Greater Paraburdoo Iron Ore Hub Proposal (Assessment No. 2189)

CMS17501 Greater Paraburdoo Iron Ore Hub – Terrestrial Fauna comments

Table 1: Department of Water and Environmental Regulation Comments on Terrestrial Fauna

Item	Topic	DWER Comment	Rio Tinto Response
Vertebrate Fauna			
1	Surveys	The surveys for vertebrate fauna are adequate to predict the impacts of the proposal.	**Noted.**
2	Environmental Management Plan (Appendix 4)	Issues relating to the management of impacts to Ghost bat (*Macroderma gigas*): • For caves that are within 300 metres (m) of proposed operations (i.e., caves 6, 16, 17 and 18) a 100 m mining restriction zone (MRZ) is proposed (MRZ [Table 1.2]). However, the term 'mining exclusion zone' (MEZ) is used for the Pilbara leaf-nosed bat (PLNB) roost at the Ratty Springs cave structure which is also larger at 250 m (Table 1.2). • The EMP includes a management-based target of "ensure no significant long-term decline in ghost bat usage of high value habitat in the Development Envelope, attributable to the Proposal" (Table 1). Acoustic monitoring of 10 significant roost sites at Western range and four regional roosts will be undertaken to "…indicate how Ghost bats use caves within the Greater Paraburdoo region (e.g., diurnal versus maternal/ caves at western range vs other regional caves)" that will be analysed bi-annually and species tracking of individuals annually for five to ten nights (Table 2-4). However, it is unclear if: recording acoustic data alone will be able to differentiate between roost usage e.g., diurnal vs maternal; the regional roosts are intended to be reference (control) sites; and whether the proposed biannual analysis of monitoring data will be adequate to measure significant changes to cave use by ghost bats. • It appears that mining activities will overlap the proposed baseline establishment period. The baseline commenced in 2020/2021 and will proceed to 2022/2023 and mining at Western Ranges is proposed to commence in 2023 (p.17). Issues relating to the management of impacts to Pilbara leaf-nosed bat (*Rhinonicteris aurantius* [Pilbara form]): • A MEZ of 250 m is proposed around the Pilbara leaf-nosed bat (PLNB) roost at Ratty Springs (Table 1.2). However, the term 'MRZ' is used for the retained ghost bat cave structures. • The Response to Submissions (RTS) states that no vibration monitoring and no vibration limits will be assigned for the Ratty Springs PLNB roost as the site does not share the same geology with the proposed mine area (Response to Submissions, Part A.4). Instead, annual visual inspections of the external structure are proposed (Table 1.2). Annual inspections may not be adequate as they may not detect changes to the internal stability of the cave structure within a reasonable period to implement actions. In addition, no evidence has been provided to support the statement that the differences in geology between the Ratty Springs cave structure and the proposed mine area will limit the transmission of vibrations and there will be no impact to the PLNB colony. • The PLNB colony at the Ratty Springs cave will be monitored using acoustic data. Acoustic surveys (call counts) will provide an indication of the activity level of the PLNB colony. However, this technique alone does not represent an accurate estimate of colony size (abundance) and behaviour as PLNB habit is to fly repeatedly in and out of the roost structure after dusk, causing an increase in	**Noted.** The Proponent has opted to apply a 250 m Mining Exclusion Zone (MEZ) over the Pilbara Leaf-nosed Bat (PLNB) roost at Ratty Spring. No direct disturbance from activities associated with the Proposal are permitted within a MEZ. Due to the restricted shape and size of the Ratty Springs roost, accessing the roost chamber is not possible; it is therefore also not possible to collect temperature or humidity data from the roost chamber. The larger MEZ around the Ratty Spring roost has been taken as a precautionary approach due to the biological importance of the site and noting that data from inside the roost chamber cannot be collected. A threshold of 10mm/s peak particle velocity (PPV) (the most conservative vibration value) will also be set for the Ratty Springs roost. For Ghost Bat roosts at Western Range, the Proponent has applied 100m Mining Restriction Zones (MRZ). In MRZ's, no direct clearing for mining activities (e.g. no drilling) will be permitted, however some indirect disturbance may potentially extend into the MRZ. The 100m MRZ for Ghost Bat roosts is considered sufficient based on the high number of suitable caves within the Development Envelope (18 caves, the majority of which will not be impacted by the Proposal), the documented highly transitory nature of Ghost Bats at Western Range, no evidence of roost site fidelity of Ghost Bats at Western Range, and the low resident Ghost bat population (approximately 10 resident individuals). It is important to note however that the environmental objective of the MEZ and MRZ's is the same. To ensure the structural integrity of the caves is not impacted by the Proposal so that these important features will remain, providing enduring habitat for PLNB and Ghost bat beyond the life of the Proposal. The MEZ and MRZ's have also been modified since they were presented in the ERD. The zones now represent a buffer around the known cave dimensions rather than around the cave entrance, providing protection around the entire roost. The MEZ over the PLNB Ratty Spring roost has also been increased from 150 m to 250 m as a precautionary approach based on significance of the roost site and acknowledging accessing the roost chamber is not possible to install/collect temperature or humidity data from the roost chamber. Responses to issues relating to the management of impacts to Ghost Bat The Proponent notes that generally, acoustic recording only provides relative abundance rather than individual numbers. However, from baseline monitoring since 2019, accurate estimates of Ghost Bat numbers including cave usage and the low number of Ghost Bats residing in the Western Ranges (n=10), have been confirmed through acoustic monitoring. The results of acoustic monitoring have been verified against other monitoring methods including scat hormone analysis and visual cave inspections. Continuous acoustic monitoring data is available from 2019 for the 10 Ghost Bat caves specified in the EMP (Rio Tinto 2021a). As construction activities are set to commence in 2023, this provides a minimum of four years of baseline data for this species at Western Range. Baseline monitoring will continue until implementation of the Proposal commences; the Proponent will ensure the baseline data collection period does not overlap with the implementation phase of the Proposal. Maternity cave classification via acoustic monitoring has been accurately inferred from the presence of continued roosting in caves during the maternity period. The results of this method are consistent with the scat hormone analysis and visual cave inspections conducted within Western Range and across other Rio Tinto Ghost Bat monitoring

