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Regional Landfill Strategy

Feasibility Study

NEWROC



DALCON
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Acknowledgements

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Report produced by:
GILES PERRYMAN BSc, DMS
JOHN CAVANAGH

ASK Waste Management
PO BOX 401
Brunswick Heads
NSW. 2483
AUSTRALIA

+ 61 (0)447 393363
admin@askwm.com
www.askwm.com

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EXECUTIVE SUMMARY

The North Eastern Wheatbelt Regional Organisation of Councils (the NEWROC) engaged ASK Waste Management (ASK) to assess their current facilities and regional situation and develop achievable concepts to improve waste management across the region.

ASK has completed a desktop assessment of the NEWROC landfills and modelled four Options to consider as a future strategy for the Shires to adopt.

Landfill Assessment

Initially the landfills were assessed for fatal flaws, which resulted in only five facilities passing.

Table E.1 - Fatal flaw test results

Facility name	Result	Reason
Koorda Landfill (Existing)	Fail	<5 years of capacity
Koorda Landfill (New)	Pass	
Mt Marshall - Bencubbin LF	Pass	
Mt Marshall - Beacon LFI	Pass	
Mukinbudin Landfill	Fail	< 2m to bedrock
Nungarin Landfill	Fail	< 2m to bedrock
Trayning - Kununoppin LF	Fail	<1km from airport
Trayning - Trayning LF	Fail	Closed
Trayning - Yelbeni Landfill	Pass	
Wyalkatchem Landfill	Pass	

The new Koorda site has been "knocked-out" because the costs related to setting up the site as a landfill could easily be in excess of \$250,000.

Trayning's Yelbeni landfill has been "knocked-out" on account of its close proximity to the Wyalkatchem landfill. Similarly, the Beacon landfill has been "knocked-out" due to its remoteness in relation to the other facilities in the region.

The remain two landfill sites are ranked as:

1. Wyalkatchem site
2. Mt Marshall's Bencubbin site,

Options Assessment

The Options assessed and the net annual income is shown in **Table E.2**. Options 2, 3 & 4 all allow for the collection of gate fees for commercial waste, this is estimated to generate approximately \$300,000 of revenue per year.

The assessment shows that Options 3 and 4 would provide better environmental outcomes as the other landfills would be closed and transfer stations established. These two Options would also result in

better compliance as transfer stations have less regulatory issues to consider, and the remaining landfills would be staffed and have sufficient revenues to fund full compliance.

Table E.2 - Financial summary for each option

Option	Net annual income
Option 0: Baseline cost of current operation	-145,287
Option 1: All landfills unstaffed (remote access)	-180,255
Option 2: All landfills (remote access) plus two staffed landfills	60,786
Option 3: All transfer stations (remote access) plus two staffed landfills - weekly collection	67,193
Option 3: All transfer stations (remote access) plus two staffed landfills - fortnightly collection	104,633
Option 4: All transfer stations (remote access) plus one staffed landfill - weekly collection	115,473
Option 4: All transfer stations (remote access) plus one staffed landfill - fortnightly collection	137,313

Recommendations

The key recommendations made are listed below, the full details of recommendations are provided in **Section 8**.

1. The NEWROC Shires should adopt Option 3 or Option 4 as their future waste disposal strategy.
2. Complete a thorough sensitivity analysis with the model to determine that the preferred option is consistent under all likely scenarios.
3. Ask Avon Waste to review the transport modelling assumptions and rationale.
4. The NEWROC Shires should consider and decide to either establish a single staffed Regional landfill at Bencubbin, or two staffed landfills at Bencubbin and Wyalkatchem.
5. The NEWROC Shires should agree to set one uniform waste fee (per capita) for the operation of all the facilities and transport of waste between the facilities. This will mean no Shire is disadvantaged, based on the location of the staffed landfills.
6. A maximum quantity of domestic waste per rate payer should be adopted by the NEWROC.

7. Should NEWROC adopt one of the Options then a detailed implementation plan should be developed and communicated to residents explaining the reasons for and benefits of the changes.
8. The community should be made aware of the need to 'self-police' the remote access facilities.
9. Complete a Whole of Life cost analysis of the current waste services and the estimated costs for the selected future services to determine the costs and appropriate fees and charges for residential rates and commercial gate fees.
10. Operational Management Plans (OMP) should be produced for the transfer stations, a general OMP may be sufficient for all the sites.
11. An Operational Management Plan should be produced for the staffed landfill(s).
12. Develop or purchase an electronic gatehouse records system for the staffed landfill(s).
13. Produce Landfill Closure Management Plans (LCMP) for all the landfills as required under the Rural Landfill Regulations.
14. All landfills should be surveyed to determine the current landform, this will be required to produce the LCMPs.
15. NEWROC should plan to increase the gate fees over the next 3 – 5 years to meet breakeven costs.
16. The data provided by the remote access systems (the user and when used, plus CCTV footage) and the electronic gatehouse records system for the staffed landfill(s), will provide accurate information about when facilities are used and by whom, together with waste quantities brought from each transfer station or remote access landfill to the staffed landfill(s). This information should be reviewed after 18 – 24 months, and the rationalisation of the number of facilities should be considered, based on the frequency of use.

Immediate next steps

The initial steps suggested would ensure the projects detailed assessment are completed and NEWROC are able to select an Option, develop the plan, communicate with the community and seek funding, these steps include:

1. NEWROC provisionally agree to one or more of the Options for further consideration.
2. Complete a more detailed assessment of the preferred Option(s), including:
 - a. Ask Avon Waste to review and provide feedback on the transport modelling assumptions, costs and rationale.
 - b. Complete a sensitivity analysis with the financial model (changes to waste quantities and other assumptions) to quantify these impacts on the validity of the economic results.
3. NEWROC select a preferred Option for implementation.
4. Produce a detailed project plan, with costing and an implementation schedule including most of the recommendations listed above. This will provide the information for the Shires and towards any funding application. The project plan should be developed with consideration of the criteria and information required for any funding stream.
5. Develop and implement a communication plan with the NEWROC community explaining the reasons, benefits and changes to services resulting from the project.
6. Liaise with potential funding stream providers to explain the project benefits and potential for replication throughout rural WA, then complete funding applications.
7. Implement the remainder of the project.

1 INTRODUCTION

The North Eastern Wheatbelt Regional Organisation of Councils (the NEWROC) engaged ASK Waste Management (ASK) to assess their current facilities and regional situation and develop achievable concepts and strategies to improve waste management across the region.

The NEWROC is a voluntary organisation that unites councils from the Shires of Koorda, Mount Marshall, Mukinbudin, Nungarin, Trayning and Wyalkatchem to work together for the economic prosperity of the region which covers close to 19,500 square kilometres and is home to around 2,500 people.

