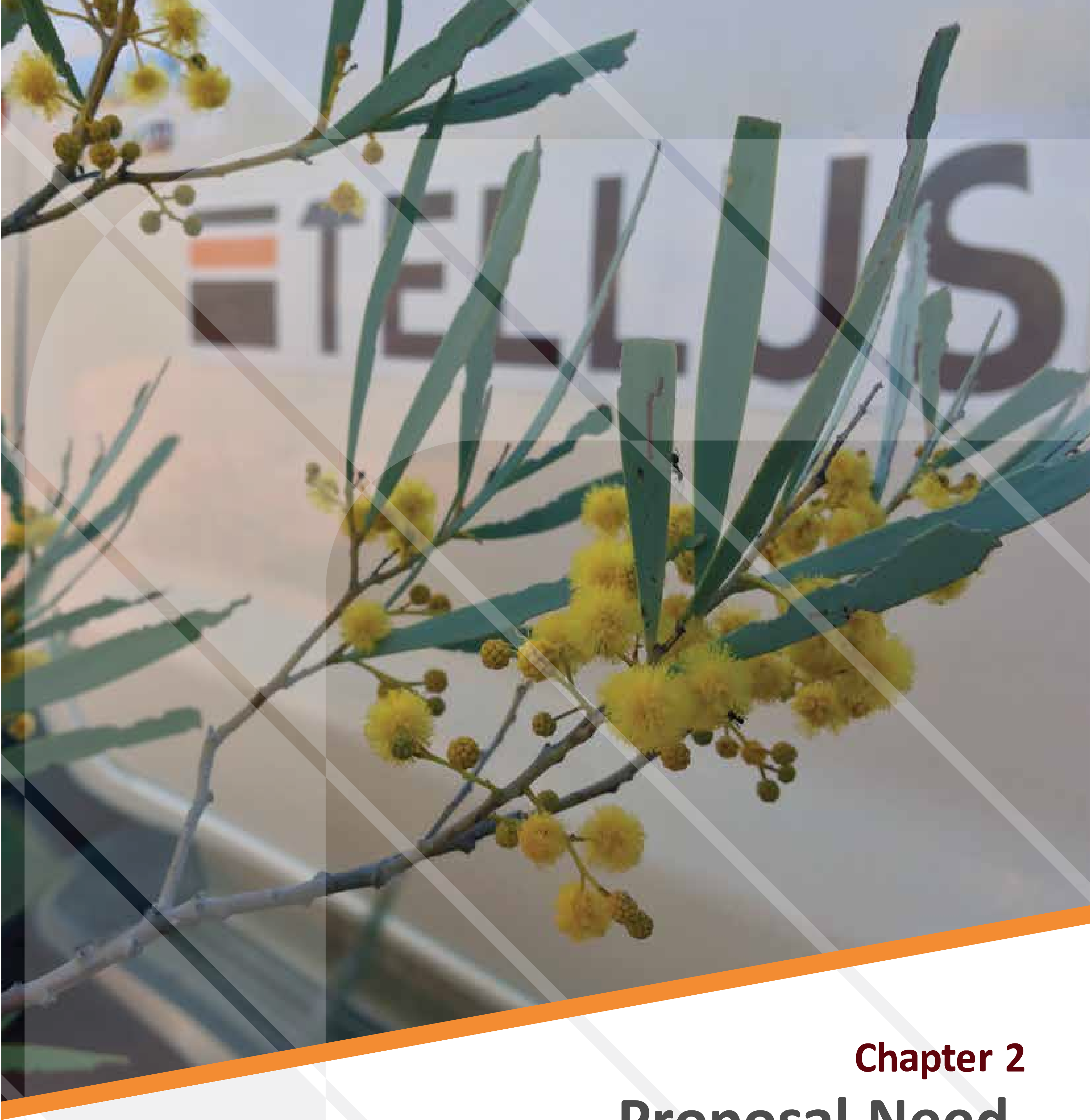

Chapter 2

Proposal Need, Alternatives and Benefits

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ABBREVIATIONS

EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
ESM	Environmentally Sound Management
GIS	Geographic Information System
IWDF	Intractable Waste Disposal Facility
NaCl	Sodium Chloride
NT	Northern Territory
PFS	Pre Feasibility Study

2 PROPOSAL NEED, ALTERNATIVES AND BENEFITS

2.1 Introduction

This chapter presents the strategic need for the Proposal and the feasible alternatives that were investigated during the development of the Proposal. This chapter also outlines potential benefits to the NT and to Australia that would result during construction and operation of the Proposal.

2.2 Strategic need for the Proposal

The worldwide need for salt is examined as is the need for a safe and secure storage facility for both hazardous and intractable waste and for other valuable materials (such as document archives, film archives, museum artefacts, computer servers, and a host of other valuable documents and equipment) in Australia.

2.2.1 Need for salt

What is salt, how is it harvested and what is it used for?

Salt, or sodium chloride, is a mineral that naturally occurs in our seas and in underground deposits. It is a chemical compound with the formula NaCl. For every gram of salt, almost 40% is sodium (Na) and just over 60% is chlorine (Cl).

There are three ways in which salt can be harvested - via solar evaporation, solution mining and deep underground mining:

- **Solar evaporation -** salt is harvested via solar evaporation from seawater or salt lakes. The wind and sun evaporate the water from shallow pools, leaving the salt behind. The salt is usually harvested once every 12 to 18 months when it reaches a specific thickness. After harvest, the salt is washed, drained, cleaned and refined. Only areas with low annual rainfall and high evaporation rates can have successful solar evaporation facilities. Worldwide, approximately 40 % of salt is produced via solar evaporation (Roskill 2014).
- **Solution mining -** salt is extracted from salt beds or domes via solution mining. In solution mining, wells are erected over salt beds or domes and water is injected to dissolve the salt. The salt solution (or brine) is then pumped out. The brine is treated to remove minerals and pumped into vacuum pans (sealed containers in which the brine is boiled and then evaporated until the salt is left behind). The salt is then dried and refined. Worldwide, approximately 34 % of salt is produced via solution mining (Roskill 2014).
- **Deep underground mining -** deep underground mining for salt is much like mining for any other mineral. Typically, the salt exists as deposits in ancient underground seabeds which became buried through tectonic changes over millions of years. Many salt mines use the room and pillar system of mining whereby shafts are sunk down to the floor of the mine, and rooms are carefully constructed by drilling, cutting and blasting between the shafts. After the salt is removed and crushed, a conveyor hauls it to the surface. Worldwide, approximately 26 % of salt is produced via deep shaft mining (Roskill 2014).

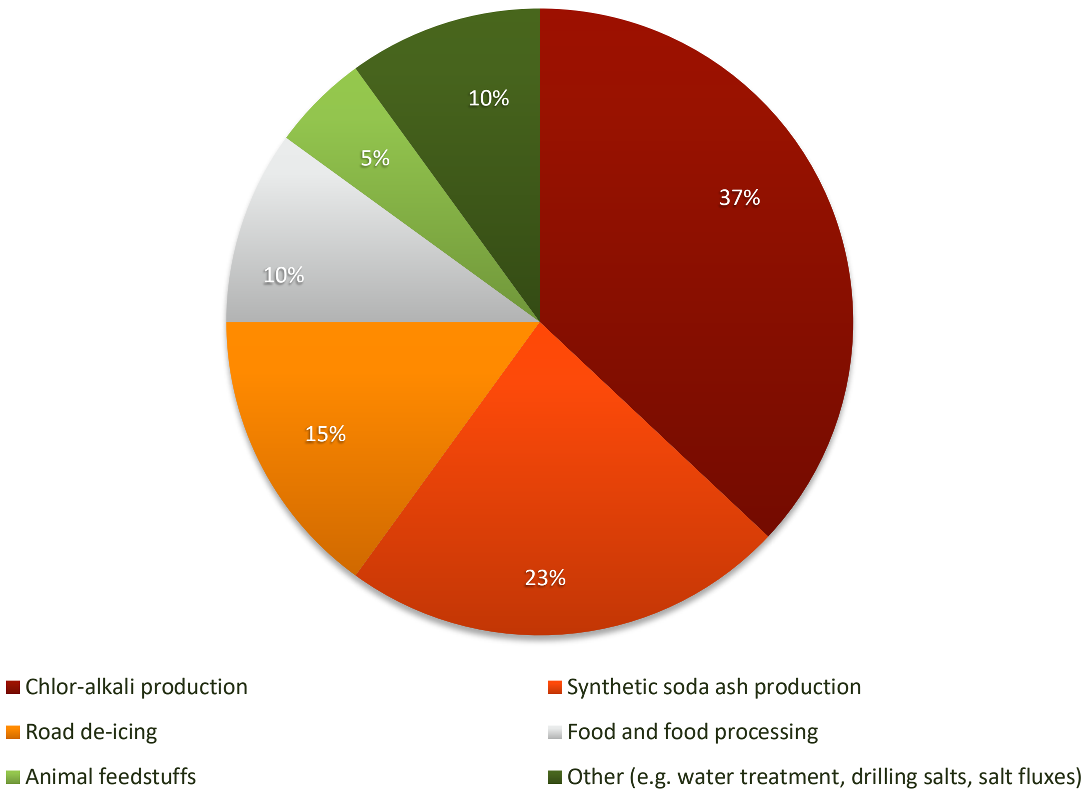
Salt is one of the most widely used substances on Earth. It has over 14,000 direct and indirect uses. The most familiar use of salt is for food and food processing (both for humans and animals). It is widely used in the chemical industry for chlor-alkali production and synthetic soda ash production.

In cold northern hemisphere countries, salt is used extensively as a de-icing agent on roads. Other industrial uses of salt include drilling salts used in the oil and gas industry and salt fluxes used in the smelting and mining industries.

Global salt supply

According to a 2014 report prepared by Roskill, salt has greater than 14,000 commercial applications globally. As shown in Figure 2-1, approximately 80 % of salt is consumed across four main markets. These include:

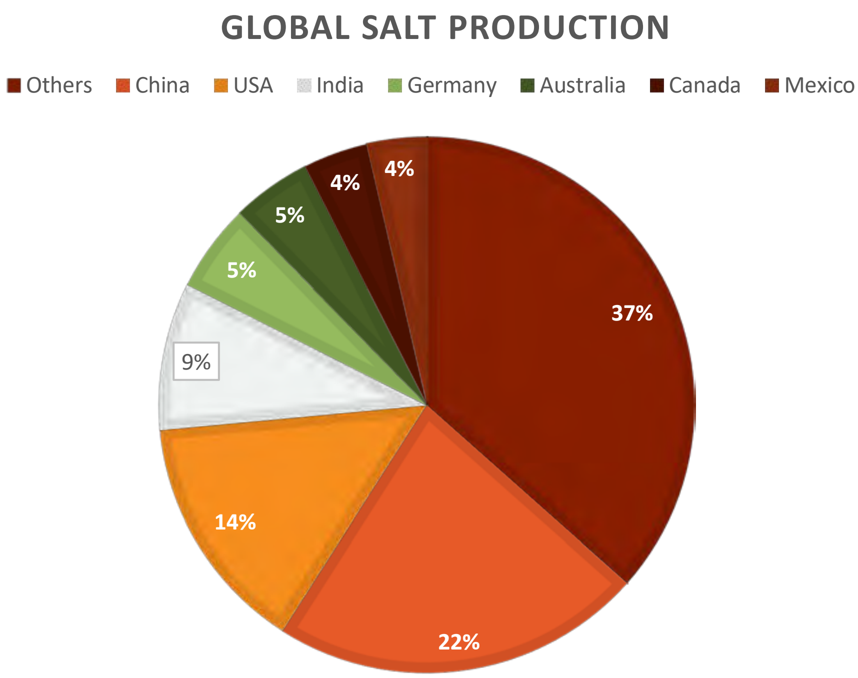
- Chloralkali production.
- Synthetic soda ash production.
- Road de-icing.
- Food/food processing.



Source: Roskill, 2014

Figure 2-1 Global uses of salt

Over 110 countries produce salt. Seven leading producing countries, each with output of over 10 million tonnes per year account for almost 65 % of the world total (refer to Figure 2-2). Australia is the only country with predominantly export-oriented production. Mexico is the second largest exporter of salt, shipping around 80 % of its output while Canada and Germany export around 40 % and 15 % of their production respectively. India is becoming one of the leading salt exporting countries with shipments growing by 32 % per year from 2007 to 2013.



Source: Roskill, 2014

Figure 2-2 Global salt production by leading countries in 2012

Over 100 countries produce salt, but seven countries (each with an output of more than 10 million tonnes per year) account for over 60 % of the world's total salt production. The world's leading companies who are the highest producers of salt are shown in Figure 2-3.

China overtook the United States to become the largest producer of salt in 2006, producing approximately 62 million tonnes. Despite producing vast quantities of salt, both China and the United States are still net importers of salt. The three next-largest producers (India, Germany and Canada) export about 15 to 30 % of salt produced, while Australia is almost totally export-oriented.

With estimated output of 13.3 Mt in 2012, Oceania (essentially Australia) accounted for 4.8 % of world salt production (refer to Figure 2-3). Exports, mainly to China, Japan, Taiwan, South Korea, and Indonesia, on average account for over 90 % of Australian salt production (Roskill 2014). Production mainly comes from solar salt operations in Western Australia, where the combination of a hot dry climate, modern infrastructure and proximity to Asian markets has encouraged development of a significant salt industry.