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		activity that is not a true reflection of bat abundance (Cramer et al., 2016; Bullen and Reiffer, 2020). Acoustic data in combination with infrared or thermal video censusing techniques should be used to approximate trends in colony size from the call data (Bullen and Reiffer, 2020). • An environmental outcome of "…no significant long-term decline in the Pilbara Leaf-nosed bat population utilising the permanent maternity roost at Ratty Springs, attributable to the Proposal" has been assigned for the PLNB colony at the Ratty Springs cave (Table 1). The trigger and threshold criteria are based on a 'lower call limit' (LCL [Summary Table 1]) that is derived from the long-term average of nightly call counts (Figure A.2) and is based on several other PLNB maternity roosts. It is unclear whether this is adequate to detect changes in PLNB activity and colony size, within and between years. In addition, setting criteria limits based on lower limits will only capture change in minimum values. Therefore, an increase or decrease in the number of peak events (e.g. breeding period July to March) or a seasonal shift may not be captured using the proposed criteria. • Acoustic data will be analysed on a quarterly basis, therefore there is a risk that trigger and threshold criteria may be exceeded prior to detection and management actions being implemented (Table 2.6). • It appears that mining activities will overlap the proposed baseline establishment period. The baseline commenced in 2020/2021 and will proceed to 2022/2023 and mining at Western Ranges is proposed to commence in 2023 (p.17). Actions required: • The definitions for the MRZ and the MEZ should include the activities that will be 'restricted' (or excluded) and those that will be 'unrestricted' (or included). In addition, the Proponent should explain why there is disparity between the size of the MRZ and MEZ (i.e. 100 m for the retained ghost bat cave structures vs 250 m for the Ratty Spring PLNB cave structure). • The MRZ and MEZ should take into consideration the full extent of the cave structures. • The assumption that the Ratty Springs cave structure will not be subject to vibration levels that will cause a significant change in the PLNB colony and use of the roost site should be verified using blast testing, monitoring, and modelling. In addition, as the Ratty Springs cave structure is a maternal roost site for the PLNB, it is recommended that vibration limits are set based on blast modelling and testing and are incorporated in the Environmental Management Plan (EMP) using outcome-based management provisions. • It is recommended that the Proponent should consult with the Department of Biodiversity, Conservation and Attractions (DBCA) regarding a minimum baseline for the ghost bat and PLNB. However, it is anticipated that a minimum baseline of two years (or two breeding seasons) should be established for the ghost bat and PLNB colonies, prior to ground disturbing activities. The Proponent should demonstrate the adequacy of any proposed baseline. • Provide information on how the activity data (call counts) for PLNB will be verified to estimate the size of the colony e.g. using infrared camera analysis (or other methods). • The monitoring should be designed using Before-After-Control-Impact analysis and the EMP should include the statistical and analytical methods (EPA 2020) to measure significant changes in the PLNB and ghost bat colonies.	programs currently being undertaken in concert with Robert Bullen (BatCall WA). This method is also far less invasive for the species than other methods that require cave entry Radio Frequency Identification (RFID) tagging and scat analysis, especially for a species such as the Ghost Bat that is easily disturbed. Currently there are few Ghost Bat roosts known and monitored at a regional scale from Western Range (within 20-50km), to act as direct control/reference sites. Identifying such locations will be required, specifically in areas such as Panhandle, Turee and Western Turner Syncline. Data from the regional roosts (once located) in addition to acoustic monitoring undertaken at several other Rio Tinto sites across the Pilbara will allow for a bioregion wide comparison of population and seasonal trends, with the regional roosts considered reference sites. The Proponent is targeting commencement of work to identify Ghost Bat roosts at a regional scale in 2022. Recording of Ghost Bats acoustic data in the 10 Ghost Bat caves specified in the EMP (Rio Tinto 2021a) will be continuous throughout the year. Analysis of data will be undertaken on a quarterly (Ghost bat roosts within 300 m of activities) or biannual (all other retained Ghost bat roosts) basis. This method uses permanent acoustic recorders set up outside of the cave with microphones situated in the roost chamber, allowing for an increased likelihood of recording echolocation and social calls of this species, without the impact of cave entry by personnel. As Ghost Bats do not show roost site fidelity, specifically in the Western Ranges area, continuous acoustic monitoring is the best method to monitor the presence of Ghost Bats and to measure changes in caves usage across the site. As this method uses continual data collection, it allows for changes to be identified and attributed to activities associated with the Proposal (unlike other monitoring methods such as scat analysis which only allow identification of whether a site was utilised over the collection period). It is also noted that the low number of Ghost Bats residing in the Western Ranges (n=10), the high number of suitable Ghost Bat caves and no site fidelity at Western Ranges leads to high variability in individual cave usage throughout the year. The Proponent does not consider that more frequent data analysis will help identify potential changes considering these factors. <u>Responses to issues relating to the management of impacts to Pilbara leaf-nosed bat</u> A geotechnical assessment of the Ratty Springs PLNB roost will be conducted prior to mining activities to establish the roost's geotechnical sensitivity to structural instability. As a precautionary measure, a threshold of 10mm/s PPV (the most conservative vibration value) will be set for the Ratty Springs roost for the duration of the Proposal due to its biological importance. A vibration monitor will be located at the roost or close by (due to space constraints with other monitoring equipment) and vibration monitoring requirements and triggers/thresholds have been included in the EMP (Table 2.3 and Table 2.4, Rio Tinto 2021a) and captured in the site's blast management controls for the roost. Initial blast modelling using Australian Standards (k = 1140 and b -1.6) as the 95% confidence level has indicated that <10mm/s PPV is achievable using a mix of support and production drill and blast parameters. Modelling using Brockman Iron geology data from the Proponent's other operations in the Pilbara also indicates that <10mm/s PPV can be achieved (k = 731 and b -1.28 as the 95% confidence level). Both initial models assumed 14W-16W and 20W were the nearest mine pits at approximately 350m; these pits have now been removed from the design, with the nearest proposed pits at Western Range to the Ratty Springs PLNB roost now greater than 2,800m away. The results of both initial models are presented in Figure 1 and Figure 2 below. Detailed modelling using site specific data will be undertaken prior to any pit blasting associated with Western Range being undertaken.

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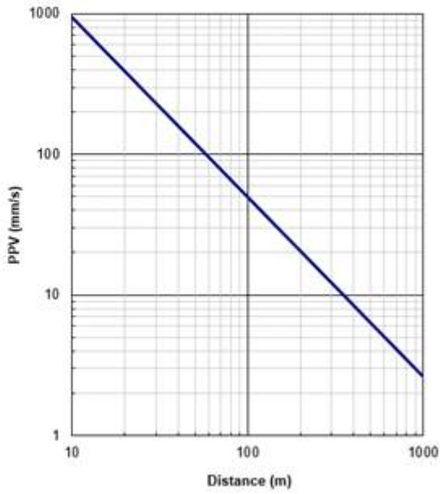
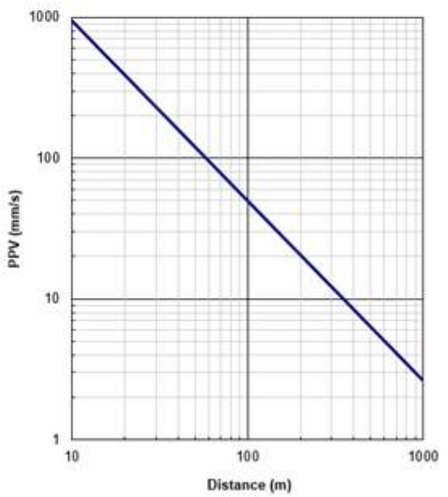
		• Clarify if the regional roosts monitored for ghost bats (i.e. Pan Handle, Turee Creek and Karijini) are intended to be reference sites. • Revise the trigger and threshold criteria based on LCL to detect changes in the seasonal use of the Ratty Springs roost by PLNB (i.e. Table 2.6). In addition, consider including an upper call limit (and relevant trigger and threshold criteria) and increasing the frequency of the call analysis during critical periods (such as during the breeding cycle for the PLNB - July to March). • Consider including scat analysis (for DNA and hormones) as a monitoring technique for PLNB, as has been used for the West Angelas Project (ghost bat). • For consistency with other projects, the following terms (related to bats) should be defined (e.g. TSSC 2016): ○ Roost: is the area within a roost structure (i.e. cave, adit or artificial structure) where the bats actually aggregate during roosting. ○ Colony: group of individuals occupying a roost structure at a particular time. ○ Population: all individuals of the species in a defined geographical area. For example, for the PLNB this is usually the whole Pilbara population. • With reference to the targets, the term 'long-term' needs to be defined (Table 1).	RioTinto **Vibration Prediction for** Peak Particle Velocity: $PPV = K(SD)^b$ Scaled Distance: $SD = \frac{D}{\sqrt{MIC}}$ K — PPV value when SD = 1 — 731 — mm/s b — Local rock exponent — -1.28 — (-1.6 typ) MIC — Max charge in 8ms — 150 — kg D — Distance from blast — 350.6 — m SD — Scaled Distance — 28.6 — m/√kg PPV — Peak particle velocity — 10.0 — mm/s Dist (m) / SD (m/√kg) / PPV (mm/s): 10 / 0.8 / 947.6; 20 / 1.6 / 390.2; 30 / 2.4 / 232.2; 50 / 4.1 / 120.8; 75 / 6.1 / 71.9; 100 / 8.2 / 49.7; 200 / 16.3 / 20.5; 300 / 24.5 / 12.2; 500 / 40.8 / 6.3; 750 / 61.2 / 3.8; 1000 / 81.6 / 2.6  *Figure 1 Initial blast modelling using Australian Standards (k = 1140 and b -1.6) as the 95% confidence level* RioTinto **Vibration Prediction for** Peak Particle Velocity: $PPV = K(SD)^b$ Scaled Distance: $SD = \frac{D}{\sqrt{MIC}}$ K — PPV value when SD = 1 — 731 — mm/s b — Local rock exponent — -1.28 — (-1.6 typ) MIC — Max charge in 8ms — 150 — kg D — Distance from blast — 350.6 — m SD — Scaled Distance — 28.6 — m/√kg PPV — Peak particle velocity — 10.0 — mm/s Dist (m) / SD (m/√kg) / PPV (mm/s): 10 / 0.8 / 947.6; 20 / 1.6 / 390.2; 30 / 2.4 / 232.2; 50 / 4.1 / 120.8; 75 / 6.1 / 71.9; 100 / 8.2 / 49.7; 200 / 16.3 / 20.5; 300 / 24.5 / 12.2; 500 / 40.8 / 6.3; 750 / 61.2 / 3.8; 1000 / 81.6 / 2.6  *Figure 2 Initial blast modelling using Brockman Iron geology data from the Proponent's other operations in the Pilbara (k = 731 and b -1.28) as the 95% confidence level*