Within the NEWROC region, there are eight operating landfills. The Trayning landfill is currently closed. Koorda Shire Council has started exploring sites to develop a new landfill.

There are varying services across the district in regard to kerbside collections. Avon Waste is the primary provider holding individual agreements with each Shire.

Table 1.1 shows the Shires and their corresponding landfill/s as well as information about populations, land size and distance to the state capital.

Table 1.1 - NEWROC Landfills

Shire	Shire Population	Shire Land Size	Facility	Town Population	Distance to Perth (km)
Koorda	414	2836 km ²	Koorda Landfill	268	236
Mt Marshall	521	10190 km ²	Bencubbin Landfill	242	275
			Beacon Landfill	160	333
Mukinbudin	555	3414 km ²	Mukinbudin Landfill	355	298
Nungarin	257	1145 km ²	Nungarin Refuse Disposal Site	145	278
Trayning	350	1651 km ²	Kununoppin Landfill	100	257
			Yelbeni Landfill	50	222
			Trayning Landfill (closed)	194	-
Wyalkatchem	516	1595 km ²	Wyalkatchem Landfill	397	192

1.1 ISSUES

The nine waste facilities across the NEWROC region are registered, however, none are gated or manned. Common challenges seen at these facilities include commercial waste being dumped (sometimes illegally), non-residents depositing waste at the sites, and maintaining site compliance.

The uncontrolled disposal of waste at all the NEWROC sites also means that there are no gate fees being recovered. Currently residential rates are subsidising commercial waste disposal from businesses, organisations and State departments located in the region.

Without any monitoring, there is also no way to collect data or be sure of exactly what kinds of waste are being deposited. Potential environmental risks of unmonitored landfills include air pollution, groundwater contamination and public health issues, for example contact with hazardous substances or disease spread through live-in rodents and other animal vectors.

It is also possible that waste generated in Shires close to the NEWROC are transported to the NEWROC landfills to avoid paying gate fees elsewhere.

As per DWER policy and in alignment with the NEWROC objective to solve problems as a collective, this report intends to recommend scenarios that aggregate landfills to create a regional solution that results in less but larger and more efficiently run landfills.

1.2 REPORT APPROACH

This report has been produced in line with the following methodology;

- Complete a desktop assessment of the existing landfills operated by the Shires in NEWROC to identify the facilities that would be suitable as regional sites, based on;
 - Proximity of watercourses and depth to groundwater (where available)
 - Proximity to sensitive receptors (residential and commercial properties)
 - All weather access (sealed roads)
 - Potential airspace (operational life) based on site size and depth of excavatable soil
 - Suitability of location within the NEWROC region.
- Assess five potential options for the future operation of the facilities, including:
 0. All landfill operations stay as they are.
 1. Keep all the current sites but install remote access systems for Shire residents and CCTV to control the use of the sites.
 2. As above, but also staff two key sites for a limited time each week for the receipt of commercial waste, for which a gate fee would be paid.
 3. Maintain two sites as landfills to service the NEWROC area, these would be staffed with limited opening hours each week. The other sites would be converted to transfer stations, with remote access system for Shire residents and CCTV to monitor the use of the sites.
 4. Maintain a single staffed landfill facility for the region, supported by remote access system and CCTV monitored transfer stations at all other locations.
- Assess each option on their environmental, compliance, social and technical merits.
- Produce an economic assessment based on the capital and operational costs for each option and include any additional revenue that the option may generate.
- Summarise the findings to provide NEWROC with the information needed to make an informed decision about their future strategic direction, including recommendations and the next steps required.

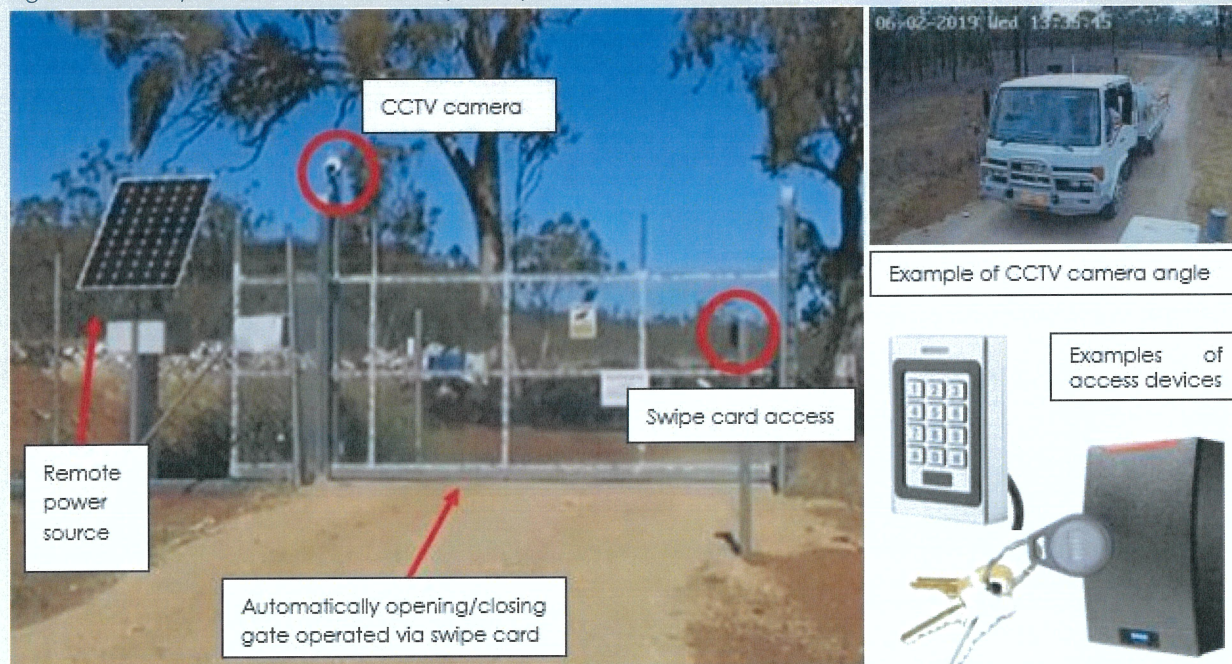
2 DEFINITIONS OF INFRASTRUCTURE OPTIONS

In this report, ASK proposes several different scenarios which illustrate situations that may be foreign to the reader. The following section aims to outline the definition of each of these situations and the related technologies.

2.1 REMOTE ACCESS SYSTEM

A remote access system is an automated, unmanned system that allows access to a site via an electronic key (e.g. swipe card, RFID or 'fob' tag, or electronic keypad). A CCTV camera provides extra security and monitoring of people entering and exiting. **Figure 2.1** shows an example of a remote access system used at a landfill in NSW. This system has a remote power source (solar panel) which powers the automatic gate, CCTV camera and remote access technology as mains power is unavailable at the site.

