MIDLAND REDEVELOPMENT AUTHORITY

SITE ENVIRONMENTAL MANAGEMENT PLANS

REMEDIATION OF HELENA EAST PRECINCT FORMER RAILWAY WORKSHOPS, MIDLAND

VERSION 2

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ATA Environmental
environmental scientists

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1. INTRODUCTION

1.1 Site Location and Background

The former Midland Railway Workshops site occupies an area of approximately 70ha and is located immediately south of the Midland town centre (Figure 1). It is separated from the Midland town centre by a rail line reserve as shown on Figure 2.

In January 2000, the Midland Redevelopment Authority (MRA) was formed according to the Midland Redevelopment Act (1999) to undertake and manage the redevelopment of land south and northwest of the city centre (Figure 2), including the former Midland Railway Workshops site.

Since its formation, the MRA has overseen the remediation, restoration and redevelopment of approximately 75% of the Workshops site. These projects have contributed to a progressive revitalisation of the Midland area and its surrounds, attracting additional capital investment in the form of the commercial and residential development, and are creating employment opportunities for Midland.

The last major precinct to be remediated and restored is Helena East and the Southern Embankment, which are located centrally in the Midland Railway Workshops site (see Figure 2). Helena East is the oldest area of the Workshops and is historically where the majority of maintenance and manufacturing activities were undertaken. This area also has a large number of Heritage-listed buildings, which the MRA will restore to provide a strong link to the historical use of the site.

The Public Environmental Review (PER) document (ATA, 2005) describes the contamination status of Helena East and the Southern Embankment and the proposed remediation strategy to allow development of the site in accordance with the Midlandmetro Concept Plan 2010 (MRA, 2005). This Site Environmental Management Plan for the remediation of the Helena East Area has been prepared to accompany remedial works outlined in the PER.

A summary description of the site, surrounding environment, physical environment and proposed remediation are included in this document. The PER (ATA, 2005) provides more detailed information. Appendices referenced are provided in the PER.

1.2 Scope of Work

The purpose of these plans is to outline the management measures proposed with respect to the environment and public health and safety on the site. It is anticipated that the contractor will develop project specific Environmental and Health and Safety Management Plans that are tailored to the final project design and methodology.

This plan is intended to guide contractors and the project team in managing the project and to prepare more refined management plans once civil design aspects of the work have been finalised.

1.3 Objectives

This Site Environmental Management Plan:

- provides a summary of the site, its history and the nature and extent of contamination;
- outlines the proposed remediation strategy including environmental management measures during and post remediation; and
- establishes performance indicators to be used to demonstrate successful remediation.

2. SITE DESCRIPTION & PROPOSED REMEDIATION SUMMARY

The site in the context of this Management Plan can be defined as the Helena East Precinct and the Southern Embankment area (Figure 3). The site includes the WA Meat Industry Authority (MIA) land to be used as a Containment Area for contaminated soil for the purposes of this Management Plan.

2.1 Proposed Land Use, Historical Uses and Surrounding Environment

2.1.1 Land Tenure and Proposed Land Use

Helena East and the Southern Embankment are situated within the Helena Precinct under the Midland Redevelopment Scheme (gazetted 8 Feb 2005).

The MRA proposes that the Helena East and Southern Embankment areas be developed for a number of land uses including:

- Residential (low to medium density);
- Commercial;
- Education;
- Mixed Use (Commercial/Residential);
- Community Uses, eg Public Open Space, Museum.

The Heritage status of buildings and areas within Helena East is an integral part of land use planning. The proposed site layout and associated land use following redevelopment are shown on Figure 4.

The WA Meat Industry Authority (MIA) saleyards site is located east of Lloyd Street and south of Clayton Street as shown on Figure 2. The western most portion of the MIA site has been used in the past as a waste disposal area and it is proposed that waste material from Helena East and the Southern Embankment is disposed in the MIA Containment Area as an alternative to landfilling large quantities of low level contaminated soil.

2.1.2 Historical Site Uses

Helena East comprises the central portion of the former Midland Railway Workshops, which operated from 1904 until its closure in 1994. The Workshop site was used for the fabrication, maintenance and repair of locomotives and other rolling stock during this time.

The Southern Embankment comprises a portion of land immediately abutting the southern boundary of Helena East (Figure 3). It is an area in which waste produced during the Workshops operations were deposited as landfill that progressively formed an embankment extending south towards the Helena River Floodplain.

The proposed MIA Containment Area (Figure 2) comprises the western portion of the sheep and cattle saleyard that was established around 1910.

2.1.3 Surrounding Environment

Helena East and the Southern Embankment areas are surrounded by the following land uses:

- North: Railway Reserve and Midland town centre.
- South: Helena River floodplain and Helena River.
- East: Western Australian Police Service (WAPS) site, Area E (proposed hospital development); and Areas B, C, D (to be used for WAPS activities and commercial activities). The CADCOM complex is located adjacent to the central eastern boundary of Helena East.
- West: Former rail yards remediated and subject to future residential redevelopment (Helena West Precinct). The far western section of the Helena West Precinct, adjacent to Amherst Road, currently has housing being built as part of the Woodbridge Lakes residential development.

The nearest established residential area is approximately 200m to the north across Railway Parade in Midland. Semi-rural residences exist approximately 150m-200m south of the southern site boundary. The closest primary schools are Midland and Woodbridge Primary Schools located approximately 800m both north and west of Helena East, respectively.

Various parties holding lease agreements with the MRA are currently using several buildings within Helena East on a daily basis. Several of these leases are due to expire in the next 12 months.

The proposed MIA Containment Area is surrounded by the following land uses:

- North Saleyards to be redeveloped as commercial subject to the MIA-MRA Cabinet Decision.
- South Brickworks (Austral Bricks).
- East Saleyards to be developed for commercial use subject to the MIA-MRA Cabinet Decision.
- West WAPS site to be used for WAPS activities and commercial activities (Areas B, C, and D), portion of Austral brickworks site.

The containment area is located within a commercial/light industrial area with the closest residential areas situated approximately 350m to the north across Railway Parade and approximately 650m to the south near Stirling Crescent.

2.2 Current Site Condition

Helena East is a generally flat, with buildings and infrastructure associated with the former Midland Railway Workshops covering much of the site. Approximately 35% or 6ha of the total Helena East area (17ha) is covered by buildings, with the three main blocks alone covering an area of approximately 4ha (see Figure 3). Bitumen hardstand or sub-base materials such as gravel and crushed blue metal cover almost all of the remainder of the site.

The Southern Embankment is characterised by a very narrow flat area abutting the southern boundary of Helena East leading to an embankment of some 8m height that slopes down to the Helena River floodplain. Originally the natural embankment was closer to the Helena East boundary, but progressive filling extended the embankment southwards over time.

The area of the Southern Embankment covered by this proposal is approximately 0.8ha and due to historic landfilling of waste is estimated to contain approximately 70,000m^3 of building rubble, coal cinders, ash/clinker, foundry slag, occasional asbestos products and hydrocarbon contaminated soils (ENV, 2002b). Recent investigations (ATA Environmental, 2005) have indicated that the volumes of hydrocarbon contaminated materials in the fill south of the tarpaulin shop and above ground fuel storage tank are approximately three to four times greater than predicted by previous investigations.

The proposed MIA Containment Area is a narrow, flat portion of land located at the western edge of the saleyards site adjacent to the eastern boundary of the WAPS 'Area B, C, D' and 'Area E' Precincts and the brickworks operated by Austral Bricks. Animal holding yards and truck unloading areas abut the eastern edge of the proposed Containment Area.

The northern part of the proposed Containment Area contains an office and stand of trees with much of the rest of the site covered by hardstand for trucks to turn around and unload animals. A truck washdown bay and solids settling area is located centrally in the proposed Containment Area with a detention basin situated at the far southern end. It has been noted that all surface water on the site drains to the detention basin with extra water being pumped to the Hazelmere settling ponds on the southern side of Helena River (ENV 2003a).

2.3 Physical Environment

2.3.1 Climate

The site experiences a Mediterranean climate with hot dry summers and cool wet winters. Climatic data recorded for Perth Airport (approximately 4km southwest of the site) shows the area receives an average annual rainfall of 790mm, the majority of which is received between May and August (Bureau of Meteorology, 2005).

The predominant wind direction recorded at the Perth Airport is easterly in the morning and southwest to westerly in the afternoon. During the winter months the

prevailing wind direction changes to a north-easterly direction in the morning with the afternoon wind losing its south-westerly predominance with winds coming from all directions. During summer afternoons the south-westerly is the strongest, reaching speeds in excess of 20km/hr.

2.3.2 Topography

The topography of the land in and around the Workshops and saleyards sites has been heavily altered over time to facilitate development. The topography of Helena East and the proposed MIA Containment Area is generally flat with an elevation approximately 14m AHD. The narrow portion of the Southern Embankment area that abuts the southern edge of Helena East is also similar in height.

The Southern Embankment also comprises a steep embankment of some 8m that slopes down to the Helena River floodplain that has a general elevation of approximately 4m to 6m AHD.

2.3.3 Geology

A stratigraphic sequence of the geology underlying Helena East and the proposed MIA Containment Area has been interpreted from observations made during onsite investigations undertaken to date. Broadly, the stratigraphy of the site comprises four main units in the upper 30m below ground level (BGL), which are described in this document as Inert Fill, Waste Fill, Upper Clays, and Lower Sands (Table 1). The relationships between these units are described below. The locations of interpreted geological cross sections for the site are shown on Figure 5. Three east – west cross sections are presented in Figures 6a to 6c, and a north – south cross section is presented in Figure 6d.

TABLE 1
STRATIGRAPHIC SUMMARY

Unit	Description	Geological Formation	Approx. Depth mBGL
Inert Fill	Gravel, limestone roadbase	-	0m – 0.3m
Waste Fill	Ash, cinder, metal fragments, rubble	-	0.3m – 0.5m
Upper Clays	Silty and sandy clays, clayey sands.	Guildford Formation	0.5m – 10m
Lower Sands	Unconsolidated sands with some silt, slightly indurated sandstone.	Guildford Formation Osborne Formation, Henley Sandstone Member.	10m – ?25m ?25m – ?40m
Shale	Grey to black shale.	Leederville Formation, Pinjar Member	?40m – ??

2.3.4 Hydrogeology

Groundwater at Helena East has been subject to detailed hydrogeological investigations. Hydrogeological data from an earlier investigation (ENV 2003b), together with additional investigations undertaken as part of this PER have been reviewed by an independent consulting hydrogeologist (Crisalis, 2005 and 2006).

Site-specific investigations demonstrate that the groundwater gradients and flow direction across the site are strongly affected by the relatively complex geology within the Upper Clays unit, as well as by the ability of rainfall to infiltrate the ground (correlating to the presence or absence of extensive hardstand areas).

Broadly, two groundwater systems have been identified and investigated: a complex shallow flow system perched within the Upper Clays, referred to as the Shallow Superficial Aquifer (SSA), and a deeper aquifer in the Lower Sands called the Lower Superficial Aquifer (LSA), which is in direct hydraulic continuity with the Henley Sandstone (ENV, 2003b) and essentially forms a single hydrogeological unit. The Henley Sandstone is underlain at depth by shale (interpreted as the Pinjar Member of the Leederville formation), which forms an aquiclude capping the extensive regional aquifer system in the Leederville Formation. The Leederville Aquifer is understood to be confined under pressure by the Pinjar Shale.

Bore elevation and construction information is summarised in Table 2.

