



GLEN INNES SEVERN COUNCIL
Landfill Environmental Management Plan (LEMP)
Glen Innes Landfill

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**LANDFILL ENVIRONMENTAL
MANAGEMENT PLAN (LEMP)
GLEN INNES LANDFILL**

December 2010

for Glen Innes Severn Council

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Appendix A – Maps
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Date: 14 December 2010
Report: CodyHart 10.2044.5

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1. EXECUTIVE SUMMARY

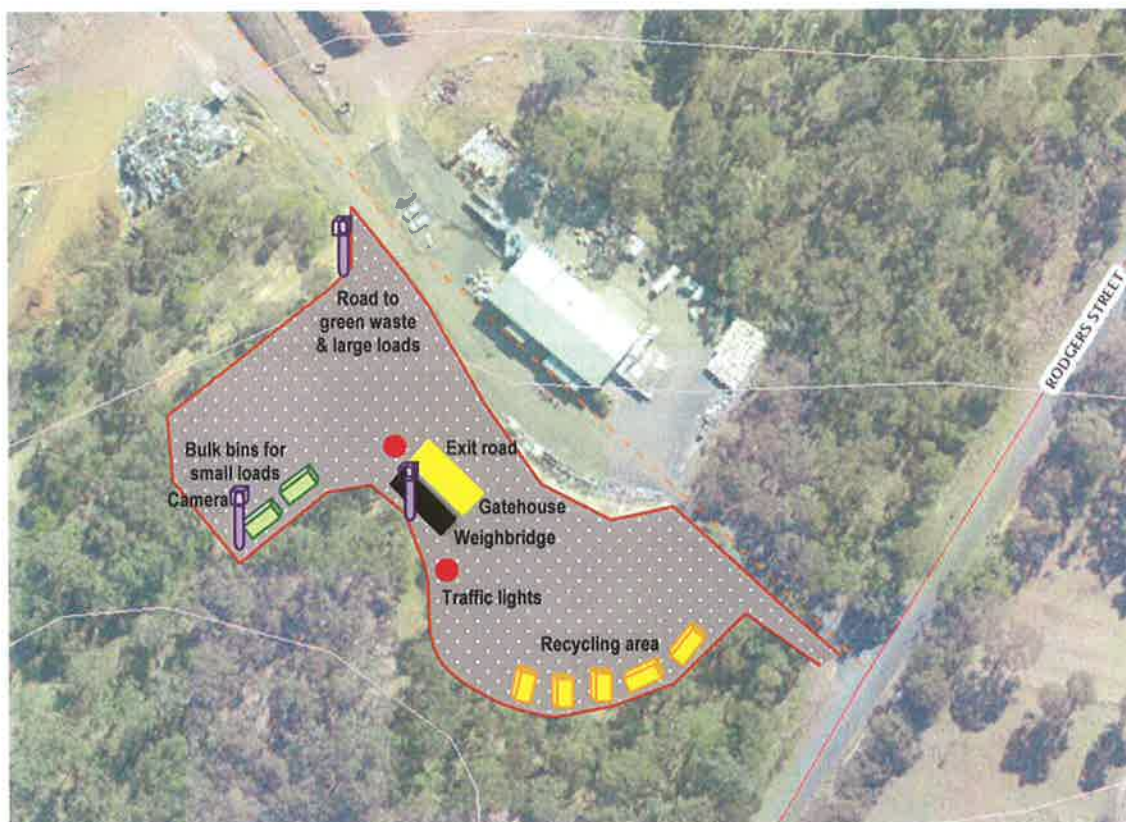
This document is the Year 2010 Landfill Environmental Management Plan (LEMP) specific to operations that impact on environmental issues of the Glen Innes Landfill owned and operated by the Glen Innes Severn Council.

The landfill covers approximately 4.2 hectares between Blue Hills and Rodgers Road (Figure 1). Any new landfills or landfill extensions post September 2000 require a base barrier system and a leachate collection system. Glen Innes Council was ahead of these requirements. In the 1990s the southern section of the landfill was lined with a one metre thick clay liner, a bund wall placed between the new landfill cell and the remaining quarry, and a leachate collection and treatment system was installed.

