coffey environments
SPECIALISTS IN LIVING AND WORKING PLACES

REMEDIATION ACTION PLAN
MANILLA HOSPITAL COMBINED MPS
HEALTH ONE CENTRE
COURT ST, MANILLA NSW

Prepared for:

Health Infrastructure Pty Ltd
C/- Coffey Projects
213 Darby Street
NEWCASTLE NSW 2300

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ABBREVIATIONS

C6-C36	Hydrocarbon chainlength fraction
bgs	below ground surface
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CMP	Construction Management Plan
COC	Contaminants of Concern
DECC	Department of Environment and Climate Change (formerly known as Department of Environment and Conservation (DEC))
ESA	Environmental Site Assessment
ESI	Environmental Site Investigation
ID	Identification
mg/kg	milligrams per kilogram
NATA	National Association of Testing Authorities
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NSW EPA	Environment Protection Authority of New South Wales (now part of DECC)
PAH	Polycyclic Aromatic Hydrocarbon
PID	Photoionisation Detector
QA	Quality Assurance
QC	Quality Control
SB	Soil Bore
SMP	Site Management Plan
SOP	Standard Operating Procedures
SS	Surface Sample

ABBREVIATIONS

TP	Test Pit
TPH	Total Petroleum Hydrocarbon
UST	Underground Storage Tank
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Health Infrastructure Pty Ltd contracted Coffey Environments Pty Ltd (Coffey) to prepare a Remedial Action Plan (RAP) for the Manilla Hospital located on Court Street, Manilla NSW (the site).

The site is located in a commercial and residential area**.** Residential properties are located to the west and south. Three residential properties are situated to the north and then sporting fields and the Namoi River located approximately 350m to the north. Agricultural land and market gardens are situated to the east and northeast respectively.

Health Infrastructure, have requested that the RAP is prepared such that it can be submitted with the Phase 2 Environmental Site Assessment (ESA) report to Department of Planning as part of the Environmental Assessment report.

The site has been used as a hospital since about 1908. The site presently comprises hospital buildings dating from early 1900's to mid 1900's, coal bin and boiler, mortuary, underground fuel storage tank; and workshop.

The proposed redevelopment involves demolition of existing structures and construction of a Combined MPS / Health One centre.

The key objectives of the RAP are to:

- Outline remediation measures that will reduce or eliminate the risk of identified soil contamination; and
- Ensure that the site is remediated to a level consistent with the proposed land use.

In order to achieve the objectives of the RAP, the following scope of works was completed:

- Review of available reports and related correspondence from previous environmental investigations and in particular the Phase 2 ESA Report (ENVIWARA00401AA-R01), dated 3 June 2008, prepared by Coffey;
- Develop the appropriate remediation and validation strategies for the site; and
- Review the environmental controls to be implemented during the remedial works to protect the health of workers, the general public and to protect the environment.

This RAP is prepared on the basis that future site use is generally consistent with commercial land use. Coffey recognises that hospital patients are likely to be more susceptible to adverse effects from contaminants, however, the exposure duration and the opportunity for exposure to contaminated soil is considered to be low.

The following potentially sensitive areas and possible receptors located on site and within a 500m radius of the site should be considered:

- Demolition/excavation/construction workers at the site;
- Hospital workers and patients at the site;
- Residents of adjacent and nearby properties;
- Aquatic ecosystems within the Namoi River; and
- Threatened tree species on the batter slope.

EXECUTIVE SUMMARY

A Stage 1 Environmental Site Investigation was completed by Department of Commerce in December 2008 (reference Go37b) and Coffey Environments completed a Phase 2 Environmental Site Assessment (ESA) for the site in July 2009 (reference ENVIWARA00401AA-R01).

The Phase 2 ESA identified areas of soil contamination or high risk of soil contamination at three locations on the site. These are summarised below:

- A localised hotspot of petroleum hydrocarbon contamination of surface soil located to the west of the workshop;
- Diesel underground storage tank (UST) located to the north of the main hospital building, adjacent to the coal loader; and,
- Ash and asbestos containing fill material located on the steep northern batter slope, with petroleum hydrocarbons, polycyclic aromatic hydrocarbons, heavy metals, asbestos containing materials, and Dioxin/Furans being the contaminants of concern.

This RAP provides site information, a summary of the investigations conducted on the site previously including details of the contamination identified, provides a preliminary Qualitative Risk Assessment, discusses the remedial goals and the strategies proposed for remediation and validation and provides a Remediation Management Plan to mitigate and minimise risk to human health and the environment during works.

In summary, the proposed works involve the removal of the diesel UST and related infrastructure, excavation of contaminated soil from around the UST and the TPH Hotspot, and validation of the resulting excavations. Fill material will be removed from the batter slope of an embankment on the northern side of the site for construction purposes, and will be relocated on-site and capped. The parts of the batter slope that are not covered by buildings will be capped.

A site validation report documenting the remediation strategy and outcomes/site status will be issued following the completion of site remediation and validation works.

A site management plan to provide guidance on the long term management of the capped areas will be prepared following completion of capping.

1 INTRODUCTION

1.1 Background

Health Infrastructure contracted Coffey Environments Pty Ltd (Coffey Environments) to prepare a Remedial Action Plan (RAP) for the Manilla Hospital located on Court Street, Manilla NSW (the site).

The site is located in a commercial and residential area**.** Residential properties are located to the west and south. 3 residential properties are situated to the north and then sporting fields and the Namoi River located approximately 350m to the north. Agricultural land and market gardens are situated to the east and northeast respectively. The site location and surrounding area are shown on **Figure 1.**

Health Infrastructure, have requested that the RAP is prepared such that it can be submitted with the Phase 2 Environmental Site Assessment (ESA) report to Department of Planning as part of the Environmental Assessment report.

The site has been used as a hospital since about 1908. The site presently comprises:

- Hospital buildings dating from early 1900's to mid 1900's;
- Coal bin and boiler;
- Mortuary;
- Underground fuel storage tank; and
- Workshop.

The proposed redevelopment involves demolition of existing structures and construction of a Combined MPS / Health One centre.

A plan showing site features is presented in **Figure 2**.

1.2 Objectives

The key objectives of the RAP are to:

- Outline remediation measures that will reduce or eliminate the risk of identified soil contamination; and
- Ensure that the site is remediated to a level consistent with the proposed land use.

1.3 Scope of Works

In order to achieve the objectives of the RAP, the following scope of works was completed:

- Review of available reports and related correspondence from previous environmental investigations and in particular the Phase 2 ESA Report (ENVIWARA00401AA-R01), dated 15 July 2009, prepared by Coffey;
  - Develop the appropriate, remediation and validation strategies for the site;
  - Review the environmental measures to be undertaken during the remedial works to protect the health of workers, the general public and to protect the environment; and

This RAP describes the result of the above scope of works for presentation to Health Infrastructure and Department of Planning, and after review, implementation as part of the development works program.

2 SITE SUMMARY

2.1 Site Identification

Site identification details are summarised in **Table A**:

TABLE A – SITE IDENTIFICATION DETAILS

SITE NAME:	MANILLA HOSPITAL
Site Address:	Court Street, Manilla NSW
Total Site Area:	Approximately 1 hectare (ha)
Title Identification Details:	Lot 14 of DP 814059, and the north western corner of Lot 13 DP 814059 Parish of Manilla and County of Darling.
Current Zoning:	The site is currently zoned partly 2(V) Residential Village or Urban Zone
Current Site Use:	The current and proposed land use comprises a hospital.
Proposed Site Use:	Redevelopment of current site use

2.2 Site History

A site history review was conducted for the Stage 1 Preliminary Environmental Site Investigation (ESI) completed by Department of Commerce in December 2008. The results of the Stage 1 ESI indicated that the site had been used as a hospital since about 1908 and prior to that was vacant Crown Land. Current and former infrastructure on the site included:

- Hospital buildings dating from early 1900's to mid 1900's;
- Coal bin and boiler;
- Former morgue;
- Current mortuary;
- Underground diesel fuel storage tank;
- A former workshop was located to the west of the current workshop;
- A former incinerator.

The following potential sources of contamination and areas of environmental concern were identified:

- Imported fill materials, potentially containing a range of contaminants;
- Ash from the coal boiler;
- Underground diesel fuel storage tank;
- Pest control around buildings;
- Galvanised iron sheds, carports, garages;
- Lead based paints on buildings.

Asbestos containing debris were observed in the surface soils and fill. Asbestos fragments were also observed in the subfloor of parts of the main hospital building and on the surface of the steep batter slope in the vicinity of the mortuary/coal bin.

2.3 Site Condition and Infrastructure

During the Phase 2 ESA the site was observed to consist of a generally level area on the southern half, with a steep batter slope on the northern half. The batter slope was vegetated with bushes and trees. The level area of the site contained the hospital infrastructure.

The main hospital building is located in approximately the middle of the site, and a nurse's quarters building is located to the west of the main hospital building. These buildings were constructed of brick with an iron roof.

A mortuary is located immediately to the north of the main hospital building, and a workshop is located to the northeast of the main hospital building.

A coal bin, and underground storage tank (UST) is located to the north-northeast of the main hospital building.

A ring road, paved with bitumen, circles around the hospital infrastructure. A garden bed is located to the south of the main hospital building. The remainder of the hospital site, which is not covered with buildings, the ring road, or the garden bed, is generally grassed. There are areas of concrete paving around some of the buildings.

Two outlet pipes, presumed to be used for stormwater, are located on the western side of the steep batter slope. These are presumed to be the outlet for stormwater drains within the hospital grounds.

The upper part of the batter slope is partially comprised of fill material.

2.4 Surrounding Land-Use

The land around the property is predominantly low density residential.

Residential properties are located to the north and west of the site. The east of the site is bounded by Kanangra Road, open space and residential properties. The site is bounded to the south by other parts of the existing Manilla Hospital, a water treatment plant, and residential properties. 3 residential properties are situated to the north and then sporting fields and the Namoi River located approximately 350m to the north. Agricultural land and market gardens are situated to the east and northeast respectively.

2.5 Site Topography and Drainage

The site consists of a generally level area on the southern half, with a steep batter slope on the northern half. The northern batter slopes at up to approximately 25^{o} downwards to the north.

Two outlet pipes, presumed to be used for stormwater, are located on the western side of the steep batter slope. These are presumed to be the outlet for stormwater drains within the hospital grounds.