TABLE 2
BORE ELEVATION AND CONSTRUCTION DATA

Bore ID	Ground	Standing Water Level	Screened Interval	Base of Hole	Aquifer
	AHD	AHD	mBGL	mAHD	
ATA-1	13.65	9.91	3 - 9	4.65	SSA
ATA-2	13.59	9.73	2 - 8	5.59	SSA
ATA-3	13.7	12.33	2 -5	8.70	SSA
ATA-4	13.79	12.44	1 - 6	7.79	SSA
ATA-5	13.8	9.62	5 - 9	4.80	SSA
ATA-6	13.4	11.61	2 - 5	8.40	SSA
ATA-7	13.29	8.14	2 - 6	7.29	SSA
ATA-8	13.43	8.85	1.5 - 7	6.43	SSA
ATA-9	13.52	11.99	1.5 - 8	5.52	SSA
ATA-10	13.73	11.21	1.5 - 8	5.73	SSA
ATA-11	13.46	11.21	1.5 - 7	6.46	SSA
ATA-12	13.25	6.15	3.5 - 8.5	4.75	SSA
ATA-13	13.42	(Dry)	2 - 7	6.42	SSA
ATA-14	13.44	(Dry)	1 - 7	6.44	SSA
ATA-15	13.72	3.12	12 - 15	-1.28	LSA
ATA-16	13.66	4.35	10.5 - 13.5	0.16	LSA
ATA-72	5.97	2.52	2.5 - 5.5	0.47	LSA
ATA-73	6.14	2.54	2.5 - 5.5	0.64	LSA
ATA-75	6.29	2.58	2.5 - 5.5	0.79	LSA
ATA-76	5.82	2.52	3 - 5	-0.18	LSA
ATA-77	5.73	2.59	2 - 5	0.73	LSA
B3	5.37	4.44	2.5 - 7	-1.63	LSA
H5B	13.25	6.94	? - 11	2.25	SSA
H5H	13.40	11.45	? - 7	6.40	SSA
HE-1	13.63	12.27	1.5 - 10.5	3.13	SSA
HE-2	*13.72*	*4.45*	*9 - 15*	*-1.28*	*LSA*
HE-3	*13.72*	*4.30*	*9 - 15*	*-1.28*	*LSA*
HE-5	14.08	4.59	9 - 16	-1.92	LSA
HE-6	13.93	6.74	8 - 14	-0.07	Intermediate*
HE-7	*13.65*	*4.56*	*5.5 - 11.5*	*2.15*	*LSA*
HE-8	13.77	3.83	8 - 14	-0.23	LSA

	Ground	Standing Water Level	Screened Interval	Base of Hole	
HE-9	13.82	6.12	8 - 14	-0.18	Intermediate*
HE-11	13.24	4.43	7 - 13.5	-0.26	LSA
HE-14	13.91	5.68	? - 13	0.71	Intermediate*
HE-15	13.47	4.37	? - 12	1.47	LSA
HE-17	13.59	9.34	? - 12	1.59	SSA
HP-13	12.15	6.22	4 - 9	3.15	SSA
HP-15	12.55	7.79	4 - 9	3.55	SSA
HWMW1	13.10	4.48	7 - 13	0.10	LSA

Notes: Italicised bores were decommissioned and filled with a bentonite-cement grout mixture on 25/1/2006.
Shaded bores are considered to represent the LSA system.
Intermediate* indicates bores which have water levels intermediate between the SSA and LSA.

The perched SSA system has formed in the Upper Clays due to their generally low permeability.

Twenty groundwater monitoring bores (including two dry bores) are screened within the SSA, with groundwater in these bores found at between approximately 12mAHD and 7mBGL at Helena East (deeper towards the Southern Embankment). The LSA is confined or semi-confined by the Upper Clays.

The main hydrogeological features of the SSA and LSA are summarised in Table 3, based on the data from extensive Helena East and Southern Embankment investigations.

TABLE 3
HELENA EAST & SOUTHERN EMBANKMENT
HYDROGEOLOGICAL DATA SUMMARY

	Shallow Superficial Aquifer	Lower Superficial Aquifer
Groundwater Elevation	7 – 12 mAHD	3 – 4.5mAHD
	1.5 – 6.5 mBGL	9 – 10.5 mBGL
Groundwater Flow Direction	SW (generally)	WNW
Horizontal Hydraulic Gradient	(variable)	0.0035 (locally)

Limited drilling information indicates that the LSA is approximately 30m in vertical extent, extending through unconsolidated sands comprising the Henley Sandstone Member. The Shale unit at approximately 40mBGL forms a basal aquiclude to the LSA. No site-specific investigations have been undertaken in the underlying Leederville Aquifer.

2.3.5 Site Drainage and Surface Water

Storm water run-off from roofs and paved surfaces is currently collected by an existing drainage network and directed to outfalls into the Helena River floodplain. The drainage network is old and will require progressive replacement as part of the redevelopment project. Existing outlets discharge storm water direct without trapping of pollutants.

The proposed MIA Containment Area is for the most part covered by hardstand and stormwater drainage is directed via drains to the basin located at the southern end of the containment area.
In a regional context, the Helena River floodplain is situated near the southern boundary of Helena East and Southern Embankment areas. The Helena River is a major tributary of the Swan River, with its confluence located at South Guildford. The Helena River flow in summer is highly restricted. Mosquito control is required by the local council in the seasonally stagnant pools.

2.3.6 Vegetation, Flora, Fauna and Wetlands

A site visit conducted by ATA Environmental on the 1 December 2005 showed that the remaining vegetation in the Helena East, Southern Embankment and MIA Containment areas is representative of the Swan Complex, albeit highly degraded.

There is an absence of significant vegetation due to historical clearing and building activities onsite. This has resulted in a lack of fauna habitat and a lack of fauna at the site. Consequently there are no fauna values to be impacted.

According to the *Geomorphic Wetlands Swan Coastal Plain Dataset* provided by the Department of Environment (DoE) the Southern Embankment abuts a Conservation Category Wetland (Floodplain) (UFI 13628). A Floodplain is a seasonally inundated flat.

2.4 Social Environment

2.4.1 Indigenous Heritage

The Midland Redevelopment Authority has consulted with Aboriginal community group representatives and made two separate applications under Section 18 of the Aboriginal Heritage Act 1972 to develop the land within its scheme area. The remediation works proposed in Helena East pose no management issues with respect to Section 18 of the Aboriginal Heritage Act 1972.

2.4.2 Non-Indigenous Heritage

The former Midland Railway Workshops site represents the most substantial industrial complex established by the State Government in the period around the turn of the century and contains a large number of Heritage buildings. Many of the oldest and most significant buildings onsite are located within Helena East and essentially remain unchanged since their construction. On this basis the preservation of these buildings is a primary focus of the redevelopment of the workshops site.

Figure 4 illustrates the main Heritage-listed structures located within Helena East that will be retained as part of the redevelopment plan. The 1904 Power House was literally the engine room for the workshops. Together with the adjacent Boiler House and the Hot and Cold Wells, it provided the infrastructure that generated electricity for the workshops.

2.5 Public Safety

2.5.1 Existing Site Access and Traffic

Helena East is surrounded on all sides by cyclone fencing, that is along Yelverton Drive to the north, Centennial Place to the east, the 6-7m embankment down the to Helena River Floodplain in the south and between the site and the Woodbridge Lakes development to the west (pers. comm. K.Hutchinson, MRA. 11/11/05).

Other than for train access, the site entrance is located at the north end of the site where security staff controls vehicle and pedestrian traffic 24 hours per day.

Currently most traffic onsite is pedestrian traffic, and vehicle traffic is limited to service vehicles, security vehicles and parking for use of occupied by lessees. Trains enter and exit the site from the west for service and restoration. This includes the "Dinner Train" 2-3 times per week, Public Transit Authority passenger rolling stock several times per week as required, and occasional rolling stock that are being refurbished by the Australian Railway Historical Society (ARHS).

2.5.2 Services and Associated Infrastructure

Following closure in 1994 many of the services present across the workshops site were decommissioned. At Helena East all of the major services, with the exception of some minor electrical lines, water and sewer have been severed.

At the MIA Containment or the Southern Embankment Areas there are no services that present a danger to the workers onsite or the public.

2.6 Nature and Extent of Contamination

Helena East has been most intensively investigated, due to the long history of industrial use of that portion of the site, as well as the variety of potentially contaminating activities which took place there. A total of some 250 locations were tested across Helena East, and approximately 10 locations across the Southern Embankment (see Figure 7). A total of 43 locations were tested at the MIA Containment Area.

A review of contamination identified in previous investigations and additional investigations by ATA for this PER indicates that contamination can broadly be assigned to one of three categories as follows:

- Waste Fill deposits from historical dumping at the site (generally comprising bulk soil, metal fragments, ash, slag, asbestos, and other debris), which is contaminated and/or geotechnically unsuitable.

- Natural soil affected by contamination migrating from overlying sources (e.g. hydrocarbons).

- Groundwater impacted via migration of contaminants through overlying fill and/or natural soil.

2.6.1 Soil Contamination Overview

Laboratory results of soil samples have been compared to values in Table 1 of *Assessment Levels for Soil, Sediment and Groundwater* (DoE, 2003). Soil results have been compared to the Ecological Investigation Levels (EILs), which are designed to protect the environmental receptors. The EILs are the most stringent assessment levels, and are therefore also protective of human health. Soil that exceeds one or more EIL criteria is considered contaminated for the purposes of this document. However, depending on the presence of environmental receptors and the proposed future land use, it is possible to use less stringent criteria that are still protective of human health (the Health Investigation Levels or HILs of DoE, 2003).

The Waste Fill material is characterised by some asbestos contamination (Figure 8a), and by concentrations of a variety of heavy metals that exceed the EIL guidelines (Figure 8b,c). Soil underlying contaminated fill does not exhibit concentrations of heavy metals that exceed EIL guidelines, indicating negligible impact by the overlying fill. However, some natural soil has been impacted by the migration of one of more of the following through the soil profile:

- cyanide;
- total petroleum hydrocarbons (TPHs);
- polycyclic aromatic hydrocarbons (PAHs); and/or
- solvents, comprising volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, and xylenes (BTEX), and halogenated aliphatic and aromatic hydrocarbons.

Overall, contamination associated with Waste Fill deposits comprises the bulk of soil contamination identified at the site, with an estimated *in situ* volume of up to 100,000m^3 in total identified in the Helena East and Southern Embankment areas.

Restriction of heavy metal contamination to the Waste Fill unit supports the view that the contaminants in the waste fill are not mobile and therefore not contributing to contamination of either adjacent or deeper soil through leaching of heavy metals (as presented in ENV, 2002b). It can similarly be argued that the asbestos associated with the Waste Fill is not mobile within the soil profile. In addition to asbestos materials associated with the Waste Fill, limited asbestos has been identified in surface soil along the southern portion of Helena East. This material is considered to be mainly derived from asbestos sheeting that clad the former Plating Shop.

Soil affected by hydrocarbons and/or solvents (i.e. TPHs, PAHs, BTEX and/or minor amounts of VOCs; Figure 8d,e) is also relatively extensive at Helena East and the Southern Embankment, with an estimated *in situ* volume of 30,000m^3 (including approximately 5,000m^3, which overlaps with Waste Fill in the Southern Embankment).

Cyanide contamination is very localised and minor. It is only identified at 3 sample locations adjacent to a former cyanide treatment plant area (Figure 8a).

At the MIA Containment Area, investigations by ENV (2003a) revealed that the western end of the saleyards site contains fill similar in nature to the Waste Fill unit at Helena East and Southern Embankment. The fill varies between approximately 0.5m and 1.5m thickness and is contaminated with heavy metals (As, Ba, Cu, Pb, Mn, Hg, Ni and Zn) and/or asbestos. A dedicated asbestos dump containing buried asbestos-containing materials is located in the central part of the site.

2.6.2 Groundwater Contamination Overview

Laboratory results for groundwater samples taken across the site (Figure 9) have been compared to assessment levels for Fresh Waters as well as Drinking Water. The majority of the assessment levels are presented in Table 3 of *Assessment Levels for Soil, Sediment and Water* (DoE, 2003).

Extensive low-level metal impacts (i.e., above Fresh Waters levels) have been identified at Helena East and the Southern Embankment (Figure 10a), although Drinking Water levels are only exceeded for manganese and nickel. Metals that exceed either the Fresh or Drinking Water assessment levels in the most recent round of sampling of 32 bores in August/September 2005 comprise cadmium (7 bores above Fresh Waters), copper (18 bores above Fresh Waters), manganese (1 bore above Drinking Water), mercury (4 bores above detection limits, and consequently above Fresh Waters), nickel (15 bores above Fresh Waters, 6 bores above Drinking Water), and zinc (all but 2 bores above Fresh Waters).

It is considered that elevated zinc may be a regional phenomenon, not necessarily related to the presence of Waste Fill at the site. One bore near Yelverton Drive, considered to be representative of water entering the MRA site, contains zinc and copper at concentrations exceeding the stringent Fresh Waters assessment levels. The former Plating Shop is considered to be the source for high nickel concentrations in at least two bores.

Hydrocarbon and solvent contamination in groundwater is localised within areas of the site where extensive hydrocarbons and/or solvents were identified in soil, particularly south of the Power House/Element Shop and south of the Tarpaulin Shop (Figure 10b). Based on soil and groundwater results for hydrocarbons, it is considered that there may be multiple overlapping plumes of different composition in the vicinity of the Power House/Element Shop, and two separate plumes south of the Tarpaulin Shop.

A layer of light non-aqueous phase liquid (LNAPL) comprising hydrocarbon fractions similar to mineral turpentine and degraded diesel was identified in one bore south of the Element Shop. PAHs that exceed the Fresh Waters assessment levels are naphthalene (3 bores) and total PAHs (2 bores). Solvents that exceed the Drinking Water assessment levels are benzene (2 bores), toluene (1 bore), ethylbenzene (2 bores), and xylenes (1 bore); one other bore is likely to exceed the criteria for BTEX, based on detectable concentrations of C_{6-9} chain-length hydrocarbon material. A variety of VOCs were identified in six bores adjacent to the Power House/Element

Shop, predominantly comprising halogenated aliphatic hydrocarbons (including tetrachlorethene, trichlorethene, dichloroethane, dichloroethene, and vinyl chloride). At three bores, one or more VOCs exceed both Fresh Waters and Drinking Water assessment levels.

