Christchurch City Council

Scarborough Park Toilets PRK 1467 BLDG 002 EQ2

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Scarborough Park Toilets

Quantitative Assessment Report

Sumner, Christchurch

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Status: Final

Approved By

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CPEng 209860

Summary

Scarborough Park Toilets, Sumner, Christchurch
PRK 1467-BLDG 002 EQ2

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

Background
This is a summary of the Quantitative report for the Scarborough Park Toilets and is based on the Detailed Engineering Evaluation Procedure document issued by the Structural Advisory Group on 19 July 2011, visual inspections on 19 January 2012, available drawings and calculations.

Key Damage Observed
Cracking was observed to the exterior concrete masonry unit (CMU) walls, concrete foundations, exterior concrete columns, and the villaboard ceiling. The cracking was primarily due to displacement of the structure as it moved horizontally (and vertically) on relatively narrow and shallow strip-footing foundations.

Critical Structural Weaknesses
No potential critical structural weaknesses have been identified, except for potential rock falls due to a steep rock face located approximately 20m to the rear of the subject building. Evaluation of this potential hazard is beyond the scope of this project.

Indicative Building Strength
Based on the information available, and from undertaking a quantitative assessment, the building's capacity has been assessed to be more than 33% NBS, but less than 67%NBS, as limited by the roof diaphragm and its connections to the CMU walls.

The building has been assessed to have a seismic capacity of less than 67% NBS and is therefore classed as earthquake risk

Recommendations
It is recommended that:

- A strengthening scheme should be developed to increase the overall capacity of the building to at least 67% NBS.
- The potential hazard from rock falls should be evaluated.
- If it is decided to strengthen the building, then a detailed assessment of the foundation adequacy should be performed which may entail a level survey.

Contents

1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council (CCC) to undertake a detailed seismic assessment of the Scarborough Park toilet building, located in Sumner, Christchurch, following the M6.3 Christchurch earthquake on 22 February 2011.

The purpose of the assessment is to determine if the building is classed as being earthquake prone or earthquake risk in accordance with the Building Act 2004.

The seismic assessment and reporting have been undertaken based on the qualitative and quantitative procedures detailed in the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) on 19 July 2011.

2 Compliance

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

2.1 Canterbury Earthquake Recovery Authority (CERA)

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee to carry out a full structural survey before the building is re-occupied.

We understand that CERA require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). CERA have adopted the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) on 19 July 2011. This document sets out a methodology for both initial qualitative and detailed quantitative assessments.

It is anticipated that a number of factors, including the following, will determine the extent of evaluation and strengthening level required:

1. The importance level and occupancy of the building.
2. The placard status and amount of damage.
3. The age and structural type of the building.
4. Consideration of any critical structural weaknesses.

Christchurch City Council requires any building with a capacity of less than 34% of New Building Standard (including consideration of critical structural weaknesses) to be strengthened to a target of 67% as required under the CCC Earthquake Prone Building Policy.

2.2 Building Act

Several sections of the Building Act are relevant when considering structural requirements:

Section 112 - Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to the alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

The Earthquake Prone Building policy for the territorial authority shall apply as outlined in Section 2.3 of this report.

Section 115 – Change of Use

This section requires that the territorial authority is satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'.

This is typically interpreted by territorial authorities as being 67% of the strength of an equivalent new building or as near as practicable. This is also the minimum level recommended by the New Zealand Society for Earthquake Engineering (NZSEE).

Section 121 – Dangerous Buildings

This section was extended by the Canterbury Earthquake (Building Act) Order 2010, and defines a building as dangerous if:

1. In the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
2. In the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
3. There is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
4. There is a risk that other property could collapse or otherwise cause injury or death; or
5. A territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone (EPB) if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property.

A moderate earthquake is defined by the building regulations as one that would generate loads 33% of those used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

2.3 Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake on 4 September 2010.

The 2010 amendment includes the following:

1. A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
2. A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
3. A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
4. Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply 'as near as is reasonably practicable' with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.

Where an application for a change of use of a building is made to Council, the building will be required to be strengthened to 67% of New Building Standard or as near as is reasonably practicable.

2.4 Building Code

The Building Code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.

On 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- increase in the basic seismic design load for the Canterbury earthquake region (Z factor increased to 0.3 equating to an increase of 36 – 47% depending on location within the region);
- Increased serviceability requirements.

2.5 Institution of Professional Engineers New Zealand (IPENZ) Code of Ethics

One of the core ethical values of professional engineers in New Zealand is the protection of life and safeguarding of people. The IPENZ Code of Ethics requires that:

Members shall recognise the need to protect life and to safeguard people, and in their engineering activities shall act to address this need.

1.1 Giving Priority to the safety and well-being of the community and having regard to this principle in assessing obligations to clients, employers and colleagues.

1.2 Ensuring that responsible steps are taken to minimise the risk of loss of life, injury or suffering which may result from your engineering activities, either directly or indirectly.

All recommendations on building occupancy and access must be made with these fundamental obligations in mind.

3 Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The loadings are in accordance with the current earthquake loading standard NZS1170.5 [1].

A generally accepted classification of earthquake risk for existing buildings in terms of %NBS that has been proposed by the NZSEE 2006 [2] is presented in Figure 1 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance: Legal Requirement	Improvement of Structural Performance: NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement required under Act)	Unacceptable	Unacceptable

Figure 1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year).

Table 1: %NBS compared to relative risk of failure

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

3.1 Minimum and Recommended Standards

Based on governing policy and recent observations, Opus makes the following general recommendations:

3.1.1 Occupancy

The Canterbury Earthquake Order[1] in Council 16 September 2010, modified the meaning of "dangerous building" to include buildings that were identified as being EPB's. As a result of this, we would expect such a building would be issued with a Section 124 notice, by the Territorial Authority, or CERA acting on their behalf, once they are made aware of our assessment. Based on information received from CERA to date and from the DBH guidance document dated 12 June 2012 [6], this notice is likely to prohibit occupancy of the building (or parts thereof), until its seismic capacity is improved to the point that it is no longer considered an EPB.

3.1.2 Cordoning

Where there is an overhead falling hazard, or potential collapse hazard of the building, the areas of concern should be cordoned off in accordance with current CERA/territorial authority guidelines.

3.1.3 Strengthening

Industry guidelines (NZSEE 2006 [2]) strongly recommend that every effort be made to achieve improvement to at least 67%NBS. A strengthening solution to anything less than 67%NBS would not provide an adequate reduction to the level of risk.

It should be noted that full compliance with the current building code requires building strength of 100%NBS.

3.1.4 Our Ethical Obligation

In accordance with the IPENZ code of ethics, we have a duty of care to the public. This obligation requires us to identify and inform CERA of potentially dangerous buildings; this would include earthquake prone buildings.

[1] This Order only applies to buildings within the Christchurch City, Selwyn District and Waimakariri District Councils authority

4 Building Description

4.1 General

The Scarborough Park Toilets building is located at Scarborough Park, Sumner, Christchurch, and is a single storey small rectangular concrete masonry unit (CMU) building with a light-weight timber-framed roof, designed in 2005. The building is founded on concrete perimeter strip footings with the concrete floor slab-on-grade not connected to the perimeter footings by any reinforcing steel tying the two elements together. The two isolated exterior columns are founded on individual concrete piers.

