Reporting**	The proponent shall submit to the CEO the first Compliance Assessment Report fifteen (15) months from the date of issue of this Statement addressing the twelve (12) month period from the date of issue of this Statement and then annually from the date of submission of the first Compliance Assessment Report, or as otherwise agreed in writing by the CEO.	Submit Compliance Assessment to the CEO.	Compliance Assessment Reports.	Overall	The first report to be submitted by 28 March 2020 and from then on annual by 28 March each year.	COMPLIANT	The first CAR document (BHP Nickel West 2020b) was submitted to the DWER CEO in March 2020 addressing compliance with the conditions for the first 12 month period following the granting of the Statement 1087 approval. This CAR document presents the third report addressing compliance with the conditions of the Statement 1087 approval. As outlined in Section 5 *Proposed Changes to the Compliance Assessment Plan*, in 2020 BHP Nickel West proposed that future CAR documents cover the financial year period 1 July to 30 June, with

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
								submission by 30 October (to align to other standard Government financial year reporting requirements). The request for agreement of the DWER CEO for this change was provided as part of the 2020 CAR submission (Section 5). No response from the DWER CEO has been received to this request. In the absence of a response BHP Nickel West continues to comply with a March submission date for the CAR
1087:M4.6.2	**Compliance Reporting**	The Compliance Assessment Report shall: (1) be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf; (2) include a statement as to whether the proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.	Compliance Assessment Report developed in accordance with the approved Compliance Assessment Plan.	Compliance Assessment Reports.	Overall	The first report to be submitted by 28 March 2020 and from then on annual by 28 March each year.	COMPLIANT	This CAR complies with reporting requirements, specifically: 1. Endorsement by the General Manager of BHP Nickel West, as an authorised delegate of the CEO of BHP Nickel West. 2. BHP Nickel West has complied with all conditions of the Statement 1087 approval during the reporting period. Statements to this effect are included within this CAR document. 3. Nil potential non-compliances with the conditions of the Statement 1087 approval occurred during the reporting period. Accordingly, no corrective or preventative actions have been required to address potential non-compliances. 4. Following approval of this CAR document by the DWER CEO, this CAR document will be made publicly available through the BHP Nickel West website as outlined by the approved CAP report (refer to https://www.bhp.com/sustainability/environment/regulatory-information/). 5. Proposed changes to the CAP document are outlined in Section 5 *Proposed Changes to the Compliance Assessment Plan*.
1087:M5.1	**Public Availability of Data**	Subject to condition 5-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) management plans and reports relevant to the assessment of this proposal and implementation of this Statement.	To be determined in consultation with CEO.	Written advice from CEO confirming manner approved.	Overall	To be determined in consultation with the CEO.	COMPLIANT	Environmental data, management plans and reports relevant to the EPA assessment of the Project are publicly available through the EPA website (refer to https://www.epa.wa.gov.au/proposals/mt-keith-satellite-project). This public availability of the Project assessment information is considered to be appropriate, with further actions for the public availability of the assessment information by BHP Nickel West not considered to be considered necessary. Environmental data, management plans and reports relevant to the implementation of the Statement 1087 approval are publicly available through the BHP website (refer to https://www.bhp.com/sustainability/environment/regulatory-information/). To date, this publicly available information includes: • Flora and Vegetation Environmental Management Plan (EMP) Rec 0.2 (BHP Nickel West 2019); • Compliance Assessment Plan (BHP Nickel West 2020a); • Compliance Assessment Report 2019 (BHP Nickel West 2020b) and • Compliance Assessment report 2020. Following approval by the DWER CEO, this CAR document will additionally be made publicly available through the BHP website. To note, the DWER CEO has not provided written advice to BHP Nickel West on the approved manner or the timing for the public availability of information required under Condition 5-1 of the Statement 1087 approval. BHP Nickel West consider the above actions for public availability to meet the intent of Condition 5-1 and the objectives of the DWER CEO for the public availability of environmental data, management plans and reports.
1087:M5.2	**Public Availability of Data**	If any data referred to in condition 5-1 contains particulars of:	Proponent request to CEO to not make	Notice in writing to CEO notifying of any	Overall	As required from time to time.	NOT REQUIRED	No requests were made by BHP Nickel West to the CEO DWER to not make environmental data publicly available during the reporting period.

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
		(1) a secret formula or process; or (2) confidential commercially sensitive information; the proponent may submit a request for approval from the CEO to not make these data publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publicly available.	certain data publicly available, including explanation and reason why.	information not to be made publicly available.				Consistent with standard practices, BHP Nickel West will seek to ensure public availability of all environmental data which relates to the implementation of, and compliance with, the Statement 1087 approval.
1087:M6.1	**Flora and Vegetation Management Plan**	The proponent shall implement the proposal to meet the following environmental objective: (1) Avoid, where possible, and minimise indirect impacts as far as practicable to Priority flora, the Violet Range PEC and the Wanjarri Nature Reserve.	Implement the proposal in accordance with the Flora and Vegetation Environmental Management Plan (FVEMP).	MKS FVEMP. Compliance Assessment Reports.	Overall	The first report to be submitted by 28 March 2020 and from then on annual by 28 March each year.	COMPLIANT	BHP Nickel West has implemented the Project to avoid and minimise, where possible, indirect effects to DBCA-classified 'priority' flora taxa, the Violet Range 'priority' ecological community and the adjacent 'Class A' Wanjarri Nature Reserve. The avoidance / minimisation measures have been implemented through the Flora and Vegetation EMP (BHP Nickel West 2019b) (as described below under Condition 6-3).
1087:M6.2	**Flora and Vegetation Management Plan**	In order to meet the requirements of condition 6-1, the proponent shall implement the Flora and Vegetation Environmental Management Plan (Version 0, September 2018).	Implement the proposal in accordance with the FVEMP.	MKS FVEMP Compliance Assessment Reports.	Overall	Throughout the life of the Project. Annual compliance assessment reporting commencing 28 March 2020.	NOT REQUIRED	The Flora and Vegetation EMP dated December 2019 (Revision 0.2) was prepared in accordance with Condition 6-3 (below). Accordingly, implementation of the previous revision of the Flora and Vegetation EMP under Condition 6-2 is no longer required, with implementation of the revised/approved Flora and Vegetation EMP to be regulated in accordance with Condition 6-3 (as addressed below).
1087:M6.3	**Flora and Vegetation Management Plan**	The proponent shall implement the most recent version of the Flora and Vegetation Environmental Management Plan which the CEO has confirmed by notice in writing, addresses the requirements of condition 6-1, on advice of the Department of Biodiversity, Conservation and Attractions.	Implement the current and most recent version of the FVEMP.	Written notice from CEO confirming the FVEMP addresses condition 6-1, on advice from DBCA. Compliance Assessment Reports	Overall	Throughout the life of the Project. Annual compliance assessment reporting commencing 28 March 2020.	COMPLIANT	The current revision of the Flora and Vegetation EMP (BHP Nickel West 2019b, Revision 0.2) was approved by the DWER CEO in February 2021 (DWER 2021). Consistent with the approved Flora and Vegetation EMP, the environmental management actions implemented to minimise the direct and potential indirect effects of the Project to flora and vegetation values has included: • Implementation of the Environmental Heritage Impact Assessment process (internal process) prior to land disturbance (control of direct effects). • Environmental monitoring within pre-defined quadrats for: o DBCA-classified 'priority' native flora taxa (tagged individuals); o vegetation communities; and o introduced flora taxa (weeds) at defined monitoring sites located in close proximity to Project and distant from the Project (control sites). • Hygiene inspections of equipment and vehicles to minimise the risk of introduction of introduced flora taxa (weeds), with targeted spray control for any identified infestations. The key environmental outcomes from the implementation of the management actions in the Flora and Vegetation EMP has notably included: • All clearing of native vegetation for the Project has occurred within the authorised Development Envelope (spatial area), and within the total authorised clearing limit (area in hectares); • Maintenance of plant health condition of tagged DBCA-classified 'priority' flora taxa adjacent to the Project (compared to control sites); • No measurable effect to vegetation condition in proximity to the Project (including for the Violet Range 'priority' ecological community and the adjacent 'Class A' Wanjarri Nature Reserve), with no measured exceedance of trigger criteria or threshold criteria; and

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
								• No recorded new infestations of introduced flora taxa, and no exceedance of trigger criteria or threshold criteria for the extent of weed occurrence. The results of the environmental monitoring which demonstrate the above key outcomes are outlined within the following consultant reports: • Stantec Australia Pty Ltd (2022) *Mt Keith Satellite 2021 Flora and Vegetation Monitoring Report*. Report prepared by Duncan L of Stantec Australia Pty Ltd for BHP Billiton Nickel West Pty Ltd. March 2022. • Astron Environmental Services Pty Ltd (2022) *Mt Keith Vegetation Remote Sensing Analysis March 2022.* Report presented by Delfos J (Dr.) of Astron Environmental Services Pty Ltd for BHP Billiton Nickel West Pty Ltd. March 2022. A copy of the environmental monitoring reports by Stantec (2022) and Astron 2022) are provided in Appendix 3 and Appendix 4, respectively. The Astron (2022) remote sensing analysis identified that the most significant changes related to vegetation for the 2017 to 2021 period, as well as the 2020 to 2021 period, for the project area were due to clearing associated with the extension of the mine or establishment of roads or other infrastructure. Notably, positive change was evident in case of vegetation along creek lines in some areas. There was some correlation with annual rainfall seeing increases in vegetation condition and cover from 2020 to 2021 reflect the higher annual rainfall in 2021 compared to 2020. The Stantec (2022) monitoring report outlines a general decline in flora and vegetation health condition at both 'impact' and 'control' monitoring sites reflecting below average rainfall in 2019,2020 and the second half of 2021. Generally, the health rating of the four 'priority' flora species experienced a slight increase in March 2021, followed by a slight decrease in October 2021 primarily due to favorable few months of rainfall prior to March and lower rainfall prior to October assessments. Review of meteorological data for the local area indicated that annual rainfall in 2021 (210 mm) was similar to the long-term average (228 mm) from 1890 to 2021, but well above the annual rainfall recorded in 2020 (144 mm). To note, the environmental monitoring completed during 2019 and 2020 for DBCA-classified 'priority' flora taxa has occurred at a quarterly frequency (first 2 years of Project operations in spring, summer, autumn and winter). As outlined within the approved Flora and Vegetation EMP Revision 0.2 (BHP Nickel West 2019b), future environmental monitoring DBCA-classified 'priority' flora taxa will be undertaken bi-annually (spring and autumn). The environmental monitoring for vegetation condition will remain unchanged, with monitoring to continue at an annual frequency (spring).
1087:M6.4	**Flora and Vegetation Management Plan**	The proponent shall continue to implement the Flora and Vegetation Environmental Management Plan (Version 0, September 2018), or any subsequent revisions as approved by the CEO in condition 6-3, until the CEO has confirmed by notice in writing that the plan meets the objective specified in condition 6-1.	Implement the current and most recent version of the FVEMP.	Compliance Assessment Reports. Written notice from CEO confirming that the objective specified in condition 6-1 has been met.	Overall	Throughout the life of the Project until CEO confirms in writing that the objective specified in condition 6-1 has been met. Annual compliance assessment reporting	COMPLIANT	The Flora and Vegetation EMP (BHP Nickel West 2019b, Revision 0.2) continues to be implemented for the Project as described above under Condition 6-3.

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
						commencing 28 March 2020.		
1087:M7.1	**Aboriginal Heritage**	Prior to the commencement of ground-disturbing activities, the proponent shall consult with the Tjiwarl Native Title Claim Group and ensure that the proponent has complied with its obligations under the *Aboriginal Heritage Act 1972*.	Consult with the Tjiwarl Native Title Claim Group and comply with obligations under the *Aboriginal Heritage Act 1972*.	Compliance Assessment Report.	Pre-construction	Prior to commencement of ground-disturbing activities.	COMPLETED	As described within the first CAR document (BHP Nickel West 2020b), consultation with the Tjiwarl Native Title Claim Group and BHP Nickel West occurred prior to the commencement of ground disturbing activities for the Project, with a summary of this consultation supplied to the DWER CEO to verify compliance with Condition 7-1. The requirements of Condition 7-1 for consultation prior to the commencement of ground disturbing activities has been completed. To note, ongoing consultation with the Tjiwarl Native Title Claim Group and BHP Nickel West will continue to occur during operation of the Project in accordance with the cultural agreement between the parties. Further reporting under Condition 7-1 of the Statement 1087 for consultation with the Tjiwarl Native Title Claim Group during ongoing operations is not proposed (as Condition 7-1 relates only to pre-construction consultation). BHP Nickel West obtained Consent approval under Section 18 of the *Aboriginal Heritage Act 1972* (WA) prior to the commencement of commencement of ground disturbing activities for the Project which may affect sites or objects of Aboriginal heritage value (WA Minister for Aboriginal Affairs 2019). The requirements of Condition 7-1 for compliance with obligations under the *Aboriginal Heritage Act 1972* (WA) prior to the commencement of ground disturbing activities has been completed. To note, ongoing compliance with the *Aboriginal Heritage Act 1972* (WA) will continue to occur during operation of the Project in accordance with the granted Section 18 Consent approval. BHP has confirmed to the Tjiwarl Native Title Claim Group that, consistent with its normal processes, BHP will only act on this existing section 18 approval following extensive consultation. Further reporting under Condition 7-1 of the Statement 1087 for compliance with the *Aboriginal Heritage Act 1972* (WA) and the conditions of the Section 18 Consent is not proposed (as Condition 7-1 is only applicable for pre-construction), with ongoing compliance to be reported through the State Department of Planning, Lands and Heritage.
1087:M8.1	**Greenhouse Gas Reporting**	The proponent shall publicly report the greenhouse gas emissions from the proposal on an annual basis, in a manner approved by the CEO.	To be determined in consultation with CEO.	Written notice form CEO approving manner of reporting.	Overall	Throughout the life of the Project. Annual reporting in accordance with the National Greenhouse and Energy Reporting Scheme (NGERS).	COMPLIANT	As identified in the first CAR document, BHP Nickel West reports greenhouse gas emissions through the NGERS, with the first report on greenhouse gas emissions from the Project submitted during 2020, and a further report in 2021. The NGERS provides a national framework for all large companies to report emissions data, with the NGERS website providing the repository for all emissions data across Australia. As acknowledged by the DWER (2020a) Compliance Audit, emissions data from the Project will continue to be publicly reported through the NGER framework as the manner approved by the DWER CEO (in lieu of reporting through an annual CAR document).



- Development Envelope (1,265 ha)
- Borefield
- Building (other than workshop) or camp site
- Dam saline water or process liquor
- Exploration disturbance
- not otherwise described in this Table
- Laydown or hardstand area
- Mining void
- Run-of-mine pad
- Topsoil stockpile
- Transport or service infrastructure corridor
- Waste dump or overburden stockpile (class 1)

BHP

BHP NiW - Northern Operations
Nickel West

Mt Keith Satellite Project - Native Vegetation Clearing (to 31 December 2021)

0 0.35 0.7 1.05 1.4
Kilometres

Coordinate System: GDA 1994 MGA Zone 51Transverse Mercator

Scale @ A4:	1:35,000	Prepared: TJ Richards	Figure:
Date:	29/03/2022		

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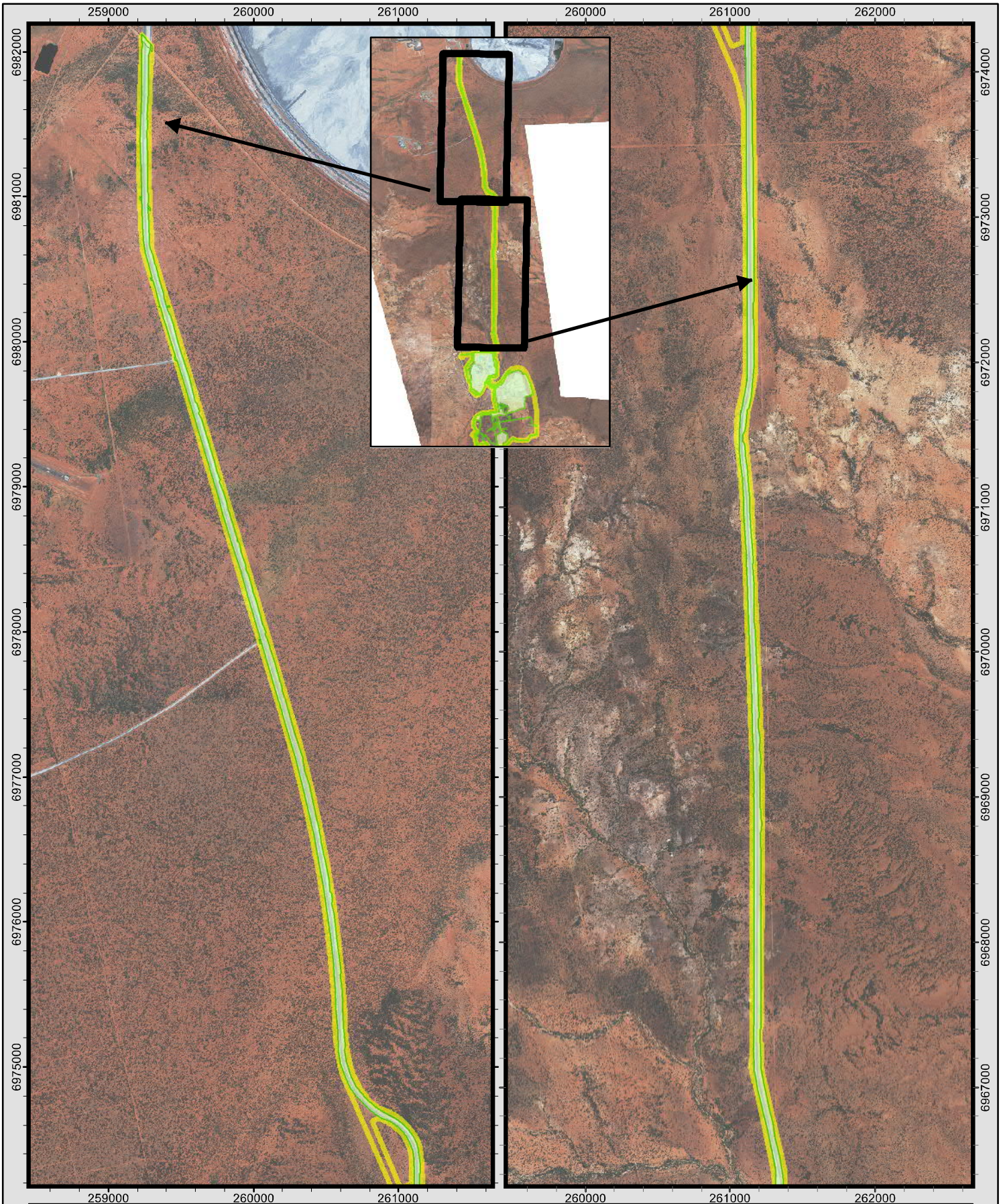
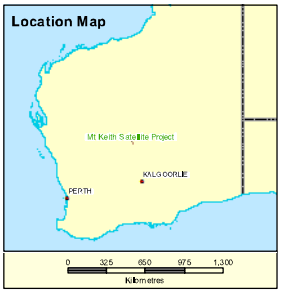


Development Envelope (1,265 ha)
Native Vegetation Clearing (805.3 ha)



BHP

BHP NiW - Northern Operations
Nickel West

Mt Keith Satellite Project - Native Vegetation Clearing (to 31 December 2021)

0 0.35 0.7 1.05 1.4
Kilometres
Coordinate System: GDA 1994 MGA Zone 51Transverse Mercator

Scale @ A4: 1:35,000	Prepared: P. Gant	Figure:
Date: 29/03/2022		

Document Path: Y:\Jobs\A501_A1000\A9861\Project\A986_029_MKS_Clearing_Calcs_Figure2_RevC.mxd

5. Proposed Changes to the Compliance Assessment Plan

BHP Nickel West has reviewed the approved CAP document (BHP Nickel West 2020a) and proposes the following changes to the CAP document:

- In the 2020 CAR it was proposed that future CAR documents will cover a financial year period 1 July to 30 June annually, with submission by 30 October. The purpose of this proposed change is to better align the compliance reporting timeframes with other standard Government reporting requirements for BHP Nickel West, as well as to provide a sufficient time (4 months) for both the receipt of input external reports (e.g. consultant flora and vegetation monitoring reports) and the drafting of the CAR documentation by BHP Nickel West personnel.
- Subject to agreement on the above change, the next CAR document would then be due 30 October 2022 covering the period 1 January 2021 to 30 June 2021 (6 month period), before then moving to reporting on the full financial year (12 month period) in subsequent reports.
- BHP Nickel West respectfully awaits advice from DWER CEO in this regard
- The CAP document in Section 2.6 identifies that annual CAR documents will include monitoring data collected to support the Hydrological Processes EMP (BHP Nickel West 2018b). In the 2020 CAR BHP Nickel West proposed that as the Hydrological Processes EMP is not regulated by the conditions of the Ministerial Statement 1087, the CAP document is amended to remove reference to reporting such data within future annual CAR documents. Whilst noting this requested change, it should be noted that groundwater abstraction data will continue to be reported to DWER CEO in accordance with Condition 1-1 of the Statement 1087 approval (as provided in this CAR document).
- BHP Nickel West respectfully awaits advice from DWER CEO in this regard.
- The CAP document in Section 2.6 identifies that annual CAR documents will include monitoring data collected to support the Mine Closure Plan (BHP Nickel West 2019c). In the 2020 CAR BHP Nickel West proposed that as the Mine Closure Plan is not regulated by the conditions of the Ministerial Statement 1087, the CAP document is amended to remove reference to reporting such data within future annual CAR documents. The Mine Closure Plan is regulated by DMIRS under the Mining Act 1978 (WA), with BHP Nickel West continuing to report on the monitoring data for the Mine Closure Plan through that process.

BHP Nickel West respectfully requests written notice from the DWER CEO that the above changes to the CAP document are acceptable. Following confirmation from the DWER CEO that the proposed changes are acceptable, BHP Nickel West will submit a revised CAP document (incorporating the above changes) to the DWER CEO for approval in accordance with Condition 4-1.

6. References

Astron Environmental Services Pty Ltd (2022) *Mt Keith Remote Sensing Analysis.* Report prepared by Fisk C (Dr.) of Astron Environmental Services Pty Ltd for BHP Billiton Nickel West Pty Ltd. March 2021.

BHP Billiton Nickel West Pty Ltd (2017) *Mt Keith Satellite Project*. Form for the referral of a proposal to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986. May 2017.

BHP Billiton Nickel West Pty Ltd (2018a) *Mt Keith Satellite Project Environmental Review*. Revision D. July 2018.

BHP Billiton Nickel West Pty Ltd (2018b) *Hydrological Processes Environmental Management Plan – Mt Keith Satellite Project*. Revision A. April 2018.

BHP Billiton Nickel West Pty Ltd (2019a) *Nickel West Mt Keith Satellite Project – Compliance Assessment Plan*. Version 1. September 2019.

BHP Billiton Nickel West Pty Ltd (2019b) *Flora and Vegetation Environmental Management Plan – Mt Keith Satellite Project*. Version 0.2. December 2019.

BHP Billiton Nickel West Pty Ltd (2019c) *Mt Keith Satellite Mine Closure Plan*. December 2019.

BHP Billiton Nickel West Pty Ltd (2020a) *Nickel West Mt Keith Satellite Project – Compliance Assessment Plan*. Version 2. October 2020.

BHP Billiton Nickel West Pty Ltd (2020b) *BHP Nickel West Mt Keith Satellite Project – Compliance Assessment Report*. March 2020.

BHP Billiton Nickel West Pty Ltd (2020b) *BHP Nickel West Mt Keith Satellite Project – Compliance Assessment Report*. March 2021.

Department of Water and Environmental Regulation (2018) Post Assessment Form 2 – Statement of Compliance.

Department of Water and Environmental Regulation (2020a) *Statement 1087 - Mt Keith Satellite Project*. Compliance audit of the Statement 1087 approval for the Mt Keith Satellite Project prepared by Da Silva K of the Department of Water and Environmental Regulation. May 2020.

Department of Water and Environmental Regulation (2020b) *Ministerial Statement 1087 – Proposal – Compliance Assessment Plan Approval*. Letter of the Department of Water and Environmental Regulation to BHP Billiton Nickel West Pty Ltd approving a revised Compliance Assessment Plan (Revision 2) under Condition 4-1 of the Statement 1087 approval. October 2020.

Department of Water and Environmental Regulation (2021) *Mt Keith Satellite Project – Ministerial Statement 1087 – Flora and Vegetation Management Plan - Approved.* Letter of the Department of Water and Environmental Regulation to BHP Billiton Nickel West Pty Ltd approving a revised Flora and Vegetation Environmental Management Plan (Revision 0.2) under Condition 6 of the Statement 1087 approval. February 2021.

Environmental Protection Authority (2017) *Decisions Pursuant to s.39(1) under the Environmental Protection Act 1986 - Mt Keith Satellite Project.* Assessment decision of the Environmental Protection Authority on the Mt Keith Satellite Project Referral. July 2017.

Environmental Protection Authority (2018) *Mt Keith Satellite Project.* Report and recommendations of the Environmental Protection Authority to the Western Australian Minister for Environment under Section 44 of the Environmental Protection Act 1986 (WA). Report 1625. November 2018.

Stantec Australia Pty Ltd (2022) *Mt Keith Satellite 2021 Flora and Vegetation Monitoring Report*. Report prepared by Duncan L of Stantec Australia Pty Ltd for BHP Billiton Nickel West Pty Ltd. March 2021.

Western Australian Minister for Aboriginal Affairs (2019) *Aboriginal Heritage Act 1972 Consent Pursuant to Section 18(3)*. Consent approval granted to BHP Billiton Nickel West Pty Ltd by the Western Australian Minister for Aboriginal Affairs for the Mt Keith Satellite Project. January 2019.

Western Australian Minister for Environment (2018) *Mt Keith Satellite Project*. Statement 1087 approval granted to BHP Billiton Nickel West Pty Ltd by the Western Australian Minister for Environment under s45(5) of the Environmental Protection Act 1986 (WA). December 2018.

Appendix 1 – Statement of Compliance

Statement of Compliance

1. Proposal and Proponent Details

Proposal Title	*Mt Keith Satellite Project*
Statement Number	*1087*
Proponent Name	*BHP Billiton Nickel West Pty Ltd*
Proponent's Australian Company Number *(where relevant)*	ACN 004 184 598

2. Statement of Compliance Details

Reporting Period	*1/01/21* to *31/12/21*

Implementation phase(s) during reporting period (please tick ✓ relevant phase(s))							
Pre-construction		Construction	✓	Operation		Decommissioning	

Audit Table for Statement addressed in this Statement of Compliance is provided at Attachment:	Table 1
An audit table for the Statement addressed in this Statement of Compliance must be provided as Attachment 2 to this Statement of Compliance. The audit table must be prepared and maintained in accordance with the Department of Water and Environmental Regulation (DWER) *Post Assessment Guideline for Preparing an Audit Table*, as amended from time to time. The 'Status Column' of the audit table must accurately describe the compliance status of each implementation condition and/or procedure for the reporting period of this Statement of Compliance. The terms that may be used by the proponent in the 'Status Column' of the audit table are limited to the Compliance Status Terms listed and defined in Table 1 of Attachment 1.	

Were all implementation conditions and/or procedures of the Statement complied with within the reporting period? (please tick ✓ the appropriate box)			
No (please proceed to Section 3)		Yes (please proceed to Section 4)	✓

3. Details of Non-compliance(s) and/or Potential Non-compliance(s)

The information required Section 3 must be provided for each non-compliance or potential non-compliance identified during the reporting period covered by this Statement of Compliance.

Non-compliance/potential non-compliance 3-1

Which implementation condition or procedure was non-compliant or potentially non-compliant?
Was the implementation condition or procedure non-compliant or potentially non-compliant?
On what date(s) did the non-compliance or potential non-compliance occur (if applicable)?

Was this non-compliance or potential non-compliance reported to the Chief Executive Officer, DWER?	
☐ Yes ☐ Reported to DWER verbally Date _____ ☐ Reported to DWER in writing Date _____	☐ No

What are the details of the non-compliance or potential non-compliance and where relevant, the extent of and impacts associated with the non-compliance or potential non-compliance?
What is the precise location where the non-compliance or potential non-compliance occurred (if applicable)? (please provide this information as a map or GIS co-ordinates)
What was the cause(s) of the non-compliance or potential non-compliance?
What remedial and/or corrective action(s), if any, were taken or are proposed to be taken in response to the non-compliance or potential non-compliance?
What measures, if any, were in place to prevent the non-compliance or potential non-compliance before it occurred? What, if any, amendments have been made to those measures to prevent re-occurrence?
Please provide information/documentation collected and recorded in relation to this implementation condition or procedure: • in the reporting period addressed in this Statement of Compliance; and • as outlined in the approved Compliance Assessment Plan for the Statement addressed in this Statement of Compliance. (the above information may be provided as an attachment to this Statement of Compliance)

For additional non-compliance or potential non-compliance, please duplicate this page as required.

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.
INITIALS: MM

4. Proponent Declaration

I, ...Michael Moscarda, A/General Manager Northern Operations.,

declare that I am authorised on behalf of BHP Billiton Nickel West Pty to submit this form and that the information contained in this form is true and not misleading.

Signature:..... Date: 30/03/22

Please note that:

- it is an offence under section 112 of the *Environmental Protection Act 1986* for a person to give or cause to be given information that to his knowledge is false or misleading in a material particular; and
- the Chief Executive Officer of the DWER has powers under section 47(2) of the *Environmental Protection Act 1986* to require reports and information about implementation of the proposal to which the statement relates and compliance with the implementation conditions.

5. Submission of Statement of Compliance

One hard copy and one electronic copy (preferably PDF on CD or thumb drive) of the Statement of Compliance are required to be submitted to the Chief Executive Officer, DWER, marked to the attention of Manager, Compliance (Ministerial Statements).

Please note, the DWER has adopted a procedure of providing written acknowledgment of receipt of all Statements of Compliance submitted by the proponent, however, the DWER does not approve Statements of Compliance.

6. Contact Information

Queries regarding Statements of Compliance, or other issues of compliance relevant to a Statement may be directed to Compliance (Ministerial Statements), DWER:

Manager, Compliance (Ministerial Statements)

Department of Water and Environmental Regulation

Postal Address:	Locked Bag 10 Joondalup DC WA 6919
Phone:	(08) 6364 7000
Email:	compliance@dwer.wa.gov.au

7. Post Assessment Guidelines and Forms

Post assessment documents can be found at www.epa.wa.gov.au

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.
INITIALS: MM

ATTACHMENT 1

Table 1 Compliance Status Terms

Compliance Status Terms	Abbrev	Definition	Notes
Compliant	C	Implementation of the proposal has been carried out in accordance with the requirements of the audit element.	This term applies to audit elements with: • ongoing requirements that have been met during the reporting period; and • requirements with a finite period of application that have been met during the reporting period, but whose status has not yet been classified as 'completed'.
Completed	CLD	A requirement with a finite period of application has been satisfactorily completed.	This term may only be used where: • audit elements have a finite period of application (e.g. construction activities, development of a document); • the action has been satisfactorily completed; and • the DWER has provided written acceptance of 'completed' status for the audit element.
Not required at this stage	NR	The requirements of the audit element were not triggered during the reporting period.	This should be consistent with the 'Phase' column of the audit table.
Potentially Non-compliant	PNC	Possible or likely failure to meet the requirements of the audit element.	This term may apply where during the reporting period the proponent has identified a potential non-compliance and has not yet finalized its investigations to determine whether non-compliance has occurred.
Non-compliant	NC	Implementation of the proposal has not been carried out in accordance with the requirements of the audit element.	This term applies where the requirements of the audit element are not "complete" have not been met during the reporting period.
In Process	IP	Where an audit element requires a management or monitoring plan be submitted to the DWER or another government agency for approval, that submission has been made and no further information or changes have been requested by the DWER or the other government agency and assessment by the DWER or other government agency for approval is still pending.	**The term 'In Process' may not be used for any purpose other than that stated in the Definition Column.** The term 'In Process' may not be used to describe the compliance status of an implementation condition and/or procedure that requires implementation throughout the life of the project (e.g. implementation of a management plan).

Appendix 2 – MKS Water Meter Readings - Abstraction

ID	METER DESCRIPTION	JAN-21	FEB-21	MAR-21	APR-21	MAY-21	JUN-21	JUL-21	AUG-21	SEP-21	OCT-21	NOV-21	DEC-21	ANNUAL TOTAL*
MKS1	MKS MINE - In pit dewatering	0	0	0	0	0	0	0	0	0	0	8100	7516	15,616
MKS2	MKS MINE - Ex pit bore	1546	0	0	341	0	1735	0	3701	1867	1128	750	2295	13,363
MKS3	MKS MINE - SMW Shaft	3184	3184	3184	3184	3184	3184	0	0	0	0	450	7858	27,412
MKS4	MKS MINE - QUBE Standpipe	0	0	0	0	0	0	312	74	459	69	5460	8650	15,025
MKS5	MKS MINE - Turkeys Standpipe	0	0	0	0	0	0	256	355	416	137	70581	63012	134,757
	MONTHLY TOTAL	4,730	3,184	3,184	3,525	3,184	4,919	568	4,130	2,742	1,334	85,341	89,330	206,173

*Volumes in kilolitres (kL)

Appendix 3 – Stantec (2022) Mt Keith Satellite 2021 Flora and Vegetation Monitoring Report

MT KEITH SATELLITE 2021 FLORA AND VEGETATION MONITORING REPORT

PREPARED FOR BHP NICKEL WEST | March 2022

Quality statement

Project manager	Project technical lead
Stephanie Kemp	Natasha Banning

PREPARED BY		
Steve Martin	.....	15 / 02 / 2022
CHECKED BY		
Laurren Duncan	.....	25 / 02 / 2022
REVIEWED BY		
Beiha Yanez	.....	03 / 03 / 2022
APPROVED FOR ISSUE BY		
Beiha Yanez	.....	03 / 09 / 2022

Ground Floor, 226 Adelaide Terrace, PERTH, WA 6000
TEL +61 (08) 6222 7000
STATUS Final | Project No 300003369

Executive summary

Stantec Australia Pty Ltd (Stantec) was commissioned in 2021 by BHP Nickel West to undertake flora and vegetation monitoring at the Mt Keith Satellite Project (MKS project) to meet the requirements of the *Flora and Vegetation Environmental Management Plan – Mt Keith Satellite Project* (FVEMP), approved under Ministerial Statement (MS) 1087. The flora and vegetation monitoring program consists of Priority Flora health monitoring and vegetation condition monitoring. This report details the findings of annual vegetation condition monitoring program conducted in October 2021, and a summary of the biannual Priority Flora assessments undertaken in March and October 2021.

With the development of the MKS project, there were potential indirect impacts associated with the construction of the haul road and other mine infrastructure. Those impacts include habitat fragmentation, alteration of surface water flows, and the spread of weeds. As part of the FVEMP, 37 vegetation quadrats were monitored: 25 'impact' quadrats within or adjacent to the MKS development envelope and 12 'control' quadrats in areas considered unaffected by MKS operations. Additionally, the health of four Priority Flora species were monitored bi-annually across 11 sites. Six of those sites were adjacent to mine infrastructure or the haul road and were assigned as 'impact' sites. Five Priority Flora sites outside of the impact area were assigned as 'control' sites.

In general, plant health across most of the Priority Flora taxa impact sites assessed at MKS in 2021 did not change considerably from the previous assessment with little change in the combined percentage of reproductive and vegetative plants at each site between years. The only impact site with a notable change in overall plant health was the *Hibbertia* sp. Sherwood Breakaways east impact site which had a general decrease in plant health ratings since 2020. In comparison, the general plant health of both *Hibbertia* sp. Sherwood Breakaways control sites increased between 2020 and 2021. This indicates that the decline in plant health at the *Hibbertia* sp. Sherwood Breakaways east impact site was beyond the variation in plant health observed at the control sites and may be due to more than just environmental factors such as climate. The remaining Priority Flora control sites also either increased or remained similar to the previous assessment.

During 2021 there were variations in plant health ratings between March and October, in response to above average rainfall prior to the March assessment followed by below average rainfall prior to the October assessment. In addition, flowering times generally coincided with at least one of the two assessments in 2021 resulting in an increase in the percentage of reproductive plants at certain sites such as *Verticordia jamiesonii*. Although as previously noted the presence of reproductive features does not reflect improvements within the population's health, rather its maturity and evidence of reproduction. Recent plant deaths were recorded across most of the impact and control sites of each taxa. The most deaths between 2020 and 2021 were recorded at the *Hibbertia* sp. Sherwood Breakaways impact sites (a total of seven plants) whereas the respective control sites recorded no recent plant deaths. Conversely, the control site of *Hybanthus floribundus* subsp. *chloroxanthus* recorded a higher number of recent plant deaths between assessments compared to the corresponding impact sites.

Relative to each of the respective control sites, the impact sites of *Hibbertia* sp. Sherwood Breakaways and *Verticordia jamiesonii* had lower overall health ratings while the *Hybanthus floribundus* subsp. *chloroxanthus* impact sites had higher overall health ratings. However, the control site of *Hybanthus floribundus* subsp. *chloroxanthus* is considered to be too close to MKS operations to be an appropriate comparison to the impact sites. While the *Eremophila* sp. long pedicels sites are both control sites without a corresponding impact site, overall plant health at the western control site was higher than the northern control site.

Vegetation condition ratings ranged from 'degraded' to 'excellent' across the impact and control quadrats in 2021 with no change in vegetation condition ratings across most of the impact and control quadrats between 2020 and 2021. Decreases in vegetation condition ratings were recorded at one infrastructure impact quadrat, one haul road impact quadrat and one control quadrat, all of which were due to deaths of lower story plants impacting overall vegetation structure. Meanwhile, vegetation condition ratings increased at two haul road impact quadrats and one infrastructure impact quadrat, likely associated with the increases in plant cover and health observed since the previous assessment.
When considering the number of quadrats in each disturbance category the extent of those changes were comparable across the impact and control sites. The control quadrats had the highest proportion of quadrats in 'very good' and 'excellent' condition compared to the impact quadrats located adjacent to the haul road and mine infrastructure. This proportion was due in part to the reallocation of some of the vegetation quadrats disturbance categories (impact or control). The reallocation provided a more accurate comparison of vegetation condition between the impact and control quadrats compared to the last assessment. Similar to 2020, the mine infrastructure impact quadrats had the lowest proportion of quadrats in 'very good' to 'excellent' condition relative to the impact quadrats adjacent to the haul road and the control quadrats.

Plant health ratings for each dominant species recorded at the impact and control quadrats in 2021 were generally similar to previous values with both the haul road and infrastructure impact quadrats having a higher proportion of dominant species considered 'reproductive' or 'vegetative' compared to the control quadrats. The control quadrats also had a higher number of plant deaths, with four of the nine recorded between assessments. Three of the remaining plant deaths were at the haul road impact quadrats and two were at the infrastructure impact quadrats. Overall, the highest plant cover values and health ratings were assigned to tree species and the smaller shrub and herb species were generally classified as 'declining' likely due to specific plant vulnerabilities to dry conditions or nearby disturbance.

Extended dry seasonal conditions and dust deposition may have impacted vegetation condition ratings and contributed to the declines in Priority Flora health observed in 2021. The months of February and March did provide some relief, but not enough to overcome the below average rainfall recorded in 2019, 2020 and the second half of 2021. Dust deposition on the vegetation could be exacerbating water stress. Possible alterations to surface water flow from the MKS project could also alter water availability, however soil surface hydrology around the MKS project is unable to be inferred from the collected monitoring data.

Sightings of weed species were recorded at two Priority Flora control sites in July 2020 but they were not observed in subsequent assessments. No weeds were recorded across the quadrats assessed 2021.

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1 Introduction

The Mt Keith Satellite (MKS) project is located in the north-eastern Goldfields region of Western Australia, within the Yakabindie and Mt Keith pastoral leases. The MKS operation is approximately 52 kilometres (km) northwest of Leinster, 15 km south of the existing Mt Keith Nickel Operation and immediately west of the Wanjarri Nature Reserve (WNR). Additionally, it resides within the Violet Range Priority Ecological Community (PEC) with Priority Flora populations adjacent to mine infrastructure. The MKS project was approved under Ministerial Statement (MS) 1087 and requires the implementation of the approved Flora and Vegetation Environmental Management Plan (FVEMP).

The initial disturbance began in February 2019 with vegetation clearing and construction works followed by the commencement of mining operations in April 2019. With the development of the MKS project, potential indirect impacts on WNR, Violet Range PEC and Priority Flora were identified in previous baseline studies primarily attributed to the clearing of native vegetation associated with the construction of mine landforms (pits and waste rock dumps) and the transport corridor (haul road) (BHP Nickel West 2019). These include habitat fragmentation, the introduction or spread of weeds, altered fire regimes, altered surface water flows and dust deposition (BHP Nickel West 2019). Outside of MKS operations, grazing can occur due to the nearby pastoral stations and dry seasonal conditions have a considerable impact on vegetation health as most of the flora in this bioregion is reliant on sporadic rainfall and short-term moisture availability.

In order to assess potential impacts from the development of the MKS operation on the Violet Range PEC and WNR, 37 vegetation quadrats were established and monitored in December 2018, prior to any operation disturbance. Of the vegetation quadrats, 25 are classified as 'impact' quadrats and 12 as 'control' quadrats (that were outside of the impact area).

Out of the 14 priority-listed taxa recorded within the MKS project area, four were selected as indicator species of concern for monitoring due to their proximity to the MKS haul road or other mine features (BHP Nickel West 2019):

- *Eremophila* sp. long pedicels (G. Cockerton 1975) (P2);
- *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2);
- *Hybanthus floribundus* subsp. *chloroxanthus* (P3); and
- *Verticordia jamiesonii* (P3).

Both impact and control sites were monitored for Priority Flora.

From December 2018 to March 2020, Western Botanical monitored vegetation condition and Priority Flora health quarterly. Stantec Australia Pty Ltd (Stantec) completed the quarterly Priority Flora health assessments in July, September and December 2020, and the annual vegetation condition monitoring in September 2020, as per the FVEMP.

In 2021, the timing of the priority flora health assessments was changed to bi-annual (Autumn and Spring) with the vegetation condition monitoring remaining annually (Spring).

Specifically, the objectives of the 2021 flora and vegetation monitoring program were to:

- undertake field monitoring of 37 vegetation quadrats and 11 Priority Flora sites according to the FVEMP (and the previous methodology of Western Botanical);
- compare vegetation condition over time between impact and control quadrat sites assessed in October 2021;
- compare plant health between impact and control Priority Flora sites since December 2018; and
- identify factors (if any) affecting vegetation condition and Priority Flora health, including impacts from mining related disturbances.

This report details the findings of the annual vegetation condition monitoring program as well as a summary of the biennial Priority Flora assessments conducted by Stantec in 2021. Any assessments prior to July 2020 were reported on by Western Botanical but the data has been presented in this report for comparison.

2 Climate and environment

The MKS project is located within the Eastern Murchison sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA version 7) (Department of Agriculture, Water and the Environment 2012). This subregion consists of extensive areas of elevated red/red-brown desert sandplains with minimal dune development, breakaway complexes, internal drainage and saline lake systems (Cowan 2001). The vegetation surrounding the MKS development envelope is primarily comprised of stony, mulga shrublands (*Acacia aneura* complex) in association with various understorey genera, including *Senna, Eremophila,* and *Maireana* (BHP Nickel West 2019).

The climate is characterised as semi-desert to arid with hot, dry summers and cool, mild winters. The closest Bureau of Meteorology (BOM) weather station is Leinster Aero (station number 12314), located approximately 47 km away from the MKS project area. Leinster Aero has an average annual rainfall of 253 millimetres (mm) between 1994 and 2021 (BOM 2021). Generally, more rainfall is received in summer and early autumn, mainly linked to local thunderstorms or the influence of tropical cyclones to the north (Beard 1990, Pringle et al. 1994).

Since the flora and vegetation monitoring program was established in December 2018, rainfall has generally been below average. In the 12 months prior to the October 2021 monitoring, only 168 mm of rainfall was recorded at the weather station, but above average rainfall was recorded during February, March and May of 2021. This contributed to the higher rainfall total received 12 months prior to the 2021 assessment relative to the 107 mm received 12 months prior to the 2020 assessment. It is assumed that the monthly rainfall volume recorded at the Leinster Aero weather station reflects the average rainfall received at the Priority Flora monitoring sites and the vegetation condition quadrats (**Figure 2-1**).

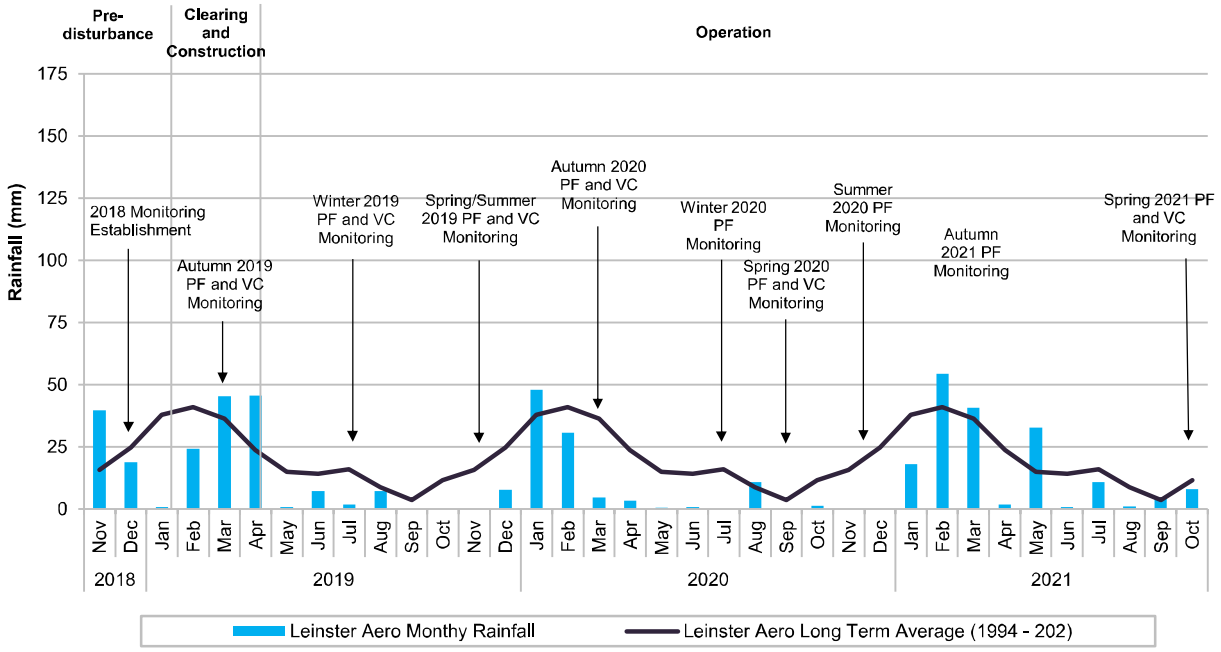

Figure 2-1 Monthly rainfall recorded at Leinster Aero weather station (station number 012314) from November 2018 to October 2021

3 Monitoring methods

3.1 Stantec personnel

In 2021, the monitoring has been undertaken by Stantec environmental scientists, Laurren Duncan (March and October), Ben McMillan (March) and Steve Martin (October) (**Table 3-1**). All field staff have previously conducted Priority Flora and vegetation condition assessments as well as rehabilitation monitoring across multiple sites in the Goldfields region. These include the Mt Keith Nickel Mine, Kambalda Nickel Concentrator plant, Leinster Nickel Mine and Sunrise Dam Gold Mine.

Table 3-1 Stantec project staff experience

Stantec Staff	Qualifications	Flora License	Professional Experience
Laurren Duncan	BSc (Environmental Science and Natural Resource Management)	FB62000014-2	3 years
Ben McMillan	BSc. (Environmental Biology), BSc. (Hons)	FB62000058-2	7 years
Steve Martin	Bsc. (Conservation and Wildlife Biology)	FB62000345	5 years

3.2 Priority Flora monitoring

3.2.1 Methodology

All revisions to the Priority Flora and vegetation condition assessment methodology or monitoring design made in 2020 are detailed in Stantec (2021). The remaining limitations associated with the monitoring design or methodology are detailed in **Appendix A .**

Four indicator Priority Flora species of concern are monitored due to their proximity to either the haul road or mine landforms and therefore risk of indirect impacts:

- *Eremophila* sp. long pedicels (G. Cockerton 1975) (P2);
- *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2);
- *Hybanthus floribundus* subsp. *chloroxanthus* (P3); and
- *Verticordia jamiesonii* (P3).

For each indicator species two or more monitoring sites were established by Western Botanical in December 2018 including up to 25 individuals of the target taxa with a total of 11 Priority Flora sites established. The sites of each indicator species were then assigned as either an 'impact' or 'control' site. 'Impact' sites were assumed to be located in an area in which potential indirect environmental impacts on Priority Flora from the MKS project may occur. 'Control' sites were assumed to be situated a sufficient distance from the MKS project that they were considered unlikely to be impacted by potential indirect environmental impacts. Based on on-ground observations, the site conditions (i.e. soil types, vegetation cover, topography) were assumed to be comparable between the 'impact' and 'control' sites.

Across each of the 11 Priority Flora sites, up to 25 individuals of each taxa at each site were:

- permanently tagged and labelled;
- marked using a GPS;
- photographed; and
- assigned a plant health score.

Comments were also given based on recent weather conditions, foliar condition, dust loads, interruptions to sheet flow, erosion, salt loads, weeds, or observable grazing which may be impacting the site. The individual plants consisted of both mature and juvenile individuals (with juvenile defined as being smaller in size than mature plants and with no evidence of reproductive maturity).

The plant health scoring system is based on plant foliage and the presence of reproductive features such as flowers, seeds or pods (**Appendix B**). The scores range from 1 to 7(a-d) and were split into four main categories in this report:

- ‘Vegetative’ which consists of scores 7a, 7b, 7c and 7d. Plant foliage is healthy, but may be actively growing (a), static (b) reduced (c) and/or pigmented (d) if it is normal for prevailing seasonal conditions.
- ‘Reproductive’ which does not directly measure plant health but indicates the priority flora site is reproducing. Scores can range from 4 to 6 depending on the stage of reproduction. While healthy foliage is expected there have been cases where observable reduced foliage has been recorded on reproductive plants.
- ‘Declining’ which represents observably reduced foliage (3) and/or partial canopy loss (2) due to extended dry seasonal conditions or abnormal localised impacts.
- ‘Dead’ which is the irreversible death of the plant and is given a score of 1.

The plant health scale used is a qualitative measure of plant health and with the change in monitoring personnel, personal interpretation of the plant health scale may affect plant health scores. Between the March and October 2021 assessments, previously recorded as dead, individual ESPLP_217 was showing signs of life, altering its score from dead (1) to vegetative (7b).

3.2.2 Monitoring locations

The health of 11 sites of Priority Flora were monitored by two Stantec environmental scientists in March and October 2021 (**Table 3-2**). The location of the sites in relation to MKS project and the haul road is provided in **Appendix C** . More detailed maps of each individual plant location have been provided as part of the Results and Discussion section.

Two *Eremophila* sp. long pedicels control sites were established in 2020 and assessed starting from the July 2020 monitoring round upon request by BHP Nickel West (further information in Stantec (2021)). Additionally, 17 *Hybanthus floribundus* subsp. *chloroxanthus* individuals were tagged and added to the existing sites near the Six Mile Well Pit, to increase the number of individuals assessed towards the ideal site count of 25, outlined in the FVEMP for the MKS project (BHP Nickel West 2019).

Table 3-2: Number of individuals assessed in March and October 2021 at the eleven Priority Flora sites

Priority Species	Tag ID	Site Type	Site Location	Count
***Hybanthus floribundus* subsp. *chloroxanthus* (P3)** ^	HFC_51 to 62 and 253 to 257	Control	South of Six Mile Well Pit	17 (12)
	HFC_63 to 74 and 250 to 252	Impact	Southwest of Six Mile Well Pit	15 (12)
	HFC_75 to 90 and 241 to 249	Impact	West of Six Mile Well Pit	25 (16)
***Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2)**	HSPSB_91 to 115	Control-east	Wanjarri Nature Reserve	25
	HSPSB_166 to 190	Control-west	Far West of Haul road	25
	HSPSB_1 to 25	Impact	East of Haul road	25
	HSPSB_141 to 165	Impact	West of Haul road	25
***Verticordia jamiesonii* (P3)**	VJ_116 to 140	Control	Wanjarri Nature Reserve	25
	VJ_26 to 50	Impact	East of Haul road	25
***Eremophila* sp. long pedicels (G. Cockerton 1975) (P2)** ^	ESPLP_191 to 215	Control-west	Western edge of Wanjarri Nature Reserve	25 (0)
	ESPLP_216 to 240	Control-north	Northern edge of Wanjarri Nature Reserve	25 (0)

^ Count includes additional tagged individuals included in the July 2020 assessment - previous site sizes noted in brackets next to current site count.

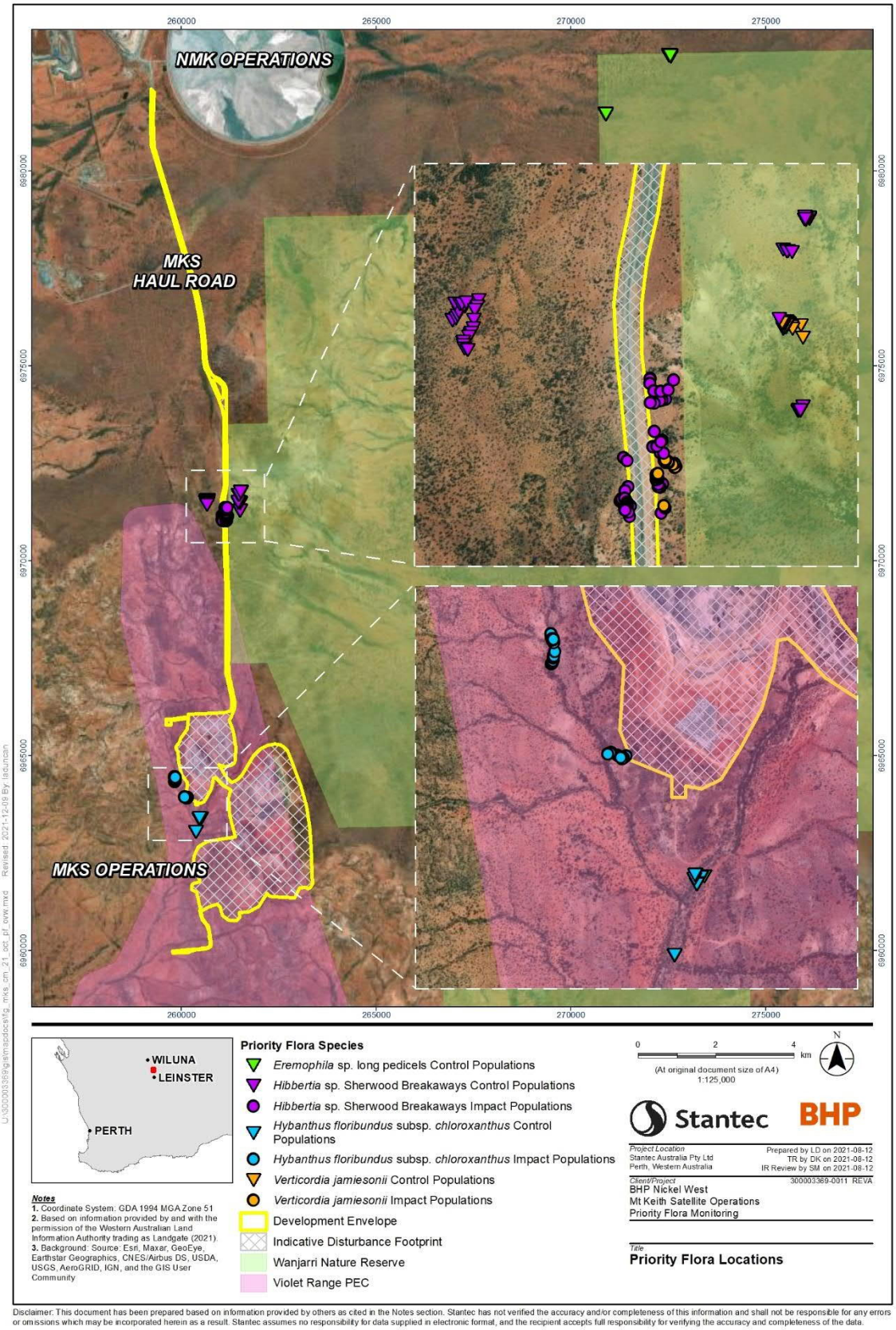

Figure 3-1 Overview of Priority Flora sites monitored in March and October 2021

3.3 Vegetation condition monitoring

3.3.1 Methodology

The vegetation condition monitoring was based on assessing of 14 m x 14 m quadrats, permanently marked by steel posts (**Figure 3-2**). These vegetation condition quadrats were established in December 2018 by Western Botanical and assigned as either an impact quadrat or control quadrat. Impact quadrats were assumed to be situated within the spatial area in which potential environment effects may occur, whilst control quadrats were assumed to be situated a sufficient distance away from the MKS project and unlikely to be indirectly impacted by the MKS project.

In September 2020, the impact quadrats were categorised based on their location to either the haul road or mine infrastructure. Generally, the quadrats were marked with four posts: one centre post and three corner posts situated at the north/north-west, south/south-west and east/north-east corner of the quadrat (**Figure 3-2**). However, due to the presence of tracks and bank structures, which overlap onto the quadrat area, not all quadrats have corner posts. Furthermore, some quadrats, situated within Wanjarri Nature Reserve, do not have any quadrat posts and are only marked by GPS.

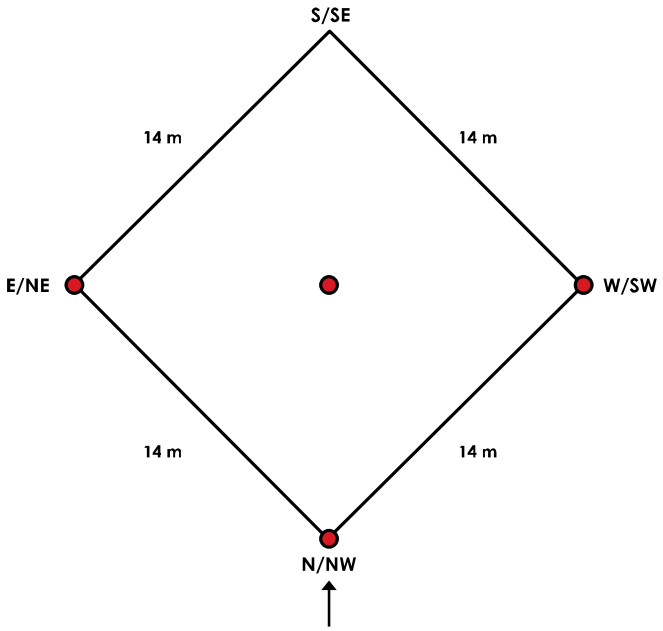

Figure 3-2 Schematic of a typical vegetation monitoring quadrat with corner posts at the at the north/north-west, south/south-west and east/north-east corner of the quadrat. Photo direction indicated by the arrow.

For each monitoring quadrat the following data were collected:

- one quadrat photograph; taken from the north or north-western corner of the quadrat;
- overall vegetation condition, assessed using the scale outlined by Keighery (1994) (**Appendix B**);
- overall extent of grazing impacts recorded as nil, light, medium or heavy (any grazing which appeared to have occurred in the last 12 months was considered 'recent grazing' and was determined by the field observer searching for evidence of recent grazing such as freshly broken stems and leaves, otherwise it was considered 'historic grazing');
- dust deposition from nearby mine infrastructure was recorded, considering dust on the soil surface as well as the vegetation;
- any maintenance required for the sites noted in the quadrat comments;
- if any weeds were present, the species was noted and total weed cover was estimated;
- the percentage cover of up to five dominant species were estimated (for this assessment, dominant species were defined as having a cover of 2% or more, or more than one individual within the quadrat, where cover can be less than 2%);
- the general plant health exhibited by each dominant species was assessed using the observable plant health scale which was based on plant foliage and the presence of reproductive features such as flowers, seeds or pods (BHP Nickel West 2019) (**Appendix B**); and

- a species list of native perennials and annuals were also recorded.

While most plants were identified to species level, some plants were only identified to genus level due to a lack of identifying features (e.g. flowers or fruiting bodies) present at the time of assessment. The taxonomy of Mulga (*Acacia aneura* complex) was reviewed in 2012 and divided into several species that belong to the Mulga group (Maslin and Reid, 2012). Where possible, each *Acacia aneura* complex individual recorded was identified to species level but if there were not enough identifying features it was recorded as *Acacia aneura*.

3.3.2 Monitoring location

The 37 monitoring quadrats were surveyed from the 7th - 18th of October 2021. More detailed maps of each individual plant location have been provided as part of the results and discussion section. The 37 monitoring quadrats were classified as follows:

- 17 impact – haul road quadrats;
- 8 impact – infrastructure quadrats; and
- 12 control quadrats.

The broad vegetation community associations of each quadrat, determined from previous monitoring (BHP Nickel West 2019), are provided in **Table 3-3**, as well as their location relative to MKS project.

Control quadrats, MKS EIA 35, MKS EIA 36 and MKS EIA 37, were established within 10 m of the haul road when the monitoring program was established in 2018. The outcomes of the 2020 assessment concluded that these quadrats were not suitable for use as control quadrats in future monitoring rounds as they were not far enough from the MKS disturbance footprint to provide an appropriate comparison. As such, these quadrats were changed from 'control' quadrats to 'haul road impact' quadrats given their proximity to the MKS haul road. In addition, MKS EIA 19, MKS EIA 20 and MKS EIA 28 were deemed to not be suitable as haul road impact quadrats given their distance further away from MKS haul road (between 110 m and 15 km) hence they were changed to 'control' quadrats.

Table 3-3 Vegetation quadrats monitored at Mt Keith Satellite Operations in 2021; note quadrats highlighted in orange changed disturbance category and quadrats highlighted in red were cleared prior to the 2021 assessment and were not monitored

Quadrat	Disturbance category	Coordinates (GDA94) 51J	Approximate location	Vegetation association (BHP Nickel West 2019)
MKS EIA 1	Impact – Haul Road	261082 6973489	~ 40 m west of MKS haul road	Drainage line Mulga shrubland
MKS EIA 2	Impact – Haul Road	261089 6972365	~ 40 m west of MKS haul road	Groved Mulga shrubland
MKS EIA 3	Impact – Haul Road	261117 6971563	~ 9 m west of haul road	Groved Mulga shrubland / Archaean granite geology
MKS EIA 4	Impact – Haul Road	261049 6971565	~ 75 m west of haul road	Groved Mulga shrubland/ Stony ironstone Mulga shrubland
MKS EIA 5	Impact – Haul Road	261204 6970774	~ 80 m east of haul road	Drainage line Mulga shrubland
MKS EIA 6	Impact – Haul Road	261139 6971172	~13 m east of haul road	Archaean granite geology
MKS EIA 7	Impact – Haul Road	261216 6970204	~ 90 m east of haul road	Drainage line Mulga shrubland
MKS EIA 8	Impact – Haul Road	261231 6969060	~ 60 m east of haul road	Stony ironstone Mulga shrubland
MKS EIA 9	Impact – Haul Road	261218 6969942	~95 m east of haul road	Weathered basalt, *Hakea leucoptera* subsp. *sericipes* / *Eremophila pantonii* shrubland
MKS EIA 35	Impact – Haul Road (formerly Control)	261071 6971248	~ 3 m west of haul road	Stony ironstone Mulga shrubland
MKS EIA 36	Impact – Haul Road (formerly Control)	261071 6971159	~ 52 m west of haul road	Stony ironstone Mulga shrubland
MKS EIA 37	Impact – Haul Road (formerly Control)	261077 6971050	~ 48 m west of the haul road	Stoney ironstone low shrubland
MKS EIA 10	Impact - Infrastructure	260553 6966093	~ 320 m north of Run-of-mine	Stony ironstone Mulga shrubland
MKS EIA 11	Impact - Infrastructure	260029 6965525	~ 250 m east of Run-of-mine	Stony ironstone low/Mulga shrubland
MKS EIA 12	Impact - Infrastructure	259909 6964937	~ 150 m east of Six Mile Well pit	Weathered basalt, *Hakea leucoptera* subsp. *sericipes* / *Eremophila pantonii* shrubland
MKS EIA 13	Impact - Infrastructure	260866 6964098	~ 80 m from Six Mile Well pit	Drainage line Mulga shrubland
MKS EIA 14	Impact - Infrastructure	263217 6963155	~ 400 m south-east of WRL	Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland
MKS EIA 15	Impact - Infrastructure	260412 6961163	~ 2.2 km south west of WRL, ~ 450 m from Jones Creek track	Mulga over *Maireana triptera* shrubland/ Drainage line Mulga shrubland
MKS EIA 16	Impact - Infrastructure	260261 6961683	~ 1.8 km south west of WRL, ~ 250 m from Jones Creek track	Drainage line Mulga shrubland
MKS EIA 17	Impact – Infrastructure (Cleared)	261346 6963029	~ 170 m from WRL	Drainage line Mulga shrubland
MKS EIA 18	Impact - Infrastructure	261285 6964460	~ 195 m south east of Run-of-Mine/ Six Mile Well	Drainage line Mulga shrubland

MKS EIA 23	Impact – Haul Road	261105 6971373	~ 25 m east of haul road	Granitic Mulga shrubland on Archaean geology
MKS EIA 24	Impact – Haul Road	261118 6971266	~ 10 m west from haul road	Granitic Mulga shrubland on Archaean geology.
MKS EIA 25	Impact – Haul Road	261127 6971134	~ 2 m east of haul road	Granitic Mulga shrubland on Archaean geology.
MKS EIA 26	Impact – Haul Road	261131 6971093	~ 7 m east of haul road	Granitic Mulga shrubland on Archaean geology.
MKS EIA 27	Impact – Haul Road	261122 6971012	~ 4 m west of haul road	Granitic Mulga shrubland on Archaean geology.
MKS EIA 19	Control (formerly Impact – Haul Road)	270893 6981469	~ 12 km east of haul road in Wanjarri Nature Reserve	Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland
MKS EIA 20	Control (formerly Impact – Haul Road)	272524 6982988	~ 15 km east of haul road in Wanjarri Nature Reserve	Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland
MKS EIA 21	Control	261186 6973491	~ 60m east of haul road, within Wanjarri Nature Reserve	Hardpan Mulga shrubland with *Acacia thoma* co- dominant
MKS EIA 22	Control	261218 6972404	~ 87 m east of haul road, within Wanjarri Nature Reserve	Groved Mulga woodland
MKS EIA 28	Control (formerly Impact – Haul Road)	261239 6970770	~ 110 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 29	Control	261255 6970160	~ 100 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 30	Control	261261 6969699	~ 125 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 31	Control	261263 6969421	~ 114 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 32	Control	261277 6968983	~ 110 m east of haul road, within Wanjarri Nature Reserve	Stony ironstone Mulga shrubland
MKS EIA 33	Control	261280 6968863	~ 114 m east of haul road, within Wanjarri Nature Reserve	Stony ironstone Mulga shrubland
MKS EIA 34	Control	261298 6968771	~ 114 m east of haul road, within Wanjarri Nature Reserve	Stony ironstone low shrubland
MKS EIA 38	Control	261304 6967527	~ 130 m east of haul road	Stony ironstone low shrubland.

