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Tellus Ref: TSR-5-40-20-00-G-CO

12th September 2016

Dear Richard,

Former Hydro Aluminium Smelter, Kurri Kurri – Demolition and Remediation Environmental Impact Statement Application Number SSD 14_6666

Thank you for the opportunity to provide a submission on the Former Hydro Aluminium Smelter Environmental Impact Statement (EIS) prepared by Ramboll Environ for Hydro Aluminium Kurri Kurri Pty Ltd. Tellus Holdings Ltd (Tellus) response to the environmental impact assessment (EIA) outlined in the EIS is provided for your consideration.

Whilst the proposed Containment Cell design might be adequate for short term containment (present to a few hundred years), it fails to remove the burden of monitoring, management and potentially future remedial works on the site from future generations.

Whilst Spent Pot Liner is the largest and most visible hazardous waste issue for aluminium assets, other hazardous waste streams are likely to be located and in need of permanent isolation within an environment that completely removes legacy risks for hazardous waste management. The EIS does not adequately cover the potential for an off-site near surface arid geological repository option that can completely remove legacy risks for the environment and companies' liabilities.

Tellus objects to the proposal on the basis that:

a. A near surface arid geological repository is a valid alternative option to the base case outlined in the EIS with specific examples available in Australia.
b. The EIA and supporting EIS does not include a discussion of the potential impacts (adverse or beneficial) of a near surface arid geological repository within the project altneratives chapter.
c. The EIS has not adequately addressed the Secretary's Environmental Assessment Requirements for modelling surface and groundwater impacts. Tellus recommends that to adequately address potential risks to receiving groundwater and surface water environments, a conceptual site model describing potential sources, pathway, receptors, and fate of any potentially contaminated waters from the proposed Containment Cell must be provided in the EIS. The model should be of sufficient detail for the general reader to understand:
    i. The source(s) of potential contaminants.
    ii. The mechanism(s) of their release.
    iii. The pathway(s) for transport.

iv. Likely concentrations of contaminants.
v. The potential for human and ecological exposure to these potential contaminants.

d. The EIS does not include detailed assessment of cumulative impacts (adverse or beneficial) of a near surface arid geological repository compared to the preferred option. Nor does the cumulative impact assessment include consideration of future (legacy) soil, surface and/or groundwater impacts on local sensitive environments and human populations.
e. The proposed onsite Containment Cell option is not capable of permanently isolating material due to constraints with respect the life of the engineered liner, and the residual risks with respect to leachate and contamination.
f. The preferred option would result in the loss of 2.5 hectares of two endangered ecological communities (EEC). Whilst the percentage to be cleared is low comparable to the amount of vegetation in the area (as shown in Table 18.4 in the EIS), an off-site interstate would avoid the loss of EEC species. Furthermore, there would be no requirement for bio-banking or environmental offsets.
g. The EIS does not include detailed landform geological evolution modelling which should assesses the stability and future erosion risks associated with the proposed Containment Cell due to natural events such as earthquake and/or climate change.
h. The proposed containment cell relies on engineered barriers, including leachate systems, which have limited life span. The EIS should assess these limiting factors for containing hazardous waste against a near surface arid geological repository that does not require any engineered barriers or leachate systems.
i. The EIS states on more than one occasion that removing the hazardous waste within the existing capped cell would result in traffic impacts on the local community. However, the risk assessment on traffic delays on local roads (Table 10.6 in the EIS) concluded a residual risk category of "low". Therefore, traffic impacts should not be a reason to exclude an off-site option.
j. Carbon emissions with respect to transport should be weighed against the ability of a solution to permanently isolate wastes and the reduced ongoing emissions over time etc.

Thank you for considering the information contained within Tellus' submission.

Kind regards,

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FORMER HYDRO ALUMINIUM SMELTER, KURRI KURRI DEMOLITION AND REMEDIATION ENVIRONMENTAL IMAPCT STATEMENT APPLICATION NUMBER SSD 14_6666

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ABBREVIATIONS

CSR	Corporate Social Responsibility
EEC	Endangered Ecological Community
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
SPL	Spent Pot Line

1 GENERAL COMMENTS

Information contained within this document is intended to provide determining authorities the necessary information for which to make informed decisions on all options available for the immediate and long term containment of hazardous wastes that satisfy environmentally sound management techniques.

Whilst the proposed Containment Cell design might be adequate for short term containment (present to a few hundred years), it fails to remove the burden of monitoring, management and potentially future remedial works on the site from future generations.