Figure 2.1 Example of Remote Access System (Warialda Rail Landfill - Gwydir Shire Council, NSW)



This system can be used for both landfills and transfer stations and has the added benefit of recording data about who is using the facility, at what time, and how often.

2.2 TRANSFER STATION

A transfer station is a processing site for the temporary disposal of waste. This waste is then picked up and taken to a landfill to be disposed of properly. There are many different ways to design a transfer station. Generally, waste is disposed into skip bins and, when full, hauled to a central landfill which then buries the waste. Considering the scale of the NEWROC facilities, it is most likely that several front lift bins, as seen in **Figure 2.2**, would be placed at the facility for customers to place their waste into. Once full, these front lift bins would be picked up and replaced with empty bins by Avon Waste who would then transfer the waste to a central location for landfilling.

Figure 2.2 Example of Avon Waste front lift bin used at a transfer station



There are significant environmental and operational advantages to transfer stations. Since the waste is not buried on site, there are virtually no environmental impacts or liabilities normally associated with landfills, which are important issues for DWER. There are, however, costs related to transporting the waste from the transfer station to a landfill.

As mentioned above, unmanned transfer stations could be fitted with a remote access system to keep track of the comings and goings of waste and users and restrict entry by only giving access to rate-paying residents.

2.3 STAFFED LANDFILLS

A landfill is a site where waste is amassed and buried. A specified area is dug, waste placed in the hole and intermittently covered with dirt or cover material. All waste facilities currently in the NEWROC region are considered landfills.

A staffed landfill has a gatehouse where at least one staff member monitors and interrogates waste loads entering the site. The staff member checks the wastes and often issues a gate fee for the waste to be deposited. The staff on site also provide operational management of the landfill, ensuring that it is neat, safe and managed correctly. Staff can also direct customers to the most appropriate place to dump waste and educate residents on improving the way they manage their waste at home.

When combined with a remote access system, a staffed landfill does not need to be staffed every day. In small rural areas, it is common to have specific opening hours (for example three days a week, four hours per day) which allows those without an access key to enter the landfill. This is particularly useful to monitor and monetise the waste brought in by commercial entities who cannot access landfills (since they may not have a key for the remote access system).

With staff on site, gate fees can be introduced, providing an income stream for the Shire or regional group. Staffed landfills also mean that wastes that cannot be accepted at the facility (for example uncovered asbestos) are not dumped illegally.

2.4 REGIONAL LANDFILL

A regional landfill is very similar to a staffed landfill; however, it is open more often, staffed more often and accepts waste from a larger area (e.g. the entire region). A regional landfill would be the primary disposal point for all commercial waste. Generally, all surrounding facilities in the region would be turned into transfer stations with remote access systems (to discourage unwanted dumping by commercial entities), with the waste being transferred to the central regional landfill.

There are many advantages to this practice. One is the economic advantage of a centralised operation which would only require the staff, facilities and plant for one location. Another advantage is the environmental benefits of having a landfill which is monitored and maintained on a regular basis allowing an improved level of compliance with DWER guidelines.

Nevertheless, there is a cost associated with transporting waste from a widespread number of transfer stations to the one regional facility. This may require a coordinated, 'milk-run' style operation which would gain the advantages of economies of scale.

3 EXISTING FACILITIES

The NEWROC is a voluntary organisation of Councils working together for the economic prosperity of its member communities. Established in 1994, the NEWROC includes councils from the Shires of Koorda, Mt Marshall, Mukinbudin, Nungarin, Trayning and Wyalkatchem.

The region hosts nine landfills, as shown in **Figure 3.1**. All landfills are currently unmanned and most have unrestricted 24-hour access. The following section describes each Shire and the landfills residing within the Shire's bounds. Information for these descriptions was provided by the Shires and gathered from research undertaken by Ian Watkins (2012) and site visits conducted by ASK in 2019.

Figure 3.1 Map of the NEWROC waste facilities



3.1 SHIRE OF KOORDA

The Shire of Koorda stretches over 2836 square kilometres in the north-western portion of the NEWROC region and is home to 414 people. Koorda has one landfill site which is reaching capacity. The Shire has done preliminary siting for a new landfill at the old golf course; however, ASK was unable to obtain verified information about planning and approvals that confirm the new site. Avon Waste service the town with a kerbside pickup which is disposed of at the Koorda landfill.

3.1.1 Koorda Landfill

Annual Disposed (tonnes)	750
Town Population	270
Approx. Site Size	15 ha
Facility Lifespan	<10 years

The Koorda landfill is an unmanned site with a perimeter fence which is open and free to the public with 24 hours access.

In a recent visit, it was observed that the site was not maintained adequately; waste was not covered or disposed in a central spot, stockpiles of metal, greenwaste and timber were mixed together, and there were litter issues particularly because the waste was not covered, no fencing surrounded the waste area and the bunds encompassing the dump site were not high enough to prevent litter.

The site was found to be sandy with clay and gravel 2m below the surface. Although it is said to be close to full, recent observations saw that the life of the site could be extended if managed to landfill best practice standards.

The closest receptor to the current Koorda landfill is a property approximately 600m northeast of the landfill. There is an 80m unsealed access road into the landfill.



3.1.2 New Koorda Landfill

Approx. Site Size	14 ha (5 ha usable)
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Koorda has done preliminary work repurposing the old golf course into a new landfill site. There is limited information about this site at present. Test pits have been dug and approximately 5 ha of the site can be excavated to a depth of 3m (test pit seen in picture on right). The Shire of Koorda is relatively confident that the site will be appropriate, however, ASK does not know the extent of surveyance, planning and approvals that have been completed.



3.2 SHIRE OF MT MARSHALL

The Shire of Mount Marshall is the geographically largest of the six NEWROC shires, covering 10190 square kilometres with a population of 521. There are two landfills situated in the towns of Bencubbin and Beacon, in the southern section of the Shire. These towns are situated in relative proximity to the other landfills in the NEWROC region, with Beacon being the northernmost facility. Only 33% of the population reside outside these two town centres.

Both sites are land tenure on private property and leased by the Shire.

3.2.1 Bencubbin Landfill

Annual Disposed (tonnes)	560
Town Population	240
Approx. Site Size	10 ha
Facility Lifespan	10 – 15 years

Bencubbin landfill is located in the southern part of the Shire of Mount Marshall. It is unmanned with lockable gates. Avon Waste disposes of kerbside waste at this facility from Bencubbin and Beacon. The site is well-fenced and recycling activities are present, however there is some concern about whether there is a viable end market for some of the recyclable materials. The site is sand based and there is currently room for more pits to be dug inside the site.