An existing drainage swale along the northern batter slope is used to divert overland stormwater flow away from the site via an easement situated between Lot 5 and Lot 6 Strafford Street. It is understood that the drainage swale and easement are to remain in place during remediation works.

2.6 Geology

2.6.1 Regional

The Manilla - Narrabri 1:250,000 geological map indicates that the site locality is underlain by the Lowana Formation, which consists of green-black siltstone and mudstone with thin white tuffaceous beds.

2.6.2 Site Specific

Based on the observations made during the Phase 2 ESA the geology within the investigation area is generally consistent with the regional geology indicated by the Manilla - Narrabri 1:250,000 geological map.

Ash, likely to be from the coal fired boiler and/or the former incinerator, was observed in boreholes and test pits on or near the northern batter slope. Waste materials, including brick and concrete fragments, glass, plastic, timber, ceramic pipe, and potential asbestos containing material (PACM) were also observed in test pits on the northern batter slope.

The subsurface conditions encountered at the site during the Phase 2 ESA have been summarised in Table B.

TABLE B: SUMMARY OF SUB SURFACE CONDITIONS

GENERAL DESCRIPTION	LOCATION	TOP OF MATERIAL (m)	BASE OF MATERIAL (m)
Topsoil: Gravelly Sand, fine to medium grained, brown, fine gravel	SB1 & SB2	0.0	0.3
Bitumen	SB3, SB4, SB5, & SB6	0.0	0.1
Fill (general soil): Gravelly Sand, fine to medium grained, brown, fine gravel. Gravelly Clay (SB8 only), medium plasticity, orange/dark brown, fine gravel.	SB3, SB4, SB5, SB6, SB7* & SB8	0.0 to 0.1	0.3 to 2.0*

GENERAL DESCRIPTION	LOCATION	TOP OF MATERIAL (m)	BASE OF MATERIAL (m)
Fill (containing waste materials): gravelly sand, fine to medium grained, brown/grey, fine to coarse gravel. Contains brick fragments, cement fragments, plastic, glass, ceramic pipe, metals, timber and PACM.	TP1, TP2, TP3* & TP4*.	0.0 to 2.0	0.4 to 3.0*
Fill (containing ash): gravelly sand, fine to medium grained, grey, fine to coarse gravel, 50% ash.	TP3 & TP4	0.0	0.1 to 2.0
Residual Soil: Gravelly Clay, Sandy Clay, medium to high plasticity, brown/orange, fine to medium grained gravel.	SB1, SB2, SB3, SB4, SB8, TP1 & TP2	0.3 to 0.9	0.8 to 1.6
Extremely Weathered Claystone: Gravelly Clay, medium to high plasticity, pale grey, pale to dark brown, orange, fine to medium grained gravel.	SB1*, SB2*, SB3*, SB4*, SB5*, SB6*, SB8*, TP1* & TP2*	0.8 to 2.5	1.0* to 3.0*

*Denotes maximum depth of excavation. Base of material may extend beyond this depth.

2.6.3 Regional

The nearest water course is the Namoi River which generally runs in an east-west direction located approximately 330m to the north of the site.

A search of groundwater bores registered with Department of Water and Energy was carried out by DOC as part of the Stage 1 ESI. The search identified four registered bores within 500m of the site. Information on these bores is provided below.

TABLE D: REGISTERED BORE SEARCH RESULTS

BORE ID	DEPTH OF BORE (m)	STANDING WATER LEVEL (m BGS)	APPROXIMATE DISTANCE AND DIRECTION FROM SITE (km)	AUTHORISED USE
GW060682	76	NR	0.1 west	Domestic
GW902357	79.2	NR	0.3 northwest-west	Domestic Stock
GW585536	61	NR	0.15 south	NR
GW021704	10.7	7	0.5 northeast	Domestic Stock

Note: NR = not recorded

2.6.4 Site Specific

The depth to groundwater below the site is not known. Groundwater inflows were not encountered in the boreholes or test pits completed as part of the Phase 2 ESA. Boreholes were extended to a maximum depth of 3m. Seepage at the toe of the fill batter was not observed at the time of the Phase 2 ESA investigation.

It is considered that groundwater is likely to be in the vicinity of 10m or more below the ground surface of the majority of the site. Groundwater may be shallower at the northern side of the site, beyond the toe of the steep batter slope.

3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

3.1 Network Geotechnics, Geotechnical Investigation - September 2007

Network Geotechnics Pty Ltd (Network) conducted a Geotechnical Investigation at the site which was reported in reference HGS1031, dated September 2007.

Network was commissioned by Hunter Geotechnics to review field and laboratory data collected by Hunter Geotechnics and to make recommendations for footing design and related geotechnical advice for the proposed redevelopment of the hospital. A targeted assessment of contamination was also included.

The investigation by Hunter Geotechnics (in August 2007) consisted of the excavation of nine test pits to depths ranging from 1.5m to 3.0m. Laboratory testing of the samples collected included:

- analysis of six samples for a suite including metals, phenols, organochlorine pesticides (OCP), poly-chlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAH); and
- Analysis of a piece of fibrous plaster for asbestos.

The test pit logs provided by Hunter Geotechnics indicated that the profile at the site was fill to depths up to 2.5m below ground surface (bgs), underlain by alluvial clayey gravel and mudstone. The fill was noted as containing building waste and ash.

The piece of fibrous cement material encountered during the investigation works was confirmed as containing asbestos and concentrations of other chemicals of potential concern were below the National Environmental Protection Measure (NEPM) guidelines that were adopted for the purpose of the Network Geotechnics investigation. The investigation criteria adopted (land use) from NEPM guidelines was not referenced in the report, however the concentrations reported were below the most stringent criteria of the NEPM guidelines.

Network Geotechnics concluded that because asbestos contaminated material and uncontrolled fill was identified, a detailed contamination assessment including a sample density of 25 samples per hectare was recommended.

3.2 HLA-Envirosciences, Hazardous Material Survey – September 2007

HLA Envirosciences Pty Limited (HLA) conducted a Hazardous Material Survey (HMS) and asbestos risk assessment for the site which was reported in reference N2218201_HAZMAT_RPT, dated 4 September 2007.

The stated purpose of the HMS was ‘to identify the location, extent and condition of accessible asbestos based and other hazardous construction material present through the site’. Other hazardous materials addressed in the report were synthetic mineral fibres (SMF), lead based paint and PCB materials.

The report described the presence of hazardous material based on visual inspection and non destructive methods of accessible areas, in addition to laboratory testing of suspected hazardous materials.

Nineteen samples of suspected asbestos containing material was laboratory tested and eleven were reported as containing asbestos (chrysotile, amosite and/or crocidolite) in a number of building materials and areas within the site.

Seven samples of paint fragments were collected and tested for lead content from various areas of the site, with one testing positive for containing lead.

None of the fluorescent light fittings inspected were assessed as potentially containing PCB capacitors.

An appendix of the HLA report provided a Hazardous Material register, detailing the survey findings including hazardous material identified or suspected, its location, the risk, and action level. For the specific information of the materials identified, the relevant areas/buildings, the assessed risk and the recommended actions, refer to the HMS report.

3.3 Department of Commerce, Stage 1 Preliminary Environmental Site Investigation - December 2008

The Geotechnical and Environmental Unit of the DOC conducted the Stage 1 Preliminary Environmental Site Investigation (ESI) for the proposed redevelopment within the site which was reported in reference 08-GO37B, dated December 2008.

The objective of the ESI was to identify past and present potentially contaminating activities, potential contaminants types, discuss site conditions, provide a preliminary assessment of site contamination and assess the need for further investigation.

The ESI consisted of a desktop study of the site history, site conditions and surrounding environment and geology and hydrogeology; a review of previous investigations conducted at the site (summarised in Sections 3.1 and 3.2 above) and identification of potential area of environmental concern (AECs) and contaminants of concern.

The results of the ESI indicated that the site had been used as a hospital since about 1908 and prior to that was vacant Crown Land. Current and former infrastructure on the site included:

- Hospital buildings dating from early 1900's to mid 1900's;
- Coal bin and boiler;
- Former morgue;
- Current mortuary;
- Underground fuel storage tank;
- A former workshop was located to the west of the current workshop;
- A former incinerator.

The following potential sources of contamination and AECs were identified:

- Imported fill materials, potentially containing a range of contaminants;
- Spreading of ash from the coal boilers;
- Underground fuel storage tank;
- Pest control around buildings;
- Galvanised iron sheds, carports, garages;
- Lead based paints on buildings;
- Asbestos containing debris in the surface soils and fill. Asbestos fragments were also observed in the subfloor of parts of the main hospital building and on the surface of the steep batter slope in the vicinity of the mortuary/coal bin.

The DOC recommended that a Detailed ESI be undertaken at the site.

3.4 Coffey Environments, Phase 2 ESA

3.4.1 Summary

Coffey Environments was commissioned by Department of Commerce (DOC) to carry out a Phase 2 Environmental Site Assessment (ESA) at the site in preparation for development of a new hospital facility on the site.

Development of the site will consist of the demolition and removal of the existing hospital buildings and construction of a new Combined MPS / Health One centre.

The objective of the Phase 2 ESA was to assess the contamination status of the site, assess potential risk posed by contaminants to health and the environment, and provide adequate information for preparation of a remedial action plan (RAP). The work will be carried out in accordance with the relevant sections of NSW Department of Environment and Climate Change (DECC) Guidelines.

The Stage 1 Preliminary Environmental Site Investigation carried out by DOC identified five AECs on the site. Soil samples were collected from each AEC. The results of the laboratory testing undertaken during the Phase 2 ESA indicated that generally soil contamination consists of total petroleum hydrocarbons (TPH) in surface soils, and asbestos in fill materials. Polycyclic aromatic hydrocarbons (PAH) were also detected at concentrations below the nominated investigation levels in samples collected of the fill material encountered during the Phase 2 ESA. It is considered that the TPH contamination identified is likely to be from leaks and spills of oil and fuels used/stored at the site. The asbestos is likely to be from former demolished buildings that have been used as fill material on the site.

The fill material identified on site during this Phase 2 ESA varied in depth from 0.3m to greater than 3.0m below ground surface. Fill materials were generally encountered at the rear (northern) side of the site and the thickness of fill material encountered, appeared to increase in the areas to the northeast.