Organochlorine pesticides are present at concentrations exceeding the Fresh Waters assessment levels in the same bore where free-phase LNAPL was identified (Figure 10b).

The data indicate that the lateral extent of the hydrocarbon and solvent plume south of the Power House/Element Shop has a limited extent within the Shallow Superficial Aquifer. To assist with the PER, two bores (ATA-15 and ATA-16) were initially installed to assess impacts in the Lower Superficial Aquifer. Low concentrations of VOCs, derived from common solvents known as DNAPLs (dense non-aqueous phase liquids, which are denser than water and can move vertically in aquifers irrespective of whether the aquifer is saturated with water) were identified in one of these bores.

Two hydrocarbon plumes are located south of the Tarpaulin Shop (Figure 10b): one to the southeast, by the Water Tank (which was used for diesel storage), and one adjacent the southwest corner of the Tarpaulin Shop. Both plumes extend from the southern portion of Helena East into the Southern Embankment. TPH in groundwater, derived from an LNAPL source (light non-aqueous phase liquids, which are less dense than water) appears to have migrated through the permeable Waste Fill to the Lower Sands; consequently, contamination is migrating through this material along the upper surface of the Lower Superficial Aquifer. No free-phase NAPL was identified in the affected bores, and additional work has confirmed that the plumes do not reach the Helena River, truncating near the Southern Embankment southern boundary.

Investigations by ENV (2003a) across the saleyards site included the installation of several groundwater monitoring bores, two of which were installed in the MIA Containment Area. ENV (2003a) recorded the presence of nickel concentrations in the bore at the southern end of the site that was greater than the Fresh Water and Drinking Water Guidelines. No other contaminants exceeding these guidelines were detected in the 2 bores at the MIA Containment Area.

2.7 Proposed Soil Remediation Strategy

It is envisaged that the proposed approach to the remediation will greatly reduce the extent of contamination associated with Waste Fill, and will remove hydrocarbon contamination to the extent practicable. Figure 11a shows the extent of soil contamination prior to remedial works, and Figure 11b shows the proposed post-remedial extent of contamination.

In order to achieve the proposed reduction in contamination, the areas of the site that have been identified as being significantly contaminated will be located by survey and remediated separately to ensure that highly contaminated materials are segregated and the volumes of soil requiring treatment or disposal are minimised.

Areas of significant contamination will be addressed by excavation. However, contamination beneath Heritage buildings and structures will not be excavated due to engineering constraints. Figure 12 illustrates the extent of the required buffer zones around Heritage buildings. The areas immediately adjacent to the Heritage structure will be remediated to the extent possible without damaging the stability of the structures. This will involve a maximum excavation depth of 300mm within 2m of Heritage structures. Beyond the 2m buffer zone around the structure, the wall of the excavation will proceed on a 1:1 slope to either the maximum depth of contamination or the maximum depth possible given the presence of other Heritage structures. The effect of this excavation strategy on remediation of contaminated areas is shown in Figure 11b, the proposed post-remedial extent of contamination.

Where this approach results in residual contamination levels in the base and walls of the excavation that exceed the assigned remediation targets, a warning barrier will be placed on the excavated surface and clean fill placed over the warning barrier to achieve design levels.

In areas not identified as significantly contaminated, geotechnically unsuitable Inert Fill material in the upper 0.5m to 1m of the soil profile will be progressively excavated until natural ground is uncovered and then screened. The oversize material will be tested and directed for disposal at an appropriate landfill while the undersize material will be stockpiled and sampled. The undersized material may be re-used in accordance with the remedial strategy.

The Southern Embankment, with the exception of the area identified as being contaminated with hydrocarbons, will be managed in accordance with the following actions:

- the embankment will be re-contoured to produce a stable landform (this may include some retaining works);
- the Waste Fill will be covered with a geotextile warning barrier;
- the warning barrier will in turn be covered with at least 1m of clean fill;
- the clean fill will be stabilized initially using mulch and then planted with grasses and shrubs to produce a stable and attractive landscape feature; and
- the design of the embankment will address surface and sub-surface drainage flows to prevent erosion of the clean fill and exposure of the barrier layer.

2.7.1 Quantity of Soil Requiring Remediation

Figure 11a illustrates the extent of soil contamination identified at Helena East and the Southern Embankment, relative to the EIL guidelines. The volume of soils identified for excavation and treatment is summarised in Table 4.

TABLE 4
ESTIMATE OF SOIL VOLUMES DESIGNATED FOR REMEDIATION

Area	Material	Contaminants	Total Volume (m^3)	Volume to be Remediated* (m^3)
Helena East	Waste Fill	Metals, Asbestos	15,000	15,000
	Upper Clays	Hydrocarbons	25,000	25,000
	Foundry	Metals, Asbestos, Hydrocarbons	9,000	9,000
Southern Embankment	Waste Fill	Metals	70,000	10,000
		Hydrocarbons	(5,000)[1]	(5,000)[1]
		TOTALS	119,000	59,000

*Remedial volumes are approximations based on currently available data. Actual volumes will be subject to validation sampling.
[1] Indicates hydrocarbon contamination in Waste Fill which overlaps with Waste Fill to be excavated due to elevated metal concentrations.

2.8 Proposed Groundwater Remediation Strategy

2.8.1 Regional Metal Contamination

Given the extensive nature of the low level metal contamination and the fact that it appears to be a regional phenomenon, there is no feasible method for remediating this impact.

The concentrations being reported are at or about the Fresh Waters assessment levels. Given the lack of a sensitive environmental receptor for this groundwater, there is little likelihood of environmental impact resulting from this low level regional contamination.

Accordingly, MRA propose that it continues to monitor concentrations for 1–3 years following redevelopment to assess whether any obvious trends are apparent. The need for monitoring beyond this period will be determined following a review of the monitoring data.

2.8.2 Nickel Contamination

As described in Section 3.5, very high concentrations of nickel in groundwater in the SSA are associated with the former Plating Shop (Figure 10a). The approach to remediating the groundwater in this area will be to excavate metal-contaminated soils in this area that may be contributing to this contamination. Where contaminated groundwater is encountered during the dewatering process of the excavation, it will be

treated by using a lime dosing plant to precipitate metals; or, if this is not feasible, the affected water will be disposed of off-site to a licensed disposal site.

The clay-rich nature of the soils hosting the SSA has limited the migration of groundwater contamination. As a result, it is anticipated that the removal of the contaminated soils and the associated interstitial groundwater, combined with treatment of dewatering effluent, will result in the removal of much of the contaminated groundwater.

On completion of the soil remediation program, it is envisaged that the MRA will propose management of any residual contamination in accordance with the DoE's monitored natural attenuation protocols (DoE, 2004). If the concentration of nickel in groundwater at the identified area remains of concern after 3 years of monitoring, the MRA will develop further management measures in conjunction the DoE.

2.8.3 SSA Hydrocarbon Contamination

As described in Section 3.5.1 and illustrated in Figure 10b, areas of hydrocarbon and/or solvent groundwater contamination have been identified in the SSA south of the Power House and south of the Tarpaulin Shop adjacent the Southern Embankment. The approach to remediating the groundwater in these areas will be to excavate any contaminated soils that are the source of this contamination. Where contaminated groundwater is encountered during the dewatering process of the excavation, it will be treated to ensure that any dewatering effluent meets appropriate criteria for discharge into the environment. Treatment options include but would not be limited to:

- gravity or plate separators in conjunction with carbon filters;
- membrane filtration; or
- treatment in a thermal desorption unit, if one is available.

The clay-rich nature of the soils hosting the SSA has limited the migration of groundwater contamination. As a result, it is anticipated that the removal of the contaminated soils and the associated interstitial groundwater combined with treatment of dewatering effluent will result in the removal of much of the contaminated groundwater.

On completion of the soil remediation program it is envisaged that the MRA propose management of any residual contamination in accordance with the Department of Environment's monitored natural attenuation protocols (DoE, 2004). If the concentration of contaminants in groundwater remains above drinking water guidelines after 3 years of monitoring, the MRA will develop further management measures in conjunction with the Department of Environment.

2.8.4 LSA Solvent Contamination

As discussed in Section 2.6.2, VOCs were detected in ATA-16, within the LSA. As a result of this, and discussions with the DoE, additional investigations of the vertical extent of hydrocarbon and solvent impact on the Lower Superficial Aquifer are being undertaken concurrent with the PER process. Additional bores have been installed

and sampled to better delineate DNAPL impacts, and the investigation is ongoing at present. The need for remedial action will be determined on completion of these additional investigations.

2.8.5 Summary of Ground Water Remediation Strategy

Groundwater quality over the site is generally quite good despite reasonably extensive soil contamination. This is attributable to the following factors:

- the nature of the contaminants, which are often present as slag and ash and not in a readily soluble form;
- the clay-rich nature of the uppermost soils, which has tended to limit the migration of contaminants due to the low permeability of the soil, and also to attenuate contaminants by adsorption on to the clays; and
- the lack of a substantial aquifer system in the upper soil profile to provide a completed pathway for migration of contaminants.

As a result, the groundwater remediation strategy proposed is based on the following principles:

- removal of as much of the contaminated soil as feasible;
- simultaneous removal of contaminated groundwater from within excavations;
- monitoring the groundwater for a sufficient period following remediation to demonstrate the effectiveness of the remediation via source removal and/or natural attenuation.

The MRA considers that in view of the relatively low level of impact identified, this strategy will ensure that off-site ground and surface water receptors are not adversely impacted.

3. ENVIRONMENTAL MANAGEMENT PLANS

3.1 Environmental Management Requirements

The following sections provide the environmental management requirements associated with the project. The following environmental management plans are included herein:

- Noise and Vibration Management Plan
- Surface and Groundwater Management Plan
- Waste Management Plan
- Asbestos Waste Management Plan
- Subsurface Management Plan
- Community Consultation.

The following management plan has been produced as a stand alone document to enable efficient review within the EPA and Department of Environment Air Quality Branch:

- Dust and Air Quality Management Plan.

The following plans will be developed following PER approval, and prior to commencement of siteworks:

- Validation Plan.
- Irrigation Management Plan.
- Groundwater and Helena River Management & Contingency Plan.
- Stormwater Management Plan - Existing stormwater/drainage vs proposed (Egis, 2002).
- Traffic Management.

Once the management plans have been approved they will be published on the MRA's website at www.mra.wa.gov.au.

4. NOISE AND VIBRATION MANAGEMENT PLAN

4.1 Purpose

The use of excavation machinery and trucks during the remediation program has the potential for generating noise and vibration impacts. Noise is not considered to be a significant issue given the commercial nature of the site, the regular noise from adjacent railroad tracks and from the active railroad workshop onsite in Helena East and the distance to residences.

The purpose of this management plan is to ensure that noise emissions from activities on the Helena East site do not elevate noise levels to an unacceptable level.

4.2 Performance Standards

Site activities must be conducted in compliance with the *Environmental Protection (Noise) Regulations 1997* (DEP, 1997) and AS 2436-1981 *Guide to Noise Control on Construction and Maintenance and Demolition Sites* (Standards Australia, 1997) at all times.

Noise emissions should not exceed the following criteria:

TABLE 4
NOISE EMISSIONS CRITERIA

Type of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	$L_{A\ max}$
Noise Sensitive Premises	0700-1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900-1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900-2200 hours All days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises at locations further than 15m from a building directly associated with a noise sensitive use	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

The noise influencing factor for the nearest noise sensitive premises will be determined before remediation and development proceeds.

In terms of vibration, all Contractors will be required to comply with the requirements of Australian Standard *AS 2670.2 Evaluation of Human Exposure to Whole Body Vibration* (Standards Australia, 1990).

4.3 Management Practices

Prior to commencement of works, an environmental work procedure will be prepared to demonstrate how the requirements of this Management Plan will be implemented.

In order to ensure compliance and to minimise the impact on adjacent land users, the following management measures will be implemented:

- Machinery will generally operate only during daylight hours.
- All equipment will be in good working order with effective silencers.
- Occupational noise exposure will be in compliance with WorkSafe WA requirements.
- Work procedures to manage noise and vibration will be developed in consultation with the DoE and WorkSafe WA.

Liaison with the City of Swan will be undertaken prior to the commencement of work to advise the proposed operating (start and finish) times and ensure compliance with regulations and limits.

