

KAYMET CORPORATION PTY LTD

REMEDIATION ACTION PLAN

**134-150 PITT STREET,
REDFERN, NSW**



Environmental Investigations

Report No. E1551.1 AB

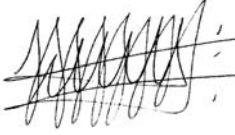
4th December, 2012

Report Distribution

REMEDIATION ACTION PLAN
134-150 Market Street, Redfern, NSW

EI Report No. *E1551.1 AB*
Date: *4th December, 2012*

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CONTENTS

1.0 INTRODUCTION.....	1
2.0 OBJECTIVES AND SCOPE OF WORK.....	4
3.0 SITE DESCRIPTION.....	5
3.1 SITE DESCRIPTION AND IDENTIFICATION	5
3.2 PROPOSED DEVELOPMENT	5
4.0 HYDROGEOLOGY & GROUNDWATER USE.....	6
5.0 PREVIOUS & ADDITIONAL INVESTIGATIONS.....	9
5.1 PREVIOUS INVESTIGATIONS	9
6.0 REMEDIATION GOALS AND ACCEPTANCE CRITERIA	16
6.1 REMEDIATION GOALS	16
6.2 EXTENT OF REMEDIATION REQUIRED	16
6.3 SOIL REMEDIATION OPTIONS.....	17
6.3.1 No Action.....	17
6.3.2 On-site Treatment	17
6.3.3 Physical Barrier System.....	18
6.3.4 Off-site Disposal to Landfill	19
6.4 REMEDIATION ACCEPTANCE CRITERIA (RAC)	20
6.4.1 Soils to Remain On-Site.....	20
6.5 DATA QUALITY OBJECTIVES	25
7.0 REMEDIATION STRATEGY & REGULATORY COMPLIANCE	27
8.0 REMEDIATION METHODOLOGY	29
8.1 TASK 1 – SITE PREPARATION AND LICENCES / APPROVALS	29
8.2 TASK 2 –ASBESTOS CONTAMINATION.....	29
8.3 TASK 3 –BASEMENT CAR PARK SECTION.....	29
8.4 TASK 4 –RECREATIONAL OPEN SPACE AREA	30
8.5 TASK 5 – ASBESTOS BENEATH BUILDINGS TO BE RETAINED	30
8.6 TASK 6 – WASTE CLASSIFICATION OF STOCKPILED FILL/SOILS.....	31
8.7 TASK 7 – OFF-SITE DISPOSAL OF FILL/SOILS.....	32
8.8 TASK 8 – CERTIFICATION OF IMPORTED BACKFILL MATERIAL	34
8.9 CONTINGENCY MEASURES	35
9.0 VALIDATION PLAN.....	39
9.1 SOIL VALIDATION.....	39
9.2 SAMPLE CONTAINMENT, PRESERVATION AND HOLDING TIMES.....	41
9.3 VALIDATION SAMPLE ANALYSIS	41
9.4 QUALITY ASSURANCE & QUALITY CONTROL PLAN	41
10.0 GROUNDWATER ASSESSMENT.....	44

11.0	OCCUPATIONAL HEALTH AND SAFETY PLAN.....	47
11.1	PERSONNEL AND RESPONSIBILITIES.....	47
11.2	SITE HAZARDS.....	47
11.3	SAFE WORK PRACTICES.....	48
11.4	EMERGENCY RESPONSE PLAN	50
12.0	ENVIRONMENTAL MANAGEMENT PLAN.....	51
12.1	STATUTORY REQUIREMENTS	51
12.2	TRAFFIC MANAGEMENT	52
12.3	EXCAVATIONS	52
12.4	STORMWATER MANAGEMENT AND CONTROL	52
12.5	CONTROL OF DUST AND ODOUR	53
12.6	NOISE CONTROL	54
12.7	MONITORING OF TRUCK LOADING.....	54
12.8	VALIDATION REPORTING	54
13.0	STATEMENT OF LIMITATIONS.....	55
	ABBREVIATIONS	58

TABLES

1	Summary of NRAtlas registered Groundwater Bores
2	Proposed Soil Remediation Acceptance Criteria
3	Contaminant Threshold (CT) Values for Waste Classification without Leachate Testing
4	Waste Classification using Leachable Concentration (TCLP) & Specific Contaminant Concentration (SCC) Values
5	Proposed Groundwater Quality Assessment Criteria

FIGURES

1	Site Location Plan
2	Existing Site Structures and Former Sampling Plan
3	Site & Remediation Plan

APPENDICES

A	Quality Assurance / Quality Control Tables
B	Proposed Development Plans

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1.0 INTRODUCTION

Environmental Investigations (EI) was engaged by Mr William Metlej of Kaymet Corporation Pty Ltd to prepare a Remediation Action Plan (RAP) for 134-150 Pitt Street, Redfern, NSW (hereafter referred to as 'the site'). The purpose of this RAP was to establish a sequential process of remediation and validation works for the site.

Previous environmental investigations indicated the site comprised of a broadly rectangular block of land with an area of approximately 6,923m², located on the south western corner of Albert and Pitt Streets. The site was found to be occupied by a number of disused structures and associated open car parking and open space belonging to the former *Rachel Forster Hospital*. The use of the site as a hospital started in the early 1940's and ceased in 2000 when staff and facilities were transferred to the nearby Prince Alfred Hospital in Camperdown. Since the closure of the hospital the majority of the site has been disused.

A major interconnected H-shaped structure combining two and five level buildings was found towards the central portion of the site. This structure was known to be used by *Rachel Forster Hospital*. An additional building extends out from the centre to the west while a detached weatherboard garage, and detached concrete block building containing a former indoor swimming pool also occupy the site. All buildings were found to be vacant with overgrowth grass and shrubs occupying the majority of the unpaved areas across the site.

The site is designated for redevelopment which will involve retaining and refurbishing an existing five storey building located on the southern side of the site and demolition of remaining buildings and structures. The construction of new multi-storey residential apartment buildings with basement car-parking facility to be excavated across the majority of the site with the exception of an area along Pitt Street which will be dedicated as an open space landscaped area.

Elevated concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) and Asbestos exceeding the adopted Soil Investigation Levels (SILs) for residential sites with minimal soil access were identified at six locations across the site, one location being the former EI borehole BH5 located beneath the existing five storey building to be retained while the other five locations are within

areas currently proposed for basement excavation.

Based on previous investigation findings as well as the redevelopment plans proposed for the site, the previously identified Asbestos contaminated soils beneath the 5 storey building to be retained at the southern part of the site are to remain beneath the existing concrete slab.

Since the site will be classed as residential with minimal access to soil, a review of the laboratory results would be required to ensure that the site meets the appropriate criteria.

This RAP details the available clean-up strategies, remediation acceptance criteria (RAC), methods and procedures by which the remediation and site validation can be achieved. The proposed remediation strategy should enable the site to be declared suitable for the intended residential development.

The purpose of this RAP therefore is to provide a systematic, field work plan designed to achieve predetermined site clean-up goals, while addressing relevant requirements of the consenting authority. This document has been prepared prior to the commencement of site remediation works, for submission to City of Sydney Council pursuant to the issuing of any relevant permits and approvals.

Outlined herein are the work practices and environmental management techniques to be implemented during the proposed remediation program, with particular discussion of:

- the remediation of impacted soils;
- the potential for off-site contaminant migration; and
- site management and Occupational Health and Safety issues.

The RAP has been developed on the basis of available, regulatory standards and guidelines, as well as the results of the previous environmental investigations. It sets out the clean-up philosophy, remediation acceptance criteria and procedures by which the remediation action will be implemented and the site validation will be achieved. The overall aim is to provide a

sequential work plan for the delineation and control of contaminated materials so that land redevelopment may proceed without posing unacceptable risks to human health and/or the environment. It has been compiled with reference to the following publications:

- ANZECC/NHMRC (1992) *Guidelines for the Assessment and Management of Contaminated Sites*, Australian and New Zealand Environment and Conservation Council / National Health and Medical Research Council;
- EPA (1994) *Guidelines for Assessing Service Station Sites*, NSW Environmental Protection Authority (EPA);
- EPA (1995) *Sampling Design Guidelines*, EPA;
- NEPC (1999) National Environment Protection (Assessment of Site Contamination) Measure 1999, National Environment Protection Council;
- DEC (2006) *Guidelines for the NSW Site Auditor Scheme (2nd Edition)*, NSW Department of Environment & Conservation (DEC); and
- DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*, DEC.
- OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*, Office of Environmental and Heritage;

2.0 OBJECTIVES AND SCOPE OF WORK

The main objective of this RAP is to provide a strategy for site remediation, which:

- minimises the environment and health/safety impacts on site workers and the general public during site remediation;
- maximises the protection of workers involved with site remediation;
- minimises potential exposure to contaminants in soil, air and groundwater;
- renders the site safe for the proposed residential land-use; and
- minimises impacts on site users and the local environment following site remediation.

Accordingly, the RAP addresses the following issues:

- definition of Areas of Environmental Concern (AEC);
- establishment of site remediation acceptance criteria for soil and target values for groundwater if required;
- review of available remediation options and selection of appropriate remedial strategies with respect to each of the identified AECs, taking into consideration the remediation goals and the practicality of the remedial options;
- development of remedial procedures for the excavation and off-site disposal of impacted fill/soil materials, where such works are deemed to be feasible;
- validation sampling of excavated areas to ensure that identified contaminated materials have been removed, as specified by the remediation strategy for the relevant AECs; and
- the issuing of a Site Remediation and Validation Report.

The RAP also outlines measures for the excavation, stockpiling, management and disposal of spoil, water and sediment controls, as well as a contingency plan to handle additional contamination identified during site remedial works.

3.0 SITE DESCRIPTION

3.1 SITE DESCRIPTION AND IDENTIFICATION

With the street address of 134-150 Pitt Street, Redfern, NSW, the site is further identified as Lot 7 in DP 664804, in the Parish of Alexandria, County of Cumberland and within the municipality of City of Sydney Council (henceforth referred to as ‘the site’) (Ref. Figure 1).

According to the Redfern-Waterloo Built Environmental Plan (Stage 1) 2006, the site is zoned “*Residential Zone – Medium Density Residential*”.

The site lies within a residential area and is broadly rectangular shaped block of land, covering a total of approximately 6,923m² with frontages to Albert Street (76m) and Pitt Street (96m) (Ref. Figures 2 and 3). The site is bounded by Albert Street to the north, Pitt Street to the east, residential properties to the south and residential properties to the west.

3.2 PROPOSED DEVELOPMENT

It is understood that the site will be redeveloped into residential apartments with a basement car parking facility occupying the majority of the site foot print, The existing garden and driveway along Pitt Street will be dedicated as open space as part of the proposed development.

Therefore, the resulting exposure setting is classified as follows

1. *Residential*, as defined under the NSW DEC (2006) *Column 2 Health-based Investigation Levels (HILs)* for residential sites with minimal access to soil including high rise apartments.
2. *Open space* as defined under the NSW DEC (2006) *Column 3 Health-based Investigation Levels (HILs)* for parks, recreational open space and playing fields (including secondary schools).

4.0 HYDROGEOLOGY & GROUNDWATER USE

4.1 Regional and Local Geology

Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map *Sydney 1:100,000 Geological Series Sheet 9130* (DMR 1991), indicated that the site overlies Ashfield Shale (*Rwa*) of the Wianamatta Group characterised by black to dark grey shale and laminite and medium to fine grained “marine” sands with podsols (*Qhd*), which is characterised by the deposits forming the Botany Sands.

The Soil Conservation Service of NSW *Soil Landscapes of the Sydney 1:100,000 Sheet* Chapman and Murphy, 1989), indicated that the site overlies a Residual Landscape – Blacktown (*bt*). According to Chapman and Murphy, this landscape type includes gently undulating rises with local relief between 10-30m. Slopes are generally <5% but occasionally up to 10%. Crests and ridges are broad (200-600m) and rounder with convex upper slopes grading into concave lower slopes and broad drainage depressions and valley flats. Rock outcrop is absent.

The dominant land uses are urban residential and light industry. Clay has often been extracted from localised deeply weathered locations where subsoils are gravelly. Minor to moderate sheet and gully erosion have occurred in the past in some locations.

Soils are shallow to moderately deep (<150cm) Red Podzolic Soils and Brown Podzolic Soils on crests, upper slopes and well-drained areas. Deep (150-300cm) Yellow Podzolic Soils and soloths on lower slopes and in drainage depressions and localised areas of poor drainage. Limitations include moderately reactive, highly plastic subsoils and low soil fertility.

4.2 Hydrogeology & Surface Drainage

Runoff from the site is also expected to follow the surface topography of the site flowing towards the south western direction. The regional topography in the vicinity of the site indicates a general fall in a north western direction towards Cockle Bay. Groundwater is also expected to flow towards the nearest surface water being Cockle Bay, located approximately 2km north west of the site. Cockle bay then flows towards Port Jackson, which ultimately drains into the Tasman Sea located approximately 3.5km west of the site.

4.3 Local Groundwater Usage

An online search was conducted on 5th April, 2012 using the NSW Natural Resource Atlas (NRAtlas), which records relevant information pertaining to all licensed water bores for the state of New South Wales revealed ten (10), registered monitoring bores located within 1km of the site (Ref. Table 1).

Table 1. Summary of NRAtlas registered Groundwater Bores

Bore No.	Drilled Date / Bore Depth (mBGL)	SWL (m BGL) / Salinity *	Bore Purpose	
			Authorised	Intended
GW071907	2008 / 180.00	11.60 / 345.0	Recreation Groundwater	Recreation Groundwater
GW106192	2004 / 6.00	4.0 / -	Domestic	Domestic
GW109744	2002 / 4.00	- / -	Monitoring Bore	Monitoring Bore
GW109745	2002 / 3.50	- / -	Monitoring Bore	Monitoring Bore
GW109746	2002 / 4.20	- / -	Monitoring Bore	Monitoring Bore
GW109747	2002 / 3.80	- / -	Monitoring Bore	Monitoring Bore
GW109749	2002 / 4.50	- / -	Monitoring Bore	Monitoring Bore
GW109750	2002 / 3.50	- / -	Monitoring Bore	Monitoring Bore
GW109751	2002 / 3.50	- / -	Monitoring Bore	Monitoring Bore
GW111016	2004 / 4.50	- / -	Monitoring Bore	Monitoring Bore

Notes

SWL = Standing Water Level

* Salinity Units - not recorded, - = information not available.

The existence of groundwater bores of authorised recreational uses indicates some beneficial uses of groundwater in the locality.

4.4 ACID SULFATE SOILS

Acid Sulfate Soils (ASS) are naturally occurring sediments containing iron sulphides. Sediments containing ASS have often been deposited in estuarine conditions, previously existing in a specific area. As ASS comprise natural geological materials, their occurrence is not related to site boundaries or anthropogenic contamination, but rather extends across areas/regions previously suitable for their deposition.

When ASS are exposed to air (e.g. due to bulk excavation or dewatering), the oxygen reacts with iron sulphides in the sediment, producing sulphuric acid. This acid can sometimes be produced in large quantities and drain into waterways causing severe short and long term socio-economic and environmental impacts, including damage to man-made structures and natural ecosystems.

ASS can either be classified as actual acid sulphate soils (AASS) which are soils that have already reacted with oxygen to produce acid, or potential acid sulfate soils (PASS) which are soils that contain iron sulphide, but have not been exposed to oxygen (e.g. soils below the water table) and therefore have not produced sulphuric acid (although they have the potential to do so).

4.3.1 Acid Sulfate Soil Risk Map

Review of the *Botany Bay Acid Sulfate Soil Risk Map* (1:25,000 scale; Murphy, 1997) provided by the Department of Land and Water Conservation (DLWC), in conjunction with the *Guidelines for the Use of Acid Sulfate Soil Risk Maps* (Naylor *et al.*, 1998), indicated that the site lies within a sandplain landscape, with “no known occurrences of acid sulfate soil materials”.

5.0 PREVIOUS & ADDITIONAL INVESTIGATIONS

5.1 PREVIOUS INVESTIGATIONS

Preliminary Environmental Site Assessment – DP, 2003

A previous Preliminary Contamination Assessment of the site was conducted by DP in November, 2003, the findings of which were documented in a report titled “*Preliminary Contamination Assessment at 134-150 Pitt Street, Redfern, NSW*”, (Ref. DP Project 36299A, dated November 2003). The work carried out by DP may be summarised as a limited assessment of historical site use with implementation of a limited field sampling program and preparation of a report presenting the results of the assessment of potential soil contamination.

In summary ten soil sampling locations (B1 to B10) were conducted across the site allowing samples to be collected from each borehole. Given the limited site accessibility all boreholes were drilled at accessible areas using a truck/ute mounted drilling rig.

As no conceptual design plans for the proposed development were available, selected samples were analysed for potential organic and inorganic contaminants, and contaminant levels were compared with the NSW EPA (1998) *Health-based Investigation Level for commercial/industrial sites* (HIL Column 4) with respect to sealed areas, provisional phytotoxicity-based investigation levels (PPIL Column 5) with respect to unsealed areas and the NSW EPA (1994) *Contaminated Sites: Guidelines for Assessing Service Station Sites* threshold concentrations for sensitive Sites with respect to petroleum hydrocarbons.

The results are summarised as follows:

Concentrations of heavy metals, TRH, BTEX, PCB, OCP, Phenols, PAH and benzo(a)pyrene were well within the adopted guideline criteria with the exception of:

- *Samples B2/0.5 and B9/1.5 which registered PPIL exceedance of lead and zinc respectively;*

- *No asbestos was detected in the soil samples that were sent for asbestos analysis.*
- *General waste classification for the brown sand and clay filling with crushed bricks, gravels with a trace of glass, ash and slag are provisionally classified as Inert Waste with the exception of the material within the vicinity of Sample B2/0.5 which is provisionally classified as Industrial Waste. Please note that Inert Waste with respect to PAH that is classified under Approval Number 1999/05 have to be disposed off at a Solid Waste Landfill, and may incur a cost commensurate with Solid Waste .*

Based on the analytical findings, DP considered that the site can be rendered suitable for the proposed construction of the mixed residential and commercial buildings subject to the removal of the soil material within the vicinity of Bores 2 and 9 if the area is not designated to be permanently paved and/or capped under building footprints.

Due to the presence of buildings and hence, access constraints, it was considered that additional assessment was required to fully characterise the subsurface condition of the subject site and to meet NSW EPA specified sampling density.

In addition, the waste classification should be verified with further investigation at the time of site development when the entire site is accessible and the subsoils are exposed for inspection/investigation

DP Letter dated – DP, May 2007

As the site is to be redeveloped into residential unit blocks with a parcel of land in the central eastern portion of the site to be allocated as open space (eastern portion of the site, along Pitt Street), to be dedicated to Council, an update of the previous contamination assessment was requested by the by the Redfern Waterloo Authority.

As requested the results of the review of the preliminary contamination assessment report undertaken at the site by DP in May, 2003 were documented in a letter prepared by DP titled, “*Review of previous reports, Rachel Forster Hospital, 134-150 Pitt Street, Redfern, NSW*” (Ref. DP Project 44825, dated May, 2007). This letter details the rationality of the findings in the context of the proposed development plan and to assess the suitability of the site for the proposed development.

Given the proposed development, DP adopted the relevant site assessment criteria:

Landscaped open space Areas:

NSW EPA Contaminated Site: Guidelines for the NSW Site Auditor Scheme (2006). Health based investigation Levels for Parks, recreational open space and playing fields (includes secondary schools) Open Space (HIL column 3) and Provisional Phytotoxicity-based Investigation Level (PPIL Column 5) for the top 500 mm of soil.

Residential Areas:

NSW EPA Contaminated Site: Guidelines for the NSW Site Auditor Scheme (2006). Health based investigation Levels for Residential Development with minimal soil access (HIL column 2) and Provisional Phytotoxicity-based Investigation Level (PPIL Column 5) for the top 500 mm of soil in unsealed area.. Given that the thresholds for TPHs and BTEX compounds are not provided under DEC (2006) and for this reason the EPA (1994) *Threshold Concentrations for Sensitive Land Use – Soils* were adopted as the default criteria for these parameters.

On the basis of the previous assessment results and development plans, the following conclusions and recommendations were made:

- *The land parcel proposed to be dedicated to Council can be rendered suitable for the proposed open space area subject to the removal of the top soil (nominally to 0.5 m bgl) material. Given the fact that the proposed open space is currently a bitumen paved carpark, it is envisaged that appropriate earthworks involving removal of the bitumen*

pavement and surficial filling will be required. In this regard, the detected contaminants in the vicinity of Bores 6 and 10 can be removed at the time of site development.

- *In this regard, the site can be rendered suitable for the proposed construction of residential land use subject to the removal of the contaminated surficial filling material in the open space area. The process is envisaged to be simple and straightforward, and the extent of excavation can be determined via step out validation analysis.*
- *As the proposed development involves the construction of residential/ apartments with 2 levels of basement car park at the western portion of the site, bulk excavation to depths in excess of 6 m and off-site disposal of spoil would be required.*

In other words, contaminated soil present in the vicinity of Bore 9 will be removed as part of the site bulk excavation process. The current development plans also indicate that soil material in the vicinity of Bore 2 is to be permanently concrete paved and is to be used as driveway. In this regard, it is considered that the site can be made suitable for the proposed development.

In summary, the site can be rendered suitable for the proposed development with open space and residential/apartments.

Additional Environmental Investigation – EI, 2012

The main objective of the EI (2012) investigation was to appraise the degree of site contamination (if any) by strengthening the previous preliminary investigation by DP, thereby assessing the land's suitability for the proposed residential development. The scope of works included:

- A review of the previous Contamination Assessment prepared by DP in November, 2003 and May 2007;
- A detailed site walkover inspection;

- A review of underground service plans;
- sub-surface investigations, by way of ten additional test boreholes (BH1 to BH10) distributed across the site on a judgemental basis close to potential sources of contamination;
- collection of natural and fill soil samples at multiple levels from the ten sampling locations;
- laboratory analysis of selected soil samples for relevant analytical parameters; and
- data interpretation and reporting.

The EI 2012 investigation went on to further investigate areas of environmental concern and ultimately assess the potential for on-site contamination associated with the identified former land uses. Based on the findings of this investigation, it was concluded that:

- The soil profile across the site was characterised generally by fill materials consisting of brown to light brown / grey to light grey gravely silty sand with brick and crushed concrete fragments and minor ash traces, grass and tree rootlets, dry; overlying natural brown to light grey sand, fine to medium grained, dry (0.3 to 2.8m BGL); overlying natural red/grey clay, medium-high plasticity, dry (0.3 to 6m BGL)
- Ten test boreholes (BH1 to BH10) were drilled across the site and selected using a mixed judgemental / systematic, triangular sampling pattern, with allowance for structural obstacles. These boreholes were constructed in addition to the initial ten previously drilled by DP (*Ref.* DP Project 36299A, November 2003).
- Although all laboratory analytical results for all tested samples for all heavy metals were found to be well within the adopted SILs, the PPILs levels were exceeded for arsenic in sample BH3-1, copper in samples BH10-1 and BH10-2, lead in sample BH7-1 and zinc in samples BH7-1, BH7-2 and BH9-1. The proposed development plans (*Ref.* Appendix A) show areas surrounding boreholes BH3, BH7, BH9 and BH10 are ultimately designed to be

permanently paved under the proposed basement and/or buildings footprints no remediation of these areas is considered warranted.

