CENTRAL LAND COUNCIL

Submission to the Environmental Protection Agency of the Northern Territory

Rover 1 Project

Referral dated 18 August 2023 by Castile Resources Pty Ltd

ACKNOWLEDGEMENT

Central Land Council acknowledges the traditional owners of the Northern Territory who, with their ancestors, have been custodians and stewards of the Territory and its resources for tens of thousands of years.

A. EXECUTIVE SUMMARY

1. Central Land Council (**CLC**) submits that the Rover 1 Project (**Proposed Action**) should be assessed at Tier 3 (environmental impact assessment) level by the Northern Territory Environment Protection Authority (**NT EPA**).

2. CLC welcomes the decision of Castile Resources Pty Ltd (**Proponent**) to refer the Proposed Action to the Northern Territory Environment Protection Authority (**NTEPA**) as a proponent initiated environmental impact statement referral (**EIS Referral**).[1] CLC further welcomes the NTEPA's decision to accept the EIS Referral.[2]

3. CLC agrees with the Proponent that the appropriate level of environmental impact assessment for the Proposed Action is an environmental impact statement.[3] The Proposed Action is a new mine: it falls squarely within the remit of this method of assessment. Any lesser form of environmental impact assessment would be inadequate.

4. CLC further submits that the NTEPA must widen the scope of the Proponent's draft Terms of Reference (**ToR**) in order to properly assess the impact of the Proposed Action on the environment.[4]

5. Time constraints have precluded more thorough research and field investigations. As such, this report comprises a desktop study of the Rover 1 area based on previous country visit reports and work area clearances, and, where available, anthropological reports.

6. This submission must be read with the advice annexed as Annexure A to this submission (**Hydrogeological Advice**). The Hydrogeological Advice has been prepared by Dr Ryan Vogewill, Director & Principal Hydrogeologist, and Rachel Hamilton, Senior Hydrogeologist, Hydro Geo Enviro Pty Ltd. CLC adopts the Hydrogeological Advice, and it forms part of this submission.

B. INTRODUCTION

7. The Proposed Action consists of a new underground mine operation approximately 70km southwest of Tennant Creek. The Proponent intends to target an ore body containing copper, gold and cobalt at a depth of between 300m and +1,000m, and intends to process 500,000 tonnes of ore per annum. The Proponent intends to process the ore onsite.[5]

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[1] See *Environment Protection Regulations 2020* (NT) (**EP Regulations**) r 43.
[2] See NTEPA Notice of Decision dated 26 September 2023; EP Regulations rr 46, 50 generally.
[3] See Castile Resources Pty Ltd, *Rover 1 Project Proponent Initiated EIS Referral under the Environment Protection Act 2019 Statement of Reasons*, 28 August 2023 (**Statement of Reasons**), p 1.
[4] Relevantly, the *Environment Protection Act 2019* (NT) (**EP Act**) defines 'environment' as being 'all aspects of the surroundings of humans including physical, biological, economic, cultural and social aspects': see s 6.
[5] See Castile Resources Pty Ltd, *Referral form – Environment Protection Act 2019*, 18 August 2023) (**Referral Form**) p 2.

8. The total disturbance area is estimated to be approximately 177ha. The EIS Referral also proposes that water will be supplied from the dewatering of the underground workings and from a groundwater bore field to be constructed nearby. The EIS also indicates that the preferred option to power the mine is natural gas, sourced from the existing gas pipeline located approximately 40km east of the area of the Proposed Action.[6]

9. The Proposed Action is located on Aboriginal land, being Karlantijpa South Aboriginal Land Trust.[7] While the Proponent is party to an agreement with CLC for exploration over the land the subject of the Proposed Action, the Proponent has not yet been granted a mining lease nor has it secured an agreement with the CLC to mine pursuant to the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (**Land Rights Act**).[8]

10. The EIS Referral comprises the following documents:

    a. Referral Form dated 18 August 2023;

    b. Referral Report and Appendices dated 28 August 2023;

    c. Referral Statement of Reasons dated 28 August 2023; and

    d. Referral Draft Terms of Reference for an Environmental Impact Statement dated 28 August 2023

    (together, the **Referral Documents**).

11. CLC makes this submission in accordance with regulation 52(1)(b) of the *Environment Protection Regulations 2020* (NT) (**EP Regulations**). The NTEPA must consider this submission (among other things) before making a decision as to what level of assessment the Proposed Action requires.[9]

C. CLC'S ROLE

12. CLC is a statutory authority established under section 21 of the Land Rights Act. CLC has functions and duties under the Land Rights Act, including:

    a. ascertaining and expressing the wishes and opinion of Aboriginals living in the area of the CLC's responsibility as to the management of Aboriginal land in the area;

    b. protecting the interests of traditional Aboriginal owners of, and other Aboriginals interested in, Aboriginal land in the area of the CLC's responsibility; and

    c. assisting Aboriginals in the taking of measures likely to assist in the protection of sacred sites on land (whether or not on Aboriginal land) in the area of CLC's responsibility.[10]

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[6] See Castile Resources Pty Ltd, *Rover 1 Project Proponent Initiated EIS Referral under the Environment Protection Act 2019 Referral Report*, 28 August 2023 (**Referral Report**) p vii.
[7] See *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) s 3.
[8] The Proponent acknowledges this in the Referral Form: see p 2.
[9] EP Regulations r 56(c).
[10] Land Rights Act s 23(1).

13. CLC is also the recognised Aboriginal/Torres Strait Islander native title representative body for the southern region of the Northern Territory pursuant to section 203AD of the *Native Title Act 1993* (Cth) (**Native Title Act**). This includes the following pastoral leases over which the Federal Court of Australia has made native title determinations:

    a. Tennant Creek Pastoral Lease;[11]

    b. Phillip Creek Pastoral Lease;[12]

    c. Singleton Pastoral Lease;[13]

    d. Stirling Pastoral Lease; and[14]

    e. Neutral Junction Pastoral Lease.[15]

14. Native title representative bodies perform various assistance and facilitation functions.[16] Such functions are carried out pursuant to service agreements between CLC and the registered native title bodies corporate.

15. The prescribed bodies corporate for the above areas are respectively:

    a. Ngurramarla Aboriginal Corporation (**NAC**);

    b. Warlmanpa Warumungu Aboriginal Corporation (**WWAC**);

    c. Mpwerempwer Aboriginal Corporation (**MAC**);

    d. Eynewantheyne Aboriginal Corporation (**EAC**); and

    e. EAC and Kaytetye Tywerate Arenge Aboriginal Corporation (**KTAAC**).

16. In making these submissions, CLC represents and has considered the interests of:

    a. the traditional Aboriginal owners[17] of the Karlantijpa Aboriginal Land Trust;

    b. affected native title holders for Tennant Creek Pastoral Lease, Phillip Creek Pastoral Lease, Singleton Pastoral Lease, Stirling Pastoral Lease, and Neutral Junction Pastoral Lease;

    c. NAC, WWAC, MAC, EAC, and KTAAC; and

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[11] *Freddie on behalf of the Kankawarla, Kanturrpa, Kurtinja, Patta, Pirrtangu, Purrurtu and Warupunju landholding groups v Northern Territory of Australia* [2019] FCA 1024.
[12] *Freddie v Northern Territory* [2017] FCA 867.
[13] *Rex on behalf of the Akwerlpe-Waake, Iliyarne, Lyentyawel Ileparranem and Arrawatyen People v Northern Territory of Australia* [2010] FCA 911.
[14] *Pwerle v Northern Territory* [2016] FCA 304.
[15] *Pwerle v Northern Territory* [2016] FCA 304 and *Kngwarraye on behalf of the members of the Arnerre, Wake-Akwerlpe, Errene and Ileyarne Landholding Groups v Northern Territory of Australia* [2011] FCA 765.
[16] See *Native Title Act 1993* (Cth) (**Native Title Act**) s 203BB.
[17] See Land Rights Act s 3.

d. Aboriginal residents of Tennant Creek and nearby communities and outstations, which include Mungalawurru, Kunayungku, Ngappamilarnu, Partnparinj, Kaliwanpa, Mungkarta and Junkaji

(together, the **Affected Aboriginal constituents**).

D. CLC's SUBMISSION ON LEVEL OF ASSESSMENT

17. CLC submits that the Proposed Action must be assessed at the level of an environmental impact statement. An environmental impact statement is necessary because:

    a. the Proposed Action is likely to have a **significant impact** on the environment;

    b. the **level of confidence** in predicting potential significant impacts of the Proposed Action, taking into account the extent and currency of existing knowledge, is **low**;

    c. the **level of confidence** in the effectiveness of any proposed measures identified in the Referral Documents to avoid, mitigate or manage potential significant impacts of the Proposed Action is **low**;

    d. the **extent of community engagement** that has occurred in relation to the Proposed Action is **low**; and

    e. the **capacity of communities and individuals** likely to be affected, particularly Aboriginal communities and individuals, to access and understand information about the proposed action or strategic proposal and its potential significant impacts is **low**.[18]

18. Notably, CLC's view accords with that of the Proponent that an environmental impact statement is required for the Proposed Action.[19]

Significant impact on the environment

19. The term 'environment' is broadly defined by the EP Act, and includes 'all aspects of the surroundings of humans including physical, biological, economic, cultural and social aspects'.[20]

20. CLC's view is that the Proposed Action is highly likely to have a significant impact on the environment having regard to:

    a. the context and intensity of the impact, and

    b. the sensitivity, value, and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.[21]

[18] In accordance with the EP Regulations r 59(a)–(e).
[19] See Statement of Reasons p 3.
[20] EP Act s 6.
[21] See EP Act s 11.