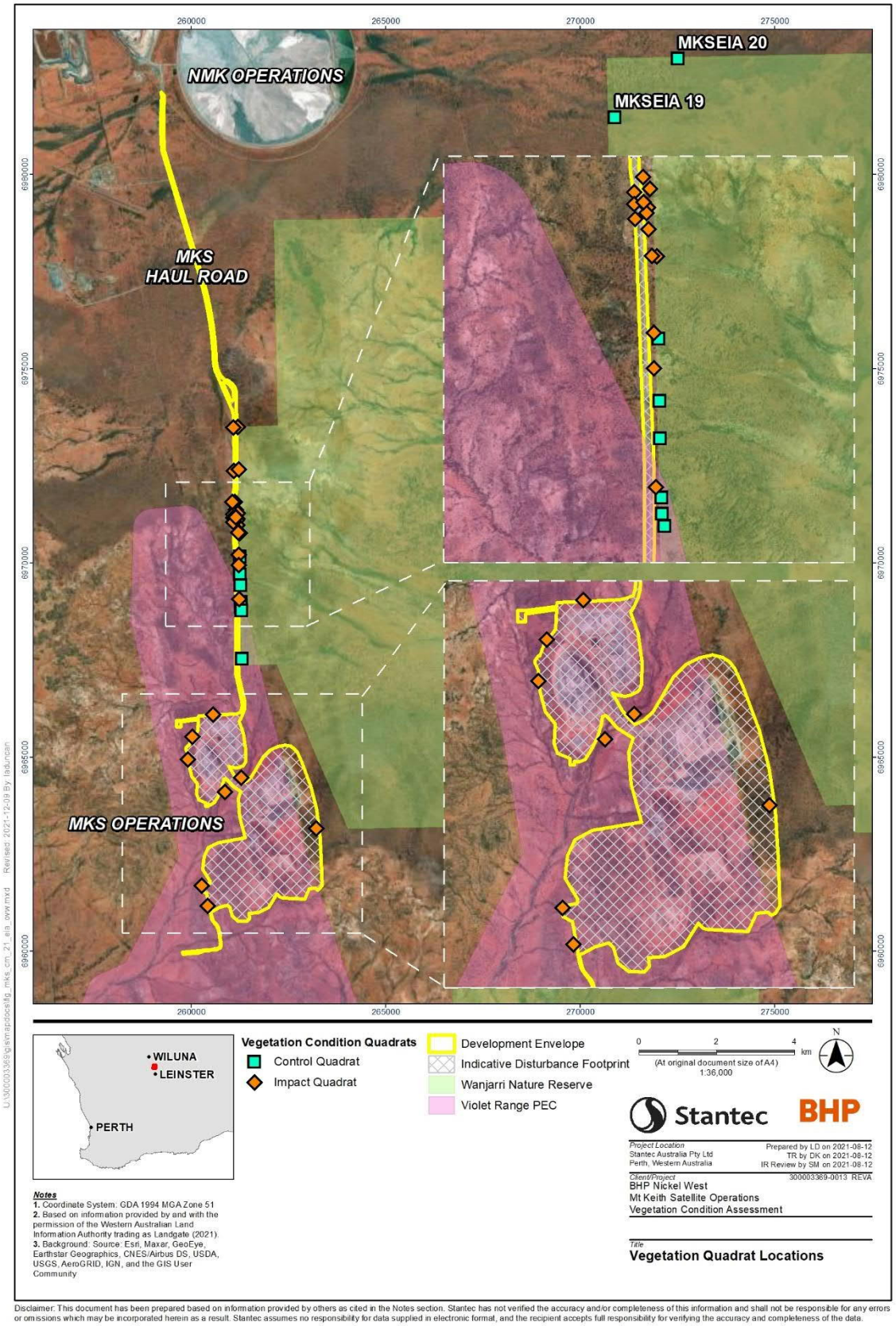

Figure 3-3 Overview of impact and control vegetation quadrats assessed in October 2021

4 Results and Discussion

4.1 Priority Flora monitoring

4.1.1 *Hybanthus floribundus* subsp. *chloroxanthus*

Three sites of *Hybanthus floribundus* subsp. *chloroxanthus* were assessed in 2021. The sites occupy the Mulga-dominated ephemeral drainage line that runs southward on the western side of the Six Mile Well pit. In July 2020, 17 additional *Hybanthus floribundus* subsp. *chloroxanthus* individuals were tagged and added to the existing sites near the Six Mile Well Pit to increase the number of individuals assessed towards the ideal site count of 25 outlined in the FVEMP. One impact site now contains 25 individuals, while the other impact site has 15 individuals and the control site has 17 individuals (**Table 3-2**). Each individual plant location is presented in **Appendix C** . Individual plant health scores and photographs from the most recent assessment in October 2021 are shown in **Appendix D** , and long term scores presented in **Appendix E** . Photographs and scores from prior assessments in 2021 have been provided previously to BHP Nickel West.

Over the last year, December 2020 to October 2021, the combined percentage of vegetative and reproductive plants at the impact sites remained relatively similar ranging between 80% and 88% (**Figure 4-1**). However, the proportion of reproductive and vegetative individuals shifted substantially as many individuals flowered in March and October 2021 (**Figure 4-2**). The percentage of dead plants did not change at the western impact site and two individuals died between December 2020 and October 2021 at the south-west impact site (HFC_70 and HFC_71) (**Figure 4-3**). The foliage of live plants was visibly greener in March 2021 with almost no dust observed on the foliage of each plant, likely in response to the substantial rainfall in February and March prior to the assessment. However, this was not the case during the October 2021 surveys. The foliage was generally yellow-green at most plants indicating some water stress, with dust was also noted on some plants likely originating from the Six Mile Well pit (**Figure 4-4**). The impact sites contain a greater proportion of plants with higher health scores compared to the control sites (**Figure 4-1**).

The percentage of vegetative plants at the southwest of Six Mile Well Pit control site has increased since March 2020, having reached the maximum score of 65% in March 2021. The following and most recent October survey noted the vegetative population shifted, with 41% of the 65% developing reproductive morphology. In March 2021, the first two deaths were recorded, further increasing in October and are now totalled at four (HFC_53, HFC_55, HFC_58 and HFC_60) (**Figure 4-1**). The dust observed at the control site may be due to the proximity (approximately 450 m downstream) to the MKS operations. Therefore, the control population may be indirectly impacted by MKS operations and an inappropriate location for a control site.

Between the 2020 and 2021 assessments, the average health of the west and south-west impact sites were generally comparable between the 2020 and 2021 assessments with little change in the percentages in reproductive and vegetative plants between assessments. In comparison, the average plant health of the control site has been slightly increasing over multiple assessments with the increase in the percentage of reproductive and vegetative plants between March 2020 and October 2021. Although, four recent plant deaths recorded at the control site relative to the two plant deaths recorded in 2021 at the western impact site. In addition, the percentage of declining and dead plants has been consistently highest at the control site relative to the impact sites since March 2020. Although, as previously noted, this may be attributed to control site location.

No weeds were noted at any of the *Hybanthus floribundus* subsp. *chloroxanthus* sites in the 2021 assessments. Previously, individual sightings of weed species **Sonchus oleraceus* and **Citrullus amarus* have been recorded at the control site but they were not sighted in recent assessments.

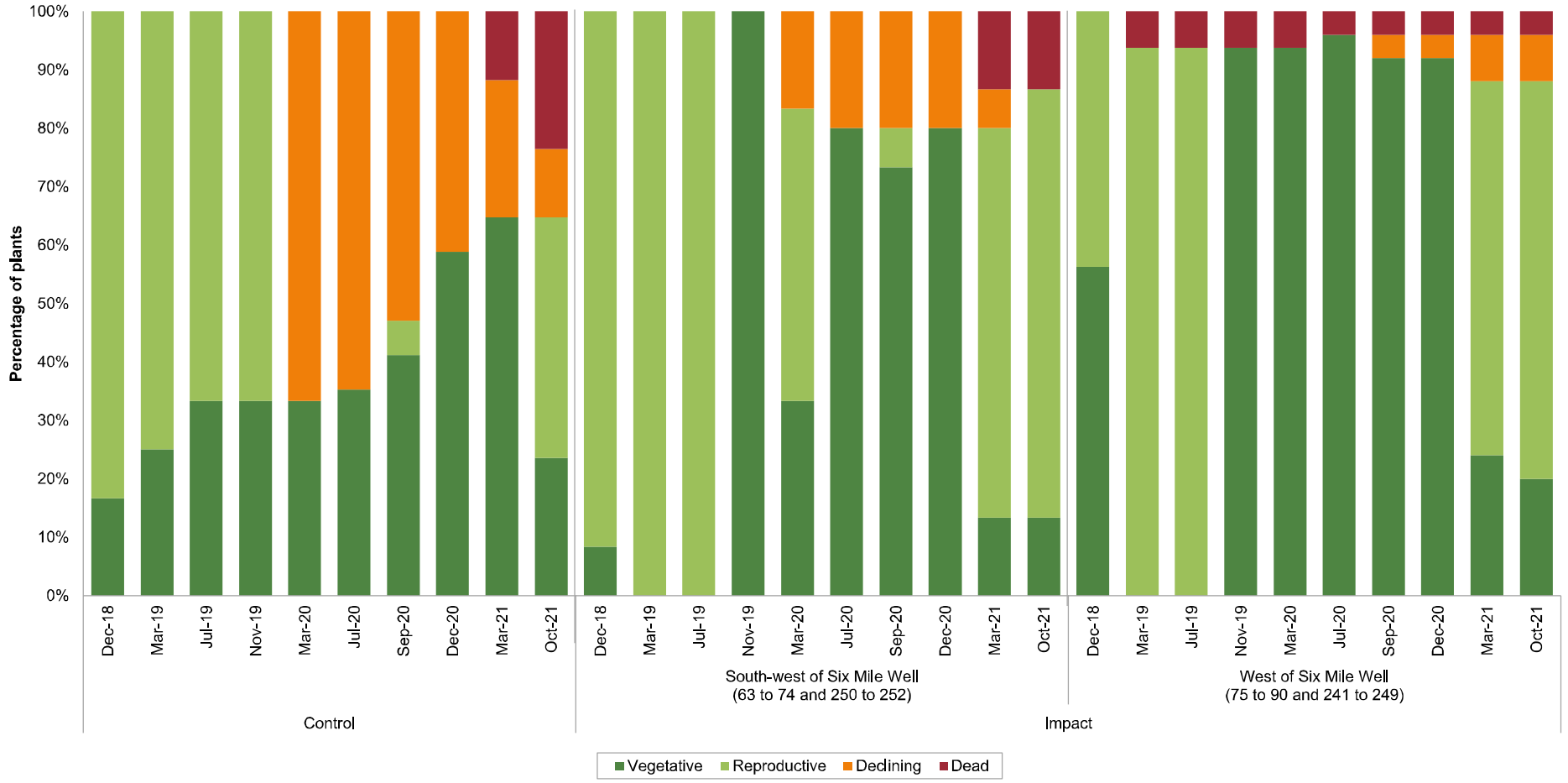

Figure 4-1 Percentage of *Hybanthus floribundus* subsp. *chloroxanthus* individuals within each plant health category, across each impact and control site, from 2018 to 2021

Figure 4-2: *Hybanthus floribundus* subsp. *chloroxanthus* impact individual HFC_251 flowering in October 2021.

Figure 4-3: *Hybanthus floribundus* subsp. *chloroxanthus* dead individuals at the south-west impact site. HFC_70 located on the left and HFC_71 located on the right.

Figure 4-4: *Hybanthus floribundus* subsp. *chloroxanthus* individuals HFC_54 at the south-west impact site in March 2021 (left) and showing signs of yellowing in October 2021 (right).

4.1.2 *Hibbertia* sp. Sherwood Breakaways

Four *Hibbertia* sp. Sherwood Breakaways sites were monitored in 2021. The sites are located on granitoid breakaways and laterite-capped hills on either side of the MKS haul road. Detailed maps of each individual plant location are in **Appendix C** . Individual plant health scores and photographs from the most recent assessment in October 2021 are shown in **Appendix D** and long term plant health scores presented in **Appendix E** .

The combined percentage of vegetative and reproductive plants increased at both impact sites between December 2020 and March 2021.This was largely due to the rainfall received two months prior to the March assessment, contributing to new growth on several plants (**Figure 2-1**). In October 2021, the assessments showed a 12-percentage point decline in the east, with the population previously scoring 60% vegetative and reproductive individuals in March and now 48%, with no change in the west of haul road. The impact sites contain a greater proportion of plants with lower health scores compared to the control sites (**Figure 4-6**). Three new plant deaths were recorded in March at the eastern impact site (HSPSB_13, HSPSB_11 and HSPSB_3) and remained unchanged in October 2021. The western impact site recorded two deaths in March, with a further two deaths in October 2021 resulting in a total of four plant deaths at the impact site (HSPSB_141, HSPSB_143, HSPSB_144 and HSPSB_157) (**Figure 4-7**). It was also noted that the extent of dust deposition on plant foliage was lower in March, likely due to increased rainfall relative to the October assessment, but it could still be observed at the soil surface. It was likely originating from the MKS haul road given the colour and amount relative to the control site where some dust was recorded.

Similar to the impact sites, the percentage of vegetative and reproductive plants between December 2020 and March 2021 increased at both control sites. This was likely in response to higher rainfall received in the two months prior to the March assessment, which was then followed by months of below average rainfall, causing an increase in declining individuals in the October assessment (**Figure 4-6**). Between the March 2021 and October 2021 assessment, the percentage of vegetative and reproductive plants at the western control site declined from 72% to 52% and from 76% to 72% at the control site in Wanjarri Nature Reserve. Green foliage was observed on most plants, although vegetation was notably more stressed in October (**Figure 4-7**). Since monitoring began in 2018, no deaths have been recorded at the control sites.

Average plant health at the east impact site was generally lower in 2021 compared to 2020 while average plant health at the west impact site was similar between assessments. While the percentage of reproductive and vegetative plants at the east impact site has been slightly increasing with each assessment since the initial decline in March 2020, the number of plant deaths has also increased particularly between December 2020 and October 2021. In comparison, average plant health of the control sites had increased between 2020 and 2021 with a higher percentage of reproductive and vegetative plants, and no plant deaths since monitoring began. Across both the impact and control sites the relatively poorer plant health experienced since March 2020 could be attributed to the extended periods of dry seasonal conditions (**Figure 2-1**). However, it has likely affected the impact sites to a greater extent due to dust deposition from the MKS haul road which the impact sites are directly adjacent to. While dust on plant foliage alone is unlikely to impact plant health, it can exacerbate existing plant water stress in water-limited environments (Matsuki et al. 2016).

No weed species were noted near the *Hibbertia* sp. Sherwood Breakaways sites in 2021 as per previous assessments.

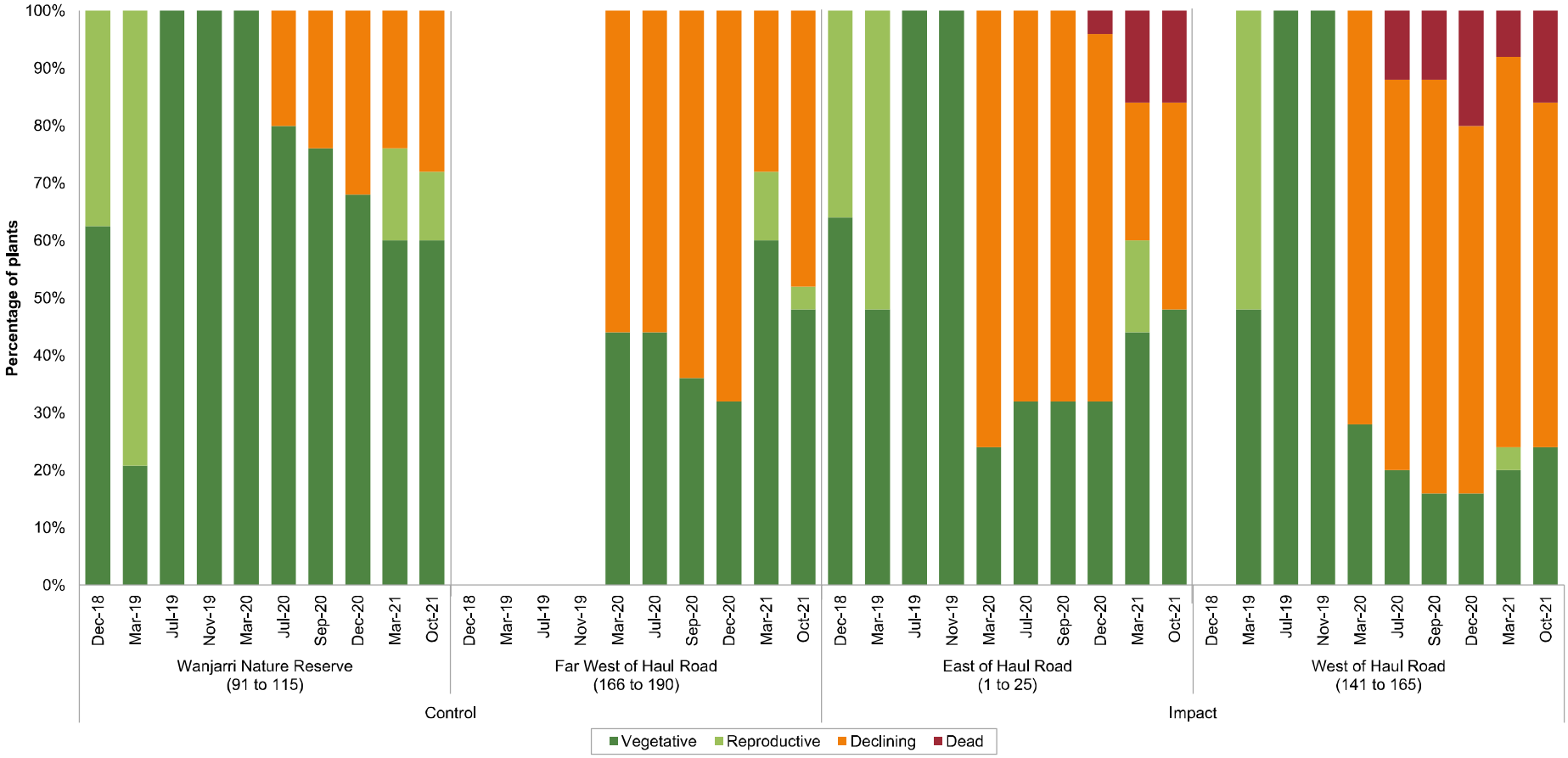

Figure 4-5 Percentage of *Hibbertia sp.* Sherwood Breakaways (R.J. Cranfield 6771) individuals within each plant health category, across each impact and control site, from 2018 to 2021

Figure 4-6 Both *Hibbertia sp.* Sherwood Breakaways (R.J. Cranfield 6771) individuals, HSPSB_141 and HSPSB_157, assessed as dead in October 2021.

Figure 4-7: *Hibbertia sp.* Sherwood Breakaways (R.J. Cranfield 6771) individual, HSPSB_98 displaying the influence of rainfall on foliage after the March (left) and October assessments (right).

4.1.3 *Verticordia jamiesonii*

Two *Verticordia jamiesonii* sites were monitored in 2021. The sites are situated on the eastern side of the MKS haul road on the same granitoid breakaways and laterite capped hills as *Hibbertia* sp. Sherwood Breakaways. Each individual plant location is presented in **Appendix C** , with plant health scores and photographs from the October 2021 assessment presented in **Appendix D** and long term plant health scores presented in **Appendix E** .

The percentage of vegetative plants at the control site, located in the Wanjarri Nature Reserve, increased from 40% in December 2020 to 52% in March 2021. The subsequent October 2021 assessment was the first instance of reproductive individuals being recorded at the control site since surveys began in 2018, and once added to the vegetative plants, reflected 64% of the population (**Figure 4-8**). One individual recorded as dead in March was unable to be found in October 2021 and was replaced with a nearby vegetative individual in the following assessment (VJ_140) (**Figure 4-9**). After a dead individual in the population is replaced with a vegetative one, the historic deaths total now stands at two in October 2021 (VJ_119 and VJ_126).

The plant health scores at the *Verticordia jamiesonii* impact site, east of haul road, were relatively unchanged between December 2020 and March 2021, except for one new death (VJ_37). Between March and October 2021, declining individuals greatly decreased from 72% to 16%, as much of those individuals now displayed reproductive morphology (52%) (**Figure 4-8**). One flowering individual had been recorded at this location previously in 2020, however this is the first time since the initial survey (December 2018) that a substantial number of individuals were reproductive (**Figure 4-10**). No signs of dust were observed on the plant foliage, with some plants visibly greener in March, which had since diminished in October 2021 (**Figure 4-11**). The change in plant foliage was most likely due to the variation in rainfall throughout the year with above-average rainfall prior to the March assessment and below average rainfall prior to the October assessment (**Figure 2-1**). The large change in plant health scores were primarily due to previously declining individuals having reproductive morphology (**Figure 4-10**). This is not a sign of improvements within the population's health, but simply a reflection that individuals were mature and reproducing.

On average, the plant health of the *Verticordia jamiesonii* impact population remained generally similar between assessments with only a slight increase in plant deaths and predominantly the percentage of reproductive plants increasing rather than vegetative plants. Similarly, at the control site the increase in vegetative and reproductive plants was also specifically reproductive plants, and the percentage of dead plants slightly decreased indicating that average plant health was generally comparable between the 2020 and 2021 assessments. Extended periods of below average rainfall have been observed since monitoring began (**Figure 2-1**) which have likely had an impact on plant health across both the impact and control sites, particularly since March 2020 when plant health began to decline. However, the *Verticordia jamiesonii* impact site is located in close proximity to the MKS haul road and experiences similar levels of disturbance from vehicle generated dust as *Hibbertia* sp. Sherwood Breakaways. As such, the faster decline and generally poorer health of the impact site relative to the control site could be attributed to the combined impact of extended dry seasonal conditions and dust deposition from the MKS haul road.

No weed species were observed near the *Verticordia jamiesonii* sites during the October 2021 assessment.

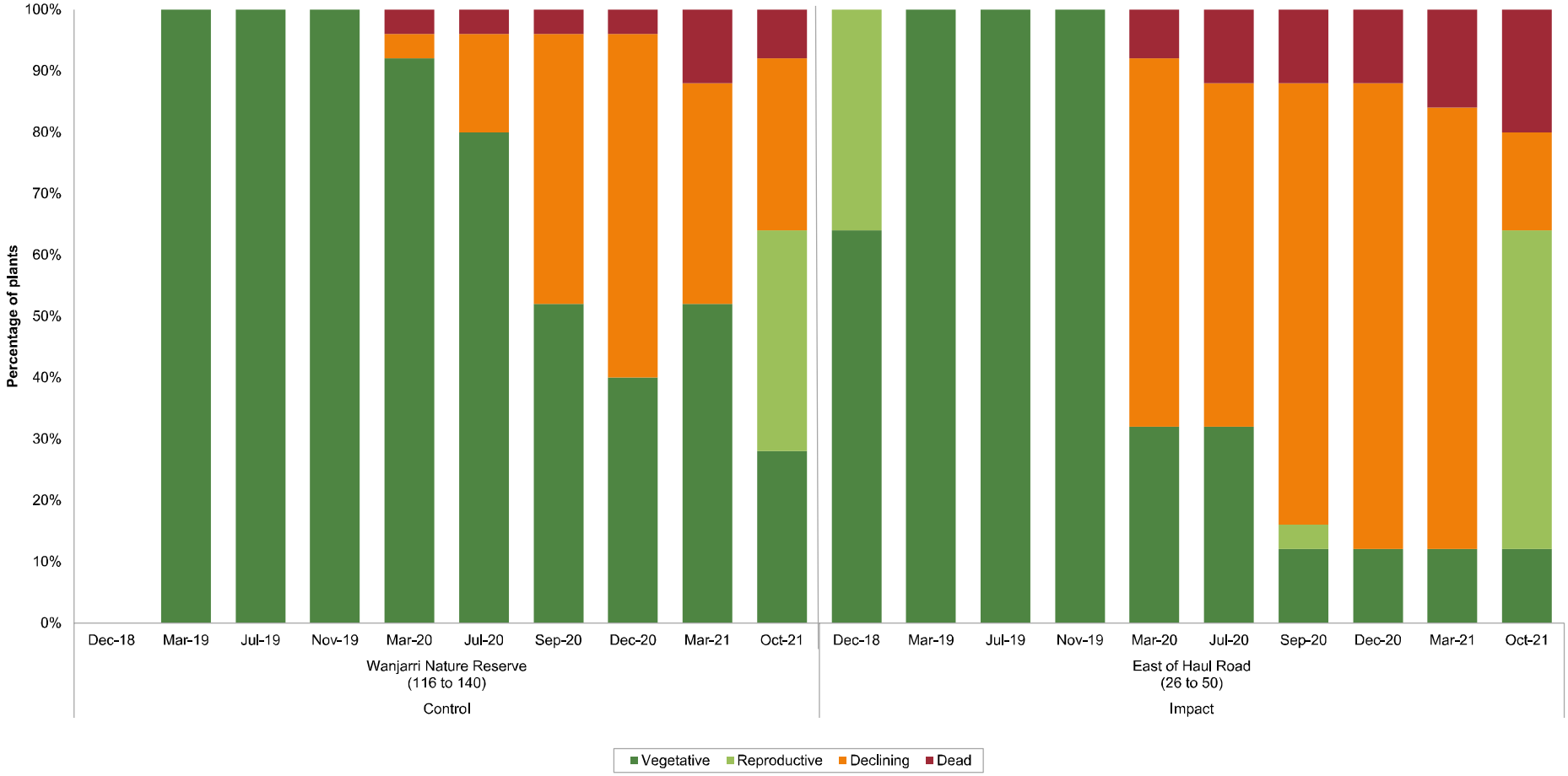

Figure 4-8 Percentage of *Verticordia jamiesonii* individuals within each plant health category across each impact and control site from 2018 to 2021

Figure 4-9: *Verticordia jamiesonii* individual VJ_140, assessed in March 2021 and replaced in October 2021, (left, with a score of 1 and right, with a score of 7a).

Figure 4-10: East of haul road *Verticordia jamiesonii* individual VJ_31, assessed in March 2021 as declining (left) and in October 2021, having lost a large proportion of foliage but displaying reproductive morphology.

Figure 4-11: *Verticordia jamiesonii* individual VJ_44, showing greener foliage following high rainfall events in March 2021 compared to October 2021, where the individual experienced below average rainfall for the four months prior.

4.1.4 *Eremophila* sp. long pedicels (G. Cockerton 1975)

Eremophila sp. long pedicels was first discovered at NMK in 1996 and is locally abundant on hardpan plains and adjacent sandplains near the margins of drainage lines downstream of the NMK central discharge tailings storage facility (CDTSF). Two control sites have been assessed since July 2020, both situated along the north-western corner of Wanjarri Nature Reserve, with no impact site identified. Prior to the July 2020 assessment, data on the health of individual plants was not collected but descriptive data was recorded during the vegetation condition assessments (detailed in Stantec (2021)). Each individual plant location is presented in **Appendix C** with plant health scores and photographs from October 2021 presented in **Appendix D** and long term plant health scores presented in **Appendix E** .

The control site on the western edge of Wanjarri Nature Reserve showed some small changes in plant health ratings in a relatively stable population. In March 2021, the vegetative and reproductive plant score was 84% and reduced to 76% in October 2021 (**Figure 4-12**). It is currently at its lowest score since records began in July 2020, although it is still the healthiest site of *Eremophila* sp. long pedicels, and no plant deaths have occurred.

The control site on the northern edge of Wanjarri Nature Reserve had a more notable change in condition (**Figure 4-12**). In March 2021, a response to high rainfall was noted and the production of vegetative individuals increased to 72% from 40% in December 2020. Although in the sequential monitoring program in October 2021, the vegetative individuals decreased to 56% (**Figure 4-13**). This increase in condition in March, followed by a decrease in October can be seen in ESPLP_230 (**Figure 4-13**). The reduction in vegetative numbers was most likely an outcome of the population readjusting to the below average rainfall patterns the population has experienced for a number of years (**Figure 2-1**).

Three new deaths were recorded at the northern site in March 2021 (ESPLP_216, ESPLP_217 and ESPLP_234) and one previously dead individual (ESPLP_231) could not be located and therefore replaced with a new vegetative plant (ESPLP_258). It is possible that the rainfall events did not occur soon enough for these water-stressed plants to survive (**Figure 2-1**). In October 2021, a previously presumed dead plant (ESPLP_217) had showed signs of being vegetative again and was scored as Vegetative (7b). The population recorded one new death, (ESPLP_225, **Figure 4-14**) and with the additional historical deaths (ESPLP_216 and ESPLP234) the population remains unchanged with three historic plant deaths.

No weeds were noted at either *Eremophila* sp. long pedicels control site during the March or October 2021 assessment. Previously, one small **Rumex vesicarius* (Ruby Dock) individual was observed near the western site during the July 2020 assessment but it has not been sighted in subsequent assessments.

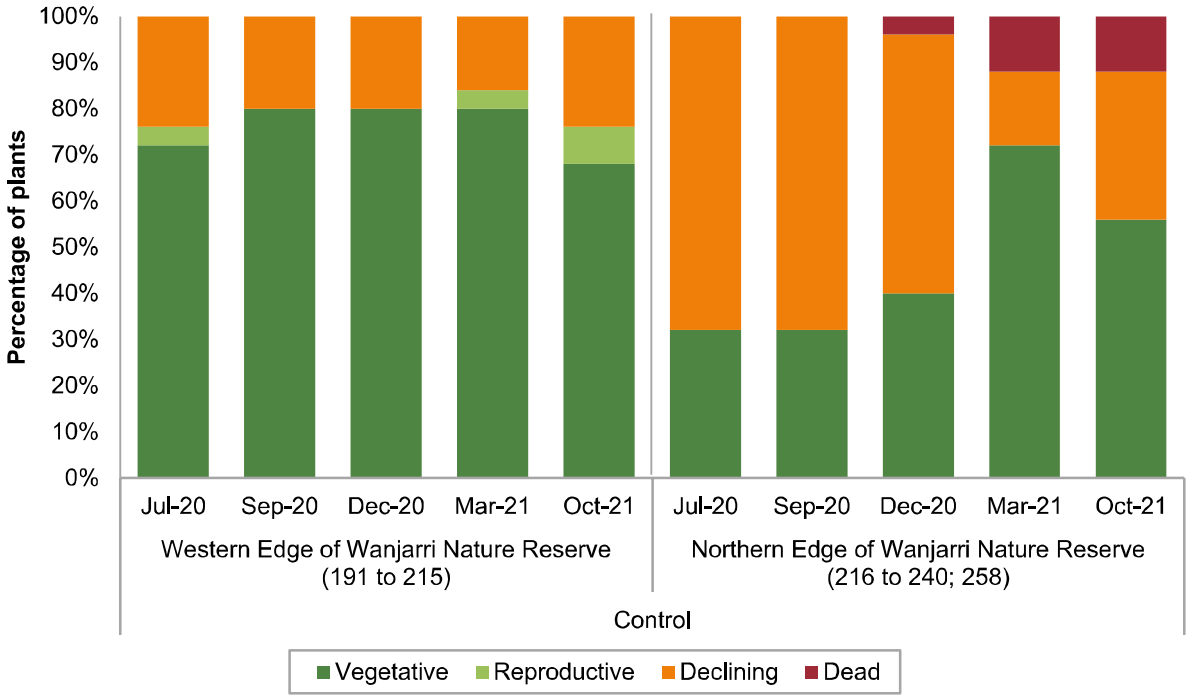

Figure 4-12 Percentage *of Eremophila sp. long pedicels* (G. Cockerton 1975) individuals within each plant health category across each impact and control site from 2018 to 2021

Figure 4-13: Individual ESPLP_230, was previously assessed with a score of 2 in December 2020. In March 2021 (left) the foliage began to recover and improved with a score of 3. In October 2021 (right), the individual declined back to a score of 2.

Figure 4-14: *Eremophila* sp. long pedicels individual ESPLP_225, in March 2021 and dead in October 2021.

4.2 Vegetation Condition Monitoring

Overall, average vegetation condition ratings did not substantially change across most of the impact and control quadrats between 2020 and 2021 (**Figure 4-15**) with ratings ranging from 'degraded' to 'excellent' condition (**Figure 4-16**) (raw data presented in **Appendix F**). Only a few quadrats changed in condition between assessments across the control and impact quadrats and when considering the number of quadrats in each disturbance category the extent of those changes were comparable. The reallocation of quadrat disturbance categories in 2021 following the 2020 assessment (**Section 3.2.2**) resulted in a higher proportion of quadrats in 'very good' to 'excellent' condition being recorded at the control quadrats rather than the haul road impact quadrats (**Figure 4-15**). Similar to 2020, the impact quadrats adjacent to mine infrastructure had the lowest proportion of quadrats in 'very good' to 'excellent' condition relative to the impact quadrats adjacent to the haul road and the control quadrats. Weeds were not observed across any of the vegetation quadrats in 2021.

Across the 11 control quadrats assessed in 2021, average vegetation condition was similar between 2020 and 2021 with most quadrats in 'very good' condition (63%) (**Figure 4-15**, **Appendix G**). Only MKS EIA 33 had a decrease in vegetation rating from 'very good' to 'good' between 2020 and 2021 due to the deaths of lower story shrubs impacting overall vegetation structure (**Appendix F**). Most signs of disturbance observed across the control quadrat had a minimal impact on vegetation condition. Relatively low levels of vehicle generated dust were recorded at several quadrats due to their location to Wanjarri Nature Reserve and grazing was observed at MKS EIA 32, MKS EIA 21 and MKS EIA 31.

The vegetation at impact quadrats adjacent to the haul road varied the most in condition ratings compared to the other disturbance types, but on average remained similar to the previous assessment in 2020 with most quadrats in either 'excellent' (35%) or 'very good' (35%) condition (**Figure 4-15**, **Appendix G**). Only three of the 18 quadrats changed in vegetation condition between 2020 and 2021 with ratings increasing at MKS EIA 1, from 'degraded' to 'good', and at MKS EIA 37 from 'good' to 'very good' (**Figure 4-17, Appendix F**). The vegetation condition rating at MKS EIA 3 decreased from 'good' to 'degraded'. The increase in vegetation condition ratings was due to increases in plant cover and health while the decrease at MKS EIA 3 was due to further plant deaths. The quadrats with 'excellent' condition ratings were situated towards the middle of the haul road where there was previously a large bund along the edge of the haul road which was assumed to have provided protection from dust deposition (**Appendix G**). However, the bund was cleared prior to the 2021 assessment, which may have resulted in an increase in dust deposition over time. As observed in the previous assessment, most quadrats had water stressed vegetation. While below average rainfall has been recorded over the past three years (**Figure 2-1**), moderate to high dust levels associated with the haul road were observed on plant foliage and the soil surface which has likely exacerbated any rainfall related impacts.

The eight impact quadrats adjacent to mine infrastructure were in 'degraded' to 'very good' condition with half of the mine infrastructure impact quadrats in 'very good' condition (**Figure 4-15**, **Appendix G**). On average, vegetation condition was similar between assessments with increases and decreases in vegetation condition both recorded between 2020 and 2021. At MKS EIA 14, located east of the Waste Rock Landform, the vegetation condition rating decreased from 'good' in 2020 to 'degraded' in 2021 (**Appendix F**), due to further plant deaths since 2020 and recent vehicle tracks. Meanwhile, MKS EIA 17 was cleared since the previous assessment and was not replaced resulting in an increase in the proportion of quadrats in 'very good' condition, given the reduction of the number of infrastructure impact quadrats (**Figure 4-15**). Similar to 2020, high dust loads impacted most of the quadrats, particularly MKS EIA 18 and MKS EIA 4, likely exacerbating the effect of below average rainfall over the last three years (**Figure 4-18**). However, the vegetation condition rating at MKS EIA 18 increased from 'good' to 'very good' between assessments. Light grazing was noted across all infrastructure impact quadrats in 2021, most of which were considered recent (**Appendix F**).

Most of the dominant species assessed across the impact and control quadrats in 2021 were considered 'reproductive' or 'vegetative' which was similar to 2020 (with species data in **Appendix F**). In 2021, both the haul road and infrastructure impact quadrats had a higher proportion of dominant species considered 'reproductive' or 'vegetative' compared to the control quadrats. In addition, nine recent deaths were recorded since the previous assessment, four of which were at control quadrats (MKS EIA 30, MKS EIA 33, MKS EIA 34 and MKS EIA 38). Meanwhile, three deaths were recorded at the haul road impact quadrats (MKS EIA 3, MKS EIA 4 and MKS EIA 37) and two deaths were recorded at the infrastructure impact quadrats (MKS EIA 12 and MKS EIA 15). The species that died consisted of mid-storey shrubs like *Senna artemisioides* subsp. *helmsii* and *Dodonaea petiolaris* or herbs like *Ptilotus schwartzii* (**Appendix F**). Overall, the highest plant cover values and health ratings were assigned to tree species (**Appendix F**). Meanwhile, the smaller shrub and herb species were generally classified as 'declining'. It is likely that these species were more vulnerable to dry conditions and dust deposition compared to larger shrub and tree species which may have resulted in the deaths observed since 2020. It may also be expected that some mature individuals will naturally decline in health and senesce (reach mortality) over multiple years of monitoring across both impact and control sites.

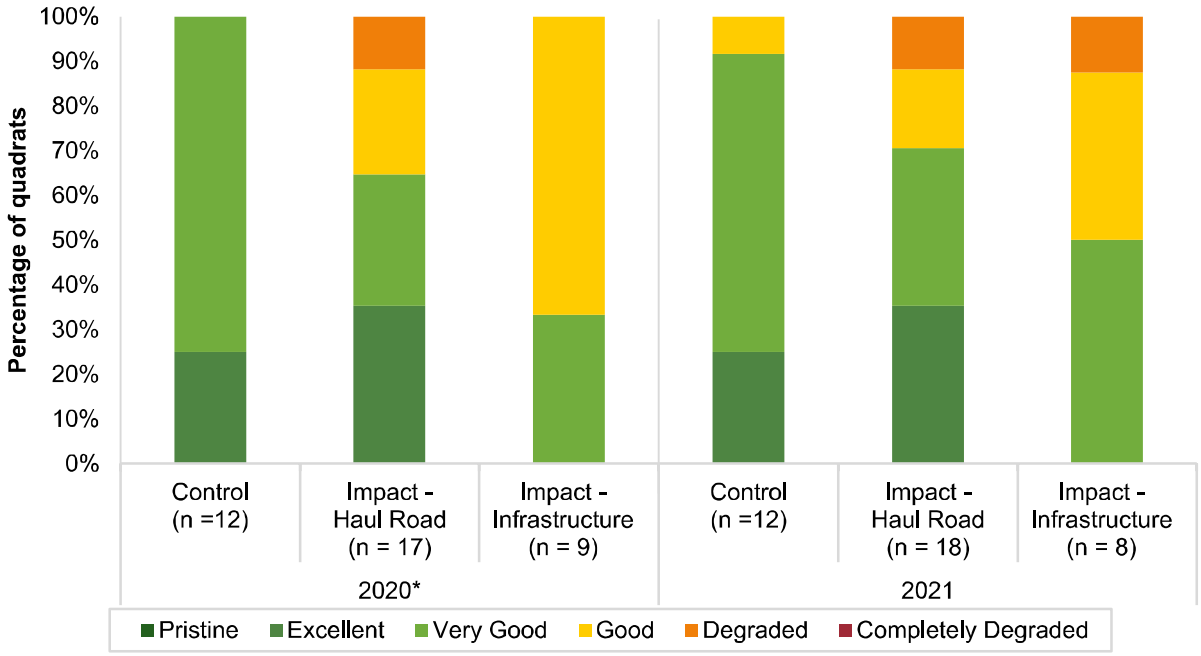

Figure 4-15 Percentage of impact and control quadrats within each vegetation condition category between 2020 and 2021 *2020 data was modified from what was presented in Stantec (2021) following the reallocation of disturbance types for each of the vegetation quadrats

Figure 4-16 Examples of the range in vegetation condition across the vegetation quadrats assessed in 2021; MKS EIA 26 (left) was rated 'excellent' while MKS EIA 14 (right) was rated 'degraded'.

Figure 4-17: MKS EIA 37 increased from 'good' in 2020 (left) to 'very good' in 2021 (right). The increase in vegetation condition rating shown in the increases in plant cover and health.

Figure 4-18 Examples of heavy dust deposition at infrastructure impact quadrats MKS EIA 4 (left) and MKS EIA 18 (right)

5 Conclusion

5.1 Priority Flora monitoring

In general, plant health across most of the Priority Flora taxa impact sites assessed at Mt Keith Satellite (MKS) in 2021 did not change considerably from the previous assessment with little change in the combined percentage of reproductive and vegetative plants at each site between years (**Table 5-1**). The only impact site with a notable change in overall plant health was the *Hibbertia sp.* Sherwood Breakaways east impact site which had a general decrease in plant health ratings since 2020. In comparison, the general plant health of both *Hibbertia sp.* Sherwood Breakaways control sites increased between 2020 and 2021. This indicates that the decline in plant health at the *Hibbertia sp.* Sherwood Breakaways east impact site was beyond the variation in plant health observed at the control sites and may be due to more than just environmental factors such as climate. The remaining Priority Flora control sites also either increased or remained similar to the previous assessment.

During 2021 there were variations in plant health ratings between March and October, in response to above average rainfall prior to the March assessment followed by below average rainfall prior to the October assessment. In addition, flowering times generally coincided with at least one of the two assessments in 2021 resulting in an increase in the percentage of reproductive plants at certain sites such as *Verticordia jamiesonii*. Although as previously noted the presence of reproductive features does not reflect improvements within the population's health, rather its maturity and evidence of reproduction. Recent plant deaths were recorded across most of the impact and control sites of each taxa (**Table 5-1**). The most deaths between 2020 and 2021 were recorded at the *Hibbertia sp.* Sherwood Breakaways impact sites (a total of seven plants) whereas the respective control sites recorded no recent plant deaths. Conversely, the control site of *Hybanthus floribundus* subsp. *chloroxanthus* recorded a higher number of recent plant deaths between assessments compared to the corresponding impact sites.

Relative to each of the respective control sites, the impact sites of *Hibbertia sp.* Sherwood Breakaways and *Verticordia jamiesonii* had lower overall health ratings while the *Hybanthus floribundus* subsp. *chloroxanthus* impact sites had higher overall health ratings. However, the control site of *Hybanthus floribundus* subsp. *chloroxanthus* is considered to be too close to MKS operations to be an appropriate comparison to the impact sites. While the *Eremophila* sp. long pedicel sites are both control sites without a corresponding impact site, overall plant health at the western control site was higher than the northern control site.

In previous assessments, extended periods of dry seasonal conditions contributed greatly to declines in Priority Flora health since monitoring began in December 2018. Rainfall was above average prior to monitoring establishment in 2018, however 2019 and 2020 were generally drier with below average rainfall recorded across most months. Vegetation in the bioregion is very responsive to moisture availability, and the return of green foliage and new growth can be a visual indicator of plant health recovery (BHP Nickel West 2019). This explains the quick increase in plant health to the above average rainfall received prior to the March 2021 assessment, but also the subsequent decline in plant health during the October assessment after months of below average rainfall. Overall, average rainfall in 2021 was higher than what has been received in the previous assessments but was still considerably below average likely resulting in the recent plant deaths recorded across all sites in 2021.

In addition, dust generated from the MKS haul road or the Six Mile Well pit has also been considered to have contributed to the poorer plant health at the Priority Flora impact sites particularly at the *Hibbertia sp.* Sherwood Breakaways and *Verticordia jamiesonii* impact sites which are located next to the haul road. While dust is common during dry conditions, additional dust has been recorded in both 2020 and 2021 at the impact sites likely originating from the MKS haul road or the Six Mile Well pit at *Hybanthus floribundus* subsp. *chloroxanthus* sites assumed based on amount and colour relative to the control site during the assessment. While dust on plant foliage alone is unlikely to impact plant health, it can exacerbate existing plant water stress in water-limited environments (Matsuki et al. 2016) especially as it accumulates after long periods of no rainfall which was the case in 2020. The combined impact of extended dry conditions and dust is likely to have resulted in the faster and greater decline in overall plant health scores observed across the *Hibbertia sp.* Sherwood Breakaways and *Verticordia jamiesonii* impact sites relative to the respective control sites, but this is less likely to have a considerable effect as more regular rainfall occurs.

Table 5-1 Summary of Priority Flora site status in 2021, compared to 2020; cells highlighted in green show a general increase in plant health since 2020, while cells highlighted red show a general decrease in plant health since 2020.

Species	Site Type	Location	Summary	Potential impacts
***Hybanthus floribundus* subsp. *chloroxanthus* (P3)**	Impact	Southwest of Six Mile Well Pit	• Overall plant health was comparable between 2020 and 2021. • Two new plant deaths in March 2021 (HFC_70 & HFC_71).	Dry seasonal conditions since the November 2019 assessment, very little dust deposition and potential interruptions to sheet flow.
		West of Six Mile Well Pit	• Overall plant health was comparable between 2020 and 2021. • No new plant deaths. • Highest overall plant health ratings in 2021.	
	Control	South of Six Mile Well Pit	• Overall plant health has slightly increased between 2020 and 2021. • Four new plant deaths in 2021 (HFC_53, HFC_55, HFC_58 and HFC_60). • Lowest overall plant health ratings in 2021.	Dry seasonal conditions since the November 2019 assessment, mild dust deposition and potential interruptions to sheet flow. Site location is likely inappropriate for comparison to impact sites.
***Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2)**	Impact	East of haul road	• Overall plant health has decreased between 2020 and 2021. • Three new plant deaths (HSPSB_13, HSPSB_11 and HSPSB_3).	Dry seasonal conditions since the November 2019 assessment, dust deposition and potential interruptions to sheet flow.
		West of haul road	• Overall plant health was comparable between 2020 and 2021. • Four new plant deaths (HSPSB_141, HSPSB_143 HSPSB_144 and HSPSB_157). • Lowest overall plant health ratings in 2021.	
	Control	Wanjarri Nature Reserve	• Overall plant health has slightly increased between 2020 and 2021. • No new plant deaths. • Highest overall plant health ratings in 2021.	Dry seasonal conditions since the November 2019 assessment.
		Far West of haul road	• Overall plant health has increased between 2020 and 2021. • No new plant deaths.	
***Verticordia jamiesonii* (P3)**	Impact	East of haul road	• Overall plant health was comparable between 2020 and 2021. • One new plant death in (VJ_37). • Lowest overall plant health ratings in 2021.	Dry seasonal conditions since the November 2019 assessment, dust deposition and potential interruptions to sheet flow.
	Control	Wanjarri Nature Reserve	• Overall plant health was comparable between 2020 and 2021. • No new plant deaths. • Highest overall plant health ratings in 2021.	Dry seasonal conditions since the November 2019 assessment.
***Eremophila* sp. long pedicels (G. Cockerton 1975) (P2)**	Control	Western edge of Wanjarri Nature Reserve	• Overall plant health was comparable between 2020 and 2021. • No new plant deaths. • Highest overall plant health ratings in 2021.	Dry seasonal conditions since the November 2019 assessment. Mild dust deposition and native and introduced grazing.
		Northern edge of Wanjarri Nature Reserve	• Overall plant health has increased between 2020 and 2021. • Three new plant deaths (ESPLP_216, ESPLP_225 and ESPLP_234).	

5.2 Vegetation condition monitoring

Vegetation condition ratings ranged from 'degraded' to 'excellent' across the impact and control quadrats in 2021 with no change in vegetation condition ratings across most of the impact and control quadrats between 2020 and 2021 (**Table 5-2**). There were some exceptions with decreases in vegetation condition ratings recorded at one infrastructure impact quadrat, one haul road impact quadrat, and one control quadrat, all of which were due to deaths of lower story plants impacting overall vegetation structure. Meanwhile, vegetation condition ratings increased at two haul road impact quadrats and one infrastructure impact quadrat likely associated with the increases in plant cover and health observed since the previous assessment. When considering the number of quadrats in each disturbance category the extent of those changes were comparable across the impact and control sites.

The control quadrats had the highest proportion of quadrats in 'very good' and 'excellent' condition compared to the impact quadrats located adjacent to the haul road as well as mine infrastructure. This was due in part to the reallocation of disturbance categories for some of the vegetation quadrats, but provided an improved comparison of vegetation condition between the impact and control quadrats. Similar to 2020, the mine infrastructure impact quadrats had the lowest proportion of quadrats in 'very good' to 'excellent' condition relative to the impact quadrats adjacent to the haul road and the control quadrats.

Plant health ratings for each dominant species recorded at the impact and control quadrats in 2021 were generally similar to previous values with both the haul road and infrastructure impact quadrats had a higher proportion of dominant species considered 'reproductive' or 'vegetative' compared to the control quadrats. However, nine recent deaths were recorded since the previous assessment, four of which were at control quadrats; three were at the haul road impact quadrats and two were at the infrastructure impact quadrats. Overall, the highest plant cover values and health ratings were assigned to tree species and the smaller shrub and herb species were generally classified as 'declining' likely due to specific plant vulnerabilities to dry conditions or nearby disturbance.

Vegetation condition scores of 'good' or less across the impact quadrats were likely due to a combination of dry seasonal conditions, dust deposition and potential interruptions to sheet flow. Although the control quadrats had a higher number of plant deaths and quadrats with downgraded vegetation condition ratings, hence climate is likely the main contributor to the changes in plant health and vegetation condition between assessments. While more rainfall was received in the year prior to the 2021 relative to the last two assessments it was still considerably below average which follows over three years of below average rainfall. In addition, above average rainfall events in February and March likely reduced the cumulative impact of dust deposition on individual plant health. Pastoral impacts were also considered unlikely to have a notable impact on vegetation condition with only light grazing noted across several quadrats, both impact and control. No weeds were recorded across the quadrats assessed in 2021.

Table 5-2 Summary of vegetation condition site status in 2021, compared to 2020; cells highlighted in green show an increase in vegetation condition ratings since 2020, while cells highlighted red show decreases in vegetation condition ratings since 2020.

Disturbance Category	Monitoring Site Name	Vegetation Condition Rating	Grazing	Weed Cover (%)
Impact – Haul Road	MKSEIA 1	Good	Light	Nil
	MKSEIA 2	Degraded	Light - Historic	Nil
	MKSEIA 3	Degraded	Nil	Nil
	MKSEIA 4	Good	Nil	Nil
	MKSEIA 5	Very Good	Light - Historic	Nil
	MKSEIA 6	Excellent	Light	Nil
	MKSEIA 7	Very Good	Light - Historic	Nil
	MKSEIA 8	Very Good	Light	Nil
	MKSEIA 9	Excellent	Light	Nil
	MKSEIA 19	Excellent	Light - Historic	Nil
	MKSEIA 20	Very Good	Light - Historic	Nil
	MKSEIA 23	Excellent	Light - Historic	Nil
	MKSEIA 24	Excellent	Light	Nil
	MKSEIA 25	Excellent	Nil	Nil
	MKSEIA 26	Excellent	Nil	Nil
	MKSEIA 27	Very Good	Nil	Nil
	MKSEIA 35	Good	Light	Nil
	MKSEIA 36	Very Good	Light	Nil
	MKSEIA 37	Very Good	Light - Historic	Nil
Impact - Infrastructure	MKSEIA 10	Good	Light	Nil
	MKSEIA 11	Good	Light - Historic	Nil
	MKSEIA 12	Good	Light	Nil
	MKSEIA 13	Very Good	Light	Nil
	MKSEIA 14	Degraded	Light	Nil
	MKSEIA 15	Very Good	Light - Historic	Nil
	MKSEIA 16	Very Good	Light - Historic	Nil
	MKSEIA 18	Very Good	Light - Historic	Nil
Control	MKSEIA 19	Excellent	Light - Historic	Nil
	MKSEIA 20	Very Good	Light - Historic	Nil
	MKSEIA 21	Very Good	Medium	Nil
	MKSEIA 22	Very Good	Light - Historic	Nil
	MKSEIA 28	Very Good	Light - Historic	Nil
	MKSEIA 29	Very Good	Light	Nil
	MKSEIA 30	Very Good	Light	Nil
	MKSEIA 31	Very Good	Light - Historic	Nil
	MKSEIA 32	Excellent	Light	Nil
	MKSEIA 33	Good	Light	Nil
	MKSEIA 34	Excellent	Light	Nil
	MKSEIA 38	Very Good	Light - Historic	Nil

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Appendices

We design with community in mind

Appendix A Limitations

A.1 Priority Flora monitoring

The desktop assessment and on-ground verification conducted during the 2020 assessment determined that no impact sites of *Eremophila* sp. long pedicels had been established since there were no plants/extant sites of this taxon within or adjacent to MKS. Without an *Eremophila* sp. long pedicels impact site, the inclusion of this species in the monitoring program cannot contribute to overall conclusions of Priority Flora health within the potential impact area of the MKS project.

The position of the *Hybanthus floribundus* subsp. *chloroxanthus* control site was likely too close to the MKS project to provide a reliable comparison of plant health between control and impact sites of that taxa. The control site was approximately 450 m downstream of the MKS project and recorded dust deposition as well as lower plant health scores compared to its respective impact sites (located less than 230 m from the MKS project).

Certain factors should be considered when assessing change in plant health scores between monitoring rounds. A decline in plant health (or mortality) may occur at either 'impact' or 'control' sites for reasons other than the environmental effects of the MKS project. Non-project related disturbances may include climate factors (e.g. rainfall, wind) which may have localised effects depending on vegetation or soil properties or geology and topography or anthropogenic factors such as pastoral activities (e.g. grazing, weed spreading or dust-generation through track use). Where possible, observable differences related to non-project disturbances, for example recent grazing activity, were recorded during field monitoring.

With the inclusion of both mature and juvenile individuals at each impact and control Priority Flora site it may also be expected that some mature individuals will naturally decline in health and senesce (reach mortality) over multiple years of monitoring across both impact and control sites. When plants reach mortality they are not immediately replaced, but are retained in the dataset. While this tracks the number of dead plants at the location over time, it does not provide an indication of new individuals that may have emerged since December 2018. In the event a dead plant can no longer be visibly located and assessed, sampling intensity can be maintained by including new individuals at the site where feasible.

Stantec continues to use the plant health scale historically used by Western Botanical. It is noted as a qualitative measure of plant health, although the measurable quantitative aspect is lost during the plants reproductive stage. The reproductive stage of an individual may not be an accurate measurement of condition but rather a stage of the lifecycle. An individual may be improving or declining in condition, all while going through its reproductive stages. With the program now biannual, proportions of the population's condition may be left unmonitored, for longer, while the 'reproductive' rating is selected.

A.2 Vegetation condition assessment

Between December 2018 and March 2020, only descriptive data on vegetation condition was collected quarterly for each quadrat. However, the revised methodology introduced in September 2020 incorporates previously collected descriptive data, listed in Stantec (2021), with quantitative comparisons of vegetation condition, plant cover, and plant health between quadrats. As this is the second year of assessment where the revised methodology has been used, comparisons of vegetation condition ratings, estimated plant cover, plant health scores or weed cover can only be directly compared between the 2020 and 2021 assessment. This may limit overall conclusions on whether vegetation condition has been impacted by mining disturbances since the previous data is unstandardised between assessments.

Since the previous assessment the spatial distribution of the impact and control quadrats was modified to increase the reliability of the impact-control vegetation condition comparisons. This addressed a limitation in the vegetation condition assessment monitoring design highlighted in Stantec 2021 which was that MKS EIA 35, MKS EIA 36 and MKS EIA 37 were not suitable to be used as control quadrats, while MKS EIA 19, MKS EIA 20, and MKS EIA 28 were not suitable to be used as haul road impact quadrats. However even with the change in control quadrats there is still a lack of control quadrats that represent the vegetation associations near the mine infrastructure where nine impact quadrats are situated.

There are limitations associated with the use of plant health scores and vegetation condition ratings in assessing the impact of mining disturbance on vegetation. Primarily, the assignment of vegetation condition ratings can vary based on the assessor, the time of year the assessment was made and the amount of time since the initial disturbance (EPA 2016). It is also partially influenced by the assessor's previous knowledge of what that vegetation looked like historically and how that vegetation type would appear when it is in good condition (EPA 2016).

Appendix B Vegetation assessment criteria

Table B-1 Observable Plant Condition Scale (BHP Nickel West 2019)

Category	Score	Descriptor	Prevailing Conditions	Observations
Vegetative	7 a-d	Plants vegetative	Normal, dry season	Foliage healthy and normal for prevailing seasonal conditions. Foliage may be **(a)** actively growing, **(b)** static or **(c)** reduced and/or **(d)** may demonstrate variable levels of auxiliary pigments (anthocyanins). No flower buds initiated, no flowers present, no fruits attached to plant.
Reproductive	6	Plants pre-reproductive	Normal, soon after rainfall	Foliage healthy and normal for prevailing seasonal conditions. Flower buds initiated but no flowers open, no fruits attached to plant.
	5	Plants reproductive	Normal, following sufficient rainfall	Foliage healthy and normal for prevailing seasonal conditions. Flowers open, developing fruits may be attached to plant.
	4	Plants post-reproductive	Normal, drying season, following sufficient rainfall	Foliage healthy and normal for prevailing seasonal conditions. No flowers present. Current season fruits containing viable seeds may be attached to plant and/or the plant may have recently dehisced viable seeds.
Declining	3	Plants exhibiting reduced foliage	Either (a) Reflecting extended dry seasonal conditions; or (b) Abnormal, localised impacts possible, requires investigation	Foliage observably reduced and not normal for prevailing seasonal conditions. Plants exhibiting discoloured-yellowed leaves, increased leaf fall.
	2	Plants with partial dead canopies	Abnormal, localised impacts possible, requires investigation	Foliage observably reduced and not normal for prevailing seasonal conditions. A portion (estimate % of plant canopy is alive) of the plant canopy is alive while a proportion is dead (dried leaves attached or dead stems held within plant canopy).
Dead	1	Plant completely dead	Abnormal, localised impacts possible, requires investigation	No live foliage held on plant, no live bark observable, irreversible death of plant.

Table B-2 Vegetation Condition Scale (Keighery, 1994)

Category	Description
Pristine	Pristine or nearly so. No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix C Plant health score maps October 2021

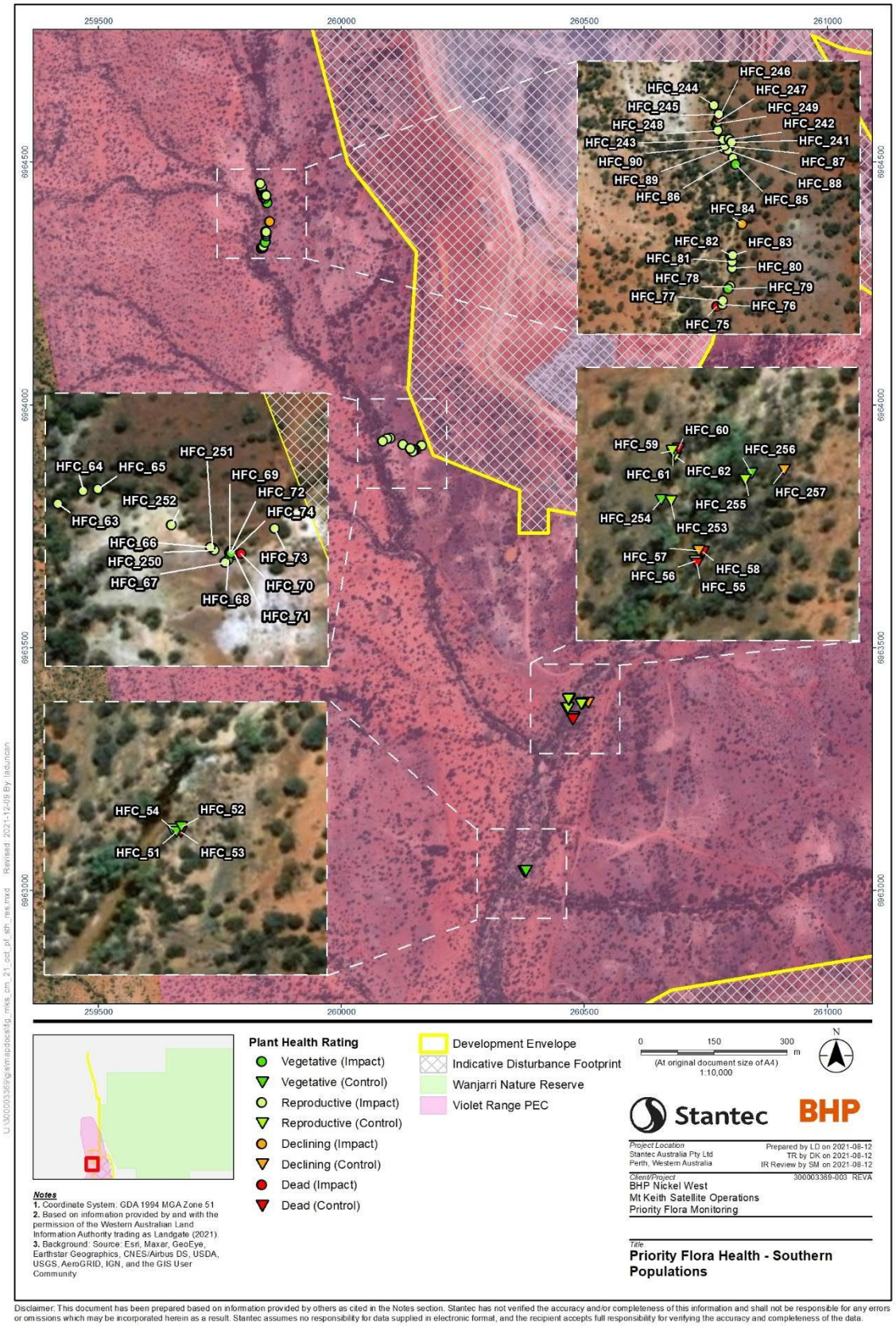


Figure 0-1 Visual representation of the plant health scores of all *Hybanthus floribundus* subsp. *chloroxanthus* individuals assessed in October 2021

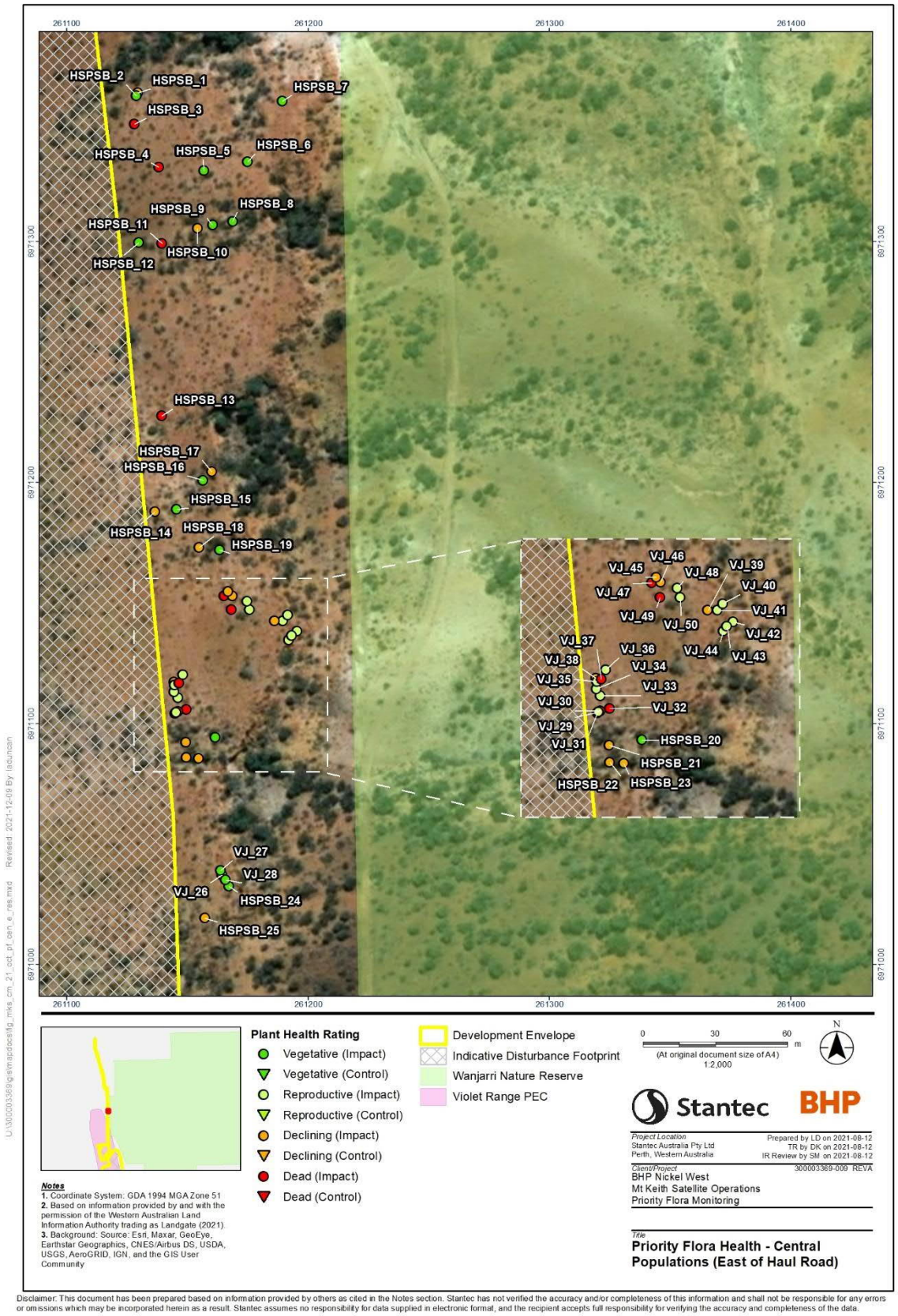


Figure 0-2 Visual representation of the plant health scores of *Hibbertia sp.* Sherwood Breakaways and *Verticordia jamiesonii* individuals east of the haul road, assessed in October 2021

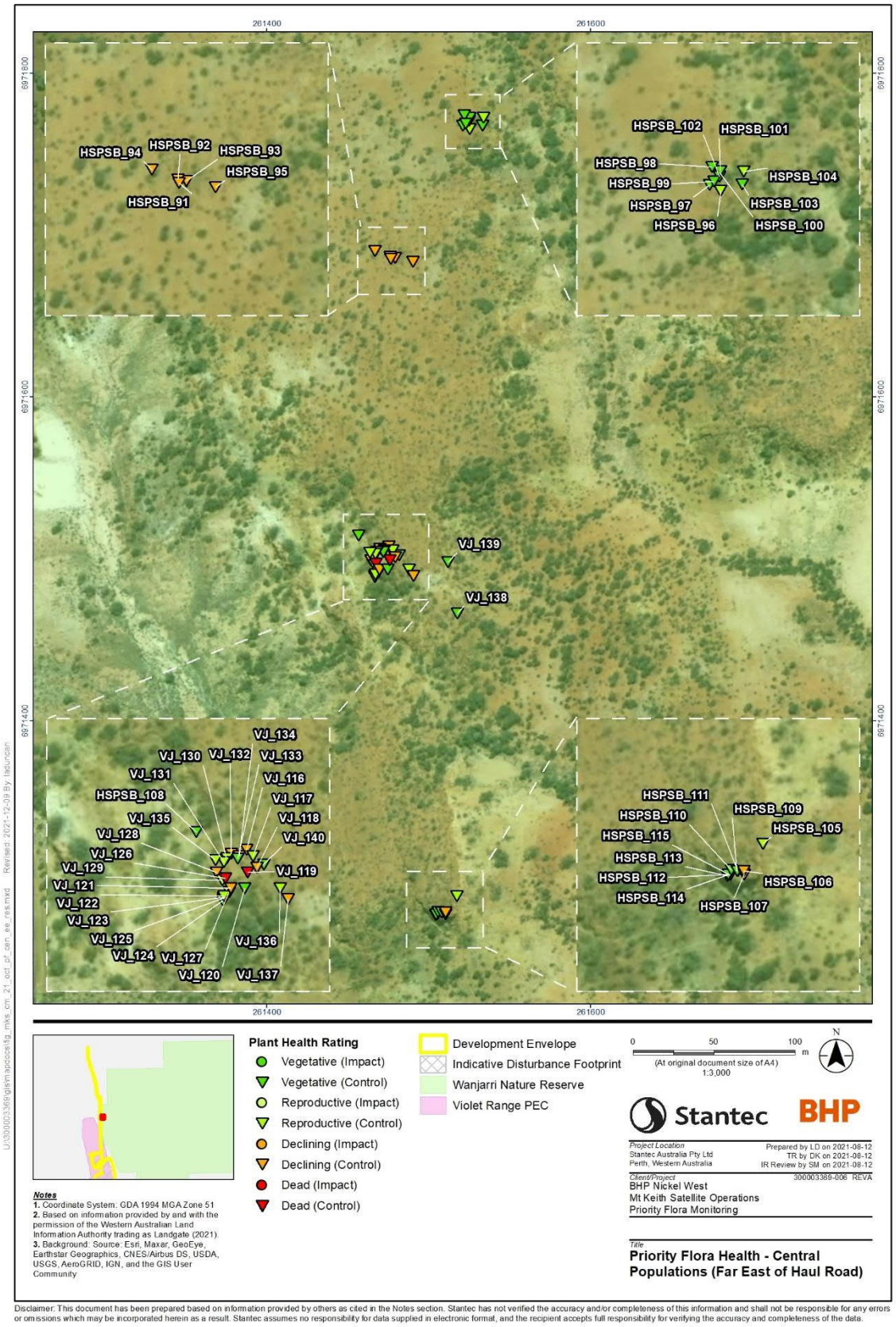


Figure 0-3 Visual representation of the plant health scores of *Hibbertia sp.* Sherwood Breakaways and *Verticordia jamiesonii* individuals far east of the haul road, assessed in October 2021