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			Blast vibration monitoring will be undertaken for all blasts within 300 m of the Ratty Spring roost to ensure the 100mm/s PPV vibration trigger is not exceeded. This will include modelling of PPV prior to blasting, vibration monitoring of actual PPV, and analysis of modelled versus actual PPV. Exceedances of 10mm/s PPV associated with the Proposal will trigger an update of the mine plan and blast model and blast management procedures. Biannual (or as triggered if sooner) inspections for structural damage to the Ratty Spring cave entrance will be undertaken if vibration levels exceed 10mm/s PPV. Potential impacts to the roost will be managed through reduced vibration levels (a threshold of 10mm/s PPV, the most conservative vibration value) and lower call limit (LCL) trigger and threshold values. Lower call limit monitoring will be undertaken continuously with quarterly analysis to identify any changes to the roost population. Bi-annual (or as triggered if earlier) inspections of the roost will also be undertaken to identify structural instability (e.g. rock fall). Infra-red cameras have been used on a periodic basis at the Ratty Springs roost through the life of the monitoring, consistent with most monitoring of PLNB roosts conducted by Rio Tinto. This method is used to calibrate the formula for calculating the number of calls vs. the number of individual bats to enable the Ratty Springs roost population to be estimated. Infra-red cameras will still periodically be used to readjust the formula to ensure accurate population estimates from the acoustic monitoring. Analysis of the long-term data at this roost and other PLNB roosts suggests the formula for creating a lower call limit (LCL) is an appropriate monitoring method for identifying potential impacts to the Ratty Spring roost associated with the Proposal. Roosts will naturally trigger the LCL, however prolonged or repeated triggers indicate a more serious decline. The population count for the roost is highly variable both between and within years, as shown from the long-term data (monitored since 2015) provided in Figure 8 of Bat Call (2020a). The trigger and threshold criteria are based on a LCL that is derived from the long-term average of nightly call counts; readjusting the LCL based on the yearly estimated population at the roost is considered too complex as there are too many unknown variables (seasonal variation, population movements, relationships to other unknown roosts in the area etc.), likewise with a seasonal LCL (pers. com Robert Bullen, Bat Call WA). An upper call limit (UCL) will show population growth at the Ratty Springs roost. However, population growth is not a proposed trigger or threshold level requiring management for the Proposal. The Proponent is confident that LCL is a more relevant indicator of potential impacts to PLNB population at Ratty Springs Roost. Increases or decreases in the number of peak events or a seasonal shift will still be continuously monitored, analysed (quarterly) and reported (annually) and provide context to the current status of the Ratty Spring roost. Due to the remote location of the roost and the lack of telemetry technology currently available for acoustic recordings, real-time analysis is unable to be undertaken. As such, continuous monitoring and quarterly analysis currently provides the only practical way to effectively monitor the roost and any changes to its population. This is consistent with monitoring by the Proponent at other Pilbara leaf-nosed bat roost sites. Continuous acoustic monitoring data is available for the Ratty Springs Roost from 2019 (minimum of four years baseline data), with additional data from 2015 and 2017 available. As mining activities are set to commence in 2023, this provides more than the minimum two years of baseline data for this species. Due to the restricted shape and size of the Ratty Springs roost accessing the roost chamber to place mats to collect Pilbara Leaf-nosed Bat scats is not possible. Discussions with Dr. Linette Umbrello (DBCA-presentation at the Biodiversity Conference) who has tried to undertake DNA scat analysis for this species has also stated that current methods are unsuitable for this species. Accurate population counts can currently be obtained via acoustic recorders and infra-red camera counts.

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			General Responses As the management of the Ghost Bat population in Western Range is based on the continued presence of the species in the Development Envelope, BACI analysis is not deemed suitable. BACI design would be a suitable analysis method if there was a large enough sample size of roosts to act as replicants or control sites. For Ghost Bats in Western Range the small population size (n=10) and lack of roost site fidelity means any values would not be statistically robust. Likewise, there is a lack of other known Pilbara Leaf-nosed Bat roosts in the vicinity to act as appropriate control sites in a BACI analysis. Instead monitoring undertaken at several other Rio Tinto sites for both bat species will allow for a Pilbara wide comparison of population and seasonal trends to act as reference sites. For consistency with other projects the aforementioned terms relating to bats (roost, colony and population) have been defined and used in the revised EMP (Rio Tinto 2021a). 'Long term' refers to decades (not years) in duration. Long-term impact is defined as an impact resulting in a permanent loss of environmental value/s, or where intensive and/or un-proven management intervention, potentially over decades would be required to restore the environmental value/s. The definition for long-term impact and long-term adverse (in terms of impact) have been included in the revised EMP (Rio Tinto 2021a).
Short-range endemic (SRE) invertebrates			
3	Summary	The information provided is insufficient to assess potential impacts to SRE invertebrates. This is largely because identifications of the majority of specimens have not been completed to a level (species/morphospecies or genetic lineages) that allows determination of their distributions, and a comparison of the specimens across the entire development envelope has not been attempted. Consequently, there is insufficient information to determine which, if any, species are restricted to impact zones. Therefore, a high degree of uncertainty remains with respect to the potential for adverse impacts to SREs in the development envelope. Further detail is provided below.	**Noted, please refer to responses below.** Additional supplementary information is provided in Attachment 2, Biologic (2021a) Memorandum: *Short Range Endemic invertebrates consolidated impact assessment*.
4	Response to submissions – general comment	The comments below reflect the provision of new information in the form of a level 1 survey (Biologic 2021) in the Western Range (WR) area and clarification is required on some points, as discussed below.	**Noted, please refer to responses below.**
5	RTS No. 16	The RTS states that there were few sampling points within high and moderate suitability habitats in proposed pit areas, particularly in the Western Range area. An additional survey round (Biologic 2021) has been conducted in the WR area and it has adequately sampled the area. However, the report lacks critical information regarding species identifications and their distributions in relation to impacts areas, that are required to assess and quantify impacts to SREs, and a review of the impacts to SREs using consolidated information from all surveys has not been undertaken. The shortfalls in Biologic (2021) and work required to address them are discussed below. Analysis: 1. The report does not consolidate previous survey data and specimens from previous surveys have not been compared. 2. The majority of potential SRE species (12 out of 20) are not identified to species level so their distributions cannot be determined and therefore potential impacts to SRE species cannot be determined. Additionally, Biologic states that "Due to the lack of genetic support and sampling in the immediate area around	**Noted.** The Proponent has undertaken further SRE analysis and assessment (provided in Biologic 2021a and 2021b, Attachment 2 and Attachment 3 respectively) including: • Consolidation of SRE species and habitat information from all surveys completed to date within the Development Envelope, including: a. Alignment of SRE identifications from all previous surveys (as much as practicable based on available specimens, taxonomic frameworks, and genetic sequences); b. Updated taxonomic and ecological information relevant to assessment of species distributions relative to potential impact areas; c. Indicative linear ranges in the local or wider regional area for all SRE species, to the best available data; d. Consolidation of SRE habitat mapping and occurrence of SRE species in habitat types mapped throughout the Development Envelope; and e. Occurrence of SRE species in relation to proposed impact areas. • Environmental Impact Assessment of SRE species values and habitat values in relation to potential impacts of the Proposal, including direct and indirect impacts, and cumulative impacts as much as practicable within the constraints of available data.