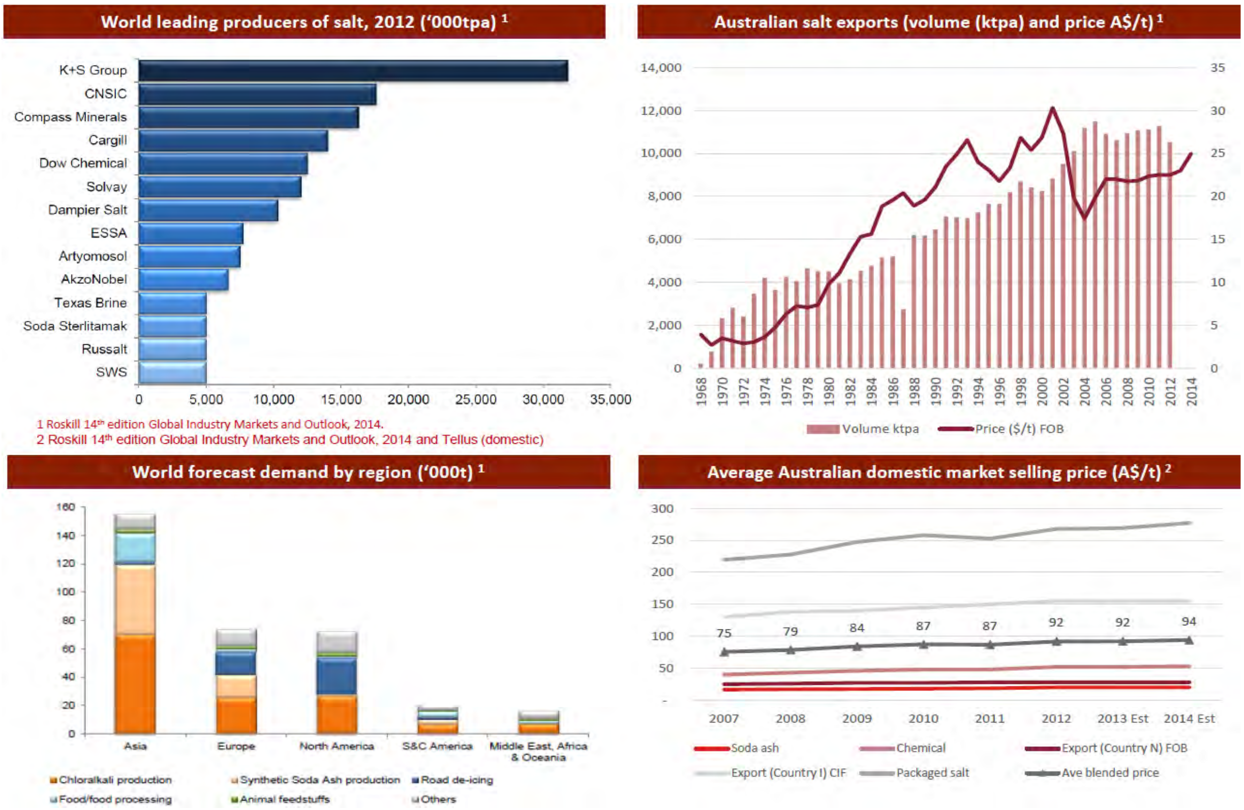


Figure 2-3: Salt industry trends

Global demand

World demand for salt is forecast to grow by 3 % per year through to 2018. World capacity is estimated at 400 million tonnes per year with China accounting for a quarter. Global demand for salt was approximately 278 million tonnes in 2012 (Roskill 2014). It is estimated that this demand will increase (by 53 million tonnes) to 330 million tonnes in 2018 (a growth of approximately 3%).

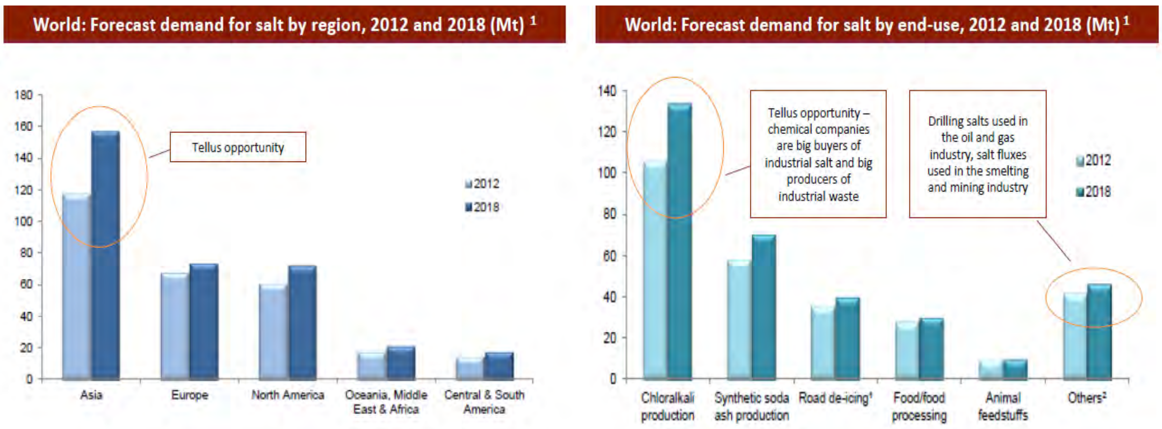
Asian demand for salt was about 117 million tonnes in 2012. It is estimated that this demand will increase (by 39 million tonnes) to 156 million tonnes in 2018, a growth of about 5 % per annum (Roskill 2014). Based on these estimates, Asia is forecast to account for almost 75 % of the worldwide growth in demand for salt from 2012 to 2018 (refer to Figure 2-4).

The worldwide demand for salt is expected to be the greatest in the chemical industry (specifically chlor-alkali production) and for other industrial end-uses. These include drilling salts used in the oil and gas industry and salt fluxes used in the smelting and mining industry (refer to Figure 2-4).

Projected world demand of around 330Mt in 2018 would exceed estimated demand in 2013 by more than 40 million tonnes. Asia is forecast to account for more than two-thirds of this growth, with China alone accounting for half.

Most of the production increase will come from technology improvements and modernisation of harvesting techniques. As shown in Figure 2-4, a growing share of Chinese consumption will be supplied by imports suitable for the chemical industry. Leading exporting countries such as Mexico, Chile, India and Australia are expanding (Roskill 2014).

Rock salt in Asia is mined primarily in China, Pakistan, Thailand and Uzbekistan, but Asian buyers of high grade salts are concerned about the quality and reliability of supply.



Source: Adapted from Roskill, 2014

Figure 2-4 Salt trends and opportunities for the proponent and the Proposal

Domestic salt market

In Australia, over 95 % of salt is produced via solar evaporation of sea water in coastal ponds. Australia is the sixth largest producer of salt and the largest exporter of salt worldwide (about 60 percent of salt imported to Asia comes from Australia). Approximately 90 % (13.2 million tonnes) of salt produced in Australia in 2012 was exported. Most of this salt was used in the chloro-alkali industry (95 %). Approximately 0.7-1.0 million tonnes of salt produced in Australia is used for domestic purposes (Roskill 2014).

Challenges and opportunities in the salt market

Through desktop research, industry consultation, and domestic and international site visits, the proponent has developed a high level of understanding of both the international and domestic salt demand and supply forecasts. A summary of the current salt market, the challenges and opportunities in the salt market and how these challenges and opportunities relate to the Proposal is provided in Table 2-1.

Given the specification and quality of the proponent's salt within the Chandler Formation, the chlor-alkali industry in China, Japan and Indonesia are considered to present the greatest opportunity for the export of salt from the Proposal.

Table 2-1 Challenges and opportunities in the salt market

Current situation	Challenges and opportunities	Competitive advantage of the Proposal
• Asia consumes about 42 % of the global supply of salt. Demand for salt is growing at 3-5 % per annum in Asia. • Australia is the largest external supplier of salt to Asia (about 60% of salt imported to Asia comes from Australia). However, Australia is near production capacity. It is becoming increasingly difficult to secure approvals for new solar evaporative salt projects in Australia (there have been three recent failed applications 2.5 Mtpa, 3- 4 Mtpa and approximately 1 Mtpa). • Australia produces approximately 13,2 million tonnes of salt per annum predominantly via solar evaporative salt facilities in Western Australia. • In Australia and Asia, salt is produced predominantly via solar evaporative salt facilities – heavy rain can disrupt salt production in solar evaporative facilities for months at a time. This process is also quite inefficient (about 65 tonnes of sea water is needed to produce one tonne of salt) and time intensive (the process can take between 12-18 months).	• There is growing concern by Asian salt buyers about reliable supply, quality and price pressure. • There is an approximate six million tonne shortfall of salt expected in the Asian market by 2018. • To meet this shortfall, up to 47,000 hectares of new solar evaporative salt facilities would be required along environmentally sensitive coastal areas (worldwide). • There are production constraints, however. It is becoming increasingly difficult to obtain approval for new coastal solar evaporative salt facilities due to their environmental impact. • There are new markets in Asia and growing demand from existing markets, but growing supply pressures. • An opportunity exists to meet the growing demand for salt in Asia. This opportunity is deep mining of rock salt in the Chandler Formation in the NT. Currently, no deep rock salt mining exists in Australia.	• Unlike solar evaporative salt facilities which are located in environmentally sensitive coastal areas and, are becoming increasingly difficult to obtain planning approval for, the Proposal will have a relatively small surface footprint and is located in semi-arid zone, in a geographically and tectonically stable area. • Extensive investigations have proven that billions of tons of salt are contained within the Chandler Formation. Mining this salt could easily be scaled up to meet the growing supply requirements in Asia. • Core testing shows high grade salt is available to be mined for the growing edible and industrial salt market in Asia. • Existing logistics infrastructure is in place and has spare capacity. The Adelaide/Darwin Railway Line is located adjacent to the proposed Apirnta Facility and would be used to transport salt from the proposed Chandler Facility to port facilities in Adelaide. • Australia is a gateway to Asia. We are closer than India and Chile who supply salt to Asia.

Growing Asian demand for salt is driving long term supply requirements and pricing upwards. There is a potential shortfall in meeting the demand for high quality salt for the Asia which currently rests at 6 million tonnes by 2018 (Roskill 2014).

Australia exports salt mostly to China (24.5 %), Japan (21 %) and Taiwan (18 %). China and Japan are the proponent's target markets. For example:

- China is losing approximately one million tonnes per annum of coastal salt production due to urbanisation, importing about 7.5million tonnes in 2013.
- In 2012, Japan imported 7.4 million tonnes per annum of salt. About 13 % of this demand was met from Japanese production, 45 % was imported from Mexico (by Mitsubishi), and 34 % from Australia (by Mitsui/Dampier).

2.2.1 Need for a safe and secure storage facility for waste materials

The problem

Over the last 20 years, waste production in Australia has grown at six times population growth (ABS 2016). Australians are the second highest emitters of hazardous waste per capita due to the economy being driven largely by mining, oil and gas, and manufacturing. Approximately 10 % of the waste Australian's produce is hazardous. That means approximately six million tonnes per year of known hazardous waste is produced and is growing at approximately 3% per annum. There is also approximately 900 million tonnes of reported legacy waste (hazardous waste generated historically) estimated to be temporarily stored in the NT and across other Australian states and territories.

Traditional re-processing, incineration, treatment before landfilling, storage/disposal into man-made engineered landfill are temporary solutions, often do not extinguish liability, can be very expensive from a full lifecycle perspective, especially if sent overseas, and are not viewed today as world's best practice. Many of these options support the old linear economy of 'use and dispose'. This has created a growing legacy and forecast pool of waste materials which require long term storage, recovery of valuable materials that supports the circular economy or the permanent isolation of hazardous materials using sound environmental management principals. These solutions are not readily available.

Governments have realised or are increasingly realising that the previous widespread use of engineered surface landfills with either no liner, or liners with lifespans of 10 to 30 years as a catch-all solution with no or limited discrimination in waste acceptance has created many contaminated sites that pose environmental hazards and have ongoing remediation requirements.

The degradation of ageing landfill facilities has created significant contamination problems with numerous examples of waste breaching the liners and landfill perimeters and spreading into groundwater aquifers. As a result of this emerging and widespread environmental problem, governments globally are now banning surface landfill of hazardous waste and are endorsing geological repositories capable of permanently isolating waste from the biosphere as a final solution for end of life hazardous waste disposal as best practice.

The difference between landfills and geological repositories is illustrated in Figure 2-5. The key difference being that even with a well-engineered landfill, the artificial liner usually only isolate hazardous waste for 10- 30 years before degradation of the liner creates a contamination risk, whereas a geological repository is passively safe on a geological timescale. As a result, international regulators are restricting landfill development and their use for most hazardous waste types.

