



# **BARKLY REGIONAL COUNCIL TENNANT CREEK WASTE MANAGEMENT FACILITY**

## **ENVIRONMENTAL MANAGEMENT PLAN**

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## 1 INTRODUCTION

### 1.1 BACKGROUND

Barkly Regional Council (BRC or Council) is located in the Northern Territory (NT) in central Australia, 1,000km south of Darwin and approximately 500km north of Alice Springs. The BRC area has a population of approximately 6,650 people and Tennant Creek is the principal town in the area with a population of approximately 3,000 people. The primary industries in Tennant Creek are mining and tourism.

Council operate several small-scale landfill facilities, with their largest landfill located in Tennant Creek. An Environmental Management Plan (EMP) for Tennant Creek Waste Management Facility has been prepared with the following considerations:

- The specific site operational requirements outlined in Environmental Protection License (EPL) 281 dated 1<sup>st</sup> of July 2019;
- Waste Management and Pollution Control Act 1998;
- Recommendations from a 2021 Master Plan and Waste Management Strategy prepared by GreenTec;
- Local community objectives to improve the environmental aspects of the community;
- Available funding; and
- Remoteness of location.

BRC have engaged GreenTec Consulting (GreenTec) to prepare an EMP for the Tennant Creek Waste Management Facility.

### 1.2 PURPOSE

The purpose of the EMP is to provide details for implementing a range of environmental aspects relating to landfilling and site operations at Tennant Creek Waste Management Facility. This EMP serves as an overarching document for the Leachate Management Plan (LMP), Emergency Response Management Plan (ERMP) and the Landfill Closure and Rehabilitation Plan (LCMP) for the site, prepared by GreenTec in 2021. Additionally, this EMP provides documentation of the proposed environmental management objectives and implementation strategies for the benefit of:

- BRC management and operational staff who will be responsible for the day-to-day management of the solid waste and landfill operations including its environmental performance;
- Any contractors and visitors to site who undertake tasks on behalf of the BRC;
- Local and state government regulators who need to confirm that practical strategies have been put in place for achieving environmental objectives;
- Consultants/contractors who undertake environmental monitoring, reporting or auditing; and
- To provide assurance to members of the public concerned with environmental aspects of site operations.

The aim of the Tennant Creek Waste Management Facility EMP is:

- To effectively manage environmental risks and to operate in accordance with current legislation, regulations and guidelines, in particular the *Waste Management and Pollution Control Act 1998*;
- To facilitate operational compliance with conditions of EPL 281, issued by the Northern Territory Environmental Protection Authority (NT EPA);
- To provide an EMP that is in accordance with the NT EPA Guideline for the Preparation of an Environmental Management Plan (2015);
- To ensure that operational procedures designed to protect human/environmental health are effectively implemented;
- To outline the effective management of waste materials, preventing unlicensed discharge

- of wastes to stormwater drains, watercourses, groundwater and land; and
- To minimise inconvenience to residents by controlling dust, odour and noise nuisance from landfill activities.

### 1.3 ENVIRONMENTAL PLAN STRUCTURE

A summary of the EMP structure is presented in **Table 1** below.

**TABLE 1 - ENVIRONMENTAL MANAGEMENT PLAN STRUCTURE**

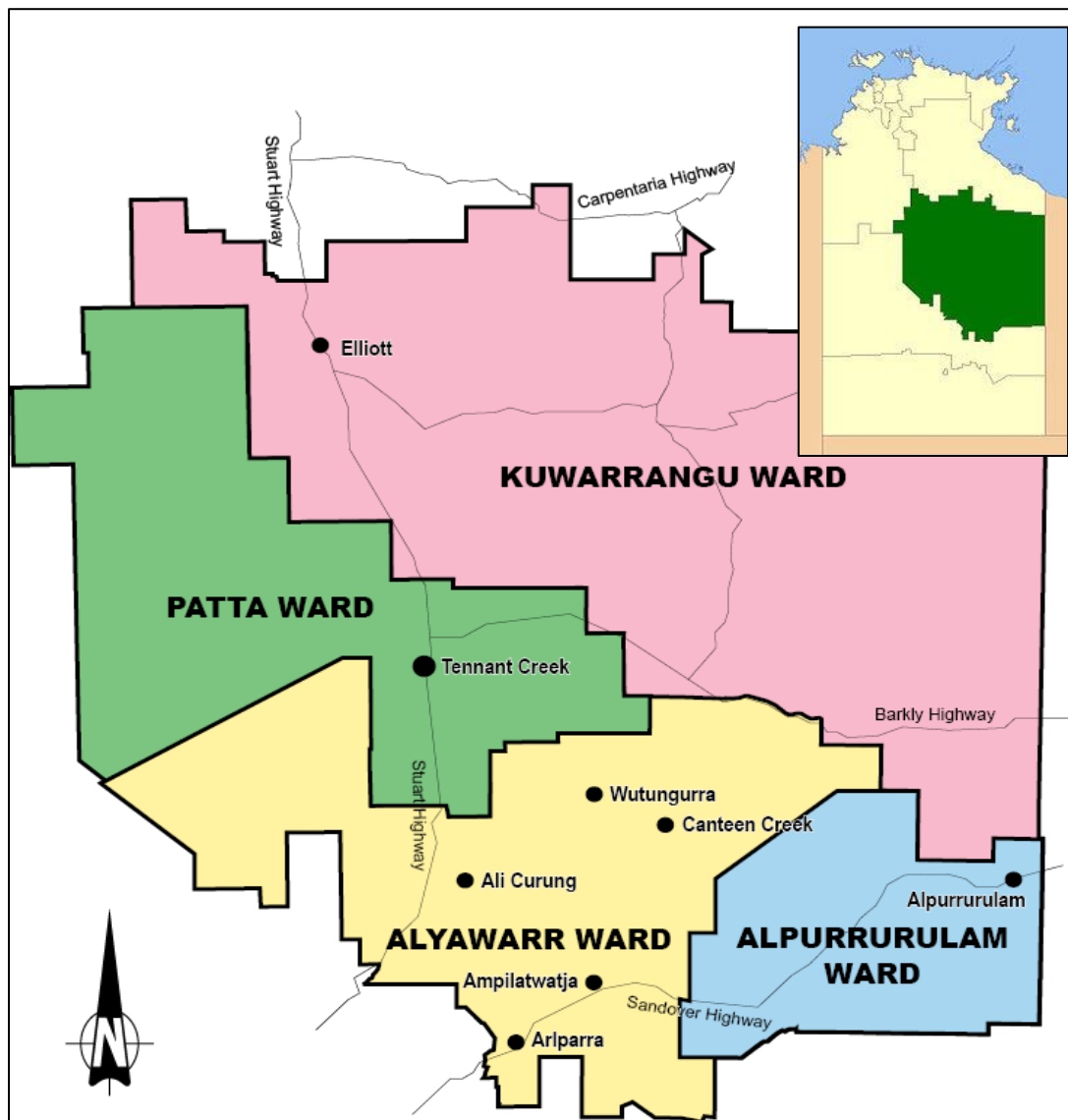
Section	Description
<b>Section 1</b>	Introduction
<b>Section 2</b>	Describes the site conditions, solid waste landfilling and other operations at Tennant Creek Waste Management Facility.
<b>Section 3</b>	Outlines the various environmental impacts associated with the landfilling operations and outlines relevant management strategies.
<b>Section 4</b>	Outlines the environmental monitoring considerations and environmental impacts outlined in Section 3.
<b>Section 5</b>	Describes the training and awareness required for staff.

