



ERA Energy Resources of Australia Ltd

**APPENDIX A ERA RESPONSE TO STAKEHOLDER FEEDBACK
ON THE 2018 RANGER MINE CLOSURE PLAN**

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
1	Minister Canavan (DIIS)	Approval Letter received 20 December 2018 (MS18-002530)	Paragraph 5	It is my expectation that the outcomes of the Feasibility Study will be incorporated into the 2019 MCP.	N/A	N/A	Addressed	entire document	Where practicable, the outcomes of the feasibility study have been incorporated throughout the MCP (and has been considered in the writing of the entire document to ensure consistency with the FS outcomes). An example of where this has not been possible, is the risk assessment review in Section 10. The FS risk assessment was aimed at a different business level, whilst the MCP specific assessment completed in August 2019 and incorporated was specifically 2019 MCP related.
2	Minister Canavan (DIIS)	Approval Letter received 20 December 2018 (MS18-002530)	Paragraph 5	I request that the next version of the MCP reflect information as at the time of submission, noting that areas of the current plan were based on 2016 planning.	1 Introduction, Purpose and Scope	N/A	Addressed	1 Introduction, purpose and scope	The 2019 MCP has undergone extensive update to reflect and address the latest available information. In most instances, the information updates will be from the 2018 MCP until June 30 2019. Therefore, the updated 2020 MCP will include information updates from the July 1 2019 - June 30 2020 time period. An example of an exemption to this, is the August 2019 Risk Assessment. A summary of this assessment was incorporated into the 2019 MCP.
3	Minister Canavan (DIIS)	Approval Letter received 20 December 2018 (MS18-002530)	Paragraph 6	ERA's ongoing work to further define and agree the closure criteria for Ranger is noted. I encourage ERA to continue this through the Minesite Technical Committee, with the intent of finalising closure criteria, where practically possible, within the next 18 months.	6 Development of Closure Criteria	N/A	Ongoing	8 Closure completion criteria	Closure criteria will be finalised where practically possible within the next 18 months. Certain criteria are pending completion of further studies being undertaken by both ERA and SSB. The MCP will be updated accordingly once criteria have been finalised.
4	Minister Canavan (DIIS)	Approval Letter received 20 December 2018 (MS18-002530)	Paragraph 6	I also request that ERA provide a comprehensive update on closure criteria in the next MCP. This includes an update not only on environmental and technical matters, but also the status of the cultural criteria to be agreed with traditional owners. It is incumbent on ERA to demonstrate that it has made significant progress with respect to closure criteria.	6 Development of Closure Criteria	N/A	Ongoing	8 Closure completion criteria	The MCP Section closure completion criteria has been updated with developments from the past 12 months. The development of the cultural criteria and monitoring has progressed, and is currently with the GAC and NLC. It is aimed to have these finalised cultural criteria presented within the 2020 MCP.
5	Minister Canavan (DIIS)	Approval Letter received 20 December 2018 (MS18-002530)	Paragraph 4	I request that ERA expand the best Practicable Technology chapter to make references to all BPT assessments carried out by ERA.	8 Best Practicable Technology	N/A	Addressed	9 Best practicable technology	The BPT Section of the MCP has been expanded to make reference to all BPT assessments completed and planned.
6	Minister Canavan (DIIS)	Approval Letter received 20 December 2018 (MS18-002530)	Paragraph 4	I request that ERA expand the content on cumulative impact and risk to include consideration of major contingencies for critical closure activities.	9 Risk Assessment and Management	N/A	Addressed	10 Risk Assessment and Management 11 Closure Implementation	A consideration of major contingencies for critical closure activities has been expanded and included within the Closure Implementation Section 11. The risk assessment for the MCP was recently updated, and summarised within Section 10.
7	DIIS	Letter to support Minister Approval 18 January 2019	Paragraph 5	I encourage ERA to give a clear identification of changes from the 2018 MCP so the regulators can focus their review efforts on new and amended content.	1.4.3 Review and Updates	N/A	Addressed	Mine Closure Plan Checklist Table	A MCP checklist table has been included at the beginning of the document which identifies the key updates and changes made to the 2019 MCP. Many sections have had significant updates. Two new sections have been added. The order of sections has been changed. All text has been reviewed and changes made to improve clarity and consistency. It is intended that the 2020 MCP update will follow the same layout as the 2019 MCP and so it will be easier to denote which sections have been updated.
8	DIIS	Letter to support Minister Approval 18 January 2019	Paragraph 5	It would be appropriate for the 2019 MCP to reflect, to the greatest extent possible, ERA's planned rehabilitation activities, the outcomes of its recent studies and progress addressing outstanding knowledge needs.	7 Supporting studies 10 Closure implementation	N/A	Addressed	7 Supporting studies 11 Closure implementation	All efforts have been made to incorporate, to the greatest extent possible, all planned rehabilitation activities, outcomes of recent studies, and updates on progress of KKNs. Refer to the various Sections of the MCP for detail.
9	DIIS	Letter to support Minister Approval 18 January 2019	Paragraph 7	Finalise Ranger's closure criteria, where practically possible, within the next 18 months. I encourage ERA to continue consultation on relevant criteria with a view to seeking minister's approval of some, if not all, through the 2019 MCP.	6 Development of Closure Criteria	N/A	Ongoing	8 Closure completion criteria	Closure criteria will be finalised where practically possible within the next 18 months. Certain criteria are Pending completion of further studies being undertaken by both ERA and SSB. The MCP will be updated accordingly once criteria has been finalised.
10	DIIS	Letter to support Minister Approval 18 January 2019	Paragraph 4	As per the Environmental Requirements, all aspects of the ERs must be implemented in accordance with BPT. Expansion of the BPT section of the MCP will better demonstrate the ERA is reviewing the best available rehabilitation options so the environmental outcomes are consistent with the Environmental Requirements.	8 Best Practicable Technology	N/A	Addressed	9 Best practicable technology	The BPT Section of the MCP has been expanded to make reference to all BPT assessments completed and planned.
11	DIIS	Letter to support Minister Approval 18 January 2019	Paragraph 6	Identify clearly where it is seeking approval of the implementation of major works in the 2019 MCP.	1 Introduction, Purpose and Scope Appendix 1.2	N/A	Addressed	11 Closure Implementation	Applications to be submitted to regulators for approval for specific closure activities over the next 24 months are listed in Section 11. There are no major works seeking approval via the 2019 MCP.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
12	DIIS	Letter to support Minister Approval 18 January 2019	Paragraph 8	Much of ERA's long-term planning, for example post-2026 access and the retention, storage and transfer of data described in Chapter 12 (Management of Information and Data), is dependent on governments completing the regulatory and administrative frameworks supporting Ranger's closure, close-out and stewardship.	12 Management of Information and Data	N/A	Ongoing	14 Management of Information	It is acknowledged that all longterm closure planning is dependant upon regulatory support. It is aimed to work closely with regulators in all matters, and enable a synergistic and mutually beneficial approach to achieve timely application submissions and approvals receipt.
13	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 1	The Plan must include a timeline for securing access beyond 8 January 2026 as a contingency.	N/A	N/A	Pending	N/A	Discussions are underway for securing access beyond 8 January 2026. Further details on progress of obtaining such access, and any conditions associated with the access, will be provided in MCP updates. However, a timeline for obtaining such approval cannot be provided as consultations and outcomes of such consultations cannot be pre-empted.
14	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 1	The 2019 plan must refer to and respond to each of the recommendations of the SSB in Report 568.	N/A	N/A	Addressed	N/A	All of the SSB recommendations and additional comments are incorporated into this table. This table has been prepared to provide a suitable responses to each of the SSB comments on the 2018 MCP. All efforts have been made to update the text of the MCP to reflect the responses provided within this table.
15	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 1	Plan must meet: <ul style="list-style-type: none"> closure plan guidelines accepted by the Commonwealth Minister; and requirements of clause B7 of Annex B of the Authorisation. 	N/A	N/A	Addressed	3 Closure Obligations and Commitments	The 2019 MCP has been updated to meet the WA Closure Plan Guidelines (discussed in Section 3) and the requirements of Annex B (B7) of the Ranger Authorisation. This has included the addition of two sections, and the obligations and stakeholder and consultation registers to more closely align with the guidelines.
16	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 2	Address the Key Knowledge Needs as defined in Report 658.	N/A	N/A	Addressed	7 Supporting studies Appendix 7.1 KKNs	Key Knowledge Needs represent the gaps in knowledge that must be addressed in order to fulfil the environmental requirements applicable to closure. KKNs are an iterative process, enabling formal modification, close-out and addition of KKNs in response to the progress of scientific research and mine site rehabilitation. The KKNs for which ERA is the lead are Addressed in projects outlined in Section 7 – Supporting Studies. All relevant research outcomes of the KKNs inform the rehabilitation and monitoring processes outlined in the mine closure plan. A description of the KKNs that are the responsibility of ERA, or ERA/SSB combined is provided in Appendix 7.1
17	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 1	The financial provision for closure must be included as required by B.7 of Annex B and this should include contingency planning and the impact on scheduling.	N/A	N/A	Addressed	13 Financial Provision for Closure	A new section has been included within the 2019 MCP to address financial provision for closure as per Annex B (B7) of the Ranger Authorisation.
18	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 3	We support the comments of the Supervising Scientist as Section 6.6.1 of Report 658 that there is no need for a tiered risk-based approach to water and sediment in relation to high risk contaminants. We agree with this assessment and emphasis that the closure criteria be based on numeric values in relation to Constituents of Potential Concern (COPC) such as Magnesium. We support further research and solute modelling for rare minerals or unknown COPC analytes.	6.4 Water and Sediment 6.6 Soils	N/A	Ongoing	8 Closure completion criteria 12 Closure monitoring and maintenance	Work is in progress to address these issues. Further detail is provided within the Section 8 Closure Completion Criteria and Section 12 Closure Monitoring.
19	NLC/GAC	GAC and NLC comments on the 2018 MCP table	Page 4	We agree with the SSB recommendation that where 'the use of ALARA terminology within final criteria statements results in closure criteria that are not quantifiable or measurable. It is recommended that ERA update these criteria with quantitative values that reflect ALARA.' (Section 6.6.1, Report 658). Refer to SSB Issue, Water and Sediment Theme.	6.4 Water and Sediment	N/A	Addressed	8.4.2 Management objectives and outcomes.	The MCP has been updated to clarify the use of ALARA in respect to closure criteria. ANZG (2018) supports the use of narrative statements for guideline values and water quality objectives. Several examples of narrative draft water quality objectives are used in Table 8-3, eg demonstrating what water quality is ALARA, and for aesthetic water values.
20	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 2	Appendix 1.2 RPA Mine Closure Plan Assessment Process Include outcomes of the Feasibility Study in the next iteration of the Plan. We note that ERA has committed to undertake this in the schedule outline in Appendix 1.2 of the Plan.	1 Introduction, Purpose and Scope Appendix 1.2	N/A	Addressed	11 Closure implementation	Where practicable, the outcomes of the feasibility study have been incorporated throughout the MCP (and has been considered in the writing of the entire document to ensure consistency with the FS outcomes). An example of where this has not been possible, is the risk assessment review in Section 10. The FS risk assessment was aimed at a different business level, whilst the MCP specific assessment completed in August 2019 and incorporated was specifically 2019 MCP related.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
21	NLC/GAC	ARRTC comments on the 2018 RCMP table1	Page 4	Closure monitoring and maintenance must be clearly distinguishable from rehabilitation activities, as required by B.7 of Annex B.	11 Closure Monitoring and Maintenance	N/A	Addressed	12 Closure monitoring and maintenance	Section 12 describes the 'closure monitoring and maintenance' activities for the closure and post-closure periods. The Section 11 describes the activities that are considered rehabilitation activities for closure.
22	NLC/GAC	GAC and NLC comments on the 2018 MCP table	Page 4	The Plan is to include a compliance and monitoring process for meeting the cultural closure criteria that is agreeable to the NLC and GAC. The NLC and GAC will propose a process for cultural criteria compliance monitoring for the 2019 plan. The proposed process will include direct involvement by traditional Aboriginal owners with technical support.	N/A	N/A	Ongoing	12 Closure monitoring and maintenance 8 Closure Completion Criteria	Cultural criteria compliance monitoring is still being developed with close collaboration with GAC and NLC. This is awaiting finalisation and will be included within the 2020 MCP.
23	NLC/GAC	GAC and NLC comments on the 2018 MCP	Page 3	The reference to the location for the application and measurement of ER 1.2(d) must be at the boundary of the Ranger Project Area (RPA) and not beyond it. The Mirarr traditional Aboriginal owners consider any mine-derived change to biodiversity outside of the RPA to be detrimental. The proposal in the plan at Section 6.4 and table 6-3 apply and assess closure criteria relating to ERs 1.2(d) at Magela Creek downstream of the Gulungal confluence, within Kakadu National Park and outside the RPA, is not supported by the Supervising Scientist (Section 6.6.2, report 658). The NLC and GAC do not agree to a compliance point outside of the RPA. To comply with the ERs, the compliance point for water quality closure criteria must be applied at the RPA boundary.	6 Development of Closure Criteria 6.4 Water and Sediment	N/A	Addressed	12.5.1 Surface water and sediments	Post-closure surface water compliance monitoring locations have been updated within the MCP. The existing compliance points on Magela and Gulungal Creeks (MG009 and GCLB) are proposed for assessing ecosystem protection off the RPA. The locations were altered to avoid compliance points located outside of the RPA boundary. In addition the closure criteria has also been updated (Section 8 Closure Completion Criteria).
24	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	.	Additional comment Ensure that the closure criteria for ecosystem restoration use consistent and clearly defined terminology.	6.5 Flora and Fauna	N/A	Addressed	7 Supporting studies 8 Closure completion criteria	Updating the content within the Closure Criteria and Supporting Studies sections has addressed these inconsistencies.
25	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	EXECUTIVE SUMMARY	Tailings consolidation modelling should be reviewed to provide greater certainty on consolidation time frames, the volume of contaminants which will express into the groundwater and the ability to capture and treat 99% of the expressed pore water. This should consider the heterogeneous nature of the tailings mass and the direction of solute expression	7.1 Tailings Consolidation Modelling	LAN3B — Where ,when and how much consolidation will occur on the landform?	Addressed	7.1.2 Pit 1 tailings consolidation 7.1.3 Pit 3 tailings consolidation	Consolidation model for Pit 1 was reviewed in 2012 and 2015. The 2015 model has been and is being validated with settlement plates data installed in Pit 3. It is demonstrated that the average tailing settlement predicted by the model is in close agreement with the measured average settlement, as shown in Figure 7-5 in the MCP. The consolidation model for Pit 3 was reviewed in 2019 with cone penetration test data. It was noted that the measured porewater pressure profiles within the tailings closed matched with those predicted by the consolidation model. A typical pore pressure profile comparison is given in Figure 7-7 of the MCP. It is planned to conduct the next cone penetration test, to review the Pit 3 consolidation model, in the last quarter of 2019. The impact of the expressed tailings pore water, from the revised consolidation model, will be assessed within the groundwater solute transport modelling by INTERA. Refer to Sections 7.1.2 and 7.1.3.
26	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Executive Summary	An assessment of radiation dose to humans and biota from the rehabilitated minesite is required to demonstrate that radiation closure criteria can be met. Additional information on the radiological properties of the rock to be used on the surface of the landform is required to inform the dose assessment.	7.10.1 Radiation Dose Assessment	RAD6 — Radiation dose to wildlife. RAD7 — Radiation dose to the public.	Ongoing	7.10.1 Radiation dose assessment (uranium) 7.10.3 Dose assessment: actinium 7.10.4 Gamma and radon flux survey Pit 1	ERA are currently modelling the predicted radiation doses to members of the public and wildlife from the final landform. The dose assessment will incorporate potential exposure to radiation from both the U-238 and U-235 series. See 7.10.1 & 7.10.3 for further detail. ERA will undertake gamma and radon flux surveys on the Pit 1 final landform to confirm average surface waste rock uranium content. This can be extrapolated to the extent of the final landform based on ERA's knowledge of uranium content of the stockpiles. See Section 7.10.4 for further detail.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
27	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	EXECUTIVE SUMMARY	Recommendation Further information is required on the rehabilitation of the Tailings Storage Facility, including on the extent of contamination within the walls of the dam and the long-term movement of contaminated groundwater from beneath the dam.	7.1 Tailings Consolidation Modelling	WS1 — Characterising contaminant sources on the Ranger Project Area WS2 — Predicting transport of contaminants in groundwater	Pending	7.8 Future Studies	This information will become available following submission of relevant applications to address TSF contaminated material and TSF deconstruction. A drilling program is currently being undertaken to assess the extent of contamination within the TSF walls in order to inform the appropriate strategy. Groundwater monitoring for contamination is ongoing.
28	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Executive Summary	Further work is required to provide reliable predictions of surface water contaminant concentrations post-rehabilitation; including (i) the characterisation of contaminant source terms, (ii) verifying the conceptualisation of key groundwater contaminant pathways, (iii) additional information on the interactions between surface water and groundwater, and (iv) more detailed ground and surface water modelling.	7 Supporting Studies	WS1 — Characterising contaminant sources on the Ranger Project Area. WS2 — Predicting transport of contaminants in groundwater. WS3D — Where and when does groundwater discharge to surface water? WS3G — To what extent will the interaction of contaminants between sediment and surface water affect their respective qualities?	Ongoing	7.8 Surface Water Modelling	Progress on each of these areas has been made and described in the section 7 Supporting studies. It is agreed that further work is required, and work on each of the relevant KKNs is progressing. Updates to the surface water monitoring are currently underway by Water Solutions, and is described in future studies in section 7.
29	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Executive Summary	While there is agreement with many of the proposed closure criteria presented in the RMCP, some criteria need further clarification. All closure criteria should be quantified and accompanied by a suitable monitoring program. In the absence of agreement on an acceptable level of environmental effect outside of the Ranger Project Area, closure criteria should aim to prevent any mine-derived change to biodiversity and be applied at the boundary of the Ranger Project Area.	6 Development of Closure Criteria 11 Closure Monitoring and Maintenance	N/A	Ongoing	8 Closure completion criteria 11 Closure implementation 12 Closure monitoring and maintenance	Further clarification has been provided to the closure criteria, noting that some are still under development with input from stakeholders. These have been linked to suitable monitoring programs with quantifiable outputs as far as practicable. This will be further developed in the 2020 MCP with further progression is achieved on finalisation of criteria. The approach to developing water criteria has changed to align with the national water quality management framework approach to setting water quality objectives. A stakeholder water quality working group is being reformed. This group will work on progressing water and sediment closure criteria and the associated monitoring program once criteria are agreed. This is acknowledged in the relevant sections on criteria development and monitoring. The existing compliance points on Magela and Gulungul Creeks (MG009 and GCLB) are proposed for assessing ecosystem protection off the RPA.
30	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Executive Summary	As acknowledged within the RCMP, all rehabilitation activities will need to be supported by best practicable technology (BPT) analyses.	8 Best Practicable Technology	N/A	Addressed	9 Best practicable technology	BPT is a review to select the best practical technology and, as such, will not be appropriate for activities. Operations, such as the nursery production for seedlings, will not undergo a BPT but will be run according to best practice and under the Nursery Association national guidelines. The list of planned BPTs within the Section 9 are those dictated by the Authority and any additional requirements for planned applications.
31	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 2.4 Summary of Recommendations for General Observations Page 12	In the next version of the RMCP include detailed contingency plans for all key activities. Additional Comments: A thematic report structure is recommended and may include: - A description of the proposed activity; - A schedule for undertaking the proposed activity, including clear milestones; - Supporting evidence to demonstrate that the activity will result in achievement of the relevant ERs; - An associated closure criteria that will be used to assess the success of the activity; and - Associated monitoring program(s).	6 Development of Closure Criteria 10 Closure Implementation 10.9 Contingencies 11 Closure Monitoring and Maintenance	N/A	Ongoing	11 Closure Implementation	Contingency plans have been included within the MCP for the key activities that have been approved to date. Contingency planning will form part of the BPT and risk analysis assessments for future applications of key activities (i.e. deconstruction of TSF, deconstruction of processing plant, final landform). The restructured MCP is a standardised industry structure that follows both the WA MCP guidelines and the recommendations in the Authority (Annex B7).

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
32	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 3.1 Summary of Recommendations and Additional Comments for the Risk Assessments Page 15	In the next version of the RMCP provide further information to justify the assignment and ranking of risks, risk classes and controls, and including the outcomes of an assessment of cumulative risks to the success of rehabilitation and to the protection of the offsite environment (CT1). Key Knowledge Needs to be Addressed: CT1. Additional Comments: (i) To justify the assignment and ranking of risks, risk classes, controls and control effectiveness, the risk assessment should include: • evidence to justify the likelihood and consequence rankings, including key assumptions and the level of certainty associated with the information informing this evaluation • a clear distinction between existing and proposed controls, and evidence to support control effectiveness rankings including consideration of control applicability or availability during the three closure phases (i.e. decommissioning, stabilisation and monitoring and post-closure) a clear plan to obtain additional information to inform the assessment of each risk, to improve the control effectiveness, or to identify new risks as further information is obtained, where required.	9.1 Risk Assessment Methodology Overview 9.2 Previous Risk Assessment 9.3 Closure Risk Assessment 9.3.5 Risk Identification 9.4 Risk Assessment Results	CT1 — Assessing the cumulative risks to the success of rehabilitation and the protection of the offsite environment.	Ongoing	10 Risk assessment and management	The 2019 MCP includes further information to justify the assignment and ranking of risks, risk classes and controls. It is acknowledged that further development and refinement will be achieved in the 2020 risk assessment update, and these continual improvements will be included within each MCP update. KKN CT1. Assessing the cumulative risks to the success of rehabilitation on-site and to the protection of the off-site environment / CT1A. What are the cumulative risks to the success of rehabilitation on-site and to the off site environment? is a joint responsibility for completion between ERA and SSB and is currently 90% complete. Update of results from related projects will be included within the 2020 MCP.
33	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 4.3 Summary of Recommendations for Best Practicable Technology Page 17	In the next version of the RMCP identify the full range of planned (or potentially required) BPT assessments.	8 Best Practicable Technology	N/A	Addressed	9 Best practicable technology	The BPT Section of the MCP has been expanded to make reference to all BPT assessments completed and planned.
34	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Assess the potential risks of extreme events and landscape-scale processes on landform stability.	9.3 Closure Risk Assessment	LAN2 — Landscape-scale processes and extreme events affecting landform stability.	Addressed	10 Risk assessment and management	These risks were considered under Category B, C & D of the August 2019 Risk Assessment. This also included consideration of greater than expected rainfall events, variation of predicted Pit 1 & 3 consolidation, excessive erosion impacting landform stability and the potential effects of large scale fire or cyclone events.