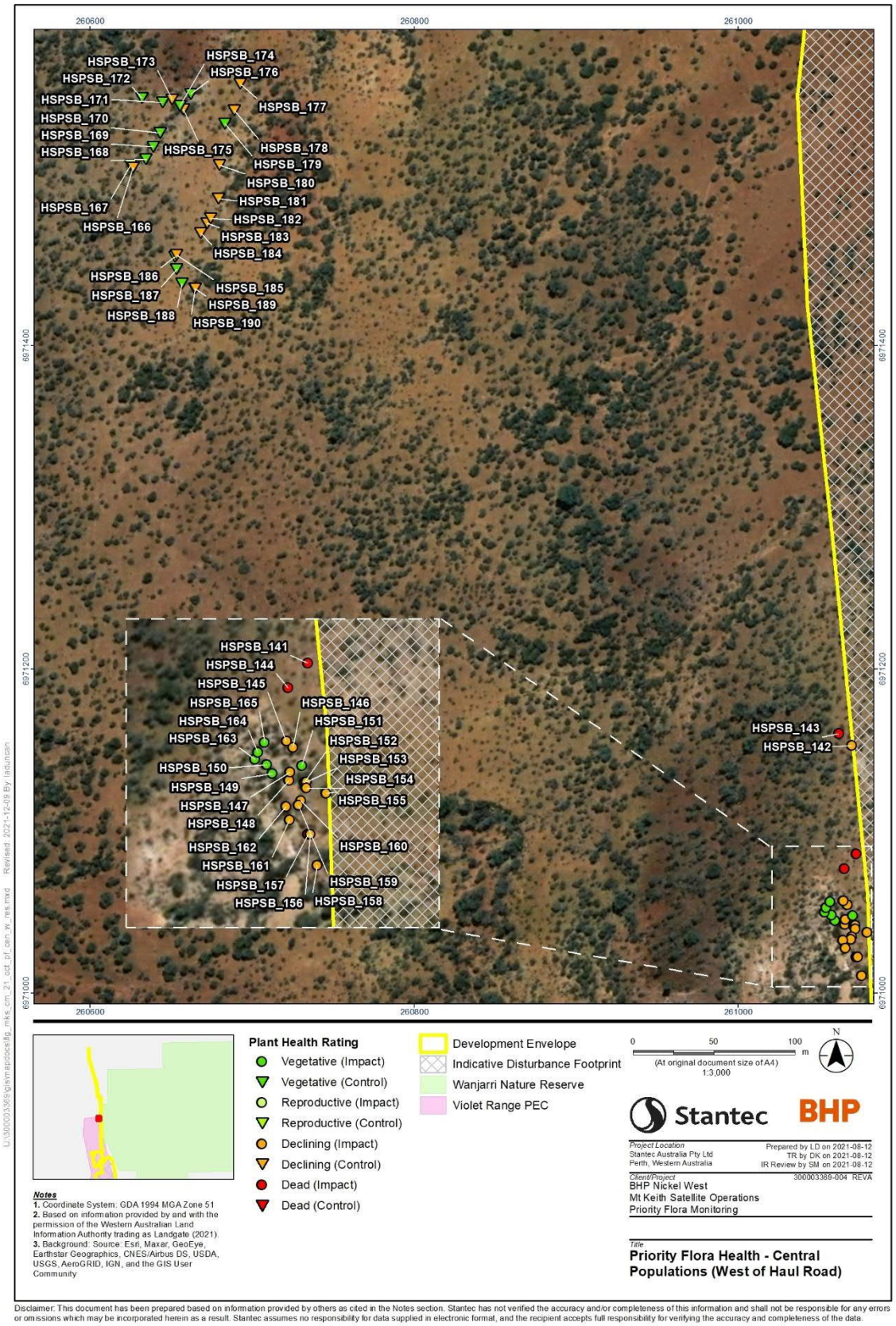


Figure 0-4 Visual representation of the plant health scores of *Hibbertia sp.* Sherwood Breakaways individuals west of the haul road, assessed in October 2021

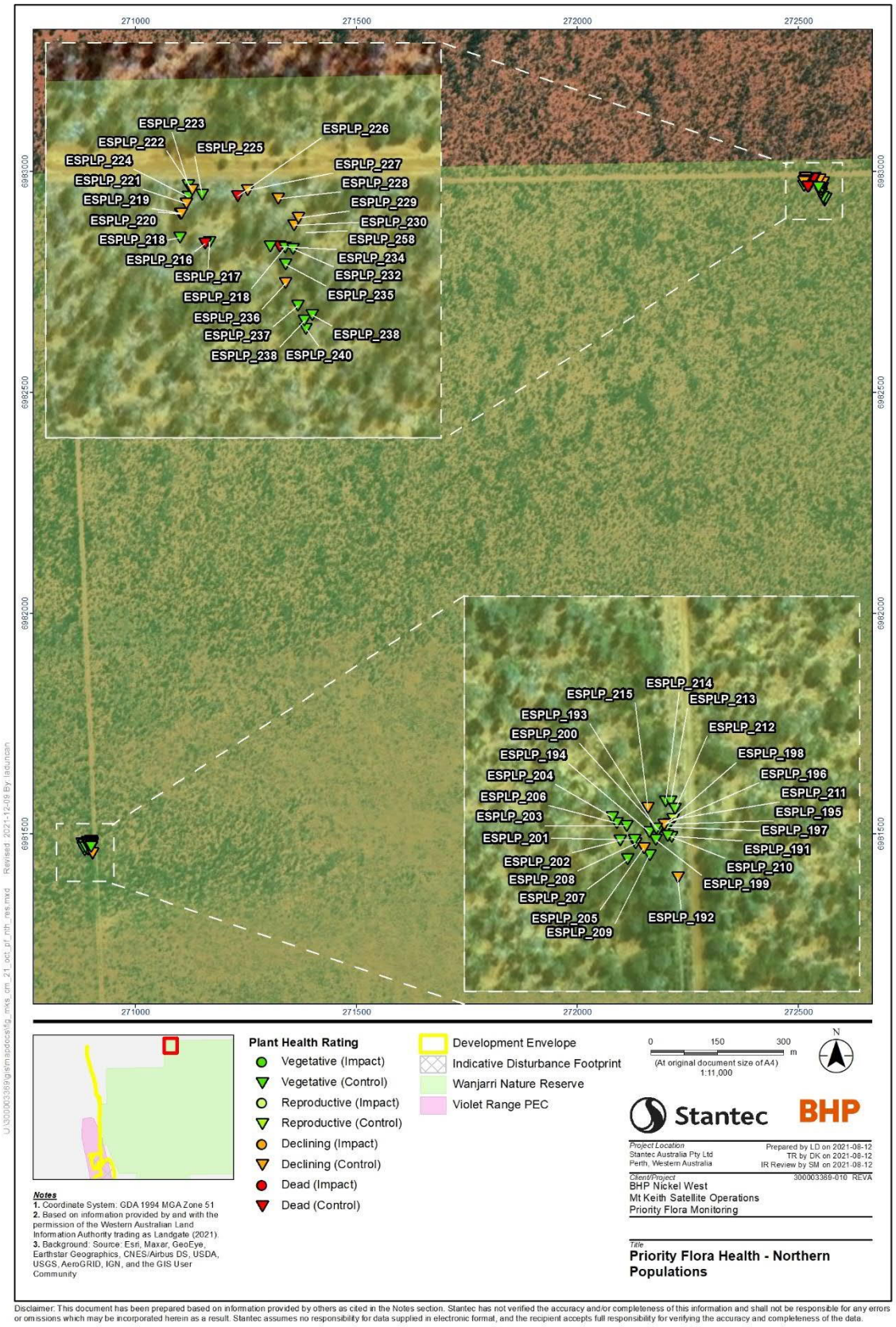


Figure 0-5 Visual representation of the plant health scores of *Eremophila* sp. long pedicels individuals assessed in October 2021

Appendix D Individual plant photographs and health ratings in October 2021

D.1 Hybanthus floribundus subsp. *chloroxanthus*

Table D-1 Photograph and plant health rating of *Hybanthus floribundus* subsp. *chloroxanthus* individuals located at the control site south of Six Mile Well Pit for the October 2021 assessment

Site: Control, South of Six Mile Well Pit (Tag ID 51 to 62 and 253 to 257)					
Tag ID	**HFC_51**	**HFC_52**	**HFC_53**	**HFC_54**	**HFC_55**
Photo					
Category (score)	Vegetative (7b)	Vegetative (7c)	Dead (1)	Reproductive (4)	Dead (1)
Tag ID	**HFC_56**	**HFC_57**	**HFC_58**	**HFC_59**	**HFC_60**
Photo					
Category (score)	Reproductive (6)	Declining (3)	Dead (1)	Reproductive (6)	Dead (1)

Site: Control, South of Six Mile Well Pit (Tag ID 51 to 62 and 253 to 257)					
Tag ID	**HFC_61**	**HFC_62**	**HFC_253**	**HFC_254**	**HFC_255**
Photo					
Category (score)	Reproductive (6)	Reproductive (6)	Reproductive (4)	Vegetative (7d)	Reproductive (5)
Tag ID	**HFC_256**	**HFC_257**			
Photo					
Category (score)	Vegetative (7b)	Declining (2)			

Table D-2 Photograph and plant health rating of *Hybanthus floribundus* subsp. *chloroxanthus* individuals located at the impact site south-west of Six Mile Well Pit for the October 2021 assessment

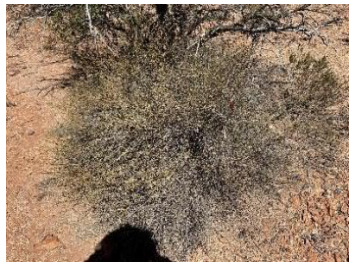
Site: Impact, South-west of Six Mile Well Pit (Tag ID 63 to 74 and 250 to 252)					
Tag ID	**HFC_63**	**HFC_64**	**HFC_65**	**HFC_66**	**HFC_67**
Photo					
Category (score)	Reproductive (4)	Reproductive (4)	Reproductive (4)	Reproductive (4)	Reproductive (4)
Tag ID	**HFC_68**	**HFC_69**	**HFC_70**	**HFC_71**	**HFC_72**
Photo					
Category (score)	Vegetative (7d)	Reproductive (6)	Reproductive (6)	Dead (1)	Reproductive (4)
Tag ID	**HFC_73**	**HFC_74**	**HFC_250**	**HFC_251**	**HFC_252**
Photo					
Category (score)	Reproductive (6)	Vegetative (7b)	Reproductive (4)	Reproductive (4)	Reproductive (4)

Table D-3 Photograph and plant health rating of *Hybanthus floribundus* subsp. *chloroxanthus* individuals located at the impact site west of Six Mile Well Pit for the October 2021 assessment

Site: Impact, West of Six Mile Well Pit (Tag ID 75 to 90 and 241 to 249)					
Tag ID	**HFC_75**	**HFC_76**	**HFC_77**	**HFC_78**	**HFC_79**
Photo					
Category (score)	Dead (1)	Reproductive (4)	Reproductive (4)	Reproductive (4)	Vegetative (7d)
Tag ID	**HFC_80**	**HFC_81**	**HFC_82**	**HFC_83**	**HFC_84**
Photo					
Category (score)	Reproductive (4)	Reproductive (6)	Vegetative (7d)	Reproductive (6)	Declining (3)
Tag ID	**HFC_85**	**HFC_86**	**HFC_87**	**HFC_88**	**HFC_89**
Photo					
Category (score)	Vegetative (7d)	Reproductive (4)	Vegetative (7b)	Reproductive (4)	Reproductive (4)

Tag ID	HFC_90	HFC_241	HFC_242	HFC_243	HFC_244
Photo					
Category (score)	Reproductive (4)	Reproductive (4)	Reproductive (4)	Reproductive (4)	Reproductive (4)
Tag ID	**HFC_245**	**HFC_246**	**HFC_247**	**HFC_248**	**HFC_249**
Photo					
Category (score)	Reproductive (4)	Dead (1)	Vegetative (7d)	Reproductive (4)	Reproductive (4)

D.2 *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771)

Table D-4 Photograph and plant health rating of *Hibbertia* sp. Sherwood Breakaways individuals located at the impact site east of the haul road for the October 2021 assessment

Site: Impact, East of Haul Road (Tag ID 1 to 25)					
Tag ID	**HSPSB_1**	**HSPSB_2**	**HSPSB_3**	**HSPSB_4**	**HSPSB_5**
Photo					
Category (score)	Declining (2)	Vegetative (7d)	Dead (1)	Dead (1)	Vegetative (7c)
Tag ID	**HSPSB_6**	**HSPSB_7**	**HSPSB_8**	**HSPSB_9**	**HSPSB_10**
Photo					
Category (score)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Declining (2)

Site: Impact, East of Haul Road (Tag ID 1 to 25)					
Tag ID	**HSPSB_11**	**HSPSB_12**	**HSPSB_13**	**HSPSB_14**	**HSPSB_15**
Photo					
Category (score)	Dead (1)	Vegetative (7d)	Dead (1)	Declining (3)	Vegetative (7d)
Tag ID	**HSPSB_16**	**HSPSB_17**	**HSPSB_18**	**HSPSB_19**	**HSPSB_20**
Photo					
Category (score)	Vegetative (7d)	Declining (2)	Declining (3)	Vegetative (7d)	Vegetative (7d)
Tag ID	**HSPSB_21**	**HSPSB_22**	**HSPSB_23**	**HSPSB_24**	**HSPSB_25**
Photo					
Category (score)	Declining (2)	Declining (3)	Declining (2)	Vegetative (7d)	Declining (3)

Table D-5 Photograph and plant health rating of *Hibbertia* sp. Sherwood Breakaways individuals located at the impact site west of the haul road for the October 2021 assessment

Site: Impact, West of Haul Road (Tag ID 141 to 165)					
Tag ID	**HSPSB_141**	**HSPSB_142**	**HSPSB_143**	**HSPSB_144**	**HSPSB_145**
Photo					
Category (score)	Dead (1)	Declining (2)	Dead (1)	Dead (1)	Declining (3)
Tag ID	**HSPSB_146**	**HSPSB_147**	**HSPSB_148**	**HSPSB_149**	**HSPSB_150**
Photo					
Category (score)	Declining (2)	Declining (2)	Declining (3)	Vegetative (7c)	Vegetative (7c)
Tag ID	**HSPSB_151**	**HSPSB_152**	**HSPSB_153**	**HSPSB_154**	**HSPSB_155**
Photo					
Category (score)	Vegetative (7d)	Declining (2)	Declining (2)	Declining (3)	Declining (3)

Tag ID	HSPSB_156	HSPSB_157	HSPSB_158	HSPSB_159	HSPSB_160
Photo					
Category (score)	Declining (2)	Dead (1)	Declining (2)	Declining (2)	Declining (3)
Tag ID	**HSPSB_161**	**HSPSB_162**	**HSPSB_163**	**HSPSB_164**	**HSPSB_165**
Photo					
Category (score)	Declining (2)	Declining (2)	Vegetative (7b)	Vegetative (7c)	Vegetative (7c)

Table D-6 Photograph and plant health rating of *Hibbertia* sp. Sherwood Breakaways individuals located at the impact site far west of the haul road for the October 2021 assessment

Site: Impact, Far West of Haul Road (Tag ID 166 to 190)					
Tag ID	**HSPSB_166**	**HSPSB_167**	**HSPSB_168**	**HSPSB_169**	**HSPSB_170**
Photo					
Category (score)	Declining (3)	Reproductive (6)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)
Tag ID	**HSPSB_171**	**HSPSB_172**	**HSPSB_173**	**HSPSB_174**	**HSPSB_175**
Photo					
Category (score)	Vegetative (7a)	Vegetative (7d)	Declining (3)	Vegetative (7d)	Declining (3)
Tag ID	**HSPSB_176**	**HSPSB_177**	**HSPSB_178**	**HSPSB_179**	**HSPSB_180**
Photo					
Category (score)	Vegetative (7d)	Declining (2)	Declining (3)	Vegetative (7d)	Declining (2)

Tag ID	HSPSB_181	HSPSB_182	HSPSB_183	HSPSB_184	HSPSB_185
Photo					
Category (score)	Declining (3)	Declining (3)	Declining (2)	Declining (3)	Declining (3)
Tag ID	**HSPSB_186**	**HSPSB_187**	**HSPSB_188**	**HSPSB_189**	**HSPSB_190**
Photo					
Category (score)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Declining (2)

Table D-7 Photograph and plant health rating of *Hibbertia* sp. Sherwood Breakaways individuals located at the control site in Wanjarri Nature Reserve for the October 2021 assessment

Site: Control, Wanjarri Nature Reserve (Tag ID 91 to 115)					
Tag ID	**HSPSB_91**	**HSPSB_92**	**HSPSB_93**	**HSPSB_94**	**HSPSB_95**
Photo					
Category (score)	Declining (2)	Declining (2)	Declining (2)	Declining (2)	Declining (3)
Tag ID	**HSPSB_96**	**HSPSB_97**	**HSPSB_98**	**HSPSB_99**	**HSPSB_100**
Photo					
Category (score)	Reproductive (6)	Vegetative (7b)	Vegetative (7b)	Vegetative (7d)	Vegetative (7d)
Tag ID	**HSPSB_101**	**HSPSB_102**	**HSPSB_103**	**HSPSB_104**	**HSPSB_105**
Photo					
Category (score)	Vegetative (7c)	Vegetative (7b)	Vegetative (7c)	Reproductive (6)	Reproductive (4)

Tag ID	HSPSB_106	HSPSB_107	HSPSB_108	HSPSB_109	HSPSB_110
Photo				See photo point below	
Category (score)	Declining (2)	Declining (3)	Vegetative (7c)	Vegetative (7b)	Vegetative (7b)
Tag ID	**HSPSB_111**	**HSPSB_112**	**HSPSB_113**	**HSPSB_114**	**HSPSB_115**
Category (score)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)
Photo point ***Photo point established in September 2020 due to plant location on edge of breakaway***					

D.3 Verticordia jamiesonii

Table D-8 Photograph and plant health rating of *Verticordia jamiesonii* individuals located at the control site in Wanjarri Nature Reserve for the October 2021 assessment

Site: Control, Wanjarri Nature Reserve (Tag ID 116 to 140)					
Tag ID	**VJ_116**	**VJ_117**	**VJ_118**	**VJ_119**	**VJ_120**
Photo					
Category (score)	Declining (2)	Reproductive (5)	Declining (2)	Dead (1)	Vegetative (7b)
Tag ID	**VJ_121**	**VJ_122**	**VJ_123**	**VJ_124**	**VJ_125**
Photo					
Category (score)	Declining (2)	Reproductive (5)	Reproductive (5)	Vegetative (7c)	Vegetative (7d)

Site: Control, Wanjarri Nature Reserve (Tag ID 116 to 140)					
Tag ID	**VJ_126**	**VJ_127**	**VJ_128**	**VJ_129**	**VJ_130**
Photo	Photo not taken				
Category (score)	Dead (1)	Reproductive (5)	Declining (2)	Reproductive (5)	Reproductive (5)
Tag ID	**VJ_131**	**VJ_132**	**VJ_133**	**VJ_134**	**VJ_135**
Photo					
Category (score)	Reproductive (5)	Declining (3)	Vegetative (7b)	Declining (2)	Reproductive (5)
Tag ID	**VJ_136**	**VJ_137**	**VJ_138**	**VJ_139**	**VJ_140**
Photo					
Category (score)	Reproductive (5)	Declining (3)	Vegetative (7b)	Vegetative (7b)	Vegetative (7a)

Table D-9 Photograph and plant health rating of *Verticordia jamiesonii* individuals located at the impact site east of the haul road for the October 2021 assessment

Site: Impact, East of Haul Road (Tag ID 26 to 50)					
Tag ID	**VJ_26**	**VJ_27**	**VJ_28**	**VJ_29**	**VJ_30**
Photo					
Category (score)	Vegetative (7c)	Vegetative (7c)	Vegetative (7c)	Reproductive (6)	Dead (1)
Tag ID	**VJ_31**	**VJ_32**	**VJ_33**	**VJ_34**	**VJ_35**
Photo					
Category (score)	Reproductive (5)	Dead (1)	Reproductive (5)	Reproductive (5)	Reproductive (5)
Tag ID	**VJ_36**	**VJ_37**	**VJ_38**	**VJ_39**	**VJ_40**
Photo					
Category (score)	Reproductive (5)	Dead (1)	Declining (2)	Declining (2)	Reproductive (5)
Tag ID	**VJ_41**	**VJ_42**	**VJ_43**	**VJ_44**	**VJ_45**

Photo					
Category (score)	Reproductive (5)	Reproductive (5)	Reproductive (5)	Reproductive (5)	Declining (3)
Tag ID	**VJ_46**	**VJ_47**	**VJ_48**	**VJ_49**	**VJ_50**
Photo					
Category (score)	Declining (3)	Dead (1)	Reproductive (5)	Dead (1)	Reproductive (5)

D.4 *Eremophila* sp. long pedicels (G. Cockerton 1975)

Table D-9 Photograph and plant health rating of *Eremophila* sp. long pedicels individuals located at the control site on the western edge of Wanjarri Nature Reserve for the October 2021 assessment

Site: Control, Western edge of Wanjarri Nature Reserve (Tag ID 191 to 215)					
Tag ID	**ESPLP_191**	**ESPLP_192**	**ESPLP_193**	**ESPLP_194**	**ESPLP_195**
Photo					
Category (score)	Vegetative (7c)	Declining (2)	Vegetative (7d)	Vegetative (7d)	Declining (3)
Tag ID	**ESPLP_196**	**ESPLP_197**	**ESPLP_198**	**ESPLP_199**	**ESPLP_200**
Photo					
Category (score)	Declining (3)	Vegetative (7d)	Declining (2)	Vegetative (7c)	Vegetative (7c)

Site: Control, Western edge of Wanjarri Nature Reserve (Tag ID 191 to 215)					
Tag ID	**ESPLP_201**	**ESPLP_202**	**ESPLP_203**	**ESPLP_204**	**ESPLP_205**
Photo					
Category (score)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)	Declining (2)
Tag ID	**ESPLP_206**	**ESPLP_207**	**ESPLP_208**	**ESPLP_209**	**ESPLP_210**
Photo					
Category (score)	Vegetative (7b)	Vegetative (7b)	Reproductive (5)	Vegetative (7c)	Vegetative (7b)
Tag ID	**ESPLP_211**	**ESPLP_212**	**ESPLP_213**	**ESPLP_214**	**ESPLP_215**
Photo					
Category (score)	Reproductive (4)	Vegetative (7c)	Vegetative (7b)	Vegetative (7b)	Declining (3)

Table D-10 Photograph and plant health rating of *Eremophila* sp. long pedicels individuals located at the control site on the northern edge of Wanjarri Nature Reserve for the October 2021 assessment

Site: Control, Northern edge of Wanjarri Nature Reserve (Tag ID 216 to 240; 258)					
Tag ID	**ESPLP_216**	**ESPLP_217**	**ESPLP_218**	**ESPLP_219**	**ESPLP_220**
Photo					
Category (score)	Dead (1)	Vegetative (7b)	Vegetative (7b)	Declining (2)	Vegetative (7b)
Tag ID	**ESPLP_221**	**ESPLP_222**	**ESPLP_223**	**ESPLP_224**	**ESPLP_225**
Photo					
Category (score)	Declining (3)	Declining (2)	Vegetative (7c)	Vegetative (7b)	Vegetative (7a)
Tag ID	**ESPLP_226**	**ESPLP_227**	**ESPLP_228**	**ESPLP_229**	**ESPLP_230**
Photo					
Category (score)	Dead (1)	Declining (2)	Declining (3)	Declining (3)	Declining (2)

Tag ID	ESPLP_232	ESPLP_233	ESPLP_234	ESPLP_235	ESPLP_236
Photo					
Category (score)	Vegetative (7c)	Vegetative (7a)	Dead (1)	Vegetative (7a)	Declining (3)
Tag ID	**ESPLP_237**	**ESPLP_238**	**ESPLP_239**	**ESPLP_240**	**ESPLP_258 (ESPLP_231 replacement)**
Photo					
Category (score)	Vegetative (7c)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)	Vegetative (7d)

Appendix E Priority Flora monitoring data 2018 to 2021

Table E-1 *Hybanthus floribundus* subsp. *chloroxanthus* monitoring data from 2018 to 2021

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Hybanthus floribundus subsp. chloroxanthus P3	51 to 62 and 253 to 257	Control, south of Six Mile	12	Dec-18	0	0	0	2	2	10	0	0	10	0	0	0	0
			12	Mar-19	0	2	0	1	3	0	9	0	9	0	0	0	0
			12	Jul-19	0	2	0	2	4	8	0	0	8	0	0	0	0
			12	Nov-19	0	2	0	2	4	8	0	0	8	0	0	0	0
			12	Mar-20	0	4	0	0	4	0	0	0	0	0	8	8	0
			17	Jul-20	0	5	1	0	6	0	0	0	0	9	2	11	0
			17	Sep-20	0	5	1	1	7	0	0	1	1	6	3	9	0
			17	Dec-20	0	5	2	3	10	0	0	0	0	4	3	7	0
			17	Mar-21	2	7	0	2	11	0	0	0	0	3	1	4	2
			17	**Oct-21**	**0**	**2**	**1**	**1**	**4**	**4**	**1**	**2**	**7**	**1**	**1**	**2**	**4**
	63 to 74 and 250 to 252	South-west of Six Mile	12	Dec-18	0	0	0	1	1	11	0	0	11	0	0	0	0
			12	Mar-19	0	0	0	0	0	0	12	0	12	0	0	0	0
			12	Jul-19	0	0	0	0	0	12	0	0	12	0	0	0	0
			12	Nov-19	0	0	12	0	12	0	0	0	0	0	0	0	0
			12	Mar-20	0	4	0	0	4	2	4	0	6	0	2	2	0
			15	Jul-20	3	5	4	0	12	0	0	0	0	1	2	3	0
			15	Sep-20	0	3	6	2	11	1	0	0	1	0	3	3	0
			15	Dec-20	2	3	5	2	12	0	0	0	0	1	2	3	0
			15	Mar-21	0	0	1	1	2	3	7	0	10	1	0	1	2
			15	**Oct-21**	**0**	**1**	**0**	**1**	**2**	**2**	**0**	**9**	**11**	**0**	**0**	**0**	**2**
	75 to 90 and 241 to 249	West of Six Mile	16	Dec-18	0	9	0	0	9	7	0	0	7	0	0	0	0
			16	Mar-19	0	0	0	0	0	0	15	0	15	0	0	0	1
			16	Jul-19	0	0	0	0	0	15	0	0	15	0	0	0	1
			16	Nov-19	0	0	15	0	15	0	0	0	0	0	0	0	1
			16	Mar-20	0	14	1	0	15	0	0	0	0	0	0	0	1
			25	Jul-20	9	11	3	1	24	0	0	0	0	0	0	0	1
			25	Sep-20	1	9	1	12	23	0	0	0	0	1	0	1	1
			25	Dec-20	2	10	5	6	23	0	0	0	0	1	0	1	1
			25	Mar-21	1	4	1	0	6	0	14	2	16	1	1	2	1
			25	**Oct-21**	**0**	**1**	**0**	**4**	**5**	**2**	**0**	**15**	**17**	**1**	**0**	**1**	**2**

Table E-2 Hibbertia sp. Sherwood Breakaways (RJ Cranfield 6771) monitoring data from 2018 to 2021

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Hibbertia sp. Sherwood Breakaways (RJ Cranfield 6771) P2	91 to 115	Control, Wanjarri Nature Reserve	24	Dec-18	0	6	2	7	15	9	0	0	9	0	0	0	0
			24	Mar-19	0	4	0	1	5	1	18	0	19	0	0	0	0
			25	Jul-19	0	0	1	24	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	1	0	24	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	14	4	7	25	0	0	0	0	0	0	0	0
			25	Jul-20	0	12	1	7	20	0	0	0	0	4	1	5	0
			25	Sep-20	0	6	2	11	19	0	0	0	0	2	4	6	0
			25	Dec-20	0	5	0	12	17	0	0	0	0	3	5	8	0
			25	Mar-21	5	3	1	6	15	4	0	0	4	1	5	6	0
			25	**Oct-21**	**0**	**10**	**3**	**2**	**15**	**2**	**0**	**1**	**3**	**2**	**5**	**7**	**0**
	1 to 25	East of Haul road	25	Dec-18	0	9	0	7	16	0	9	0	9	0	0	0	0
			25	Mar-19	0	8	0	3	11	2	12	0	14	0	0	0	0
			25	Jul-19	0	0	0	25	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	2	0	23	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	5	0	1	6	0	0	0	0	0	19	19	0
			25	Jul-20	0	3	2	3	8	0	0	0	0	11	6	17	0
			25	Sep-20	0	2	1	5	8	0	0	0	0	9	8	17	0
			25	Dec-20	0	1	1	6	8	0	0	0	0	9	7	16	1
			25	Mar-21	1	6	4	0	11	2	2	0	4	2	4	6	4
			25	**Oct-21**	**0**	**0**	**1**	**11**	**12**	**0**	**0**	**0**	**0**	**4**	**5**	**9**	**4**
	141 to 165	West of Haul Road	25	Dec-18	0	0	0	0	0	0	0	0	0	0	0	0	0
			25	Mar-19	0	4	0	8	12	0	13	0	13	0	0	0	0
			25	Jul-19	0	3	0	22	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	0	0	25	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	7	0	0	7	0	0	0	0	0	18	18	0
			25	Jul-20	0	4	0	1	5	0	0	0	0	9	8	17	3
			25	Sep-20	0	4	0	0	4	0	0	0	0	10	8	18	3
			25	Dec-20	0	2	2	0	4	0	0	0	0	3	13	16	5
			25	Mar-21	2	2	1	0	5	0	0	1	1	4	13	17	2
			25	**Oct-21**	**0**	**1**	**4**	**1**	**6**	**0**	**0**	**0**	**0**	**5**	**10**	**15**	**4**
	166 to 190	Far West of Haul Road	25	Dec-18	Previous results not available at time of reporting.												
			25	Mar-19													

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
			25	Jul-19													
			25	Nov-19													
			25	Mar-20	0	2	2	7	11	0	0	0	0	0	14	14	0
			25	Jul-20	0	0	2	9	11	0	0	0	0	11	3	14	0
			25	Sep-20	0	0	2	7	9	0	0	0	0	10	6	16	0
			25	Dec-20	0	0	2	6	8	0	0	0	0	9	8	17	0
			25	Mar-21	7	2	6	0	15	3	0	0	3	0	7	7	0
			25	**Oct-21**	**1**	**0**	**0**	**11**	**12**	**1**	**0**	**0**	**1**	**8**	**4**	**12**	

Table E-3 *Verticordia jamiesonii* monitoring data from 2018 to 2021

					Number of individual plants in each health category													
					Vegetative					Reproductive				Declining			Dead
Species	Tag #	Site Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Verticordia jamiesonii (P3)	VJ 116 to 140	Wanjarri Nature Reserve	25	Dec-18													
			25	Mar-19	0	25	0	0	25	0	0	0	0	0	0	0	0
			25	Jul-19	0	13	4	8	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	0	0	25	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	13	9	1	23	0	0	0	0	0	1	1	1
			25	Jul-20	0	7	6	7	20	0	0	0	0	3	1	4	1
			25	Sep-20	0	4	4	5	13	0	0	0	0	7	4	11	1
			25	Dec-20	0	3	2	5	10	0	0	0	0	9	5	14	1
			25	Mar-21	0	6	7	0	13	0	0	0	0	6	3	9	3
			25	**Oct-21**	**1**	**3**	**1**	**2**	**7**	**0**	**9**	**0**	**9**	**2**	**5**	**7**	**1**
	VJ 26 to 50	East of Haul Road	25	Dec-18	0	13	0	3	16	7	0	2	9	0	0	0	0
			25	Mar-19	0	21	0	4	25	0	0	0	0	0	0	0	0
			25	Jul-19	0	3	0	22	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	3	0	22	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	8	0	0	8	0	0	0	0	0	15	15	2
			25	Jul-20	4	0	0	4	8	0	0	0	0	13	1	14	3
			25	Sep-20	0	3	0	0	3	1	0	0	1	14	4	18	3
			25	Dec-20	0	3	0	0	3	0	0	0	0	11	8	19	3
			25	Mar-21	0	3	0	0	3	0	0	0	0	7	11	18	4
			25	**Oct-21**	**0**	**0**	**3**	**0**	**3**	**1**	**12**	**0**	**13**	**2**	**2**	**4**	**5**

Table E-4 E*remophila* sp. long pedicels monitoring data from 2018 to 2021

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
Species	Tag #	Site Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Eremophila sp. long pedicels (G. Cockerton 1975) (P2)	ESPLP 191 to 215	Control/ Western Edge of Wanjarri Nature Reserve	0	Dec-18	Previous data was descriptive and therefore no plant health scores were given. In July 2020, 25 individuals were established at each known population and scores were assigned.												
			0	Mar-19													
			0	Jul-19													
			0	Nov-19													
			0	Mar-20													
			25	Jul-20	0	4	14	0	18	0	0	0	0	6	0	6	0
			25	Sep-20	0	4	8	8	20	0	0	0	0	5	0	5	0
			25	Dec-20	0	4	6	10	20	0	0	0	0	4	1	5	0
			25	Mar-21	8	11	1	0	20	0	1	0	1	2	2	4	0
			25	**Oct-21**	**0**	**9**	**5**	**3**	**17**	**0**	**1**	**1**	**2**	**4**	**2**	**6**	**0**
	ESPLP 216 to 240	Control/ Northern Edge of Wanjarri Nature Reserve	0	Dec-18	Previous data was descriptive and therefore no plant health scores were given. In July 2020, 25 individuals were established at each known population and scores were assigned.												
			0	Mar-19													
			0	Jul-19													
			0	Nov-19													
			0	Mar-20													
			25	Jul-20	0	1	7	0	8	0	0	0	0	11	6	17	0
			25	Sep-20	0	1	1	6	8	0	0	0	0	7	10	17	0
			25	Dec-20	0	1	2	7	10	0	0	0	0	6	8	14	1
			25	Mar-21	15	2	1	0	18	0	0	0	0	2	2	4	3
			25	**Oct-21**	**2**	**8**	**3**	**1**	**14**	**0**	**0**	**0**	**0**	**4**	**4**	**8**	**3**

Appendix F 2021 Detailed quadrat assessments

F.1 MKS EIA 1 - Haul Road Impact

Site ID: MKS EIA 1	Co-ordinates: 51 J 261082 6973489
Location: ~ 40 m west of haul road **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition**: Good **Grazing:** Light **Weed cover:** Nil **Photo direction:** N	**Comments:** Drainage at this site is from south-east to north-west. Previous plant deaths. Heavily impacted by dust due to proximity to haul road. Loss of foliage on Acacia trees. Stressed vegetation, particularly *S. ectogama* which has lost most of its foliage. Ants present. Cryptograms present but covered in dust. Rabbit warrens observed. Subject peg had to be reinstated, removed in grading of fence line track.

Species	Cover (%)	Plant Health Score	Comments
Aristida jerichoensis	60	3	Dry. Good cover.
Sida ectogama	12	7d	Covered in dust. Loss of foliage.
Acacia aneura	30	7b	Covered in dust. Loss of foliage.
Eremophila latrobei	2	4	Dusty. Stressed.
Eremophila galeata	2	5	Dusty. Stressed.

Other species: *Acacia ramulosa var. linophylla, Acacia quadrimarginea, Solanum lasiophyllum, Sclerolaena eurotioides, Ptilotus exaltatus, Poaceae sp.*

2020

2021
Photo shifted to northern most post.

F.2 MKS EIA 2 - Haul Road Impact

Site ID: MKS EIA 2			Co-ordinates: 51 J 261089 6972365
Location: ~ 40 m west of MKS haul road	**Comments:** Water stressed vegetation. Multiple dead shrubs. Heavy dust cover over plants. Kangaroo scats and termite mounds present. Internal drainage in Grove.		
Veg. Type: Groved Mulga shrubland			
Veg. Condition: Degraded			
Grazing: Light, historic			
Weed cover: Nil			
Photo direction: NW			
Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	50	7b	Okay, but dusty and dry.
Eucalyptus lucasii	2	7b	Mostly outside quadrat.
Acacia tetragonophylla	2	4	Post-flowering. Partially dead canopy.
Sida ectogama	<2	2	Little live foliage remaining.
Eremophila latrobei	<2	3	Little live foliage remaining. Dusty. Yellowing.
Other species: *Eragrostis eriopoda, Poaceae sp., Psydrax latifolia, Eremophila pungens* (P4)			

2020

2021

F.3 MKS EIA 3 - Haul Road Impact

Site ID: MKS EIA 3	Co-ordinates: 51 J 261117 6971563
Location: ~ 9 m west of haul road	**Comments:** Soil surface 95% gravely stones, 5% silty sand and clay. All plants are water stressed. Some dead shrubs present, including all upper storey shrubs and trees. Dust affected. Track runs through the quadrat.
Veg. Type: Groved Mulga shrubland / Archaean granite geology	
Veg. Condition: Degraded	
Grazing: Nil	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Eremophila galeata	5	5	Partially dead canopy.
Acacia pruinocarpa	2	7b	Good condition.
Ptilotus obovatus	2	5	Partially dead canopy.
Senna glaucifolia	2	7c	Good condition.
Solanum lasiophyllum	0	1	Dead.
Ptilotus schwartzii	2	5	Replaces *Solanum lasiophyllum*

Other species: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771), *Poaceae* sp.

2020

2021

F.4 MKS EIA 4 - Haul Road Impact

Site ID: MKS EIA 4	Co-ordinates: 51 J 261049 6971565
Location: ~ 75 m west of haul road	**Comments:** Cleared road and soil bund. This area gets a lot of dust from vehicular traffic and this is clearly visible on *Mulga*, *Senna* and *Eremophila* species. Drainage is west to south west so it is expected that the haul road may have minimal impact on sheet flow. No cryptograms. Historical Acacia deaths. Directly adjacent to haul road. Soil surface has high dust coverage.
Veg. Type: Groved Mulga shrubland/ Stony ironstone Mulga shrubland	
Veg. Condition: Good	
Grazing: Nil	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	15	5	Dust affected.
Eremophila galeata	2	2	Very stressed.
Ptilotus obovatus	0	1	Dead
Eremophila latrobei	<2	2	Very stressed.
Senna glaucifolia	<2	2	Replaces *Ptilotus obovatus*

Other species: *Eriachne mucronata*

2020

2021

F.5 MKS EIA 5 - Haul Road Impact

Site ID: MKS EIA 5	Co-ordinates: 51 J 261204 6970774
Location: ~ 80 m east of haul road **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition:** Very good **Grazing:** Light, historic **Weed cover:** Nil **Photo direction:** N	**Comments:** Site lies 100m downstream from the MKS haul road and about 15m west of the WNR track. Minor drainage line drains from southern end of the breakaway in a south-east direct into the Wanjarri Nature Reserve. The haul road interrupts that drainage path. Cryptograms on soil surface. Litter present under trees. Pedestalling erosion present. Vegetation is water stressed and dust affected. Historical *Acacia* deaths recorded. Termite mounds and kangaroo scats observed.

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	15	7b	Good condition.
Acacia tetragonophylla	10	4	Old flowers still attached to plant.
Sida ectogama	20	3	Dry, foliage loss observed.
***Eremophila pungens* (P4)**	3	7c	Good condition.
Eremophila forrestii	2	3	Dry, foliage loss observed.

Other species: *Acacia craspedocarpa, Eremophila galeata, Eremophila jucunda subsp. jucunda, Psydrax latifolia, Enneapogon avenaceus, Eremophila compacta, Ptilotus exaltatus, Sclerolaena eurotioides, Eremophila latrobei, Dodonaea petiolaris, Ptilotus obovatus , Ptilotus helipteroides, Aristida jerichoensis, Senna sp.* Meekatharra

2020

2021

F.6 MKS EIA 6 - Haul Road Impact

Site ID: MKS EIA 6	Co-ordinates: 51 J 261139 6971172
Location: ~13 m east of haul road	**Comments:** Post has WB 30 on it and all four posts are installed. All vegetation is in good condition considering dry seasonal conditions. Minimal dust impact. Area protected by large bund along the edge of the haul road, in previous assessment but was not observed in 2021.
Veg. Type: Archaean granite geology	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Callitris columellaris	10	7d	Good condition.
***Thryptomene* sp. Leinster (P3)**	15	7d	Good condition.
Acacia pruinocarpa	2	7b	Good condition.
Acacia quadrimarginea	10	7b	Good condition.
Eriachne mucronata	2	3	Dry, with dead patches.

Other species: *Acacia rhodophloia, Acacia aneura, Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771), Hakea leucoptera subsp. sericipes, Acacia tetragonophylla, Dodonaea petiolaris, Verticordia jamiesonii, Poaceae sp., Calytrix uncinata*

2020

2021

F.7 MKS EIA 7 - Haul Road Impact

Site ID: MKS EIA 7	Co-ordinates: 51 J 261216 6970204
Location: ~ 90 m east of haul road	**Comments:** Drainage from the west, interrupted by haul road. Two posts installed. Kangaroo scats and termite mounds were present. Litter present under large *Acacia* shrubs. Half of quadrat dominated by vegetation, but other half is almost bare. Historic shrub deaths to the west of the quadrat. Upper storey healthy while lower storey was water stressed. Dust affected.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very good	
Grazing: Light, historic	
Weed cover: Nil	
Photo direction: N	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	30	7b	Lower branches have reduced foliage. Previously grazed.
Eremophila compacta	<2	3	Stressed adult beneath Mulgas.
Sida ectogama	20	3	Dusty and stressed. Some foliage loss.
Eremophila granitica	<2	3	Dusty and stressed. Some foliage loss.
Acacia thoma	20	7b	Good condition.

Other species: *Enneapogon caerulescens, Ptilotus obovatus, Ptilotus exaltatus, Eremophila galeata, Eremophila forrestii, Ptilotus helipteroides, Senna sp.* Meekatharra, *Aristida sp.*

2020

2021

F.8 MKS EIA 8 - Haul Road Impact

Site ID: MKS EIA 8	Co-ordinates: 51 J 261231 6969060
Location: ~ 60 m east of haul road	**Comments:** This site may dependent on sheet flow from the west. Site is covered in stony ferruginous rocks and boulders. No annuals at time of assessment. Evidence of grazing, possibly historic. Dust present on vegetation. Termite mounds and rabbit warrens present. Dead grasses and shrubs observed. Litter present under Acacias.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Very good	
Grazing: Light	
Weed cover: Nil	
Photo direction: N	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	20	7b	Healthy adult individuals.
Psydrax suaveolens	<2	3	
Eremophila spectabilis	10	6	Dry, but full canopy.
Eremophila latrobei	<2	6	Stressed individuals under *Acacias*.
Senna glaucifolia	<2	7c	

Other species: *Ptilotus schwartzii, Eriachne helmsii, Eremophila jucunda subsp. jucunda, Eragrostis eriopoda, Sida sp. Golden calyces glabrous (H.N. Foote 32)*

2020

2021

F.9 MKS EIA 9 - Haul Road Impact

Site ID: MKS EIA 9	Co-ordinates: 51 J 261218 6969942
Location: ~95 m east of haul road	**Comments:** Soil surface is 95% quartz, ironstone rocks and gravel with 5% silty sand. No cryptograms observed. Site is on a low rise, higher than surrounding landscape and unlikely to be affected by interruption to drainage due to the haul road. Many young *Hakea leucoptera* observed. Many Maireanas stressed. No annuals. Less impacted by dust than other quadrats observed despite being closer to the haul road.
Veg. Type: Weathered basalt, *Hakea leucoptera* subsp. *sericipes*/ *Eremophila pantonii* shrubland	
Veg. Condition: Excellent	
Grazing: Nil	
Weed cover: Nil	
Photo direction: N	

Species	Cover (%)	Plant Health Score	Comments
Hakea leucoptera* subsp. *sericipes	10	4	Healthy. Old seed pods present. Many juveniles.
Maireana triptera	<2	3	Stressed. Loss of foliage.
***Senna* sp. Meekatharra**	<2	7b	Dusty, but healthy. Juveniles present.
Eremophila pantonii	<2	5	Healthy. Flowering.
-	-	-	-

Other species: *Atriplex semilunaris, Ptilotus obovatus, Maireana georgei*

2020

2021

F.10 MKS EIA 10 - Infrastructure Impact

Site ID: MKS EIA 10	Co-ordinates: 51 J 260553 6966093
Location: ~ 320 m north of Run-of-mine	**Comments:** Topsoil stockpile in the background of photo. Note east peg is 8m from center peg (closer than standard 10m distance). Drainage comes from the west, the Run-of-mine is north of the quadrat so drainage may not be interrupted. Very bare quadrat. Low cover of cryptograms present. Some understorey shrub death. No annuals. Litter present under Acacias. Dust present on vegetation. Vegetation is dry, reflecting extended dry seasonal conditions. Old rabbit warrens present.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Good	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	5	7b	Some dust, full canopy.
Ptilotus schwartzii	<2	5	Actively flowering.
Eremophila forrestii	<2	3	Some loss of foliage. Lots of dust present.
Eremophila spectabilis	<2	7d	Very dry. Yellowing leaves. Dusty.
Ptilotus obovatus	<2	5	Very dry, foliage loss. Flowering.

Other species: *Eremophila latrobei, Psydrax suaveolens, Eriachne helmsii, Enneapogon caerulescens, Acacia pruinocarpa*

2020

2021

F.11 MKS EIA 11 - Infrastructure Impact

Site ID: MKS EIA 11			Co-ordinates: 51 J 260029 6965525
Location: ~ 250 m east of Run-of-mine **Veg. Type:** Stony ironstone low/Mulga shrubland **Veg. Condition:** Good **Grazing: Light,** historic **Weed cover:** Nil **Photo direction:** NW	**Comments:** Six mile well pit and run-of-mine in background. 100% rocky laterite with quartz stones and gravel. Lichens present on rocks. Light dust layer visible on rocks. Dry vegetation, with sparse cover. Many dead understorey plants, particularly *P. schwartzii.* Likely affected by extended dry seasonal conditions. Note: This site is positioned perpendicular to the MKS clearing edge and transversely across the slope.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	2	7c	Healthy. Previously grazed, with browse line observed.
Acacia quadrimarginea	<2	2	Loss of 70% foliage.
***Thryptomene* sp. Leinster (P3) (EIA_11_001)**	<2	3	Stressed individuals.
Eremophila latrobei	<2	2	Stressed and dry.
Ptilotus obovatus	<2	3	Dry. Some foliage loss.
Other species: *Harnieria kempeana, Senna glaucifolia, Ptilotus schwartzii*			

2020

2021

F.12 MKS EIA 12 - Infrastructure Impact

Site ID: MKS EIA 12	Co-ordinates: 51 J 259909 6964937
Location: ~ 150 m east of Six Mile Well pit	**Comments:** All *Maireana* sp. plants stressed, likely reflecting extended dry seasonal conditions. High dust load present on foliage. No annuals. No cryptograms present. Rabbit scats and burrows observed.
Veg. Type: Weathered basalt, *Hakea leucoptera* subsp. *sericipes*/ *Eremophila pantonii* shrubland	
Veg. Condition: Good	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Eremophila pantonii	8	7c	
***Acacia aneura* sens. lat.**	15	7c	
Maireana triptera	2	2	Very stressed.
Senna artemisioides* subsp. *helmsii	<2	2	Loss most of canopy.
***Grevillea inconspicua* (P4) (EIA_12_001)**	2	7b	

Other species: *Eremophila scoparia ,Maireana georgei, Maireana tomentosa, Sclerolaena eurotioides, Lysiana sp.*

2020

2021

F.13 MKS EIA 13 - Infrastructure Impact

Site ID: MKS EIA 13	Co-ordinates: 51 J 260866 6964098
Location: ~ 80 m from Six Mile Well pit **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition:** Very good **Grazing:** Light **Weed cover:** Nil **Photo direction:** NW	**Comments**: Creek bed at the site is normal with healthy fringing grasses and a sandy creek bed. On western bank of Jones Creek. Creek banks composed of silty sand overlaying polymictic rocks including weather sandstone and concreted Wiluna hardpan. All vegetation in good condition, most are vegetative. *Eucalyptus camaldulensis* in healthy condition. Some historic shrub death. Heavy dust deposition on vegetation and soil surface. Ants present. Only middle post present.

Species	Cover (%)	Plant Health Score	Comments
Acacia caesaneura	10	5	Seeding. Vegetative.
Acacia burtikii	15	4	Budding. Vegetative.
Themeda triandra	15	4	Budding. Declining.
Dodonaea viscosa	5	4	Budding. Vegetative.
***Dodonaea rigida* (EIA_13_012)**	5	4	Budding. Vegetative.

Other species: *Ptilotus exaltatus, Ptilotus obovatus, Duperreya sericea, Grevillea inconspicua, Santalum spicatum, Eucalyptus camaldulensis subsp. obtusa, Eremophila granitica, Hemigenia exilis, Eremophila pantonii, Eremophila oldfieldii subsp. angustifolia, Hybanthus floribundus subsp. chloroxanthus*

2020

2021

F.14 MKS EIA 14 - Infrastructure Impact

Site ID: MKS EIA 14	Co-ordinates: 51 J 263217 6963155
Location: ~ 400 m south-east of WRL	**Comments:** Eastern side of MKS, outside clearing margin. Track runs through quadrat. Previous Acacia deaths observed as well as recent plant deaths. Vegetation is dry. Post missing.
Veg. Type: Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland	
Veg. Condition: Degraded	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia caesaneura	10	7b	
Acacia ramulosa* var. *linophylla	5	7b	
Triodia basedowii	2	7d	
***Eragrostis* eriopoda**	<2	7b	
-	-	-	-

Other species: *Eremophila spectabilis*

2020

2021

F.15 MKS EIA 15 - Infrastructure Impact

Site ID: MKS EIA 15	Co-ordinates: 51 J 260412 6961163
Location: ~ 2.2 km south west of WRL, ~ 450 m from Jones Creek track	**Comments:** Historical Acacia deaths. Kangaroo scats present. Several dead *Maireana* individuals. Annual grass cover. Dust affected Acacias. This site is a minor drainage line within a stony plain. Drainage here is from the east, from the south-western corner of the MKS development envelope.
Veg. Type: Mulga over *Maireana triptera* shrubland/ Drainage line Mulga shrubland	
Veg. Condition: Very good	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Ptilotus obovatus	5	5	Some foliage loss but flowering.
Acacia aneura	40	5	Historic browsing lines. Vegetative. Flowering.
Eremophila galeata	5	5	Green foliage on end of stems, browning at base. Vegetative. Flowering.
Aristida jerichoensis	40	7d	High cover.
Senna artemisioides* subsp. *helmsii	2	2	Little foliage remaining.
Other species: *Solanum lasiophyllum, Ptilotus schwartzii, Maireana georgei, Ptilotus helipteroides*			

2020

2021

F.16 MKS EIA 16 - Infrastructure Impact

Site ID: MKS EIA 16	Co-ordinates: 51 J 260261 6961683
Location: ~ 1.8 km south west of WRL, ~ 250 m from Jones Creek track **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition:** Very good **Grazing:** Light, historic **Weed cover:** Nil **Photo direction:** NW	**Comments:** All vegetation in good condition for dry extended seasonal conditions. Cryptograms are present but dry. High grass cover. Dead *Acacia tetragonophylla* present and annual species. Dust on foliage of most species. Stream channel showing clayey sand on banks and stony stream bed. This site lies downslope of the MKS development with a large proportion of its catchment interrupted by MKS. Dust on foliage. Risk of water starvation or increased sedimentation from adjacent mining operations.

Species	Cover (%)	Plant Health Score	Comments
Sida ectogama	5	5	Dusty. Vegetative.
Eremophila granitica	5	5	Browning of stem ends. Vegetative.
Eremophila galeata	5	7d	Browning foliage and foliage loss.
***Acacia ?craspedocarpa (hybrid)* (EIA_16_001)**	25	7c	
***Acacia aptaneura* (EIA_16_002)**	60	7c	
Other species: *Eriachne helmsii, Psydrax suaveolens, Solanum lasiophyllum, Ptilotus obovatus, Eremophila latrobei, Ptilotus exaltatus, Senna artemisioides subsp. filifolia, Aristida jerichoensis, Santalum ?lanceolatum, Ptilotus helipteroides*			

2020

2021

F.17 MKS EIA 18 - Infrastructure Impact

Site ID: MKS EIA 18	Co-ordinates: 51 J 261285 6964460
Location: ~ 195 m south east of Run-of-Mine/ Six Mile Well	**Comments:** Jones Creek, upstream of bridge crossing on the eastern bank. Grasses on edge of the creek are stressed, dusty and grazed. *Eucalyptus camaldulensis* are healthy. Heavy dust load on most shrubs and grasses. Soil surface also covered in dust. Ants present.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	25	5	Flowering and vegetative.
Santalum spicatum	20	5	Flowering and declining.
Aristida jerichoensis	10	7b	
Acacia burkittii	10	5	Pods on plants.
Themeda triandra	5	7d	

Other species: *Santalum lanceolatum, Acacia aneura, Eucalyptus camaldulensis subsp. obtusa, Eragrostis eriopoda, Eremophila gilesii, Sida ectogama, Maireana tomentosa, Ptilotus obovatus, Eremophila latrobei, Teucrium teucriiflorum, Rhagodia drummondii, Ptilotus exaltatus*

2020

2021

F.18 MKS EIA 23 - Haul Road Impact

Site ID: MKS EIA 23	Co-ordinates: 51 J 261137 6971361
Location: ~ 25 m east of haul road	**Comments:** Previously cleared by haul road, need to move quadrat. Minimal dust load despite close distance from haul road. Foliage vegetative.
Veg. Type: Granitic Mulga shrubland on Archaean geology	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia quadrimarginea	10	7b	
Callitris columellaris	5	7b	
***Thryptomene* sp. Leinster (P3)**	10	6	Vegetative, post flowering.
Ptilotus obovatus	2	5	Declining, flowering.
Dodonaea petiolaris	2	5	Declining, flowering.

Other species: *Eriachne helmsii, Acacia aneura, Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771), Eremophila latrobei, Eremophila jucunda subsp. jucunda, Eriachne mucronata, Calytrix uncinata, Olearia stuartii*

2020

2021

F.19 MKS EIA 24 - Haul Road Impact

Site ID: MKS EIA 24	Co-ordinates: 51 J 261187 6971273
Location: ~ 10 m west from haul road	**Comments:** Looking southwards parallel to the haul road. No annuals. Most shrubs are vegetative, but dry. Recent foliage loss on *Thryptomene* sp. Leinster and *Calytrix uncinata* shrubs. Minimal dust load on vegetation. Quadrat re-established due to quadrat being too close to haul road.
Veg. Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
***Thryptomene* sp. Leinster (P3)**	15	7c	
Dodonaea petiolaris	<2	7d	Yellowing and foliage loss.
Eriachne mucronata	<2	2	
Calytrix uncinata	5	7d	-
Verticordia jamiesonii	2	7d	-

Other species: *Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771), Poaceae sp.*

2020

2021

F.20 MKS EIA 25 - Haul Road Impact

Site ID: MKS EIA 25	Co-ordinates: 51 J 261174 6971135
Location: ~ 2 m east of haul road	**Comments:** Looking south, haul road to right. Quadrat moved away from haul road downslope from the MKS haul road. All vegetation in good condition. Light dust impact. No cryptograms.
Veg. Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Excellent	
Grazing: Nil	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia pruinocarpa	5	7b	Good condition.
Acacia rhodophloia	2	7b	Good condition.
Acacia aneura	2	7d	Some minor foliage loss and browning of leaves observed.
Calytrix uncinata	5	7b	Good condition.
Dodonaea petiolaris	<2	3	Some foliage loss of yellowing of leaves.

Other species: *Ptilotus obovatus, Ptilotus schwartzii, Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362),Sclerolaena eriacantha*

2020

2021

F.21 MKS EIA 26 - Haul Road Impact

Site ID: MKS EIA 26	Co-ordinates: 51 J 261162 6971094
Location: ~ 7 m east of haul road	**Comments:** Moved quadrat away from haul road. Most plants are vegetative, but smaller lower storey shrubs are losing foliage. Small dust load.
Veg. Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Excellent	
Grazing: Nil	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Callitris columellaris	15	7b	
***Thryptomene* sp. Leinster (P3)**	15	7d	
Dodonaea petiolaris	5	3	
Acacia pruinocarpa	5	7b	
Acacia rhodophloia	2	7b	

Other species: *Acacia aneura, Hakea leucoptera subsp. sericipes, Verticordia jamiesonii, Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771), Ptilotus obovatus, Eriachne mucronata, Calytrix uncinata*

2020

2021

F.22 MKS EIA 27 - Haul Road Impact

Site ID: MKS EIA 27	Co-ordinates: 51 J 261177 6970972
Location: ~ 4 m west of haul road	**Comments:** Southern edge of Breakaway landform. Haul interrupts surface drainage from west to east. Mid slope from MKS haul road. Lichens present. Little under trees. Light dust load. Dry but vegetative shrubs.
Vegetation Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Very good	
Grazing: Nil	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	40	7b	
Dodonaea petiolaris	<2	3	
Scaevola spinescens	2	7b	
Sida ectogama	<2	7d	
***Eremophila pungens* (P4)**	2	7a	

Other species: *Psydrax suaveolens, Ptilotus schwartzii, Thryptomene sp. Leinster, Eremophila shonae subsp. shonae, Poaceae sp.*

2020

2021

F.23 MKS EIA 35 – Haul Road Impact

Site ID: MKS EIA 35	Co-ordinates: 51 J 261071 6971248
Location: ~ 3 m west of haul road	**Comments:** Half quadrat on haul road boundary, moved 10m west from haul road. Sparse vegetation present. Dust on rocks and soil surface. Foliage loss on *Thryptomene* sp. Leinster (P3). Cryptograms present but covered in dust and dry.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Good	
Grazing: Light	
Weed cover: Nil	
Photo direction: W	

Species	Cover (%)	Plant Health Score	Comments
Eremophila latrobei	<2	2	Stressed.
Acacia aneura	<2	7c	Dusty.
Ptilotus obovatus	<2	5	Flowering, some foliage loss.
***Thryptomene* sp. Leinster (P3)**	<2	3	Dusty and dry.
Acacia rhodophloia	<2	7b	

Other species: *Maireana triptera, Eremophila jucunda subsp. jucunda, Acacia pruinocarpa, Eremophila pungens, Maireana georgei, Dodonaea microzyga, Rhagodia drummondii, Senna* sp. Meekatharra,

2020

2021

F.24 MKS EIA 36 - Haul Road Impact

Site ID: MKS EIA 36	Co-ordinates: 51 J 261071 6971159
Location: ~ 52 m west of haul road **Veg. Type:** Stony ironstone Mulga shrubland **Veg. Condition:** Very good **Grazing:** Light **Weed cover:** Nil **Photo direction:** N	**Comments:** Dust impacts on flora and vegetation. Soil is firm silty with abundant discontinuous lag gravel of angular quartz and subangular ironstone. Site slope towards the new haul road, which intercepts drainage from the easterly direction. Shrubs in good condition, except for some *Thryptomene* sp. Leinster (P3) deaths. Light browsing present. Some cryptograms and ants present.

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	<2	5	Grazing lines, flowering.
Acacia rhodophloia	10	7b	Grazing line,
***Thryptomene* sp. Leinster (P3)**	5	6	Declining.
Acacia pruinocarpa	<2	7c	Large adult outside quadrat, but juvenile within.
Dodonaea petiolaris	<2	3	Dry.

Other species: *Eremophila jucunda* subsp. *jucunda, Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771), Eriachne mucronata*

2020

2021

F.25 MKS EIA 37 - Haul Road Impact

Site ID: MKS EIA 37	Co-ordinates: 51 J 261077 6971050
Location: ~ 48 m west of the haul road	**Comments:** Dust impacts likely on flora and vegetation, with dust covering soil surface. Site has shallow silty sand over extensive outcropping and sub cropping weather granite. Area subject to dust from vehicular movement on MKS haul road. Historic shrubs death observed. Acacia in good condition considering extended dry seasonal conditions and proximity to haul road. Scats, termite mounds and lichen present.
Vegetation Type: Stoney ironstone low shrubland	
Veg. Condition: Very Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo direction: N	

Species	Cover (%)	Plant Health Score	Comments
Acacia pruinocarpa	8	7b	
Acacia quadrimarginea	8	7b	
Dodonaea petiolaris	<2	7b	Dust present.
***Thryptomene* sp. Leinster (P3)**	0	1	Dead and replaced.
Eremophila jucunda* subsp. *jucunda	<2	3	Dust present.
Calytrix uncinata	<2	5	Replaces *Thryptomene* sp. Leinster. Flowering.