The central road area is over previous landfill. By re-engineering the roadway to contain solid waste and direct leachate to the current leachate sump, the current northern and southern sections of the landfill can become one. This will allow better management and deposition of a greater volume of solid waste.

Quarterly environmental monitoring for leachate, groundwater, surface water and methane has been conducted since Year 2001, and shows that the leachate removal and treatment system is working effectively. No leachate ingress into surface water or groundwater has been detected. A geophysical resistivity survey conducted in Year 2003 corroborated that groundwater was not being affected. A risk assessment in the same year concluded that the leachate pump-out is efficient. Even in a wet period, pumping was only required for approximately four hours a day. The recommended two extra downgradient wells closer to the landfill have been installed. The quarry dam pump-out management plan has been written and implemented.

Manning and fencing of the landfill have improved operations. However, more recyclables would be recovered and operations greatly enhanced by charging rates similar to those of Armidale Dumaresq Council and having a demountable gatehouse, weighbridge and a bulk bin receival area for small loads. A hypothetical layout is depicted below.



Base map from SIX © NSW Dept of Lands 2006, downloaded December 2010

Managing the landfill as a single mass, the landfill will last 19 more years if filling to RL 996 m with a track dozer. Alternatively using a heavy, steel wheeled compactor, the landfill will last 35 more years, thus providing an extra 16 years of landfilling. A brand new, fifty tonne, steel wheeled compactor costs ~\$1 M to \$1.2 M.

A new landfill, lasting say 100 years, has to take into account the cost of the land, approvals, site development, best practice liner, leachate collection, and landfill gas recovery and groundwater monitoring wells. A 2009 study for the Federal Government estimated these establishment costs for a small landfill to be in the order of \$40 per tonne for the life of the landfill. Delaying the need for a new landfill for an extra 16 years by managing the present Glen Innes Landfill as a single mass and using a heavy, steel wheeled compactor will save in the order of \$4.08 M to \$6.93 M.

Some of the savings can be well spent assuring the stability of the current landfill and improving its surface water and landfill gas controls. This LEMP provides information on the type, location and sizing of these controls and a staged program for their installation. Proposed surface water controls on the southern section of the landfill are depicted below.



A landfill can be managed as both a landfill and park land. By minimising the size of waste cells, a greater proportion of the site can be in grass restoration phase using water sensitive urban design.



(GCCC 2007)

2. INTRODUCTION

This LEMP

- ❖ Provides direction on the selection and implementation of appropriate environmental management techniques during the remaining operational life of the landfill.
- ❖ Reflects the requirements of the Environment Protection Licence 5939 for the Glen Innes Waste Management Depot, under Section 55 Protection of the Environment Operations Act 1997.
- ❖ Reflects Glen Innes Severn Council commitment to improving the performance and sustainability of the landfill.

Glen Innes Council submitted a LEMP to EPA Armidale in February 1998 which was last updated in Year 2002. This Year 2010 LEMP draws on historical information provided in the 1992 LEMP and generally follows LEMP requirements outlined in the *Environmental Guidelines: Solid Waste Landfills* (EPA NSW 1996).

3. SITE OVERVIEW

The land occupied by the landfill forms part of Lot 7014 DP1028490 (Figure 1) under the Glenn Innes Severn Local Environmental Plan. The Lot also accommodates a recycling facility, three dams that treat leachate pumped from the base of the landfill, 'the town common' land on the north of the lot, and vacant land used for Council stockpiling on the lot's southeast.

Figure 1: Location of Glen Innes Landfill



Base map SIX (Spatial Information Exchange) © NSW Department of Lands 2006, downloaded 1 October 2010

The site was formerly owned and operated by the Glen Innes Municipal Council, but also received solid waste from the Severn Shire Council. The two Councils amalgamated in 2004 to become the Glen Innes Severn Council.

3.1 Zoning

The Lot was previously called Reserve R87449 which was gazetted on 10th October 1969 as a Rubbish Depot (Appendix A). It is currently zoned as Special Uses 5(a) and the surrounding zoning is Rural 1(a).