In addition, in accordance with the Preliminary Contamination Assessment conducted by DP (Ref. DP Project 36299A, dated November 2003) the land parcel to be dedicated to Council (land fronting Pitt Street) can be rendered suitable for the proposed open space area subject to the removal of the top soil (nominally to 0.3m to 0.5m BGL) material. Given the fact that the proposed open space is currently a bitumen paved carpark, it is envisaged that appropriate earthworks involving removal of the bitumen pavement and surficial filling will be required

- Low concentrations of the TPH heavier fractions were identified in some of the tested samples; however all were found to be well within the adopted SIL.
- No detectable concentrations of any VOCs were identified in any of the tested samples, with all laboratory PQLs being within the adopted US EPA 2011, *Region 9 Screening Level for residential soil* criteria.
- Low concentrations of phenols were identified in the majority of the tested samples, with all laboratory results being within the corresponding SILs.
- No detectable concentration of any of the screened OCPs, PCBs and OPPs compounds were identified in any of the tested samples, with all laboratory quantitation limits being within the corresponding SILs.
- Elevated concentrations of Total PAHs were identified in samples BH7-2 (140mg/kg) and BH9-1 (83mg/kg), high levels of the associated compound Benzo(a)Pyrene was identified in samples BH2-1 (4.4mg/kg), BH4-1 (4.1mg/kg), BH7-2 (9.7mg/kg) and BH9-1 (6.9mg/kg) exceeding the adopted SILs of 80mg/kg and 4mg/kg, respectively. Low concentrations of PAHs compounds were identified in the majority of the remaining tested samples; however, these results were found to be either below PQLs and/or within the adopted SILs.
- Apart from chrysotile asbestos found in samples BH4-1 and BH5-1 no asbestos were identified in any of the other tested samples.

In view of the above findings, it is considered that the site can be made suitable for the proposed land use after carrying out of the following recommendations:

1. Preparation of a Remediation Action Plan (RAP) and notification to Council in accordance with the local government guidelines.
2. Excavation and removal of the PAH-impacted fill/soils from the areas surrounding BH2, BH4, BH7 and BH9 found to be above the adopted SILs.
3. Excavation and removal of the PAH-impacted fill/soils from the areas surrounding former B6, B9 and B10 (Ref. DP Project 36299A, dated November 2003) found to be above the adopted SILs.
4. Excavation and removal of the heavy metals-impacted fill/soils from the areas surrounding former B6 and B10 (Ref. DP Project 36299A, dated November 2003) found to be above the adopted SILs for recreational open space.
5. Excavation and removal of the fill/soils from the area of BH4 found to be impacted with Asbestos. As the area of BH5 is within the existing building footprint which will remain on-site, EI recommend a localised cap and contain remediation option for this particular area.
6. Confirm that excavated areas are left free of contamination by comparing analytical results for excavation surfaces and any backfill material, against the respective DECCW/EPA thresholds.
7. Preparation of a final site validation report by a qualified environmental consultant, certifying site suitability for the proposed development.

6.0 REMEDIATION GOALS AND ACCEPTANCE CRITERIA

6.1 REMEDIATION GOALS

The main objectives of the remediation programme are to remediate and/or remove contaminated site soils and to ensure that contaminant concentrations in remaining soils are consistent with the relevant regulatory criteria for residential and/or recreational land uses.

6.2 EXTENT OF REMEDIATION REQUIRED

It was considered prudent that the benefits and limitations of the proposed remedial works be reviewed in the context of the specific investigation findings of the subject site, to ensure that the most appropriate remedial option will be adopted. Based on the investigation findings, it was noted that the extent of site remediation works would be limited to the following actions:

- Excavation and removal of Asbestos contaminated soils from the central sections of the site at the former EI location of BH4;
- Excavation and removal of all surface fill soils across the proposed basement car park for classification and off-site disposal.
- Excavation and removal of the heavy metal-impacted fill/soils down to between 0.3 and 0.5m below ground from the areas surrounding former DP boreholes B6 and B10 found to be above the adopted SILs for recreational open space.
- Implement a cap and contain strategy for Asbestos contaminated soils at the former EI borehole BH5 beneath the five storey building to be retained.
- soil validation sampling and laboratory testing, following the complete removal of affected fill/soil materials from the site.

6.3 SOIL REMEDIATION OPTIONS

A number of soil remediation options were reviewed to examine the suitability of each method in accordance with a number of relevant documents, including the following:

- DEC (2006) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*; and
- ANZECC (1999) *Guidelines for the Assessment and On-site Containment of Contaminated Soil*.

Possible options for achieving the remediation goals were identified and reviewed as follows:

- no action;
- on-site treatment of contaminated material;
- physical barrier system; and
- removal of contaminated material to landfill.

6.3.1 No Action

The “No Action” option involves no remedial response to the contamination that may be identified on the subject site. This option was not considered appropriate because it did not offer a satisfactory means of reducing potential risks to human health and/or the environment, resulting from the potential migration of volatile organic compounds associated with the presence of petroleum-based contaminants.

6.3.2 On-site Treatment

Regulatory authorities including the NSW EPA recommend in-situ soil treatment for the management of residual soil contamination, wherever possible. In-situ treatment would ideally remove or at least, decrease any associated human health and environmental risks to acceptable levels, without the need for costly and labour intensive excavation and off-site disposal works. The range of contaminants identified on the site, however are not considered treatable in their current form. The Asbeston and PAHs associated with the imported fill cannot be isolated and

removed from the filling, or degraded with the application of bioremediation methods. On-site treatment of the contaminated material was therefore not viewed to be a feasible remediation option.

6.3.3 Physical Barrier System

With respect to the management of fill/soil contamination, a physical barrier system would involve the installation of a capping layer of low permeability material such as clay, synthetic membrane or pavement (concrete and asphalt). The installation of a capping layer must be designed with adequate measures in place to safely manage ongoing risks so as to minimise the potential for health impacts due to exposure of site users to contaminants; and the potential for infiltration of water into the subsurface (in the case of capping) or lateral movement of groundwater. This will, in turn minimize the potential for off-site impacts.

1. the potential for health impacts due to exposure of site users to contaminants; and
2. the potential for infiltration of water into the subsurface (in the case of capping), or lateral movement of groundwater. This will, in turn minimise the potential for off-site impacts due to contaminant migration via the groundwater pathway.

On-site encapsulation of impacted fill/soil materials is considered the most efficient and responsible method of remediation as per the Waste Avoidance and Resource Recovery Act 2001. It should be noted, however, that this method requires that a site Environmental Management Plan (EMP) to be prepared and implemented for the ongoing management of the site and would result in some form of notification of the presence of the material, usually on the planning certificate issued under Section 149 of the Environmental Assessment and Planning Act 1979.

This option was only considered appropriate for soils beneath the existing five storey building as the remainder of the site is to be either excavated or be used for recreational open space.

6.3.4 Off-site Disposal to Landfill

Complete removal of the contaminated fill would involve the excavation, stockpiling and transport of contaminated materials to licensed landfills. This option would adequately address the remediation goals through the removal of the contaminants from the subject site. Moreover, with the removal of any identified contaminated fill soils, the long-term liability associated with soil contamination would be minimised, along with substantial improvement of subsurface site conditions with regard to soil contamination.

Consequently, the recommended remedial strategy involves excavation, classification and off-site disposal of soils, although it is acknowledged that this plan may be refined as works progress to ensure optimal management of remediation requirements. This option would adequately address the remediation goals and release future liability associated with human exposure to contaminants.

Wherever possible, the remediation phase shall be integrated with the site development, so as to cause minimum disruption and allow cost effective clean up. During the remediation phase, the site would be examined for (evidence of) abandoned USTs and other infrastructure, including waste sumps and (stormwater) drains. Should a tank or impacted soils be encountered, the area will be isolated and corresponding remediation performed.

Selected Remediation Strategy

The selected remediation option will involve capping of soils at the location of BH5 as this area will continue to be covered by a five-storey building and excavation and off-site disposal of remaining fill soils both from the area of the proposed basement car parking facility and recreational open space area.

The implementation of a Site Environmental Management Plan to ensure the continued safe containment of the capped material would need to be prepared.

6.4 REMEDIATION ACCEPTANCE CRITERIA (RAC)

6.4.1 Soils to Remain On-Site

As the site will ultimately to be used for residential use, the remediation acceptance criteria (RAC) have been based on the NSW DEC 2006, Column 2 Health-based investigation levels (HILs) for Residential with minimal access to soils including high-rise apartments and flats (NEHF D).

Thresholds for certain TPHs and the BTEX compounds are not provided under DEC (2006) and for this reason the EPA (1994) *Threshold Concentrations for Sensitive Land Use - Soils* were adopted as the default criteria for these parameters. The proposed RAC with respect to the potential contaminants of concern in soils are detailed in Table 2.

Conformance with the RAC will be deemed to have been attained when either all validation samples show contaminant concentrations that are below the specified criteria, or, as a minimum, the 95% upper confidence limit (UCL) mean concentration values of each contaminant in the remediated area (i.e. across the excavated surface), are below the respective RAC.

The proposed Remediation Acceptance Criteria (RAC) with respect to the potential contaminants of concern in soils is detailed in Table 2.

Table 2 - Proposed Soil Remediation Acceptance Criteria

Contaminant		RAC (mg/kg)
Heavy Metals:	Arsenic	400 ^a
	Cadmium	80 ^a
	Chromium	400 ^a
	Copper	4,000 ^a
	Lead	1,200 ^a
	Mercury	60 ^a
	Nickel	2,400 ^a
	Zinc	28,000 ^a
TPHs:	TPH: C6-C9	65 ^b
	TPH: C10-C36	1000 ^b
BTEX:	Benzene	1 ^b
	Toluene	1.4 ^b
	Ethyl benzene	3.1 ^b
	Xylene	14 ^b
PAHs:	total PAHs	80 ^a
	Benzo(a)pyrene	4 ^a
Asbestos		Nil
PCBs:	total PCBs	50 ^a
OCPs:	Aldrin+Dieldrin	40 ^a
	Chlordane	200 ^a
	Total DDT + DDD + DDE	800 ^a
	Heptachlor	40 ^a

Notes:

- a) NSW DEC 2006, Column 2 HILs for Residential with minimal access to soil settings.
b) NSW EPA 1994, Threshold concentrations for sensitive land use soils.

On the basis of the findings of the previous assessments, it is considered that the primary contaminants of concern are Heavy Metals, PAHs and asbestos. In order to provide for contingency situations, RAC are also established for other likely contaminants. These additional RAC should, however, only be used as and when required (e.g. if signs of such contaminants are observed or suspected).

6.4.2 Excavated Soils Intended for Off-Site Disposal

Prior to being removed from the site for landfill disposal, excavated soils must be classified in accordance with the DECCW (2009) *Waste Classification Guidelines* (the ‘Waste Guidelines’). Under these guidelines, fill/soils may be classified into the following groups: *General Solid Waste*, *Restricted Solid Waste*, *Special* or *Hazardous Waste*, subject to laboratory test results for total and leachable contaminant levels, the later involving the *Toxicity Characteristics Leaching Procedure* (TCLP). The total and TCLP results for each parameter will then be interpreted against the respective DECCW (2009) thresholds (*Ref.* Tables 3 and 4), in order to classify the waste. Soils containing asbestos may also be classified as *Special Waste – Asbestos Waste*, assuming no other contaminant is present at such a level as to render the material *Restricted Solid Waste* or *Hazardous Waste*.

Table 3. Contaminant Threshold (CT) Values for Waste Classification without Leachate Testing

Contaminant	Maximum Values of Specific Contaminant Concentration for Classification without TCLP	
	General Solid Waste CT1 (mg/kg)	Restricted Solid Waste CT2 (mg/kg)
Arsenic	100	400
Benzene	10	40
Benzo(a)pyrene	0.8	3.2
Cadmium	20	80
Chromium (VI)	100	400
Ethylbenzene	600	2400
Lead	100	400
Mercury	4	16
Nickel	40	160
C6-C9 petroleum hydrocarbons	N/A	N/A
C10-C36 petroleum hydrocarbons	N/A	N/A
Phenol (non-halogenated)	288	1152
Polychlorinated biphenyls	N/A	N/A
PAHs (total)	N/A	N/A
Toluene	288	1152
1,1,1-Trichloroethane	600	2400
1,1,2-Trichloroethane	24	96
Xylenes (total)	1000	4000

Source:

NSW DECCW (2009) *Waste Classification Guidelines*

N/A = Not applicable – these contaminants are only assessed using Specific Contaminant Concentration thresholds (Ref. Table 3)

Table 4. Waste Classification using Leachable Concentration (TCLP) & Specific Contaminant Concentration (SCC) Values

Contaminant	Maximum Values for <i>Leachable Concentration</i> and <i>Specific Contaminant Concentration</i> when used <u>together</u>			
	<i>General Solid Waste</i>		<i>Restricted Solid Waste</i>	
	Leachable Concentration	Specific Contaminant Concentration	Leachable Concentration	Specific Contaminant Concentration
	TCLP1 (mg/L)	SCC1 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)
Arsenic	5.0	500	20	2000
Benzene	0.5	18	2	72
Benzo(a)pyrene	0.04	10	0.16	23
Cadmium	1.0	100	4	400
Chromium (VI)	5	1900	20	7600
m-Cresol	200	7200	800	28800
o-Cresol	200	7200	800	28800
p-Cresol	200	7200	800	28800
Cresol (total)	200	7200	800	28800
Ethylbenzene	30	1080	120	4320
Lead	5	1500	20	6000
Mercury	0.2	50	0.8	200
Nickel	2	1050	8	4200
TPH C ₆ -C ₉	N/A	650	N/A	2600
TPH C ₁₀ -C ₃₆	N/A	10000	N/A	40000
Phenol (non-halogenated)	14.4	518	57.6	2073
PAHs (total)	N/A	200	N/A	800
1,1,1-Trichloroethane	30	1080	120	4320
1,1,2-Trichloroethane	1.2	43.2	4.8	172.8
Xylenes	50	1800	200	7200

Note:

N/A = not applicable (assessed using SCC1 and SCC2 values, only)

Should the analytical results exceed the SCC2 and/or TCLP2 thresholds, then the materials will be classified as *Hazardous Waste*. In such cases, material stabilisation treatment with EPA approval may be necessary, should the offsite disposal of such waste fill/soil be required. This approach is discussed in more detail under the contingency plan in Section 8.0.

6.5 DATA QUALITY OBJECTIVES

The scope of remediation works has been devised broadly in accordance with the following Data Quality Objective (DQO) process, as defined in Australian Standard “*Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds*” (AS 4482.1 – 1997). The DQO process for the proposed remediation and site validation program is outlined as follows:

(a) State the Problem

The site requires to be rendered suitable for residential purposes. The remediation validation program will therefore need to verify that the remediated site will be rendered suitable for the intended land use, such that remaining site soils do not present a risk of harm to human health or the environment for residential purposes.

(b) Identify the Decision

The progress and completeness of the site remediation works will be assessed on the basis of the validation analyses. Remediation will be deemed to be complete when all validation samples taken from the excavation base and walls of the remedial excavation meet the RAC, and/or when the remediation goals have been attained (eg. successful construction/placement of the concrete capping layer). The required decisions are therefore related to answering the following two questions: *Is the soil quality suitable for the proposed land use?* and *Will site soils require further remediation and/or special management before the site can be used for residential purposes?*

(c) Identify Inputs to the Decision

Inputs to the decision will include:

- soil validation sampling from wall and base surfaces within the remedial excavations;
- systematic soil validation sampling from remediated excavation surfaces;
- sampling from stockpiled material for waste classification;
- laboratory analytical results for tested validation samples; and
- assessment of analytical results in relation to the RAC.

(d) Define the Boundary of the Assessment

The boundary of the assessment is defined by the boundary of the subject site.

(e) Develop a Decision Rule

Laboratory test results will be assessed against the adopted RAC for soils remaining on site, and against SCC/TCLP thresholds for waste classification for soils to be disposed off site. Should the RAC be exceeded then additional excavations and/or investigations will be required to delineate vertical and lateral extent of contamination. Laboratory test results will be accepted if:

- all contracted laboratories are accredited by NATA for the analyses undertaken;
- all detection limits fall below the RAC;
- analyte concentrations in rinsate samples do not vary significantly from concentrations in the distilled water used for equipment rinsing;
- RPDs for duplicate samples are within accepted limits; and
- laboratory QA/QC protocols and results comply with NEPM requirements.

(f) Specify Acceptable Limits on Decision Errors

The remediation consultant must identify the potential decision errors, evaluate the potential consequences and severity of decision error consequences, define the null hypothesis and specify what level of false positive or false negative decision error will be acceptable for the validation assessment. Details are to be presented in the final validation assessment report.

(g) Optimise the Design for Obtaining Data

The sampling program should be designed to satisfy the DQOs in the most resource-effective manner.

7.0 REMEDIATION STRATEGY & REGULATORY COMPLIANCE

Remediation Strategy

The preferred remediation strategy is to excavate and stockpile the contaminated soils, classify and dispose all identified contaminated fill/soils to an appropriately-licensed landfill facility.

Subject to access restrictions, site remediation can be commenced after the demolition of the existing site structures, to provide the required level of access for plant equipment needed for the removal of the contaminated (fill) soils.

The surface and boundary walls of the excavations will be validated to confirm the complete removal of any contaminated material. Excavations will be conducted using appropriate earthmoving equipment and, where necessary, the spoil will be stockpiled prior to assessment, classification and off-site disposal. Should it become necessary for affected soils to remain on-site, a management plan must be put in place to ensure future occupants of the site have no access to potentially contaminated soils. The detailed validation process is presented in Section 9.

The remediation approach proposed by EI will essentially comprise the following stages:

- excavate and dispose asbestos contaminated fill/soils from the location of BH4;
- excavate and dispose contaminated fill/soils across the entire site where basement excavations are proposed;
- excavate and dispose contaminated fill/soils across the recreational open space area along pit street to a depth of 0.3-0.5m BGL
- Cap and contain Asbestos contaminated soils from the former BH5 under the existing five storey building to be retained.

- conduct waste classification of soils designated for off-site disposal;
- prepare a site management plan for capped soils; and
- validate excavated surfaces within the remediated areas, to confirm their suitability for the intended land use.

Regulatory Compliance

The following notifications, licenses and approvals will be required to undertake the site remediation works:

- Council approval of the RAP document and Notification for Category 2 Remediation works (i.e. 30 days notice prior to works commencement); and
- documentary receipts and evidence of disposal of classified waste fill/soils at appropriately-licensed landfill facility;

8.0 REMEDIATION METHODOLOGY

Details (methodology) of the key work tasks are described below. They will not necessarily be conducted in the prescribed sequence.

8.1 TASK 1 – SITE PREPARATION AND LICENCES / APPROVALS

At least 30 days prior to the commencement of remediation, notice shall be given to the City of Sydney Council. A list of all required work permits will be obtained from Council and arrangements are to be made to obtain the necessary approvals from the relevant regulatory authorities, including approval of the RAP by an EPA-accredited Site Auditor (if necessary).

The site itself will be prepared in accordance with the requirements of the Environmental Management Plan outlined in Section 12.

8.2 TASK 2 –ASBESTOS CONTAMINATION

The results from the investigation phase indicated that Asbestos impacted fill/soils were present at the former EI location of BH4. As this area will ultimately be excavated for the provision of the basement car park the following methodology is proposed:

- excavation and stockpiling of all shallow fill soils in the vicinity of BH4 followed by classification for off-site disposal.
- validation sampling of the base and side walls of the final excavation.

8.3 TASK 3 –BASEMENT CAR PARK SECTION

The results from the investigation phase indicated that PAH impacted fill/soils were present at the former EI locations of BH2, BH4, BH7 and BH9 as well as the former DP location of B9.

As these areas will ultimately be excavated for the provision of a basement car park, the following methodology is proposed:

- excavation and stockpiling of all shallow fill soils followed by classification for off-site disposal.
- validation sampling of the base and side walls of the final excavations.

8.4 TASK 4 –RECREATIONAL OPEN SPACE AREA

The results from the previous DP investigation phase indicated that PAH impacted fill/soils were present at the former DP locations of B6 and BH10

These areas will ultimately be used for recreational purposes. The following methodology is proposed:

- excavation and stockpiling of all shallow fill soils to 0.5m beneath the bitumen paved driveway followed by classification for off-site disposal.
- validation sampling of the base and side walls of the final excavations.

8.5 TASK 5 – ASBESTOS BENEATH BUILDINGS TO BE RETAINED

Effective in situ capping of the asbestos impacted fill at the location of EI borehole BH5 may be achieved by a minimum 100mm thick concrete slab (currently in place) and the capped area is not likely to be disturbed in the future, either by deliberate earthworks or by natural processes such as erosion. In summary, the process of capping of impacted fill would be as follows:

- Define the area to be capped, ensuring that a buffer zone of at least 0.5 metre of clean soil or minimum 100mm thick slab is allowed for around the margins of the impacted area;
- Ensure the impacted area is adequately covered with impermeable concrete in good condition and with no cracks; and
- Identify the capped area for inclusion on a site plan.

Site Management Plan

- Prepare and implement an ongoing Site Management Plan (SMP) to ensure that the capped area is appropriately managed into the future so that the Asbestos impacted fill is not exposed in an uncontrolled manner and that human health is protected; and
- Note on the titles documents (typically on the Section 149 Certificate) the presence of the Asbestos impacted fill remaining on the site and the requirement for the SMP.

8.6 TASK 6 – WASTE CLASSIFICATION OF STOCKPILED FILL/SOILS

Prior to being assigned to an appropriate waste disposal facility, all waste fill/soils will be classified in accordance with the DECCW (2009) *Waste Classification Guidelines*. If required, disposal consent will be obtained from the NSW DECCW prior to spoil transport.

All excavated soils shall be stockpiled separately within the designated excavation area, or transported to a suitable compound (under Waste Tracking Certificates) for temporary storage, to enable waste classification sampling and testing. All stockpile heights must be limited to a maximum of 2m. Upon classification, the materials will be transported and disposed to EPA-licensed landfill facilities.

Stockpiled fill/soils will be sampled and laboratory analysed for classification in accordance with the following methodology:

- collection of one sample per 100m³ of stockpiled material produced by the bulk (basement) excavations;
- collection of one intra-laboratory duplicate for every ten (10) primary samples collected and one inter-laboratory duplicate for every twenty (20) primary samples collected;
- collection of one rinsate blank per sampling round;

- preparation of a letter report providing interpreted soil disposal classification for each stockpile.

The proposed sampling plan may be altered by variations in stockpiling introduced by site constraints. Where anomalies in fill/soil consistency are noted (such as heavy staining, odour and/or presence of waste or oils), additional sampling and analysis may be necessary.

If the stockpiled materials contain concentrations of contaminants that exceed the disposal guidelines for *Restricted Solid Waste* (i.e. are classed as potentially *Hazardous Waste*), they will be held on-site pending the determination of alternative disposal arrangements and/or on-site treatment. If required, disposal consent will be sought from the EPA prior to spoil transport. Contingency measures to handle and manage the disposal of spoil materials that fail to meet landfill threshold criteria are provided below.

8.7 TASK 7 – OFF-SITE DISPOSAL OF FILL/SOILS

Classified fill/soils that are deemed suitable for disposal shall be loaded onto EPA-licensed waste vehicles for transport to the designated landfill facility. Other important requirements are as follows:

Excavation Considerations

Excavation depths should be in accordance with the DA conditions. If further excavation is required, it should not jeopardise the stability of adjoining properties and structures.