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		the Study Area, it is difficult to say how restricted these Potential SRE species will be to the Study Area." 3. A number of species complexes have been found in the study area, for example, the isopod Buddelundia 36 type. A species complex is a taxon that is composed of multiple cryptic (difficult to identify based on morphology) species and usually can only be separated using genetic data. Consequently, their inferred distributions should be interpreted with caution because they do not represent a single species. The presence of numerous species complexes and the largely unresolved specimen identifications creates additional uncertainty around the SRE species distributions and makes assessing impacts to SRE fauna particularly challenging. 4. The report uses a novel approach to assess the likelihood of taxa being restricted to the study area. It classifies the potential SRE taxa collected into three groups: 1) potential SRE likely found beyond study area based on habitat type; 2) potential SREs that appear locally abundant with the potential to be restricted in distribution to the range itself; and 3) Potential SRE invertebrate taxa that were represented by one specimen or collection event only. In this instance, the approach has been incorrectly applied because it focuses on whether the taxa are restricted to the study area and not the impact areas. 5. Groups 2 and 3 are considered to be potentially restricted to the study area. The report states that "molecular work would be required to confirm whether taxa are restricted to the study area" (p. 6). Group 3 contains singletons for which "distribution cannot be worked out even with further molecular or taxonomic work unless further specimens are located" (p. 6). However, it may be possible to determine distributions for some species by comparing specimens from earlier surveys. For example, Aname specimens have been collected from three sites over the three different surveys and two of these sites appear to be outside the impact areas. Genetic analysis could allow the specimens to be matched and may determine if they are not restricted to impact areas. Habitat assessment: 6. The habitat types are not consistent between the different survey reports or the Environmental Review Document (ERD). For example, Astron has not mapped gorges/gullies in WR, while the Biologic mapping shows numerous gorge/gully habitats that they consider high suitability habitat for SREs. 7. The ERD discusses impacts to high and moderately suitable SRE habitat. However, the Biologic report maps habitat types rather than habitat. A consistent mapping approach is recommended to reduce uncertainty. Figures: 8. Figure 4.4 maps the locations of potential SREs but has numerous taxon symbols overlapping so the taxon distributions are not clear and it is difficult to interpret. 9. The figures do not illustrate the areas of impact in relation to the species recorded. 10. A map illustrating the locations of all species from all surveys across the development envelope has not been provided.	The Biologic (2021a) report has been updated to incorporate further work and is attached for DWER's consideration (Attachment 2). Analysis 1. Biologic's (2021) report presents data from the Western Australian Museum (WAM) database searches and previous reports within the wider local area, including Astron (2018) and Bennelongia (2012) (Section 4.1). This includes species found within 40km of the Proposal. However, as most of these specimens were not identified past the genus level, the ability to compare specimens at the species-level with the Biologic (2021b) survey specimens is limited. The Proponent has since undertaken molecular analysis to allow for further comparison between specimens of different surveys at the species level. Section 2 and Table 2.1 (Biologic 2021a) document the methods of data consolidation and alignment following completion of all SRE work. 2. Section 2 and Table 2.1 (Biologic 2021a) document the methods of data consolidation and alignment following completion of all SRE work. This includes the approach used to resolve as many records as possible to species or OTUs described in the memorandum. Sections 2.2.1 - 2.2.6 document the approach to individual fauna groups. The Proponent has undertaken molecular analysis (DNA barcoding using the mitochondrial gene COI) of taxa collected within the Study Area and wider local area from both the Biologic (2021b) and Astron (2018) surveys. A total of 96 specimens, 60 from the Biologic (2021b) survey and 36 from Paraburdoo (Astron 2018) were sequenced and this information has allowed for species level determinations (genetic operational taxonomic units (OTUs) or morpho-species) and assessment of distributions for the taxa collected at Western Range. The genetic work has now resolved the majority of identifications at the species (or genetic OTU) level, and Table 2.1 (Biologic 2021a) provides an update of local and regional linear ranges for each taxonomic unit. It is not practicable to obtain a successful sequence for every individual, especially given legacy issues from previous studies, but a reasonable attempt has been made to obtain species level OTUs for all groups and align previous identifications with material collected recently by Biologic. The lack of genetic sequences from the immediate local area outside of the Development Envelope was again identified as a data gap that limits the ability to confirm wider species distributions, although available regional genetic databases were checked to obtain any possible alignments with sequence material from the wider region. 3. The Proponent acknowledges the presence of species complexes due to the incomplete taxonomic frameworks that exist for several groups and the difficulty of assessing impacts to these potential SRE fauna at the species level. Biologic 2021a Section 2.1 and Table 2.1 document the collation of available linear range data, and Sections 2.2.1 - 2.2.6 provide further detail regarding fauna groups including cryptic species. In the absence of clear delineation within species complexes (particularly those comprising cryptic species), the Proponent and their consultants have taken a conservative approach and assumed individuals as representing Potential SRE and have used habitat occupancy as a potential surrogate for understanding their distribution within the Development Envelope. Table 2.2 details the occurrence of each of the species within each mapped habitat type. 4. The Proponent notes that the Biologic (2021b) report was not intended to be an impact assessment report, and as such considered fauna and fauna habitat restrictions within the Study Area as opposed to the conceptual disturbance footprint. The fauna grouping approach in Biologic 2021b has been superseded by the impact assessment approach in Biologic 2021a.

Item	Topic	DWER Comment	Rio Tinto Response
			5. The fauna grouping approach in Biologic 2021b has been superseded by the impact assessment approach in Biologic 2021a. The Proponent has undertaken molecular analysis (DNA barcoding using the mitochondrial gene COI) to resolve species-level identifications and further investigate species distributions from both the Biologic (2021b) and Astron (2018) surveys. Following the consolidation and alignment of SRE fauna records (Biologic 2021a) a total of 60 species/OTUs have been recorded from the Development Envelope: • Eight species are known to be widespread and are not considered SREs. • 20 OTUs (including indeterminate taxa) have uncertain distributions. • The remaining 32 species/ OTUs are considered Potential SREs based on the nominal range criteria and current taxonomic/ ecological information. Three further taxa (*Buddelundia* `sp. Biologic-ISOP047`, *Cryptops* `sp. Biologic-CHIL022`, and Geophilomorpha `sp. Biologic-CHIL025`) represent new, unique OTUs recorded only from single sites or a few sites, inside proposed impact areas. Based on current information, these taxa have not been detected outside the Development Envelope, although their habitats (Gorge/ Gully, Rocky Hills, and Low Hills habitats) form a mosaic of interconnected rocky/ mountainous habitat that is extensive beyond impacts throughout the Development Envelope and the wider local area. These habitats will remain connected within the Development Envelope and the wider area post development. Biologic (2021a) conclude the potential impacts of the Proposal are unlikely to cause a significant risk to the long-term persistence of these three taxa. <u>Habitat Assessment</u> 6. The Astron (2018) and Biologic (2021b) SRE survey areas and associated habitat mapping do not overlap; the Proponent has updated the Figure 6.4 in the ERD to reflect all SRE survey data (Figure 6.4 is included as Attachment 1). Further detail regarding habitat types/assessment is included in Section 2.3, Table 2.2 and Figure 2.1 (Biologic 2021a, Attachment 2). 7. Biologic (2021a) Table 3.2 provides an updated assessment of the overall habitat value for SRE taxa recorded within the Development Envelope across all surveys; high (Gorge/Gully), medium (Breakaway/Cliff, Rocky Hill, Low Hills, Riverine, and Drainage), and low value (Alluvial Plain, and Stony Plain). The Terrestrial Fauna ERD Chapter has been revised to reflect the updated habitat value assessment (Rio Tinto 2021b). Section 2.3 and Table 2.2 Biologic (2021a) details the occurrence of each of the SRE species and OTUs in relation to the habitat types mapped across the Development Envelope. These are visually presented on Figure 6.4 in the ERD (Attachment 1) and Figure 2.1 Biologic (2021a) (Attachment 2). 8. Noted. Figures have been revised and included in the updated Terrestrial Fauna ERD Chapter (Figure 6.4) and Biologic (2021a) memorandum (Attachment 1 and 2 respectively). Figures now have fewer overlapping Potential SRE taxon symbols making interpretation clearer. 9. Noted. Figures have been revised and included in the updated Terrestrial Fauna ERD Chapter (Figure 6.4) and Biologic (2021a) memorandum (Figure 2.1) (Attachment 1 and 2 respectively). Figures present Potential SRE records and the conceptual disturbance footprint. 10. Noted. Figures have been revised and included in the updated Terrestrial Fauna ERD Chapter (Figure 6.4) and Biologic (2021a) memorandum (Figure 2.1) (Attachment 1 and 2 respectively).