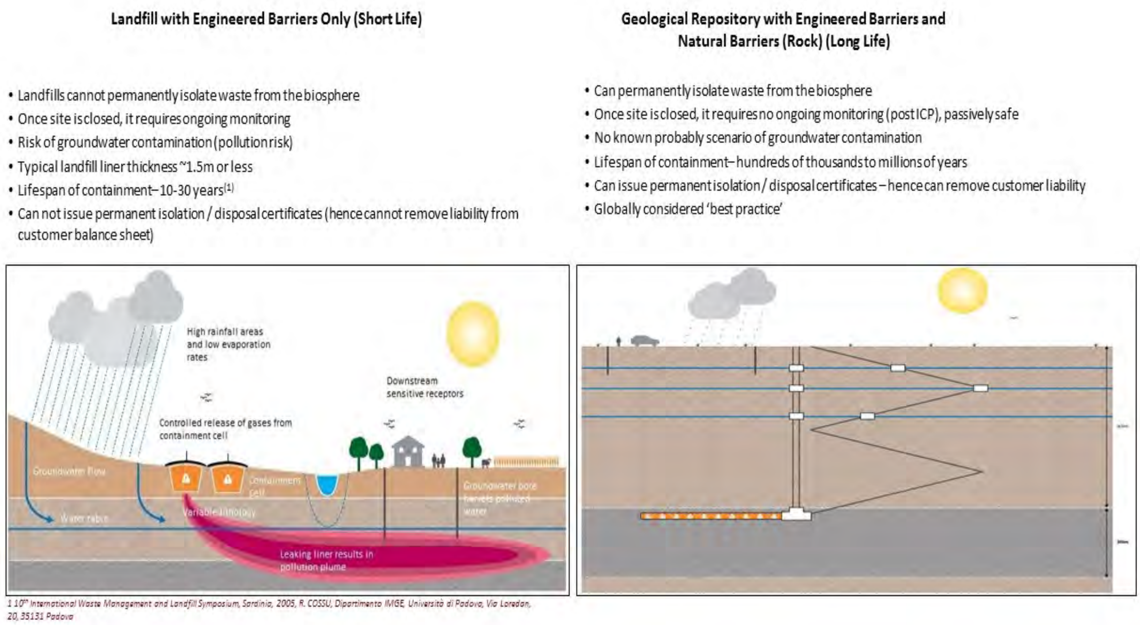


Figure 2-5 Difference between landfill and a geological repository

The solution

There is a need and regulatory obligation to provide for the safe and secure storage, recovery of valuable materials and the permanent isolation of hazardous waste. The solution put forward involves the storage (retrievable) and recovery of valuable materials and the permanent isolation of such wastes in a deep underground geological repository that safeguards human health and the environment from harm over geological time. This can be achieved by applying proven scientific and environmentally sound management principles.

A geological repository is an underground storage or disposal facility of hazardous waste that relies on both a natural geological barrier (e.g. a salt bed) and man-made engineered barriers that both form part of a multibarrier system as part of an overall safety case that is globally recognised for its permanent isolation capabilities. The natural geological barrier isolates waste from the biosphere safely and permanently. Once the repository is closed, it requires very little ongoing monitoring as the geological barrier is passively safe. The lifespan of containment is in the hundreds of thousands to millions of years. As a result, geological repositories that can permanently isolate materials are globally considered 'best practice' for hazardous waste.

The proposed Chandler Facility would be categorised as a deep geological repository. This infrastructure could contribute towards solving the legacy and forecast pool of waste materials in the NT which require long term storage, the recovery of valuable materials that supports the circular economy, or the permanent isolation of hazardous materials using sound environmental management principals. These solutions would become available if the proposed Chandler Facility is approved (approval for a recovery plant that would be accommodated within the proposed technology park would be covered in a separate approval).

The Proposal would operate in an environment that is not constrained by significant social or environmental sensitivities. It would be located in a very remote area - the nearest community is Titjikala, located approximately 25 kilometres by road from the proposed Chandler Facility and the closest regional centre would be Alice Springs located approximately 120 kilometres to the north of the proposed Chandler Facility. It is located in an area that is geologically stable (very low seismicity and no volcanic or tectonic activity). The climate is arid (low rainfall and high evaporation rates).

Groundwater in the area is not connected to groundwater used for domestic purposes (including drinking) by communities in the vicinity of the proposed Chandler Facility. There is also an absence of permanent surface water (indicating that groundwater and surface water systems are not connected). There is a lack of commercial mineral deposits (other than salt) and there is no potential for medium to high agriculture in the vicinity of the Proposal.

Waste hierarchy

There is a clear difference between what is considered best practice for hazardous and non-hazardous wastes. The 'waste hierarchy' methodology suggests the primary focus of waste management should be on reusing, recycling and recovering materials. This methodology is a broadly accepted policy for general (non-hazardous) wastes (refer to Figure 2-6).

A different framework is appropriate for hazardous wastes, which present a danger to health or the environment and, as such, should generally not be re-integrated into manufacturing processes for re-use. With these kinds of wastes, international best practice as reflected in conventions such *as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* ('The Basel Convention') adopt environmentally sound management principles, which focus on the permanent removal of such wastes from the biosphere, and in so doing protect the environment and human health.

One of the advantages of geological repositories is that one can also support the circular economy using long term storage by placing 'like-with-like' materials for operational safety reasons and to create opportunities for the future recovery of valuable materials. The proponent's business model mirrors international solutions operating in the United Kingdom, Europe and North America (refer to Figure 2-6).

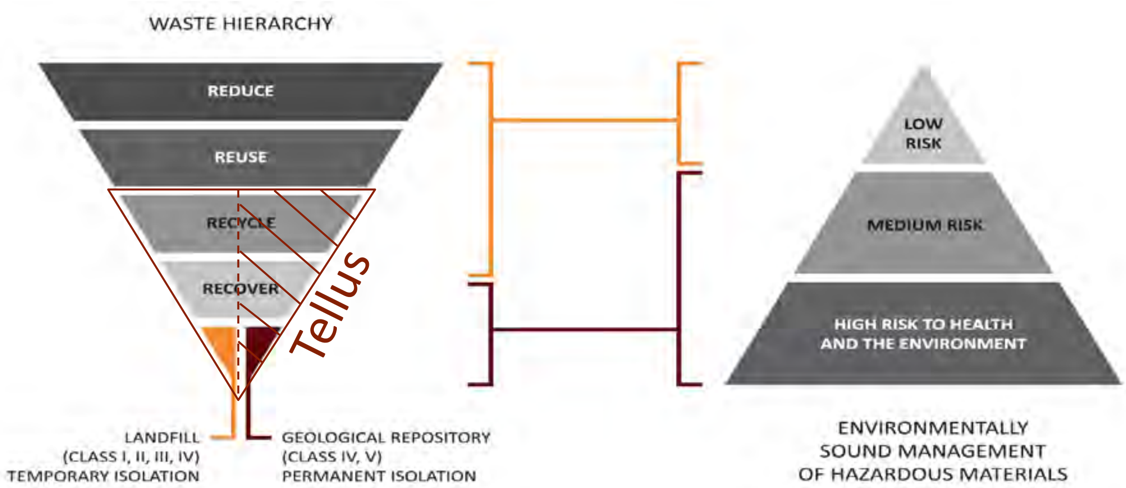


Figure 2-6 The waste hierarchy and the proponent's service offering

Waste classifications in Australia and the Northern Territory

A hazardous waste, as defined in the Australian Government's *National Waste Policy: Less waste, more resources (2009)*, is a substance or object that exhibits hazardous characteristics, is no longer fit for its intended use and requires disposal.

The term 'hazardous waste' is widely used in the community and is taken to mean the wastes that states and territories (the jurisdictions) regulate as requiring particularly high levels of management and control.

The jurisdictions use varied terminology to describe these wastes, reflecting the fact that some are controlled not because they are hazardous in the normal sense of the word, but rather because they pose risks to public amenity (e.g. through odour). All of these wastes are nevertheless considered to be hazardous wastes within the scope of this report, noting that the design of the proposed Chandler Facility is geared towards those wastes deemed to be at the more intractable end of the traditional waste hierarchy spectrum.

States and territories variously describe these waste types as *controlled, trackable, prescribed, listed* or *regulated* wastes. Most jurisdictions operate a tracking system under the National Environmental Protection Measures to ensure that hazardous waste is appropriately managed. These tracking systems generate data that is as a key source in compiling and reporting Australia's annual arisings of hazardous waste.

There are four waste classifications in the NT as per the *Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory* (NT EPA 2003). These are:

- **Domestic garbage.** This includes wastes generated from household sources (and may include hazardous or putrescible waste).
- **Hazardous waste**. This includes any waste containing significant quantities of a substance which may present a danger to the life or health of living organisms when released into the environment. These wastes may both include medical and radioactive wastes.
- **Clinical waste.** This includes waste that which has the potential to cause sharps injury, infection or public offence, and includes sharps, human tissue waste, laboratory waste, animal waste resulting from medical, dental or veterinary research or treatment that has the potential to cause disease.
- **Putrescible waste**. This includes organic wastes capable of decomposition by micro-organisms.

The main waste-generating sectors identified within Australia (ASCEND 2015) are:

- Chemical trading companies.
- Waste companies.
- Mining companies.
- Hydrocarbons (e.g. oil and gas industry).
- Environmental engineering companies.
- Federal government (in terms of obtaining waste that is usually exported overseas and assisting with disposal of wastes during disaster events [e.g. oil spill]).
- Other wastes.

These sectors would be the sources of wastes likely to be disposed of at the proposed Chandler Facility (refer to Figure 2-7).

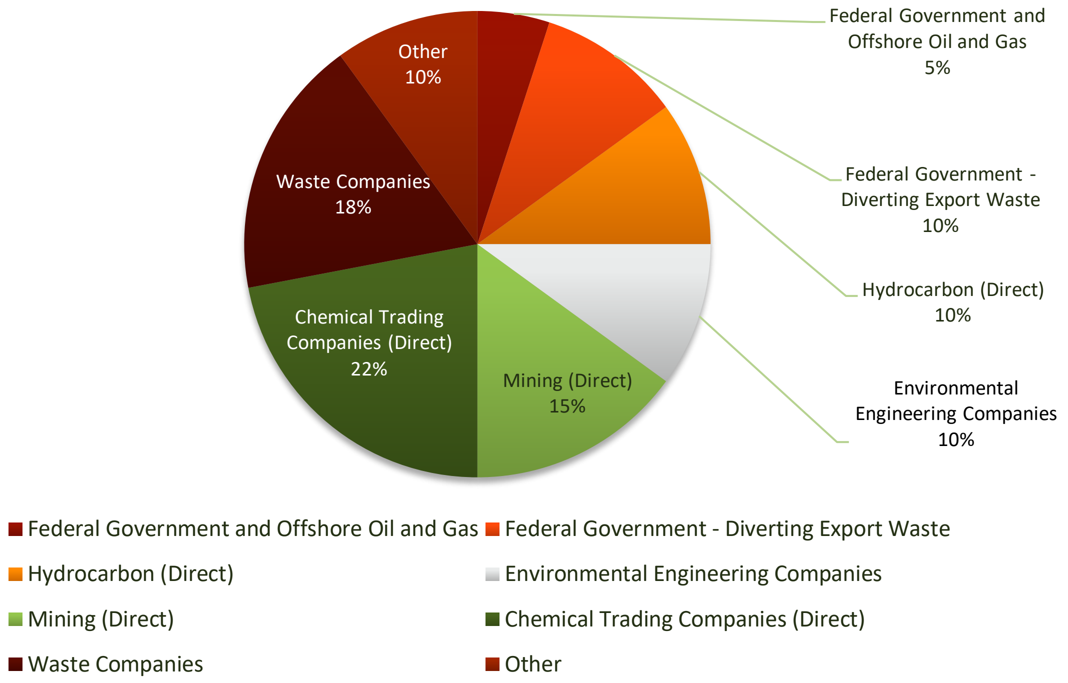


Figure 2-7 Waste sources by sector

Existing waste volumes in Australia

Australia produces approximately six million tonnes per annum of known hazardous waste (KMH Environmental 2013). Of this, the NT produces approximately 0.9 million tonnes per annum of reported hazardous waste (ASCEND 2015). A market overview of hazardous waste in Australia is provided in Table 2-2.

Table 2-2 Australian waste and hazardous waste market summary

Category	Market overview
Sustainability	• Australia is one of the highest emitters of hazardous waste on a per capita basis • Over the last 20 years, waste production in Australia has grown at six times population growth
Market size – volume (Mt)	• Australia produces approximately 53.3 Mt of multiple waste material • Approximately 11% (5.9 Mtpa) hazardous waste gets produced annually • Approximately 900 Mt of reported legacy waste stockpiles
Market size value (A$)	• Approximately $14.2 billion Australian waste market • Approximately $2.4 billion existing / reported hazardous waste market • Approximately 50,000 + jobs, growth sector, relatively recession proof
Growth (%)	Approximately 3.0 – 4.0 % per annum
Legacy	Significant volumes currently stored around Australia in temporary facilities – this leads to significant liability exposures.

Mt – million tonnes

Mtpa – million tonnes per annum

Controlled waste[1] transported domestically between states and territories amounted to approximately 188,000 tonnes during 2009 and 2010, declining to 179,000 tonnes for 2010 – 11. These wastes consisted primarily of inorganic chemicals, oils, soil/sludge, acids, alkalis, and putrescible/organics (Australian Bureau of Statistics [ABS] 2013).

Legacy waste refers to those hazardous wastes that exist from previous historical activities. Table 2-3 presents legacy waste volumes in Australia for a range of waste types including spent pot liner, fly ash, muds and hazardous wastes.