The building is located only approximately 20m from a steep rock face that may represent a potential hazard from falling rocks during future seismic events, as discussed in the referenced Geotechnical report.

The building is situated on a flat site and is approximately 8.6m long in the longitudinal east-west direction and 5.2m wide in the transverse north-south direction. The eaves of the roof are approximately 2.4m from the ground.

4.1.1 Gravity Load Resisting System

The gravity load resisting system consists of plywood roof sheathing on laminated timber beams bearing on concrete masonry unit (CMU) perimeter walls on strip concrete footings. Two circular concrete columns are located on the west side to support a decorative element.

4.1.2 Seismic Load Resisting System

Seismic loads in both principal directions are resisted by the perimeter CMU shear walls. The ceiling over the building was designed to provide a flexible diaphragm to distribute the lateral loads to and from the wall elements.

The perimeter foundation strip footings have been designed with a width of 300mm and an embedded depth of approximately 300mm – relatively light foundations.

The perimeter walls are constructed from 190mm thick CMU with walls as shown in the drawings in Appendix B. All cells are grouted and the walls are reinforced with RB12 verticals at 600mm centres and with D12 horizontal steel at 600mm centres.

5 Survey

Due to the non-intrusive nature of the site survey, some connection details, particularly at the roof diaphragm, could not be ascertained.

Copies of the following drawings were referred to as part of this assessment:

- One set of structural plans dated 2005 and prepared by the CCC, Project Number 562/1435, Drawing numbers A01 through A06.

No copies of the structural design calculations have been obtained for this building.

The drawings have been used to identify the structural systems, investigate any potential critical structural weaknesses (CSW) wherever possible, and identify details which require particular attention.

6 Damage Assessment

The above-ground building structure suffered only minor to moderate damage as a result of the recent earthquake events but repair is required. Further investigation is required to detect any foundation damage because the under-ground elements were not readily visible.

7 General Observations

Overall the building structure has performed moderately well under seismic conditions, which would be expected for a small single storey structure with reinforced CMU walls. However, the building has sustained visible damage because of the severity of the ground motion. Damage to structural elements has weakened the building so repairs are required.

The CMU walls suffered minor cracking, mostly at the base and at mortar joints near window or door openings, as did the two non-structural concrete columns on the west side, as well as the concrete paving.

The 6mm ceiling villaboard (sometimes known as “Hardiboard”) is substantially damaged.

The concrete strip footing foundations have undergone permanent horizontal displacements of approximately 150mm towards the west, suggesting that the relatively narrow and shallow strip footings were not buried at a sufficient depth to be fully restrained by the underlying soils. The possibility of leaks in underground plumbing pipes requires investigation.

The cracks in the circular concrete columns appear to be due to the large displacements imposed on the top of the columns when the toilet building displaced westward in a sledding motion during the earthquake. This was due to the shallow and narrow foundations and the fact that the pier foundations of the columns are not connected to the building foundation.

8 Detailed Seismic Assessment

8.1 Critical Structural Weaknesses

As outlined in the Critical Structural Weakness and Collapse Hazards draft briefing document, issued by the Structural Engineering Society (SESOC) on 7 May 2011, the term 'Critical Structural Weakness' (CSW) refers to a component of a building that could contribute to increased levels of damage or cause premature collapse of the building.

No critical structural weaknesses have been identified with this building, but there is a potential hazard from rock fall that requires further investigation.

8.2 Seismic Coefficient Parameters

The seismic design parameters based on current design requirements from NZS1170.5:2004 and the NZBC clause B1 for this building are:

- Site soil class D, clause 3.1.3 NZS 1170.5:2004;
- Site hazard factor, Z=0.3, B1/VM1 clause 2.2.14B;
- Return period factor R_u = 1.0 from Table 3.5, NZS 1170.5:2004, for an Importance Level 2 structure with a 50 year design life;
- μ_{max} = 1.25 for a reinforced CMU shear wall building without special steel detailing.
- The building was designed in 2005 for a seismic hazard factor of Z = 0.22 versus the current code requirement of Z = 0.3 (0.73 times current code.)

8.3 Detailed Seismic Assessment Results

A summary of the structural performance of the building is shown in the following table. Note that the values given represent the worst performing elements in the building, as these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing element.

Table 2: Summary of Seismic Performance

Structural Element/System	Failure mode and description of limiting criteria	% NBS based on calculated capacity
CMU walls in-plane	Capacity of reinforced masonry	90%
Walls out-of-plane	Flexure	90%
Roof diaphragm	Capacity of the ceiling diaphragm & connections	40%
Foundation pad	Resistance to sliding & lateral bearing capacity of the soil	50%

8.4 Discussion of Results

The building has a calculated seismic capacity of 40%NBS as governed by the capacity of the ceiling diaphragm. .

The permanent displacement of the building westward toward the open drain by approximately 150mm confirms that there is insufficient friction developed and or insufficient horizontal bearing resistance developed by the site soils. This lack of resistance to horizontal rigid body foundation movement occurred because the foundations are too shallow. Therefore underground plumbing pipes may well have been damaged by this displacement.

The villaboard ceiling lining capacity noted above, was calculated assigned a value of 3.5kN/m, but may be over-estimated by current design practice specifications (The capacity may be less than half this specified shear capacity based on experiences with similar elements such as tongue and groove ceiling diaphragms: "Shear capacity of the existing tongue and groove timber floors/"diaphragms" was determined using Appendix 11B of the 2006 NZSEE Guidelines (NZSEE, 2006) and was found to be 1.83 kN/m. This agrees closely with the 1.75 kN/m (i.e. 120 plf) expected strength value recommended in FEMA-356 and is similar to that obtained by recent laboratory testing undertaken at the University of Auckland. This capacity is significantly less than the 6.0 kN/m detailed in Table 11.1 of the NZSEE Guidelines (NZSEE, 2006) which are believed to be un-conservative and currently under revision." – Reference: Proceedings of the Ninth Pacific Conference on Earthquake Engineering, Building an Earthquake-Resilient Society. 14-16 April 2011, Auckland, New Zealand. Paper Number 075, Auckland Art Gallery A Celebration of the New and Old by S.J. Oliver & C.S.M. Mackenzie, Holmes Consulting Group, Auckland, New Zealand.)

Additionally, the adequacy of both the stainless steel (SS) bolted and nailed connection elements from the villaboard ceiling to the CMU walls is unknown because size of nails and spacing of SS bolts and nails was not specified on the drawings.

Furthermore, the roof diaphragm was designed to consist entirely of the villaboard ceiling sheathing but this ceiling sheathing is interrupted at the central service corridor and therefore has limited capacity. As a result, it has buckled and cracked during the Canterbury earthquake sequence.

Because of shallow foundations and the use of weak 6mm villaboard ceiling-lining during construction, and because of lack of specified connections of ceiling to the CMU walls, the subject building structure suffered minor to moderate earthquake damage. The ceiling diaphragm has a much lower capacity than apparently assumed by the designers and needs replacement.

While undertaking the current detailed engineering evaluation, the building was calculated to have a capacity of approximately 40%NBS due to limitations of the diaphragm connections. Further, the earthquake induced cracking of the concrete wall and column elements has impacted the current capacity and it will be less than 100%NBS otherwise calculated - due to the weakening effect of the earthquake damage, perhaps by 10%, so estimated capacity is 90%NBS.