Item	Topic	DWER Comment	Rio Tinto Response
6	RTS No. 19	The DWER submission requested a table that included listing where each taxon was found in relation to the impact sites (i.e. inside and/or outside disturbance areas). Appendix 10 of the RTS includes a table with the sample location for each specimen collected, but it does not clearly identify the taxa that are restricted to impact areas. In addition, the table does not contain the results of the most recent surveys (Biologic 2021). Therefore, the RTS does not provide the information required to assess species distributions and potential impacts to restricted species, as requested. Unresolved specimen identifications The assessment of impacts to SRE invertebrates is limited by the unresolved taxonomy and no alignment of the majority of specimens collected as most of the taxa are not identified to species level (or morphological or genetic codes where relevant). For example, Aname sp. indet. has been collected from four sites but it is not possible to determine whether it is a single species without further analysis (e.g. genetic analysis would be required if the specimens are females, juveniles or damaged). Taxonomic identifications are required to be resolved to inform the accurate distributions of species in relation to the impact areas, as recommended in Astron 2018 and Biologic 2021. EPA Guidance states that "all potential SRE specimens will be identified to the lowest taxonomic level possible" and encourages proponents to "utilise molecular analysis methods in situations where traditional taxonomic identification is not possible or will not adequately address questions of SRE restriction to proposed impact areas" (EPA 2016). Therefore, it is recommended that genetic analysis be used to resolve the issues raised in order to provide data for the impact assessment and reduce uncertainty regarding the potential threats to SREs from the proposal. Work required Due to the lack of a consolidated report and resolution of the outstanding taxa identities and their distributions, there is currently insufficient information to assess the potential impacts to SREs in the development envelope. The following work is required to enable impact assessment: 1. Resolve the identifications of all taxa collected using genetic analysis, including comparison of specimens collected from Astron (2018) and Biologic (2021). Provide an explanation for any taxa that cannot be resolved (e.g. old or poor quality specimen). 2. Consolidate the records from all surveys across the entire development area, describe the distributions of species and identify any taxa that are potentially restricted to the impact areas. 3. Revise the habitat assessment and quantify areas of impact to each SRE habitat type. Provide mapping to illustrate the SRE habitat types in relation to the known locations of the taxa (identified to lowest taxonomic level possible) consolidated from all surveys, as per the work required in the Environmental Scoping Document (ESD) (Item 15). 4. Re-analyse and assess the potential impacts to SREs in the development envelope incorporating the results of the consolidated review and discuss the cumulative impacts to SREs from the existing approved areas of clearing and the additional areas as part of this Proposal, as per ESD Item 13b and 16. 5. Discuss mitigation and management measures specific for SRE taxa.	**The Proponent notes DWER'S requests.** The Proponent has undertaken further SRE analysis and assessment (Biologic 2021a and 2021b) including: • Table 2.3 in Biologic 2021a presents an up-to-date consolidated list of taxa and occurrence in relation to proposed impact areas. • Table 2.1 in Biologic 2021a presents an up-to-date, consolidated list of species identifications across all surveys within the Development Envelope; Section 2 of Biologic 2021a provides detail on the alignment and consolidation of these identifications in addition to information provided in Biologic 2021b. 1. The Proponent has undertaken molecular analysis (DNA barcoding using the mitochondrial gene COI) to resolve species-level identifications and further investigate species distributions from both the Biologic (2021b) and Astron (2018) surveys. Specimens from 2011 survey were not chosen for genetic analysis as it was deemed that the material would likely be too old or not preserved adequately and hence unlikely to produce high quality sequences (Biologic 2021a). A total of 96 specimens, 60 from the Biologic (2021b) survey and 36 from Paraburdoo (Astron 2018) were sequenced and this information has allowed resolution of species level determinations (genetic OTUs/morpho-species) to provide regional context where available DNA sequence data exists. In total, the molecular analysis resulted in 30 OTUs being designated to specimens from the Development Envelope (Western Range and Paraburdoo). From these specimens, 23 taxa were identified from the Biologic (2021b) Study Area, not including indeterminate species (sp. indet.), of which 16 were regarded as Potential SRE and six classified as Widespread. One taxon, *Karaops* `sp. Biologic-ARAN036` was considered to be a Confirmed SRE based on data available to date. Biologic (2021a) have since consolidated and aligned all SRE fauna records including consideration of the molecular work; this has resulted in a total of 60 species/OTUs being recorded from the Development Envelope: • Eight species are known to be widespread and are not considered SREs. • 20 OTUs (including indeterminate taxa) have uncertain distributions. • The remaining 32 species/ OTUs are considered Potential SREs based on the nominal range criteria and current taxonomic/ ecological information. Biologic (2021b) identified limitations and constraints to undertaking molecular analysis to include: • Breadth of data available to undertake comparisons • The accessibility of pre-existing regional sequences • The success rate of genetic sequencing. Biologic (2021a) note that despite the successful taxonomic and genetic alignment of most of the SRE material collected in the Development Envelope, there will always be a residual amount of specimen material that cannot be resolved morphologically, genetically, or spatially due to a variety of reasons. The practicalities of genetic sub-sampling mean that not all the material can be sequenced, some DNA sequences fail or are contaminated, sometimes the material is too degraded for genetic or morphological work, and often morphological taxonomic frameworks disagree with genetic results (Biologic 2021a). 2. The Proponent has undertaken further work which is presented in Biologic (2021a) (Attachment 2), including: • Table 2.1 provides a consolidated list of all SRE invertebrate fauna recorded from all surveys within the Development Envelope

Item	Topic	DWER Comment	Rio Tinto Response
			• Table 2.2 details the occurrence of each of the SRE species and OTUs in relation to the habitat types mapped across the Development Envelope • Table 2.3 presents taxa distribution in relation to the conceptual disturbance footprint impacts • This data is visually presented in Figure 2.1. Following the consolidation and alignment of SRE fauna records (Biologic 2021a) a total of 60 species/OTUs have been recorded from the Development Envelope as described above under item 1 of this RTS No. 19. Three taxa (*Buddelundia* `sp. Biologic-ISOP047`, *Cryptops* `sp. Biologic-CHIL022`, and Geophilomorpha `sp. Biologic-CHIL025`) represent new, unique OTUs recorded only from single sites or a few sites, inside proposed impact areas. Based on current information, these taxa have not been detected outside the Development Envelope, although their habitats (Gorge/ Gully, Rocky Hills, and Low Hills habitats) form a mosaic of interconnected rocky/ mountainous habitat that is extensive beyond impacts throughout the Development Envelope and the wider local area. Biologic (2021a) conclude the potential impacts of the Proposal are unlikely to cause a significant risk to the long-term persistence of these three taxa. 3. The Proponent has revised the habitat assessment including detail presented in Biologic (2021a) (Attachment 2): • Section 3.2 - 3.3 presents potential direct impacts to SREs and SRE habitat • Table 2.2 details the occurrence of each of the SRE species and OTUs in relation to the habitat types mapped across the Development Envelope • Table 3.2 presents habitat type and proportion of total area (%) likely to be disturbed/retained following implementation of the Proposal • This data is visually presented on Figure 2.1. The Terrestrial Fauna ERD Chapter has also been updated along with associated figures. Relationships between habitats and SRE taxa have been shown based on all relevant sampling records (those that were able to be resolved to species or genetic OTU level). None of the habitat types are expected to be strictly limited to the Development Envelope, and all habitats are known to occur more widely in the local and regional area. 4. The Proponent has considered potential direct and indirect cumulative impacts to SREs following consolidation of all survey data. Most species and OTUs (53 out of 60 taxa) were recorded beyond proposed impact areas, or both inside and outside of impacts (Biologic 2021a). The SRE habitat types that these taxa are associated with also occur extensively beyond proposed impact footprint, with a high proportion of their current extent occurring outside proposed impact areas. The potential impacts to these 53 taxa and their habitats from the implementation of the Proposal were therefore considered Low. Four indeterminate taxa were recorded from sites with from existing infrastructure impacts or from existing and proposed infrastructure areas. In each of these four cases, the combined disturbance to the surrounding habitat was minimal, and suitable habitat is likely to remain intact, supporting the persistence of SRE species. Biologic (2021a) assessed the potential impacts to these four taxa from the implementation of the Proposal to be Low. Three further taxa (*Buddelundia* `sp. Biologic-ISOP047`, *Cryptops* `sp. Biologic-CHIL022`, and Geophilomorpha `sp. Biologic-CHIL025`) represent new, unique OTUs recorded only from single sites or a few sites, inside proposed impact areas (Biologic 2021a). Based on current information, these taxa have not been detected outside the Development Envelope, although their habitats are well represented in the wider local

Item	Topic	DWER Comment	Rio Tinto Response
			area beyond the Development Envelope. The SRE habitats (Gorge/ Gully, Rocky Hills, and Low Hills habitats) form a mosaic of interconnected rocky/ mountainous habitat that is extensive beyond impacts throughout the Development Envelope and the wider local area. The residual impacts to Rocky Hills habitat and Low Hills habitat from development of the Proposal are Low. Biologic (2021a) assessed the potential impacts of the Proposal to be unlikely to cause a significant risk to the long-term persistence of these three taxa in the Development Envelope. Although the Proposal may result in the direct loss of SRE individuals via mining activities, clearing, and land surface changes at sites within the impact footprint, these impacts are unlikely to cause the loss of any species / OTUs (Biologic 2021a). This is because the recorded occurrence of SRE species and OTUs within the Development Envelope is unlikely to represent the total range or distribution of any of the taxa recorded, due to the sampling artefacts inherent in SRE surveys. Especially for the singletons and species recorded only from single sites, it is unlikely that a single sampling location would encapsulate the total distribution range of the species; rather, it indicates an association to a particular habitat type that can be assessed as a proxy where the sampling to date failed to detect a more complete distribution range. Section 3 of Biologic (2021a) provides further detail on assessment of potential impacts associated with the Proposal. 5. The proposed impact areas have been revised to avoid impacts to high value SRE habitats including Breakaway, Gorge/Gully and Riverine habitat as much as practicable following application of the mitigation hierarchy (avoidance, minimisation, rehabilitation, offset). Mining Exclusions Zones (MEZ) with coverage of Gorge/ Gully, Rocky Hills, and Low Hills habitats will help mitigate impacts to high value habitat. Mitigation and management measures are outlined in Section 6.7 of the revised ERD Terrestrial Fauna ERD Chapter (Rio Tinto 2021b) with a focus on high value fauna habitats. It is considered that additional mitigation and management measures (Biologic 2021a) to those proposed in the ERD are not necessary due to: • the relatively limited spatial extent of the proposed impacts to SRE habitat • the known or likely wider occurrence of all SRE habitat types in the local area beyond the Development Envelope • the minor effects of indirect impacts that are likely limited to the immediate vicinity of the proposed mining and construction areas • the application of the mitigation hierarchy to manage known residual impacts as far as practicable as detailed in section 6.7 of the Terrestrial Fauna ERD Chapter.
7	IBSA	Please note that any survey reports or data that are revised after their initial acceptance into the Index of Biodiversity Surveys for Assessments (IBSA) – e.g. as a result of the assessment process – should be updated in IBSA. The Proponent should contact ibsa@dwer.wa.gov.au for assistance in such cases.	**Noted.** The Proponent will provide revised survey reports and data where appropriate for the Index of Biodiversity Surveys for Assessments (IBSA) to facilitate assessment.