35	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Given the tailings deposition method is currently under review the control effectiveness rating of C1 for the tailings consolidation risk should be reconsidered.	9.5.4 Landform (TB1)	N/A	Addressed	10 Risk assessment and management	The risk assessment was updated with the risk assessment in August 2019, after the part approval was received for the Pit 3 modification to deposition application. The risk is to be managed as a class III risk.
36	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Provide the following information on the proposed flow and sediment control structures, including: • the design • a program of maintenance • the volume of bedload requiring disposal • potential impacts and planned mitigation measures that the structures are ineffective.	10.7.8 Erosion and Sediment Control	N/A	Addressed	11.16.7 Erosion and sediment control, Section 12.10	Design features are provided in Section 11. The maintenance is included within Section 12 - Monitoring and maintenance.
37	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Incorporate a summary of the standalone application for rehabilitation of the Ranger 3 Deeps exploration decline into future versions of the RMCP.	10.5.1 Contaminated Sites Closure Objectives and Risks	N/A	Addressed	11.8 Ranger 3 Deeps exploration decline	This is incorporated into the implementation Section 11.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
38	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Quantify closure criteria L7 and L8.	6.2.1.3 Erosion Characteristics Table 6.1	N/A	Addressed	7 Supporting Studies	Additional studies have been conducted and information included in Section 7 regarding the landform theme, these include an updated DEM, tailings consolidation modelling. The outcomes of these works provide further validation to the closure criteria developed for the landform. The outcomes of on-going and future studies (Section 7.10) will be considered in future reviews of the criteria.
39	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Provide information on the background bedload yields, to assess the potential impacts associated with bedload transport to Magela and Gulungul creeks (should this occur).	7.3 Trial Landform	LAN3E — How much suspended sediment will be transported from the rehabilitated site by surface water	Ongoing	7 Supporting studies Appendix 7.1 KKNs	This KKN is planned to be completed in 2020, and the results will be incorporated into the next MCP update, and will supply the details requested in the comment.
40	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Use synthetic rainfall datasets in flood modelling	7.5.2 Landform Flood Study	N/A	Ongoing	7.5.2 Landform Flood Study	The LEM (landform evolution model) does utilise a synthetic rainfall data set for 10,000 years, and also considers climate change scenarios
41	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment The probable worst-case scenario should be retained in the closure criteria and clearly defined, in consultation with the Supervising Scientist.	6.2.1.2 Isolation of Tailings Table 6-1	N/A	Ongoing	8 Closure completion criteria	Finalisation of the completion criteria is aimed for the inclusion into the 2020 MCP, and this will done in consultation with the SSB.
42	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Use the BACIP method described by Moliere and Evans (2010) to assess suspended sediment loads in closure criteria L11.	6.2.1.3 Erosion Characteristics Table 6.1	LAN3E — How much suspended sediment will be transported from the rehabilitated site by surface water?	Ongoing	8.2 Landform 12.4 Landform monitoring	The BACIP method is utilised for TSS as described in Section 8.2 and Section 12.4. It is intended that all methodologies will be assessed and selected accordingly for TSS, and other monitoring requirements, and will be specified within the MCP monitoring section as decisions are finalised.
43	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment Provide a detailed backfill plan for Pit 3 including: • types and volumes of contaminated material that will require disposal (e.g. hydrocarbons, soil, waste from HDS plant) • plans for material segregation (if required) • disposal methods to be used (e.g. mixing with waste rock, layering, cells, etc.) • schedule for plant demolition and disposal.	10.3 Pit 3 Closure	N/A	Ongoing	N/A	This information will be received in the Pit 3 backfill application due to be submitted in October 2020, and will therefore appear in the 2021 MCP update.
44	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 30	Additional comment The final landform design should be revised to avoid gully formation over tailings for both Pit 1 and Pit 3.	9.5.4 Landform (TB1)	LAN3A — What is the optimal landform shape and surface (e.g. riplines, substrate characteristics) that will minimise erosion?	Addressed	Section 7 & 11	The landform model - FLv6.2 - was provided to SSB at the completion of FS study.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
45	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 31	Additional comment Provide further details on monitoring method to demonstrate how relevant information will be collected to assess landform performance over time, including: • how gully formation will be measured on the revegetated landform • details of monitoring data required for Ongoing validation of erosion modelling • water quality monitoring methods to be used for assessing landform erosion (e.g. turbidity as a surrogate for suspended sediment in surface water).	11.2 Landform Monitoring	LAN4 — Development of remote sensing methods for monitoring erosion. LAN5 — Development of water quality monitoring methods for assessing landform erosion.	Pending	7 Supporting studies Appendix 7.1 KKNs	Suspended sediment/turbidity will be monitored on the constructed Pit 1 landform to assist in the calibration/validation of future model predictions of suspended sediment transport. Thus the KKN LAN3E. <i>How much suspended sediment will be transported from the rehabilitated site (including land application areas) by surface water?</i> will be finalised in 2020 to provide the requested information to be included in the MCP update when available. LAN 4 & 5 are SSB KKNs.
46	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 28	Recommendation Before commencing construction of the final landform (other than over Pit 1) ERA must address the listed KKNs, and demonstrate that the final landform design minimises erosion to the greatest extent possible (LAN3), considering the baseline erosion and sediment transport characteristics (LAN1) and in consideration of landscape-scale process and extreme events (LAN2). Key Knowledge Needs to be Addressed: LAN1, LAN2 and LAN3.	7.5 Landform Design and Studies 8 Best Practice Technologies 10.7.8 Erosion and Sediment Control	LAN1 — Baseline erosion and sediment transport characteristics in areas surrounding the Ranger Project Area (KKN Addressed). LAN2 — Landscape-scale processes and extreme events affecting landform stability. LAN3 — Erosion of the rehabilitated landform (excluding LAN3.A and LAN3.D).	Ongoing	7 Supporting studies Appendix 7.1 KKNs	It is intended that the listed KKNs will be addressed through ongoing studies prior to the construction of the final landform. LAN1 has been removed from the KKNs. Applications to undertake these activities are planned to be submitted in Q3 2022 (Final Landform) and will provide additional information which will be incorporated into following MCP updates.
47	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 28	Additional Comment (ii) Update the RMCP to reflect that tailings deposition into Pit 3 has generally been onto either a small beach or down the pit wall and directly into the water.	10.3.2 Pit 3 Backfill and Closure Design	N/A	Addressed	7.2 Tailings properties 11.3.1.1 Tailings deposition	The 2019 MCP has incorporated the details of the approved Pit 3 Tailings Deposition Application (July 2019) which covers this topic in detail.
48	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 28	Recommendation In accordance with the previous recommendations of the Supervising Scientist; before the placement of the grade 1s waste rock cap on Pit 1 ERA must address the listed KKNs, and provide a digital elevation model (DEM) of the final landform design that has been demonstrated, using erosion modelling, to minimise erosion to the greatest extent possible (LAN3.A and LAN3.D). Key Knowledge Needs to be Addressed: LAN3.A and LAN3.D.	7.5 Landform Design and Studies 8 Best Practice Technologies 10.7.8 Erosion and Sediment Control	LAN3A — What is the optimal landform shape and surface (e.g. ripples, substrate characteristics) that will minimise erosion? LAN3D — What are erosion characteristics of the final landform under a range of modelling scenarios (e.g. location, extent, time frame, groundwater expression and effectiveness of mitigations)?	Ongoing	7.5 Landform design and performance	Information on PSD and PAW modelling, plant rooting depth, sub-surface consolidated layer, and more has been added. Consistent with information previously provided as part of 2019 App. 3 to Pit 1 Application - Ref: Lu P, Meek I, Skinner R. 2019. Supporting Information on Revegetation Growth Substrates at Ranger for Pit 1 Application. Energy Resources of Australia Ltd report, Feb. 2019
49	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 28	Additional Comment (i) Provide additional information, including: • detailed construction plans and timelines • engineering designs, construction tolerances and a digital elevation model • material movement and balances (including reference to consolidation models) • assumed availability rates/capacities of key equipment • mapped locations of material grades • quality control procedures to be employed during construction • a schedule showing material movements as the landform is constructed.	10.7.2 Final Landform Construction	N/A	Pending	N/A	This additional information will be provided within the MTC application (final landform and revegetation) due for submission in 2022.
50	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Improve the scheduling for disposal of contaminated material into the pits, including the 4.6 million tonnes of mineralised material from the northern wall of the Tailing Storage Facility that will be placed in Pit 3 in 2025, and the other mineralised material that will be placed in the lower sections of the pits. It should be clarified how this material will be placed below the low-grade 2 rock cap.	10.7.4 Tailings Dam Area 10.7.6 Pit 3 Area	N/A	Ongoing	11 Closure Implementation	Current implementation plans are summarised within the implementation Section 11. The TSF deconstruction will be subject to an application proposed to be submitted in October 2021. Detailed quantities and scheduling will be included within this application.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
51	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional Comment (iii) Clarify if <i>finished surface level</i> is the surface of the waste rock landform, and therefore much of the infrastructure would remain <i>in situ</i> and simply be buried.	10.6.2 Demolition methods	N/A	Completed	11 Closure Implementation	The underground services/buried items will be demolished (which involves breaking up infrastructure) and relocated to be buried on site at 8m level deep below the final landform (Pit 3).
52	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Include discussion on the placement of contaminated material from RP2 and RP3 in the Exploration Decline, as indicated in Figure 10-14.	10.7.8 Erosion and Sediment Control Figure 10-14	N/A	Addressed	11 Closure Implementation	This action is no longer proposed. All contaminated material will be directed to Pit 3. No contaminated material is planned to be transferred to R3D. The figure has been updated.
53	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Develop a water balance for Pit 1 to support the statement that > 99% of the process water expressed by consolidation will be recovered for treatment by January 2026.	7.1.2 Pit 1 Tailings Consolidation	N/A	Addressed	7.1.2 Pit 1 tailings consolidation	Solute and volume balance studies conducted on Pit 1 from January 2017 to December 2018 indicate that all tailings consolidation flux is being recovered by the decant structures. Recovery of all the tailings consolidation flux is expected to continue while Pit 1 decant structures are operated. Refer to Section 7.1.2.
54	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Information on the new tailings deposition strategy in Pit 3 should be included in future versions of the RMCP, including the consolidation time frames, and any differential settlement predicted using the updated Pit 3 consolidation model.	7.1.3 Pit 3 Tailings Consolidation	N/A	Addressed	7.1.3 Pit 3 tailings consolidation 11.3.2 Schedule of progressive tasks	Information is included within updated Section 7.1.3.
55	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Assess the adequacy of existing monitoring data from historical revegetation trials and analogue sites to inform recommendation and future work. If existing data are insufficient or inappropriate, further data should be collected from the trial landform or relevant reference sites.	10.8.3 Revegetation Strategy and Implementation Appendix 10.2 Revegetation Strategy	ESR1 — Determining the characteristics of terrestrial vegetation in the areas surrounding the mine site.	Addressed	7.3 Trial landform 7.4 Environmental protection	Assessment has been made of the existing monitoring data of revegetation trials on the trial landform (historic and current) and for reference sites taking into consideration the suite of species and growth medium properties. Knowledge gaps identified were used to inform further trials. Monitoring of the trial landform and Pit 1 will provide confidence in the revegetation program.
56	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Further detail is required to support the deliberate introduction of weeds on the final landform.	10.7.8 Erosion and Sediment Control	N/A	Addressed	N/A	The MCP has been updated to confirm that there will be no introduction of exotic species into the RPA. Occurrence of weed species will be actively managed during closure. The use of the term "weed" was in error and has been removed.
57	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment It should be acknowledged that landform erosion modelling results are dependent on the specific scenario modelled, and are indicative only (e.g. not to be referenced as providing precise locations or depths of potential gully formation on the final landform).	7.5 Landform Design and Performance	LAN3 — Predicting erosion of the rehabilitated landform	Addressed	N/A	This was noted on page 7-78 of the 2018 MCP: "Supervising Scientist have advised ERA that landform erosion modelling results are indicative only and should not be used to provide precise locations or depths of potential gully erosion, as such this information has only been used to guide the development of the final landform. However, as outlined in Chapter 6, Section 6.2.1.3, tailings will be below the natural landscape, and are not expected to be exposed (Supervising Scientist, 2017a)."
58	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.1 0 Summary of Recommendations and Additional Comments for the Landform Page 29	Additional comment Provide details on how predicted maximum final landform slopes were calculated.	7.5 Landform Design and Performance	LAN3A — What is the optimal landform shape and surface (e.g. riplines, substrate characteristics) that will minimise erosion?	Addressed	Section 7	The methodology of calculation of maximum landform slopes was via a GIS package to extract the long section from the provided final landform topography (which was generated from the landscape evolution modelling). The slopes can also be calculated from a contour plan of the same final topography.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
59	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.3.2 Construction Material Page 20	Additional comment It is noted that the material movement areas shown in Figure 10-31 do not include the area to the north-west of the Tailings Storage Facility surrounding the trial landform and RP1 as shown in Figure 10-36. This should be clarified.	10.7 Final Landform Figure 10-31 Figure 10-36	N/A	Addressed	N/A	Figure 10.31 in the 2018 MCP illustrated reclamation areas, which are described in the 2019 MCP as closure domains. Notwithstanding the change in terminology, and update of figures, the 2018 Figure 10.31 demonstrates the four areas that will require cut/fill to construct the final landform (with volumes summarised in 2018 Table 10-12). However, the 2018 Figure 10-36 covers the categories of backfill techniques, with the TSF considered Category B. The two figures are not meant to be an exact match. The TLF and the RP! will not be covered with waste.
60	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 5.7.2 Exploration Decline Page 23	Additional comment A standalone application for the rehabilitation of the Ranger 3 Deeps exploration decline was submitted for assessment in July 2018 and is currently under review. This application does not propose the complete backfill of the decline. The information contained within the application should be incorporated into (or appended to) future versions of the RMCP. The exploration decline should be included in Table 10-1: Current schedule of closure tasks. Figure 10-14: 2025 closure summary shows contaminated material being placed in the exploration decline. This is not currently reflected in the standalone application or other sections of the RMCP. This needs to be clarified.	10 Closure Implementation Table 10-1 Figure 10-14	N/A	Addressed	11.8 Ranger 3 Deeps exploration decline	Information within the 2019 MCP has been updated to reflect that within the Ranger 3 Deeps approval. No contaminated material will be disposed of within the decline.
61	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.6.1 Page 46	It is incorrectly asserted that the ERs require an effect to be regional in nature to be considered detrimental. ER1.2(d) states that to be considered detrimental a change must be in excess of that observed naturally in the region (i.e. outside the range of natural variability), not that changes must be regional in nature.	6.4 Water and Sediment	N/A	Addressed	8.4.2 Management objectives and outcomes	ER1.2d states: "...the company must ensure that operations at Ranger (Mine) do not result in: change to biodiversity or impairment of ecosystem health outside of the Ranger Project Area. Such change is to be different and detrimental from that expected from natural biophysical or biological processes operating in the Alligator Rivers Region." So it is considered there is no conflict in ERA's assumptions. ERA does consider the scale of change as an important issue, and this is recognised in the project on ecosystem vulnerability. The two outcomes for the water and sediment management objective are stated as: First outcome - mine derived sedimentation or analytes from surface or ground waters discharged to surface waters off the RPA do not cause detrimental impact to the ecosystem health of the Alligators River Region, and that there will be no detrimental environmental impact off the RPA from tailings contaminants for at least 10,000 years.
62	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 50	Additional comment Additional information should be provided to support the site wide water balance model, including: • detailed plans and timelines for all activities related to water management, storage and treatment and brine disposal • availability, rates, capacities of key plant and equipment (e.g. water treatment plants, brine injection bores, etc.) • updated modelling assumptions and modelling uncertainty analyses.	3.2.9.6 Site Water Model 10.2 Water Treatment 10.9.1 Water Treatment	N/A	Ongoing	2.2.9.7 Site water model 11.5 Water treatment	Additional information regarding the Water Balance Model are routinely provided to stakeholders at MTC meetings/stakeholder forums. Detailed information is now available within the Ranger Water Management Plan. The scope of the MCP is to describe the broader process by which the model is maintained and validated. The predominant uncertainty with respect to the water model is rainfall variance. This is captured in model outputs which show the range of possible outcomes consequence of input of rainfall datasets representing increments from the range of historical data. Whilst additional uncertainty analysis is employed for example to compare alternate strategies and understand contingency requirements, such analysis is outside of the scope for the MCP. An Integrated Water Treatment Strategy application will be submitted in January 2020 and this information will be provided in updated MCPs.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
63	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 50	Additional comment A schedule should also be included for water treatment, indicating the planned options for process water treatment and demonstrating that these options will be sufficient to treat the predicted process water volumes.	10.2 Water Treatment	N/A	Addressed	2.2.9.7 Site water model 11.5 Water treatment	A schedule for water treatment has been included. Three active process water treatment routes are planned: • Treatment using the existing Brine Concentrator. The Brine Concentrator will be the principal path for active process water treatment, with its feed water stream drawn from the bulk process water inventory – which is typically the highest. A feasibility study is underway to incrementally expand the distillate production capacity of the Brine Concentrator through an upgrade of the vapour recompression fan in unit three. Under the median forecast, the Brine Concentrator will be decommissioned in June 2025 – after all sources of process water have ceased. • Treatment using the HDS plant. This plant will treat an intermediate range of process water in terms of salt concentration, to minimise treatment cost and maximise plant throughput. HDS plant operation is planned from 2019 through to the end of 2021. • Treatment using reverse osmosis technology, of similar nature to (and perhaps using) the Brine Squeezer. This treatment process will target sources of process water with lower salt concentration, and is expected to run through to the middle of 2025. The contributions of the three active process water treatment routes are shown in Figure 11-29.
64	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 50	Additional comment Include a detailed schedule that outlines the predicted process water volume and intended storage locations over time.	10.2 Water Treatment	N/A	Addressed	2.2.9.7 Site water model Figure 2-9 11.5 Water treatment	Forecasts of process water volumes over time are provided in Figure 2-10. In the operational phase ahead of closure, free process water will be stored between the TSF and Pit 3, with the balance between the two storages varied to suit the operational requirements of the dredge and Pit 3 deposition and process water return infrastructure. Additional detail to describe the schedule is provided in Section 11.
65	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 50	Recommendation Before commencing backfill of Pit 3 or construction of the final landform ERA must address the listed KKNs, and demonstrate that the environment surrounding the minesite (WS4) will not be impacted (WS5, WS6, WS7, WS8, WS9 and WS10) by contaminants arising from the rehabilitated minesite (WS1, WS2 and WS3). Key Knowledge Needs to be addressed included WS1 - WS10.	7.4.2 Contamination Investigations 7.4.3.1 Water and Sediment Baseline 7.6 Ecosystem Establishment 7.7 Groundwater Modelling 7.8 Surface Water Modelling 7.9 Brine Management	WS1 — Characterising contaminant sources on the Ranger Project Area. WS2 — Predicting transport of contaminants in groundwater. WS3 — Predicting transport of contaminants in surface water. WS4 — Characterising baseline aquatic biodiversity and ecosystem health (KKN Addressed). WS5 — Determining the impact of contaminated sediments on aquatic biodiversity and ecosystem health. WS6 — Determining the impact of nutrients on aquatic biodiversity and ecosystem health. WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Ongoing	7 Supporting studies Appendix 7.1 KKNs	It is intended that the listed KKNs will be addressed through ongoing studies prior to the backfilling of Pit 3 and construction of the final landform. Several KKNs require input from SSB. Applications to undertake these activities are planned to be submitted in Q4 2020 (Pit 3 Backfill) and Q3 2022 (Final Landform) and will provide additional information. Refer to Appendix 7.1 for description of studies to address these KKNs.
66	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 50	Additional comment Demonstrate that the Tailings Storage Facility is able to be used as a process water storage post-2020, and provide relevant contingencies options for the event the Tailings Storage Facility is determined to be unsuitable for water storage.	10.2 Water Treatment 10.9.1 Water Treatment	N/A	Pending	N/A	Further studies are required to demonstrate that the TSF will be suitable for use as a water storage facility. Relevant contingency options will be considered in the event that the studies demonstrate that the TSF is unsuitable for water storage.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
67	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment Provide further detail on timeframes that sediment control infrastructure is expected to remain in place (i.e. criteria for removal) and any ongoing maintenance requirements (e.g. sediment removal and disposal locations).	10.7.8 Erosion and Sediment Control	N/A	Pending	11.2.2 Schedule of progressive tasks	Further planning is required to assess the option to retain sediment control infrastructure as permanent. This involves assessing the impacts of re-disturbing areas for removal. The Water Solutions (2017) Preliminary Flood Modelling and Hydraulic Design report suggests that "once the monitoring program identifies that the vegetation on the site has been well established and that erosion processes have been reduced to acceptable levels, the temporary erosion protection measures may be decommissioned...Attempts to remove these erosion limitation features would likely re-disturb the environment, which is undesirable. It is recommended that these features remain in place."
68	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment Further details the Pit 3 brine injection system should be provided in the RMCP, including: <ul style="list-style-type: none"> the expected lifespan of brine injection bores and factors that may affect this time frames and potential issues associated with the construction of additional brine injection bores, should they be required any other brine disposal methods that might be used in the case that the brine injection system fails (i.e. failure of all bores, or the underbed drain extraction system). 	7.9 Brine Management	N/A	Addressed	11.3.3.1 Brine injection 11.5 Water treatment	Five brine injection bores have been installed to enable brine concentrator brine to be injected into the underfill layer in the base of Pit 3. It is not possible to definitively estimate the lifespan of injection wells as the system has yet to be operated since the substantial improvement in brine concentrator utilisation from 2017 to the present. However the four remaining wells are thought to be adequate. Noting the critical role of this system, contingency wells have been included in the budget for rehabilitation. A trial has been conducted for the necessary directional drilling method required for installation of such wells from the exterior of Pit 3. There is sufficient time to construct these contingency wells as the existing wells are intended to be used sequentially. Alternate brine disposal methods have been considered at a concept level, as have a range of options for restoration of the underdrain bore system. These will be further developed in the very unlikely circumstances require.
69	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment It is critical that ERA fulfil its commitment to continue water treatment for as long as necessary to treat and dispose of all process water (including expressed tailings pore water) onsite. This commitment is fully supported by the Supervising Scientist, along with the intention to increase the capacity of process water treatment over time, which will be necessary to achieve treatment of all process water by 2025. This commitment should be included as a contingency in section 10.9.1.	10.9.1 Water Treatment	N/A	Ongoing	11.5 Water treatment 11.5.3 Contingency plans	ERA is committed to continuing to treat water until such time as inventories are eliminated. The current plan facilitates this outcome within the legislated timeframe for average rainfall scenarios. However ERA continues to investigate opportunities to increase process water treatment capacity, whilst monitoring progress of existing facilities and inventories as influenced by external factors (e.g. rainfall). Decisions to implement such initiatives will be dependent on ongoing assessment of business case, risk and contingency and BPT analysis as may be appropriate for identified technologies.