Waste materials, including asbestos containing materials, were noted in the fill materials in the batter slope. Ashes from the boiler and/or incinerator were also noted in fill materials noted in soil bores completed as part of this Phase 2 ESA, and were generally encountered in those locations situated within the batter slope.

Given the variability of the fill materials encountered during the Phase 2 ESA, it is possible that contamination may be present in fill materials that were not sampled and analysed during the assessment.

In addition to the above, due to the nature of contamination typically caused by USTs and associated infrastructure, it is likely that additional hydrocarbon contamination (in the form of TPH) is located in the soil immediately adjacent and underneath the UST, which cannot be sampled during a Phase 2 ESA due to potential damage that could be caused to the UST and associated infrastructure.

Based on the results obtained during this Phase 2 ESA, the nature of contamination associated with USTs and associated infrastructure, and the variability of the fill materials encountered, Coffey recommends that a combination of remediation works and management procedures be carried out at the site during site redevelopment.

Remediation works would initially involve:

- The decommissioning and removal of the UST and associated infrastructure, and the removal of TPH contaminated soil adjacent to the workshop. Remediation of hydrocarbon impacted soil may involve either treatment (on or off site) or offsite disposal. A suitably qualified person should be present during the removal of the UST and associated infrastructure for the purpose of identifying and sampling potentially impacted soil that may be encountered during these works; and
- Capping of fill materials on the steep northern batter slope to prevent exposure to people undertaking routine activities on the site. Capping would likely be with dense vegetation and a fence around the site, or using a geofabric where vegetation was not sustainable. Capping of the fill materials will require a site management plan to be prepared and maintained by a responsible person on site. Information about the contamination, its location and the implementation of a site management plan should also be provided to Tamworth Regional Council.

Coffey recommends the following for DOC consideration:

- Maintain and update the hazardous material register for the site. This would include adding the fill material identified along the face of the batter. Asbestos was found at 1.0m depth at TP3 location in the steep batter slope fill;
- Appropriate management of hazardous materials during demolition of the buildings;
- Preparation of a RAP, which will outline the remediation goals, methods of remediation and validation requirements. This would include information on removal of the USTs, removal and/or remediation of contaminated soils, and other information;
- Instigation of the RAP to remediate the site for the proposed development so that the site does not pose a risk to human health or the environment;
- Preparation and implementation of a site management plan (SMP) to manage and maintain the cap on the steep batter slope and associated fill material that may be present immediately south of the hospital ring road; and;
- Preparation and implementation of a construction management plan (CMP) to provide guidance on the appropriate management of contamination in fill materials on the site during construction of the MPS / Health One centre.

4 IDENTIFIED CONTAMINATION

The Phase 2 ESA identified areas of soil contamination or high risk of soil contamination at three locations on the site. Table E summarises the areas of concern and contaminants of concern.

TABLE E: AREAS AND CONTAMINANTS OF CONCERN

AREA OF CONCERN	CONTAMINANTS OF CONCERN
TPH Hotspot (SB8 0.0-0.1m) located to the west of the workshop.	TPH C10-C36
Diesel UST located to the north of the main hospital building, adjacent to the coal loader	TPH C6-C9 , TPH C10-C36, and PAH
Ash and asbestos containing fill material located on the steep northern batter slope	PAH, Heavy Metals, Asbestos, Dioxin/Furans
Area surrounding the workshop	VHCs (solvents).

5 PROPOSED SOIL REMEDIATION CRITERIA

Coffey understands that future site use is for a hospital facility which will have controls to prevent access to fill material on the slope face, primarily for safety reasons, but also for environmental reasons. Given this land use and control, Coffey Environments considers that the proposed land use is generally consistent with commercial land use. Coffey recognises that hospital patients, having potential compromised health, are possibly more susceptible to adverse effects from contaminants, however, the exposure duration and the opportunity for exposure to contaminated soil, either directly or indirectly, is considered to be low.

Thus, soil investigation levels for commercial/industrial land uses, are considered to be the relevant values for the proposed land use. These values are provided by the following references:

- NSW DEC (2006) *Guidelines for the NSW Auditor Scheme (Second Edition);* and
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*.

The NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme* present health based investigation levels for different land-uses (e.g. industrial / commercial, residential, recreational etc.).

Human health based soil investigation levels (HILs) for commercial/industrial land use, provided in Column 4 of Appendix II in the NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme* (Second Edition) have been adopted as the soil investigation levels.

NSW DEC (2006) Guidelines do not provide threshold levels for volatile petroleum hydrocarbon compounds (without speciation). NSW EPA (1994) *Guidelines for Assessing Service Station Sites* provide an indication of acceptable cleanup levels for petroleum hydrocarbons compounds at service station sites to be reused for sensitive land-uses. The DECC has advised that these guidelines should also be used for less sensitive land-uses. For semi-volatile petroleum hydrocarbons (C_{16} – C_{35} and >C_{35}) investigation levels are provided in the NSW DEC (2006) Guidelines, however, these are based on the NEPM health-based criteria, which require the laboratory analysis to unequivocally differentiate between aromatic and aliphatic compounds. If this cannot be done, the TPH C_{10} – C_{40} criteria in the service station guidelines should be applied. For this investigation, we have adopted the service station guidelines for all petroleum hydrocarbon fractions.

There are currently no national or DECC-endorsed guidelines relating to human health for material containing asbestos on sites. NSW DEC (2006) advised that until such guidelines become available, Auditors must exercise their professional judgement when assessing if a site is suitable for a specific use in the light of evidence that asbestos may be a contaminant of concern. NSW DEC (2006) stated that NSW Health will provide advice to Auditors on a case-by-case basis where appropriate. The NSW DEC previously provided interim advice that “no asbestos in the soil at the surface is permitted”. Enhealth (2005) ‘*Guidelines for Asbestos in the Non-Occupational Environment*’, provides some guidance on assessing and managing asbestos in soil although does not provide a threshold concentration or investigation level for asbestos. Coffey Environments has adopted an asbestos investigation level of “non-detect” for this site.

Adopted assessment criteria are summarised in **Table F**.

TABLE F – ADOPTED SOIL REMEDIATION CRITERIA (mg/kg unless otherwise stated)

CONTAMINANT	NSW DEC 2006 HEALTH INVESTIGATION LEVEL COLUMN F	NSW EPA 1994 THRESHOLD CONCENTRATIONS FOR SENSITIVE LAND USE-	NSW EPA 1985 CONTROL ORDER IN RELATION TO DIOXIN-CONTAMINATED WASTE	ADOPTED REMEDIATION CRITERIA
Benzene	NE	1	NE	1
Toluene	NE	1.4	NE	1.4
Ethylbenzene	NE	3.1	NE	3.1
Xylenes	NE	14	NE	14
TPH(C6-C6)	NE	65	NE	65
TPH(C10-C36)	NE	1,000	NE	1,000
Total PAHs	100	20	NE	100
Benzo(a)pyrene	5	1	NE	5
Arsenic	500	NE	NE	500
Cadmium	100	NE	NE	100
Copper	5,000	NE	NE	5,000
Chromium (III)	60%	NE	NE	60%
Lead	1500	300	NE	1500
Mercury	75	NE	NE	75
Nickel	3000	NE	NE	3000
Zinc	35,000	NE	NE	35,000
Dioxins / Furans	NE	NE	10ng/kg	10ng/kg
Asbestos	NE	NE	NE	No detection

Key:

NE = Guideline value is not established

6 QUALITATIVE RISK ASSESSMENT

6.1 Source Zone Characteristics

6.1.1 Primary Contaminant Sources and Contaminants of Potential Concern

The primary sources of contamination on the site, and the contaminants of concern are outlined in Table E in Section 4 above.

6.2 Contaminant Transport Mechanisms

The primary transport mechanisms applicable to the migration of impact identified at the site include:

- Transportation of sediments via surface water runoff;
- Air-borne movement of contaminated soil particles as dust;
- Volatilisation of hydrocarbon fractions and atmospheric dispersion; and,
- Volatilisation of hydrocarbon fractions and accumulation within enclosed spaces, such as utility conduits and vaults.

6.3 Contaminant Exposure Pathways

For contaminated soil to pose a risk to a receptor, a complete exposure pathway must exist between the source of the impact and the receptor. A complete exposure pathway consists of the following elements:

- A source (e.g. tanks, pipes) and mechanism for release (e.g. rupture, corrosion/leak or spill);
- A storage and/or transport medium (e.g., contaminants stored in soil volatilise and are transported into the atmosphere);
- An exposure point, where the receptor (e.g. human or environmental) comes in contact with the contamination; and
- An exposure route (e.g. inhalation, ingestion, dermal contact).

The following potential exposure pathways for contaminants requiring consideration and mitigating measures have been identified.

Soil

There is potential for exposure of on-site hospital workers, hospital patients and excavation/construction workers, via dermal contact, inhalation and/or incidental ingestion of contaminants of concern in surface soils and/or subsurface soils (if exposed by excavation).

Impacted soils may pose an issue for site redevelopment. Demolition/excavation workers who undertake excavation work in the vicinity of identified contamination and expose contaminated soils, would be required to take the necessary precautions by way of a suitably prepared Construction Management Plan and Personal Protective Equipment. These measures are designed to render the potential exposure routes incomplete.

Surface Water

The local stormwater system is anticipated to discharge into the Namoi River located north of the site. As such, impacted soil borne in stormwater has the potential to discharge directly into Namoi River, which may adversely affect recreational/domestic users, and aquatic ecosystems in this waterway.

Groundwater

The potential for groundwater movement of contamination at the site is low. Groundwater inflows were not observed during the Phase 2 ESA field investigations and groundwater is anticipated to be about 10m, or more, below the ground surface.

Air

There is potential for exposure through the inhalation of hydrocarbon vapours or respirable asbestos fibres. Chemical intake through inhalation is more difficult to control than intake through direct contact or ingestion. Inhalation of volatile emissions or asbestos fibres from soil by workers in or near an excavation can constitute a potentially complete exposure pathway. Vapour emissions and airborne asbestos fibres from contaminated soil may also accumulate in future on-site and off-site buildings. Residents or workers in these buildings may then inhale the vapour emissions and asbestos fibres.