Stockpiling of Contaminated Material

Temporary stockpiling of excavated filling will be required at suitable on-site location(s), or at the approved compound (under Waste Tracking Certificates). Remediated and validated areas will be isolated by temporary fencing (e.g. pickets) to prevent future access by trucks, plant or machinery involved in the remediation process.

On-site stockpiles of petroleum hydrocarbon contaminated soil must be placed within a plastic lined, bunded area and covered with weighted plastic sheeting at the end of each day. On-site stockpiles of other potentially contaminated material must be stockpiled as above if on remediated areas, but lining is not required if stockpiles are placed on yet to be remediated areas.

All stockpiles of contaminated material ($\leq 2\text{m}$ height) shall be surrounded by star pickets and marking tape, or other suitable material, to clearly delineate their boundaries. Stockpiles shall be lightly conditioned by sprinkler to prevent dust blow. Should the stockpile remain in-situ for over 24 hours, silt fences or hay bales should be erected around each stockpile to prevent losses from surface erosion (runoff).

Loading and Transport of Contaminated Material

Transport of contaminated material off the site shall be via a clearly distinguished haul route. This route shall be used exclusively for entry and egress of vehicles that haul contaminated materials within and away from the site.

Removal of waste materials from the site shall only be carried out by a recognised contractor holding the appropriate EPA licenses, consents and approvals.

Details of all contaminated materials removed from the site shall be documented by the contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate). Such information should be provided to the remediation consultant for reporting purposes. A site log shall be maintained by the contractor for each discrete excavation (numbered locations) to enable the tracking of disposed loads against on-site origin and location of the materials and corresponding (validation) sample numbers.

Measures shall be implemented to ensure no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Such measures will include the deployment of a vehicle washing/cleaning facility, which should be placed at a location before the egress point on the site. The facility shall be able to handle all vehicles and plant operating on-site.

All trucks transporting soils from the site are to be covered with tarpaulins.

Residue from the cleaning facility will be collected periodically and either dewatered on site in a contained bunded area or disposed as a slurry to an approved facility. Such residue will be deemed contaminated unless shown by validation to be below RAC criteria.

The proposed waste transport route will be notified to Council and truck dispatch shall be logged and recorded by the contractor for each load leaving the site.

Disposal of Contaminated Material and Waste Tracking

All contaminated materials excavated and removed from the site shall be disposed at an appropriately licensed landfill. Copies of all necessary approvals shall be provided to the remediation consultant prior to any contaminated material being removed from the site.

Copies of all consignment notes (issued as dockets or similar) for the transport, receipt and disposal of the materials will be maintained as part of the site log and made available to the remediation consultant for inspection and use in reports upon request.

All relevant analysis results shall be made available to the remediation contractor to enable selection of a suitable disposal location.

8.8 TASK 8 – CERTIFICATION OF IMPORTED BACKFILL MATERIAL

Soils used to backfill excavations shall be imported clean filling, which is to be certified as meeting the RAC by the supplying contractor. Analytical results presented by the contractor to validate imported filling must be derived using NATA-accredited methods, obtained on representative samples that were collected at an appropriate frequency (e.g. 1 sample per 100m³). All imported clean fill validation results must be included in the final site validation report.

NOTE: Before any soil or rock materials are imported onto the site under the VENM classification for backfilling purposes, supporting documentation must be submitted for review by the appointed Environmental Project Manager for approval.

Should excavated materials be identified to be *potentially uncontaminated*, or *potentially suitable for reuse* on the subject site, the following confirmation procedure shall be undertaken:

- the identified material is to be visually assessed to determine whether the material can be physically isolated from other potentially contaminated material;
- should it be found that isolation on a visual basis is feasible, the identified ‘clean’ materials shall be separately stockpiled in a demarcated area, which is either concrete-paved, or to be lined with an impermeable membrane;
- verification sampling and analysis shall be conducted on the isolated material at a nominal minimal frequency of one sample per 25m³; and
- subject to analytical results showing metal, TPH, BTEX and PAH concentrations that are within the RAC, isolated ‘clean’ materials may then be reused as filling material on-site, along with any additional imported and validated backfill materials.

8.9 CONTINGENCY MEASURES

Buried Building and Contaminated Materials

Any discovered tanks, sumps, pipe work, pits and/or previously unidentified zones of contaminated materials etc, will be visually inspected for signs of chemical contamination and screened for VOCs using a PID. If contamination is suspected on the basis of visual signs or detectable odours, appropriate samples will be taken and analysed prior to disposal in accordance with NSW DECCW requirements.

In the event that additional soil contamination, in the form of odours, coloured and/or oily

residues, is intercepted at any time during the proposed remedial works, excavation in that area will temporarily cease, and **under no circumstances shall the developer, or any site personnel undertake to move such materials, without prior advice by the appointed environmental specialist**. The area shall be isolated with mobile barricades and the principal environmental consultant notified. Representative samples will be screened for VOCs using a PID and analysed according to the EPA (1995) *Sampling Design Guidelines* and EPA (1994) *Minimum Soil Sampling Protocol* for the suspected contaminants.

Such soils may be stockpiled separately and, depending on their waste classification, disposed according to the DECC (2009) *Waste Classification Guidelines*. All impacted materials in the excavated area, as well as the stockpile footprint (should the stockpile be formed on un-protected ground), will be ‘chased-out’ by excavation and stockpiled until all corresponding contamination has been removed. Contaminated spoil materials that fail to meet the RAC will be handled as follows:

1. Materials will be carefully excavated and placed in separately demarcated and contained locations and separately stockpiled on the basis of on-site observations and the contaminant exceedances detected.
2. Stockpiles of excavated materials will be appropriately banded with hay bales/sandbags and if required, covered and/or lined with impermeable plastic sheeting, or alternatively placed in an appropriate container e.g. waste skip, with appropriate cover.
3. Sampling and analysis of segregated stockpiles will be conducted to determine the concentrations of the target contaminant parameters in the excavated materials.
4. Disposal arrangements will be determined based on sampling results as follows:
 - material that falls below the CT1 thresholds for *General Solid Waste* as outlined in Table 3 shall be collected and disposed direct to landfill;

- material that exceeds the CT1 screening thresholds for and shall be tested for leachability with respect to the elevated contaminants using the TCLP method, and subject to meeting the relevant disposal requirements, will be dispatched off-site for disposal as either *General Solid Waste* or *Restricted Solid Waste*; and
 - those materials that exceed the *TCLP2/SCC2* criteria for landfill disposal, as outlined in Table 4, shall be further segregated into separate stockpiles and await alternate treatment and disposal arrangements.
5. Stockpiled materials that cannot be landfilled directly (i.e. those that are awaiting TCLP results or that fail the combined specific concentration and TCLP test, or require to be stored pending treatment), will be covered by anchored geotextile to prevent erosion and wind blow of contaminated materials.
6. Approval of the immobilisation method for materials exceeding the leaching guidelines must be obtained from the NSW DECCW, and disposal consent must be sought from the Hazardous Material Advice Unit of the DECCW/EPA prior to the removal of such immobilised wastes from the site.

Asbestos Issues

Although previous investigations have not found evidence of any asbestos contamination, it is possible that asbestos materials are present in site soils, especially near buildings (or within the areas that previously contained buildings), as a result of previous building or demolition works and/or hail events.

Should buried asbestos-containing materials be observed during the proposed remedial excavations, then means to remove them and validate the respective areas will be implemented, accordingly. This may involve '*collection by hand*', which despite being labour intensive, is the most cost effective approach, or *soil disposal*. Large sheets of asbestos-containing fibro, if found, will be wetted before sealing in plastic bags. Dust suppression measures will be implemented

during all activities involving soil disturbance/movement, to minimise the release of fine particles within and around the site. All personnel involved in any asbestos handling activities will be attired in appropriate protective clothing (e.g. overalls, gloves, boots, goggles and dusk masks).

Laboratory testing of soil validation samples, collected from areas containing significant amounts of fragments/sheeting, will be conducted to monitor the levels of asbestos fibres in site soils. The proposed sampling frequency will be approximately one sample per 25m³ of excavated soil (as per the EPA (1994) *Minimum Soil Sampling Protocol*), or one sample per 100m² of surface area. Samples found to contain asbestos fibres at concentrations of greater than 0.001% w/w will trigger the need for off-site removal of contaminated soil to a licensed landfill facility, in accordance with the DECC (2009) *Waste Classification Guidelines*. The soils will be loaded directly onto licensed waste transport vehicles, using a bucket excavator, and measures will be implemented to ensure that no contaminated materials are released as dusts and/or tracked off-site onto public roadways. Documentary evidence provided by the landfill company, such as weighbridge slips and other relevant dockets, will be submitted to the reporting consultant for inclusion in the final *Site Remediation and Validation* report.

9.0 **VALIDATION PLAN**

The site will be deemed suitable for the intended residential use based on the achievement of the following validation objectives:

1. ***Excavated Areas*** – Validation of areas where impacted fill/soils have been excavated will involve sampling and analysis to ensure that contaminant concentrations at the base (and walls) of the area are within the Remediation Acceptance Criteria. The sampling frequency shall be in accordance with the NEPC (1999) and EPA (1995) Sampling Design Guidelines and all tests shall be performed by NATA-accredited environmental analytical laboratories.
2. ***Backfill Materials*** – Validation of imported, clean fill materials used for the backfilling of remediated areas to verify their suitability for the proposed land use. Sampling shall be conducted at a nominal density of 1 sample per 100m³ and all tests will be performed by NATA-accredited environmental analytical laboratories.

More details of the site validation process, including descriptions of the project data quality objectives and the QA/QC program, are provided in the following sections.

9.1 **SOIL VALIDATION**

Validation Sampling Frequency

It is proposed that soil validation samples from the various surfaces be collected and analysed at the following approximate frequencies:

- Base of Excavations – 1 sample per 25m²;
- Walls of Excavations – 1 sample per 10 lineal metres;
- Stockpiled Materials – 1 sample per 100m³ with a minimum of three samples; and
- Final Ground Surface – 1 sample per 100m².

Excavation of contaminated material shall continue until the analytical results indicate compliance with the RAC (i.e. either concentrations of all contaminants are within the RAC, or the 95% UCL average contaminant concentration for each detected parameter is within the RAC). If results indicate that additional excavation is necessary, the excavation shall be extended until the excavation surface samples indicate that the location is validated as meeting the RAC for each respective contaminant.

If the levels of contaminants are found to exceed the criteria for solid waste, soil treatment by stabilisation and/or micro-encapsulation could be required before disposal.

Sample Collection and Handling

Soil validation sampling will be directly from the exposed surface of excavation, or from the material brought to the surface by the backhoe/excavator bucket. Sampling data shall be recorded to comply with routine chain of custody requirements.

The general sampling, handling, transport and tracking procedures shall comprise:

- the use of stainless steel sampling equipment;
- washing of all sampling equipment, including drills or excavator parts in contact with the sample, in a 3% solution of phosphate free detergent (Decon 90) then rinsing with distilled water prior to each sample being collected; transfer of the sample into new glass jars or plastic bags, with each plastic bag individually sealed to eliminate cross contamination during transportation to the laboratory;
- labelling of the sample containers with individual and unique identification including Project No., Sample No., Sampling depth, date and time of sampling;
- placement of the containers into a chilled, enclosed and secure container for transport to the laboratory; and

- use of chain of custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to ultimate hand-over to the environmental laboratory.

9.2 SAMPLE CONTAINMENT, PRESERVATION AND HOLDING TIMES

Samples shall be contained and preserved in accordance with the following standard environmental protocols:

- Metals - 250g glass / refrigeration 4°C / 6 months (maximum holding period);
- TPH/BTEX - 250g glass / refrigeration 4°C / 14 days (maximum holding period);
- PAH - 250g glass / refrigeration 4°C / 14 days (maximum holding period).

9.3 VALIDATION SAMPLE ANALYSIS

Each excavation and ground surface sample obtained for soil validation purposes will be analysed for metals (8), TPHs, BTEX and PAHs, as well as any other relevant contaminant that may be identified during the waste soil classification process. Testing of imported materials intended for backfilling of excavated areas shall include but not be limited to the minimum suite specified for imported fill under the EPA (1994) guideline (e.g. heavy metals, TPHs, BTEX, PAHs, OCPs, PCBs and asbestos).

9.4 QUALITY ASSURANCE & QUALITY CONTROL PLAN

Field QA/QC

Quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy, which will be assessed through the analysis of 10% field duplicate/replicate samples.

Appropriate sampling procedures will be undertaken to prevent cross contamination, in accordance with EI's Standard Operating Procedures Manual, which specifies that:

- standard operating procedures are followed;
- site safety plans are developed prior to works commencement;
- split duplicate field samples are collected and analysed;
- samples are stored under secure, temperature controlled conditions;
- chain of custody documentation is employed for the handling, transport and delivery of samples to the contracted environmental laboratory; and
- contaminated soil, fill or groundwater originating from the site area is disposed in accordance with relevant regulatory guidelines.

In total, field QA/QC will include one in 10 samples to be tested as blind field duplicates (BFD), one in 20 samples to be tested as inter-laboratory duplicates (ILD), as well as one VOC trip blank sample and one equipment wash blank sample per sample batch.

Laboratory Quality Assurance and Quality Control

The contract laboratory will conduct in-house QA/QC procedures involving the routine analysis of:

- reagent blanks;
- spike recoveries;
- laboratory duplicates;
- calibration standards and blanks;
- QC statistical data; and
- control standards and recovery plots.

Achievement of Data Quality Objectives

Based on the analysis of quality control samples (i.e. duplicates/replicates and in-house laboratory QA/QC procedures), the following data quality objectives are required to be achieved:

- conformance with specified holding times;
- accuracy of spiked samples will be in the range of 70-130%;
- field and laboratory duplicates and replicates samples will have a precision average of +/- 30% relative percent difference (RPD), and
- field duplicates will be collected at a frequency of 10% of all samples.

An assessment of the overall data quality should be presented in the final validation report, in accordance with the DEC (2006) *Guidelines for the NSW Site Auditor Scheme*.

10.0 GROUNDWATER ASSESSMENT

As groundwater conditions were not fully addressed during the investigation phase, an assessment of groundwater quality during and/or at the conclusion of the soil remediation phase will be necessary. The groundwater assessment requires the following tasks to be conducted:

- a) confirmation of groundwater quality with the installation of deeper groundwater monitoring wells at three locations across the site (one up gradient well and two down gradient wells);
- b) an initial round of groundwater sampling and analysis from the three, newly installed groundwater monitoring wells, including QA/QC testing comprising two field duplicate samples;
- c) laboratory analytical results for the groundwater samples to be interpreted against the adopted Groundwater Acceptance Criteria (GAC); and
- d) data interpretation and reporting, including waste classification (if necessary).

Groundwater Acceptance Criteria (GAC)

The recommended Groundwater Acceptance Criteria (GAC) are as follows (in the indicated order of priority) and are detailed in Table 5:

1. ANZECC (2000) *Trigger Values for the protection of 95% of Fresh and Marine species*, published under the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*;
2. Dutch (2000) *Groundwater intervention values for various organic and inorganic contaminants*, published by the Ministry of Housing, Spatial Planning & The Environment, Directorate General for Environmental Protection, The Netherlands, February 2000;
3. NEPC (1999) *Groundwater Investigation Levels for the protection of Fresh and Marine water aquatic ecosystems*, published under Schedule B(1) of the *National Environment Protection (Assessment of Site Contamination) Measure*; and

4. ANZECC (1992) *Summary guidelines for the protection of Fresh and Marine water aquatic ecosystems*, published under the *Australian Water Quality Guidelines for Fresh and Marine Waters*.

Table 5. Proposed Groundwater Quality Assessment Criteria (part 1 of 2)

ANALYTE	Units	Freshwater Criteria	Marine Water Criteria	ANALYTE	Units	Freshwater Criteria	Marine Water Criteria
Heavy Metals				OPPs			
Antimony	µg/L	30 ¹	20 ³	Azinphos Methyl	µg/L	0.02	NR
Arsenic	µg/L	24	50 ¹	Chloropyrifos	µg/L	0.01	0.009
Beryllium	µg/L	4 ¹	NR	Diazinon	µg/L	0.01	NR
Cadmium	µg/L	0.2	5.5	Dimethoate	µg/L	0.15	NR
Chromium III	µg/L	* 10 ¹	27.4	Fenitrothion	µg/L	0.2	NR
Chromium VI	µg/L	1.0	4.4	Malathion	µg/L	0.05	NR
Cobalt	µg/L	100 ³	1	Parathion	µg/L	0.004	NR
Copper	µg/L	1.4	1.3	Temephos	µg/L	NR	0.05
Lead	µg/L	3.4	4.4	OCPs			
Mercury	µg/L	0.6	0.4	Aldrin	µg/L	0.001 ¹	0.001 ²
Molybdenum	µg/L	300 ³	300 ³	Chlordane	µg/L	0.0004 ¹	0.0004 ²
Nickel	µg/L	11	70	DDT	µg/L	0.01	0.0001 ²
Selenium	µg/L	11	70 ¹	Dieldrin	µg/L	0.0002 ¹	0.0002 ¹
Silver	µg/L	0.05	1.4	Endosulfan	µg/L	0.2	0.01
Tin (inorganic)	µg/L	NR	NR	Endrin	µg/L	0.02	0.01
Tributyltin	µg/L	0.008 ¹	0.006	Heptachlor	µg/L	0.09	0.001 ²
Vanadium	µg/L	NR	100	Lindane	µg/L	0.2	NR
Zinc	µg/L	8.0	15	Toxaphene	µg/L	0.2	NR
TPHs				PCBs			
C ₆ -C ₉	µg/L	NR	NR	Total PCBs	µg/L	0.001 ¹	0.004 ²
C ₁₀ -C ₁₄	µg/L	Total 600 ³	Total 600 ³	Aroclor 1242	µg/L	0.6	NR
C ₁₅ -C ₂₈	µg/L			Aroclor 1254	µg/L	0.03	NR
C ₂₉ -C ₃₆	µg/L						
BTEX				Phenolics			
Benzene	µg/L	950	700	Phenol	µg/L	320	400
Toluene	µg/L	300 ¹	1000 ³	2-chlorophenol	µg/L	490	NR
Ethyl benzene	µg/L	150 ³	150 ³	4-chlorophenol	µg/L	220	NR
Total Xylenes	µg/L	** 550	70 ³	2,4-dichlorophenol	µg/L	160	NR
PAHs				2,4,6-trichlorophenol	µg/L	20	NR
Total PAHs	µg/L	3.0 ¹	3.0 ²	2,3,4,6-tetrachlorophenol	µg/L	20	NR
Naphthalene	µg/L	16	70	Pentachlorophenol	µg/L	10	22
Benzo(a)pyrene	µg/L	0.05 ³	0.05 ³	2,4-dinitrophenol	µg/L	45	NR

Notes

NR = no currently available published criteria

Freshwater Criteria are ANZECC/ARMCANZ (2000) 95% Freshwater Trigger values, unless otherwise indicated

Marine Criteria are ANZECC/ARMCANZ (2000) 95% Marine Trigger values, unless otherwise indicated

* ANZECC/ARMCANZ (2000) provides no current freshwater trigger value for Cr III. NEPC (1999) GIL Total Chromium is 10 mg/L

** ANZECC/ARMCANZ (2000) freshwater trigger value for o-xylene is 350 mg/L + for p-xylene is 200 mg/L

¹ NEPC (1999) Groundwater Investigation Level for the protection of freshwater aquatic ecosystems, NEPM

² NEPC (1999) Groundwater Investigation Level for the protection of marine aquatic ecosystems, NEPM

³ Dutch (2000) Groundwater Intervention Value (level at which groundwater remediation is required)

Table 5. Proposed Groundwater Quality Assessment Criteria (part 2 of 2)

ANALYTE	Units	Freshwater Criteria	Marine Water Criteria	ANALYTE	Units	Freshwater Criteria	Marine Water Criteria
<i>CHCs (in SVOCs)</i>				<i>CHCs (in VOCs)</i>			
Chlorinated Benzenes	µg/L	0.007 - 15.0 ¹	NR	Vinyl Chloride	µg/L	NR	NR
1,2-dichlorobenzene	µg/L	160	NR	1,1-Dichloroethene	µg/L	NR	NR
1,3-dichlorobenzene	µg/L	260	NR	Carbon Tetrachloride	µg/L	NR	NR
1,4-dichlorobenzene	µg/L	60	NR	1,1,1-Trichloroethane	µg/L	NR	NR
1,2,3-trichlorobenzene	µg/L	10	NR	Trichloroethene	µg/L	NR	NR
1,2,4-trichlorobenzene	µg/L	170	80	1,1,2-Trichloroethane	µg/L	6500	6500
Hexachlorobutadiene	µg/L	0.1 ¹	0.3 ²	<i>Miscellaneous</i>			
1,1,2-trichloroethane	µg/L	6500	1900	Total Cyanide	mg/L	7	4
Hexachloroethane	µg/L	360	NR	Fluoride	mg/L	NR	NR

Notes

NR = no currently available published criteria

Freshwater Criteria are ANZECC/ARMCANZ (2000) 95% Freshwater Trigger values, unless otherwise indicated

Marine Criteria are ANZECC/ARMCANZ (2000) 95% Marine Trigger values, unless otherwise indicated

¹ NEPC (1999) Groundwater Investigation Level for the protection of freshwater aquatic ecosystems, NEPM

² NEPC (1999) Groundwater Investigation Level for the protection of marine aquatic ecosystems, NEPM

11.0 OCCUPATIONAL HEALTH AND SAFETY PLAN

11.1 PERSONNEL AND RESPONSIBILITIES

All site work must be undertaken in a controlled and safe manner with due regard to potential hazards, training and safe work practices. The practices outlined should generally comply with the OH&S policies specified by the relevant Authority.

Before undertaking works on site, all personnel will be made aware of the officer responsible for implementing health and safety procedures. All personnel should read and understand the Occupational Health and Safety Plan prior to commencing site works and sign a statement to that effect. Contractors employed at the site will be responsible for ensuring that their employees are aware of, and comply with, the requirements of this document.

11.2 SITE HAZARDS

Chemical Hazards

On sites of this nature, chemical compounds or substances that may be present include heavy metals, TPHs, PAHs and asbestos. The possible risks to site personnel associated with these contaminants include:

- ingestion of contaminated soil or water;
- dermal contact with contaminated soil or water; and
- inhalation of dusts, aerosols or vapours containing contaminants.

Physical Hazards

The following hazards are associated with conditions that may be created during site works:

- heat exposure;
- buried services;
- noise;
- dust;
- electrical equipment; and
- the operation of heavy plant equipment.

11.3 SAFE WORK PRACTICES

Personnel will endeavour, wherever possible, to avoid direct contact with potentially contaminated material. Workers are to ensure that surface waters or groundwater is not ingested or swallowed and that direct skin contact with soil and water is avoided.

All personnel on site will be required to wear the following protection at all times:

- steel-capped boots;
- safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary);
- hard hat meeting AS1801-1981 requirements; and
- hearing protection meeting AS1270-1988 requirements when working in the vicinity of machinery or plant equipment (if noise levels exceed exposure standards).

