Douglas Partners
Geotechnics / Environment / Groundwater

Report on
Geotechnical and Hydrogeological Assessment

Proposed Scottish Hospital Redevelopment
Nield Avenue, Paddington

Prepared for
The Presbyterian Church (NSW) Property Trust

Project 71484.01
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Integrated Practical Solutions

Douglas Partners
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Geotechnical and Hydrogeological Assessment
Proposed Scottish Hospital Redevelopment
Nield Avenue, Paddington

1. Introduction

This report presents the results of a geotechnical and hydrogeological assessment for proposed redevelopment of the Scottish Hospital at Nield Avenue, Paddington. The work was requested by Cerno Management, the project managers, acting on behalf of The Presbyterian Church (NSW) Property Trust.

The construction of four multi-storey buildings with associated one to two levels of basements for carparking is proposed. The buildings will range from four to six storeys in height. Geotechnical assessment was carried out to put together available information on the existing geological profile for feasibility planning and preliminary design of basements and foundations.

The geotechnical and hydrogeological assessment comprised collecting and reviewing previous investigations carried out in the area, a review of the preliminary schematics of the proposed development and a site walkover by an experienced geotechnical engineer. Details of the documents reviewed in this assessment are given in this report, together with information on likely subsurface conditions and properties followed by comments relevant to design and construction practice.

2. Background

Several geotechnical investigations and environmental assessments have been carried out for various proposed developments on the Scottish Hospital site by Douglas Partners Pty Ltd (DP) and Dames & Moore Pty Ltd (DM), now URS Australia Pty Ltd. These reports are listed below:

- DP Report on Geotechnical Investigation for a Proposed Nursing Home Extension (Project 28538A dated 29 June 2000). The extension was to be in the central section of the site, in-between the existing nursing home and the operating theatre.
- DP Report on Contamination Assessment for a Proposed Nursing Home Extension (Project 28538A dated 6 July 2000). This assessment was carried out in conjunction with the aforementioned geotechnical investigation.
- DP Report on Hydrogeological Assessment for a Proposed Nursing Home Extension (Project 28538A dated 6 July 2000). This assessment was carried out in conjunction with the aforementioned geotechnical investigation.
- DP Letter Report on Geotechnical Investigation (Project 28538 dated 29 September 1999). This factual report was carried out in the central section of the site, in-between the existing nursing home and the operating theatre.
- DP Report on Geotechnical Investigation for a two storey extension (Project 13895 dated 9 July 1990). The extension was to be in the south-east corner of the site.

- DM Report on Geotechnical Investigation for the Theatre Complex (Ref: 08061-002-70 dated June 1984). The Theatre Complex was constructed and present on-site.
- Results from DM boreholes drilled in 1974 for the Nursing Home Building proposed on site about that time and still in use.

The investigations have used similar numbering systems. To avoid confusion, some of the test bores and pits have been allocated new numbers for the purpose of this report. These allocated numbers are listed in Table 1. The relevant results from each investigation have been included in separate Appendices of this report (refer Table 1 for Appendix reference).

Table 1: Historical Boreholes Allocated Numbering System

Investigation	Original Numbers	Allocated Numbers	Appendix
Douglas Partners 2000	Boreholes 1 to 4 and Boreholes 101 to 110	Boreholes 1 to 4 and Boreholes 101 to 110	C
Douglas Partners 1999	Boreholes 1 to 7	Boreholes 201 to 207	D
Douglas Partners 1990	Boreholes 1 to 4 Penetrometer 5 Test Pit 6	Boreholes 301 to 304 Penetrometer 305 Test Pit 306	E
Dames & Moore 1974	Boreholes 1 to 8	Boreholes 401 to 408	F
Dames & Moore 1984	Boreholes 9 to 12	Boreholes 409 to 412	G

The results and information contained within previous reports and drawings have been considered in formulation of the geological model of the site and preparation of comments provided in this present report.

3. Site Description

The site is located in Paddington in an area bounded by the following streets and public access areas:

- Brown Street to the west.
- Cooper Street to the south.
- Stephen Street and a walkway to the east.
- Nield Avenue and Dillon Street Reserve to the north.

The site is an irregular shaped area of about 1.47 hectares with maximum north – south and east – west dimensions of approximately 145 m and 120 m respectively. The site slopes and steps down to the north from Cooper Street at RL 29 – 30 relative to Australian Height Datum (AHD) to the boundary with Dillon Reserve at RL 14 – 16.

The Scottish Hospital grounds include three buildings (the Old Scottish Hospital; the existing Nursing Home and the Theatre Complex), a driveway off Nield Avenue and carpark at the northern end of the site, together with walkways and footpaths connecting buildings, grassed and garden areas which include numerous large trees. Woollahra Municipal Council's "Register of Significant Trees" indicates several significant trees on site. These include Moreton Bay and Port Jackson Figs, Norfolk Island

and Kauri Pines, a Weeping Lilly Pilly and a Holm Oak which range in height from 15 – 32 m and have canopy spreads of up to 33 m.

4. Regional Geology & Hydrogeology

Reference to the Sydney 1:100 000 Geological Series Sheet 9130 indicates that the site is underlain by Hawkesbury Sandstone of Triassic age on the western boundary and south-west corner. The bedrock is mantled by man-made fill overlying alluvial and estuarine deposits, comprising mainly peaty quartz sand, silt and clay, within the remainder of the site. A map showing the different geological units relative to the site boundaries is provided below in Figure 1.

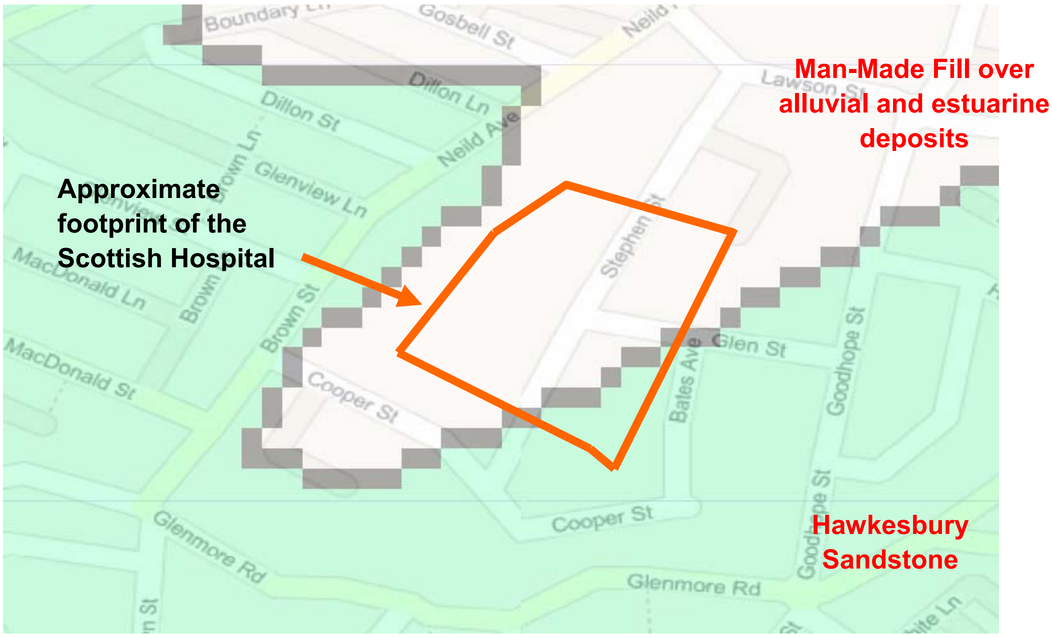


Figure 1: Distribution of Geological Units

The Hawkesbury Sandstone is generally well cemented and only in a few localities is there significant intergranular flow and little correlation between individual bores. Most water is encountered in the Hawkesbury Sandstone in fracture zones and bedding plane partings, the latter particularly in weathered zones. Flows rarely exceed 4 litres/sec, most being seeps in the order of 0.4 litres/sec or less. Occasionally weathered dykes act as barriers to water movement and there may be local relatively rapid initial flow, when such a barrier is penetrated. Some open joints (5 mm width), to depths of 30 m or more, and faulted zones, may allow significant flow in deep excavations.