Estimates of existing stockpiles of these legacy wastes, and potential annual additions to them each year. This shows that if legacy wastes began to move off the sites produced, then the total market for hazardous wastes in Australia would grow 7-fold to 38 million tonnes.

Table 2-3 Estimated legacy waste volumes in Australia (tonnes)

Legacy waste categories in Australia	Annual production (Mt)	Historical stockpile (Mt)	Source/comment
SPL (stockpiled)[1]	-	785,000	Market movement for 'annual generation' of spent pot liner is approximately 115,000 tonnes (ASCEND 2015). Blue Environment Pty Ltd (2015) quotes current Australian stockpiles of 900,000 tonnes. 'Historical stockpile quantity of 0.8 Mt' is calculated as 'total stockpile minus 'annual production.
Fly ash (stockpiled)[2]	6,600,000	400,000,000	Ash Development Association of Australia (2014)
Red mud[3]	26,000,000	500,000,000	ASCEND (2015)
Reported hazardous	5,500,000	-	ASCEND (2015)
TOTAL[4]	**38,000,000**	**900,000,000**	

1. *SPL: 'Annual generation' of 115,000 t included in ASCEND market estimates. Blue Environment et al[6] quotes current Australian stockpiles of 900,000 t. 'Historical stockpile quantity' calculated as Total Stockpile minus Annual generation.*
2. *Figures quoted from: Ash Development Association of Australia (2014) Annual membership survey results 2013, HBM Group Pty Ltd, Wollongong, available from: http://www.adaa.asn.au/uploads/default/files/adaa_mship_report_2013.pdf.*
3. *Figures extrapolated from: EnviroRad Services (2005). A Report prepared for the Radiation Health and Safety Advisory Council. Naturally Occurring Radioactive Materials (NORM) in Australian Industries - Review of Current Inventories and Future Generation: http://www.arpansa.gov.au/pubs/norm/cooper_norm.pdf.*
4. *Rounded to 2 significant figures.*

[1] Controlled waste means any matter that is within the definition of waste in the National Environmental Protection Measure for the *Movement of Controlled Waste between States and Territories*.

The proponent has researched the domestic hazardous waste market since 2012 and has determined the highest potential customer by volume is the chemical trading sector (refer to Figure 2-7). This sector is closely followed by waste companies and the mining sector. The remainder of the market in domestic hazardous waste generation is made of environmental engineering firms as well as government / research sectors. Hazardous waste volumes reported by the States or Territories which could be received at the proposed Chandler Facility is listed in Figure 2-8.

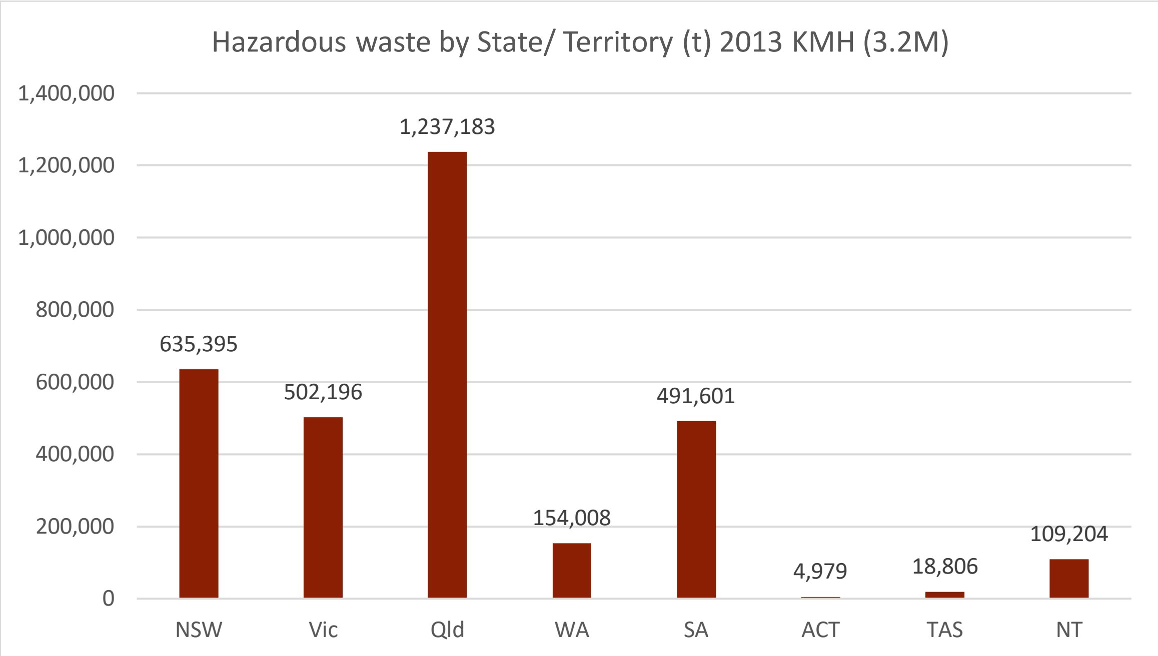


Figure 2-8 Hazardous waste volumes by State or Territory in Australia

Predicted waste volume trends in Australia

The *Hazardous Waste Infrastructure Needs and Capacity Assessment* (Blue Environment Pty Ltd 2015) projected waste volume growth for 29 waste groups individually over 20 years in Australia. Projections from the waste groups varied from a shrinkage (of -3% per annum) to exponential growth (of 10 % per annum), with the majority growing at an overall average volume growth of (3 % per annum). Related market intelligence reports carried out by IBIS World (ASCEND 2015) estimate the following:

- Waste treatment and storage service in Australia is expected to grow 3.7 % from 2016 to 2021.
- Waste remediation and materials recovery service is expected to grow 4.1 % from 2016 to 2021.
- Hazardous waste hauling in Australia is expected to grow 4 % from 2015 to 2020.

Figure 2-9 presents projected waste volumes in the hazardous waste market between 2014 and 2034. The figure shows that in 2016, Australia produces approximately six million tonnes of hazardous waste. By 2034, that volume is anticipated to rise to 10 million tonnes. The Proposal will assist in the management of a small percentage of the projected hazardous waste market within Australia and overseas. Of the total volume produced per annum in Australia, the proponent forecast capacity volume of the total hazardous waste volume shown in Figure 2-9.

The orange line in Figure 2-9 shows that despite a predicted increase of hazardous waste over the next 20 years, the Proposal is seeking approval for, a ceiling of 400,000 tonnes (capacity) of hazardous waste per annum, although average volumes are expected to be significantly less than this amount (year one 30,000 tonnes, average 340,000 tonnes per annum). Approval of the Chandler Facility, would not increase production of hazardous waste in Australia but go a long way to assisting in a legacy and forecast production waste management issue.

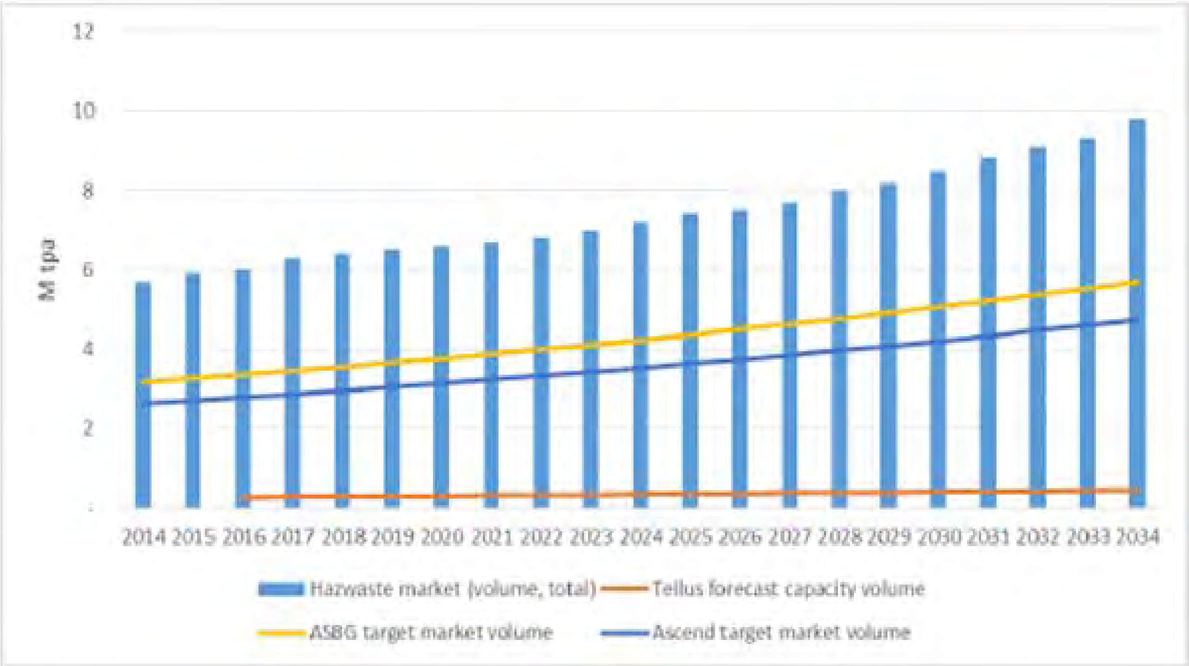


Figure 2-9 Market volume waste assumptions versus total market (excluding legacy waste)

How waste is currently managed in Australia

Sustainable waste management practices in Australia align with the traditional waste management hierarchy of waste avoidance – re-use – recycle, the hierarchy is shown in Figure 2-10 and outlines the options available in waste management.

Waste that cannot be readily reused or recycled is generally disposed of at landfills and landfills are given a category according to what type of materials they can accept. The categories range from Class I (suitable for inert landfill which is generally non-hazardous and stable) to Class V (intractable waste that is a problem to manage due to its toxicity or chemical or physical characteristics).

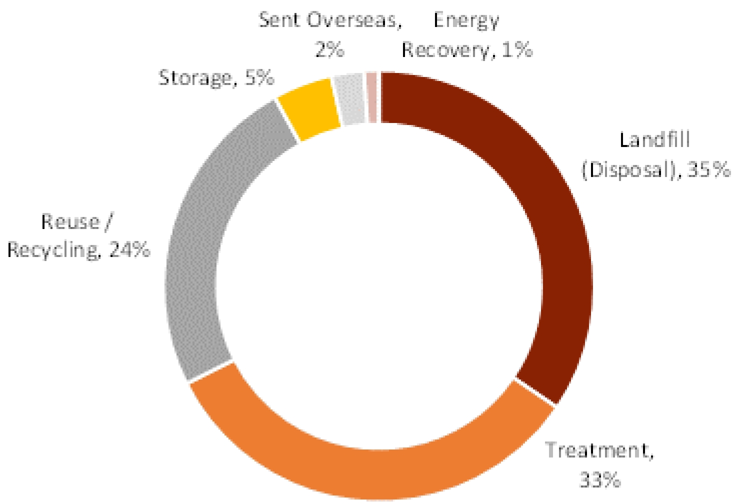


Figure 2-10 Waste treatment and disposal options

As discussed above, hazardous waste is defined as waste that poses a threat or risk to public health, safety or the environment and includes substances which are toxic, infectious, mutagenic, carcinogenic, teratogenic, explosive, flammable, corrosive, oxidising and radioactive (WasteNet 2016). Hazardous waste requires disposal at facilities categorised as Class IV. Many of these facilities are located in less than ideal locations and rely on man-made and maintained structures for their integrity, thus compromising their capability to isolate wastes from the environment. Moreover, they regularly end up in general landfill due to incorrect disposal by the user of the hazardous waste.

Intractable waste is defined as waste which is a management problem by virtue of its chemical or physical characteristics which make it difficult to dispose of or treat safely (WasteNet 2016). Intractable waste requires disposal at facilities categorised as Class V. There is a lack of facilities categorised as Class V in Australia. The only Class V facility is the Mt Walton East Intractable Waste Disposal Facility (IWDF) in Western Australia. The proponent currently project manages the Mt Walton East IWDF under a separate entity named ClayVault WA (50/50 joint venture). The Mt Walton East IWDF is currently under care and maintenance and has not had a waste campaign since 2008. Owing to a lack of appropriate Class V facilities within Australia, many intractable wastes are either stockpiled, exported overseas at great costs or disposed of inappropriately.

Governments and improved standards are driving changes to hazardous waste management in Australia, with legislative and environmental management practice changes being implemented nationwide. For example, fly ash and used tires are no longer being accepted at conventional landfills, and waste-to-energy projects that allow for energy recovery are likely to produce some level of bottom-ash which cannot be landfilled. Some changes are also being driven by corporate accounting standards, with waste producing companies now looking to find methods of sustainable waste disposal with reduction or removal of contingent liabilities.

Need for a safe and secure storage facility for hazardous waste materials

There is a need and obligation to provide for the safe and secure storage of both hazardous and intractable waste generated in Australia. As a first-world, developed country we have an obligation to offer world-class storage and isolation solutions for waste produced not only domestically but for waste produced by our near-neighbours (as per our commitments as a signatory to the Basel and Waigani Conventions).