21. Put simply, the Proposed Action is a new mine in a largely undisturbed area. CLC refers generally to the Referral Documents in forming its view, and specifically points to the following elements:

The context and intensity of the impact[22]

a. Estimated depth of mining between 300m and 1,000m+.

b. Significant land clearing proposed over an area of 177ha[23], including 120ha for the gas pipeline and haul road, noting that there is no existing track.[24]

c. Preliminary estimated daily water demand of 4,382m^3/d.[25] CLC notes that the proponent does not have a water license for this estimated water take. One implication of this is that the potential impacts of this water extraction on the environment and other current and future water users have not been considered by the Water Controller (as per section 90(1) of the *Water Act 1992* (NT)) and that the Proposed Action has not been subject to the opportunities for public comment that the water licencing framework provides.

The sensitivity, value and quality of the environment impacted and the duration, magnitude and geographic extent of the impact[26]

d. The loss of 57 ha of potential Greater Bilby habitat.[27] The greater bilby is listed as a vulnerable species under both the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and the *Territory Parks and Wildlife Conservation Act 1976* (NT), and also listed as a vulnerable species on the IUCN Red List of Threatened Species 2022.2.[28]

e. The Proposed Action has an estimated footprint of 1,77ha over Miyikampi, Pawurrinji, and Kanturrpa estates, including a complex of sacred sites.[29] Further information about this is at E below.

f. The access road is in close proximity to Kunayungku outstation,[30] a community in which affected Aboriginal constituents visit often. Further information about this is below at E.

g. The Proposed Action is near to Partnparinji campsite, which affected Aboriginal constituents visit for hunting and foraging expeditions and for residing on country for extended periods. Further information about this is at E below.

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[22] See EP Act s 11(a).
[23] Referral Report p 10 – note that p 40 indicates that the total area proposed to be cleared is approximately be 117ha. This appears to be a typographical error as this is greater than the area proposed to be cleared for the pipeline.
[24] Referral Report p 10.
[25] Referral Report p 16.
[26] See EP Act s 11(b).
[27] Referral Report p 42.
[28] Macrotis lagotis — Greater Bilby (environment.gov.au)
[29] Referral Report p 9.
[30] Referral Report p 17.

h. The area of the Proposed Action contains Kanturrpa, Miyikampi, and Pawurrinji ceremonial sites. Further information about this is at E below.

i. There are significant knowledge gaps regarding the hydrogeological characteristics and spatial distribution of the aquifers onsite, despite a high risk of significant drawdown impacts and regional scale connections through the Cambrian Limestone formations (See Annexure A)

22. CLC further notes that the Referral Documents do not contain sufficient information for the NTEPA to properly assess the impact of the Proposed Action on the environment, and are not sufficient to allow an understanding of risk to environmental and cultural values. We expand on this below.

Confidence in predicting significance of impacts is low

23. CLC submits that the Referral Documents contain critically limited information regarding the impacts of the Proposed Action (which, in light of the above, will almost certainly be significant). The NTEPA cannot predict the impact of the Proposed Action without further information gained from an environmental impact assessment. No lesser form of environmental impact assessment would be appropriate.

24. CLC specifically notes the following elements of the Referral Documents which indicate uncertainty as to the impacts of the Proposed Action:

a. No on-ground studies of groundwater dependent ecosystems (**GDEs**) have been undertaken. Only a desktop study using BOM data appears to have been conducted.[31]

b. There has been no assessment of the existence of (and potential impact on) GDEs near the site including possible ephemeral pools, shallow groundwater dependant vegetation, or other features that all may have biodiversity and cultural values.

c. There is insufficient information about the level and outcome of consultation with affected Aboriginal constituents about the likelihood and significance of the Proposed Action's impact on cultural values, or independent studies of these values.

d. There is a lack of sufficiently detailed knowledge regarding the hydrogeological characteristics and the spatial distribution of the aquifers onsite:

i. An exhaustive understanding of hydrogeological connections between the Hooker Creek and Montejinni Limestone Aquifers is required, particularly for input (and testing) in the groundwater model. Potential connectivity between the shallow and deep aquifers was established in 2012 hydrogeological testing but were not incorporated into the groundwater modelling.

[31] Referral Report p 6.

ii. No site specific hydrogeological data has been provided for the relocated site.

iii. Hydraulic parameters have been produced from inadequately presented and analysed aquifer testing data.

iv. The current sensitivity analysis is only focused on mine inflows. Sensitivity of drawdown in the model needs to be explored and presented.

v. No drawdown predictions have been provided nor have any drawdown receptors been identified. The shallow nature of the groundwater table (~4.8mbgl) will require management of groundwater levels during dewatering for operations and abstraction for water supply.

vi. All of these gaps in turn lead to uncertainty about the hydrological impacts of the Proposed Action on cultural values.

e. No certainty or detail has been provided about the power source and its impacts.[32]

f. In respect of the key physical components:

i. No detailed specifications have been provided for the paste plant.[33]

ii. The size of the water management infrastructure and length of pipelines required is unknown.[34]

iii. The alignment of the gas pipeline is undetermined and its impacts uncertain.[35]

iv. The location and impacts of the borefield is unknown.[36]

v. Location of access and haul road is unclear.[37]

vi. Limited details for sewerage management despite proposing discharge to ground model/landfill.[38]

vii. Size of on-site landfill not specified.[39]

g. There is potential for acid-forming waste rock and acid-rock drainage. However, limited information has been provided in regards to model for segregation from other waste rock.[40]

h. There is significant uncertainty about tailings management, including in relation to water and electricity demands and paste plant waste streams. The testing of

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[32] Referral Report p 9
[33] Referral Report p 9.
[34] Referral Report p 9.
[35] Referral Report p 9.
[36] Referral Report p 9.
[37] Referral Report pp 10–11.
[38] Referral Report pp 10, 17.
[39] Referral Report p 10.
[40] Referral Report p 14.

tailings product is proposed to occur from a pilot treatment plant in late 2023 (i.e. at the end of the Definitive Feasibility Study).[41]

i. No groundwater model has been developed (including in respect of mine closure[42]) and the volume of water required has not been confirmed.[43]

j. Solar is one preferred power option[44] but is unclear whether or not a solar field included in land clearing estimate.

k. The management of hazardous materials has not been confirmed.[45]

l. No mine closure plan has been provided, and no assessment of the capacity for traditional owners to participate in closure planning process has been included.[46]

25. CLC makes corresponding recommendations for matters to be included in the Draft ToR at F below.

26. CLC further notes that the Proponent has provided limited information regarding cultural values which may be impacted by the Proposed Action. For convenience, CLC has provided a high-level summary of the cultural values that are likely to be present in the area of the Proposed Action at E below. Thorough investigation of cultural values, undertaken by CLC with traditional owners, must be included in the final Terms of Reference for the Proposed Action.

Confidence in effectiveness of proposed measures is low

27. The Proponent has acknowledged the significant gaps in the information provided, and has consequently proposed limited measures to address the impact of the Proposed Action.

28. It logically follows that the NTEPA cannot be confident that any proposed measures will be effective. This justifies assessment at the level of an environmental impact statement.

Extent of community engagement that has occurred is low

29. There appears to be no ascertainment of local workforce or proposal to provide employment for local Aboriginal people. Rather, the workforce is proposed to fly-in, fly-out from Darwin.[47]

30. While CLC is aware that consultation with traditional owners was undertaken in the form of 'liaison committee meetings' in July 2023, the outcomes of these meetings is not clear.[48] It is also not clear whether or not broader community consultations were held,

[41] Referral Report pp 1, 15
[42] Referral Report p 18.
[43] Referral Report p 16.
[44] Referral Report p 16.
[45] Referral Report p 16.
[46] Referral Report p 18.
[47] Referral Report p 18.
[48] Referral Report pp 23, 25, 27.

whether these were publicly notified, the level of detail that was given to attendees, and the outcomes of any such consultation.

Capacity of communities and individuals likely to be effected to access information is low

31. Given the complexity involved with the Proposed Action and its impact, there will be limited capacity for communities and individuals likely to be affected to access and understand information about the project and its potential significant impact.

E. CULTURAL VALUES

Connection to country and traditional owner description

32. The subject land traditionally lies within the Warlpiri linguistic region yet there are historic encroachments of Warlmanpa and Warumungu: all share extensive similarities in their complex moiety and subsection systems and designations. Their function is to create and sustain networks of exchange and reciprocity as insurance against times of resource scarcity.