5. Field Work

The field work comprised a detailed geological inspection of the site and adjacent areas by an experienced geotechnical engineer.

The locations of the site features from the site inspection and as indicated on the survey plan are shown on Drawing 1 in Appendix A. Photos of selected site features are presented in Appendix B (Plates 1 – 12). The locations of photos are shown on Drawing 2 in Appendix A.

The main items noted during the site inspection are:

- The Scottish Hospital building is on the southern side of the site (refer Photos 1 to 3 and 18 to 20). The external condition of the building appears to be relatively good and has been extended in a couple of areas. The building has been rendered which may hide cracks or other problems. The building is presently unoccupied.
- Retaining walls (refer Photos 3, 4 and 10) on the southern and western boundaries range in height between 2 – 3 m. The walls are constructed either of brick or sandstone block and were in poor to fair condition.
- There is an old tank (refer Photo 5) on the southern boundary. The contents of the tank have been drained and the soil surrounding the area appears to have been appropriately assessed and remediated.
- The ground slopes from the southern (Cooper Street) and western boundaries (Brown Street) towards the north and east respectively (refer Photo 6 to 10 and 14 to 17).
- Sandstone crops out at a few locations (refer Photos 7 and 9) in the south-western corner of the site. The sandstone appears to be undercut at one location, suggesting a weaker layer that has been subject to weathering. A few detached boulders were adjacent to the sandstone outcrops (refer Photo 8).
- Several significant trees (refer Photo 11 to 13) were observed on the southern, western and northern boundaries.
- The external condition of the two to three storey nursing home building appears to be fair to good.
- The central section of the site is terraced (refer Photos 15 to 17) and appears to have been constructed using filling. A retaining wall at the top of the terraced slope comprises dry stacked sandstone blocks (refer Photo 17).
- The external condition of the Theatre Complex on the eastern side of the site appears to be relatively good (refer Photo 21). The building appears to have been constructed on piles (refer Photo 22 to 24).
- The ground surface beneath the operating theatre is deeply (approximately 300 – 400 mm) eroded at one location mid-way up the slope (refer Photo 24). The erosion gully indicates that filling comprising sand and bricks has been placed in the upper 400 mm of the subsurface profile.

6. Geological Profile

Details of the subsoil conditions encountered in the test bores and pits in the previous investigations are presented in Appendices C to G. Notes defining classification methods and descriptive terms used by DP in logging the bores and pits are given in the Appendix C. The locations of the bores and pits are given in Drawing 1. Summary geological sections are given in Drawings 3 to 7 in Appendix A.

Based on the information available, an appropriate geological model for the site, in increasing depth order, is as follows:

FILLING (Unit 1)	Sand, clay, brick, crushed rock and building rubble to depths of up to 8.5 m. The depth of filling appears to significantly increase towards the northern end of the site; overlying;
SAND (Unit 2)	Loose and medium dense sand to depths of up to 4 m below ground surface levels. The sand appears to taper out towards the northern part of the site as the depth of filling increases;
WEATHERED SANDSTONE (Unit 3)	A 0.5 – 2 m layer of extremely to very low strength sandstone appears to be present beneath either the filling or sand;
MEDIUM AND HIGH STRENGTH SANDSTONE (Unit 4)	At or near the surface towards the southern end of the site, the depth increasing rapidly to the north of the site where it is present at depths of up to 10.5 m.

The groundwater level has only been accurately recorded at one location. In DP's (2000) Bore 1 the groundwater level was measured at 7.3 m depth (RL 8.3). It appears that further upslope, towards the southern end, the water is mainly seepage and flows over the soil/bedrock interface. Therefore, seepage is probably generally higher towards the southern side of the site where the rock is higher. The groundwater table is expected to be below the basement excavations.

While a substantial number of test bores have been drilled on site to date, some of the earlier investigations do not provide detailed information regarding the fill and strength of rock and were carried out using different classification systems. The investigations were also carried out for different purposes. Therefore, once design details have been finalised, additional investigation is recommended in strategic areas that do not include reliable test data.

7. Proposed Development

Drawings prepared by JPR Architects Pty Ltd indicate that the proposed development is to include the demolition of the existing nursing home and theatre building followed by construction of four separate multi-storey buildings (4 – 6 storeys) with associated basement (one to two levels) carparking. The existing Scottish Hospital is also to be upgraded.

Column working loads are anticipated to be up to 5000 kN for the multi-storey buildings.

Excavation up to 6 m depth is anticipated for the two levels of basement.

8. Comments

8.1 Excavation Conditions

The proposed bulk excavation levels range from RL 10.5 – 13.0 and will generally encounter geological Units 1 to 3 (filling, sands and weathered rock) with Unit 4 (medium and high strength sandstone) possibly intersected at the southern end of the site.

Excavation within the filling, sands and weathered sandstone (Units 1 to 3) should be readily achievable by bulldozer blade or hydraulic excavator. Some light to medium ripping assistance or the use of rock hammers may be required for layers of stronger rock that are interbedded within Unit 3.

Excavation within medium and high strength sandstone (Unit 4) will require medium to heavy rock breaking equipment. Rock breaking equipment will generally induce noise and vibrations that could be disturbing to surrounding residents and generate vibrations that could disturb surrounding structures founded on sands. Given the small amount of excavation within this unit and the sensitivity of structures in the surrounding area, it would be prudent to excavate this material with a rock saw with limited assistance provided by a hydraulic hammer following sawing. Vibration levels should be kept below a vector sum peak particle velocity (VSPPV) of 5 mm/s to avoid disturbing surrounding structures, which are possibly founded on sands. Monitoring of vibration levels and dilapidation surveys of surrounding buildings are recommended, particularly if there are any concerns regarding potential claims in the future.

All excavated materials will need to be disposed in accordance with current DECCW policies. Under the Protection of the Environment Operations Act (1997), both the waste/fill generating and receiving sites must be satisfied that materials meet the criteria for waste disposal. This includes filling and virgin excavated natural materials (VENM), such as may be removed from site. Accordingly, environmental testing will need to be carried out to classify spoil prior to disposal. The type and extent of testing undertaken will depend on the final use or destination of the spoil, and requirement of the receiving site.

Based on the current limited groundwater information, it is anticipated that there will be some seepage over the bedrock surface into the excavation at the southern end of the site. Such seepage may need to be collected during construction by the judicious placement of drainage sumps and by intermittent pumping. It is likely that most seepage will infiltrate into the sandy filling or natural sand profile. At this stage, it is not possible to estimate the likely extent and rate of seepage. It is anticipated that the volume of seepage will be low and that it should be readily handled by sump and pump measures if necessary. It is suggested that monitoring of flow during the early phases of excavation below the groundwater table be undertaken to assess long-term pumping requirements.

Excavation and piling works may intersect the protection zones of the heritage listed trees on site. An appropriately qualified professional should be consulted regarding the effect of construction works on the tree protection zones.

The proposed bulk excavation levels will generally expose filling and sand with some areas of weathered or possibly stronger sandstone. The presence of poorly compacted filling and loose sands may result in some areas of the proposed BEL being problematic for a construction platform for large piling rigs. Careful assessment of the subgrade at BEL by an experienced geotechnical engineer will be required prior to establishing a piling rig onto site. It is likely that a layer of crushed rock, recycled concrete or similar would be required in order to create a suitable construction platform. The thickness of the layer will depend on the subsurface conditions and the size of the rig but the minimum thickness is likely to range from 200 – 500 mm.