In the event that personnel are required to work in areas of potential contact with hazardous materials, the following Modified *Level D* Protection will be required:

- disposable coveralls (if necessary) to prevent contact with splashed soil or materials;
- steel-capped boots;
- nitrile work gloves meeting AS2161-1978 requirements or heavy duty gauntlet gloves;
- safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary);
- hard hat meeting AS1801-1981 requirements; and
- hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards.

In the event that personnel are required to work in areas of potential contact with water contaminated by hazardous substances, the following Modified *Level D* Protection will be required:

- disposable coveralls to prevent contact with splashed water;
- water-proof boots fitted with steel toe when working around machinery;
- nitrile work gloves meeting AS2161-1978 or heavy duty gauntlet gloves;
- safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary);
- hard hat meeting AS1801-1981 requirements when working within the site; and
- hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards.

11.4 EMERGENCY RESPONSE PLAN

An essential component of the OH&S Plan will involve the development of an Emergency Response Plan for all aspects of site works. This will ensure the safety of the personnel working on-site given an emergency situation occurs. Any emergency will be reported immediately to the site office and/or the Site Safety Officer, and the appropriate emergency assistance should be sought by telephoning the relevant authority.

The works contractor will be responsible for ensuring that site personnel are aware of the emergency services available and appropriate contact details. A Site Safety Officer must be contactable, or available, on-site during remediation and development works. These and other important telephone numbers are listed at the front of this RAP.

12.0 ENVIRONMENTAL MANAGEMENT PLAN

12.1 STATUTORY REQUIREMENTS

The work shall be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The successful contractor shall have in place an Environmental Management Plan (EMP) such that work on the site complies with the requirements of the following Acts:

- *Pollution Control Act;*
- *Environmental Offences and Penalties Act;*
- *Hazardous Chemicals Act;*
- *Environmentally Hazardous Chemicals Act;*
- *Dangerous Goods Act;*
- *Protection of the Environment Operations Act;*
- *Construction Safety Act;* and
- *Occupational Health and Safety Act (WorkCover).*

The contractor shall also be responsible to ensure that the site works comply with the following conditions:

- fugitive emissions and dust leaving the confines of the site must be suitably controlled and minimised;
- water containing any suspended matter or contaminants must not leave the site in a manner which could pollute the environment, and must be minimised and suitably controlled;
- vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas; and
- noise and vibration levels at the site boundaries must comply with the legislative requirements.

In order to achieve a minimisation of adverse environmental effects, the following measures are recommended to be adopted by the appointed contractor.

12.2 TRAFFIC MANAGEMENT

All vehicular traffic shall use only routes approved by the Council to and from the selected landfill. All loads shall be tarpaulin-covered and lightly wetted to ensure that no materials or dust are dropped or deposited outside, or within the site. Each truck prior to exiting the site, shall be inspected prior to despatch and either logged out as clean (wheels and chassis), or hosed down within the wheel wash / wash down bay until designated as 'clean'.

12.3 EXCAVATIONS

Records of all excavations and stockpile locations shall be maintained. All unsealed contaminated stockpile locations will be re-validated following spoil removal. A site diary or log will also be maintained to record daily progress, abnormal occurrences, incidents, truck movements and load characteristics.

12.4 STORMWATER MANAGEMENT AND CONTROL

Appropriate measures shall be taken to ensure that potentially contaminated water does not leave the site. Such measures should include, but not be limited to:

- construction of stormwater diversion channel and linear drainage sumps with catch pits in the remediation area to divert and isolate stormwater from any contaminated areas;
- provision of sediment traps including geotextiles or hay bales; and
- discharge of any water to drains and water bodies must meet the appropriate effluent discharge consent condition under the *Pollution Control Act* or *Protection of the Environment Operations Act*. This will be verified by sampling and analyses undertaken

by the contractor. Laboratory analytical reports for tested discharge waters must be maintained on site and made available for inspection by Council's representative or the relevant authority.

12.5 CONTROL OF DUST AND ODOUR

Control of dust and odour during the course of the remediation works shall be maintained by the contractor and may include but not necessarily be limited to:

- the use of a water cart, as and when appropriate, to eliminate wind blown dust;
- use of sprays or sprinklers on stockpiles or loads to lightly condition the material;
- use of tarpaulin or tack-coat emulsion or sprays to prevent dust blow from stockpiles or from vehicle loads;
- covering of stockpiles or loads with polythene or geotextile membranes;
- restriction of stockpile heights to 2m above surrounding site level;
- ceasing works during periods of inclement weather such as high winds or heavy rain; and
- regular checking of the fugitive dust and odour issues to ensure compliance with the EMP requirements, undertaking immediate remedial measures to rectify any cases of excessive dust or odour (e.g. use of misting sprays or odour masking agent).

12.6 NOISE CONTROL

Noise and vibration will be restricted to reasonable levels. All plant and machinery used on site will be noise muffled to ensure that noise emissions do not breach statutory levels. Working hours will be restricted to those specified by Council (e.g. 7.00 am to 7.00 pm weekdays and 7.00 am to 5.00 pm Saturdays; no Sunday work shall be permitted).

12.7 MONITORING OF TRUCK LOADING

All loads will be lightly conditioned and covered before leaving the site. Each load of contaminated spoil leaving the site shall be, such that its origin, despatch time, cleanliness of the vehicle, route, destination and arrival time are recorded. Appropriate (trip ticket) docket information confirming disposal shall be maintained for inspection.

12.8 VALIDATION REPORTING

A validation assessment report prepared by a qualified environmental consultant in accordance with NSW EPA Contaminated Sites (1997) *Guidelines for Consultants Reporting on Contaminated Sites* and other appropriate guidance documentation shall be submitted to an EPA-accredited Site Auditor (where applicable) at the completion of each stage of the remediation works programme. The remediation report shall confirm that the site has been remediated to a suitable standard for the proposed development and occupation and that no related adverse environmental effects have occurred as a result of the temporary works.

No building construction other than the necessary demolition and excavation works will commence until the validation report has been agreed by the appointed EPA-accredited Site Auditor. The validation report shall include details of the total volume of contaminated materials removed from site, present detailed analytical results, confirm that placed fill meets the RAC and indicate the final disposal destination of the materials removed from site.

13.0 STATEMENT OF LIMITATIONS

This RAP has been prepared with reference to the relevant DECCW guidelines. It is based on reviews of previous environmental site investigation reports, most of which included specific searches through relevant, historical databases and numerical data. It was assumed that the historical records were complete at the time of preparing the investigative reports. Although land use may not have been specified, some of the conclusions drawn were also based on interpretations of the anecdotal and visual information that were made available during the course of these investigations.

This RAP also relies upon data, measurements and/or results taken at, or under, the particular times and conditions specified in the corresponding report. For example, numerical data presented in the reports were the result of discrete and specific sampling methodologies used in accordance with best industry practices and standards. Due to the site-specific nature of soil sampling from point locations, however, it is considered likely that all variations in subsurface conditions across a site cannot be fully defined, no matter how comprehensive the field investigation program.

No warranties are made as to the information provided in this RAP. All strategies, conclusions and recommendations made in this RAP are of the professional opinions of EI personnel involved with the project and while normal checking of the accuracy of information has been conducted, any circumstances outside the scope of this RAP or which were not made known to EI personnel and which may impact on those opinions are not the responsibility of EI.

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Please contact the undersigned if you have any queries or require additional information.

For and on behalf of,
ENVIRONMENTAL INVESTIGATIONS



ERIC GERGES
Environmental
Senior Engineer



DR VAGNER JORDEN
Principal Environmental Engineer

REFERENCES

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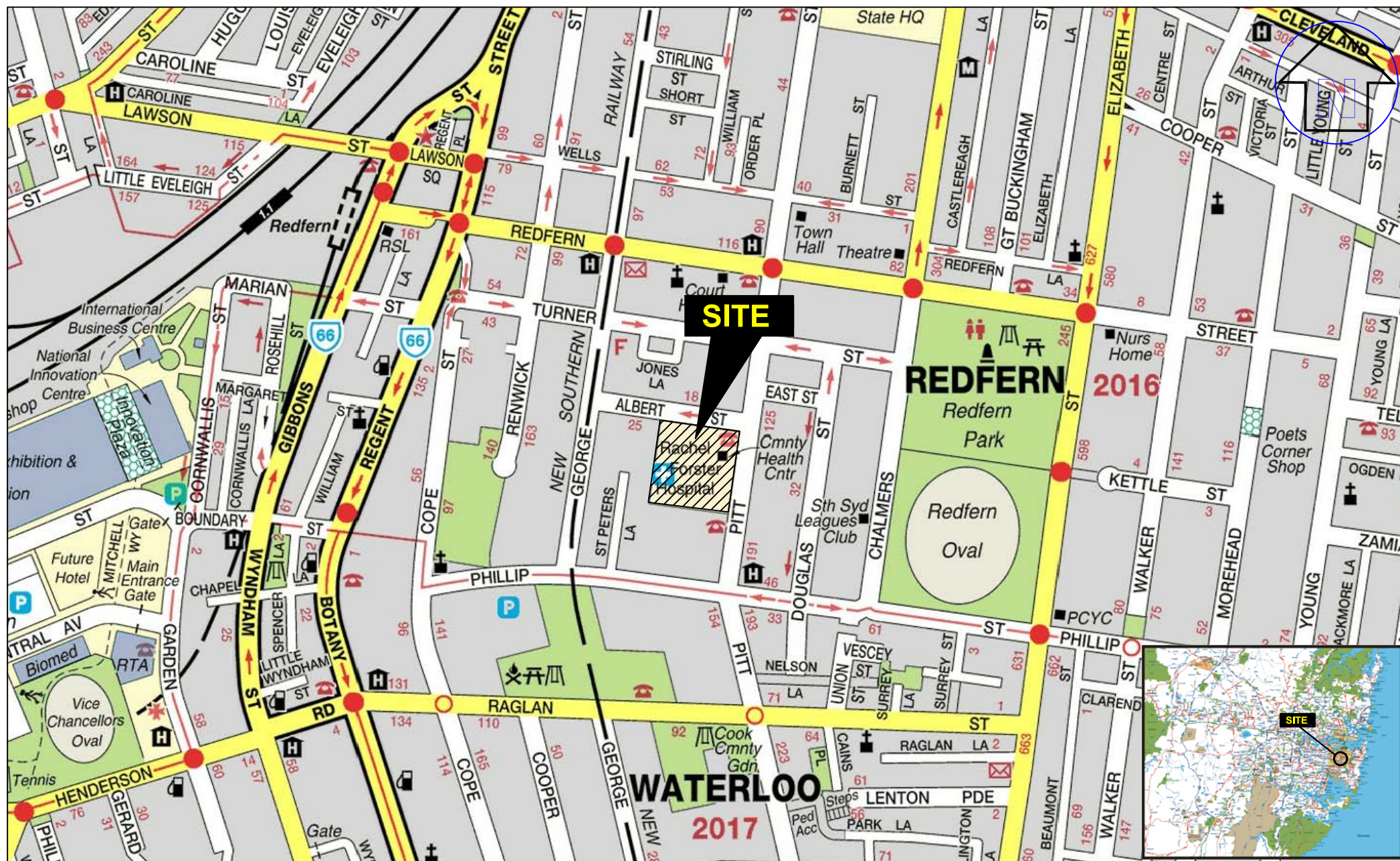
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ABBREVIATIONS

AAS	Atomic Absorption Spectrometry
AHD	Australian Height Datum
AST	Aboveground Storage Tank
ANZECC	Australian and New Zealand Environment Conservation Council
BAP	Benzo(a)pyrene
BGL	Below Ground Level
BH	Borehole
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
COC	Chain of Custody documentation, or Chemical of Concern (subject to context)
DAC	Data Acceptance Criteria
DEC	NSW Department of Environment and Conservation (now DECC)
DECC	NSW Department of Environment and Climate Change (formerly DEC)
DP	Deposited Plan
DQO	Data Quality Objective
EI	Environmental Investigations
EIL	Ecological Investigation Level
EPA NSW	Environment Protection Authority, New South Wales
ESA	Environmental Site Assessment
GC-ECD	Gas Chromatograph-Electron Capture Detector
GC-FID	Gas Chromatograph-Flame Ionisation Detector
GC-MS	Gas Chromatograph-Mass Spectrometer
HDPE	High Density Polyethylene
HIL	Health Based Investigation Level
ICP-AES	Inductively Couple Plasma – Atomic Emission Spectra
NATA	National Association of Testing Authorities, Australia
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
OCPs	Organochlorine Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photo-ionisation Detector
PIL	Phytotoxicity-based Investigation Levels
PQL	Practical Quantitation Limit (laboratory instrument detection limit)
QA/QC	Quality Assurance / Quality Control
RAC	Remediation Acceptance Criteria
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
SIL	Soil Investigation Level
SWL	Standing Water Level (a measurement to current groundwater level)
TOC	Top of bore Casing (water levels are generally measured relative to TOC)
TP	Test Pit
TPHs	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
UCL	Upper Confidence Limit

FIGURES



P O Box 215, ST PETERS 2044
Ph (02) 9516 0722 Fax (02) 9516 0744

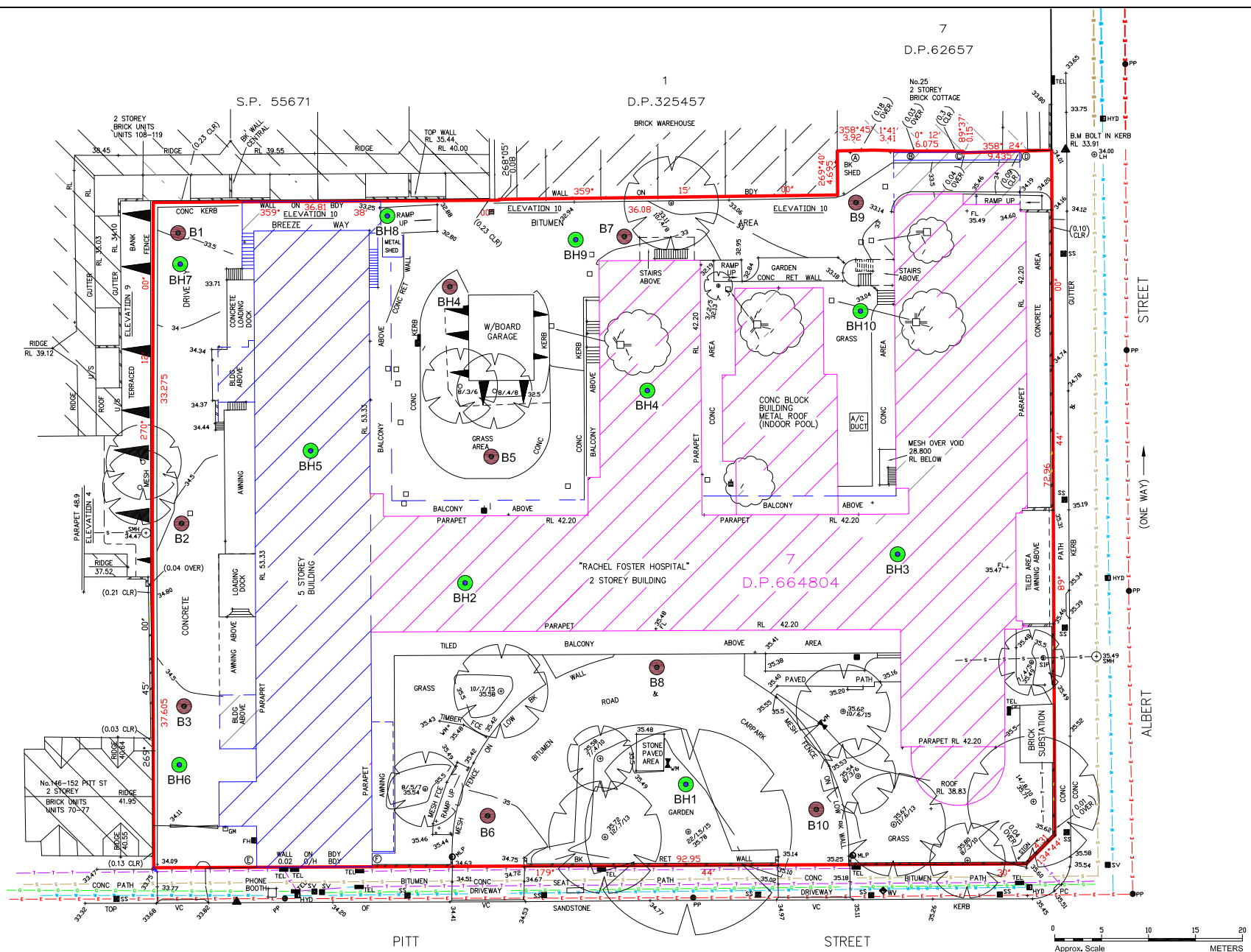
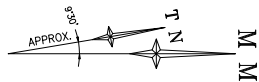
Drawn:	A.B
Approved:	T.G
Date:	16-11-12
Approx Scale:	N.T.S

Kaymet Corporation Pty Ltd
Remediation Action Plan
134-150 Pitt Street, Redfern, NSW
Site Location Plan

Figure:

1

Project: E1551.1

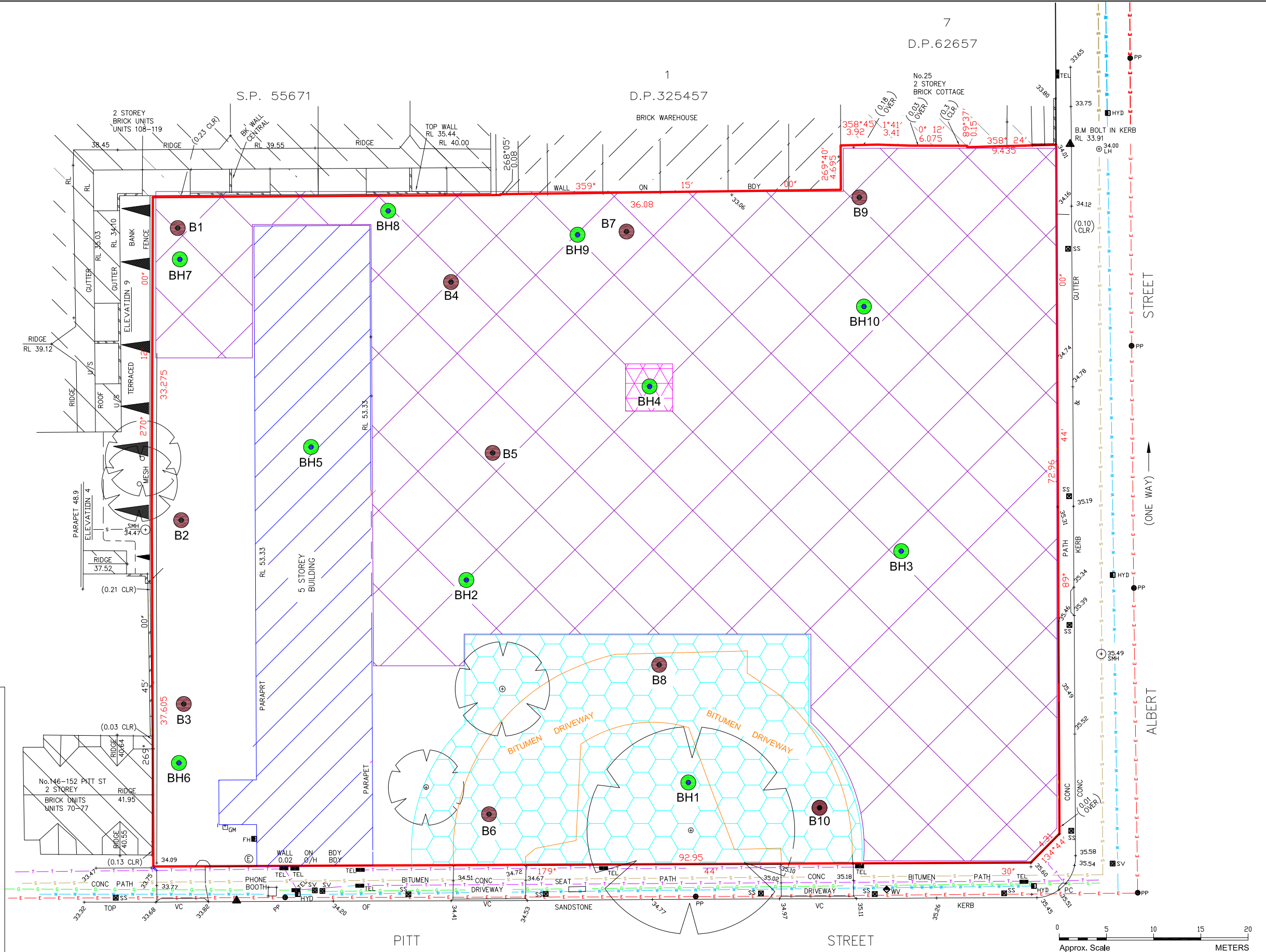
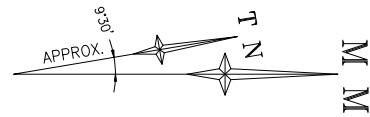


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Drawn:	T.G.
Approved:	V.J.
Date:	16-11-12
Approx Scale:	as shown

Kaymet Corporation Pty Ltd
Remediation Action Plan
134-150 Pitt Street, Redfern NSW
Existing Site Structures and Former Sampling Plan

Figure:
2
Project: E1551.1



LEGEND

- Heavy Metal & PAH in Fill Remedial Area
- Asbestos in Fill Remedial Area
- Building to be retained under an EMP
- Approx. area to be a dedicated park
- Borehole location (E.I. 03/2012)
- Borehole location (D.P. 11/2003)
- Approx. site boundary



P O Box 215, ST PETERS 2044
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Drawn:	T.G.
Approved:	V.J.
Date:	16-11-12
Approx Scale:	as shown

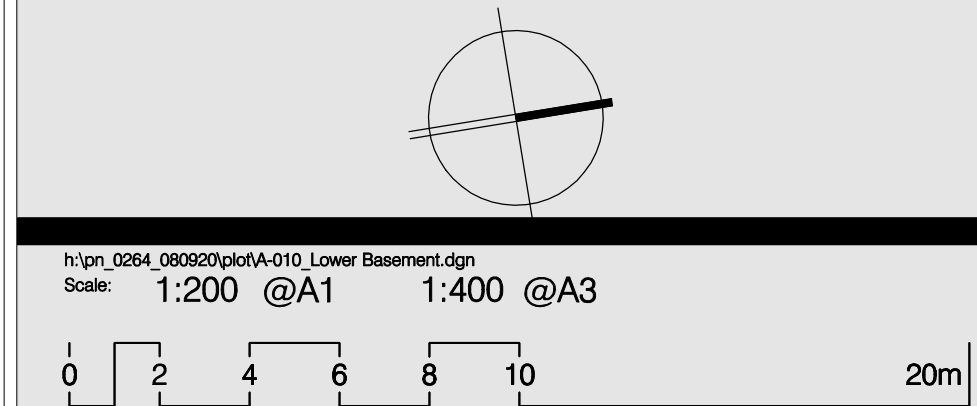
Kaymet Corporation Pty Ltd
Remediation Action Plan
134-150 Pitt Street, Redfern NSW
Site & Remediation Plan