33. Thus, a Warlpiri estate group typically comprises a singular descent group, generally founded on patrilineal descent, that is, a group of people who share a common male apical ancestor. In general, there are two ways through which people express this connection: through their father's father (patrilateral relations) termed *kirda,* or owner; and through their mother's father, called *kurdungurlu* or 'policeman'. The *kirda* for one estate will also be *kurdungurlu* for another. Those individuals taking on these roles have important and distinct responsibilities towards an estate depending on their assigned role as either *kirda* or *kurdungurlu*.

34. There are three local estates around the proposed Rover 1 mine. They are:

Miyikampi

a. The Miyikampi estate's interests lie generally to the west of the Rover 1 area, however, the estate abuts both Pawurrinji to the north-west and Kanturrpa to the east. Similarly to Kanturrpa, the Miyikampi estate shares ceremonial interests in the sites complex in the west of the Rover exploration area, thus a company relationship between the three estates who are spatially and socially close.

Pawurrinji

b. The Pawurrinji group heartland lies in the west of the Rover tenements, their estate centred on the eponymous claypan and soakage complex of Pawurinji through to the Ngappamilarnu outstation, yet this group is in close association spatially and socially with both Miyikampi and Kanturrpa with 'strong ceremonial ties'.

c. The main area for Pawurrinji ceremonial activity in company with Miyikampi and Kanturrpa is in the site complex that dominates the west of the Rover area. The main Dreaming for Pawurrinji wends its way through this complex, thus linking their interests to an area dominated by Miyikampi and Kanturrpa interests.

Kanturrpa

d. The Kanturrpa group are of the Warlmanpa linguistic group, and their estate is defined by the travels of their principle Dreaming. The estate is extensive, from the Murchison Ranges in the south to approximately Helen Springs Station in the north. To the east, Kanturrpa abuts the Warupunju estate and inherits an important Dreaming from them. In the west, Kanturrpa meets Miyikampi and Pawurrinji in and around the Rover tenements. As with Miyikampi and Pawurrinji above, the Kanturrpa group has extensive ties to the dominant sites complex in the area.

Zoning related concerns

35. Concerns over zoning within and around the Rover 1 area focus on access and exclusion. Mining operations by necessity will involve the exclusion of non-mining persons from the area, thus excluding TOs from enjoying the benefits of ownership and rights appurtenant thereto for the duration of mining and subsequent rehabilitation and closure. That is, no access will be permitted for hunting or foraging, or the exercise and transmission of cultural knowledge over an extended period.

Country and Culture

36. The negotiated use and occupation of country is substantially underpinned by, *inter alia*, common subscription to Dreaming tracks passing through country and sites associated thereto, kinship attachments and ties between groups. Ties of this nature characterise the close relationship between Miyikampi, Pawurrinji and Kanturrpa groups, who share common *kirda* and *kurdungurlu*. That is, Kanturrpa, in company with Miyikampi, act as *kurdungurlu* for Pawurrinji; conversely, Pawurrinji are *kurdungurlu* for the former groups.

Land use practices

37. Currently, land use is cyclic and linked to availability of foraging and hunting resources in season.

38. While Kunayungku is no longer a permanent home, it was a thriving community in earlier days. Traditional owner Doris Kelly observed that she had lived here in the 1970's and 1980's, and she had moved to Tennant Creek as she was advised by the 'Department' that her children needed to attend school; the 'desire to live' on country is tempered by contemporary realities. Nonetheless, traditional owners maintain their continuing connection to country by visiting and camping there often, availing themselves of the rights of occupation and use that accompany traditional ownership, and transmitting cultural values to the children.

39. Partnparinji campsite is frequently used for hunting and foraging expeditions and for residing on country for extended periods, for example, over school holidays. There is water available from a soak nearby.

40. By continuing to hunt and forage on land and exercise their entitlements, collecting bush foods and medicines, firewood, and other cultural resources, Traditional Owners thus maintain their residential and ownership rights over country; their connection to their traditional land 'remains strong'.

Culturally significant plant and animal species

41. There are many plant species that are encountered and collected by traditional owners in and around the Rover 1 area; the following are but a sample of the richness of this environment.

42. Encountered frequently within the immediate vicinity of Rover 1 are *Marrawaji* trees, the Desert Walnut (*Owenia reticulata*). These trees are significant in that they mark a Dreaming track of great importance to the Kanturrpa group. The 'walnuts' are also prized as a food source, and their oil is applied to sores on the skin. The leaves are used to make a poultice. Apart from the desert walnut, the Warpunungku, or Ghost Gum (*Corymbia aparrerinja*); the Warliji, or Desert Bloodwood (*Eucalyptus setosa*); and the Kumpalpa, or Corkwood (*Hakea divaricate*) are considered culturally significant trees.

43. *Papirta* or Bush potato (*Ipomoea costata*) are encountered throughout the area in foraging patches, associated with spinifex grasslands. The tubers are valued as a food source. Traditional owners forage for bush medicines such as the plant 'jungarrayi jungarrayi', or bush 'Vicks' (*Streptoglossa odora (female), Pterocaulon serrulatum (male)).* The leaf, when bruised, is placed in pillows to help sleep; they can also be applied to the chest to clear congestion.

44. The land provides cultural resources required for ceremony, such as *dinchi*, the seed heads of which grow in white tufts; when rolled between the fingers they break down to become light and fluffy, similar to feather down. The tufts are affixed to paint on the body in ritual designs for ceremony.

45. There are also many animal species that are significant to traditional owners. Prevalent in the area is the *Kurtinja*, or bush turkey (Australian bustard: *Ardeotis australis)*. Their meat is highly prized, often cooked directly in hot coals, and the white under feathers are important for decoration for ceremony. The *kalawurra* or the Sand Goanna (*Varanus gouldii*) is prized as both a food source and as bush medicine. The animal is cooked in hot coals, and their yellow fat is an important dietary element. The oil is applied to the skin for medicinal purposes. These two species are the primary prey for hunting expeditions: the yield from a successful hunt is often distributed to relatives and associates according to traditional practice.

46. In summary, the Rover 1 locale is part of a broader extensive food gathering area, replete with important and culturally significant resources; a resource-rich environment that has sustained traditional occupation over deep time.

Sacred Sites and areas of cultural significance

47. The Castile tenements are dominated by a complex of sacred sites in the west that form a nexus for ceremonial activity between Kanturrpa, Pawurrinji and Miyikampi estates. This site complex dominates the area west of Rover 1, and is characterised by a series of soaks and swamps overlooked by a hill, the northern slope of which is restricted to men only. It is these sites that form a 'convergence' of ceremonial interest and ritual interaction for the three neighbouring groups.

48. The broader Rover area hosts a number of important Dreamings that are marked on the cultural landscape by sacred sites, trees, and other significant features. The various groups identify with one or more Dreamings that travel in the area and create sites in their wake, thus underpinning their claims to ownership of country. It is these various

group attachments to these sites that structures the complex relations between them and the intertwining assignment of ownership and responsibilities.

F. CLC's SUBMISSION ON DRAFT ToR

49. In accordance with the above, CLC submits that the final Terms of Reference for the Proposed Action must require the Proponent to:

    a. undertake on-ground surveys of terrestrial ecosystems, including ground-water dependant ecosystems;[49]

    b. provide detailed information regarding the power source for the Proposed Action, including during construction and operation, and account for any likely associated impacts (e.g. further land to be cleared and its location);[50]

    c. provide detailed information regarding tailings management for the Proposed Action and the remediation of contaminated sites before, during, and after the closure of the mine;

    d. provide detailed information about the management of hazardous materials before, during, and after the closure of the mine;

    e. identify the location of the proposed borefield, and map the extent of aquifer drawdown from groundwater use (so far as is possible);[51]

    f. apply for a water license through the EIS process, and provide clear justification for the quantity, method, and impacts of the Proposed Action's water take;

    g. provide details regarding sewerage management plans;[52]

    h. identify the size and location of the proposed on-site landfill;[53]

    i. identify the extent of any land clearing for the purposes of solar power infrastructure;[54]

    j. explicitly consider and, to the greatest extent possible, implement the wishes of traditional owners in planning for mine closure;[55]

    k. approach CLC to undertake a cultural values and social impact assessment in tandem with traditional owners;

    l. describe how impacts to cultural values will be mitigated;

[49] Cf. Draft Terms of Reference for an Environmental Impact Statement dated 28 August 2023 (**Draft ToR**) p 14.
[50] Cf. Draft ToR p 8.
[51] Cf Draft ToR pp 15–16.
[52] This is not included in the Draft Tor.
[53] Cf. Draft ToR p 5.
[54] This is not included in the Draft Tor but is referred to in the Referral Report p 16.
[55] Cf. Draft ToR p 9.

m. describe how traditional owners will maintain the benefits of ownership and rights throughout the life of the Proposed Action;

n. carry out the groundwater investigation plan proposed in the March 2023 review under the supervision of an onsite hydrogeologist, including:

    i. installation of bores to monitor impacts at any potential drawdown receptors;

    ii. careful consideration of bore construction methods;

    iii. at least one deep bore into the basement and through the ore zone;

    iv. aquifer testing at no fewer than four sites;

    v. development of a conceptual model calibrated against a meaningful transient dataset and holistically explore sensitivity, conceptual and predictive uncertainty for shallow aquifer drawdown at all receptors (yet to be identified); and

    vi. assessment of the location of (and impact potential on) any groundwater dependant ecosystems

G. HYDROGEOLOGICAL ADVICE (ANNEXURE A)

H. CLC CONTACT (ANNEXURE B)

ANNEXURE A – HYDROGEOLOGICAL ADVICE

REVIEW OF THE ROVER-1 SUBMISSION TO THE NORTHERN TERRITORY ENVIRONMENTAL PROTECTION AUTHORITY.