Project alternative options including the option of an off-site arid near-surface geological repository, were made available to the proponent prior to the submission of the EIS.

Tellus considers that:

1. The proposed Hydro Containment Cell does not meet the criteria required to be considered a near surface geological repository. To remove legacy risks associated with the preferred option, a near surface arid geological repository is a higher level of standard and can remove environmental, social and company liability.

2. The current alternative "off-site disposal" option included in the EIS does not adequately address factors with respect to arid near surface geological repositories.

3. A near surface arid geological repository is a valid alternative option to the base case outlined in the EIS with specific examples available in Australia.

4. The proposed Containment Cell design might be adequate for short term containment (present to a few hundred years), it fails to remove the burden of monitoring, management and potentially future remedial works on the site from future generations.

5. The EIA and supporting EIS does not include a discussion of the potential impacts (adverse or beneficial) of a near surface arid geological repository within the project alternatives chapter.

6. The EIS has not adequately addressed the Secretary's Environmental Assessment Requirements for modelling surface and groundwater impacts. Tellus recommends that to adequately address potential risks to receiving groundwater and surface water environments, a conceptual site model describing potential sources, pathway, receptors, and fate of any potentially contaminated waters from the proposed Containment Cell must be provided in the EIS. The model should be of sufficient detail for the general reader to understand:

    a. The source(s) of potential contaminants.
    b. The mechanism(s) of their release.

c. The pathway(s) for transport.
d. Likely concentrations of contaminants.
e. The potential for human and ecological exposure to these potential contaminants.

If the above information is presented elsewhere in the EIS, it should be addressed in the groundwater impact/risk assessment section and/or a separate Appendix.

7. The preferred option would result in the loss of 2.5 hectares of two endangered ecological communities (EEC). Whilst the percentage to be cleared is low comparable to the amount of vegetation in the area (as shown in Table 18.4), an off-site option that currently exists interstate, would avoid the loss of EEC species or any bio-banking / offset requirements.

8. The EIS does not include detailed assessment of cumulative impacts (adverse or beneficial) of a near surface arid geological repository compared to the preferred option. Nor does the cumulative impact assessment include a quantitative modelled assessment (as per the SEAR requirement) of future (legacy) soil, surface and/or groundwater impacts on local sensitive environments and human populations.

9. The proposed Containment Cell relies on engineered barriers, including leachate systems, which have limited life span. The EIS should assess these limiting factors for containing hazardous waste against a near surface arid geological repository that does not require any engineered barriers or leachate systems.

10. The EIS does not include detailed landform geological evolution modelling which should assesses the stability and future erosion risk of the proposed Containment Cell due to natural events such as earthquake and/or climate change.

Tellus believes the EIS would benefit from an assessment of all available containment options, including an offsite arid near-surface geological repository, as shown in Figure 1. The assessment should quantify impacts and/or risks across environmental, social and economic criteria.

There are significant environmental and engineering differences between a Containment Cell, like the Containment Cell proposed by Hydro, and a near surface arid geological repository. Table 5-8 in the EIS compares the design of preferred option (a containment cell) against historical landfills. The EIS should include a column to the right of the preferred option comparing it to a near surface arid geological repository.

Tellus has provided a summary of differences in Appendix A and Figures 2 and 3. Tellus recommends the EIS include a similar comparison of environmental, social and economic constraints between a Containment Cell and a near surface arid geological repository.

Figure 1 Example of an Australian near surface arid geological repository in thick, continuous natural clay bed with complete lack of water table.