Any complaints regarding noise and vibration shall be recorded on an *Environmental Incident & Hazard Form.* Reporting of Incidents and Exceedances (in accordance with Section 7.4) will be undertaken whenever unacceptable noise emissions or vibration is generated. Reporting of these events to the DoE will be undertaken where necessary.

4.4 Monitoring

Ongoing noise monitoring for the duration of the works is not envisaged.

However, a noise monitoring program will be implemented by the proponent if complaints are received concerning off-site impacts of noise originating from the site, or if it is considered that the off-site impacts of noise are unacceptable.

The monitoring program should assess if the noise is within the guidelines of the *Environmental Protection (Noise) Regulations 1997* (DEP, 1997) and *AS 2436-1981* (Standards Australia, 1981) and whether corrective measures are required. Corrective actions may include a modification of work practices, re-assessment of equipment used on site and rescheduling of site works.

Due to the Heritage status of buildings at the former Midland Workshops, it is considered prudent for dilapidation surveys to be undertaken prior to remedial works.

It is envisioned that dilapidation survey will be required as part of contractual specifications for the remedial works.

If complaints are received concerning off-site impacts of vibration originating from the site, or if it is determined that the off-site impacts of vibration are unacceptable, a vibration monitoring program will be implemented. The monitoring program will be used to assess if the vibration from site works is within the *AS 2670.2 -1990* guidelines, or whether corrective measures are required.

5. SURFACE AND GROUNDWATER MANAGEMENT PLAN

5.1 Purpose

The occurrence of rainfall or the excessive use of water sprays for dust suppression during the remediation program has the potential to generate contaminated surface runoff as a result of contact with contaminated soil.

The remediation program also has the potential for contributing to groundwater pollution as a result of poor surface water management. Groundwater monitoring has indicated that groundwater underneath the site is contaminated as a result of historical landuse.

This Surface and Groundwater Water Management Plan has been prepared to ensure that activities on the Helena East site do not impact on the beneficial use of surface and groundwater by detrimentally affecting the water quality of these resources.

5.2 Performance Standards

Where surface water is proposed for discharge offsite and into the environment (Helena River Floodplain), this effluent must comply with DoE (2003) and the Australian and New Zealand (ANZECC) *2000 Australian Water Quality Guidelines* (AWQG) *for Fresh and Marine Waters (ANZECC, 2000)* Aquatic Ecosystems guidelines. It should also comply with the Stormwater Drainage Strategy prepared by EGIS Consulting (2002).

5.3 Management Practices

If considered necessary, earth bunds shall be constructed around areas of known contamination at the time of excavation to prevent surface water flows into or out of contaminated areas. This approach will, where necessary, be assisted by the use of a perimeter drain(s) around major excavations.

If any dewatering is required during remedial works, then sampling, containment, treatment and disposal of water will be undertaken as appropriate.

Prior to works commencing onsite, a designated washdown area will be established at a suitable location onsite. All machinery used in contaminated areas (including trucks transporting contaminated material offsite) will be thoroughly decontaminated with high-pressure water sprays or equivalent prior to leaving the site to prevent the spread of contaminated material. Any residual material captured from cleaning the machinery will be treated and/or disposed of appropriately.

Any incidents, exceedances or complaints regarding surface water drainage shall be recorded on an *Environmental Incident & Hazard Form.*

5.4 Treatment of Contaminated Dewatering Effluent

It is acknowledged that dewatering may be required for remedial works, and if dewatering effluent is produced it will need to be managed appropriately. It is proposed to include the management of dewatering effluent in the remediation contract specifications, and that the contractor will need to meet the requirements of a contaminated effluent management plan when treating and disposing of the effluent.

It is anticipated that the management of dewatering effluent will include the following:

- Preparation of a contaminated effluent management plan to be developed in consultation with the contractor's dewatering strategy.
- Trialling of the dewatering effluent decontamination system prior to the commencement of dewatering.
- Routine sampling and analysis of the dewatering influent and effluent during the course of dewatering.
- Periodic submission and reporting of the laboratory analysis results to the Department of Environment.
- Provision of a summary report detailing the results of the dewatering monitoring.

5.5 Monitoring

A number of groundwater monitoring bores have been installed as part of the environmental investigations at the Helena East site at the locations shown in Figure 9. Following the remedial works program, a Groundwater Management and Contingency Plan will be developed in consultation with an experienced hydrogeologist including assessing the need to install additional groundwater monitoring bores. Groundwater monitoring will be performed to assess the impact of source (i.e. contaminated soil/fill) removal on groundwater quality.

Following remedial works, a stormwater system will be installed as described by Egis (2002) in the *Stormwater Discharge Strategy from the Midland Redevelopment Authority into the Helena River Floodplain*. This Strategy applies to the entire Midland Redevelopment Authority site, including Helena East, and it has previously been referenced in stormwater management plans approved by the DoE for other MRA referral areas (e.g. Helena West). MRA will prepare a Stormwater Management Plan including the approved strategy.

It is considered that, except for surface water management in the immediate area of the remedial works, surface water will continue to flow to the existing drainage system as it has been for numerous years.

Accordingly, it is considered that surface water monitoring at or around the Helena East site is not required at this point. However, in the event of a planned or unplanned (eg spill) discharge of any nature that could impact on the environment, such incidents will be recorded on an *Environmental Incident & Hazard Form* and also reported to the DoE. In these instances, the DoE may require that water samples be taken to determine compliance with the performance standards (Section 5.2).

6. WASTE MANAGEMENT PLAN

6.1 Introduction

In order to manage the environmental and social issues applicable to the removal of contaminated material across the site, a Waste Management Plan (WMP) has been prepared. The purpose of this WMP is to detail how contaminated soil will be removed, and the environmental protocols for managing the remediation.

The plan includes and addresses the following specific items.

- A Waste Tracking System (WTS) to ensure all the excavated contaminated material is accounted for and removed off-site.
- Management requirements for excavating, transporting and stockpiling of contaminated material.
- Identifying transport routes for shifting material off-site.

6.2 Management of Remedial Works

The remediation approach is to remove contaminated soil/fill and to replace it with clean soil, except where Heritage Buildings will be retained. The remediation approach will allow the development of the site in accordance with the proposed concept plan.

The approach for validation testing to demonstrate remediation and removal of contaminated soil will be formulated as the details of remediation are finalised, and prior to commencement or remedial works.

Specific procedures have been prepared that will be followed by the Remediation Contractor to ensure all works are undertaken in a safe and effective manner. These are outlined below.

1. **Waste Tracking System (WTS)** to ensue all the contaminated soil is accounted for and managed appropriately.
2. **Waste Handling** for managing the excavation, transportation and stockpiling of contaminated material.
3. **Use of Clean** fill to ensure only suitable fill is used.

Each procedure will address the objective, and provide actions to achieve the objectives, performance indicators, monitoring programs and potential corrective actions.

In the event that any dumps containing asbestos are encountered, then an Asbestos Waste Management Plan will be prepared to insure that they are handled appropriately to prevent the release of airborne fibres both in the short and long term.

6.3 Waste Tracking System Procedure

6.3.1 Background

To facilitate the development of the Helena East Precinct, contaminated soil needs to be removed and replaced with clean sand fill, or moved to the proposed containment area on former MIA land.

6.3.2 Objective

The objective of the Waste Tracking System (WTS) is to account for the management of all excavated contaminated material.

6.3.3 Controls

The WTS will be used to manage and monitor the movement of contaminated material and will:

- Record and document the transfer of contaminated soil using a logging sheet of estimated volumes leaving the excavations and a notation of the destination.
- Provide corrective actions to rectify any accidental misplacement or spillage of waste.

6.3.4 Actions

The following actions are to be used to effectively manage the movement of contaminated soil:

- An initial site induction for all personnel involved with the remediation.
- The Remediation Contractor will provide a Tracking Log Sheet (TLS) at the completion of remedial works to document the movement of all contaminated material at the site.

6.3.5 Key Performance Indicators

Key performance indicators for the effective performance of the WTS are:

- All loads are identified and accounted for.
- All waste moved off-site is disposed to the appropriate class of landfill.

6.3.6 Monitoring and Reporting

Monitoring and reporting will include:

- All TLS and landfill dockets are to be summarised at the completion of the remediation phase for inclusion into the Remediation and Validation Report.

- A check of the WTS will be undertaken by the Environmental Supervisor to ensure all details are being completed correctly and that material is being relocated in conformance to the WTS.

6.3.7 Corrective Action

The following corrective actions may need to be implemented:

- Where material has been placed on natural ground, the Remediation Contractor will be required to remove the waste including the underlying 0.lm of ground beneath the fill. The Environmental Supervisor will collect samples from the natural ground beneath the misplaced fill and test for contaminants as per the Validation Plan.

6.4 Waste Handling Procedure

6.4.1 Background

Contaminated soil will be excavated and disposed off-site to a landfill facility, or will be placed in the Meat Industry Authority (MIA) Containment Area.

6.4.2 Objective

The objective of this procedure is to ensure the transportation and handling of all contaminated material is undertaken in a safe and environmentally responsible manner.

6.4.3 Controls

This procedure will be used to control the following tasks and items:

- Rate of excavation based on compliance to air quality, noise and vibration criteria.

- Characterisation of the material for class of landfill.

- Stockpiling of material and its management prior to movement.

6.4.4 Actions

The following actions are to be used for managing the excavation, transfer, and stockpiling of contaminated material.

Excavation

- The ground is to be wetted down with a fine water spray to prevent dust emissions prior to and during earthworks, as necessary.

- All contaminated material is to be removed in a damp condition to reduce the potential for dust generation and adverse air quality as per the requirements of the *Dust and Air Quality Management Plan.*

- Machinery operating in the remediation zone is to be thoroughly cleaned with a high-pressure hose or otherwise be decontaminated prior to leaving the zone.

Stockpiles

- Temporary stockpile locations for contaminated material will be identified by the Environmental Supervisor in consultation with the Remediation Contractor.

- Where ever possible, stockpiles are to be located on top of existing contaminated ground or alternatively on top of a limestone base.

- All temporary stockpile locations are to be inspected daily by the Remediation Contractor and at regular twice weekly intervals by the Environmental Supervisor.

- Runoff from the stockpiled material is to be managed in accordance with the *Surface and Groundwater Management Plan.*

- Dust suppression techniques are to be used on stockpiles in accordance with the *Dust and Air Quality Management Plan.*

Characterisation for Assessment of Management Options

- Stockpiles or in situ deposits of material for off-site disposal will be characterised in accordance with the *Guidelines for Acceptance of Solid Waste to Landfill* (DoE, 2005). Samples will be tested for those containments identified by onsite investigations.

Transportation

- Material will be transported off-site once approval has been provided by the landfill operator.

- All movement of material for disposal is to be recorded using the WTS.

- Trucks are to be roadworthy and operated in accordance with transport regulations.

- Truck loads of contaminated material are to be covered with tarpaulins prior to leaving the site to prevent dust emissions whilst in transit.

- All truck loads are to be within legal weight limits.

- Trucks are to be kept to dedicated clean limestone tracks or must exit through a vehicle washdown area to remove any contaminated material that may be adhering to tyres and wheels.

- Trucks will exit the site via the designated entrance according to the approved contractor's traffic management plan.
- Trucks are to use the major arterial road network to the landfill facility.
- The Remediation Contractor will continuously monitor the road condition at the entrance/exit to the work site and sweep/wash as necessary.
- Where required the transporter is to comply with Controlled Waste Regulations 2004 for the transport of contaminated material.

6.4.5 Key Performance Indicators

Key Performance indicators for this procedure are:

- no visible dust emissions from contaminated material;
- no spillage of contaminated material;
- all loads are disposed at a location that complies with all State Government statutory and regulatory requirements; and
- no traffic accidents.

6.4.6 Monitoring and Reporting

Monitoring and reporting will include:

- As per the *Dust and Air Quality Management Plan*, dust emissions above action levels are to be reported as soon as possible to the Environmental Supervisor and will then be reported in writing to the DoE inclusive of corrective action.
- Compliance to the air quality criteria (action levels) outlined in the *Dust and Air Quality Management Plan*.
- Any accidents involving the spillage of contaminated material from trucks will be reported immediately to the Environmental Supervisor, along with the corrective action undertaken.
- Earthmoving and traffic accidents are to be reported verbally and in writing directly to the Site Superintendent (and Police if off-site) immediately following the incident.
- Routine random checks will be undertaken by the Environmental Supervisor of waste handling practices to ensure conformance to this procedure. These will be noted in the Environmental Field Activity Report Sheet that is completed for each day of environmental site attendance.

6.4.7 Corrective Actions

The following corrective actions may need to be implemented:

- Dust emissions above action levels are to be rectified as soon as possible using dust suppression techniques as outlined in the *Dust and Air Quality Management Plan.*

- If material does not comply with the *Landfill Waste Classification and Waste Definitions 1996* (DoE, 2005), treat it with immobilisation agents to reduce contaminant leachability.