The closest receptor to the Bencubbin landfill is the adjacent golf course, followed by a property located 800m north. The access road is an 300m unsealed track.



3.2.2 Beacon Landfill

Annual Disposed (tonnes)	380
Town Population	160
Approx. Site Size	1 ha
Facility Lifespan	>30 years

The Beacon Landfill is a small site that takes waste from the local community. The site was recently extended 0.8 hectares to the west and is situated on sandy soil which allows for easy excavation. Avon Waste does not dispose of kerbside waste at this facility. It is unmanned and has unrestricted 24 hours access. Both the extended site and original site are well-fenced.

The closest property to the Beacon landfill is approximately 2km away. The site is accessed via an 500m unsealed road.

3.3 SHIRE OF MUKINBUDIN

The Shire of Mukinbudin has a population of 555 and is located on 34 hectares on the eastern edge of the NEWROC region. There is only one landfill in the Shire and Avon Waste takes the towns kerbside collection to that site.

3.3.1 Mukinbudin Landfill

Annual Disposed (tonnes)	1000
Town Population	355
Approx. Site Size	20 ha
Facility Lifespan	>30 years

The Mukinbudin landfill is a relatively new landfill, having been built about 10 years ago, and is an unmanned, fenced site with unrestricted 24-hour access. The site is built on an expired shallow gravel quarry, resulting in a hard rock base

that does not allow excavation and means all cover material is brought in from an external source. In 2012, extensive evidence of past fires was recorded, as well as a general observation that significant management was necessary to retain the site. The road into the landfill site is a 500m unsealed road with all-weather access. The closest property is approximately 2.5km away.

3.4 SHIRE OF NUNGARIN

The Shire of Nungarin is a relatively small Shire spanning over 1145 square kilometres and housing approximately 257 people. There is one landfill that services the small town of Nungarin, with Avon Waste depositing the town's kerbside waste at the site.

3.4.1 Nungarin Landfill

Annual Disposed (tonnes)	470
Town Population	145
Approx. Site Size	5 ha
Facility Lifespan	>30 years

The Nungarin landfill is an unmanned site with 24hours unrestricted access. It has partly fenced around the perimeter. The entrance to the landfill is along a 360m unsealed road which does not allow all-weather access. The closest property is 1.53km away.



3.5 SHIRE OF TRAYNING

The Shire of Trayning is situated in the central southern portion of the NEWROC region and has three landfills within its 1651 square kilometres, servicing a population of 350. One landfill, Trayning, is currently closed but may still be used by residents as it has unrestricted access. The Shire has a kerbside collection that is handled by Avon Waste, with all waste being disposed of at the Kununoppin landfill. Trayning and Yelbeni have a kerbside recycling collection as well as central drop-off recycling facilities in town.

3.5.1 Kununoppin Landfill

Annual Disposed (tonnes)	180
Town Population	100
Approx. Site Size	10 ha
Facility Lifespan	<10 years

The Kununoppin landfill is a small unmanned site built on sand and gravel and has 24-hour unrestricted access. The site is fenced with a basic farming fence and no gates. It is adjacent to the airport. In recent observations, the site has been in need of a major clean up as rubbish has begun to pile up and requires levelling.

3.5.2 Trayning Landfill

Annual Disposed (tonnes)	360
Town Population	200
Approx. Site Size	25 ha
Facility Lifespan	Closed

The Trayning facility is currently marked as closed to the public, however, is unmanned and unfenced, allowing 24-hour unrestricted access. When visiting in June 2019, despite having a "closed" sign, the site was observed to have recently been used to dump waste. It was also observed that the site was in desperate need of tidying up and rehabilitation.



3.5.3 Yelbeni Landfill

Annual Disposed (tonnes)	100
Town Population	50
Approx. Site Size	15 ha
Facility Lifespan	10 – 15 years

The Yelbeni Landfill is the main Shire landfill and is within 1 km from the Yelbeni township. It is an unmanned site with basic fencing that is accessible 24 hours. Avon Waste disposes all kerbside waste here from Kununoppin, Trayning and Yelbeni townships. The site is built on sandy/gravel and is easy to excavate despite being an old gravel quarry.

3.6 SHIRE OF WYALKATCHEM

The Shire of Wyalkatchem is the south-western position of the NEWROC group. It has a total population of 516 and covers 1595 square kilometres. There is only one landfill in Wyalkatchem which receives all of the waste from the kerbside collection serviced by Avon waste.

3.6.1 Wyalkatchem Landfill

Annual Disposed (tonnes)	930
Town Population	400
Approx. Site Size	35 ha
Facility Lifespan	20 – 30 years

The Wyalkatchem landfill is one of the largest facilities in the NEWROC. The current landfill facility occupies 20.8 ha of the total space. It is unmanned, has unrestricted 24-hour access and is fenced. The site is adjoined to the cemetery. The facility is well managed, and the current use space is about 8000 square meters, with approximately 50,000 square meters available for future expansion. There is also good documentation of previously buried waste.

The closest property is approximately 2.5 km away. The road leading from the main (sealed) road into the main cell is unsealed and 200 m long with all-weather access.



4 WASTE QUANTITIES

Without a gatehouse or weighbridge, no NEWROC facility has the technical capabilities to gather accurate waste quantity data. In order to produce waste quantity data for this report, ASK has taken the 8-year average of non-metropolitan landfills in Western Australia from the Recycling Activity Review (ASK, 2010-2018).

Table 4.1 shows the kilograms of waste per person according to the 8-year average by waste type (MSW is Municipal Solid Waste (domestic waste), C&I is Commercial & Industrial, and C&D is Construction & Demolition). For simplicity, ASK has rounded the results to the nearest hundred kilograms.

Table 4.1 - Per capita landfill (kg/person)

Waste type	WA Rural Average 2010 -18	Rounded values used for report
MSW	511	500
C&I	496	500
C&D	835	800
Total (kg)	1,842	1,800
Total (tonne)	1.84	1.8

Table 4.2 shows the approximate tonnage, extrapolated from the population statistics, for the NEWROC region as a whole and each individual Shire.