70	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment Clarify why tailings pore water expression during deposition has increased by more than 30% in consolidation modelling results between 2014 and 2016.	7.1 Tailings Consolidation Modelling Table 7-1	N/A	Addressed	7.1.3 Pit 3 tailings consolidation	Further explanation has been included within Section 7.1.3.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
71	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment The RMCP should detail future hydrogeological work that will be undertaken to refine the Ranger Conceptual Model, and explain how this will further inform rehabilitation planning, particularly with regard to: <ul style="list-style-type: none"> • further refinement and characterisation of key hydrogeological units, aquifers and groundwater flows in high-risk areas for contaminant transport (around Pit1, Pit 3 and the Tailings Storage Facility) • further information on surface water/groundwater interactions • improved characterisation of existing contaminated groundwater (e.g. under the Tailings Storage Facility) and contaminated sites (e.g. LAAs). 	7.10.3 Conceptual Site Modelling	WS1 — Characterising contaminant sources on the Ranger Project Area. WS2 — Predicting transport of contaminants in groundwater. WS3D — Where and when does groundwater discharge to surface water? WS3E — What factors are likely to be present that influence contaminant transport between groundwater and surface water?	Addressed	7.4.2 Contamination investigation 7.7 Groundwater modelling 12.5.2 Groundwater	Work has been undertaken by ERA and INTERA in the last 12 months to update the Ranger Conceptual Model. Groundwater monitoring, specifically to support closure criteria, is detailed within Section 12.5.2. This monitoring has been designed to support further refinement of key hydrogeological units, and groundwater / surface water interaction via collection of groundwater quality and high resolution water level data via dataloggers. All monitoring data collected for both operational requirements and specific studies is used to support ongoing updates to the Ranger Conceptual Model. The updated Ranger Conceptual Model (INTERA 2019) details all refinements made to the characterisation of all hydrogeological units within the model domain, which includes all high risk areas. Project planning and scoping is underway to support future studies specifically to quantify the contamination below the TSF and Processing Area. These studies will support the development of the remediation plan. The TSF contaminated materials application will specifically address contamination as a result of operation of the TSF. KKN WS2 and WS3 are to address surface water and groundwater interactions.
72	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment Further work is required to quantify contaminant source terms and factors that influence their mobilisation on a whole-of-site basis, including existing groundwater contamination and contaminants predicted to arise from the waste rock landform, the billabongs and contaminated soils and sediments disturbed during rehabilitation. For the waste rock source term: <ul style="list-style-type: none"> • ensure that an appropriate infiltration rate is used to understand vadose zone behaviour and to determine the concentrations of contaminants in waste rock seepage, and update contaminant transport modelling accordingly Context: ERA and SSB ascertained that infiltration rate likely to be higher than currently stated. ERA plans to investigate infiltration rates in waste rock across the site to ensure that the appropriate rate is used in contaminant transport modelling. Modelling will need to be updated accordingly <ul style="list-style-type: none"> • improve the estimate of sulfide minerals and associated oxidation potential in the waste rock landform 	3.2.8 Stockpiles 7.3.2.3 Solute Loss 7.4.2.1 Contamination Investigations in LAAs 7.10.4 Soil Assessment	WS1 — Characterising contaminant sources on the Ranger Project Area. WS2 — Predicting transport of contaminants in groundwater.	Ongoing	7.4.3.1 Water and sediment baseline 7.7 Groundwater modelling	ERA has numerous projects underway to address this. Refer to the summary of activities against KKNWS1A <i>What contaminants (including nutrients) are present on the rehabilitated site (e.g. contaminated soils, sediments and groundwater; tailings and waste rock)?</i>
73	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 51	Additional comment Provide further information to demonstrate that there are sufficient appropriate disposal options for treated water throughout the rehabilitation process, as irrigation areas are decommissioned.	10.2 Water Treatment 10.9.1 Water Treatment	N/A	Pending	N/A	Further assessment is required to demonstrate that there are sufficient appropriate disposal options for treated water throughout the rehabilitation process. This will require assessing the capacity within release storages, expected evaporative losses from storage surfaces, capacity in the remnant application areas, rehabilitation requirements and turbomister capacity. This information will be updated in future iterations of the MCP. An integrated water treatment strategy application is planned to be submitted to regulators in early 2020.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
74	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 52	Recommendation For the tailings and pore water source term: • additional data are required to update the tailings consolidation modelling and water balance accounting for both pits, taking into account the heterogenous nature of the tailings in the pits, and the effect this may have on the amount of contaminants mobilised from tailings and the direction and rate of solute expression.	7.1 Tailings Consolidation Modelling	WS1 — Characterising contaminant sources on the Ranger Project Area WS2 — Predicting transport of contaminants in groundwater	Addressed	7.1 Tailings Consolidation Modelling	Model was updated in 2015 by Fitton (Figure 7.5). Ongoing measurements of tailings settlement have been undertaken on a monthly basis to confirm the model is still valid. Available measurements relevant to flows in and out of the waste rock cap on top of Pit 1 have been used to construct a solute mass balance, using magnesium as the representative solute, and a water (volume) balance. The solute balance indicates that the measured mass of solute recovered through the decant towers matches the mass of solute estimated to have been expressed from tailings (Figure 7-6). The consolidation model for Pit 3 has recently been reviewed with the results obtained from the cone penetration test (CPT) by Fitton (2019a). It was noted that the pore pressure profiles measured in the last CPTs closely agree with those predicted by the consolidation model. Expression of tailings pore water with respect to local scale and regional scale ground water impacts is to be assessed within the groundwater solute transport modelling being undertaken by INTERA.
75	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 52	Additional comment The potential risks associated with the generation of acid sulfate sediments due to mine-derived sulfate needs to be assessed, particularly in Coonjimba, Georgetown and Gulungul billabongs.	7.4.2.3 Generation of Acid Sulfate Soils in Billabongs 7.10.6 Surface Water Pathway Risk Assessment 9.5.1 RPA Waterbodies (TA1) 9.5.2 Offsite Waterbodies (TA2) 10.5 Contaminated Sites	WS5 — Determining the impact of contaminated sediments on aquatic biodiversity and ecosystem health. WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health. WS7B — What is the risk associated with emerging contaminants?	Pending	7.4.2.3. Assessment of acid sulfate sediments (ASS) and development of a preliminary site wide ASS conceptual model	The 2018 MCP addresses acid sulfate soil risk assessment that was undertaken with regard to the Coonjimba Billabong. Further assessments are planned to be carried out for the Georgetown and Gulungul billabongs (2020). It was planned that EcoZ undertake assessments in 2018, however this was deferred until the ERM Conceptual model has been finalised.
76	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 52	Recommendation For the groundwater source term: • characterisation of the existing groundwater contamination onsite, including beneath the Tailings Storage Facility, and update the Ranger Conceptual Model and contaminant transport models accordingly • proposed remediation and active management options for groundwater during and after the rehabilitation of contaminated sites (e.g. the processing area, stockpiles and the Tailings Storage Facility) • to demonstrate that LAAs will not result in a significant groundwater contamination source, include data from bores representing all aquifers and areas of the Ranger Project Area that could be impacted (i.e. Aquifer 1 and Aquifer 2).	7.1 Tailings Consolidation Modelling 7.7 Groundwater Modelling 7.7.1.11 LAAs Conceptual Model 10.5 Contaminated Sites Management	WS1 — Characterising contaminant sources on the Ranger Project Area WS2 — Predicting transport of contaminants in groundwater WS9 — Optimisation of water quality monitoring programs and assessment methods	Pending	7.4.3.6 Prediction of existing groundwater contamination 7.4.2.1 Investigations into potential contamination in LAAs 7.10.9 Contaminated Sites	No additional characterisation of groundwater contamination has occurred within the last 12 months. Project planning and scoping is underway to support future studies specifically to quantify the contamination below the TSF and processing area. These studies will support the development of the remediation plan and will be detailed in future MCP updates. The TSF contaminated materials application will specifically address contamination as a result of operation of the TSF. Section 7.10.9 identifies planned future studies relating to contaminated sites.
77	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 53	Additional comment Develop an understanding of the spatial and temporal (seasonal) interactions between groundwater and surface water. This work is required as a priority, particularly in light of the significant concerns related to water quality in Magela Creek raised in Appendix 8.1 of the RMCP (2011–12 ITWC PFS BPT Assessment).	7.10.3 Conceptual Site Modelling 7.10.6 Surface Water Pathway Risk Assessments	WS3D — Where and when does groundwater discharge to surface water? WS3E — What factors are likely to be present that influence contaminant transport between groundwater and surface water? WS3G — To what extent will the interaction of contaminants between sediment and surface water affect their respective qualities?	Addressed	12.5.2 Groundwater	The updated monitoring section discusses closure monitoring, which has been designed to support further refinement of key hydrological units and groundwater / surface water interaction via collection of groundwater quality and high resolution water level data using dataloggers.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
78	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 53	Additional comment Reactive transport modelling is required for calcium so that its effect on magnesium toxicity in the receiving surface waters can be understood (calcium has been shown to ameliorate magnesium toxicity).	7.7.3.4 Reactive Transport Modelling	WS7E — How will Mg:Ca ratios influence Mg toxicity?	Pending	7.10.11 Surface water modelling	ERA project 1260-02 - Mg:Ca input into Surface Water Model - is underway to address this. Outcomes will be reported in the next MCP and inform inputs to the surface water model. This project is listed project against KKN WS3C. <i>What factors are likely to be present that influence contaminant (including nutrients) transport in the surface water pathway?</i>
79	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 53	Additional comment To enable more reliable predictions of contaminant concentrations in surface water, the contaminant transport modelling, particularly the surface water model, needs to be refined using more relevant and appropriate data and assumptions, including: <ul style="list-style-type: none"> • undertaking contaminant transport modelling at increased temporal and spatial resolution (particularly around the period of peak solute delivery to the surface water system) • developing better understanding of groundwater/surface water interactions that will control the location and timing of delivery of contaminated groundwater to the surface water system • implications of groundwater recovery as groundwater levels return to a stable state after rehabilitation • improved understanding of the role of groundwater/surface water interactions in solute migration • assessment of confidence in modelled outputs using statistical, sensitivity and uncertainty analyses for each model, as well as analysis of cumulative uncertainty where multiple models are interconnected. 	7.8 Surface Water Modelling	WS2 — Predicting transport of contaminants in groundwater WS3 — Predicting transport of contaminants in surface water	Pending	7.7 Groundwater modelling 7.8 Surface water modelling	The surface water contaminant transport modelling is currently being updated and refined to improve outputs with consideration of the relevance and appropriateness of data and assumptions. Updated information will be provided within the future update of the MCP.
80	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 53	Additional comment All numerical modelling should be based on: <ul style="list-style-type: none"> • the data-driven Ranger Conceptual Model, which needs to include sufficient detail and confidence for high-risk areas (e.g. the Magela Creek bed, the Djalkmarra sands and the MBL zone) • detailed and reliable quantification of all potential contaminant source terms onsite, including existing groundwater contamination on the minesite • a calibration period that is sufficient to stress the model to the extent that its behaviour during pre-mining, operational and post-mining conditions can be assessed, including mine-impacted and baseline variability in groundwater levels, stream flow and associated processes • all available data, including pre-mine data if available, with clear justification for the exclusion of data not used • surface water and groundwater interactions at a temporal scale appropriate for the baseline variation in groundwater levels and surface water flow. 	7.7.1 Ranger Mine Conceptual Model 7.8 Surface Water Modelling	WS1 — Characterising contaminant sources on the Ranger Project Area WS2 — Predicting transport of contaminants in groundwater WS3 — Predicting transport of contaminants in surface water	Addressed	7.7 Groundwater modelling 7.8 Surface water modelling	ERA agrees that all numerical modeling should be based on the points identified. ERA has committed to the development and update of the sitewide groundwater model to predict post-closure solute loading to creeks from all sources using uncertainty analysis. A detailed update on the progress of modelling to date was provided by INTERA at ARRTC41. A subsequent update on the completed conceptual model was provided at ARRTC42.
81	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 53	Additional comment A robust analysis of model uncertainty will need to be undertaken to quantify and understand the level of uncertainty associated with the modelled outputs.	7.10.3 Conceptual Site Modelling	N/A	Pending	7.7.1 Groundwater modelling	The Ranger Mine sitewide modelling process complies with the guiding principles from the Australian Groundwater Modelling Guidelines. The Ranger Mine groundwater calibrated model will meet all indicators for the Level 3 confidence level (highest confidence level) after completion of the planned peer review by an independent hydrogeologist with modelling experience. Furthermore, ERA have made a commitment to have INTERA update minor sections of the report to address comments made by SSB. The outstanding concerns relate to development of a formal uncertainty analysis which ERA has committed to undertake (and will be included in future MCP when complete).

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
82	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Organism assemblages for all stages of creek flow should be characterised and assessed for their sensitivity to contaminants.	7.4.3.1 Water and Sediment Baseline	WS7— Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Pending	7 Supporting studies Appendix 7.1 KKNs	KKN WS7c addresses this issue and is assigned to SSB. The SSB project 'Seasonal sensitivity' (to Mg) profile for organisms in the Magela creek channel' commenced in July 2018 and is due for completion in late 2019 .
83	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Assess the potential contribution of subterranean fauna in Magela Creek sand beds to ecological processes and the biodiversity of the ARR and if significant, then determine the potential impact of contaminants on these communities.	7.4.3.1 Water and Sediment Baseline	WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Ongoing	7 Supporting studies Appendix 7.1 KKNs	As per the KKN, ERA is responsible for assessing contaminants on ecological communities and processes. This requires input from SSB to establish contribution of subterranean fauna in order to determine potential impacts. The MCP will be updated as information becomes available.
84	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Provide information on concentrations of suspended sediments and contaminants (including nutrients) bound to sediments, including: • effects of sediment mobilisation on surface water quality • physical effects of suspended sediment on aquatic biodiversity • where, when and to what extent contaminants may accumulate in downstream sediments • monitoring methods.	7.4.3.1 Water and Sediment Baseline 7.10.6 Surface Water Pathway Risk Assessment	WS3H — Where and when will suspended sediments and associated contaminants accumulate downstream? WS5 — Determining the impact of contaminated sediments on aquatic biodiversity and ecosystem health.	Pending	7 Supporting studies Appendix 7.1 KKNs	Suspended sediment transport and accumulation will be predicted by the surface water model. Several projects to assess the biological impacts of contaminated sediments are listed against KKN WSSA. SSB has developed a rehabilitation standard to protect aquatic biodiversity from the effects of sedimentation. Information on these projects and agreement on monitoring approaches will be included in the next MCP update.
85	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Determine potential levels of exposure of humans to contaminants from drinking water from onsite waterbodies (i.e. consumption rates, locations, concentrations) and assess the risk to human health.	6.4 6.4 Water and Sediment	RAD9C — What are the concentrations of contaminants in drinking water sources?	Pending	7.8 Surface Water Modelling Appendix 7.1 KKNs	Concentrations of contaminants in surface water will be predicted by the surface water model. The human health risk associated with this is Addressed by KKN RAD9D. <i>What is the dietary exposure of, and toxicity risk to, a member of the public associated with all contaminant sources, and is this within relevant Australian and/or international guidelines?</i> ERA has an initial assessment project 1260-08 Bush tucker Diet Assessments and two update projects (1260-09 and 1260-10) scheduled to address this KKN.
86	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Assess the risk of eutrophication to on and offsite waterbodies when surface water model results predicting nutrient concentrations become available.	7.10.6 Surface Water Pathway Risk Assessment	WS6 — Determining the impact of nutrients on aquatic biodiversity and ecosystem health.	Pending	7.8.5 Conclusion 7.9.2 Surface water pathway risk assessments	A project has been scheduled to address this. Refer to details included within ERA project 1260-04 <i>Eutrophication Risk Study</i> listed against KKN WS6C.
87	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Provide additional details on remediation of onsite waterbodies.	10 Closure Implementation	N/A	Pending	7.9.11 Surface water modelling 7.9.2 Surface water pathway risk assessments	Results of surface water modelling and the numerous assessments based on those results, including ERA project 1221-09 - <i>Surface Water Pathway Risk Assessments (release pathways onsite)</i> , is scheduled for 2020. This will assess the risks related to onsite water bodies and inform BPT and ALARA assessments of water management options, including remediation of off-site water bodies.
88	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment To enable assessment of the ecological implications of an exceedance of a water quality closure criterion, the closure criteria need to be numerical values and should be applied at the boundary of the Ranger Project Area until such time as there is agreement on an acceptable level of detriment for areas outside of the Ranger Project Area.	7.8 Surface Water Modelling 11.3 Water and Sediment Monitoring	N/A	Accepted	8.4 Water and sediment 12.5 Water and sediment monitoring	The approach to developing water criteria has changed to align with the national water quality management framework approach to setting water quality objectives. The closure criteria has been revised to establish numerical values and will be applied to the boundary of the RPA.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
89	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Define the process for ALARA in the context of closure criteria and provide examples of water and sediment criteria that are ALARA.	6.4 Water and Sediment	N/A	Addressed	8.4.2 Management objectives and outcomes.	The MCP has been updated to clarify use of ALARA, as a process, in respect to closure criteria. ANZG (2018) supports the use of narrative statements for guideline values and water quality objectives. Several examples of narrative draft water quality objectives are used in Table 6-3, eg demonstrating what water quality is ALARA, and for aesthetic water values.
90	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Propose closure criteria for sulfate, specifically in relation to the risk of acid sulfate sediment generation for billabongs.	6.4 Water and Sediment 7.4.2.3 Generation of Acid Sulfate Soils in Billabongs	WS5 — Determining the impact of contaminated sediments on aquatic biodiversity and ecosystem health. WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Addressed	8.4.3.3 Step 3. Define relevant indicators.	A guideline criteria for this has been proposed based on the SSB rehabilitation standard for sulfate.
91	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Acknowledge that there may be a requirement in future to consider the reintroduction of a closure criterion for pH, depending on the outcome of acid sulfate soil investigations.	6.4 Water and Sediment	N/A	Addressed	8.4.3.3 Step 3. Define relevant indicators.	This is acknowledged within this section. It is stated that SSB is also investigating the need for a pH standard.
92	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Provision should be made for a periodic review of contaminants measured in the post-rehabilitation monitoring program outlined in the RMCP, and closure criteria developed where required in the future.	11.3 Water and Sediment Monitoring	WS9 — Optimisation of water quality monitoring programs and assessment methods	Completed	8.4.3.3 Step 3. Define relevant indicators	COPC are discussed in 8.4.3.3 Step 3. Define relevant indicators. In that section it is noted that a review of COPC for all sources on the Ranger Mine is being conducted by ERM Ltd as part of the background concentrations of COPC in groundwater project (refer Section 7 Supporting Studies). A project to review COPCs again following sampling of contaminated sites is scheduled and listed against KKN WS1. Further detail has been provided within the Pit 3 Tailings Application (Iles & Humphrey 2014 Draft Water Quality Closure Criteria). A discussion paper was also submitted to the MTC water and sediment working group.
93	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Assess the risk of contaminated groundwater on riparian and aquatic vegetation.	7.10.6 Surface Water Pathway Risk Assessment 7.10.7 Phase 3 Closure Criteria and Detrimental Impact Framework Development	WS3B — What concentrations of contaminants from the rehabilitated site will aquatic (surface and ground-water dependent) ecosystems be exposed to? WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Ongoing	N/A	SSB is assessing this through their project Ecohydrology and Sensitivity of Riparian Vegetation. Field work commenced in late 2018 and pot trials to determine possible toxicity of magnesium to riparian tree species commenced in shade-house facilities at CDU in April 2019. A SSB groundwater project has also been linked to this study. ERA has provided advice and information to inform future assessments.
94	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Assess the potential risk of contaminant plumes in creek channels forming a barrier that inhibits organism migration and connectivity	7.10.6 Surface Water Pathway Risk Assessment 7.10.7 Phase 3 Closure Criteria and Detrimental Impact Framework Development	WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Pending	N/A	This KKN is assigned to SSB. SSB are conducting a collaborative project with Charles Darwin University and the National Environmental Science Program (NESP). The project effects of surface and groundwater egress of mining-related solutes on aquatic ecological connectivity, Magela Creek, commenced in November 2018. Completion is expected in mid-2020. Updates will be incorporated into the next MCP.
95	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Assess whether there are additional key aquatic guidelines for which water quality guidelines need to be developed (e.g. flow-dependent insects, hyporheic biota and stygofauna).	7.10.7 Phase 3 Closure Criteria and Detrimental Impact Framework Development	WS7 — Determining the impact of chemical contaminants on aquatic biodiversity and ecosystem health.	Pending	N/A	This KKN is assigned to SSB (KKN WS7c). SSB have two projects listed against this in their project description paper submitted to ARRTC May 2019.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
96	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 54	Additional comment Provide evidence that the proposed closure criteria are applicable to contaminant mixtures.	6.4 Water and Sediment	N/A	Pending	N/A	KKN WS7A assigned to SSB and is being addressed by their project <i>Assessing the toxicity of mine water mixtures for operational and closure scenarios</i> .
97	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment Revise the proposed groundwater monitoring plan to clearly demonstrate that monitoring will be undertaken at an appropriate spatial and temporal scale to: <ul style="list-style-type: none"> observe trends in groundwater level recovery and contaminant transport post-rehabilitation that can be used to validate groundwater models, and recalibrate if necessary detect significant increases in contaminant concentrations in aquifers surrounding Pit 1, Pit 3 and the TSF, to enable downstream mitigation of impacts if required (i.e. groundwater interception or abstraction). 	11.3 Water and Sediment Monitoring	WSSA — Will contaminants in sediments result in biological impacts, including the effects of acid sulfate sediments? WS7G — What concentrations of contaminants will be detrimental to the health of (non-riparian) aquatic vegetation?	Addressed	12.5.2 Groundwater	The post-closure solute transport modelling being undertaken by INTERA will inform the development of specific long term groundwater monitoring beyond that currently detailed in Section 12.5.2. Updates on the development of a site wide groundwater monitoring plan will be included in future MCP updates.