References

Astron Environmental Services Pty Ltd (Astron). 2018. *Greater Paraburdoo Level 2 Fauna Survey*. Report prepared for Rio Tinto Iron Ore, April 2018. Report reference: 14283-18-BISR-1Rev0_181127.

Bat Call 2020a. *Paraburdoo Western Range, Pilbara WA, Acoustic Survey of Ghost Bat Activity, July 2018 to February 2020.* Report prepared for Rio Tinto, February 2020.

Bennelongia. (2012). *Turee Syncline Iron Ore Project, short range endemic invertebrates survey*. Unpublished report prepared for Rio Tinto Iron Ore. Bennelongia Environmental Consultants Pty Ltd, Jolimont, WA.

Biologic Environmental Survey. 2021a. *Memorandum: Greater Paraburdoo Short-Range Endemic Invertebrate Fauna Consolidated Impact Assessment*. Report to Rio Tinto Iron Ore. November 2021. (Attachment 2).

Biologic Environmental Survey. 2021b. *Western Range Project Short-Range Endemic Invertebrate Fauna Survey*. Report to Rio Tinto Iron Ore. December 2021. (Attachment 3).

Rio Tinto. 2021a. *Environmental Management Plan, Greater Paraburdoo Iron Ore Hub*. December 2021.

Rio Tinto. 2021b. *Environmental Review Document – Terrestrial Fauna*. Rio Tinto.

Attachment 1

Figure 6.4, Environmental Review Document – Terrestrial Fauna. Rio Tinto. 2021b.

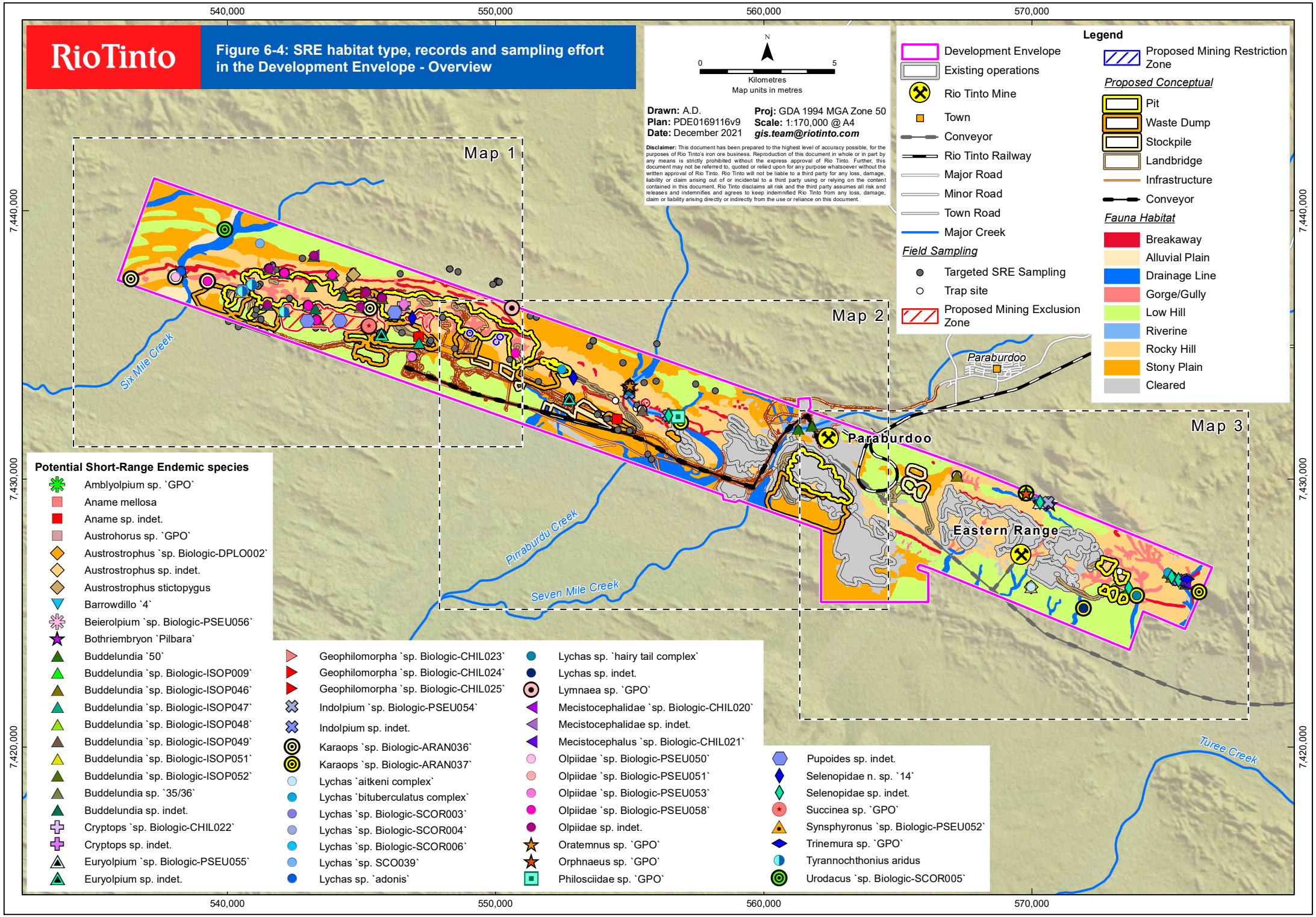
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Figure 6-4: SRE habitat type, records and sampling effort in the Development Envelope - Overview
N
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Kilometres
Map units in metres
Drawn: A.D.
Plan: PDE0169116v9
Date: December 2021
Proj: GDA 1994 MGA Zone 50
Scale: 1:170,000 @ A4
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Legend
Development Envelope
Existing operations
Rio Tinto Mine
Town
Conveyor
Rio Tinto Railway
Major Road
Minor Road
Town Road
Major Creek
Field Sampling
Targeted SRE Sampling
Trap site
Proposed Mining Exclusion Zone
Proposed Mining Restriction Zone
Proposed Conceptual
Pit
Waste Dump
Stockpile
Landbridge
Infrastructure
Conveyor
Fauna Habitat
Breakaway
Alluvial Plain
Drainage Line
Gorge/Gully
Low Hill
Riverine
Rocky Hill
Stony Plain
Cleared
Map 1
Map 2
Map 3
Six Mile Creek
Pirraburdu Creek
Seven Mile Creek
Paraburdoo
Eastern Range
Turee Creek
540,000
550,000
560,000
570,000
7,440,000
7,430,000
7,420,000
Potential Short-Range Endemic species
Amblyolpium sp. `GPO`
Aname mellosa
Aname sp. indet.
Austrohorus sp. `GPO`
Austrostrophus `sp. Biologic-DPLO002`
Austrostrophus sp. indet.
Austrostrophus stictopygus
Barrowdillo `4`
Beierolpium `sp. Biologic-PSEU056`
Bothriembryon `Pilbara`
Buddelundia `50`
Buddelundia `sp. Biologic-ISOP009`
Buddelundia `sp. Biologic-ISOP046`
Buddelundia `sp. Biologic-ISOP047`
Buddelundia `sp. Biologic-ISOP048`
Buddelundia `sp. Biologic-ISOP049`
Buddelundia `sp. Biologic-ISOP051`
Buddelundia `sp. Biologic-ISOP052`
Buddelundia sp. `35/36`
Buddelundia sp. indet.
Cryptops `sp. Biologic-CHIL022`
Cryptops sp. indet.
Euryolpium `sp. Biologic-PSEU055`
Euryolpium sp. indet.
Geophilomorpha `sp. Biologic-CHIL023`
Geophilomorpha `sp. Biologic-CHIL024`
Geophilomorpha `sp. Biologic-CHIL025`
Indolpium `sp. Biologic-PSEU054`
Indolpium sp. indet.
Karaops `sp. Biologic-ARAN036`
Karaops `sp. Biologic-ARAN037`
Lychas `aitkeni complex`
Lychas `bituberculatus complex`
Lychas `sp. Biologic-SCOR003`
Lychas `sp. Biologic-SCOR004`
Lychas `sp. Biologic-SCOR006`
Lychas `sp. SCO039`
Lychas `sp. `adonis`
Lychas sp. `hairy tail complex`
Lychas sp. indet.
Lymnaea sp. `GPO`
Mecistocephalidae `sp. Biologic-CHIL020`
Mecistocephalidae sp. indet.
Mecistocephalus `sp. Biologic-CHIL021`
Olpiidae `sp. Biologic-PSEU050`
Olpiidae `sp. Biologic-PSEU051`
Olpiidae `sp. Biologic-PSEU053`
Olpiidae `sp. Biologic-PSEU058`
Olpiidae sp. indet.
Oratemnus sp. `GPO`
Orphnaeus sp. `GPO`
Philosciidae sp. `GPO`
Pupoides sp. indet.
Selenopidae n. sp. `14`
Selenopidae sp. indet.
Succinea sp. `GPO`
Synsphyronus `sp. Biologic-PSEU052`
Trinemura sp. `GPO`
Tyrannochthonius aridus
Urodacus `sp. Biologic-SCOR005`