The building has a seismic capacity greater than 33% NBS so it is not defined as earthquake prone in accordance with the Building Act 2004. However, strengthening work is recommended to increase the overall building capacity to at least 67% NBS.

8.5 Limitations and Assumptions in Results

The results have been reported as a %NBS and the stated value is that obtained from our analysis and assessment. Despite the use of best national and international practice in this analysis and assessment, this value contains uncertainty due to the many assumptions and simplifications which are made during the assessment. These include:

- Simplifications made in the analysis, including boundary conditions such as foundation fixity;
- Assessments of material strengths based on limited drawings, specifications and site inspections;
- The normal variation in material properties which change from batch to batch;
- Approximations made in the assessment of the capacity of each element, especially when considering the post-yield behaviour.

9 Geotechnical Assessment

The following is a summary of the Geotechnical Desk Study for the Scarborough Park Toilet Block carried out by Opus International Consultants. The full report can be found in Appendix C.

Key findings were reported as follows:

- The building is founded on 300mm wide strip footings, 750mm deep piles for pillars.
- There has been lateral displacement of 150mm towards open drain.
- 80mm of ground subsidence has been observed externally.
- No level survey has been undertaken to date therefore the performance of the existing foundations is unknown. A level survey is recommended to assess performance.
- DBH guidelines are based on timber framed construction and tolerances for a concrete block structure are likely to be less than the DBH guidance. It is suggested that a Structural Engineer reviews the results of the level survey to determine if building needs to be relevelled.
- Site is located within the Cliff Collapse Rockfall Risk Zone. Future use of the toilet block should align with CCC's policy on rockfall risk tolerance.
- A desktop geotechnical evaluation of the site by the Christchurch office of Opus concluded the site soils should be categorised as class D.

9.1 Peak Ground Acceleration and Displacement

Peak accelerations recorded from the 22 February 2011 earthquake were 1.88g (city); 2.2g (near the epicentre, close to Scarborough, at Heathcote Valley Primary School.) This is the highest PGA ever recorded in New Zealand.

Satellite images indicate the net displacement of the land south of the fault was 500mm westwards and upwards; the land movement would have been greater during the earthquake.

Interpolation of United States Geological Survey (USGS) Shakemap: South Island of New Zealand (22 Feb, 2011) indicates that this location has likely experienced a horizontal Peak Ground Acceleration (PGA) of approximately 1g to 2g during the 22nd February 2011 earthquake.

10 Conclusions

a. The building has a seismic capacity of 40%NBS as governed by the ceiling diaphragm, and is therefore not classified as earthquake prone, however is classified as earthquake risk.
b. The cracking to the CMU walls, concrete foundations, exterior concrete columns, and interior cladding such as villaboard ceiling, is primarily due to displacement of the structure as it moved 150mm horizontally (and vertically) on relatively narrow and shallow foundations

11 Recommendations

a. Strengthening work is recommended to increase the overall building capacity to at least 67%NBS.
b. The potential hazard from rock falls should be evaluated.
c. If it is decided to strengthen the building, then a detailed assessment of the foundation adequacy should be performed which may entail a level survey.

12 Limitations

a. This report is based on an inspection of the structure with a focus on the damage sustained from the 22 February 2011 Canterbury Earthquake and aftershocks only. Some non-structural damage is mentioned but this is not intended to be a comprehensive list of non-structural items.
b. Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at the time.
c. This report is prepared for the CCC to assist with assessing remedial works required for council buildings and facilities. It is not intended for any other party or purpose.

13 References

[1] NZS 1170.5: 2004, *Structural design actions, Part 5 Earthquake actions,* Standards New Zealand.

[2] NZSEE: 2006, *Assessment and improvement of the structural performance of buildings in earthquakes,* New Zealand Society for Earthquake Engineering.

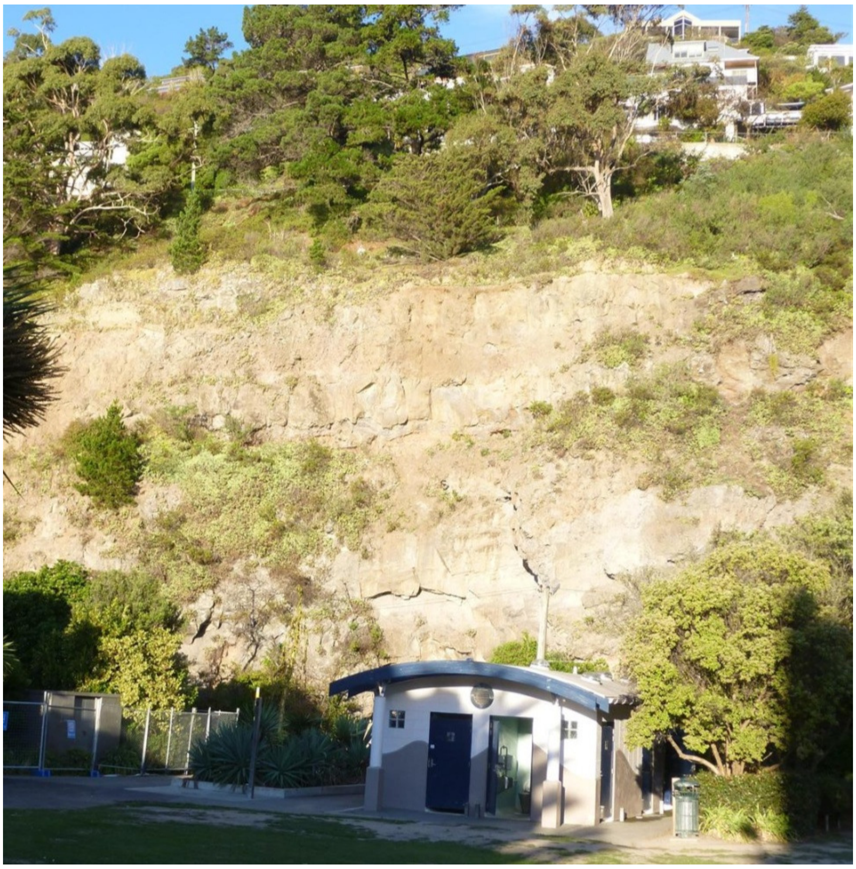
[3] Engineering Advisory Group, Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure, Draft Prepared by the Engineering Advisory Group, Revision 5, 19 July 2011.

[4] Engineering Advisory Group, *Guidance on Detailed Engineering Evaluation of Non-residential buildings, Part 3 Technical Guidance*, Draft Prepared by the Engineering Advisory Group, 13 December 2011.

[5] SESOC, *Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes*, Structural Engineering Society of New Zealand, 21 December 2011.