The proponent recognises there is an opportunity to provide a unique service to both government and industry in the storage and isolation of wastes that cannot be further reduced, reused, recycled or recovered. The types of wastes that fall into this category are generally classified as hazardous or intractable wastes which, as discussed above, are categorised as high risk waste to human health and/or the environment. These wastes require environmentally sound management techniques to permanently isolate them without increasing risk to humans and the environment.

The proposed Chandler Facility would provide for the safe and secure , recovery or permanent isolation of waste in a deep underground geological repository within a stable geological formation (it would meet both international and national industry requirements for a deep geological repository[2]).

Isolation would be provided by a combination of engineered and natural barriers (rock and salt) and no obligation to actively maintain the facilities would be passed on to future generations (refer to Figure 2-11). Deep rock salt repositories have very high integrity for waste disposal, due to the inert nature of the salt and its geological plasticity (salt will creep over time, effectively self-healing which contributes to the passively safety case advantage of geological repositories).

A typical room sized cavity dug into an underground salt strata will shrink at a rate of about 10 to 15 centimetres per year (Atkins 2015) or one to 1.5 metres over 10 years. Over time, any material inside the room will become encapsulated within the salt strata. A detailed post-closure safety assessment of the proposed Chandler Facility, which modelled containment performance of high hazard chemical waste, concluded a strong safety case with complete containment performance into geological time, well beyond the sorts of timeframes that are commonly measured against typical landfills (refer to Chapter 21).

[2] *Australian Radiation Protection and Nuclear Safety Agency – Expectations Guideline*

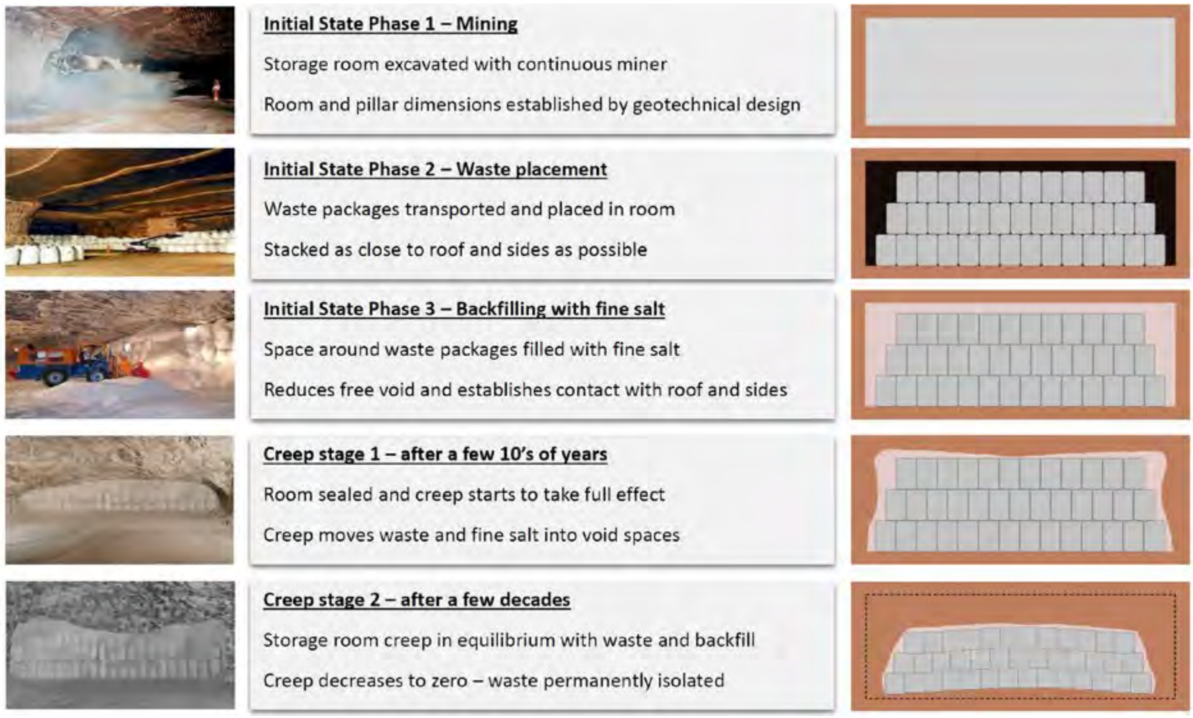


Figure 2-11 By using engineered and natural salt barriers the waste becomes permanently isolated

The Chandler Facility offers an opportunity to provide an economically and practically accessible end point solution for hazardous and intractable waste storage and isolation in Australia (a solution that is currently being successfully utilised in the United Kingdom, Europe, the United States and Canada).

The proposed Chandler Facility would have a licenced capacity to store up to 400,000 tonnes per annum, although average volumes are expected to be significantly less than this amount (year one 30,000 tonnes, average 340,000 tonnes per annum). The current market analysis suggests the volumes and sources of waste would be provided from the following and as shown in Figure 2-12.

- Chemical trading companies which represent 22 % of the market.
- Waste companies which represent 18 % of the market.
- Mining companies which represent 15 % of the market.
- A combined total of representing 35 % of the market, would be sourced across environmental engineering companies, hydrocarbon (oil and gas) industry.
- The remaining 'other' volume of waste (9,400 tonnes per annum), representing 10% of the market, would be sourced from state or local governments (asbestos), heavy industry and construction companies.

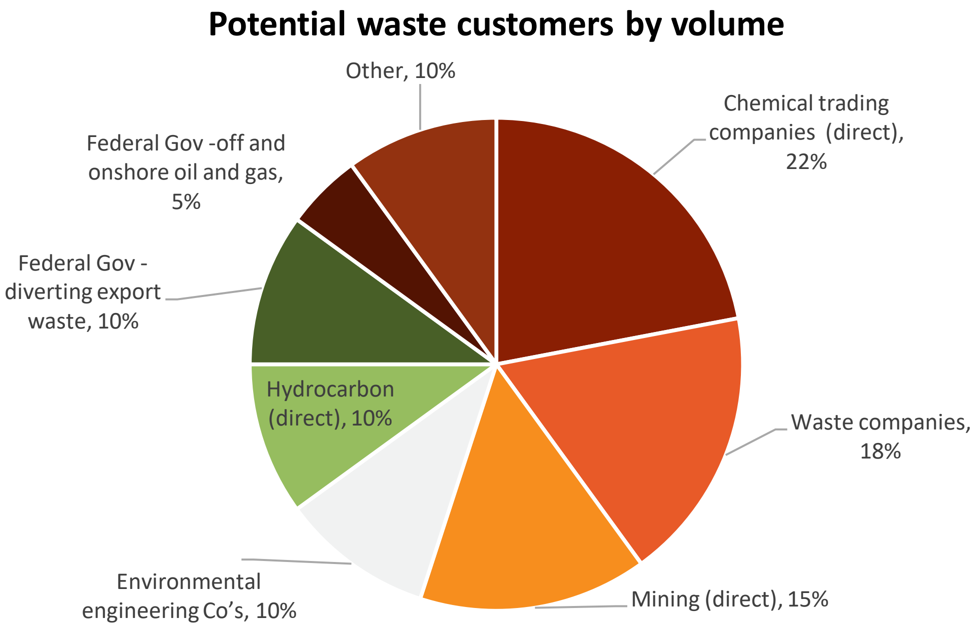


Figure 2-12 Potential waste customers by volume

Over the 25 year underground life of the Proposal, the volume of waste requiring long-term safe and secure storage or permanent isolation would vary due to:

- Advances in resource recovery technology.
- Industry and consumer behaviour in waste management.
- Fluctuation in market conditions and subsequent increase or decrease in major projects, resulting in a subsequent decrease or increase of waste generated.
- Frequency of state and national emergency events (e.g. man-made).
- Population growth. Infrastructure Australia (2015) suggests that the population of Australia will be 30.5 million people in 2031, a growth of 8.2 million or 36.5 % from 2011. Over the last 20 years, waste production in Australia has grown at six times population growth.

2.2.2 Need for a safe and secure storage facility for other materials

The Proposal offers governments and the waste industry a long term, environmentally safe, and cost effective option, to temporarily or permanently store a range of other materials, not just hazardous waste. These include:

- The storage of government or private archives/documentation and libraries.
- High value artworks and pieces of cultural significance.
- Bullion and estate jewellery.
- High value equipment.
- Electronic storage devices (CD, DVD, video tape, hard drives and microfiche).
- Customs and exercise captured items.

2.3 Proposal alternatives

This section presents the range of options and alternatives that were investigated for the Proposal. These include:

- Not proceeding with the Proposal.
- An alternative site selection and access assessment.
- Mine access options to optimise ecological sustainability.
- The consideration of alternative environmental management measures.
- Alternatives at a national, NT, regional and local scale.
- A comparison of short and long-term advantages and disadvantages of the alternatives.

2.3.1 Not proceeding with the Proposal

The consequences of not proceeding with the Proposal would mean that the associated economic and environmental benefits would be foregone. Not proceeding with the Proposal would result in the following:

- Up to 12.5 million tonnes of high grade salt for export to Asia and the domestic market would not be produced.
- Up to 10 million tonnes of hazardous wastes would be either exported overseas or stored inappropriately in locations across Australia, awaiting an appropriate long-term storage solution.
- Loss of capital expenditure during construction of the mine worth $676 million.
- Loss of expenditure during operation of the mine worth $3 billion.
- Loss of 270 construction jobs (540 indirect jobs).
- Loss of 180 operational jobs.
- Loss of business opportunities for local and regional suppliers.

- Loss of taxes, royalties and levies over the life of the Proposal to the Commonwealth and NT governments.

2.3.2 Site selection and access alternatives

Selecting a preferred site

Tellus is committed to developing the Proposal in a responsible manner, giving due consideration to the environment, society, stakeholders and staff, safety, clients, company shareholders and the Board. Tellus is hence developing the project through a staged gate process, within a capital investment framework, which increases in rigor and detail as each gate is passed through. Figure 2-13 outlines this framework and process.

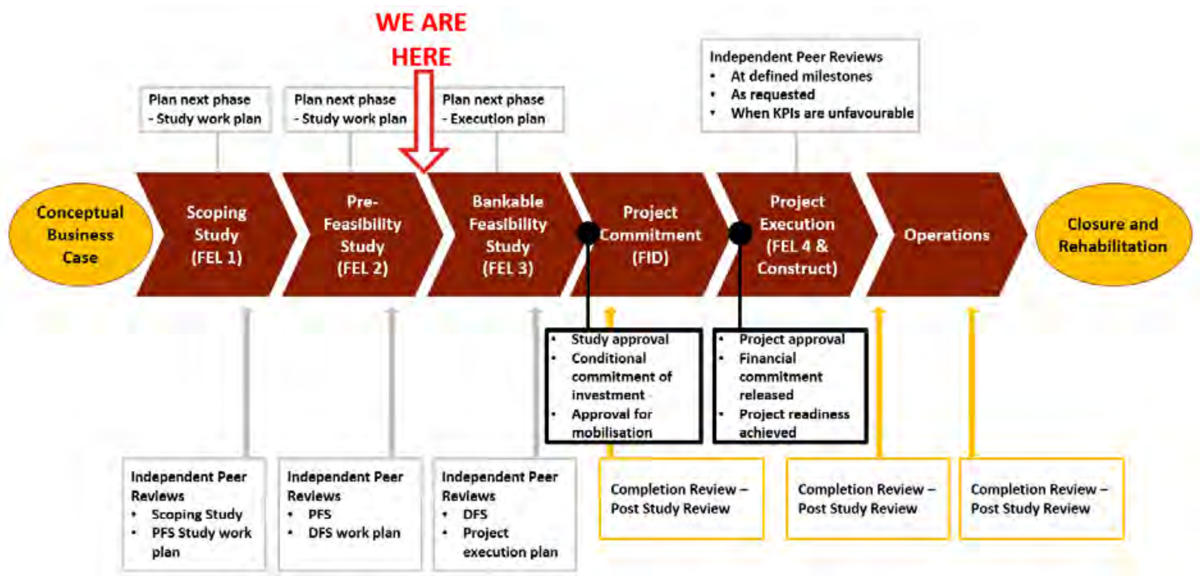


Figure 2-13 Illustrative example of stage gate feasibility study framework

To date, Tellus has undertaken two phases of study; the initial scoping study and the pre-feasibility study. As the studies progressed, project definition has improved. The studies have included a detailed site selection process to identify and refine suitable sites for the proposed Facility. The next stage is to complete a bankable feasibility study to confirm design assumption and apply a higher degree of engineering.

The site selection process for the three pre-development phases are listed in Table 2-5.

The final stage of project execution which includes final detailed design would be undertaken subject to planning approvals and financial commitment in place.