Vapour emissions and airborne asbestos fibres from contaminated soil is a potential issue for site redevelopment. Demolition/excavation workers who undertake excavation work in the vicinity of contaminated soils, would be expected to take the necessary precautions by way of a suitably prepared Construction Management Plan and Personal Protective Equipment. These measures will render the potential exposure routes incomplete.

6.4 Potential Receptors

This RAP is prepared with the basis that future site use is non-sensitive commercial.

The following potentially sensitive areas and possible receptors located on site and within a 500m radius of the site should be considered:

- Demolition/excavation/construction workers at the site;
- Hospital workers and patients at the site;
- Residents of adjacent and nearby properties;
- Aquatic ecosystems within the Namoi River; and
- Endangered tree species on the fill batter slope.

7 REMEDIAL GOALS

The development of remediation goals firstly involves evaluation for each of the following categories:

- Primary and Secondary Source Control - removal/treatment actions to remove the contaminant source(s) or reduce them to an acceptable level;
- Transport Control - containment measures to limit contaminant transport; and
- Exposure Pathway Control - institutional controls to limit human or environmental exposure to contamination.

Based on review of available data, the following sources of contamination have been identified:

- TPH hotspot – TPH C10-C36 impact at SB8 adjacent to the workshop;
- The diesel UST; and
- Fill materials on the steep northern batter slope.

Based on this assessment, the suggested sequence of remediation for the site are:

- Demolition of the coal bin and boiler to provide access for removal of the UST;
- Removal of the UST and excavation of the surrounding contaminated soil, and excavation of the TPH hotspot adjacent to the workshop;
- Providing a waste classification for the excavated materials, and disposing off-site to an appropriately licensed landfill;
- Validation sampling and analysis from the excavations for the contaminants of concern;
- Additional excavation where contaminant concentrations exceed remediation criteria;
- Reinstating the excavations with suitable material from on-site, or imported virgin excavated natural material (VENM), i.e. validated clean fill;
- Construction of the new Combined MPS/Health One centre;
- Removal of approximately 1285m^3 of material from the batter slope. Material will be removed for construction of the Northern Aged Care Wing and Staff Accommodation (not including a bulking factor);
- Relocation of approximately 950m^3 of excavated material in an area to the east of the hospital, and 335m^3 of material in an area on the northwest corner of the site (not including a bulking factor). These areas are shown on Figure 4;
- Capping exposed areas of the steep northern batter slope (i.e. areas not covered with new buildings);
- Capping the 1285m^3 of materials relocated onsite;
- Erect fencing around the steep northern batter slope to prevent general access to the area. Fencing that provides a physical barrier such as star pickets with mesh, bollards or flagging tape are suitable for this purpose;
- Prepare and implement a site management plan to provide ongoing management procedures to ensure the cap remains effective.

8 PROPOSED REMEDIAL STRATEGIES

8.1 Preliminary Works

Coffey Environments advises that the remedial works outlined below should be coordinated with demolition of the existing structures and construction of the new facility. Part of the remediation, such as removal of the UST, will require some of the existing structures to be removed. Part of the remediation, such as capping the northern batter slope, can't be completed until after the new facility is constructed.

A hazardous material survey was carried out by HLA-Envirosciences (see Section 3.2 above), and identified asbestos in the existing buildings. Appendix A of the HLA report lists details of the location of these materials.

An AS1 licensed contractor must be employed to remove asbestos containing materials from the site. We recommend that the contractor refer to the HLA report to identify the locations of the asbestos containing materials (ACM).

Because ACM was identified as a contaminant of concern at the site during the Phase 2 ESA, it is important that any ACM in buildings is removed efficiently and does not further contaminate any surrounding area on the site. Coffey Environments recommends that the site owner obtains asbestos clearance certificates of this from the demolition contractor.

8.2 Diesel UST

Information provided about the diesel UST indicates it has a capacity of approximately 13,600 litres, with approximately 630 litres of fuel currently in the UST. USTs are generally installed to a maximum depth of 3m to 4m. The location of the UST is shown on **Figure 2.**

The proposed remediation strategy for the diesel UST will involve:

- Removal of any product and /or water in the UST and associated piping;
- Removal of the UST and associated infrastructure (i.e. pipe work and dip point). A destruction certificate for the UST should be retained as proof that the UST was appropriately destroyed. This certificate would be included in the validation report;
- Excavation of secondary contaminant sources; surrounding and visually impacted soils within the excavation. The soils will also be screened with a photo-ionisation detector (PID) to check for the presence of volatile organic compounds (VOCs), which can indicate contaminated soil that is not visually impacted. It is estimated approximately 330m^3 of soil will be excavated (not including a bulking factor), it is noted that the volume of soil excavated could vary significantly depending on the contamination found in the soil beneath and immediately surrounding the UST;
- Soil stockpiling for sampling and classification for off-site disposal;
- Validating the walls and base of excavations in accordance with sampling densities stated in NSW EPA 1994, quality control measures, analysis and assessment using the Site Remediation Criteria. (See Section 9.1 below for specific details).

8.3 TPH Hotspot

TPH C10-C36 contamination was identified in sample SB8 0.0-0.1m, adjacent to the workshop and in the vicinity of the former incinerator.

Because the contamination is anticipated to be localised and shallow, it is proposed to remove this contamination by excavating the contaminated soil and disposing to an off-site facility. It is estimated approximately $2m^3$ of soil will be excavated (not including a bulking factor) from the hotspot area, it is noted that volume of soil excavated could vary depending on the contamination found in the soil.

The excavated soils will be stockpiled with contaminated material from the UST excavation, and a waste classification provided prior to disposal at an appropriately licensed facility.

8.4 Steep Northern Batter Slope

The steep northern batter slope is partially constructed of fill materials containing ash from the boiler and/or incinerator and building rubble from demolished buildings, including asbestos containing materials. A geotechnical investigation (Department of Commerce Report *Manilla MPS & Health One Facilities, Geotechnical Investigation*, Report No. 08-GO37A, dated June 2009) has indicated that batter slope is not stable, and no machines can traverse the slope.

The volume of fill materials containing ash and building rubble is difficult to estimate as the nine test pits excavated in the batter slope were limited to the top and bottom edge of the slope and show varying depths of fill materials. Based on the information available, the estimated volume of ACM in the steep northern batter slope requiring extraction is $950m^3$ for the Northern Aged Care Wing, and $335m^3$ for the Staff Accommodation (not including a bulking factor).

The batter slope is proposed to be remediated by capping the fill material to prevent direct exposure of individuals to possible contamination, and also to prevent asbestos fibres and/or ash becoming airborne, and to prevent erosion causing sediment migration. Two options for capping are outlined below:

Option 1 – capping with vegetation alone

- In areas not covered by the new buildings, placement of seeded matting or mulch in areas where current vegetation is not sufficiently dense to achieve the remediation goal;
- In areas covered by the new buildings, but where the surface of the batter slope is still accessible (i.e. under overhanging building supported on piers) maintenance of vegetation is considered to be impractical. In these areas, capping with a geofrabric (such as bidim) or shotcrete is recommended;
- Placement of a fence along the crest and near the toe of the batter slope to prevent people walking into the area. On the northern side, the fence could be the boundary fence, and does not need to be placed directly at the toe of the slope; and
- Implementation of a site management plan (SMP) to ensure the cap is maintained and managed.

Option 2 – capping with geofabric and vegetation

- Removal of grass, weeds and bushes from the slope. Any endangered species tree should be retained where possible;
- In areas not covered by the new buildings, placement of a permeable geofabric over the slope. The geofabric would need to be fitted around the trees. There are several types of geofabrics available that allow vegetation growth, some of these are durable and long lasting, other are biodegradable and will break down over a period of months to years. A discussion of the types of geofabrics, and the advantages and disadvantages is provided below;
- Placement of geofabric or matting to stabilise the slope in the long-term by promoting vegetation growth. Long-term slope stabilisation will minimise erosion and manage wind blown dust potential;
- Should a biodegradable geofabric be used, a fence would need to be placed around the batter slope to prevent people walking into the area; and,
- Implementation of a site management plan (SMP) to ensure the cap is maintained and managed.

Table G summarise some of the advantages and disadvantages of different geofabric types should Option 2 be chosen.

TABLE G – ADVANTAGES AND DISADVANTAGES OF DIFFERENT GEOFABRICS

GEOFABRIC TYPE	ADVANTAGES	DISADVANTAGES
Biodegradable Jute Matting (i.e MacJute, or Jute Biodegradable Erosion Control Net)	Low to Medium Cost Easy to install on slope and around trees Will prevent erosion until vegetation becomes established Provides a temporary cap until vegetation is established	Not durable, will biodegrade. Won't remain as a marker for cap management. Very limited slope stabilising properties. Relies on vegetation for stabilisation
Durable Geofabric (i.e. Trinter Erosion Control Net, and Enkamat)	Medium Cost Reasonably easy installation Durable, will allow geofabric to act as marker for cap management	Limited slope stabilising properties, relies on vegetation for stabilisation
Durable, Stabilising Geofabrics (i.e. Castoro Reno Mattress, MacMat R)	Reasonably easy installation Durable, will allow geofabric to act as marker for cap management Will help to stabilise slope	Higher Cost

8.5 Crest Behind Batter Slope

Remaining fill material to the south of the Batter Slope can be managed by placement of a clean soil cover of approximately 0.5m thick with a visual marker layer on the top of the contaminated fill.

An existing drainage swale along the northern batter slope is used to divert overland stormwater flow away from the site via an easement situated between Lot 5 and Lot 6 Strafford Street. It is understood that the drainage swale and easement are to remain in place during remediation works.

The distance south of the batter slope requiring the clean soil cover (approximately 6-8m) can be adjusted in the field based on the observed presence of fill.

8.6 Placement and Capping of Fill Removed from Batter Slope

Based on the information available, the estimated volume of fill material, including ACM, in the steep northern batter slope intended for relocation is approximately 950m^3 for construction of the Northern Aged Care Wing, and approximately 335m^3 for construction of the Staff Accommodation (not including a bulking factor).

The material will be removed during construction, and it is anticipated that the material for construction of the Northern Aged Care Wing will be removed during the first stage of works, and the material for construction of the Staff Accommodation will be removed in a second stage of works.

The material removed for construction of the Northern Aged Care Wing is proposed to be relocated to Lot 13, in an area to the west of the hospital. This area is proposed to be used as landscaped open space, and it is possible that staff and patients in the hospital will access this area.