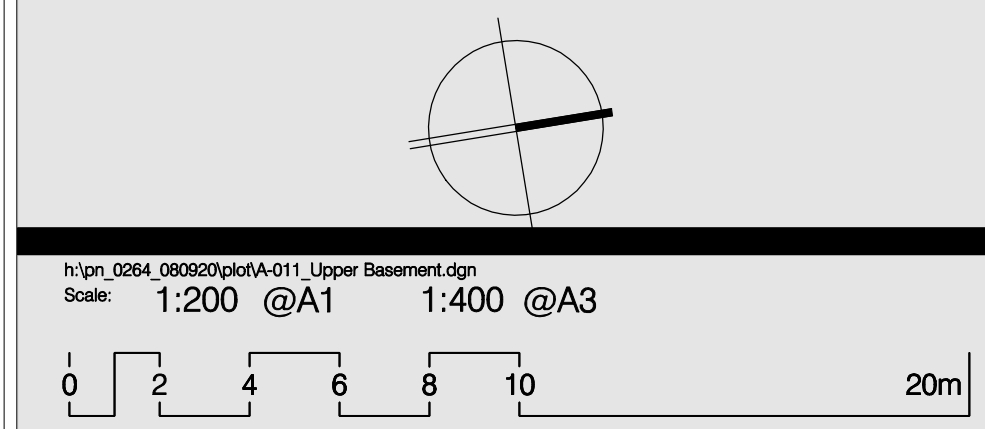
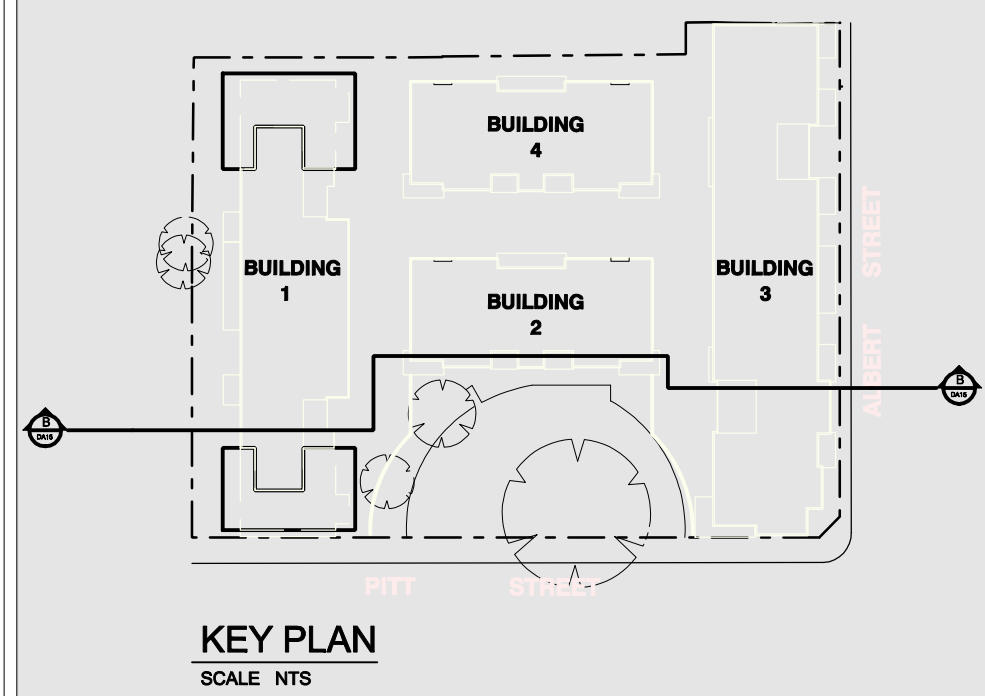
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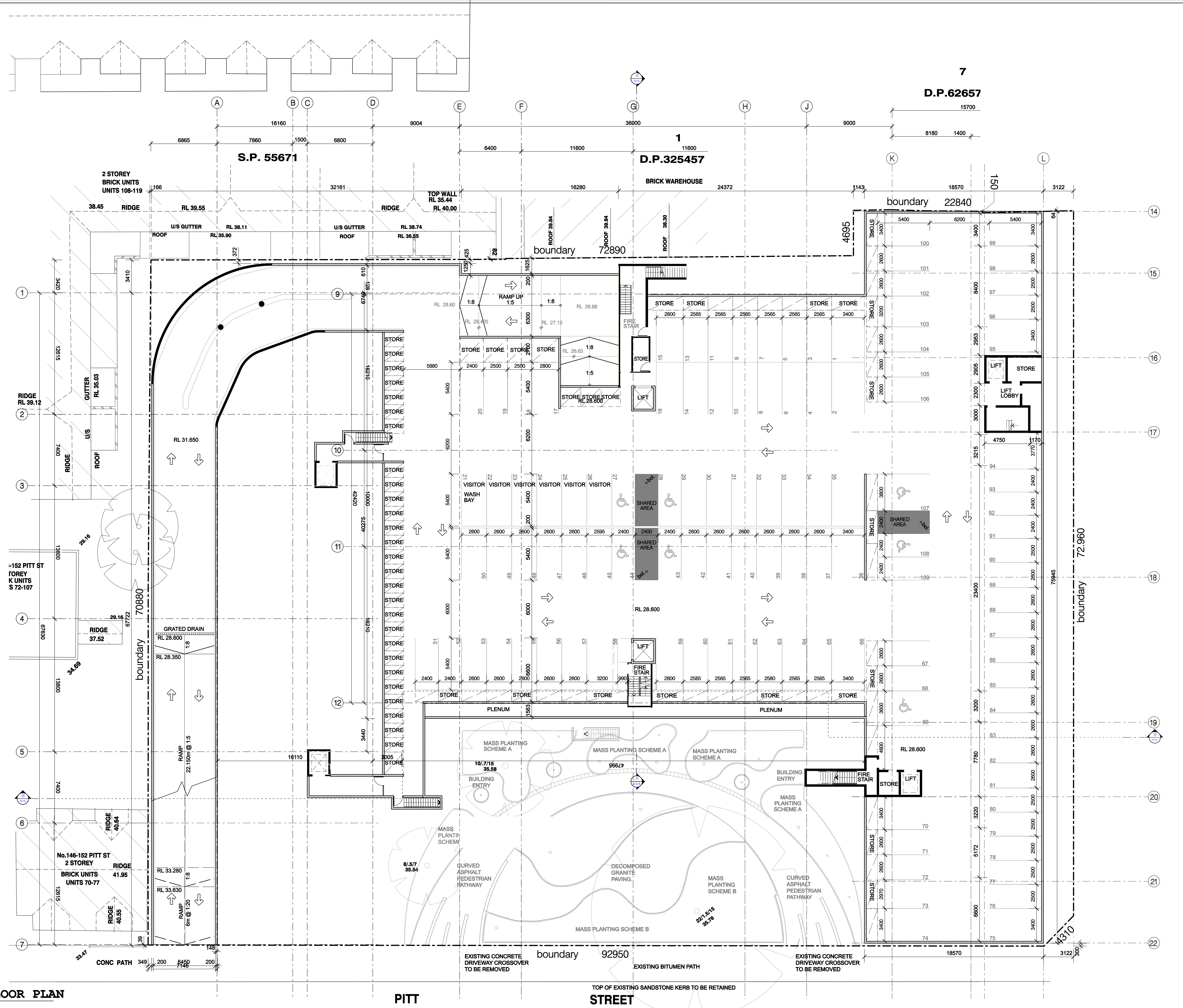
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APPENDIX A
PROPOSED DEVELOPMENT PLANS





1 UPPER BASEMENT FLOOR PLAN
SCALE 1:200



ARCHITECTURE & BUILDING WORKS
L8 / 4 Hogben Street,
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P.O. Box 501, Dulwich Hill, 2203
Australia
Tel: (02) 9553 4744
Fax: (02) 9553 4766
Email: info@abwworks.com.au

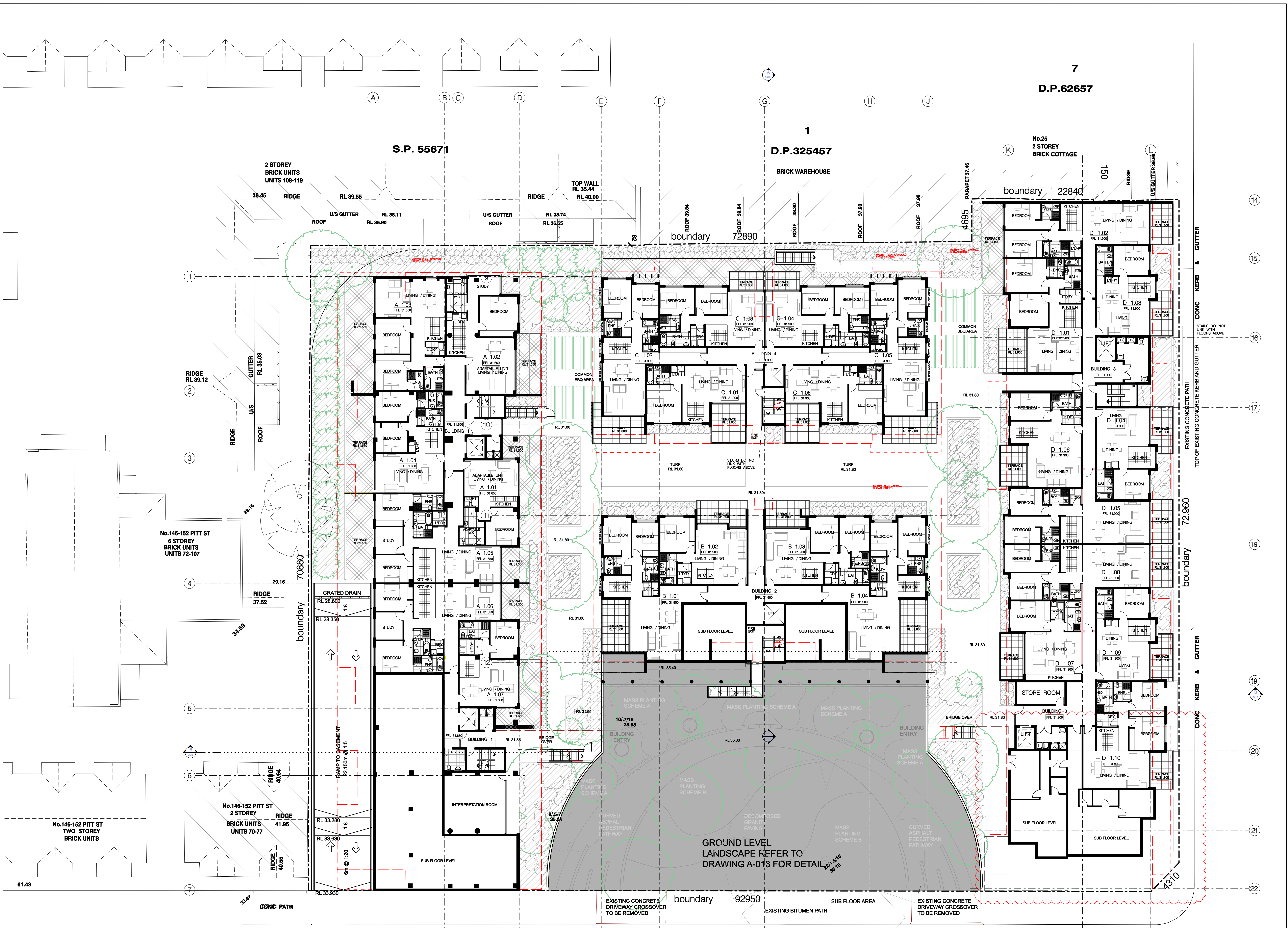
Architects
Construction Managers
Interior Designers
Town Planners

PITT ST REDFERN
134-144 PITT ST, REDFERN

PROJECT	ADDRESS
134-144 PITT ST, REDFERN	

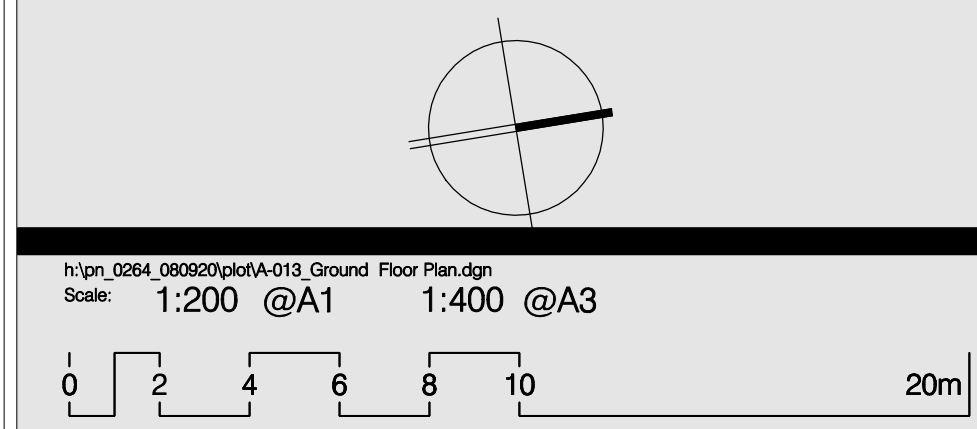
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Drawing Status:	AUTHORITY APPROVAL				
Client:	KAYMET PTY LTD				
Project Number:	PN 0264				
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TL	04/03/09	TL	24/03/09	TL	04/12/08
APPROVAL	DATE				
ISSUE	REVISION DESCRIPTION				
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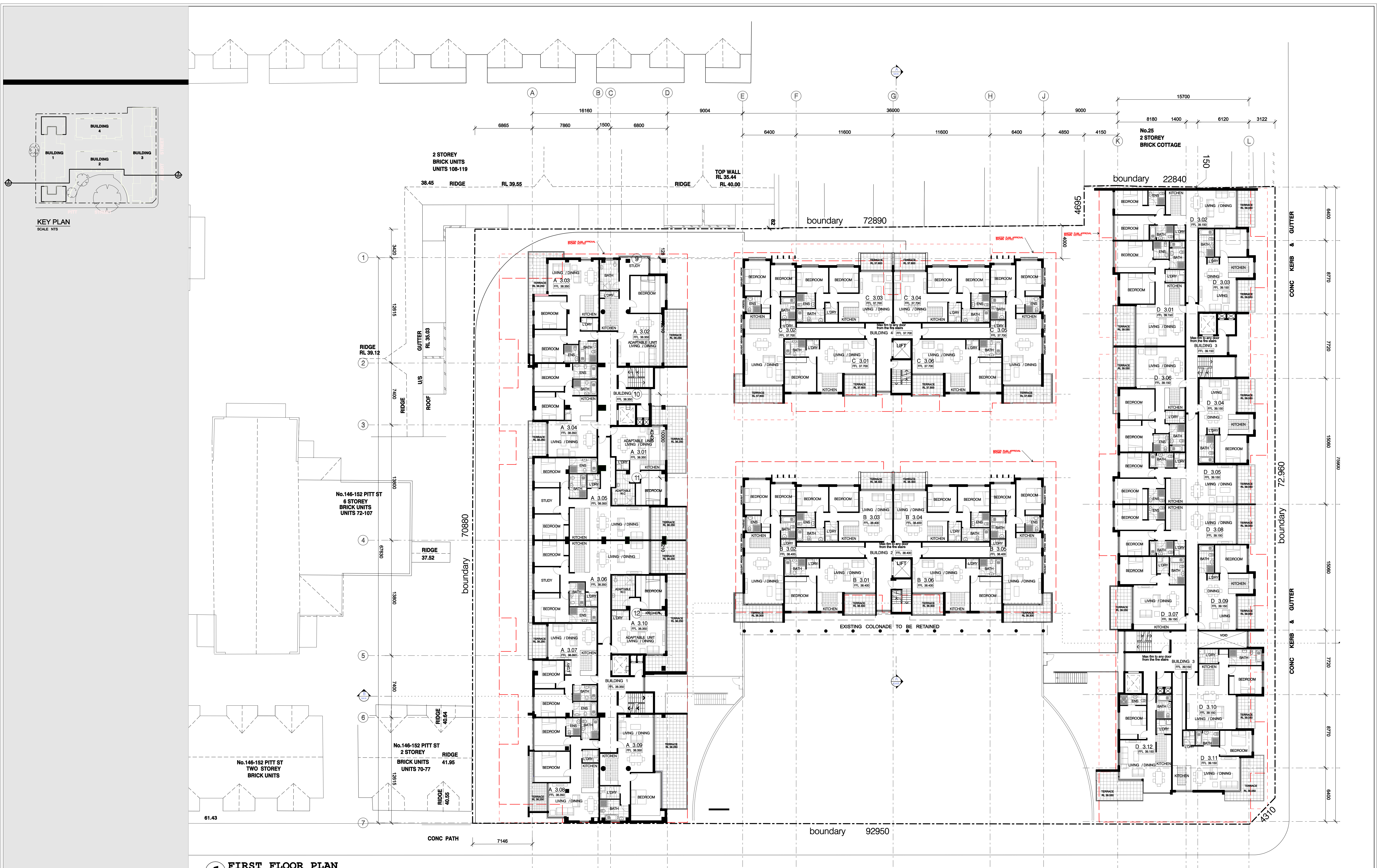
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1 SCALE 1:200







1 FIRST FLOOR PLAN
SCALE 1:200

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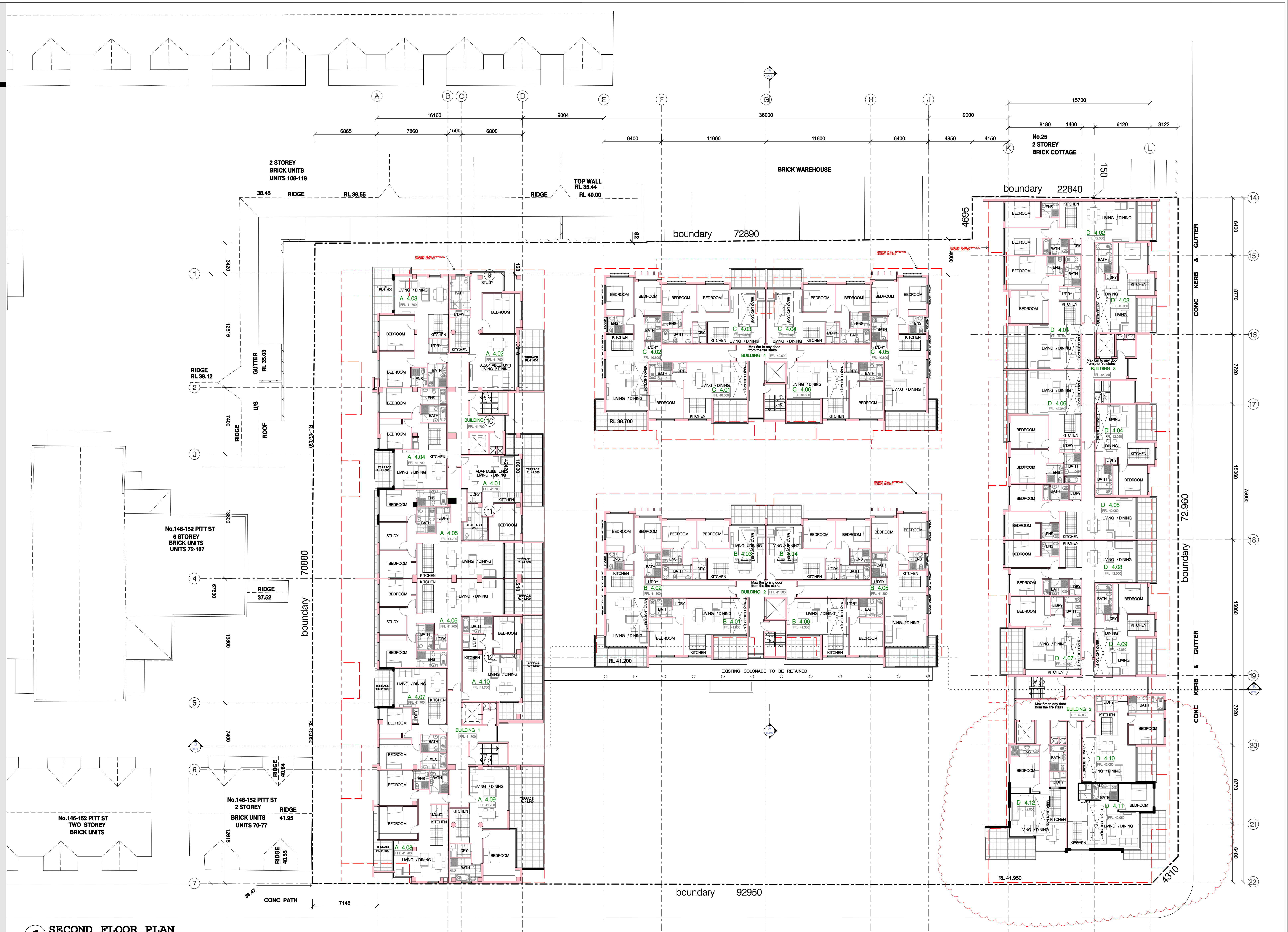
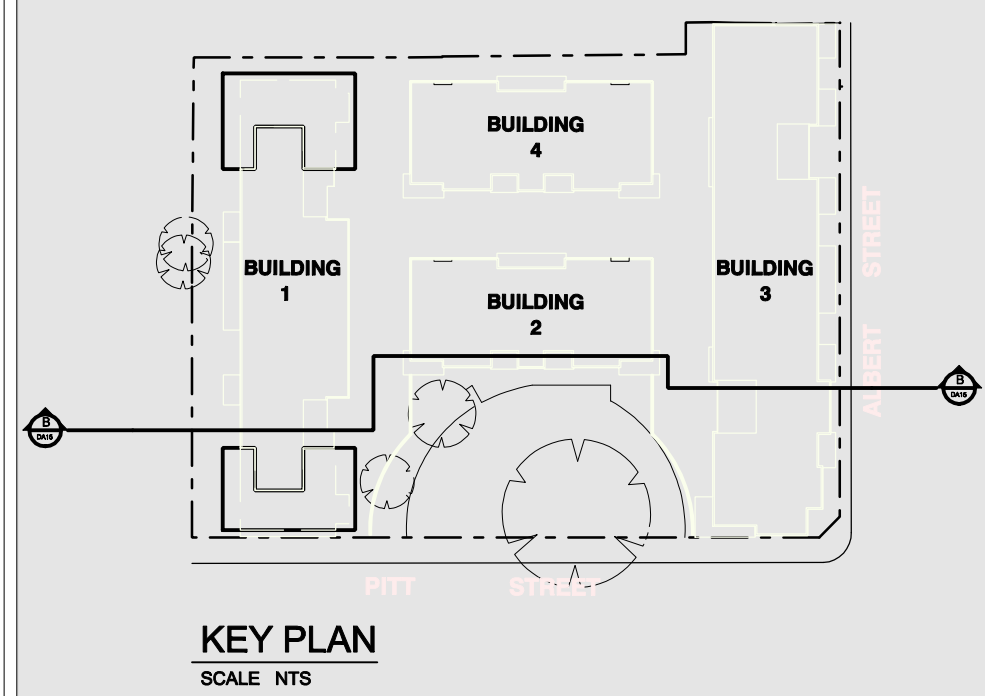
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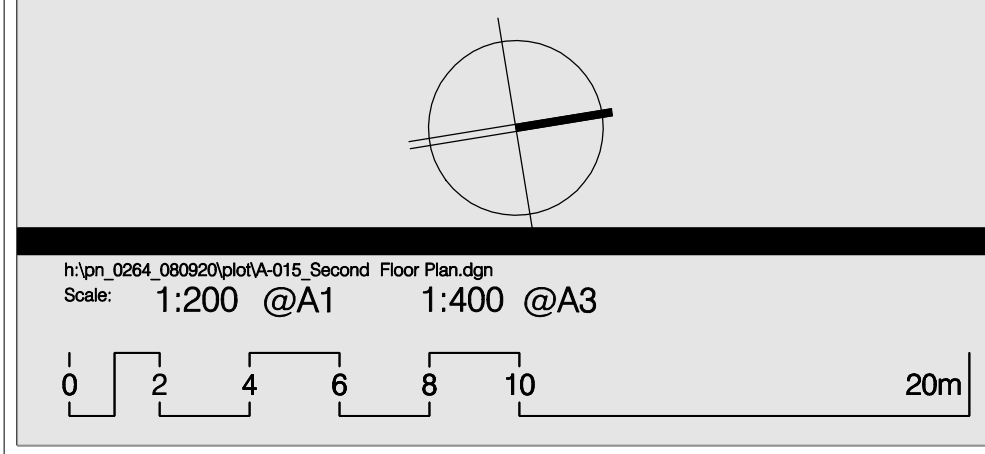
PROJECT	PITT ST REDFERN	
ADDRESS	134-144 PITT ST, REDFERN	