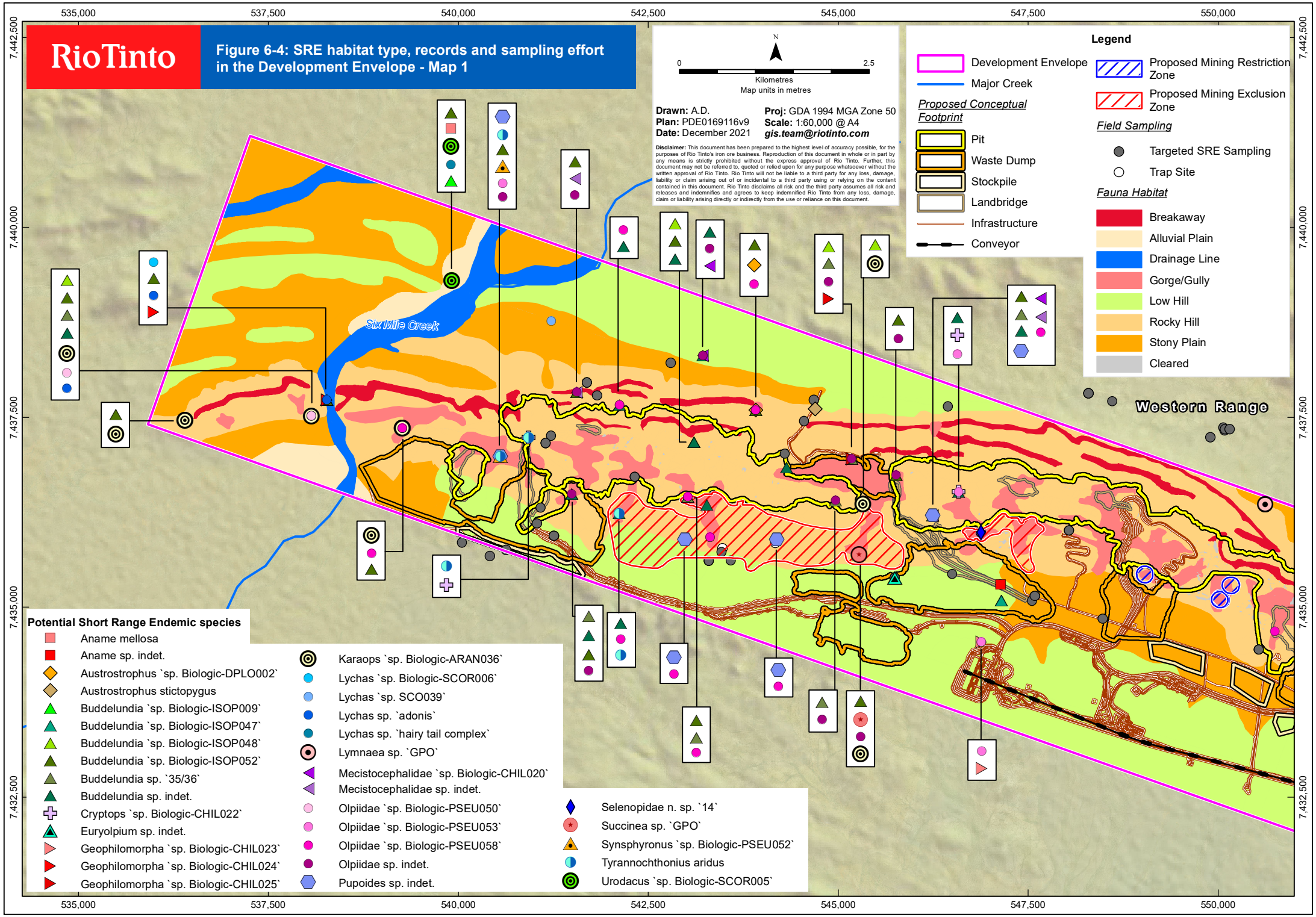
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Figure 6-4: SRE habitat type, records and sampling effort in the Development Envelope - Map 1
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2.5
Kilometres
Map units in metres
Drawn: A.D.
Plan: PDE0169116v9
Date: December 2021
Proj: GDA 1994 MGA Zone 50
Scale: 1:60,000 @ A4
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Legend
Development Envelope
Major Creek
Proposed Conceptual Footprint
Pit
Waste Dump
Stockpile
Landbridge
Infrastructure
Conveyor
Proposed Mining Restriction Zone
Proposed Mining Exclusion Zone
Field Sampling
Targeted SRE Sampling
Trap Site
Fauna Habitat
Breakaway
Alluvial Plain
Drainage Line
Gorge/Gully
Low Hill
Rocky Hill
Stony Plain
Cleared
Six Mile Creek
Western Range
Potential Short Range Endemic species
Aname mellosa
Aname sp. indet.
Austrostrophus `sp. Biologic-DPLO002`
Austrostrophus stictopygus
Buddelundia `sp. Biologic-ISOP009`
Buddelundia `sp. Biologic-ISOP047`
Buddelundia `sp. Biologic-ISOP048`
Buddelundia `sp. Biologic-ISOP052`
Buddelundia sp. `35/36`
Buddelundia sp. indet.
Cryptops `sp. Biologic-CHIL022`
Euryolpium sp. indet.
Geophilomorpha `sp. Biologic-CHIL023`
Geophilomorpha `sp. Biologic-CHIL024`
Geophilomorpha `sp. Biologic-CHIL025`
Karaops `sp. Biologic-ARAN036`
Lychas `sp. Biologic-SCOR006`
Lychas `sp. SCO039`
Lychas sp. `adonis`
Lychas sp. `hairy tail complex`
Lymnaea sp. `GPO`
Mecistocephalidae `sp. Biologic-CHIL020`
Mecistocephalidae sp. indet.
Olpiidae `sp. Biologic-PSEU050`
Olpiidae `sp. Biologic-PSEU053`
Olpiidae `sp. Biologic-PSEU058`
Olpiidae sp. indet.
Pupoides sp. indet.
Selenopidae n. sp. `14`
Succinea sp. `GPO`
Synsphyronus `sp. Biologic-PSEU052`
Tyrannochthonius aridus
Urodacus `sp. Biologic-SCOR005`
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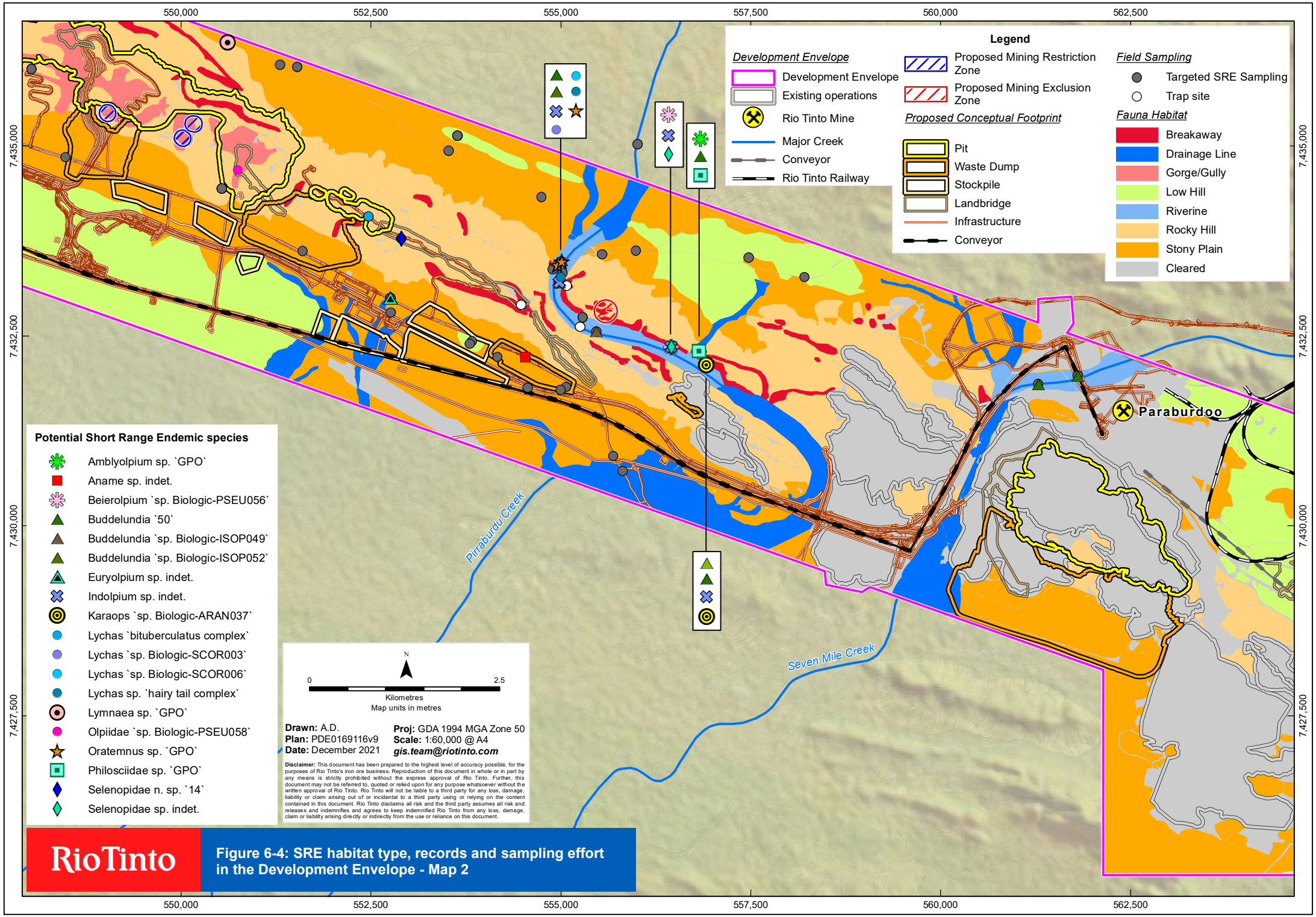
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Legend
Development Envelope
Development Envelope
Existing operations
Rio Tinto Mine
Major Creek
Conveyor
Rio Tinto Railway
Proposed Mining Restriction Zone
Proposed Mining Exclusion Zone
Proposed Conceptual Footprint
Pit
Waste Dump
Stockpile
Landbridge
Infrastructure
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Targeted SRE Sampling
Trap site
Fauna Habitat
Breakaway
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Low Hill
Riverine
Rocky Hill
Stony Plain
Cleared
Paraburdoo
Pirraburdu Creek
Seven Mile Creek
Potential Short Range Endemic species