## 2 SITE DESCRIPTION AND OPERATIONS

### 2.1 SITE LOCATION

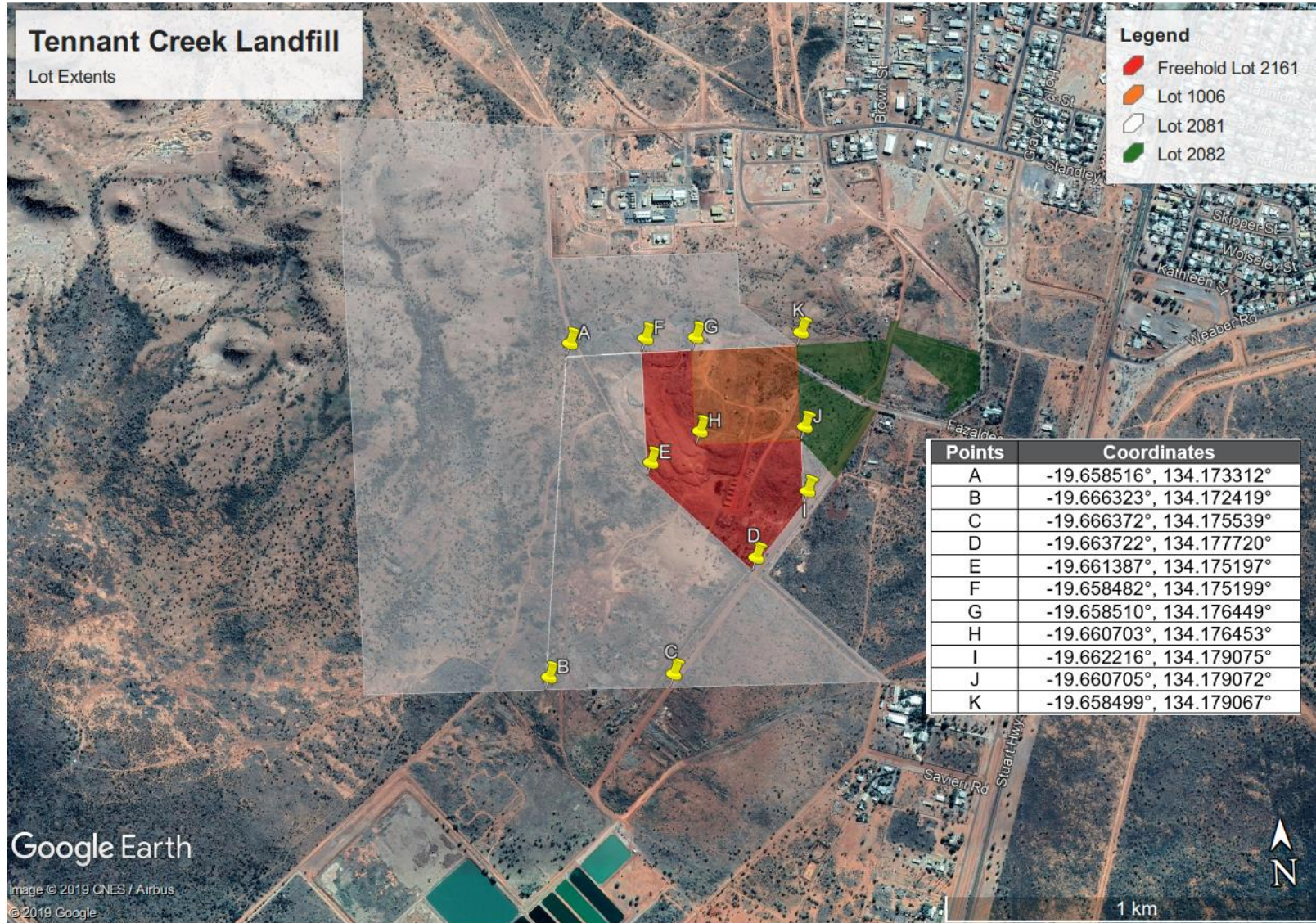
Tennant Creek Waste Management Facility is located predominately within Lot 1006 and Lot 2161, at 79 Fazaldeen Road. The landfill extends into Lot 2081 and partially into Lot 2082 (entry road). Lot 1006 is held under a Crown Lease in perpetuity to Barkly Regional Council. Approval for Council to continue operations on Lot 2161 has been acquired. Lots 2081 and 2082 are Vacant Crown Land. A map of the BRC area is provided in **Plate 1**, lot extents are shown in **Plate 2** and an aerial image of Tennant Creek WMF is provided in **Plate 3**.

**PLATE 1 - BARKLY REGIONAL COUNCIL**





**PLATE 2 - TENNANT CREEK WASTE MANAGEMENT FACILITY LOT EXTENTS**





**PLATE 3 - TENNANT CREEK WASTE MANAGEMENT FACILITY (GREENTEC, 2021)**



**2.2 RAINFALL AND CLIMATE**

Tennant Creek is located 376m above sea levels with climate considered to be arid in nature with evaporation exceeding rainfall. Temperatures in the summer range from average lows of ~24°C and average highs of 37°C with winter temperature averages ranging from 12°C to 28°C.

The average annual rainfall statistics for Tennant Creek (BoM - Station 015135) have been provided below in **Table 2**.

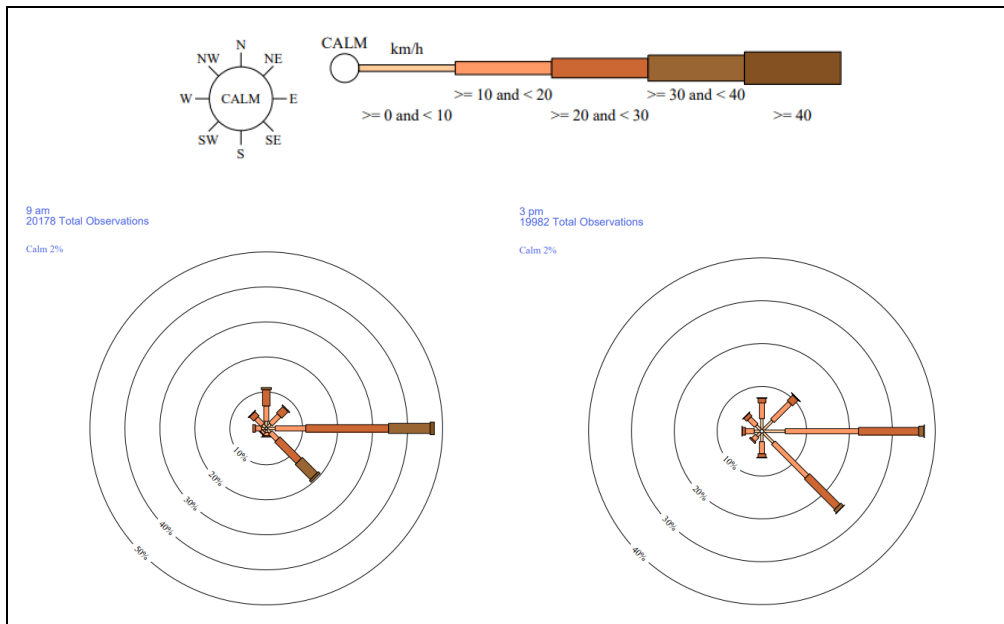
**TABLE 2 - MEAN RAINFALL AND EVAPORATION**

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	116	117	54	16	8	5	5	2	7	19	40	74	465
Evaporation (mm pan)	381	314	347	324	267	216	233	288	348	406	405	400	3,942
Difference (mm)	365	196	293	308	258	211	227	286	341	388	365	326	3,477
Ratio of Evaporation to Rainfall	3.3	2.7	6.4	20.5	32.5	40.8	45.6	125.3	47.0	21.8	10.1	5.4	8.5

The average pan evaporation statistics were calculated using the mean daily evaporation data for Tennant Creek (BoM – Station 015135) and multiplied by the corresponding number of days for that month (Non-Leap year). The average annual pan evaporation is over 8 times the average rainfall, with evaporation in winter months between 40 to 125 times higher than the respective monthly rainfall and approximately 3 to 5 times higher in summer months.