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DATE	18/09/10	TL
DATE	24/03/09	TL
DATE	04/12/08	TL
DATE		APP'D

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Drawing Status:	AUTHORITY APPROVAL				
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1 SECOND FLOOR PLAN
SCALE 1:200



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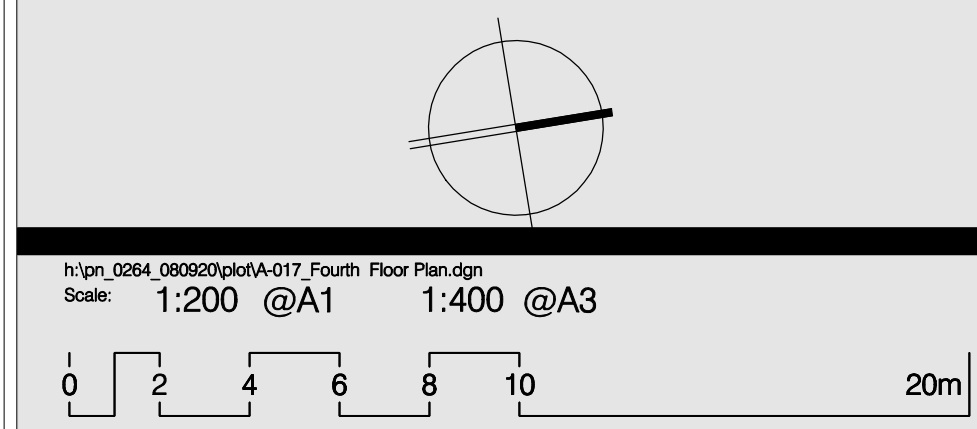
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TL	1	ISSUED TO THE DEPARTMENT OF PLANNING	24/03/09
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APPRO	DATE	REVISION DESCRIPTION	
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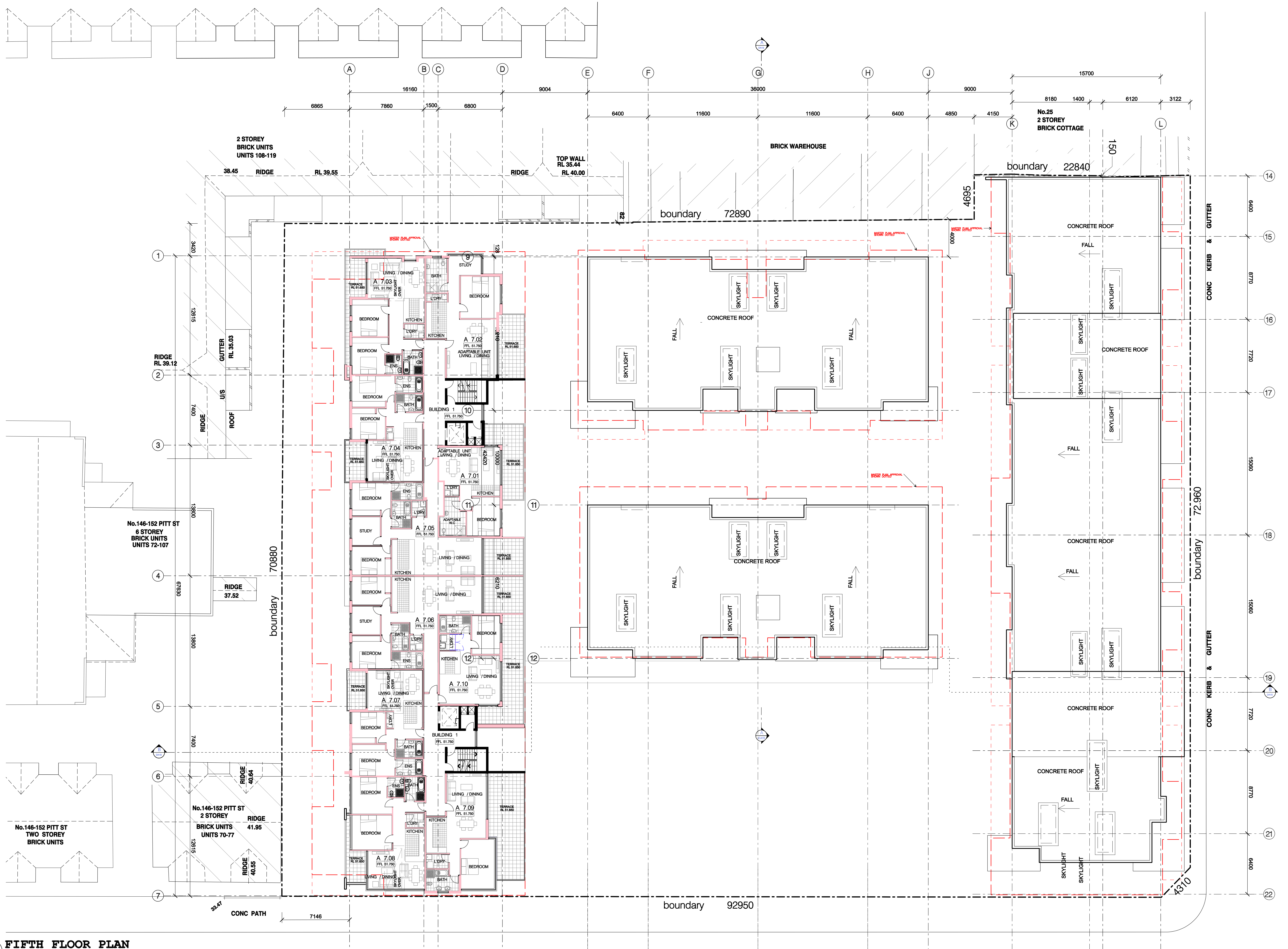
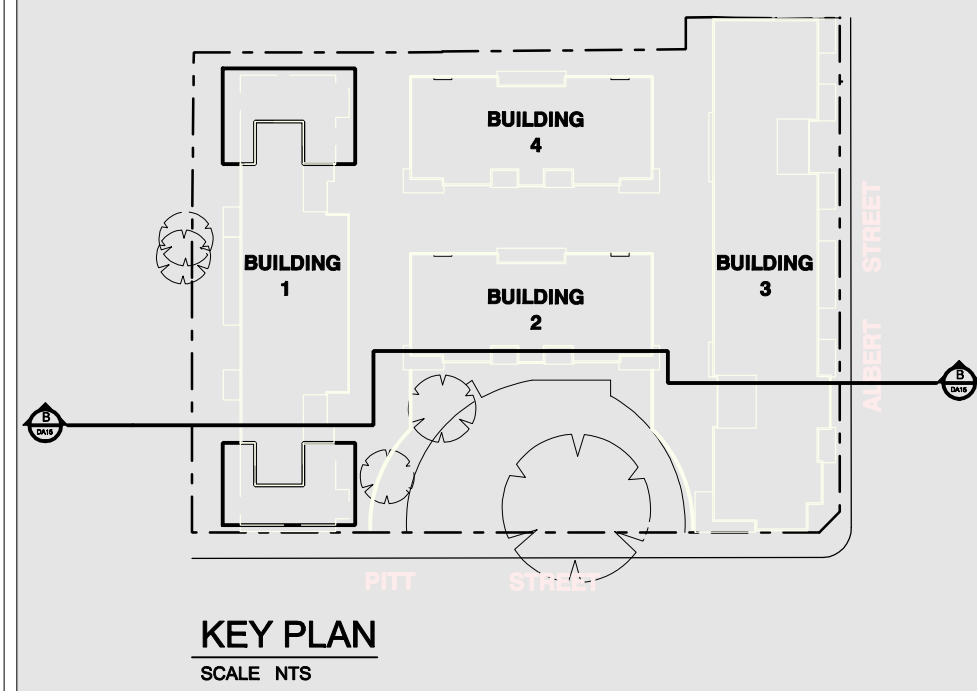
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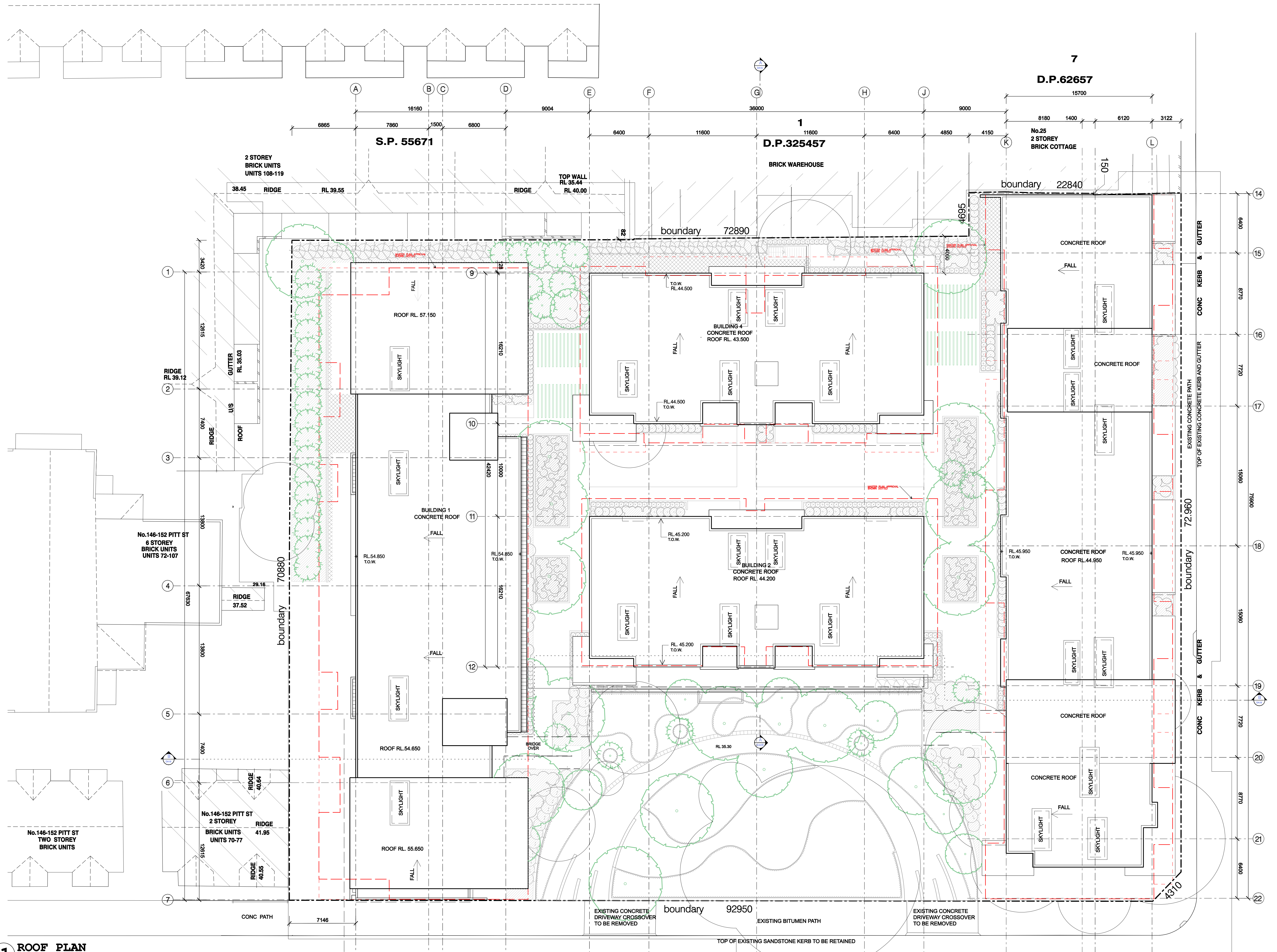
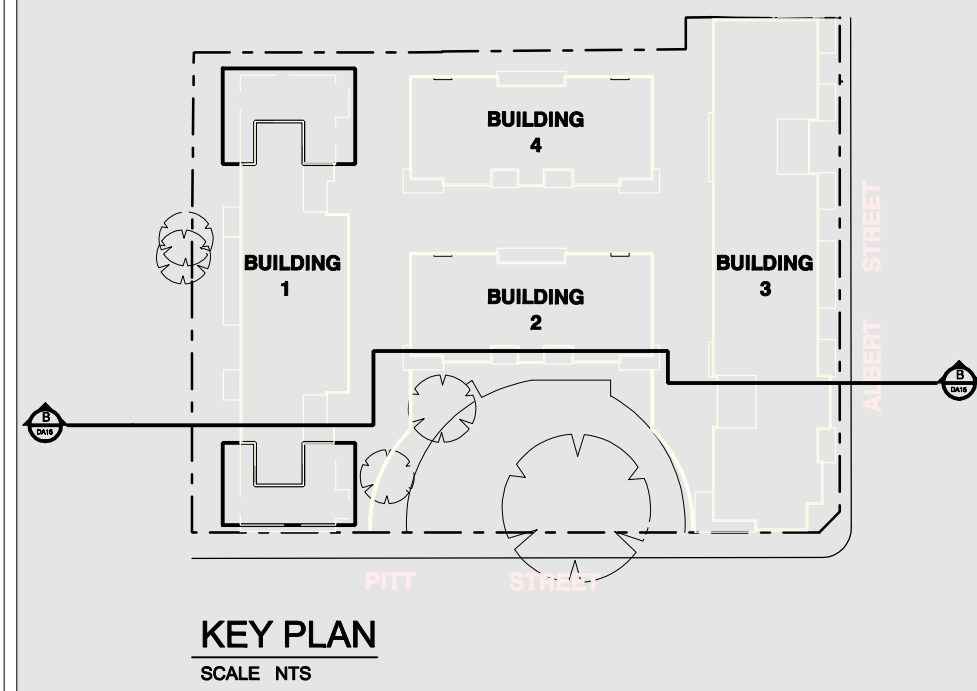
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1 FIFTH FLOOR PLAN
SCALE 1:200



1 ROOF PLAN
SCALE: 1:200

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Scale: 1:200 @A1 1:400 @A3
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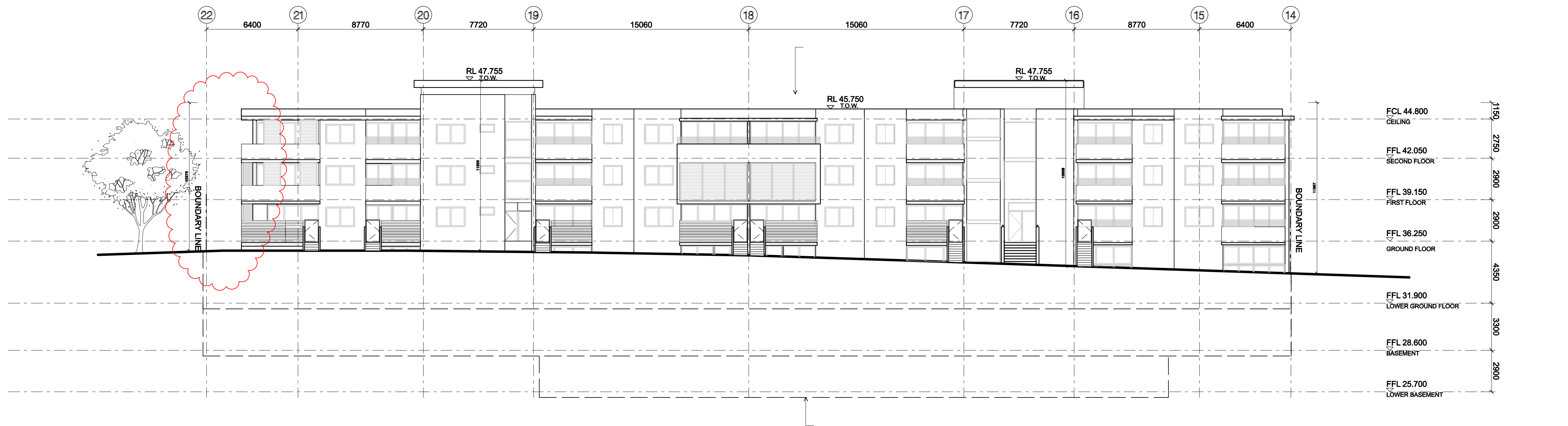
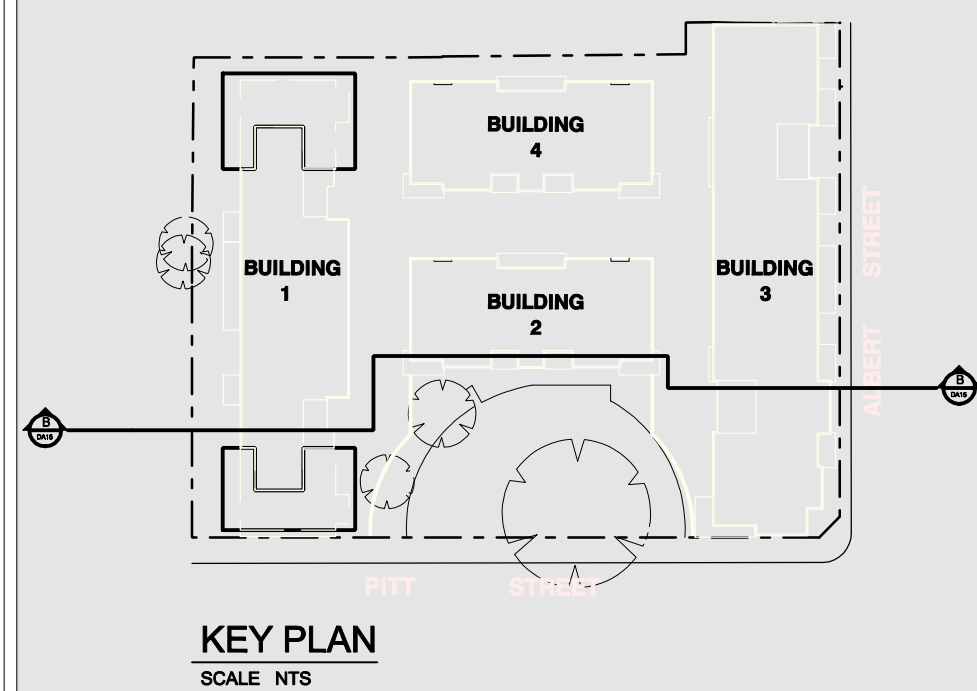
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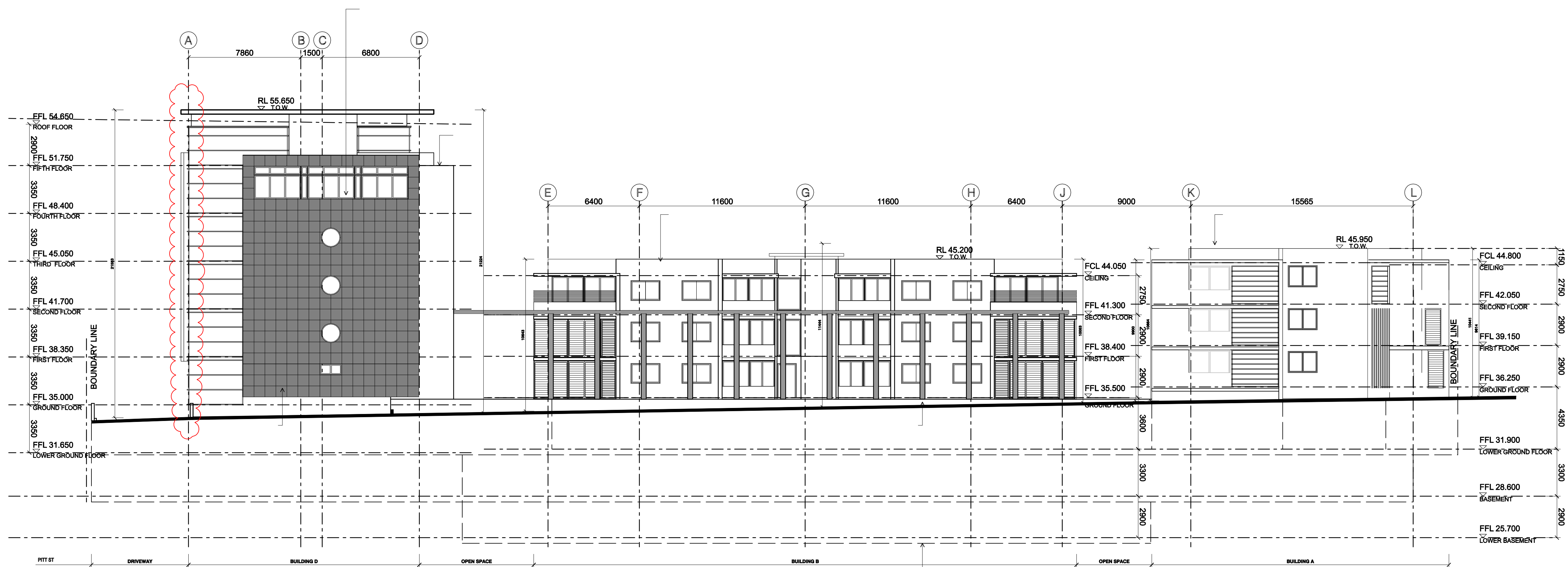
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TL 18/12/10
TL 18/09/09
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TL 04/12/08
APPROX DATE

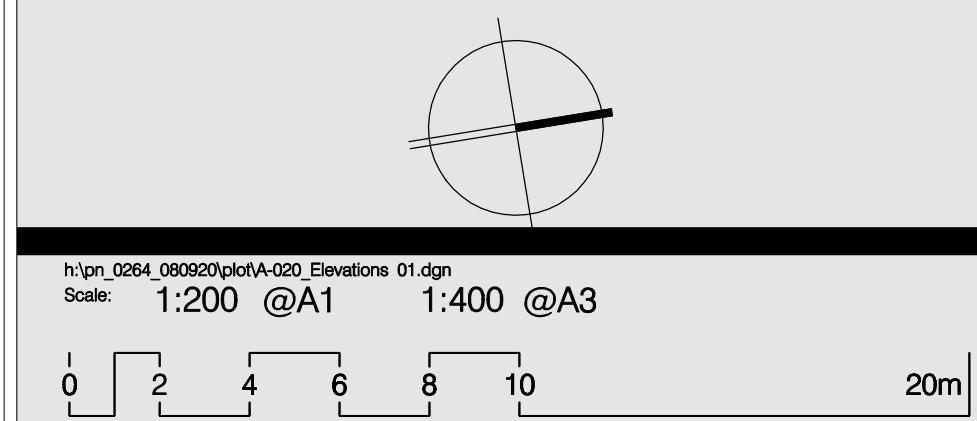
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Date Printed: **7/08/2012**
Issue: **D1**
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1 NORTH ELEVATION BUILDING 3 (ALBERT STREET VIEW)
SCALE 1:200