98	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment Assess the potential for offsite impacts associated with mobilisation and accumulation of contaminants via transport of suspended sediments.	6.4 Water and Sediment 7.10.6 Surface Water Pathway Risk Assessment	WS3H — Where and when will suspended sediments and associated contaminants accumulate downstream? WSSA — Will contaminants in sediments result in biological impacts, including the effects of acid sulfate sediments?	Addressed	7 Supporting studies Appendix 7.1 KKNs	Sediment transport and accumulation will be predicted by the surface water model. ERA has several projects assessing the risk associated with sediment contamination. Refer to projects listed against KKN WSSA. <i>Will contaminants in sediments result in biological impacts, including the effects of acid sulfate sediments?</i>
99	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment Undertake modelling of the potential contaminant accumulation in sediments post-rehabilitation, based on the results of surface water contaminant modelling, to demonstrate that sediment closure criteria are likely to be met.	7.8 Surface water modelling	WS3H — Where and when will suspended sediments and associated contaminants accumulate downstream? WSSA — Will contaminants in sediments result in biological impacts, including the effects of acid sulfate sediments?	Pending	7.10.11 Surface water modelling	Surface water contaminant modelling is currently being developed. This will inform modelling of the potential accumulation of contaminants in sediments and likelihood of achieving sediment closure criteria. ERA has several projects assessing the risk associated with sediment contamination. The section of the MCP will be updated when results become available.
100	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment The surface water monitoring program should include: <ul style="list-style-type: none"> acknowledgment that additional contaminants that have not been previously identified as a risk may need to be considered in future (e.g. findings from contaminated site investigations) and include provision in the post-rehabilitation monitoring program for periodic review of contaminants key sites on the Ranger Project Area (e.g. Georgetown Billabong, Coonjimba Billabong, RP1 and other onsite waterbodies, while they are present) for demonstration that concentrations of contaminants are as low as reasonably achievable acknowledgment that grab sampling may need to be conducted more frequently than monthly in the initial period after completion of rehabilitation works sampling for Ra-226. 	7.4.2 Contamination Investigations 7.4.3 Water and Sediment Studies 11.3 Water and Sediment Monitoring	WSSA — Will contaminants in sediments result in biological impacts, including the effects of acid sulfate sediments? WS7G — What concentrations of contaminants will be detrimental to the health of (non-riparian) aquatic vegetation?	Addressed	7.4.2.3 Assessment of acid sulfate sediments (ASS_ and developmetn of a preliminary site wide ASS conceptual model 7.8 Surface modelling 12.5 Water and sediment monitoring	These sites are included in the revised monitoring program and the potential use of event triggered monitoring is discussed in addition to monthly grab sampling. The COPC list is currently being reviewed and a project to review again following contaminated sites sampling is scheduled. Project 1221-07 <i>Acid Sulfate Sediments Conceptual Model</i> is underway to address this. Previous studies have also addressed this.
101	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment For parameters/locations where criteria are proposed for multiple outcomes (e.g. human health, recreation, ecosystem protection), state that the most conservative criterion across the outcomes applies.	6.4 Water and Sediment	N/A	Addressed REVIEW SECTION	8.4 Water and sediment	This was stated in the 2018 MCP. Separate draft criteria were proposed for each protection objective so achievement could be measured. It was stated that: <i>In some instances, the same parameter appears against several objectives. In most cases the ecosystem protection criteria are more stringent than, for example, human health criteria. Criteria values for each outcome are given so compliance with each particular outcome and objective can be assessed.</i>

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
102	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment Reassess closure criteria for nutrients, as the currently proposed criteria are less than baseline water quality values.	6.4 Water and Sediment	N/A	Addressed	8.4.2 Management objectives and outcomes	The concentration criteria for nutrients have been removed. The annual additional load limits are proposed instead (Table 8-3). These have applied at the Ranger Mine for several decades and are based on natural distributions of nitrate and phosphate. Work to assess the same approach for ammonia is scheduled. See projects listed against KKN WS6B. <i>Can Annual Additional Load Limits (AALL) be used to inform ammonia closure criteria?</i>
103	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 6.8 Summary of Recommendations and Additional Comments for Water and Sediment Page 55	Additional comment Develop a sedimentation closure criterion for aquatic ecosystem protection in billabongs	6.4 Water and Sediment	WS5 — Determining the impact of contaminated sediments on aquatic biodiversity and ecosystem health.	Pending	Appendix 7.3 KKN Projects	The development of a sediment closure criterion for aquatic ecosystem protection is dependent on further studies. There is a KKN dedicated to effects of sedimentation on ecosystem health (KKN WS5). In addition, SSB have published a rehabilitation standard for sedimentation. This section of the MCP will be updated when information becomes available.
104	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 61	Recommendation Before commencing construction of the final landform ERA must address the listed KKNs, and complete an assessment of radiation dose to wildlife and humans from both tailings and waste rock sources (RAD7 and RAD8), using all relevant data and knowledge on radionuclide activity concentrations (RAD1, RAD2 and RAD3) and relevant exposure pathways (RAD3, RAD4 and RAD5). Key Knowledge Needs to be Addressed (RAD1 - RAD7).	N/A	RAD1 — Radionuclides in the rehabilitated site. RAD2 — Radionuclides in aquatic ecosystems. RAD3 — Radon progeny in air. RAD6 — Radiation dose to wildlife. RAD7 — Radiation dose to the public.	Ongoing	7 Supporting studies Appendix 7.1 KKNs	Agreed - It is intended that the listed KKNs will be addressed through ongoing studies before construction of the final landform. RAD 4 & 5 have been removed from the KKNs. Additional information which will be incorporated into following MCP updates.
105	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Reconsider the view that the waste rock on the surface of the landform (with estimated uranium activity concentration of 0.8 Bq/g) is not radioactive.	2.3.5 Radiation 3.2.8 Stockpiles	RAD1 — Radionuclides in the rehabilitated site.	Accepted	2.2.8. Stockpiles	Agreed. This sentence has been removed.
106	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Identify the representative organisms upon which the radiation dose assessment for wildlife will be based.	6.3.1.2 Radiation Effects on Biota	RAD6A — What are the representative organism groups that should be used in wildlife dose assessments for the rehabilitated site?	Pending	7 Supporting studies Appendix 7.1 KKNs	The Identification of the representative organisms upon which the radiation dose assessment for wildlife will be based, is one of the studies underway to fulfill the overarching radiation dose assessment. The species list will be included in future iterations of the MCP.
107	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide information on radon and radon progeny concentrations in the air due to the final landform.	7.3.3 Radon exhalation	RAD3 — Radon progeny in air	Pending	7.10.1 Radiation dose assessm	Radiological parameters required for the radiation dose assessment will be outlined in future iterations of the MCP and provided in detail within ERA's application for approval to construct the final landform. See Section 7.10.1 for further detail.
108	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide information on the activity concentration of radionuclides in dust due to the final landform	7.3.3 Radon exhalation	RAD1 — Radionuclides in the rehabilitated site RAD6 — Radiation dose to wildlife RAD7 — Radiation dose to the public	Pending	7.10.1 Radiation dose assessm	Radiological parameters required for the radiation dose assessment will be outlined in future iterations of the MCP and provided in detail within ERA's application for approval to construct the final landform. See Section 7.10.1 for further detail.
109	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide information on gamma dose rates on the final landform.	7.5.1 Final Landform	RAD1 — Radionuclides in the rehabilitated site.	Pending	7.10.1 Radiation dose assessm	Radiological parameters required for the radiation dose assessment will be outlined in future iterations of the MCP and provided in detail within ERA's application for approval to construct the final landform. See Section 7.10.1 for further detail.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
110	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide information on concentration ratios for uranium and actinium decay series radionuclides in bush foods.	7.4.1.3 Bushfood Radiation Baseline	RAD1 — Radionuclides in the rehabilitated site. RAD6 — Radiation dose to wildlife. RAD7 — Radiation dose to the public.	Pending	7.10.1 Radiation dose assessment	Radiological parameters required for the radiation dose assessment will be outlined in future iterations of the MCP and provided in detail within ERA's application for approval to construct the final landform due for submission in 2022. See Section 7.10.1 for further detail.
111	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide an estimate of radiation doses to the public from the final landform.	6.3.3.1 Radiation Doses to Members of the Public	RAD7 — Radiation dose to the public	Pending	7.10.1 Radiation dose assessment	The radiation dose assessment is contingent upon the completion of current and future closure studies. The completed dose assessment will be included in future iterations of the MCP. See Section 7.10.1 for further detail.
112	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide whole-organism concentration ratios for the representative organisms.	6.3.1.2 Radiation effects of Biota	RAD6 — Radiation dose to wildlife	Pending	7.10.1 Radiation dose assessment	The prediction of radiation dose to wildlife forms part of the radiation dose assessment. This study is underway and will be included in future iterations of the MCP. See Section 7.10.1 for further detail.
113	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide tissue to whole-organism conversion factors for converting tissue-specific activity concentrations to whole-organism activity concentrations.	6.3.1.2 Radiation effects of Biota	RAD6 — Radiation dose to wildlife	Pending	7.10.1 Radiation dose assessment	The prediction of radiation dose to wildlife forms part of the radiation dose assessment. This study is underway and will be included in future iterations of the MCP. See Section 7.10.1 for further detail.
114	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide an estimate of radiation dose rates to wildlife from the final landform	6.3.1.2 Radiation effects of Biota	RAD6 — Radiation dose to wildlife	Pending	7.10.1 Radiation dose assessment	The prediction of radiation dose to wildlife forms part of the radiation dose assessment. This study is underway and will be included in future iterations of the MCP. See Section 7.10.1 for further detail.
115	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Include data and analyses to demonstrate what the average uranium activity concentration across the landform surface will be.	7.5.1 Final Landform Material Properties	RAD1 — Radionuclides in the rehabilitated site.	Pending	7.10.4 Gamma and radon flux survey Pit 1	This will be included in the 2020 MCP following results of the gamma and radon flux surveys undertaken at the completion of the construction of the Pit 1 final landform (Section 7.10.4).
116	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Use monitoring data collected over all years to derive statistical results for baseline water radionuclide concentrations at Magela Creek upstream or otherwise explain why only the data from 2010 to 2013 have been used.	7.4.1 Pre-mining Radiation Baseline	N/A	Ongoing	7.4.1.2 Baseline water radiation	Table 7-15 will be updated in the 2020 MCP. Please refer to Table 7-18 which includes baseline values for Ra226 and U as part of the surface water quality analysis. The concentrations provided in Table 7-18 were derived from ERA sampling undertaken between 1992 and 2018.
117	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Include data and analyses to demonstrate what the radionuclide activity concentration of the tailings will be.	7.2 Tailings Properties	RAD1A — What are the activity concentration of uranium and actinium series radionuclides in the rehabilitated site, including waste rock, tailings and land application areas?	Pending	7.7.2 Ranger Mine conceptual model	Radionuclide concentrations in tailings will be quantified as part of the future studies to define solute transfer source terms for the Ranger Mine conceptual model. See section 7.7.2 and box 6 of Figure 7-74.
118	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Provide estimates of radionuclide activity concentrations in surface water surrounding the mine site.	7.3.2 Runoff, Soil Erosion and Solute loss 7.4.2 Contamination Investigations	RAD2 — Radionuclides in aquatic ecosystems	Pending	7.8 Surface water modelling	Radionuclide concentrations in surface water are predicted within the surface water model (Section 7.8). ERA are in the process of updating the surface water model, the results of which will be available in the 2020 MCP.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
119	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Include groundwater radionuclide monitoring within the radiation monitoring program.	11.3.2 Groundwater Considerations 11.4 Radiation Monitoring	N/A	Addressed	Section 12 Table 12-9	Post-closure monitoring of radionuclides in groundwater is now included in Table 12-9. Radionuclides are also included in Table 12-7 of the groundwater monitoring program discussed in Section 12. Monitoring during the closure and post-closure phases will continue to be refined as relevant studies are completed. Changes and additional detail regarding groundwater radionuclide monitoring will be incorporated into future iterations of the MCP and the Annual Ranger Water Management Plan.
120	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Include bioaccumulation monitoring of radionuclides in bush foods within the radiation monitoring program	11.4 Radiation Monitoring 11.5 Flora and Fauna Monitoring	RAD1 — Radionuclides in the rehabilitated site. RAD6 — Radiation dose to wildlife. RAD7 — Radiation dose to the public.	Addressed	Section 12: Table 12-9	Post-closure monitoring of radionuclides in bushfoods is now included in Table 12-9. Monitoring during the closure and post-closure phases will continue to be refined as relevant studies are completed. Changes and additional detail regarding radionuclide monitoring in bushfoods will be incorporated into future iterations of the MCP.
121	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 7.8 Summary of Recommendations and Additional Comments for Radiation Page 62	Additional comment Include soil radionuclide monitoring within the radiation monitoring program.	11.3.1 Surface Water and Sediment 11.4 Radiation Monitoring 11.7 Soils monitoring	N/A	Addressed	Section 12: Table 12-9	Post-closure monitoring of radionuclides in soil is now included in Table 12-9. Monitoring during the closure and post-closure phases will continue to be refined as relevant studies are completed. Changes and additional detail regarding soil radionuclide monitoring will be incorporated into future iterations of the MCP.
122	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 8.4 Delineation of Contaminated Soils Page 65	Additional comment Although the RMCP acknowledges that soils in the processing plant area will require remediation, no data indicating the extent (e.g. depth and surface area/volume) of contaminated soil in this area are presented, or referenced. The RMCP needs to indicate the volume of contaminated soil, as well as the proposed method for recovery and placement of this soil into the Pit.	7.4.2.1 Contamination Investigation in LAAs	N/A	Pending	7.10.9 Contaminated sites	Data including depth, surface area and volume of contaminated soil will be provided following the contaminated soil assessment of the processing area. When completed, this information will be included in future updates of the MCP.
123	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 8.6 Summary of Recommendations and Additional Comments for Soils Page 65	Additional comment Develop a site-specific EIL for uranium and any other contaminants that are not covered by National Environmental Protection Measure guidelines.	6.6 Soils 6.8.5 Soils 6.8.2 Radiation	N/A	Pending	12.9 Soil monitoring	This is planned to be developed as part of soil monitoring for contamination.
124	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 8.6 Summary of Recommendations and Additional Comments for Soils Page 65	Recommendation Before commencing backfill of Pit 3 ERA must address the listed KKNs, and complete a whole-of-site contaminated site assessment to inform the requirement for soil remediation (WS1 and RAD1), including within the walls of the Tailings Storage Facility. Key Knowledge Needs to be Addressed: • WS1. Characterising contaminant sources on the Ranger Project Area • RAD1. Radionuclides in the rehabilitated site Key Knowledge Needs to be Addressed included WS1 and RAD1.	7.4.2.1 Contamination Investigation in LAAs	RAD1 — Radionuclides in the rehabilitated site. WS1 — Characterising contaminant sources on the Ranger Project Area.	Ongoing	7 Supporting Studies Appendix 7.1 KKNs	Prior to commencing backfill of Pit 3 the listed KKNs will be addressed and a whole-of-site contaminated site assessment will be completed to inform soil remediation. This includes contamination assessment within the walls of the Tailings Storage Facility. Drilling is currently scheduled to undertake samples of the TSF walls. An application to decommission the TSF will include further details on the strategy for remediation based on the outcomes of drilling and contamination assessment.
125	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 8.6 Summary of Recommendations and Additional Comments for Soils Page 65	Additional comment Assess the risk of contaminated soils within the Ranger Project Area impacting the environment outside the Ranger Project Area.	6.6 Soils 6.8 Status of Closure Criteria 7.3 Trial Landform	N/A	Ongoing	7.10.9 Contaminated sites	A risk review was held as part of the Feasibility study to identify further work required to scope and assess potentially contaminated sites to the correct level to satisfy the closure objectives and relevant legislation. The Contaminated Site Register was updated throughout 2018 and has been reviewed to identify contamination volume, clean up requirements, and the potential impact of the contamination outside of the Ranger Project Area. (Refer to Section 7.10.9)

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
126	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 8.6 Summary of Recommendations and Additional Comments for Soils Page 65	Additional comment To support the risk assessment that soils in the LAAs pose a low risk as a source of potential contamination, information should be presented on relevant contaminants and suspended sediments (e.g. if soils are disturbed as part of any required remediation).	6.6 Soils 6.8 Status of Closure Criteria 7.3 Trial Landform	N/A	Pending	N/A	Additional information will be provided within future updates to the MCP.
127	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 68	Additional comment Provide the survey methods used for the regional vegetation survey program.	7.6.3.1 Flora and Fauna Monitoring Sites	N/A	Pending	12 Closure monitoring and maintenance	ERA is committed to longterm monitoring of reference sites, and review and refinement of methodology and site selection is ongoing with regulators.
128	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 81	Recommendation Before commencement of revegetation activities on the final landform ERA must address the listed KKNs, and develop an ecosystem restoration strategy which includes consideration of both flora and fauna (EE1, EE2, EE3 and EE4), and is based upon an appropriate trajectory model (EE5) that accounts for key influences on revegetation establishment (EE6, EE7 and EE8). Key Knowledge Needs to be addressed including EE1 - EE8.	N/A	ESR1 — Determining the characteristics of terrestrial vegetation in the areas surrounding the mine site. ESR2 — Determining the requirements to support a faunal community similar to areas surrounding the Ranger Project Area. ESR3 — Understanding how to establish native terrestrial vegetation, including understory species. ESR4 — Determine the density of introduced species in areas surrounding the Ranger Project Area. (KKN for SSB) ESR5 — Develop a revegetation trajectory for Ranger Mine. ESR6 — Understanding the impact of contaminants on vegetation establishment and sustainability. ESR7 — Understanding the effect of waste rock properties on vegetation establishment and sustainability ESR8 — Understanding fire resilience and management in ecosystem restoration	Ongoing	7 Supporting studies Appendix 7.1 KKNs	This recommendation is the intent of ERA. The KKNs will be addressed and studies information utilised in the final RPA landform revegetation plan.
129	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 81	Recommendation In accordance with the previous recommendations of the Supervising Scientist; before the placement of the grade 1s waste rock cap on Pit 1 ERA must address the listed KKNs, and demonstrate that the waste rock landform will provide sufficient plant available water to support a mature vegetation community (EE7.B). Key Knowledge Needs to be Addressed include EE7B.	7.3.5 Plant Available Water Studies	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	Appendix 7.1 KKNs 7.3.5 Plant available water studies	The results of the completed KKN are summarised within Section 7.3.5 of the updated MCP. Demonstrated that 4-6 m of waste rock landform with various levels of rock contents can maintain a positive PAW water balance while supporting a vegetation similar to one of the reference sites.
130	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 82	Additional comment Expand the Revegetation Strategy to an ecosystem restoration strategy.	10 Closure Implementation	N/A	Ongoing	7 Supporting studies Appendix 7.1 KKNs	The rehabilitation of the RPA will consider ecosystem establishment, and not simply the revegetation of the site. An ecosystem rehabilitation strategy will be developed, incorporating relevant KKN information, when complete, and be included within future MCP updates.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
131	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 82	Additional comment Provide information demonstrating that waste rock can maintain long-term species diversity through recruitment and regeneration and whether there are factors that could be manipulated to facilitate this.	7.3 Trial Landform	ESR7 — Understanding the effect of waste rock properties on vegetation establishment and sustainability	Ongoing	7.3 Trial landform Appendix 7.1 KKNs	Revegetation monitoring does include recruitment and regeneration post-fire. Future trials are planned to investigate potential factors to be modified for benefit in longterm ecosystem self-sustainability.
132	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 82	Additional comment Key findings and knowledge gaps should be synthesised from all previous work, and based on this a monitoring program should commence on the trial landform to inform the Ecosystem Restoration Strategy.	10 Closure Implementation	N/A	Ongoing	7.3 Trial Landform Appendix 7.1 KKNs 12 Closure monitoring and maintenance	TLF monitoring results have been updated within the 2019 MCP, along with updated summaries of previous studies. The monitoring section update within the MCP has utilised these results. Similarly, Ongoing and planned studies on the TLF will be monitored accordingly, to inform the finalisation of the ecosystem rehabilitation strategy.
133	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 82	Additional comment Information and data from previous revegetation studies need to be collated and incorporated into the Ecosystem Restoration Strategy, including: • up-to-date monitoring results for the trial landform, including monitoring of grasses and groundcover species • findings and recommendations from revegetation studies conducted at Ranger that pre-date the trial landform • a synthesis of key findings and knowledge gaps.	7.6 Ecosystems Establishment 10 Closure Implementation	ESR2 — Determining the requirements to support a faunal community similar to areas surrounding the Ranger Project Area. ESR3 — Understanding how to establish native terrestrial vegetation, including understory species. ESR5 — Develop a restoration trajectory for Ranger Mine.	Ongoing	7.5 Landform design and performance 11.16 Final landform 12.4 Landform monitoring Appendix 7.1 KKNs	Agreed - refer to Appendix 11.2 Revegetation Strategy.
134	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 82	Additional comment Additional information on the works proposed in the revegetation application should include: • detailed action plans and timelines, including methods (i.e. planting, irrigation) • seed availability and collection plan • nursery details and propagation studies • target and planned planting densities and methods (e.g. final target density for each species) • habitat to be installed (e.g. nesting boxes, rock piles) • Ongoing management activities, including weed control and infill planting • any other project specific assumptions or information which would be required to conduct a detailed assessment of the activity.	10 Closure Implementation	ESR2B — What habitat, including enhancements, should be provided on the rehabilitated site to ensure the colonisation of fauna, including threatened species?	Ongoing	N/A	The MCP cannot include this level of detail until further revegetation trials have progressed, and relevant KKNs completed. Thus, the revegetation strategy will remain at the current high level of detail in the 2019 MCP. Further detail will be added into each MCP update, with the ERA Ranger Revegetation Implementation Plan to be developed with the full detail in preparation for execution, and with adequate timing for review.
135	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide further information to demonstrate that sufficient seed can be sourced to complete revegetation in the time frame required and reach the desired end state (including the amount of seed and resulting tube stock for each species), and consider classifying seed availability as a Class 3 risk.	10 Closure Implementation	ESR3 — Understanding how to establish native vegetation, including understorey species.	Ongoing	10 Risk Assessment and Management	Seed availability in the 2019 MCP risk assessment is rated as a Class III risk, but is managed as a class IV risk due to the risk rating for the project schedule. The collection of seed has commenced with back-up air conditioning provided within the new seed storage facility at the nursery. The determination of quantity and type of seed required for rehabilitation plans of the RPA and a schedule for seed requirements are complete and a seed matrix is updated monthly for internal reporting.