8.2 Excavation Support

8.2.1 General

The filling, sand and weathered sandstone of Units 1 to 3 will require both temporary shoring support and permanent retaining wall support during excavation and as part of the final construction. In view of the highly variable material strength of the upper units, it is recommended that shoring and retaining wall support extend below the base of Unit 3 (extremely to very low strength sandstone). Retaining structures will therefore be required to support most of the perimeter upper excavation, both during the basement construction process and as part of the final structure.

The choice of a retaining wall system will be dependent on the available founding conditions (noting that retaining walls should not be founded on filling), the space available, cost and the preferences of the contractor/client.

The options for excavation support include:

a) Battering of the excavation side walls (if space permits) followed by construction of a block retaining wall or similar. A maximum batter slope of 2H:1V is considered appropriate for the batters in filling and sands and 1H:1V in weathered rock. These temporary batter slopes are appropriate up to a maximum height of 3 m. Flatter slopes may be required if groundwater seepage occurs within batters during construction.

b) A contiguous pile shoring or retaining wall. This type of wall system comprises closely spaced piles in a row to form a structurally stable wall. As constructed, these walls do not form a water proof barrier and erosion of sands behind the wall may occur if the gaps between the piles are not progressively shotcreted as excavation proceeds. The gaps in between the piles should not exceed 25 mm.

   Due to the presence of sands and the depth of groundwater, continuous flight auger (CFA) piles are recommended. If socketing into bedrock is required for lateral restraint, then confirmation should be obtained from the drilling contractor that the nominated piling rig can socket into medium or high strength sandstone. Care also needs to be exercised by the driller during the installation of CFA piles to avoid “decompression” of the surrounding sands. Decompression is caused by the rotating auger drawing in sand when it stops penetrating the soil profile at the required rate. Sand is then removed from the soil profile, up on the auger flights, loosening the soil profile resulting in loss of strength (where the soil is providing lateral restraint) and settlement problems particularly for nearby structures supported on high-level footings.

   A contiguous pile wall system could form part of the final structure. There may be a need for either a separate internal wall or shotcreting of the exposed surface of the piles.

The new shoring wall may need to be designed with temporary anchors if lateral movements during construction are to be limited. Recommendations on ground anchor design for the above retaining wall systems are presented in Section 7.5.3.

Vertical excavation within the medium to very high strength sandstone (Units 4) is considered feasible but regular inspections of the face by an experienced engineering geologist or geotechnical engineer will be necessary at every 1.5 m drop in the excavation level for assessment of potential instability. Allowance should be made for the rockbolting or anchoring of any blocks formed by adversely dipping joints and/or faults or shotcreting of seams detected during excavation inspections.

8.2.2 Design of Lateral Support

The design of retaining walls should take due account of both lateral earth pressures and surcharges acting on the walls.

The earth pressure coefficients and bulk unit weights provided in Table 2 are suggested for the preliminary design of walls including cantilevered or single anchored/propped walls.

Table 2: Design Parameters for Retaining Structures

Strata	Bulk Unit Weight, (kN/m^3)	Earth Pressure Coefficients			
		‘Active’ Temporary K_a (temp)	‘Active’ Permanent K_a (perm)	‘At Rest’ Temporary K_o (temp)	Passive
Filling and Sands (Units 1 and 2)	20	0.35	0.4	0.55	2.0
Weathered sandstone (Unit 3)	22	0.1	0.15	0.2	4.0 or 400 kPa
Medium and high strength sandstone (Unit 4)	24	0.0	0.0	0.0	5000 kPa

Wall design using the parameters and a triangular earth pressure distribution assume the following:

- a level surface behind the top of the excavation;
- sufficient drainage provided behind the retaining walls so that hydrostatic pressures cannot develop;
- construction traffic and other surcharge loadings (e.g. stacked materials) are not applied at the crest of the retaining walls, for a distance of, say 5 m behind the wall/shoring; and
- Passive resistance may be developed in natural sands only from beneath one pile diameter below the bulk excavation level. The passive pressures calculated are ultimate values to which an appropriate factor of safety (i.e. 2.5 or 3) should be incorporated.

If these conditions are not met, the additional pressures associated with sloping ground, surcharges and/or hydrostatic loads will need to be taken into account.

The active earth pressure coefficient, K_a, to be used for estimating soil pressures in Table 2 are for a flexible wall allowing some lateral or outward "tilting" movement. Where it is necessary to limit movement, it is suggested that the wall be designed for K_0 (lateral earth pressure coefficients "at rest") conditions in combination with an analytical approach that considers the excavation and propping or anchoring sequence.

The final or detailed design of retaining walls are normally undertaken using programs such as WALLAP or FLAC, which can take due regard of soil-structure interaction during the progressive stages of wall construction, anchoring and bulk excavation.

8.2.3 Ground Anchors

The use of inclined pre-stressed "tie-back" (ground) anchors may be considered for the lateral restraint of retaining/shoring wall systems for the temporary, construction condition. Ground anchors should be inclined below horizontal and may be fairly steep, so as to form the bond zone within the underlying bedrock. Inclined anchors however introduce vertical forces into retaining walls.

The preliminary design of temporary ground anchors for the support of piled shoring wall systems may be carried out on the basis of the maximum allowable (working) bond stresses given in Table 3.

Table 3: Maximum Bond Stresses for Temporary Anchor Design

Material Description	Allowable Bond Stress (kPa)
Loose or denser natural sands (Unit 2)	40
Weathered sandstone (Unit 3)	200
Medium or high strength sandstone (Unit 4)	1000

Note: The above parameters are based on the assumption that the anchor holes are clean and thoroughly flushed, with grouting and other installation procedures carried out carefully and in accordance with normal good anchoring practice.

Ground anchors should be designed to have a free length that extends up to at least a plane drawn upwards at an angle of 45° from the toe of the wall with a minimum free length of 3 m. After installation, each anchor should be proof loaded to 125% of the design working load and locked-off at about 80% of the working load. Periodic checks should be carried out during the construction phase to ensure that the "Lock-Off" load is maintained and not lost due to creep effects or other causes. The successful anchoring contractor should be required to demonstrate that the design or his nominated average bond stresses and lengths are achievable with his proposed anchor construction methods.

It is anticipated that ground anchors for the shoring system will be temporary only and that the walls of the structure will provide permanent retention. If permanent ground anchors are used then they will need to be inspected during all stages of installation by an experienced engineering geologist or geotechnical engineer. They would need to be appropriately designed and provided with appropriate permanent corrosion protection. Further advice should be sought if permanent ground anchors are considered.

Approval will be required from adjacent property owners, where temporary or permanent rock anchors extend below neighbouring properties, roads or public access areas.

8.3 Foundations

Due to the high anticipated column loadings and the need to achieve uniform founding conditions, it is recommended that all footings extend to found in medium to high strength sandstone. Shallow footings at the southern end of the site may be appropriate; however, piled footings are anticipated over the majority of the site due to the depth of filling and sand.

For piled footings, the expected collapsing ground conditions will generally require either cased bored piles or continuous flight auger (CFA), grout or concrete-injected piles. Some obstructions in the filling may be encountered during drilling and, as such, it may be necessary to mobilise an excavator during piling works, so as to remove any large obstructions from any fixed pile positions. The potential issues outlined in Section 8.2.1 b) regarding CFA piling should be observed by the drilling contractor.

Foundations bearing in medium or high strength sandstone could be proportioned on the basis of a maximum allowable bearing pressure of 5000 kPa and, for piles, an allowable shaft adhesion of 500 kPa.