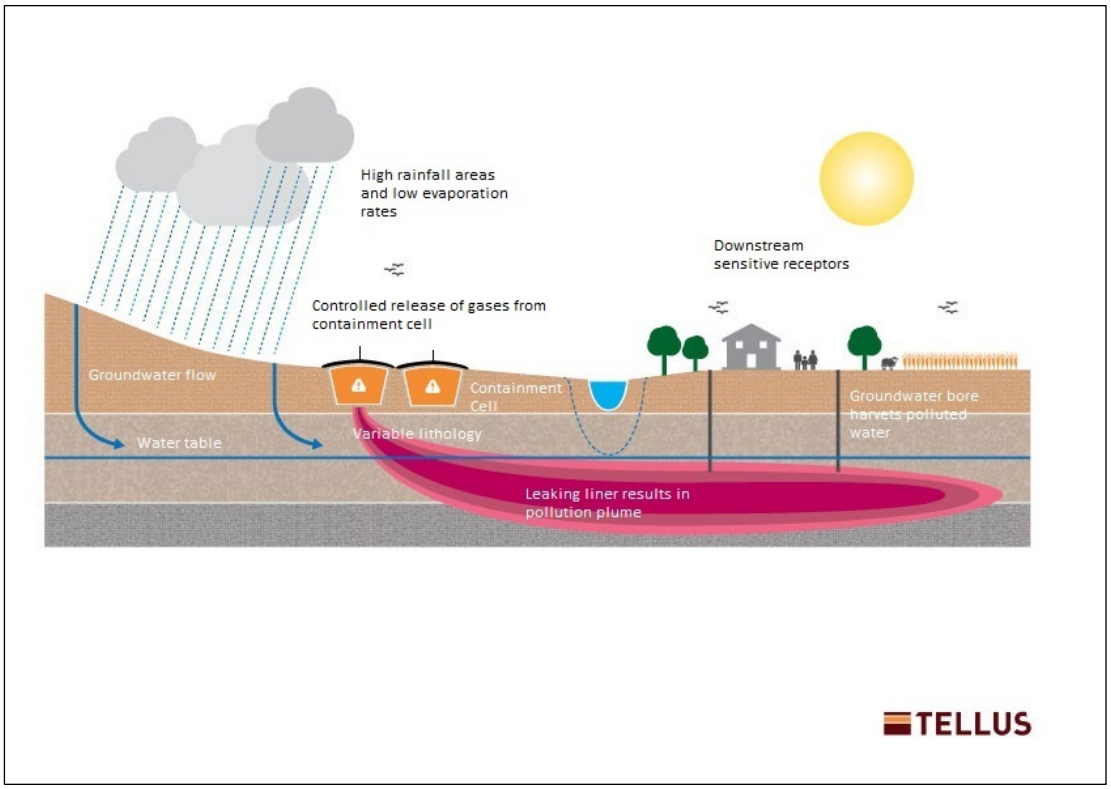

Figure 2 Containment cell showing typical environmental constraints

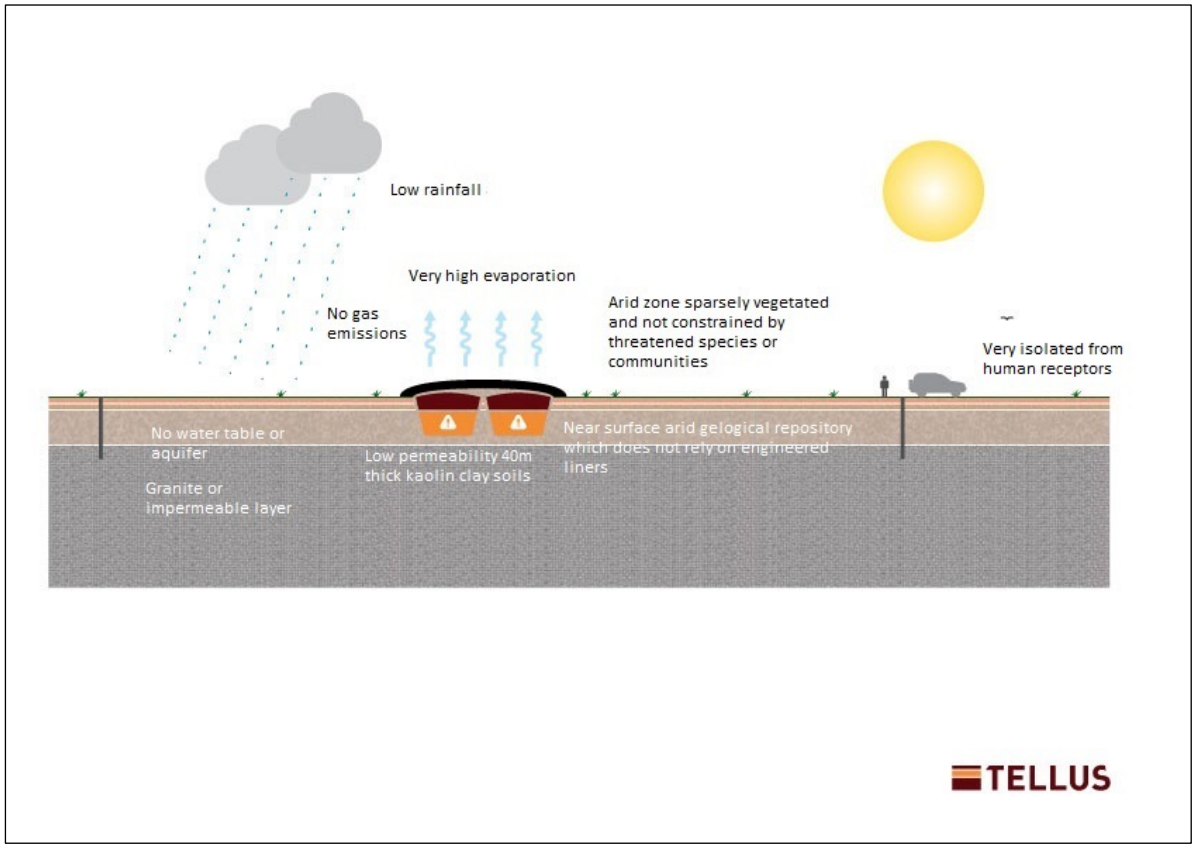

Figure 3 Near surface arid geological repository showing typical environmental advantages

The EIS does not include detailed quantitative assessments for important issues such as potential infiltration and seepage. The EIS does not appear to meet the SEAR requirement of modelling surface and groundwater in and around the vicinity of the proposed Containment Cell.

There is a lack of available surface water quality data provided in the EIS for upstream and downstream receiving surface water bodies including Swam Creek, Black Waterholes Creek and Wallis Creek. The EIS would benefit from undertaking detailed quantitative assessment, including modelling, of the above aspects.

The risk assessment of the EIS concludes there is a *high residual risk* of contaminated runoff. This risk could be completely removed if the near surface arid geological repository option was assessed.

The EIS states on more than one occasion that removing the hazardous waste within the existing capped cell off-site would result in traffic impacts on the local community. However, the risk assessment on traffic delays on local roads concluded a residual risk category of “low” (Table 10.6 in the EIS). A low residual impact is easily managed through the proposed management measures within the EIS. Therefore, traffic impacts should not be a reason to exclude an off-site option.

The EIS states on more than one occasion the need for the proponent to achieve corporate responsibility on matters relating to carbon footprint. The EIS would benefit from having cumulative carbon footprint impacts of a near surface arid geological repository (which although potentially

geographically further away would be able to permanently isolate carbon from the biosphere and hence issue “carbon credits” or other such offsets (dependent on future legislation). This is compared to the preferred option which would not be able to permanently isolate greenhouse gases from the environment.

Ten categories have been listed in Table 1 for the proponent’s consideration. Where appropriate, a response to the comments and questions listed in Table 1 would be appreciated.

Table 1 Categories for further consideration by the proponent

Category	Tellus comment