136	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Further information should be provided to explain why fire was not classified as a class III risk.	9 Risk Assessment and Management	N/A	Addressed	10 Risk Assessment and Management	In the updated MCP risk assessment, fire is classified as a Class III risk. Evaluation based on meeting rehabilitation requirements by Jan 2026, and if a cyclone or bushfire event destroyed large areas of RPA rehabilitation.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
137	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide information on which species are currently able to be grown from seed, and which are not able to be successfully propagated.	10 Closure Implementation	ESR3 — Understanding how to establish native vegetation, including understory species.	Ongoing	7.3.4 Revegetation trials 11.17 Revegetation Strategy and Implementation	As nursery trials continue, this information will be compiled indicating any seed requiring pretreatment for assisted germination rates. Soil ameliorants (that are applicable for tube stock) will also be investigated. Recalcitrant species will also be identified. 100% species diversity return in the short term is not a realistic goal for rehabilitation on a waste rock landform.
138	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide information to demonstrate that plant roots will be able to penetrate a waste rock substrate to a sufficient depth to address plant available water requirements, including understory species and accounting for macropores.	7.3.5 Plant Available Water Studies	ESR7D — Are there any other properties of the rehabilitated site that could be attributed to any observed impairment of ecosystem establishment and sustainability, including vegetation and key functional groups of soil fauna? ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.4.5 Root extrivation trial 2019	Summary of 2019 root excavation trial has been added to the Supporting Studies Section. Plant roots are able to penetrate the waste rock substrate.
139	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide uncertainty analysis for all modelling undertaken in relation to demonstrating that there will be sufficient plant available water in the final landform.	7.3.5 Plant Available Water Studies	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.5 Plant available water studies	Information on PSD and PAW modelling, plant rooting depth, subsurface consolidated layer, and more has been added to the 2019 MCP. Consistent with information previously provided as part of 2019 App. 3 to Pit 1 Application. Supporting information available within the reference Lu P, Meek I, Skinner R. 2019. Supporting Information on Revegetation Growth Substrates at Ranger for Pit 1 Application. Energy Resources of Australia Ltd report, Feb. 2019
140	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide evidence to demonstrate that compaction layers: • will improve the water-holding capacity of the waste rock • will not lead to other issues affecting plant growth (e.g. physical restriction of roots, formation of perched water tables) Further information on the internal properties in each area of the final landform (e.g. nature, depth and extent of compacted layers) should be provided, in conjunction with a conceptual model and water balance (under a range of rainfall scenarios) demonstrating that there will be sufficient water available for revegetation (including understorey).	7.3.5 Plant Available Water Studies 10 Closure Implementation	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.5 Plant available water studies	The results of the completed KKN are summarised within Section 7.3.5 of the updated MCP. Demonstrated that 4-6 m of waste rock landform with various levels of rock contents can maintain a positive PAW water balance while supporting a vegetation similar to one of the reference sites.
141	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide further information on the internal properties of the final landform (e.g. nature, depth and extent of compacted layers), in conjunction with a conceptual model and water balance (under a range of rainfall scenarios) to demonstrate that there will be sufficient water available for revegetation.	7.3.5 Plant Available Water Studies	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.5 Plant available water studies	The results of the completed KKN are summarised within Section 7.3.5 of the updated MCP. Demonstrated that 4-6 m of waste rock landform with various levels of rock contents can maintain a positive PAW water balance while supporting a vegetation similar to one of the reference sites.
142	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide further evidence to support the assumption that understorey is a minor component of evapotranspiration.	7.3.5 Plant Available Water Studies	N/A	Addressed	7.3.5 Plant available water studies 7.4.7 Reference site ecohydrological studies	During the dry season, understorey evapotranspiration is a minor component of the total system evapotranspiration. This is supported by the additional information within the 2019 MCP Supporting Studies Section. In particular, the figure relating to soil water dynamics at the analogue area which shows that during the dry season soil water is almost completely depleted in the top 1 m. This is where the understorey plants extract water from. Hutley et al 2000, showed that dry season understorey evapotranspiration is a minor component of the total evapotranspiration. Despite this, the CDU/ERA modelling included the simulated understorey evapotranspiration. REF: L. B. HUTLEY, A. P. O'GRADY and D. EAMUS 2000. Evapotranspiration from Eucalypt open-forest savanna of Northern Australia, Functional Ecology, 14, 183–194

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
143	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Provide information on soil formation properties for each type of waste rock to be used in landform construction, including: • weathering rates • soil texture information for the entire waste rock substrate (i.e. not just < 2mm fraction).	7.4.3.5 Fate of Chemicals in the Magela Creek System	ESR7C — Will evological processes required for vegetation sustainability (e.g. soil formation, reproduction and nutrient cycling) occur on the rehabilitated landform?	Ongoing	Appendix 7.1 KKNs 7.5.1.1 Waste rock particle size distribution	The associated KKN study will be progressed, and the PSD investigation will be reported on within the 2020 MCP update.
144	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment The lack of a seasonal trend in radon exhalation rates on the waste rock-only section of the trial landform should be investigated in the context of the ability of the waste rock substrate to retain water.	7.4.1.1 Baseline Terrestrial Radiation	N/A	Addressed	N/A	Bollhöfer, A., Doering, C., 2016. Long-term temporal variability of the radon-222 exhalation flux from a landform covered by low uranium grade waste rock. J. Environ. Radioact. 151, 593–600. has discussed the effect of the soil moisture on the radon emission.
145	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Include more relevant information on fire and plant survivability in the region, including reference to fire severity and intensity, and survivability of specific species.	7 Supporting Studies	ESR8 — Understanding fire resilience and management in revegetation.	Ongoing	N/A	Reporting on the completed Project 1240-30 (Trial landform fire report) will be presented in the 2020 MCP update. Monitoring of fire response will continue.
146	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 83	Additional comment Determine the most appropriate fire management regime to ensure a fire resilient ecosystem on the rehabilitated site, including reference to faunal colonisation	11.1 Stabilisation and Monitoring Phase Overview	ESR8 — Understanding fire resilience and management in revegetation.	Ongoing	N/A	Information on fire management in the Maintenance and Monitoring Section has been updated. The fire management strategy will be continually developed as knowledge increases with ongoing monitoring. Reporting on the completed Project 1240-30 (Trial landform fire report) will be presented in the 2020 MCP update.
147	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Include a defined trajectory (or trajectories) in relation to vegetation community establishment, using site-specific indicators relating to ecosystem composition, structure and function.	6.5 Flora and Fauna	ESR5 — Develop a revegetation trajectory for Ranger Mine.	Ongoing	7 Supporting studies Appendix 7.1 KKNs	This information has been identified as a KKN and thus studies will be conducted to enable the formulation of such defined rehabilitation trajectories, to be utilised in monitoring, assessment of rehabilitation success against completion criteria, and the potential for requirement for further works if the ecosystem re-establishment is not on track of this defined trajectory. The KKN ESR5 studies are progressing, and an update will be provided in the 2020 updated MCP.
148	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Provide details on which species would be included in the understorey (in consideration of requirements for faunal colonisation), and evidence to support the assumption that direct seeding is the best option for the establishment of such species.	10.8.3.3 Tree and Shrub Planting, and Establishment of Understorey 10 Closure Implementation	ESR2 — Determining the requirements to support a terrestrial faunal community similar to areas surrounding the Ranger Project Area. ESR3 — Understanding how to establish native vegetation, including understorey species.	Ongoing	7.3.4.2 Vegetation monitoring and performance	Planned trials on rehabilitation understorey species are described in Section 7.6.3. It is not assumed that these species will be direct seeded, but predominantly introduced via tubestock. Habitat requirements for fauna return will be considered under KKN ESR2B, and will be reported on in the 2020 MCP
149	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Clearly justify why some closure criteria would be more important than others, in relation to the Environmental Requirements.	6.5 Flora and Fauna 6.5.1 Justification for Outcome, Parameter and Criteria	N/A	Addressed	8.5 Flora and fauna	Some criteria, such as canopy architecture and ground cover index, are not independent of each other and should be considered collectively, or within the context of meeting the overall closure objective as a whole. This approach was recommended by DPIR as part of their initial assessment of the Ranger Mine closure criteria and ERA agrees with this recommendation.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
150	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Assess the risk of potential impacts of contaminants leached from waste rock on revegetation and fauna, including details on how this would be avoided or mitigated.	7 Supporting Studies	ESR6 — Understanding the impact of contaminants on vegetation establishment and sustainability. ESR6B — Based on the structure and health of vegetation on the Land Application Areas, what species appear tolerant to the cumulative impacts of contaminants and other stressors over time?	Ongoing	Appendix 7.1 KKNs	SSB are undertaking KKN ESR6A. <i>What concentrations of contaminants from the rehabilitated site may be available for uptake by terrestrial plants?</i> ESR6B will be completed and reported on in updated MCP
151	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Provide information on nitrogen dynamics in the rehabilitated landform, including an assessment of the potential for nitrogen to be a limiting factor for nutrient cycling, and nutrient availability and presence of soil biota to assist in plant growth.	7.10.2 Evaluation of Key Attributes of Nutrient Cycling	ESR7A — What is the potential for plant available nutrients (e.g. nitrogen and phosphorus) to be a limiting factor for sustainable nutrient cycling in waste rock? ESR7C — Will ecological processes required for vegetation sustainability (e.g. soil formation, reproduction and nutrient cycling) occur on the rehabilitated landform? ESR7D — Are there any other properties of the rehabilitated site that could be attributed to any observed impairment of ecosystem establishment and sustainability, including vegetation and key functional groups of soil fauna?	Ongoing	Appendix 7.1 KKNs	KKN ESR7 A,C & D studies with provide information on this query, and a summary of study findings will be summarised in the 2020 MCP update.
152	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Acknowledge that comprehensive surveys to inform the status of weeds and feral animals will be required before and during the rehabilitation process, including the entire Ranger Project Area and surrounding areas.	10 Closure Implementation 11.5.2 Weed Monitoring	ESR2C — What is the risk of feral animals to faunal colonisation and long-term sustainability? ESR5B — How can we develop restoration trajectories (flora and fauna) to predict when the rehabilitated site will move to a sustainable ecosystem without further management intervention (e.g. different fire and weed scenarios)?	Ongoing	Appendix 7.1 KKNs	Studies are underway and will be reported on in the 2020 MCP update. The KKN for fauna outside the RPA has been assigned to SSB.
153	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Provide information to assess how vegetation community development may be affected by landform stability, including re-contouring the landform surface.	7 Supporting Studies	ESR3 — Understanding how to establish native vegetation, including understorey species. LAN3 — Predicting erosion of the rehabilitation landform	Ongoing	Appendix 7.1 KKNs 7.5 Landform design and performance	Landform stability is considered in the final landform design, and follow up monitoring. Refer to updated MCP relevant sections (7.5). The predicted date for completion of KKN LAN3 - will be the end of 2020, and thus results will be discussed in the 2021 updated MCP.
154	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Refine the vegetation mortality contingencies to consider mortality beyond the first 6 months and the potential for mortality to vary between species and locations.	11.1 Stabilisation and Monitoring Phase Overview	ESR3 — Understanding how to establish native vegetation, including understorey species. ESR5 — Develop a restoration trajectory for Ranger Mine.	Ongoing	Appendix 7.1 KKNs 7.3.4 Revegetation Trials	Ongoing revegetation trials (described in Section 7.3.4) will address these queries

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
155	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Provide evidence to demonstrate that appropriate measures will be taken to ensure fauna colonisation of the rehabilitated site.	7.4.4 Flora and Fauna Baseline Monitoring	ESR2 — Determining the requirements to support a terrestrial faunal community similar to areas surrounding the Ranger Project Area.	Ongoing	N/A	Work on fauna return strategies is ongoing and updates may be expected in 2020 MCP. Studies related to KKN ESR2 are underway.
156	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Quantify the magnitude of potential sources of feral animals (i.e. no. of animals per unit area), to allow comparison of densities between areas inside the Ranger Project Area and adjacent areas of Kakadu National Park.	7.4.4 Flora and Fauna Baseline Monitoring	ESR2C — What is the risk of feral animals to faunal colonisation and long-term sustainability?	Ongoing	N/A	Studies are underway and will be reported on in the 2020 MCP update. The KKN for fauna outside the RPA has been assigned to SSB.
157	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Assess the risk of feral animals impacting on faunal colonisation of the rehabilitated site	7.4.4 Flora and Fauna Baseline Monitoring	ESR2C — What is the risk of feral animals to faunal colonisation and long-term sustainability?	Ongoing	N/A	Studies are underway and will be reported on in the 2020 MCP update. The KKN for fauna outside the RPA has been assigned to SSB.
158	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Provide the rationale for the nominated 200 m weed buffer zone.	10.8.3.3 Tree and Shrub Planting, and Establishment of Understorey 11.5.2 Weed Monitoring	ESR3A — How do we successfully establish terrestrial vegetation, including understorey?	completed	N/A	This nominated zone has been changed to the following: During revegetation establishment and early development a 'weed and fire buffer zone' will be maintained to reduce the risk of fire and weedy plant species (potentially including some natives) impacting on the revegetated areas. As the resilience of the revegetated ecosystems increases, this effort will gradually be diminished (considerate of Ongoing risk) until the management effort required to sustain the revegetation are aligned to those of Kakadu National Park.
159	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comments Mitigations to address integrated landscape risks, such as weather, should be Addressed in the Ecosystem Restoration Strategy.	9 Risk Assessment and Management	LAN2B — How will these landscape-scale processes impact the stability of the rehabilitated landform?	Ongoing	N/A	When further studies are completed, these mitigations will be included within the ecosystem rehabilitation strategy.
160	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 84	Additional comment Provide information to justify the ≥ 15–30 % similarity as the closure criterion for species composition and relative abundance.	6.5.1.2 Community Composition	ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including ground cover) are awaiting further consideration. Information to justify the similarity percentage range for species composition and relative abundance will be provided in updated MCPs following outcomes of ongoing studies.
161	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment A proposed revegetation species list (including both over- and understorey species) should be provided.	6.5.1.2 Community Composition	N/A	Ongoing	7.3.4.3 Overstorey and midstorey performance 7.3.4.4 Understorey establishment	Overstorey and midstorey performance (Section 7.3.4.3) and understorey establishment (Section 7.3.4.4) have been added to the 2019 MCP. Outcomes of ongoing studies will inform this list and this will be updated accordingly. A preliminary species list (including understorey species) was presented at the the Ranger Consultative Closure Group (August 2019). The list is likely to be finalised and presented in the 2020 MCP.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
162	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Provide information to justify the proposed total species number closure criterion of ≥ 35 .	6.5 Flora and Fauna Table 6-4	ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Pending	N/A	This information is pending finalisation of reference sites. This criterion will be updated when this information becomes available.
163	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment The canopy architecture criterion (F3) should not be expressed as presence/absence, rather should be presented as ranges and broken down into an appropriate classification of strata.	6.5 Flora and Fauna Table 6-4	ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Ongoing	N/A	The points made in the comment are noted. The finalisation of completion criteria will occur after further studies relating to KKNs are completed. ERA and SSB continue to liaise and discuss reference site selection, data analysis and assessment metrics.
164	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Clarify what is meant by canopy/groundcover index in relation to criterion F4 and do not include rocks in the assessment of understorey cover. Table 6-4.	6.5 Flora and Fauna Table 6-4	ESR1B — Which indicators of similarity should be used to assess revegetation success? ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including ground cover) are awaiting further consideration.
165	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Update terrestrial fauna closure criteria using data gathered with contemporary fauna sampling methodologies.	6 Development of Closure Criteria	ESR2 — Determining the requirements to support a faunal community similar to areas surrounding the Ranger Project Area. ESR2A. What faunal community structure (composition, relative abundance, functional groups) is present in the areas surrounding the RPA?	Ongoing	N/A	It is intended that the fauna completion criteria will be finalised (with stakeholder input) after studies to address relevant KKNs have been completed. The MCP will be updated with this information, as appropriate.
166	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Include standard quantitative biodiversity indices (e.g. species richness and abundance) for fauna that allow assessment of whether terrestrial fauna communities on the rehabilitated site are comparable (or on a trajectory to be comparable) with those in adjacent areas of Kakadu National Park.	6.5 Flora and Fauna Table 6-4	ESR2 — Determining the requirements to support a faunal community similar to areas surrounding the Ranger Project Area. ESR5 — Develop a restoration trajectory for Ranger Mine	Ongoing	N/A	The development of quantitative biodiversity indices is pending further studies. This will be updated once information becomes available (there are a number of KKNs that are being Addressed by both ERA and SSB on this topic). Future MCPs will incorporate this information when available.
167	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Provide evidence to support the assumption that fauna will colonise the rehabilitated site, once suitable habitat has established.	7.4.4 Flora and Fauna Baseline Monitoring	ESR2 — Determining the requirements to support a faunal community similar to areas surrounding the Ranger Project Area. ESR2B — What habitat, including enhancements, should be provided on the rehabilitated site to ensure the colonisation of fauna, including threatened species?	Ongoing	N/A	Work on fauna return strategies is ongoing (including relevant KKNs) and updates may be expected in the 2020 MCP.
168	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Provide information to justify the proposed plant reproduction closure criterion of evidence of flowering and fruiting in 80% of species, including consideration of the amount and periodicity of flower, fruit and seed resources provided in the revegetated site.	6.5 Flora and Fauna	ESR1B — Which indicators of similarity should be used to assess revegetation success? ER7C - Will ecological processes required for vegetation sustainability occur on the rehabilitated landform?	Ongoing	N/A	Information to justify this criteria is pending further studies and finalisation of the reference sites. This will be updated when suitable information is available. At present, woody species are being assessed and of these evidence has demonstrated that only a single species has not reproduced on site trials.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
169	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Criterion F7 should capture seedling germination/sucker emergence, survivorship and growth, and the term framework species should be clearly defined. Table 6-4	6.5 Flora and Fauna Table 6-4	ESR5A — What are the key sustainability indicators that should be used to measure restoration success?	Pending	N/A	A review of this criterion is pending further research and finalisation of reference sites. Monitoring against closure criteria is an ongoing process, and effective recruitment over time will be assessed, through repeated surveys for flowering/fruitletting, and presence and development of recruits.
170	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Criterion F13 should be reworded to; feral animal densities 'not greater than' those in surrounding areas, as opposed to similar to those in surrounding areas.	6.5 Flora and Fauna Table 6-4	ERS2 - Determining the requirements to support a terrestrial faunal community similar to areas surrounding the RPA.	Addressed	N/A	This criterion has been reworded in terms of weeds and feral animals to "not greater than" the surrounding areas. Note - Previous wording was used to align with the KKN. Work on fauna return strategies (including criteria / monitoring approaches) is ongoing and updates may be expected in 2020 MCP.
171	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 85	Additional comment Criteria for nutrient cycling (F8) should be expanded to include a more detailed assessment of nutrient cycling, including: • quantification of nutrients present • relative abundance for soil biota • appropriate spatial scales.	6.5 Flora and Fauna 6.5.1.3 Long Term Viability of the Ecosystem Table 6-4	ESR7A — What is the potential for plant available nutrients (e.g. nitrogen and phosphorus) to be a limiting factor for sustainable nutrient cycling in waste rock? ESR7C — Will ecological processes required for vegetation sustainability occur on the rehabilitated landform?	Pending	N/A	This criterion will be further developed when the relevant studies (for the associated KKNs) are complete. This information will be included in the updates of the 2020 MCP.
172	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 86	Additional comment Weed monitoring and weed control, at some frequency, will need to continue until closure.	11.5.2 Weed Monitoring	N/A	Addressed	12.7.3 Weed monitoring	Additional information on weed management and monitoring has been provided in Section 12.
173	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 86	Additional comment Criterion F11 (plant available water) should incorporate sustainability of a mature plant community.	6.5 Flora and Fauna 6.5.1.3 Long Term Viability of the Ecosystem Table 6-4	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	8.5 Flora and fauna	Information on PSD and PAW modelling, plant rooting depth, sub-surface consolidated layer, and more has been added. Consistent with information previously provided as part of 2019 App. 3 to Pit 1 Application - Ref: Lu P, Meek I, Skinner R. 2019. Supporting Information on Revegetation Growth Substrates at Ranger for Pit 1 Application. Energy Resources of Australia Ltd report, Feb. 2019
174	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 86	Additional comment Table 6-4. The criterion proposed for fire resilience should clearly detail how resilience would be assessed and what an acceptable value for resilience is. Consideration should also be given to how the restored vegetation community responds to fire regimes that are characteristic of the surrounding area, rather than how it may respond to a single fire.	6.5 Flora and Fauna 6.5.1.3 Long Term Viability of the Ecosystem Table 6-4	ESR8 — Understanding fire resilience and management in revegetation.	Addressed	8.5 Flora and fauna 12.7 Flora and fauna monitoring Appendix 7.1 KKNs	The criteria proposed for fire resilience has been improved to detail how resilience would be assessed and to establish an acceptable measure of this. Trials are being carried out to assess behaviour and responses of vegetation to fire regimes. There are specific KKNs to address this.
175	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 86	Additional comment Revise the proposed monitoring methods and frequency based upon the risks and mitigations identified through a trajectory model.	11.5 Flora and Fauna Monitoring	ESR5 — Develop a restoration trajectory for Ranger Mine	Ongoing	Appendix 7.1 KKNs 9 Risk assessment and management	A State-and-Transition Model for Ranger Mine revegetation is under development (in collaboration with ERA, SSB and CSIRO) and will enable the revegetation objectives (including the conceptual model), pathways, risks, contingencies and monitoring to be more clearly articulated in the 2020 MCP.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
176	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 86	Additional comment The vegetation and fauna monitoring program should include detailed information about: • justification for site selection • survey methods and quantitative metrics being to assess condition and natural variability • how the data from these surveys are being used to derive or update closure criteria.	11.5 Flora and Fauna Monitoring	ESR5A — What are the key sustainability indicators that should be used to measure restoration success?	Ongoing	N/A	Information derived from KKN studies will be used to further develop the monitoring programmes which will be updated in the 2020 MCP with information available. Site selection of 'reference' or analogue sites is still under discussion with SSB. Monitoring programmes cannot be finalised until the reference sites and completion criteria are further developed.
177	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 89	Additional comment Update the TARP.	11 Closure Monitoring and Maintenance	N/A	Ongoing	10 Risk Assessment and Management	This section will be continually improved with each update of the MCP and with further monitoring information available.
178	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Section 9.7 Summary of Recommendations and Additional Comments for Ecosystem Restoration Page 89	Recommendation Develop detailed monitoring plans that cover and distinguish between all the necessary types and periods of monitoring, including: • 'operational' monitoring to detect potential impacts during the implementation phase of rehabilitation • progressive rehabilitation monitoring to confirm that rehabilitated areas are performing as expected and if necessary, inform future rehabilitation activities • monitoring to verify surface and groundwater modelling predictions • post-2026 stabilisation and maintenance phase monitoring. • resources required to fulfil monitoring requirements • any other project specific assumptions or information which would be required to conduct a detailed assessment of the appropriateness of the monitoring programs.	11 Closure Monitoring and Maintenance	N/A	Ongoing	12 Closure monitoring and maintenance	Additional information on monitoring has been provided in the Closure monitoring and maintenance Section. This will continue to be developed in subsequent iterations of the MCP as further information becomes available.