Table 2-4 Tellus' three phase site selection process

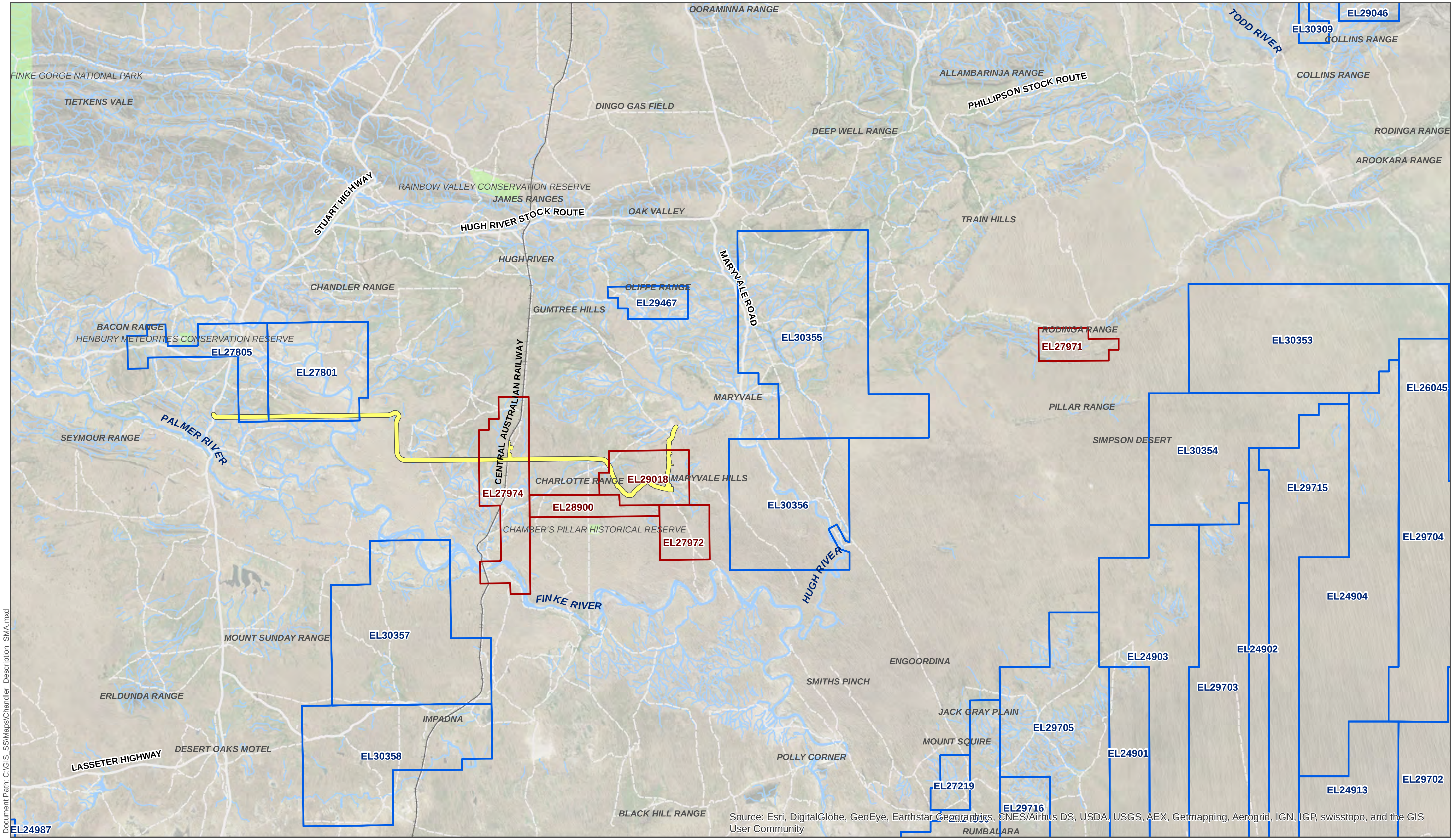
Phase 1 - Desktop study	Phase 2 - Pre-feasibility study	Phase 3 – Bankable feasibility study
• Prepare a methodology to identify suitable sites. • Assemble relevant digital information at a basin and regional scale. • Categorise all information to indicate suitability in terms of the selection criteria. • Apply the methodology and demonstrate its use. • Identify potentially suitable basins. • Identify potentially suitable areas at a regional scale and shortlist potentially suitable target sites and alternatives. • Conduct reconnaissance field surveys over suitable areas. • Assemble a fatal flaw checklist/ exclusion criteria & identify areas with flaws and exclude them.	• Assemble more detailed information. • Refine or re-apply the methodology. • Conduct detailed field investigation of suitable target areas. • Conduct detailed field studies including drilling and surface monitoring. • Identify the site potentially most suitable. • Continue identifying fatal flaws and exclude them. • Prepare a report for select community stakeholder comment with description of the Proposal and alternative sites.	• Conduct detailed field investigation of preferred location. • Conduct detailed field studies including drilling and surface monitoring over preferred location. • Prepare supplementary environment and/or engineering reports (where required).

In 2010, the proponent reviewed several regional geological areas within Australia and selected the Amadeus Basin, NT as a suitable basin for further evaluation. A selection criteria was developed and undertaken at a regional scale and assessed using available data, against a range of categories (refer to Table 2-6).

Five areas were viewed as potentially suitable, one as intermediate potential and two defined as being unsuitable or unknown, the location of sites are shown in Figure 2-14. The areas that were identified as being most prospective were Charlotte North (preferred location) and the Mt Charlotte site (alternative site). The location of the preferred sites are shown in Figure 2-15. More detailed studies were then undertaken to confirm suitability and allowed further predevelopment investigations to take place.

Table 2-5 Regional site and target selection criteria

Category		Mt Charlotte	ELA North	ELA East	Eastern railroad	ELA South	Railroad	Ooramina	Bluebush
3	Site Selection	S	S	S	S	I	U	U	S
4	Ownership, legal permitting and contractual	S	S	S	S	S	I	I	I
5	Market analysis and logistics	I	I	I	I	I	S	I	I
6	Geology, mineral resource potential & hydrology	S	S	S			U		
7	Predevelopment – exploration	S	S	S	S	S	S	S	S
8	Development – mining	S	S	S	S	S	S	S	S
9	Salt processing	S	S	S	S	S	S	S	S
1	Storage processing	S	S	S	S	S	S	S	S
1	Infrastructure	I	I	I	I	I	S	U	I
1	Health and safety	S	S	S	S	S	S	S	S
1	Environment and community	S	S	S	S	S	S	S	S
1	Cost estimates	I	I	I	I	I	I	I	I
1	Implementation - Human Resources	I	I	I	I	I	I	I	I
1	Implementation - Contracting strategy,	S	S	S	S	S	S	S	S
1	Work program	S	S	S	S	S	S	S	S
1	Financial analysis	I	I/P	P	P	P	P	P	P
1	Risk analysis (Business and Safety);	S	S	S	I	I	S	I	S
Understanding level of knowledge		I		I	I	I	I	U	U
Ranking S = Suitable P = Potential I = Intermediate U = Unsuitable		S	S	S	S	I	U	U	S



N

8 4 0 8 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Existing road
- Existing track
- Watercourse
- Mineral titles exploration license - granted (Tellus Holdings Ltd)
- Mineral titles exploration license - granted

Figure 2-14
Location of prospective sites on a regional level

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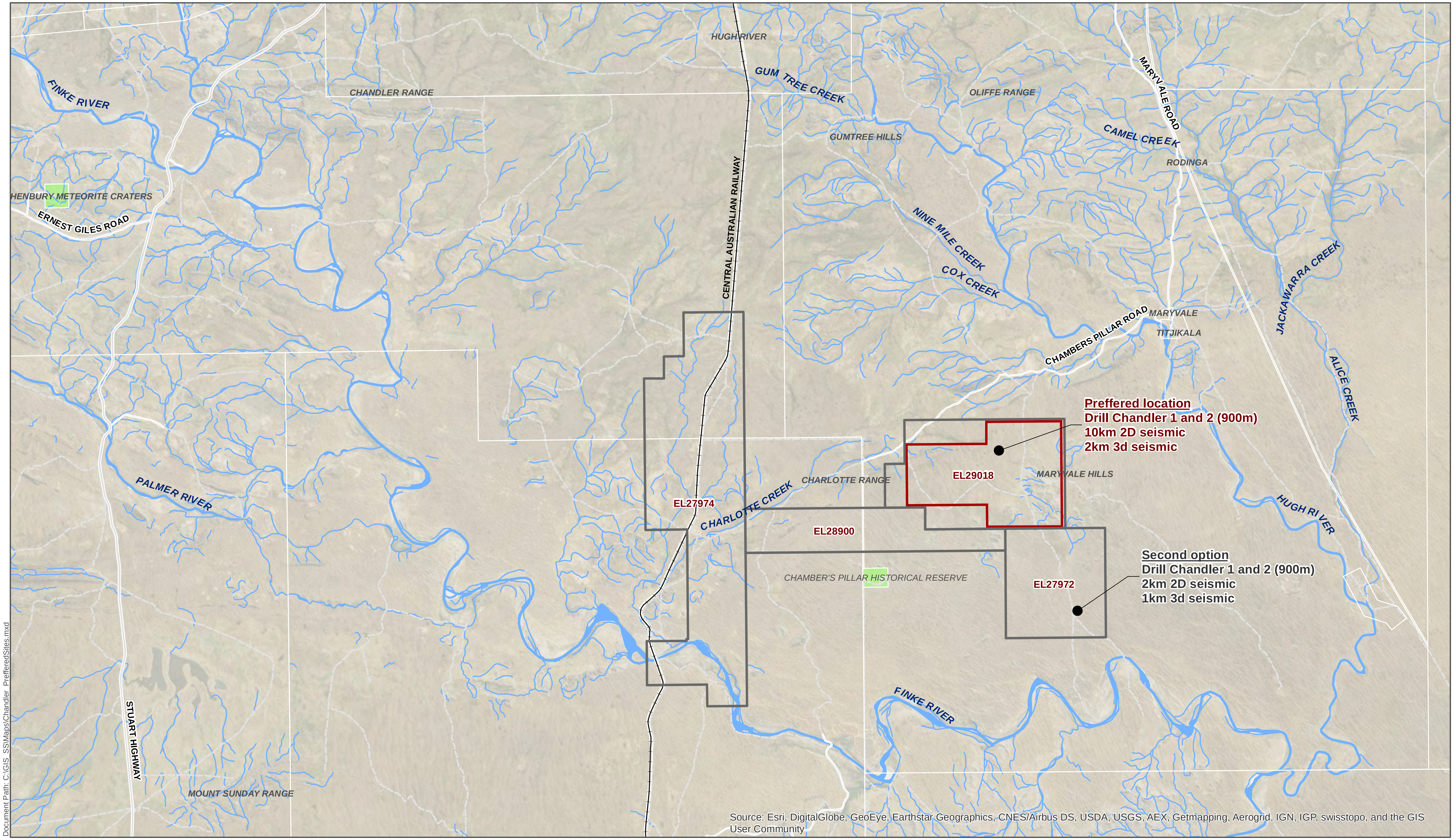

Document Path: C:\GIS_SS\Maps\Chandler_PrefferedSites.mxd

N

5 2.5 0 5 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Railways
- Existing road
- Existing track
- Watercourse
- ML30612
- Mineral titles exploration license - granted (Tellus Holdings Ltd)

Figure 2-15
Location of preferred sites

TELLUS

Tellus Holdings Ltd makes every effort to ensure this map is free of errors but does not warrant the map or its features are either spatially or temporally accurate or fit for a particular use.
Tellus Holdings Ltd provides this map without any warranty of any kind whatsoever, either expressor implied.

Underground location

The Chandler salt formation is an extensive flat lying salt bed at a depth of approximately 800m. The mineable horizon is not constrained in extent and therefore the underground mine location is able to be influenced by other factors such as most suitable mine entry location.

To locate the proposed underground salt mine, the following considerations were assessed:

- Availability of existing data such as seismic lines, oil wells and existing groundwater bores.
- Depth to salt.
- Thickness of the salt formation.
- The extent (length and width) and continuity of the salt formation.
- Salt quality of identified mining horizons.
- Suitable mine entry (portal) locations.
- Suitable ventilation and egress shaft locations.
- Alignment of decline.

Mine entry (portal)

Five potential mine entry points for access by a decline (access tunnel) were chosen and individually assessed against a range of criteria which included environmental, engineering and economic factors. Three potential sites were selected on the slopes of local hills. A further two locations were selected within low lying, flat areas.

For each location, consideration was also given to the proximity of existing stock / farm tracks and the Central Australian Railway (Adelaide to Darwin). Consultations with Traditional Owners and the Central Land Council were undertaken to determine areas of cultural importance or sensitivity.

Mine decline route

Studies were undertaken to determine how best to link the portal entrance to the salt mine. Alignments of the proposed decline route assessed previous seismic data and drill hole core data for information on the potential presence of groundwater, gas, fractures and rock types.

The pre-feasibility study and value engineering studies, recommended a decline as the primary mechanism to access the salt beds. In addition, two large diameter raise bored shafts were recommended for egress and ventilation.

Decline access has the best fit to a set of benefit criteria and weightings selected by Tellus and industry experts. Decline access is considered technically feasible with no fatal flaws having been accepted as a viable option in a number of independent studies commissioned by Tellus.

The pre-feasibility study assessed multiple underground access options for the proposed Chandler Facility. Weightings across financial, environmental and social were applied. The decline option was the preferred option over a shaft option. In addition to the decline, the Proposal would also be serviced by two shafts at five metre internal, finished diameter (5.5 metre excavated diameter). Each shaft would be developed by raise boring in a staged manner as the decline is advanced. The downcast shaft (intake air) would also be used for salt hoisting and personnel riding, its total depth would be approximately 820 metres.