Corporate Social Responsibility (CSR)	For Tellus that means community approval, responsible environment management, responsible stewardship of the asset and products, uncompromising high health and safety standards, a business underpinned by good governance, risk management and quality assurance. We believe an off-site near surface arid geological repository solution can clearly demonstrate CSR to Kurri Kurri residents and future developers of the site and region by removing risks associated with hazardous wastes in an area that is identified and zoned for future development.
Environmental Outcome for Site	The clearance and complete removal of all hazardous waste from the Hydro site presents the best immediate and future long term environmental outcome for Kurri Kurri and its future development potential. An off-site near surface arid geological repository ensures the complete removal of the Kurri Kurri hazardous waste from the biosphere in a geologically stable, arid environment. This means: • Kaolin clay soils have very high permeability levels which are comparable to “engineered” designs of a containment cell. The clay is a “natural” geological barrier meaning there is no requirement for engineered containment. • Average rainfall that is approximately five times lower than the Kurri Kurri site which reduces the risk of soil erosion. • It has no surface water bodies. • Groundwater interaction is not possible because the correct location will lack an aquifer system or standing water table.
Legacy	An off-site near surface arid geological repository would provide an opportunity to permanently isolate their legacy waste and, remove all future contingent liability and institutional control associated with an on-site containment solution. In addition, large volumes of SPL could be managed with a dedicated cell which would also introduce the option of future re-use.
Risk	The suggested offsite near surface arid geological repository facility replicates global best practice techniques for the permanent isolation of hazardous waste. This option will remove inherent risk to the public or natural environment associated with the placement of hazardous waste in an urban environment.
Effectiveness of the cap	Threats to the effectiveness of the cap may arise from; • **Erosion-** has any erosion modelling been done for the structure? The scenarios modelled should be over a minimum period of 10,000 years (longer if possible) and should allow for a range of climate models (global warming and ice-age). The erosion modelling should take into account some failure of the cover vegetation. • **Erosion** - Has any modelling been done to determine if the nearby watercourse shown in Figure 13-1 will ever change course and potentially contribute to erosion of the site?.