3.2 Area

The current portion of land under landfill is approximately 4.2 hectares (Figure 2). This is similar to the area designated as a landfill on a map first drawn by Council in 1995 (Appendix A).

Figure 2: Landfilled area (shaded)



Base map from SIX (Spatial Information Exchange) © NSW Dept of Lands 2006, downloaded November 2010

3.3 Surrounding environmental characteristics

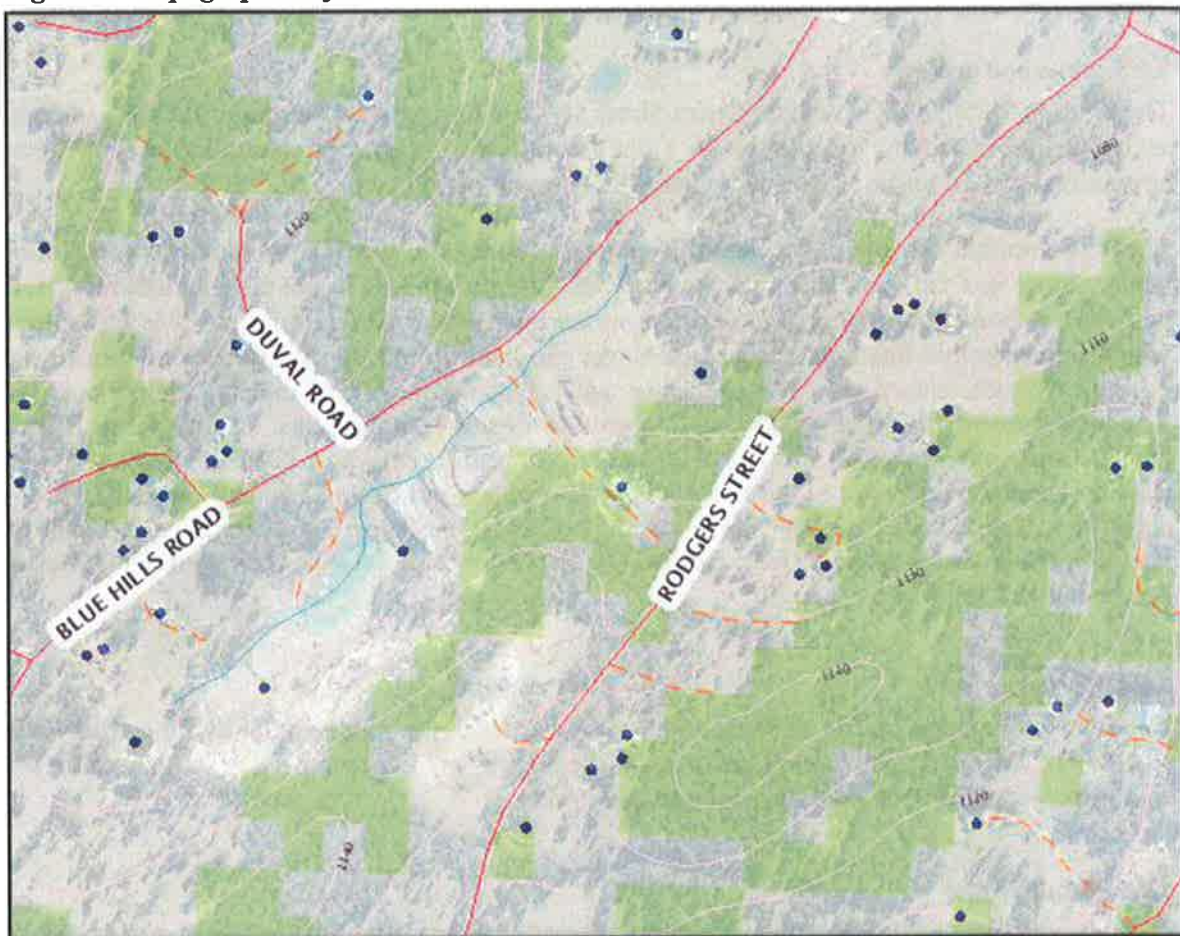
Glen Innes is located in the New England Tablelands of northern New South Wales. Prior to landfilling, the site was a road base gravel quarry for the Glen Innes Municipal Council.