Other species: *Acacia aneura, Acacia rhodophloia, Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771),Hakea leucoptera subsp. sericipes*

2020

2021

F.26 MKS EIA 19 - Control

Site ID: MKS EIA 19	Co-ordinates: 51 J 270893 6981469
Location: ~12 km from haul road in Wanjarri Nature Reserve	**Comments:** Along fence line of Wanjarri Nature Reserve. Triodia is stressed, likely from dry seasonal conditions. Grazing impacting individual species including *Eremophila* sp. long pedicels (P2). Cattle and kangaroo scats present.
Veg. Type: Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland	
Veg. Condition: Excellent	
Grazing: Light,	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Triodia basedowii	10	3	
Acacia aneura	20	7b	
Acacia burkittii	5	7b	
Eragrostis eriopoda	2	4	Post flowering.
Grevillea deflexa	5	7c	

Other species: *Eremophila spectabilis, Psydrax suaveolens, Eremophila* **sp. long pedicels (G. Cockerton 1975)**

2020

2021

F.27 MKS EIA 20 - Control

Site ID: MKS EIA 20	Co-ordinates: 51 J 272524 6982988
Location: ~15 km from haul road in Wanjarri Nature Reserve	**Comments:** *Eremophila* sp. long pedicels occurring in patches under Mulga with older seed pods present. Very dry vegetation. Cryptograms present but dry. Grasses are dry. No impacts from MKS, but nearby WNR track and grazing observed.
Veg. Type: Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland	
Veg. Condition: Very good	
Grazing: Light, historic	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Eragrostis eriopoda	10	4	
Triodia basedowii	10	4	
Acacia incurvaneura	20	7c	
Grevillea deflexa	2	3	
Eremophila spectabilis	2	3	

Other species: *Acacia caesaneura, Ptilotus obovatus, Eremophila* sp. long pedicels

2020

2021

F.28 MKS EIA 21 - Control

Site ID: MKS EIA 21	Co-ordinates: 51 J 261186 6973491
Location: ~ 60m from haul road, within WNR	**Comments:** Old 4WD track nearby. No posts established at quadrat. Heavy dust load. Almost all plants are vegetative, but dry and dusty. Grazing of grasses evident. Soil is a red silty sand with abundant but discontinuous ferruginous pizolitic gravel.
Vegetation Type: Hardpan Mulga shrubland with *Acacia thoma* co- dominant	
Veg. Condition: Very good	
Grazing: Medium	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia thoma	30	7b	Healthy but smothered in dust.
***Acacia* aneura**	10	7b	High dust load.
Eremophila jucunda* subsp. *jucunda	5	7d	
Eremophila spectabilis	5	7d	
Eragrostis eriopoda	2	7d	

Other species: *Solanum lasiophyllum, Eriachne mucronata, Ptilotus schwartzii*

2020

2021

F.29 MKS EIA 22 - Control

Site ID: MKS EIA 22			Co-ordinates: 51 J 261218 6972404
Location: ~ 87 m from haul road, within WNR **Vegetation Type:** Groved Mulga woodland **Veg. Condition:** Very good **Grazing:** Light, historic **Weed cover:** Nil **Photo direction:** N	**Comments:** Almost all plants are water stressed. Control quadrat is close to MKS haul road and receives dust from the road. 10 m away from the WNR track. Historical *Acacia* deaths observed.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	10	3	
Sida ectogama	5	7d	
Aristida jerichoensis	<2	2	
Eremophila latrobei	<2	2	
Acacia tetragonophylla	5	5	-
Other species: *Acacia thoma*			

2020

2021

F.30 MKS EIA 28 - Control

Site ID: MK SEIS 28	Co-ordinates: 51 J 261239 6970770
Location: ~ 110 m east of haul road, within WNR	**Comments:** Site lies 100m downstream of the newly constructed road. The WNR fence line track is nearby with a high bund east of the track. Ants and termite mounds were present. Cryptograms on soil surface. Light dust load. At base of drainage line, depression in landscape.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very good	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Sida ectogama	30	2	
Eremophila galeata	5	5	Flowering.
Acacia aneura	25	4	Old pods present.
Acacia quadrimarginea	20	7c	
Eremophila jucunda* subsp. *jucunda	2	3	

Other species: *Ptilotus exaltatus, Enneapogon avenaceus, Senna glaucifolia, Psydrax suaveolens, Eremophila granitica, Dodonaea petiolaris, Lysiana sp., Senna sp. Meekatharra, Ptilotus helipteroides, Eremophila shonae subsp. shonae, Senna artemisioides subsp. ×sturtii*

2020

2021

F.31 MKS EIA 29 - Control

Site ID: MKS EIA 29	Co-ordinates: 51 J 261255 6970160
Location: ~ 100 m east of haul road, within WNR	**Comments:** Monitoring peg is approximately 15 m east of the WNR track in a minor drainage. Vegetation in good condition, but dry. Centre post installed. Minor pedestalling western side of quadrat. Lower dust load than the other quadrats. Historic *Acacia* deaths. Ants present. Dead *Maireana* shrubs in center of quadrat.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very good	
Grazing: Light	
Weed cover: Nil	
Photo direction: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia quadrimarginea	20	7c	Browsing lines across lower branches.
Sida ectogama	5	7d	
Acacia aneura	15	7b	
Eremophila jucunda* subsp. *jucunda	<2	2	Dusty. Stressed.
-	-	-	-

Other species: *Acacia caesaneura, Eremophila forrestii, Aristida jerichoensis, Acacia thoma, Eremophila galeata, Lysiana sp. Ptilotus helipteroides, Enneapogon caerulescens, Ptilotus exaltatus*

2020

2021

F.32 MKS EIA 30 - Control

Site ID: MKS EIA 30			Co-ordinates: 51 J 261261 6969699
Location: ~ 125 m east of haul road, within WNR	**Comments:** Monitoring peg is approximately 15m east of the WNR track a minor drainage line. Dusty vegetation.		
Veg. Type: Drainage line Mulga shrubland			
Veg. Condition: Very good			
Grazing: Light			
Weed cover: Nil			
Photo direction: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Sida ectogama	15	2	
Acacia caesaneura	30	7b	
Dodonaea petiolaris	0	1	Dead. Not Replaced.
Eremophila galeata	<2	3	
-	-	-	-
Other species: *Ptilotus exaltatus, Ptilotus obovatus ,Eremophila compacta, Psydrax suaveolens, Enneapogon caerulescens, Lysiana sp*			

2020

2021

F.33 MKS EIA 31 - Control

Site ID: MKS EIA 31			Co-ordinates: 51 J 261263 6969421
Location: ~ 114 m east of haul road, within WNR **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition:** Very good **Grazing:** Light, historic **Weed cover:** Nil **Photo direction:** NW	**Comments:** Monitoring peg is approximately 10m east of the WNR track in a minor drainage line. Soil surface is intact with a clay and cryptogram crust. No annuals. All vegetation in good condition considering extended dry seasonal conditions. Insect galls on vegetation. Only middle post installed. Some dust present on vegetation. Grazing observed with browsing lines across Acacia shrubs/trees.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Sida ectogama	10	2	Dusty. Stressed.
Eremophila latrobei	<2	3	
Acacia caesaneura	40	6	
Eremophila spectabilis	<2	2	Small individual under Mulgas.
Eriachne helmsii	<2	7c	
Other species: *Eremophila jucunda* subsp. *jucunda.*			

2020

2021

F.34 MKS EIA 32 - Control

Site ID: MKS EIA 32			Co-ordinates: 51 J 261277 6968983
Location: ~ 110 m east of haul road, within WNR	**Comments:** Site is 100% covered in stony ferruginous rocks and boulders. No annuals at time of assessment. Only middle post installed. Grassed grazed to butts. Vegetation dry, likely due to extended dry seasonal conditions. Leaf litter present under Acacias.		
Veg. Type: Stony ironstone Mulga shrubland			
Veg. Condition: Excellent			
Grazing: Light			
Weed cover: Nil			
Photo direction: NW			
Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	15	7b	
Acacia thoma	10	7b	
Eremophila spectabilis	<2	6	
Eremophila latrobei	<2	7c	Insect damage.
Senna glaucifolia	<2	7b	One healthy individual.
Other species: *Acacia aneura sens. lat., Eriachne mucronata, Eremophila jucunda* subsp. *jucunda, Ptilotus schwartzii, Eragrostis eriopoda*			

2020

2021

F.35 MKS EIA 33 - Control

Site ID: MKS EIA 33			Co-ordinates: 51 J 261280 6968863
Location: ~ 114 m east of haul road, within WNR	**Comments:** Site is very bare. Multiple dead *Maireana* sp. individuals. Only middle post present. Cryptograms on soil surface. Some pedestalling erosion present. Dry vegetation with further lower storey shrub deaths.		
Veg. Type: Stony ironstone Mulga shrubland			
Veg. Condition: Good			
Grazing: Light			
Weed cover: Nil			
Photo direction: NW			
Species	Cover (%)	Plant Health Score	Comments
***Senna* sp. Meekatharra**	10	7b	Fallen over tree, living and healthy.
***Acacia aneura* sens. lat.**	15	7b	Some insect galls.
Dodonaea petiolaris	0	1	Dead, not replaced.
***Maireana* sp.**	<2	2	Only few individuals remaining.
Ptilotus obovatus	<2	2	
Other species: *Acacia quadrimarginea, Hibiscus sp., Hakea preissii, Aristida sp.*			

2020

2021

F.36 MKS EIA 34 - Control

Site ID: MKS EIA 34	Co-ordinates: 51 J 261298 6968771
Location: ~ 114 m east of haul road, within WNR	**Comments:** Quadrat situated on a rocky outcrop next to WNR track. Dominated by *Thryptomene* sp. Leinster (P3). Lichens present on rocks. Some vegetation affected by extended dry seasonal conditions (*P. schwartzii, D. rigida*).
Veg. Type: Stony ironstone low shrubland	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo direction: E	

Species	Cover (%)	Plant Health Score	Comments
***Thryptomene* sp. Leinster (P3)**	20	4	Budding.
Acacia pruinocarpa	5	7b	Few adolescent trees.
***Dodonaea rigida* (EIA_13_012)**	<2	6	Post flowering.
Ptilotus schwartzii	<2	2	
-	-	-	-

Other species: *Acacia quadrimarginea, Hibiscus sp., Aristida sp., Scaevola spinescens*

2020

2021

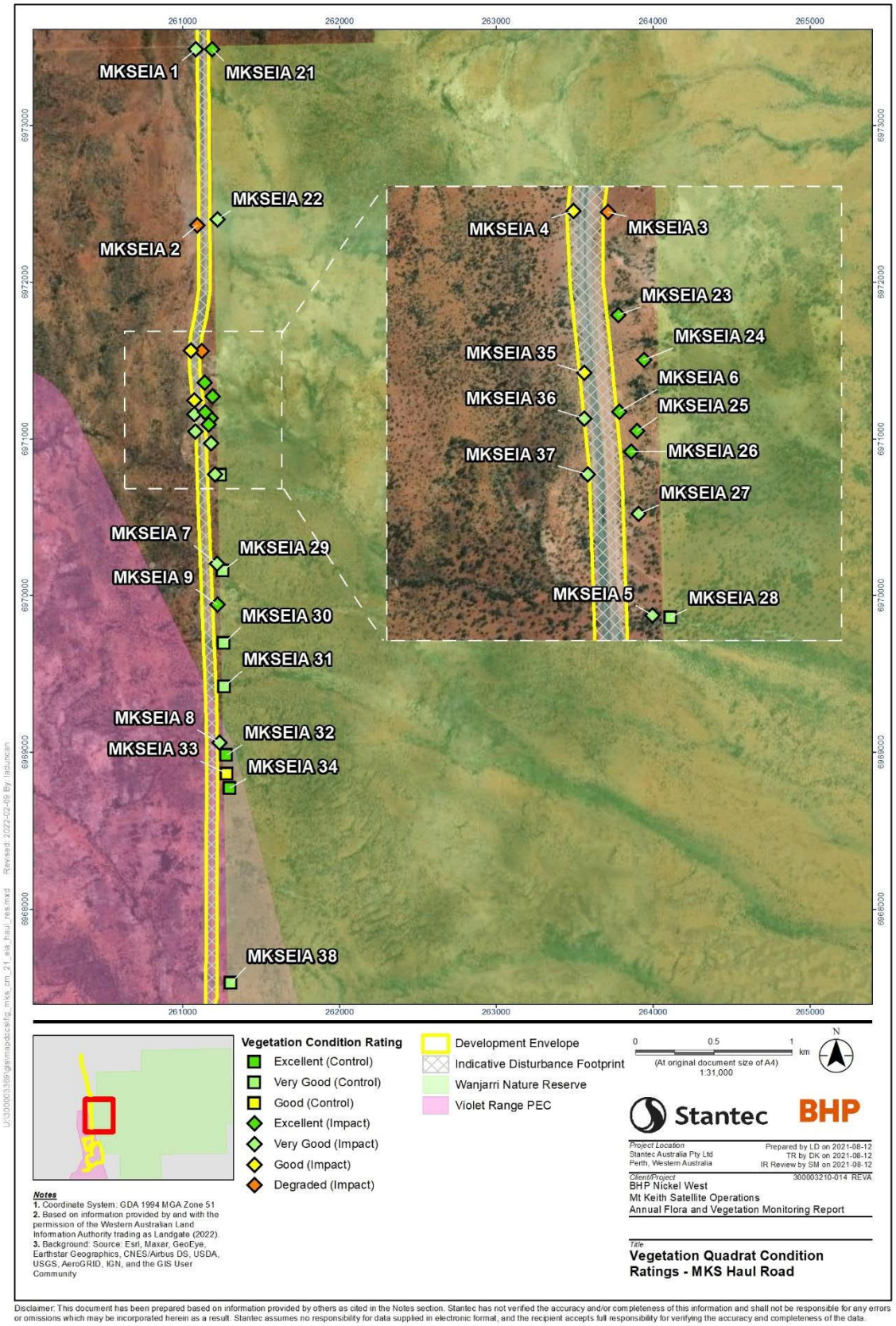
F.37 MKS EIA 38 - Control

Site ID: MKS EIA 38			Co-ordinates: 51 J 261304 6967527
Location: ~ 130 m east of haul road	**Comments:** Dust impacts and flora and vegetation. Ants and multiple rabbit warrens. Litter under trees. *Maireana* sp. individuals very dry, likely due to extended dry seasonal conditions.		
Veg. Type: Stony ironstone low shrubland.			
Veg. Condition: Very good			
Grazing: Light, historic			
Weed cover: Nil			
Photo direction: NW			
Species	Cover (%)	Plant Health Score	Comments
Maireana triptera	15	2	Few dead individuals.
Acacia burkittii	15	7b	Insect galls.
Acacia aptaneura	10	7b	Browsing line.
Eremophila oldfieldii	5	7b	
***Eremophila ?compacta* (EIA_38_001)**	0	1	Dead and replaced.
Senna artemisioides subsp. ?filifolia	<2	6	Replaces Eremophila ?compacta.
Other species: *Acacia aneura, Eremophila granitica, Enneapogon caerulescens, Sclerolaena eurotioides, Ptilotus obovatus, Eremophila latrobei, Lysiana sp.*			

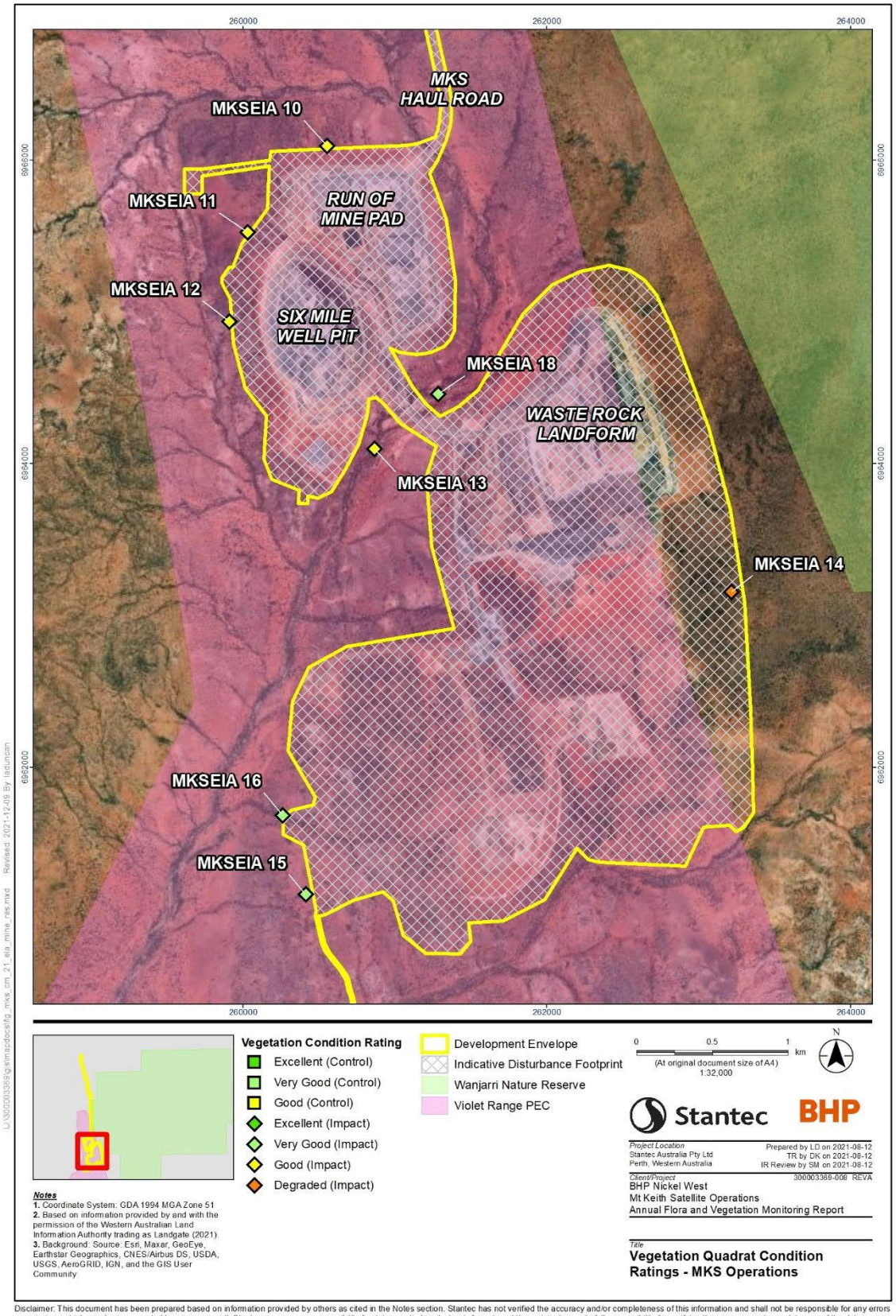
2020

2021

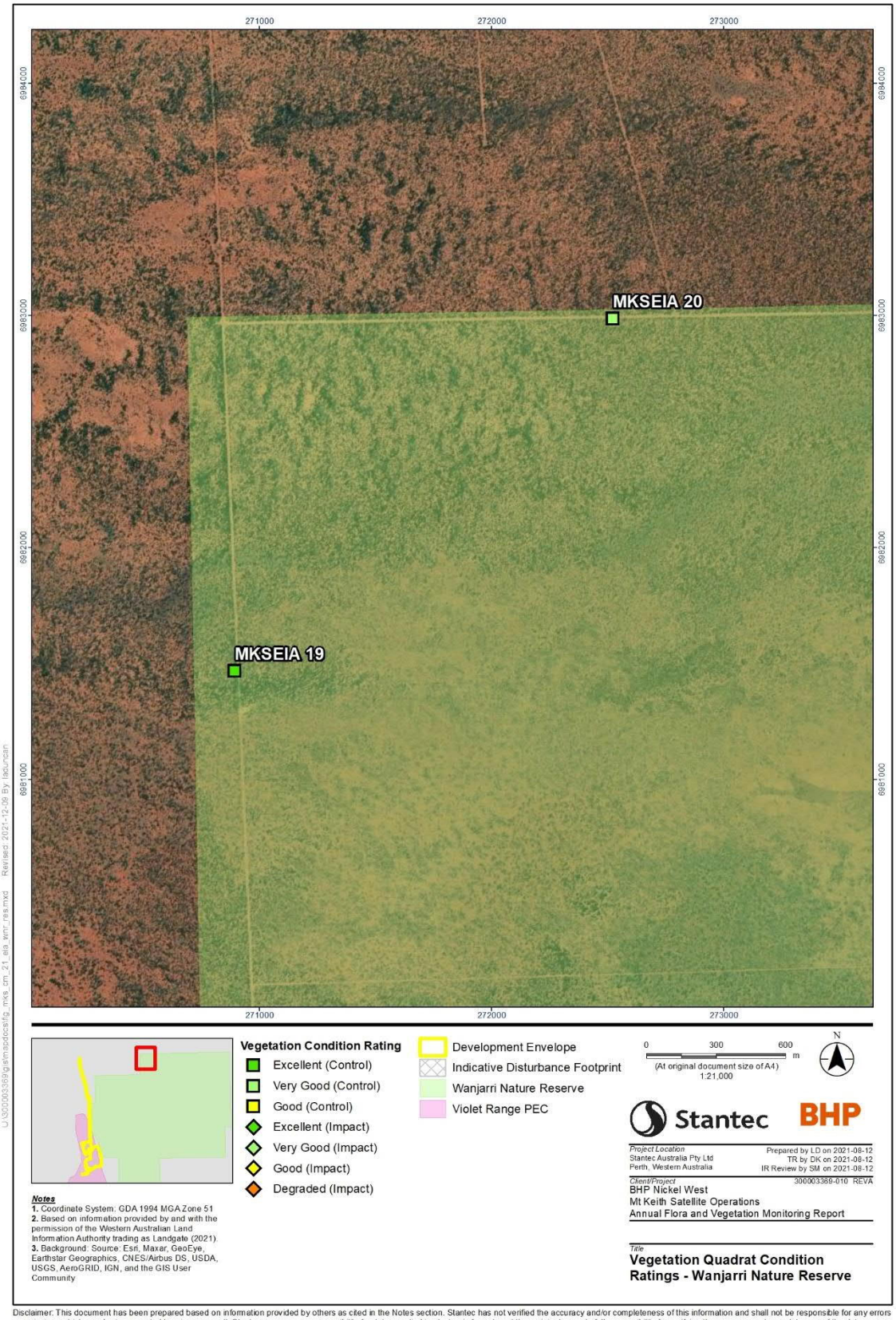
Appendix G Vegetation condition rating maps 2021



G-1 Visual representation of the vegetation condition ratings for vegetation quadrats assessed in October 2021 situated along the MKS haul road.



G-2 Visual representation of the vegetation condition ratings for vegetation quadrats assessed in October 2021 situated at MKS Operations.



G-3 Visual representation of the vegetation condition ratings for vegetation quadrats assessed in October 2021 situated on the northern edge of Wanjarri Nature Reserve.

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Appendix 4 – Astron (2022) Mt Keith Vegetation Remote Sensing Analysis 2021

23 March 2022

Our Reference: 2400-003-22-EOLR-1Rev0_220323

Yvette Weber
Lead Environment – Northern Operations
BHP Nickel West Operations
125 St Georges Terrace
Perth WA 6000

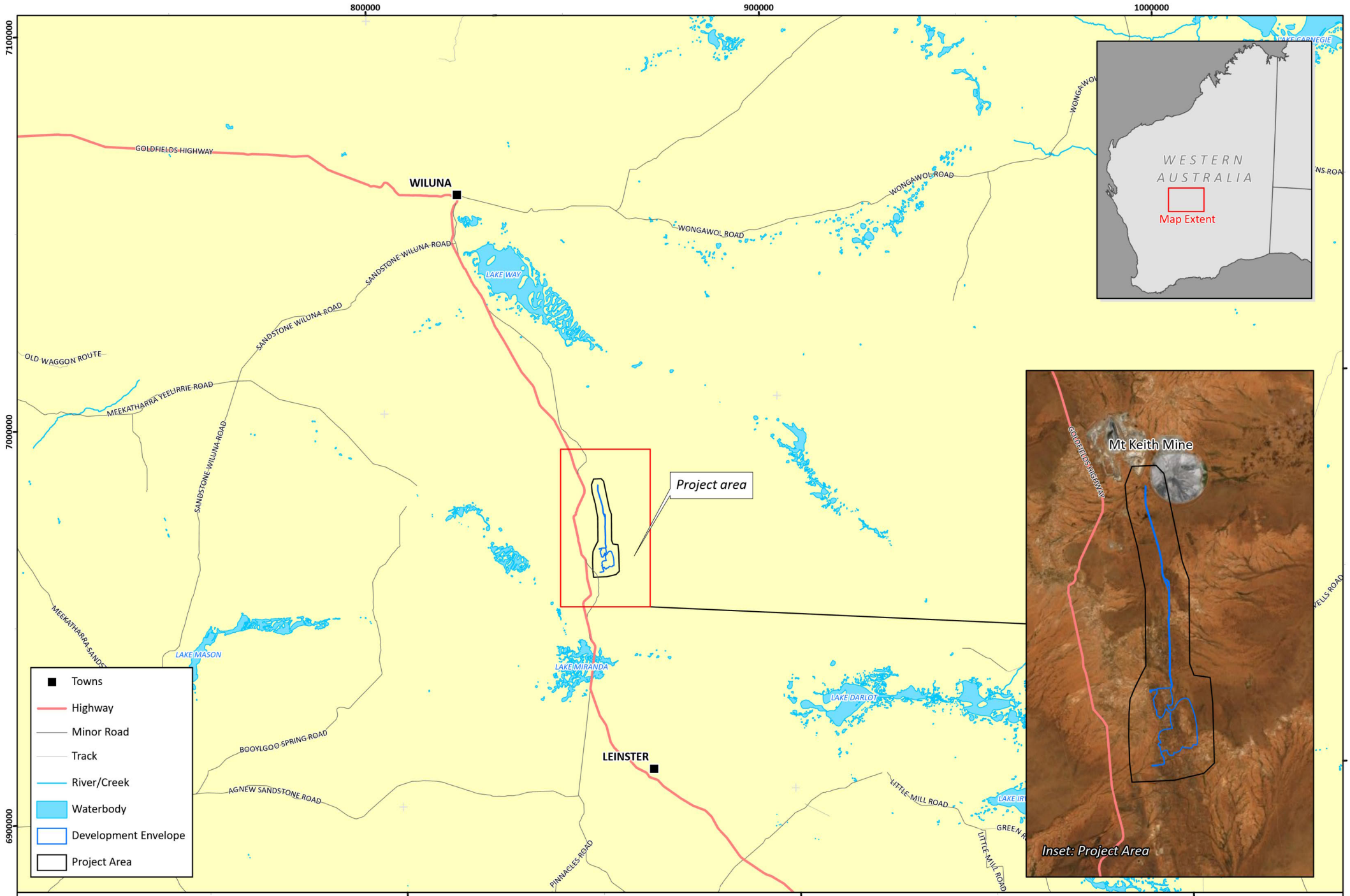
Dear Yvette,

Re: Mt Keith Vegetation Remote Sensing Analysis, March 2022

1 Introduction

BHP Nickel West (NiWest) Operations requested Astron Environmental Services (Astron) to undertake a remote sensing analysis of vegetation condition encompassing the Mt Keith Satellite Project (the project area), approximately 18 km south of the Mt Keith mine operations. The project area is 109 km^2 and located within the Violet Range (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation) Priority Ecological Community (the Violet Range PEC) (Figure 1). The Wanjarri Nature Reserve, occurring on the eastern border of the development envelope of the project area, supports conservation significant flora and is the only reserve in the northern part of Eastern Goldfields (CALM 1996).

Astron completed a two-stage remote sensing analysis in 2020 (Astron Environmental Services 2020, 2021) which involved the acquisition of Sentinel-2 and WorldView-2/3 imagery from 2015 to 2020 to conduct a time series analysis assessing vegetation condition across the project area. For this year's analysis, WorldView-2/3 imagery was used to assess post-disturbance vegetation condition within the project area to fulfil compliance obligations outlined in the Mt Keith Satellite Project Flora and Vegetation Environmental Management Plan (FVEMP) (BHP Nickel West 2018). The following report describes and discusses changes in vegetation condition across the Mt Keith Satellite Project.



BHP Nickel West
Mt Keith Vegetation Remote Sensing Analysis

Figure 1: Project area location

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Author: R. Archibald | Drawn: L. Robinson | Date: 23-02-2022 | Figure Ref: 2400-003-22-EODR-1RevA_220125_Fig01_Locn

2 Methods

2.1 Imagery Acquisition

Vegetation condition in the Mt Keith project area was analysed using WorldView imagery. WorldView-2 and WorldView-3 were launched by Maxar in 2009 and 2014, respectively. Both sensors collect reflectance data across eight multispectral bands within the electromagnetic spectrum, including visible and near infrared (NIR) wavelengths. These sensors differ in their spatial resolution. WorldView-2 has a spatial resolution of 0.5 m to 2 m while WorldView-3 has a spatial resolution of 0.3 m to 1.2 m (GeoImage 2010, DigitalGlobe 2013).

Image capture dates for this study are outlined in Table 1. The 2017 and 2021 imagery were processed by Geoimage, while the 2020 imagery was processed by Astron. Astron implemented additional work to improve registration of the 2021 imagery to the 2020 imagery so that the spatial alignment was suitable for the analysis.

Table 1: Imagery acquired for vegetation assessment.

Sensor	Image Acquisition Date
WorldView-2	21st September 2017
WorldView-3	29th September and 6th and 26th October 2020
WorldView-3	14th October 2021

2.2 Vegetation Analysis

For the WorldView images, the Modified Soil Adjusted Vegetation Index (MSAVI; Equation 1) was derived from surface reflectance values in 2020 and 2021, and Top of Atmosphere (TOA) values for 2017 (Equation 1). MSAVI exploits the reflectance properties of live vegetation (low red range, high near infrared range reflectance) to measure vegetation health. Higher values returned by the index indicate healthy vegetation while lower values indicate dry vegetation or cover other than vegetation (Qi et al. 1994).

$$\mathbf{MSAVI} = \frac{\mathbf{2} \times \boldsymbol{\rho_{NIR}} + \mathbf{1} - \sqrt{(\mathbf{2} \times \boldsymbol{\rho_{NIR}} + \mathbf{1})^2 - \mathbf{8} \times (\boldsymbol{\rho_{NIR}} - \boldsymbol{\rho_R})}}{\mathbf{2}}$$

Equation 1: The Modified Soil Adjusted Vegetation Index. Where ρ_{NIR}: NIR band reflectance of the image, ρ_R: red band reflectance of the image.

The 2021 MSAVI layer (current) was then used to analyse change between the baseline (2017) and the current layer, as well as between the previous (2020) and current layer. The method calculates per pixel change by subtracting the baseline or previous image from the current 2021 layer. This produced the following MSAVI change layers:

- WorldView MSAVI change from 2017 to 2021 (MSAVI layer 2021 – MSAVI layer 2017)
- WorldView MSAVI change from 2020 to 2021 (MSAVI layer 2021 – MSAVI layer 2020).

The MSAVI change values do not represent percent change. Values greater than 0 indicate a linear increase in MSAVI values between dates (for example, 0.1 is a small increase and >0.3 is a large increase), values less than 0 indicate a decrease in MSAVI (for example, -0.1 is a small decrease and <-0.3 is a large decrease), while 0 indicates no change. To test for statistically significant MSAVI change, a cluster analysis was used, which is discussed in more detail in the following paragraphs.

The proportion of vegetation cover was also calculated using the MSAVI layers. By setting a threshold for each MSAVI layer based on visual inspection of the data, binary layers were produced that represent healthy green vegetation and dead vegetation or non-vegetation. These were used to calculate the vegetation cover statistics. As the extent of the imagery changed over time, vegetation cover was calculated within the common area of the WorldView time series (2017 extent) to provide comparable information over time. The baseline (2017) binary layer was also vectorised to enable the extraction of MSAVI values from vegetation only (referred as 'vegetation segments'). Images were produced to show the MSAVI change values from 2017 to 2021 as well as from 2020 to 2021 within the vegetation segments defined at baseline (2017). Using the same vegetation segments consistently enables comparison and monitoring of vegetation health over time. Images simply showing MSAVI change across all features in the landscape throughout both time periods were also presented (referred to as 'landscape').

To identify hotspots of positive and negative vegetation change, geospatial cluster analysis was performed. This involved analysing change values for each pixel in the context of change values for neighbouring pixel values. The Getis-Ord statistic was calculated to separate aggregations of pixels with similar levels of change from areas of random change. For instance, positive clusters indicate pixels with positive change surrounded by other pixels with positive change and differing from the general trend across the scene (Getis and Ord 1992). It is important to note that in case of a uniform trend (decrease, no change or increase), no clusters will be returned. Therefore, the cluster results should be viewed along with the change layers. The Getis-Ord statistic assigns a Z-score to each cluster and the statistical significance of the Z-score is measured based on a Monte-Carlo approach. Then, from significant Z-scores, a kernel density calculation is performed to produce raster layers of MSAVI clusters. Colours indicate the clustering of different values; as an example, darker blue refers to the concentrated highly positive MSAVI values, while lighter colours indicate a clustered occurrence of slightly positive or negative MSAVI change values, and clustering of highly negative MSAVI values are indicated with a deeper red colour.

2.3 Auxiliary Data

To identify natural influences on vegetation condition within the project area, data on rainfall and fire history were collected and analysed.

Rainfall data interpolated for the project location (120.55°E, -27.40°S) were sourced from the Scientific Information for Land Owners (SILO) database (Queensland Government 2020). SILO sources climatic data from the Bureau of Meteorology and interpolates data between weather stations to provide a complete dataset for any location. Annual (1 October to 31 September) rainfall, long-term annual average rainfall (1890 to 2021) and monthly rainfall for 2020 to 2021 were calculated.

Fire history for the area was extracted from the Northern Australian Fire Information (NAFI) database (NAFI 2022). This database provides annual updates on fire history by way of fire boundary shapefiles, with attributes including month of the fire.

3 Results and Discussion

3.1 Rainfall

The data extracted from SILO (Figure 2) indicate that annual rainfall in 2021 (210 mm) was similar to the long-term average (228 mm) from 1890 to 2021 but well above the annual rainfall recorded in 2020 (144 mm). Annual rainfall in 2017 (358mm) was higher than that recorded in any subsequent year. Rainfall was above the long-term monthly average in February, March and May 2021 (Figure 3). However, monthly rainfall was well below the long-term monthly average for the remaining months in the October 2020 to September 2021 period.

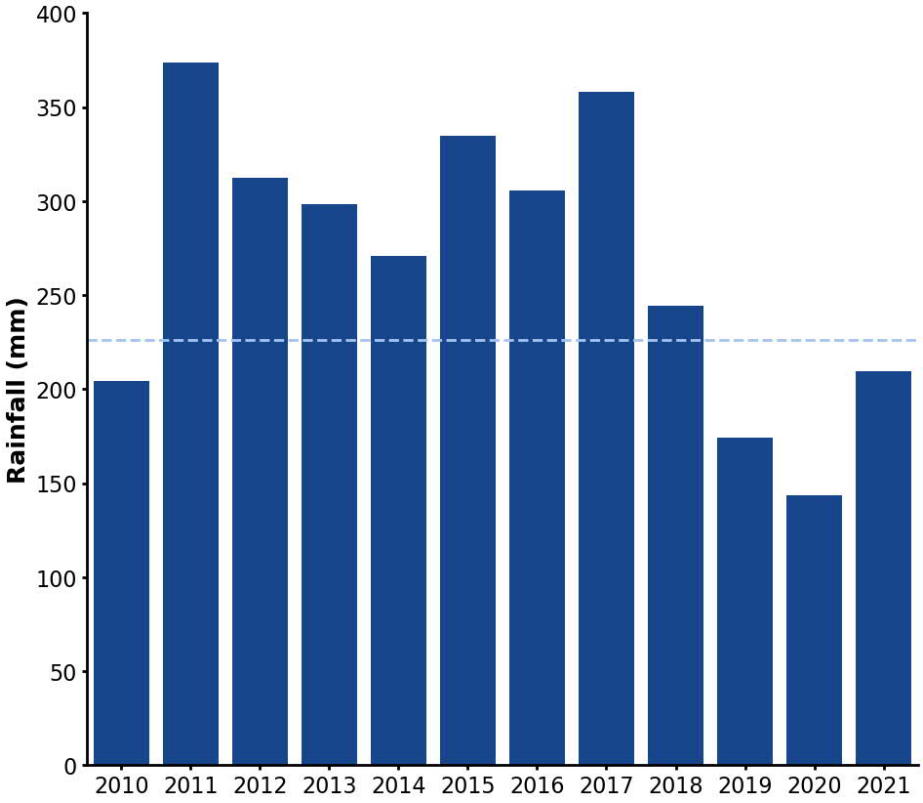


Figure 2: Rainfall total for 12-month periods from (1st October to 30th September) from 2010 to 2021 for the project area (data from SILO, 120.55°E, -27.40°S (Queensland Government 2020)). Dashed line represents the long-term average for the period 1890 to 2021.

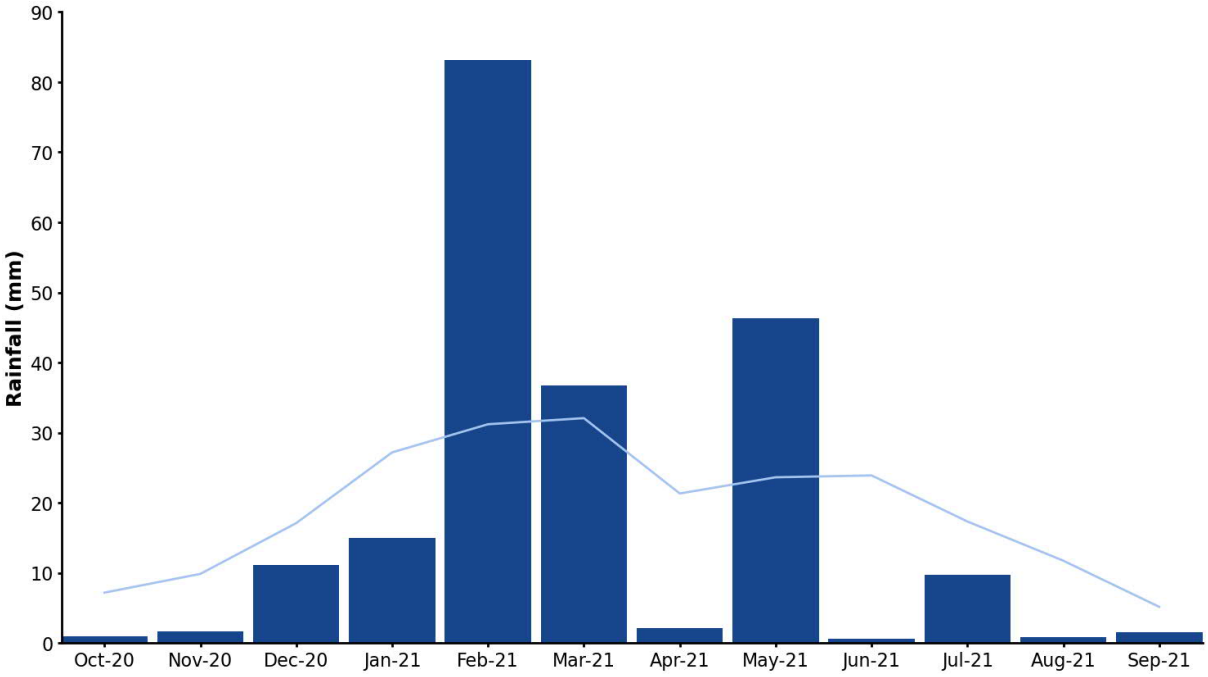


Figure 3: Monthly rainfall total for October 2020 to September 2021 (data from SILO grid -27.40, 120.55 (Queensland Government 2020)). Plotted line represents long-term monthly average (1890 to 2021).

3.2 Fire History

Based on the NAFI database, no fires were identified in the project area since January 2017. Visual examination of WorldView imagery also did not indicate any sign of fire.

3.3 MSAVI and Vegetation Cover

MSAVI statistics for the landscape (vegetation and non-vegetation) and for vegetation segments only were extracted from the 2017, 2020 and 2021 MSAVI raster layers (Table 2). The percentage of landscape covered by vegetation (within the common area) for each year, as well as the MSAVI threshold to separate vegetated pixels from non-vegetated pixels, was also presented.

MSAVI statistics for the landscape were similar across the time series of WorldView imagery. A reduction in MSAVI values was recorded in 2020, followed by a slight increase in 2021, however the values remained below those of 2017. Trends in vegetation cover show a correlation with MSAVI.

It should be noted that the MSAVI threshold for 2021 has not identified all vegetation cover within the area. As a result, a proportion of the vegetation has not been captured in the vegetation segments and landscape layers. The vegetation that has been excluded is most likely not photosynthetically active at present, due to dry seasonal conditions.

Table 2: Modified Soil-Adjusted Vegetation Index (MSAVI) and vegetation cover statistics derived from WorldView-2 (2017) and WorldView-3 (2020 and 2021) data. Note that all statistics are confined to the study area as shown in Figure 1.

Statistics	Landscape (vegetation and non-vegetation)			Vegetation segments		
	2017	2020	2021	2017	2020	2021
5th percentile	0.03	0.02	0.02	0.11	0.04	0.05
Mean MSAVI	0.08	0.08	0.08	0.13	0.10	0.11
95th percentile	0.13	0.12	0.13	0.19	0.16	0.18
Standard deviation	0.03	0.30	0.03	0.03	0.04	0.04
Threshold^	-	-	-	0.11	0.11	0.11
Vegetation cover (%)*	10.62	6.89	10.14	-	-	-

^ The MSAVI threshold was used to separate vegetation from non-vegetation.

* Vegetation segments were derived from vegetation cover; therefore, a cover calculation is not applicable for segments. Cover values extracted from the common extent (2017 extent).

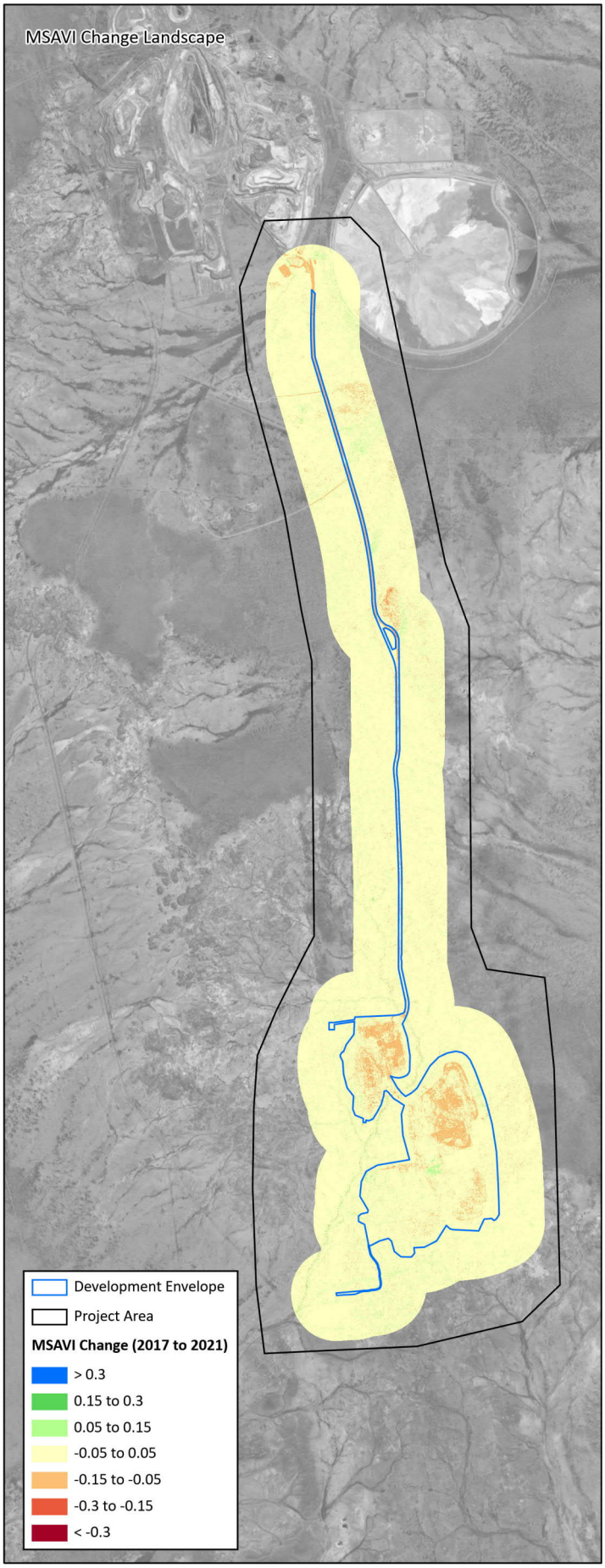
3.4 MSAVI Change

The MSAVI change statistics (Table 3) and change map (Figure 4) show a decrease in mean MSAVI in the case of vegetation segments, but no change in the case of the landscape. The majority of negative change in the study area appears to coincide with the mining footprint changes between 2017 and 2021, and this is particularly noticeable in the imagery and landscape MSAVI change layer. However, there are areas of decrease on the eastern side of the study area that appear to be related to a decline in vegetation condition. Some of this decrease in mean MSAVI may be partially attributed to the difference in annual rainfall between 2017 and 2021 (Figure 2). However, project impacts such as disruptions to surface flow could also be a factor in some areas.

The mean MSAVI change between 2020 and 2021 is minimal for both the landscape and vegetation segments (Table 3), although the MSAVI change map (Figure 5) reveals slight positive changes in the case of vegetation cover along the main creek lines. Negative change is associated with the mine footprint and extension of the mine footprint to the southeast.

Table 3: MSAVI change derived for landscape and vegetation segments (based on the 2017 segments). Note that all statistics are confined to the study area as shown in Figure 1.

Statistics	Landscape (vegetation and non-vegetation)		Vegetation segments	
	WorldView-2/3 2017 – 2021	WorldView-3 2020 – 2021	WorldView-2/3 2017 – 2021	WorldView-3 2020 – 2021
5th percentile	-0.05	-0.03	-0.10	-0.04
Mean MSAVI	0.00	0.00	-0.03	0.01
95th percentile	0.04	0.05	0.04	0.08
Standard deviation	0.03	0.03	0.04	0.04



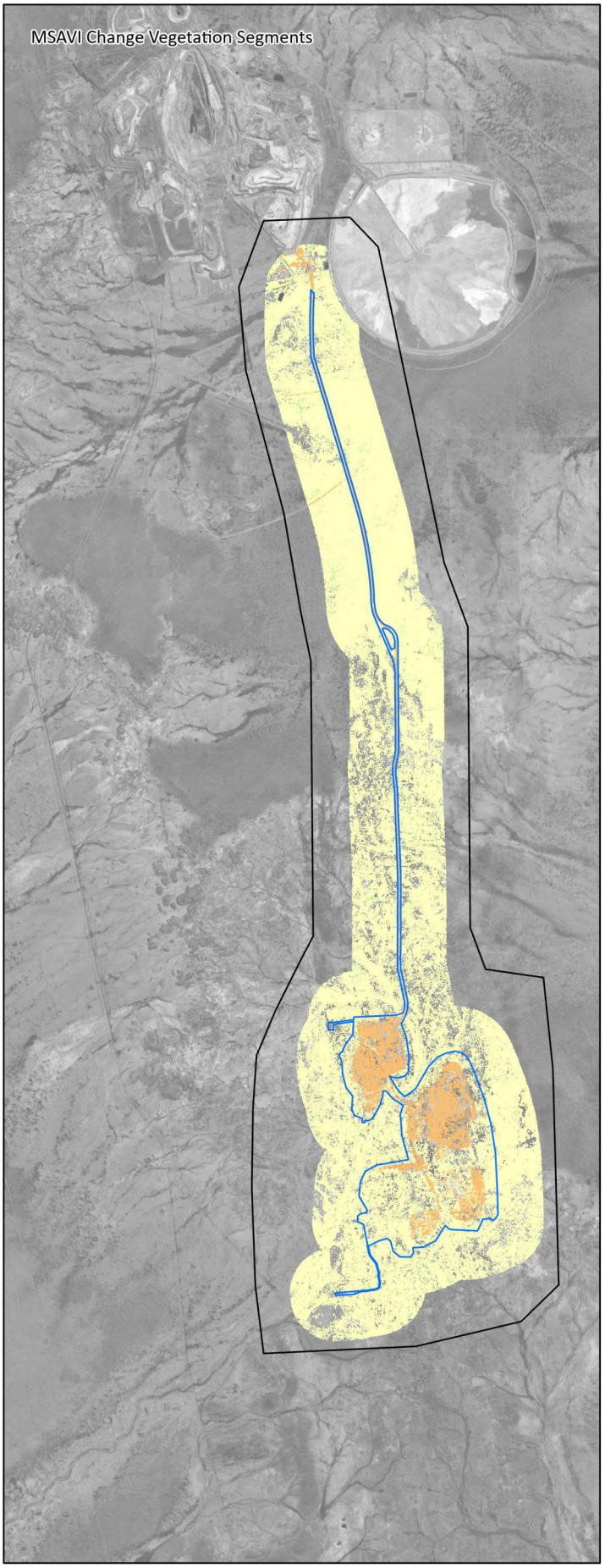


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Figure 4: WorldView Modified Soil Adjusted Vegetation Index change September 2017 to October 2021

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Author: R. Archibald	Date: 03-03-2022	Scale: 1:100,000 at A3 Coordinate System: GDA 1994 MGA Zone 51 0 1 2 3 4 5 Kilometres N
Drawn: L. Robinson	Figure Ref: 2400-003-22-EODR-1RevA_220223_Fig04_MSAVI_DIFF_Baseline	

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Figure 5: WorldView Modified Soil Adjusted Vegetation Index change September 2020 to October 2021

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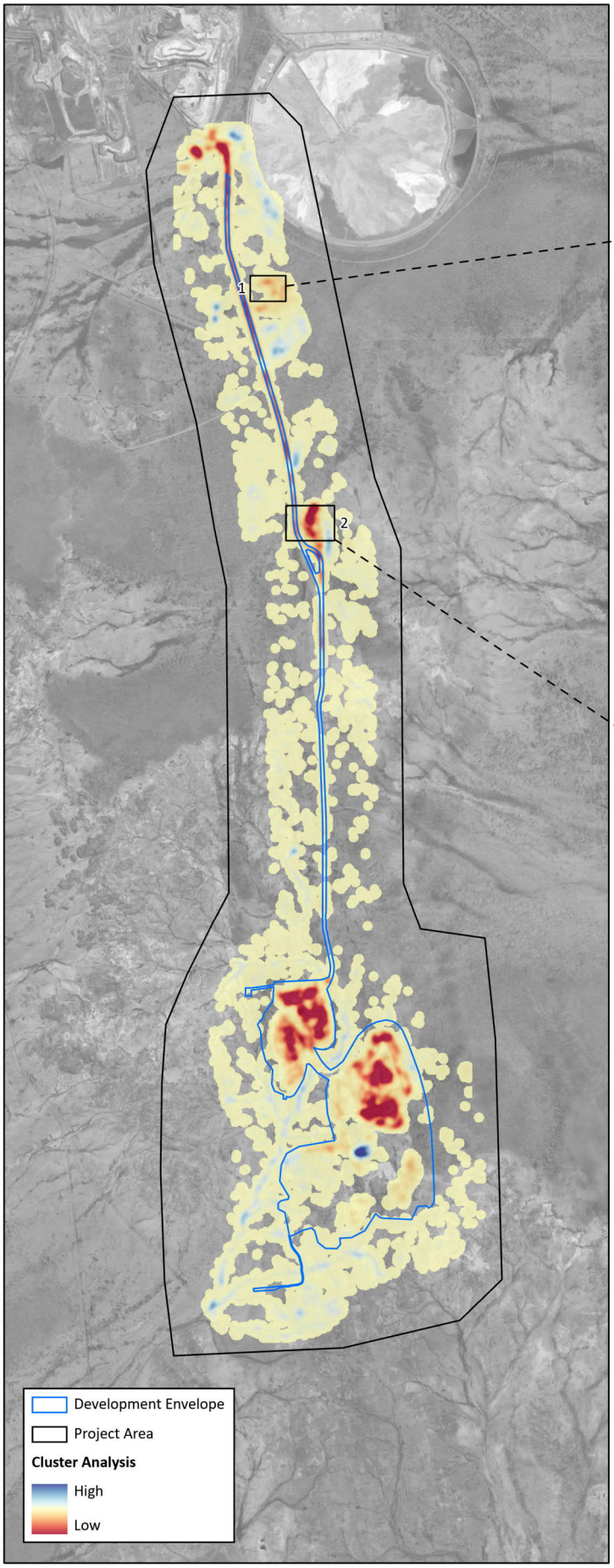
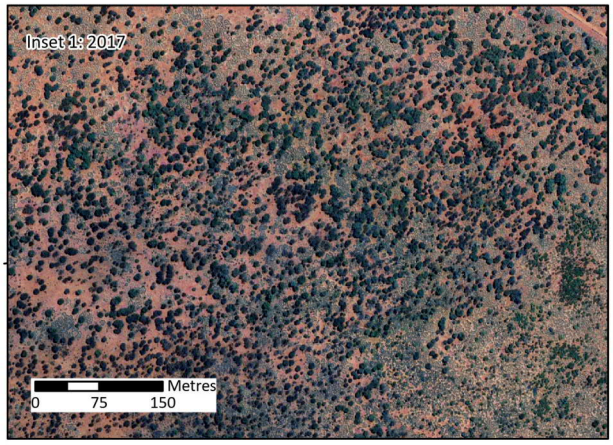
Author: R. Archibald	Date: 03-03-2022	Scale: 1:100,000 at A3 Coordinate System: GDA 1994 MGA Zone 51 0 1 2 3 4 5 Kilometres N
Drawn: L. Robinson	Figure Ref: 2400-003-22-EODR-1RevA_220224_Fig05_MSAVI_DIFF_Annual	

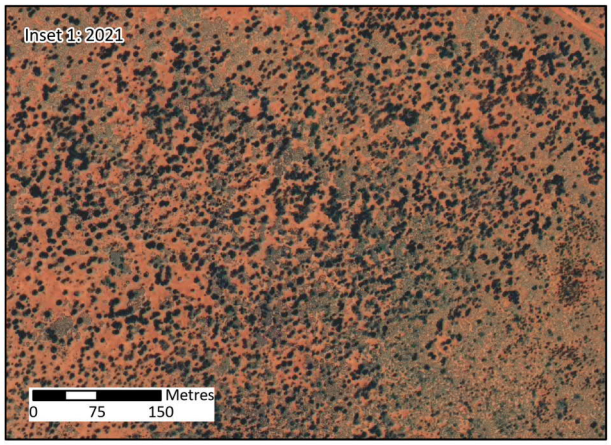
3.5 Cluster Analysis

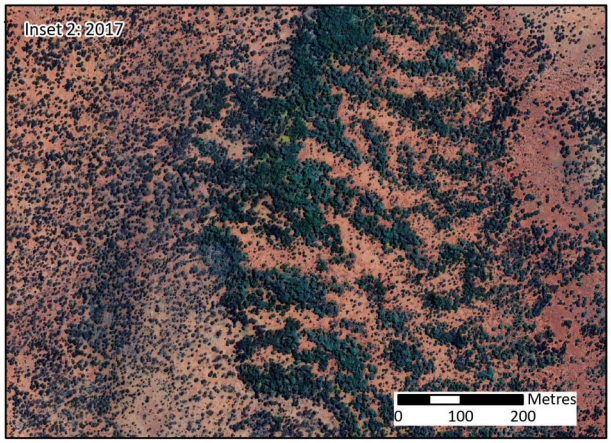
The results of the cluster analysis derived from the 2017 to 2021 and 2020 to 2021 MSAVI change layers highlight areas of statistically significant change (Figure 6 and Figure 7). For the 2017 to 2021 period, the decline hotspots related to vegetation appear to be due to a reduction in canopy cover as well as a general decline in vegetation condition as shown by the lack of greenness in the 2021 imagery (Figure 6, Inset 1 and Inset 2). Possible disruption to surface flows arising from construction of roads may be a cause of the decline in the condition of banded mulga as shown in Figure 6, Inset 2. Areas of increase appear to be caused in part by cover other than vegetation.

For the 2020 to 2021 period, clusters of positive MSAVI change appeared along the main creek lines within the project area (Figure 7). These can be attributed to a slight increase in vegetation condition, with areas of increase in northern sections, which appear to be caused in part by the establishment of vegetation on what was previously bare ground. Clusters of negative MSAVI change were sometimes associated with vegetation condition (Figure 7, Inset 1), but were for the most part due to clearing for the extension of the mine (Figure 7, Inset 2) or changes in soil surface rather than vegetation.









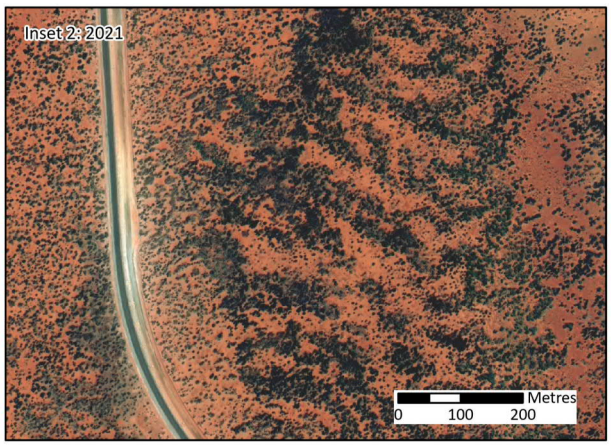


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Figure 6: WorldView cluster analysis September 2017 to October 2021

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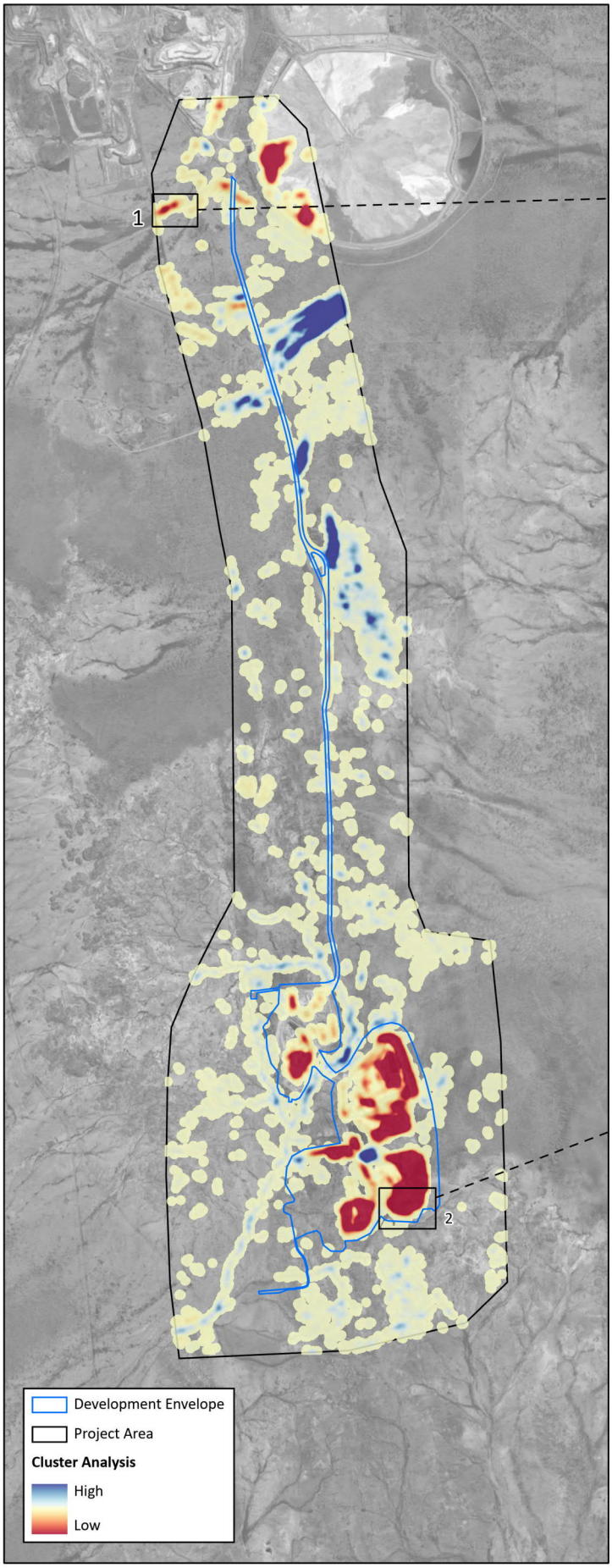
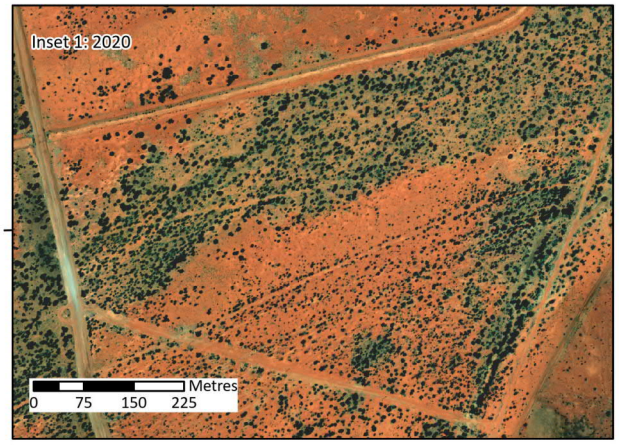
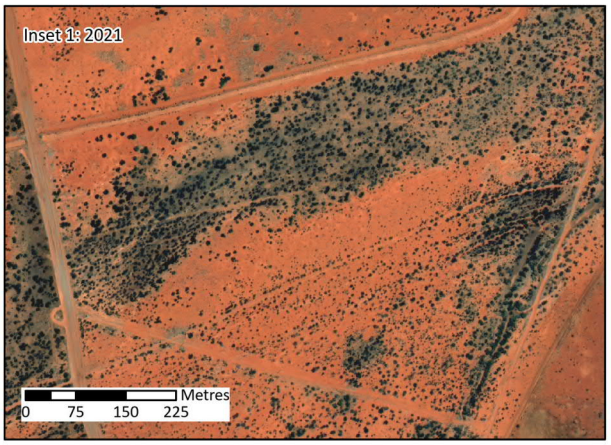
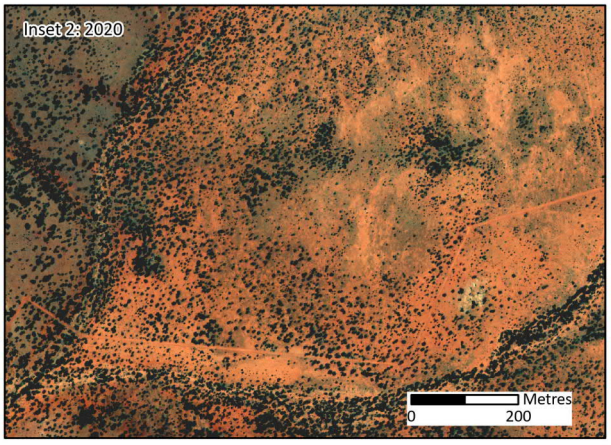
Author: R. Archibald	Date: 02-03-2022	Coordinate System: GDA 1994 MGA Zone 51
Drawn: L. Robinson	Figure Ref: 2400-003-22-EODR-1RevA_220224_Fig06_Cluster_Base	Kilometres 0 1 2 3 4

N









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Mt Keith Vegetation Remote Sensing Analysis

Figure 7: WorldView cluster analysis September 2020 to October 2021

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Author: R. Archibald	Date: 03-03-2022
Drawn: L. Robinson	Figure Ref: 2400-003-22-EODR-1RevA_220224_Fig07_Cluster_Annual

Coordinate System: GDA 1994 MGA Zone 51
Kilometres
0 1 2 3 4

N

4 Conclusions

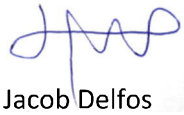
The most significant changes related to vegetation for the 2017 to 2021 period, as well as the 2020 to 2021 period, for the Mt Keith project area were due to clearing associated with the extension of mine or establishment of roads and other infrastructure. Vegetation across the majority of the project area did not undergo any major change in condition that could be related to project impacts. However, possible secondary impacts relating to disruption of surface flows were identified in one case. Positive MSAVI change was evident in case of vegetation along creek lines in some areas.

Significant hotspots of decline were mostly associated with the extension of the mine and establishment of new infrastructure. The cluster map for the 2020 to 2021 period indicates a hotspot of significant slight positive change along the main creek line.

The timeseries of MSAVI values across the project area show some correlation with annual rainfall. Increases in vegetation condition and cover from 2020 to 2021 reflect the higher annual rainfall in 2021 compared to 2020. MSAVI was lower in 2021 compared to 2017, which is not unexpected given that rainfall in 2021 was only about two thirds of that for 2017.

This report was prepared by Liam Robinson (GIS/Remote Sensing Analyst) and reviewed by Timea Kovacs-Ledo (Senior Remote Sensing Analyst) and Dr Robert Archibald (Principal Scientist). If you have any queries, please do not hesitate to contact myself or Emma Ryan (Project Coordinator).

Yours sincerely
ASTRON ENVIRONMENTAL SERVICES



Jacob Delfos
Manager – Earth Observation

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Appendix 5 – Hydrological Processes EMP

Hydrological Processes Environmental Management Plan (HPEMP)

The HPEMP is not subject to the conditions of the Statement 1087 approval, however the CAP prepared under Condition 4-1 of the Statement 1087 identifies that annual CAR submitted will include monitoring information collected during implementation of the HPEMP.

The HPEMP was implemented during the reporting period and address:

- Weather data
- Jones Creek peak flow water level not conducted during reporting period
- Jones Creek sediment sampling
- Monitoring of groundwater bores

During the reporting period there was insufficient flow events resulting in substantial and long duration ponding within Jones Creek to enable water sampling. Sediment samples were taken during the reporting period and results provided below. Refer to table.

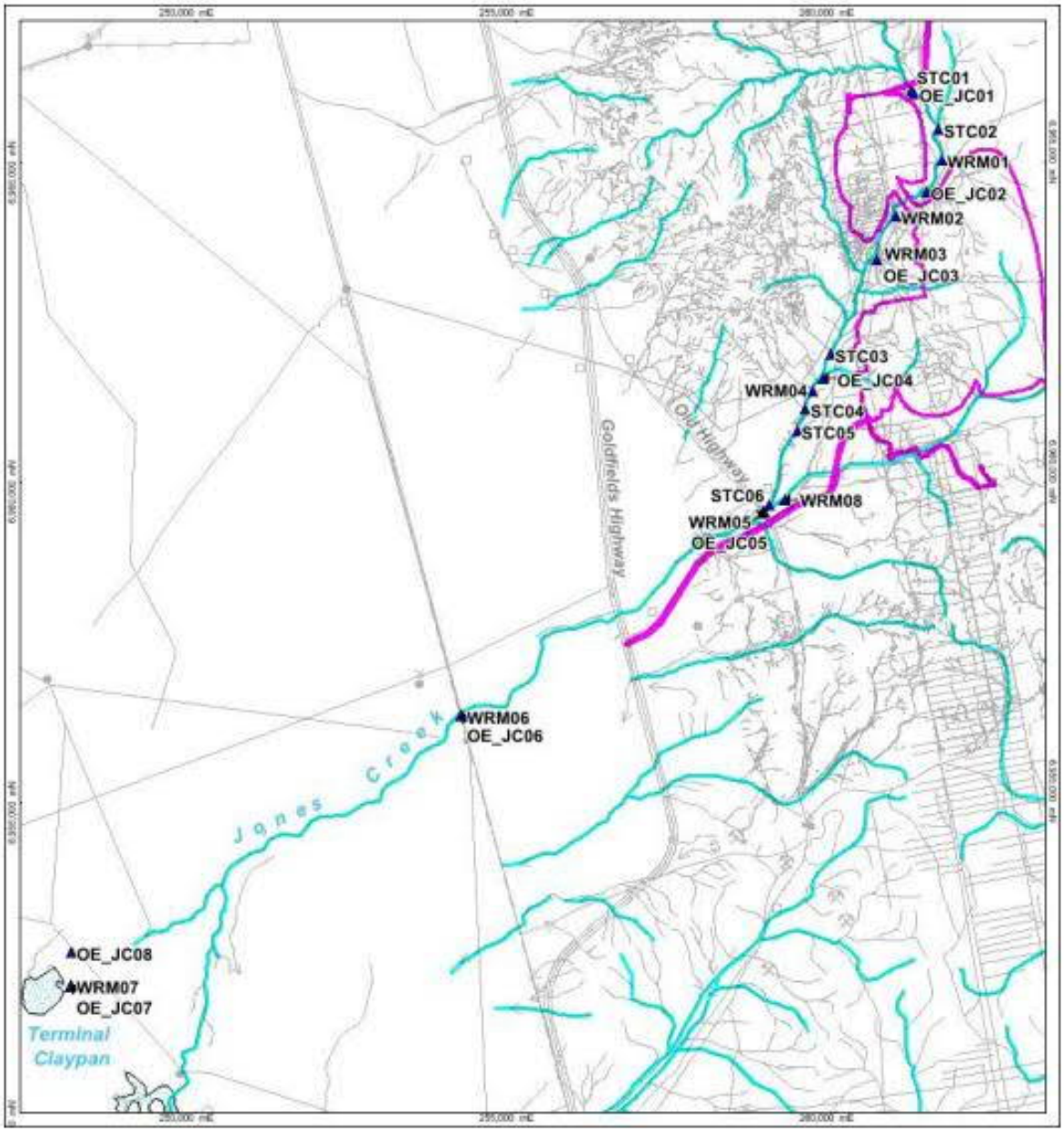
Groundwater quarterly monitoring has identified continued localised groundwater drawdown in the monitoring bores within close proximity to the Six Mile Well shaft; as predicted by modelling completed prior to Project implementation. The monitoring bores at the Goliath Mine Pit do not indicate notable groundwater drawdown. Refer to graphs.

Trigger: >5% clay sized particles				
Date	**JCS01 (OE_JC01)**	**JCS02 (OE_JC02)**	**JCS03 (OE_JC03)**	**JCS04 (OE_JC04)**
30/11/2021	6	4	4	6

Note:

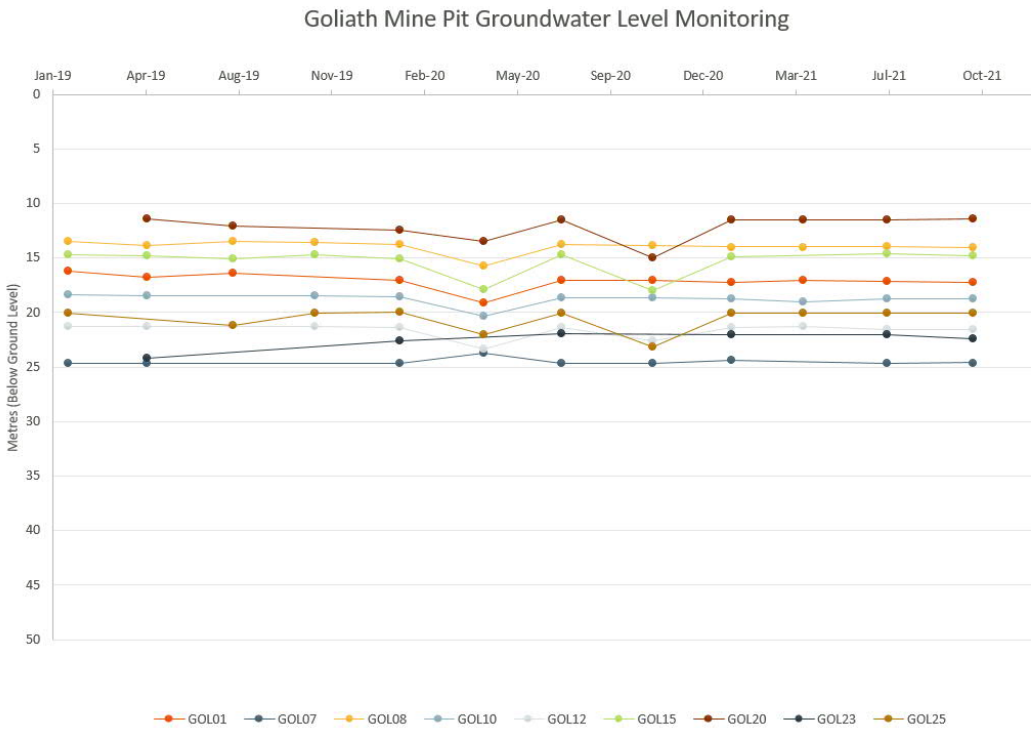
Not all monitoring locations could be accessed due to access track conditions and access to third party tenements. Only four locations could be accessed and sampled: these locations were geographically closest to the MKS project area.