179	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Executive Summary	Additional information is required to give confidence in the ability of the final landform to support vegetation in the long term, particularly concerning plant available water, soil formation and the establishment of understorey species.	10 Closure Implementation	N/A	See specific responses to the executive summary comment above	N/A	see specific comments
180	SSB	Internal Report 658 Assessment Report: Ranger Mine Closure Plan Rev# 0.18.0 May 2018 as submitted in September 2018	Executive Summary	The Revegetation Strategy presented should be expanded to an ecosystem restoration strategy, based upon a suitable ecosystem trajectory model which addresses the interdependencies between flora and fauna.	7 Supporting Studies	ESR2 — Determining the requirements to support a faunal community similar to areas surrounding the Ranger Project Area. ESR5 — Develop a restoration trajectory for Ranger Mine.	Ongoing	7 Supporting studies Appendix 7.1 KKNs	Additional studies in regard to fauna recolonisation on rehabilitation sites at Ranger Mine are continuing, as is the KKN studies in regard to development of a rehabilitation trajectory. The ecosystem rehabilitation strategy will be finalised when this additional information is available.
181	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Ranger 3 Deeps decline - very generic overview but fails to note specific rehab needs relating to the overall closure of Ranger.	3.2.3 Ranger 3 Deeps Exploration Decline	N/A	Addressed	11 Closure Implementation	R3D application to decommission R3D was approved by the Minister for Primary Industry and Resources NT, in consultation with the Australian Minister for Resources and Northern Australia on 15 April 2019. Details of decommissioning of R3D are included in Implementation Section 11.
182	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Lack of detail on total waste materials. How much of each type of 'mineral type' from Table 3-1 were mined from Pit 1 and then Pit 3 MCP should ARRTC document: • how much of what ore grade was mined, including whether laterite or fresh rock; and • how much waste rock was used on tailings dam walls, is currently in pit 1 & pit 3, how much remains in specific stockpiles.	3.2 Overview of Operations Table 3-1	N/A	Ongoing	2.2. Overview of operations	The MCP covers mine closure. A summary of the project is provided in Section 2, with a discussion on stockpiles in Section 2.2.8. The specifics of the ore grades and ore type are irrelevant for the discussion of closure. It is agreed that a waste inventory is required for closure planning and implementation, and amounts of waste currently backfilled into pits is provided in Section 11 on implementation. Details on the TSF walls and deconstruction will be provided in an application planned for submission in 2021 and, once approved, these details will be included within the next MCP update.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
183	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Use a more recent reference there are much more recent references to ANCOLD (and related ICOLD) standards than 1984 The Rio Tinto standard is missing the reference.	3.2.4 Tailings Storage	N/A	Addressed	2.2.5 TSF	The reference cited (Hart, B & Davies, S. 1984. Capacity of waters in the Magela Creek system, Northern Territory, to complex copper and cadmium. Technical memorandum 7, Supervising Scientist for the Alligator Rivers Region, AGPS, Canberra) does not seem to be appropriate to the text and is therefore an error that has been corrected in the text. The Rio Standard title is provided, but a year has been added.
184	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	It is wrong to assert that the tailings are 'neutralised' - whilst this used to happen in the early years of Ranger, it hasn't been practiced for ~25 years with tailings pH only raised to ~pH 4 or so - i.e. still quite acidic.	3.2.4 Tailings Storage 3.2.5 Tailings Dam	N/A	Addressed	2.2.5. TSF	This section of the MCP has been updated to clarify that the pH of the tailings stored within the TSF is approximately pH 4 (acidic).
185	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	How can a 1981 reference cite a 1995 or 2005 application? Multiple other references should be cited for tailings deposition in Pit 1.	3.2.6 Pit 1	N/A	Addressed	2.2.6. Pit 1	Error as noted. This section of the MCP has been updated.
186	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	A simple analysis of annual (or quarterly) corporate reports from ERA shows that the total waste rock mined at Ranger from both pits 1 & 3 is approximately 252 million tonnes (Mt) - virtually double the "127 million tonnes."	3.2.8 Stockpiles	N/A	Addressed	2.2.8. Stockpiles	The simple analysis was incorrect by G Mudd. The 127 million tonnes was stated as the waste in the stockpiles as was for the time of reporting for the 2018 MCP. This is not the same as the total waste mined for the life of mine. Waste has been utilised onsite for activities such as ramp construction and backfill.
187	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Water balance model - No data on water quality or detailed water chemistry given. Required for understanding risks and closure planning.	3.2.9.6 Site Water Model	N/A	Addressed	2.2.9.6. Site Water Model	Solutes concentrations within the water balance model are only meaningfully tracked within the process water circuit. Total Dissolved Solids (TDS) is the only total solute concentration that has practical relevance. Treated water from the process water treatment plants and treated water from the pond water treatment plants is of a very high quality, and does not pose a challenge for management from the point of view of release water chemistry. Behaviour of solutes derived from process water in the post-closure phase is addressed via the solute transport model. Inclusion of additional detail is beyond the scope of the MCP and is provided within the Water Management Plan.
188	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	The MCP fails to adequately address the 30% chance that process water will remain in January 2026. That is, based on Figure 3-8, page 3-22, there is a modelled 30% chance that process water inventory may not be reduced to zero by the statutory time of RPA relinquishment in January 2026.	3.2 Overview of Operations	N/A	Addressed	2.2.9.7 Site water model	Figure 2-10 has been updated. Measures to mitigate the risk of excess water inventory remaining on site in 2026 were captured in the mine closure risk assessment (refer to Appendix 9.1 in 2018 MCP). Other scenarios and contingencies were addressed within the Feasibility Study. Options to further reduce the risk of excess water storage (post-2026) will be presented within a future application (due for submission January 2020); requiring modification of the existing water treatment system for the purpose of optimising the processing capacity.
189	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Use of drinking water guideline values fails to ensure ecosystem protection eg: • Natural uranium concentrations in upstream Magela Creek waters are typically 0.05-0.5 ug/L yet standard proposed is 17ug/L Proposed values for SO4, NO3 and NO2 would result in contamination of Magela Creek system.	6.4 Water and Sediment	N/A	Addressed	8.4 Water and sediment	Drinking water guidelines were not proposed to ensure ecosystem protection. Separate draft criteria were proposed for each protection objective so achievement could be measured. It was stated that: <i>In some instances, the same parameter appears against several objectives. In most cases the ecosystem protection criteria are more stringent than, for example, human health criteria. Criteria values for each outcome are given so compliance with each particular outcome and objective can be assessed.</i> The section on water and sediment criteria has been revised. In line with ANZG (2018) draft guideline values are listed for each protection objective. It is stated that the water quality objectives for each COPC (yet to be agreed) will be based on the most stringent of the guidelines.
190	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Monitoring approach beyond 2026: • What is the legal basis? • Who will be liable? • How will failures be enforced and funded? • Who will undertake the monitoring?	11 Closure Monitoring and Maintenance	N/A	Ongoing	N/A	Discussions are underway for securing access beyond 8 January 2026. Further details on progress of obtaining such access, and any conditions associated with the access, will be provided in MCP updates. As per the Ranger Authority (Annex A clause 13.3) the Company must carry out a monitoring program approved by the Supervising Authority or the Minister with the advice of the Supervising Scientist following cessation of operations until such time as a relevant close-out certificate is issued under clause 9.3.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
191	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Landform objective 4: include quantitative targets or criteria.	6.2 Landform	N/A	Ongoing	7 Supporting Studies	Additional studies have been conducted and information included in Section 7 regarding the landform theme, these include an updated DEM, tailings consolidation modelling. The outcomes of these works provide further validation to the closure criteria developed for the landform. The outcomes of on-going and future studies (Section 7.10) will be considered in future reviews of the criteria.
192	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Gavin Mudd	Landform objective 3: worst case scenarios should be 'worst case' and unexpected not 'realistic and reasonable.'	6.2 Landform	N/A	Addressed	N/A	Worst case' discussions must include scenarios that may indeed happen. They can be unexpected, they will be realistic and they will be reasonable. They cannot be unrealistic nor unreasonable or the discussion becomes unrealistic and redundant.
193	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	States that nickel is being considered as a COPC, but no rehab standard has been established?	7.4.3.3 Constituents of Potential Concern	WS1A — What contaminants are present on the rehabilitated site?	Addressed	7.3.2.4 Solute loss 8.4.3.3 Step 3. Define relevant indicators	The water and sediment technical working group agreed on the COPC to be considered in assessments and that not all would need closure criteria (or rehab standards). The nickel concentrations predicted to emerge to the creek (Table 7-5) are several orders of magnitude lower than the ANZECC (2000) guideline for 99% species protection.
194	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	What is the basis for assuming that a 7m waste rock cover will not pose a constraint on plant-available water?	7.3.4 Revegetation Trials Page 58	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.5 Plant available water studies	The depth has been revised to 6m. New content discussing PAW is included in the MCP from 2019 App. 3 to Pit 1 Application - Ref: Lu P, Meek I, Skinner R. 2019. Supporting Information on Revegetation Growth Substrates at Ranger for Pit 1 Application. Energy Resources of Australia Ltd report, Feb. 2019
195	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	The plant available water studies assumed a 4 m thick waste rock layer. How applicable will this be to the proposed 7 m thick layer of waste rock on the final landform? Page 7-43 While baseline data from MCUS are given in table 7-13, there is virtually no discussion of the results except for EC and Mg	7.3.5 Plant Available Water Studies 7.4.3.1 Water and Sediment Baseline	ESR7 — Understanding the effect of waste rock properties on vegetation establishment and sustainability	Addressed	7.3.5 Plant available water studies 7.4.7 Reference site ecohydrological studies	The results of the completed KKN are summarised within Section 7.3.5 of the updated MCP. Demonstrated that 4-6 m of waste rock landform with various levels of rock contents can maintain a positive PAW water balance while supporting a vegetation similar to one of the reference sites. A reference is given to a document (Klessa 2000) describing the baseline chemistry of Magela Creek which is summarised in the table. The discussion on p. 7-43 (2018 MCP) focuses on EC and Mg as they were the parameters the author (Klessa, 2005) used to show the hydrological behaviour of the creek and how it influences the water quality of the creek.
196	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	Mistake. The Mg value will protect 99% of species, not 1%! See my specific comments on the SS rehab standards documents.	7.4.3 Water and Sediment Studies	N/A	Addressed	7.4.3 Water and sediment studies	This error (1%) has been corrected. A 99% protection of species criteria applies.
197	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	While baseline data from MCUS are given in table 7-13, there is virtually no discussion of the results except for EC and Mg.	7.4.3.1 Water and Sediment Baseline	N/A	Addressed	7.4.3.1 Water and sediment baseline	This section has been updated to include further discussion regarding the baseline data from MCUS.
198	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	What is the basis for the assumption that COPCs from tailings/process water e.g. other metals, will pose a negligible risk? Yes, the amounts are much lower than COPCs from waste rock, and under Ranger operations concentrations off site e.g. in ARRTC Magela Creek are low, but some of these metals are much more toxic than the COPCs identified from waste rock e.g. Cu, Cd and during rehab could be mobilised e.g. Fe? Perhaps monitor during initial decommissioning phase to check they are low risk, especially iron.	7.4.2 Contamination Investigations	WS1— Characterising contaminant sources on the Ranger Project Area	Addressed	7.7.3 Ranger Mine conceptual and model solute transport areas of interest/concern 12.5 Water and sediment monitoring	Modelling results described in the 2018 MCP (in Tables 7-16 and 7-17) for these COPCs from tailings showed that the concentrations and loads expected to reach the creek are much lower than local, national or international guideline values. The predicted additional concentrations for these COPC are well below guideline values and for some of the COPC are lower than detection limits. The plume from tailings and process water in Pit 3 will not reach the creeks for ~1000 years. So transport from this source is not amenable to direct monitoring. Process water expressing from Pit 1 buried tailings may move to Corridor Creek in the post-closure monitoring period. Monitoring will be undertaken in that period to validate the models and assess environment protection.
199	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	No numerical criteria for contaminants in soils are given, although reference is made to other criteria e.g. HILs and EILs. It is hard to see what limits of contaminants in soil will be ALARA? This leaves the CC for soils quite open ended. More attention needed.	6.6 Soils	N/A	Pending	8 Closure Completion Criteria	ERA acknowledge that further work is required on the soils closure criteria and the developemnt of a U EIL . This work is currently being completed and will be included in future updates of the MCP.
200	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	I think this table needs more explanation re. radiation CC for terrestrial and aquatic biota. How many species would need to be exposed above 400 µGy/h to trigger action? Just one?	6.3 Radiation Table 6-2	RAD6 — Radiation dose to wildlife	Ongoing	8.3.1.2 Radiation effects on bi	Action will be triggered if dose rates are above the benchmark dose rate for a specific representative organism. See Section 8.3.1.2.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
201	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	The plan states here that an assessment process rather than compliance with a single numeric criterion to determine closure outcomes in the water and sediment theme are being considered. Yet the advisory rehab standards about to be published by SS are all single numeric criteria for metals, sulfate and ammonia in waters. Can this inconsistency be resolved? I understand this is a work in progress. It may be necessary to develop both short term (pulse/acute) and chronic criteria. For assessing exposure data, USA is proposing a Fixed Monitoring Benchmark approach that takes account of metals criteria varying with water chemistry as well as frequency of exceedance. (See recent paper on-line early view by Ryan, Santore and Delos in SETAC journal IEAM).	Executive Summary 6.4.1.1 Risk Based Tiered Approach to Water and 6.4.1.1 Sediment Closure Criteria and ALARA 6.8.3 Water and Sediment	N/A	Addressed	8.4 Water and sediment	ERA has changed its approach to the development of water criteria to align with the national water quality management framework approach for setting water quality objectives. ERA intends to follow up the suggested approach for assessing exposure data with ARRTC and SSB. The SSB standards are proposed as guideline values (Step 6 of the national water quality management framework). SSB rehabilitation standards are values below which no impact will occur. It does not mean that exceeding them will result in an impact (especially one that is detrimental to ecosystem health as per the ER). ERA has engaged BMT to develop a framework for interpreting effects of exceeding water quality criteria (using Mg as a case study) including determining if impacts will be detrimental to a range of environmental values (taken from the Ranger environmental requirements). There is also a joint SSB-ERA project being conducted by CSIRO on cumulative impacts to aquatic systems. The two projects have a degree of overlap and complement each other. It is expected results will be presented to ARRTC in 2019.
202	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	Limits for Mg and ammonia-N do not agree (are higher than) proposed SS rehab standards.	6.4 Water and Sediment Table 6-3: Closure criteria – water and sediment	N/A	Addressed	8.4.2 Management objectives and outcomes	SSB rehabilitation standards are not the same as closure criteria and were released later than the writing of the 2018 MCP. In the revised approach to setting water criteria the SSB rehabilitation standards are proposed as guideline values for ecosystem protection. See Table 8-3: Closure criteria – water and sediment
203	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	Will the reference set of biota be local species? How determined?	6.3.1.2 Radiation Effects on	RAD6A — What are the representative organism groups that should be used in wildlife does assessments for the rehabilitated site?	Pending	N/A	The KKN RAD6A was largely addressed in a previous EIS, and the KKN is aimed to be closed out soon after review by the MTC and ARRTC. Therefore, a summary of this KKN, and therefore an answer to this query, will be supplied within an updated studies section in the 2020 MCP.
204	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	“Permeate” in last dot point is not defined above in the five water classes.	3.2.3 Ranger 3 Deeps Exploration Deline	N/A	Completed	2.2.9 Water management 2.2.9.2 Water treatment plants	Permeate represents the release quality output from the pond water treatment plants which uses ultra/micro filtration and reverse osmosis to remove a significant amount of dissolved solids from pondwater. The final quality of permeate can be discharged to the release water system subject to conditions of the Authorisation.
205	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Jenny Stauber	For completeness, it would have been good to report actual results for the more recent sediment monitoring program. Actual data for U concentrations in sediments should also be included e.g. example results from Parry (2016).	7.4.3.1 Water and Sediment Baseline	WS3A — What is the nature and extent of surface water movement, now and over the long-term?	Addressed	7.7.3.4 Processing plant area conceptual model Figure 7-80	This section has been updated to include a figure of uranium concentrations in reference and onsite billabongs and a table of regional background values for several metals.
206	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	The Closure Plan also does not accord any special priority to or final criterion for threatened plant or animal species, notwithstanding the exceptionally high numbers of threatened species in the surrounding area (Woinarski and Winderlich 2014). It would not be unreasonable to include a final criterion that these should be present in the revegetated site in comparable abundance and diversity to surrounding areas.	6.5 Flora and Fauna	N/A	Ongoing	4.3.3.3 Fauna species	A number of conservation significant species (mostly bird species listed under various migratory agreements) have been recorded on the RPA during surveys (Table 4-8). ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including faunal species) are awaiting further consideration. It must be noted that to include final criterion for conservation significant species is not typical in a MCP, as these species are intrinsically rare and/or recalcitrant.
207	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	For the parameter of ‘fire resilience’ the Closure Plan proposes a final criterion of ‘Vegetation demonstrates resilience similar to analogue sites in response to fire’. The explanation of this criterion (at p. 6-33) does not clarify how ‘resilience’ will be assessed here, or what an acceptable value for resilience is. Furthermore, the relevant issue is not how the restored vegetation may respond to a single fire, but rather how the restored vegetation community responds to fire regimes characteristic of the surrounding area.	6.5.1.3 Long Term Viability of the Ecosystem	ESR8 — Understanding fire resilience and management in revegetation.	Addressed	8.5 Flora and fauna 12.7 Flora and fauna monitoring Appendix 7.1 KKNs	The criteria proposed for fire resilience has been improved to detail how resilience would be assessed and to establish an acceptable measure of this. Trials are being carried out to assess behaviour and responses of vegetation to fire regimes. There are specific KKNs to address this

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
208	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	The treatment of 'native fauna' (p. 6-34) is cursory and not likely to provide a good or reliable measure of the trajectory and proximity of the fauna assemblage towards that in analogue environments in KNP. The Closure Plan suggests that the faunal communities will be based on techniques described in Corbett (1999), notwithstanding major advances in fauna sampling technology (e.g. remote cameras) in the last 20 years (Gillespie et al. 2015), and the now well-established application of more systematic fauna sampling in KNP and elsewhere (e.g., Woinarski et al. 2010). Furthermore, 'presence of major functional groups' does not adequately meet a need to consider the resemblance of species composition and abundance between the restored site and analogue sites: for example, a single honeyeater may be present somewhere on the revegetated area but this does not imply that the site is sufficiently close to analogue sites that may typically have a dozen honeyeater species at a density of >5 birds/ha. Also, special attention should be paid in the Closure Plan to those animal groups that may be most likely to be challenging to restore, most notably the large proportion (10-40%) of vertebrate species that depend upon tree hollows (Taylor et al. 2003)	6.5.1.3 Long Term Viability of the Ecosystem	ESR2 — Determining the requirements to support a terrestrial faunal community similar to natural ecosystems surrounding the mine site ESR2A — What faunal community structure is present in the areas surrounding the Ranger Project Area ESR5A — What are the key sustainability indicators that should be used to measure restoration success?	Ongoing	Appendix 7.1 KKNs 8.5.1.3 Long term viability of the ecosystem	These comments are noted. References in the MCP have been updated. There are a number of KKNs studies to be completed that will assist in providing informed detail on the fauna completion criteria, and assisted habitat return. It is recognised that whilst there are no barriers for species to ingress onto the rehabilitation sites, the return of specific habitat requirements will not be possible for all species, and will take some time for others to develop.
209	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	For the plant species composition parameter, one 'final criterion' is that 'Bray-Curtis similarity index >15-30 percent' (Table 6.4), stated somewhat differently in the text (p. 6-31) that 'any similarity that falls within this range (about 10 to 30 percent) shall be acceptable'. The justification for this criterion is sourced from 7.6.3. However, the text there (and notably Figure 7.45) indicates that the mean similarity in vegetation composition between sites of different vegetation classification units (C2, C3 and C4) averages 20-30%, so it is appropriate to aim for a higher floristic similarity for the revegetated site with appropriate analogues. Furthermore, there is no reason for this criterion to have an upper cap (i.e. 30%), given that the more similar to the analogue sites the better – i.e. the target should be expressed as at least x%, rather than a-b%. Note that a Bray-Curtis similarity of 30% is actually quite low – i.e. it indicates the two compared areas are more dissimilar than similar. These sites clearly have very different plant species compositions, but their Bray-Curtis similarity is $2*(3+2)/(19+15) = 29\%$, which would comfortably meet the suggested 'final criterion'. Hence, I consider the proposed closure criterion of 15-30% similarity is too low to meet the objective that 'revegetation ... is similar ... to adjacent areas'.	7.6.3 Flora Species Composition and Community Structure	ESR1B — Which indicators of similarity should be used to assess revegetation success? ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Ongoing	N/A	Minor corrections made. No major changes to be made until the selection of 'appropriate' reference sites is resolved, and relevant KKN studies are complete This criterion has been revised and additional justification has been provided, including reference to source data, within the update MCP.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
210	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	For vegetation community structure, the proposed final criteria relate to canopy cover and ground cover index. As demonstrated in some early trials at the Ranger site, revegetation (especially when dominated by fast-growing Acacia species) can acquire dense canopy cover very rapidly, but this provides a misleading and inadequate measure of its structural resemblance to analogue vegetation. Far better would be to focus on well-established parameters such as woody basal area and stem diameter size composition (e.g. the characteristic profile of number and proportion of stems 2-5 cm dbh, 5-10 cm dbh, 10-20 cm dbh, 20-30 cm dbh, 30-40 cm dbh, etc.). There are many existing estimates of woody basal areas of eucalypt forests and woodlands in this region, so there is a robust evidence base for characterising a preferred state or convergence towards analogue sites for this parameter.	6.5.1.2 Community Composition	ESR1B — Which indicators of similarity should be used to assess revegetation success? ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including canopy cover, ground cover) are awaiting further consideration.
211	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	Table 6-4 gives the next closure criterion for this parameter as 'total species number over 400 ha is >35'. This value appears not to be based on any assessment from analogue sites of the number of tree and shrub species normally present in a 4 km ² area, but is instead derived too arbitrarily from the number of species on the preferred planting list (47 or 48, at Table 7-27) minus an arbitrary quota (30%) of these that may not persist. It is highly likely that the number of shrub and tree species in any 400 ha area in Kakadu National Park is very much higher than 35: It would be estimated that it is typically much greater than 100. Accordingly, the target proposed here is not based on appropriate evidence.	6.5 Flora and Fauna Table 6-4	ESR1C — What values should be prescribed to each indicator of similarity to demonstrate revegetation success?	Ongoing	N/A	The points made in the comment are noted. The finalisation of completion criteria will occur after further studies relating to KKNs are completed. ERA and SSB continue to liaise and discuss reference site selection, data analysis and assessment metrics.