The material removed for construction of the Staff Accommodation is proposed to be relocated to Lot 14, in the north western corner of the site. This area is proposed to be used as landscaped open space also. Figure 4 shows the proposed fill locations.

In both areas, the material will be placed in an approximately 0.5m thick layer, and then covered with a durable geofabric. A minimum 0.5m thick layer of soil will placed over the geofabric and vegetation growth promoted. The soil should be placed in 300mm thick layers and compacted to at least 95% relative density.

The soil cap will be sourced from on-site clayey material. This material will be validated that it is suitable for use as a cap, through visual inspection and sampling and analysis. The contractor will be responsible for validation of the capping material by an environmental consultant.

The material from the steep batter slope will need to excavated and handled under supervision of an AS1 licensed contractor because of asbestos contamination.

An SMP will be developed and implemented for long-term management of the capping system.

8.7 Stockpiling Procedures

If temporary stockpiling of material is required, the following general procedures will be followed:

- Access to any stockpile(s) of potentially contaminated material should be limited by keeping stockpiles within the temporary fencing defining the remediation area, or erecting a separate temporary fence around the stockpile;
- Stockpiles should be placed on level ground. If this is not possible stockpiles should not be placed on slopes greater than 5^{o};
- Material should be placed on strong impermeable plastic sheeting, or hardstand areas (i.e. bitumen or concrete), to prevent the contamination of the underlying soils. Material should generally not be stockpiled more than 2m high;
- Stockpiles should be covered by weighted polythene sheets or tarpaulins to prevent erosion of stockpiled materials. Heavy objects not containing sharp edges should be placed on the sheets to prevent them from being blown by wind;
- Adequate straw bales and/or silt fences will be placed around the perimeter of the stockpile area to filter runoff from the stockpiles and prevent overland storm water flow from affecting the base of the stockpile; and,
- Silt fencing or hay bales should also be placed up-slope of the stockpiles to prevent storm water running into the stockpile.

9 VALIDATION PROGRAMME

To demonstrate that the site has undergone appropriate and effective remediation works, a validation programme in accordance with Coffey Environments Standard Operating Procedures and relevant guidelines will be undertaken. The relevant guidelines are:

- Australian Standard AS 4482.1 (1997) Guide to the Sampling and Investigation of Potentially Contaminated Soils;
- EPA (1997) Guidelines for Consultants Reporting of Contaminated Sites;
- NEPM (1999) *National Environment Protection (Assessment of Contaminated Sites) Measure*.

9.1 Validation of UST and TPH Hotspot Excavation

Following completion of the excavation works outlined in Section 8.2 and 8.3, the number and location of soil samples collected from the excavation will be in accordance with industry standards. For a single tank and other small excavations, the minimum number of soil samples collected for validation will be one from the base and one from each wall of the excavation.

For larger excavations or shallow trenches, the number of samples collected for validation is generally one or 1 per $10m^2$ from the excavation walls or trench base and 1 per $10m^3$ from the excavation base. At each location, samples will generally be collected from the middle of the wall. However, if a distinct variation in soil type or gross contamination is observed at the practical extent of excavation, additional soil samples will be collected.

Soil samples from the UST excavation will be analysed for TPH and total PAHs. Soil samples from the TPH Hotspot excavation will also be analysed for TPH, lead and PAHs.

A recently gazetted regulation Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008, requires that a validation report be prepared after tank removal in accordance with EPA guidelines. This will be complied with by the issuing of a Validation Report following the completion of remediation works. Removal followed by replacement or modification of a UST requires the validation report to be provided to the local authority not later than 60 days after removal replacement or remediation completion. It is Coffey Environments understanding that no replacement UST is planned.

9.2 Validation of Steep Northern Batter Slope Cap

Following completion of the capping activities, Coffey Environments will visit the site to validate (by observation) that the cap is properly placed and covers the required areas, and that fencing is installed (where required).

The findings of this visit will be included in the validation report.

Should there be any concerns that the cap and/or fence are not adequately installed, Coffey Environments would notify Health Infrastructure such that this can be amended prior to finalising the validation report.

9.3 Waste Classification of Stockpiled Excavated Soils

Soil excavated from the UST and TPH Hotspot excavations will require waste classification prior to being disposed at an appropriately licensed landfill.

Based on the estimated volumes of soil to be excavated described in Sections 8.2 and 8.3 above, Coffey Environments estimates about 330m^3 (including a bulking factor of 1.5) will be stockpiled.

It is important to note that soil excavated from the UST and TPH Hotspot excavations should be stockpiled separately and not mixed with other excavated materials such as soil containing asbestos fibres.

Following stockpiling of the excavated material, samples will be collected to allow waste classification. Samples will be collected at a rate of 1 per 100m^3, or a minimum of four samples for volumes less than 100m^3.

A waste classification letter would be provided for off-site disposal of the stockpile. This letter should be provided to the operators of the landfill. The waste dockets for the disposal of the material should be retained as evidence that the material was disposed of appropriately, and a copy of each docket should be provided to Coffey Environments.

The waste classification letter and copies of the waste dockets would be included in the validation report as an appendix.

9.4 Backfill Material for Excavations

Coffey Environments understands that material excavated from the southern part of the site, which comprises residual soils, is proposed for use as backfill material for the excavation. The Phase1 and Phase 2 ESA's found no indication of contamination of this material.

Imported fill material may be required to reinstate the excavations. Any imported material is required to be certified as suitable under the DECC (2008) *Excavated Natural Material Exemption*, or to fit within the DECC (2008) *Waste Classification Guidelines* definition of Virgin Excavated Natural Material (VENM).

9.5 Soil Sampling Methodology

Sampling and analysis of soil will be undertaken in accordance appropriate standards and guidelines using procedures which are summarised as follows.

1. Samples will be collected from the walls and floors of excavations by the excavator/backhoe bucket, in order to avoid personnel entering excavations deeper than 1.4m below the surrounding ground surface. Otherwise, samples may be collected manually, or with the aid of the excavator/backhoe;
2. Where an excavator or backhoe is used, samples will be collected from at least 0.15 m below the surface of the soil in the bucket and from where there is no direct contact with the bucket;
3. Samples from the excavations and stockpiles will be collected using a clean trowel or gloved hand and will be collected from at least 0.15 m below the surface. Personnel will change gloves between each sample and any sampling tool will be decontaminated to minimise potential cross contamination;
4. Sampling equipment will be decontaminated by brushing with potable water, then scrubbing with a solution of laboratory grade detergent solution (Decon 90) and potable water, and then followed by rinsing with potable water;

5. Selected samples will be placed directly into clean “zip-lock” plastic bags and screened for volatile organic compounds (VOCs, i.e. BTEX and TPH) using a PID calibrated to a known concentration of isobutylene in air. The headspace in the soil sample will be allowed to equilibrate prior to screening to indicate of the presence of VOCs when measured using the PID. VOC concentrations, sample type, and location will be recorded on standard field forms;
6. The samples collected for laboratory analysis will be placed in laboratory supplied glass jars and will be stored on ice in a cooler after sampling and during transportation;
7. A chain of custody form will be completed, detailing the sample identities, date/s of collection, method of preservation and analytes requested for analysis. Samples will be transported with the chain of custody form to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

9.6 Quality Assurance and Quality Control

Quality Assurance/Quality Control (QA/QC) is an industry required practice that verifies the usability of the data collected. The following QC samples, and the respective frequency, will be collected or prepared:

- Field duplicate (intra laboratory duplicates) and triplicate (inter laboratory duplicates) samples will be collected and analysed at a ratio of one duplicate per 15 primary samples and one triplicate per 30 primary soil samples. Field triplicate samples will be analysed by a secondary NATA accredited laboratory;
- An equipment rinsate sample, where appropriate, will be collected in the field daily during soil sampling;
- One field blank will be collected per sampling day;
- Laboratory prepared trip spike and trip blank samples will also accompany the soil samples collected during validation works.

Samples retained but not requiring immediate analysis will be kept in refrigerated storage at the laboratory.

9.7 Reporting

Upon completion of the remedial and validation works a Remediation and Validation Report will be produced summarising the works conducted, the results and any recommendations. The report will be written to comply with relevant guidelines as outlined in Section 5. The preparation of the report will be the responsibility of the Principal Contractor for the remediation works.

10 SITE CONTROL

Potential environmental impacts of the remedial works are associated with the removal of the UST and any surrounding contaminated soil, and exposure to the potentially contaminated fill materials on the steep northern batter slope. This section of the RAP outlines procedures to mitigate such potential risks.

10.1 Contaminated Soil Management

A construction management plan (CMP) will be prepared for the site for management of contaminated soils during construction. The contractor will be responsible for providing and implementing the CMP. As the remediation will likely occur during construction activities, and will be undertaken by the primary contractor, a separate CMP for remediation of contaminated materials is considered not warranted.

The remediation program is intended to be undertaken in a staged approach as follows:

- Designated areas will be excavated using a large excavator and contaminated soil will be placed in a stockpile to be sampled for waste classification;
- The soil will be transported off-site for disposal to a suitably licensed landfill;
- Validation sampling of the excavation and stockpile areas will be performed on an ongoing basis as excavations are extended;
- Two areas of the steep batter slope will have material removed for construction purposes. These excavations will not require validation as some contaminated material will remain and will be capped with either buildings or geofabric; and
- The material removed from the batter slope will be relocated to two areas on site (see Figure 4) and capped with a geofabric and 0.5m of compacted soil cover.

Information describing excavation areas, validation samples and soil movements will be recorded during the remediation works. The areas where the fill material removed from the batter slope is placed should be accurately recorded, with GPS co-ordinates recorded of the edges of the areas.

Stockpiles will be individually identified to ensure that each stockpile is properly classified according to contaminant concentrations and to ensure that mixing of different classes of waste does not occur.

The soil removed during the excavations will be stockpiled on paved areas or polyethylene sheeting (if required), and will be surrounded by silt barriers to ensure that surface runoff on other parts of the site is not impacted by the potentially contaminated soil. The stockpiles will not be placed near drainage lines, gutters or storm water pits where practicable. Additional drainage control works will be constructed on-site if required. If wet weather conditions are encountered, excavation works will cease and stockpiles covered with HDPE lining to prevent erosion of stockpiled material.