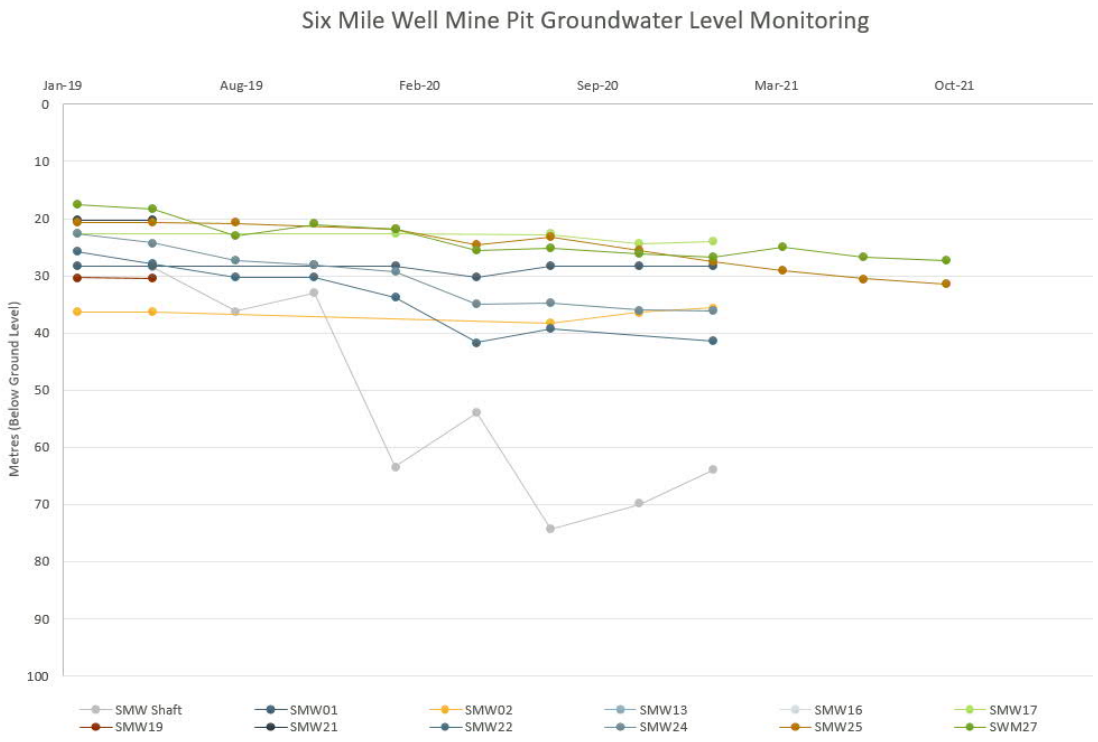
JCS01 is closest to the haul road in north. JCS04 is furthest away from Goliath pit and adjacent to third party tenements. Refer to image below



Legend:
WRM – stream pool sampling locations
OE – creek and clay pan sampling locations
MWES Consulting, 2017b

Mt Keith Satellite Groundwater – Standing Water Levels





Appendix 6 – Mt Keith Satellite Mine Closure Plan 2019

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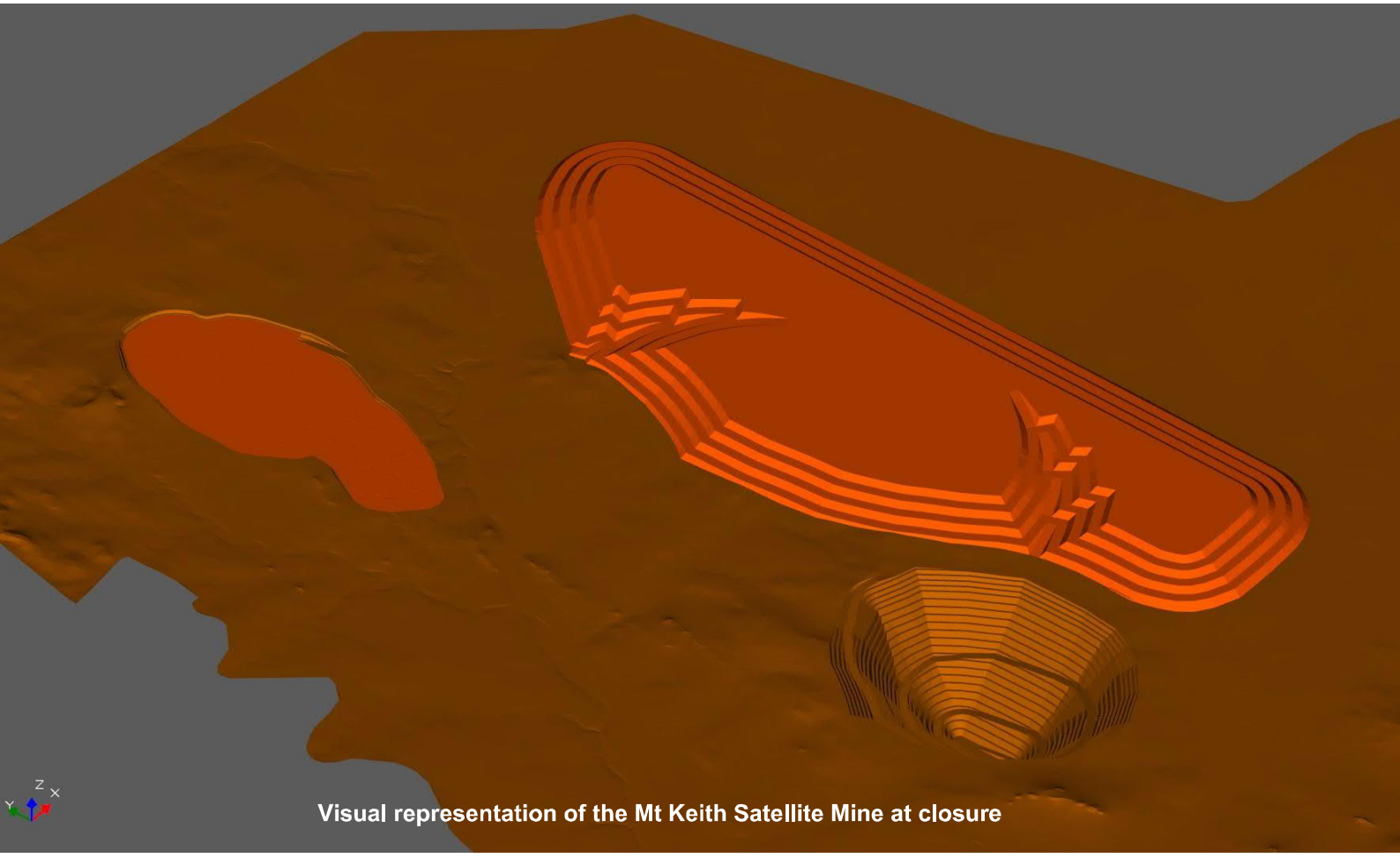
MT KEITH SATELLITE MINE CLOSURE PLAN

DECEMBER 2019



Visual representation of the Mt Keith Satellite Mine at closure

Mine Closure Plan Cover Page

MINE CLOSURE PLAN REQUIREMENT	
Title of Project	Mt Keith Satellite Project
Document Title	Mt Keith Satellite Mine Closure Plan 2019
Document ID Number and Version Number	NiW-MKS-MCP-2019, Version 5.0
Mineral Field Numbers	53 and 36, East Murchison Goldfields
Mineral Tenements:	M36/422, M36/399, M36/294, M36/288, M36/286, M36/246, M36/185, M36/184, M36/183, M36/677, L36/110, L36/206, M36/658, M53/166, M53/217 and M53/218
Company Name	BHP Billiton Nickel West Pty Ltd
Contact Details:	Carl Bagnall Manager – Closure Planning Nickel West BHP 125 St Georges Terrace, Perth WA 6000 E-mail: Carl.N.Bagnall@bhpbilliton.com Office: +61 (8) 6321 6062 Mobile: +61 (0) 477 701 292

Checklist

Qu. No.	Mine Closure Plan (MCP) Checklist	Y/N NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
1	Has the Checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of Checklist.)	Y	vii (after this Checklist)	N/A			
Public Availability							
2	Are you aware that from 2015 all MCPs will be made publicly available?	Y	N/A	N/A	N/A	N/A	N/A
3	Is there any information in this MCP that should not be publicly available?	N	N/A	N/A	N/A	N/A	N/A
4	If "Yes" to Q3, has confidential information been submitted in a separate document/section?	N/A	N/A	N/A	N/A	N/A	N/A
Cover Page, Table of Contents							
5	Does the MCP cover page include • Project Title • Company Name • Contact Details (including telephone numbers and email addresses) • Document ID and version number • Date of submission (needs to match the date of this checklist).	Y	i	Before this checklist	N/A		
Scope and Purpose							
6	State why the MCP is submitted (as part of a Mining Proposal or a reviewed MCP or to fulfil other legal requirements)	Y	1 to 3	Refer **Section 1**	N/A		
Project Overview							
7	Does the project summary include: • Land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land /	Y	4 to 8	Refer **Section 2**	N/A		

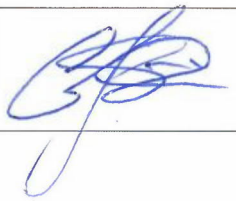
Qu. No.	Mine Closure Plan (MCP) Checklist	Y/N NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
	reserve [including surrounding land] is being managed) • Location of the project; • Comprehensive site plan(s); • Background information on the history and status of the project.						
Legal Obligations and Commitments							
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?	Y	11 to 12, Appx A	Refer **Section 3**	N/A		
Stakeholder Engagement							
9	Have all stakeholders involved in closure been identified?	Y	16	Refer **Section 4**	N/A		
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	16 Appx B	Refer **Section 4**	N/A		
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?	Y	16	Refer **Section 4**	N/A		
Post-mining land use(s) and Closure Objectives							
12	Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?	Y	18 to 21 and 67 to 87	Refer **Sections 5 and 9**	N/A		
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post mining land use (including contaminated sites)?	Y	30 to 63	Refer **Section 7**	N/A		
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DER as required under the Contaminated Sites Act 2003?	NA			N/A		
Development of Completion Criteria							

Qu. No.	Mine Closure Plan (MCP) Checklist	Y/N NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
15	Does the MCP include an appropriate set of specific completion criteria and/ closure performance indicators?	Y	23 to 24	Refer **Section 6**	N/A		
Collection and Analysis of Closure Data							
16	Does the MCP include baseline data (including pre-mining studies and environmental data)?	Y	30 to 63	Refer **Section 7**	N/A		
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	47 to 51	Refer **Section 7.2**	N/A		
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?	Y	53 to 63	Refer **Section 7.5**	N/A		
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?	Y	30 to 66 Appx. C	Refer **Sections 7 and 8**	N/A		
20	Does the MCP include information relevant to mine closure for each domain or feature?	Y	30 to 87	Refer **Sections 7, 8, and 9**	N/A		
Identification and Management of Closure Issues							
21	Does the MCP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature?	Y	67 to 87	Refer **Section 9**	N/A		
22	Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?	Y	65 to 87	Refer **Sections 8 and 9**	N/A		
Closure Implementation							
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	67 to 87	Refer **Section 9**	N/A		

Qu. No.	Mine Closure Plan (MCP) Checklist	Y/N NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
24	Does the MCP include a closure work program for each domain or feature?	Y	67 to 87	Refer **Section 9**	N/A		
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	Y	10 67 to 87	Refer **Figure 2-3** and **Section 9**	N/A		
26	Does the MCP contain a schedule of research and trial activities?	Y	67 to 87	Refer **Section 9**	N/A		
27	Does the MCP contain a schedule of progressive rehabilitation activities?	Y	67 to 87	Refer **Section 9**	N/A		
28	Does the MCP include details of how unexpected closure and care and maintenance) will be handled?	Y	67 to 87	Refer **Section 9**	N/A		
29	Does the MCP contain a schedule of decommissioning activities?	Y	67 to 87	Refer **Section 9**	N/A		
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	88 to 92	**Section 10**	N/A		
Closure Monitoring and Maintenance							
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	88 to 92	**Section 10**	N/A		
Financial Provisioning for Closure							
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	67 to 87 and 94 to 95	Refer **Sections 9 and 11**	N/A		
33	Does the MCP include a process for regular review of the financial provision?	Y	94 to 95	**Section 11**	N/A		
Management of Information and Data							
34	Does the MCP contain a description of management strategies including systems, and processes for the retention of mine records?	Y	97	**Section 12**	N/A		

Corporate Endorsement

I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Department of Mines, Industry Regulation and Safety.

Position	Name	Signature	Date
NiW Manager Closure Planning	Carl Bagnall		23.12.19
General Manager Northern Operations	Chris Stone		23/12/19.

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1 PURPOSE AND SCOPE

1.1 MCP Purpose

The purpose of this Mine Closure Plan (MCP) is to define the objectives and commitments of BHP Billiton Nickel West Pty Ltd (NiW) in relation to closure of the Mt Keith Satellite Nickel Project (MKS Project), located in the Northern Goldfields of Western Australia (WA) (**Figure 1-1**).

MKS will form part of the NiW Asset, which is 100% owned and operated by BHP Limited (BHP). NiW is a fully integrated mining and processing nickel business with all its operations located within WA, and a head office in Perth.

NiW operations consist of:

- Mount Keith Mine (NMK) (Nickel Mine & Concentrator), 430 kilometres (km) north of Kalgoorlie;
- Leinster Nickel Mine (Nickel Mine & Concentrator) (NLN), 370 km north of Kalgoorlie;
- Cliffs Nickel Mine, 5 km south of NMK;
- Kambalda Nickel Concentrator (NKC), 60 km south of Kalgoorlie;
- Kalgoorlie Nickel Smelter (NKS), 15 km south of Kalgoorlie;
- Kwinana Nickel Refinery (NKW), 40 km south of Perth; and
- Other activities including mineral exploration and support facilities (e.g. mining accommodation villages, airports).

The locations of the NiW operating sites (referred to above) are shown in **Figure 1-1.**

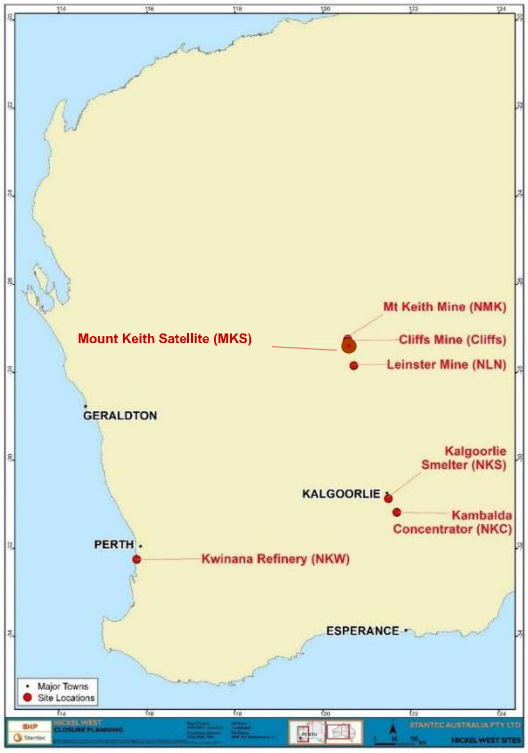

Figure 1-1: NiW Current Site Locations

This document is intended to satisfy statutory obligations that require the submission of a MCP with a Mining Proposal (DMIRS and EPA, 2015) and is a revision of the previously submitted MKS MCP approved by DMIRS in February 2019 (REG ID: 76846).

The MCP, once approved by regulatory authorities, provides NiW the certainty that the commitments made within this MCP – if met by NiW and verified as such to the satisfaction of authorities – are acceptable to the State Government as a basis for complying with statutory obligations and relinquishing mining tenements and residual liabilities.

This MCP has been prepared in general accordance with the '*Guidelines for Preparing Mine Closure Plans*' (Version 2, 2015) jointly released by the former Department of Mines and Petroleum (DMP), which is now known as the Department of Mines, Industry Regulation and Safety (DMIRS), and the Environmental Protection Authority (EPA). These statutory guidelines are referred to hereafter in this MCP as the '2015 Guidelines'.

This MCP has also been prepared consistent with relevant BHP requirements, including *Our Requirements for Closure* (2019).

1.2 MCP Scope

The scope of this MCP is to detail the proposed closure solutions and related commitments for the MKS Project areas and associated infrastructure. Specifically, these land disturbances and assets comprise the following features:

- Two open pit mines;
- One waste rock landform (WRL);
- A run-of-mine (ROM) pad;
- Water infrastructure;
- Administration buildings; and
- Haul roads, access roads and hardstand areas.

All ore from the MKS Project will be hauled to, and processed at, NMK. Closure of the processing and administration infrastructure at NMK is covered under the 2018 Mine Closure Plan which is the overarching document for this MCP.

The MCP has emphasis on the basis for and details of capital works program to be completed at mine closure. However, the MCP also describes key trial and related activities pre-closure and the post closure execution monitoring and maintenance program as part of a staged, credible path to relinquishment of mining tenements and residual liabilities.

Once the accompanying mining proposal for MKS (incorporating this MCP) is approved, the relevant commitments stated in this MCP will be incorporated in the site-wide NMK MCP during the next iteration of the NMK MCP, anticipated to be submitted in 2021. As part of the NMK MCP, the closure commitments for the MKS mining area (stated in this MKS MCP) will be reviewed over time to ensure they continue to reflect contemporary knowledge, technology, government policy/guidelines and rehabilitation experience. On this basis, the commitments made in this MKS MCP may be amended from time to time as part of revisions made to the NMK MCP which are approved by the DMIRS. The NMK MCP is reviewed triennially by NiW in accordance with the 2015 Guidelines, or at a frequency otherwise specified in statutory approvals or agreed with the DMIRS. The NiW Manager Closure Planning, or delegate, is responsible for coordinating these reviews.

1.3 Identification Phase Study (IPS)

NiW implemented a significant program of closure studies as part of the IPS. As per BHP standards, the IPS is the first stage in the development of a Major Project. Major Projects are developed for investments which are complex and/or requiring significant investment to ensure that the commitment and expenditure of funds is sound.

While the IPS did not specifically address the changes to NMK associated with the MKS Project, the work completed for NMK has informed this MCP, and therefore the conclusions of the study are directly relevant to the MKS Project.

Further details on the IPS, including its importance to contemporary NiW closure designs, are provided in the NMK MCP (BHP, 2018).

1.4 Stakeholder Engagement

NiW considers stakeholder engagement as an integral and essential component of successful mine closure planning. NiW implemented an unprecedented program of engagement with key closure stakeholders as part of the IPS. In total, more than 20 meetings were held with regulatory authorities and other stakeholder groups over the past two years to discuss and seek their input on the development of the IPS program, informing this MCP revision.

The main regulatory and interested authorities engaged by NiW during the IPS included:

1. DMIRS;
2. DWER;
3. Department of Planning, Lands and Heritage (DPLH), formerly the Department of Lands (DoL);
4. Environmental Protection Authority (EPA);
5. Department of Jobs, Tourism, Science and Innovation (DJTSI); and
6. Department of Biodiversity, Conservation and Attractions (DBCA), formerly the Department of Parks and Wildlife (DPaW)

NiW has maintained regular engagement with the DMIRS since the inception of the IPS program in July 2015. The purpose of this engagement was to involve the DMIRS from the outset in the development of the IPS scope and to seek progressive DMIRS feedback. The feedback from DMIRS has been considered, where relevant, in the development of this MCP.

Further details on the stakeholder engagement program implemented in support of this MCP revision is included in **Section 4.**

2 SITE AND PROJECT SUMMARY

2.1 Site Location

The MKS Project will be an open-cut nickel mining operation situated in the Northeast Goldfields of WA (**Figure 2-1**). The MKS Project is located 700 km northeast of Perth and 410 km north of Kalgoorlie and is situated within the Shire of Leonora Local Government Area (LGA). The nearest population centres are Wiluna, 100 km to the north, and Leinster, 70 km to the south. The Wanjarri Nature Reserve is the nearest gazetted conservation area, located to the east of the MKS Project.

2.2 MKS Overview

The MKS Project will consist of two open pits (Six Mile Well and Goliath), one WRL and associated supporting infrastructure. Ore will be hauled to and processed at the nearby NMK mine site, located 20 km to the north. The MKS Project has a disturbance footprint of 1075 hectares (ha) within a development envelope of 1259 ha (see **Table 2-2**). Approximately 11 Million tonnes (Mt) will be mined per year. The open pits will be mined below the water table and dewatering of groundwater will be required during operations. The current plan is for the Six Mile Well open pit to be backfilled during operations.

2.3 Land Ownership and Operations Tenure

The MKS Project is situated within mining tenements issued under the *Mining Act 1978* (WA). These tenements comprise Mining Leases, Miscellaneous Licences and General Purpose Leases. The numbers and locations of these tenements are shown in **Table 2-1** and **Figure 2-2.** These tenements cover a total area of approximately 10,346 hectares (ha), and are held by NiW or its wholly owned subsidiary BHP Billiton Yakabindie Nickel Pty Ltd. The MKS Project and all associated tenements are located within the Murchison region.

Table 2-1: Mining Tenements

Domain	Infrastructure	Tenements
Landforms	WRL and ROM Pad	M36/143, M36/183, M36/185, M36/422
Mine workings	Open Pits	M36/183, M36/184, M36/185, M36/246
Non-Process Infrastructure	Administration Buildings, Fuel Farm, Dewatering Facility, Bridge Crossings (North and South), Drainage Controls, Unsealed Roads, Haul Road to NMK (20 km), Laydown areas and Topsoil Stockpiles.	M36/677, M36/658, M36/399, M36/294, M36/286, M36/288, L36/110, L36/206, M53/218, M53/217, M53/166 M36/467*

* Note: Tenement beneficially held by Nickel West following transfer from Australian Nickel Investments Pty Ltd. A copy of the signed transfer is provided as evidence of ownership. Transfer will be lodged once assessment for duties has been completed.

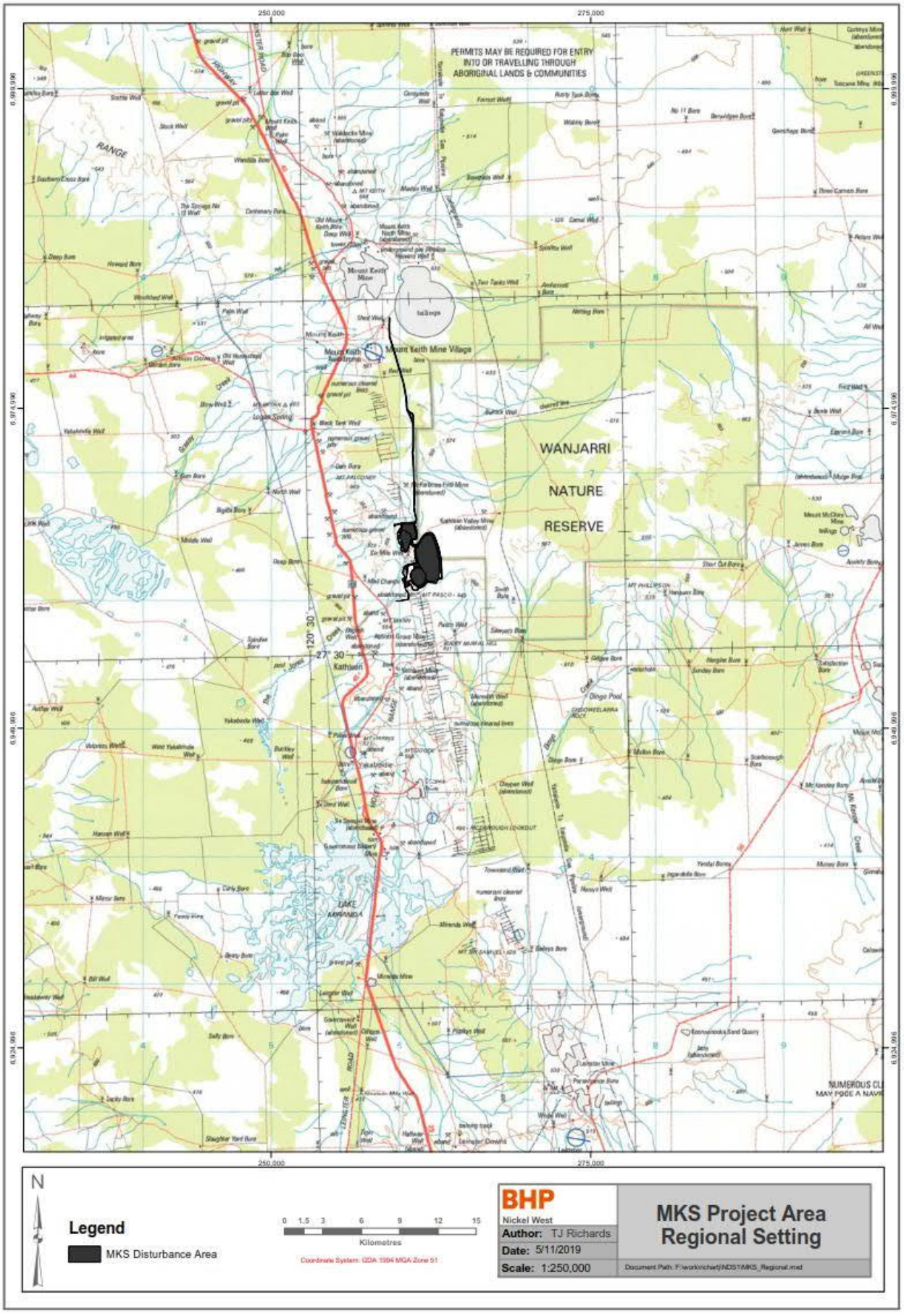

Figure 2-1: Regional Setting

2.4 Pastoral Tenements

In addition to the tenements listed in **Table 2-1**, NiW holds the Yakabindie and Mt Keith Pastoral Leases, which overlap the mining and related tenements. These pastoral leases cover a total area of 250,000 ha and are sub-leased by NiW to a third party (pastoralist).

2.5 Statutory Approvals History

Approval for mining at MKS Project was originally granted under the Yakabindie Nickel Proposal (YNP). The EPA approved the YNP with conditions in December 1990 (Statement 117). Since its original approval the YNP has been subject to six reviews under s46 of the *Environmental Protection Act 1986* (EP Act). These reviews related to changes to the proposal, changes to the conditions of the approval and extensions of the time limit of approval. The YNP was never developed and EPA approval expired on 21 October 2007.

The main differences between the YNP and the MKS Project are:

- The MKS Project has a smaller disturbance footprint;
- The YNP required a section of the Jones Creek to be diverted;
- The YNP incorporated the development of two WRLs; and,
- The YNP included the development of a TSF.

The MKS Project constitutes a substantial revision of the 1990 proposal, and has been referred to the EPA, with the level of assessment was set as "Environmental Review." This MCP has been developed to support the Environmental Review Document.

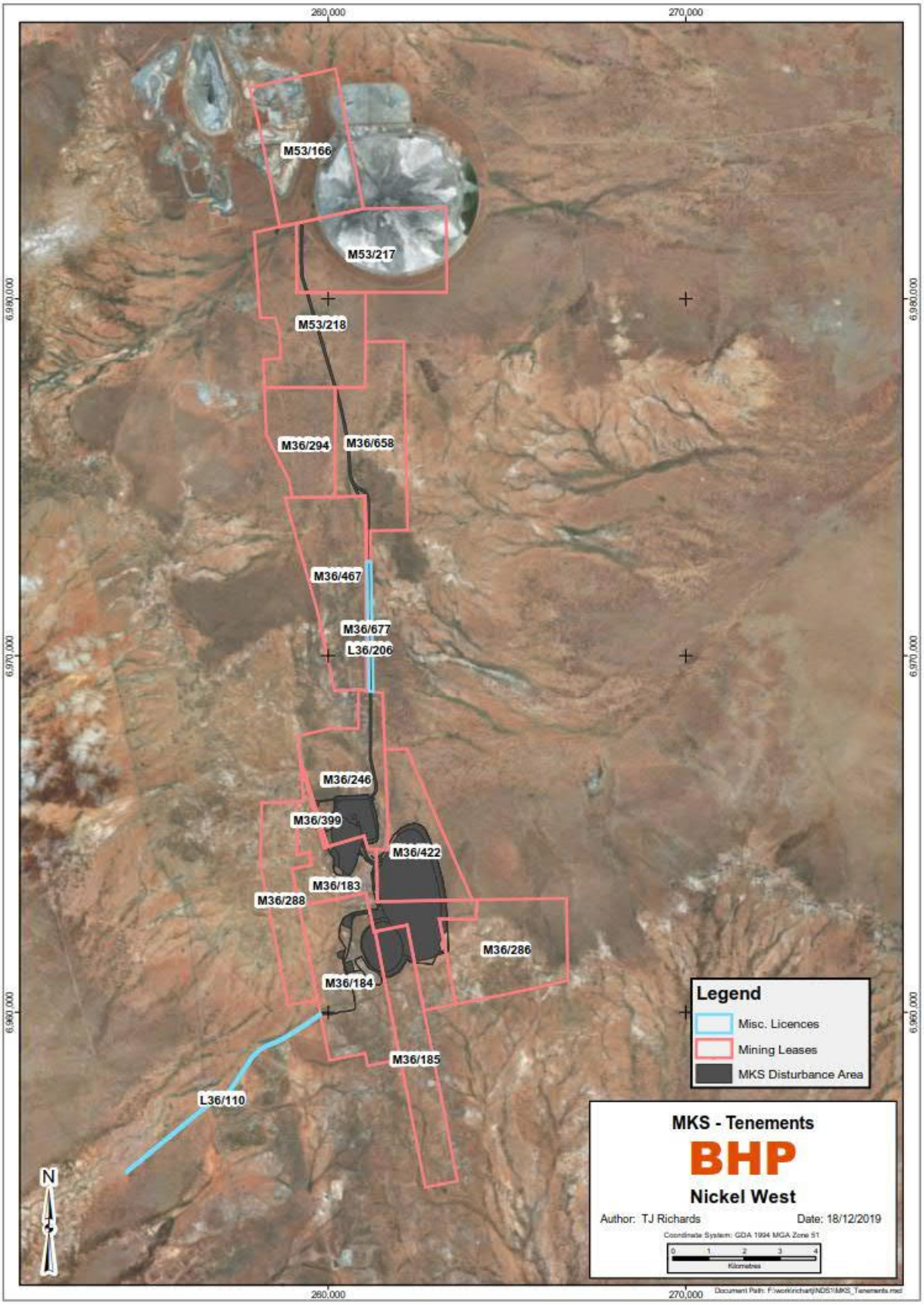

Figure 2-2: Mining Tenements

2.6 Closure Domains

For the purposes of organising closure planning, the closure scope resulting from the MKS Project has been classified into common disturbance types, which are referred to as closure domains (**Figure 2-3**). The definition of closure domains adopted in this MCP is generally consistent with the model presented as Appendix I in the 2015 Guidelines.

The domains are segregated by mining landforms groups which are generally common in closure objectives, scope and legal obligations.

The MKS closure domains include:

Waste Rock Landforms:

- WRL; and
- ROM pad.

Open Pits:

- Six Mile-Well Open Pit; and
- Goliath Open Pit.

Non-process Infrastructure:

- Administration Buildings;
- Fuel Farm;
- Dewatering Facility;
- Bridge Crossings (North and South);
- Drainage Controls;
- Unsealed Roads;
- Haul Road to NMK (20 km);
- Laydown areas; and
- Topsoil Stockpiles.

A Figure showing the mine site layout and assigning all disturbed areas to a closure domain is presented in **Figure 2-3.** Sub-domain details, including the proposed disturbance areas, are provided in **Table 2-2.**

Table 2-2: Group, Domain, Sub-Domain and Planned Disturbance Area for MKS

Group	Domain	Sub-Domains	Planned MKS Disturbance Area (ha)
Landforms	WRL	NA	559
	ROM Pad	NA	
Mine workings	Open pits	Six Mile Well Pit	220
		Goliath Pit	

Group	Domain	Sub-Domains	Planned MKS Disturbance Area (ha)
Infrastructure	Non-Process Infrastructure	Administration Buildings; Fuel Farm; Dewatering Facility; Creek Crossings (North and South); Magazine; Drainage Controls; Unsealed Roads; Laydown areas; and Topsoil Stockpiles.	190
		Haul Road to NMK (20 km);	106
Total			1075

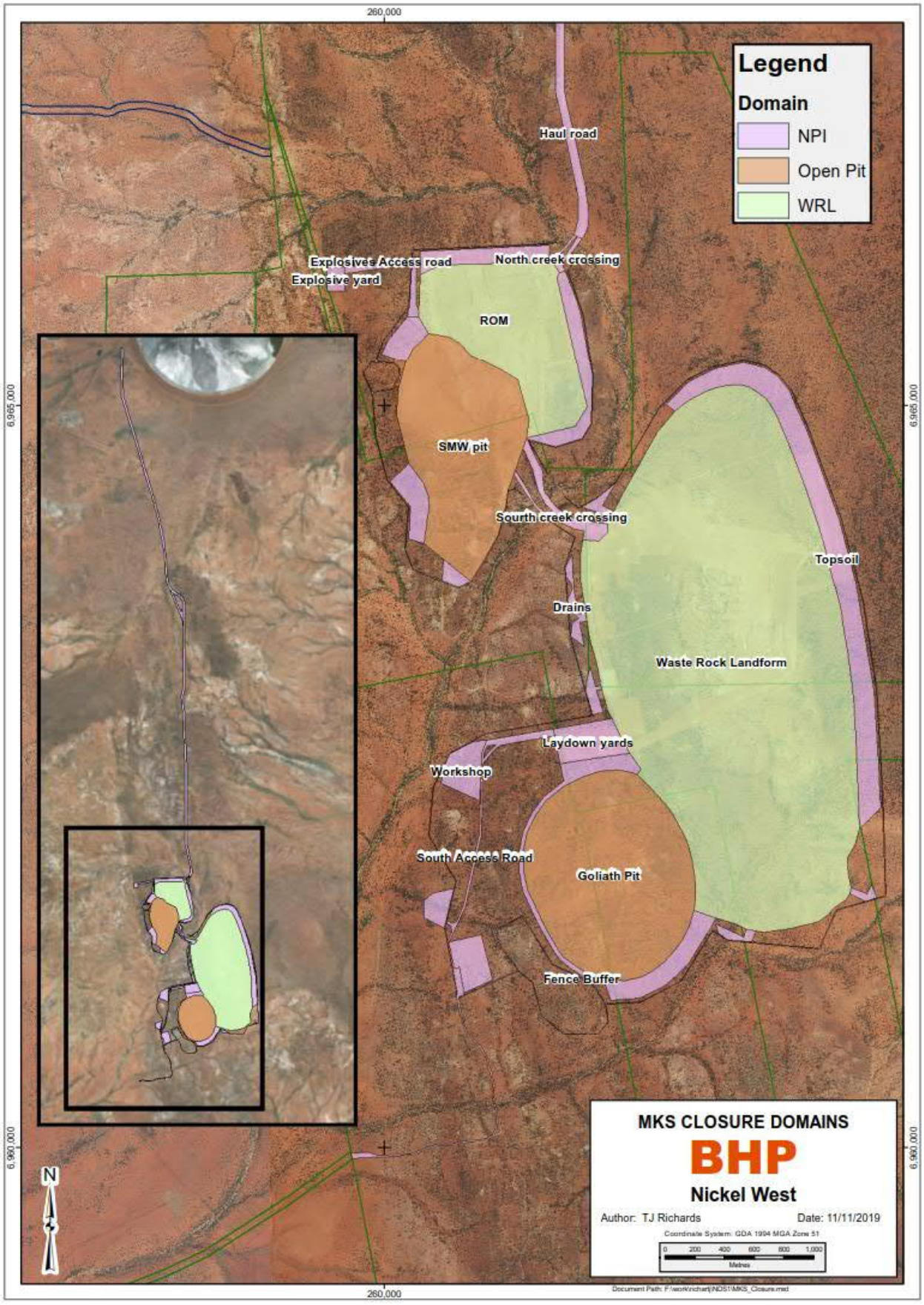

Figure 2-3: MKS closure domains

3 CLOSURE OBLIGATIONS AND COMMITMENTS

Once the MKS Project is approved, NiW will have a range of legal and other obligations which will be applicable to closure. These closure obligations will be predominantly derived from commitments made by NiW in approval applications, conditions imposed by the Minister for the Environment, and tenement conditions. A register of current binding conditions (i.e. tenement conditions) that relate specifically to mine closure and rehabilitation has been developed and is presented in **Appendix A.**

Additional closure obligations will be added to the next iteration of the NMK MCP. Details are provided below in relation to the specific legal and other obligations that inform closure planning at MKS.

3.1 Legislative Obligations

Table 3-1 provides a list of the statutes considered relevant to closure planning for the MKS Project.

Table 3-1: Applicable Legislation

Type	Name
Safety	*Radiation Safety Act 1975 (WA)*
	Occupational Health and Safety Act 1984 (WA)
	Health (Asbestos) Regulations 1992 (WA)
	Dangerous Goods Safety Act 2004 (WA)
	Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007 (WA)
Environment	*Rights in Water and Irrigation Act 1914 (WA)*
	Wildlife Conservation Act 1950 (WA)
	Conservation and Land Management Act 1984 (WA)
	Environmental Protection Act 1986 (WA)
	Environmental Protection Regulations 1987 (WA)
	Environment Protection Regulations 1997 (WA)
	Environmental Protection and Biodiversity Conservation Act 1999 (Cth)
	Environment and Biodiversity Conservation Regulations 2000 (Cth)
	Environmental Protection (Rural Landfill) Regulations 2002 (WA)
	Contaminated Sites Act 2003 (WA)
	Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA)
	Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA)
	Environmental Protection (Controlled Waste) Regulations 2004 (WA)
	Contaminated Sites Regulations 2006 (WA)
	Biodiversity Conservation Act 2016 (WA)
	Biosecurity and Agriculture Management Act 2007 (WA)
Heritage	*Aboriginal Heritage Act 1972 (WA)*
	Aboriginal Heritage Regulations 1974 (WA)
	Native Title Act 1993 (Cth)
Mining	*Mining Act 1978 (WA)*
	Mining Regulations 1981 (WA)
	Mines Safety and Inspection Act 1994 (WA)
	Mines Safety and Inspection Regulations 1995 (WA)
	Mining Rehabilitation Fund Act 2012 (WA)
	Mining Rehabilitation Fund Regulations 2013 (WA)
Pastoral	*Land Administration Act 1997 (WA)*

Legislative obligations pertaining to closure are primarily general in nature requiring the assessment and management of the potential for adverse impacts to people, heritage, property and the environment. These obligations also require the obtainment of statutory approvals, in some instances, to support planned closure activities. NiW acknowledges its obligations under this legislation and has in place processes to manage for compliance.

3.2 Other Obligations

MKS Project mining tenure is located within the boundary of the Tjiwarl native title determination (WAD228/2011 and WAD302/2015). This determination was made in April 2017 during the latter stages of the IPS development. On 1 November 2018 a Comprehensive Agreement was signed between Nickel West and Tjiwarl (Aboriginal Corporation) Registered Native Title Body Corporate (RNTBC). This Agreement provides the requirements and mechanism for ongoing consultation with Tjiwarl regarding matters relating to Nickel West's operations in the region. The MKS mining proposal (January 2019) that incorporated the original MKS MCP was provided to the Tjiwarl for review with no comment received for address within any revision/update of the MCP. NiW maintains regular committee meetings with the Tjiwarl that will continue to provide a forum for raising, and discussion of, issues associated with Nickel West's mining operations including closure planning.

Other obligations arising from the BHP Charter, BHP *Our Requirements for closure*, Government guidelines (including the 2015 Guidelines) and industry standards form the balance of commitments that have been considered in the development of this MCP.

3.3 Responses to DMIRS Queries regarding 2018 MKS Mine Closure Plan

The MKS MCP was submitted in January 2019 with DMIRS providing an approval letter (Registration ID 76846) in February 2019. **Table 3-2** summarises the DMIRS comments, NiW responses and where relevant additional information can be found in this MCP.

Table 3-2: Responses to DMIRS Queries Regarding 2018 MKS MCP

Reference	DMIRS Comment	NiW Response and MCP Reference/s
Letter from DMIRS dated 6 February 2019 titled "APPROVAL FOR MINING PROPOSAL WITH A MINE CLOSURE PLAN – MT KEITH SATELLITE PROPOSAL MINING PROPOSAL ON L 36/110, L 36/206, M 36/183, M 36/184, M 36/185, M 36/246, M 36/286, M 36/288, M 36/294, M 36/399, M 36/422, M 36/658, M 36/677, M 53/166, M 53/217 and M 53/218 (Registration ID 76846)	*"DMIRS expect that all key stakeholders identified in section 1.4 of the MCP and the Tjiwarl people are consulted regarding proposed post mining land use and closure objectives and the results of discussions are included in the next iteration of the MCP."*	Please refer to updated **Section 3.2** of this MCP, which states: *"MKS Project mining tenure is located within the boundary of the Tjiwarl native title determination (WAD228/2011 and WAD302/2015). This determination was made in April 2017 during the latter stages of the IPS development. On 1 November 2018 a Comprehensive Agreement was signed between Nickel West and Tjiwarl (Aboriginal Corporation) Registered Native Title Body Corporate (RNTBC). This Agreement provides the requirements and mechanism for ongoing consultation with Tjiwarl regarding matters relating to Nickel West's operations in the region. The MKS mining proposal (January 2019) that incorporated the original MKS MCP was provided to the Tjiwarl for review with no comment received for address within any revision/update of the MCP. NiW maintains regular committee meetings with the Tjiwarl that will continue to provide a forum for raising, and discussion of, issues associated with Nickel West's mining operations including closure planning."*
	"It is expected that the completion criteria is refined as rehabilitation monitoring data becomes available and as stakeholder consultation progresses. *In the next iteration of the MCP, the definition of "predicted erosion rates", "assimilative capacity of landforms", "predicted groundwater quality ranges", and details on how these criteria will be measured are required to be provided."*	As agreed during the meeting between NiW (Annette Latto, Environmental Specialist - Approvals, and Brendan May, Principal Closure Planning) and DMIRS (Melissa Harrison and Phil Boglio) on 15 April 2019, updated information will be provided in the subsequent 2021 MCP at which time MKS and NMK MCP's will be combined into a single MCP document.
	"Details of availability of key materials required for rehabilitation needs to be updated once further information becomes available following commencement of mining."	An updated materials balance inventory post-commencement of mining is provided in **Section 9.4.**
	"The location and characteristics of proposed analogue sites have not been provided. This	As agreed during the meeting between NiW (Annette Latto, Environmental Specialist - Approvals, and Brendan May, Principal Closure Planning) and

Reference	DMIRS Comment	NiW Response and MCP Reference/s
	information needs to be provided in the next iterations of the MCP. *Additional pit lake modelling/studies may also be required once further information becomes available following commencement of mining."*	DMIRS (Melissa Harrison and Phil Boglio) on 15 April 2019, updated information will be provided in the subsequent 2021 MCP at which time MKS and NMK MCP's will be combined into a single MCP document.
	"Although practical planning for premature closure (permanent or suspended operations under care and maintenance) may not be done in early stages of the project, consideration must be given in the MCP for how BHP Billiton Nickel West plans to deal with these closure scenarios which may arise from economic, environmental, safety or other external pressures. Please refer to section 4.12.3 of the Guidelines for preparing Mine Closure Plans (DMP, 2015) for further information."	**Section 9.1** has been updated to align with the closure execution strategy section of the approved NMK (Reg ID 70984) and Cliffs (Reg ID 74863) MCP's.
	"Details of monitoring methodologies need to be provided in the next iteration of the MCP."	As agreed during the meeting between NiW (Annette Latto, Environmental Specialist - Approvals, and Brendan May, Principal Closure Planning) and DMIRS (Melissa Harrison and Phil Boglio) on 15 April 2019, updated information will be provided in the subsequent 2021 MCP at which time MKS and NMK MCP's will be combined into a single MCP document.
	"The level of information provided does not adequately address the requirements of section 4.14 of the Guidelines for preparing Mine Closure Plans (DMP, 2015). *The MCP must contain a summary of the mine closure costing, methodology, assumptions and financial processes to demonstrate that the costs of meeting closure outcomes have been properly considered, fully understood and adequate provisions have been made in corporate accounts for these costs. This*	**Section 11** has been updated to align with the financial provisioning section of the approved NMK (Reg ID 70984) and Cliffs (Reg ID 74863) MCPs.

Reference	DMIRS Comment	NiW Response and MCP Reference/s
	information must be provided in the next iteration of the MCP."	

4 STAKEHOLDER ENGAGEMENT

4.1 Overview

NiW considers effective stakeholder engagement to be integral to achieving success in mine closure. Those internal and external stakeholders who have involvement, influence or interest in closure planning and its outcomes will ultimately decide the success, or not, of an implemented closure plan. The early input of key stakeholders, particularly those directly impacted or which have the most influence on the acceptability of the MCP is crucial to ensuring a clear, credible and efficient path to site closure and tenement and land relinquishment.

Stakeholder engagement undertaken specifically for the MKS Project has related to obtaining Project approval. Currently the extent of this engagement has been the presentation of the Environmental Scoping Document (ESD) by the EPA to various stakeholders from the Department of Biodiversity Conservation and Attractions (DBCA), the DMIRS, the Department of Planning, Lands and Heritage (DPLH) and the Department of Water and Environmental Regulation (DWER). Most of the feedback received to date has related to Project approvals – some closure issues were raised and these are presented in **Appendix B.** Extensive stakeholder engagement related to closure planning was undertaken during the IPS that was only recently completed for the revised 2018 NMK MCP. The NMK MCP's scope and consistency in key commitments makes the stakeholder engagement conducted for the IPS relevant to the Project.

Outcomes of relevant IPS stakeholder engagement is also presented in this section and **Appendix B.** The External Stakeholder Meetings Register, provides a record of all the meetings that were held between NiW and external stakeholders during the IPS in addition to those since that are directly relevant to the MKS Project. In total, over 20 meetings were held throughout the two-year IPS period.

4.2 Next MCP Revision

The next revision and update of the NMK site MCP (scheduled for 2021) will incorporate relevant commitments from this MKS Project MCP. To inform this next NMK MCP revision, engagement on progressive closure planning will be maintained with the key stakeholders NiW consulted with during the IPS. Consultation commenced in November 2019 with the Tjiwarl AC in relation to closure planning matters at Nickel West. It is expected that specific engagement on closure matters related to NMK and MKS will have commenced prior to submission of the revised NMK MCP (scheduled for 2021).

Active engagement with the NiW workforce will be maintained and post-IPS this will emphasise the planning and implementation of progressive activities pre-closure. These activities may include rehabilitation, field trials and operational improvements that build upon the IPS findings to further reduce closure risks, uncertainties and liabilities.

Table 4-1: External Engagement Schedule

Stakeholder	Proposed Engagement Frequency
DMIRS	Bi-annual (or as required)
DWER	Annual (or as required)
DPLH	Annual (or as required)
EPA	Annual (or as required)
Pastoral Lessees	Annual (or as required)
Traditional Owners – Tjiwarl	Annual (or as required)

Should the expected closure date significantly alter before the next NMK MCP revision, then the scope and cadence of the stakeholder engagement strategy for closure will be reviewed, to ensure that it remains appropriate for the circumstances.

5 POST MINING LAND-USE/S AND CLOSURE OBJECTIVES

This section discusses the post-mining land-uses and closure objectives (consistent with those land-uses) for the MKS Project. The proposed post mining land-use/s and closure objectives are consistent with that proposed in the NMK MCP (BHP 2018).

NiW considers final land-uses and closure objectives as critical parameters in the framing of closure planning. In particular, they frame the development of appropriate closure performance criteria (**Section 6**) and the establishment of a reliable, finite and achievable path to relinquishment of mining tenements and residual liabilities.

5.1 Post Mining Land-Use/s

5.1.1 Assessment Inputs

During the IPS, the following inputs were considered in review and selection of post-mining land-uses for NMK. Consistent with these findings these inputs were utilised for the selection of post-mining land-uses for the MKS Project:

1. Land-Use Objectives;
2. Stakeholder Feedback;
3. Statutory obligations (See **Section 3**); and
4. Results from the Pastoral Land-Use Assessment.

With the exception of Statutory Obligations (see **Section 3**), each of these assessment inputs is further discussed below.

5.1.1.1 Land-Use Objectives

Achievable post-mining land-uses agreed with key stakeholders is a fundamental closure consideration. During the IPS, NiW invested in targeted studies and stakeholder engagement to identify suitable land-uses that were:

- Acceptable to key stakeholders;
- Relevant and compatible with the local environment;
- Realistic and achievable to deliver the target outcomes;
- Minimal in maintenance to aid the long-term viability of the land-use;
- Diverse and adaptive, and which do not sterilise potential for future mining;
- Ecologically sustainable in the context of the local and regional environment; and
- Resilient to changes in environmental conditions, including predicted changes in climate.

In evaluating and selecting post-mining land-use/s, NiW has considered their value and suitability at the local (site) and landscape scales. This was done primarily in response to stakeholder feedback received during the IPS, including from the DPLH and local pastoralists, which encouraged NiW to consider striking more balance (than, based on feedback and IPS Study team experience, was typical within the mining industry at closure) between the gains made within the mining tenement boundaries versus those which could be achieved in the immediate surrounds to deliver more viable, sustainable post-mining land-uses. This was particularly sought where a superior nett benefit to land-uses could be delivered to aid their economic, social and environmental sustainability post-closure.

This assessment approach was considered consistent with the closure principles identified in Section 3.1 of the 2015 Guidelines, which states:

> *"Post-mining land-uses should … include consideration of opportunities to improve management outcomes of the wider environmental setting and landscape, and possibilities for multiple land uses."*

In relation to the determination of the mix of final land-use, Section 4.8.1 of the 2015 Guidelines recognises that land-use/s should be regularly reviewed to ensure their continued feasibility, efficacy and acceptability to stakeholders:

> *"DMP and EPA acknowledge that end land uses may change over time. Agreed end land-use(s) may change in iterations of Mine Closure Plans as more information is acquired through progressive rehabilitation and continued stakeholder engagement."*

NiW has endeavoured in the revision of this MCP to be consistent with this expectation to ensure post mining land-uses are relevant, desirable and achievable, and informed by contemporary stakeholder feedback, site experience, industry case studies, Government policy and regulations and the IPS technical assessments and findings.

5.1.1.2 Stakeholder Feedback

The preferences of key stakeholders with experience in dealing first-hand with the challenges associated with land-use in the northern Goldfields and/or who are likely to inherit/manage rehabilitated lands post-relinquishment (e.g. DPLH, local pastoralists) are critical inputs in the land-use assessment conducted during the IPS.

As discussed in **Section 4**, NiW implemented a targeted program of stakeholder engagement during the IPS. This was done, in part, to materially advance the understanding of what was acceptable to key stakeholders as a mix of end land-use. The engagement on land-use primarily targeted the DPLH, the DMIRS and experienced pastoralists.

The predominant stakeholder feedback throughout IPS did not encourage a cattle grazing land-use on the heavily altered mining rehabilitated landforms (WRLs and final voids), recognising the inherent limitations and challenges in this landscape. Instead, stakeholder preferences were generally to exclude cattle from these domains and pursue a passive native vegetation outcome to soften the landscape aesthetic and increase local biodiversity

Many of the stakeholders, particularly pastoral, stated a clear preference for NiW to consider alternative measures that could more reliably, cost-efficiently and sustainably improve land capability and grazing viability of the pastoral leases beyond the mine gate.

Importantly, stakeholders were also keen for NiW to ensure that the rehabilitated site did not adversely impact (e.g. from dust, erosion, contamination of stock bores, etc.) the pastoral quality or use of the surrounding lands.

5.1.1.3 Pastoral Land-Use Assessment

As part of the IPS, NiW conducted a pastoral land-use assessment using specialist, experienced pastoralists. David Blood from Coodawa Contracting led this assessment. Mr Blood is an experienced manager of pastoral stations who has previously worked as an assessment officer with the former Department of Environment and Conservation (DEC).

Mr Blood was aided by Doug Brownlie (a former NiW pastoral manager for more than 20 years with extensive knowledge of the local pastoral conditions and related challenges/opportunities) and Mr Jim Addison (who worked for 45 years as a technical officer with the former Department of Agriculture and Food, based mostly in the WA Goldfields). This consultant team had a combined experience of 85 years in WA pastoralism and regulation.

This assessment was identified in response to early stakeholder feedback during the IPS that suggested a pastoral end land-use was not desirable nor considered feasible by key stakeholders for mine rehabilitated landscapes. Instead, there was a clear preference from stakeholders for an assessment to be conducted of what could be done, at a wider scale, to better improve the long-term viability post-closure of pastoralism in the locale.

Accordingly, NiW in consultation with the pastoralist consultants and the DPLH identified a pastoral improvement approach, which aims to exceed pre-mining grazing capability (stocking rate) in the area of the NiW mines and immediate surrounds. This option, and its ultimate scope, will be subject to further discussions with the DPLH as part of future updates of the MCP. The selected option will also be incorporated, along with other initiatives, in the development of a Rangeland Management Plan (or equivalent). The Rangeland Management Plan will be the document that incorporates all of the commitments made by NiW as part of achieving a suite of closure outcomes acceptable to the DPLH for relinquishment of tenure. The scope and commitments made within the Rangeland Management Plan will be determined in consultation with and to the satisfaction of the DPLH prior to the start of closure execution.

Details in relation to the scope and key findings from this pastoral land-use assessment is provided in the NMK MCP (BHP 2018).

5.1.2 Selected Post-Mining Land-Uses

From the evaluation of inputs described above in **Section 5.1.1.1**, **Table 5-1** identifies the post-mining land-uses proposed for the MKS Project area.

Table 5-1: MKS Post-Mining Land-Uses

Domain	Land-Use	Description
WRL	Self-Sustaining Native Vegetation (to support local biodiversity and improved post-mining aesthetics)	• Will support self-sustaining native vegetation (i.e. native vegetation species, which can survive in local conditions with nil to minimal maintenance or other intervention, will be predominant). • The land-use objective is to maintain local biodiversity whilst improving/softening the visual aesthetics of mine rehabilitation. • Grazing will be discouraged (from perimeter fencing of the landform) to reduce potential for grazing impacts to undermine core stability and revegetation/biodiversity outcomes. Use of native species unpalatable to stock will be considered in the adopted seed mix. • This land-use will not inhibit or adversely impact the pastoral activity in surrounding non-mined areas. • Funding provisions will be made for maintenance of fencing and other key features for a finite period beyond the post-closure monitoring phase to support a successful relinquishment process for mining tenements and residual liabilities.

Domain	Land-Use	Description
Non-Process Infrastructure	Self-Sustaining Native Vegetation (to support low intensity cattle grazing)	• As above. Additionally, it may, where feasible and sought by key stakeholders, support a transition to low intensity pastoral grazing over time. If the pastoral benefit is more limited than was envisaged for some areas, this will be considered in the justification or not of continuing to pursue a grazing outcome over time particularly where alternate benefits are evident (e.g. biodiversity). • It is anticipated that larger Non-Process Infrastructure areas will be initially fenced to enable vegetation to establish and develop until it is able to support limited grazing where this is deemed feasible as an extension to surrounding pastoral lands.
Open Pit	Historic Mining (to preserve mining history and support potential resumption of mining or alternate uses)	• Mining void and immediate area will be made safe and stable with access for people and stock discouraged through fencing / bunds (e.g. at top of pit access ramps, abandonment bund) and rehabilitation of former access roads. • The final void will be left to serve as a pit lake, which could be dewatered to support any future resumption of mining. • This land-use will not inhibit or adversely impact the pastoral activity in surrounding non-mined areas.

As discussed in **Section 5.1.1.3**, NiW proposes to implement an option that will help improve cattle stocking rates in the mining tenements and immediate surrounds. These works form part of the suite of closure commitments to deliver a mix of realistic, feasible and sustainable post-mining land-uses that are desired by key stakeholders.

The target post mining land-uses identified in **Table 5-1** will be subject to review over time to ensure their continued relevance and feasibility and agreement with key stakeholders. Any proposed changes to these land-uses will be discussed with the DMIRS and other relevant parties prior to their inclusion in future MCP revisions.

5.2 Closure Objectives

Realistic and achievable closure objectives have been developed, which are consistent with the post-mining land-uses (**Section 5.1**). These will be refined in further iterations of the MCP.

Closure objectives have been developed at the site (broad) and key domain (specific) levels (see **Table 5-2**). The Domain Objectives are grouped according to the Site Objective tenets – safe, stable, non-polluting, and agreed land-use. Compliance with legal and other (e.g. BHP) obligations is a primary requirement of the Site Objective.

Table 5-2: Closure Objectives

SITE Objective
Deliver safe, stable and non-polluting outcomes and agreed post-mining land-uses[1] that comply with legal and other obligations and achieve mining tenement relinquishment[2] and a "walk away" solution[3] for NiW
[1] *"Safe, stable and non-polluting outcomes"* are defined as: – *"Safe" includes the protection of people from harm primarily but also gives consideration to stock and native fauna;* – *"Stable" encompasses erosional and geotechnical stability, and* – *"Non-polluting" is both geochemical and geophysical and considers sources, pathways and sensitive receptors to qualify risk.* [2] *"Mining tenement relinquishment" is defined as a state when agreed completion criteria have been met, government "sign-off" achieved, all obligations under the Mining Act 1978 removed, and the proponent has been released from all forms of security. This is consistent with the definition of "relinquishment" provided in the DMIRS / EPA "Guidelines for Preparing Mine Closure Plans May 2015".* [3] *"Walk away solution" is defined as a state when mining tenement relinquishment has been achieved and NiW has been able to reliably discharge to the State Government or other third party its residual liabilities related to the site. At this time, the site shall either no longer require management, or if further management is required or can be reasonably expected then NiW shall make adequate provision so that the required management can be undertaken with no unacceptable outcome to the third party which inherits the site.*
DOMAIN Objectives
All Domains
Safe • Materials harmful to human health will be encapsulated or remediated. • Final landforms and land-use/s will not pose unacceptable risks to people or fauna. • Infrastructure will be removed unless agreed to by regulators and post-relinquishment land owners/managers.
Stable • Final landforms will be geotechnically stable. • Erosion stability will be achieved by controlling surface run-off and low stability materials.
Non-Polluting • Seepage will not harm sensitive groundwater receptors. • Surface water run-off will not harm the surrounding environment. • Materials harmful to the environment will be encapsulated or remediated.
Agreed Land-Use • The post-mining land-use/s will be agreed with key stakeholders. • The final landforms will not adversely impact surrounding pastoral land-use. • Revegetated areas will support self-sustaining vegetation dominated by native species. • Revegetation of rehabilitation areas and other initiatives will seek to maintain local biodiversity.

6 CLOSURE PERFORMANCE CRITERIA

Post-mining land-uses (**Section 5.1**) and closure objectives (**Section 5.2**) provide the basis for developing closure performance criteria (completion criteria).

Performance criteria must be realistic, risk-based and fit-for-purpose for the site conditions. They must be SMART (ANZMEC/MCA, 2000) – Specific, Measurable, Achievable, Relevant and Time-bound. Criteria should aim to be simple to measure and interpret, and not be ambiguous and complex to decipher creating paralysis and/or uncertainty from analysis. Performance criteria should relate the direction of effort and investment to risk. This means emphasising those aspects of closure performance that if not met could have major consequences, and limiting the focus on other aspects which do not carry this significance. For the latter, these aspects (e.g. complex measurements of often speculative ecological function) can often establish or restore over time with limited intervention provided the right landform engineering and other fundamentals are in place.

For each closure objective, performance criteria have been developed to verify the practical attainment of each objective. The closure objectives and performance criteria together comprise the framework for measuring closure success. This framework is intended to provide the basis for relinquishment of mining tenements and residual liabilities once it can be demonstrated that the performance criteria have been met to the satisfaction of regulatory authorities and arrangements for future management and maintenance have of the closed site have been agreed to by the subsequent owners or land managers (e.g. State Government as represented by the DPLH or other agency).

NiW recognises the requirement of Section 2.8 of the 2015 Guidelines, which states:

"Where relinquishment requires the transfer or return of ownership or management of infrastructure and/or land to other parties, the tenement holder(s) will be required to demonstrate that these parties have been involved in the process and understand their responsibilities and liabilities associated with the transfer. Any transfer of residual liability to the subsequent owners or land managers, including management of contaminated sites, must be clearly communicated, agreed to and documented, to the satisfaction of the relevant regulators."

Consistent with this requirement, NiW initiated engagement with the DPLH to seek their input on what may constitute acceptable outcomes to them at closure to enable a successful transfer of rehabilitated mine-sites to the State Government as the relevant owner and manager of these lands. Details of this engagement is included in **Section 4, Section 5.1**, and **Appendix B.**

6.1 Criteria Development

Performance criteria have been developed for all phases of closure planning and delivery, including:

1) **Pre-Execution** (pre-construction) – detailed design phase (e.g. DPS);
2) **Execution** (construction) – implementation of closure / rehabilitation activities; and
3) **Post-Execution** (post-construction) – period of monitoring until tenement / liability relinquishment.

This approach puts increased focus on measuring early indicators of closure performance during design and construction and less on lagging, reactive indicators in post-construction. It also recognises that the greatest opportunity to influence closure is during the planning phase and to a lesser extent the construction phase as the ability to effectively alter closure outcomes after this time is diminished.

The development of performance criteria was informed by industry benchmarking (**Section 7.5.2**) and a series of workshops conducted during the IPS that were attended by experienced closure specialists to examine the challenges faced by industry and regulators alike in developing a reliable and achievable path to relinquishment. From these reviews, and taking into account feedback on this topic from the DMIRS and the DPLH, NiW identified the root causes and lessons learned from current and past experiences within the WA mining industry (and more widely). Some of the key observations, and the NiW responses to them, have included:

1. ***Engage key stakeholders early*** – Start early with engagement, particularly with those important to ultimately accepting closure performance and enabling relinquishment of mining tenements and residual liabilities.

   NiW Response: Completed. DMIRS and DPLH were actively engaged by NiW during the IPS as the two agencies expected to principally decide acceptance of closure outcomes and relinquishment of mining tenements and residual liabilities. See **Section 4** and **Appendix C.**

2. ***Measure more earlier, and less later*** – Prescribe more criteria in the design and execution phases (when repairs to issues can often be more readily and effectively achieved and at far less cost) and less in post-execution (when site closure knowledge/experience has often 'moved on', most closure funds are already spent and it is too late to repair a latent design issue leading to inadequate, 'band aid' solutions).

   NiW Response: Completed. Performance criteria span pre-execution, execution and post-execution phases of closure, and seek to strike both continuity and balance in criteria across each of these phases. See **Table 6-1.**

3. ***Simplify criteria with a risk-based focus*** – Simplify performance criteria with relevant, measurable and achievable criteria; prioritise criteria development according to risk severity (i.e. if the consequences of poor performance are major then give this more emphasis in criteria, and vice versa); and avoid experimental criteria that cannot be relied upon, is inconclusive or won't reach a consensus in qualified opinion.

   NiW Response: Completed. Proposed criteria have attempted to improve focus on criteria that can be readily measured and objectively and which put focus on the landform fundamentals and less on complex details. See **Table 6-1.**

4. ***Develop a progressive sign off process with authorities*** – Seek a progressive assessment and sign-off process by regulatory authorities, with approval tollgates before proceeding from closure design to execution to post-execution to progressively reduce process uncertainty and latent risks.

   NiW Response: Completed. Progressive sign-offs from an independent auditor and the DMIRS is proposed. See **Section 6.2.**

Closure performance criteria will be subject to periodic review pre-closure to ensure their continued relevance and efficacy. These reviews will be informed by results from progressive rehabilitation, field trials and technical studies and relevant changes in stakeholder expectations. Any proposed changes will be documented in MCP revisions.

6.2 Performance Criteria

The closure performance criteria proposed for MKS are identified in **Table 6-1.**

Note, the compliance of closure activities with relevant legal and other obligations will be assessed as part of the pre-execution Quality Assurance (QA) audits. These audits will review the efficacy of the detailed designs prior to their execution.

A key feature of closure performance measurement will be appointment of an Independent Closure Auditor (ICA) of suitable qualifications and experience to review the integrity of work completed throughout closure planning and delivery. Whilst not a statutory appointment, it is intended that the ICA would act in a capacity akin to the CSA role under the *Contaminated Sites Act 2003* (WA), with their appointment approved by the DMIRS. Additional information on how the appointment and role of the ICA would function is described in the 2018 NMK MCP.

Additional information on how the appointment and role of the ICA would function is described below:

- Approval of the ICA by the DMIRS would be sought to ensure the DMIRS was satisfied with the independence and qualifications/experience of the appointed person/s (note more than one person is expected due to the many specialised disciplines of closure but that there would be a single Auditor lead, similar to the CSA processes where a CSA is often supported on large projects by a team of specialists to fulfil his/her duties). The DMIRS would not have to comply with the advice of the ICA – importantly, this role is not intended to replace or diminish the statutory functions of the regulatory authorities – instead it would be intended to inform the regulatory authority assessments by the DMIRS and others.

- It is proposed that the ICA would primarily engage with NiW, with their final audit reports submitted to regulatory authorities. NiW would seek to convene meetings with the ICA and regulatory authorities throughout the assessment term to ensure relevant agencies were kept abreast of the status at key milestones in the ICA reviews. At these meetings, authority feedback would be sought on key matters for address by the ICA (and/or NiW).

- At the time of appointment, the ICA (and their supporting team, and employer) should not be engaged by NiW for closure or related activities, or should not have been previously involved in the substantive development of the site MCPs. This is intended to satisfy the requirement for auditor "independence".

- The ICA would advise on the quality of the progressive closure activities to ensure their adequacy in satisfying performance criteria, including compliance with relevant statutory obligations and industry standards. It is anticipated that the ICA would be initially engaged by NiW during the detailed design phase (DPS) – the final study phase prior to execution of closure activities – but earlier engagement may occur.

- The engagement of an ICA to this QA role, and in addition to the typical QA reviews that will be implemented during the completion of closure works, is intended to strengthen the transparency and rigour of the assessment process and aid achieving a stable, predictable and progressive path to relinquishment.

Table 6-1: Closure Completion Criteria

Closure Objectives		Closure Performance Criteria			Measurement
		Pre-Execution (DPS)	Execution	Post-Execution	
Safety	Materials harmful to human health will be encapsulated or remediated	An inert cover will be applied over all exposed deleterious materials (e.g. contaminated soil, PAF waste rock, hazardous wastes)	Covers are constructed per detailed design specifications approved by regulatory authorities	No exposed material harmful to human health is observed	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the Basis of Design (BoD) and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations. This will include a validation assessment report from the CSA for components that relate to contaminated sites remediation. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. This will include a validation assessment report from the CSA for components that relate to contaminated sites remediation.
	Final landforms and land-use/s will not pose unacceptable risks to people or fauna.	• Rehabilitated (embankment) slopes will be no greater than 20°. • Stock proof fencing of the WRLs and open pit. • Construction of an abandonment bund around the open pit. • Construction of bunds at the top of pit access ramps. • Access roads will be closed and rehabilitated when they are no longer required to mitigate access.	Final landforms are constructed per detailed design specifications approved by regulatory authorities.	No unacceptable safety risks from final landforms and land-use are identified post-execution.	• (Pre-Execution) Independent Quality Assurance (QA) audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field
	Infrastructure will be removed unless agreed to by regulators and post-mining land owners/managers.	• Above ground infrastructure will be removed unless otherwise agreed. • Below ground infrastructure will be removed, decommissioned or buried up to 0.5 m below ground level (bgl).	Site infrastructure is removed per detailed design specifications approved by regulatory authorities.	No infrastructure remaining post-execution unless agreed to	• (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field • (Execution) Sign-off obtained from the relevant DMIRS Safety Inspector • (Execution) Transfer of liability agreements, as per DPLH or other third party requirements, are approved.
Stability	Final landforms will be geotechnically stable.	WRL designs to achieve a minimum post closure FoS of 1.3 under static conditions.	Final landforms are constructed per detailed design specifications approved by regulatory authorities.	No WRL material is within the ZoI.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field

Closure Objectives		Closure Performance Criteria			Measurement
		Pre-Execution (DPS)	Execution	Post-Execution	
	Erosion stability will be achieved by controlling surface run-off and low stability materials.	• WRL top surface designs will retain incidental rainfall from a critical duration PMP event. • WRL berm designs will retain incidental rainfall from a critical duration 1:1,000 year ARI rainfall event. • Surface water diversion structures will mitigate erosion risk to critical landform features. • A rock cover will be applied to all exposed tailings. • WRL embankment surfaces will consist of durable rock. • WRL embankment slopes will be no greater than 20°.	Final landforms are constructed per detailed design specifications approved by regulatory authorities.	Surface erosion is within predicted rates or the assimilative capacity of landforms.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. • (Post-Execution) Site technical audits and reports by suitably qualified person/s at 5 years and 10 years post-execution to verify the predicted rates of erosion are being achieved or are within the assimilative capacity of landforms (note, auditing will be maintained minimum 5 yearly thereafter if this has not been demonstrated within 10 years).
Non-Polluting	Seepage will not harm sensitive groundwater receptors.	• Modelling at NMK confirms that the pit lake in the final void will not cause harm post-closure to sensitive groundwater receptors including active stock bores. It is anticipated the MKS Goliath Pit will exhibit similar characteristics and become a terminal sink. • Contaminated soil exceeding remediation criteria, protective of sensitive groundwater receptors and agreed with a CSA and DMIRS, will be removed up to 0.5 m bgl.	Rehabilitation and remediation works are completed per detailed design specifications approved by regulatory authorities.	Local groundwater quality is within predicted quality ranges with no harm to sensitive receptors evident.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations. This will include a validation assessment report from the CSA for components that relate to contaminated sites remediation. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. This will include a validation assessment report from the CSA for components that relate to contaminated sites remediation. • (Post-Execution) Site technical audits and reports by suitably qualified person/s at 5 years and 10 years post-execution to verify no harm is caused to sensitive groundwater receptors (note, auditing will be maintained minimum 5 yearly thereafter if this has not been demonstrated within 10 years).
	Surface water run-off will not harm the surrounding environment.	• WRL top surface designs will retain incidental rainfall from a critical duration PMP event. • WRL berm designs will retain incidental rainfall from a critical duration 1:1,000 year ARI rainfall event. • Contaminated soil exceeding remediation criteria, protective of sensitive groundwater receptors and agreed with a CSA and DMIRS, will be removed up to 0.5 m bgl.	Final landforms are constructed per detailed design specifications approved by regulatory authorities.	Surface erosion is within predicted rates or the assimilative capacity of landforms.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. • (Post-Execution) Site technical audits and reports by suitably qualified person/s at 5 years and 10 years post-execution to verify the predicted rates of erosion are being achieved and to verify that surface water / runoff does not harm the surrounding environment (note, auditing will be maintained minimum 5 yearly thereafter if this has not been demonstrated within 10 years).