Category	Tellus comment
	• **Earthquakes** - Is the area seismically active, and could an earthquake damage either the cap or the cell liner, reducing its effectiveness? What would be the consequence? • **Climate change** - has there been an examination of how climate change (both human-induced and natural cycle) could affect the hydrogeological model for the site? Are there any scenarios where increased rainfall may significantly increase the height of the water table, or cause the cap to not cope and allow the generation of leachate? • **Engineering design** - Has any modelling been done to test the effectiveness of HDPE liners over long periods of time (thousands of years)? • **Groundwater modelling** - has any hydrogeological modelling been done to test the performance of the cap (to prevent leachate generation) or liner (to contain generated leachate) in a scenario where the HDPE is no longer effective? • **Financial modelling -** For all of the above points raised, if there was a scenario which resulted in the failure of the containment system, what financial assurance and insurance mechanisms does KK have to ensure that the public does not have to fund a remedial action at the site?
Permanent Removal of liability for Hydro, its directors and management	Under state and federal legislation, waste generators effectively remain liable for hazardous waste "from cradle to grave", essentially until the material is either no longer in existence (destroyed or recycled), or permanently isolated from the biosphere. The proposed onsite Containment Cell option is not capable of permanently isolating material due to constraints with respect the life of the engineered liner, and the residual risks with respect to leachate and contamination. Hence the onsite Containment Cell could not permanently remove the Company's (or directors or management potential personal liabilities). An off-site near surface arid geological repository facility will be able to permanently isolate material and hence can permanently remove liability subject to approvals. Evidenced through a Permanent Isolation Certificate (PIC), any associated liabilities can also be removed from the Company's financial accounts, in accordance with International Accounting Standard (IAS) 37 and Australian Accounting Standard (AAS) 137.
Economic Viability	The following factors should be considered in a cost benefit analysis of waste disposal options: • Costs associated with an on-site containment cell. • Potential for increased land availability and value. • Potential for recoverability and recycling of SPL as a result of constructing a dedicated SPL cell. • Liabilities of long term environmental monitoring and institutional control costs. • Removal of future institutional control periods.
Financial Security	Whilst not quantified in detail in the EIS, the EIS notes an appropriate financial security regime would be put in place to ensure adequate financial security throughout the life span of the Containment Cell for the total likely costs of complying with the long term environmental management obligations. Financial assurance adequacy, structures and breadth of responsibility is a very pertinent topic in environmental management of hazardous waste. It is receiving significant current interest from regulators and communities, due to widespread recognition that historic and current levels of assurance have been inadequate, leaving Government with substantial legacy rehabilitation liabilities. This level of interest has been raised by high profile corporate failures (such as Queensland Nickel) that is driving new legislation and a

Category	Tellus comment
	tougher stance from government and regulators. It is therefore likely that Hydro would need to restrict a significant level of cash upfront in order to fund this new, stronger form of financial assurance. The benefits of an off-site solution such as an arid near surface geological repository, could be two fold for Hydro – firstly, if the site is operated by a third party, it will be the third party's responsibility for the financial assurance. Secondly, given arid near surface geological repositories are passively safe, representing a much higher confidence in the safety case (and hence lower potential risk of future harm), the level of financial assurance required for such facilities will be significantly lower. The EIS proposes that the amount and form of the financial assurance will only be agreed with the EPA following Development Consent. Notwithstanding this, the relative differences in financial assurance requirements should be included in the underlying financial analysis in determining which option has the lower overall total cost of service.
Permissibility	There is no legislative impairment to the transport and permanent isolation of the hazardous waste interstate. The licensed and operational capacity of an alternative offsite near surface arid geological repository site would allow for the complete removal and placement of all hazardous waste within a 24 – 30 month period.

2 SPECIFIC COMMENTS ON THE EIS

Table 2 lists more specific comments relating to the EIS.