- The contractor should ensure that material that has been spilt off-site is to be cordoned off and the emergency authorities immediately notified. A spill response team will be used to recover material as soon as practical.

- Minor traffic accidents are to be assessed and changes made to controls if applicable; major accidents causing injury or death are to be reported to both Worksafe and the Police.

6.5 Use of Clean Fill Procedure

6.5.1 Background

A large volume of clean fill will be brought onto site to reinstate excavations.

This procedure will define the transport routes for bringing material onto site, validation of the fill as clean and details how the fill will be deposited. Alternatively, the potential exists to reuse onsite fill material, if it has been tested according to the *Landfill Waste Classification and Waste Definitions 1996* and is considered appropriate for reuse.

6.5.2 Objectives

The objective of this procedure is to ensure that fill brought onto site is clean and that it complies with the DoE EILs (DoE, 2003).

6.5.3 Controls

These procedures will be used to control the following tasks and items:

- characterise the clean fill prior to importation; and
- manage dust emissions

6.5.4 Actions

The following actions are to be followed for managing the importation of clean fill onto the Helena East site:

- Soil sourced from natural sand quarry sites will be considered to be clean if a letter or certificate to such effect is provided. If sourced elsewhere, the soil is to be tested for potential contaminants based on previous landuse in accordance with DoE guidelines for the assessment of site contamination (DEP, 2001). If sourced onsite fill may be reused as appropriate if potential containment concentrations are less than EILs following sampling in accordance with *Landfill Waste Classification and Waste Definitions 1996*.

- All loads brought onto site are to be recorded on a logging sheet.

- The transport route to the site will be along Yelverton Road from the west or Clayton Street from the east. All carting must be along the major arterial road network as per an approved Traffic Management Plan.

- Trucks will enter the site via the main entrance specified in the Contractor's Traffic Management Plan.

- A dust suppressant is to be applied over the soil cover following placement in accordance with the *Dust and Air Quality Management Plan*.

6.5.5 Key Performance Indicators

Key Performance Indicators for this procedure include:

- all fill brought onto site is to be verified as clean; and

- no visible dust emissions off the soil cover.

6.5.6 Monitoring and Reporting

Monitoring and reporting will include:

- compliance to the air quality criteria outlined in the *Dust and Air Quality Management Plan;* and

- routine random checks will be undertaken by the Environmental Supervisor of clean fill loads to ensure the material is being relocated in conformance to this procedure.

6.5.7 Corrective Actions

The following corrective actions may be implemented:

- dust emissions above action levels are to be rectified as soon as possible using dust suppression techniques as outlined in the *Dust and Air Quality Management Plan;* and

- the base of any clean fill that is inadvertently placed on exposed contaminated material will need to be disposed along with the contaminated material.

7. ASBESTOS WASTE MANAGEMENT PLAN

In the event that any Waste Fill containing asbestos product is encountered during remedial works at Helena East, measures need to be put in place to ensure that this waste is handled appropriately to prevent the release of airborne fibres, both immediately and in the long term.

This Asbestos Waste Management Plan (AWMP) outlines measures to prevent the release of asbestos fibres whilst handling and relocating contaminated material during the remediation phase, and in the long term after development. The AWMP focuses on management practices for visible asbestos waste products such as lagging or asbestos cement. The management of trace asbestos fibres (not visible to the naked eye) is addressed along with other contaminants in the *Waste Management Plan*.

The AWMP by ENV (2003a) for Helena West is acknowledged in the preparation of this plan. It was considered applicable as the conditions for remedial works at Helena East are very similar to those at the adjacent Helena West site.

7.1 Background

Asbestos products were widely used on the Workshops in the form of insulation, such as in lagging and brake linings and fibre cement construction materials. Up until the 1970s, asbestos products were mostly co-disposed into the Waste Fill material in an uncontrolled manner, with large amounts of asbestos products dumped at specific locations.

Although asbestos dumps (AD) within Helena East have not been not identified during site investigations, the potential exists for small asbestos dumps to be situated within other parts of the site. During site remedial activities, a large volume of soil and waste material will be excavated, and the possibility that an asbestos dump may be discovered cannot be discounted. In order to minimise the potential for asbestos release from exposure and removal of any asbestos dumps, particular contingency measures have been prepared. These measures are described in the following sections.

7.2 Asbestos Waste Management – Remediation Phase

7.2.1 Precautionary Measures

As a precautionary measure, the following actions will be undertaken:

- areas with a potential for ADs will be identified to the Remediation Contractor;
- daily checking of excavations in potential AD areas by the Environmental Supervisor to confirm status;
- all workers will undergo a site induction that informs them of the dangers of asbestos, how to recognise asbestos products and the procedures to follow should an asbestos dump be uncovered;

- conduct asbestos fibre monitoring in the vicinity of sites with a potential for ADs (details in the *Dust and Air Quality Management Plan;* PER Appendix 11); and

- prevent dust emissions (details in PER Appendix 11).

7.2.2 Procedures for Controlling Exposed Asbestos Products

Where an asbestos dump is visibly encountered during remedial activities, the asbestos must be removed in accordance with Worksafe WA and the *Code of Practice for the Safe Removal of Asbestos* (NOHSC, 2002).

The following measures are to be undertaken to prevent the release of asbestos fibres:

1. Wet material with large volumes of low pressure water and/or a suitable wetting agent for dust suppression;

2. Cover the exposed asbestos with a suitable cover such as Bidim or builders plastic; and

3. The AD will be cordoned off and declared as an asbestos dump exclusion zone from the rest of the site works. This will be achieved by constructing a physical boundary surrounding the dump with star-pickets and coloured warning tape outlining the presence of asbestos. This boundary will be at least 10m away from the location of any other active excavations. Warning signs will be placed at the boundary of the exclusion zone.

Where fibrous asbestos is encountered (as opposed to asbestos cement products) the site must be registered with Worksafe. The removal of fibrous asbestos must be conducted by a licensed asbestos removalist, under the authority and with the involvement of Worksafe who will determine the appropriate personal protective equipment (PPE).

Where asbestos cement products have been encountered, the following measures must be undertaken to remove the asbestos:

1. Only personnel with the appropriate PPE and training will be allowed to work inside the AD exclusion zone. The minimum protective equipment worn for personnel will be disposable coveralls and a personal air-purifying respirator.

2. The asbestos will be placed by hand into plastic bags that are impermeable to asbestos dust in accordance with the *Landfill Waste Classifications and Definitions* (DoE, 2005). The bags will be appropriately signed according to *Safety Signs for the Occupational Environment* (Standards Australia, 1994) and placed into leak proof containers. Earthmoving machinery will endeavour to minimise ground disturbance, dust generation and asbestos breakage. Material will be sprayed with low pressure water as it is loaded into the bags.

3. A decontamination facility is to be provided for personnel in direct contact with the asbestos to ensure safe removal of their PPE.

4. Material from the AD will be disposed off-site to a landfill licensed to accept asbestos wastes in accordance with the *Landfill Waste Classifications and Definitions* (DoE, 2005).

5. Trucks will be washed down before leaving the site in the designated washdown area (details in the *Waste Management Plan;* Section 6 of this document). Used disposable coveralls and masks are to be removed prior to exiting the exclusion zone and placed in bags for disposal along with the other asbestos waste.

6. Asbestos fibres will be continuously monitored during all earthwork activities in this zone. Additional monitoring at the boundary of the AD exclusion zone will be performed to ensure personnel working outside of the asbestos exclusion zone have not been exposed to levels in excess of the capacity of their PPE. General asbestos monitoring will be performed at the boundary of the exclusion zone (see *Dust and Air Quality Management Plan*; PER Appendix 11).

7.3 Asbestos Waste Management – Post Development Phase

After remediation, a barrier comprising of a geotextile warning sheet and clean soil cover over the waste fill material will prevent exposure to any asbestos from remaining asbestos dumps. A minimum 1m cover will apply to uncovered areas such as landscaped areas, with a minimum 0.5m cover where development consists of hardstand or buildings. All trenching for services would be completed within cover material. Details of the soil cover are provided in the *Waste Management Plan*; (Section 6 of this document).

Potential exposure to asbestos may occur where the cover is breached and Waste Fill material exposed. Breaching of the cover is unlikely due to specific controls and placement of warning signs. In addition, the land will be managed by public organisations (City of Swan and Department of Planning and Infrastructure, DPI). Check wording! Details of post remediation management of the waste fill are provided in the *Subsurface Management Plan* (Section 8 of this document).

7.4 Management Responsibilities

7.4.1 Pre-Remediation Phase

The Remediation Contractor is responsible for the implementation of the asbestos control procedures during the remediation phase. This includes ensuring personnel wear the appropriate PPE. Non-compliance may render the Remediation Contractor liable for legal action.

All complaints and non-conformances will be immediately reported to the Environmental Supervisor. An Environmental Incident Report Form will be used for reporting. The Environmental Supervisor will respond to all incidents and complaints

and maintain them in an up-to-date logbook. Full details are provided in the *Waste Management Plan* (Section x of this document).

7.4.2 Post Development

The future site owner (City of Swan and DPI) will be responsible for implementing the asbestos control procedures after development. This is based on prevention of breaching of the clean soil cover. Full details of measures to achieve this are provided in the *Waste Management Plan* (Section 6 of this document).

8 SUBSURFACE MANAGEMENT PLAN

8.1 Purpose

The proposed remediation of Helena East will include removing large volumes of waste material and replacing it with clean fill. It will also include retaining contaminated waste material *in situ*. This will occur primarily along the southern border of Helena East, which is referred to as the Southern Embankment, but also around the margins of Heritage listed buildings that are to be retained as part of the workshops redevelopment.

This Subsurface Management Plan (SMP) has been prepared to manage the environmental issues specifically applicable to the retention of contaminated material across the site. It is anticipated that a condition will be included in the upcoming Ministerial Statement for the Helena East Precinct that will likely be similar to the following:

TABLE 5
ANTICIPATED MINISTERIAL STATEMENT CONDITION

Subject: Soil Quality	
Action	Prepare a Subsurface Constraints Register detailing location and depth of retained waste fill, including details of cover construction
Objective	To prevent uncontrolled interaction with the waste fill
Evidence	Sub-surface Constraints Register
Timing	Post Remediation

The purpose of this SMP is to detail the management of any future subsurface works in the vicinity of residual contaminated fill at Helena East. The objectives of the SMP are as follows:

- prevent unmanaged exposure to contaminated materials;
- maintain warning barrier intact (as practicable);
- ensure that if works beneath the warning barrier are required then they are properly managed and the barrier reinstated; and
- develop a plan for a subsurface constraints register to manage ground disturbing activities.

It should be noted that this plan has been based upon a similar plan and register produced by ENV Australia (ENV, 2005) for the remediation and redevelopment of Helena West (Ministerial Statement 640), which was approved by the Environmental Protection Authority (EPA).

8.2 Subsurface Constraints Register Plan

8.2.1 Background

A Subsurface Constraints Register (SCR) is a register of the status of the underlying ground at the Helena East site, outlining the location of constraints on subsurface activities and the necessary protocols for undertaking activities in those constrained areas. The SCR identifies the location and construction details of the cover and the depth of soil separation between the current ground surface and the underlying residual contaminated fill. It also acts as a reference database to ensure future construction or maintenance activities are undertaken in an appropriately safe manner.

Following the remediation phase, the SCR for Helena East will detail the following:

- surveyed locations of waste fill retention and warning barriers;
- contaminants of concern in each area;
- necessary procedures when undertaking subsurface activities;
- appropriate personal protective equipment (PPE) that should be worn if undertaking activities within the residual contaminated fill; and
- who is responsible for ensuring compliance with the SCR.

This information is detailed in the following sections.

8.2.2 Objective

To ensure that any post remediation ground disturbing activities undertaken at the site will not intercept the residual contaminated fill, or if necessary, the proper precautions and procedures are followed.

8.2.3 Responsibility

Management of the SCR will be the responsibility of MRA prior to the land being transferred to the City of Swan and Department of Planning and Infrastructure (DPI), who will manage the register in the long term.

8.2.4 Controls

These procedures will be used to control the issue of uncontrolled access to residual contaminated material.

8.3 Location of Residual Contaminated Soil

The remediation strategy for Helena East has been designed to remove as much contaminated soil as possible; however, it is anticipated that two types of residual contaminated soil will remain as follows:

- In areas immediately surrounding Heritage buildings, where excavation is not permitted in the interests of preserving the building; and
- Waste fill material in the Southern Embankment that has not been identified as heavily contaminated will be retained.

This section discusses the necessary procedures for locating this retained material and procedures for the placement of warning barriers as required.