Table 4.2 - Waste tonnage per Shire

Description	NEWROC TOTAL	Koorda	Mt Marshall	Mukinbudin	Nungarin	Trayning	Wyalkatchem
Population	2613	414	521	555	257	350	516
Pop percent of NEWROC	100%	16%	20%	21%	10%	13%	20%
MSW	1320	210	260	280	130	180	260
C&I	1320	210	260	280	130	180	260
C&D	2090	330	420	440	210	280	410
Total tonne	4730	750	940	1000	470	640	930

Table 4.3 gives a further breakdown of the origin of the different wastes likely to be deposited at the landfills, including:

- Domestic waste (MSW) collected via MGB (Mobile Garbage Bin or "wheelie bin"): Figure based on the proportion of the Shire population living within each key town, assuming that 90% of MSW generated in each town is collected via kerbside MGBs, with the remaining 10% taken to landfill as 'bulky waste'.
- Commercial waste (C&I) collected by contractors: Figure based on the proportion of the Shire population living within each key town, assuming that 40% of C&I generated in each town is collected via kerbside MGBs and front lift commercial collections, with the remaining 60% taken to landfill as self-hauled C&I waste.
- Domestic waste (MSW) dropped off to facilities by rate-paying residents
- Commercial waste (C&I) 'leakage' dropped off to facilities: Meaning the C&I waste that will be disposed of by residents using their 'resident' passes at the remote facilities, assumed at a rate of 50%
- Commercial waste (C&I), not including 'leakage', taken to the landfill by business owners who would pay a gate fee to dispose of the waste
- Construction & Demolition waste (C&D) taken to the landfill by the waste generator (e.g. building contractor) who would pay a gate fee to dispose of the waste

Table 4.3 - Waste landfilled - baseline

Description	NEWROC TOTAL	Koorda	Mt Marshall	Mukinbudin	Nungarin	Trayning	Wyalkatchem
MSW collected via MGB	877	122	185	163	67	158	182
C&I collected by contractor	379	53	80	70	29	68	79
Total collected waste	1256	175	265	234	95	226	261
MSW drop-off (to facilities)	443	88	75	117	63	22	78
C&I drop-off 'leakage' (to facilities)	470	79	90	105	51	56	91
Total drop-off to facilities	913	166	165	222	114	78	168
C&I (exc. 'leakage') to landfill	470	79	90	105	51	56	91
C&D to landfill	2090	330	420	440	210	280	410
Total 'gate fee' incurring waste	2560	409	510	545	261	336	501
TOTAL ALL WASTE	4730	750	940	1000	470	640	930

Table 4.4 indicates the tonnage of waste that would be deposited at each of the landfill sites if Option 1 was adopted. Option 1, as illustrated in **Section 6.1.2**, implements remote access systems at every landfill, however, this Option does not accommodate commercial users who are not rate-paying residents. Thus **Table 4.4** only displays waste that is brought in by rate-paying residents who are assumed to use their access rights to deposit 50% of the total C&I waste generated (i.e. 'leakage').

Table 4.4 - Waste quantities expected at each facility once all landfills have remote access (Option 1)

Facility	Total MSW drop-off	C&I 'leakage' to Facilities	Total waste drop-off
Koorda - Koorda	88	79	166
Mt Marshall - Bencubbin	45	54	100
Mt Marshall - Beacon	30	36	66
Mukinbudin	117	105	222
Nungarin	63	51	114
Trayning - Kununoppin	6	16	23
Trayning - Trayning	12	31	44
Trayning - Yelbeni	3	8	11
Wyalkatchem	78	91	168
TOTAL (tonnes per annum)	443	470	913

5 DESKTOP ASSESSMENT OF LANDFILLS

The following desktop assessment of landfills in the NEWROC region has been performed in two stages; first, a fatal flaw test to deduce which landfills are viable options, and second, a multi-criteria analysis that uses a scoring and weighting system to determine the ranking, from best (1) to worst (10), of the landfills.

The criteria for the fatal flaw test and multi-criteria analysis are based on ASK's extensive experience in the waste industry, constraints identified via DWER requirements, and the landfill characteristics ranking system appropriated from Neal Bolton's *The Handbook of Landfill Operations* (1995).

5.1 FATAL FLAW TEST

A fatal flaw test was used to "knock-out" landfill sites which were not suitable as regional facilities. Some of the qualities of a regional landfill are explained in **Section 2.4**. Characteristics that would result in a 'failed' grade are outlined in **Table 5.1**.

Table 5.1 - Fatal flaw test conditions

Category	Fatal Flaw
Soils	Less than 2m to bedrock
Surface Water	Within wetland; <100m from surface water
Airport Safety	<1km from airport/aerodrome
Habitat Value	Critical habitat
Visual Impacts	Within 500m of visual public impact
Groundwater	<5m below lowest point
Remaining Site Capacity	<5 years of capacity remaining

Table 5.2 shows the results for the fatal flaw test and the reason for the 'fail' grade.

Table 5.2 - Fatal flaw test results

Facility name	Pass/Fail	Reason
Koorda Landfill (Existing)	Fail	<5 years of capacity remaining
Koorda Landfill (New)	Pass	
Mt Marshall - Bencubbin landfill	Pass	
Mt Marshall - Beacon Landfill	Pass	
Mukinbudin Landfill	Fail	Less than 2m to bedrock
Nungarin Landfill	Fail	Less than 2m to bedrock
Trayning - Kununoppin Landfill	Fail	<1km from airport/aerodrome
Trayning - Trayning Landfill	Fail	Closed
Trayning - Yelbeni Landfill	Pass	
Wyalkatchem Landfill	Pass	

Koorda's new landfill site, Mt Marshall's Bencubbin and Beacon landfills, Yelbeni landfill in Trayning and Wyalkatchem landfill passed the fatal flaw test. These sites were considered for the regional sites in Options 2, 3 and 4 in **Section 6.1**.

5.2 MULTI-CRITERIA ANALYSIS

5.2.1 Selection criteria

A multi-criteria analysis was used in this report to rank the suitability of the sites. The factors for the multi-criteria analysis are detailed in **Table 5.3**, including the marking criteria for each category and weighting.

These factors have been selected for their environmental, operational, social and technical impacts on the suitability of the waste facility.

Weighting of factors allows for a score that corresponds to the importance of the category. Remaining site capacity, for example, is given a weighted value of 8, while road access is given a weighted value of 2. This is because it would be inaccurate to assume that a score of 10 for road access and a score of 10 for remaining site capacity are of equal value.