The Wind Rose data for Tennant Creek Airport shown in **Plate 4** indicate predominantly easterly winds in both the morning and the afternoon.

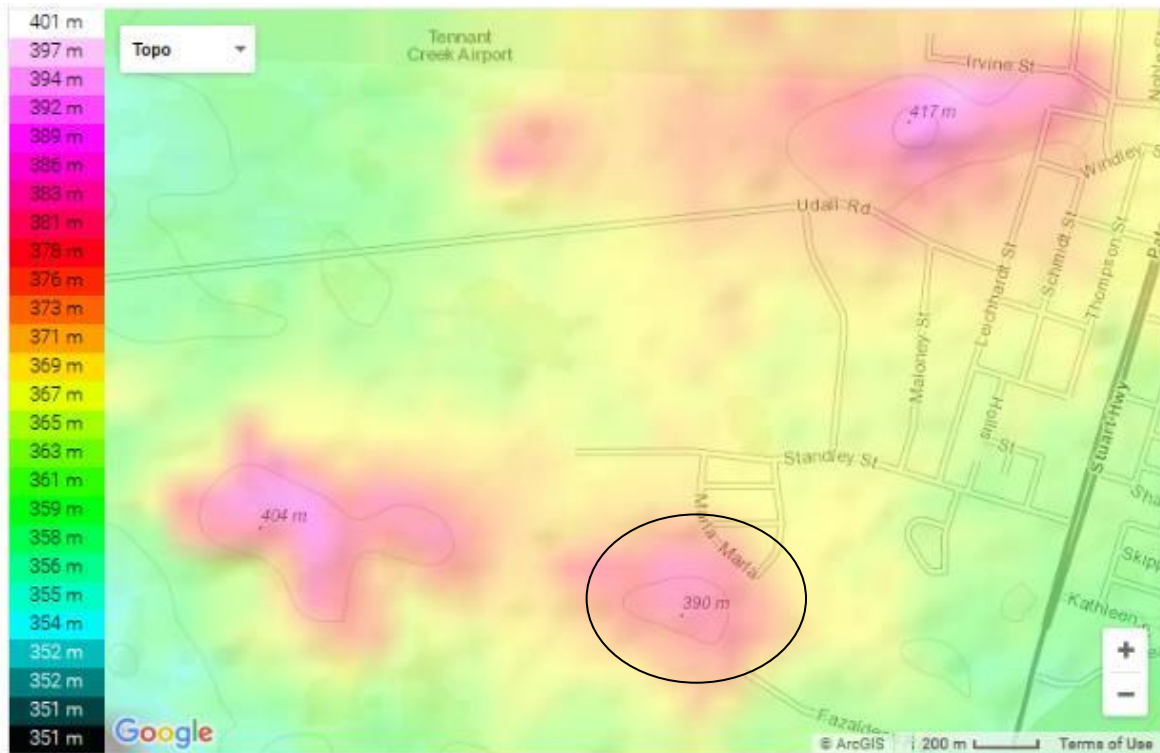
**PLATE 4 - WIND ROSE DATA FROM TENNANT CREEK AIRPORT**



### 2.3 SITE TOPOGRAPHY

The landfill site is saddled against a natural rise in the topography with this rise seen at peak height of RL 390m. The landfill site slopes from north to south east with the lowest point of the site at RL 365m. A topographical map is shown in **Plate 5**.

**PLATE 5 - TOPOGRAPHIC MAP**



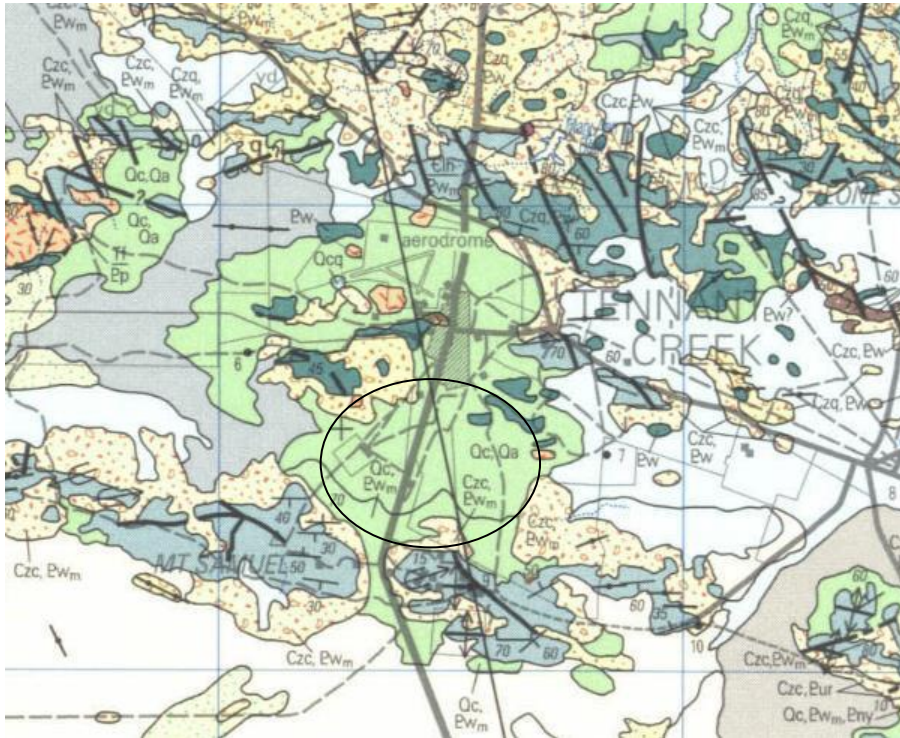
### 2.4 GEOLOGY

A 1:100,000 geological map was sourced from Geoscience Australia as shown below in **Plate 6** which indicates geology of Carraman Formation of the Early Proterozoic Warramunga Group. Site soils consist of a gravelly clay material near the surface tending to be more clay extending beneath the surface with this evident in the sediment dam and new landfill trench excavations.

On site excavations conducted by Council show uniform brown clayey soils overlaying the Carraman Formation which appears to have the capacity to effectively isolate the landfill area from deeper aquifers. The existing natural soil formation (clayey soils) is estimated to have an approximated permeability of  $10^{-6}$  to  $10^{-8}$  m/sec (Tennant Creek Town Council, 2006). If correct, soils excavated to create future waste cells and leachate containment ponds, are suitable for the construction of low permeability earthen waste cell liners and final capping.



**PLATE 6 - SITE GEOLOGY**



**2.5 SITE HYDROLOGY**

Groundwater hydrological conditions cannot be confirmed due to the absence of groundwater monitoring boreholes and associated data on site and in the local area. The following historical monitoring boreholes were checked in-field by Council staff in April 2021, with the aim to obtain groundwater level data (all bores were reported to be abandoned, decommissioned and/or unusable):

- RN013251;
- RN002099;
- RN016253; and
- RN001048.

Anecdotal evidence from a variety of sources and historical reporting in the Tennant Creek area indicates that the water table is at least 60 metres below ground level and that it is low yielding and of a quality unsuitable for domestic or agricultural use. Due to the groundwater conditions in the township area, the main water supply is sourced some distance south at the Kelly Well Borefields. It is also noted that the Tennant Creek WMF site is not located within the constraints imposed by a coastal estuarine or groundwater recharge area (*Hydrology of Australia, 1987*).