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Contents

Introduction

Castile Resources Pty. Ltd. are proposing to develop the Rover 1 Project 70km south-west of Tennant Creek. The project includes an underground mine, on-site processing facility, tailings storage facility, waste rock dump and paste plant. Water for the mining operation will come from dewatering the underground workings and a (yet to be constructed or investigated) nearby borefield. A series of documents supporting this proposed activity have been submitted to the Northern Territory Environment Protection Authority (NT EPA). At the request of the Central Land Council (CLC) the following documents that have been reviewed:

- Appendix G Hydrogeology Investigations - March 2012
- Appendix H Preliminary Groundwater Report - Dec 2020
- Appendix I Review of Castile Resources Groundwater Investigation Drilling Program - March 2022
- Appendix-b-ecological-assessment.PDF
- Rover 1 Project Draft Terms of Reference for an Environmental Impact Statement - August 2023
- Castile Resources Ltd Exploration Mining Plan for Rover Project - March 2023

Initially the overall summary and recommendations will be presented followed by a detailed review of each document. Note that all page numbers referred to herein are the PDF file pages, not the report's page numbering.

Overall Review Summary

This review of the hydrogeological and impact assessment work at the Rover 1 site, focuses on environmental impacts of the project particularly in relation to GDEs including those with primarily cultural values (as opposed to high biodiversity values). The reports provided are not sufficient to allow an understanding of risk to environmental and cultural values. A summary of issues is presented by subject area.

Inadequate Investigations, Monitoring and Conceptual/Numerical Modelling

Currently there is a lack of sufficiently detailed knowledge regarding the hydrogeological characteristics and the spatial distribution of the aquifers onsite. Previous work from 2012 provided some baseline hydrogeological data but significant knowledge gaps still exist. Given that this project has had groundwater monitoring infrastructure installed since 2011, this lack of transient monitoring data is seen as a significant shortcoming. No site-specific hydrogeological data has been provided for the relocated Rover 1 site, which is seen as another significant shortcoming.

Hydraulic parameters have been produced from inadequately presented and variably analysed aquifer testing data. These were then used to generate the groundwater model but in many cases literature values for hydraulic properties have been used. A detailed understanding of hydrogeological connections between the water table, Hooker Creek and Montejinni Limestone Aquifers is required, particularly for input (and testing) in the groundwater model. Potential for connectivity between the shallow and deep aquifers was established in 2012 hydrogeological testing but was not incorporated into the groundwater modelling.

The lack of detailed aquifer understanding results in conceptual uncertainty in the subsequent groundwater model. Constructing a robust predictive groundwater model is unlikely with the current dataset, subsequentially the current model is very simplistic and uncalibrated. This does not meet the requirements of even a Class 1 model according the Australian Groundwater Modelling

Guidelines (Barnett et al, 2012, Australian groundwater modelling guidelines, Waterlines report, National Water Commission, Canberra).

Regardless more effort could have been made with the existing model to explore the sensitivity of modelling predictions to variations in hydraulic parameters and hydrogeological conceptual uncertainty. Also, drawdown and sensitivity of drawdown to parameter uncertainty in the model needs to be explored and presented, the current sensitivity analysis is only focussed on mine inflows. Impacts from the water supply borefield also need to be assessed. A larger aerial extent model is required to assess drawdown in all aquifers and this needs to be designed and constructed as per the Australian Groundwater Modelling Guidelines.

Hooker Creek Formation Aquifer

The upper aquifer (Hooker Creek Formation) underwent a reasonable testing program in 2012; bores were low yielding (~1-2L/s) and produced transmissivities around 1-5m^2/d. However, it appears that localised variations in lithology (most likely sandstones) which support groundwater could support vegetation in the upper sections of the Hooker Creek Formation. How this formation is connected to deeper aquifers needs to be better defined. There are also other possible interpretations of some of the aquifer testing data presented that would result in different aquifer parameters. There needs to be more exploration of these data to present the uncertainty in these aquifer parameter estimates.

Montejinni Limestone Aquifer

The lower aquifer/s (Montejinni Limestone Formation) testing program in 2012 was insufficient, reasons for this include but aren't limited to:

- Deeper bores were screened across both the upper and lower sections of the Montejinni Limestone Aquifer, as well as the separating confining layer, making hydrogeological differentiation between the upper and lower sections difficult. It is necessary to have nested piezometers with multiple bores at the same location screened only in each individual unit to assess vertical head differences and connectivity. The existing monitoring bore construction method has in some cases potential to connect these aquifers, which could cause water quality or quality impacts regardless of the mine progressing and should be decommissioned.
- Only two of the deeper bores were subjected to constant rate aquifer tests, and neither tests were of adequate duration, particularly in the context of determining aquifer boundary (recharge or barrier) effects.
- The highest yielding bore was tested at less than half its observed airlift rate, hence this test failed to appropriately stress the aquifer. This results in a suboptimal estimate of aquifer parameters. The reports are unclear about which monitoring bores were used for which drawdown analyses and subsequent aquifer parameter estimation. In some cases, only recovery data is presented and the reasons for this are unclear.

Previous testing indicates that high yielding zones (commonly associated with fracturing and cavities) likely exist within the Montejinni Limestone Aquifer. These high permeability zones need to be delineated within the zone of the decline at Rover 1 and incorporated in the modelling as these areas will pose a major risk for drawdown propagation to the surface. There is no incorporation of structural features in the modelling which may limit its effectiveness in estimating decline and mine inflows.

The deeper aquifer's water quality is slightly to moderately saline with elevated nitrate and fluoride. There is little detail of how excess dewatering water will be managed. This will need to be carefully

considered and an operational site water balance produced including discharge options and subsequent impact predictions.

Impact to Environmental and Cultural Assets

The shallow nature of the groundwater table (~4.8mbgl) will require management of groundwater levels during dewatering for operations and abstraction for water supply yet no drawdown predictions have been provided nor have any drawdown receptors been identified. It is likely that at least some vegetation is seasonally reliant upon groundwater. The impact assessment modelling, associated monitoring plan and Terms of Reference should incorporate and address impacts to drawdown receptors. Worst case areas of drawdown influence need to be determined, monitoring bores need to be installed and groundwater trigger levels at any sensitive receptors should be proposed.

Essentially, there has been no assessment of the existence of (and impact potential on) groundwater dependant ecosystems near the site including possible ephemeral pools, shallow groundwater dependant vegetation, or other features that all may have biodiversity and cultural values.

No assessment of impact potential for mine infrastructure (tailings, waste rocks, acid rock drainage etc) including surface water management has been provided, although this may exist in other documents not reviewed. Surface water management required to protect mine infrastructure also has the potential to cause impact to the environment including cultural assets.

Recommendations

As part of this review we would make the following recommendations:

1. The groundwater investigation plan proposed in the March 2023 review, needs to be carried out and expanded including installation of bores to monitor impacts at any potential drawdown receptors. Noting that these have yet to be identified (see below). Careful consideration of bore construction methods, materials and screen depths (including nested piezometers) is essential for a successful bore construction program. Bores must be installed as per the Minimum Construction Guidelines. Following this a detailed hydrogeological cross-section including stratigraphy, lithology, screened intervals and groundwater levels in each aquifer should be generated to form the basis of a new conceptual model for modelling. Given the existence of bores at the site since 2011 it is unclear why monitoring (preferably monthly but at least quarterly) has not been routinely undertaken for groundwater heads and quality. This need to be urgently rectified for existing bores and all new bores need to be similarly monitored.
2. During this drilling program the onsite hydrogeologist should pay particular attention to:
    a. Logging the Hooker Creek Formation sediments in sufficient detail to delineate the sandstone/permeable zones and layers.
    b. The presence of fractures, solution joints and cavities within the Montejinni Limestone need to be investigated and integrated with an understanding of the structural geology of the area. These zones are important as this is where permeability appears highest and connectivity between aquifers is most likely.
    c. When drilling beneath the water table it is advised that an approximate flow rate be estimated at the end of each rod (following circulation for about 5 minutes). This data allows interpretation of higher yielding zones at various depths more accurately.