Material removed from the steep northern batter slope will need to excavated and handled under supervision of an AS1 licensed contractor.

The excavation and stockpile areas will be isolated from the surrounding site areas through the use of temporary barricades and fencing.

10.2 Water Management

Rain water may collect and accumulate in open excavations. In the event of water accumulating within the excavations in a significant volume, appropriate management measures need to be considered to manage the potentially impacted water. Based on the level of contamination present, water will be either pumped, treated and discharged to sewer (under agreement with the appropriate authorities) or will be pumped out and disposed off-site by a licensed contractor, to a NSW DECCW licensed Liquid Waste Treatment Facility.

Surface water runoff must be controlled on the site to ensure that potentially impacted material and/or water is not discharged to the surrounding area. The surface water runoff and sediment entrained in the water will be managed by installing silt barriers along the perimeter of the site to filter solid particles from the surface water, as it may flow off-site.

Fences and silt barriers will be monitored and maintained by the principal contractor for the development because this aspect relates to general environmental management of the site and not only to remediation works.

10.3 Air Emissions

The main type and source of air emissions from the site during remedial works is anticipated to be hydrocarbon odours released from exposed and open excavations and from the stockpiled or transported soil prior to final disposal.

The actual concentrations of the air emissions will vary depending on weather conditions and the composition of the impacted soils. Air emission and odour controls will ensure that no offensive odours will be detected at the site boundary. The closest residents to the site are to the immediate north.

If considered necessary, the following hydrocarbon odour management procedures may be used.

- Undertaking the excavation works in a staged manner to limit the surface area of odorous material exposed;
- Application of odour suppressants (Biosolve or Killsmell) via spray applicator;
- Covering of the stockpiled and transported soil, to suppress the release of the odours.

In addition, as a precautionary management measure, air monitoring will be carried out during the excavation works using a PID that measures VOCs. Air quality within the work area and within workers' breathing zones will be monitored during the site activities using a PID as a screening tool. Workers will immediately withdraw from the work area if VOCs are greater than 10ppm in the workers' breathing zone. The Project Manager and Office Safety Coordinator (OSC) must approve re-entry into the work area. A range of actions from the use of respirators by site personnel, to watering or covering of stockpiles, to the suspension of site works will be assigned to different PID action levels.

Records of air monitoring conducted during excavation works and complaints will be made available to relevant regulatory officers (i.e., NSW DECCW, Tamworth Regional Council, Department of Planning) upon request.

10.4 Dust

The remedial works on the site will involve excavation works, stockpiling, transportation and placement of soil and general movement of vehicles across the site. Dust generation is therefore considered to be a potential environmental impact to the surrounding environment and the public.

The following potential sources of dust generation have been identified, and the measures to be taken to minimise dust levels are as follows.

General Site Area

- High density weave shade cloth will be placed around the remediation area.
- A communication and complaints register will be operated on site to ensure that concerns of local residences and businesses are recorded and addressed.
- Contractors working on site will be apprised of the need to keep dust generation to a minimum. If visual inspection of the dust levels indicates that unacceptable levels are being generated, then work will cease until measures have been undertaken to reduce the dust, or until weather conditions are more suitable. This may involve an alteration of the work plan or the use of water sprays.

Excavation Areas

- If dust migration from excavation areas is considered excessive due to high winds, the works will be delayed or limited during these periods.

Stockpile Areas

- The temporary stockpiling of the impacted soils may result in dust generation. The stockpiles may be covered by a high density polyethylene (HDPE) sheet, to reduce the off-site movement of dust from stockpiles. In addition, regular dampening of stockpiles with water mist may also be carried out to minimise dust generation. The amount of water used for dust suppression needs to be kept to a minimum in order to prevent runoff.
- Stockpiles will not exceed the height of the fencing in order to reduce dust and odours spreading to the surrounding environment.

Haulage of Soils

- Trucks transporting contaminated soil (for disposal) or imported fill to the site must be covered in order to minimise dust generation.
- Consideration for a tyre grid/wash may be required to prevent dust being transported off-site via vehicular movement to and from the site.

10.5 Asbestos and Ash from the Steep Northern Batter Slope

The steep northern batter slope is proposed to be capped to prevent migration of airborne asbestos fibres and ash. Excavation of material from two areas on the batter slope, and relocation and capping of the material on site is proposed as part of the remediation works. A construction management plan will be prepared to provide guidance on dealing with the fill materials in the batter slope, amongst other aspects. The contractor will be responsible for ensuring that the CMP is followed during excavation and placement of the material from the batter slope.

During the excavation and placement of materials from the batter slope, and prior to the batter slope being capped, there is the potential for asbestos fibres and ash to become airborne and be inhaled or ingested by workers within the remediation area, and outside of the remediation area.

In general, the dust control measures provided in Section 10.4 above are expected to be adequate to manage the potential for asbestos and ash to become airborne. In addition to the measures above, asbestos air monitoring should be undertaken and the batter slope should be kept damp to minimise dust generation. It is important not to apply excessive water, as this could affect the slope stability and also cause erosion through run-off.

Workers are expected to wear a tyvek suit and a respirator whilst working on the slope, or other areas where asbestos containing material is identified.

10.6 Noise Controls

Noise impact associated with the site works is acknowledged as an important environmental issue. Some noise will be generated during the excavation activities when using machinery such as excavators, backhoes and soil screening equipment. Contractors must comply with Tamworth Regional Council regulations regarding noise emission in residential and commercial areas and allowable work hours. Contractors must liaise with hospital management on appropriate working hours such that hospital patients are not excessively disturbed.

In the event that standard practises are not sufficient to reduce noise to acceptable and required levels, a noise monitoring program may be implemented. This program would involve short term operator attended noise surveys at the noise source, as well as at surrounding properties to quantify the contribution of noise levels from the site to the ambient background levels.

10.7 Traffic

No major traffic disruptions are expected as a result of the on-site works. Excavation and other equipment will be transported to the site in accordance with standard regulatory requirements.

10.8 Working Hours

Working hours for onsite remedial works will be completed in accordance with Tamworth Regional Council and the Manilla Hospital management staff requirements.

It is anticipated that working hours would be within nominated statutory timeframes.

10.9 Access Restriction

As the remediation area will be classified as a construction area it is necessary to restrict access solely to authorised staff and contractors who have appropriate site safety induction and any required personal protective equipment for remediation works. A temporary fence should be erected around the remediation area to limit unauthorised access. Signage, including contractor details and contact numbers, should be erected near the gate of the remediation area. The signage will remain displayed on the site entrance throughout the duration of the remediation works. The site supervisor shall control site access and shall induct authorised visitors on an “as needed” basis.

11 OCCUPATIONAL HEALTH AND SAFETY

The contractor must establish an appropriate Occupational Health & Safety Plan (OHSP) prior to the commencement of the remedial and validation works in order to protect workers at the site as well as people in the surrounding areas. The site specific OH&SP should consider the following.

- Hazard Identification and Control;
- Air monitoring during excavation and stockpiling works;
- Chemical Hazard Control;
- Handling Procedures;
- Personal Protective Equipment;
- Work Zones;
- Decontamination procedures;
- Contingency Plans; and
- Incident Reporting.

The OHSP should be periodically reviewed and updated prior to various project tasks being conducted.

The contractor, supporting sub-contractors and third party observers to the site will be required to work strictly to this plan. During site activities, only approved personnel should be allowed access to the remediation work area.

12 LICENCES AND APPROVALS

It is assumed that the remediation works will be approved as part of the MPS/Health One centre construction approval by Department of Planning (assuming the development is approved). Works should be completed in accordance with the conditions of the approval from Department of Planning.

Tamworth Regional Council will need to be notified of Category 2 remediation works at least 30 days prior to the commencement of works.

An AS1 licensed contractor is required for the excavation and handling of asbestos material.

The UST should be removed in accordance with the Australian Institute of Petroleum Code of Practice "*The Removal and Disposal of Underground Petroleum Storage Tanks AIP CP22-1994*".

Impacted soil requiring off-site disposal will be transported and disposed to licensed waste facility. Material leaving the site will be tracked and documented. Waste disposal dockets and UST destruction certificates will be obtained and included in the site validation report.

13 CONTACTS

The following contact numbers for project personnel are given for the duration of the project. In the event that project personnel change, the relevant parties will be notified.

TABLE H – PROJECT PERSONNEL CONTACT NUMBERS

PERSONNEL	CONTACT NUMBER
Environmental Consultant, Project Manager Emma Coleman, Coffey Environments Pty Ltd	Phone: (02) 4016 2300 Mobile: 0428 104 881 Fax: (02) 4016 2380
Civil Contractor TBA	Phone: (02) TBA Mobile: TBA Fax: TBA

14 COMMUNITY RELATIONS

Details of remediation works should be discussed with Hospital management and the nearest residents. In particular, those residents to the north of the works should be advised of the proposed works and contractor and Coffey Projects contact details should be made available to them. It is recommended that truck routes for movement of contaminated soil be considered when assessing the impacts of remediation works on nearby residents. In addition, residents (and especially schools that may be on the truck route) be informed of truck movements containing contaminated soil in their vicinity and avoided if practicable.

Every effort should be made to ensure that the community is appropriately involved. Enquiries regarding environmental and contamination issues from members of the local community and neighbouring properties should be documented and referred to contractors, or Coffey Projects who are project managing.

15 REFERENCES

Coffey Environments Pty Ltd (2009) Phase 2 Environmental Site Assessment, reference ENVIWARA00401AA-R01

Department of Commerce (2008) Stage 1 Preliminary Environmental Site Investigation, reference 08-GO37B

HLA Envirosciences Pty Ltd (2007) Hazardous Material Survey – Manila Hospital Site, Manilla NSW, reference N2218201_HAZMAT_RPT

Network Geotechnics Pty Ltd (2007) Proposed Extensions to Manilla Hospital – Report on Geotechnical Assessment, reference HGS1031

NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM).

NSW EPA (1997) Guidelines for Consultants Reporting on Contaminated Sites. ISBN 0 7310 3892 4.

NSW EPA (1994) Guidelines for Assessing Service Station Sites. ISBN 0-7310-3712-X.

NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme (2nd ed). ISBN 1 74137 859 1

NSW DECC (2008) Waste Classification Guidelines. Part 1: Classifying Waste. ISBN978 1 74122 810 6

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SPECIALISTS IN LIVING AND WORKING PLACES

Important information about your **Coffey** Environmental Report

Uncertainties as to what lies below the ground on potentially contaminated sites can lead to remediation costs blow outs, reduction in the value of the land and to delays in the redevelopment of land. These uncertainties are an inherent part of dealing with land contamination. The following notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report has been written for a specific purpose

Your report has been developed on the basis of a specific purpose as understood by Coffey and applies only to the site or area investigated. For example, the purpose of your report may be:

- To assess the environmental effects of an on-going operation.
- To provide due diligence on behalf of a property vendor.
- To provide due diligence on behalf of a property purchaser.
- To provide information related to redevelopment of the site due to a proposed change in use, for example, industrial use to a residential use.
- To assess the existing baseline environmental, and sometimes geological and hydrological conditions or constraints of a site prior to an activity which may alter the sites environmental, geological or hydrological condition.

For each purpose, a specific approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible, quantify risks that both recognised and unrecognised contamination pose to the proposed activity. Such risks may be both financial (for example, clean up costs or limitations to the site use) and physical (for example, potential health risks to users of the site or the general public).

Scope of Investigations

The work was conducted, and the report has been prepared, in response to specific instructions from the client to whom this report is addressed, within practical time and budgetary constraints, and in reliance on certain data and information made available to Coffey. The analyses, evaluations, opinions and conclusions presented in this report are based on those instructions, requirements, data or information, and they could change if such instructions etc. are in fact inaccurate or incomplete.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man and may change with time. For example, groundwater levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project and/or on the property.

Interpretation of factual data

Environmental site assessments identify actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from indirect field measurements and sometimes other reports on the site are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of Coffey through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other problems encountered on site.

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Important information about your **Coffey** Environmental Report

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered with redevelopment or on-going use of the site. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. In particular, a due diligence report for a property vendor may not be suitable for satisfying the needs of a purchaser. Your report should not be applied for any purpose other than that originally specified at the time the report was issued.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other professionals who are affected by the report. Have Coffey explain the report implications to professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), field testing and laboratory evaluation of field samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Contact Coffey for additional assistance

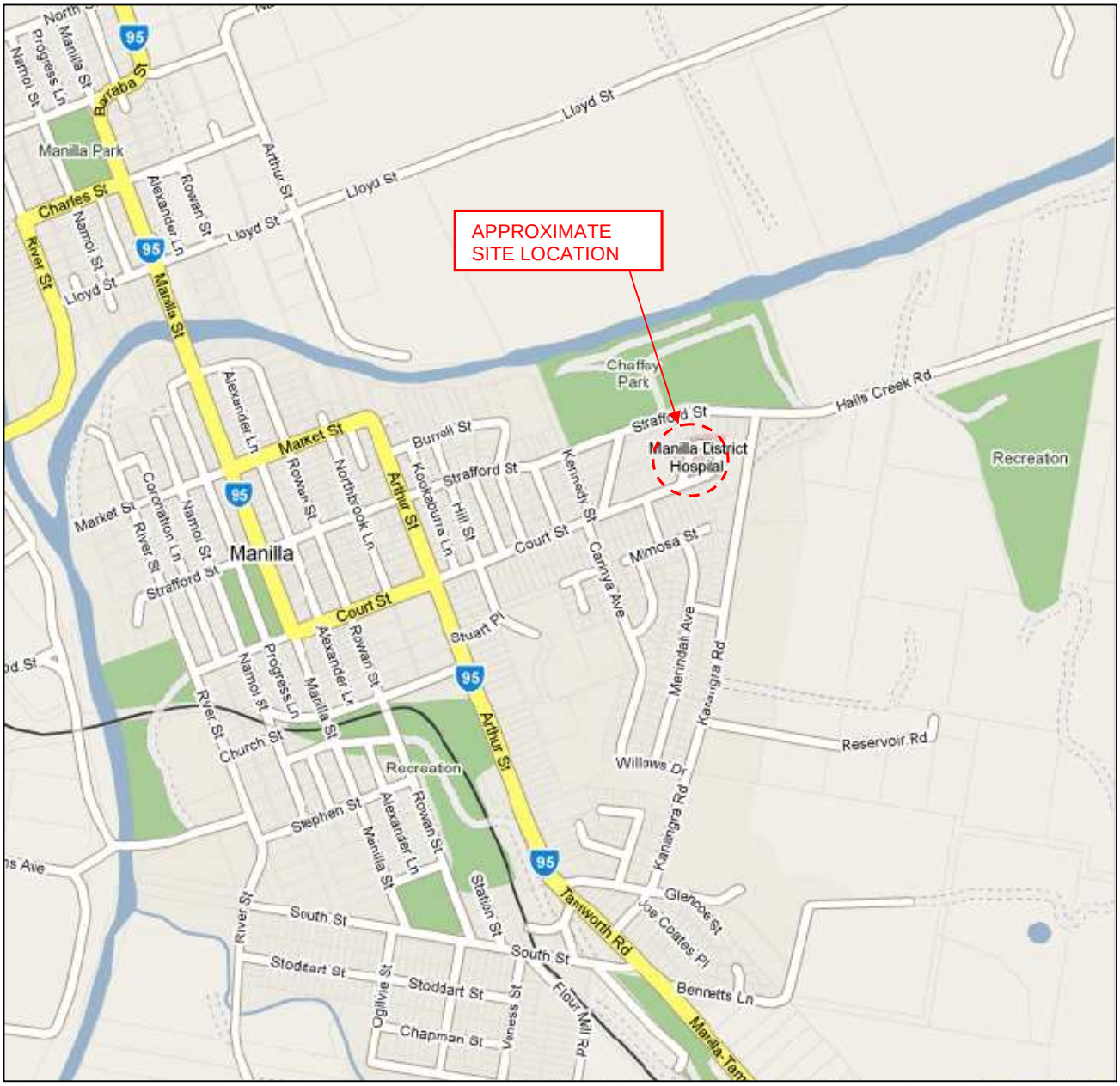
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to land development and land use. It is common that not all approaches will be necessarily dealt with in your environmental site assessment report due to concepts proposed at that time. As a project progresses through planning and design toward construction and/or maintenance, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

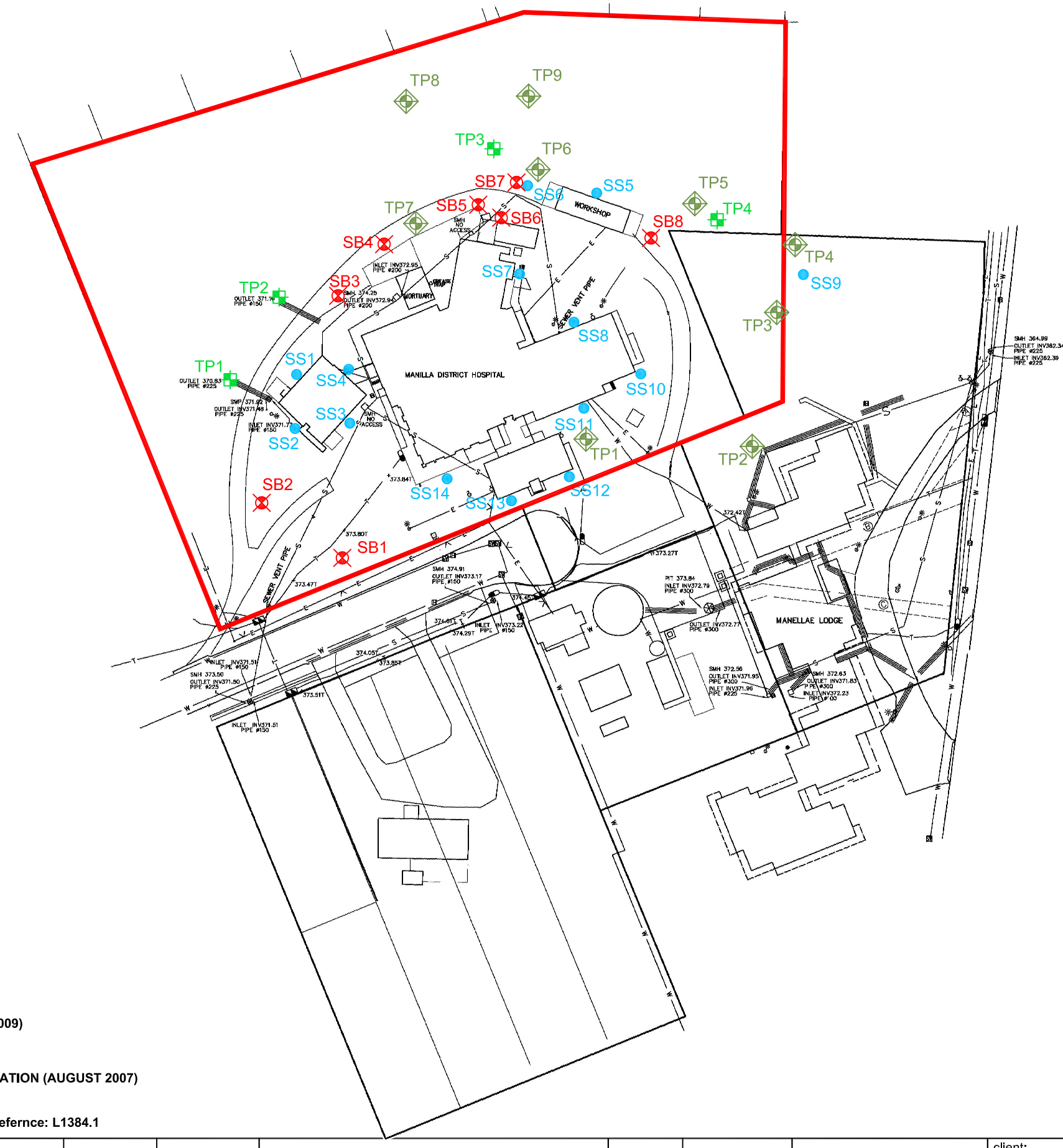
Environmental reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