Table 5.3 – Scoring system for multi-criteria analysis

Category	Scoring			Weighting
	10	5	1	
Road Access	<1.5km to paved road; on all weather road <500m	Requires <1.5km road improvement	Requires >1.5km road improvement	2
Remaining Site Capacity	>30 years of capacity	15 to 30 years of capacity	<10 years of capacity	8
Soils	Clay or low permeability	Sandy loam	<2m to bedrock (FATAL FLAW)	5
Depth to Groundwater	>20m	>10m to <20m	<5m	6
Surface Water	>500m from lake, wetland, perennial stream	>100m or <300m from surface water	Within wetland; <100m from surface water (FATAL FLAW)	7
Flood Hazard	No apparent flood hazard	100 to 500 year flood plain	Within 100 year floodplain; effects cannot be mitigated	7
Airport Safety	>2km from any airport/aerodrome	>1km to <1.5km from any airport/aerodrome; can demonstrate "no hazard"	<1km from any airport/aerodrome (FATAL FLAW)	8
Land Ownership	Council owned	Lease >10 years	Lease <10 years	4
Habitat Value	Low habitat value	High habitat value	Critical habitat value	3
Visual Impacts	Operation not visible off-site	Operation visible off-site	Impairment of scenic vistas	2
Downwind Impacts	>3km upwind from dwellings	>1 to <3km upwind from dwellings	<1km upwind from dwellings	3
Current Landfill Size (ha)	40	20	5	8
Available Space for Separating/Stockpiling	Well-established separation piles large suitable area >10ha	<2ha >5ha	No separation or stockpiling space available	8
Annual MSW Tonnage (current)	>400 tonnes	200 tonnes	50 tonnes	4
Town Population	>450	>200	>50	4
Possibility for Extension	Planned extension	Possible extension; not researched	No possibility for extension	5
Average Driving Distance to Other Facilities in Region	<20km	50 to 60km	>100km	5

5.2.2 Multi-criteria analysis scoring

Table 5.4 reveals the scores for each facility in each category according to the scoring and weighting system outlined in **Table 5.3**. For each landfill, the appropriate score was given for each category and this score was multiplied by the weighting to give the result shown in **Table 5.4**.

The right-hand columns show the total value for each landfill and its corresponding rank. Rows highlighted in green represent landfills which passed the fatal flaw test from **Section 5.1**, while the rows shaded red represent the landfills that failed. Failed landfills were included in the multi-criteria analysis, despite their "knocked-out" status, for the purpose of transparency.

Table 5.4 - Multi-criteria analysis scores

Facility name	Road Access	Remaining Site Capacity	Soils	Depth to Groundwater	Surface Water	Flood Hazard	Airport Safety	Land Ownership	Habitat Value	Visual Impacts	Downwind Impacts	Current Landfill Size (ha)	Available Space for Separating/Stockpiling	Annual MSW Tonnage (current)	Town Population	Possibility for Extension	Average Driving Distance to Other Facilities in Region	Total	Rank
Koorda Landfill (Existing)	20	8	25	18	70	70	80	40	30	20	15	32	8	20	24	5	15	500	7
Koorda Landfill (New)	14	40	35	30	49	70	80	40	30	14	15	32	80	20	20	25	15	609	3
Mt Marshall - Bencubbin landfill	20	24	25	30	49	70	80	20	30	20	9	32	56	16	24	35	25	565	5
Mt Marshall - Beacon Landfill	18	80	25	30	35	56	80	20	30	20	15	8	8	12	16	35	10	498	8
Mukinbudin Landfill	18	80	5	30	35	70	80	40	30	18	15	40	80	28	32	35	20	656	2
Nungain Landfill	20	80	35	30	35	70	80	40	30	20	15	8	24	16	16	35	20	574	4
Trayning - Kununoppin Landfill	20	8	25	18	35	70	8	40	30	20	15	16	40	4	12	15	25	401	9
Trayning - Trayning Landfill	0	0	0	0	0	0	0	0	0	0	0	48	0	12	16	0	20	96	10
Trayning - Yelbeni Landfill	20	16	25	18	35	70	80	40	30	20	15	32	64	4	4	25	25	523	6
Wyalkatchem Landfill	20	64	25	30	70	70	80	40	30	18	15	72	80	24	32	40	35	745	1

5.2.3 Multi-criteria analysis results

Table 5.4 reveals the rankings of the NEWROC landfills. Of the eligible landfills (shaded green), Wyalkatchem has the most suitable landfill, followed by the new Koorda site, Mt Marshall's Bencubbin site, Trayning's Yelbeni site and Mt Marshall's Beacon landfill.

For the purposes of this report, the new Koorda site has been "knocked-out" because the costs related to setting up the site as a landfill are unquantifiable at this stage of its development. It is understood that DWER has asked the Shire to complete a Flora and Fauna Survey of the site. In addition, the site may require a hydrogeological survey and other site assessments, together with the infrastructure required to establish the site. The costs of these works could easily be in excess of \$250,000.

Trayning's Yelbeni landfill has been "knocked-out" on account of its close proximity to the Wyalkatchem landfill. From ASK's experience and common-sense logic, it would not make sense to have two regional sites so close together, especially when Wyalkatchem landfill had a significantly higher score.

Similarly, the Beacon landfill within the Shire of Mt Marshall has been "knocked-out" due to its remoteness in relation to the other facilities in the region (see **Figure 3.1** for map of landfill sites).

From the results of the multi-criteria analysis and the extra common sense "knock-outs", the following has been deduced:

- Wyalkatchem landfill and Bencubbin landfill are the most suitable sites for the regional landfills mentioned in Options 2 and 3 (See **Sections 6.1.3** and **6.1.4**)
- Wyalkatchem landfill is the most suitable site for the single regional landfill described in Option 4 (See **Section 6.1.5**)

Before conducting the desktop assessment of landfills, ASK proposed three staffed landfill sites for Options 2 and 3. However, after analysing the results, it became clear that two sites would be adequate to service the NEWROC region.

Wyalkatchem landfill scored almost 100 points higher than the next landfill (Mukinbudin – 'failed' fatal flaw test) making it a clear winner for Option 4 which proposes the establishment of one staffed regional landfill site that would service all commercial entities in the region. Option 4, as described in **Section 6.1.5**, requires all other landfill sites to be converted into transfer stations. **Section 6.3** discusses the additional transportation costs that accompanies this option.

6 FUTURE STRATEGY ASSESSMENT

6.1 OPTIONS ASSESSMENT

ASK has identified five potential options available to the NEWROC:

- Option 0: No change (Baseline)
- Option 1: All landfills fitted with remote access
- Option 2: All landfills fitted with remote access plus two staffed landfills
- Option 3: All transfer stations fitted with remote access plus two staffed landfills
- Option 4: All transfer stations fitted with remote access plus one staffed regional landfill

The following section will break down each option including the capital and operational expenditures, transport costs, revenue streams and cessation of existing costs.

See **Appendix A** for a full breakdown of costs.

6.1.1 Option 0: No change

If no change was to be implemented, the current situation in the NEWROC region would remain the same; every Shire would operate their waste facility independently with varying levels of operational capacities, planning and budgets. **Table 6.1** indicates the costs associated with waste facilities in the NEWROC region in its current state. This is considered the baseline for the other options.