8.3.1 Southern Embankment

Areas of the Southern Embankment that have been identified as heavily contaminated with hydrocarbons and/or metals will be delineated, excavated and stockpiled separately from other waste fill for specific treatment or off-site disposal. The remainder of the Southern Embankment will be managed in accordance with the following actions:

- the southern face of the embankment will be re-contoured to produce a stable landform (depending on geotechnical and engineering constraints, this may include some retaining works);
- the areas of waste fill at the top of the embankment that underlie land intended for redevelopment will be excavated to the underlying clean natural soil and managed as for other waste fill;
- after excavation of unsuitable materials, the residual waste fill remaining will be covered with a visual warning barrier;
- the warning barrier will in turn be covered with at least 1m of clean fill;
- the clean fill will be stabilised (eg initially using mulch) and then planted with appropriate grasses and shrubs to produce a stable landscape feature; and
- the design of the embankment will address surface and sub-surface drainage flows to prevent erosion of the clean fill and exposure of the barrier layer.

The location of waste fill covered by warning barriers and clean fill remaining in the Southern Embankment will be clearly identified on a diagram following completion of works. Warning barrier survey coordinates, comprising heights (mAHD) and eastings/northings, will also be provided with this diagram. The western extent of the warning barrier will be located directly adjacent to the existing warning barrier covering the remaining waste fill at Helena West.

8.3.2 Heritage Buildings

In the case of residential and commercial zoned land the MRA wishes to remove to contaminated material above Health Investigation Level "F" to the extent possible given the constraints imposed by Heritage buildings and engineering constraints for deep excavations. MRA emphasises that much of the commercial and some of the residential land at Helena East is constrained by Heritage structures. The strategy for commercially-zoned land will be as follows:

- All contaminated material present above HIL-F levels will be excavated for subsequent treatment and/or disposal, unless engineering or Heritage constraints prevent the removal of materials adjacent to structures or at depth.

- Where material above HIL-F levels is to be left at depth on land zoned for commercial or residential use, it will be covered by a visual warning barrier. Where feasible at least 0.5m of clean fill will be placed above the warning barrier and the ground surface will be treated in a manner that minimises the risk of erosion using hardstand or an equivalent treatment approved by the DoE.

The location of the residual contamination covered by the warning barrier surrounding Heritage buildings will be clearly identified on a diagram following completion of works. The Heritage buildings affected will be listed in the final SCR.

8.4 Warning Barrier

It is envisaged that the warning barrier used will be either A12 Bidim cloth or Max 30 Enkagrid, which are the same barriers selected for use in Helena West.

Bidim is a synthetic geotextile made from a continuous filament, non-woven polyester fabric that has been needle punched to allow water infiltration. It is widely used in the road building industry for improving low bearing capacity soils and in the earthmoving industry for erosion control. Bidim has high tensile and tear resistant strength, which makes it ideal for use as a warning barrier as it will resist puncturing.

Enkagrid is a welded, rigid geogrid for stabilisation of soil structures on low bearing capacity soils. It has a high passive bearing resistance and exhibits almost equal tensile strength in both longitudinal and transverse directions, making it suitable for soil stabilisation applications and as a warning barrier to puncturing. At Helena West, Enkagrid was used in preference to Bidim as it allows for the growing of trees as roots can pass through the grid. It also prevents wind throw.

Locations of retained waste fill and the associated warning barriers will be detailed on a diagram at the completion of works. An example of technical specifications for Enkagrid are provided as Attachment 1.

8.5 Nature of Subsurface Constraints Register

The primary risk to human health through contact with the waste fill is the potential presence of loose asbestos fibres. As asbestos disposal was historically uncontrolled, as a conservative measure, all waste is considered to be potentially tainted with fibres. Metal and hydrocarbon concentrations are also likely to be elevated and are thus the most significant other contaminant in terms of human contact.

The contaminants present may be at different locations across the Helena East site and Southern Embankment, eg. it is expected that elevated hydrocarbon concentrations will only be present around the heritage listed buildings against which the materials will remain *in situ*.

8.6 Procedures for Undertaking Subsurface Activities

The following procedures will need to be undertaken prior to any proposed ground disturbing activities within the Helena East redevelopment area:

1. Contact the custodian (MRA/City of Swan; as appropriate) to obtain permission to undertake subsurface activities. The custodian will require information on the proposed activity, location (MGA co-ordinates) and depth of excavation.

2. The custodian will check if the location of disturbance correlates with an area of residual waste fill, and either grant approval or not. Survey drawings detailing the locations and depth to the warning barriers will be provided at the completion of works. An example form to request permission to undertake subsurface activities will be provided in the final Subsurface Management Plan.

Once approval to proceed has been granted to the proponent by the custodian:

3. The custodian will advise of the position of the waste fill/warning barrier. All digging must first be performed by hand to confirm the depth to the warning barrier. Personal protective equipment to be worn is detailed in Section 8.7. Once the depth to the waste fill/warning barrier is established, machinery can be used to dig no closer than within 0.3m of the warning barrier.

4. If the depth of excavation must break the warning barrier and intercept waste fill, all excavated waste fill must be stockpiled adjacent to the pit on a layer of robust builders plastic and the necessary PPE worn (detailed in Section 8.7). A water spray must be used to dampen down any waste fill that is excavated.

5. Before disposal of stockpiled material and waste cuttings, the Environmental Supervisor will collect samples from the material and arrange for their analysis (by a NATA accredited laboratory), to assist with its landfill classification. samples from the stockpile. The samples will be analysed for the following parameters:

- asbestos;
- heavy metals (arsenic, cadmium, chromium, copper, mercury, lead, nickel, zinc, barium, manganese, molybdenum, tin and antimony); and
- hydrocarbons (as necessary and specified by the SCR).

The sampling frequency will be in accordance with the DoE Contaminated Sites Management Series – *Landfill Waste Classifications and Waste Definitions* (DoE, 2005). Analytical results are to be assessed against Tables 3 and 4 in the above document and the stockpiled material is to be disposed of at the appropriate landfill facility.

6. Where waste material has inadvertently been placed on natural ground, the Contractor will be required to remove the waste including the underlying 0.1 m of ground beneath the waste (and disposing of it in accordance with point 5 above). The Environmental Supervisor will collect validation samples from the ground beneath where the waste was stockpiled to ensure all contaminated soil has been removed, and submit the samples to a NATA accredited laboratory for analysis of the contaminants described in (5). Analytical results are to be assessed against Ecological Investigation Levels outlined in the DoE Contaminated Sites Management Series – *Guidelines for the Assessment of Soil, Sediment and Water* (DoE, 2003).

7. At the completion of works, the excavation shall be reinstated with at least 0.5m of clean fill where feasible around Heritage buildings, and a minimum of 1m clean soil cover over the Southern Embankment. The appropriate Bidim or Enkagrid warning barrier must be reinstated as part of the repair.

8. All equipment that has been in contact with waste fill should be washed down prior to leaving the site and the sediments disposed of accordingly.

8.7 Personal Protective Equipment

In the instance that subsurface works will involve the handling of residual contaminated fill the following occupational health and safety procedures and personal protective equipment (PPE) must be adhered to:

- gloves must be worn;

- persons working in the vicinity must wear a half face air purifying respirator with a Class PI particulate filter for asbestos and airborne particulates (unless sample data indicates that asbestos is not present at the location of disturbance); and

- the cabs of excavators must be closed and sealed with internal air-conditioning turned on recirculation during the excavation works.

8.8 Key Performance Indicators

Key performance indicators (KPIs) for the effective management of subsurface activities are:

- all subsurface activities will be registered through the approvals processes;
- no incidences of exposure to waste fill; and
- no incidences of non-conformance to required occupational health and safety procedures.

8.9 Monitoring and Reporting

Monitoring and reporting will include the following:

- a log book will be maintained detailing any subsurface activities;
- any large excavations will be inspected by the custodian to ensure the warning barrier has been reinstalled correctly; and
- all cover details in the SCR will be updated continually in response to any future construction/ maintenance activities.

8.10 MIA Containment Cell

The WA Meat Industry Authority (MIA) saleyards site is located east of Lloyd Street and south of Clayton Street, as shown on Figure 2. The westernmost portion of the MIA site has been used in the past as a waste (including asbestos) disposal area. It is accordingly proposed that waste material from Helena East and the Southern Embankment is disposed in the MIA Containment Area as an alternative to disposing of large quantities of low-level contaminated soil to landfill.

The Cell will have the following broad characteristics:

- Prior to depositing Waste Fill in the Cell, the base will be prepared with clean clay to a depth of approximately 300mm. The clay will be compacted and leveled to provide a stable non-eroding surface over the existing asbestos dump.
- Selected waste, conforming to the strict acceptance criteria, will be placed and compacted into a stable landform that will drain readily following capping. The maximum height of the cell will be 12m; a typical section through the Cell is illustrated in the inset in Figure 13.
- On achievement of the final landform, a compacted clay cap of 300–500mm thickness will be placed over the Cell. The cap will be placed under engineering supervision to achieve a nominal permeability less than 10^{-6}m/s.

- At least 500mm of clean free-draining soil will be deposited on the cap and drainage structures incorporated into the cell to prevent erosion.

- Shallow-rooted shrubs and grasses will be planted over the Cell to achieve a stable landform consistent with the amenity of the area.

8.10.1 MIA Soil Acceptance Criteria

The following acceptance criteria will be used for soil placed within the MIA Containment Cell:

- The average plus standard deviation of concentration results is less than two (2) times the Concentration Limit (CL1) Criteria for a Class 1 Landfill or 95% Upper Confidence Limit (UCL) is less than two (2) times the concentration Limits for a Class 1 Landfill; and

- The average plus standard deviation of ASLP results is less than the ASLP criteria for a Class 1 Landfill (ASLP1) or 95% Upper Confidence Limit (UCL) is less than the ASLP criteria for a Class 1 Landfill (ASLP1).

8.10.2 Benign Nature of MIA Cell

The MIA containment cell has been designed to be a stable non polluting structure, which will require minimal management into the future. This design, when coupled with the stringent controls proposed over the material placed in the cell, will ensure that there will be minimal potential for contaminants to migrate from the cell.

The features of the containment cell design that limit the need for on-going management are:

1. Nature of Materials placed in the Cell

The assessment criteria set for material placed in the bund are similar to those for a Class 1 Landfill. Class 1 landfills are unlined facilities, and the waste acceptance criteria for these facilities have been set with the objective that they do not require capping or extensive post-closure management. Due to the non-polluting nature of the materials they accept, Class 1 landfills can generally be sited on porous or permeable soils with little capacity to attenuate pollutants.

In consideration of the above, even in the absence of any containment structure or management controls, the MIA containment cell would not be expected to pose any significant threat to the surrounding environment.

2. Nature of Surrounding Environment

There are few controls placed over the siting of Class 1 landfills other than that they should not be sited in Priority 1 or 2 Water Protection Areas.

The MIA Containment Cell will be located in an area of clay rich soils. These soils will act to limit the rate of migration of contaminants as the clays will attenuate contaminants that may be present.

The lack of a well developed, continuous superficial aquifer within these sediments indicates that there is limited ability for the groundwater to transport contaminants towards the Helena River, which is located to the south of the cell.

3. Design of Containment Cell

The containment cell has been designed with the following features that will act to limit the likelihood of impacts:

- its surface contours are stable and capable of shedding any incident stormwater without erosion;
- the cell cap will be designed to facilitate drainage of stormwater and direct it away from the cell;
- the surface of the clay cap will covered with a topsoil/ growing medium and planted with shallow rooted species that will act to provide a stable non-eroding surface; and
- the cell design incorporates a low permeability clay cap ($<10^{-6}$ m/s permeability), which will minimise infiltration of stormwater through the soils contained in the cell.

8.10.3 Management Framework for Containment Cell

The following management framework is proposed to ensure that the responsibility for the future management of the cell is clear, the integrity of the structure is maintained, and contained soils are not inadvertently disturbed:

- The land on which the Containment Cell is to be sited will be excised from the title covering the MIA site and a specific title will be created that will be retained by MRA for the specific purpose of the Containment Cell.
- The land title will have an annotation identifying the presence of the contaminated soils and the management plan.
- The surface of the containment cell will be assessed annually for at least the first 3 years following final capping. The assessment will check stability, subsidence, cap integrity and erosion, to ensure that the cell is maintaining its ability to minimise stormwater infiltration. Any problem areas will be rectified and the annual inspections will continue until any subsidence has ceased, the drainage controls are working effectively, and the vegetation cover is sufficiently established to prevent erosion.

9. REPORTING AND COMMUNICATION

9.1 General

The progress and management of site works during remediation will be reviewed on an ongoing basis throughout the duration of the remedial works.