Table 2 Specific matters relating to the EIS

Section of Hydro EIS	EIS reference / Statement	Tellus response
Figure 3-1	Location plan	This figure would benefit by showing more clearly the hydrological network that is described in Section 3.1.1.3. For example, showing the hydraulic connectivity between Swamp Creek, Wallis Creek and the Hunter River.
		Was water and contamination of water raised an issue of concern by the local community. This section would benefit from more transparent information on local issues.
Chapter 4	Consultation	This section would benefit from providing a more robust account and discussion of local issues and other issues raised by key stakeholders. The objective of a consultation chapter is to highlight all issues raised and discuss them, not send the reader to an external website to find out what the issues of concern or support are.
5.3	Assessment of alternatives to the project.	This section does not include the option and assessment of a near surface arid geological repository. (This is considered separate to the option of a "off-site disposal" which is focused on the Cessnock Waste and Reuse Centre and other licensed facilities in and around Sydney).
5.3	Truck movements on local roads	How many truck movement would it require to haul all of the Capped waste to the nearest offsite facility? What is the impact on the Level of Service (as determined by the NSW Roads and Maritime guidelines) to local roads should materials be taken off-site What duration would the transport of materials occur over and is that considered to be a short, medium or long-term impact? What off-site route options have been considered and what other traffic management measures were considered? Have potential rail logistics been considered which is particularly relevant for longer transport distances
5.3.4	Reference is made to the preferred location having the appropriate geology and environment.	The preferred location is only a few metres from a known groundwater aquifer and surface water body. The EIS should compare the preferred location against the site characteristics required for a near surface arid geological repository.
	References the sites leachate issues.	If a site was available that does not and will not have to deal with leachate, would Hydro consider it in this EIS?
	References the site as a landfill.	Refer to Appendix A in this response regarding the advantages of a near surface arid geological repository over a landfill.
Table 5.8	Depth to groundwater in excess of 3 metres	The EIS should consider and quantify the environmental, social and economic benefits for a containment site that has no groundwater aquifer systems or standing water table.

	Cell construction	The EIS should consider soil permeability levels in an arid environment and compare them to the proposed Containment Cell.
	Cell construction	Would the proponent consider a site that does not require any leaching design because the natural geological barrier of that site is a better that any engineered barrier such as a geomembrane, geo-synthetic clay, HDPE or LLDPE liner.
	Cell construction	Would the proponent consider a site that does not require any gas venting to control in-situ waste?
5.3.5	Examples of Containment Cells in Australia	There are a number of examples of arid near surface geological repositories in Australia either existing or proposed.
5.3.6	Transport to an offsite facility may present an adverse impact on local communities	Would the proponent consider an option that involves the majority of transport via rail to a site that is approximately 75km from the nearest local community?
6.2	References environmental and social benefits of the preferred location	There can be no greater environmental and social benefit than completely and permanently removing the immediate and future long term risks of legacy hazardous waste from the Kurri Kurri site. However, Section 6.4 acknowledges the site presents a number of environmental legacies. This contradicts the statement made about the preferred option providing environmental and social benefits.
Table 6.2	Transport risks	The transport of hazardous and dangerous goods in Australia occurs every day. Commonwealth legislation and Australian codes of practice ensure risks of hazardous materials are kept as low as possible. If the proponent is suggesting the transport risks are high or too hazardous, where is the quantifiable evidence to suggest this is the case?
8.2.1	Aboriginal relic	Would the proponent consider an alternative site that is not constrained by any known items of cultural heritage significance, therefore, avoiding any disturbance to the existing relic?
8.3	References a peak of 75 additional vehicle movements per day for the preferred option.	The proponent's EIS does not provide any discussion in this section or provide an adequate cross reference as to whether 75 vehicle movements alter the Level of Service on existing the local road network. When a cross reference to the Traffic Impact Assessment is made, 75 vehicle movements relate only to cars. There are also 57 truck movements per day referenced for the preferred option. Therefore, vehicle (truck and car) movements exceed 75 per day.
Figure 8-3	Light blue arrows	The Figure legend does not include the light blue arrows shown on this figure. What are they meant to indicate and how is this water movement controlled and/or treated? Does the receiving surface water body have a name? If so, it should be labelled on this figure.
8.4.1	Location to nearby receptors	The fact the preferred option will require legacy water management and treatment, and is located close (500m) to nearby residents, does not completely satisfy the statements made in the EIS that the preferred option brings environmental and social benefits.
Figure 8-4	Light blue arrows	Refer to comment made against Figure 8-3.
Figure 8-5	Proposed excavation grade	This figure clearly shows that the excavation will be as deep as 5m on average and up to a maximum of 8 metres on the west