3. Drilling should include at least one deep bore into the basement and through the ore zone. No bores have been constructed into the basement and hydrogeological properties have been purely estimated. While it is unlikely the basement holds significant water stores, this needs to be confirmed, particularly in the area surrounding the decline and orebody to refine the simplistic current understanding of conceptual hydrogeology.
4. Aquifer Testing should be carried out at numerous sites (at least four), in all aquifers with suitably long durations to determine aquifer parameters, leakage and boundary effects. This needs to occur at the new Rover 1 site and at the to be determined the water supply borefield. Testing needs to include water table monitoring during testing to assess drawdown propagation and leakage. The testing program should be proposed with clear objectives to address the knowledge gaps identified herein, while engaging experienced drilling operators, and hydrogeologists. Bore installations should follow the Australian minimum construction guidelines. The groundwater monitoring network for this testing should include all new sites and selected old bores (i.e. those with appropriate construction). Aquifer testing hydraulic parameter calculations and interpretations should be clearly depicted on step-rate plots, constant rate plots and recovery plots with appropriate axis (logarithmic and semi logarithmic) and scales. Monitoring bores need to be installed such that time and distance drawdown data analysis methods can be applied to provide confidence in hydraulic parameter calculations.
5. It is likely the Montejinni Limestone aquifer is connected regionally to the Roper River via the Georgina Basin aquifer (through the Cambrian Limestone formations). This needs to be explored for impact risk.
6. Expand the aerial extent and refine the groundwater model incorporating data from the proposed investigation program and a refined conceptual model as per the comments herein. This model should be calibrated against a meaningful transient dataset and holistically explore sensitivity, conceptual and predictive uncertainty for shallow aquifer drawdown at all receptors which are yet to be identified (see below). The modelling needs to confirm to the Australia Groundwater Modelling Guidelines, preferable resulting in a Class 2 or better model.
7. Assessment of the location of (and impact potential on) any groundwater dependant ecosystems is missing. This will including pools/hand dug soak areas, shallow groundwater dependant vegetation, or any other features that all may have biodiversity and cultural values. In this context there needs to be an assessment of vegetation NDVI and NDWI on and around the project are to see if there are particular areas that may be accessing groundwater and remain perennially active (NDVI) and hydrated (NDWI). Essentially the first stage of the GDE toolkit (Richardson et all, 2011) needs to be applied to the project but hasn't.

Appendix G Hydrogeology Investigations - March 2012

General Comments

This assessment does not appropriately distinguish between the unconfined and confined aquifer systems. The bore investigation program involves testing only one bore below 120m and therefore lacks assessment of the hydraulic properties of the higher yielding Montejinni aquifer. The other units are also not suitably assessed for hydraulic properties or heads.

It appears groundwater flow contours have been based on the Hooker Creek Formation only. Groundwater model input data has been based on these groundwater contours for all model layers, an assumption of no vertical head gradients which is unlikely. Other model input data is a mixture of the data from the Hooker Creek and the Montejinni aquifer testing. Model inputs for the two main

aquifers needs to be refined and based on measured data. The modelling presented is insufficient to understand environmental risk.

Realistic hydrogeological cross-sections of bores including stratigraphy, bore diagrams, screened intervals and groundwater levels are required to form the basis of the conceptual model. A plan view map of investigation bores, Rover campsite bores, any proposed water supply bores and mine infrastructure is also required. No details of Rover camp bores V1, V2 or V3 are presented, particularly which aquifer they are screened over. Table 3 as well as Figures 12 and 13 use groundwater level data from these bores, but these data are hard to interpret without any construction details.

Based on the bore logs the deeper aquifer's alluvial coarsely grained sands and lenses of sandstone produce ~10L/s, while the fractured dolomite zones (DS5-90) have the potential to yield high amounts of water (>25L/s). The modelling for this investigation assumes the high yielding zones are a gritty mudstone or basal conglomerate. This is one of many conceptual uncertainties that need more exploration and justification.

Itemised Comments

Page 10 - Figure 2:

> Comment - This cross-section shows an ore body ~350-500mbgl. Deeper bores in this investigation are less than 120m and terminate in the conglomerate unit of the Wiso Basin. Although unlikely, it is unclear whether groundwater exists in the sandstone or the altered zones around the ore deposit.

Page 13 - Figure 6:

> Comment - The vegetation (particularly the larger trees) in this photograph and Appendix B (referring forward) suggests some vegetation will be using groundwater. Small amounts of rainfall between May and October (Fig. 5) combined with a shallow upper aquifer (4-8mbgl) support the potential presence of groundwater dependant vegetation (GDV). Further characterisation of vegetation types, typical rooting depths and potential plant groundwater use, as defined initially by remote sensing with normalized difference vegetation index (NDVI) and Normalized Difference Water Index (NDWI), are required. Dewatering the Hooker Formation aquifer to construct the box cut could impact nearby vegetation. The extent of drawdown surrounding the box cut needs to be established under both an expected and worst-case scenario throughout the mining schedule.

Page 16 - "Structural features are limited and restricted to layering partings with occasional random jointing. However some of the localised coarse sandstones and conglomerates in addition to fractured zones provide well defined primary and secondary porosities which host significant yields of ground water."

> Comment - Here it is acknowledged significant yields of groundwater can be intercepted in fracture zones and within the coarse sandstones and conglomerate units. Attempts to delineate these areas (and their connectivity) should have been central to hydrogeological investigations. Successfully mapping the extent of these high permeability areas (as well as potentially confining mudstone units) and testing them is crucial for determining hydraulic connections between the aquifer systems, including impacts of dewatering and water supply. This in turn will enable the most appropriate dewatering program and environmental risk management strategy to be employed.

Page 16 - Figure 9:

> Comment - Golden yellow clay unit present in bore DS1-120 only, this could be a confining layer or a local clay lense, seems rather significant at 14m thick but appears to not be laterally extensive.

Page 17 - “The Wiso Basin aquifer is reported to be interconnected with the Georgina Basin aquifer through the Cambrian Limestone formations (Knapton, 2009, Figure 10). This system represents the source of the majority of the base flow in the Roper River”

> Comment - The Montejinni Limestone Formation is the main aquifer intersected during groundwater investigations at Rover 1. This Cambrian Limestone Formation appears to be connected to the adjacent Georgina Basin and the Roper River. This connection needs to be better established and monitored. Dewatering associated with Rover 1 could have the potential to impact on base flows into the Roper River via the Cambrian Limestone Formations but the constant head boundaries used in the model limits our understanding of semi-confined aquifer drawdown propagation. Although it is unlikely that the drawdown from Rover will reach the Roper River, this must still be demonstrated with the modelling.

Page 19 - Table 1:

Comments by bore ID

DS1-120

Comments

1. DS-120 intersected a significant potential confining/semi confining layer of which the lateral extent was not determined.
2. The bore has been screened through Montejinni Limestone (including across this 20m potential confining layer) and therefore no distinction between an upper or lower Montejinni Limestone aquifer can be made. Field data suggests different hydraulic properties between the upper and lower section of the Montejinni Limestone intersected in this bore.
3. The only hydrogeological bore that has been drilled beyond 90m. The orebody lies beneath 300mbgl.

DS5-90

> Comment - Very similar average sustainable yield and flow rate (unlike other bores), how were average sustainable yield values determined? Also, a flow rate of 25L/s is noted in the bore log during drilling below 57m, this is nearly double what was tested or what is noted in the Table 1. The methods used for these sustainable yield determinations need to be provided.

Page 19 - “Near surface water bodies to about 60m are separated by about 15m from the intermediate set of water strikes (~63m to 93m depth). The deepest set of water strikes at between 110m and 120 m below surface is separated by a confining layer about 20.0m thick.”

> Comment - Three aquifers have been identified during drilling operations, subsequent bore design (e.g., screened intervals) and test pumping procedures don’t address this sufficiently. Each aquifer needs to be isolated and tested separately. This is particularly important for

establishing connectivity and thus impacts upon upper aquifers that are more likely to support groundwater dependant ecosystems (GDE's).

Page 20 - Table 2:

Comments by bore ID

DS1-120

Comment - Constant rate pumping test only carried out for 720 mins (12 hours). An extended test (~72 hours) is recommended to better delineate aquifer boundaries and drawdown responses.

DS5-90

Comment - Airlift yield recorded as 25.5L/s yet constant rate test conducted at 11L/s with a maximum drawdown of 5.34m. This test has failed to stress the aquifer which is the objective of a constant rate test. Observations of gravel passing through equipment is not a good sign regarding bore integrity and construction methods.

Page 21 - Table 3:

Comments by bore ID

DS5-90

Comment - Groundwater level significantly higher (>1.5m) than all other bores, this indicates a separate semi/confined aquifer or head gradients possible indicate of some type of flow barrier.

Page 21 - Hydraulic Parameters Section 3.3.3

Comment - Generally this section lack clarity with no reference to pumping test plots in appendix. Identifying DS1-90, DS5-90 and DS1-120 as within a confined to semi confined aquifer systems is sound. More analysis is needed to determine whether they are within the same localised confining aquifer, over what extent the aquifer is confined.

Page 21 - "The deep aquifers were assumed to be confined, homogeneous and isotropic."

Comment - This doesn't seem a valid assumption given the geology and the lack of definition between the two deeper aquifers. The effect of anisotropy should have been tested with the model.