The foundation design parameters assume that the foundation excavations (e.g. pads or piles) are clean and free of loose debris, with pile sockets free of smear and adequately roughened immediately prior to the placement of concrete. Pads and piles proportioned for the above design values would not be expected to settle more than 5 mm, and (due to the presence of high strength rock in places) probably substantially less than this amount.

Pad foundation excavations should be inspected and tested (by spoon testing in a third of footings) by an experienced geotechnical professional prior to pouring concrete to confirm that the material is adequate for the required bearing capacity. CFA piles, however, are a proprietary product that would need to be certified by the piling contractor.

8.4 Seismic Design

In accordance with the Earthquake Loading Standard, AS1170.4 - 2007 the site is assessed to a hazard factor (z) of 0.08 and a subsoil class “De” are recommended. The subsoil class may be revised to “Ae” provided all loads are transferred to medium or high strength sandstone.

8.5 Floor Slabs

The groundfloor slab at the lowest level of the basement is expected to be used for carparking and hence will probably only be lightly loaded. Where the base of excavation will expose rock, it will provide adequate support for a slab-on-grade.

Where the slab subgrade comprises sand, it is recommended that a minimum 100 mm thick compacted recycled concrete or gravel subbase be placed, overlain by a geofabric separator and then the blue-metal drainage layer.

Where the slab subgrade comprises uncontrolled filling, the slab should be suspended.

Articulation of the floor slab between the slab supported on sand and those supported on bedrock should be provided as part of measures by the designer to allow for differential settlement of the slab between unlike materials.

8.6 Hydrogeology & Groundwater

The site generally slopes toward the north east with discontinuous filling and overburden soil overlying Hawkesbury Sandstone. Water was only recorded in Borehole 1 at 7.3 m depth (RL 8.3) in clayey sand above bedrock and not observed in other boreholes. The groundwater table is expected to be below the level of the basement excavations.

Seepage, however, should be expected from along the top of the rock surface and through joints and fractures in the sandstone, particularly following periods of extended wet weather. Therefore, the levels of seepage are anticipated to be generally higher towards the southern side of the site where the rock is higher. Seepage should be readily controlled by perimeter drains to direct seepage around the excavation and building structures. Subfloor drainage should be provided below the basement floor slab to assist drainage of the seepage. Given the presence of trees on the site, it would be prudent to direct the seepage into infiltration trenches down-slope of the buildings so as to maintain moisture conditions as close as possible to the pre-construction case.

It is anticipated that the permanent groundwater table is within the Hawkesbury Sandstone or in the clay or filling below the site excavation levels. Groundwater flow is expected to be relatively low in the clay and will be fracture controlled in the rock. It is anticipated that the proposed development on the site will have no significant influence on the existing groundwater flow system, both on the site and surrounding area.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at Nield Avenue, Paddington. The work was carried out under the amended DP Conditions of Engagement. This report is provided for the exclusive use of The Presbyterian Church (NSW) Property Trust for the specific project and purpose as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party.

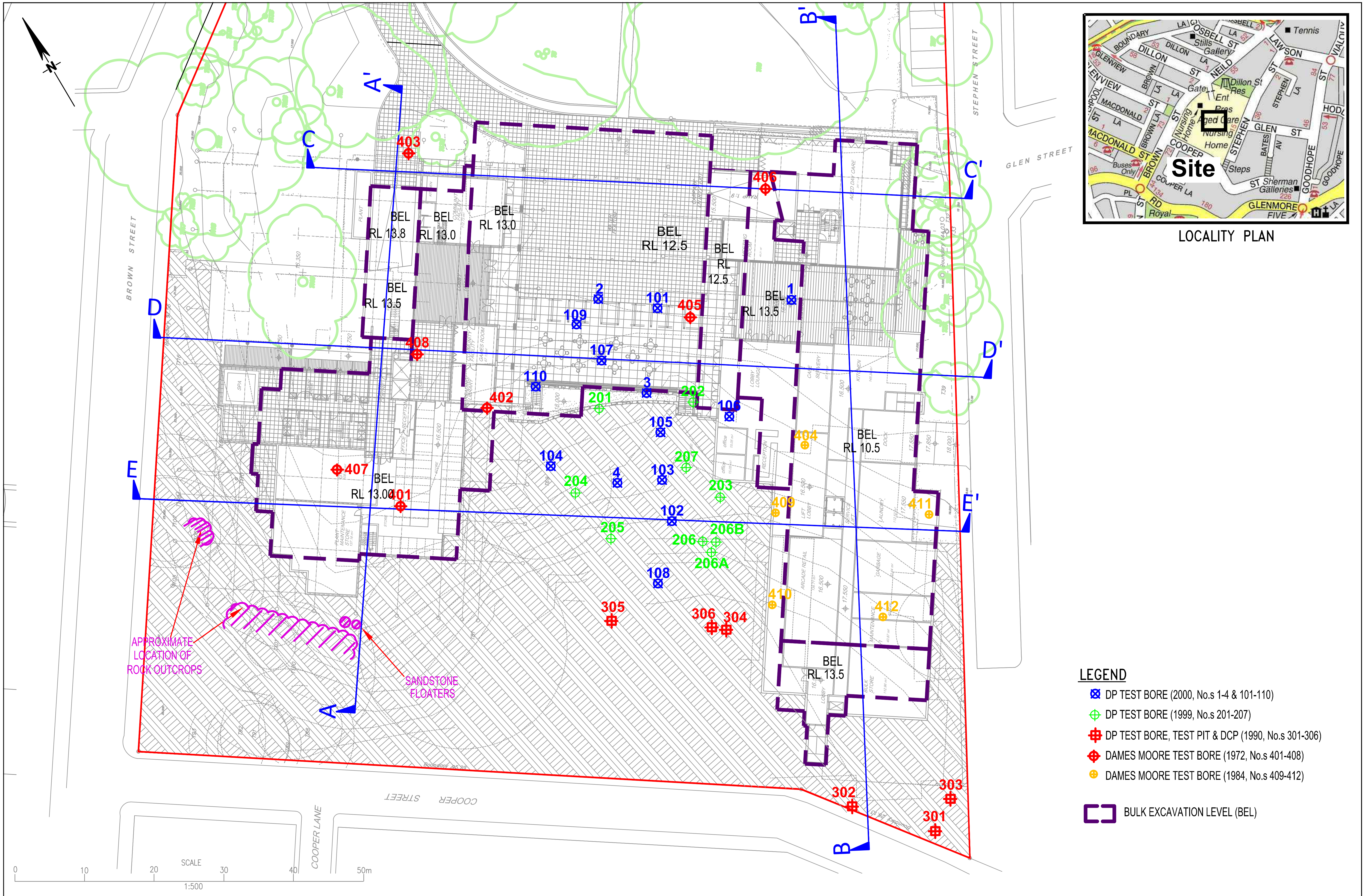
The results provided in the report are considered to be indicative of the sub-surface conditions on the site only to the depths investigated at the specific sampling and/or testing locations, and only at the time the work was carried out. DP's advice may be based on observations, measurements, tests or derived interpretations. The accuracy of the advice provided by DP in this report is limited by unobserved features and variations in ground conditions across the site in areas between test locations and beyond the site boundaries or by variations with time. The advice may be limited by restrictions in the sampling and testing which was able to be carried out, as well as by the amount of data that could be collected given the project and site constraints. Actual ground conditions and materials behaviour observed or inferred at the test locations may differ from those which may be encountered elsewhere on the site. If variations in subsurface conditions be encountered, then additional advice should be sought from DP and, if required, amendments made.