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Buddelundia `50`
Buddelundia `sp. Biologic-ISOP049`
Buddelundia `sp. Biologic-ISOP052`
Euryolpium sp. indet.
Indolpium sp. indet.
Karaops `sp. Biologic-ARAN037`
Lychas `bituberculatus complex`
Lychas `sp. Biologic-SCOR003`
Lychas `sp. Biologic-SCOR006`
Lychas sp. `hairy tail complex`
Lymnaea sp. `GPO`
Olpiidae `sp. Biologic-PSEU058`
Oratemnus sp. `GPO`
Philosciidae sp. `GPO`
Selenopidae n. sp. `14`
Selenopidae sp. indet.
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Kilometres
Map units in metres
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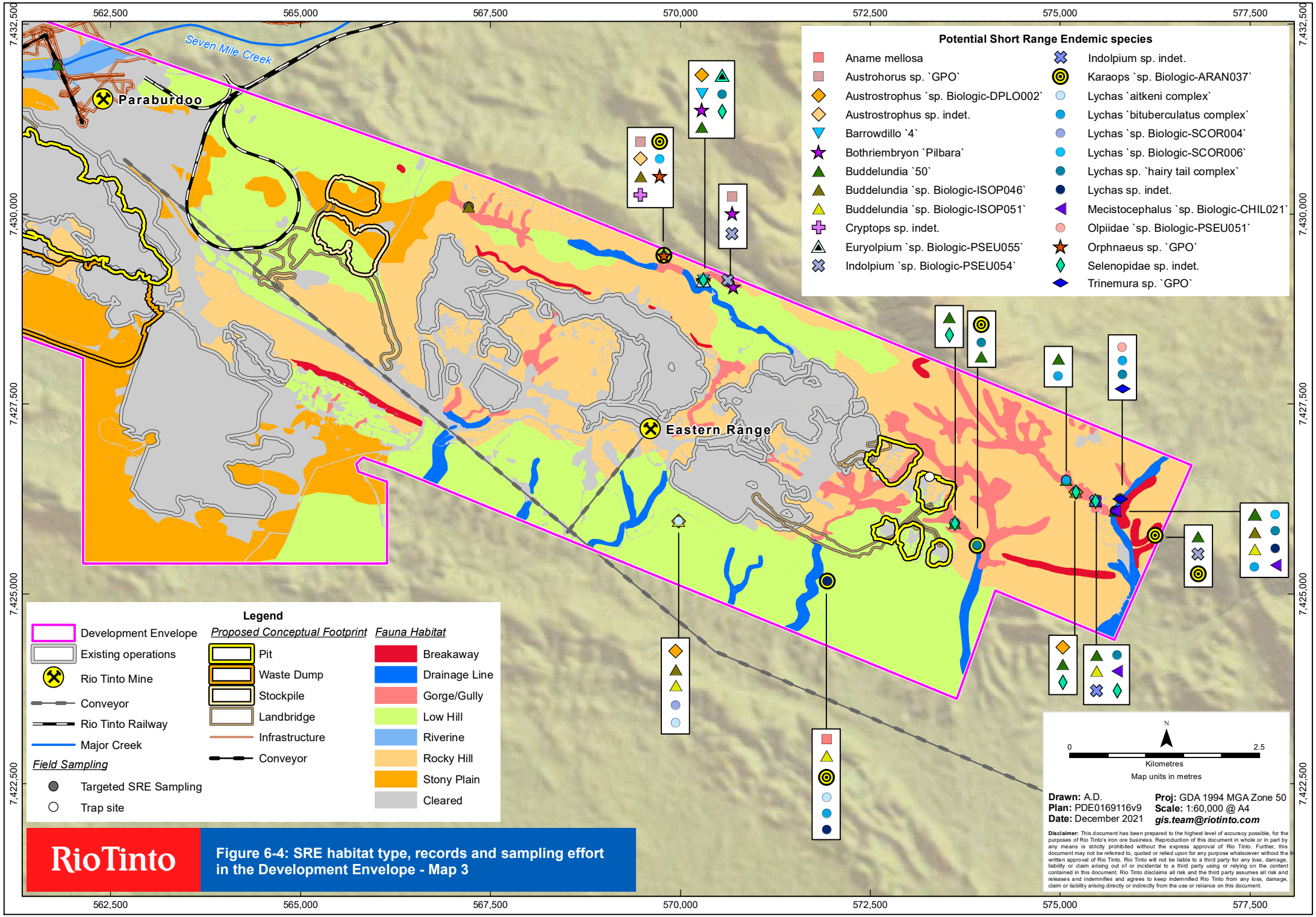
Figure 6-4: SRE habitat type, records and sampling effort in the Development Envelope - Map 2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7,422,500
Seven Mile Creek
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Eastern Range
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Buddelundia `sp. Biologic-ISOP046`
Buddelundia `sp. Biologic-ISOP051`
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Indolpium `sp. Biologic-PSEU054`
Indolpium sp. indet.
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Lychas `bituberculatus complex`
Lychas `sp. Biologic-SCOR004`
Lychas `sp. Biologic-SCOR006`
Lychas sp. `hairy tail complex`
Lychas sp. indet.
Mecistocephalus `sp. Biologic-CHIL021`
Olpiidae `sp. Biologic-PSEU051`
Orphnaeus sp. `GPO`
Selenopidae sp. indet.
Trinemura sp. `GPO`
Legend
Development Envelope
Existing operations
Rio Tinto Mine
Conveyor
Rio Tinto Railway
Major Creek
Field Sampling
Targeted SRE Sampling
Trap site
Proposed Conceptual Footprint
Pit
Waste Dump
Stockpile
Landbridge
Infrastructure
Conveyor
Fauna Habitat
Breakaway
Drainage Line
Gorge/Gully
Low Hill
Riverine
Rocky Hill
Stony Plain
Cleared
N
0
2.5
Kilometres
Map units in metres
Drawn: A.D.
Plan: PDE0169116v9
Date: December 2021
Proj: GDA 1994 MGA Zone 50
Scale: 1:60,000 @ A4
gis.team@riotinto.com
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Figure 6-4: SRE habitat type, records and sampling effort in the Development Envelope - Map 3

Attachment 2

Biologic Environmental Survey. 2021a. *Memorandum: Greater Paraburdoo Short-Range Endemic Invertebrate Fauna Consolidated Impact Assessment*. Report to Rio Tinto Iron Ore. December 2021.

Attachment 3

Biologic Environmental Survey. 2021b. *Western Range Project Short-Range Endemic Invertebrate Fauna Survey*. Report to Rio Tinto Iron Ore. December 2021.