Page 21 -" Drawdown in observation bores DS1-90 and DS1-120, 238.6m from bore DS5-90, were minimal at 0.59m and 0.86m respectively."

Comment - This confirms DS5-90 is connected to both DS1-90 and DS1-120. Drawdown contour figures from these constant rate tests would have been helpful.

Page 22 - Figure 12:

Comment - It is unclear which aquifers have been contoured in this figure. These contours need to be split into a surface aquifer and a (potentially two) deeper aquifer/s. It is not clear where these levels came from as they aren't the same as Table 3 which is the data referenced. Not all bores are shown on the contour map and should be.

Page 24 - Table 4:

> Comment - No reasoning given for different pumping test analysis undertaken. Four different methods have been used and then averaged. All four solutions are intended for different conceptual hydrogeological scenarios and averaging them all together does not seem like robust science. More details regarding these analyses, methods and solutions should have been included in report appendices. Barrier effect are also present and the non-recovery drawdown data should be analysed in this context, whys are only recovery aquifer testing data used?

Page 26 - Table 6: “Although pump test data indicate overlying aquifer system may be locally leaking downwards, the siltstone at the lowest of this sequence can be regarded as a confining layer”

> Comment - This statement contradicts itself. The pumping test data has proven the aquifers are connected yet the model is treating it as a confining layer. Semi confined seem more appropriate.

Page 26 - Table 6: In the description for depth 80-104m - “Fracture porosities and permeability are enhanced in zones where vughs occur within the lithologies.”

> Comment - Which lithologies are vughs found within? This is important to understand secondary porosity and implications groundwater storage properties. Also note the need to understand fracture extent and connectivity for drawdown predictions.

Page 27 - Figure 14:

> Comment - A dolomitic aquifer groundwater signature Vs rainfall and seawater signature would be helpful on this plot to assist in interpreting possible origins of groundwater and recharge/discharge regimes. Why aren’t the investigation bores included on this piper plot? Would be helpful for determining chemical signatures of confined and unconfined aquifer/s and for indicating which bores are closer to recharge zones.

Page 28 - Table 7:

> Comment - The TDS of DS5-90 is significantly higher than all other bores implying a different aquifer source. DS5-90 is also the highest yielding bore.

Page 35 - Figure 22:

> Comment - Interpolation of groundwater levels and topography uses data from multiple aquifers. The countering has lumped the aquifers together making the contours unreliable.

Page 35 - “However, although the correlation was poor, the initial heads was interpolated by making use of the Akima Interpolation Method due to a lack of piezometric information across the area. “

> Comment - No further explanation of this method, is it appropriate? An Akima spline is a type of non-smoothing spline that gives good fits to curves where the second derivative is rapidly varying, I don’t think that is appropriate in this case as gradients in aquifers generally don’t change quickly. Minimum curvature and kriging are more commonly used for groundwater.

Page 37 - “Ground water levels mimic topography for the first slice and all layers beneath will have the same initial head value.”

> Comment - This is an assumption with no data to back it up. With the existing data set (6 data points) it’s hardly surprising that there is limited correlation as shown in the figure. This assumption overlooks the two aquifer systems present and particularly that the deeper one is semi-confined/confined.

Page 38 - “By assigning constant head values around the entire model border, the worst case scenario effects are supported.”

> Comment - This does not create a worst-case scenario for drawdown, only mine inflows. Constant heads are not conservative in an impact assessment context, in fact they cause all drawdown to be contained in the model domain even if naturally it would propagate past these artificial boundaries.

Page 37 - “The complex geological conditions were simplified and input data was generated by means of analysing aquifer test data supported by detailed lithological information.”

> Comment - While geological conditions need to be simplified for practicalities sake, aquifer test data for the deeper aquifer is lacking and crucial parameters have been overlooked; for example, all model layers have the same head value and the groundwater flow direction in the deeper aquifer (including exchange between these aquifers) has not been established. Essentially the complex geological conditions are over simplified and the model has little value in determining drawdown impacts. There is little confidence that the model is providing reliable mine inflow predictions either.

Page 40 - “Sealing of these layers during the construction phase will mitigate any large and long-term flows into the decline”

> Comment - I don’t think sealing the higher hydraulic conductivity layers is a practicable option, particularly for the box-cut section. Likely problems include the logistics of sealing a permeable layer, high cost, leakage and pressure build up behind the ‘wall’. The modelling needs to explore these issues not just assume a perfect seal and no head changes due to sealing.

Page 41 - Figure 32:

> Comment - At a glance (and without further data e.g. drilling details, depths, location) it appears the broken sections of fossiliferous dolomite at the base of this core maybe the most prospective for an aquifer.

Page 42 -” The gritty mudstone has been identified as the most probable host rock for the aquifer as it shows high levels of weathering and has usually resulted in regular and prominent core loss during drilling.”

> Comment - Seems counter intuitive as mudstones are typically not aquifers, they are aquitards/aquicludes unless highly fractured (which they could be in which case they don’t represent and aquiclude). This section (4.5.5) is hard to understand. Trying to identify the highly conductive zone is a good strategy, looking at the core/chips from DS5-90 would be a good start as this was the most transmissive section intersected during drilling.

Page 42 -" This suggests that the thickening of the weathered zone is most likely related to a slumping of the gritty mudstone and that occurrences of increased weathering are likely sporadic, confined and limited in areal extent and will not be intersected by the current design path for the decline."

> Comment - A lot of generalisations about weathering profile and very definitive that the current design won't intersect the weathered zone, particularly when the weathering zone is only suggested. This needs more investigation.

Page 44 -"… which was expected due to the fact that recharge will not impact upon confining layers with large hydraulic conductivities."

> Comment - Confining layers do not have large hydraulic conductivities, that is what makes them confining.

Page 46 -" However, inspections of drill cores and photos revealed that these sequences are subject to heterogeneity and limited in areal extent and as such that they may not sustain large yields over a prolonged period of time."

> Comment - The extent and heterogeneity of the confined aquifer is one of the biggest unknowns and has large implications for environmental impact assessment, management planning, dewatering borefield design and dewatering regimes. Needs more investigation and assessment.

Page 46 - "…and the highest pertain to the siltstone-sandstone and dolomite with minor mudstone sequence in Bore DS5-90".

> Comment - Which lithology/ies within this sequence have the higher hydraulic conductivities needs to be quantified.

Page 47 -" Further drilling to investigate the extent of the deeper confined aquifers around the proposed decline. Discharging bores are to be tested at a rate no less than 80 per cent of their measured airlift yields"

> Comment - Agreed.

Page 56 - DS5-90 Bore Log - "Sandstones and siltstones are thinly layered and highly weathered. Significant yielding water strike is located at about 79 and this, due to the coarser nature of rock chips, appears is a fractured zone."

> Comment - This zone produced 25L/s during construction and the evidence of fracturing makes it significant. Can these fractures be mapped or located in any of the core? Fracture zones need to be delineated particularly if they are the main conduits for groundwater flow in the confined aquifer.

Page 74 - Field Water Quality Assessment Graphs

> Comment - The graphs for the deeper confined bores (DS1-90 and DS1-120) show a slight freshening trend indicating they are drawing on fresher sources of water within the aquifer. In comparison to the graphs for shallower bores (DS4-60 and DS7-60) show a rising TDS trend, indicating they are drawing on more saline sources of water within the aquifer. There is no graph included for DS5-90, the most productive bore. This needs more assessment as this could represent leakage from another aquifer.

Appendix H Preliminary Groundwater Report - Dec 2020

General Comments

This report identifies the three different aquifers and stipulates a bore investigation program that will help identify some important knowledge gaps. Expansion of this investigation program to include potential drawdown receptors is required, once these receptors have been identified.

Itemised Comments

Page 3 - "This will partly draw on the comprehensive hydrogeological assessment prepared for the previous Rover 1 exploration target located 2km the south given the geological similarities between the sites."

> Comment - Calling the previous assessment comprehensive is generous and misleading.

Page 7 -" There are no permanent surface water features within or close to the Rover 1 project area. There is a floodout area, draining northward around 10km east of the site. With seasonal rains there may be intermittent small streams and pools"

> Comment - Water Observations From Space Data on Geoscience Australia Portal agrees with no permanent surface water features, but there are areas which inundate 20-40% of the time and needs to be included in their impact assessment. The floodout area mentioned is a likely area of enhanced recharge which should be investigated further with temporal groundwater level data collected from this site and compared to rainfall/surface water flow events. Impacts to any GDV, intermittent streams and pools in regards to groundwater recharge and the presence of GDE's needs to be considered not just impact to permanent surface water features.

Page 8 - Figure 4:

> Comment - Several areas of concern are potential receptors to the east, south-east and north-west of the box cut. Receptors to the east and south-east include the un-named major watercourse ~15km to the east, while to the west (~8km) the Harrison River.

Page 9 - Figure 5:

> Comment - Schematic stratigraphy figure only to ~150 mbgl but host rocks are ~300 mbgl. It's recommended in further reporting a cross section extending to the orebody be included.