Groundwater in the wider regional area is deep and located beneath indurated Warramunga sediments, which are anticipated to be highly impervious, meaning groundwater contamination from landfilling is unlikely. Additionally, the aquifer which the town's main water supply is approximately 20km south, meaning landfilling activities are very unlikely to impact this specific aquifer. Furthermore, the installation of groundwater monitoring bores to depths between 60m – 100m on site is economically unfeasible based on discussions with Council.

It has been previously established in the 2006 EMP that the deep groundwater table, coupled with the low permeability soils encountered at the site, makes groundwater contamination “not likely to be a significant concern” (Tennant Creek Town Council).

## 2.6 SITE BOUNDARIES

GreenTec undertook a test pit investigation in March 2021 which determined the approximate depths and extents of landfilling which has occurred outside the boundary of Lot 2161 and into Lot 2081. No remediation works have been undertaken on the waste located outside the boundaries.

It was previously recommended for Council to liaise with NT EPA to discuss possible solutions. It is understood that approval is being sought from the Central Land Council (CLC) to acquire approximately 25 hectares of land within the adjacent Lot 2081 for landfilling activities which would include this area. It is anticipated that landfilling would not extend any further into this adjacent Lot, but this area would be used for excavation of cover and capping soils and potential for future resource recovery operations.

## 2.7 FLORA AND FAUNA

As described previously, both Lots 1006 and 2161 have been used historically for disposal of domestic, commercial and industry waste for many decades.

Despite historic use, native flora had re-established across most of the area, including the capped and stabilised parts of the landfill form. From anecdotal information and observations on the site native fauna consists of various bird species, including Hawks, and reptiles indigenous to the area, including snakes and lizards. Kangaroos and wallabies have also been observed from time to time.

No negative environmental impact from landfill activities have been observed on the wider flora and fauna so far, and future management endeavours to keep the impact negligible in the future.

## 2.8 CULTURAL HERITAGE

Tennant Creek is located within the culturally rich Barkly area, which for thousands of years has been the home of nine distinct Aboriginal groups, each with their own cultural heritage and language (Tourism NT). The Warumungu Aboriginal Land Trust is the predominate indigenous landholder surrounding the Tennant Creek township (NT Government, 2021).

Tennant Creek Waste Management Facility resides predominately within Lot 1006 and Lot 2161, however, waste is located in adjacent property lots 2081 and 2082. Lot 1006 is under a Town Planning Zone designated for Community Purpose (NT Government, 2004). In September 2007, a federal court case recognised native title rights to Lot 2081 and agreed Lots 2082 and 2161 are extinguished of any native title due to their smaller lot size and location within the township (FCA, 2007). Tennant Creek was the first town in Australia to have a native title determination by consent rather than litigation. Benefits for approximately 200 Warumungu native title holders were established (CLC, n.d.).

Native title rights and interests are defined to allow Aboriginal peoples access to traditional laws and customs observed in connection with the land or waters. The Patta Warumungu people claim historical connection to the area with earliest evidence of the Aboriginal occupants predating sovereignty, that is, prior to 1824. Laws and customs of the indigenous Patta Warumungu people require the use of the area for dreaming tracks, ceremonial life, social organisation, systems of land tenure, acquisition of rights, punishment, and permission to enter country. The area is also used to collect food, Spinifex wax and ochre (FCA, 2007).

## 2.9 LANDFILL ACCEPTANCE CRITERIA

The Tennant Creek WMF is currently operating under NT EPA Environmental Protection Licence EPL 281 for the following activities:

- a) *“Operating premises for the disposal of waste by burial that service, or are designed to service, the waste disposal requirements of more than 1,000 persons.”*



- b) “Collecting, transporting, storing, re-cycling, treating or disposing of a listed waste (as per Table 1) on a commercial or fee for service basis, other than in or for the purpose of a sewerage treatment plant.”
- c) “Operating premises, other than a sewerage treatment plant, associated with collecting, transporting, storing, recycling, treating or disposing of a listed waste (as per Table 1) on a commercial or fee for services basis.”

The landfill is defined as Municipal Solid Waste Landfill and accepts a range of waste materials from the local domestic and commercial sectors.

## 2.10 CURRENT SITE OPERATION

Domestic waste is delivered to the facility and any potentially hazardous materials are removed. **Table 3** outlines the authorised wastes to be handled at Tennant Creek WMF.

**TABLE 3 - AUTHORISED WASTES**

Listed Waste	Collection	Transport	Storage	Treatment	Recycling	Disposal
Acidic solutions or acids in solid form	✓	✓	✓	×	×	×
Lead or lead compounds	✓	✓	✓	×	×	×
Tyres	✓	✓	✓	×	×	✓
Waste mixtures, or waste emulsions, of oil and water or hydrocarbon and water	✓	✓	✓	×	×	×

The site accepts domestic waste, small amounts of commercial waste and limited regulated waste. Asbestos is not accepted at the facility.

Cover material is sourced from landfill excavations or earthmoving contractors. Some cover material has also been sourced from excavations from Lot 2081. The quality of the cover material is assessed at the gate, where a decision is made to accept or reject the material. Types of material received and how they are managed on site is discussed in the Waste Management Strategy (GreenTec, 2021). This Waste Management Strategy outlines waste diversion and potential resource recovery operations.

## 2.11 HOURS OF OPERATION

Solid waste landfilling operations at Tennant Creek are conducted between the hours listed in **Table 4**.

**TABLE 4 - TENNANT CREEK WMF OPERATING HOURS**

Days	Hours
Monday to Saturday	8:00am to 5:00pm
Sunday	8:00am to 12:00pm (Noon)

## 2.12 APPROVALS

Tennant Creek WMF operates under the NT EPA license EPL 281 issued on the 1<sup>st</sup> of July 2019. The licensed activity is as follows:

- “Operating **premises** for the disposal of **waste** by burial that service, or are designed to

service, the **waste** disposal requirements of more than 1000 persons.

- Collecting, transporting, storing, re-cycling, treating or disposing of a **listed waste** (as per Table 1) on a commercial or fee for service basis, other than in or for the purpose of a sewage treatment plant.
- Operating **premises**, other than a sewage treatment plant, associated with collecting, transporting, storing, re-cycling, treating or disposing of a **listed waste** (as per Table 1) on a commercial or fee for service basis”.

### 2.13 COMPLAINTS

All environmental harm complaints from operations at the facility must be handled through the waste centre and be recorded into the complaints register. All received complaints must provide the following information:

- Date and time of complaint;
- Complaint method;
- Reason for complaint;
- Complainer information; and
- Subsequent actions or non- actions taken with included response information to the received complaint.

It is understood that all external complaints are handled through Council’s complaints process and are logged electronically.

### 2.14 RELEVANT DOCUMENTS

A number of specialised management plans have been prepared for Tennant Creek WMF which are applicable to landfilling and disposal operations and should be read in conjunction with this document. These management plans are:

- Waste Management and Pollution Control Act (NT Government, 1998);
- Tennant Creek Master Plan (GreenTec, 2021);
- Waste Management Strategy (GreenTec, 2021);
- Leachate Management Plan (GreenTec, 2021);
- Emergency Response Management Plan (GreenTec, 2021);
- Landfill Closure Management Plan (GreenTec, 2021); and
- Environmental Protection License 281 (NT EPA, 2019).