		to east cross section. This Figure would benefit from showing the reader where the existing groundwater tables are in relation to the proposed works.
Figure 8-6	Proposed use of liners	An alternative option for a liner could include natural geological barriers.
Table 10.6	Risk assessment Soil and water Biodiversity Greenhouse gas emission	The risk table could be improved by showing the risk prior to mitigation so a meaningful comparison can be made against the proposed mitigation measures and residual risk category. The above statement is particularly important when reading the aspect of soil and water. Mitigation response states "in the event that leachate is generated it is expected to be of low quantity". This "quantity" should be stated and backed up by a quantitative assessment which is standard approach for an EIA for a proposal as contentious as this one. The mitigation measures proposed against the impact of removing EEC does not seem appropriate. It reads as an impact not as a mitigation measure. Please make it clearer as to how many individual flora threatened flora species would be removed. It is unclear how the preferred option i.e. in operation, would result in a high "residual" risk? This section references construction emissions from vehicles. This section would benefit from the assessment of long term gaseous emissions from the Containment Cell.
10.3	Conclusion of risks	It is difficult to agree with the conclusions reached in this section when pre mitigated risks have not been included in the assessment. In some important areas of the EIS, a quantified risk assessment does not feature. Again, it is difficult to agree with the conclusions reached. Finally, some of the mitigations measures listed in Table 10.6 are not read as true mitigation measures.
11.2.1	Meteorological conditions	It is standard practice for an EIS to show wind roses. This section of the report would benefit from showing this data and any commentary around whether local sensitive receptors have experienced any air or odour issues.
13.2.2.1	Existing geology and soils	No reference is given to site specific soils or geology within the area of the proposed containment cell. The EIS would benefit from having this information added and cross sectional Figure to support the text.
13.2.2.1	Baseline water quality	Can the proponent please provide more informative baseline water quality data. This section describes a downstream receiving surface water body near the proposed containment cell and baseline water results should be presented in this section. If there is not water quality data, a statement should be provided to explain why not.
13.3.2.2	Groundwater	The SEAR request modelling of potential surface water and groundwater impacts of the proposal. It isn't clear where in the EIS this SEAR requirement has been addressed?

		A more detailed / quantified assessment of potential risks on the receiving groundwater environment is recommended. A Site Groundwater Model would assist in understanding the existing groundwater system and help to explain the potential scale and spatial impacts on local groundwater quality. Tellus recommends that to adequately address potential risks to receiving groundwater and surface water environments, a conceptual site model describing potential sources, pathway, receptors, and fate of any potentially contaminated waters from the proposed Containment Cell must be provided in the EIS. The model should be of sufficient detail for the general reader to understand: i. The source(s) of potential contaminants. ii. The mechanism(s) of their release. iii. The pathway(s) for transport. iv. Likely concentrations of contaminants. The potential for human and ecological exposure to these potential contaminants.
13.3.1	Soil	The EIS does not address the long term geological stability of the proposed cell cap. Threats to the effectiveness of the cap may arise from: • Erosion - has any erosion modelling been done for the structure? The scenarios modelled should be over a minimum period of 10,000 years (longer if possible) and should allow for a range of climate models (global warming and ice-age). The erosion modelling should take into account some failure of the cover vegetation. • Erosion - has any modelling been done to determine if watercourses immediately to the west and east of the proposed containment cell will ever change course and potentially contribute to erosion of the site?
Figure 13-1	Local hydrology	The watercourse that lies immediately to the east and is shown should be named. There is also a watercourse 45 m west of the proposed containment cell. This is not shown in Figure 13-1 and should be.
14.2.2	Potential hazards	How is the proponent going to ensure that human actions in the future (e.g. greater than a couple of hundred years from now) do not compromise the cell cap? • Any form of institutional control? • Monitoring? • Risk Assessment? • Method of knowledge retention? For example, what if someone excavated on the site for a building foundation or basement?
Table 15.6	LoS referenced “7”	This appears to be a typographical error. LoS should be ranked as either A to F. With a predicted increase in vehicle movements at the intersection of Hart Road/Off Ramp, can the proponent please explain why the AM Peak Average Delay decreases from a baseline result of 11.1 seconds to 10.8 seconds? Wouldn’t additional truck (57) and car (75)