Page 10 -" The water bearing lithologies appear to be porous sandstone bounded and confined by layers of low porosity such as siltstone. The deeper aquifer yields up to 11 L/s."

> Comment - Agreed but the deeper aquifer may yield significantly more in fracture zones. The bore log for DS5-90 records 25L/s being yielded during construction as well evidence of fracturing in the lithology description from the same zone.

Page 10 - "The hydrogeological studies at the first Rover 1 site show groundwater flowing in a north-easterly direction."

> Comment - Where is this data from? I assume Figure 12 in 2012 report, but these contours are for the upper aquifer groundwater levels only. See previous comments above regarding data source for 2012 report, Figure 12.

Page 11 - “The 2012 hydrogeological investigations found that groundwater quality at the site is poor, particularly in the deeper confining layers. The TDS is between 1,250-2,800 mg/L, with elevated nitrate and fluoride”

> Comment - Not accurate as the water quality table (Table 7) in 2012 report has a TDS of 6,230 mg/L for highest yielding bore DS5-90. This may have implications for the disposal of any of excess dewatering or drilling water.

Page 13 -” Given the inferred north-east groundwater flow path, it could be argued that a long-term receptor could be the Tennant Creek West borefield, a possibility that should be included as a scenario when modelling.”

> Comment - Agreed, why hasn’t it? Noting that the current model cannot do this.

Page 13 - “There was no data available for central NT, but being in the arid zone, and with essentially no riparian vegetation nearby, there is no expectation of either aquatic or terrestrial GDE’s in the area.”

> Comment - Figures and Appendix B note that the area has some large trees and thick ground vegetation. Further investigation into vegetation types, typical rooting depths and plant water use regimes (using NDVI and NDWI) are warranted. The shallow nature of the watertable indicates some groundwater dependence is not only possible but likely. Given that project bores have been in place since 2011 why is there no monitoring data? I don’t think the lack of site-specific data for this project in the NT governments fault. The proponent has had ample opportunity to collect these data themselves.

Page 15 - Table 2:

Comments

1. RB2 is the only bore below the basement contact. If water is intersected in basement rocks then provisions to investigate this zone will need to be made. The 2012 investigation reports no water in basement but I’m not sure where this data has come from. I have seen no hydro data below 120 m. While water is unlikely, it hasn’t been ruled out and if present could be more saline limit it use and creating impacts where discharged.
2. No mention of placement of screens for RB2 bore and several options exist e.g. whole length of bore or over most transmissive zone or basement rocks. What depth interval is the constant rate test testing? it seems the hydrogeologic characteristics of the basement rocks. This means only one bore, RB4, is being tested in the permeable section of the Montejinni Limestone (previously identified in DS5-90 and DS1-120). It is recommended at a minimum four bores be tested within the Montejinni Limestone. The aquifer spatial extents, varying degrees of weathering and varying lithologies identified in 2012 warrants this.
3. Note: Simple opportunistic hydro data could be collected during any RC/air hammer/air-rotary drilling onsite. Data such as the level water is cut, rough flow rates at the end of each drilling rod and geological log data could infer more here regarding lateral extent of units and potential flow rates.

Page 17 - “The formation is expected to be consolidated and therefore no gravel pack is required in the annulus.”

> Comment - Gravel pack is highly recommended, particularly in deeper bores. Deeper piezometers need to have an annular seal between the Montejinni Limestone Aquifer and

the overlying Hooker Formation aquifers, gravel pack provides the base to form this seal. Gravel packing also increases well efficiency and decreases the risk of casing collapsing during airlifting and pumping. Bores should be gravel packed to ~5m above the screen interval as per the water bore Minimum Construction Guidelines available at https://adia.com.au/wp-content/uploads/2020/09/Minimum-Construction-Requirements-Edition-4.pdf. Existing bores may need to be decommissioned again as per the Minimum Construction Guidelines.

Page 17 - "Test should include a 3x 100min step test followed by a 12-24-hour constant rate test."

Comment - A 72 hour constant rate is recommended. As the test is attempting to establish lateral extents of permeable zones, leakage and boundary conditions, a longer test is more likely to provide robust aquifer parameters and interact with boundaries. Aquifer testing drawdown/recovery graphs and hydraulic parameters are presented but it is unclear on some occasions how the parameters were determined from the field data (analytical method, which monitoring bores were used and where they were screened etc).

Page 17 - "As an alternative to the more expensive and time-consuming pumping tests, the remaining bores could be subject to a slug test."

Comment - While slug tests can provide hydraulic parameter data, they are less robust than a pumping test and cannot give estimates of storage properties. They are hard to carry out as a large 'slug' of water needs to be 'funnelled' into the bore instantaneously which can be hard to do in practice. If bores are very low yielding it may be more warranted. Time drawdown and distance drawdown aquifer testing methods are more appropriate.

Page 18 - "Existing bores at the first Rover 1 site to the south can be included in the data collection network and a logger in RN011575 might be worth considering if it is still serviceable."

Comment - Agreed, why hasn't transient data been collected?

Appendix I Review of Castile Resources Groundwater Investigation Drilling Program - March 2022

General Comments

The proposed methodology in this document is generally sound. It identifies the three aquifers and details a bore construction program to investigate them.

Additional drilling will be required when the location of potential GDEs is determined. Several areas of concern are potential receptors to the east, south-east and north-west of the box cut. Receptors to the east and south-east include the major watercourse (Figure 4) ~15km to the east, while to the west (~8km) the Harrison River exists. Also note the lack of assessment of near site GDV or GDE potential.

Itemised Comments

Page 1 - "The Wiso Basin hosts a regional scale groundwater system."

Comment - Regional scale system means regional scale connections. Roper River recharge via Wiso Basin should be investigated (see previous comments).

Page 1 - “Previous investigations completed by VDM at Rover 1 in 2012 identified significant aquifers within the basal sequence of the Montejinni Limestone with lesser aquifers occurring higher in the Montejinni Limestone sequence and a watertable aquifer in the Hooker Creek Formation.”

Comment - Agreed, these need to be assessed at this site.

Page 1 - “For the purpose of locating bore sites a groundwater gradient to the north/north-east has been assumed around the box-cut/northern infrastructure.”

Comment - While this is a plausible assumption, and the 2012 reports shows the groundwater gradient in the water table aquifer of the Hooker Creek Formation (upper aquifer) in this direction, however the groundwater gradients in the Montejinni Limestone also needs to be established.

Page 1 - “A nested site is recommended approximately 3 km north-east of the site infrastructure to act as a downgradient background monitoring point.”

Comment - Agreed, nesting required at most sites.

Page 1 - “Although assumed to be low permeability (VDM, 2012) there is no information available on the hydraulic characteristics of the basement rocks that host the mineralised zone. This information will be needed to constrain groundwater inflows into the decline and underground workings. The drilling plan does not explicitly include any deep basement investigation bores as we recommended completing packer tests on the bores drilled in the upcoming geotechnical program. If this is not practical than additional bores drilled into the basement may be required in the future

Comment - Agreed, the hydraulic characteristics of the basement need to be determined as previously noted. Packer testing program will need to be well designed, using approaitely constructed bores. A few initial concerns include having no gravel pack (annular flows could be substantial from Montejinni Limestone) and the requirement of a good confining layer above/at packer depth to isolate basement rocks for testing.

During geotechnical drilling the acquisition of water flow data at the end of each rod (needs to be circulated properly before rod change) could help with basement hydraulic characteristics.

Any structural features (e.g. fracturing) in the basement should be a focus and targeted by geotechnical investigations, these are likely zones for enhanced permeability.

Page 3 - Table 3:

Comment - Table is clear and justifies each location well. The table lacks bore construction detail, but the nominal depths and target formations are good.

The main concern with the bore program design is the test pumping of only one bore. No details into test pumping program (e.g. test durations) particularly which aquifers will be tested. It is recommended at least four sites in each aquifer be tested to increase the accuracy of results.

Appendix-b-ecological-assessment.PDF

General Comment

This document effectively only deals with the impact of ground disturbance at the site. There needs to be an assessment of vegetation NDVI and NDWI on and around the project are to see if there are

particular areas that may be accessing groundwater and remain perennially active (NDVI) and hydrated (NDWI). The location of ephemeral streams and pools also needs to be determined. Essentially the first stage of the GDE toolkit (Richardson et all, 2011) needs to be applied. The full reference for this is Richardson S, et al 2011 Australian groundwater-dependent ecosystem toolbox part 1: assessment framework, Waterlines report, National Water Commission, Canberra.

Itemised Comments

Page 10 - Figure 2-1 repeated below

> Comment - It shows Little Lake Surprise (a site of botanical significance) to the north east, Porcupine Swamp to the east and Algoolgoora Swamp (another site of botanical significance) to the south. Monitoring sites are required to measure drawdown propagation the south-east to monitor any impacts to Algoolgoora Swamp. Modelling does not suitable assess drawdown propagation and needs to as per previous comments. Where are any culturally significant sites?