**2.15 ROLES AND RESPONSIBILITIES**

**Table 5** outlines the various roles and their responsibilities relating to onsite operations.

**TABLE 5 - ROLES AND RESPONSIBILITIES**

Role	Responsibilities
Site Supervisor	<ul style="list-style-type: none"> <li>• Ensure employees and contractors understand their obligations under the EMP;</li> <li>• Monitoring compliance with the EMP;</li> <li>• Maintenance and inspections;</li> <li>• Report any non-compliances with the license conditions to the NT EPA as soon as practicable after becoming aware (and in any case within 24 hours); and</li> <li>• Ensure that all the on-site safeguards and controls are in place.</li> </ul>
Director of Infrastructure	<ul style="list-style-type: none"> <li>• Oversee implementation, on-going management and coordinate any future reviews of the EMP.</li> </ul>
All landfill staff and contractors	<ul style="list-style-type: none"> <li>• Understand and comply with the requirements of the EMP;</li> <li>• All personnel to undergo inductions;</li> <li>• Be aware of emergency procedures and responses;</li> <li>• Report any potential environmental breaches to manager / supervisor.</li> </ul>

### **3 ENVIRONMENTAL RISK ASSESSMENT**

An environmental risk assessment using the source, receptor and pathway model has been developed to address specific environmental risks relevant to Tennant Creek Waste Management Facility.

#### **3.1 SOURCE**

A source is the origin of an environmental risk which can lead to contamination or environmental harm. Sources of environmental impact at Tennant Creek WMF include:

- Leachate;
- Landfill gas (LFG) and odour;
- Landfill fire or site fire;
- Dust;
- Litter;
- Vermin;
- Invasive flora species; and
- Noise.

#### **3.2 PATHWAY**

A pathway is the route by which potential environmental harm or contamination can travel. Key pathways for potential environmental harm at Tennant Creek WMF include:

- Surface flow (runoff);
- Subsurface flow (underlying soils, aquifers or subsurface infrastructure that allow for contaminants to enter receptors); and
- Airborne (dust, odour and landfill gas).

#### **3.3 RECEPTOR**

The receptor is the location where the environmental harm or impact is registered, this can be onsite and offsite. Possible receptors of environmental harm from Tennant Creek WMF include:

- Groundwater;
- Surface water;
- Surrounding infrastructure;
- Surrounding land users;
- Vegetation and flora; and
- Fauna.

#### **3.4 RISK MATRIX**

Environmental risks are assessed using a risk matrix, which evaluates the likelihood and consequence of a specific risk to attain an associated level of risk.

##### **3.4.1 Likelihood**

The likelihood of a risk is probabilistic, based on the following classifications (from 1 – 5):

1. Rare – Only occurs in exceptional circumstances.
2. Unlikely – Will probably not occur in most circumstances;
3. Possible – Could occur in some circumstances;
4. Likely – Will probably occur in most circumstances; and
5. Almost certain – Expected to occur in most circumstances.

##### **3.4.2 Consequences**

Consequences from an identified environmental risk are classified as follows (from A – E):

A: Negligible

- Minimal onsite impact.

B: Minor

- Low onsite impact, minimal localised offsite impact and no larger scale offsite impact.

C: Moderate

- Mid level onsite impact, low level localised offsite impact and minimal larger scale offsite impact.

D: Major

- High level onsite impact, mid level localised offsite impact or low level larger scale offsite impact or short term impact to an area of high conservation value or special significance.

E: Severe

- Catastrophic onsite impact, high level (or above) localised impact, mid level (or above) larger scale offsite impact or mid to long term or permanent impact to an area of high conservation value or special significance.

### 3.4.3 Risk Rating

The level of risk is qualitatively assessed based on the combination of likelihood and consequence, as shown in Table 6 below.

**TABLE 6 - RISK CALCULATOR**

Likelihood	Consequence				
	Negligible (A)	Minor (B)	Medium (C)	Major (D)	Severe (E)
Almost Certain (5)	M (5A)	H (5B)	H (5C)	V (5D)	V (5E)
Likely (4)	M (4A)	M (4B)	H (4C)	H (4D)	V (4E)
Possible (3)	L (3A)	M (3B)	M (3C)	H (3D)	V (3E)
Unlikely (2)	L (2A)	M (2B)	M (2C)	M (2D)	H (2E)
Rare (1)	L (1A)	L (1B)	M (1C)	M (1D)	H (1E)

V = Very high risk - Immediate action required with a full analysis;

H = High Risk - Management required from senior staff, implement high level controls;

M = Medium risk - Plan and schedule appropriate controls;

L = Low risk - Manage with standard operating procedures or as deemed appropriate by relevant authorities.

### 3.4.4 Risk Assessment

An environmental risk assessment that incorporates site specific control measures to reduce the level of risk is provided in **Table 7** below. This assessment will enable supervisors to assess the environmental risks associated with Tennant Creek WMF and establish timeframes for the implementation of specific controls. Additional information on emergency response is outlined in the Emergency Response Management Plan prepared by GreenTec (2021).



**TABLE 7 - RISK ASSESSMENT**

Source	Receptor	Pathway	Pathway Description	Risk Description	Risk Level	Control Measures and Justification	Risk Level
Leachate	Site personnel and users	Air	Volatilised leachate becoming airborne.	Odour, nuisance.	Medium (4A)	Cover waste with daily cover or intermediate cover and undertake progressive final capping, as specified in the LCMP.	Low (2A)
	Local residents	Subsurface	Migration of leachate through groundwater and bore extraction.	Contamination of fresh water aquifers that is used by the community.	High (3D)	Groundwater is very deep (>60m) and the landfill is underlain by a low permeability soil. Groundwater in the area is not suitable for agriculture or domestic use. Evaporation on site far exceeds rainfall.	Medium (1D)
	Surface water bodies (creeks, ponds, dams)	Surface	Leachate impacted surface water runoff.	Contaminated stormwater runoff impacting surrounding ecology.	Low (2A)	Maintain a small operational tip face (maximum 20m x 5m). Cover waste with daily or intermediate cover as appropriate. Ensure no leachate is discharged offsite and maintain clean water diversion drains.	Low (1A)
		Subsurface	Migration of leachate within groundwater.	Direct or indirect consumption of leachate. Adverse impacts to ecosystems.	Low (2A)	Due to the large attenuation zone between the landfill and groundwater it is unlikely that leachate will impact the groundwater.	Low (2A)
	Flora and Fauna	Surface	Leachate impacted surface water runoff.	Contaminated stormwater runoff impacting surrounding ecology.	Low (2A)	Maintain a small operational tip face (maximum 20m x 5m). Cover waste with daily or intermediate cover as appropriate. Ensure no leachate is discharged offsite and maintain clean water diversion drains.	Low (1A)
		Subsurface	Migration of leachate within groundwater.	Potential impacts to deep rooted flora.	Low (1B)	Minimal deep rooted flora surrounding site. High evaporation rates make it unlikely for surrounding flora to take in leachate impacted water.	Low (1B)