Closure Objectives		Closure Performance Criteria			Measurement
		Pre-Execution (DPS)	Execution	Post-Execution	
	Materials harmful to the environment will be encapsulated or remediated.	• An inert cover will be applied over all exposed deleterious materials (e.g. contaminated soil, PAF waste rock, hazardous wastes). • Contaminated soil exceeding remediation criteria, protective of sensitive groundwater receptors and agreed with a CSA and DMIRS, will be removed up to 0.5 mbgl.	Covers are constructed per detailed design specifications approved by regulatory authorities.	No exposed material harmful to the environment is observed.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations. This will include a validation assessment report from the CSA for components that relate to contaminated sites remediation. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. This will include a validation assessment report from the CSA for components that relate to contaminated sites remediation.
Agreed Land-Use	The post-mining land-uses will be agreed with key stakeholders.	Agreement with key stakeholders is obtained for the post-mining land-uses (or in the event of inconsistency in views between some stakeholders the DMIRS is supportive of proposed land-uses).	Landforms to support agreed land-uses are constructed per detailed design specifications approved by regulatory authorities.	Post-mining land-uses approved by regulatory authorities are achieved over time.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations and agreed land-use. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. • (Post-Execution) Site land-use assessments and reports by suitably qualified person/s at 5 years and 10 years post-execution to confirm that the predicted land characteristics to support the proposed land-uses are in place or with time would support the proposed end land-uses (note, auditing will be maintained minimum 5 yearly thereafter if this has not been demonstrated within 10 years).
	The final landforms will not adversely impact surrounding pastoral land-use.	• Final landforms will be designed protective of active stock water bores in surrounding areas. • Final landforms will be designed protective of surface water run-off quality to surrounding areas. • WRLs and the open pit will be fenced to exclude stock (cattle). • Pastoral improvement opportunities for surrounding areas will be adopted to increase the benefits from closure to local pastoralism.	Closure activities are completed per detailed design specifications approved by regulatory authorities.	No adverse impacts from final landforms to the pastoral land-use on surrounding lands is observed.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations and causing no adverse impact on surrounding pastoral land-use. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. • (Post-Execution) Land-use assessments and reports by suitably qualified person/s at 5 years and 10 years post-execution to confirm that no adverse impact from the final landforms to surrounding pastoral activities is taking place (note, auditing will be maintained minimum 5 yearly thereafter if this has not been demonstrated within 10 years).

Closure Objectives		Closure Performance Criteria			Measurement
		Pre-Execution (DPS)	Execution	Post-Execution	
	Revegetated areas will support self-sustaining vegetation dominated by native species.	• Seed mixes for revegetated areas will include representative taxa from local vegetation communities. • Seed mixes will be optimised from rehabilitation trials conducted during operations.	Rehabilitation activities are completed per detailed design specifications approved by regulatory authorities.	• Weeds will not compromise the target diversity and density of native perennial vegetation species. Unless otherwise agreed with DMIRS (and for reasons that may include the introduction and spread of weeds in the local region outside of the control of NiW), the targets will be based on objectives that achieve rehabilitation areas where weed presence and density is comparable to pre-mining analogue sites. • Nil to minimal maintenance of rehabilitated areas for weeds and to maintain plant vigour is required beyond the establishment of perennial species.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations and the revegetation specification • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. • (Post-Execution) Rehabilitation assessments conducted post wet season (end of summer) and reports by suitably qualified person/s on an annual basis for three years post-execution then at 5 years and 10 years post-execution to confirm revegetated areas are low in weed density (achieving prescribed targets agreed with the DMIRS), self-sustaining (i.e. require minimal to nil maintenance) and are not providing an ongoing source of weed invasion for adjacent areas of environmental sensitivity, including the Nature Reserve, PEC and significant flora. Auditing will be maintained minimum 5 yearly until performance objectives are achieved if not demonstrated within the initial 10 years.
	Revegetation of rehabilitation areas and other initiatives will seek to maintain local biodiversity.	• Seed mixes for revegetated areas will include representative taxa from local vegetation communities. • Seed mixes will be optimised from rehabilitation trials conducted at NiW nearby sites.	Rehabilitation activities are completed per detailed design specifications approved by regulatory authorities.	• Establishment of key structural vegetation species, diversity and cover trending toward appropriate analogue sites. Analogue sites are to be agreed with the DMIRS. • Revegetation in rehabilitation areas demonstrates viability through propagule development and seedling recruitment as demonstrated by observed and recorded evidence of reproduction, for mature plants (e.g. fruit, seed or flowers) and native perennial seedlings (second generation), or as otherwise agreed with the DMIRS.	• (Pre-Execution) Independent QA audit* and report to verify that the detailed design is consistent with the BoD and other stated criteria and will achieve the closure objectives, including compliance with relevant legal obligations and maintaining local biodiversity. • (Execution) As-Constructed Report by the contractor to verify compliance of completed works in accordance with the approved design specifications. • (Execution) Independent QA audit* and report to verify that the findings of the As-Constructed Report are accurate and consistent with observations/evidence in the field. • (Post-Execution) Rehabilitation assessments conducted post wet season (end of summer) and reports by suitably qualified person/s on an annual basis for three years post-execution then at 5 years and 10 years post-execution to confirm revegetated areas generally represent the perennial plant cover and diversity found in the site locale. Auditing will be maintained minimum 5 yearly until performance objectives are achieved if not demonstrated within the initial 10 years.

** Audits will be undertaken by a suitably experienced person/s whose appointment, including qualifications/experience, are acceptable to the DMIRS.*

7 TECHNICAL KNOWLEDGE BASE

Relevant, accurate, reliable data underpins effective closure planning. Both contemporary and historical data are important to accurately characterise closure risks. Site data is essential to ensure local conditions are well understood and to inform the development of fit-for-purpose solutions. Predicted changes in climate are also important to ensure rehabilitated landforms and other closure features are compatible with anticipated future conditions.

The following sections provide a summary of the key information collected during the specific baseline studies (related to the MKS project) and data collected during the IPS, which informed the development of this MCP.

7.1 Baseline Data

7.1.1 Climate

- **Semi-arid region where average evaporation exceeds rainfall by 12 times**
- **Long-term average annual rainfall is approximately 260 mm**
- **Climate change is predicted to increase the frequency / intensity of extreme rainfall and drought events**

The MKS site lies within a semi-arid region, which experiences cool winters and hot summers. The Bureau of Meteorology (BoM) data for Leinster airport shows the mean monthly range in daily minimum temperature is 6 to 23°Celsius (°C) and in maximum temperature is 19 to 37°C (**Figure 7-1**). Wind strengths are generally moderate, averaging between 16 to 21 km per hour (km/h) throughout the year, and are typically easterly to north-easterly (BoM, 2017).

High temperatures and low humidity throughout much of the year produce an average yearly pan evaporation rate of more than 3,200 millimetres (mm) at Leinster. Average evaporation exceeds average rainfall in all months of the year. The long-term average annual rainfall is approximately 260 mm, although substantial variation occurs. Mean monthly rainfall peaks during the summer months between January and March (up to 40 mm), and is lowest in spring (**Figure 7-1**).

Although intense rainfall can occur at any time of year, most of the rainfall in the area is associated with two distinct patterns:

- Summer – Intensive rainfall can occur due to tropical lows, or localised thunderstorms associated with tropical weather patterns in the north of WA; and
- Winter – Variable intensity rainfall related to westerly frontal systems associated with temperate rainfall patterns in the south of WA.

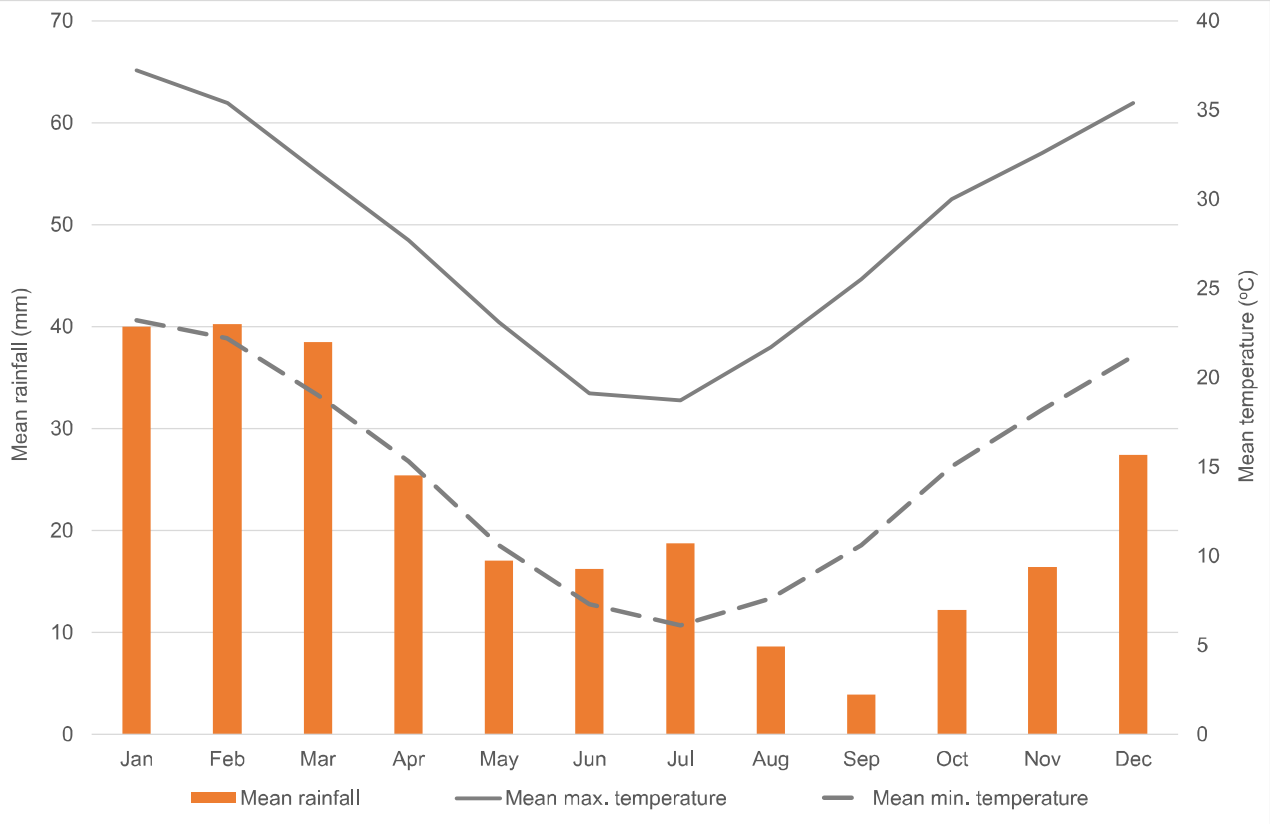

Figure 7-1: Mean climate statistics for Leinster airport (Source: BoM 2017)

The frequency analysis of rainfall data is an important part of hydrological design procedures. Analysis of rainfall data from single stations is often unreliable and may not provide temporally or spatially consistent data to use for design purposes. Instead, a set of accurate, consistent intensity-frequency-duration (IFD) design rainfall data has been derived for the whole of Australia by the BoM. The design IFD data for the MKS site per annual exceedance probability (AEP) event is presented in **Table 7-1.**

Table 7-1: IFD design rainfall intensity (mm)

Duration	Design Rainfall Depth (mm) per AEP event					
	50%	20%	10%	5%	2%	1%
5 min	4.65	7.37	9.48	11.8	15.2	18.1
10 min	7.2	11.4	14.7	18.2	23.2	27.5
15 min	8.88	14.1	18.1	22.4	28.7	33.9
30 min	11.9	18.9	24.3	30.1	38.7	46
1 hour	15.2	24	30.8	38.1	49.3	58.9
2 hour	18.9	29.7	38	47.1	60.9	72.9
3 hour	21.5	33.6	43	53.3	68.6	81.8
6 hour	27	42	53.6	66.1	84.2	99.6
12 hour	34.2	53.1	67.5	82.7	104	122
24 hour	42.9	66.7	84.3	103	129	151
48 hour	51.8	80.7	102	123	156	184
72 hour	56.3	87.6	110	133	171	203

Due to the arid climate, conservative design criteria are required for closure planning, including the capacity or rehabilitated areas to withstand severe weather conditions such as high intensity, short-duration rainfall events.

Predicted changes in climate is also an important factor to consider in closure planning. For the MKS Project, the general forecast changes in climate include:

- Increased seasonal rainfall variation;
- Mean temperature increase; and
- Shifting rainfall patterns, frequency, intensity and runoff.

Climate change is expected to influence existing regional vegetation, run-off volumes, wind and water erosion and sediment transport, revegetation of rehabilitated landforms, design capacity of surface water features, and feasible land-use.

7.1.2 Physical Environment

A summary of the key features of the physical environment of the MKS Project is presented below.

7.1.2.1 Biological Environment

- **Wanjarri Nature Reserve is the main ecological receptor in the region**
- **Priority flora and fauna species have been identified within the MKS Project area**
- **The MKS Project area is situated in the Violet Ranges vegetation complexes Priority 1 Priority Ecological Community**
- **No fauna species of conservation significance have been reported within the MKS Project area**

7.1.2.1.1 Biogeographical Context

The MKS Project is in the Murchison Bioregion, as defined by the Interim Biogeographical Regionalisation for Australia (IBRA) classification system (Thackway, 1995).

The Wanjarri Nature Reserve is the closest conservation area and the nearest Environmentally Sensitive Area (CALM, 1996) to the MKS Project (**Figure 7-3**), with its western boundary located on the eastern margin of the tenements. The Wanjarri Nature Reserve is 53,000 ha in size and recognised as a Class A Nature Reserve (**Figure 7-3**). It is the only reserve in the northern part of the eastern Goldfields and has significant conservation, research, scientific, historical and cultural values (Cowan, 2001). There are no Nationally Important Wetlands (DoE, 2015) or Ramsar wetlands near the MKS Project.

There are no Threatened Ecological Communities (TEC) near the MKS Project; however, there are several Priority Ecological Communities (PEC) in the region. The MKS Project lies centrally within the Priority 1, Violet Ranges PEC (Perseverance Greenstone Belt) and the disturbance footprint represents 5.87% of the currently mapped PEC (Western Botanical, 2017).

Within the Murchison Bioregion, the MKS Project is in the Eastern Murchison subregion (MUR01), (**Figure 7-2**), which covers an area of 7,847,996 ha. This subregion comprises extensive areas of elevated red/red-brown desert sand plains with minimal dune development, breakaway complexes, and internal drainage and salt lake systems associated with the occluded palaeodrainage system. The Murchison Bioregion generally has rich flora and fauna, with most species also widespread through adjacent bioregions (Cowan 2001).

7.1.2.1.2 Flora

Regional Flora and Vegetation Communities

Vegetation within the Eastern Murchison subregion is dominated by low mulga woodlands (*Acacia aneura* complex) on plains, reduced to scrub on hills, with a tree steppe of *Eucalyptus and Triodia* on sandplains. Saltbush (*Atriplex*) shrublands occur on calcareous soils and saline areas are characterised by low samphire (*Tecticornia*) shrublands (Beard 1990; Thackway and Cresswell 1995). Numerous priority flora is known from the subregion (Cowan 2001).

Local Flora and Vegetation Communities

The MKS Project study area has been subject to extensive field surveying since 1990, including desktop, reconnaissance and detailed surveys and targeted work for Acacia species. These assessments were consolidated by Western Botanical in 2017; and a total of 393 species from 140 genera and 51 families have been reported in the MKS Project area over that time (Western Botanical, 2017). Most taxa recorded were common, widespread in distribution and representative of the flora of the region. Dominant genera included *Acacia, Eremophila, Maireana, Senna, Sida* and *Eragrostis*.

Vegetation condition outside the areas directly impacted by exploration and track maintenance are described as being in Pristine condition with little evidence of pastoral activities. Areas having been disturbed in previous exploration works are regarded as being in Excellent condition while completely cleared areas were recorded as Completely Degraded (Western Botanical, 2017).

The MKS Project is situated within the Violet Ranges (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation) Priority 1 PEC, with the Project disturbance footprint representing 1135 ha or 6% of the Violet Ranges PEC (Western Botanical, 2017; 2019).

A total of 38 vegetation associations and four vegetation association complexes have been mapped across the Project area and these were further categorised into six sub-units (**Figure 7-2**), according to the underlying geology (Western Botanical, 2017). : – – – –

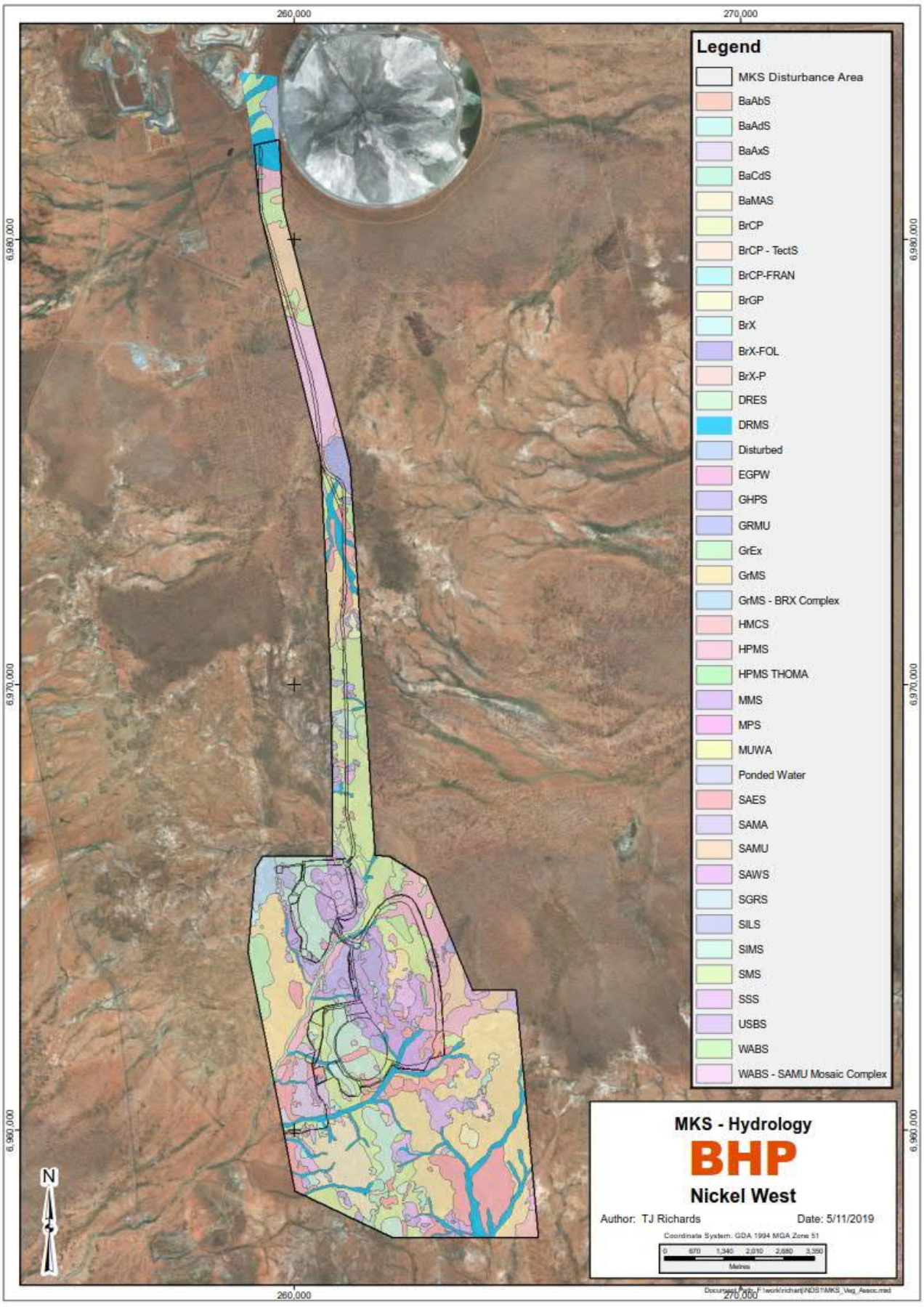

Figure 7-2: Vegetation associations within the MKS Project area

Flora of Conservation Significance

A total of 14 Priority Flora species were encountered during flora surveys including one Priority 1, two Priority 2, seven Priority 3 and four Priority 4 species (**Table 7-2**). Two of these Priority Flora are not directly impacted by the MKS Project (Anacampseros sp. Eremaean ((F. Hort, J. Hort & J. Shanks 3248) P1; Sida picklesiana – P3) and only nine are directly impacted by the Project disturbance footprint. Small proportions of the overall local population of *Hybanthus floribundus* subsp. *Chloroxanthus* (P3), *Hemigenia exilis* (P4), *Grevillea inconspicua* (P4) and *Thryptomene* sp. Leinster (P3) will be impacted by the development of the mine voids and WRL while *Thryptomene* sp. Leinster (P3) and *Verticordia jamiesonii* (P3) will be impacted by the development of the haul road (Western Botanical, 2017).

Table 7-2: Priority Flora from within the MKS Project Area

Species	Priority Code
Anacampseros sp. Eremaean (F. Hort, J. Hort & J. Shanks 3248)	Priority 1
Eremophila sp. long pedicals (G Cockerton 1975)	Priority 2
Hibbertia Sherwood Breakaways (R.J. Cranfield 6771)	Priority 2
Aristida aff. jerichoensis var. *subspinulifera*	Priority 3
Hibiscus krichauffianus	Priority 3
Sida picklesiana	Priority 3
Thryptomene sp. Leinster (BJ Lepschi & LA Craven 4362)	Priority 3
Tribulus adelacanthus	Priority 3
Verticordia jamiesonii	Priority 3
Hybanthus floribundus subsp. *chloroxanthus*	Priority 3
Eremophila sp. Leinster (R.J. Cranfield 6767) within Eremophila pungens	Priority 4
Grevillea inconspicua	Priority 4
Gunniopsis propinqua	Priority 4
*Hemigenia exilis**	Priority 4

Note: Priority codes refer to Western Australian flora species listed at the State level under the *Wildlife Conservation Act 1950*.

7.1.2.1.3 Fauna

7.1.2.1.4 Regional Fauna

Fauna within the Eastern Murchison subregion is known to be rich and diverse, and characterised by low levels of endemism. In the north-eastern Goldfields, 36 mammals, 178 birds, 93 reptiles and 11 amphibians have been recorded over the last 25 years (Murphy, 1994).

Across the subregion, rare vertebrate fauna species include; great desert skink (*Egernia kintorei*), malleefowl (*Leipoa ocellata*), Alexandra's parrot (*Polytelis alexandrae*) and mulgara (*Dasycercus blythi*). Calcrete aquifers in the northern part of the subregion are also known to support a wide range of subterranean aquatic fauna and short-range endemics (Cowan 2001).

7.1.2.1.5 Local Fauna

Multiple terrestrial fauna studies have been undertaken within the MKS Project area since 2005. Cumulatively a total of 135 vertebrate species, including 17 mammals, 77 birds, 38 reptiles and three frogs have been recorded (Biota, 2017).

Eight fauna habitats have been identified within the MKS Project area (Biota, 2017):

- Hills and Slopes, Sclerophyll Shrublands;
- Undulating Plains, Sclerophyll Shrublands;
- Drainage tract – Mulga;
- Undulating Plains – Grass Dominated;
- Undulating Plains – Chenopod Shrublands;
- Areas of Internal Drainage – Mulga;
- Drainage Line; and
- Hills and Slopes, Chenopod Shrublands.

Two landscape features intersected by the MKS Project area were identified has having elevated value as habitat for conservation significant species:

1. The breakaway feature (an extension of the Barr Smith Range) associated with both the Hills and Slopes, Sclerophyll Shrublands habitat (BRX – Breakaway Plateaux Mulga Shrublands vegetation type) and the Undulating Plains – Chenopod Shrublands habitat (BCP – Breakaway Chenopod Plains vegetation type) is considered to be potential habitat for the Black-footed Rock-wallaby and Long-tailed Dunnart; and
2. The isolated groved mulga (GRMU) within the Areas of Internal Drainage – Mulga habitat is the best example of this vegetation type locally. It is considered locally significant in the context of vertebrate fauna, predominantly avifauna. Although occurring within the MKS Project Area boundary, the transport corridor has been aligned to avoid impact to this habitat.

7.1.2.1.6 Fauna of Conservation Significance

No species of conservation significance have been recorded in the MKS Project area although, the Brush-tailed Mulgara (Priority 4) was recorded within 500 m of the boundary. Additional targeted surveys for both the Night Parrot (*Wildlife Conservation Act 1950* [WC Act] Schedule 1, *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] Endangered) and Black-footed Rock-wallaby (WC Act Schedule 2, EPBC Act Endangered) were also conducted during 2017. While no evidence of the Night Parrot was recorded, the Black-footed Rock-wallaby was sighted 13.5 km north west of the MKS Project area (Biota, 2017).

7.1.2.1.7 Exotic Species

A total of six weed species have been recorded across the MKS Project area, in small isolated populations including (Western Botanical, 2017):

- *Rumex vesicarius* (Ruby Dock);
- *Cenchrus ciliaris* (Buffel Grass);
- *Cenchrus setiger* (Birdwood Grass);
- *Bidens bipinnata* (Tick Weed);
- *Lysimachia arvensis* (Pimpernel); and
- *Mesembryanthemum nodiflorum* (Slender Iceplant).

Several feral animal species have been found locally. Wild dogs (*Canis familiaris*) have been recorded, and are an issue for pastoralism in the region. Goats (*Capra hircus*) and rabbits (*Oryctolagus cuniculus*) are known from the area may impact revegetation establishment and success in rehabilitation areas. The presence of feral cats (*Felis catus)* and foxes (*Vulpes vulpes*) may impact native fauna and potential future recruitment.

7.1.2.1.8 Stygofauna

Subterranean fauna was assessed at the MKS Project during 2017 (Stantec, 2017a). Ten taxa from four higher level taxonomic groups (Amphipoda, Bathynellacea, Oligochaeta, and Ostracoda) have been collected.

Stygofauna assemblages were found to be sparsely distributed, reflecting the network of habitable regolith, alluvial and fractured groundwater systems present, that appear to be closely associated with Jones Creek and its tributaries (Stantec, 2017a).

During the assessment, two stygobitic species, *Atopobathynella* sp. OES11 and *Gomphodella* sp. IK2, were only recorded from within the proposed Six Mile Well groundwater drawdown impact areas. However, both taxa had distributions that regionally extend beyond the impact zones. The remaining eight species recorded were not of conservation concern as they were collected from non-impacted areas and are likely to possess broader distributions (Stantec, 2017a).

7.1.2.2 Surrounding Land-Use

The dominant land-use surrounding the MKS Project is *"low-quality and extensive livestock grazing"* (Cowan, 2001). Other surrounding land-uses and zones include Unallocated Crown Land (UCL), Crown reserves, conservation (Wanjarri Nature Reserve) and mining (nickel and gold) (**Figure 7-3**)).

Other surrounding land-uses include Unallocated Crown Land (UCL), Crown reserves, conservation (Wanjarri Nature Reserve) and mining (nickel and gold).

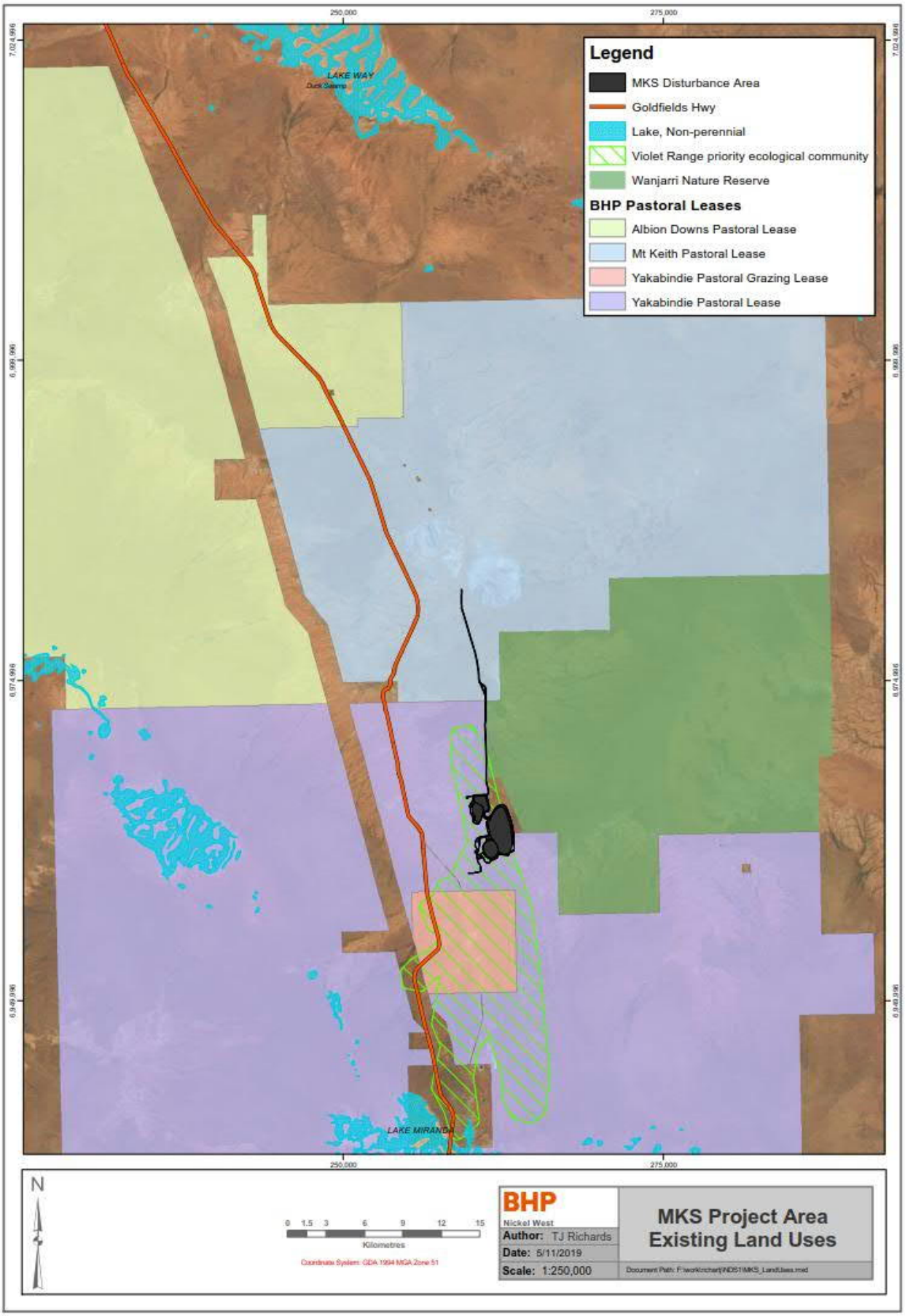

Figure 7-3: Existing Land-Uses Surrounding the MKS Project area

7.1.2.3 Geology

The geology at the Project is typical of Yilgarn Craton Archaean greenstone belts, consisting of a faulted and folded, NNW-striking layered sequence of high grade metamorphic sediments, volcanics, and felsic intrusives (BHP, 2017).

Nickel sulphide mineralisation at the deposits is associated with lozenges of adcumulate ultramafic or dunite cores (BHP, 2017) mantled by peridotite. Each lens is located at the intersection between steeply-dipping synvolcanic faults that act as conduits for extrusive lava (Perring, 2016). The mineralisation at both the Six Mile and Goliath deposits consist of multiple stacked lenses of disseminated Fe-Ni-Cu sulphides [principally pentlandite, violarite and pyrrhotite (Porter Geoconsultancy, 2017)]. Komatiitic flows and dacitic intrusives comprise the rocks surrounding these ultramafic cores (
Figure 7-4 and **Figure 7-5**).

The extents of the ultramafic cores within each deposit are 1400 m x 200 m at Six Mile Well, and 1000 m x 200 m at Goliath North (at the surface) (Porter Geoconsultancy, 2017).

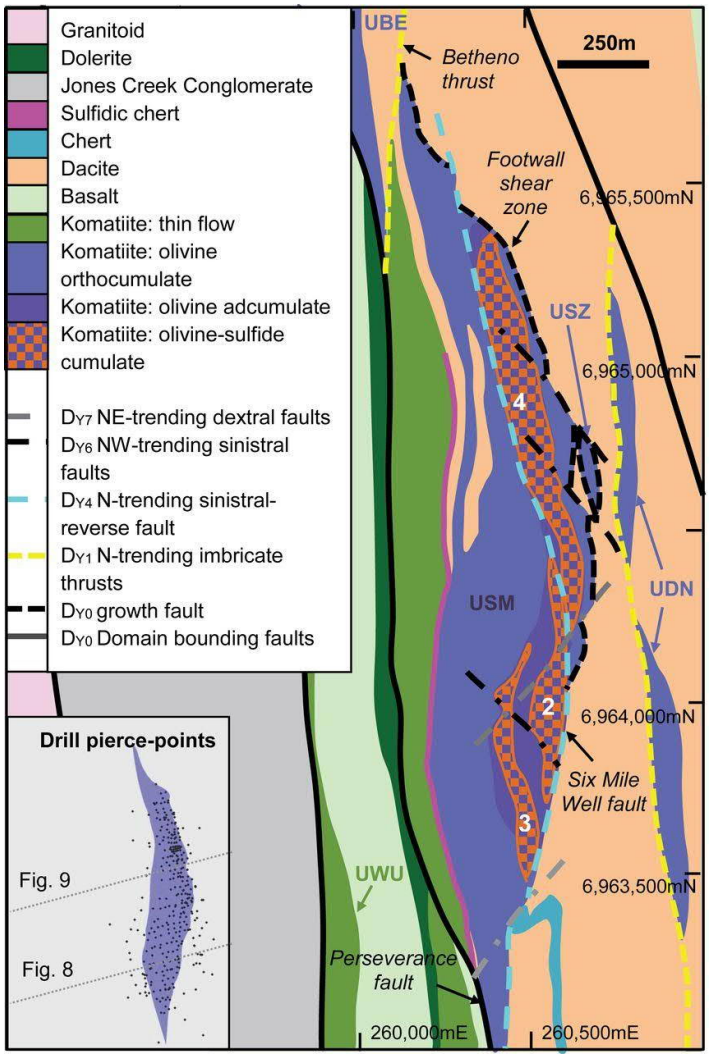

Figure 7-4: Geology of the Six Mile Well deposit (Porter Geoconsultancy, 2017)

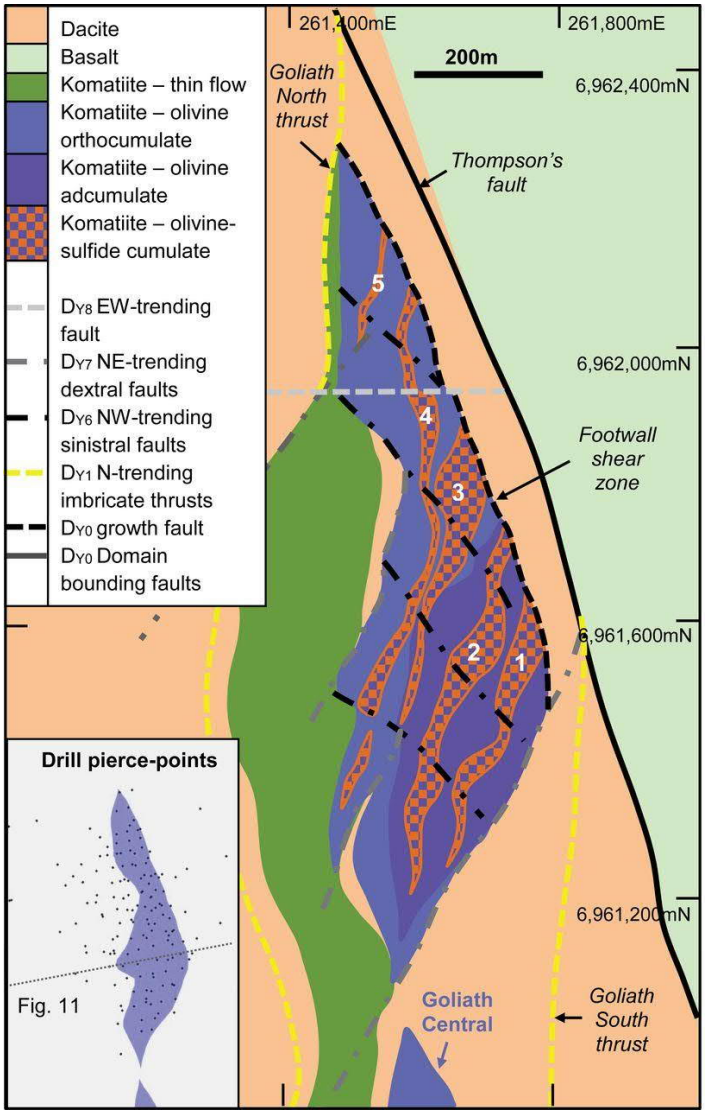

Figure 7-5: Geology of the Goliath deposit (Porter Geoconsultancy, 2017)

7.1.2.4 Surface Hydrology

- **The MKS Project is situated within the Jones Creek upper catchment**
- **The Jones Creek is incised into the Barr-Smith Range; the upper slopes of the valley are steep and rocky. The Creek is a freshwater system that rapidly dries to form a series of disconnected pools**
- **Short ephemeral creeks drain down the sides of the Barr-Smith Range and flood out onto the sedimentary deposits on the lower slopes of the valley**
- **A risk-based approach adapted from ANCOLD Guidelines has provided the basis for developing BoD criteria**

The MKS Project is situated within the Jones Creek upper catchment (**Figure 7-6**). Jones Creek is a lateral tributary stream which drains to the southwest and terminates into a large floodplain area which contains numerous clay plans (MWES, 2017). Beyond this, the system drains into the major regional valley which contains Lake Miranda (MWH, 2016).

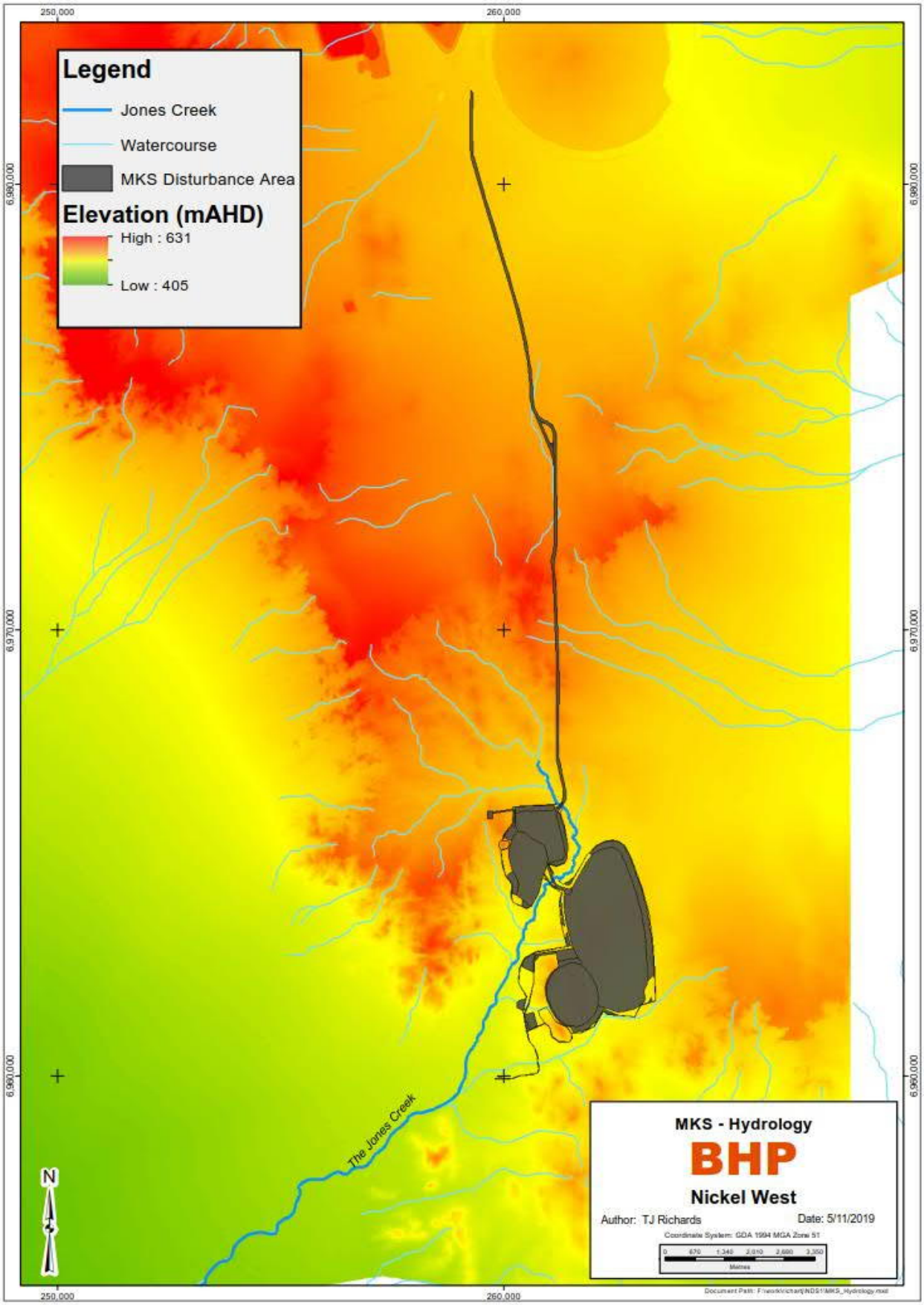

Figure 7-6: MKS hydrology

The Jones Creek is incised into the Barr-Smith Range. The upper slopes of the valley are relatively steep, rocky and sparsely vegetated. Short ephemeral creeks drain down the sides of the Barr-Smith Range and flood out onto the sedimentary deposits on the lower slopes of the valley (MWES, 2017).

During large flood events water movement is rapid, due to the steep nature of the ranges and the rocky nature of the substrates. Typically, Jones Creek flows once or twice a year, in response to moderate or high intensity rainfall of 25 mm or more. In the terminal claypans, depths of over two metres have been recorded following intensive rainfall (MWES, 2017).

Jones Creek is a freshwater system that after significant rainfall, rapidly dries to form a series of disconnected pools. Due to the temporal nature of the creek, water quality is highly variable. In contrast, on filling, the Jones Creek terminal clay-pan sustains a fresh-brackish water ecosystem for several months (MWES, 2017) (MWH, 2016).

7.1.2.4.1 WRL

Modelling for a 1 in 1000 year peak flooding event indicated that approximately 500 m of the WRL toe will be located inside the Jones Creek floodplain and will be subject to rare and brief inundation; with the potential risk of erosion along the WRL toe (**Figure 7-7**). It was recommended that the risk could be moderated by the following on closure (MWES, 2017):

- The exposed WRL toe (~500 m) be rock armoured to minimum elevation of 529 mRL and
- Drainage from the northeast of the WRL be routed around the north end of the WRL to the main creek in a controlled way.

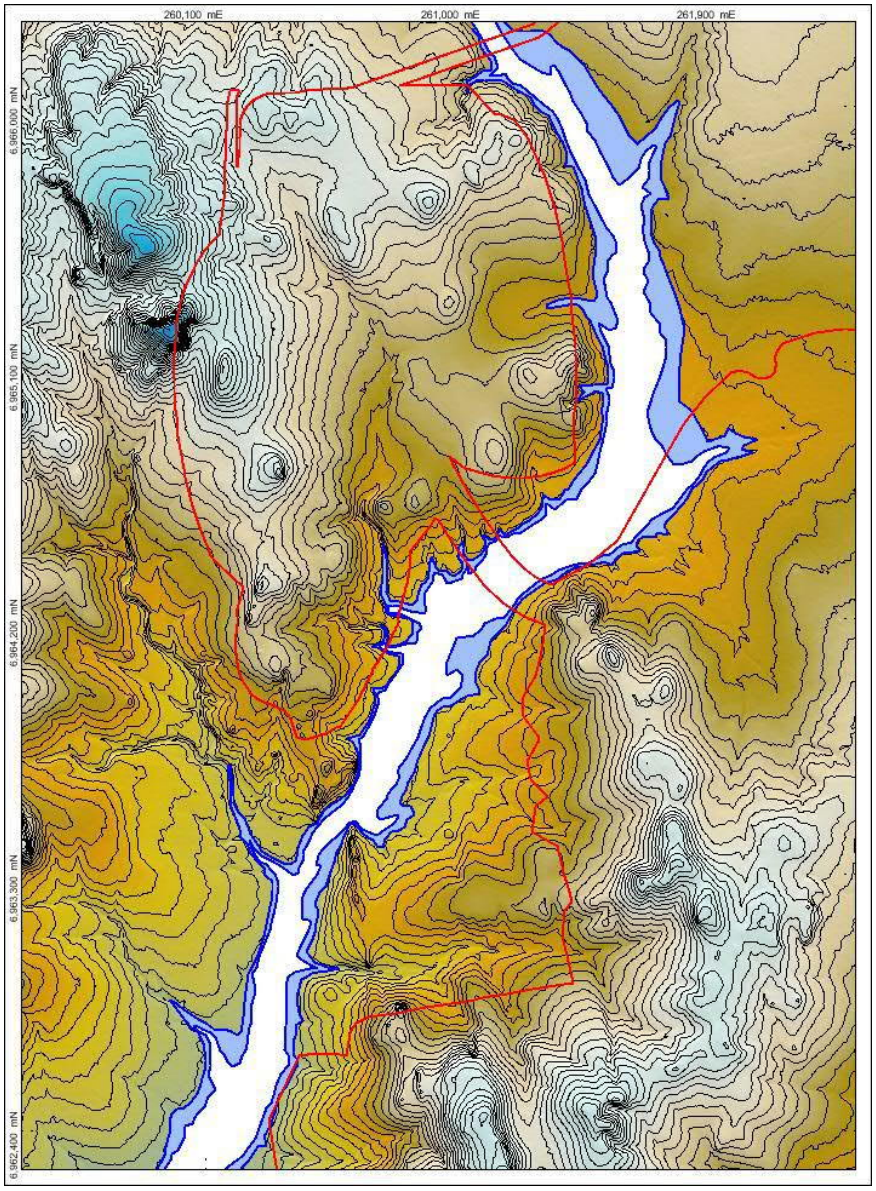

Figure 7-7: MKS Project modelled peak flood

MKS Project infrastructure (outline in red) and modelled peak flood levels for the 1:100 (white) and 1:1000 year events (Blue) (MWES, 2017)

7.1.2.4.2 Open pit

For the majority of creek flow events, there is no potential interaction between the flood water and proposed open pits. The potential for interaction only occurs at the margins of extreme flood levels which will occur very rarely and last only a matter of hours. Two small gullies are below the peak flood level at the Six Mile Well open pit disturbance area (**Figure 7-8).** The surface profile line (black) depicted in **Figure 7-8** is along the western edge of the Six Mile Well open pit disturbance area (red line). A small amount of permanent bunding will be required to isolate the Six Mile Well open pit from high-stage creek flow. These bunds can be managed by short bunds of less than 1.5 m high. It is likely that these bunds will be incorporated into the normal operational pit perimeter bund and extended a further metre above the 1:1000 year level.

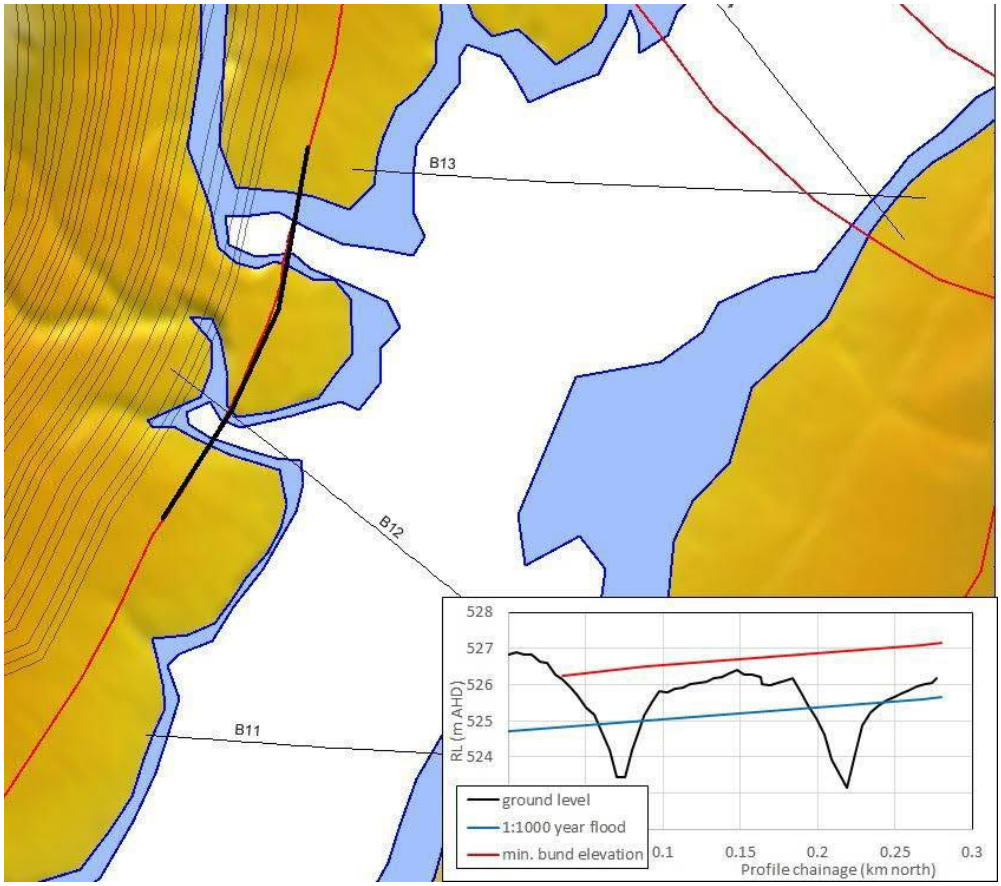

Figure 7-8: Jones Creek peak flow level near the SMW pit

7.1.2.4.3 Storm water drains

Permanent clean storm water drains diveriting stormwater flow from unimpacted areas around the site will also be required (MWES, 2017):

- North from NW corner of the Six Mile Well open pit. Length: 800 m, fall: 550-540 m, maximum depth: 2 m;
- South from NW corner of the SMP. Length: 200 m, fall: 545-539 m, maximum depth: 0.5 m;
- North around the WRD toe: Length: 1300 m, fall: 531-527 m, maximum depth: 1 m; and
- South around the WRD toe: Length: 1200 m, fall: 530-529 m, maximum depth: 1 m.

The final design capacity of the clean storm water drains should be 1:10 year peak flow and should include bunding such that peak flows exceeding the 1:100 year level remain on the clean side of the drain (MWES,2017).

7.1.2.4.4 Bridge crossings

Two bridge crossings over the Jones Creek will be required at the MKS Project (**Figure 2-3**). The surface profiles of the South and North crossings are presented in **Figure 7-9.** Due to the low frequency and duration of flow events, a low level "ford" was considered as an appropriate creek-bed crossing. The following measures were recommended to mitigate excess sediment entrainment by intermittent creek flow events (MWES, 2017):

- Very coarse rock armouring of the bank cut sections up to the 1:100 year flood;
- Minimum build-up of road surface above natural creek level in the main stream;
- Initial construction and maintenance (after flow events) to use stockpile of suitably graded material (minimal fines and particle sizing compatible with creek sediments); and
- Best operational practice to minimize vehicle tracking of sediment during wet periods including:

- Cladding of roads with appropriate materials;
- Road drain and surface maintenance to avoid build – up of sediment on roadways; and
- Wheel wash as appropriate.

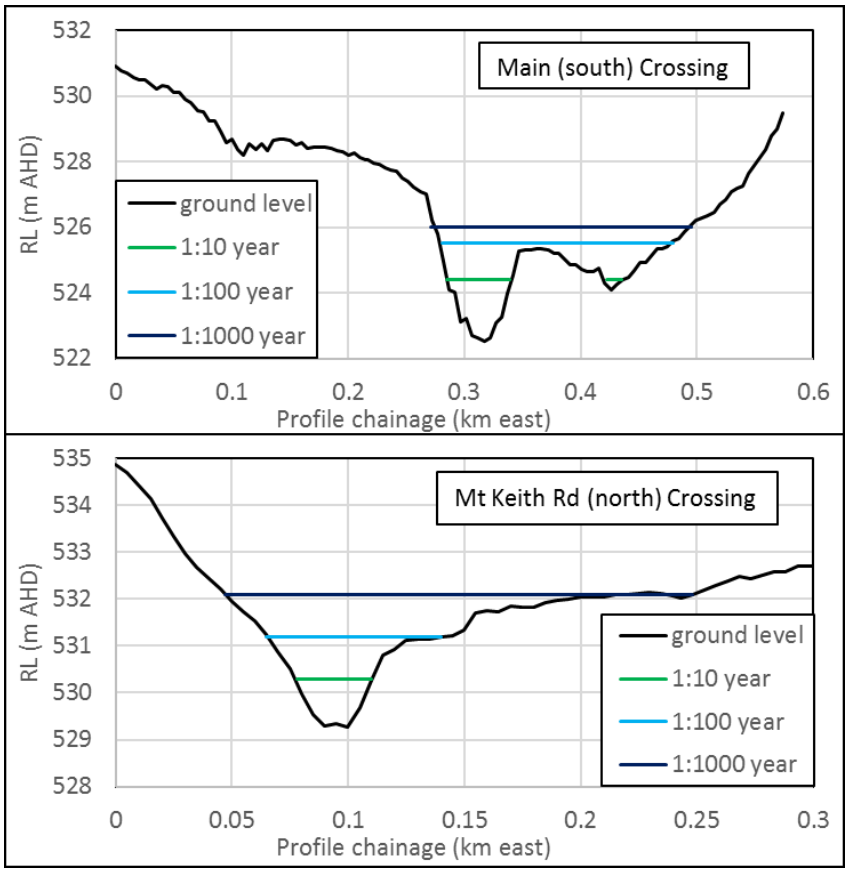

Figure 7-9: Profiles of the South and the North bridge crossing areas showing various flooding events

7.1.2.4.5 Haul road

The haul road route is considered to pose relatively minor risks in regards to drainage management. The risks of impacts are likely to be minimised by relatively low surface gradients, drainage lines were only slightly incised and have small catchment areas, cross gradients are low and unable to sustain frequent overland flow. The following measures were recommended during the haul road construction (MWES, 2017):

- Competent rock cladding of material exposed in cuttings and in table drains on steeper sections;
- Adequate spacing of cross drains to minimise erosion in the table drain; and
- Low crown or outfall profile in areas where overland flow needs to be maintained.

7.1.2.4.6 Figure Closure basis of design

Flood studies at the nearby NMK site were used to underpin the basis of design (BoD) criteria determined as appropriate for surface water management features post-closure:

- Upstream catchment diversion structures will be designed to convey run-off from a critical duration 1:300 to 1:10,000 ARI rainfall event; to be determined on the basis of risk;
- Upstream catchment diversion structures will be designed to pass run-off from a critical duration PMP rainfall event;

- WRL top surfaces will be designed to retain incidental rainfall from a critical duration PMP rainfall event within cells;
- WRL berms will be designed to retain incidental rainfall and upstream run-off from a critical duration 1:1,000 year ARI rainfall event; and
- Drainage controls will be designed to achieve a 300 year design life.

The application of this BoD criteria within the design parameters of selected closure alternatives is covered in **Section 9.**

7.1.2.5 Hydrogeology

- **Groundwater is relatively scarce within the MKS Project area**
- **Groundwater is brackish, alkaline and the concentrations of most metals are low**
- **The Goliath open pit lake will function as a terminal sink aiding long-term groundwater management**
- **The backfilled Six Mile Well open pit will refill to a level close to the original static water level over about 50 years**

Groundwater is relatively scarce in the local region. There is no laterally continuous regolith horizon aquifer due to elevation, depth to water table and erosional denudation. Most of the bedrock lithology's have no primary or secondary porosity and drilling across most of the area has generated no groundwater yield (MWES, 2017).

The largest aquifer in the MKS Project area is the regolith-zone over the Six Mile Well dunite ultramafic which will be largely drained and mined. The host greenstone belt rocks also contain an array of minor narrow, steep and localised aquifers associated with geological contacts and structural features. Water level data indicates a degree of interconnection between these features and this array is likely to be continuous for 10's of kilometres to the north and south (MWES, 2017).

Baseline groundwater quality was tested from 50 samples collected during the drilling program and the following was noted (MWES, 2017):

- The salinity was considered brackish, with a highly variable EC, ranging between 1000 and 5000 µS/cm.
- The pH was slightly alkaline
- Concentrations of most metals were low and below laboratory detection levels. The exceptions were Ni and Bo which were elevated.
- Concentrations of nutrients were consistent with other arid regions of Western Australia.

On closure, the Goliath open pit floor will sit at approximately 80 m AHD, and the water level will gradually stabilise at less than 140 m AHD, resulting in a pit lake with a water level more than 300 metres below the pit crest. Short term fluctuations relating to the most extreme rainfall events will result in relatively minor variations from the long-term water level trend line, having a magnitude of no more than 2 m and duration of several months. Salinity has been modelled to reach approximately 5.5 g/L after 100 years and continues to rise linearly thereafter. Over thousands of years as salinity increases above 50 g/L then brine factor reductions in pit lake evaporation rate superimpose a very gradual rise in water table level and a very gradual reduction in the rate of salinity increase (MWES, 2017).

Groundwater levels in the backfilled Six Mile Well open pit will recover to the original static water level after about 50 years. Water levels will then continue to rise and slightly exceed baseline levels (due to increased recharge through the backfill) over about 100 years and long-term water quality is expected to be slightly improved. Groundwater is the volumetrically dominant source of water which will re-fill the void, so that void water quality groundwater will reflect the quality of natural groundwater (brackish at approximately 4.5 g/L) and with low levels of trace elements. A very gradual reduction in salinity will occur due to enhanced rainfall recharge through the back-fill (MWES, 2017).

7.2 Soil and Mine Waste Material Characterisation

- **Most waste rock is expected to be durable and to demonstrate good erosion stability**
- **Conservatively between 10-25% of the total waste rock volume may be PAF**
- **PAF rock will be encapsulated within the final WRL**

7.2.1 Soil Characteristics

The regional soil landscape of the Murchison subregion consists of an extensive plateau of low relief, characterised by gently undulating wash plains and sand plains sitting below lateritic or silcrete mesas and hills. Mesas form the top of the landscape over granitic basement geology, and typically have lateritic breakaways with kaolinised footslopes. Hills are typically low rises or domes of granite, gneiss or quartz (Tille 2006).

The wash plains comprise gently inclined alluvial surfaces, typically with an almost continuous cemented laterite or red-brown hardpan formed below thin soils. Sand plains occur with stony plains and wash plains, characterised by red sandy loamy soils supporting mulga shrublands with spinifex grasslands (and some halophytic shrublands and eucalypt woodlands) (Tille, 2006).

A baseline assessment of soil was undertaken in March 2012 (OES, 2012). A total of five major soil units were identified across the MKS Project area including; Mulga sandplains, hills and slopes, stony plains, drainage lines and sparse Mulga woodlands. A summary of the physical and chemical characteristics of each soil unit is presented in **Table 7-3**.

7.2.1.1.1 Mulga sandplain

Soils from the Mulga sandplain unit were classified as sand to sandy clay loam with a weak to moderate consistence. They were generally moderately to very strongly acid, non-saline, non-sodic and had a moderate to rapid drainage class. Concentrations of metals were low, and nutrient levels were considered adequate for plant growth (OES, 2012).

7.2.1.1.2 Hills and Slopes

Soils from the hills and slopes unit had a high proportion of coarse material. The pH of soil was slightly to moderately alkaline and they were classified as non-saline to moderately saline. Concentrations of total metals, nutrients and plant available nutrients were low. The soil was unlikely to hardset and had a moderately slow to moderate drainage class (OES, 2012).

7.2.1.1.3 Stony Plains

Soils from the stony plains unit ranged from sandy loam or clay loam sand with a high proportion of coarse material. The soil was very strongly acid to moderately alkaline, classified as having a non-saline salinity and unlikely to hardset. Soil from this management unit was sodic indicating that they might be prone to dispersion. Concentrations of metals and nutrients were low (OES, 2012).

7.2.1.1.4 Drainage Lines

Soils from the drainage lines unit were classified as sand to clayey loam sand with a weak to moderate consistence. This soil had a higher proportion of silt and clay in comparison to the other soil management units. They were generally slightly acid to neutral pH, non-saline, non-sodic and had a moderate to very rapid drainage class. Concentrations of most metals except Cr were low. Concentrations of plant nutrients were also low (OES, 2012).

7.2.1.1.5 Sparse Mulga Woodlands

Soils from the sparse Mulga woodlands were classified as sand to clay loam sand with a loose consistence and few small, weak aggregates. The soil was characterised as stable to very stable, non-sodic to very sodic, non-hardsetting and had moderate to rapid drainage. The pH of the soils from the sparse Mulga woodlands was generally neutral to very strongly acid and had low concentrations of total metals and adequate amounts of plant-available nutrients (OES, 2012).

Table 7-3: Physical and chemical properties of soil units from the MKS Project area

Soil unit	Physical properties						Chemical properties						
	Soil texture	Coarse Fragments	Soil colour	Soil stability	Soil Strength (kPa)	Hydraulic conductivity (mm/hr)	pH (H20)	Salinity class (dS/m)	Organic Carbon (%)	Nutrient status	Effective CEC (meq/100g)	ESP (%)	Total metal concentrations
Mulga sandplain	Sand to sandy clay loam	0 to 84	Red to Reddish yellow	Stable 3b	Non – hardsetting (<10)	Rapid to moderate	Very strongly to moderately acid (4.3 to 5.9)	Non saline	Low	Low	Very low	Not measured	Elevated Cr
Drainage line	Sand to clay loam sand	3 to 90	Red to reddish yellow	Stable 3b	Non – hardsetting (<25)	Very rapid to moderate	Slightly acid to neutral (5.9 to 8.0)	Non saline to slightly saline	Very low	Low	Low	Non-sodic	Elevated Cr
Hills and slopes	Loamy sandy to clay loam	21 to 78	Red to reddish yellow	Stable 3b	Non – hardsetting to hardsetting	Moderate to moderately slow	Moderately acid to alkaline (5.5 to 9.0)	Non saline moderately saline	Moderate	Low to moderate	Low to moderate	Non-sodic	Elevated Cr
Stony plains	Sandy loam to clay loam sand	6 to 87	Red to reddish yellow	Unstable to Stable 2 and 3b	Non – hardsetting	Very rapid to moderate	Very strongly acid to moderately alkaline (4.7 to 8.1)	Non saline to very saline	Low	Moderate	Moderate	Non-sodic to sodic	Low levels
Sparse mulga woodlands	Sand to clay loam sand	6 to 90	Red to reddish yellow	Stable to Very Stable 3 and 6	Non – hardsetting	Moderate to rapid	Very strongly acid to neutral (4.5 to 8.0)	Non saline to very saline	Low to moderate	Low to moderate	Moderate	Non-sodic to very sodic	Elevated Cr

*The values represented the average values for the good, moderate and poor ratings relative to suitability for plant growth and material stability (OES, 2012)

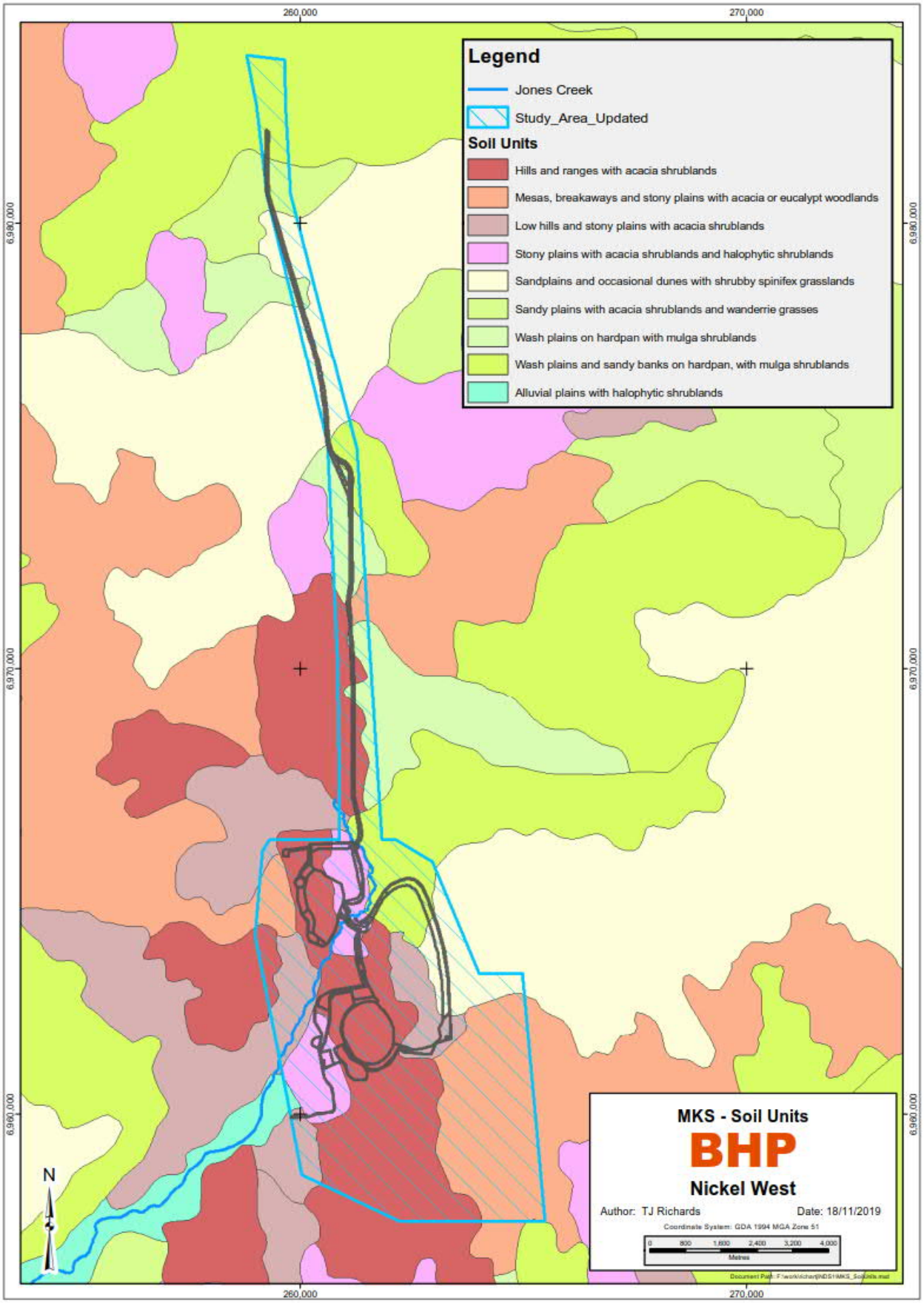

Figure 7-10: MKS Project soil units

7.2.2 Rehabilitation Resources

A minimum of 150 mm of topsoil shall be removed and stockpiled for use in rehabilitation. Soil from each soil unit was assessed for its suitability for rehabilitation purposes. Soils from the Mulga sandplain, drainage line, stony plains and sparse Mulga woodlands were considered suitable for use on lower slopes and flat areas only. Due to the high proportion of coarse material present in the hills and slopes unit, soil from this management unit was considered suitable for application to WRL slopes.

The volume of soil required for rehabilitation will be balanced against the volume of soil that is recovered during mining. A prioritised soil deployment plan will be developed based upon soil quality and volume, and an assessment of areas requiring rehabilitation including total area and aspect (elevated, flat, sloped).

7.2.3 Mine Waste Characteristics

7.2.3.1 Mine Waste Geochemical Characteristics

The geochemistry of proposed waste rock from the MKS Project has been analysed via two direct studies (Woodward-Clyde, 1991; ANSTO, 1996) and one review study (GCA, 2005).

Woodward-Clyde (1991) analysed samples from the Six Mile Well deposit over a range of 17 material sub-categories and analysed a sample of tailings supernatant and seepage waters. Waste rock samples were tested for acid formation potential, salinity and multi-element suites.