Table 6.1 - Baseline economic analysis

		Facility cost		Transport
Facility	Capital	Operational	Annualised Capex & Opex	N.A.
Collection truck mobilisation				
Koorda Landfill (Existing)		14,000	14,000	
Mt Marshall - Bencubbin landfill		19,436	19,436	
Mt Marshall - Beacon Landfill		12,851	12,851	
Mukinbudin Landfill		25,000	25,000	
Nungarin Landfill		12,000	12,000	
Trayning - Kununoppin Landfill		15,000	15,000	
Trayning - Yelbeni Landfill		15,000	15,000	
Wyalkatchem Landfill		32,000	32,000	
NEWROC TOTAL		145,287	145,287	
		TOTAL ANNUAL COST		145,287
Additional Revenue		Income		
Commercial' waste gate fee income		-		
Net income		-145,287		

There are no capital expenditures necessary for this option. All landfills are operational in their current state. This current state, however, lends itself to an environmentally dangerous legacy and the forfeiture of potential funds. Economically, the NEWROC region's waste facilities are presently running at a loss of approximately **\$145,000**.

As will be discussed in Options 2, 3 and 4, the introduction of staffed facilities and gate fees would allow NEWROC to charge for the use of their waste facilities. This would generate income for the NEWROC Shire councils and cover the cost of maintaining the waste facilities, as well as reducing the unfair financial burden

of compliance and closure costs on the rate paying portion of landfill users (who currently fund all the costs associated with landfills in the region).

Currently, waste is not being transferred between Shires. Avon Waste services each Shire individually and occasionally directs waste to one landfill within the Shire (e.g. Shire of Trayning, where all waste is directed to the Yelbeni facility). This current strategy does avoid transport costs, however, in the long term, creates a disparate and individualised system that increases environmental risks, regulatory non-compliance and operational costs since each facility must be maintained separately.

6.1.2 Option 1: All landfills with remote access

Option 1 requires all landfills to be converted into fenced and monitored landfills with a remote access system. All landfills would be eligible for this option. As described in **Section 2.1**, a remote access system would be set up at each landfill that would include an automated sliding gate, an electronic key/keypad to open the gate, and a CCTV camera monitoring the entrance. **Table 6.2** outlines the estimated costs of Option 1 for each facility.

Table 6.2 - Option 1: All landfills with remote access economic analysis

Facility	Facility cost			Transport
	Capital	Operational	Annualised Capex & Opex	N.A.
Collection truck mobilisation				-
Koorda Landfill (Existing)	39,000	18,371	20,971	-
Mt Marshall - Bencubbin landfill	24,000	23,807	25,807	-
Mt Marshall - Beacon Landfill	24,000	17,222	19,222	-
Mukinbudin Landfill	24,000	29,371	31,371	-
Nungarin Landfill	24,000	16,371	18,371	-
Trayning - Kununoppin Landfill	39,000	19,371	21,971	-
Trayning - Yelbeni Landfill	31,500	19,371	21,671	-
Wyalkatchem Landfill	24,000	36,371	38,371	-
NEWROC TOTAL	229,500	180,255	197,755	
			TOTAL ANNUAL COST	197,755

Additional Revenue	Income		
Commercial' waste gate fee income		-	
Net income		-197,755	

The annual cost for the NEWROC to have remote access at all the landfills would be approximately **\$200,000**. This includes all the operational costs and the amortised capital costs. The capital expenditure of setting up each landfill with a remote access system has been costed at approximately \$21,000. This figure accounts for:

- The design and approvals (licencing) process;
- Any necessary groundworks (level site);
- Any chain-link fencing (at entrance of facility) if required;
- Any additional 1.8m stock fencing needed (around remaining perimeter of drop off area);
- Signage to indicate new procedure for customers;

- An automated access gate;
- The access and CCTV system (single camera); and
- Installation of the gate and access/CCTV system.

Option 1 does not require any transport between facilities, nor does it generate any revenue streams or savings for the NEWROC.

Option 1 does not cater to commercial customers as access would only be given to rate-paying residents for the disposal of domestic waste. Therefore, commercial waste (C&I and C&D) generated in the region would have to be transported by the waste generator to landfills outside the NEWROC region.

Option 1 is problematic unless paired with other strategies, as evidenced in Options 2, 3 and 4.

6.1.3 Option 2: All landfills with remote access plus two staffed landfills

Option 2 was originally defined to include three staffed landfills, however, once the assessment of the landfills had been completed, the result showed that of the landfills that passed the fatal flaw assessment, there would be no benefit to include three facilities (see **Section 5**).

Therefore Option 2 includes the staffing of two landfills in conjunction with Option 1 (all landfills fitted with a remote access system). As described in **Section 2.3**, introducing two staffed landfills in the NEWROC region would require the construction of a gatehouse with appropriate amenities (including a GenSet to provide air-conditioning and power) and additional staff who would work at least three half-days per work week at the two staffed facilities. **Table 6.3** outlines the estimated costs of Option 2 for each facility.

Table 6.3 - Option 2: All landfills with remote access plus two staffed landfills economic analysis

Facility	Facility cost			Transport
	Capital	Operational	Annualised Capex & Opex	N.A.
Collection truck mobilisation				
Koorda Landfill (Existing)	39,000	18,371	20,971	
Mt Marshall - Bencubbin landfill (staffed)	41,130	52,647	56,163	
Mt Marshall - Beacon Landfill	24,000	17,222	19,222	
Mukinbudin Landfill	24,000	29,371	31,371	
Nungarin Landfill	24,000	16,371	18,371	
Trayning - Kununoppin Landfill	39,000	19,371	21,971	
Trayning - Yelbeni Landfill	31,500	19,371	21,671	
Wyalkatchem Landfill (staffed)	41,130	65,211	68,727	
NEWROC TOTAL	263,760	237,935	258,466	
			TOTAL ANNUAL COST	258,466

Additional Revenue		Income	
Commercial waste gate fee income		298,721	

Net income		40,255	
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The annual net income for the NEWROC to have remote access at all the landfills, and two landfills being staffed part-time would be approximately \$40,000. This includes all the operational costs and the amortised capital costs (approximately \$260,000) and income from gate fees at approximately \$300,000 per year (see **Section 6.2** for details of the gate fee income).

The capital expenditure to fit all landfills with a remote access system is the same as in Option 1.

Option 2 requires added capital expenditure at the two staffed landfills to:

- Purchase and install
 1. 3m x 4m Gatehouse (second hand)
 2. Boom gate
 3. 3KW Generator for gatehouse a/c and computer

Option 2 also has associated operational costs including:

- Site staff (gatehouse operator) for three half-days per week for each staffed landfill
- Electronic waste records system (waste records and finance)

Since commercial traffic would be directed to the two staffed landfills, the NEWROC would be able to collect gate fees and generate an income from the waste disposed by these commercial entities. Rate-paying residents would still have access to their local landfill via the remote access system.

6.1.4 Option 3: All transfer stations with remote access plus two staffed landfills

Option 3 requires the same as Option 2 (All sites with remote access and three landfills staffed) but all non-staffed sites are converted to transfer stations. A transfer station, as described in **Section 2.2**, does not store waste. As the name suggests, residential waste deposited at a transfer station would be collected and transferred to one of the two staffed landfills for disposal.