Source	Receptor	Pathway	Pathway Description	Risk Description	Risk Level	Control Measures and Justification	Risk Level
LFG (explosive and asphyxiant gases)	Site personnel and users	Air	Direct LFG venting to atmosphere	Asphyxiation or explosion caused by LFG.	Low (1B)	Landfill gas causing explosions or asphyxiation is considered rare. Conditions on site are very dry, meaning decomposition of waste occurs at a very slow rate.	Low (1B)
LFG (odour)	Site personnel and users	Air	Direct LFG venting to atmosphere	Nuisance, odour.	Medium (4A)	Odour is likely present. Covering and capping of the waste whilst limiting the active tip face can reduce the odour detected at the landfills surface.	Low (3A)
Dust	Local residents and site personnel / users	Air	Airborne dust from earthworks or trafficking	Nuisance, potential health impacts	Low (3A)	Wet down access roads when large traffic is expected. Dust produced onsite is considered insignificant when compared to normal vehicle movements on unsealed roads surrounding the community.	Low (2A)
Litter	Local residents	Air	Litter blown in the wind	Mainly visual impacts and potential for fauna to ingest	Low (1A)	Windborne litter is unlikely to reach the township. Maintain daily and intermediate cover to prevent waste becoming airborne. Regularly tend to litter scattered across site. Fencing can be used if necessary.	Low (1A)
	Flora and Fauna				Medium (4A)	Maintain daily and intermediate cover to prevent litter impacting flora and fauna. Regularly tend to litter scattered across site. Fencing can be used if necessary.	Low (3A)
	Surface water bodies				Low (1A)	No nearby surface water bodies. Maintain daily and intermediate cover to prevent waste becoming airborne. Regularly tend to litter scattered across site. Fencing can be used if necessary.	Low (1A)

Source	Receptor	Pathway	Pathway Description	Risk Description	Risk Level	Control Measures and Justification	Risk Level
Invasive flora species	Flora and fauna	Air, surface water runoff, animals	Seeds present in the waste received can spread to the surrounding environment via wind, surface water or animals.	Spread of invasive flora species can impact ecosystems.	Medium (3C)	Maintain adequate cover. Undertake progressive capping.	Low (1B)
Landfill fire	Site users and workers	Air, direct contact	Smoke containing toxic compounds, possible ingestion or inhalation of ash.	Dangerous emissions from the burning of waste (including sulphur dioxide, lead, mercury) can cause serious immediate and/or long-term health problems.	High (3D)	Fire controls outlined in the ERMP to be implemented.	Medium (2D)
	Local residents				Medium (2D)	Closest residential property is 300m from the landfill. Fire controls outlined in the ERMP to be implemented.	Medium (2C)
	Fauna				High (3D)	Fire controls outlined in the ERMP to be implemented.	Medium (2D)
Exposed waste and ponded water	Local residents	Airborne disease – flies and mosquitoes	Exposed waste and ponded water can become a breeding ground for diseases	Flies and mosquitoes in contact with exposed waste or ponded water can	Medium (2D)	Limit active tip face. Maintain adequate cover. Undertake progressive capping. Ensure adequate drainage around site.	Low (1B)

Source	Receptor	Pathway	Pathway Description	Risk Description	Risk Level	Control Measures and Justification	Risk Level
			which can impact the community.	spread disease to the community .			
	Flora and fauna	Vermin and invasive fauna	Exposed waste becoming a food source for vermin or fauna.	Waste becoming a food source or invasive fauna and vermin leading to elevated population levels.	Medium (2D)	Limit active tip face. Maintain adequate cover. Undertake progressive capping.	Medium (2D)

## **4 RECOMMENDED ENVIRONMENTAL MANAGEMENT**

### **4.1 GENERAL CONTROLS**

#### **4.1.1 Inductions**

All staff and contractors entering the Tennant Creek Waste Management Facility, excluding the general public, should be inducted on arrival to site. The induction should cover the following items as a minimum:

- Site layout;
- Administrative procedures;
- Access and exits;
- Emergency procedures;
- Bushfire Management Plan;
- Environmental protocols; and
- Evacuation procedures.

In addition to the general items above, if required, all inductees should be informed of any specific daily items, events or notices. Additional information on emergency procedures is provided in the Emergency Response Management Plan prepared by GreenTec (2021).

#### **4.1.2 Site Security & Signage**

The site should maintain adequate fencing to restrict unauthorised access to maximise safety, protect people and to prevent illegal dumping. As a minimum, all landfill trenches should be fenced, and it is recommended that there is also perimeter fencing to all areas of the site. It is noted that locals often travel through the landfill on foot which could pose a significantly health and safety threat, particularly if a trench is left open. Perimeter fencing is strongly recommended to deter locals from walking through the landfill site.

Site signage is written in English and is clear to follow. Directions to the drop off locations are provided, and each waste bay is clearly shown. Speed limits are also posted around the site. One potential avenue to explore would be erected signs written in the local Indigenous languages.

### **4.2 PEST, VERMIN AND VECTOR CONTROL**

Pests, vermin and noxious weeds are controlled via the following action during operations:

- Waste is compacted by tracking with a 20 tonne vehicle and covered with soil on a daily basis;
- A pesticide spray is to be used to control outbreaks of flies;
- Monthly inspections by the site supervisor shall be undertaken to identify any noxious weeds and arrange for their spraying; and
- Weekly inspections of sewers, culverts and drains by the site supervisor to identify excessive rodent investigation and arrange for treatment as required.

Intermediate and final covers shall be implemented as per the Landfill Closure Management Plan prepared by GreenTec (2021) to limit pests and vermin. Post closure inspections will be required to identify the presence of noxious weeds and to spray accordingly.

### **4.3 COVERING OF WASTE**

The active filling area of the landfill should be restricted to an area that is able to be covered with at least 150mm of cover soil at the end of each day. It is understood that this soil is currently sourced



from external contractors and undergoes visual inspection at the gate to confirm suitability. Approval is being sought to continue sourcing cover material from the adjacent Lot 2081.

Where areas of the landfill are not to be worked on within a 3 month timeframe intermediate cover soil (300mm) shall be applied.

Where an area of the landfill has reached the final landform height as specified in the filling plan, a final cap is recommended, the details of which are discussed in the Landfill Closure Management Plan (LCMP) for Tennant Creek Waste Management Facility (GreenTec, 2021).

Effective covering of the waste reduces leachate generation, minimises odours, lowers the risk of clean water contamination, prevents windborne litter and limits the exposure of waste to fauna.

#### 4.4 STORMWATER MANAGEMENT

##### 4.4.1 Context

Stormwater management aspects include the following environmental receptors:

- Protecting assets;
- Adopting appropriate practices;
- Reducing maintenance costs;
- Supply effective drainage infrastructure to accommodate worst case flow conditions; and
- Enhanced sediment and erosion control techniques to protect the environment.

##### 4.4.2 Management Plan

A basic Stormwater Management Plan for the Tennant Creek WMF is outlined in **Table 8**.

**TABLE 8 - STORMWATER MANAGEMENT PLAN**

Objective -Stormwater Management	
Water quality discharging site will not cause an impact on the downstream environment.	
Implementation Strategy	<p>Clean water shall be diverted from the landfill areas using diversion drains or bunds.</p> <p>Appropriately sized drainage infrastructure shall be in place to effectively drain, divert or transfer water including, if required including providing seasonal overland flow diversion bunds.</p> <p>Appropriate sediment and erosion control measures shall be regularly implemented to all exposed surfaces or the surfaces to be maintained, these measures may include silt fencing, straw bales, etc. as required.</p> <p>Maintenance and clean out of sediment dams and drains shall be undertaken on a regular basis.</p>
Monitoring	A minimum of monthly routine inspections of stormwater infrastructure shall be undertaken, as well as after any significant rainfall event. Any noteworthy concerns or incidents must be reported to the site supervisor.
Reporting	Site supervisor must report incidents. The site supervisor shall keep an electronic copy of all incidents or noteworthy concerns which includes information about investigations and remedial actions implemented.
Remedial action	<p>Undertake investigation and complete corrective actions as required. Remedial actions include:</p> <ul style="list-style-type: none"> <li>• Regrading soil to promote flow of surface water away from the working face</li> </ul>

	<p>to avoid contact with waste mass;</p> <ul style="list-style-type: none"> <li>• Place and compact waste such that any water impacted by leachate is collected within the landfill;</li> <li>• Fill in erosion channels and regrade perimeter of landfill batters if waste is exposed; and</li> <li>• Maintain the diversion drain around the landfill to minimize the volume of clean water entering the landfilling area.</li> </ul>
Plan	All of the above actions shall be contained in a written plan for the site with an official document number that has been discussed and agreed with operations staff. The plan shall extend out at least 3 years with planned start dates and people recorded as being responsible for ensuring the work is completed.