The landfill site is between Blue Hills Road to the west and Rodgers Road to the east (Figure 2). It is adjoined to the south by a quarry previously owned by the Severn Shire Council (Figure 1). **What is referred to as 'the town common' adjoins to the north.** In earlier days surface tin mining was carried out in the town common by individuals, and in the 1980s three exploratory drill holes for tin, to a maximum depth of 254 metres were drilled.

3.3.1 Topography

Topographical fall starts at 1130 AHD (Australian height Distance) on the non-landfilled south eastern portion of the site, and finishes 40 metres lower at 1090 AHD on the northern section of the landfill (Figure 3).

Figure 3: Topographical fall



Base map from SIX © NSW Dept of Lands 2006, downloaded November 2010

3.3.2 Climate

Glen Innes climate information is sourced from the Glen Innes Ag Research DPI facility (Bureau of Meteorology Station No. 056013) (<http://www.dpi.nsw.gov.au/research/centres/glen-innes/climate>). Its additional evaporation data assists with water balance calculations, and frost information assists in understanding climate extremes encountered by plants, water pipes and landfill equipment. Rainfall data is based on 96 years of records and the temperature data is based on 35 years.

Table 1: Glen Innes Ag Research Station climate data

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Max temp °C	25.2	24.4	23.1	19.8	16.2	13.1	12.4	13.9	16.8	19.8	22.1	24.4	
Min temp °C	13.5	13.3	11.4	7.9	4.9	1.8	0.7	1.2	4.1	7.1	9.8	12.0	
Rainfall (mm)	106	94	72	41	50	43	57	49	54	78	88	108	848
Evaporation (mm)	171	134	133	93	62	48	53	75	105	137	153	174	1336
Number of frosts	0	0	1	4	11	17	21	20	12	5	1	1	93

The Northern Tablelands is a cool temperate highlands region. Climatic conditions include average annual rainfall of 848 mm with marked summer incidence, a wide temperature range, and precipitation exceeding evaporation only in winter months. There is a 200-day frost interval (April - October) and intensely cold winter conditions.

3.3.3 Soils and geology

The Grafton 1:250,000 Geological Series Sheet SH 56-6 defines the Glen Innes Landfill site area as being dominated by igneous rocks - undifferentiated granites or granodiorites laid down approximately 215 million years ago during the Permian period.

There is minimal topsoil in the landfill environs. When drilling for groundwater monitoring wells, diorite was the main base rock encountered - diorite has less quartz than granodiorite. Both vertical and horizontal fractures are evident in the quarry and road cuttings on Blue Hills Road which indicates that this may be the case under the landfill and its surrounds. The diorite was overlain by sedimentary clay and shale that are composed mostly of mineral grains and rock fragments derived from the weathering and erosion of pre-existing rocks. Bands of rhyolite, an igneous rock, were noted in the diorite of well GW2 and the clays of GW3 (Figures 4-6). The clay/diorite interface in most of the area of the town common just downgradient of the landfill is at a depth of approximately 20-21 m. The 20 to 21 m of upper clay provides a natural cut-off wall for landfill leachate that may egress from the site. On the western side at GW2, the clay/diorite interface was higher at 2.5 m.

3.3.4 Surface water

An ephemeral stream on the western border of the landfill site runs parallel to Blue Hills Road (Figure 3). Its catchment comprises mainly the higher gradient properties to the south and southwest and pump-out from the southern quarry dam.

3.3.5 Groundwater

A study of solely groundwater levels surrounding the landfill was undertaken in Year 2002. Wells GW3 and GW4R were installed in Year 2004. Their groundwater levels were incorporated into the groundwater flow direction computation (Figure 4).