Appendix A – Photographs

General view



Rock face behind toilet facility

Right (north) wall (Note slab cracks. Note central CMU wall pier much stiffer)

Rear (east) wall (Note the displacement of the building relative to surrounding slab)

Front side (Note columns on separate foundation than building)

Front view showing column attachment and ceiling deformation

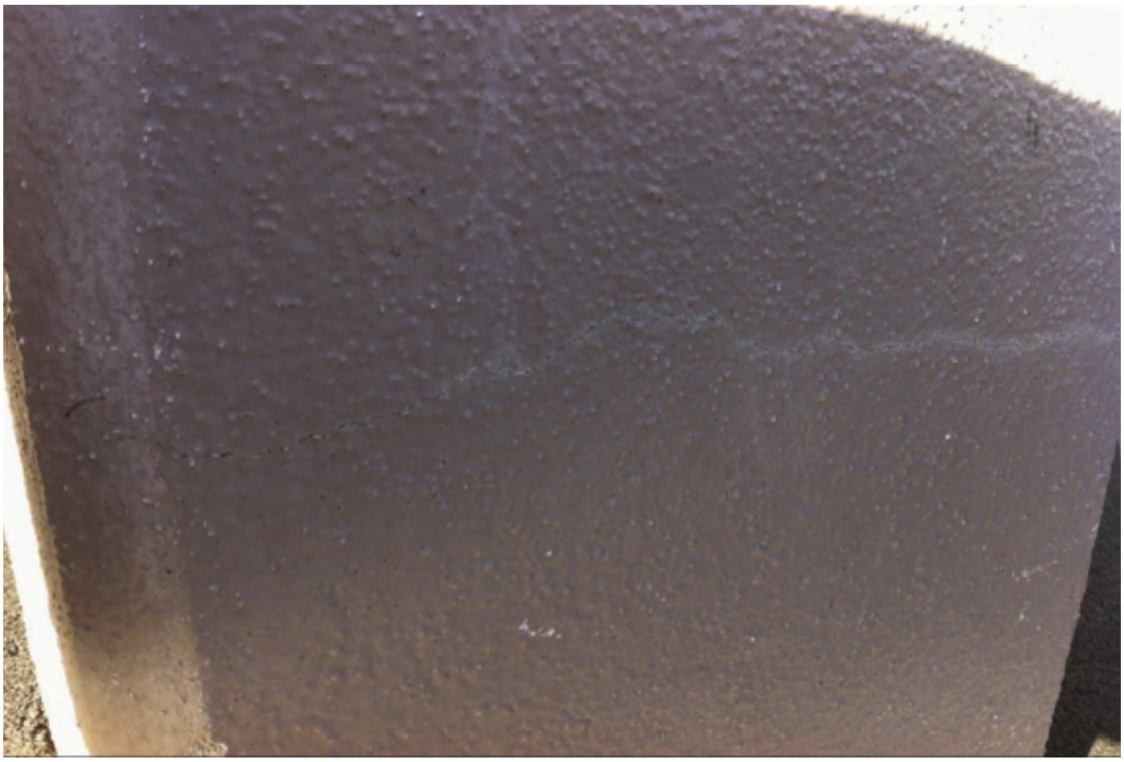
Column foundations isolated from rest of building

Cracks in concrete column

Separation between building foundation and footpath on the east side about 10-20mm

Hairline cracking at east side wall 1m long

Hairline cracking and break away at the southeast corner



Hairline cracking on the southeast corner column

Movement in the eave on the south end

Hairline cracking on the southwest corner column

Hairline cracking and breakaway at the southwest corner

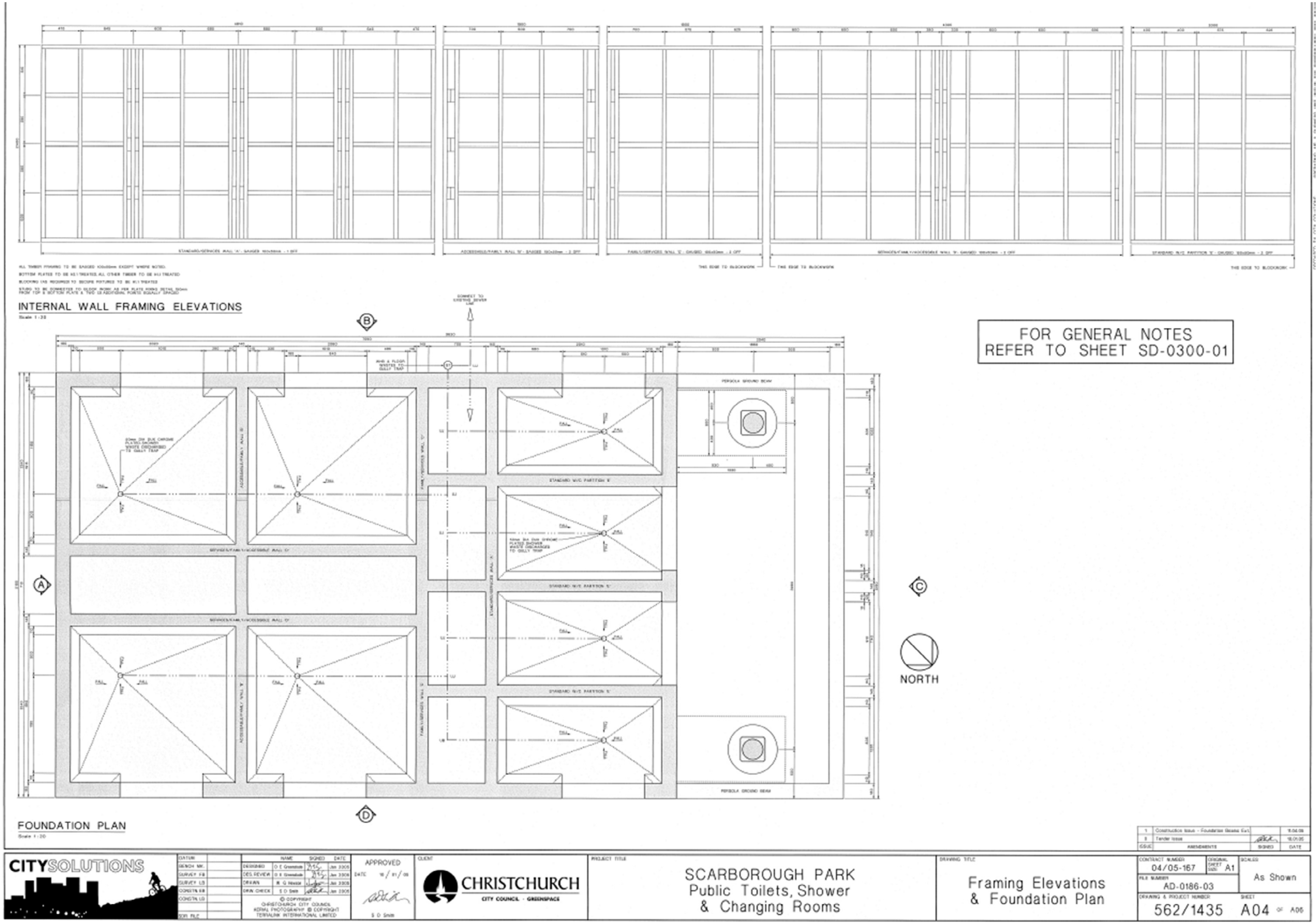
Cracking where the wall meets the ceiling in the southeast corner toilet