Underground layout

The overall layout of the proposed underground mine design was influenced by a number of factors including:

- Location of decline, ventilation and egress shafts.
- Underground access road configuration.
- Selected mining equipment (e.g. cutting height of continuous miner, width of machinery).
- Effect of salt creep over time.

The mine layout has been developed covering the planned 25 year underground life of mine and the underground footprint is approximately 3,200 metres x 1,500 metres or 480 hectares. More detail is provided in Chapter 3.

Aboveground layout

During the preparation of the draft EIS and pre-feasibility studies, site conditions, known environmental constraints and the result of value engineering studies were used to refine conceptual design drawings of the Proposal

2.3.3 Logistics alternatives

Access roads

If approved, access to the proposed Chandler Facility during construction would be via a public road named Maryvale Road. The Maryvale Road is predominantly an unsealed dirt road and is approximately 120 kilometres from Alice Springs to Maryvale store and the Community of Titjikala (refer to Figure 1-1).

A new private road, approximately five kilometres north of the Maryvale store, was originally put forward as an option to by-pass Maryvale store and the Titjikala community. However, after further desktop and field investigation, this option was rejected on the grounds of potential environmental constraints.

During the 2015 groundwater drilling program, a car accident occurred along the Maryvale Road. Following the incident, a decision was made to seek an alternate access route to the Chandler Facility for the operation of the Proposal.

Three existing access tracks across the Maryvale Station and Henbury leading to the Stuart Highway were identified and labelled A, B and C. A desktop environmental and engineering constraints assessment for each potential access route was then undertaken.

A Geographic Information System (GIS) was the tool used to identify potential constraints including but not limited to surface water features, clay pans, large stands of open woodland, sand dunes, rocky outcrops and gully erosion. Conversely, the GIS was also used to identify areas of potential opportunities including flat low lying areas void of gully erosion or areas potentially sensitive to high ecological value.

Following further on-site consultation with representatives from the Commonwealth Department of the Environment, the proponent selected option C as the preferred (long-term) access route. Option C was the preferred option because it would:

- Be constructed within an existing dirt road access corridor.
- Avoid isolating existing ecological communities on the Maryvale Station and Henbury Station.
- Avoid large scale disturbance to existing cattle grazing activities.
- Avoid items of cultural heritage importance.
- Minimise disturbance to riparian vegetation along significant drainage lines.
- Minimise the permanent removal of existing terrestrial vegetation.
- Allow for the construction of appropriate downstream sediment and erosion control measures.

Following the selection of the alternate access route, detailed environmental site investigations were undertaken over a 12-month period. The specialist biodiversity and cultural heritage field investigations included participation from local ecological consultants and Traditional Owners.

The studies carried out along the 60-kilometre access track assisted the proponent to confirm baseline environmental conditions. Cultural heritage, surface water, soil and biodiversity constraints were identified, mapped and have been discussed in the appropriate impact assessment chapters of this EIS. In addition, this information will be used to minimise potential impacts to these elements during the detailed engineering design process. The results were also presented to affected pastoralists as part of the EIS consultation process.

Port linkages

Depending on the equipment used for transport from Chandler, there may be a requirement for portside storage of bulk salt. Both Darwin and Adelaide ports have infrastructure for bulk loading of vessels, however in order to store bulk salt in large quantities, there would be a need for a salt bunker or silo storage (similar to a grain bunker/silo).

Initial research suggests finding existing infrastructure to accommodate the required construction and operation workforce would be difficult and this would require significant investment, particularly given portside property is costed at a premium. Open air storage of salt in Darwin, given its cyclonic climate is also foreseen as not viable.

These challenges were a large factor in pursuing a containerised export option in the pre-feasibility study. Ultimately the modelling aims to provide the most economic method to move the salt from the proposed Chandler Facility to port, with the least amount of capital required. In lieu of finding suitable existing bulk infrastructure to export salt, a containerised solution for transport and temporary storage of salt is the preferred option.

2.3.1 Options to optimise ecological sustainability for the Proposal

Solution mining versus room and pillar mining

In solution mining, holes are drilled and lined from the surface down to a rock salt formation. Water is then pumped into the holes under pressure to dissolve the underground salt and form brine, which can be recovered by pumping. Salt can then be extracted from the brine.

This method would require significant volumes of groundwater to be used in the process. Significant volumes of brine waste would also be generated.

Traditional room and pillar salt mining would avoid having to use large volumes of groundwater. By avoiding brine waste management, the surface disturbance footprint within the Chandler Facility was significantly reduced.

Energy sources

The proposed Chandler Facility is very remote and is not serviced by any forms of existing infrastructure other than the Maryvale Road, site access track and a small exploration camp. Hence, the site needs to be completely self-sufficient for power generation, accommodation, potable and other water, sewerage treatment and communications. The PFS activities included preliminary design and both capital and operating cost determination for all infrastructure and service items. Further details on sources of energy and associated infrastructure are described in Chapter 3.

Salt mineral processing

Wet and dry salt processing methods including the need for large evaporation ponds were assessed during preparation of the PFS and the EIS. The benefits and adverse effects of both alternatives are discussed in Table 2-8.

2.3.2 Consideration of alternative environmental management measures for key risks

A range of environmental risk scenarios were tabled during an environmental risk workshop. The Proposal's description (refer to Chapter 3) was used as the basis of the assessment and used to identify possible risks that may have a likelihood of occurring during the Proposal lifecycle. During the workshop, identified risks were assigned a likelihood and consequence, and given a risk ranking. Following a ranking of risks, attendees in the workshop then considered appropriate management measures to complete the pre-mitigated risk assessment (refer to Chapter 6).

Post management residual risks were then reviewed. Where residual risks were ranked as being extreme or high (e.g. key risks), alternative environmental or engineering management measures were discussed by attendees in the workshop.

The following factors were discussed for key residual risks:

- Best practice techniques in similar dual business models that currently operate in Europe and North America.
- Changes to design elements for above and below ground infrastructure.

- Consultation with pastoralists and Traditional Owners of the land.
- Additional environmental field investigations.
- The proponents Environmental Management System.

The above steps allowed the design and EIS team to consider viable Proposal alternatives that have assisted in addressing potential long-term adverse effects and seeking ways to maximise potential short or long-term beneficial effects. These are discussed in more detail in Section 2.3.3.

2.3.3 Adverse and beneficial effects of alternatives at national, Territory, regional and local levels

Table 2-6 lists alternatives that were considered significant by the proponent for the Proposal. It provides an overview of whether the alternatives considered, and then rejected or selected for the Proposal were considered as having an adverse or beneficial effect[3].

Three levels of significance are required to be addressed in the Terms of Reference, namely national, NT and local. In addition, the Proposal included international and regional aspects, as these were deemed to be relevant by the proponent in the context of the Terms of Reference. Where appropriate, comments on the nature of the effects in relation to the Proposal are provided in

Part D of the EIS provides further detail on the beneficial and/or adverse effects of the Proposal including, where appropriate, a description of the effect over the short, medium or long-term.

[3] *For the purpose of assessing 'effect' against considered alternatives, environmental, social and economic criteria were selected as being the most appropriate criteria.*

Table 2-6 Alternatives considered throughout the development of the Proposal

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Do nothing option	R		×	✓	✓	✓	✓	The do nothing option would fail to achieve the net beneficial effect of providing salt to the international and domestic market for which there is demand (refer to Section 2.2.1). In addition, the do nothing option would not provide the opportunity and long-term beneficial effect of assisting Australia, and other developing nations in the Pacific region, with a long-term solution to the management of hazardous waste that adopts best practice techniques adopted in Europe and Norther America and carried out using environmentally sound management (ESM) practices.
Salt mine only option	R		×					This option would provide salt to the international and domestic market for which there is demand (refer to Section 2.2.1). However, it would not achieve the intended objective of a dual business stream.
Store and permanently isolate waste only option	R		×					This option would provide a long-term solution to the management of hazardous waste that adopts best practice techniques adopted in Europe and Norther America and carried out using ESM practices. However, it would not achieve the intended objective of a dual business stream.

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Store and permanently isolate waste in salt	S	✓			✓	✓	✓	This option would meet best practice techniques adopted in Europe and Northern America and carried out using ESM.
Store and permanently isolate waste in silt/clay	R		×				✓	This option has merit. However, too much scientific uncertainty exists surrounding potential pathways that could lead to potential groundwater contamination. Based on the precautionary scientific principle, this option was not carried forward into the EIS.
Darwin (East Arm) Storage and Transfer Facility	R		×			✓	✓	This option was the proponents original option for temporary storage of waste materials and salt export. Due to further logistical studies, the proponent decided to centralise the storage and transfer facility to a location closer to the Chandler Facility. Whilst proposal logistics would improve over the long-term, relocating the storage and transfer facility meant a loss of local jobs and investment in the Darwin region.
Brewer Estate (Alice Springs) Storage and Transfer Facility	R		×			✓	✓	In January 2016, the proponent selected the Brewer Estate as the preferred regional location for a storage and transfer facility. Subject to further appraisal and value engineering studies completed, the proponent decided to look at another location and much closer to the proposed Chandler Facility. Whilst proposal logistics would improve over the long-term, relocating the storage and transfer facility

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								meant a loss of local jobs and investment in the Alice Springs region.
Apirnta Facility	S	✓		✓	✓	✓	✓	This option would provide long-term beneficial logistic effects, create long-term regional and local jobs and due to its remote location, would provide for the safe temporary storage of waste materials before being transported to the proposed Chandler Facility. In addition, the proposed Apirnta Facility would be a central point of receipt and temporary storage for both international and national wastes[4].
Australian network of remote storage and transfer facilities (using a contractual arrangement with a tier one logistics firm)	S	✓			✓	✓	✓	Using a tier one logistics firm to temporarily store and transport hazardous waste materials safeguards the transport of these waste types within the NT and interstate. A tier one logistics firm would be selected who operate and are proven transporters of hazardous wastes and dangerous goods under relevant Commonwealth legislation and Australian Codes of Practice. This approach should provide regulators within the NT and other jurisdictions that the proponent is aware of what measures need to be taken to safely transport hazardous and/or dangerous goods to its proposed facilities.

[4]*Approval for the acceptance of international wastes are being sought under international conventions which the Australian Government is a signatory to. Refer to Chapter 4 for more detail.*

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Transport of salt and waste materials by road only	R		×			✓	✓	During the risk assessments undertaken during the preparation of the EIS (refer to Chapter 6 for more information), this alternative option was ranked with an extreme risk even after management measures were considered. Consequently, it was removed as a viable alternative and no further consideration was given in the EIA process. This alternative option was not carried into the EIS for assessment.
Transport of salt and waste materials by rail only	R		×		✓			This alternative option, whilst a safer one than the road only option, would not achieve the logistic objectives for the transport of salt from the Chandler Facility to port or, waste materials from the Apirnta Facility to the Chandler Facility. This alternative option was not carried into the EIS for assessment.
Transport of salt and waste materials using a combination of road and rail haulage.	S	✓			✓	✓	✓	This alternative option would achieve the logistic objectives for the transport of salt and wastes between the proposed Apirnta and Chandler Facilities. For these reasons, it was the preferred alternative for Proposal logistics.
Rail siding location	S	✓				✓	✓	Potential beneficial effects associated with the rail siding may apply to local landowner on the Henbury Estate. These potential beneficial effects would be investigated during detailed design.
Salt processing (wet)	R		×				✓	This option would have an 11 hectare footprint. It would also require significant volumes of groundwater. Following the

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								results of tests undertaken on the halite (salt) from the Chandler Formation, the method of wet processing was not considered necessary. In addition, and to improve the Proposal's ecological sustainable footprint, this alternative option for salt processing was no longer considered viable.
Salt processing (dry)	S	✓					✓	Dry salt processing was the preferred alternative and it would avoid the loss of up to 11 hectares of local plant and fauna habitat as well as items considered culturally sensitive.
Hydraulic backfill	S	✓					✓	This alternative method of waste emplacement would make better use of void space in the excavated salt rooms. This method would also assist in the management of hazardous liquid wastes, both incoming and generated during operation. For example, contaminated surface waters collected in sediment traps from hardstand areas within the mine infrastructure area could be used within the hydraulic backfill process.
Darwin Port (salt export)	R		×			✓	✓	Proposal feasibility studies considered this alternative port site as economically unfeasible. The decision to not use Darwin Port may have resulted in a loss of local jobs and revenue for the NT Government.
Adelaide Port (salt export)	S	✓			✓		✓	Proposal feasibility studies considered this alternative port site as economically feasible. The decision to use a Port in

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								Adelaide may contribute to local jobs and revenue for the South Australian Government.
Maryvale Road access (construction only)	S	✓				✓	✓	This alternative option for site access is only a medium term access option. Owing to concerns the proponent has with respect to the structural integrity and safety of the (public) Maryvale Road, it would only utilise it during the construction of the Proposal. The use of the road would potentially bring business to the Maryvale Store which is considered a beneficial effect over the 4 year construction period.
Maryvale Road access (operation)	R		×					As stated above, this option, over the life of the 25 year mine, is not considered a viable option based on health and safety reasons.
Proposed Henbury Access Road (construction access)	R		×			✓	✓	This alternative option is considered to be a safer option that the Maryvale Road alternative because it is a private road. However, owing to economic constraints at this stage of the Proposal, the upgrade of the existing (private) Henbury access road is not yet feasible. This means a loss of potential local and regional jobs.
Proposed Henbury Access Road Option A (operation access)	R		×				✓	Owing to biodiversity and land use identified in desktop, field work and, during consultation with the Department of Environment, this alternative route for operational access was screened out of the EIA process.