## 4.5 SEDIMENT AND EROSION CONTROL

### 4.5.1 Context

Effective implementation of sediment and erosion control measures for the solid waste landfills will lead to compliance with the conditions outlined in **Section 5.2**.

### 4.5.2 Management plan

A basic Sediment and Erosion Control Plan for the Tennant Creek WMF is outlined in **Table 9**.

**TABLE 9 - SEDIMENT AND EROSION CONTROL PLAN**

<p><b>Objective - Sediment and Erosion Control</b></p> <p>Sediment generation shall be minimised through effective implementation of sediment and erosion control measures.</p>	
Implementation Strategy	Clean water shall be diverted from the landfill areas using diversion drains or bunds. Water from disturbed surfaces shall flow through sediment and erosion control devices before discharging off site, this can include silt fences, straw bales, etc. as required.
Monitoring	A minimum of monthly routine inspections of stormwater infrastructure shall be undertaken, as well as after any significant rainfall event. Any noteworthy concerns or incidents must be reported to the site supervisor.
Reporting	Site supervisor to report incidents. The site supervisor shall keep an electronic copy of all incidents or noteworthy concerns which includes information about investigations and remedial actions implemented.
Remedial action	<p>Where breaches of sediment control measures occur, an investigation shall be undertaken to determine the actions required to remediate.</p> <p>Remedial actions include:</p> <ul style="list-style-type: none"> <li>• Regrading soil to promote flow of surface water away from the working face to avoid contact with waste mass;</li> <li>• Place and compact waste such that any water impacted by leachate is collected within the landfill;</li> <li>• Fill in erosion channels and regrade perimeter of landfill batters if waste is exposed; and</li> <li>• Maintain the diversion drain around the landfill to minimize the volume of clean water entering the landfilling area.</li> </ul>

Plan	All of the above actions shall be contained in a written plan for the site with an official document number that has been discussed and agreed with operations staff. The plan shall extend out at least 3 years with planned start dates and people recorded as being responsible for ensuring the work is completed.
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## 4.6 AIR QUALITY

### 4.6.1 Context

Solid waste landfilling operations can cause dust to be generated during excavation, placement and delivery of materials to the landfills. These airborne particles can cause visibility issues with the potential to extend past site boundaries. Onsite operations may cause odour during solid waste landfilling. Air quality requires careful monitoring and planned procedures to be in place in the event of a fire onsite.

### 4.6.2 Management plan

An air quality management plan for the Tennant Creek WMF is outlined in **Table 10**.

**TABLE 10 - AIR QUALITY MANAGEMENT PLAN**

Objective – Air Quality	
Airborne dust and odour particles shall be minimised as far as possible.	
Implementation Strategy	<p>Vehicle speed limits to be limited to reduce dust. Additional dust suppression techniques, such as wetting of main haul roads shall be considered if airborne dust becomes problematic.</p> <p>BRC must not cause or permit general waste to be burnt on site, as part of EPL 281 condition 27.</p> <p>Ensure that there is a plan in place including the possibility of utilising local public fire protection infrastructure or devices to deal with a fire should one occur.</p> <p>Waste material to be covered as soon as practical to reduce the incidence of odour.</p>
Monitoring	<p>Visual observation of excessive dust shall be reported to the site supervisor.</p> <p>Monthly checks on all equipment shall be undertaken. The outcome of the equipment checks shall be documented electronically and updated each month. Any noticeable equipment faults or irregularities shall be reported to the site supervisor.</p>
Reporting	<p>Site supervisor to report complaints. The site supervisor shall keep an electronic copy of all complaints or noteworthy concerns which includes information about investigations and remedial actions implemented. All complaints related to air quality shall be recorded and followed up once corrective procedures are in place.</p>
Remedial action	<p>Excessive visible airborne dust or odour emissions shall be investigated, and remedial actions undertaken to reduce emissions. Revisit control measures outlined in Section 3.4.4 (Risk Assessment).</p>
Plan	<p>All of the above actions shall be contained in a written plan for the site with an official document number that has been discussed and agreed with operations staff. The plan shall extend out at least 3 years with planned start dates and people recorded as being responsible for ensuring the work is completed.</p>

## 4.7 NOISE

### 4.7.1 Context

Solid waste landfilling operations can cause noise with the use of earthmoving machinery and disposal vehicles. Appropriate controls need to be put in place to management the effect of noise outside the landfill site boundary.

### 4.7.2 Management Plan

A noise management plan for the Tennant Creek WMF is outlined in **Table 11**.

**TABLE 11 - NOISE MANAGEMENT PLAN**

<b>Objective – Noise</b>	
To reduce the impact on sensitive receptors.	
Implementation Strategy	Earthmoving activities to be conducted during the day between 8am - 5pm only. All machinery shall be well maintained and regularly serviced in accordance with manufactures guidelines with all machinery equipped with mufflers. The external site boundaries should be screened with vegetation to reduce noise.
Monitoring	Monthly checks on all equipment shall be undertaken. The outcome of the equipment checks shall be documented electronically and updated each month. Any noticeable equipment faults or irregularities shall be reported to the site supervisor.
Reporting	Site supervisor to report noise complaints.
Remedial action	Excessive noise complaints to be investigated and action taken to fix issues. Noise is not expected to be an issue as machinery operational time is limited and the site location is in an agricultural area some distance away from local residences.
Plan	All of the above actions shall be contained in a written plan for the site with an official document number that has been discussed and agreed with operations staff. The plan shall extend out at least 3 years with planned start dates and people recorded as being responsible for ensuring the work is completed.

## 4.8 REHABILITATION MANAGEMENT

Basic rehabilitation is discussed herein, with detailed rehabilitation management outlined in the sites Landfill Closure Management Plan (LCMP).

### 4.8.1 Context

No end use has been established for the Tennant Creek WMF site so a generic rehabilitation approach has been adopted, with the objectives of rehabilitation being to:

- Provide an acceptable post-disturbance land use capability and suitability;
- Provide acceptable post-disturbance landforms;
- Ensure that surface water and groundwater that reach receiving environments from the site achieved appropriate water quality standards, consistent with the characteristics of the receiving environment; and
- Ensure that no other potential long-term impacts on human health and the environment is threatened because of the closed facility or infrastructure.

#### 4.8.2 Management Plan

A basic rehabilitation management plan for the Tennant Creek WMF is outlined in **Table 12** below. Refer to the Tennant Creek LCMP (GreenTec, 2021) for more details on rehabilitation.

**TABLE 12 - REHABILITATION MANAGEMENT PLAN**

Objective - Rehabilitation Management	
To ensure closure of Tennant Creek Waste Management Facility will have an environmental impact on the downstream environment.	
Implementation Strategy	Ensure that implementation of topsoil capping, revegetation strategies, erosion and sediment control and ongoing monitoring is implemented.  Appropriately sized drainage infrastructure shall be in place to effectively drain, divert surface water from the site.
Monitoring	Routine inspections of capped trenches and stormwater infrastructures on a regular basis.
Reporting	Site supervisor to report incidents.
Remedial action	Investigation and corrective actions as required to ensure landfill areas are safely rehabilitated to a suitable condition to protect the environment.
Plan	All of the above actions shall be contained in a written plan for the site with an official document number that has been discussed and agreed with operations staff. The plan shall extend out at least 3 years with planned start dates and people recorded as being responsible for ensuring the work is completed.