This report must be read in conjunction with the attached "Notes Relating to This Report" and any other attached explanatory notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

Douglas Partners Pty Ltd

Appendix A

Drawings
About this Report



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: The Presbyterian Church (NSW) Property Trust	TITLE: **Location of Test Bore and Pits** **Scottish Hospital Redevelopment** **Nield Avenue, PADDINGTON**	PROJECT No: 71484.01
	OFFICE: Sydney — DRAWN BY: VOJTA		DRAWING No: 1
	SCALE: As shown — DATE: 15.9.2010		REVISION: B

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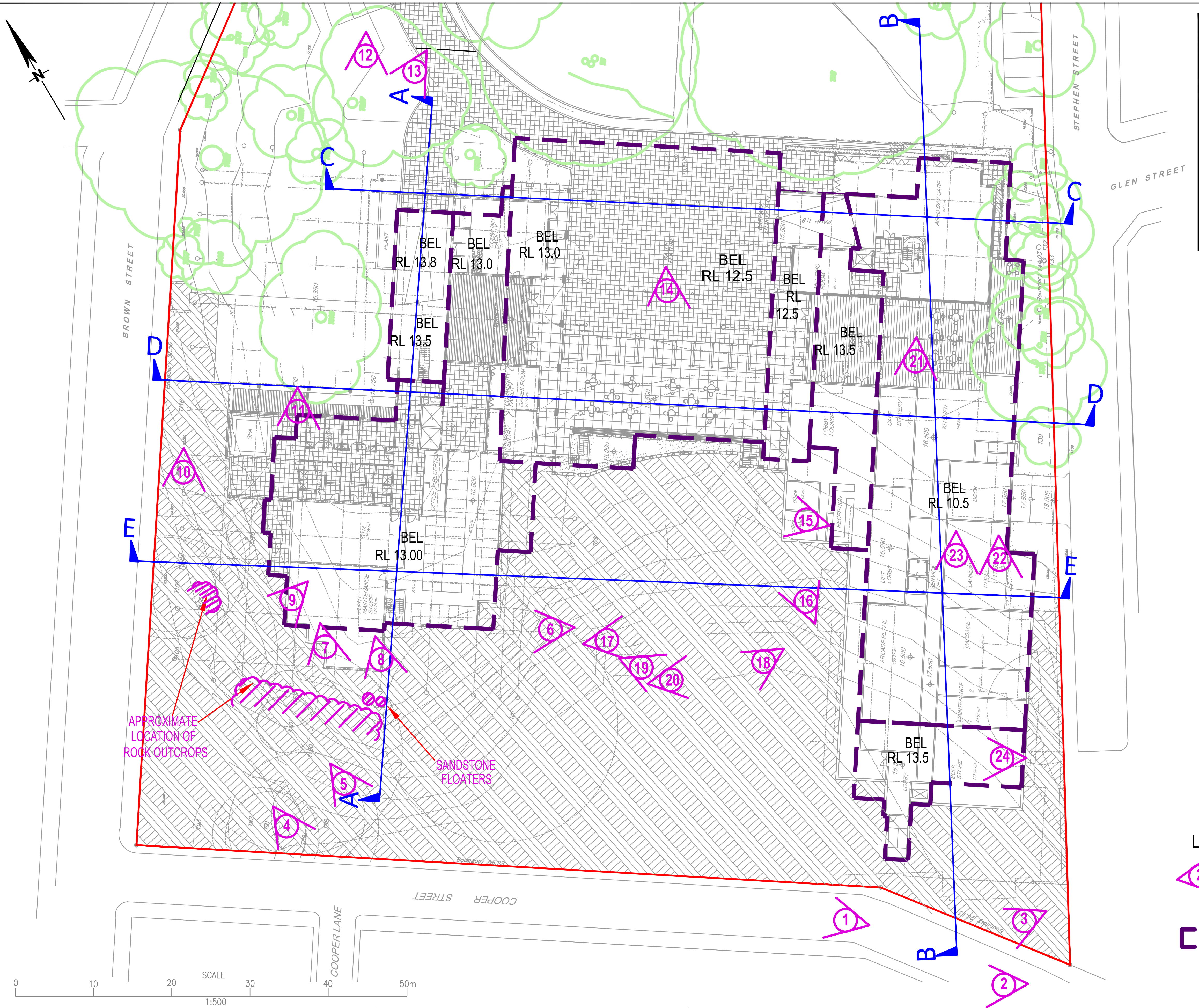

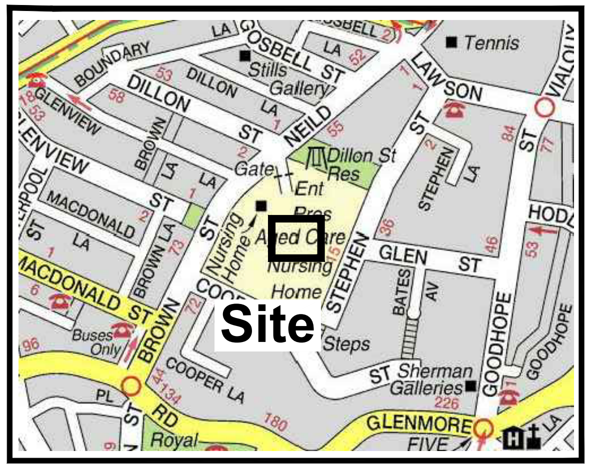

LOCALITY PLAN

LEGEND

PHOTO PLATE WITH NUMBER & DIRECTION OF VIEW

BULK EXCAVATION LEVEL (BEL)

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CLIENT: The Presbyterian Church (NSW) Property Trust		TITLE:	Location of Site Photos Scottish Hospital Redevelopment Nield Avenue, PADDINGTON
OFFICE: Sydney	DRAWN BY: VOJTA		
SCALE: As shown	DATE: 15.9.2010		

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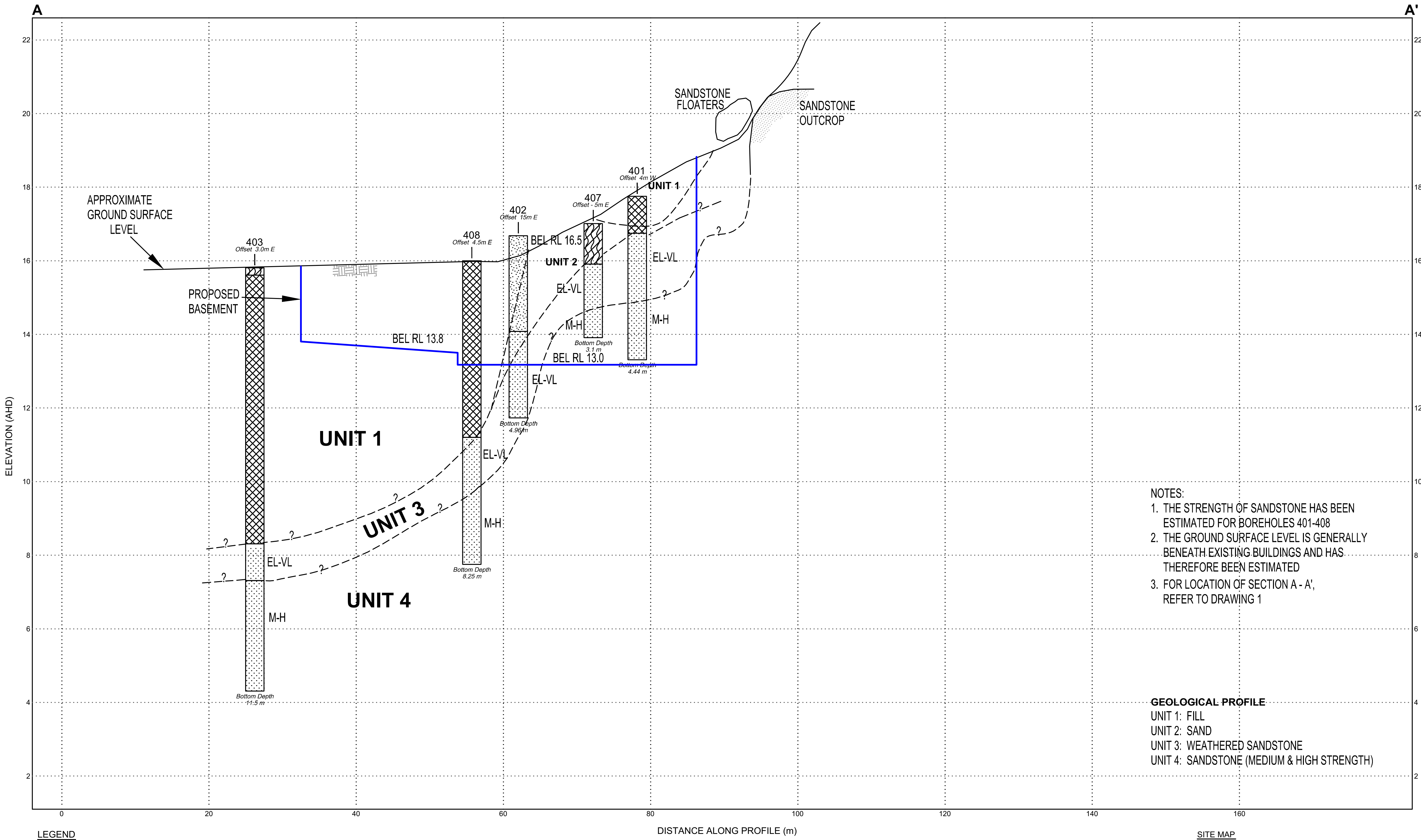
PROJECT No:	71484.01
DRAWING No:	2
REVISION:	B