Table 6.4 outlines the estimated costs of Option 3 for each facility.

Table 6.4 - Option 3: All transfer stations with remote access plus three staffed landfills economic analysis

Facility	Facility cost			Transport	
	Capital	Operational	Annualised Capex & Opex	Weekly collection	Fortnightly collection
Collection truck mobilisation				29,120	14,560
Koorda Transfer Station (Existing)	94,270	10,371	16,715	9,360	4,680
Mt Marshall - Bencubbin Landfill (staffed)	41,130	47,211	50,727		
Mt Marshall - Beacon Transfer Station	94,270	10,371	16,715	16,640	8,320
Mukinbudin Transfer Station	94,270	10,371	16,715		
Nungarin Transfer Station	94,270	10,371	16,715	19,760	9,880
Trayning - Kununoppin Transfer Station	94,270	10,371	16,715		
Trayning - Yelbeni Transfer Station	94,270	10,371	16,715		
Wyalkatchem Landfill (staffed)	41,130	47,211	50,727		
NEWROC TOTAL	647,880	156,648	201,740	74,880	37,440
TOTAL ANNUAL COST				276,620	239,180

Additional Revenue		Income		Weekly	Fortnightly
Commercial' waste gate fee income				298,721	298,721

Net income				22,101	59,541
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The annual net income for the NEWROC to convert six landfills to transfer stations with remote access and maintain two landfills (staffed part-time) would be approximately \$60,000 based on a fortnightly collection of waste from the transfer stations or approximately \$20,000 based on a weekly collection of waste from the transfer stations (see **Section 6.3** for details about the transport cost modelling).

This includes all the operational costs and the amortised capital costs (approximately \$200,000) and income from gatefees at approximately \$300,000 per year (see **Section 6.2** for details of the gatefee income). The capital expenditure to fit all the transfer stations with a remote access system is \$1000 more than in Option 1, as there would be a second camera viewing the transfer station bin area.

No budget has been included for the closure, capping and rehabilitation of the existing landfills. This will be a significant expenditure and is likely to cost \$50,000 - \$250,000 per hectare, depending on the cap design, availability of capping material and other soils. The capping of a landfill should be progressive, as the site is utilised.

Extra capital expenditure would be required for converting the current landfills into transfer stations. This would involve setting up a front lift bin system (as pictured in **Figure 2.2**) that allows for easy disposal and transportation of waste.

Although Option 3 would incur significant transport costs, there are many benefits to eliminating the number of landfills in the region. The biggest benefit is the reduction in possible environmental contamination from the uncontrolled disposal of waste at unstaffed landfills and there is less chance of an unsafe operational situation occurring.

As in Option 3, commercial customers would be directed to the two staffed landfills, thus allowing gate fees to be collected for this waste stream. Rate-paying residents could have access to their local transfer station and the two landfills via the remote access entry system.

In terms of expenditure, there is an added benefit to having a transfer station instead of a landfill; a transfer station does not require earthworks to excavate new cells nor does it require cover (e.g. soil) to be placed over the waste regularly.

The costs allowed for the establishment of the transfer stations include:

- Develop a facility design
- Gain DWER approvals (licencing)
- Complete groundworks (level site)
- Construct
 1. Hardstand area for placement of waste bins (compacted unsealed)
 2. Ramped and raised platform
- Create stormwater perimeter bunds (earthworks)
- Prepare landscaping
- Fencing the transfer station with 1.8m chain link at the front and 1.8m stock fencing on the other three sides
- Purchase four 6m³ front lift bins for each transfer station
- Remote access CCTV system (with two cameras)

The capital expenditure for the two staffed landfills includes:

- Purchase and install
 1. 3m x 4m Gatehouse (second hand)
 2. Boom gate
 3. 3KW Generator for gatehouse a/c and computer
- Operational costs including:
 1. Site staff (gatehouse operator) for three half-days per week for each staffed landfill
 2. Electronic waste records system (waste records and finance)

6.1.5 Option 4: All transfer stations with remote access plus one staffed regional landfill

Option 4 is almost identical to Option 3 except that instead of two staffed landfills, there would be only one staffed landfill in the NEWROC region. As described in **Section 2.4**, the regional landfill would be the single point for all commercial customers to dispose of their waste. All other landfills would be converted into transfer stations, accessible by rate-paying residents, with the waste being transferred to the single regional landfill.

Table 6.5 outlines the cost of converting all landfills to transfer stations except one, which would then be converted into a staffed regional landfill.

Table 6.5 - Option 4: All transfer stations with remote access plus one staffed regional landfill economic analysis

Facility	Facility cost			Transport	
	Capital	Operational	Annualised Capex & Opex	Weekly collection	Fortnightly collection
Collection truck mobilisation				22,880	11,440
Koorda Transfer Station (Existing)	94,270	10,371	16,715	40,560	17,680
Mt Marshall - Bencubbin Transfer Station	94,270	10,371	16,715		
Mt Marshall - Beacon Transfer Station	94,270	10,371	16,715		
Mukinbudin Transfer Station	94,270	10,371	16,715		12,480
Nungarin Transfer Station	94,270	10,371	16,715		
Trayning - Kununoppin Transfer Station	94,270	10,371	16,715		
Trayning - Yelbeni Transfer Station	94,270	10,371	16,715		
Wyalkatchem Regional Landfill	41,130	47,211	50,727	-	-
NEWROC TOTAL	701,020	119,808	167,728	63,440	41,600
TOTAL ANNUAL COST				231,168	209,328

Additional Revenue			Income	Weekly	Fortnightly
Commercial' waste gate fee income				298,721	298,721

Net income				67,553	89,393
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The annual net income for the NEWROC to convert seven landfills to transfer stations with remote access and maintain a single landfill (staffed part-time) would be approximately \$90,000 based on a fortnightly collection of waste from the transfer stations or approximately \$65,000 based on a weekly collection of waste from the transfer stations (see **Section 6.3** for details about the transport cost modelling).

Option 4 requires the same capital and operation costs as Option 2, however, these costs would only need to be spent on one facility, instead of two. The remaining landfills would be converted into transfer stations, as discussed in Option 3.

Although increasing transport costs, a single regional landfill allows for a consolidated, economical approach to waste management. All commercial customers would be directed to the single facility, potentially extending the transport time for commercial customers located far from the single facility's location. Similarly, all waste disposed at the transfer stations would need to travel to the one central location.

Option 4 also allows for costs to be centralised in one location; only one facility would require staff, a gatehouse, and operational attention (e.g. cell excavation and daily cover). This would save money in the long-term and allow for a concentrated effort in one location instead of spreading the responsibility and expenditure over several facilities.