A summary of the review will be prepared on a weekly basis and will include:

- a summary of incidents and incident investigation results and proposed actions for mitigation of related potential environmental impacts;
- compliance of the site works with established performance standards; and
- suggested improvements or modifications to the EMPs and/or programs and procedures to address environmental issues associated with the remediation works.

At the completion of works, a site validation report confirming that validation results indicate that remediation was in accordance with stipulated clean up criteria will be prepared and submitted to the DoE. This report will follow the guidelines presented by DEP (2001).

9.2 Site Induction

During the Site Induction, potential environmental impacts and issues will be communicated to all site personnel. These communications may be in the form of training sessions and notices in a prominent position in the work place and will include:

- information on the potential impacts of on-site contaminants;
- information to assist site personnel in identifying unacceptable off-site environmental impact problems;
- a list of site contacts to be notified in the event of unacceptable off-site environmental impacts;
- instructions that all site personnel are responsible for taking action in the event of unacceptable impacts;
- instructions that all site personnel are required to report all environmental incidences on an *Environmental Incident & Hazard Form*; and
- an outline of the contingency action plan that is to be used to rectify unacceptable off-site environmental impact or discharge problems.

9.3 Monitoring Programs

Static air monitoring (dust and asbestos) will be undertaken around the perimeter of the site as a check to determine (as described in Sections 6.2.4 and 7.3.1) whether the precautions and work procedures are being applied in a satisfactory manner. Implementation of the dust air monitoring program will commence prior to works commencing onsite and will be implemented for the duration of remediation activities. The asbestos monitoring program will only be undertaken during the activities involving the removal of asbestos containing soils.

The results of the monitoring will be reviewed as they become available, and will be included in the close out report for the remediation to be submitted to DoE.

9.4 Complaints, Incidents and Exceedances

Site personnel will be responsible for reporting environmental incidents and complaints on an *Environmental Incident & Hazard Form*.

Environmental incidents must be reported to the Site Superintendent's environmental representative.

Environmental incidents are defined as:

- significant discharges or impacts that result from site works that exceed or have the potential to exceed the criteria of the DoE as specified in this EMP;
- unearthing of contamination that has not been identified by previous site investigations;
- the lack of adequate emergency environmental impact control equipment, including water supplies and water spray equipment for dust control, and windbreaks at such time that there were requirements to control off-site impacts with the equipment; and
- faulty or inoperable environmental monitoring equipment.

Environmental Incident & Hazard Forms and contact details for management of site activities will be provided in a readily accessible place whilst site works are being carried out. This will ensure that staff are able to immediately complete and submit a written record in the event of any environmental incident.

The *Environmental Incident & Hazard Form* will include:

1. An Incident Reporting Section to be completed by the person reporting the incident. This section requires input of initial details of the incident, including:
    - the name of the person submitting the report;

- the source of off-site impacts or discharges, including a description of the details of the operations that were being undertaken that resulted in the discharge or impact;

- the duration of the environmental incident if it results in, or had the potential to result in, unacceptable off-site impacts;

- a description of equipment or machinery being operated at the time that caused the discharge or impact; and

- a description of the impact management measures that were in place and being used when the discharge or impact occurred.

2. An Assessment Section of the Incident Form will be completed, which requires the incident to be assessed in terms of urgency and actions considered appropriate to remedy the incident and minimise environmental impacts. Information to be supplied in this section includes:

   - a brief assessment of the urgency and immediate impacts of the incident;

   - a description of the actions to be taken to rectify the discharges or impacts;

   - an Action Report Section which includes:

     - details of the actions taken to immediately remedy the incident;
     - a brief report on the success of those actions; and
     - a description of changes to work practices or operations that are required to ensure that the incident will not re-occur together with a timetable for implementation of those changes.

The *Environmental Incident & Hazard Form* will be given a sequenced identification number so that each form may be accounted for.

10. COMMUNITY CONSULTATION

10.1 Purpose

Given the location of the proposed remediation works at the former Midland Railway Workshops site, and the nature of remedial activities, there is potential for disruption to both the local and broader community as a result of the works. The works will be subject to scrutiny from regulatory authorities, stakeholders and the public. Accordingly, a communications strategy has been formulated and will be implemented in consultation with the community consultation group to ensure that the following key objectives are met:

- works will be implemented in a manner that minimises disruption to the community;
- adequate information of a sufficient quality will be made available in a timely manner to interested parties about the purpose, nature, and size of the project, and management measures that will be implemented to ensure that environmental objectives are met; and
- issues of concern associated with potential disruptions to the community will be considered and appropriately addressed.

10.2 Management Practices

10.2.1 Introduction

The MRA will provide a clear channel for the flow of information to the public. This will be in the form of community information sessions run by the MRA, by press releases to the local newspaper and by postings on the MRA website.

The following actions will be undertaken to ensure effective community consultation is maintained through the entire remediation phase:

- provide regular information briefings where the community is able to ask questions or raise concerns prior to commencement of remedial works;
- notify the public through the local press and the MRA website of the expected commencement date of remedial work, and the proposed transport route for importing clean fill and any disposal of waste material off-site to landfill;
- appoint a representative from the MRA to answer any questions that the public may have;
- advise the public of the MRA Community Feedback Line, which is provided and monitored 24 hours per day, seven days per week (1-800-224-552);

- provide monthly updates on the MRA website on the progress of the remedial works including air quality results; and

- implement a Public Complaints Register that will be operated by MRA.

10.2.2 Community Consultation Group

The MRA is committed to keeping the community informed about the on-going remediation and redevelopment activities at the Workshops Site. The MRA has been proactive and has formed a community based consultation group referred to as the Midland Central Environmental Reference Group (ERG). This group is regularly informed on all environmental issues, including land contamination and is able to provide comment back to the MRA.

10.2.3 Other Distribution of Information

The MRA has a website (www.mra.wa.gov.au), which details the proposed redevelopment and provides regular updates on all issues including environmental.

A public information session will be held prior to the finalisation of the remediation program to give key stakeholders and the local community the opportunity to comment on the proposed approach to remediation of Helena East.

The MRA is committed to making all documents readily available to the public through the website and to consult with the local community on a regular basis.

10.2.4 Public Complaints Register

A Public Complaints Register and information hotline will be managed by MRA at the Yelverton Road offices. The MRA will be responsible for maintaining an up to date log of complaints, both verbal and written, with a note of any incidents or issues raised by the public.

The Public Complaints Register will include the following:

- date and time of complaint;
- name complainant;
- nature of incident/complaint; and
- corrective actions and response.

The Public Complaints Register and input from the ERG will be used to assess how effectively the community consultation strategy is meeting its purpose. The strategy may be adjusted on an as needs basis depending on feedback received during the remedial activities, and at the discretion of MRA.

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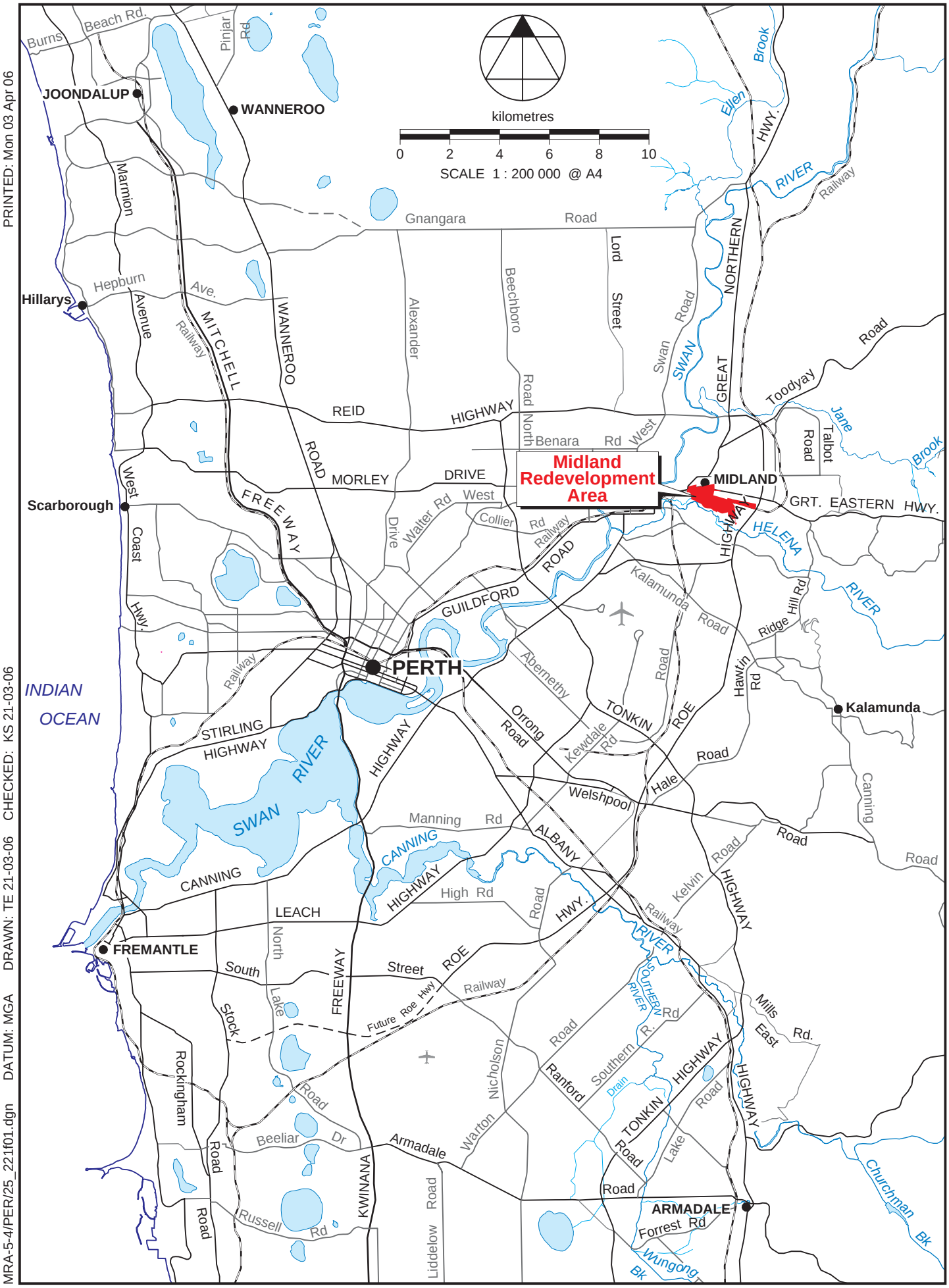
FIGURES



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ATA Environmental
environmental scientists

DUST & AIR QUALITY MANAGEMENT PLAN
REMEDIATION OF HELENA EAST SOILS
AT MIDLAND RAILWAY WORKSHOPS

REGIONAL LOCATION

FIGURE 1

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HELENA EAST

HELENA WEST

HELENA ST EXTENSION

HELENA EAST

AREA E

AREAS A, B, C & D

MIA Containment Area (Notional Containment Cell Envelope)