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Proposed Henbury Access Road Option B (operation access)	R		×				✓	Owing to biodiversity, soils and land use constraints identified in desktop, field work and, during consultation with the Department of Environment, this alternative route for operational access was screened out of the EIA process.
Proposed Henbury Access Road Option C (operation access)	S	✓					✓	This alternative option for operational access was screened in to the EIA process because it represented the alternative with the least environmental impact to local and regional biodiversity and land use. The location of this existing access (dirt/gravel) road meant local plant communities would not be isolated as a result of constructing a new road. In addition, this access road would be a private road, it is a safer alternative option over the long-term bringing beneficial health and safety effects to local and regional workers.
Internal haul road from Chandler Facility to Apirnta Facility	S	✓					✓	An alternative option was considered which would have involved bisecting an area of open woodland consisting of mulga and supporting understorey plant communities. This option also would have involved construction through a significant sand dune system. Instead of bisecting pristine plant communities, the preferred alternative was to use an existing and disturbed property access track thus avoiding adverse biodiversity impacts.
Decline access to salt horizon	S	✓	×				✓	The decline alternative option considered to reach the salt formation was assessed

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								against environmental, social and economic criteria. It was the preferred alternative. This option would result in higher greenhouse gas emissions over the long-term compared with a shaft option. However, favourable proposal economics meant this option was the preferred option. Greenhouse gas emissions associated with this option are addressed in Section 19.3. In addition, the waste rock spoil generated from construction of the decline would be re-used in the construction of the Chandler Haul Road and eventually, for the Henbury Access Road.
Shaft access to salt horizon	R	✓	×				✓	Shaft access to the salt formation was considered. It would be marginally more expensive compared to the decline alternative. It would result in fewer greenhouse gas emissions and less waste rock spoil. However, having less waste rock spoil may have meant hauling spoil material over long distances to meet the demand required for internal, access and haul road construction.
Airstrip location	S	✓					✓	A range of options were considered for an airstrip. The final decision was to utilise an area of the proposed Chandler Haul Road. The proposed haul road would involve upgrading an existing property access (dirt/gravel) road. By doing this, land disturbance would be avoided which

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								results in a beneficial effect for the Proposal.
Fly in – fly out direct to Chandler Facility	R		×				✓	This alternative option was screened out of the EIA process because it would not contribute to the growth of local and regional communities.
Drive in – drive out to Chandler Facility	S	✓					✓	This alternative was considered appropriate during construction and operation of the Proposal. It would allow staff to return to their families after their shifts (e.g. 9 days on 5 off) were completed. It is proposed to bus staff to the Proposal site which would assist in reducing the long-term ecological footprint of the Proposal.
Accommodation (Alice Springs only)	R		×				✓	This alternative was not considered appropriate due to the requirement of needing staff on-site during operations, the distance is too far to consider daily drive in and out.
Accommodation (Chandler Facility)	S	✓					✓	This alternative was considered more appropriate because it would provide benefit to day and night shift workers.
Borrow pits	S	✓					✓	Existing borrow pits are located along the Maryvale Road. Where possible, these pits would be utilised in the early periods of construction to avoid further land take and disturbance. This is considered a beneficial effect for local plant and fauna populations.
Mine waste rock	S	✓					✓	During construction of the decline, mine waste rock would be brought to the surface

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								and stockpiled. The alternative option considered was to re-use this material in the construction of haul and access roads. This approach would avoid the requirement of hauling spoil long distances to be used in road construction. The geology of the Chandler includes a large section of clay material.
Groundwater bore field	S	✓					✓	Careful site selection that has been based on non-intrusive groundwater research (refer to Chapter 8 for more information) allowed the proponent to select a site that would provide raw water to both the proposed accommodation village and Chandler Facility. The same non-intrusive technique would be used to search for potential groundwater near the Apirnta Facility and along the proposed haul road and access road.

2.3.4 The comparison of short and long-term advantages and disadvantages of the alternatives

Table 2-10 provides a comparison of short and long-term advantages and disadvantages of alternative options considered for the Proposal. Comments provided in Table 2-9 against each alternative considered explain the nature of short or long-term effects and their advantages or disadvantages.

Table 2-7 Comparison of alternatives against short or long-term advantages and disadvantages

Alternative considered	Short-term	Long-term	Advantage	Disadvantage
Do nothing option		✓		×
Salt mine only option		✓		×
Store and permanently isolate waste only option		✓		×
Store and permanently isolate waste in salt mine		✓	✓	
Store and permanently isolate waste in silt/clay	✓			×
Darwin (East Arm) storage and transfer facility		✓		×
Brewer Estate (Alice Springs) storage and transfer facility		✓		×
Apirnta storage and transfer Facility		✓	✓	
Australian network of remote storage and transfer facilities (using a contractual arrangement with a tier one logistics firm)		✓	✓	
Transport of salt and waste materials by road only	✓			×
Transport of salt and waste materials by rail only	✓			×
Transport of salt and waste materials using a combination of road and rail haulage		✓	✓	
Rail siding location		✓	✓	
Salt processing (wet)		✓		×
Salt processing (dry)	✓	✓	✓	
Hydraulic backfill		✓	✓	
Darwin Port (salt export)		✓		×
Adelaide Port (salt export)		✓	✓	
Maryvale Road access (construction only)	✓		✓	
Maryvale Road access (operation)		✓		×
Proposed Henbury Access Road (construction access)	✓			×
Proposed Henbury Access Road Option A (operation access)		✓		×
Proposed Henbury Access Road Option B (operation access)		✓		×
Proposed Henbury Access Road Option C (operation access)		✓	✓	
Internal haul road from Chandler Facility to Apirnta Facility		✓	✓	
Decline access to salt horizon		✓	✓	×
Shaft access to salt horizon		✓	✓	×
Airstrip location		✓	✓	
Fly in – fly out direct to Chandler Facility		✓		×
Drive in – drive out to Chandler Facility		✓	✓	

Alternative considered	Short-term	Long-term	Advantage	Disadvantage
Accommodation (Alice Springs only)		✓		×
Accommodation (Chandler Facility)		✓	✓	
Borrow pits	✓		✓	
Mine waste rock		✓	✓	
Groundwater bore field		✓	✓	

2.4 Proposal benefits

The Proposal would result in positive environmental, social and economic benefits to the NT and Australia. These benefits include:

Proceeding with the Proposal would result in significant social and economic benefits in the NT and within Australia. The Proposal would:

- **Provide an innovative unique dual revenue business in remote Central Australia** -the business would commercialise an industrial bulk commodity (salt) and provides an equipment and archives storage business and a storage, recovery and permanent isolation business for hazardous waste generated in the NT and within Australia.
- **Diversify the economy.** - development of enabling environmental infrastructure which would assist in providing utility support services to other existing and new projects that generate waste as a result of the 'Developing the North' strategy.
- **Major investment in regional Australia** - the capital expenditure is estimated to be around A$676 million (nominal, including finance and contingency) for the Proposal. Around 67 % of all construction costs would be spent in Australia (36% spent in the NT).
- **Boost the economy over the 29-year project life** - on average, there would be spending of just under $81 million per annum to operate the Proposal. Of this, 64 % would be spent in Australia (a total of 52% would be spent in the NT). The site could be expanded for generations.
- **Royalties, taxes and levies** - over the 29-year term could support other parts of the NT and the Australian economy.
- **Create training and long term job opportunities** -
    - About 270 jobs during construction (720 jobs during peak build including in-directs).

Plate 2-1 Tellus has supported indigenous jobs during the development of the EIS and would continue to support indigenous employment through the construction, operation, and closure and rehabilitation of the Proposal.

    - About 150 to 180 full time equivalent workers would be employed during operation. Just over 5,400 full-time equivalent job years would be created over the life of the Proposal, an average of 217 full time equivalent job years per annum.
    - Jobs would be green, sustainable, and generally well paid covering technical (engineering, chemistry, science), commercial (sales, business) and operational skills.
    - Proposed jobs and training programs, such as:
        - Tellus' School to Jobs Program (Annual Schools Tour).
        - Tellus' Pre-employment Training Program (‘Getting Job Ready’) comprising Tellus' Traineeships Program, Tellus' Apprenticeships Program and Training Accreditation.
        - Indigenous Employment Program; comprising a 10 % indigenous employment target as well as other commitments that would benefit local indigenous people such as the sponsorship of sporting and academic programs in the nearby community of Titjikala (refer to Plate 2-1 and Plate 2-2).
        - Tellus' Employment Programs and Systems comprising a ‘Sisters in Mining’ Program; Tellus' Disabled Worker Program, Tellus’ Ranger Program and support for Social Enterprises that could generate more jobs.
- **Provide local business support and new business opportunities** - goods and services such as construction and operational materials, food, accommodation, etc. would be sourced from local business, where possible.
- **Fulfil the government’s own environmental and waste policy obligations under the following four main regulatory regimes** -
    - Environmental protection regulations (to minimise adverse impacts on the environment and human health and to meet national and international obligations);
        - Meeting NT and national obligations by providing critical infrastructure that can safely store, recover or permanently isolate difficult to manage wastes.
        - The NT EPA’s *Waste Management Strategy for the Northern Territory 2015-2022*, the NT Department of the Chief Minister *Framing the Future* and the Australian Government *National Waste Policy*.
        - Meeting international obligations under the Basel Convention (Regulation of Transboundary Movements) and Waigani Convention (Regulation of Exports and Imports) by providing critical infrastructure for our near-neighbors such as the Pacific Islands who do not have suitable infrastructure to manage such wastes. Australia currently exports waste mostly to Europe and Asia and imports small volumes of waste materials mostly from our near neighbors (Pacific Islands). The proponent is not planning on actively

marketing this service, but in the event of a man-made or natural disaster, the proposed Chandler Facility would be suitable.

  - Transport of dangerous goods regulations (to prevent accidents and promote safe transport, regulated by national legislation and codes).
  - Work health and safety regulations (hazardous chemical regulations that reduce occupational health and safety risk in the workplace).
  - Product stewardship regulations (the responsible management of products such as waste oil, asbestos, e-waste, tyres, batteries, mercury, medicines).

- **Support the circular economy** - by providing an opportunity for the future potential recovery of valuable materials (that are currently deemed waste). The Proposal could attract new salt and waste recycling and recovery industries to the NT.

Plate 2-2 Tellus would continue to support the local community through construction and operation of the Proposal

The Proposal reflects opportunities to develop the regional NT area not only as a mining area but also to diversify the economy by supporting innovative environmental utility businesses that can bring significant investment, increase trade, provide long-term jobs and provide enabling infrastructure services to the mining, oil and gas, manufacturing and agricultural industry.

The lack of hazardous waste disposal operations in the NT and Australia means there is a demand for a deep geological repository to manage such wastes in an environmentally sound way and supports the circular economy (refer to Figure 2-16).

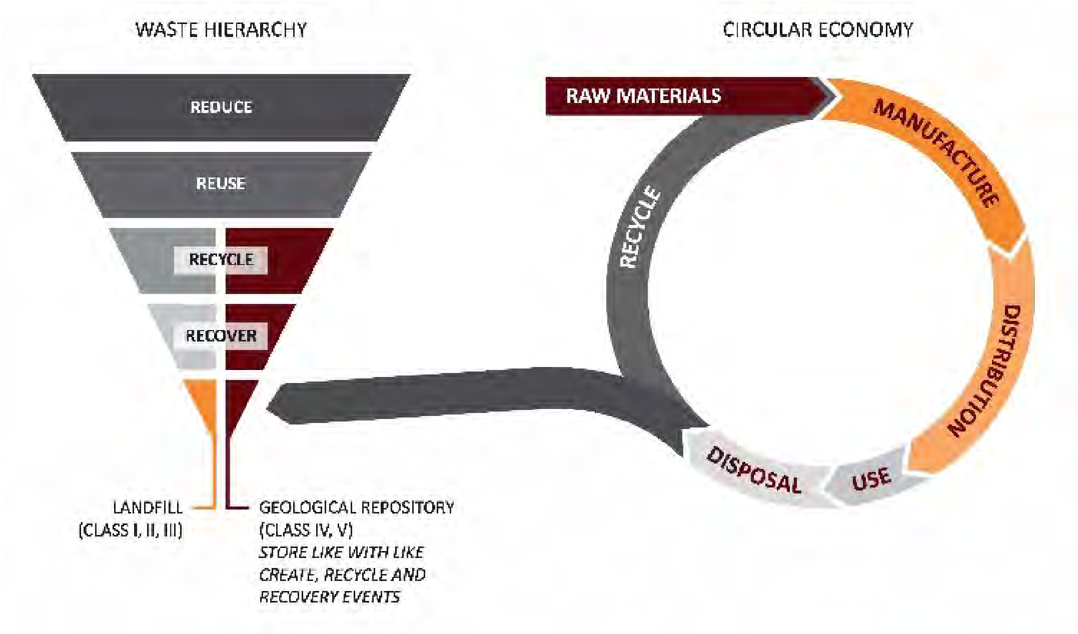

Figure 2-16 Proposal benefits associated with environmentally sound management