212	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	For vegetation community structure, the proposed final criteria relate to canopy cover and ground cover index. As demonstrated in some early trials at the Ranger site, revegetation (especially when dominated by fast-growing Acacia species) can acquire dense canopy cover very rapidly, but this provides a misleading and inadequate measure of its structural resemblance to analogue vegetation. Far better would be to focus on well-established parameters such as woody basal area and stem diameter size composition (e.g. the characteristic profile of number and proportion of stems 2-5 cm dbh, 5-10 cm dbh, 10-20 cm dbh, 20-30 cm dbh, 30-40 cm dbh, etc.). There are many existing estimates of woody basal areas of eucalypt forests and woodlands in this region, so there is a robust evidence base for characterising a preferred state or convergence towards analogue sites for this parameter.	6.5.1.2 Community Composition	ESR1B — Which indicators of similarity should be used to assess revegetation success?	Ongoing	N/A	The points made in the comment are noted. The finalisation of completion criteria will occur after further studies relating to KKNs are completed. ERA and SSB continue to liaise and discuss reference site selection, data analysis and assessment metrics.
213	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	For the objective 'long-term viable ecosystem requiring maintenance similar to adjacent areas of KNP', several of the proposed 'final criteria' are sub-optimal. The criterion 'evidence of flowering and fruiting of 80% of framework or characteristic species' is insufficient. In order to provide reassurance that the revegetated site is comparable to nearby KNP, it is important that there is also some consideration of the amount and periodicity of flower, fruit and seed resources provided in the revegetated site, not simply whether there is any evidence of any flowering or fruiting. Furthermore, the exclusion of 20% of plant species from this criterion is arbitrary and appears to be short-changing what should be considered acceptable: in analogue sites almost all plant species will flower or fruit in any year.	6.5.1.3 Long Term Viability of the Ecosystem	ESR1B — Which indicators of similarity should be used to assess revegetation success? ER7C - Will ecological processes required for vegetation sustainability occur on the rehabilitated landform? ESR5. Develop a restoration trajectory for Ranger Mine	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including reproduction criteria) are awaiting further consideration. Completion of studies to address relevant KKNs will assist this criteria development. The considered comments are noted, and ongoing discussions (including on this topic) with SSB through various forums will continue.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
214	ARRTC	ARRTC Table - Comments on the 2018 RMCP	John Woinarski	The 'final' criterion for 'recruitment/regeneration' is 'presence of seedlings and/or 'suckers; of 80% of framework species or characteristic species (based on species present)'. As for the previous attribute relating to fruiting and flowering, it is not entirely clear what is meant by 'framework species or characteristic species (based on species present)'. However, a more important concern is that the criterion does not really demonstrate that the revegetated site has population viability or demographic structure characteristic of adjacent sites in KNP. 'Presence of seedlings and/or suckers' is not the same thing as (and indeed is a far inferior parameter to) the amount and adequacy of recruitment or the achievement of an plant species age/size distribution that is comparable to intact areas.	6.5.1.3 Long Term Viability of the Ecosystem	ESR1 — Determine the characteristics of terrestrial vegetation surrounding the mine site. ER7C - Will ecological processes required for vegetation sustainability occur on the rehabilitated landform? ESR5. Develop a restoration trajectory for Ranger Mine	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including reproduction criteria) are awaiting further consideration. Completion of studies to address relevant KKNs will assist this criteria development. The considered comments are noted, and ongoing discussions (including on this topic) with SSB through various forums will continue.
215	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The weed strategy is unclear at present, limiting understanding of the how the risks of fire and weeds will be co-managed to achieve native mid and understorey and erosion objectives.	6.5 Flora and Fauna	ESR8 — Understanding fire resilience and management in revegetation.	Ongoing	11 Closure implementation Appendix 11.2 Revegetation Strategy 12.7.3 Weed monitoring	See updated studies sections on proposed revegetation protocols (including fire and weed management), and the rehabilitation strategy supplied as an appendix (including secondary introduction of fire sensitive species).
216	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	It would be good to see clear justification for the watering regime for the site. The following is unclear: "Assessment of achievement of this criterion will be through surveys conducted post any events."	6.5.1.3 Long Term Viability of the Ecosystem	N/A	Addressed	11.17.3.1 Irrigation Installation	Details on watering regime are included in the Section 11.17.3.1 of the MCP.
217	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The list of species may be amended depending on the risk of "seed availability, viability, germination and nursery production rates". These risks have also led to specification of a 70% threshold for the accepted number of species present on the final landform. It is unclear whether the changes to the species list, or the accepted composition of the landform, are acceptable. This is because the risk has not been quantified, the expected outcomes for revegetation have not been specified, and the potential variation (i.e. if those risks are realized) in relation to those expected outcomes has not been specified. It is critical that the upcoming revegetation plan includes clear and quantified expected outcomes, the expected spatial and temporal trajectory of change, and the potential for alternative outcomes, along with specification of risk mitigation measures if these outcomes are realised.	6.5.1.1 Local Native Plant Species 6.5.1.2 Community Composition	ESR3 — How do we successfully establish terrestrial vegetation, including understorey?- ESR3A How do we successfully establish terrestrial vegetation, including understorey (e.g. seed supply, seed treatment and timing of planting)?	Ongoing	6.5 Flora and fauna	This criterion has been revised and additional justification has been provided. Also, the Species Establishment Program has been explained in the Supporting Studies Section. Trials are currently underway to assist in the quantification of these risks. The supply of seed is managed as a class IV risk (Section 10) and is thus recognised as an issue requiring effective management. The completion of related KKNs will enable further information to inform completion criteria development and management strategies for mitigation of risk.
218	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	"As there are limited mitigations available to correct any identified issues with the landform, landform design and the construction methods will be key to ensuring that water will be available in the long term." Given the uncertainty surrounding the potential availability of PAW, to evaluate the potential for revegetation success it would be reasonable to understand the plan, including alternative options, for the deposition of the final waste rock layer.	6.5.1.3 Long Term Viability of the Ecosystem	ESR7 — Understanding the effect of waste rock properties on vegetation establishment and sustainability	Addressed	7.5 Landform design and performance 11.16 Final landform	Information on PSD and PAW modelling, plant rooting depth, sub-surface consolidated layer, and more has been added. Consistent with information previously provided as part of 2019 App. 3 to Pit 1 Application - Ref: Lu P, Meek I, Skinner R. 2019. Supporting Information on Revegetation Growth Substrates at Ranger for Pit 1 Application. Energy Resources of Australia Ltd report, Feb. 2019
219	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	I realise these models are in development, but many of the pathways in the models rely on assessing quantitative data, with uncertainty. As such, there is a need for specification of the underpinning sampling strategy, and to agree and specify the tolerance for uncertainty in the data, before it can be concluded that any thresholds specified in the nodes have been crossed.	6.4.1.1 Risk Based Tiered Approach to Water and Sediment Closure Criteria and ALARA Figure 6-3, 6-4, 6-5	N/A	Addressed	8.4 Water and sediment	The risk based tiered approach to developing closure criteria has been replaced by an approach based on the national water quality management framework. This comment is referring to the decision trees for drinking water, recreation and ecosystem The frameworks will be largely used to assess the outcomes of predictive models of future surface water concentrations to a large extent than for interpreting measured data as (i) there is an existing compliance framework in place for interpreting water quality during the operational phase, and (ii) the largest source of contaminants entering the surface water environment from the rehabilitated site are predicted to peak 270 years after rehabilitation. Uncertainty is being addressed in the solute transport predictive models.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
220	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	Species composition targets account for trees and shrubs only, and do not account for non-woody native species (i.e. ground cover, assessed according to cover and 'architecture' only). If so, it should be clear that the relevant outcome also only refers to trees and shrubs (i.e. "Species composition and community structure is similar to adjacent areas of KNP") I am unsure why ER's 1.1 and 2.1 are not relevant to this table (i.e. as per Table 6-6).	6.5 Flora and Fauna Table 6-4	ESR1 — Determine the characteristics of terrestrial vegetation in the areas surrounding the Ranger Project Area. ESR3A — How do we successfully establish terrestrial vegetation, including understorey (e.g. seed supply, seed treatment and timing of planting) ESR5A — What are the key sustainability indicators that should be used to measure restoration success?	Ongoing	8.5 Flora and fauna	Closure criteria relating to tree and shrub composition and structure have been clarified. Additional criteria relating to understorey species are under consideration.
221	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The following is unclear: "However, some criteria such as canopy architecture and ground cover index, are better assessed collectively, or within the context of meeting the overall closure criteria as a whole."	6.5 Flora and Fauna 6.5.1 Justification for Outcome, Parameter and Criteria	ESR1B — Which indicators of similarity should be used to assess revegetation success?	complete	8.5 Flora and fauna	This terminology has been revised and clarified. This is a recommendation from the DPIR Review Report of the draft Closure Criteria.
222	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The time to recover from fire for trees is estimated at 6cm, based on a single study by Gardener in 2007, and trial land form growth rate results suggest a 5-7 year fire free interval is required. It is unclear whether this includes all tree species in the species list, and what the implications are for shrub and ground cover species (exotic and native) not assessed by either study.	6.5.1.3 Long Term Viability of the Ecosystem P6-33	ESR8 — Understanding fire resilience and management in revegetation.	Ongoing	8.5 Flora and fauna 12.7 Flora and fauna monitoring Appendix 7.1 KKNs	The criteria proposed for fire resilience has been improved to detail how resilience would be assessed and to establish an acceptable measure of this. Trials are being carried out to assess behaviour and responses of vegetation to fire regimes. There are specific KKNs to address this
223	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The table is not consistent in specifying spatial or temporal scales, and many of the terms used are vague and subject to linguistic uncertainty (and therefore multiple interpretations).	6.7 Cultural Table 6-4	N/A	Ongoing	8.7 Cultural	This table has been updated in the 2019 MCP, but will be further developed in 2020 to improve clarity and specificity. Cultural criteria are currently under development with Traditional Owners
224	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The trial landform informs 'some' of these uncertainties to date but many factors are difficult to disentangle.	N/A	N/A	N/A	N/A	General comment is unclear -many studies, other than those on the TLF, are being undertaken to inform closure planning.
225	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	It is not clear whether the following statement indicates ER's 1.1, 2.1 and 2.2, and the objectives in Table 6-4 and Table 6-6, are not achievable: "The topography hydrology and substrate of the final landform will be different to the pre-mining environment and there is no real analogue in the natural surroundings, which means that a local indigenous ecosystem more ecologically appropriate to the changed conditions may be used as a guide for revegetation of the site (McDonald et al., 2016). Therefore, the reference ecosystem in the case of Ranger mine will be a conceptual model synthesised from numerous reference sites, field indicators, and historical and predictive records." As such, it is critical this conceptual model is made available, such that the likelihood of ERs being met can be assessed.	6.5 Flora and Fauna	N/A	Ongoing	N/A	A State-and-Transition Model for Ranger Mine revegetation is under development (in collaboration with ERA, SSB and CSIRO) and will enable the revegetation objectives (including the conceptual model), pathways, risks, contingencies and monitoring to be more clearly articulated in the 2020 MCP.
226	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The timeframe over which fauna are expected to recolonise the site is unclear, and the strategy to deal with species which do not utilise the site over the accepted timeframe is not specified.	6.5 Flora and Fauna	ESR2 — Determining the requirements to support a terrestrial faunal community similar to areas surrounding the Ranger Project Area.	Ongoing	N/A	Work on fauna return strategies is ongoing and updates will be included in the 2020 MCP update.
227	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	Figure 6-5. Again, the impact to 'biodiversity', 'ecosystem health and processes' requires definition, and an understanding of the underpinning sampling strategy, to have confidence in the ability to conclude the outcome nodes in the model.	6 Development of Closure Criteria Figure 6-5	N/A	Addressed	N/A	Figure removed.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
228	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The cumulative risk assessment referred to in 6.8.4 addresses quite a number of the major ecological risks (but not all), focuses on the closure criteria which have data as assessment endpoints, but recognises the gaps for future iterations of the approach. In addition, at the time of the report the full suite of interventions (or strategies) for rehabilitation had not been articulated, and data availability was, and will remain limited. The CERA could be used to help refine ongoing monitoring to address the highest risks, but I think articulation of the rehabilitation plan and the desired/expected/alternative endpoints, and further exploration of competing models (structural uncertainty) is necessary. That is: <ul style="list-style-type: none"> Quantitatively defining the desired endpoint(s) for restoration with stakeholders, taking into account the parameters and criteria referred to in Ch6, and specification of space and time. Understand from stakeholders/experts whether there are competing expected future trajectories under the current proposed rehabilitation plan (i.e. structural uncertainty), and the likelihood of these transitions. Interrogating these models for the critical uncertainty that impedes the choice of management strategy, and highlights where further work/experimentation is required to resolve the best course of action.	6.8.4 Flora and Fauna	CT1 — Assessing the cumulative risks to the success of rehabilitation and the protection of the offsite environment.	Ongoing	N/A	A State-and-Transition Model for Ranger Mine revegetation is under development (in collaboration with ERA, SSB and CSIRO) and will enable the revegetation objectives (including the conceptual model), pathways, risks, contingencies and monitoring to be more clearly articulated in the 2020 MCP. The comment that more detail is need to be articulated is one that will be Addressed with updates of each MCP and the inclusion of further information provided by by KKN studies and ongoing monitoring.
229	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	The criteria for the canopy cover and ground cover index are vague, but refer to the analogue sites. It is unclear what constitutes a 'comparable' rock, debris (?) and vegetation, in relation to analogue sites.	6.5.1.2 Community Composition	ESR1B — Which indicators of similarity should be used to assess revegetation success?	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including ground cover) are awaiting further consideration.
230	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	It is not clear how the targets were deemed acceptable (i.e. 80% target for percentage of framework or character species reproducing), nor over what timeframe these targets will be assessed.	6.5.1.3 Long Term Viability of the Ecosystem	ESR1B — Which indicators of similarity should be used to assess revegetation success? ER7C - Will ecological processes required for vegetation sustainability occur on the rehabilitated landform? ESR5. Develop a restoration trajectory for Ranger Mine	Ongoing	N/A	ERA and SSB continue to work on reference site selection, data analysis and assessment metrics. Meanwhile, some criteria (including reproduction criteria) are awaiting further consideration. Completion of studies to address relevant KKNs will assist this criteria development.
231	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	There is a need to define a spatially and temporally explicit landform (i.e. deposition of final layer) and rehabilitation plan that accounts for cultural, flora, fauna and erosion objectives. This plan needs quantitative definition of the desired final restoration states (with stakeholders) taking into account the parameters and criteria referred to in Ch6.	6 Development of Closure Criteria	N/A	Ongoing	Section 8 & 11	This query appears to request a defined final landform (both in time and space). The temporally specific details (i.e. when) are provided in the schedule (where possible) on activities (what) that will produce the final landform (Section 11). The spatially explicit landform details (where)- are explained in the domain description of what will be done where and when, but still resulting in the final landform at the end. The closure rehabilitation objectives are described in Section 6, and are dictates from the regulation covering the rehabilitation at the Ranger Mine. Not all completion criteria are yet finalised, and progress of crieria development is discussed in Section 8.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
232	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Libby Rumpff	P6-26, points (4) and (5), are unclear and require clarification. These are considered as relating to the need to define the i) goal ecosystem state(s) in relation to key compositional and functional attributes, ii) what constitutes a detrimental change from this state, and iii) an estimate of predicted or expected changes, in relation to the goal state. <ul style="list-style-type: none"> • “Develop more sophisticated measures of whether changes are detrimental noting changes to water quality and/or to assemblages of macroinvertebrates and aquatic flora may not necessarily mean a change to ecosystem state or the loss of a key ecosystem function.” • “Where biodiversity and ecosystem function cannot be assured (either temporarily or permanently), being able to better understand and communicate what are the implications of that loss.” 	6.4.1.1 Risk Based Tiered Approach to Water and Sediment Closure Criteria and ALARA	N/A (SSB)	Ongoing	8 Closure completion criteria	These points are being addressed through a consultancy project; the BMT project and linked Cumulative Ecosystem Risk Assessment (SSB-ERA-CSIRO). Both projects are underway in 2018 and will be presented to ARRTC in 2019. The MCP will be updated accordingly. Note the risk based tiered approach to developing closure criteria for surface water related closure criteria has been replaced by an approach based on the national water quality management framework.
233	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Summary	There are multiple planning options, but the uncertainty regarding the direction and magnitude of key processes (e.g. water availability, compaction, toxicity, fire risk and weed risk) and their combined effects on the success of the vegetation restoration efforts, have not been specified. There is a need to document the expected trajectories of change (i.e. hypotheses), with uncertainty. This is particularly relevant for the understorey, faunal, and cultural outcomes.	6 Development of Closure Criteria	ESR5 — Development a revegetation trajectory for Ranger Mine.	Ongoing	N/A	A State-and-Transition Model for Ranger Mine revegetation is under development (in collaboration with ERA, SSB and CSIRO) and will enable the revegetation objectives (including the conceptual model), pathways, risks, contingencies and monitoring to be more clearly articulated in the 2020 MCP.
234	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Table 7-1 comparison of consolidation model from 2014 and current indicates that the area for wick drainage must be greatly expanded to achieve target consolidation by January 2026 (i.e. from ~238,000 to ~418,000 m2). Does this change during model updating indicate material properties or process conditions in pit 3 that are dissimilar to pit 1, and thus what other surprises may occur?	7.1 Tailings Consolidation Modelling Table7-1	LAN3B — Where, when and how much consolidation will occur on the landform?	Pending	7.1 Tailings consolidation modelling	Further information is supplied within Section 7.1. Additional information will be updated to future MCP when KKN LAN3B completed.
235	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Actual data from pit 1 has not been shown together with model predictions in the MCP overview (e.g. Fig 7-4 process water egress from pit 1 during consolidation from 2013). A direct comparison with available data would be beneficial to improve confidence in modelling.	7.1 Tailings Consolidation Modelling Table7-1 7.1.2 Pit 1 Tailings Consolidation	LAN3B — Where ,when and how much consolidation will occur on the landform?	Addressed	7.1.2 Pit 1 tailings consolidation	Acknowledged and further information is supplied within Section 7.1.2 (Figure 7-5). Additional information will be updated to future MCP when KKN LAN3B completed.
236	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	It was concluded that “stream flow within Magela Creek will be sufficient to dilute the post closure mine inputs of COPC to low background concentrations....no exceedances of proposed criteria downstream of the Gulungul confluence”. Nevertheless, the ongoing work on an independent surface water model is welcome and should include rigorous uncertainty analysis and testing of assumptions.	7.8 Surface Water Modelling Conclusion	WS3A — What is the nature and extent of surface water movement, now and over the long-term?	Pending	7.10.11 Surface water modelling	Ongoing work on the surface water model is continuing throughout 2019. These aspects are currently being addressed in the update of the model. A report is likely to be available to ARRTC in 2019. The MCP will be updated once this information becomes available.
237	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	A worst case series of models to examine what it would take to exceed criteria concentrations could help identify aspects that need more focus.	7.8 Surface Water Modelling Conclusion	WS3A — What is the nature and extent of surface water movement, now and over the long-term?	Pending	7.10.11 Surface water modelling	Ongoing work on the surface water model is continuing throughout 2019. Sensitivity analysis will be included in the development of post-closure solute transport modelling to support identification of future studies. The MCP will be updated once this information becomes available.
238	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	A title of “Site characterisation and modelling” would better reflect the content of this section of the MCP.	7.10.3 Conceptual Site Modelling	N/A	Addressed	7.10.9 Conceptual site water modelling	This heading has been updated and reflects future works to conceptualise possible scenarios to inform planning.
239	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Queries on the trial landform with a focus on plant available water (PAW) have previously been raised by ARRTC to ERA (following May 2018 meeting). It does not appear that the overview MCP information addresses these detailed questions and our concerns on limited PAW within the top few metres that is available to roots of developing canopy and understorey.	7.3.5 Plant Available Water Studies	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.5 Plant available water studies	The results of the completed KKN are summarised within Section 7.3.5 of the updated MCP. Demonstrated that 4-6 m of waste rock landform with various levels of rock contents can maintain a positive PAW water balance while supporting a vegetation similar to one of the reference sites.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
240	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	The lack of 'closed' water balance studies on the trial landform is a shortcoming, despite the very worthwhile studies on runoff and PAW in analogue sites (e.g. Georgetown analogue). A closed water balance is typical practice at many mine restoration sites (e.g. Century Mine, mine sites in Canada) that gives more confidence to water balance components.	7.3.5 Plant Available Water Studies	ESR7B — Will sufficient plant available water be available in the final landform to support a mature vegetation community?	Addressed	7.3.5 Plant available water studies	The results of the completed KKN are summarised within Section 7.3.5 of the updated MCP. Demonstrated that 4-6 m of waste rock landform with various levels of rock contents can maintain a positive PAW water balance while supporting a vegetation similar to one of the reference sites.
241	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Possibility of crushing the surface (e.g. with a sheep foot roller) to improve fines and water retention in the top metre or so (i.e. rather than the top ~7m that may have limited accessibility to plant roots). There are simplification and assumptions in the PAW models for waste rock only (as per the queries raised by ARRTC), with consequences for plant stress and survival rates that could be Addressed at this late stage by such actions at the surface of the waste rock (i.e. with no additional material – topsoil spread, laterite additions).	7.3.5 Plant Available Water Studies	ESR7 — Understanding the effect of waste rock properties on vegetation establishment and sustainability	Ongoing	7.3.5 Plant available water studies 7.4.7 Reference site ecohydrological studies	Information on PSD and PAW modelling, plant rooting depth, subsurface consolidated layer, and more has been added to the 2019 MCP. Consistent with information previously provided as part of 2019 App. 3 to Pit 1 Application. Supporting information available within the reference Lu P, Meek I, Skinner R. 2019. Supporting Information on Revegetation Growth Substrates at Ranger for Pit 1 Application. Energy Resources of Australia Ltd report, Feb. 2019 Further PSD reporting will be included within the 2020 MCP.