Cracking in mortar joint above door at midpoint on west wall

Roof structure in the service corridor

Service corridor

Appendix B – Drawings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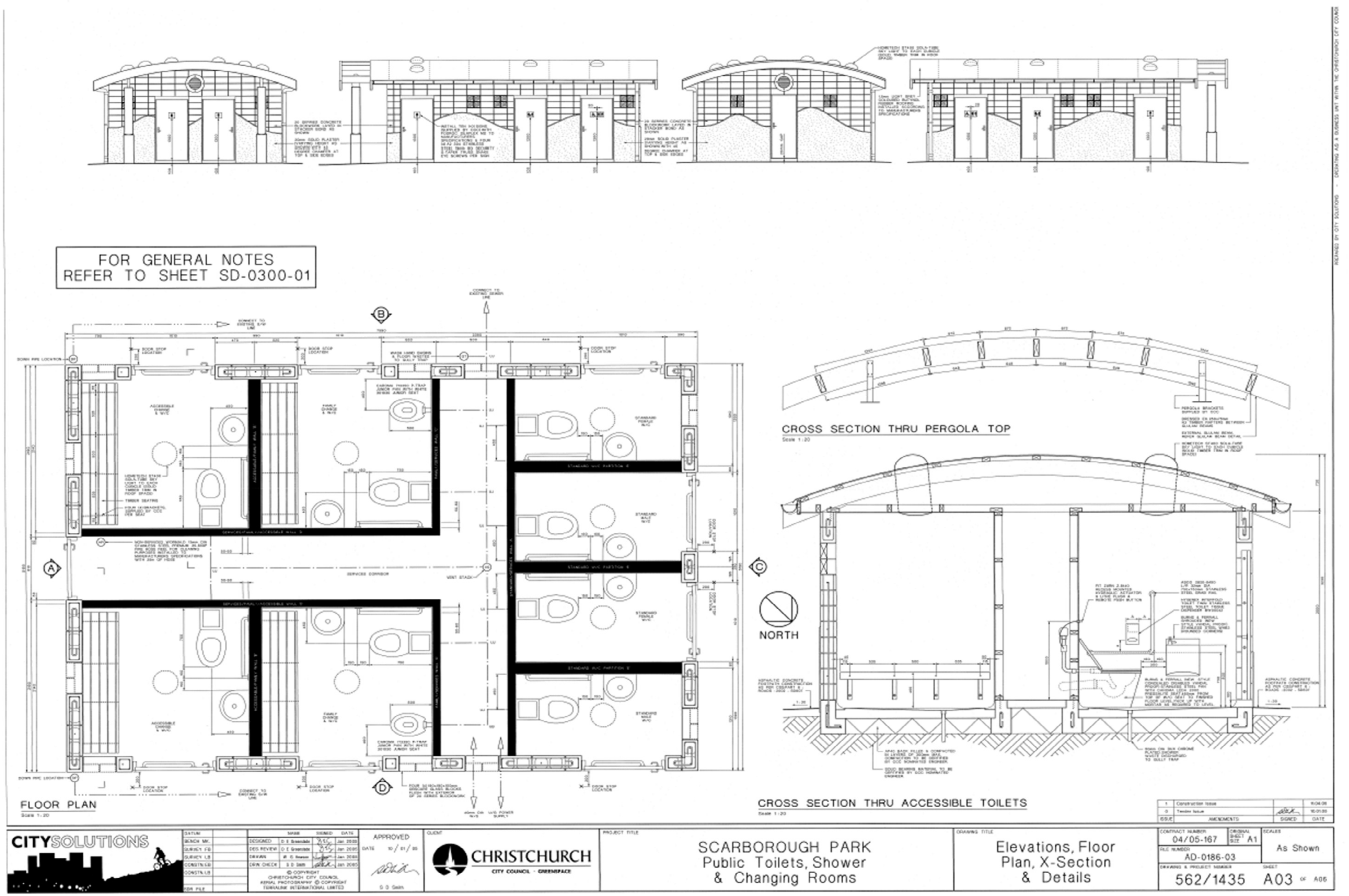
FOR GENERAL NOTES
REFER TO SHEET SD-0300-01
NORTH
FOUNDATION PLAN
CITYSOLUTIONS
CHRISTCHURCH
CITY COUNCIL · GREENSPACE
APPROVED
SCARBOROUGH PARK
Public Toilets, Shower
& Changing Rooms
Framing Elevations
& Foundation Plan
04/05-167
A1
As Shown
AD-0186-03
562/1435
A04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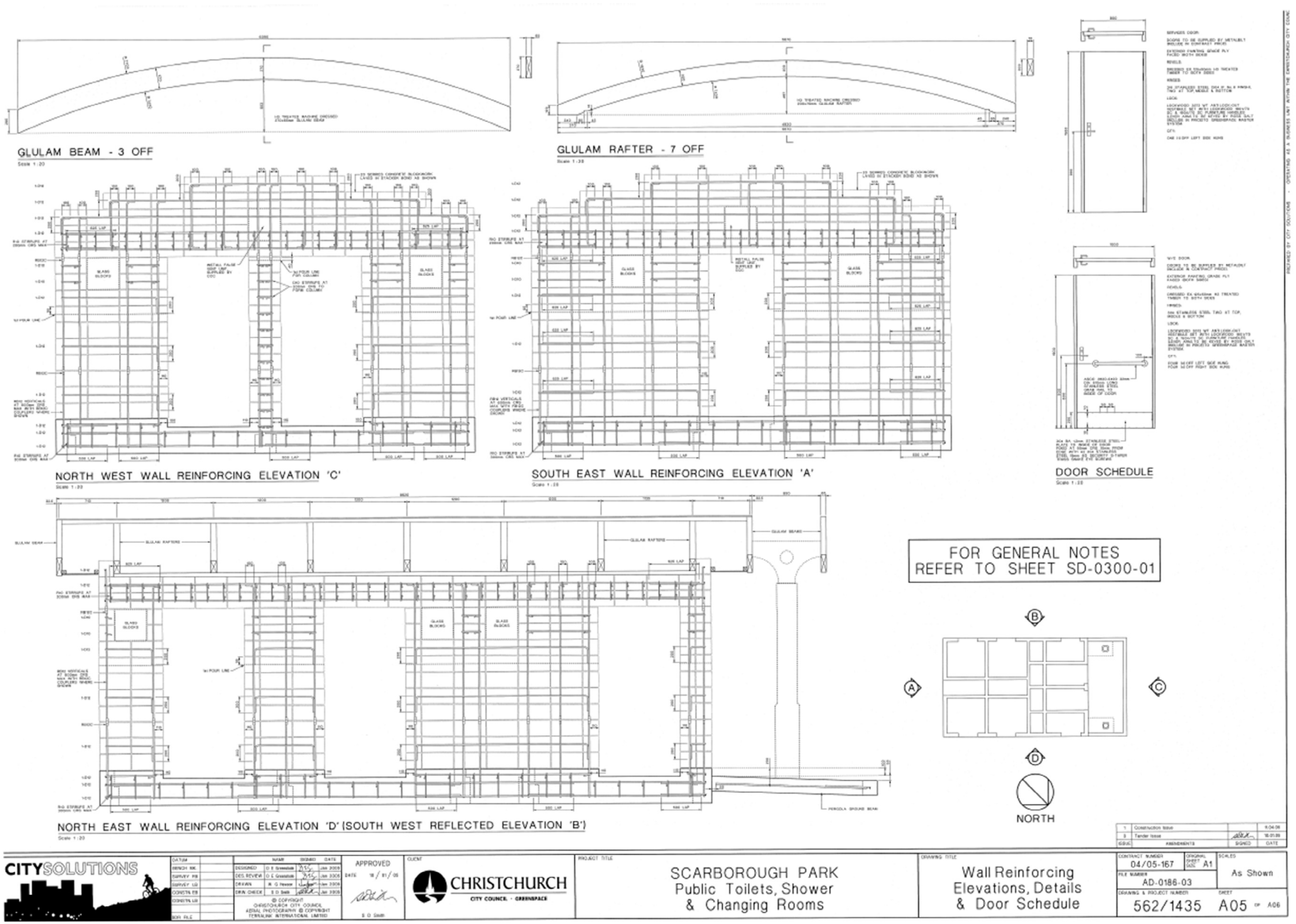
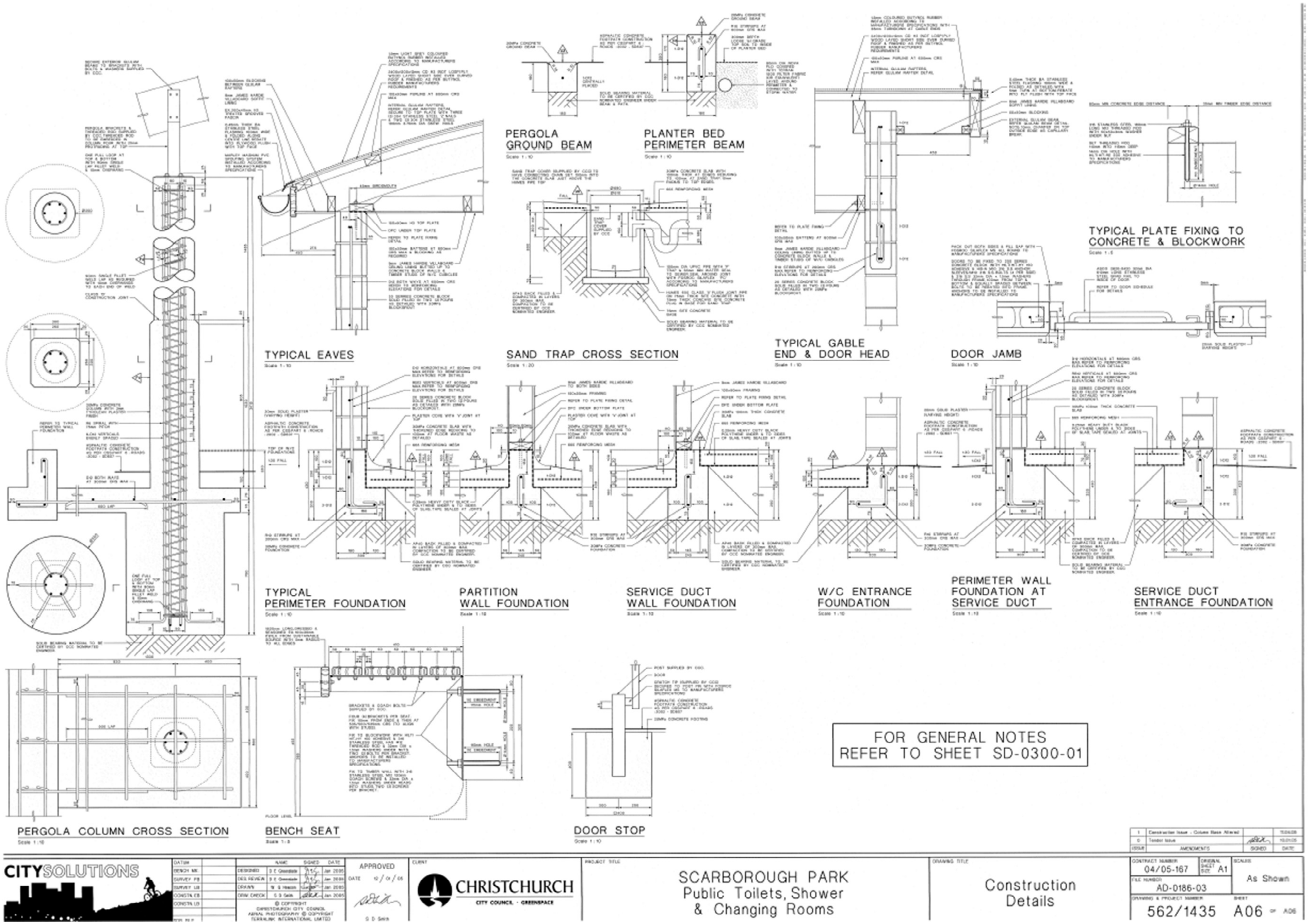
CROSS SECTION THRU PERGOLA TOP
CROSS SECTION THRU ACCESSIBLE TOILETS
NORTH
CITYSOLUTIONS
CHRISTCHURCH
CITY COUNCIL · GREENSPACE
SCARBOROUGH PARK
Public Toilets, Shower
& Changing Rooms
Elevations, Floor
Plan, X-Section
& Details
04/05-167
AD-0186-03
As Shown
562/1435
A03