		movements per day (sated in Section 15.3.1) increase the delay at this intersection?
Chapter 18	Biodiversity	The preferred option would result in the loss of 2.5 hectares of two endangered ecological communities (EEC). Whilst the percentage to be cleared is low comparable to the amount of vegetation in the area (as shown in Table 18.4), an off-site option that currently exists interstate, would negate the need for any loss of EEC species or any bio-banking/offset requirements.
20.3	Greenhouse gas impact assessment	Would the proponent assess the GHG impact of an off-site option in the EIS and compare it to the preferred option?
	Greenhouse gas impact assessment	Carbon emissions with respect to transport should be weighed against the ability of a solution to permanently isolate wastes and the reduced ongoing emissions over time etc.
22.2.1	Human Receptors	The text currently states that off-site residents are potential receptors for particulates/vapour and noise generated from the works. Where in the EIS are risks associated with potential leachate from surface or groundwater assessed against the same receptors. The EIS concluded that groundwater contamination is not going to be an issue (see table 22.3 p. 22-211). Tellus recommends that to adequately address potential risks to receiving groundwater and surface water environments, a conceptual site model describing potential sources, pathway, receptors, and fate of any potentially contaminated waters from the proposed Containment Cell must be provided in the EIS. The model should be of sufficient detail for the general reader to understand the source(s) of potential contaminants, the mechanism(s) of their release, the pathway(s) for transport, and the potential for human and ecological exposure to these potential contaminants. If this information is presented elsewhere in the EIS, it should be addressed in the groundwater impact/risk assessment section.
Table 23.2	Consideration of potential cumulative impacts	This section should assess potential cumulative impacts associated with soil, surface water and groundwater contamination. See above comment for how this can be achieved. This section should also assess cumulative impacts associated with competing future land uses against the long term operation of the proposal. The cumulative impact assessment section is very light in detail. It is recommended that a risk based approach to potential cumulative impacts be adopted and presented.
23.2	Cumulative impact assessment	Would the proponent consider assessing the cumulative impacts associated with an off-site near surface arid geological repository?

APPENDIX A HAZARDOUS WASTE LANDFILL VERSUS A NEAR SURFACE REPOSITORY

Category	Attribute	Typical containment cell	Environmental constraint (yes/no)	Near surface arid geological repository	Environmental constraint (yes/no)
Host Environment	**Geology**	Variable geology and permeability requiring additional engineered liners	Yes	Uniform geology in 80Myr old stable low permeability kaolin 30m thick clay bed	No
	Soils	Variable soils with high permeability	Yes	Very low permeability with a standard requirement of 6 x10-6	No
	Hydrogeology	Often in proximity to water table	Yes	No detectable aquifer systems or standing water table level.	No
	Climate	High rainfall	Yes	Semi-arid with very low rainfall and high evaporation rates	No
	Future climate change	Increased rainfall	Yes	As above	No
	Topography	Variable	No	Flat to lightly undulating	No
Engineering controls	**Synthetic liner**	Required - sometimes in combination with clay liner	Yes	Not required due to natural properties of host geology	No
	Clay liner	Required, sometimes in combination with synthetic liner	No	Not required due to natural properties of host geology	No
	Leachate collection system	Normally required	Yes	Not required due to natural properties of host geology and climate	No
	Cover during operations	Not normally used	Yes	Design includes temporary cover during waste emplacement	No
Procedural controls	**Waste acceptance criteria**	Criteria include leachate thresholds	Yes	No leachate criteria required	No
	Monitoring during operations	Required	NA	Monitoring to be performed on precautionary principle basis	NA
Receptors	**Human**	Can be in close proximity and affected by leachate plumes	Yes	Nearest human receptor is 75 km away	No

Category	Attribute	Typical containment cell	Environmental constraint (yes/no)	Near surface arid geological repository	Environmental constraint (yes/no)
	Flora and fauna	Can be in environmentally sensitive areas	Yes	No sensitive flora and fauna receptors	No
	Social licence	Can often be subject to NIMBYism	Yes	Broad support for project from nearest community	No
Closure	**Method of closure**	Engineered cap including man made materials	Neutral	Closure cap only uses compacted original natural materials derived from the site	No
	Monitoring after closure	Required	Yes	Required during institutional control period	Neutral
Post closure	**Human Intrusion**	Increased potential can exist due to proximity to population	Yes	Low potential exists due to remoteness of site	No
	Erosion	Potentially susceptible to future erosion	Yes	Erosion studies carried out to 10k years after closure – no impact	No
	Climate change	Potentially susceptible to future climate change e.g. higher average rainfall	Yes	Climate studies carried out to 10k years after closure – no impact	No
	Passive safety achieved	Difficult to achieve	Neutral	Passive safety not requiring further intervention achieved at end of institutional control period	Neutral