#### 4.9 ENVIRONMENTAL IMPACTS

Where environmental impacts have been observed or reported, it is up to Council staff to identify and correct the nonconformities and take actions to mitigate the environmental impacts. These actions are outlined in risk assessment provided in **Section 3.4.4** and also as part of the Emergency Response Management Plan prepared by GreenTec (2021) for more significant environmental emergencies.

The site supervisor must report any environmental nonconformances to the NT EPA within 24 hours of becoming aware. The nonconformities shall be investigated to establish the cause and evaluated with the inclusion of preventative strategies to avoid reoccurrence. These strategies are to be monitored by the site supervisor for effectiveness. After this, a review of the risk assessment and associated management plans may be necessary.



## 5 ENVIRONMENTAL MONITORING AND MEASUREMENT

### 5.1 CONTEXT

Environmental monitoring will be considered during and after completion of operational activities at Tennant Creek Landfill for the following environmental areas:

- Surface water quality;
- Groundwater;
- Noise; and
- Air quality.

### 5.2 SURFACE WATER QUALITY

The estimated capacity of the onsite sediment dam is approximately 2,250m<sup>3</sup> (assumed 1.5m deep with an area of 1,500m<sup>2</sup>), located in the south east corner of the site. This dam contains sediment laden water and the water treatment mechanism is evaporation, with no discharges to surrounding land noted due to the high evaporation in the area. Therefore, surface water quality monitoring is currently not undertaken on site. Based on the low risk of overflow and contaminant migration to surrounding environments and site specific constraints, surface water quality monitoring is not recommended. It is recommended to excavate out the excess soil in the pond during the dry season when the pond is dry to maintain capacity.

There are no specified conditions relating to monitoring of point source discharges in EPL 281. However, Council must ensure the following:

- That there is no migration or overflow of a contaminant or waste, which causes or may cause environmental harm, beyond the boundary of the land on which the premises are located;
- That a contaminant or waste, which causes or may cause environmental harm, enters water; and
- That stormwater does not come into contact with a contaminant or waste, which causes or may cause environmental harm.

Water is currently managed on site by directing sediment-laden water to a sediment dam, where the water ultimately evaporates.

Management of leachate is discussed in the Leachate Management Plan prepared by GreenTec (2021). Leachate monitoring has not been undertaken as the landfill is unlined, meaning leachate parameters of concern and their associated concentrations cannot be determined.

### 5.3 GROUNDWATER MONITORING

Groundwater monitoring onsite has not been undertaken as there are no boreholes on site. Boreholes have not been installed due to the deep groundwater levels, highly impervious ground conditions, economic feasibility of installing monitoring wells and low risk of impacting any groundwater, particularly groundwater that is suitable for domestic or agricultural purposes.

It has been previously established that the deep groundwater table, coupled with the low permeability soils encountered at the site, makes groundwater contamination “not likely to be a significant concern”. At this stage, the establishment of a groundwater monitoring network is considered unfeasible, however, Council may want to consider installation of a groundwater monitoring network in the future to confirm any assumptions and to ensure environmental compliance.

#### **5.4 NOISE MONITORING**

Noise monitoring in the form of a field assessment should be conducted in the event of a complaint. There have been no reported noise complaints at Tennant Creek WMF, which is expected given that the landfill is some distance from the township. No regular noise monitoring is required.

#### **5.5 AIR QUALITY MONITORING**

Air Quality (dust) must not cause an environmental nuisance to sensitive receptors. In the event of complaint, the incident should be investigated in the form of a field assessment with the assessment completed within 14 days. There should be follow up with the person who made the air quality complaint. It is to be noted that there have been no reported air quality complaints at Tennant Creek WMF.

#### **5.6 MANAGEMENT PLANS**

All the above actions shall be contained in a written operations plan for the site with an official document number that has been discussed and agreed with operations staff. The plans shall extend out at least 3 years with planned start dates and people recorded as being responsible for ensuring the work is completed. The following plans should be reviewed once every three years and updated accordingly:

- Environmental Management Plan (GreenTec, 2021);
- Emergency Response Management Plan (GreenTec, 2021);
- Leachate Management Plan (GreenTec, 2021); and
- Landfill Closure Management Plan (GreenTec, 2021).

Once these documents have been reviewed and updated, the site operations plan shall be updated accordingly.

Reviews of the management plans shall include:

- Results of internal audits and evaluation of compliance with legal and other requirements applicable to the landfill facility;
- Complaints or relevant external party correspondence;
- Environmental performance;
- Tracking of objectives and targets;
- Status of corrective and preventative actions;
- Follow up actions from previous management reviews;
- Changing circumstances, including developments in legal and other requirements pertaining to environmental aspects; and
- Recommendations.

## 6 TRAINING AND AWARENESS

BRC is committed to continuous improvement of its Environmental Management System to effectively manage its and our environmental footprint and prevention of pollution throughout all operations. This is reinforced by an Environmental Policy that is designed to achieve a culture of environmental awareness and management across the organisation (see **Appendix A**).

All Council staff including subcontractors should have an awareness of the BRC EMP and its principles, including clauses in supply conditions and contracts outlining the requirements for compliance to the EMP.

The EMP prepared for Tennant Creek Waste Management Facility shall be implemented and maintained by BRC, ensuring the following:

- An official document number with a registered owner responsible for updating the EMP as required;
- All actions recorded with a 3-year timeframe;
- Planned start dates for each action;
- Adequate discussion and agreement with operations staff; and
- A person responsible at the site for ensuring all actions are completed.

All personnel engaged in waste management to undergo inductions and be trained in, understand and:

- Comply with the requirements of the EMP;
- Staff are to be aware of emergency procedures and responses;
- Staff are to be trained in and have appropriate equipment to handle any environmental emergency that could possibly occur on Council's premises or during the course of our operations; and
- Staff to be trained in the management of chemical and hazardous substances and wastes to eliminate the potential of pollution.

## 7 REFERENCES

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# **APPENDIX A**



# BARKLY REGIONAL COUNCIL



## ENVIRONMENTAL POLICY STATEMENT

Barkly Regional Council is committed to continuous improvement of the Environmental Management System to effectively manage our environmental footprint and prevention of pollution throughout our operations.

All documentation and processes are underpinned by AS/NZS ISO 14001, as well as compliance to relevant local state and federal statutory, legislative and regulatory requirements.

A culture of environmental awareness and management across the organisation is achieved by:

- Awareness of the Barkley Regional Council Environmental Management System and principles by all workers and subcontractors, including clauses in supply conditions and contracts outlining the requirements for compliance to the Council Environmental Management Plan;
- The setting of targets and objectives for continuous improvement to enable measurement of environmental performance;
- Trained staff and appropriate equipment to handle any environmental emergency that could possibly occur on Council's premises or during the course of our operations
- Liaison with state government authorities to ensure that we meet requirements for the prevention of pollution and effective waste management;
- The provision of adequate resources to enable proactive planning and implementation of activities designed to eliminate the incidence of pollution;
- Proactive management of chemical and hazardous substances and wastes to eliminate the potential of pollution within areas of control by Council and
- Review of the Environmental Management System, actions and outcomes by Executive and Senior staff and regular monitoring of the system to ensure compliance.

**Barkly Regional Council is committed to protecting the environment through responsible management**

**Edwina Marks**  
CEO

**1 March 2014**



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