NOTES:
1. THE STRENGTH OF SANDSTONE HAS BEEN ESTIMATED FOR BOREHOLES 401-408
2. THE GROUND SURFACE LEVEL IS GENERALLY BENEATH EXISTING BUILDINGS AND HAS THEREFORE BEEN ESTIMATED
3. FOR LOCATION OF SECTION A - A', REFER TO DRAWING 1

GEOLOGICAL PROFILE
UNIT 1: FILL
UNIT 2: SAND
UNIT 3: WEATHERED SANDSTONE
UNIT 4: SANDSTONE (MEDIUM & HIGH STRENGTH)

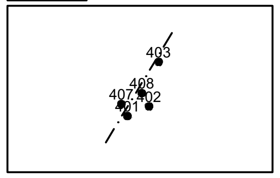
LEGEND
- Filling
- Clayey Sand
- Sandstone fine grained
- Sand
- Topsoil

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
Water level

SITE MAP



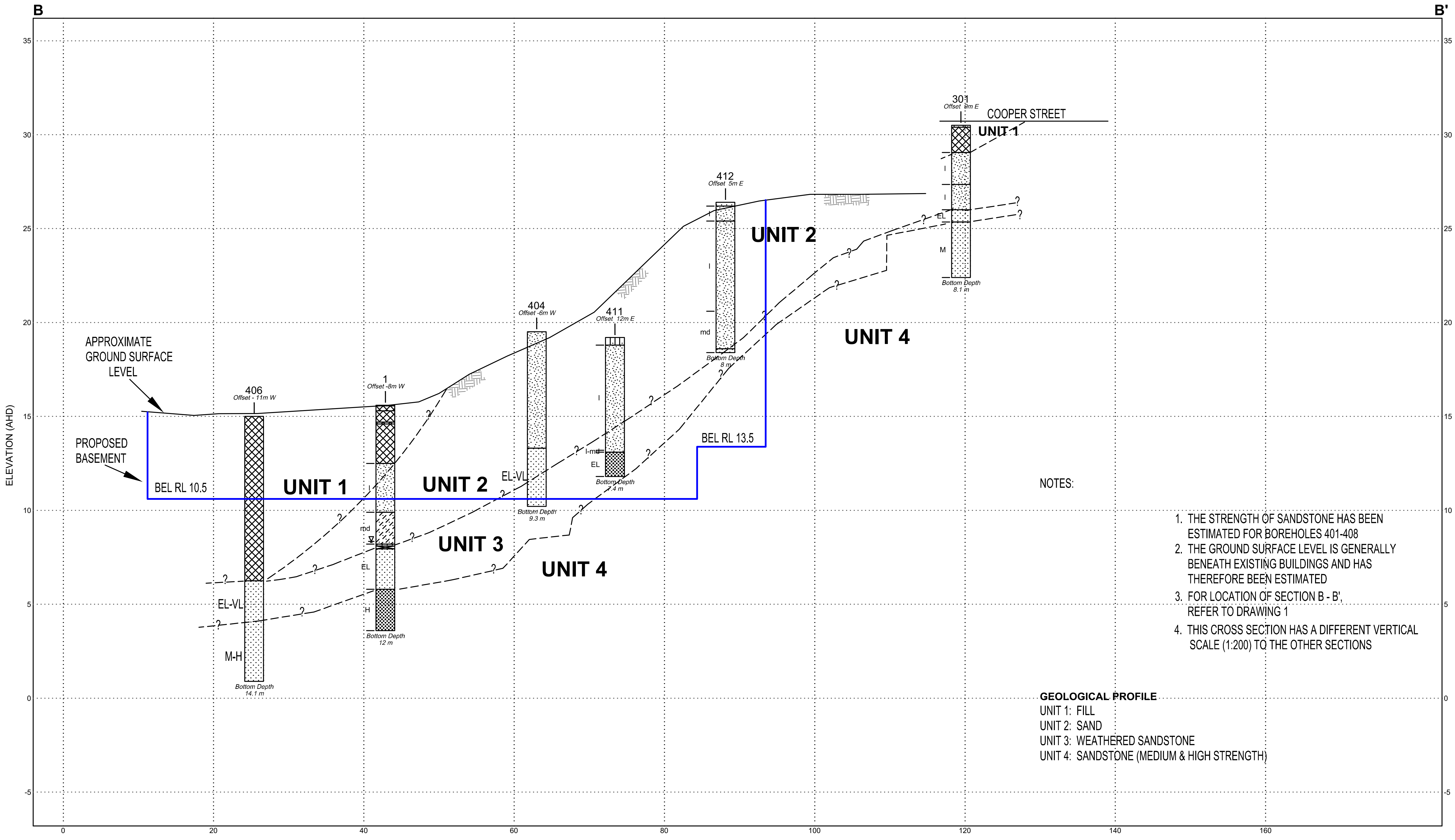
0 10
Horizontal Scale (metres)

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: The Presbyterian Church (NSW) Property Trust		
OFFICE: Sydney	DRAWN BY: LD	
SCALE: As shown	DATE: 16.9.2010	

TITLE: **CROSS SECTION A-A'**
Scottish Hospital Redevelopment
Nield Avenue, Paddington

PROJECT No:	71484.01
DRAWING No:	3
REVISION:	B



NOTES:

1. THE STRENGTH OF SANDSTONE HAS BEEN ESTIMATED FOR BOREHOLES 401-408
2. THE GROUND SURFACE LEVEL IS GENERALLY BENEATH EXISTING BUILDINGS AND HAS THEREFORE BEEN ESTIMATED
3. FOR LOCATION OF SECTION B - B', REFER TO DRAWING 1
4. THIS CROSS SECTION HAS A DIFFERENT VERTICAL SCALE (1:200) TO THE OTHER SECTIONS

GEOLOGICAL PROFILE

UNIT 1: FILL
UNIT 2: SAND
UNIT 3: WEATHERED SANDSTONE
UNIT 4: SANDSTONE (MEDIUM & HIGH STRENGTH)