EXTENT OF SOUTHERN EMBANKMENT

Helena River

GREAT EASTERN HIGHWAY

OLD GREAT NORTHERN HIGHWAY

VICTORIA STREET

KEANE STREET

HELENA STREET

MARION ST

RAILWAY PARADE

WELSH ROAD

PADBURY TERRACE

SAYER STREET

BROCKMAN ROAD

LLOYD STREET

LOTON AVENUE

HERROY AVENUE

FERGUSON STREET

MOORE AVENUE

BUSHBY STREET

ROBINSON ROAD

RAILWAY DRIVE

RESERVE

YELVERTON

AMHERST

MONTREAL ROAD

ROAD

STIRLING CRESCENT

WHITEMAN ROAD

AV

CLAYTON STREET

MILITARY ROAD

HWY

LEGEND

- Midland Redevelopment Authority Boundary
- Helena East Area Boundary
- Cadastral / Proposed Cadastral Boundary
- River / Stream

metres

0 100 200 300 400 500

SCALE 1 : 7 500 @ A3

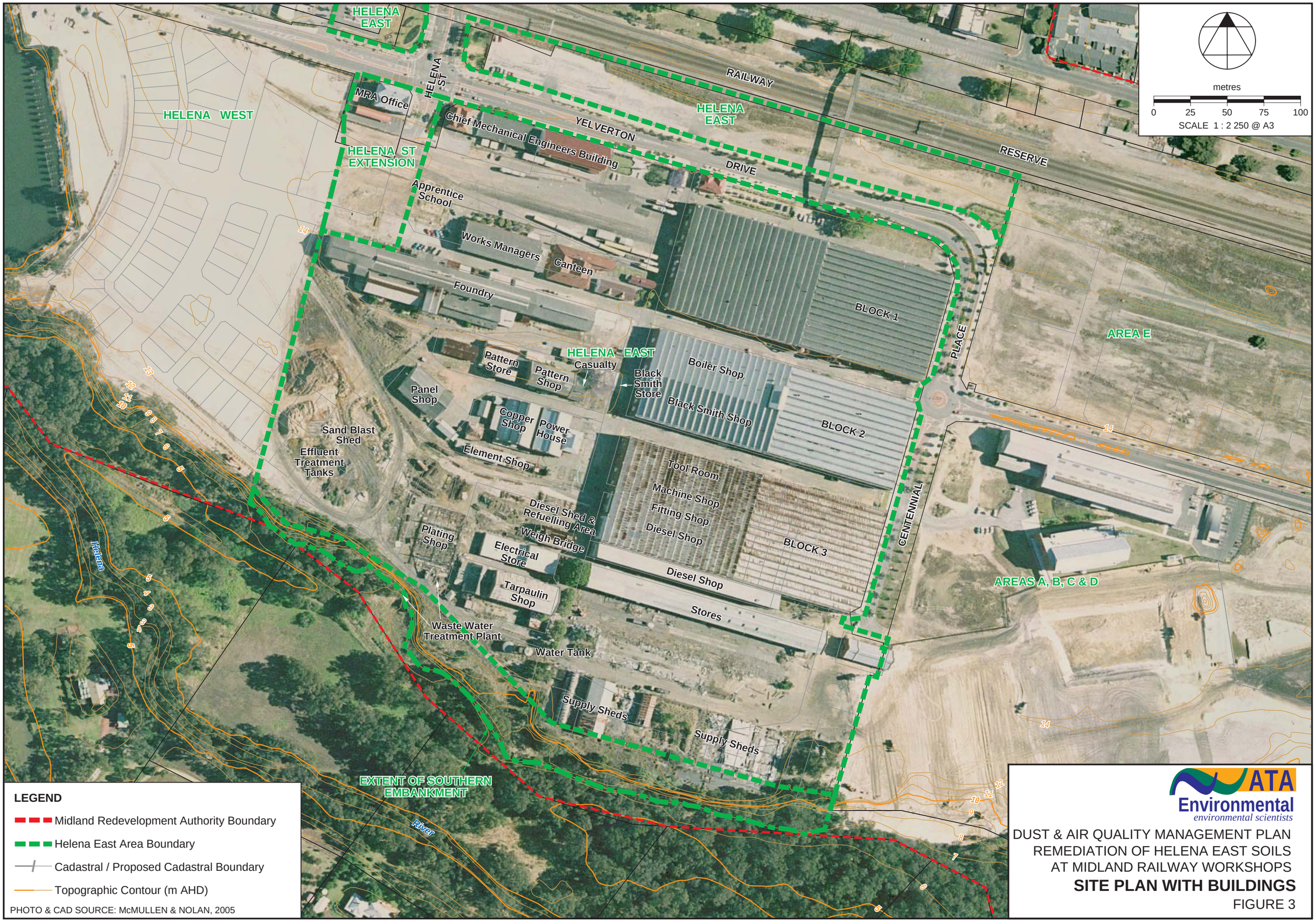
SOURCE: McMullen Nolan & Partners, PHOTO 2005; CAD 2004

ATA Environmental
environmental scientists

DUST & AIR QUALITY MANAGEMENT PLAN
REMEDIATION OF HELENA EAST SOILS
AT MIDLAND RAILWAY WORKSHOPS

HELENA EAST PRECINCT AREA WITHIN THE MRA AREA

FIGURE 2



LEGEND

- Midland Redevelopment Authority Boundary
- Helena East Area Boundary
- Cadastral / Proposed Cadastral Boundary
- Topographic Contour (m AHD)

PHOTO & CAD SOURCE: McMULLEN & NOLAN, 2005

ATA Environmental
environmental scientists

DUST & AIR QUALITY MANAGEMENT PLAN
REMEDIATION OF HELENA EAST SOILS
AT MIDLAND RAILWAY WORKSHOPS

SITE PLAN WITH BUILDINGS

FIGURE 3

PRINTED: Mon 03 Apr 06
CHECKED BY: KS 21-03-06
DRAWN BY: TE/EDS 21-03-06
DATUM: MGA
MRA-5-4/PER/25_221f03.dgn

PRINTED: Mon 03 Apr 06
CHECKED BY: KS 21-03-06
DRAWN BY: TE/EDS 21-03-06
DATUM: MGA
MRA-5-4/PER/25_221f04.dgn

HELENA EAST
HELENA WEST
HELENA ST EXTENSION
HELENA ST
RAILWAY
YELVERTON DRIVE
RESERVE
PLACE
CENTENNIAL
AREA E
AREAS A, B, C & D
MRA Office
Chief Mechanical Engineers Building
Works Managers
Canteen
Foundry
Pattern Store
Pattern Shop
Panel Shop
Copp Shop
Power House
Element Shop
Plating Shop
Diesel Shed & Refuelling A
Weigh Bridge
Electrical Store
Tarpaulin Shop
Water Tank
BLOCK 1
BLOCK 2
BLOCK 3
Stores
Helena
River
Rivbed
EXTENT OF SOUTHERN EMBANKMENT

metres
0 25 50 75 100
SCALE 1 : 2 250 @ A3

LEGEND

- Helena East Area Boundary
- Cadastral Boundary
- Building Outline

ENV Sample Locations

- H3-24 Soil Sampling Location
- HW1 Groundwater Monitoring Well

ATA Sample Locations

- ATA-9 Groundwater Monitoring Bores
- 29 Soil Sample Locations

Contaminants

- Asbestos (detected)

BASE SOURCE: McMULLEN & NOLAN, May 2005
SAMPLING DATA SOURCE: ENV Australia, April 2005

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environmental scientists

DUST & AIR QUALITY MANAGEMENT PLAN
REMEDIATION OF HELENA EAST SOILS
AT MIDLAND RAILWAY WORKSHOPS

SITE LOCATIONS WITH ASBESTOS IDENTIFIED

FIGURE 4

PRINTED: Mon 03 Apr 06

CHECKED BY: KS 21-03-06

DRAWN BY: TE/EDS 21-03-06

DATUM: MGA

MRA5-4/PER/25_221f05.dgn

Midland Town Centre

Midland Railway Station

HELENA EAST

HELENA WEST Redidential Development (Former Railyards)

HELENA ST EXTENSION

HELENA EAST

Primary School

Mixed Residential

Residential

AREA E Proposed Hospital Development

Western Australian Police Services (WAPS) Site

AREAS A, B, C & D

MIA Containment Area (Notional Containment Cell Envelope)

EXTENT OF SOUTHERN EMBANKMENT

Helena River Floodplain

Helena River

GREAT EASTERN HIGHWAY

VICTORIA STREET

RAILWAY

RESERVE

YELVERTON DRIVE

MONTREAL ROAD

AMHERST ROAD

HELENA STREET

MARION ST

WELSH ROAD

PADBURY TERRACE

PARADE

SAYER STREET

BROCKMAN ROAD

LLOYD STREET

LOTON AVENUE

HERROY AVENUE

FERGUSON STREET

ELGIE AVENUE

MOORE AVENUE

BUSHBY STREET

ROBINSON ROAD

CLAYTON STREET

MILITARY ROAD

HWY

STIRLING CRESCENT

WHITEMAN ROAD

AV

LEGEND

- Midland Redevelopment Authority Boundary
- Helena East Area Boundary
- Cadastral / Proposed Cadastral Boundary
- River / Stream

metres

0 100 200 300 400 500

SCALE 1 : 7 500 @ A3

SOURCE: McMullen Nolan & Partners, PHOTO 2005; CAD 2004

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DUST & AIR QUALITY MANAGEMENT PLAN
REMEDIATION OF HELENA EAST SOILS
AT MIDLAND RAILWAY WORKSHOPS

LAND USES SURROUNDING HELENA EAST PRECINCT

FIGURE 5

PRINTED: Mon 03 Apr 06
CHECKED BY: KS 21-03-06
DRAWN BY: TE/EDS 21-03-06
DATUM: MGA
MRA-5-4/PER/25_221f06.dgn

HELENA EAST
HELENA WEST
HELENA ST
HELENA ST EXTENSION
MRA Office
Chief Mechanical Engineers Building
YELVERTON
DRIVE
RAILWAY
RESERVE
Apprentice School
Works Managers
Canteen
Foundry
BLOCK 1
PLACE
AREA E
HELENA EAST
Casualty
Pattern Store
Pattern Shop
Black Smith Store
Boiler Shop
Black Smith Shop
BLOCK 2
Panel Shop
Copper Shop
Power House
Element Shop
Sand Blast Shed
Effluent Treatment Tanks
Tool Room
Machine Shop
Fitting Shop
Diesel Shop
BLOCK 3
CENTENNIAL
Diesel Shed & Refuelling Area
Weigh Bridge
Electrical Store
Plating Shop
Tarpaulin Shop
Diesel Shop
Stores
AREAS A, B, C & D
Waste Water Treatment Plant
Water Tank
Supply Sheds
Supply Sheds
EXTENT OF SOUTHERN EMBANKMENT
Helena
River
13
12
11
10
9
8
7
6
5
14
6
5
4
3
2
1
14
6
5

metres
0 25 50 75 100
SCALE 1 : 2 250 @ A3

LEGEND

- Midland Redevelopment Authority Boundary
- Helena East Area Boundary
- Cadastral / Proposed Cadastral Boundary
- Topographic Contour (m AHD)
- Indicative Air Monitoring Locations

PHOTO & CAD SOURCE: McMULLEN & NOLAN, 2005

ATA Environmental
environmental scientists

DUST AND AIR QUALITY MANAGEMENT PLAN
REMEDIATION OF HELENA EAST SOILS AT
MIDLAND RAILWAY WORKSHOPS

INDICATIVE AIR MONITORING LOCATIONS

FIGURE 6

ATTACHMENT 1

ENKAGRID SPECIFICATIONS

COLBOND

Enkagrid® MAX
CE Product Information

Product description

Enkagrid MAX is a rigid, biaxial geogrid for stabilization of soil structures on low bearing capacity soils. Enkagrid MAX is a welded geogrid and its gridstructure of extruded bars delivers increased passive bearing resistance and optimum interaction in most soil types.

By stabilizing the subbase Enkagrid MAX can reduce the granular fill material up to 30 % and decreases construction time significantly. Enkagrid MAX is delivered on site in 5m wide rolls and during installation the product is easy to handle. Enkagrid MAX offers high strength with low strain.

Enkagrid MAX exhibits almost equal tensile strength in both longitudinal and transverse directions, making it most suitable for soil stabilization applications. It has to be covered within four weeks after installation.

Application

Enkagrid MAX is ideal for subbase reinforcement with optimal price/performance. Examples of applications are:

- construction haul roads
- permanent unpaved roads
- paved roads
- working platforms on weak subsoils
- parking areas
- multi layer applications

Over the past years Enkagrid MAX has proven itself in many different projects worldwide under extreme conditions.

Performances

Technical properties

	Enkagrid MAX 20		Enkagrid MAX 30		Enkagrid MAX 40		
	M[3]	T[4]	M[3]	T[4]	M[3]	T[4]	
Tensile strength (kN/m)[1]	25	- 3	34	- 2	47	- 4	EN ISO 10319
Strength at 2.0 % strain (kN/m)[1]	8	- 2	11	- 2	13	- 2	EN ISO 10319
Strength at 5.0 % strain (kN/m)[1]	17	- 2	23	- 2	28	- 3	EN ISO 10319
Strain at break (%)[1]	10	+/- 2	10	+/- 3	10	+/- 4	EN ISO 10319
Polymer	PP		PP		PP		
Aperture size A x B (mm)[2]	44 x 44		44 x 43		44 x 42		

[1] 95% confidence level on elongation = mean + tolerance
[2] A = nominal aperture size longitudinal direction; B = nominal aperture size transverse direction
[3] M = Mean value
[4] T = Tolerance value

Dimensions, identification and weights

Enkagrid MAX	Grid			Rolls			
Type	Width	Length	Area	Color-code[5]	Ø	Length	Gross-weight kg[6]
	m	m	m²		m	m	
Enkagrid MAX 20	5	100	500	Orange + yellow	0.45	5	126
Enkagrid MAX 30	5	100	500	Orange + green	0.50	5	142
Enkagrid MAX 40	5	100	500	Orange + blue	0.55	5	155

[5] According to EN ISO 10320: Identification on site
[6] Gross weight = geogrid + core + packaging

Individual values may vary from above mentioned data.

Quality Assurance

The Quality Management System of Colbond Geosynthetics, at Arnhem (development and sales) and Obernburg (production), has been approved by Lloyd's Register Quality Assurance Limited for the ISO 9001:2000 quality management system standard (Certificate No. 935136).

All Enkagrid MAX types are CE-certified by an independent notified body (0799-CPD).

0799-CPD

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