242	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Processing plant sources. Given the lack of groundwater data in this area, it is possible that this area is a long-term source, albeit at relatively low levels, of various COPC. Some surprises here in either specific COPC, or the long tailing of source contaminants, could be anticipated.	7.7.1.10 Processing Plant Area Conceptual Model	WS1A — What contaminants are present on the rehabilitated site?	Addressed	7.4.3.1 Water and sediment baseline 7.4.3.3 Constituent of potential concern	Groundwater quality data are available at 77 bores located within and down gradient of the processing plant area over many years. Soil concentration data are available at more than 30 locations within the processing plant area. Section 5.2.3 of the 2016-2017 annual groundwater report (ERM 2017) identifies several newly installed bores and bores added to the annual monitoring program in and near the processing plant area. Monitoring results demonstrate that the bulk of solutes in soils in the processing plant area are primarily located at shallow depths and higher concentrations in monitoring bores are primarily within the processing plant area. After almost four decades of operations, contaminants have not migrated any appreciable distance from the source area, so it is reasonable to expect that future COPC releases from any sources in the soil and COPC migration in the groundwater will occur at very slow rates. As described in Section 5.5 of the RCM report (INTERA 2016), the processing plant area will likely act as a long-term COPC source to groundwater, but the combination of relatively low source concentrations, slow migration rates, and large dilution effects in the creeks indicate that it will yield a negligible contribution to loading to surface waters.
243	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Main aquifers and faults – alluvial sediments, small area of rocks surrounding the Deeps Faults, large area of low K rocks (UMS and LMS) providing water to Brockman bore field. The Northern Ranger fault is presumed low permeability. Given constraints on time and access to detailed reporting, data on the significance of the Deeps Faults area has not been examined (e.g. bore and wireline logs, permeability and aquifer pump tests). It is not yet clear as to whether the characterisation and modelling of these features provides a reasonable balance between simplicity and realistic evaluation of groundwater flow.	7.7.1.5 Sitewide-Scale Conceptual Model	WS2A— What is the nature and extent of groundwater movement, now and over the long-term?	Addressed	7.7 Groundwater modelling	The Deeps fault area is very deep. Evidence can be provided to show it has no impact to groundwater flow (provided within INTERA 2017 Report)
244	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	3D groundwater flow model for pits 1 and 3 calibrated to observed groundwater heads only 2005-2006, yet this model was used for variable density conditions and solute transport modelling (presumable for conservative solute transport).	7.7.3 Pit 3 Solute Transport Modelling	WS2A— What is the nature and extent of groundwater movement, now and over the long-term?	Ongoing	7.7 Groundwater modelling	An update to the 2016 Ranger Conceptual Model was undertaken by INTERA throughout 2018 and early 2019. The work involved updates to the conceptualisation and calibration of the 3D groundwater model for the 37-year period, from commencement of mine operations (1980) through to 2017. INTERA presented the details of the updated conceptualisation and calibration were presented at the May 2019 ARRTC forum. The SSB were consulted throughout the update and calibration process and reviewed the final calibration report. An additional review is currently being undertaken at the request of ARRTC. Updates to the solute egress modelling for post-closure, including a detailed uncertainty analysis, is currently being undertaken with results expected in the second half of 2020.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
245	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	All modelling results should be expressed in probabilistic terms (i.e. rather than a single exact concentration or time) to reflect natural variability and uncertainty.	7.10.3 Conceptual Site Modelling	N/A	Ongoing	7.7 Groundwater modelling	Modelling results will be presented with a supporting uncertainty analysis to provide confidence and reflect natural variability. INTERA has provided ERA with a preliminary approach detailing the proposed uncertainty analysis methodology. This was provided to SSB for review and feedback in May 2019. New information will be incorporated into future MCPs.
246	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Groundwater inflow/outflow is ~0.001% of the total water balance, which is dominated by rainfall, ET and surface water flow, however a range of values or confidence limits should be provided in Fig 7-50 and text for both the major and minor components of the water balance.	7.7.1.5 Sitewide-Scale Conceptual Model Figure 7-50	WS2A— What is the nature and extent of groundwater movement, now and over the long-term?	Addressed	7.7.1 Ranger Mine conceptual model	As described in INTERA (2016) <i>Conceptual model for Ranger Mine</i> report, the estimated groundwater component of the regional water budget is negligible (7E-04 %) compared to other components. Adding confidence limits to the major and minor components does not significantly change the understanding of the relative contributions of all regional water budget components. The regional water budget calculation is found in Section 3.3.5 (INTERA 2016). Groundwater flow represents about 0.002 % of the water balance for the sitewide-scale domain as described in Section 4.9 of INTERA (2016). The Figure 7-50 (included in the 2018 MCP) has been superseded by the 2019 update of the groundwater model and excluded from the 2019 MCP.
247	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Numerical modelling scope should be expanded to include quantitative uncertainty analysis. While leading practices in quantitative uncertainty analysis (which goes beyond trial and error sensitivity analysis) have been led by groundwater modelling practitioners, these techniques should also be considered for surface water and reactive transport modelling.	7.10.3 Conceptual Site Modelling	N/A	Pending	7.7.2 Ranger Mine conceptual model future work 7.7.12 Preliminary approach for predicting post-closure groundwater solute loading to creeks using uncertainty analysis	Uncertainty analysis to support the post-closure solute transport modelling is planned to be undertaken. A preliminary proposal from INTERA was requested by ERA and provided to stakeholders for review and feedback in May 2019. New information will be incorporated into future MCPs.
248	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Groundwater flow during operations and post-closure. The backfilled pits do not appear to influence groundwater flow post-closure in the figure, whereas there is no data presented in the overview regarding the permeability of tailings/backfill and changes over time, and with waste rock near the cover surface. A 10-fold increase in permeability is mentioned on page 7-115, both within alluvium and between Pit 3 and creek alluvium. Such a low factor of hydraulic conductivity variation is surprising and should be justified.	7.7 Groundwater Modelling Figure 7-53	WS2A— What is the nature and extent of groundwater movement, now and over the long-term?	Addressed	7.7.3 Ranger Mine conceptual and model solute transport areas of interest/concern	Figure 7-76 depicts the conceptual flow paths expected under post-closure conditions, and depicts groundwater flowing from upgradient through the backfilled pits and then to the downgradient creeks. The Pit 3 and Pit 1 post-closure solute egress reports assumed no changes to the K of the pit backfill post-closure (INTERA 2014a, b), which is a conservative assumption because weathering is expected to increase the clay content and thereby decrease the K of the waste rock and consolidation is expected to decrease the K of the tailings. The K values assumed for waste rock and tailings in the modelling are 10 and 1.0E-3 m/d, respectively (INTERA 2014a, b). At the direction of ARRTC members in 2013, INTERA carried out sensitivity analyses of Pit 3 solute loading to Magela Creek for a ten-fold increase in the K of the hydrogeologic units located between the pit and the creek. These sensitivity analyses (summarised in Appendix D.3 of the RCM report [INTERA 2016]), like the linear feature sensitivity analysis (with K equal to 100 times the parent rock K) described in the response above, showed no significant increase in loading. It was assumed that while local variations could exceed a ten-fold difference in K, a ten-fold increase for entire individual hydrogeologic units was deemed a relatively large increase and adequate for sensitivity analyses purposes.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
249	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Peak Mg loadings from Pit 3 sources. The waste rock is the most important source of Mg loading, though it peaks only several hundred years. In contrast, the peak loading of Mg from tailings and brine is lower, with peaks at several thousands of years. In overview, this evaluation appears reasonable, however, the apparent precision of model results in Table 7-31 imply a confidence and certainty that is questioned . For example, the year of peak loading for both base case and low permeability cap case (brine) is 10,000 years, an outcome which appears convenient at the bounds of the timeframe of interest. In reality it may be 8,000-12,000 years for example, and there should be a real difference in the base case and alternative cap case. This overview raises serious questions about the recommendation that a low K cap is of "little benefit" (eg. Page 7-133).	7.7.1.7 Pit 3 Conceptual Model	WS1 — Characterising contaminant sources on the Ranger Project Area	Addressed	7.7.3.1 Ranger Mine conceptual model Pit 3	All analyses were conducted within a term of reference of a 10,000-yr performance period, which is the regulatory time frame requirement for tailings-derived materials specified by the Ranger Authorisation. Conducting analyses beyond this time frame has not been previously examined. Additional solute modelling is planned for 2019 to evaluate the uncertainty in loading and timing. Brine loading is still increasing at the end of the 10,000-yr simulation for both the base case and low-K caps scenarios. Both scenarios included a very conservative no-flow boundary condition along the north bank of Magela Creek that effectively forced all COPCs to migrate to the creek. Simulations were conducted for 10,000 years because that is the regulatory time frame for tailings per the Ranger Authorisation. Peak loading is defined as the highest loading during the 10,000-year performance period.
250	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	The figure caption refers to information (e.g. for bores other than OB27) that is not actually presented, perhaps it is incorrect, or part of the figure is missing.	7.7 Groundwater Modelling Figure 7-60	N/A	Addressed	7.7.3.5 LAAs conceptual model	This caption for Figure 7-83 has been updated.
251	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Note concerns about implied precision around the 10,000 year boundary (above). Peak load of Mg, U and Ra are compared with operational average annual loads, whereas nutrient loads are compared with natural inputs to the system. The overview MCP does not justify this approach, which indicates favourable outcomes for Mg, U and Ra but not necessarily in the context of natural levels and significance for ecosystems and human health.	7.7.2 Pit 1 Solute Egress Modelling – Conclusions	WS1 — Characterising contaminant sources on the Ranger Project Area	Addressed	7.7.4 Pit 1 solute egress modelling-Conclusions	The loads are compared to annual additional load limits (AALL) which are currently in place to protect human health (Mn, Ra, U, Po), or the environment based on natural loads in the system (nitrate and phosphate). It was stated that the COPC would be diluted to meet the site-specific or national guidelines for ecosystem protection. Post closure surface water modelling is continuing to predict concentrations in the creeks and billabongs, which will be compared against criteria and used to assess ecosystem and human health outcomes.
252	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	A separate (?) reactive transport model was then developed to evaluate Mg and U retention in the alluvial sands (minimal) compared with weather rock (significant attenuation). It is not stated in the MCP overview, but assumed that this modelling was batch type, without 3D and transient flow conditions. The attenuation results appear to be reasonable in a relative sense, although the details of various assumptions and limitations in the modelling need to be examined more closely (e.g. geochemical reaction pathways).	7.7.3 3 Solute Transport Modelling	N/A	Addressed	7.7.5.4 Reactive transport modelling	The reactive transport modelling was developed for the Pit 3 solute egress modelling and can be found in Section 6 of that report (INTERA 2014a).
253	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Given the importance of these tests, along with reactivity and compaction tests, a larger number of samples (e.g. more than 2 sub-samples for each) would have been preferable. It's not clear how representative these samples are, and why for example the particle size does not account for particles over 1 mm (Fig 7-73).	7.9.1 Pit 3 Underfill Tests	N/A	Addressed	7.9 Brine management	These technical studies were complete as part of the work to design the underfill and confirm the capacity for brine injection. Changes in permeability of the underfill will not significantly change the outputs of the groundwater model as it is surrounded by low-K formations.
254	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	It is noted there was no evidence of degradation on larger rocks, with little difference in reactivity – thus partly justifying the limited testing approach.	7.9.1 Pit 3 Underfill Tests	N/A	Addressed	7.9 Brine management	These technical studies were completed as part of the work to design the underfill and confirm the capacity for brine injection. Changes in permeability of the underfill will not significantly change the outputs of the groundwater model as it is surrounded by low-K formations.
255	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Permeability results, at a density of 2.2 tonnes/m ³ were in the range typical of a sand gravel mixture. It is not clear if this information has informed the groundwater modelling which shows little difference in regional flow paths through rock and backfilled pits after mining (comments above).	7.9.1 Pit 3 Underfill Tests	N/A	Addressed	7.9 Brine management	These technical studies were completed as part of the work to design the underfill and confirm the capacity for brine injection. Changes in permeability of the underfill will not significantly change the outputs of the groundwater model as it is surrounded by low-K formations.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
256	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	It could be argued that single numeric criterion are less ambiguous particularly for regulatory and management response purposes. However, in my opinion it is worthwhile to further assess the likely impacts now, rather than after a 'trigger'. Determining whether short-term exceedances are of material significance for the Environment fundamental to success. Figure 6-5 shows an indicative risk based tiered decision tree for ecosystem protection off the RPA, for which at least one comment is offered at this point: "predicted to be changed compared to natural changes" may require a suitable time scale that accounts for response lags and cumulative effects (e.g. with acid sulphate soils or uranium in sediments). Presumably, ongoing supporting studies are being designed to address whether or not changes are detrimental.	6.4.1.1 Risk Based Tiered Approach to Water and Sediment Closure Criteria and ALARA 6.8.3 Water and Sediment	N/A	Pending	8 Closure Completion Criteria	ERA has engaged BMT to develop a framework for interpreting effects of exceeding water quality criteria (using Mg as a case study) including determining if impacts will be detrimental to a range of environmental values (taken from the Ranger environmental requirements). There is also a joint SSB-ERA project being conducted by CSIRO on cumulative impacts to aquatic systems. The two projects have a degree of overlap and complement each other. It is expected results will be presented to ARRTC in 2019.
257	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	This modelling is in the process of being updated for the next iteration of the MCP, so comments here are brief. Modelling results (e.g. Figure 7-66 and 7-67) should in future be presented alongside observed actual concentrations (e.g. Mg concentration downstream of RPA).	7.8 Surface Water Modelling	N/A	Pending	N/A	Calibration of the surface water model uses existing data and this will be reported when results are reported (expected in late 2019). Current monitoring results are not comparable to the predicted post-closure concentrations as the scenarios (sources, water management, pathways etc.) are different. The plume from tailings and process water in Pit 3 will not reach the creeks for ~1000 years. So transport from this source is not amenable to direct monitoring. Process water expressing from Pit 1 buried tailings may move to Corridor Creek in the post-closure monitoring period. Monitoring will be undertaken in that period to validate the models and assess environment protection.
258	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	The 10,000 year compliance time horizon is applied to the tailings and process water, but is not explained why not to the waste rock (which is a larger source).	7.7.3 3 Solute Transport Modelling	N/A	Addressed	N/A	The Ranger Authorisation does not stipulate a compliance time horizon for waste rock. However, the post-closure modelling predicts waste rock loading for the 10,000-yr compliance period for tailings.
259	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Recharge on undisturbed materials is 5-10% of annual average rainfall on average, but there is little discussion in the overview Ch 7 of the possible significance of higher recharge through disturbed materials.	7.7.1.5 Sitewide-Scale Conceptual Model	N/A	Addressed	N/A	The significance of higher recharge through disturbed materials was investigated in previous INTERA modelling work and found to have a small to negligible impact on solute loading to creeks (Section 5.4.5 of the Pit 3 solute egress report (INTERA 2014a) and Section 5.8.3.2 of the RCM report (INTERA 2016). The effects of recharge rate on leaching from vadose zone waste rock will be evaluated as part of current/future work on source terms. Given the large differences in hydraulic properties, the presence of disturbed material over the weathered rock does not necessarily increase the recharge rate into the underlying geologic material. Recharge to the water table could increase if the water table moves above the underlying weathered rock into the overlying disturbed materials.
260	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Possibility of a compaction surface before the final raise level to improve water retention and limit percolation/leaching in the backfill below the final landform. This may be worth considering as part of the pit 1 restoration, whether or not it is equivalent to the "low permeability cover" modelled by INTERA with respect to leaching of COPC.	7.3.5 Plant Available Water Studies	N/A	Addressed	N/A	The 2-3m sub-surface consolidated layer referred to with regard to plant available water is not related to any INTERA or CoPC modelling. A 'low permeability cover', as mentioned in the ARRTC comment, is currently not considered as part of the Ranger post-closure solute transport modelling. No purposeful stratification of the waste rock beyond that which occurs through normal material movement processes has been included in the post-closure solute transport modelling. All waste rock used within the final landform has been modelled to have a relatively high hydraulic conductivity in comparison to all HLU's used within the model with the exception of the Magela Creek Sediments and MBL zone.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
261	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Soil assessment, Phase 3 closure criteria and significant additional surface water modelling are currently planned or in progress. Given the timeline to closure, these studies should be progressed and completed as soon as practicable.	7.10.4 Soil Assessment 7.10.5 Surface Water Modelling 7.10.6 Surface Water Pathway Risk Assessments 7.10.7 Phase 3 Closure Criteria and Detrimental Impact Framework Development	N/A	Addressed	7 Supporting studies 10 Closure implementation	All studies have been included in the Ranger closure schedule and linked to implementation or approval milestones.
262	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Did the trial landform include gathering data on infiltration?	7.3 Trial Landform	N/A	Addressed	7.3.2.1. Infiltration	Additional information has been added to Section 7.3.2.1 to address gathering data on infiltration (2013 PhD by Shao).
263	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	There is evidently significant experience with revegetation trials at various locations on the site (Table 7-26 and Figure 7-41). With respect to PAW, some of these trials focused on topsoil spreading, hydromulching and irrigation. However the details are not provided within the MCP overview, so on the basis of the information presented it is difficult to evaluate evidence what topsoil spreading, compaction surfaces or surface crushing for example could be beneficial to avoid moisture stress during revegetation.	7.6.1 Revegetation Trials (1982 – 1999)	ESR7 — Understanding the effect of waste rock properties on vegetation establishment and sustainability	Addressed	7.3.5 Plant available water studies 7.4.7 Reference site ecohydrological studies 7.6.3.2 Species establishment program	Topsoil is not available for final landform rehabilitation and thus is not discussed within the 2019 MCP as a valid option. TLF monitoring results have been updated within the 2019 MCP, along with updated summaries of previous studies, the species establishment program focused on systematically reviewing all target species, including grasses and groundcovers. Information on PSD and PAW modelling, plant rooting depth, subsurface consolidated layer, and more has been added to the 2019 MCP.
264	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Groundwater in the alluvial aquifer requires thousands of years to flow a distance of 21 km from the southern to northern boundary of the domain. There are however inherent uncertainties regarding the depth and extent of higher K pathways within the alluvium due to natural depositional variability and lack of bore data below the floodplain to map the depth and extent of alluvium and weathered rock boundary.	7.7.1.4 Regional-Scale Conceptual Model	WS2A — What is the nature and extent of groundwater movement, now and over the long-term?	Addressed	7.7 Groundwater modelling	The statement provided within the 2018 MCP relating to groundwater movement in the alluvial aquifer (section 7.7.1.4) is valid. This is supported by strong body of knowledge compiled to assess the depth and extent of the weathered rock boundary. A combination of 3,000 exploration and groundwater bores have been drilled to collect data. Geophysical survey and interpretive cross-sections have been used to create the boundary. The groundwater travel time over large distances in the Magela Creek alluvium is independent of depth and thickness. Therefore, travel time is independent of the uncertainties in the depth and extent of higher K pathways within the alluvium. Further detail is provided within Appendix D.3 of the RCM report (INTERA 2016) "Uncertainty in Hydraulic Conductivity of Magela Creek" - presented at the MTC meeting on 5 November 2014.
265	ARRTC	ARRTC Table - Comments on the 2018 RMCP	Wendy Timms	Given the timeline for closure, it is surprising that closure criteria for water and sediment are not yet all agreed. Closure criteria that require the most attention include: <50% completion - turbidity and herbicides in surface water, and soils COPC 50% completion - uranium and nutrients (sediment), sulfate-acid sulphate soils.	6.4 Water and Sediment	N/A	Ongoing	8.4 Water and sediment	SSB reported the following water and sediment rehabilitation standards as complete: Magnesium (surface water), Uranium and Manganese (surface water), Ammonia (surface water), Sulfate – acid sulphate soils (surface water), Other metals (surface water). These are suggested as draft water quality guideline values at step 5 of the national water quality management framework. Their suitability as closure criteria can be assessed under steps 6 - 9 of the same framework which will be discussed with the stakeholder water quality working group. Details surrounding turbidity, herbicides, nutrients are also discussed within the SSB report.
266	ACF	Unfinished Business: Rehabilitating the Ranger uranium mine	Summary of recommendations Page 31	Energy Resources of Australia's next iteration of the Mine Closure Plan adopts a public consultation framework.	5 Stakeholder Engagement	N/A	Addressed	5 Stakeholder Engagement	ERA's stakeholder consultation is extensive, extended for the life of the mine and described within Section 5, and detailed within the stakeholder consultation register.
267	ACF	Unfinished Business: Rehabilitating the Ranger uranium mine	Summary of recommendations Page 31	Energy Resources of Australia's next iteration of the Mine Closure Plan should adequately address the social impacts of mine closure, particularly on the Mirarr people.	6.7 Cultural 7 Supporting Studies	N/A	Addressed	5 Stakeholder Engagement	The 2019 MCP does discuss social impacts within the Section on Stakeholder Consultation, and is managed risk with details provided within the risk assessment Section 9.
268	ACF	Unfinished Business: Rehabilitating the Ranger uranium mine	Summary of recommendations Page 31	Energy Resources of Australia's next iteration of the Mine Closure Plan should adequately address ecological remediation of the site including the closer alignment of SSB's research.	5 Stakeholder Engagement 10.8 Revegetation	N/A	Addressed	7 Supporting studies	The Supporting Studies section of the MCP identifies a number of research programs aimed at adequately addressing ecological remediation which considers outcomes and feedback from SSB research. Review of the stakeholder consultation register indicates the close working relationship ERA has with its stakeholders, including SSB, on all aspects of closer.

#	Stakeholder	Comment Submission	Stakeholder Reference	Stakeholder comment	MCP 2018 Reference	Related KKN	Status	Reference 2019 MCP	ERA Response
269	ACF	Unfinished Business: Rehabilitating the Ranger uranium mine	Summary of recommendations Page 31	Energy Resources of Australia's next iteration of the Mine Closure Plan should adequately address credible worst-case scenario modelling, particularly in relation to landform, erosion and tailings management.	N/A	LAN3 — Predicting erosion of the rehabilitated landform	Addressed	7 Supporting studies	Such modelling does take into account such scenarios. Refer to studies Section 7 for details.
270	ACF	Unfinished Business: Rehabilitating the Ranger uranium mine	Summary of recommendations Page 31	Energy Resources of Australia's next iteration of the Mine Closure Plan should work with what is achievable on the rehabilitated site.	10.8 Revegetation	N/A	Addressed	7 Supporting studies 11 Closure Implementation	Various research projects and ongoing trials continue to inform and improve the knowledge of what is achievable on the rehabilitated site. The outcomes of future studies and projects will continue to be incorporated into future MCPs.
271	ACF	Unfinished Business: Rehabilitating the Ranger uranium mine	Summary of recommendations Page 31	Energy Resources of Australia's next iteration of the Mine Closure Plan should adequately address enhanced modelling around contaminant mixtures and contaminant pathways.	N/A	N/A	Pending	7.7 Groundwater modelling 7.8 Surface water modelling	CT1. Assessing the cumulative risks to the success of rehabilitation on-site and to the protection of the off-site environment is a SSB KKN and will be reported on in the updated MCP when information becomes available.