LEGEND

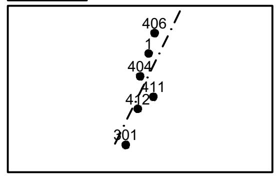
- CORE LOSS
- Bituminous Concrete
- Clayey Sand
- Concrete
- Filling
- Sand
- Sandstone coarse grained
- Sandstone fine grained
- Sandy Silt
- Silty Sand

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
Water level

SITE MAP



0 10
Horizontal Scale (metres)

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: The Presbyterian Church (NSW) Property Trust	TITLE: **CROSS SECTION B-B'** **Scottish Hospital Redevelopment** **Nield Avenue, Paddington**	PROJECT No: 71484.01
	OFFICE: Sydney / DRAWN BY: LD		DRAWING No: 4
	SCALE: As shown / DATE: 16.9.2010		REVISION: B

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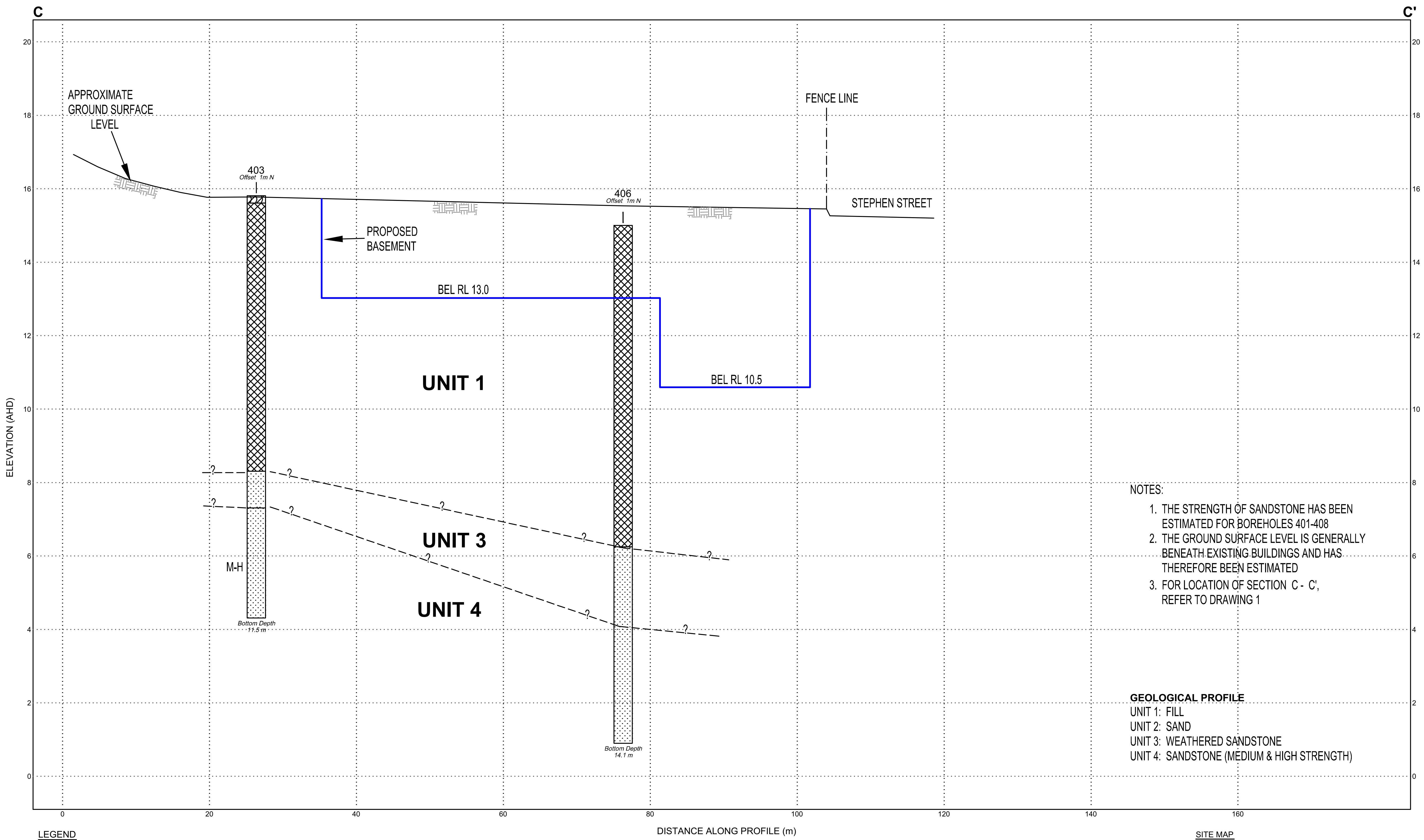


LEGEND

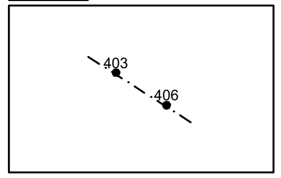
- Topsoil
- Filling
- Clayey Sand
- Sandstone fine grained

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
≡ - Water level

SITE MAP



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Horizontal Scale (metres)

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: The Presbyterian Church (NSW) Property Trust		TITLE: **CROSS SECTION C - C'** **Scottish Hospital Redevelopment** **Nield Avenue, Paddington**	PROJECT No: 71484.01
OFFICE: Sydney	DRAWN BY: LD		DRAWING No: 5
SCALE: As shown	DATE: 16.9.2010		REVISION: B

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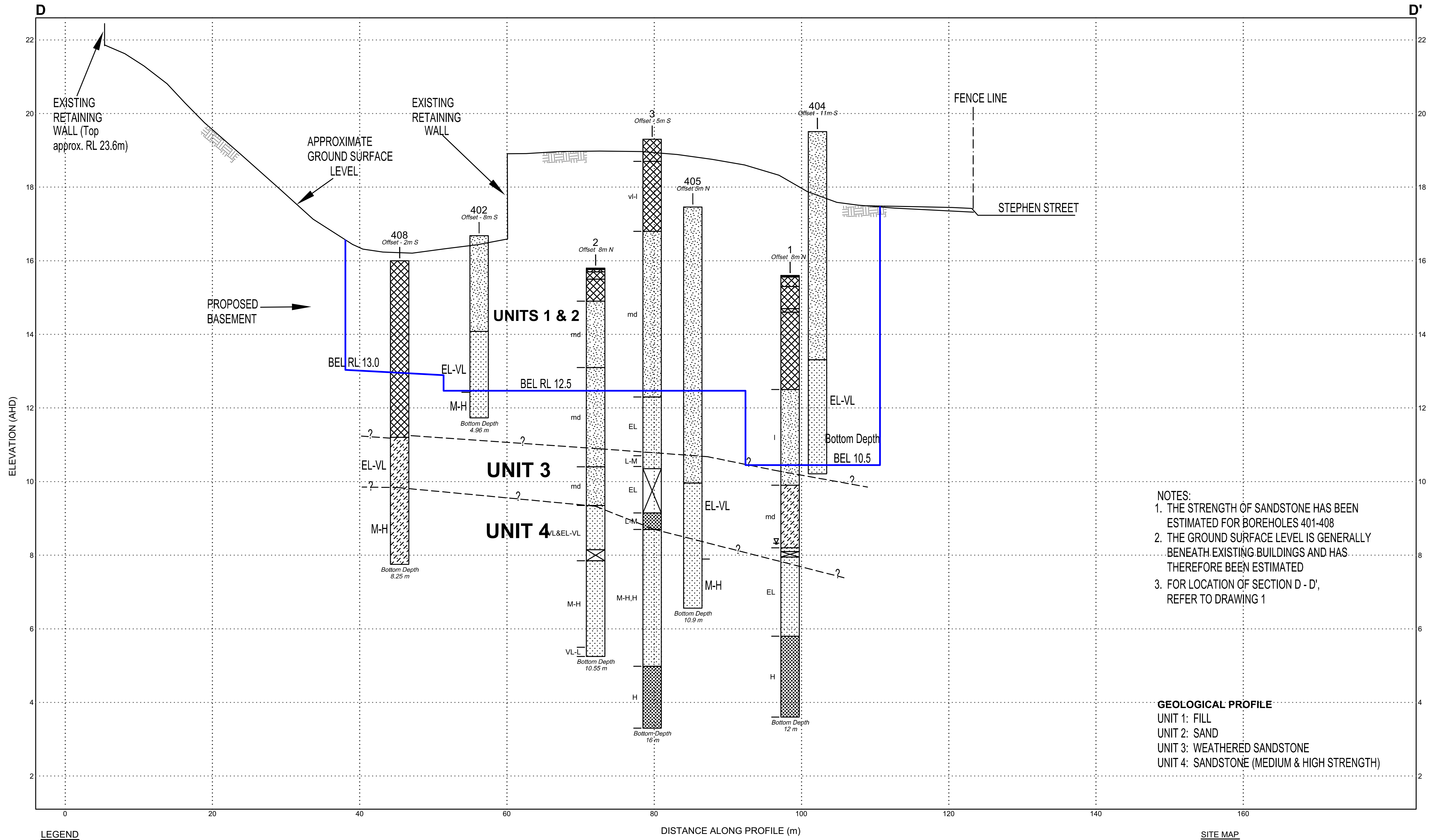