ANSTO (1996) analysed samples predominantly from the Goliath deposit, with a minor number of samples from the Six Mile Well deposit. Four samples of variable weathering states were analysed for tailings geochemistry. Waste rock samples were tested for acid formation potential and salinity.

GCA (2005) was commissioned as a later stage study, to assess both prior geochemical reports to ascertain whether further analysis was required for the characterisation of the deposits.

In the assessments conducted by Woodward-Clyde (1991) and ANSTO (1996), the following sampling density was applied:

Six Mile Well

- 72 waste rock samples (Woodward-Clyde) across 42 drill holes
- 12 waste rock samples (ANSTO) across 11 drill holes

Goliath

- 78 waste rock samples across 14 drill holes

From the above studies (GCA 2005; Woodward-Clyde 1991; ANSTO 1996) the following conclusions were made:

Waste Rock

- All regolith samples across both sites were classified as NAF.
- Most of the waste rocks tested for Six Mile Well and Goliath North were NAF.
- The volcanic sediment (footwall massive sulphide) present at both sites generally displays total sulphur values of 2.1–16.4% (offset to a degree by a groundmass with pH-buffering capacity), is classified as PAF (long lag) and is recommended to be encapsulated effectively within the WRL as AMD risk waste rock.
- Based on general estimates of rock proportions within the drilling database and on a conservative basis, it is estimated that the PAF volcanic sediment (footwall massive

sulphide) may comprise between 10-25% of the total waste rock volume to be mined from both the Six Mile Well and Goliath deposits.
- Internal waste zone rocks (waste bedrocks within ore zones that are not segregated for stockpiling as low-grade ore) can be expected to create soluble Ni forms upon weathering, and should be encapsulated within the WRL as AMD waste rock. All talcose ores (from oxide to fresh) are included within this category and will be selectively placed within the WRLs at the MKS Project.

Tailings
- Tailings can be considered NAF but may show elevated salinity and alkalinity over time.

7.3 Zone of instability

As part of the detailed design phase, assessment will be undertaken to better understand the closure related risks associated with the mining landforms, including the WRL and final voids. This assessment will include site specific assessments of the Zone of Instability (ZoI), to the satisfaction of the DMIRS, around the mining void to determine the positioning of abandonment bunds. Nickel West will utilise planar wedge analysis (PWA) and/or DMIRS methodology to estimate the ZoI and where discrepancy is identified between the two methods, this will be subject to further assessment to determine the most appropriate method. Additionally, if the assessments determine that the ZoI extends beyond the currently approved disturbance envelope additional controls will be implemented to reduce the potential footprint. These controls may include buttressing the pit wall with competent material to minimise the ZoI area.

7.4 Waste rock erosion properties and relative volumes

A review of the lithologies from the Six Mile Well and Goliath deposits was undertaken by Mine Earth (2017) to inform a desktop assessment of the likely erosion properties of key waste rock types. A review of the drilling database for these deposits has identified a variety of rock types including:
- Mafic rocks (basalts and dolerites)
- Ultramafic rocks
- Sedimentary rocks (siliceous/arenaceous sediments and shales)
- Felsic rocks (intrusives and porphyries)
- Metamorphic rocks (amphibole-chlorite metamorphics).

An assessment of the mineralogy and drillcore behaviour of these rock types was conducted to identify the main controls on each rock's physical characteristics (Mine Earth 2017). The results of this assessment are summarised below:
- Mafic rocks – It is likely that the mafic units will demonstrate good erosion stability.
- Ultramafic rocks – It is likely that the ultramafic units will demonstrate low erosion stability; especially from the weathered profile (oxide and transition zones).
- Sedimentary rock – Siliceous sediments should demonstrate good erosion stability; shale units may however demonstrate low erosion stability.
- Felsic rocks – It is likely that the felsic units will demonstrate good erosion stability.
- Metamorphic rocks – It is likely that the metamorphic units will demonstrate moderate erosion stability.

The physical review highlighted that the ultramafics and shale may demonstrate low erosion stability, whereas most of the other rock types should demonstrate moderate to high erosion stability. The ultramafic and shale waste rock units should not be placed on final WRD slopes because of concerns about their long-term erosion stability. These findings should be verified during mining however, once as-mined waste rock has been generated.

7.4.1 Waste Rock Volumes

The volumes of the broad lithological suites were estimated by viewing the drilling database and applying proportions to the planned excavated volumes (**Table 7-4** and **Table 7-5**). From this base, it is indicated that the ultramafics, sediments and mafic units are dominant at both Six Mile Well and Goliath deposits.

Table 7-4: Estimated Rock Unit Percentages for Six Mile Well

Oxidation	Hangingwall				Ore horizon	Footwall		
	Mafics	Sediments	Cliffs ultra-mafic	Sulphidic Chert	NMK ultramafic (waste)	Sediments	Felsics	Mafics
Oxidise	3%	1%	3%	1%	6%	6%	1%	1%
Transitional	3%	1%	3%	1%	6%	5%	1%	1%
Fresh	7%	2%	7%	2%	20%	15%	2%	2%
Total	**13%**	**4%**	**13%**	**4%**	**32%**	**26%**	**4%**	**4%**

Table 7-5: Estimated Rock Unit Percentages for Goliath

Oxidation	Hangingwall				Ore horizon	Footwall	
	Sediments	Mafics	Felsics	Cliffs ultramafic	NMK ultramafic (waste)	Sediments	Mafics
Oxidise	3%	4%	1%	2%	3%	4%	4%
Transitional	3%	3%	1%	1%	2%	3%	3%
Fresh	9%	11%	2%	6%	13%	11%	11%
Total	**15%**	**18%**	**4%**	**9%**	**18%**	**18%**	**18%**

7.5 Other Closure Related Data

The results of rehabilitation trials at the nearby NMK operations are presented in this section, given their applicability to the rehabilitation of the MKS Project. The results of a rehabilitation benchmarking study, undertaken during the IPS are also included in this section.

7.5.1 NMK Rehabilitation Trials and Monitoring

- **Results to date from rehabilitation trials at NMK will be used to inform selected final landform designs at the MKS Project**
- **Placing topsoil on caprock or a rocky mine waste and deep ripping may be advantageous**

NiW has undertaken progressive rehabilitation and monitoring since the mid-1990s at nearby NMK where a total of 78 ha has been rehabilitated. In addition to progressive rehabilitation, rehabilitation (revegetation) trials have also been carried out on NMK WRLs. These trial areas have been subject to periodic monitoring to assess their performance and enable the identification and application of relevant learnings to future rehabilitation planning.

A summary of these trials and the key observations is included below and will be used to inform rehabilitation activities at the MKS Project.

7.5.1.1 NMK WRL Rehabilitation Trials

Since 1996, NMK WRL rehabilitation trials have focussed on:

1. Optimal slope geometry (concave design); and
2. Surface treatments to promote vegetation establishment.

7.5.1.1.1 Optimal Slope Geometry (Concave Design) Trial

In 2006, NiW commissioned Landloch to analyse potential WRL slope designs at NMK, including cover materials and erosion susceptibility. Modelling of erosion on various slope profiles was undertaken including simulated rainfall events and its effect on differing slope compositions, or design configurations. The study suggested that the concave shape had a theoretical advantage in minimising erosion over the equivalent linear slope.

As a result of this study, a concave slope rehabilitation trial was established on the southwest side of the West WRL (**Figure 7-11**) in 2007. The trial was designed to investigate concave slope design methodologies and applied cover materials. The 2007 trial section covered an area of ~27 ha. The prescribed slope treatment required the application of a thick cap rock and topsoil cover, followed by contour ripping and seeding with local species.

The 2008 rehabilitation section covers a total area of 12 ha. Topsoil was applied at a depth not exceeding 300 mm over 300 mm to 500 mm of caprock. Deep ripping to a depth of 1.4 m was applied along the contour. Hand seeding with local native seeds occurred at a rate of 9 kg/ha mixed with 1 kg/ha of Spongelite (soil improver). The additional 2009 rehabilitation section covered an area of 9.5 ha. Topsoil was applied at a depth of ~150 mm over 300 mm to 500 mm caprock, and was also deep ripped and hand seeded at a rate of 9 kg/ha.

Note, in some parts of the concave slope the topsoil cover exceeded 0.5 m, and was possibly over 1 m thick in sections. Whilst not formally recorded, anecdotal evidence obtained during the IPS suggests these sections may have received a thicker application of soil to overcome shortfalls in the construction methodology to achieve the design.

The performance to date of the concave slope has not been in line with expectations, with significant erosion evident in sections (**Plate 7-1**).

Plate 7-1: Erosion Gullies Observed in Concave Slope Trials

Notably, the results to date suggest:

- Slope length, steepness, cover treatments and drainage control influence batter stability;
- As NMK topsoil can be erodible, a thick surface layer of topsoil is unsuitable for long length slopes;
- The surface of the topsoil is prone to forming a crust which impacts the germination of seed and inadequate water capture;
- Where surface relief (e.g. broken surface, small crevices, cleared vegetation mulch, small swales) is not provided vegetation growth is unlikely to be sustainable;
- Safe cross-ripping of steep slopes can be problematic limiting the potential for effective slope treatment; and
- There were shortfalls in the quality controls applied during the construction of the slope (e.g. excessive topsoil placement [~0.5 m] in sections, ripping 'across' not 'on' the contour). Closure requires effective QA control during design, execution and post-execution to ensure performance expectations are met.

Figure 7-11: NMK Rehabilitated Areas and Monitoring Transects

7.5.1.1.2 Surface Treatments to Promote Revegetation

Various surface treatments on batter and berm rehabilitation have been trialled at NMK over the past two decades. Trialled surface treatments include varying depths of topsoil application and the use of wood mulch over oxide rock substrate. In addition to the trials, annual monitoring has been conducted since 2010 by Outback Ecology and prior to this by Western Botanical (from 1996).

Based on monitoring results to date, the following observations are applicable to closure planning and were considered in the development and selection of the preferred WRL closure solutions for the MKS Project:

- Mixing topsoil with either caprock or a rocky mine waste (via deep ripping) appears to provide superior erosion stability and revegetation;
- Some hard rock surface breakthrough on the rehabilitation surface (i.e. a rough textured, and not laminated surface) may be important in creating surface relief to promote vegetation growth;
- While uncontrolled erosion is undesirable, minor erosion rills on slopes can assist rehabilitation processes by trapping seed and water to promote initial vegetation growth;
- Revegetation of WRL slopes in the arid and drought-prone environment is typically more challenging than the revegetation of flat surfaces, which needs to be considered in the setting of performance criteria; and
- Even if non-vegetated, rocky slopes can provide desirable erosion control and habitat diversity value.

7.5.2 Industry Benchmarking Results

- **Comprehensive closure benchmarking study completed during the IPS is directly applicable to the MKS Project**
- **Study analysed industry experience from Australia and overseas**
- **Benchmarking results were critical as input in the evaluation and selection of preferred closure alternatives**

During the IPS a comprehensive benchmarking study (Stantec, 2017b) was completed to identify the lessons learned from mine closure globally, which may have relevance to the closure of NiW operations. The study compiled information from research and interviews with subject matter experts across key strategic and technical disciplines.

During the IPS, the outcomes from the benchmarking study were used to inform the evaluation and selection of the preferred closure alternatives as well as closure objectives, BoD, closure performance criteria, preliminary engineering of closure alternatives, stakeholder engagement strategy and relinquishment planning.

A summary of key findings relevant to MKS Project closure planning aspects is provided in **Table 7-6.**

Table 7-6: Benchmarking study key findings relevant to the MKS Project

Discipline	Key Findings or Learnings	Relevance to NiW Closure
WRLs		
WRL – Angle of repose slopes	There are precedents for approval of angle of repose slopes by regulators in Western Australia (Hercules project), Queensland (Kidston mine), and Tasmania (Mt Bischoff mine).	• The preferred closure solution for the MKS WRL delivers a superior outcome with each landform embankment re-profiled to less than 20°, nominally 18°. • The WRLs will be constructed with 20 m high lifts and 20 m wide berms, or alternate optimal batter-berm slope design configurations (e.g. 10 m wide berms and 10 m high lifts, or 30 m wide berms and 20 m high lifts, etc.) that achieve BoD criteria with up to 1.5 m of competent waste rock cover applied. • All slopes will be covered with ~0.2 m growth media, ripped and seeded to promote vegetation growth.
WRL – Concave slopes	At NMK, a large concave slope was constructed, but a deep layer of low erosion resistance material was spread on the slope and significant erosion occurred. If a thin layer of topsoil had been placed instead, it may have resulted in a much more stable outcome.	• Comments as above.
WRL – Tall single slopes	Various proponents (e.g. Telfer, Jack Hills) have investigated tall single slopes (60 m, 80 m or 100 m high); however, water velocity will eventually build up down the length of the slope unless the material of which the slope is constructed is porous and durable. The San Manuel mine in Arizona is an example where tall (100 m) steep single slopes are eroding in the lower third, and may require some back sloping benches or some concavity to be introduced.	• Tall single slopes may lead to high levels of erosion due to increased water velocity down the length of the slope. The preferred closure solution for the MKS WRL delivers a superior outcome due to: – Each landform embankment being re-profiled to less than 20°, nominally 18°; – Construction of 20 m high lifts and 20 m wide berms, or alternate optimal batter-berm slope design configurations (e.g. 10 m wide berms and 10 m high lifts, or 30 m wide berms and 20 m high lifts, etc.) that achieve BoD criteria with up to 1.5 m of competent waste rock cover applied; – All slopes will be covered with ~0.2 m growth media, ripped and seeded to promote vegetation growth; and – Where single slopes are used, the linear distance will be optimised and/or the slopes flattened, to improve erosion performance.

Discipline	Key Findings or Learnings	Relevance to NiW Closure
WRL – Berm and Batter Design	Examples of WRL rehabilitation batter and berm designs were reviewed from Mt Leyshon, Jundee, Pardoo, Wodgina, Abydos and Mt McClure mines. Berms have attracted criticism for their ability to concentrate drainage and result in serious erosion issues. Much of this criticism can be overcome by maximising berm storage capacity (wider berms), constructing them correctly (level in terms of RL), discouraging ponding adjacent to the batter crest (berm back sloping and crest bunds) and minimising the potential for cross-flow within berms (cell bunds).	• The preferred closure solution for the MKS WRL will maximise the stability of these landforms as they will be constructed with 20 m high lifts and 20 m wide berms, or alternate optimal batter-berm slope design configurations (e.g. 10 m wide berms and 10 m high lifts, or 30 m wide berms and 20 m high lifts, etc.) that achieve BoD criteria. • The benches will be back sloped and contain a 1 m high bund to control drainage. • Embankments will manage a 1:1,000 year ARI rainfall event with the top surface capturing a PMP rainfall event. • Rehabilitated WRL slopes will be revegetated using native species.
WRL – Vegetated outcomes	There are instances where non-vegetated outcomes have been approved by WA regulatory authorities. Examples include Wallaby, Sunrise Dam and Red October mines. In these cases, there has been a lack of suitable materials for use as a growth medium.	• The MKS WRL preferred closure solution is to apply a ~0.2 m growth media to the top surface and embankment, rip and seed at ~7 kg/ha.
WRL – Reasons for landform failures	Wider industry experience of the IPS study team identified several primary reasons for why rehabilitated WRL landforms can fail, including: Failure to properly characterise waste rock and growth medium materials. A number of case studies have been cited where poor materials identification has resulted in material erosion, lack of vegetation and in some cases, the potential for acid metalliferous drainage. Failure to develop (and test through progressive rehabilitation pre-closure) a competent design that adequately allows for effective drainage in local conditions. Failure to construct the rehabilitated landform to the intended design due to operator error and lack of adequate QA/QC during execution.	• Materials characterisation has been a feature of the IPS to adequately define key material physical and geochemical properties at this preliminary closure planning stage. • NiW is proposing a greater focus on lead indicators in the development of closure objectives and criteria (see **Sections 5 and 6**). Increased front-end loading in design will help to ensure there is adequate focus on the development of a robust WRL final landform pre-execution that achieves the Basis of Design. • The Basis of Design specified in this MCP was informed by results of industry benchmarking to ensure their relevance and adequacy. • A rigorous QA/QC program is proposed by NiW for the construction of closure activities which will involve quality assurance reviews undertaken by qualified third parties appointed by NiW to oversee the competent completion of activities.

Discipline	Key Findings or Learnings	Relevance to NiW Closure
Open Pits		
Open Pit	Backfilling of final voids above the water table can result in a worse outcome compared to leaving the pit open with a water body. This is because it can become a flow-through system instead of a terminal sink, resulting in the migration of metals from the (former) mining area to the groundwater. Important to assess the risks associated with final voids on a case-by-case basis to ensure the solution is optimal for the local conditions (e.g. problematic materials, sensitive receptors, potential for future mining, etc.).	• The Goliath pit will be left open to develop a pit lake. • The Six Mile Well open pit will be backfilled with waste rock, however water quality predictions by MWES (2017), indicate that groundwater quality will improve due to recharge through the backfill material.
Design Criteria		
Design Criteria	WA regulators generally expect surface water infrastructure to be designed to manage large rainfall events including the management of an upstream catchment that may impact on a rehabilitated landform. It is expected that the impacts of the event would be contained and result in no unacceptable off-site impact/s.	• **Section 9** outlines the proposed design criteria for site drainage post closure and indicates that the surface of the WRLs and TSFs have been designed to contain a PMP rainfall event. The proposed closure solution is designed to convey water from a storm event between 1:300 and 1:10,000; and to capably pass >1:10,000 flood event within site drainage infrastructure.
	Failure to properly design / size drainage is a key source of waste rock landform failure. Designing to large rainfall event provides a degree of conservatism that means that the drainage infrastructure will accommodate most drainage events even if there are some errors in material characterisation or construction. Failure to plan for extreme rainfall events has resulted in significant unplanned cost to operators as evidenced in the Equity Silver mine case study where a severe storm occurred (beyond the severity predicted) and overwhelmed the waste rock landform cover and AMD treatment facility resulting in significant repair costs.	• Comments as above.
	A design life of 200 to 300 years was generally viewed by those interviewed as the length of time that it is possible to look forward and predict performance and on this basis would be suitable as criteria in the Basis of Design. Basis of Design can be something seldom used to truly anchor design criteria, being used instead to retrofit support of a preferred solution. Few practical examples are available to demonstrate an engineering design life that will remain stable for a pre-defined period of time.	• BoD were determined for MKS prior to finalising the selected closure solutions. They informed the design scope for closure alternatives, and final selections. A landform design life of 300 years was selected to help ensure these facilities will be constructed to manage risks for an extended period of time post-closure.

Discipline	Key Findings or Learnings	Relevance to NiW Closure
Relinquishment		
Mining Tenement Relinquishment	There are very few examples in WA where closed mines have been relinquished to the State Government in a co-ordinated manner. Two exceptions are the Bottle Creek mine and Alcoa's Jarrahdale mine which were relinquished in 2001 and 2005 respectively (Mackenzie 2016; DITR 2006; Grant 2007). Putting aside funds and/or other mechanisms that buffer the exposure that a custodial authority/third party has to residual liabilities post-relinquishment, may assist in applications for relinquishment of mining tenure.	• Building a credible and achievable path to timely relinquishment of mining tenure and residual liabilities post-closure was a focus of the IPS. This review recognised, in part, the challenges faced by industry and regulators alike in creating a workable and agreeable process demonstrated by the lack of examples of successful relinquishment in WA. The result has been the commitment to a range of measures in this MCP which together attempt to assist creating a timely path to relinquishment, addressing those issues that have caused process failure or paralysis in the past. These measures include an allocation in the closure cost estimate to cover reasonable costs associated with maintenance and related works post-relinquishment, increased progressive QA reviews and tollgate approvals before advancing to the next closure phase and the commitment for NiW to engage and fund an ICA (whose qualifications and experience are acceptable to the DMIRS) to independently review and report on the adequacy of the closure planning and execution works until relinquishment has been achieved (**Section 5** and **6**).
	The Queensland State Government is moving towards a progressive relinquishment process, in part, to deal with the uncertainty that a lack of standards and precedence brings to closure of mines and eventual relinquishment.	• Comments as above.
	Regulators tend to focus on lag indicators (i.e. outcomes achieved post closure), especially those associated with vegetation systems. There is a move to present more lead indicators to regulators rather than lag indicators and with focus on the macro essentials not micro details (i.e. if macros are good, micros will take care of themselves over time but not reverse will work) to provide increased certainty to proponents, regulators and the community.	• NiW is proposing a greater focus on leading indicators in the development of closure objectives and criteria (see **Section 6**). Increased front-end loading in design will help to ensure there is adequate focus on the development of a robust WRL final landform pre-execution that achieves the Basis of Design.

Discipline	Key Findings or Learnings	Relevance to NiW Closure
	Currently vegetation criteria focus on natural analogues (i.e. an undisturbed site nearby to the mine). The difficulty with this standard approach for vegetation on mined landforms is that these landforms are artificially constructed and therefore will inherently have characteristics that differ from surrounding natural systems particularly during initial decades post-closure and in some cases permanently. DMIRS have accepted for a number of mines in the Pilbara (e.g. Pardoo, Mt Dove, Wodgina, Abydos) that the *best achievable rehabilitation performance* on disturbed sites will be the vegetation target.	• Comments as above. Relevant and realistic closure performance criteria was an important pre-requisite in the development of the closure success measures per **Section 6** of this MCP.

7.5.3 Assessment of Rehabilitation Measurement Regimes

During the IPS, the regimes used previously by NiW and industry to measure rehabilitation performance were evaluated. The review purpose was to inform the development of appropriate and achievable closure performance criteria and measurement techniques. As part of this review, NiW assessed the ongoing applicability and value being created to performance measurement from Ecosystem Function Analysis (EFA) monitoring which has been previously employed at NiW. EFA is made up of Landscape Function Analysis (LFA) together with quantitative vegetation monitoring, erosion monitoring and a faunal habitat complexity assessment.

While EFA is an industry-recognised technique, it was identified as having limitations in being used as a primary technique for measuring rehabilitation success at NMK. These limitations included:

- As for all ecosystem monitoring methods, EFA can only be applied after all stages of landform construction, soil placement and vegetation establishment have occurred. It is therefore a lagging rather than leading indicator, and necessarily can only identify issues after rehabilitation works are completed when the ability to effectively repair and restore serious design and other issues is greatly diminished. More emphasis on early indicators of rehabilitation performance is considered superior as an approach, reducing the latent risks that pass through otherwise to post-execution;
- The EFA technique, along with other on-ground monitoring approaches, is limited to repeat monitoring of established transects over time. Variability within rehabilitated areas, together with limitations on resources available for monitoring, means that these localised sampling points are unlikely to fully represent the performance of the entire, diverse rehabilitated area at NMK;
- EFA is a measure of soil and vegetation aspects of rehabilitation. While it is often complemented with monitoring of erosion features in 'horizontal' transects either side of the EFA transect, and whole of – landform inspections, it does not measure other landform parameters such as geochemical changes to the soil / waste rock, geotechnical stability, etc; and
- The LFA component assesses visual indicators of landscape function, which can be used to compare with natural landscapes and can be used in completion targets. However, it is not intended as a detailed quantitative measure of soil processes. Therefore, it may be difficult to infer from LFA data the key issues or constraints that are contributing to the rehabilitation outcomes.

NiW will continue to investigate the most appropriate rehabilitation monitoring regime to best measure performance success. As part of this, all phases of closure from landform design to post-execution will be monitored and measured to more emphasise leading indicators over those lagging, and will consider the following:

- Prior to Closure Execution: Detailed plans of the proposed landform construction and rehabilitation will be prepared and approved by regulatory authorities, including detailing the objectives of the engineering drawings, material specifications, volumes and construction technique. This information will be valuable in tracking the original aims and objectives of the rehabilitation works;
- During Closure Execution: Detailed capture of actual construction including survey volumes, construction methodology, and testing of materials and seed to confirm suitability. It is important that deviations from the approved design should not occur unless agreed and signed off with NiW and, as appropriate, regulatory authorities. As an example, a key learning from the concave, single slope trial at NMK was that too thick a topsoil layer was placed on the slope – this decision was made during the construction process without appropriate input and approval, and was not detected as a construction flaw until after construction was complete. Subsequently, this has led to excessive erosion of this rehabilitated slope; and
- Post closure execution: Monitoring techniques will be suitable for the range of site-specific parameters that are required to be monitored. This will vary depending on the objectives of each rehabilitated area and may include parameters such as vegetation cover and diversity, geotechnical stability, geochemical changes, erosion (wind, water) and environmental factors (climate, dust, bushfire, etc). Identified in the IPS, a key element is expected to be the incorporation of aerial imagery (e.g. unmanned aerial vehicle surveys), with image analysis

techniques that can capture vegetation parameters such as cover, condition and potentially differentiation of plant genera (for example using an object-based image analysis approach) as well as erosion features. Such an approach is simple, cost effective, accurate and can measure an entire area at a single time as opposed to localised quadrats or transects that may be misrepresentative.

Additional details on the overall process proposed for closure performance measurement is included in **Section 6.**

8 IDENTIFICATION AND MANAGEMENT OF CLOSURE ISSUES

The effective identification, characterisation, evaluation, mitigation and monitoring and review of risks is fundamental to successful mine closure. These processes must distil data and opinion to qualify the risks requiring remedy at closure. A competent understanding of risks must inform decision-making during all phases of closure.

As part of BHP, NiW implements a systematic, comprehensive process for the identification and evaluation of closure risks. These processes comply with the relevant internal standards, including *Our Requirements for Risk Management* which is based upon guidance from *ISO 31000 Risk Management*. Consistent with Section 4.11.1 of the 2015 Guidelines the NiW approach *"allows a systematic review and analysis of risk and cost benefit in both engineering and environmental terms, as well as identification of opportunities associated with closure."*

A closure risk register was developed for MKS as a subset of the closure risk assessments that were undertaken as part of the IPS for NiW operations. The closure risk register has informed the selection of preferred closure alternatives for domains and the closure cost estimate, to allow for provision for residual risk. The MKS closure risk register is included as **Appendix C**.

An overview of the closure risk evaluation process, including results, is presented below.

8.1 Risk Evaluation Process

A Closure Risk Register is maintained for NMK and has been prepared for the MKS Project (**Appendix C**). The NMK Register was comprehensively reviewed during the IPS for NMK and has been refined specifically for the MKS Project.

In addition to closure risks, and consistent with Section 4.11 of the 2015 Guidelines, opportunities were also identified as part of evaluation workshops held during the IPS. Opportunities were defined by NiW as features inherent within the mining or natural settings that have the potential to enhance or optimise closure outcomes, aligned with closure objectives (**Section 5.2**).

Other inherent advantages at the MKS Project and considered during risk evaluation workshops were the generally favourable, inert conditions of the existing mining landforms (e.g. WRLs with low PAF generation and seepage potential; and the final Goliath void acting as a terminal groundwater sink to minimise, in combination with the high evaporation rate, the potential for any impacts from the final pit lake).

An inherent advantage of the locale is the general lack of sensitive receptors in the near vicinity of the MKS Project, reducing any potential risk severity. The exceptions to this are the stock bores located in the pastoral lands and the Wanjarri Nature Reserve. Both of these local features were considered during risk evaluations as sensitive receptors.

Both the stock bores and Wanjarri Nature Reserve are considered unlikely to be impacted by the MKS Project closure. This finding of low risk was primarily attributable to the following:

1. The location of the Wanjarri Nature Reserve is within a separate sub-catchment area and therefore it is located outside of the drainage path for surface water flows from rehabilitation areas);

2. The locations of the Nature Reserve and stock bores are cross-gradient with the regional groundwater flow and therefore groundwater typically drains away from (and not towards) these receptors; and
3. The location of the Nature Reserve is to the east of the MKS Project when the predominant easterly wind direction is considered reducing the potential for dust impacts at the Nature Reserve.

To ensure its efficacy, the NMK Closure Risk Register and effectiveness of any implemented risk controls will be subject to annual review, with a deep-dive risk evaluation conducted as part of the triennial update of the NMK MCP.

8.2 Risk Evaluation Results

The uncontrolled (inherent) closure risks ranked as having the highest potential severity and likelihood for the Project were associated with the Landforms closure domain and the ability to reliably achieve tenement and land (residual liability) relinquishment within a reasonable timeframe (across all domains).

Table 8-1 summarises those risks initially ranked as 'High' from the evaluation of uncontrolled closure risks, and includes the revised controlled (residual) risk rankings after controls were applied (**Appendix C**).

Table 8-1: Summary of High (Uncontrolled) Risks and Controlled Rankings

Domain	Risk Issue	Risk Ranking	
		Uncontrolled	Controlled
Landform	Landform failure causing instability and discharge of sediment-laden run-off and/or dust impacting the surrounding environment and land use.	High	Low
All	Relinquishment of tenements and residual liabilities not achieved and / or within a reasonable timeframe post-closure.	High	Medium

The residual risk rankings for all the uncontrolled 'High' risks identified in **Table 8-1** were reduced after the proposed control measures were considered. The Closure Risk Register (**Appendix C**) details the analyses and mitigation measures for all closure risks.

9 CLOSURE IMPLEMENTATION

This section describes the main elements of the closure execution strategy, and proposed solutions for closure domains related to the Stage J Project. As the closure date nears, and particularly when within 5 years of being realised, additional information from the detailed engineering design phase (DPS) of the closure planning will be incorporated in this section.

9.1 Closure Execution Strategy

Closure is a feature of the LoA planning at NiW. The efficacy of the NiW MCPs and related closure cost estimates are reviewed annually in accordance with BHP requirements. These updates are subject to regular internal QA and risk assurance audits to verify the rigour and compliance of the work with relevant BHP and industry standards.

As part of LoA planning, the expected life of the integrated NiW Asset is reviewed annually. The closure date determined from the LoA plan informs the intensity and cadence of annual closure planning – preliminary planning if beyond 10 years or advanced if less – to ensure NiW's preparedness for a planned closure scenario.

These reviews also assist NiW in being prepared for an unplanned (premature) closure scenario by having developed closure planning processes in place that can be leveraged to accelerate the transition of closure to a capital project for execution. As discussed in **Section 1.4.1** of the NMK MCP, such a transition occurred at NiW in 2015 when a revised, early closure date ~FY2020 was anticipated. This transformed Asset closure to being a major capital project in IPS.

Since this time, through major improvements in operational efficiencies and the feasibility of growth options, the NiW LoA date has extended from ~FY2020 to at least FY2040. This has reduced the need to advance the Asset Closure Project beyond IPS until closure is again expected within 5 to 10 years. In the meantime, information gained from the IPS has been incorporated within this MCP revision and internal planning, and the IPS key findings will be acted upon during mining to continue to minimise closure risks, uncertainties and liabilities pre-closure.

In the event of planned or unplanned suspension of the MKS mining operation or a partial closure scenario, the LoA and major capital project processes of BHP provide proven and effective frameworks to safely, effectively and efficiently transition from an operating state to any of these scenarios. In the case of suspension of a mining operation, formal notifications under the *Mines Safety Inspection Act 1994* (WA) are applicable and under any scenario of anticipated suspension or closure (partial or whole) the DMIRS and other relevant authorities will be notified and kept abreast of key developments as key decisions are being made.

Further to above, in the case of a sudden or unplanned decision to close the MKS project, NiW will accelerate the transition from an operational planning focus to resuming and completing the study phases of a major capital project (i.e. SPS, DPS). This transition will occur in accordance with the BHP major capital project framework, fully leveraging the substantial body of work already completed as part of the initial IPS study phase. This planning will involve the completion of detailed engineering designs and work packages for the selected closure alternatives and submission of an updated MCP to the DMIRS for their approval (prior to its implementation). The pre-execution phases of the stakeholder engagement program will also be completed during this time. Whilst in the event of sudden or unplanned closure the transition to the SPS/DPS study phases will be accelerated, the time then found necessary to complete these phases will be subject to a range of factors including those relating to statutory commitments, strategic objectives (including integrated whole-of-Asset closure planning) and ensuring stakeholder acceptance and effective QA control prior to execution start.

The MKS closure execution strategy has its aim to implement closure activities in an integrated, productive and effective manner from the closure date, consistent with closure objectives (**Section 5.2**) and the approved MKS MCP.

The closure execution strategy has the following five main phases:

1. **Progressive Rehabilitation** – During operations, the planned rehabilitation of disturbed areas is an important element of the execution strategy. It progressively reduces closure risks, uncertainties and costs whilst testing the effectiveness and the feasibility, including constructability, of rehabilitation designs. It provides a demonstration to stakeholders, including regulatory authorities, that NiW is delivering the target closure outcomes. It also builds rehabilitation knowledge and skills capacity in the workforce that can continue to be leveraged pre-closure and transferred to closure execution;

2. **Transitional Planning** – This covers the phase from operations to cessation to closure including the transition planning for the NiW workforce, suppliers and contractors, finalising detailed closure designs and construction specifications, internal and external stakeholder updates, obtaining final regulatory approvals and licences, development of construction management plans and QA control plans, selection of contractors to undertake the closure works and making the site safe for a transition to closure;

3. **Contractor Mobilisation** – This includes measures to safely mobilise contractors and plant to site, and working with these contractors to ensure they have all the necessary internal and external permits to commence;

4. **Decommissioning, Demolition and Disposal** – This includes decommissioning, decontamination, demolition and disposal of all equipment no longer required (except by agreement with a third party) and disposal of contaminated soils and other wastes in preparedness for rehabilitation activities; and

5. **Land Rehabilitation** – This involves the rehabilitation of disturbed ground to the approved landform designs and the completion of assurance audits (**Section 6.2**) to the satisfaction of BHP and the DMIRS.

Once this final fifth phase of land rehabilitation is completed, then the monitoring and maintenance period will commence.

Engagement with key stakeholders will be maintained by NiW throughout all closure execution phases, as appropriate.

The timing of start of some or all closure activities at the MKS Project may vary subject to strategic alignment of interests or interdependencies with other NiW sites, which if not considered may result in premature or inefficient execution. The start of some phases may also be delayed if necessary (tollgate) statutory approvals have not yet been obtained.

Consistent with the 2015 Guidelines, at least two years prior to the planned closure date, the NMK MCP will be materially updated to include specific details in relation to the decommissioning and land rehabilitation phases.

9.2 Closure Execution Activities

This section presents the selected closure alternatives and associated activities for each closure domain. These alternatives are the output from the IPS which sought to identify fit-for-purpose closure solutions that effectively and efficiently managed inherent closure risks and with outcomes that would be acceptable to key stakeholders.

The closure solutions presented in this section were informed by the following:

- Legal obligations (**Section 3**);
- BHP standards (**Section 3**);
- Stakeholder feedback (**Section 4**);
- Post-mining land-uses (**Section 5.1**);
- Closure objectives (**Section 5.2**);
- Knowledge base update (**Section 7**);
- Progressive rehabilitation (**Section 7.5.1**);
- Site rehabilitation trials (**Section 7.5.1**);
- Industry benchmarking results (**Section 7.5.2**);
- Closure risk assessment update (**Section 7.5.3**); and
- IPS Study team practical experience in mine closure.

In addition, BoD criteria were developed to provide the mandatory design parameters for the selected closure alternative. The development of this criteria considered results from industry benchmarking (**Section 7.5.2**), including from both within and external to BHP. This BoD criteria is important to define and standardise for key attributes the minimum design criteria to be met. This approach ensures that closure alternatives are anchored to a defensible and standardised suite of design criteria, which direct (and not react to) the solution scope.

Descriptions of the selected closure alternatives for each key closure domain, and supporting information including existing conditions, BoD criteria, relevant figures, key assumptions, and proposed trials, are provided below.

9.2.1 Selected Closure Alternative for Mining Landforms

DOMAINS: Mining Landforms	
Planned Conditions – Key Features (**Figure 9-1**)	
WRL: • One WRL that will be constructed east of the open pits. • The final construction will consist of 4 lifts, each 20 m high. • Due to variations in surface topography, the maximum WRL height will be 85 m. • The volcanic sediment has been classified as PAF (long lag) and should be encapsulated within the WRL	**ROM:** • The ROM will be constructed north east of the Six Mile Well open pit. • Will be constructed to 535 RL, and be approximately 15 m high. • Will be constructed from mine waste.

<table>
<tr><th colspan="2">DOMAINS: Mining Landforms</th></tr>
<tr><td colspan="2">• The ultramafic and shale waste rock units should not be placed on final WRL slopes because of concerns about their long-term erosion stability.</td></tr>
<tr><td rowspan="2">Current Operating Status:
Construction commenced</td><td>Area Disturbed: 559 ha</td></tr>
<tr><td>Area Rehabilitated: 0 ha</td></tr>
<tr><td>Location:
WRL: 262400 mE, 6963000 mN
ROM: 260800 mE, 6965500 mN</td><td>Tenements:
M36/143, M36/183, M36/185, M36/422</td></tr>
<tr><td colspan="2">Nominal Closure Date (based on current mining approvals): FY2032
Expected Closure Date (based on LoA plan, assuming future growth approvals): Earliest FY2040</td></tr>
</table>

DOMAINS: Mining Landforms

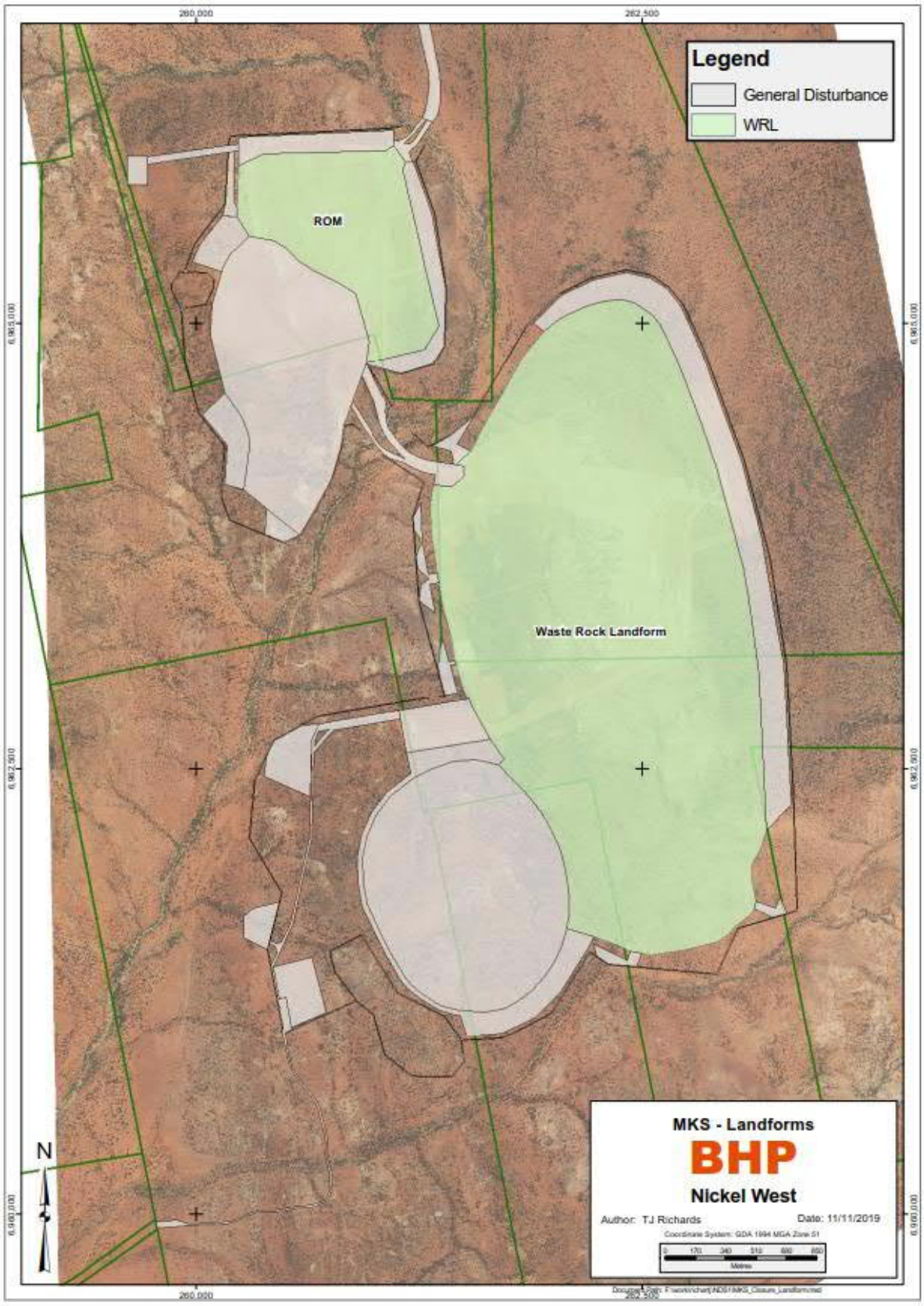

Figure 9-1: WRL and ROM pad

DOMAINS: Mining Landforms

BoD Criteria

- Final top surface to retain incidental rainfall from a critical duration PMP rainfall event.
- Final landform, including drainage controls / features, to have a 300-year design life.
- Slope stability achieved through reprofiling up to 20°, nominally 18°.
- Geotechnical FoS >1.3 under static conditions.
- Abandonment bund positioned outside of ZoI, or as agreed with the DMIRS.
- Berms will be designed to retain 1:1,000 year ARI rainfall event with adequate freeboard, with cross bunds installed at periodic intervals to minimise the concentration of drainage in any one area and encourage revegetation.
- Diversion structures will be designed/amended to convey run-off from a minimum critical duration 1:300 ARI rainfall event; with the actual design event to be determined on a risk basis from further studies.

Selected Closure Alternative – Key Features

Cover *(controlling safety, dust, erosion and surface drainage risks)*

- Up to 1.5 m* of durable rock armour applied to low stability / oxide exposures on Landform slopes.
- *Up to 0.5 m* of inert rock material applied to any residual PAF exposures on WRL top (flat) surface.*
- Place ~0.2 m* thick growth medium (topsoil and / or caprock) over waste rock.
- Waste rock that presents a real risk of generating AMD will be effectively encapsulated within the WRL.

Drainage *(controlling surface drainage and erosion risks, and promoting revegetation)*

- *Landform design will be water-retaining, limiting potential for run-off from the flat surfaces.*
- Top surface will retain incidental rainfall from a critical duration PMP rainfall event (BoD).
- Crest bunds will be installed on benches and top surfaces.
- Flat surfaces (benches and top) will be back sloped, designed to minimise overtopping risk.
- Catchment cell bund and cross bunds will maximise retention of water on the flat surfaces.
- Berms will be designed to retain 1:1,000 year ARI rainfall event with adequate freeboard, with cross bunds installed at periodic intervals to minimise the concentration of drainage in any one area and encourage revegetation.
- Construct toe bund around external perimeter of WRLs.
- The ~500 m section of WRL toe located within the Jones Creek floodplain will be rock armoured to minimum elevation of 529 mRL to account for a 1:1,000 yr flood event.
- Upstream run-off from the east of the WRL will be conveyed around the northern and southern toe of the WRL in engineered drains.
- Diversion structures will be designed/amended to convey run-off from a minimum critical duration 1:300 ARI rainfall event; with the actual design event to be determined on a risk basis from further studies.

Stability *(controlling geotechnical, seepage and erosion risks)*

- 20 m high lifts and 20 m wide berms, or alternate optimal slope design configurations (e.g. 10 m wide berms and 10 m high lifts, or 30 m wide berms and 20 m high lifts, etc.) that achieve BoD criteria (Figure 9-2).
- All slopes re-profiled to nominally 18°, up to 20°.
- Up to 1.5 m of durable rock armour applied to all low stability exposures.
- All slopes will be covered with up to 0.2 m growth medium.
- All material will be placed outside of the ZoI, or otherwise as agreed with the DMIRS.

DOMAINS: Mining Landforms

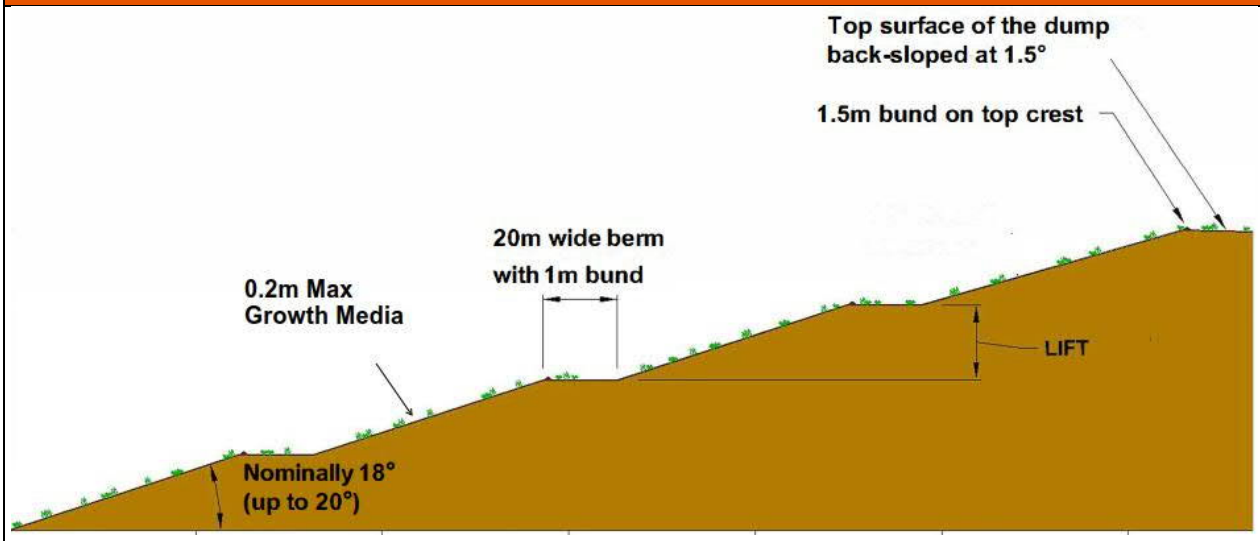

Figure 9-2: Cross-Section of Rehabilitated Landforms – Entire Slope

Zol *(controlling safety, geotechnical and erosion risks)*

- Zol boundary will be estimated to the satisfaction of the DMIRS, with an additional 10 m buffer allowance, plus more distance (up to 5 m) for drainage control and bund construction (**Figure 9-3).**

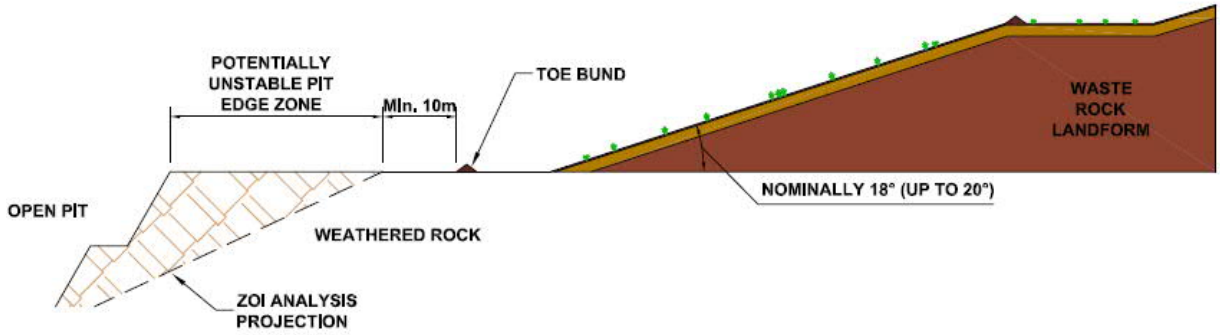

Figure 9-3: Cross-Section Showing WRL Relocated Outside Zol

Revegetation *(aiding control of dust and erosion risks, and supporting target land-use)*

- Application of up to 0.2 m thick growth medium.
- Rip on contour and sow using a 7 kg/ha native seed mix.
- Growth medium will comprise a combination of topsoil/caprock (where available).
- Catch cells and cross bunds on flat surfaces will additionally promote vegetation establishment by helping to retain rainfall run-off.

Selected Closure Alternative – Construction Activities

1. Pushdown slopes of WRLs, ROM pad and Low Grade stockpiles to nominally 18º, up to 20º.
2. Berms will be designed to retain 1:1,000 year ARI rainfall event with adequate freeboard, with cross bunds installed at periodic intervals to minimise the concentration of drainage in any one area and encourage revegetation.
3. Up to 1.5 m of durable rock armour applied to all low stability / oxide and PAF exposures on slopes.
4. Any residual PAF exposures on WRL top surface are to be covered with up to 0.5 m of inert rock material.

DOMAINS: Mining Landforms

5. Remove waste rock material from within the ZoI (including allowances) where safe to do so, or as otherwise agreed with the DMIRS.
6. Cover any used tyres and other wastes generated from site with ~5 m of inert rock material to manage the risk of contact with a surface fire, and to be well outside of any deep ripping zone within the surface profile.
7. Grade top surface to 1.5° (2.5%) back-sloped from crest edge for ~30 m.
8. Install ~1.5 m waste rock bund at WRL crest.
9. Construct low berms (1.0 m high) every ~100 m along berms and catch cells on top surfaces at ~2 cells per hectare to limit water flow and promote water storage and release.
10. Construct toe bunds and diversion drains around the external perimeter of the WRLs including within the pit side ZOI buffer area to divert local drainage away from the toe of the WRLs and enable retention of any erosional material generated from the slopes of the WRL.
11. Place up to 0.2 m growth media, rip on contour and sow with native seed (at a rate of 7kg/ha) and fertiliser on WRL surfaces.
12. Install stock fencing, locked gates and signage around all landforms.

Indicative Rehabilitation Materials Balance (see Section 7.2.3 for further details)

Feature	Waste rock (m^3)	Topsoil required (m^3)[1.]	Topsoil likely to be collected (m^3)[2.]
Landforms			
WRL	205,000,000	720,000	648,000
ROM Pad	10,785,000	119,000	107,000
Total required (domain only)	**NA**	**839,000**	**755,000**

[1.] Assuming a topsoil application depth of 0.2 m

[2.] Assuming a recovery depth of 0.15 m and a handling loss of 10%

Selected Closure Alternative – Key Assumptions

- Armour thickness up to 1.5 m will achieve erosional stability (to be confirmed by field trials pre-closure).
- Cover of PAF exposures with inert rock up to 0.5 m will achieve target control (to be confirmed by field trials pre-closure).
- Low Grade Stockpiles will not be processed during operations and therefore will require rehabilitation at closure.
- The majority of existing rehabilitation areas will not require material rework (i.e. periodic maintenance only) in order to achieve closure performance criteria and enable tenement and residual liability relinquishment.
- WRL material within the ZoI can be safely removed. It if cannot be safely removed, then an alternate solution will be agreed with the DMIRS.
- Successful revegetation can be achieved on a growth media up to 0.2 m. This was investigated during the IPS, but will be subject to further studies and field trials pre-closure. If a thinner growth medium (e.g. 0.1 m) is feasible to produce the target revegetation outcomes, as confirmed from trials, then this will be adopted.
- Use of topsoil and caprock remains as the preferred growth media at closure. If no caprock was used, then an overall topsoil deficit in the order of ~1 Mm3 could be expected across total NMK rehabilitation areas.
- Future operations, including growth projects, do not materially alter the inherent closure risks associated with WRLs and Low Grade Stockpiles (e.g. PAF risks remain low, ZoI boundaries remain equivalent).

DOMAINS: Mining Landforms			
Key Data Gaps – Research Priorities			
No.	**Data Gap**	**Proposed Research Activity**	**Indicative Timing**
1	Waste rock characterisation	A pre-mining assessment of the geochemical and physical (erodibility) of waste rock has been undertaken, but these findings need to be verified on an ongoing basis during operations.	During mining operations, as part of future NMK MCP updates
2	Detailed designs for landforms.	Develop detailed designs based on the as constructed geometry, actual waste rock properties and associated constraints / opportunities of the landforms.	
3	Topsoil inventory and quality.	Preliminary topsoil inventories have been developed for the MKS Project. However, during operations, inventories of rehabilitation materials are to be updated based on actual recovery rates. Prior to use in rehabilitated areas the quality of soil available for use is to be determined and a deployment plan developed based on these characteristics.	
4	Surface water management on and around the landforms.	Develop a plan for managing surface water post closure. Concept plans exist and these will be refined once infrastructure has been developed.	
5	Identify areas that may require rock armouring.	Identify areas on the as constructed landforms which may require rock armouring.	
6	Develop rehabilitation seed lists and plan for the collection and management of seed resources.	Develop a seed list for revegetation based on the baseline flora and vegetation assessments and investigate potential sources of seed.	
7	Selection of Analogue Sites	Determine if additional (to NMK) analogue sites are required and monitor where applicable.	

9.2.2 Selected Closure Alternative for Open Pits

<table>
<tr><th colspan="2">DOMAIN: Open Pits</th></tr>
<tr><td colspan="2">Existing Conditions – Key Features (Figure 9-4)</td></tr>
<tr><td>Goliath open pit:
Will be mined in two stages;
Stage 2 waste will be backfilled into the Six Mile Well pit; and
Following mining it is anticipated the pit shell will be 1,420 m long, 1,130 m wide and 465 m deep.</td><td>Six Mile Well open pit:
Following mining it is anticipated the pit shell will be 1,400 m long, 740 m wide and 270 m deep; and
Will be backfilled to ground level RL.</td></tr>
<tr><td>Current Operating Status:
Construction Commenced</td><td>Area to be Disturbed: 220ha</td></tr>
<tr><td>Location:
Goliath Open pit; 261600 mE, 6962000 mN
Six Mile Well pit; 260400 mE, 6965000 mN</td><td>Tenements:
M36/183, M36/184, M36/185, M36/246</td></tr>
<tr><td colspan="2">Nominal Closure Date (based on current mining approvals): FY2032
Expected Closure Date (based on LoA plan, assuming future growth approvals): Earliest FY2040</td></tr>
</table>

DOMAIN: Open Pits

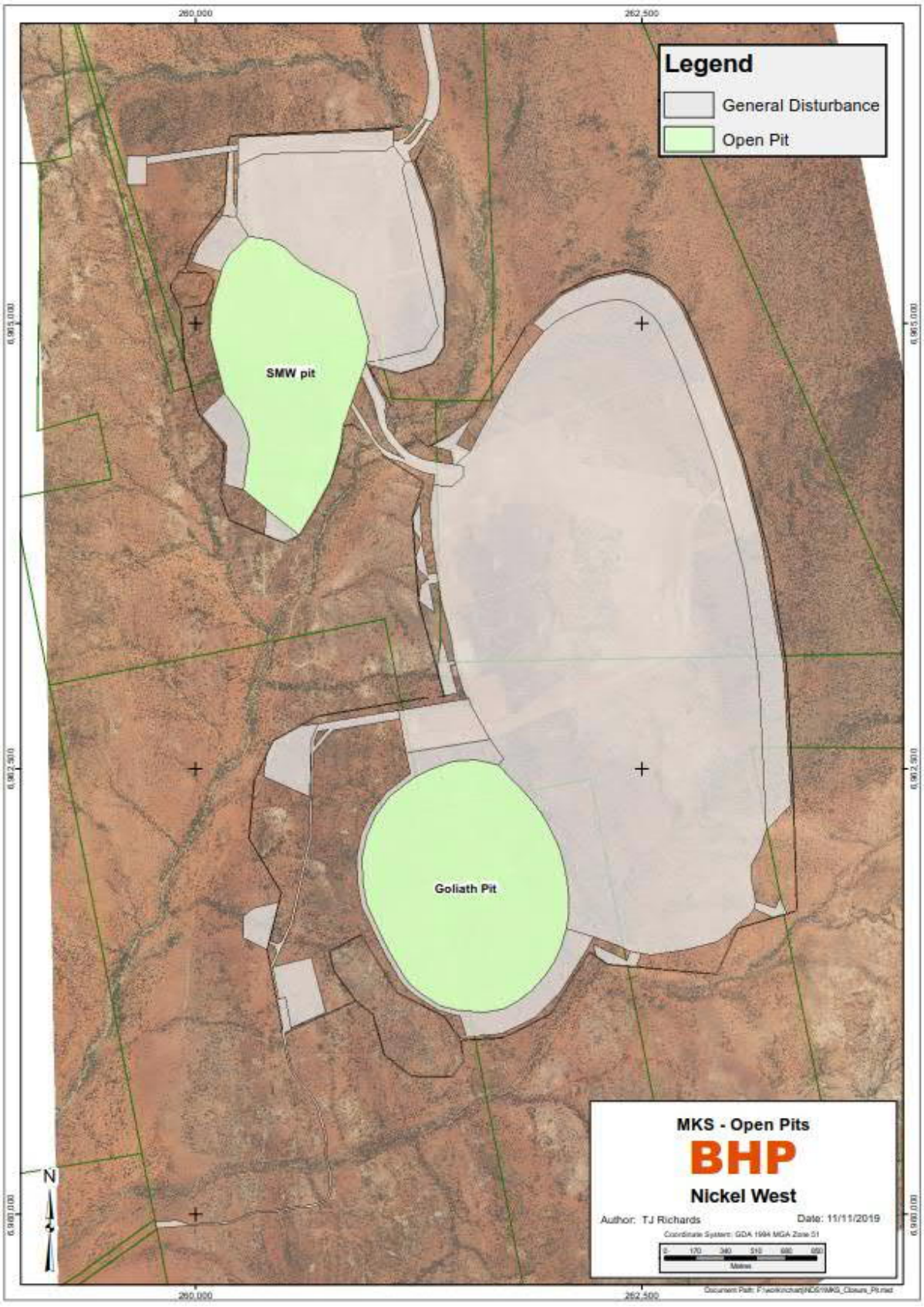

Figure 9-4: Open pits

DOMAIN: Open Pits

BoD Criteria

- For the Goliath open pit, abandonment bund positioned outside of ZoI, or as agreed with the DMIRS
- 300 year design life for water management (drainage) structures
- Diversion structures will be designed/amended to convey* run-off from a minimum critical duration 1:300 ARI rainfall event; with the actual design event to be determined on a risk basis from further studies
- Diversion structures will be designed to pass^ run-off from a critical duration PMP rainfall event

* *"Convey" a standard condition where drainage is conveyed within the diversion, below the design maximum water level*

^ *"Pass" an extreme condition where drainage, which exceeds the capacity of the diversion, is passed over engineered spillways constructed in the diversion embankment*

Selected Closure Alternative – Key Features

Safety *(controlling safety, geotechnical and erosion risks)*

- Construct pit abandonment bund with competent waste rock to prevent inadvertent vehicular access.
- Install perimeter stock fencing around the final voids (outside of the abandonment bund) to deter cattle access.
- Install bunds from waste rock across pit access ramps as a further line of defence to deter inadvertent people and stock access to the final void, and pit lake (if abandonment bunds and stock fences are breached).

ZoI *(controlling safety, geotechnical and erosion risks)*

- ZoI boundary estimated using site-specific geotechnical data and PWA methodology, with an additional 10 m buffer allowance, plus more distance (up to 5 m) for drainage control and bund construction (Figure 9-5).
- WRL material within the ZoI (including allowances) will be removed, or as otherwise agreed with DMIRS.
- 2 m high abandonment bund will be constructed outside of the ZoI (including allowances).
- Install drains, as required and where safe to do so, around crest of pit to divert water away from pit crest.

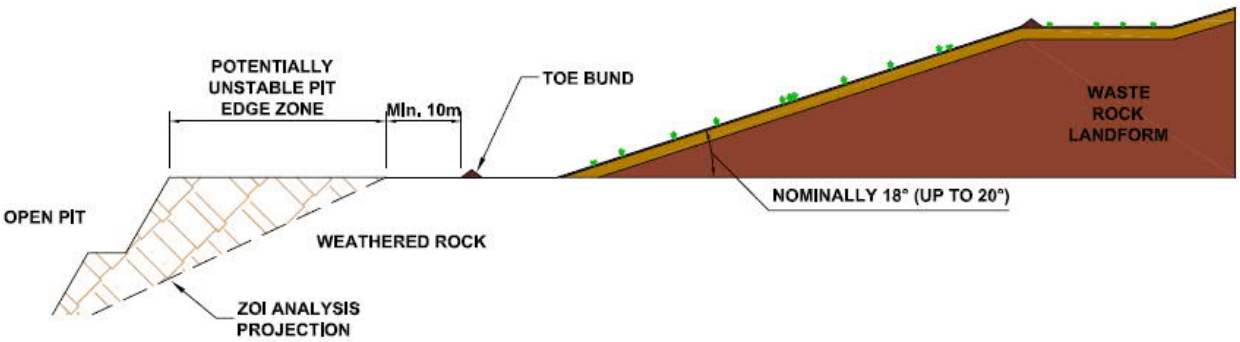

Figure 9-5: Cross-Section Showing Landform Stand-Off from ZoI Boundary

Drainage *(controlling site wide surface drainage and erosion risks)*

- Design post-mining surface water structures to minimise impacts on regional drainage and maintain downstream flows.
- All surface water diversion structures required to be located outside of the pit ZOI and abandonment bund.
- Flood protection bunds at the Six Mile Well open pit will be removed on closure.

DOMAIN: Open Pits

Revegetation of the Six Mile Well open pit backfill area if appropriate *(aiding control of dust and erosion risks, and supporting target land-use)*

- Application of up to 0.2 m thick growth medium.
- Rip on contour and sow using a 7 kg/ha native seed mix.
- Growth medium will comprise a combination of topsoil/caprock (where available).

Selected Closure Alternative – Construction Activities

Open Pit

- Pushdown slopes of WRLs up to 20º (nominally 18º), per Section 9.2.1.
- Construct 2 m high abandonment bund (consistent with DMIRS Guidelines 1997), and per design specification.
- Excavate slots across the ramp at regular intervals to permanently prevent down ramp pit access, and control run-off.
- Block off top of ramp with 2 m high earthen bund.
- Cut off and rehabilitate former access roads to the pit no longer required during closure monitoring and maintenance.
- Install stock fencing, locked gates and signage around the pit perimeter (outside of the abandonment bund).

Site Wide Drainage

- Upgrade existing surface water diversion drains per design specification.
- Construct other structures (e.g. sedimentation dams) per design specification.

Indicative Rehabilitation Materials Balance

Feature	Waste rock (m^3)	Topsoil required (m^3)[1.]	Topsoil likely to be collected (m^3)[2.]
Open Pits			
Goliath open pit	NA	NA	130,000
Six Mile Well open pit	83,000,000	186,000	167,000
Total required (domain only)	**83,000,000**	**186,000**	**297,000**

[1.] Assuming a topsoil application depth of 0.15 m

[2.] Assuming a recovery depth of 0.15 m and a handling loss of 10%

Selected Closure Alternative – Key Assumptions

- The Goliath Pit final void will become a terminal sink (pit lake) of poor water quality, with net outflows (evaporation) generally exceeding inflows (rainfall and groundwater infiltration).

Key Data Gaps – Research Priorities

No.	Data Gap	Proposed Research Activity	Indicative Timing
1	Surface water management	Develop a plan to manage surface water after closure. Concept plans exist and these will be refined once infrastructure has been developed.	During mining operations, as part of future NMK MCP updates

DOMAIN: Open Pits			
2	Revegetation of Six Mile Well open pit area.	Determine if a revegetation outcome can be achieved on the backfilled Six Mile Well open pit area.	
3	Waste rock characterisation	A pre-mining assessment of the geochemical and physical (erodibility) of waste rock has been undertaken, but these findings need to be verified on an ongoing basis during operations.	
4	Topsoil inventory and quality	Preliminary topsoil inventories have been developed for the MKS Project. However, during operations, inventories of rehabilitation materials are to be updated based on actual recovery rates. Prior to use in rehabilitated areas the quality of soil available for use is to be determined and a deployment plan developed based on these characteristics.	
5	Develop rehabilitation seed lists and plan for the collection and management of seed resources.	Develop a seed list for revegetation based on the baseline flora and vegetation assessments and investigate potential sources of seed.	

9.2.3 Selected Closure Alternative for Non-Process Infrastructure

DOMAIN: NON-PROCESS INFRASTRUCTURE	
Existing Conditions – Key Features (**Figure 9-6**)	
• Administration Offices. • Fuel Farm – non-permanent, self-bunded area with associated diversion drains. • Dewatering Facility – HDPE lined pond • Bridge Crossings (North and South) • Drainage Controls – on the western side of the WRL.	• Unsealed Roads (access roads and tracks). • Haul Road (20 km haul road to NMK) • Laydowns (Mining Contractor Laydown). • Topsoil Stockpiles.
Current Operating Status: Construction commenced	**Area Disturbed:** 296 ha **Area Rehabilitated:** 0 ha
Location: Various	**Tenements:** M36/677, M36/658, M36/399, M36/294, M36/286, M36/288, L36/110, L36/206, M53/218, M53/217, M53/166
Nominal Closure Date (based on current mining approvals): FY2032 **Expected Closure Date** (based on LoA plan, assuming future growth approvals): Earliest FY2040	

DOMAIN: NON-PROCESS INFRASTRUCTURE

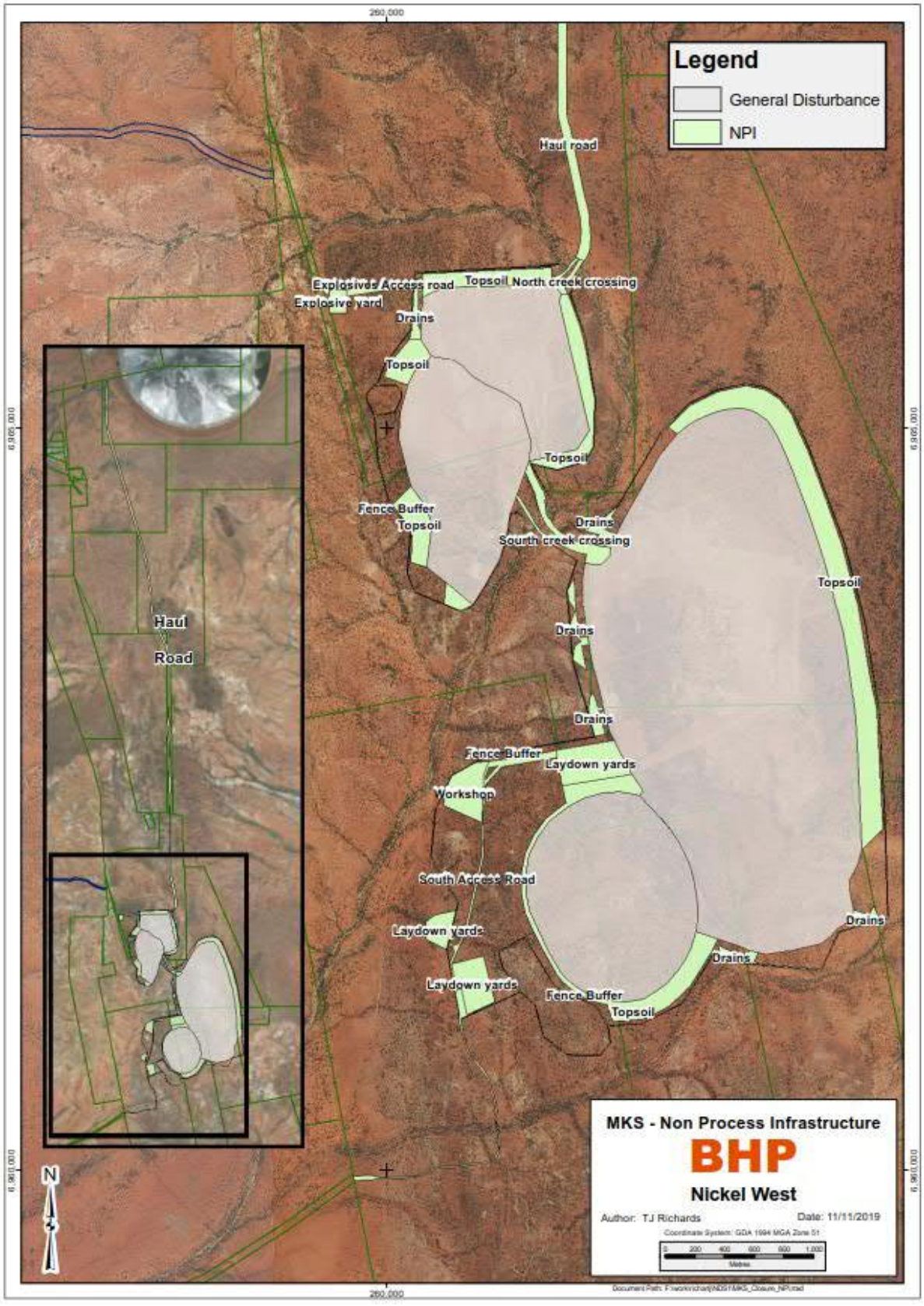

Figure 9-6: Non-Process Infrastructure

BoD Criteria

DOMAIN: NON-PROCESS INFRASTRUCTURE

- Below ground infrastructure will be removed, decommissioned or buried to nominal depth of 0.5 m bgl. In some circumstances, less clearance (i.e. <0.5 m) may be appropriate after a plant-specific risk-based assessment.
- Above ground infrastructure will be removed, unless otherwise agreed with the party who will inherit the land.
- Contaminated soil exceeding remediation criteria, agreed with a CSA and relevant regulatory authorities, will be removed up to 0.5 m bgl.