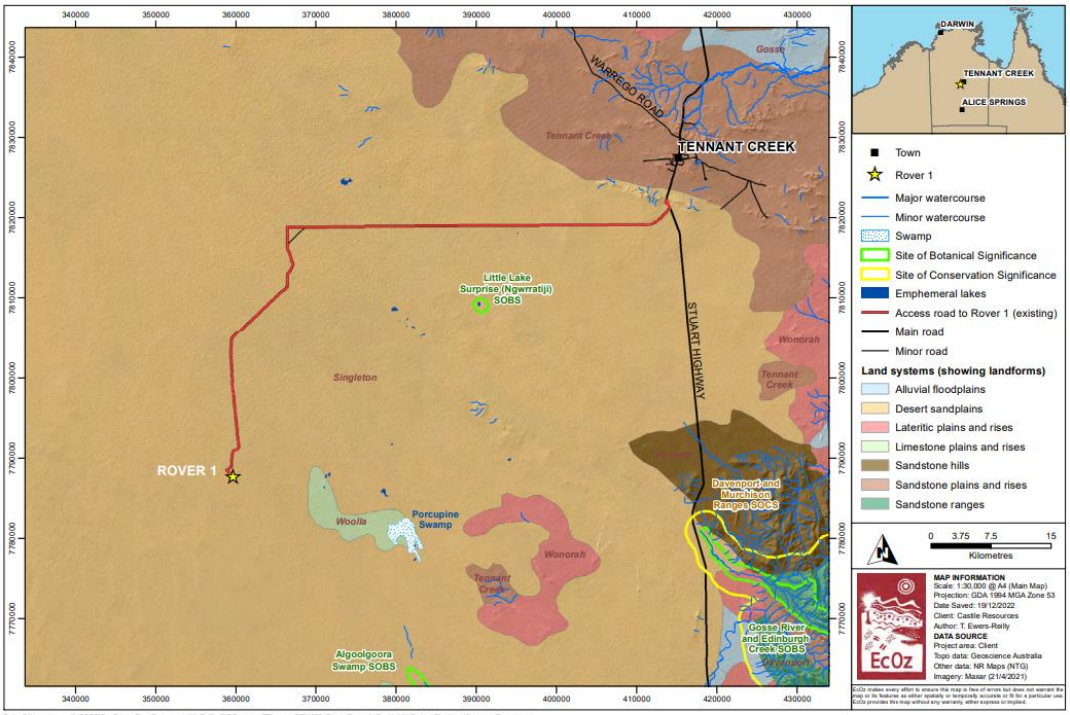

Figure 2-1. Map of SOCS, SOBS, surface water features and land systems in the vicinity of the Project area

Rover 1 Project Draft Terms of Reference for an Environmental Impact Statement - August 2023

General Comments

The draft terms of reference for The Rover 1 Environmental Impact Statement (EIS) have been reviewed regarding hydrogeological impacts. The terms of reference are generic and contain little site-specific detail. Two major areas of concern have been identified: -

1. Lack of detail in relation to the development of a robust and predictive groundwater model. There should be Inclusion of (and adherence to) the Australian Guidelines on groundwater modelling.

2. The document does not adequately identify potential GDEs and is also lacking in specific on assessment of impacts to GDEs, particularly in the inland water environmental quality section. Areas of influence need to be determined for the various project activities and groundwater trigger levels should then be established. There needs to be an assessment of vegetation (NDVI and NDWI) on and around the project to see if there are particular areas that may be accessing groundwater and remain perennially active (NDVI) and hydrated (NDWI). Essentially, the GDE toolkit (Richardson et all, 2011) should be followed as part of the EIS. This GDE impact assessment should incorporate uncertainty (both in terms of extent and magnitude) of drawdown predictions used. Impact assessment should not only use one "expected case" drawdown prediction, this should also be undertaken and presented on the worst-case scenario preferably as defined by predictive uncertainty analysis.

Itemised Comments

Page 7 – Table 1:

Comments

1. Site layout maps that include infrastructure related to water supply and dewatering should be included. These maps should include all groundwater bores currently on site, related pipelines and any off-site bores that are likely to be used for collecting environmental impact assessment data.
2. In the site layout maps required information section, 'sensitive environmental receptors' are referred to. This needs to be elaborated on to include groundwater dependant ecosystems near the site including possible ephemeral pools, shallow groundwater dependant vegetation, or other features that all may have biodiversity and cultural values.

Page 8 – Table 1:

Comments

1. The construction section should include details pertaining to any groundwater bores constructed, at a minimum this should include bore construction details, bore diagrams and hydrogeological bore logs.
2. The 'water requirements and sources' in the construction section needs to include locations and details of dewatering infrastructure.

Page 9 – Table 1:

Comment – The tailings section should include a description of the TSF groundwater monitoring bore network.

Page 10 – Table 1: "mine dewatering volumes and rates including quantification of the anticipated peak dewatering requirements".

Comment – Lacks detail as to how this will practicably be achieved e.g. pumping rates for each dewatering bore, pumping regimes, additional bores as construction progresses? A little more detail should be included rather than just a bulk dewatering volume Vs time across the site.

Page 11 - Section 2.2.7 Rehabilitation and closure:

> Comment – This section needs a bore rehabilitation strategy. Essential inclusions are plugging of bores below ground level and concrete grouting of drill holes encountering multiple or confined aquifers.

Page 18 – Table 5: “Undertake groundwater flow modelling considering seasonal, spatial and temporal variabilities.”

> Comment – A recommended addition is “provide a calibrated predictive model to assess drawdown in all aquifers, this needs to be designed and constructed as per the Australian Groundwater Modelling Guidelines.’

Page 18 – Table 5:

> Comments – Environmental values section should include characterisation of groundwater flow directions, hydrological connectivity (including between aquifers and with the ground surface via springs, swamps, aquatic or terrestrial groundwater dependent ecosystems, or other) and information on recharge zones, rates and variability.
>
> This section should include information on the occurrence of stygofauna, classified into taxonomic groups, based on field sampling and assessment of existing bores and new bores associated with the Rover 1.
>
> The relative importance of GDEs and cultural sites should also be assessed, to ensure that the highest value cultural and biodiversity sites are protected. Being impacted on marginally is not appropriate if these are the highest biodiversity or cultural value sites for example.

Page 18 – Table 5:

> Comment – Potential impacts and risks section is very generalised and does not detail any methods for assessing impacts, namely how the groundwater model will be produced and tested for sensitivity. The current groundwater model desperately needs updating, incorporating results from the upcoming borefield construction and testing program. Assumptions and parameters used in the model, and justification for their use, referring to relevant literature and following the relevant modelling guidelines should be part of this process. A dedicated sensitivity and predictive uncertainty analysis of the groundwater model should be undertaken and the predicted effects (expected, best and worst case at minimum) of groundwater extraction on the groundwater hydrological regime quantified.
>
> The following predictive outputs for maximum water extraction compared with the natural system are recommended: maps of groundwater drawdown contours at yearly intervals (monthly during dewatering operations) and drawdown levels through time (hydrographs) at key receptors (other bore users, terrestrial GDEs, aquatic GDEs including sites with cultural significance). An independent peer review of the groundwater model and predictions derived from it and detail any changes made to the proposal as a result of the peer review is advised.
>
> The potential impacts from groundwater extraction on the occurrence of stygofauna should be included.

Page 19 – Table 6:

> Comment – Relevant activities section should include dewatering and water supply.

Page 19 – Table 6:

> Comment – Environmental values section should include GDE's with maps and accompanying descriptions.

Page 19&20 – Table 6: Potential impacts and risks section

> Comment – Include potential risks and impacts to GDE's.

Page 21 – Table 6: Monitoring and Reporting

Comment – Clear and measurable outcomes should include 'trigger' groundwater levels at selected groundwater monitoring bore sites. Breaching these trigger levels should activate a clear and actionable management plan to avoid detrimental environmental impacts.

Castile Resources Ltd Exploration Mining Plan for Rover Project - March 2023

General Comments

The Exploration Mining Management Plan is relevant to only the drilling of three exploration holes for evaluating the resource at Rover 1. It does not cover any other mining operations and a new plan will need to be produced for the operational mine site and any drawdown receptors yet to be identified. These holes should also be decommissioned after drilling to make sure they do not cause inter-aquifer connectivity.

Itemised Comments

Page 10 - Step 3:

> Comment - It is unclear which bores will be accessed for drilling water and therefore which aquifer/s. If shallower bores are used (<60m) then drawdowns will need to be managed and bores left to recover to minimise potential impacts to vegetation. Alternating which bores are used to allow adequate groundwater recovery times should be considered.

Page 10 - Step 3:

> Comment - It is stated that if needed a new water bore maybe constructed to support drilling these exploration holes. If this happens the opportunity to collect new hydrogeological information should be utilised.

Page 12 - Step 4:

> Comment - No mention of groundwater impacts from extracting drilling water here. While impacts are expected to be minimal hydrogeologically, it appears groundwater impacts have been overlooked in this Step. See previous comments and note that disposal of drilling water can also create impacts and a management plan is required.

ANNEXURE B – CLC CONTACT

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