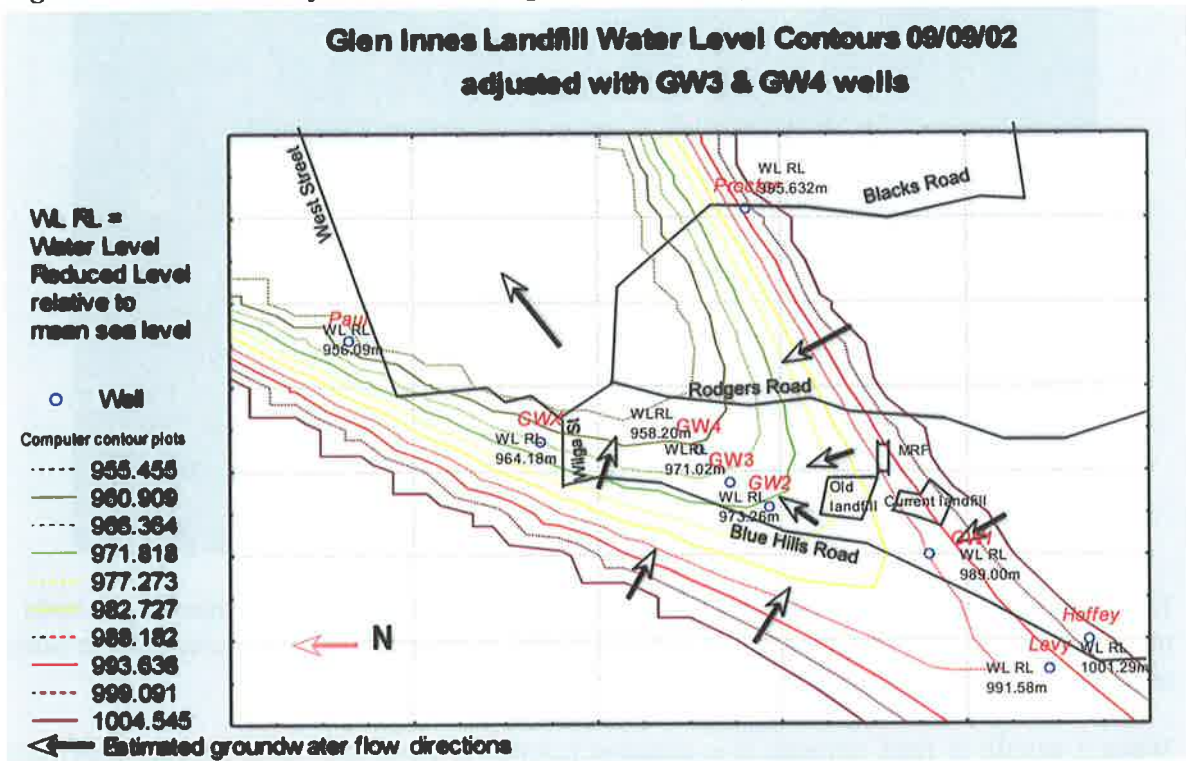
Groundwater generally moves north, northwest in the vicinity of the landfill, then under and down the valley. Taking the general groundwater flow direction into account, the beneficial uses to be protected are:

1. irrigation water if owners of downgradient wells choose to irrigate
2. the Rocky Ponds Creek.

These beneficial uses are quite distant from the landfill and there are now three wells directly downgradient from the landfill to act as an early warning system.

Groundwater velocity is moderate along the western side of the site: at well GW1 53.56 m/year, GW2 120.67 m/year, and GW3 89.27 m/year. Downgradient of the leachate dams at the centre of the site, groundwater velocity is very slow at well GW4R at 0.10 m/year.

Figure 4: Groundwater flow direction, September 2002, adjusted to include GW3 & GW4



(Hart 2010)

3.3.6 Flora and fauna

Remnant bushland is found immediately surrounding the landfill, then small rural holdings, and finally smaller residential lots as one proceeds towards the Glen Innes central business district to the northeast (Figures 1 & 2).

Flora surrounding the site includes wattles, varieties of eucalypts and spear and tussock grass. The town common to the south has eroded ephemeral stream beds. (Photograph 1) Car bodies and other metal objects protrude from the banks of the ephemeral stream on the southwest section of the town common.