Selected Closure Alternative – Key Features

Removal and Disposal *(controlling health and safety, surface and groundwater contamination and post-mining land-use risks)*

- Demolish and remove all above-ground infrastructure, unless agreed with relevant stakeholders.
- All fill material and culverts will be removed at the bridge crossings to reinstate natural flows.
- Remove or bury below ground infrastructure to 0.5m bgl, unless specific risk assessment determines less.
- If identified, remove hazardous materials and dispose on-site within a designated hazardous waste facility.
- Backfill excavated areas with suitable inert material, sourced on-site, providing a new cover of up to 0.5 m.
- Excavate contaminated soil to a maximum 0.5 m bgl in areas where remediation criteria (agreed with the CSA and relevant regulatory authorities) is exceeded, preventing potential for direct soil contact with people and fauna. See Figure 9-7.

Revegetation *(aiding control of dust and erosion risks, and supporting target land-use)*

- Application of up to 0.2 m thick growth medium.
- Rip on contour and sow using a 7 kg/ha native seed mix.
- Growth medium will comprise topsoil if available, which will be sourced from existing on-site stockpiles.

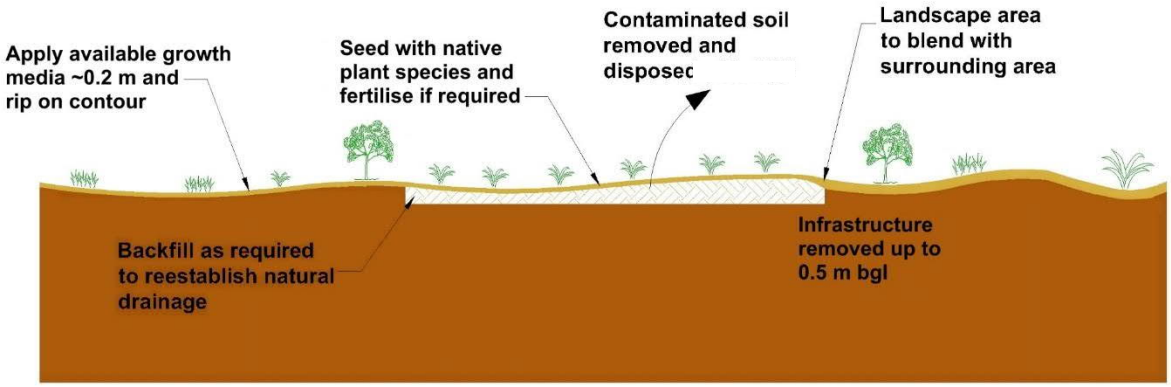

Figure 9-7: Section Illustrating Excavation /Removal and Backfill/ Rehabilitation in Processing Areas

Selected Closure Alternative – Construction Activities

1. Isolate all electrical equipment.
2. Decommission all services (e.g. electrical, water, sewer, etc) to all plant and equipment.
3. Transport all unused fuel and reagents off-site.
4. Identify, remove and dispose of (i.e. bury) all hazardous materials (including asbestos materials) at the designated hazardous waste landfill at the NMK TSF 1, or other approved disposal location (prior to the rehabilitation of that area).

DOMAIN: NON-PROCESS INFRASTRUCTURE

5. Demolish and remove all infrastructure (plant and equipment), unless otherwise agreed in writing with relevant stakeholders including the third party that will inherit and be responsible for these facilities post-relinquishment.
6. Remove scrap steel off-site for recycling, where feasible. Maximise other feasible materials recycling or re-use.
7. Dispose of non-hazardous (inert) demolition debris and non-recyclable materials to identified disposal areas on-site including the process water ponds and / or WRLs (prior to the rehabilitation of those receival areas). This includes, but is not confined to, all bitumen surfaces such as roads, car parks and hardstand areas.
8. Remove residual concrete slabs and footings up to a depth of 0.5m bgl, or cover with 0.5 m of inert rock medium.
9. All underground services will be left in-situ where they are located more than 0.5 m deep, and it is safe to do so.
10. Excavate contaminated soils up to 0.5 m bgl and transport to the TSF or alternative approved disposal facility for burial within trenches in the tailings (prior to the rehabilitation of that area).
11. Backfill excavated areas with inert waste rock and / or caprock and re-contour surface to reinstate local drainage.
12. Place up to 0.2 m of soil and / or caprock and rip and sow with a native seed mix (at rate 7 kg/ha), with fertiliser, all areas of ground disturbance.
13. Restore site drainage, as appropriate, to minimise the potential for erosion and support the post-mining land-use.
14. Install stock fencing, locked gates and signage around rehabilitated areas until revegetation has well established.

DOMAIN: NON-PROCESS INFRASTRUCTURE

Indicative Rehabilitation Materials Balance

Feature	Waste rock (m^3)	Topsoil required (m^3)[1.]	Topsoil likely to be collected (m^3)[2.]
NPI	NA	190,000	257,000
Haul and Access Roads	NA	106,000	143,000
Total	**NA**	**296,000**	**400,000**

[1.] Assuming a topsoil application depth of 0.10 m

[2.] Assuming a recovery depth of 0.15 m and a handling loss of 10%

Selected Closure Alternative – Key Assumptions

- All potentially hazardous materials (and sources) are known and accounted for.
- The demolition and removal of all plant and equipment has been assumed for now in closure planning. However, where there is residual value to the post-mining land-use and / or a third party that will inherit the management and / or ownership of the land (e.g. DPLH), then the retention of part or all of select Process Infrastructure may occur where (liability transfer) has been agreed to with those parties in writing.
- An upper limit of 6,000 mg/kg of nickel, based on NEPM Health Investigation Levels for Industrial Sites, and an excavation depth to maximum 0.5 m bgl have been assumed as the acceptable criteria for remediating contaminated soil.
- Contaminated soil below a depth of 0.5 m bgl is left in-situ under an inert cover with no potential for direct contact with persons or fauna.
- Local native vegetation is tolerant of elevated soil minerals, including nickel, and so it is not assumed if persisting within a deep root zone at >0.5 m depth as being a potential inhibitor to plant establishment and growth.
- Reprocessing of nickel contaminated soil prior to closure has not been assumed, however, this option will be investigated and pursued, if feasible, prior to or during closure works in the Process Infrastructure domain.
- Successful revegetation can be achieved on a growth media up to 0.2 m. This was investigated during the IPS, but will be subject to further studies and field trials pre-closure. If a thinner growth medium (e.g. 0.1 m) is feasible to produce the target revegetation outcomes, as confirmed from trials, then this will be adopted.
- Use of topsoil and caprock remains as the preferred growth media at closure. If no caprock was used, then an overall topsoil deficit in the order of ~1 Mm3 could be expected across total NMK rehabilitation areas.
- Future operations, including growth projects, do not materially alter the inherent closure risks associated with the Process Infrastructure domain.

Key Data Gaps – Research Priorities

No.	Data Gap	Proposed Research Activity	Indicative Timing
1	Surface water management.	A concept plan for surface water management has been developed, but this will be refined with particular emphasis on the bridge crossings.	During mining operations, as part of future NMK MCP updates
2	Topsoil inventory and quality.	Preliminary topsoil inventories have been developed for the MKS Project. However, during operations, inventories of rehabilitation materials	

DOMAIN: NON-PROCESS INFRASTRUCTURE			
		are to be updated based on actual recovery rates. Prior to use in rehabilitated areas the quality of soil available for use is to be determined and a deployment plan developed based on these characteristics.	
3	Contaminated sites.	Undertake a contaminated sites assessment and develop an appropriate management plan if required.	

9.2.4 Selected Closure Alternative for Pastoral Improvement Opportunity

In addition to implementing work programs for closure domains, execution activities to improve local pastoral conditions and land capability are also proposed as part of the suite of closure commitments for the NiW mines. The pastoral land-use assessment described in **Section 5.1.1.3** sets the context and basis for incorporating these voluntary improvement measures within the range of closure commitments for NiW mines.

The proposed pastoral improvement works (not specific to the MKS Project but which are together applicable to all NiW mines as they are located within the same collective of large pastoral leases in the region) are described in **Table 9-1.** The detailed scope for the selected pastoral works will be subject to further discussions with the DPLH as part of future updates of this MCP to ensure they are acceptable to the DPLH as a basis for tenure relinquishment at closure.

Table 9-1: Pastoral Improvement Activities for Implementation at Closure

No.	Activity	Description
1	Install 10 new stock (water) bores	Provide additional water sources within the lands surrounding the mines to increase local grazing capacity (stocking rates).
2	Install 100 km of new stock fencing	New fencing to improve stock management.
3	Fence Landforms and final void	Fencing to exclude cattle from final landforms materially altered by former mining, and that are most susceptible to active grazing impacts. Abandonment bunds and bunds at the top of pit access ramps will be installed as further lines of defence to deter cattle access to the final void.
4	Provide funding for maintenance of improvements post-relinquishment	Provide funding for the maintenance of improvements (e.g. new fencing and stock water bores) post relinquishment for a defined period of time agreed with the party to inherent the ownership and management of the land.
5	Develop a Rangelands Management Plan, with scope to be agreed between the DPLH and NiW, and implement priority improvement measures agreed with the DPLH	Develop Rangelands Management Plan, or equivalent, to assist the management of the wider rangelands and implement measures agreed with the DPLH prioritising repair of eroded landscapes and improved conservation outcomes.

The commitment to this program is intended to be an achievable, sustainable precedent for NiW. It goes beyond any legal obligations to commit to improving land capability on a wider, regional basis. It is intended to increase the feasibility of local pastoralism post-closure and leave a larger, positive legacy post-closure from NiW mining.

These pastoral (and wider land) improvement works, when implemented, are expected to deliver the following benefits:

1. ***Increased cattle stocking rates*** – Sustainably increase stocking rates in the locale by up to 500 head of cattle (note, the pre-mining stocking rate of the total mining disturbance area at NMK is ~35 head of cattle). This will be done by improving areas which are currently unviable or offer low grazing value;

2. ***Increased economic opportunities for local pastoralism*** – These measures should help increase the economic viability of local pastoral enterprises by providing additional sources of income and employment;

3. ***Protection of rehabilitated landforms and biodiversity*** – Fencing of rehabilitated mining areas, including WRLs, TSFs and the final void, will minimise the potential for inadvertent cattle access and grazing that could otherwise degrade the integrity and stability of these landforms and the target biodiversity outcomes; and

4. ***Increased biodiversity, land restoration and conservation outcomes*** – Implementation of the Rangelands Management Plan (or equivalent), with its scope and resulting commitments to be agreed to between the DPLH and NiW, and additional fencing to control stock movements should improve the condition of local landscapes aiding their ability to support a sustainable mix of post-mining land-uses.

As discussed with the DPLH during the IPS, by implementing these measures along with the other closure work programs described in **Section 9.2**, this is intended to provide the basis for DPLH (as the anticipated future land manager of the underlying pastoral estate) to consider accepting responsibility for the rehabilitated MKS site at tenement relinquishment. Discussions regarding what are the acceptable terms and conditions for the State Government to accept the residual liability of rehabilitated land post-closure at MKS will be subject to ongoing discussions and negotiations with the DPLH and the DMIRS as closure planning advances.

9.3 Closure Execution Schedule

Table 9-2 provides the closure execution (works) schedule developed to complete the main activities closure execution at NMK which will incorporate MKS. The schedule is indicative only given the preliminary stage of closure planning at this time, and will be subject to further review and refinement in future as material advances in planning are made.

Table 9-2: Indicative Closure Execution Schedule (Assuming the Nominal LoA FY2032 Closure Date)

	Activity	Start Date	Finish Date
1	Progressive Rehabilitation	Ongoing	FY2029
2	Closure Works Pre-planning*	FY2028	FY2029
3	Contractor Mobilisation*	FY2030	FY2031
4	Decommissioning, Demolition and Disposal*	FY2031	FY2033[1]
5	Land Rehabilitation	FY2032	FY2039[2]

[1] *Demolition of some facilities may be delayed until completion of land rehabilitation activities (e.g. to provide contractor housing)*
[2] *Includes an initial drying period for tailings in NMK TSF 2 before it is assumed large operating equipment can safely traverse the TSF surface.*

**This timing is integrated with the timing of the closure of NMK.*

Detailed planning for closure execution, including scheduling, will start ~5 years prior to the expected closure date. This MCP will be updated with additional information from this planning at this time and submitted to the DMIRS for their approval. During this phase, and prior to the start of major closure construction works, NiW will also submit to the DMIRS for their approval an Independent QA audit report (see **Table 6-1**) verifying that the detailed engineering design is consistent with the BoD and other relevant criteria and will achieve closure objectives.

Importantly, the closure date nominated in **Table 9-2** is for indicative purposes only. **Section 1.1** describes the basis for the expected closure date at this time being at the earliest FY2032 (subject to regulatory approvals).

9.4 Materials Balance

An inventory of the on-site rehabilitation resources (i.e. waste rock and topsoil), and the demand for these materials from the selected closure alternatives (as detailed in **Section 9.2**) is presented in **Table 9-3.**

Table 9-3: Summary of Estimated Volumes of Rehabilitation Materials at MKS

Feature	Waste rock (m^3)	Topsoil (m^3)
WRLs		
WRL (North and South)	205,000,000	648,000
ROM Pad	10,785,000	107,000
Open Pits		
Goliath open pit	NA	130,000
Six Mile Well open pit	83,000,000	167,000
NPI		
NPI	NA	190,000
Haul and Access Roads	NA	106,000
Total		
Total Required (m^3)	83,000,000	1,348,000
Total Available (m^3)	298,785,000	1,452,000
Surplus (m^3)	NA	**104,000**

The volumes provided in **Table 9-3** are indicative only and suggest there will be sufficient growth media available to ensure closure execution activities will be conducted in line with **Section 9.** These values are based on an assumption that 150mm of topsoil can be recovered during clearing activities with a loss of 10% of this recovered media during material movement activities. An application rate of 150mm has been assumed across all constructed landform surfaces (slopes and flats) with the application thickness on the NPI domain being 100mm due to the flat nature of this domain. It is noted that during future development activities additional topsoil material will be recovered where practicable. Further intensive sampling and field trials of topsoil and caprock may identify that some of this material is unsuitable as a growth medium and/or that waste rock is preferred to caprock in some circumstances. Such data will inform the update of this materials inventory in future MCP revisions.

Based on observations made to date from NiW rehabilitation trials (see **Section 7.5.1**), caprock if combined with topsoil may provide an equivalent or better growth medium to establish native vegetation on rehabilitation than if applying topsoil alone. These benefits are likely derived from the caprock properties which promote increased water retention aiding revegetation. Caprock is also expected to add additional physical competency to the growth medium, reducing erosion risk. Ultimately, pre-closure field trials and rehabilitation experience will inform the decision to use topsoil or caprock and/or a combination of both materials as the preferred growth medium on rehabilitated landforms.

10 CLOSURE MONITORING AND MAINTENANCE

10.1 Monitoring Scope

The aim of closure monitoring is to measure the performance of closure activities over time. Monitoring assesses the condition of rehabilitated landforms and other features against closure performance criteria (**Section 6.2**) to demonstrate that relevant closure objectives (**Section 5.2**) have been achieved. In doing so, closure monitoring is the final verification phase post-execution to enable relinquishment of mining tenements and residual liabilities.

Table 10-1 summarises the proposed NMK post-execution performance monitoring and reporting schedule. The monitoring activities focus on macro-indicators of rehabilitation success to verify landform fundamentals are in place.

The closure monitoring program is intended to measure the:

1. Competency of rehabilitated landforms to withstand natural regimes and forces;
2. Qualities of surface water run-off and groundwater in the locale, to demonstrate that landforms are non-polluting;
3. Revegetation success in rehabilitation areas, to demonstrate the biodiversity aspect of post-mining land uses is achieved; and
4. Pastoral improvement and land restoration outcomes, to demonstrate that the target benefits have been delivered.

Results from this monitoring will be used, along with other relevant information, to inform the QA audits conducted post-execution (**Section 6.2**). These audits will verify that closure performance criteria have been met.

Post-execution monitoring will build upon the information gained from monitoring of existing rehabilitation areas that preceded this phase during mining (pre-execution) and the construction (execution) of closure works. These monitoring results, combined with wider NiW operational experience gained from progressive rehabilitation, will continue to inform the optimisation of closure rehabilitation designs and construction.

In evaluating performance, it is important to recognise that processes like erosion, drought and fire are natural features of the landscape and that all post-mining landforms will succumb to these forces (events) over time. The task at closure is to ensure that such impacts caused to post-mining landforms are within their assimilative capacities.

Monitoring and analyses will be conducted by suitably qualified persons in accordance with relevant industry standards. Monitoring activities will also be subject to continual review prior to and post closure execution to ensure their continued relevance in providing meaningful, accurate and cost-effective verification of closure performance.

Table 10-1: Post-Closure Monitoring and Reporting Schedule

ASPECT	ACTIVITY DESCRIPTION	MONITORING YEARS POST-EXECUTION										
		1	2	3	4	5	6	7	8	9	10	11
SAFETY												
Site Safety	• Visual inspections to confirm abandonment bund integrity, condition of perimeter fencing and signage and indicators of unauthorised entry. • Verify no exposed hazardous materials (previously covered or buried) and no steep-sided erosion gullies or other features outside of fencing that pose an unacceptable safety risk to persons, stock or native fauna.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
STABILITY												
Geotechnical Stability	• Verify geotechnical performance is within predicted ranges. To be verified via field inspections and analysis of broad-scale survey data by a suitably qualified geotechnical engineer/s.	✓	✓	✓	✓	✓		✓			✓	
Erosional Stability	• Verify landform erosion is within predicted rates. This is to include erosion within and resulting from surface water structures. To be verified via field inspections and analysis of broad-scale (e.g. aerial) survey data by a suitably qualified engineer/s, with further assessment as required.	✓	✓	✓	✓	✓		✓		✓		
NON-POLLUTING												
Surface Water Quality	• Verify the quality of surface water run-off from final landforms is not adversely impacting any downstream sensitive receptors and is within the assimilative capacity of the landscape. To be verified via field inspections, and sampling / lab analysis as required.	✓	✓	✓	✓	✓		✓		✓		
Groundwater Quality	• Verify local groundwater quality is within predicted quality ranges with no adverse impact evident to (where applicable) any down-gradient sensitive receptors. To be verified via field measurement / sampling and lab analysis of groundwater quality, and (where applicable) monitoring of receptor/s.	✓	✓	✓	✓	✓		✓		✓		
LAND USE												
Biodiversity	• Monitoring of rehabilitated areas against analogue sites to compare plant cover, density and species richness (see **Table 6-1**). Monitoring will also verify established vegetation is self-sustaining. To be verified via field survey / inspections and broad-scale (e.g. aerial) survey data. This monitoring will be conducted annually post wet season for the first three years following the completion of rehabilitation activities to provide early opportunity to implement mitigation measures, as outlined in **Section 10.3**, in the instance that revegetation is	✓	✓	✓		✓					✓	

ASPECT	ACTIVITY DESCRIPTION	MONITORING YEARS POST-EXECUTION										
		1	2	3	4	5	6	7	8	9	10	11
	unsuccessful. Following the first three years of monitoring, NiW propose to reduce survey frequency. However this approach hinges on the return of initial favourable results from the initial three year period.											
Weeds and Feral Animals	• Monitoring of infestations of weeds and feral animals to inform maintenance activities. On ground weed surveys will be conducted annually post wet-season by qualified persons in the first three years following the completion of rehabilitation activities. Higher survey intensity in the initial years of vegetation establishment allows for increased opportunity to implement mitigation measures to mitigate/eradicate weed species, thus providing favourable circumstances for the establishment of native vegetation and reducing the potential for rehabilitation areas to provide a source of weed infestation to neighbouring areas of environmental sensitivity (e.g. Nature Reserve, PEC). Following the first three years of monitoring, NiW propose to reduce survey frequency. However this approach hinges on the return of favourable results from the initial three year period.	✓	✓	✓		✓					✓	
Pastoral Improvement Initiatives	• Visual inspections to confirm condition of new stock fencing and operational stock bores. • Monitoring of the wider landscape to verify the effectiveness of implemented measures arising from the Rangeland Management Plan. To be verified via field inspections and broad-scale (e.g. aerial) survey data.	✓	✓	✓	✓	✓		✓		✓		
REPORTING												
Annual Environmental Report	• Annual summary of the results from closure monitoring and maintenance activities, including assessment against closure performance criteria (**Section 6.2**).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Periodic QA Audit Reports	• QA audit reports, completed by suitably qualified person/s approved by the DMIRS, to assess cumulative monitoring results to verify compliance with closure performance criteria (**Section 6.2**), and as a basis to support the timely and effective relinquishment of mining tenements and residual liabilities.					✓					✓	
Closure Completion (Relinquishment) Report	• After the final periodic QA Audit Report has been accepted by the DMIRS as confirming closure performance criteria (**Section 6.2**) have been met, this Closure Completion Report will consolidate the collective results from all monitoring, inspections, observations and maintenance activities conducted post-execution, and the periodic											✓

ASPECT	ACTIVITY DESCRIPTION	MONITORING YEARS POST-EXECUTION										
		1	2	3	4	5	6	7	8	9	10	11
	QA audit reports submitted to the DMIRS. The purpose of this report is to provide a consolidated report to the DMIRS (and other relevant parties, including agencies that represent the future land owner / manager e.g. DPLH) that collates all relevant information to demonstrate that the closure objectives and performance criteria have been met, providing the basis for relinquishment of mining tenements and the transfer of residual liabilities (the latter subject to terms and conditions of a specific legal agreement) to the State Government or another third party.											

10.2 Monitoring Duration

The anticipated duration of monitoring after completion of all NMK closure execution activities at the MKS Project domains, is 10 years. Note, an additional year (Year 11) is shown in **Table 10-1** as the final reporting year, to submit the Closure Completion Report.

This decade of post-execution monitoring is generally consistent with Section 4.13 of the 2015 Guidelines that state *"a minimum monitoring period after closure should be provided for in the Mine Closure Plans, usually in the order of 10 years"*.

As discussed in **Section 6.2**, NiW has put significant emphasis on QA monitoring and control and independent auditing during the closure design and construction phases to identify any potential issues early when there is the greatest opportunity, during closure, to effectively address any concerns or departures from plan. This is intended to minimise the potential for issues arising during the post-execution phase helping to reduce the monitoring duration.

NiW recognises that whilst 10 years is the target post-execution monitoring period, this duration will ultimately be determined by progressive results and when regulatory authorities agree closure performance criteria has been met.

10.3 Maintenance Scope

Maintenance activities will be responsive to monitoring data. Taking an adaptive management approach, as issues are identified from data analyses, actions will be taken which include maintenance works to restore compliance to plan. Other actions may include follow up monitoring to confirm the result or to broaden the analysis to better characterise the issue and determine the most effective remedy as part of any maintenance response.

Examples of maintenance activities that could be implemented post-execution, include:

- Repairs of eroded rehabilitated landforms and surface water features;
- Restoration of failed or damaged abandonment bunds and perimeter fencing;
- Re-seed of poorly vegetated areas;
- Control of weeds in revegetated areas;
- Restoration of design capacities of surface water features; and
- Repairs of stock fencing and water bores to support the intended pastoral improvements.

These are examples only and not intended to cover the complete range of maintenance activities that could be implemented. Ultimately, the scale and timing of maintenance works will be commensurate with the issues arising and, as appropriate, will be scoped and executed in consultation with relevant stakeholders including the DMIRS.

10.4 Relinquishment Timing

Consistent with above, the relinquishment of NMK mining and pastoral tenements and any residual land liability is targeted for ~10 years after completion of all closure execution activities. The timing is after demonstration of compliance against closure performance criteria and related objectives has been shown and accepted by the DMIRS.

NiW recognises, consistent with feedback received from the DPLH and DMIRS during the IPS, that suitable funding arrangements for maintenance works associated with the rehabilitated landforms post-relinquishment will need to be agreed to with the DPLH (as the State agency likely to inherit the ownership / management of this land), or another suitable third party who seeks to assume responsibility for the tenure and/or land at this time.

This approach is considered consistent with the relevant requirements of the 2015 Guidelines, and specifically Section 2.8, which states:

"Relinquishment of a tenement requires formal acceptance from the relevant regulators that all obligations under the Mine Closure Plan associated with the tenement, including achievement of completion criteria, have been met and, where required, arrangements for future management and maintenance of the tenement have been agreed to by the subsequent owners or land managers."

At the time of this MCP, only preliminary discussions on the need for such a funding arrangement had been discussed with the DPLH (and the DMIRS), with future MCP revisions to include increasing details on the status of these negotiations

11 FINANCIAL PROVISIONING

NiW has implemented a process for annual review and update of a closure (financial) provision assigned to cover MKS closure costs. This process satisfies internal requirements of BHP that adopt industry accounting standards and best practice.

In BHP, the development of closure plans and related financial provisions are required from the outset of a mining development. Closure is also a mandatory consideration in LoA planning which is reviewed annually. These internal obligations ensure closure risks are considered throughout operational planning and decision-making.

These processes are subject to independent review and audit by the Group Risk Assessment and Assurance (RAA) team of BHP Corporate. This team assembles experienced closure and financial specialists from across BHP operations to audit the adequacy of closure plans and their related cost estimates. RAA audits are typically undertaken biannually. Audit findings are reported to the NiW Asset President and BHP Risk and Audit Committee. Information regarding BHP's closure provisions is publicly reported in the BHP Annual Reports.

In addition to above, Asset closure at NiW has been managed as a major capital project since 2015. This has imposed additional project controls and BHP governance on the development of the closure scope and cost estimate, to ensure its rigour and accuracy with sufficient contingency for risk scenarios. In 2017, the IPS produced a revised Class 4 closure cost estimate that has been adopted in the annual provision updates.

This section outlines the process, including key inputs and assumptions, used to annually review the closure cost estimate.

11.1 Cost Estimate Revision Process

By 30 June each year, the MKS closure cost estimate has been revised. This annual process involves the following main steps:

1. Review and update of the closure plan, including the general knowledge base and commitments (e.g. the total disturbance areas, as required, for closure domains, key technical assumptions, changes in statutory obligations or stakeholder expectations and the selections of preferred closure alternatives);

2. Update of the closure risk register, via workshops with key functional and operations personnel and informed by contemporary knowledge base and closure expertise;

3. Review and update of the basis of estimate used to calculate the (undiscounted) closure cost estimate in the previous year, including revision of unit rates and key assumptions for the current disturbance areas;

4. Via workshops, ranging of the uncertainties in quantities and costs for material cost items based on the updated knowledge base to inform the development of an appropriate contingency for the closure cost estimate;

5. Estimate the cash flow for expenditure over the closure execution duration based on the current LoA plan to inform development of the (discounted) closure provision to submit for internal approval and reporting;

6. Obtain internal approvals, including by NiW Asset President, of any material changes to the closure plan and/or closure provision; and

7. Update of the NiW closure provision ledger (balance sheet) and satisfy mandatory financial reporting obligations.

11.2 Cost Estimate Key Inputs

Consistent with Section 4.14 of the 2015 Guidelines, the MKS closure cost estimate is primarily comprised of:

- Pre-closure planning (study) costs, including owners team, studies / investigations, field trials and detailed engineering design work;
- Landform rehabilitation costs including land preparation, bulk earthworks (reshaping), capping of deleterious materials (e.g. tailings), application of growth medium, and revegetation;
- Contaminated sites remediation costs, including removal and disposal of contaminated soils and backfill of excavated areas with inert material;
- Decommissioning, demolition and disposal costs for all site processing and non-processing infrastructure;
- Design and execution costs for pastoral improvement initiatives to increase cattle stocking rates post-closure;
- Post-execution monitoring and maintenance costs for rehabilitation areas to assess closure performance against criteria;
- Periodic auditing and other reporting to verify that closure performance criteria and objectives have been met;
- Costs associated with making arrangements to achieve formal relinquishment and transfer to the State Government or other third party the residual tenements and/or land liability for the rehabilitated landforms;
- Costs for ongoing stakeholder engagement throughout all phases of closure from design to post-execution;
- Community transition costs;
- Closure project management costs, including owners team costs, flights and accommodation; and
- Contingency to account for uncertainties in quantities and costs for material cost items were based on a percentage of total closure costs.

Each of these primary inputs to the closure cost estimate are subject to regular review as part of the annual update process (described in **Section 11.1**) ensuring they remain accurate and reflective of contemporary knowledge.

11.3 Cost Estimate Key Assumptions

The key assumptions for the current closure cost estimate include:

- No revenue is assumed from sale of the NiW Asset, or part thereof, or its plant, equipment, materials or wastes;
- Landform areas and material quantities are based on available survey data of actual disturbance footprints and profiles. Engineering design tools (e.g. Surpac, ArcGIS) have been used to develop rehabilitation specifications and material take-offs;
- Earthmoving rehabilitation cost estimates have used the Standardised Reclamation Cost Estimator (SRCE) tool. The SRCE tool uses a first-principles cost estimation approach, relying on the Caterpillar

(CAT) handbook for works activity estimations and likely productivities for the various earthworks anticipated for closure;

- Active closure execution works will be completed in a single campaign and undertaken on a single (day) shift, twelve-hour, seven days per week basis, with equipment efficiencies (availability and utilisation) based on operational experience;
- Closure execution works will be undertaken by a third-party contractor, with project management provided by NiW and/or EPCM contractors;
- Project management services, excluding fuel, fly in / fly out (FIFO) and site accommodation costs, are based on factored industry rates;
- Allowance for FIFO and camp costs are based on actual costs incurred from NiW for the NMK site;
- Non-recyclable and hazardous wastes generated from infrastructure demolition and contaminated site remediation will be securely disposed on-site; and
- Post-closure monitoring, maintenance and management costs were estimated using a first principles approach and costed based on project team experience for the various monitoring and maintenance scopes.

12 INFORMATION MANAGEMENT

Given the inherent complexities, including decades from planning start until relinquishment of tenements and residual liabilities, the secure storage of relevant data and other information is a crucial element of effective closure planning.

At NiW, the closure planning team maintains a 'paperless' system whereby relevant documents are logged (being scanned if only a hard copy is available) in a central location on the mains computer server. This mains server is backed up daily by BHP to ensure the protection and safe storage of uploaded records. A closure document inventory is maintained according to key categories (e.g. MCPs, IPS, legal, stakeholders, technical studies).

Closure obligations derived from regulatory approvals are recorded in the NiW land management database ('Land Assist') which links operating licence, ministerial and mining tenement conditions to the site/s to which they relate. This database is maintained with new or varied approval conditions by a system administrator, and it provides alerts to the administrator who notifies key personnel in advance of when compliance items are due.

Spatial data including (but not confined to) closure domain boundaries, rehabilitation areas, topsoil and caprock stockpile locations, flora and fauna survey data and sensitive receptor locations (e.g. Wanjarri Nature Reserve, stock bores, heritage sites, etc) are maintained in the NiW Geographic Information System (GIS) database.

Landform engineering drawings are permanent records stored on the 'ProjectWise' database, maintained by NiW.

Closure documents that are stored in the NiW information management system may contain commercially sensitive or confidential information. As a control, there are restrictions on the internal personnel who can access this information (authority is required from the Manager Closure Planning) increasing the protection of the information.

Historical records, typically hard copy, from pre-2005 (i.e. the WMC era) have been archived in a records database and are physically stored in a designated facility separated from NiW offices, which can be accessed on request.

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14 ABBREVIATIONS

Abbreviation	Meaning
AEP	Annual Exceedance Probability
AER	Annual Environmental Report
AHD	Australian Height Datum
AMD	Acid Mine Drainage
ANZMEC	Australian and New Zealand Minerals and Energy Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARI	Average Recurrence Interval
bgl	Below Ground Level
BHP	Broken Hill Proprietary (Ltd)
BHPB	BHP Billiton
BoD	Basis of design
BoM	Bureau of Meteorology
CSA	Contaminated Sites Auditor accredited by WA Department of Water and Environmental Regulation
DMIRS	Department of Mines, Industry Regulation and Safety
DMP	Department of Mines and Petroleum
DBCA	Department of Biodiversity, Conservation and Attractions
DJTSI	Department of Jobs, Tourism, Science and Innovation
DMIRS	Department of Mines, Industry Regulation and Safety
DoL	Department of Lands
DoW	Department of Water
DPaW	Department of Parks and Wildlife
DPLH	Department of Planning, Lands and Heritage
DPS	Definition Phase Study
DSD	Department of State Development
DWER	Department of Water and Environmental Regulation
EFA	Ecosystem Functional Analysis
EPA	Environmental Protection Authority
FIFO	Fly-in Fly-out
FoS	Factor of Safety
FY	Fiscal Year
GIS	Graphic Information System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
ICA	Independent Closure Auditor
IFD	Intensity-Frequency-Duration
IPS	Identification Phase Study
LGA	Local Government Area
LoA	Life of Asset
MCP	Mine Closure Plan
m	Metres
m^3	Cubic Metres
mm	Millimetres
mg/kg	Milligrams per kilogram
MRF	Mining Rehabilitation Fund

Abbreviation	Meaning
MKS	Mt Keith Satellite
Mt	Million Tonnes
Mtpa	Million Tonnes per Annum
NAF	Non Acid Forming
NGO	Non-government organisation
NiW	Nickel West
NKC	Kambalda Concentrator
NKS	Kalgoorlie Smelter
NKW	Kwinana Refinery
NLN	Leinster
NMK	Mt. Keith
NOI	Notice of Intent
NRM	Natural Resource Management
OEPA	Office of Environmental Protection Authority
PAF	Potentially Acid Forming
PEC	Priority Ecological Communities
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PSEIA	Preliminary Social and Economic Impact Assessment
PWA	Planar Wedge Analysis
QA/QC	Quality Assurance/Quality Control
RA	Risk Assessment
RAA	Group Risk Assessment and Assurance
RNTBC	Registered Native Title Body Corporate
ROM	Run-of-Mine
SMART	Simple, Measurable, Achievable, Realistic and Timely
SPS	Selection Phase Study
SRCE	Standard Reclamation Cost Estimator
TEC	Threatened Ecological Communities
TransAlta	TransAlta Energy Corporation Pty Ltd
TSF	Tailings Storage Facility
UCL	Unallocated Crown Land
µS/cm	Micro Siemens Per Centimetre
WA	Western Australia
WMC	Western Mining Corporation Resources Ltd
WRL	Waste Rock Landform
YNP	Yakabindie Nickel Project
ZoI	Zone of Instability

APPENDICES

Appendix A: MKS Project Closure Obligations and Commitments Register

Appendix B: External Stakeholder Meetings Register

Appendix C: MKS Project Closure Risk Register

APPENDIX A – MKS PROJECT CLOSURE OBLIGATIONS AND COMMITMENTS REGISTER

CLOSURE OBLIGATIONS

Source	Obligation	Relevant section of the MCP
DMIRS TENEMENT CONDITIONS		
M36/422, M36/399, M36/288, M36/286, M36/285, M36/246, M36/185, M36/184, M36/183, M36/677, M36/658, M53/217, M53/218	All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion.	Refer to **Section 9** of the MCP
M36/288, M36/185, M36/184 M53/217	At the completion of operations, all buildings and structures being removed from site or demolished and buried to the satisfaction of the State Mining Engineer.	Refer to **Section 9** of the MCP
M36/288, M36/185, M36/184 M36/183 M53/217 M53/218	At the completion of operations, or progressively where possible, all access roads and other disturbed areas being covered with topsoil, deep ripped and revegetated with local native grasses, shrubs and trees to the satisfaction of the State Mining Engineer.	Refer to **Section 9** of the MCP
M36/183 M53/217	At the time of decommissioning of the tailings facility and prior to rehabilitation, a further review by a geotechnical/engineering specialist will be required to be submitted to the State Mining Engineer. This report should review the status of the structure and its contained tailings, examine and address the implications of the physical and chemical characteristics of the materials, and present and address the results of all environmental monitoring. The rehabilitation stabilisation works proposed and any on-going remedial requirements should also be addressed.	NA
L36/206	On the completion of the life of mining operations in connection with this licence the holder shall: remove all installations constructed pursuant to this licence; and on such areas cleared of natural growth by the holder or any of its agents, the holder shall plant trees and/or shrubs and/or any other plant as shall conform to the general pattern and type of growth in the area and as directed by the Environmental Officer, Department of Mines and Petroleum and properly maintain same until the Environmental Officer advises regrowth is self-supporting; unless the Minister responsible for the Mining Act 1978 orders or consents otherwise.	Refer to **Section 9** of the MCP
M53/218	On the completion of operations or progressively when possible, all waste dumps, tailings storage facilities, stockpiles or other mining related landforms	Refer to **Section 9** of the MCP

Source	Obligation	Relevant section of the MCP
DMIRS TENEMENT CONDITIONS		
	must be rehabilitated to form safe, stable, non-polluting structures which are integrated with the surrounding landscape and support self-sustaining, functional ecosystems comprising suitable, local provenance species or an alternative agreed outcome to the satisfaction of an Environmental Officer, DMIRS.	

APPENDIX B – STAKEHOLDER FEEDBACK REGISTER (2015-2019)

MKS PROJECT SPECIFIC ENGAGEMENT

Date	Document	Department	Stakeholder Comments / Issues	NiW Response
October 2017	Feedback from the EPA regarding the MKS Project Environmental Scoping Document	DBCA	Flora and vegetation in relation to rehabilitation and closure – Address potential indirect impacts persisting after mining has finished (e.g. pit lakes).	See **Section 8**
			Backfilling of pits to above the groundwater level to be considered to reduce the attraction of native fauna which may be harmed in accessing and / or contact with pit lake water or by attracting fauna or stock which may harm surrounding flora and vegetation, or predators which may prey on native fauna.	See **Sections 8** and **9.2.2**
			Prepare a Mine Closure Plan consistent with the *Guidelines for Preparing Mine Closure Plans* (DMP and EPA, 2015) which addresses the development of completion criteria to maintain the quality of groundwater and surface water, and management or removal of artificial sources (i.e. pit lakes), so that environmental values are maintained post closure.	Complete
			Changes to existing access to the reserve and amenity for members of the community and traditional owners visiting the nature reserve during construction, operation and closure should be confirmed and addressed in the ERD.	See **Section 4**
October 2017	EPA Scoping document	EPA	Prepare a Mine Closure Plan consistent with Guidelines for Preparing Mine Closure Plans (DMP and EPA, 2015), which includes methodologies and criteria to ensure progressive rehabilitation of disturbed areas to a final agreed land use.	Complete
			Model the impact of different flooding scenarios during operations and post-closure on infrastructure and final landforms.	**See Sections 7.1.2.4 and 7.1.2.5**
			Provide a description of monitoring, management, closure and rehabilitation arrangements and attach a management plan.	See **Section 10**
			Contamination of groundwater as a result of mixing with water formed in a pit lake after closure.	See **Section 7.1.2.5**
April 2019	Feedback from DMIRS in relation to the MKS MCP Version 3	DMIRS	Meeting held with DMIRS to discuss MKS MCP approval letter received (Reg ID: 76846), dated 6 February 2019 and additional email correspondence to discuss integration of NMK/MKS/Cliffs MCP's	See **Section 3.3**. Additional information in this version (5) of the MKS MCP in relation to: • Post-mining land use and closure objectives (see **Section 3.2**) • Responses to DMIRS Queries regarding 2018 MKS Mine Closure Plan (**Section 3.3**) • Closure implementation (premature closure) (see **Section 9.1**) • Financial Provisioning (see **Section 11**). Outstanding items will be incorporated in future revisions of the NMK MCP, scheduled for 2021.
July – December 2019	Mt Keith Satellite Proposal	DMIRS	Ongoing discussions regarding tenement disturbance (reference Section 1.5 of the MP) and requirement to submit revised Mining Proposal to clearly describe all current and proposed disturbances at MKS and any changes in land use since the original approval of Reg ID 76846 in February 2019.	Refer to Mining Proposal

ENGAGEMENT CONDUCTED WITH DPLH

Date	Meeting Purpose	Attendees	Stakeholder Comments / Issues	NiW Response
15/11/2016 DPLH offices Perth DPLH Update #1	Introductory meeting for NiW to provide an overview to the DPLH on the IPS works program. Seek DPLH feedback on grazing and / or other pastoral activities as a viable post-mining land use at mine sites in the Northern Goldfields.	DPLH NiW	1. In general, the DPLH raised no issues with the proposed IPS work plan and expressed appreciation for the update. 2. DPLH said that a grazing or other pastoral post-mining land use would not be the most viable and beneficial in these marginal grazing conditions, and with the investment not justified for the additional head of cattle. Consistent with the feedback received from the NiW Pastoral Sub-Lessee on 09/11/16, the DPLH was keen to see alternative measures considered to improve cattle stocking rates and general land capability within the wider pastoral leases to more substantially and sustainable increase the benefits to local pastoralism. 3. DPLH requested a presentation of the results from the contaminated sites investigations conducted as part of the IPS.	1. Noted. 2. Noted. This feedback was considered along with other stakeholder and technical inputs in the evaluations and selections of feasible post-mining land uses (Section 5.1) and pastoral improvement initiatives. 3. Completed. NiW presented to the DPLH on mine contaminated sites investigation results from IPS on 06/01/2017.
06/01/2017 DPLH offices Perth DPLH Update #2	Present the mine contaminated sites results from Stage 2 investigations and the shortlisted closure options under consideration	DPLH NiW	1. DPLH acknowledged the comprehensiveness of the work completed to date. DPLH recognised that the focus of the presentation today was non-pastoral-related and so mainly for information only for DPLH (as was requested).	1. Noted.
15/02/2017 DPLH offices Perth DPLH Update #3	Seek DPLH feedback on the draft scope of the pastoral land use and opportunity assessment.	DPLH NiW	1. The DPLH noted the scope as reasonable and did not identify any additional items they would want considered. DPLH said they would be keen to see the results to discuss what they would support in the MCPs.	1. Noted. NiW to proceed to plan on this basis. Follow up meetings were held on 31/03/2017 and 03/05/2017 to present the assessment results and implications for the MCPs.
31/03/2017 DPLH offices Perth DPLH Update #4	Update the DPLH on progress in the land use assessment	DPLH NiW	1. DPLH reconfirmed their previous feedback that pastoral/grazing is not a preferred land use by them for heavily impacted mining areas (e.g. TSFs, WRLs, voids) that have been rehabilitated in this region of the Goldfields. The DPLH were keen to see alternative approaches considered to increase overall gains to local pastoralism and to discuss the pending results from the pastoral opportunity assessment. NiW is to present these results at the next meeting. DPLH asked that NiW articulate the pros / cons in pastoral terms for any options presented.	1. Noted. Pastoral improvement options were presented at the next meeting held with the DPLH (03/05/2017), with the pros / cons, and nett gain, offered by each option discussed.
03/05/2017 DPLH offices Perth DPLH Update #5	Present findings from the land use and pastoral opportunity assessment. Obtain DPLH feedback on the selected pastoral improvement option recommended for adoption in the MCPs.	DPLH NiW	1. The DPLH agreed with the findings from the land use assessment. 2. DPLH indicated that the selected alternative was not 'gold plating' but appropriate for the circumstances. The DPLH said that by adopting the selected alternative, stocking rates in the pastoral leases could increase from the current ~1,500 head of cattle to ~2,000. 3. DPLH asked who will bear the cost of maintaining post-relinquishment the new infrastructure (bores, fencing) associated with the selected alternative. NiW confirmed that 'low maintenance costs' formed part of the criteria to evaluate different options. NiW said it estimated the maintenance costs for infrastructure proposed for the selected option would be in the order of $10K / annum and therefore low and sustainable compared with the benefits from the material increase in stocking rates in the pastoral leases. 4. The DPLH asked that NiW also consider adding 1) stock fencing for the TSFs, WRLs and final void; 2) investigate restoring areas within the pastoral leases degraded by pre-mining land uses; and 3) developing a Rangeland Management Plan for the pastoral leases (that may incorporate the land restoration measures from 2) and create pastoral and conservation Win/Win outcomes).	1. Noted. 2. Noted. 3. Completed. The selected alternative was expanded to incorporate these additional measures.
23/05/2017 NMK Mine-Site DPLH Update #6	At the request of the DPLH, NiW hosted a site visit at NMK by the Office of the Auditor General (OAG) and the DPLH to present its approach to the assessment of pastoral interests in closure planning, including its engagement approach with the DPLH to create a clearer path to relinquishment of residual liabilities post-closure.	DPLH OAG NiW	1. DPLH and OAG were both complimentary of NiW's forward planning and assessment rigour in the IPS. The DPLH and OAG also complimented NiW on its engagement approach, and for engaging early with the DPLH as a key stakeholder (as both a key advisor on pastoral matters and as the likely benefactor of the closed sites).	1. Noted.

Date	Meeting Purpose	Attendees	Stakeholder Comments / Issues	NiW Response
15/09/2017 DMIRS offices Perth DMIRS Update #10 DJTSI Update #5 DPLH Update #7	Provide a final update on the main content of the updated NMK, NLN and Cliffs MCPs, including key differences with previous MCPs. Seek final feedback from authorities on any issues or concerns requiring resolve in the MCPs.	DMIRS DJTSI DPLH NiW Note: DWER (Water Branch) were an apology; and EPA were invited but declined (stating they were "happy for DMIRS to advise" on the MCPs)	1. In general, the high quality and comprehensiveness of the work completed in the IPS was noted by the DMIRS, with no issues or concerns in the assessment findings or selected closure alternatives raised. 2. The DMIRS requested some minor additional information be included in the revised MCPs to aid their review, including: **a)** A table in each MCP that clearly identifies the key differences from the previous MCP versions; **b)** NiW to include information in the revised MCPs regarding the disposal of waste tyres; **c)** NiW to assess the interim dust risk at TSFs between the cessation of tailings disposal and the capping of the TSF surface with waste rock; and **d)** NiW to ensure the control of feral animals is addressed in the post-execution monitoring and management regime. 3. NiW to confirm with the DPLH Manager Pastoral Land (who was unable to attend the meeting), the DPLH position in relation to the acceptability of the NMK MCP proposal. This was prompted in lieu of a DPLH Officer feedback at the meeting that suggested the pastoral improvement works may not be supported in their current form by DPLH, which to NiW appeared inconsistent with previous DPLH advice. 4. The DMIRS confirmed their preference for a single electronic copy of the revised MCPs at the time of submission.	1. Noted. NiW to proceed to plan on this basis. 2. (a) Completed. See Appendix B. (b) Completed. See Section 9.2.2 of the NMK MCP. (c) Completed. See Section 9.2.2 and Appendix E of the NMK MCP. (d) Completed. See Section 10.1. 3. Completed. NiW contacted DPLH's Manager Pastoral Land, subsequent to the meeting, who confirmed that the MCP proposal (after sighting the 15/09/2015 presentation material) was acceptable to the DPLH, consistent with his previous advice to NiW. 4. Noted.
29/02/2019* DPLH Offices, Perth * Note: This engagement occurred post IPS however the outcomes are directly relevant to the MKS project.	Discuss Nickel West's historical engagement with the DPLH during the development of the updated Mine Closure Plans following completion of the IPS and Nickel West's response to each of the matters raised by the DPLH in a letter to DJTSI (DPLH ref: L00981-2014, A10393160).	DPLH NiW	1. Nickel West to document responses to the DPLH matters listed in the letter and to provide this to DPLH for comment. 2. Nickel West have provided an ongoing commitment to remain engaged with DPLH to ensure future iterations of the mine closure plans are developed collaboratively with DPLH.	1. Complete. DPLH recognised that MCPs undergo ongoing review, development and continuous improvement throughout the life of the mine. Based on the current NLN MCP, DPLH is not in a position to make any commitments regarding accepting liabilities remaining at the site post relinquishment. While there are a number of issues that need resolution, DPLH is confident the commitments from NiW to have continued engagement with DPLH will enable both parties to negotiate a way forward and find solutions that are mutually acceptable that can be included in future MCPs. 2. Ongoing. As per Section 4, NiW will continue to engage with regulatory and other interested agencies in relation to updating future iterations of the MCP.
7/11/2019* DPLH Offices, Perth	Purpose of meeting was to: 1. Provide overview of NiW operations, including pastoral setting 2. Discuss closure objectives and other key aspects of plans 3. Identify the assets expected to remain post-closure 4. Discuss the history of engagement with DPLH on closure and agree how best to maintain a stable, effective relationship over time 5. Discuss and agree on the current closure priorities working with DPLH	DPLH NiW	DPLH did not raise any issues during the meeting. It was agreed that follow-up will be required in the new year to items 3, 4 and 5 to determine agreeable outcomes.	NiW to organise a meeting with DPLH in early 2020 to further discuss items 3, 4 and 5.

APPENDIX C – MKS PROJECT CLOSURE RISK REGISTER

Domain	Risk Issue	Causes	Risk Analysis – Consequences and Likelihood (NOTE: Analysis assumes no risk controls applied)	Uncontrolled (Inherent) Risk Score	Risk Controls	Controlled (Residual) Risk Score
Landforms	Landform failure causing instability and discharge of sediment-laden run-off and/or dust impacting the surrounding environment and land use	• Water or wind erosion • Slope failure • Erodible WRL surface materials • Weathering of hard rock material • Poor slope design, and / or construction • Failed drainage structures • Earthquake/s or extreme rainfall event/s	Consequences • Unstable WRL final landform. • May result in exposure of non-competent or PAF materials. • Dust containing metals and/or asbestos containing materials could be generated. • Unacceptable rate of sediment movement beyond assimilative capacity of the surrounding areas. • Impacts to native vegetation and surface water quality in the locale may occur impacting local environmental values and pastoral land use. • Significant repair and maintenance costs. • Failure to achieve the target post-mining land use. • Potential delays in achieving tenement and land relinquishment. • These impacts are likely to result in a negative community perception of closure outcomes and potential non-compliance/s with legal obligations. Likelihood • Likely – Could easily be incurred and has generally occurred in similar projects. Benchmarking results support this.	**HIGH**	• Final WRL landform to have a 300-year design life. • WRL slopes designed to achieve a geotechnical stability FoS >1.3 under static conditions. • Batter and berm configuration of 20 m high lifts and 20 m wide berms, or alternate optimal batter-berm slope design configurations (e.g. 10 m wide berms and 10 m high lifts, or 30 m wide berms and 20 m high lifts, etc.) that achieve BoD criteria including being designed to control critical duration 1:1,000 year ARI rainfall event. • Reprofiling to a nominal 18°, and no greater than 20°. • Up to 1.5 m of durable rock armour is applied to all low stability material and PAF exposures on slopes. • All slopes will be covered with up to 0.2 m of growth medium, ripped on contour and revegetated, increasing the uptake of rainfall run-off. • WRL top surface will be water-retaining to manage rainfall from a critical duration PMP rainfall event. • Crest bunds will feature on benches and top surfaces. • Flat surfaces (benches and top) will be back sloped, designed to minimise overtopping risk. • Toe drains will be installed around perimeter of WRLs. • Funding provision for repair and maintenance in rehabilitation areas • **Section 9.2.1** includes further details of the risk control features associated with the selected alternative for the WRLs.	**LOW**
Landforms	Seepage of elevated solutes impacting sensitive groundwater receptors	• Mineral weathering and infiltration of incidental rainfall	Consequences • Metals could leach and impact groundwater quality beneath the site. • Likelihood • Possible – Could be incurred, and has occurred in a minority of similar studies or projects. Benchmarking results support that "Likelihood" should be rated either "Possible" or "Unlikely" (would be rare to occur) in lieu of the inherent groundwater conditions.	**LOW**	• Relatively low volumes of waste rock with the potential to generate acid and metalliferous drainage will be produced during mining from the MKS Project. • Mined waste rock with the potential to generate acid and metalliferous drainage will be effectively encapsulated within the WRL beyond the reach of the average seasonal wetting front – to minimize seepage risk. • Vegetated cover will enhance evapotranspiration. • Up to 1.5 m rock armouring place on exposed surfaces. • Vegetated cover will enhance evapotranspiration. • Review opportunities to process Low Grade Stockpiles prior to closure. • **Section 9.2.1** includes further details of the risk control features associated with the selected alternative for the WRLs.	**LOW**
Open Pit	WRL slope failure due to pit wall failure	• Landform toe (before or after reprofiling) overlaps with the pit ZoI • Failed drainage controls • Inflow of water into the pit resulting in an increase in pore pressure • Regional seismicity	Consequence • Uncontrolled landform slope failure and mass erosion. • Potential exposure of low competency materials and resultant erosional stability risks. • Significant repair and maintenance costs. • Failure to achieve the target post-mining land use. • Potential delays in achieving tenement and land relinquishment. Likelihood • Possible – Could be incurred, and has occurred in a minority of similar studies or projects.	**MEDIUM**	• Removal of WRL material inside the ZoI boundary (including allowances) • Implement drainage controls to divert run-off from the WRLs away from the pit crest, and upstream run-off around the pit footprint. • Reprofiling to a nominal 18°, and no greater than 20°. • Up to 1.5 m of durable rock armour is applied to all low stability material and PAF exposures on slopes. • All slopes will be covered with up to 0.2 m of growth medium, ripped on contour and revegetated, increasing the uptake of rainfall run-off.	**LOW**

Domain	Risk Issue	Causes	Risk Analysis – Consequences and Likelihood (NOTE: Analysis assumes no risk controls applied)	Uncontrolled (Inherent) Risk Score	Risk Controls	Controlled (Residual) Risk Score
					• WRL top surface will be water-retaining to manage rainfall from a critical duration PMP rainfall event. • Crest bunds will feature on benches and top surfaces. • Flat surfaces (benches and top) will be back sloped, designed to minimise overtopping risk. • Toe drains will be installed around perimeter of WRLs. • Funding provision for repair and maintenance in rehabilitation areas • **Section 9.2.2** includes further details of the risk control features associated with the selected alternative for the Open Pit.	
Open Pit	Pit lake water quality impacting sensitive environmental receptors and stock	• Poor quality water of post-mining pit lake due to geochemistry of pit walls, evapo-concentration and seepage with elevated solutes or run-off. • Stock or native wildlife drinking from pit lake • Pit lake filling and overtopping, discharging to surrounding areas and / or draining to / recharging the water table. • Higher than baseline water level in the backfilled Six Mile Well Open pit resulting in recharge to the surrounding environment.	Consequence • Potential toxicity to stock and native wildlife (mammals, birds) through ingestion and direct contact with pit lake water. • Bio-magnification of aquatic ecosystem food chain within pit lake. • Potential discharge of pit lake water to surrounding environment causing erosion and contamination of drainage lines, impacting ecological receptors and land use. Likelihood • Unlikely – Known to happen, but only rarely. Studies undertaken during the IPS indicated that once the pit lake water becomes hypersaline, fauna will not drink the water. The inherent depth of the void and its predicted function as a sink post-closure for groundwater, and the predicted low lake level due inherently reduce (in the absence of controls) risk.	**LOW**	• Construct abandonment bund and perimeter stock fencing around final void. • Construct bund across top of pit access ramps as another line of defense to deter stock (cattle) access to the pit lake. • Divert surface water away from pit to enable the pit lake to become hypersaline earlier whilst also reducing stability (erosion) risks. • Ensure stock bores in pastoral land surrounding the final void are not adversely impacted by closure activities and therefore are able to provide sufficient available water for stock (to minimise need for cattle to pursue alternate water in-pit). • **Section 9.2.2** includes further details of the risk control features associated with the selected alternative for the Open Pit.	**LOW**

Domain	Risk Issue	Causes	Risk Analysis – Consequences and Likelihood (NOTE: Analysis assumes no risk controls applied)	Uncontrolled (Inherent) Risk Score	Risk Controls	Controlled (Residual) Risk Score

Open Pit	Failure of site drainage network causing uncontrolled surface water flows	• High intensity storm events (based on flow velocity and rate)
		• Bund and drainage network criteria not designed for closure (current design for 1 in 100 years suitable for operational phase only)
		• Excessive sedimentation which fills up behind bund reducing capacity
			Consequence
			• Erosion of numerous landform features including:
			  • Toe of landforms – resulting in landform instability and release of material.
			  • Pit walls – potentially increasing instability and subsequent impacts on the WRLs.
			• Reduced downstream surface water flow to environment and pastoral receptors resulting in potential impact to surrounding land use and vegetation within the broader landscape.
			• Vegetation impacts across the broader landscape from sedimentation and elevated solutes.
			• Surface water may ultimately drain to the final void impacting stability.
			• Fill and overtopping of voids may result in release of saline and elevated solute water to the surrounding environment impacting land use and vegetation in surrounding areas.
			
			Likelihood
			• Likely – Could easily be incurred and has generally occurred in similar studies or projects. Benchmarking results support this.
				MEDIUM	• Design and construct surface water management features to achieve BoD criteria.
					• Drainage network designed to ensure that run-off, where feasible / safe to do so, is conveyed away from the open pits.
					• WRL embankments to be armoured with up to 1.5 m of waste rock.
					• Implement QA procedures during design and construction to ensure integrity of work done and its suitability for closure.
					• **Section 9.2.2** includes further details of the risk control features associated with the selected alternative for the Open Pit.
						LOW

Non-Process Infrastructure	Contaminated soil and groundwater impacting sensitive environmental receptors and land use	• Wind erosion and dust from ore stockpiles. • Erosion and exposure of any cover over buried hazardous materials	Consequences • Contamination of surface water runoff and off-site migration. • Dust containing metals and/or asbestos containing materials could be generated. • Potential impacts to stock through incidental ingestion of contaminated surface soil / dust during grazing. Likelihood • Possible – Could be incurred, and has occurred in a minority of similar studies or projects. Benchmarking results support that "Likelihood" should be rated either "Possible" or "Unlikely" (would be rare to occur) in lieu of the inherent groundwater conditions.	**LOW**	• Targeted excavation of contaminated soil up to 0.5 m bgl to remove surface contamination, reducing leachate risk, prevent direct contact with persons and fauna and mitigating contaminated surface water run-off and dust issues. • Excavated areas will be backfilled with inert waste rock / caprock preventing the potential for contact with any underlying residual metals, etc in soils below the excavation depth. • Excavated (contaminated) soil and spill and other hazardous residues from plant and equipment will be disposed of (and buried) within approved designated areas (e.g. NMK TSFs). • As a control for any residual risk, the target post-mining land use in Processing Infrastructure areas is non-pastoral (**Section 9.2.3**) and so cattle grazing will be generally discouraged, particularly in any formerly contaminated areas. • **Section 9.2.3** includes further details of the risk control features associated with the selected alternatives for the Non-Process Infrastructure domains.	**LOW**
All Domains	Safety incident to third party from accessing the site post-closure	• Unrestricted access to site (nil or failed fencing) • Absent or poor signage warning of safety hazards • Infrastructure remaining post-closure is left in an unsafe condition • Hazardous materials are left on site post-closure	Consequences • Significant injury or fatality to persons who access the site. • A serious incident is likely to result in a negative community perception. Likelihood • Unlikely – Known to happen, but only rarely. Benchmarking results support this, as incidents to third parties post-closure are known to have occurred in similar situations.	**MEDIUM**	• Access to open pits will be controlled by installing an abandonment bund and perimeter fencing around final voids and other heavily altered mining landforms (e.g. WRLs). • Former access roads to site will be rehabilitated to discourage their continued use. • Signage alerting people to the dangers and prohibiting unauthorised access will be installed around site. • All above ground and below ground infrastructure (up to 0.5 m depth) will be removed, except where it is preferred they be retained by the third party who will inherit the land post-closure. • Fill any redundant surface water ponds.	**LOW**

Domain	Risk Issue	Causes	Risk Analysis – Consequences and Likelihood (NOTE: Analysis assumes no risk controls applied)	Uncontrolled (Inherent) Risk Score	Risk Controls	Controlled (Residual) Risk Score
		• Incompatible post-mining land use exposing persons (and stock) to unsafe conditions			• Remove, and dispose of in designated areas (e.g. TSFs), all hazardous chemicals / materials. • **Section 9.2.2** includes further details of the proposed safety risk controls associated with the selected alternatives for the Open Pits.	
All Domains	Relinquishment of tenements and residual liabilities not achieved and / or within a reasonable timeframe post-closure	• Closure objectives and performance criteria not met • Closure objectives and performance criteria unrealistic, unfit for site conditions, too complex or too difficult to measure • Closure funds are exhausted when further works are still required • Late stakeholder engagement, particularly of likely party/parties to inherit land post-closure leads to unsatisfactory outcomes for future owner • Lack of early regulatory approval (and proponent and regulator adherence to thereafter) of a clearly defined and feasible path to relinquishment • Delays in regulator review or decision-making, or assessment process stalls with no feasible end • Continually changing regulatory / other stakeholder expectations during long closure planning terms • Lack of many and comparable good precedents in WA to benchmark against and provide process certainty	Consequences • Relinquishment delayed beyond reasonable time (~10 years post-execution of all closure works), or never realised at all. • Erosion of confidence in and therefore commitment to the relinquishment process, from a lack of process certainty, reducing the will and appetite of all parties to invest in it. • Excessive, protracted post-execution costs rendering relinquishment unviable. • The potential for future, productive use of the land may be stifled or delayed. • Prolonged delays may result in a negative community perception of mine closure. Likelihood • Likely – Could easily be incurred and has generally occurred in similar studies or projects. Benchmarking results support this, with a lack of comparable precedents in WA.	**HIGH**	• Setting of credible, achievable land uses and performance criteria which are fit for site conditions (and constraints). • Performance criteria with focus on landform fundamentals (e.g. surface materials, slope stability, drainage controls), recognising with these met that other features (vegetation, fauna) can be reliably expected to increase with time (and without detailed or prolonged measurement), but the same could not be expected vice versa. • Appointment of an ICA of suitable qualifications and experience to review the integrity of work completed throughout closure planning and delivery. • This MCP, and its approval by DMIRS, providing the basis for achieving relinquishment, if met. • Active engagement with regulatory authorities during the IPS to consider their feedback in the MCP. Authorities engaged included the DMIRS and DPLH, noting the DPLH was primarily engaged as the State agency most likely to inherit the management of post-mining lands at relinquishment. • Field trials proposed nearby at NMK on WRLs will confirm the effectiveness of proposed treatments reducing uncertainty in delivering at closure. • Provision in the closure cost estimate for funding limited post-execution works and a final relinquishment payment (as funds for an agreed period to provide for continued land management). • **Sections 5 and 6** include further details of the assessment and risk control features relating to relinquishment of tenements and residual liabilities.	**MEDIUM**

Domain	Risk Issue	Causes	Risk Analysis – Consequences and Likelihood (NOTE: Analysis assumes no risk controls applied)	Uncontrolled (Inherent) Risk Score	Risk Controls	Controlled (Residual) Risk Score
All Domains	Rehabilitated / closed mining areas adversely impact neighbouring areas of environmental sensitivity (adjacent Nature Reserve, the PEC, and significant flora)	• Weeds from rehabilitated/closed mining areas migrate to adjacent environmentally sensitive areas including the PEC and significant flora • Surface water and sediment run-off from rehabilitated/closed mining areas adversely impacts the adjacent environmentally sensitive areas	Consequences • Loss or reduction (in plant cover and species richness) of PEC and significant flora. • Closure performance criteria not achieved. • Target land uses not realised. • Potential delays in achieving tenement and land relinquishment. Likelihood • Likely – Could easily be incurred and has generally occurred in similar studies or projects.	**LOW**	• Regular weed inspections (**Section 10**) • Weed management and control at closure, as needed (**Section 10**). • Development of SMART completion criteria prior to closure which considers weed management and rehabilitation within a PEC. • Implement rigorous QA throughout the closure design and execution phases, including coverage of revegetation, with progressive review tollgates by regulatory authorities before proceeding from design to construction to post-execution (**Section 6.2**). • Implement pre-closure trials and studies to demonstrate proof of concept for key areas of technical or financial risk/s, including revegetation performance in local conditions, to increase the likelihood of success in closure execution (**Section 9.2**). • Appointment of an ICA of suitable qualifications and experience (acceptable to authorities) to review the integrity of work completed, including revegetation planning and execution, throughout closure planning and delivery (**Section 6.2**). • An allocation has been made in the closure cost estimate (**Section 11**) for some revegetation maintenance of rehabilitation areas post-closure. • **Section 9.2** includes further details of the revegetation risk control features associated with the selected alternatives for key domains.	**LOW**
All Domains	Land use and revegetation targets for rehabilitation areas are not achieved	• Revegetation does not establish or fails to persist from lack of rainfall, drought/s or other natural causes • Poor seed quality, unsuitable growth medium or insufficient capillary break to hostile substrate • Unrealistic target post-mining land uses • Unrealistic or inappropriate revegetation performance criteria	Consequences • Sparse or partial revegetation outcomes. • Closure performance criteria not achieved. • Target land uses not realised. • Potential delays in achieving tenement and land relinquishment. Likelihood • Likely – Could easily be incurred and has generally occurred in similar studies or projects. Benchmarking results support this, and the need for realistic post-mining land uses and closure performance criteria for post-mining landforms.	**MEDIUM**	• Application of up to 0.2 m of growth media (topsoil and/or caprock) in rehabilitation areas (assuming adequate, suitable growth medium resources). Ripping and sowing with native seed and fertiliser mix, and sowing in preferred seasons. • Setting realistic post-mining land uses and reliable, meaningful and achievable performance criteria that recognise the limitations of the local conditions (**Section 6.2**). • Implement rigorous QA throughout the closure design and execution phases, including coverage of revegetation, with progressive review tollgates by regulatory authorities before proceeding from design to construction to post-execution (**Section 6.2**). • Implement pre-closure trials and studies to demonstrate proof of concept for key areas of technical or financial risk/s, including revegetation performance in local conditions, to increase the likelihood of success in closure execution (**Section 9.2**). • Appointment of an ICA of suitable qualifications and experience (acceptable to authorities) to review the integrity of work completed, including revegetation planning and execution, throughout closure planning and delivery (**Section 6.2**). • An allocation has been made in the closure cost estimate (**Section 11**) for some revegetation maintenance of rehabilitation areas post-closure. • **Section 9.2** includes further details of the revegetation risk control features associated with the selected alternatives for key domains.	**LOW**

Domain	Risk Issue	Causes	Risk Analysis – Consequences and Likelihood (NOTE: Analysis assumes no risk controls applied)	Uncontrolled (Inherent) Risk Score	Risk Controls	Controlled (Residual) Risk Score
All Domains	Loss of revenue to Local and State Government and end of in-kind support to local community organisations resulting in a loss or disruption of services and amenities in the local community	• Loss of payment of rates to the Shire of Wiluna • Loss of royalty payments to State government • Less local employment opportunities from end of MKS mining • Loss of in-kind support to the regional community	Consequences • Reduction in Shire of Wiluna income. • Reduction in income for the State government • Level of services available from Shire to the local community decreases. • These impacts may result in a negative community perception. Likelihood • Likely – Could easily be incurred and has generally occurred in similar studies or projects. Benchmarking results support this.	MEDIUM	• Stakeholder engagement with State Government and Shire Councils to continue throughout the closure planning process to provide sufficient notice of the actual closure date, to ensure an orderly transition for any impacted services and amenities. • Implement programs, as appropriate, to minimise any potential for adverse disruption to impacted services and amenities. • During mining operations, reduce the reliance of local communities on NiW contributions by assessing their autonomy and resilience in the event of sudden or planned funding end.	LOW
All Domains	Loss of revenue to NiW contractors, suppliers and local businesses	• MKS closure results in a loss of business from NiW to third parties.	Consequences • Adverse impacts to contractors and suppliers. • These impacts may result in a negative community perception. Likelihood • Unlikely – Known to happen, but only rarely, as closure is an anticipated part of mining for these third parties. Limited dependence now of local businesses on NiW northern operations.	LOW	• Stakeholder engagement to continue throughout the closure planning process to provide sufficient notice of the actual closure date, to ensure an orderly transition for impacted contractors, suppliers and local businesses.	LOW