GLULAM BEAM - 3 OFF
GLULAM RAFTER - 7 OFF
NORTH WEST WALL REINFORCING ELEVATION 'C'
SOUTH EAST WALL REINFORCING ELEVATION 'A'
DOOR SCHEDULE
FOR GENERAL NOTES REFER TO SHEET SD-0300-01
NORTH
NORTH EAST WALL REINFORCING ELEVATION 'D' (SOUTH WEST REFLECTED ELEVATION 'B')
CITYSOLUTIONS
APPROVED
CHRISTCHURCH
CITY COUNCIL · GREENSPACE
SCARBOROUGH PARK
Public Toilets, Shower
& Changing Rooms
Wall Reinforcing
Elevations, Details
& Door Schedule
04/05-167
A1
As Shown
AD-0186-03
562/1435
A05 OF A06


PERGOLA GROUND BEAM
PLANTER BED PERIMETER BEAM
TYPICAL EAVES
SAND TRAP CROSS SECTION
TYPICAL GABLE END & DOOR HEAD
DOOR JAMB
TYPICAL PLATE FIXING TO CONCRETE & BLOCKWORK
TYPICAL PERIMETER FOUNDATION
PARTITION WALL FOUNDATION
SERVICE DUCT WALL FOUNDATION
W/C ENTRANCE FOUNDATION
PERIMETER WALL FOUNDATION AT SERVICE DUCT
SERVICE DUCT ENTRANCE FOUNDATION
PERGOLA COLUMN CROSS SECTION
BENCH SEAT
DOOR STOP
FOR GENERAL NOTES REFER TO SHEET SD-0300-01
CITYSOLUTIONS
CHRISTCHURCH CITY COUNCIL · GREENSPACE
SCARBOROUGH PARK Public Toilets, Shower & Changing Rooms
Construction Details
04/05-167
A1
As Shown
AD-0186-03
562/1435
A06

Appendix C – Geotechnical Assessment

30 October 2012

Michael Sheffield
Property Asset Manager
Christchurch City Council
PO Box 237
Christchurch 8140

6-QUCC1.20/025HC

Dear Michael,

Geotechnical Desktop Study – Scarborough Park Toilet Block

1. Introduction

This report summarises the findings of a geotechnical desktop study and site walkover completed by Opus International Consultants (Opus) for Christchurch City Council at the above property on 3 July 2012. The Geotechnical desk study follows the Canterbury Earthquake Sequence initiated by the 4 September 2010 earthquake.

The purpose of the geotechnical study is to record observed ground damage and to assess the current ground conditions and the potential geotechnical hazards that may be present at the site, and determine whether further subsurface geotechnical investigations are necessary.