2 EAST ELEVATION BUILDINGS 1, 2 & 3 (PITT STREET VIEW)
SCALE 1:200



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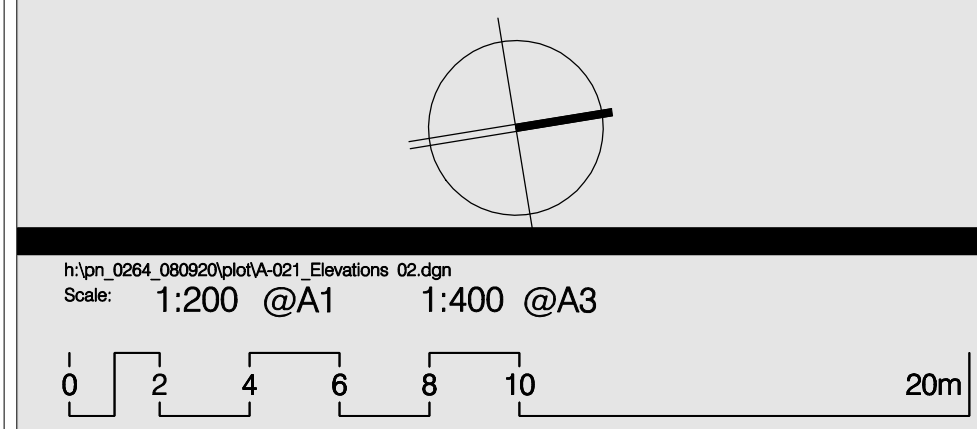
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Drawing Status: AUTHORITY APPROVAL

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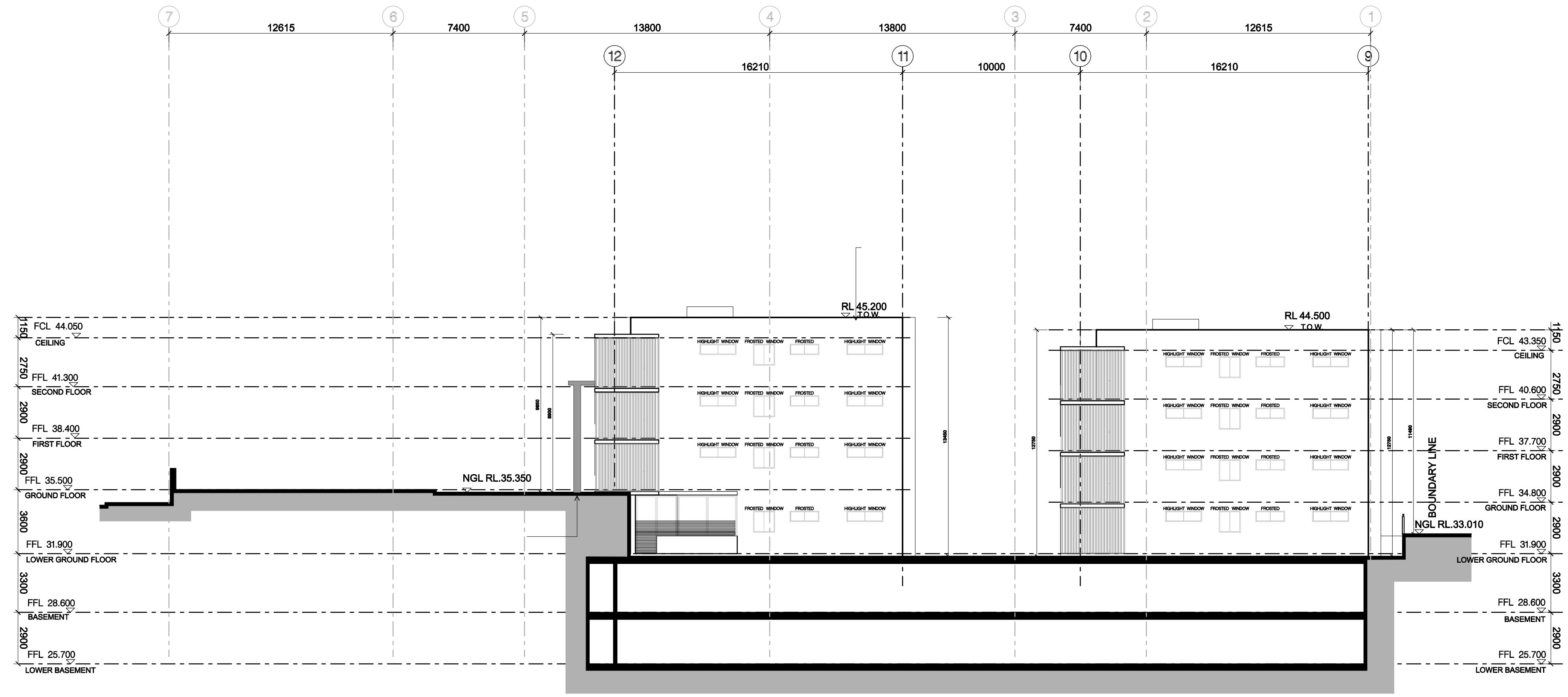
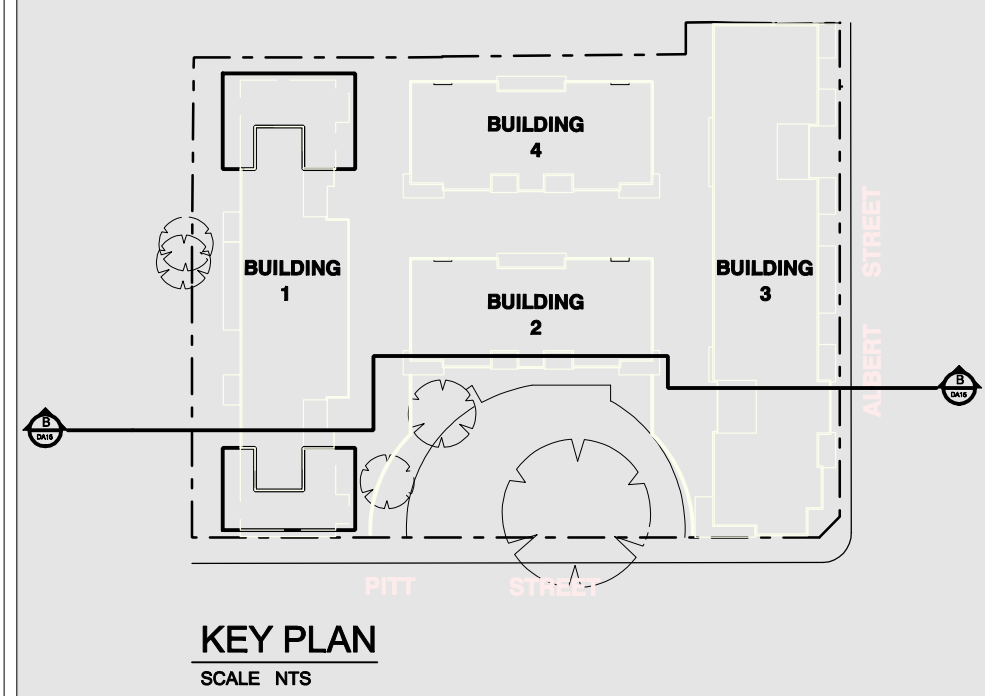
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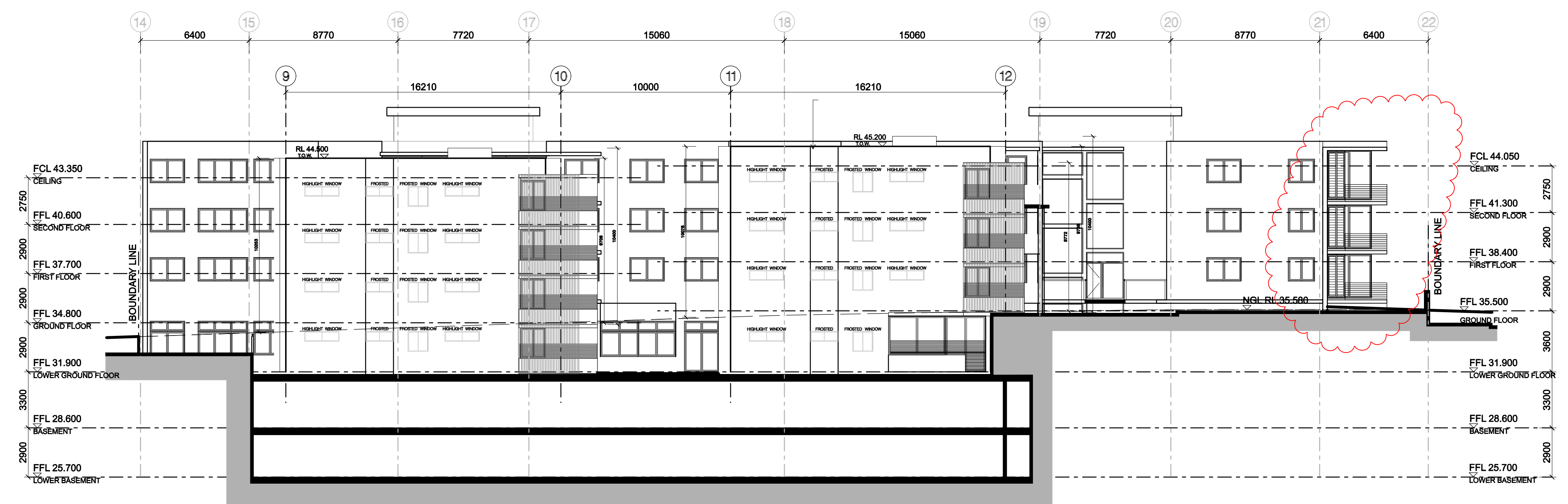


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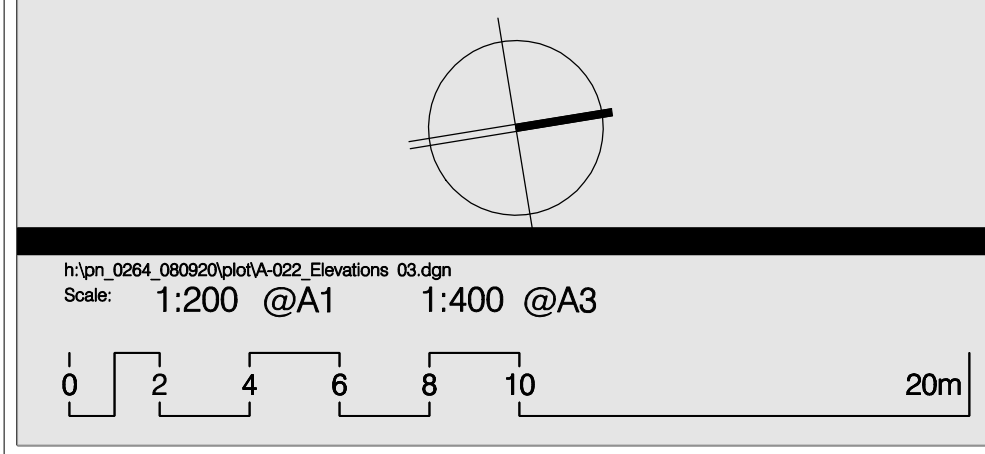
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1 NORTH ELEVATION BUILDING 2 & 4 WITH BUILDING 1 IN BACKGROUND
SCALE 1:200



2 SOUTH ELEVATION BUILDINGS 4 & 2 WITH BUILDING 3 IN BACKGROUND
SCALE 1:200



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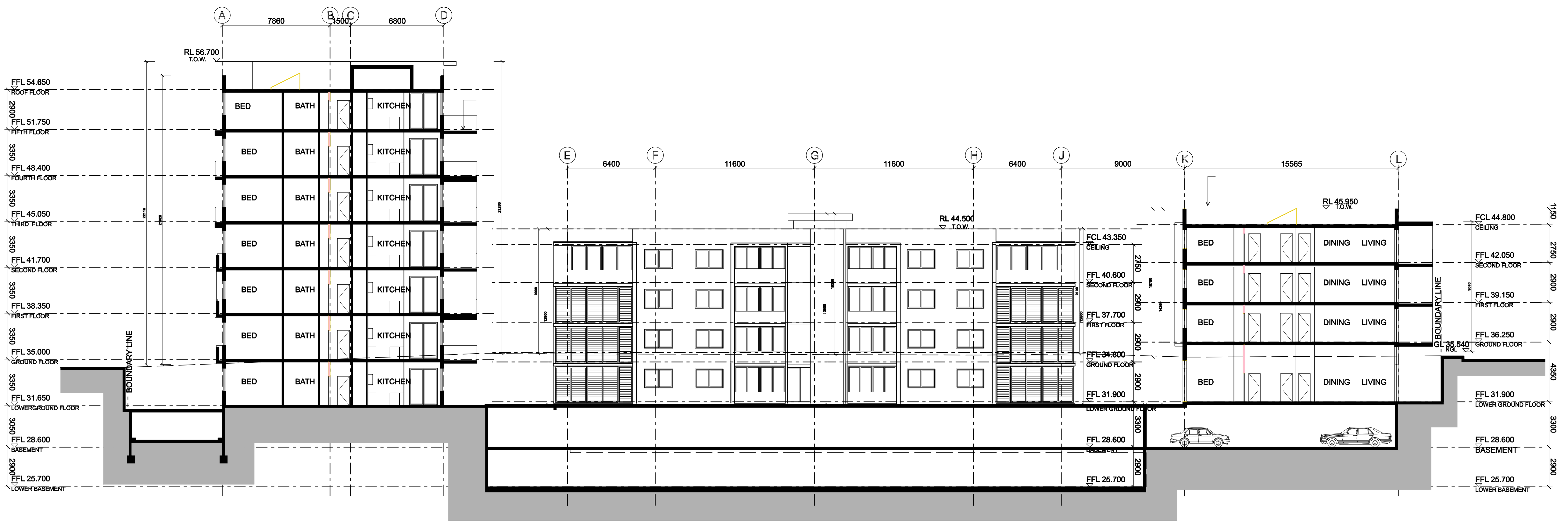
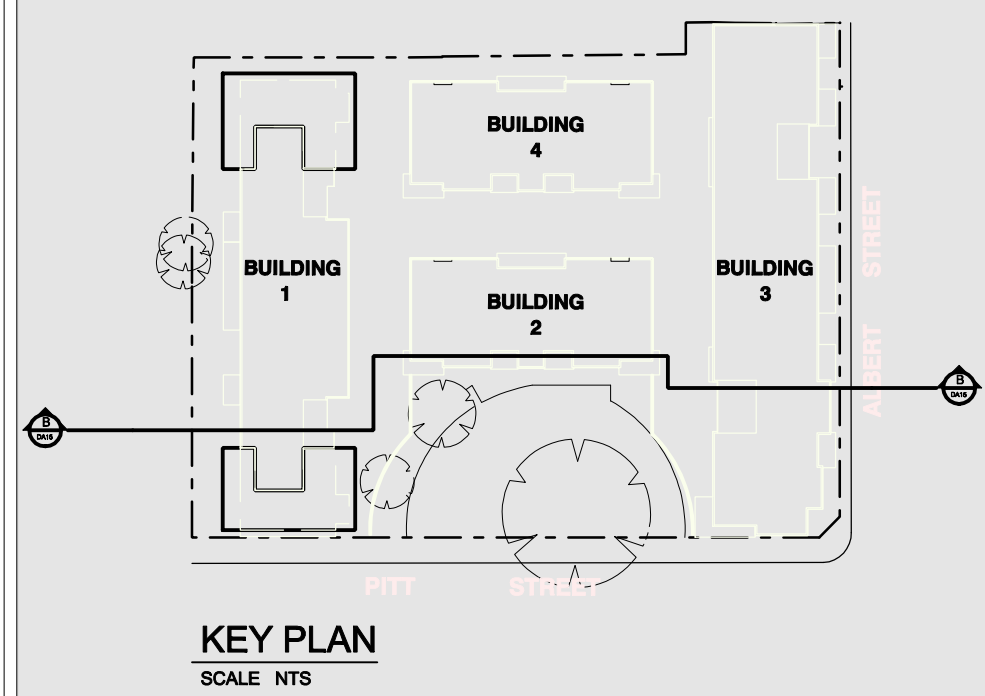
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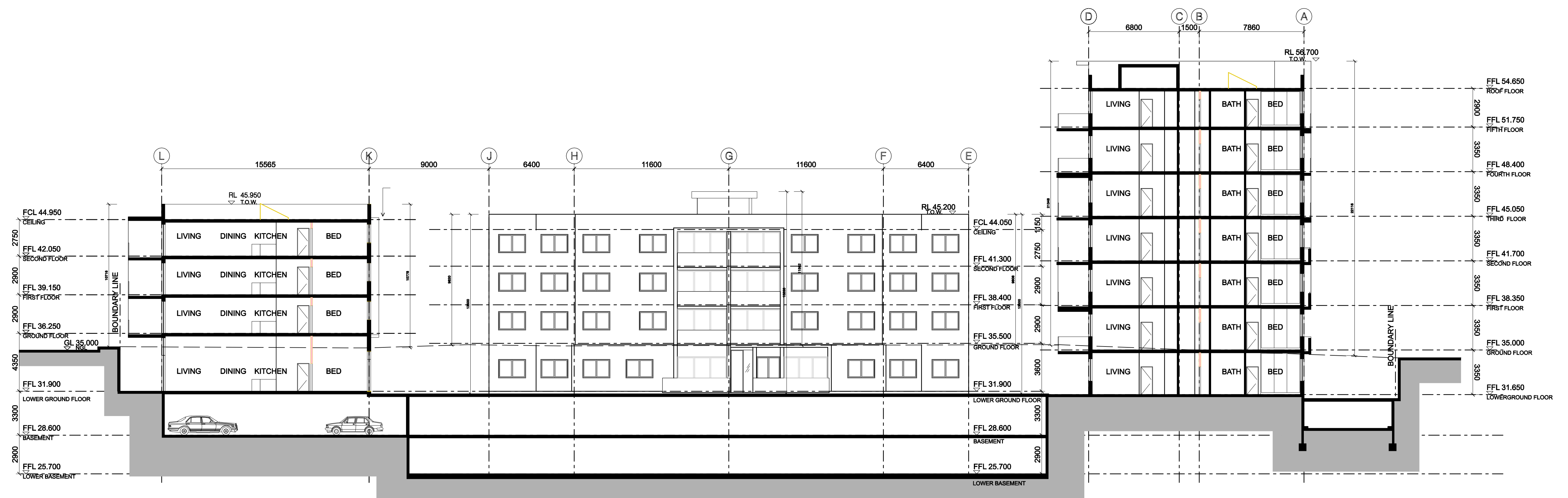
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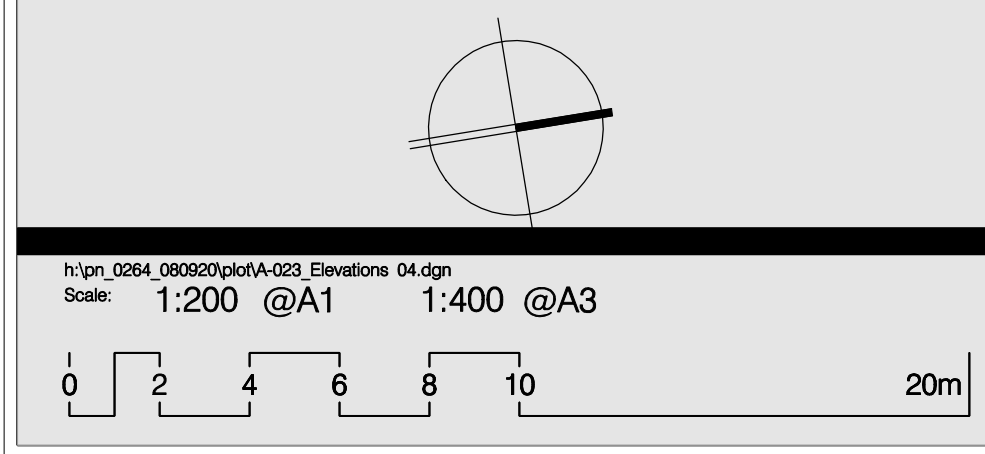
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1 EAST ELEVATION BUILDING 2
SCALE 1:200