LEGEND

- CORE LOSS
- Bituminous Concrete
- Clayey Sand
- Filling
- Sand
- Sandstone coarse grained
- Sandstone fine grained

ROCK STRENGTH

EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

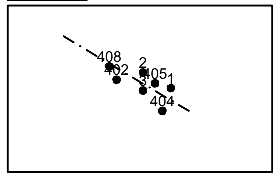
SOIL CONSISTENCY

vs - very soft	vl - very loose
s - soft	l - loose
f - firm	md - medium dense
st - stiff	d - dense
vst - very stiff	vd - very dense
h - hard	

TESTS / OTHER

N - Standard penetration test value
▽ - Water level

SITE MAP



Horizontal Scale (metres) 0 10

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: The Presbyterian Church (NSW) Property Trust		
OFFICE: Sydney	DRAWN BY: LD	
SCALE: As shown	DATE: 16.9.2010	

TITLE: **CROSS SECTION D - D'**
Scottish Hospital Redevelopment
Nield Avenue, Paddington

PROJECT No:	71484.01
DRAWING No:	6
REVISION:	B

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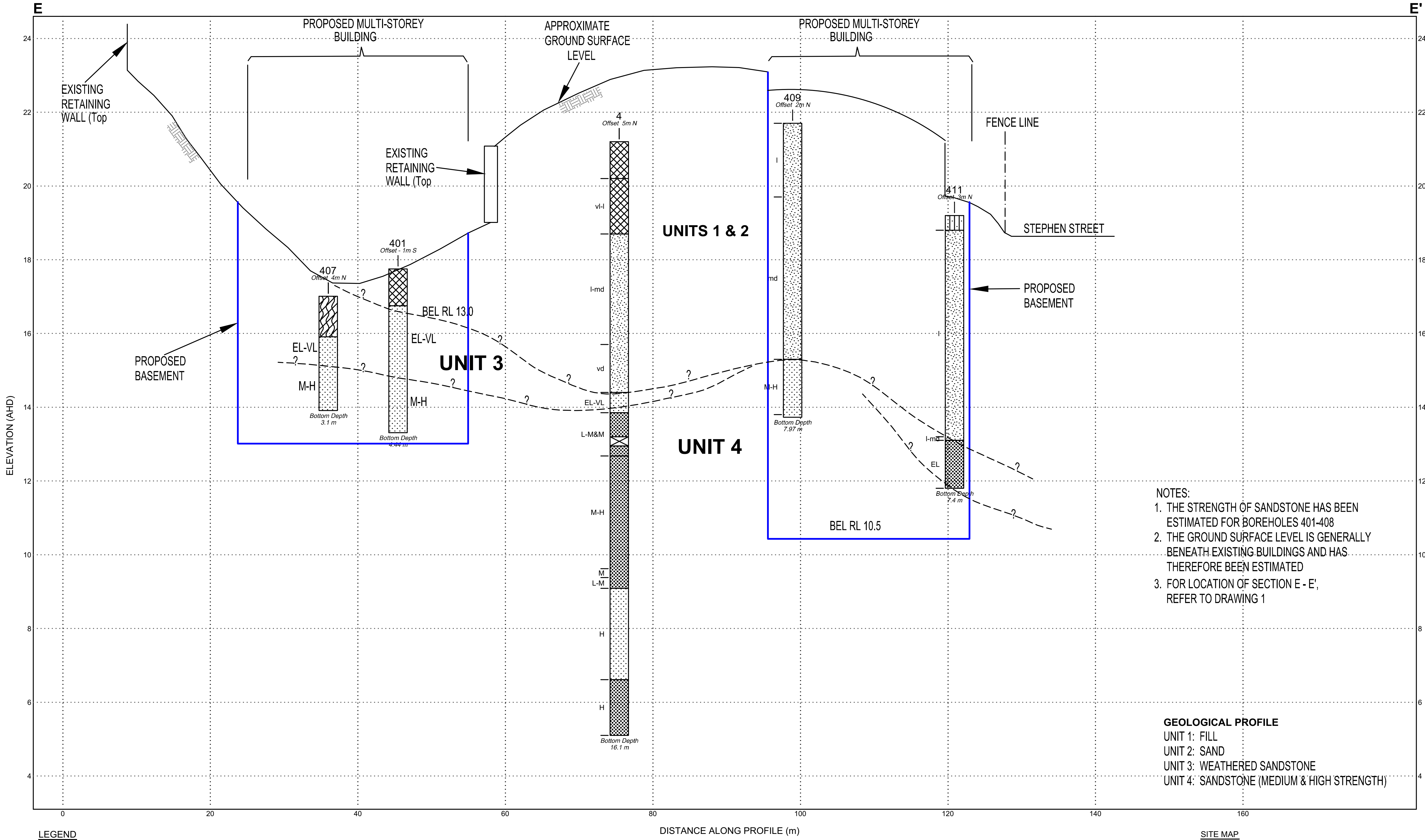


NOTES:

1. THE STRENGTH OF SANDSTONE HAS BEEN ESTIMATED FOR BOREHOLES 401-408
2. THE GROUND SURFACE LEVEL IS GENERALLY BENEATH EXISTING BUILDINGS AND HAS THEREFORE BEEN ESTIMATED
3. FOR LOCATION OF SECTION E - E', REFER TO DRAWING 1

GEOLOGICAL PROFILE

UNIT 1: FILL
UNIT 2: SAND
UNIT 3: WEATHERED SANDSTONE
UNIT 4: SANDSTONE (MEDIUM & HIGH STRENGTH)

LEGEND

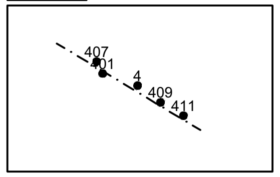
- CORE LOSS
- Filling
- Sand
- Sandstone coarse grained
- Sandstone fine grained
- Sandy Silt
- Topsoil

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
Water level

SITE MAP



0 10
Horizontal Scale (metres)

CLIENT: The Presbyterian Church (NSW) Property Trust	TITLE:	**CROSS SECTION E-E'** Scottish Hospital Redevelopment Nield Avenue, Paddington
OFFICE: Sydney	DRAWN BY: LD	
SCALE: As shown	DATE: 16.9.2010	

Douglas Partners
Geotechnics / Environment / Groundwater

PROJECT No: 71484.01
DRAWING No: 7
REVISION: B

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About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.