This Geotechnical Desk Study has been prepared in accordance with the Engineering Advisory Group's Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Revision 5, 19 July 2011.

The Geotechnical Desk Study forms part of a Detailed Engineering Evaluation prepared by Opus. A level survey has not been undertaken. The Geotechnical Desk Study has been undertaken without the benefit of any site specific investigations and is therefore preliminary in its nature.

It is our understanding this is the first inspection by a Geotechnical Engineer of this property following the Canterbury Earthquake Sequence.

2. Desktop Study

2.1 Site Description

The toilet block is located on the eastern edge of Scarborough Park, approximately 120 m north of the intersection of Heberden Avenue and Esplanade, Sumner, and is 50 m south of Scarborough Beach shoreline. The site is relatively flat, with residential properties neighbouring the site. There is a 30m high cliff face which runs parallel to Heberden Avenue, approximately 30 m to the east of the building.

The building is a single storey concrete block structure, with a footprint measuring approximately 7 m by 5 m, with two external pillars supporting a roof overhang at the western end of the toilet black. An open drain with concrete facing to the sides is located 2 m from the eastern end of the toilet block. The invert of the drain is approximately 1.0 m below road level, and runs parallel to Heberden Avenue.

2.2 Structural Drawings

Structural drawings supplied to Christchurch City Council by City Solutions show the toilet block to be founded on 300 mm wide strip footings supporting internal and external walls. The 100 mm thick floor slab is shown to be ground supported, but not tied into the strip footings. The walls of the structure are shown to be steel reinforced concrete.

The two external pillars are shown to be supported on 600mm diameter concrete piles to a depth of 750 mm, and are shown to be tied into the external strip footings.

Copies of the structural drawings are presented in Appendix A.

2.4 Regional Geology

The 1:25,000 Geological Map of Christchurch Urban Area (GNS 2008) indicates the site is underlain by beach gravel and sand of post glacial shorelines over basalt to trachytic lava flows of the Lyttelton Volcanic Group.

According to Environment Canterbury Regional Council records, groundwater is anticipated to be greater than 1.5m below ground level.

2.5 Expected Ground Conditions

Six well logs were selected from the Environment Canterbury (ECan) website. Four of the wells are located within the Scarborough Park grounds. The remaining wells are located 50m west of the toilet block.

The approximate locations of the boreholes relative to the toilet block are shown on the attached Site Location Plan. The logs of the ECan boreholes are presented in Appendix A.

Groundwater level is anticipated to be approximately 2.0m below ground level.

The investigation logs available from ECan records have been used to infer the ground conditions beneath the site, and are summarised in Table 1 below:

Stratigraphy	Thickness (m)	Depth Encountered from (m) bgl
SAND	At least 6.0 m	surface

Table 1 Interpreted Ground Conditions

2.6 Ground Damage

No evidence of liquefaction was observed in aerial photographs taken after the 4th September earthquake, and the aftershocks of 22 February and 13 June 2011, or the 23 December 2011 earthquake.

2.7 Rockfall Hazard

Information supplied by the Port Hills Geotechnical Group indicates the Scarborough Park toilet block is located entirely within the extent of the Cliff Collapse (total inundation, boulder roll and fly rock) rockfall model, as generated by GNS Science for CCC.

No rockfall has been recorded to have actually impacted the toilet block, the nearest boulder recorded was within approximately 5 m of the southeastern wall, beyond the drainage swale. The dimensions of the boulder were recorded as being 0.4 m x 0.4 m x 0.6 m.

Future use of the Scarborough Park toilet block should align with CCC's policy on rockfall risk tolerance adopted for the Port Hills.

2.8 Liquefaction Hazard

Tonkin and Taylor Ltd (T&T Ltd) have been engaged as the Earthquake Commission's (EQC) geotechnical consultants and have prepared maps showing areas of liquefaction interpreted from high resolution aerial photos for the 4 September earthquake, and the aftershocks of 22 February and 13 June 2011. An interpretation of these maps indicates the site did not suffer from liquefaction in any of the Canterbury earthquakes initiated by the 4 September 2010 earthquake, although liquefaction was reported 450m southwest of the site following the 13 June 2011 aftershock.

The 2004 Environment Canterbury Solid Facts Liquefaction Study indicates the site is in an area designated as 'moderate liquefaction ground damage potential'. According to this study, based on a low groundwater table, ground damage is expected to be moderate and may be affected by 100mm to 300mm of ground subsidence.

The Christchurch Earthquake Recovery Authority (CERA) last updated 11 December, 2011 has classified Scarborough Park and surrounding residential properties as Green Zone, indicating the repair and rebuilding process can begin.

The maps that were released by the Department of Building and Housing (DBH) on 9 February 2012 indicate that the site is classified as urban non-residential. Residential properties to the west and south of the site are classified as Technical Category 2 (yellow), which indicates that minor to moderate land damage from liquefaction is possible in future significant earthquakes.

3. Site Walkover Inspection

A walkover inspection of the interior of the building and surrounding land was carried out by a Senior Opus Engineering Geologist on 3 July 2012.

The following observations were made (refer to the Walkover Inspection Plan and Site Photographs attached to this report):

- The structure appears to be founded on concrete strip footing with a ground supported floor slab;
- A subsidence bowl in the asphalt pavement, up to 50 mm deep, located by the southwest corner of the toilet block (Photograph 4);
- 50 mm of horizontal separation of the asphalt pavement from the western edge of the toilet block footings (in-filled at time of site visit) (Photograph 5);
- Up to 70 mm of horizontal separation of the asphalt pavement from the eastern edge of the toilet block footings (in-filled at time of site visit) (Photograph 6);
- Some minor bulging and cracks in the concrete facing of the open drain located to the east of the toilet block (Photograph 7);

- 20 mm wide crack in the asphalt pavement located at the southwest corner of the toilet block (Photograph 8);
- 5 mm wide crack in the asphalt pavement located by the northwest corner of the toilet block (Photograph 9);
- 10 mm wide crack in the asphalt pavement located midway along the north facing side of the toilet block (Photograph 10);
- 5 mm wide crack in the asphalt pavement located midway along the south facing side of the toilet block (Photograph 11);
- Between 20 mm and 80 mm of settlement of asphalt pavement along the northeast corner of the toilet block (Photograph 12);
- 20 mm wide opening of asphalt pavement along the eastern edge of the toilet block (possible trench to buried services) (Photographs 13).

4. Discussion

The site is anticipated to be underlain by sand to a depth greater than 6m below ground level. Groundwater is reported to be approximately 2.0m below ground level.

Minor land damage has occurred to the toilet block, potentially due to the Canterbury Earthquake Sequence following the 4 September 2010 earthquake. There has been some cracking of the asphalt pavement around the toilet block, and minor bulging and cracking in the concrete facing to the open drain located to the east of the toilet block indicating some lateral movement. There is also evidence of up to 80 mm of subsidence of the asphalt pavement located by the southwest and northeast corners of the toilet block. The settlement of the asphalt observed is more likely to be due to lateral spreading rather than liquefaction induced subsidence.

Estimated eastward lateral displacement is in the order of 150mm. We believe the displacements observed are indications of global lateral movement of a block of land towards the open drain, rather than lateral stretch. The gaps at the eastern and western ends of the building may be due to ground oscillations.

Damage to the building's foundations are currently unknown. A level survey of the floor slab is recommended to assess the performance of the existing foundations.