2 WEST ELEVATION BUILDING 4
SCALE 1:200



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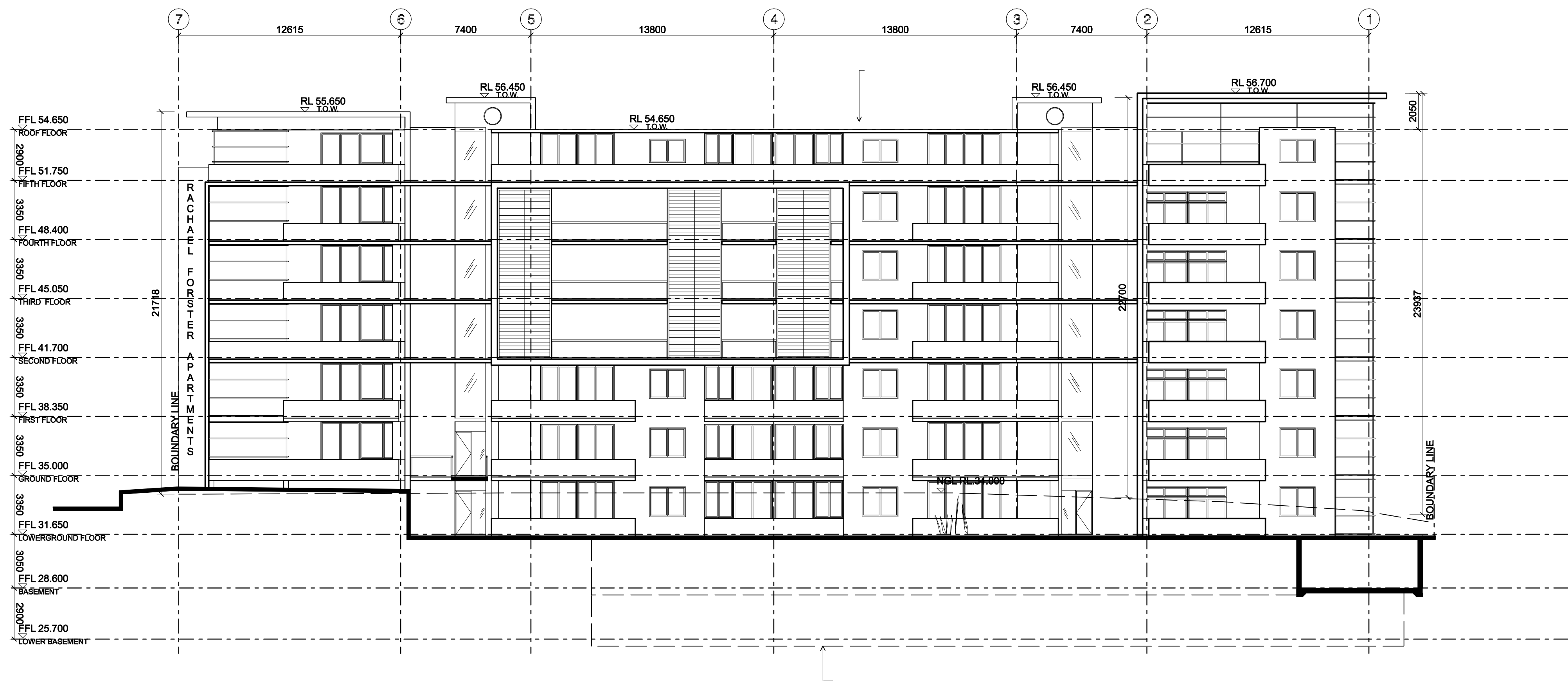
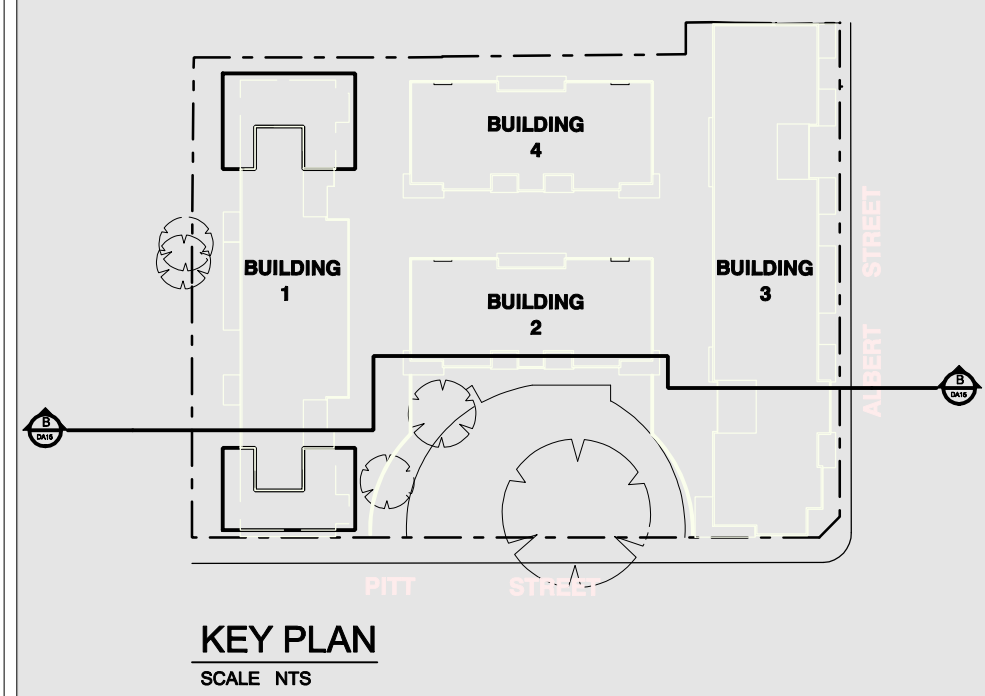
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Drawing Status:	AUTHORITY APPROVAL				
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TL	18/09/09	TL	24/03/09	TL	04/12/08
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ISSUE	REV	REVISION DESCRIPTION		APP'D	DATE
		AMENDMENTS			

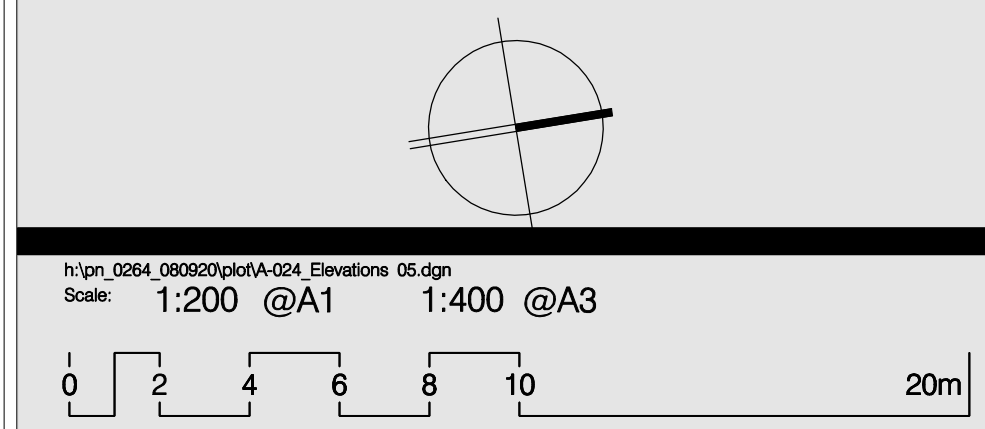
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1 NORTH ELEVATION BUILDING 1
SCALE 1:200



2 SOUTH ELEVATION BUILDING 3
SCALE 1:200



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APPENDIX B
QUALITY ASSURANCE / QUALITY CONTROL TABLES

Table QC1 - Containers, Preservation Requirements and Holding Times - Soil			
Parameter	Container	Preservation	Maximum Holding Time
Acid digestible metals and metalloids - Total and TCLP (As,Cd.,Cu,Cr,Ni,Pb,Zn)	Glass with Teflon Lid	Nil	6 months
Mercury	Glass with Teflon Lid	Nil	28 days
TPH / BTEX / VOC / SVOC / CHC	Glass with Teflon Lid	4°C, zero headspace	14 days
PAHs (total and TCLP)	Glass with Teflon Lid	4°C ¹	14 days
Phenols	Glass with Teflon Lid	4°C ¹	14 days
OCPs, OPPs and total PCBs	Glass with Teflon Lid	4°C ¹	14 days
Asbestos	Sealed Plastic Bag	Nil	N/A

Table QC2 - Containers, Preservation Requirements and Holding Times - Water			
Parameter	Container Volume (mL)	Preservation	Maximum Holding Time
Heavy Metals	125mL Plastic	Field filtration 0.45µm HNO ₃ / 4°C	6 months
Cyanide	125mL Amber Glass	pH > 12 NaOH / 4°C	6 months
TPH (C6-C9) / BTEX / VOCs SVOCs / CHCs	4 x 43mL Glass	HCl / 4°C ¹	14 days
TPH (C10-C36) / PAH / Phenolics OCP / OPP / TDS / pH	3 x 1L Amber Glass	None / 4°C ¹	28 days

Notes: ¹ = Extraction within 14 days, Analysis within 40 days.

Table QC3 - Analytical Parameters, PQLs and Methods - Soil			
Parameter	Unit	PQL	Method Reference
Metals in Soil			
Arsenic - As ¹	mg / kg	1	USEPA 200.7
Cadmium - Cd ¹	mg / kg	0.5	USEPA 200.7
Chromium - Cr ¹	mg / kg	1	USEPA 200.7
Copper - Cu ¹	mg / kg	1	USEPA 200.7
Lead - Pb ¹	mg / kg	1	USEPA 200.7
Mercury - Hg ²	mg / kg	0.1	USEPA 7471A
Nickel - Ni ¹	mg / kg	1	USEPA 200.7
Zinc - Zn ¹	mg / kg	1	USEPA 200.7
Total Petroleum Hydrocarbons (TPHs) in Soil			
C ₆ -C ₉ fraction	mg / kg	25	USEPA 8260
C ₁₀ -C ₁₄ fraction	mg / kg	50	USEPA 8000
C ₁₅ -C ₂₈ fraction	mg / kg	100	USEPA 8000
C ₂₉ -C ₃₆ fraction	mg / kg	100	USEPA 8000
BTEX in Soil			
Benzene	mg / kg	1	USEPA 8260
Toluene	mg / kg	1	USEPA 8260
Ethylbenzene	mg / kg	1	USEPA 8260
m & p Xylene	mg / kg	2	USEPA 8260
o- Xylene	mg / kg	1	USEPA 8260
Other Organic Contaminants in Soil			
PAHs	mg / kg	0.05-0.2	USEPA 8270
CHCs	mg / kg	1	USEPA 8260
VOCs	mg / kg	1	USEPA 8260
SVOCs	mg / kg	1	USEPA 8260
OCPs	mg / kg	0.1	USEPA 8140, 8080
OPPs	mg / kg	0.1	USEPA 8140, 8080
PCBs	mg / kg	0.1	USEPA 8080
Phenolics	mg / kg	5	APHA 5530
Asbestos			
Asbestos	mg / kg	Presence / Absence	AS4964-2004

Notes:

1. Acid Soluble Metals by ICP-AES
2. Total Recoverable Mercury

Table QC4 - Analytical Parameters, PQLs and Methods - Groundwater

Parameter	Unit	PQL	Method	Parameter	Unit	PQL	Method
Heavy Metals				Chlorinated Hydrocarbons (CHCs)			
Antimony - Sb	µg/L	1	USEPA 200.8	1,2-dichlorobenzene	µg/L	1	USEPA 8260B
Arsenic - As	µg/L	1	USEPA 200.8	1,3-dichlorobenzene	µg/L	1	USEPA 8260B
Beryllium - Be	µg/L	0.5	USEPA 200.8	1,4-dichlorobenzene	µg/L	1	USEPA 8260B
Cadmium - Cd	µg/L	0.1	USEPA 200.8	1,2,3-trichlorobenzene	µg/L	1	USEPA 8260B
Chromium - Cr	µg/L	1	USEPA 200.8	1,2,4-trichlorobenzene	µg/L	1	USEPA 8260B
Cobalt - Co	µg/L	1	USEPA 200.8	Hexachlorobutadiene	µg/L	1	USEPA 8260B
Copper - Cu	µg/L	1	USEPA 200.8	1,1,2-trichloroethane	µg/L	1	USEPA 8260B
Lead - Pb	µg/L	1	USEPA 200.8	Hexachloroethane	µg/L	10	USEPA 8270D
Mercury - Hg	µg/L	0.5	USEPA 7471A	Other CHCs	µg/L	1	USEPA 8260B
Molybdenum - Mo	µg/L	1	USEPA 200.8	Volatile Organic Compounds (VOCs)			
Nickel - Ni	µg/L	1	USEPA 200.8	Aniline	µg/L	10	USEPA 8260B
Selenium - Se	µg/L	1	USEPA 200.8	2,4-dichloroaniline	µg/L	10	USEPA 8260B
Silver - Ag	µg/L	1	USEPA 200.8	3,4-dichloroaniline	µg/L	10	USEPA 8260B
Tin (inorg.) - Sn	µg/L	1	USEPA 200.8	Nitrobenzene	µg/L	50	USEPA 8260B
Nickel - Ni	µg/L	1	USEPA 200.8	2,4-dinitrotoluene	µg/L	50	USEPA 8260B
Zinc - Zn	µg/L	1	USEPA 200.8	2,4,6-trinitrotoluene	µg/L	50	USEPA 8260B
Total Petroleum Hydrocarbons (TPHs)				Phenolic Compounds			
C ₆ -C ₉ fraction	µg/L	10	USEPA 8220A / 8000	Phenol	µg/L	10	USEPA 8041
C ₁₀ -C ₁₄ fraction	µg/L	50	USEPA 8000	2-chlorophenol	µg/L	10	USEPA 8041
C ₁₅ -C ₂₈ fraction	µg/L	100	USEPA 8000	4-chlorophenol	µg/L	10	USEPA 8041
C ₂₉ -C ₃₆ fraction	µg/L	100	USEPA 8000	2, 4-dichlorophenol	µg/L	10	USEPA 8041
BTEX				2,4,6-trichlorophenol	µg/L	10	USEPA 8041
Benzene	µg/L	1	USEPA 8220A	2,3,4,6-tetrachlorophenol	µg/L	10	USEPA 8041
Toluene	µg/L	1	USEPA 8220A	Pentachlorophenol	µg/L	10	USEPA 8041
Ethylbenzene	µg/L	1	USEPA 8220A	2,4-dinitrophenol	µg/L	10	USEPA 8041
m- & p-Xylene	µg/L	2	USEPA 8220A	Miscellaneous Parameters			
o-Xylene	µg/L	1	USEPA 8220A	Total Cyanide	µg/L	5	APHA 4500C&E-CN
Polycyclic Aromatic Hydrocarbons (PAHs)				Fluoride	µg/L	10	APHA 4500 F-C
PAHs	µg/L	0.1	USEPA 8270	Salinity (TDS)	mg/L	1	APHA 2510
Benzo(a)pyrene	µg/L	0.01	USEPA 8270	pH	units	0.1	APHA 4500H+
OrganoChlorine Pesticides (OCPs)				OrganoPhosphate Pesticides (OPPs)			
Aldrin	µg/L	0.001	USEPA 8081	Azinphos Methyl	µg/L	0.01	USEPA 8141
Chlordane	µg/L	0.001	USEPA 8081	Chloropyrifos	µg/L	0.01	USEPA 8141
DDT	µg/L	0.001	USEPA 8081	Diazinon	µg/L	0.01	USEPA 8141
Dieldrin	µg/L	0.001	USEPA 8081	Dimethoate	µg/L	0.01	USEPA 8141
Endosulfan	µg/L	0.001	USEPA 8081	Fenitrothion	µg/L	0.01	USEPA 8141
Endrin	µg/L	0.001	USEPA 8081	Malathion	µg/L	0.01	USEPA 8141
Heptachlor	µg/L	0.001	USEPA 8081	Parathion	µg/L	0.01	USEPA 8141
Lindane	µg/L	0.001	USEPA 8081	Temephos	µg/L	0.01	USEPA 8141
Toxaphene	µg/L	0.001	USEPA 8081	Polychlorinated Biphenyls (PCBs)			
				Individual PCBs	µg/L	0.01	USEPA 8081

Table QC5 - QC Sample Data Acceptance Criteria		
QC Sample Type	Method of Assessment	Acceptable Range
Field QC		
Blind Duplicates and Split Samples	The assessment of split duplicate is undertaken by calculating the Relative Percent Difference (RPD) of the duplicate concentration compared with the primary sample concentration. The RPD is defined as: $RPD = 100 \times \frac{ X_1 - X_2 }{\text{mean}(X_1, X_2)}$ Where: X_1 and X_2 are the concentrations of the primary and duplicate samples.	The acceptable range depends upon the levels detected: - 0-150% RPD (when the average concentration is <5 times the LOR/PQL) - 0-75% RPD (when the average concentration is 5 to 10 times the LOR/PQL) - 0-50% RPD (when the average concentration is >10 times the LOR/PQL)
Rinsate & Trip Blanks	Each blank is analysed as per the original samples.	Analytical Result <LOR/PQL
Laboratory prepared Trip Spike	The Trip Spike is analysed after returning from the field and the % recovery of the known spike is calculated.	70 - 130%
Laboratory QC		
Laboratory Duplicates	Assessment of Lab Duplicate RPD as per Blind Duplicates and Split Samples.	Lab Duplicate RPD < 15% (Inorganics) Lab Duplicate RPD < 30% (Organics) for sample results > 10 LOR
Surrogates	Assessment is undertaken by determining the percent recovery of the known surrogate spike (SS) or addition to the sample.	at least 2 SS recoveries to be within 70-130% subject to matrix effects (Organics)
Matrix Spikes Laboratory Control Samples	$\% \text{ Recovery} = 100 \times \frac{C - A}{B}$ Where: A = Concentration of analyte determined in the original sample; B = Added Concentration; and C = Calculated Concentration.	80-120% (Inorganics / Metals) 60-140% (Organics) 10-140% (SVOC and Speciated Phenols) If the result is outside the above ranges, the result must be <3x Standard Deviation of the Historical Mean (calculated over the past 12 months).
Sample Matrix Spike Duplicates	Recovery RPD	<30% (Inorganics & Organics)
Calibration Check Standards	Continuous Calibration Verification (CCV)	CCV must be within ±15% (inorganics) CCV must be within ±25% (inorganics)
Reagent, Method & Calibration Check Blanks	Each blank is analysed as per the original samples.	Analytical Result <LOR/PQL
Note: PQL - Laboratory Practical Quantitation Limit (PQL) or the minimum detection limit for a particular analyte. LOR = Limit of Reporting		

SGS Environmental Services is accredited by NATA for Chemical Testing (Reg.No.2562) and Quality System compliance to ISO/IEC 17025. The QC parameters contained within are designed to meet NEPM 1999 requirements.

Quality Control samples included in any analytical run are listed below.

Reagent/Analysis Blank (BLK) Method Blank (MB)	Sample free reagents carried through the preparation/extraction/digestion procedure and analysed at the beginning of every sample batch analysis. A reagent blank is prepared and analysed with every batch of samples plus with each new batch of solvent prior to use.
Sample Matrix Spike (MS) & Matrix Spike Duplicate (MSD)	Sample replicates spiked with identical concentrations of target analyte(s). The spiking occurs during the sample preparation and <u>prior to the extraction/digestion procedure</u> . They are used to document the precision and bias of a method in a given sample matrix. Where there is not enough sample available to prepare a spiked sample, another known soil/sand or water may be used. A duplicate spiked sample is analysed at least every 20 samples.
Surrogate Spike (SS)	At least one but up to three surrogate compounds are added to all samples requiring analysis for organics prior to extraction. Used to determine the extraction efficiency. They are organic compounds which are similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which are not normally found in environmental samples. Where possible they are surrogate compounds recommended by the USEPA.
Control Matrix Spike (CMS)	To ensure spike recoveries can be determined for every batch of samples a control matrix is spiked with identical concentrations of target analyte(s) and then analysed. These results allow recoveries to be determined in the event that the matrix spikes are unusable (eg. matrix spikes performed on heavily contaminated samples). These are analysed at least every 20 samples.
Internal Standard (IS)	Added to all samples requiring analysis for organics (where relevant) after the extraction process; the compounds serve to give a standard of retention time and response, which is invariant from run-to-run with the instruments. Where possible they are standard compounds recommended by the USEPA.
Lab Duplicates (D)	A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Lab Control Standards/Samples (LCS)	Prepared from a source independent of the calibration standards. At least one control standard is included in each run to confirm calibration validity. Thereafter they are analysed at least every one in 20 samples plus at the end of each analytical run. This data is not reported.
Continuous Calibration Verification (CCV) or Calibration Check Standard & Blank	A calibration check standard or CCV and blank are run after every 20 samples of an instrumental analysis run to assess analytical drift. Calibration Standards are checked old versus new with a criteria of $\pm 10\%$

Quality Assurance Programs are listed below:

Statistical analysis of Quality Control data (SQC)	Quality control data is plotted on control charts using the APHA procedure with warning and control limits at 2 and 3 standard deviations respectively. See also QMS Procedure "Statistical Quality Control".
Certified Reference Materials (CRM/SRM)	Certified Reference Materials and Standards are regularly analysed. These materials/standards have certified reference values for various parameters.
Proficiency Testing	Regular proficiency test samples are analysed by our laboratories. SGS Environmental participates in a number of programs. Results and proficiency status are compiled and sent to participating laboratory post data interpretation. Failure to comply with acceptable values result in further investigations.
Inter-laboratory & Intra-laboratory Testing	SGS Environmental Services has schedules in the Quality Systems to participate in Inter/Intra laboratory testing conducted internally and by other parties.
Data Acceptance Criteria Unless otherwise specified in the method or method manual the following general criteria apply to all inorganic tests. All recoveries are to be reported to 3 significant figures.	Failure to meet the internal acceptance criteria will result in sample batch repeats dependent upon investigation outcomes. For data to be accepted: <u>Inorganics (water samples)</u> - For all inorganic analytes the Reagent & Method Blanks must be less than the LOR. - The Calibration Check Standards or Continuous Calibration Verification (CCV) must be within $\pm 15\%$. - Control Standards must be 80-120% of the accepted value. - The Calibration Check Blanks must be less than the LOR. - Lab Duplicates RPD to be $<15\%$. Note: If client <u>field</u> duplicates do not meet this criteria it may indicate heterogeneity and shall be noted on the data reports for QC samples. - Sample (and if applicable Control) Matrix Spike^d Duplicate recovery RPD to be $<30\%$. - Where CRMs are used, results to be within ± 2 standard deviations of the expected value. <u>Inorganics (soil samples)</u> - For all inorganic analytes the Reagent & Method Blanks must be less than the LOR. - The Calibration Check Standards or Continuous Calibration Verification (CCV) must be within $\pm 15\%$. - Control Standards must be 80-120% of the accepted value. - The Calibration Check Blanks must be less than the LOR. - Lab duplicate RPD to be $<30\%$* for sample results greater than 10 times LOR. - Sample Matrix Spike Duplicate (MS^d/MSD) recovery RPD to be $<30\%$. In the event that the matrix spike has been applied to samples whose matrix or contamination is problematic to the method then these acceptance criteria apply to the Control Matrix Spike (CMS/D). - Where CRMs are used, results to be within ± 2 standard deviations of the expected value.

Data Acceptance Criteria

Unless otherwise specified in the method or method manual the following general criteria apply to all organic tests.

All recoveries are to be reported to 3 significant figures.

Organics

- Volatile & extractable Reagent & Method Blanks must contain levels less than or equal to LOR.
- The Calibration Check Standards or Continuous Calibration Verification (CCV) must be within $\pm 25\%$. Some analytes may have specific criteria.
- Control Standards (LCS/CMS) and Certified Reference Materials (CRM) recoveries are to be within established control limits or as a default 60-140% unless compound specific limits apply.
- Retention times are to vary by no more than 0.2 min.
- **At least two of three** routine level soil sample Surrogate Spike (SS) recoveries are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as acceptance criterion. Any recoveries outside these limits will have comment.
- Water sample Surrogates Spike (SS) recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion. Any recoveries outside these limits will have comment.
- Lab Duplicates (D) must have a RPD $< 30\%^*$.
- Sample Matrix Spike Duplicate (MS^d/MSD) recovery RPD to be $< 30\%$. In the event that the matrix spike has been applied to samples whose matrix or contamination is problematic to the method then these acceptance criteria apply to the Control Matrix Spike (CMS/D).

*Only if results are at least 10 times the LOR otherwise no acceptance criteria for RPD's apply.

Application of more stringent criteria shall be applied for clean water sample from water boards and any other nominated client contracts. Nominal 10xLOR criteria are dropped to 5xLOR where specified.

^dMatrix do not readily equate to definitive recovery due to inherent matrix interferences and thus do not have recovery compliance values set. As a guide inorganic recoveries should be between 70-130% and for organics 60-130%

Batch Structure Summary

An analytical batch is nominally considered as 20 samples or smaller. As a standard template the following should be **used as a guide** according to the above Quality Control Types:

1	MB	16	UNK_DUP
2	STD1	17	MS
3	STD2	18	MS_DUP
4	STD3	19	UNK 11
5	LCS	20	UNK 12
6	BLK	21	UNK 13
7	UNK 1	22	UNK 14
8	UNK 2	23	UNK 15
9	UNK 3	24	UNK 16
10	UNK 4	25	UNK 17
11	UNK 5	26	UNK 18
12	UNK 6	27	UNK 19
13	UNK 7	28	UNK 20 (SS if applicable)
14	UNK 8	29	UNK_DUP
15	UNK 9	30	CCV
16	UNK 10 (SS if applicable)	31	CRM / SRM / CMS / LCS