72510 / 07-06

Figures



drawn	**NLS**	coffey environments SPECIALISTS IN LIVING AND WORKING PLACES	client:	**HEALTH INFRASTRUCTURE**
approved	ELC		project:	**MANILLA COMBINED MPS / HEALTH ONE REMEDIATION ACTION PLAN COURT STREET, MANILLA HOSPITAL**
date	15-07-09		title:	**SITE LOCALITY PLAN**
scale	**NTS**		project no: **ENVIWARA00401AB**	figure no: **FIGURE 1**
original size	**A4**			



LEGEND

- APPROXIMATE TEST PIT LOCATION (MAY 2009)
- APPROXIMATE SURFACE SAMPLE LOCATION (MAY 2009)
- APPROXIMATE BOREHOLE LOCATION (MAY 2009)
- APPROXIMATE HUNTER GEOTECHNICS TESTPIT LOCATION (AUGUST 2007)

Drawing based on plan prepared by Brown & Krippner. Drawing Refernce: L1384.1

revision	description	drawn	approved	date

8 0 8 16 32
Scale (metres)

drawn	NLS
approved	ELC
date	15-07-09
scale	1:800
original size	A3

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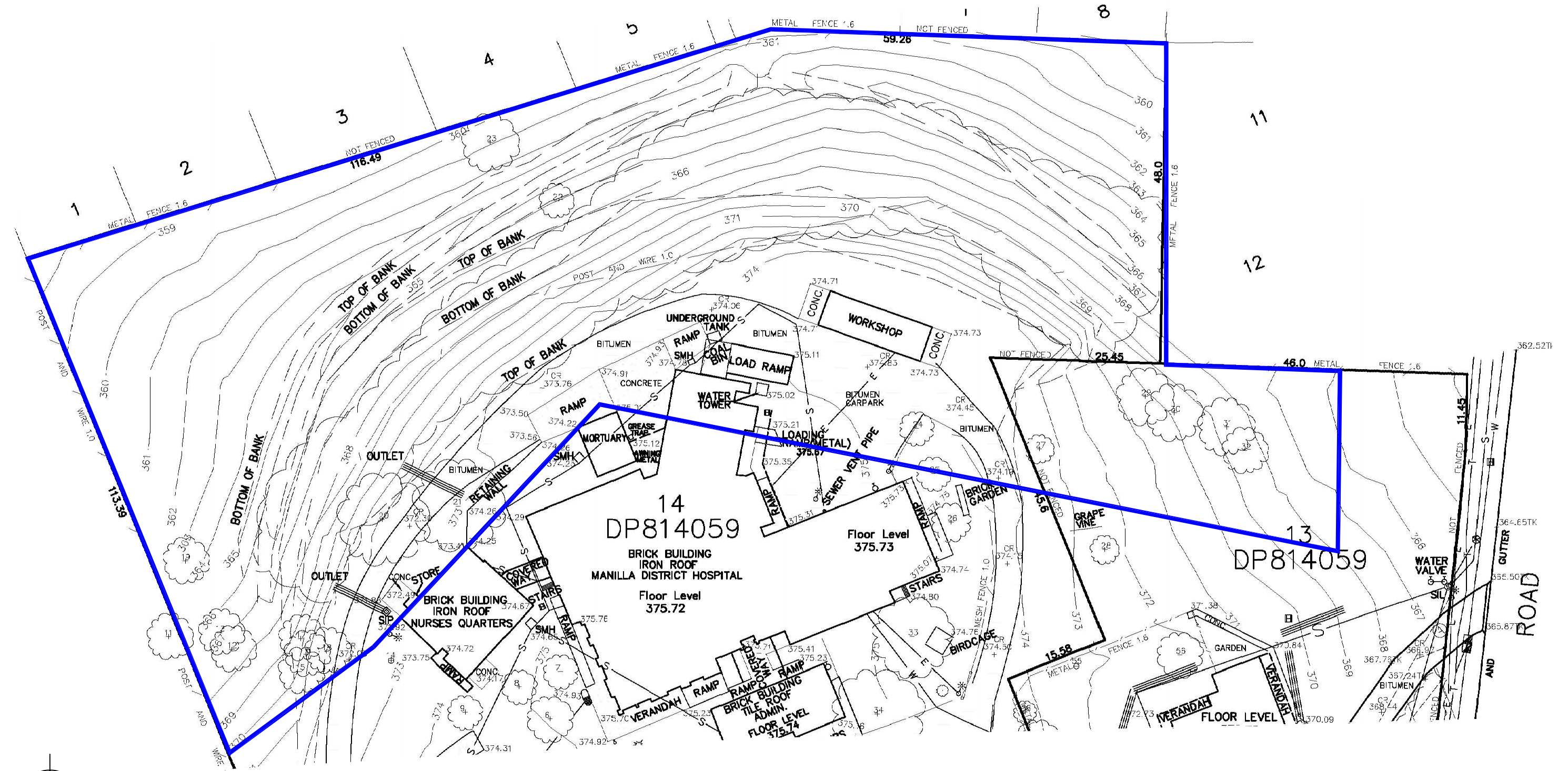
client: HEALTH INFRASTRUCTURE

project: MANILLA COMBINED MPS / HEALTH ONE REMEDIATION ACTION PLAN COURT STREET, MANILLA HOSPITAL

title: PREVIOUS SAMPLING LOCATION PLAN

project no: ENVIWARA00401AB

figure no: FIGURE 2



N

LEGEND

GENERAL REMEDIATION AREA

revision	description	drawn	approved	date

6 0 6 18 30

Scale (metres)

drawn	NLS
approved	ELC
date	18-09-09
scale	1:600
original size	A3

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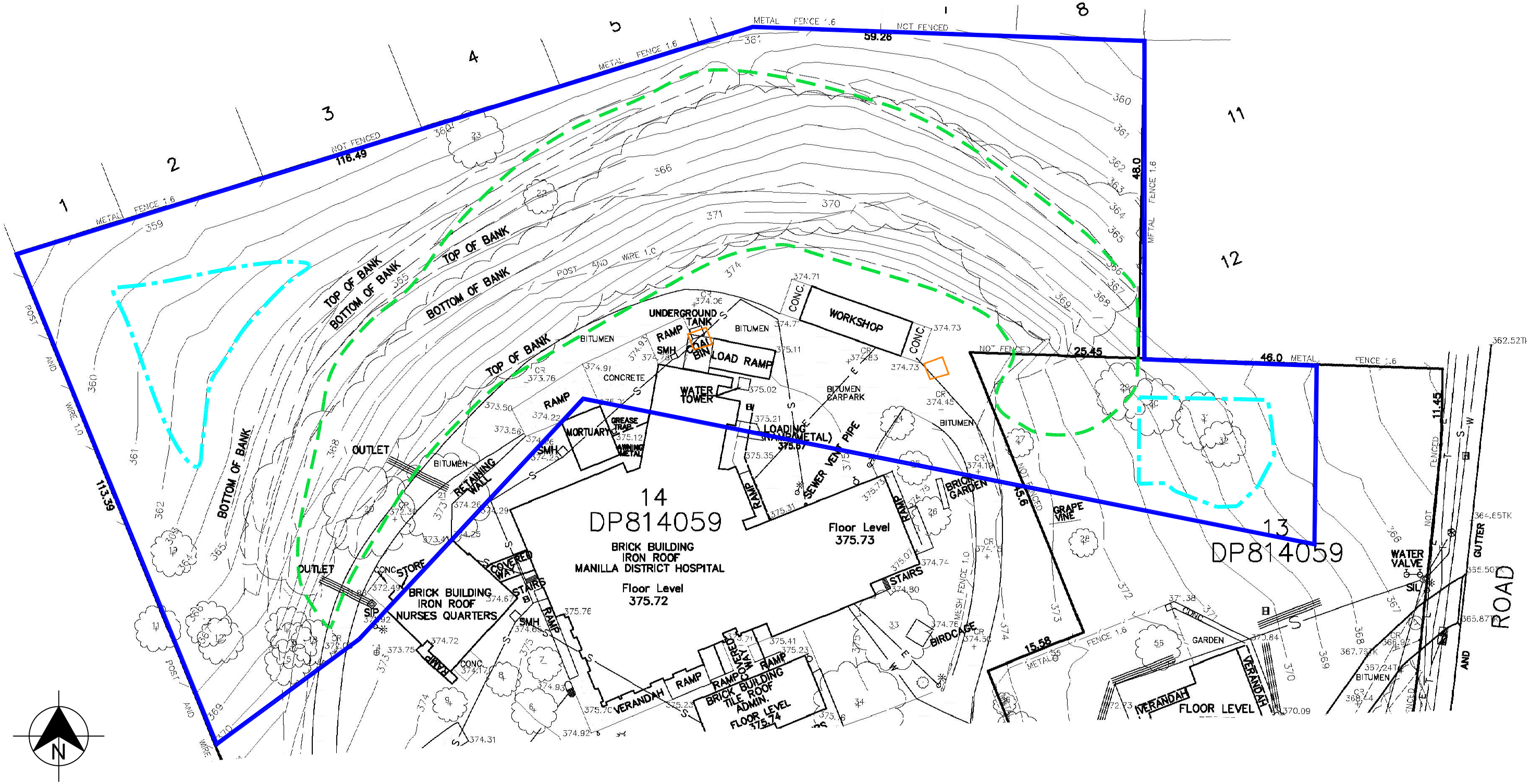
client: HEALTH INFRASTRUCTURE

project: MANILLA COMBINED MPS / HEALTH ONE
REMEDIATION ACTION PLAN
COURT STREET, MANILLA HOSPITAL

title: REMEDIATION AREA LAYOUT

project no: ENVIWARA00401AB

figure no: FIGURE 3



LEGEND

- GENERAL REMEDIATION AREA
- APPROXIMATE AREA OF FILL REQUIRING CAPPING
- APPROXIMATE AREA OF EXCAVATION REQUIRED AROUND UST AND SB8
- APPROXIMATE AREA OF FILL TO BE PLACED AND CAPPED

revision	description	drawn	approved	date

6 0 6 18 30
Scale (metres)

drawn	NLS
approved	ELC
date	18-09-09
scale	1:600
original size	A3

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SPECIALISTS IN LIVING AND WORKING PLACES

client: HEALTH INFRASTRUCTURE

project: MANILLA COMBINED MPS / HEALTH ONE
REMEDIATION ACTION PLAN
COURT STREET, MANILLA HOSPITAL

title: AREA REQUIRING REMEDIATION PLAN

project no: ENVIWARA00401AB

figure no: FIGURE 4