Structural drawings show that the building has been constructed on shallow strip footings with a concrete floor slab on grade, "Type C" foundation in accordance with DBH guidelines[1]. No damage to the footings was recorded. However, up to 80mm of settlement of the asphalt pavement along the northeast corner of the toilet block was observed, indicating possible differential settlement has occurred. Global lateral movement in the order of 150mm has been observed. This indicates a foundation re-level may be required as indicated by Table 2.3 of the DBH revised Guidance. The DBH guidelines have been prepared for residential properties, however, OPUS envisage CCC will use the DBH guidelines as a guide when reviewing building consent applications.

[1] Department of Building & Housing; Revised guidance on house repairs and reconstruction following the Canterbury earthquake, A summary of geotechnical and structural recommendations to guide house repairs and reconstruction, November 2011.

The DBH guidelines are based on the assumption that the structure is a timber framed residential property. A concrete structure is likely to be more rigid and therefore have lower tolerances to ground movement. The level of damage should be assessed by a Structural Engineer to determine the level of repair/rebuild required. If a rebuild is required, site specific site investigations are recommended for foundation design.

The concrete facing to the open drain shows evidence of movement. Irrespective of the level of repair/rebuild that may be required for the toilet block itself, the sides of the open drain are likely to require repair and strengthening to provide lateral resistance to the land supporting the toilet block structure.

GNS Science indicates an elevated risk of seismic activity is expected in the Canterbury region as a result of the earthquake sequence following the 4 September 2010 earthquake. Recent advice[2] indicates there is a 13% probability of another Magnitude 6 or greater earthquake occurring in the next 12 months in the Canterbury region. This event may cause liquefaction induced land damage at the site, similar to the ground damage that has occurred, dependent on the location of the earthquakes epicentre. There is currently a significant risk of liquefaction, differential settlements and lateral spread occurring. It is expected that the probability of occurrence is likely to decrease with time following periods of reduced seismic activity.

5. Recommendations

- A floor level survey should be carried out to determine the amount of differential settlement that has occurred to the building;

- Assessment of the findings of the level survey and this report by a Structural Engineer to determine the level of repair or rebuild required for this concrete structure.

6. Limitation

This report has been prepared solely for the benefit of Christchurch City Council as our client with respect to the particular brief given to us. Data or opinions in this desk study may not be used in other contexts, by any other party or for any other purpose.

It is recognised that the passage of time affects the information and assessment provided in this Document. Opus's opinions are based upon information that existed at the time of the production of this Desk Study. It is understood that the Services provided allowed Opus to form no more than an opinion on the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings or any laws or regulations.

Figures:
Site Location Plan
Walkover Inspection Plan
Site Photographs

Appendix A: Structural Drawings
Appendix B: ECan Borehole Logs

[2] GNS Science reporting on Geonet Website: http://www.geonet.org.nz/canterbury-quakes/aftershocks/ updated on 9 July and 13 September 2012.

SOURCE: Stronger Christchurch SCIRT Viewer (Accessed on 03/07/12)

OPUS
Opus International Consultants Ltd
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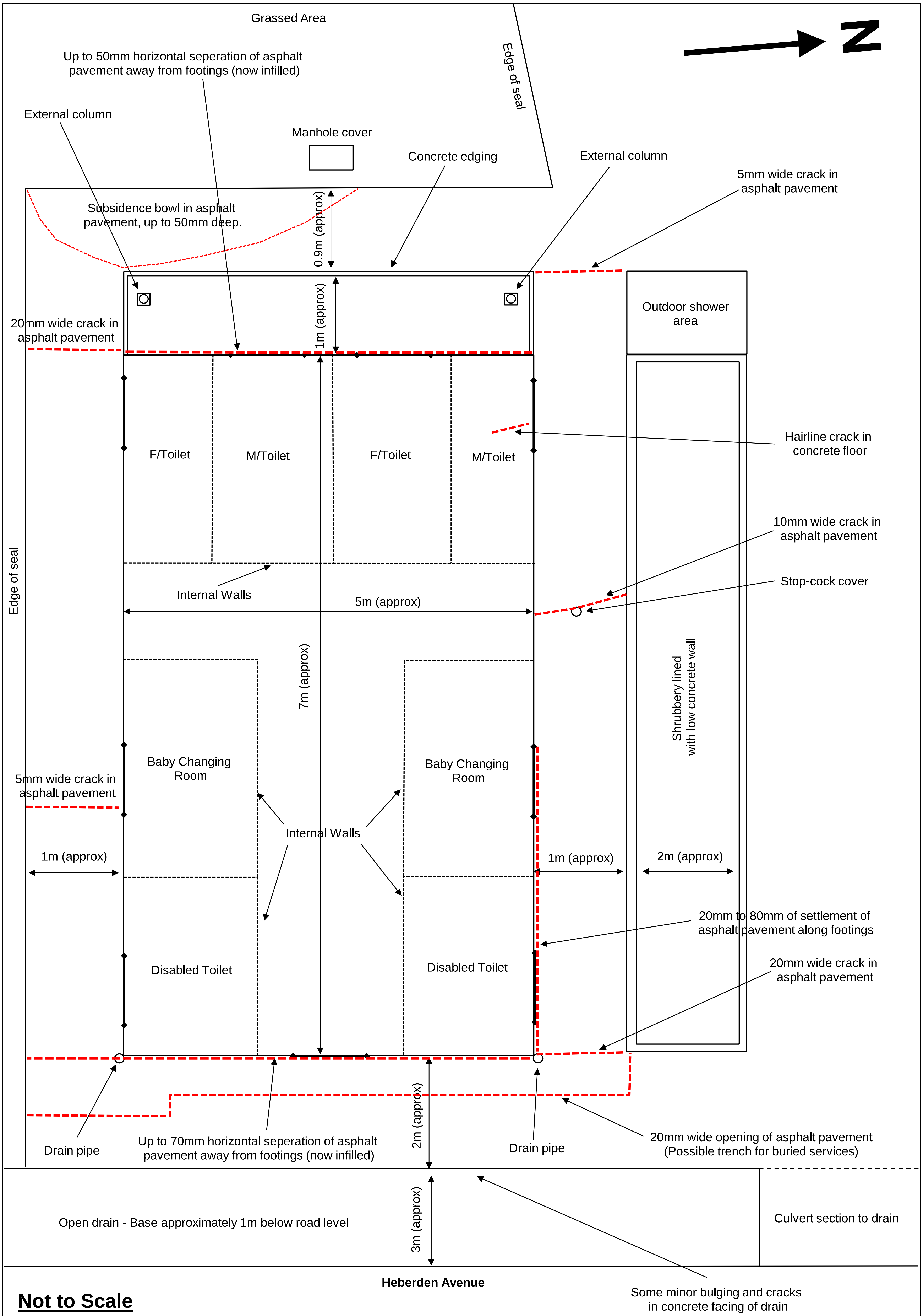
Christchurch, New Zealand
Tel: +64 3 363 5400 Fax: +64 3 365 7857

Project: Scarborough Park Toilet Block
Geotechnical Desktop Study
Project No.: 6_QUCC1.20/025HC
Client: Christchurch City Council

Site Location Plan

Drawn: 3/07/2012
Senior Engineering Geologist
Date: 3/07/2012



Not to Scale

OPUS

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Christchurch, New Zealand
Tel: +64 3 363 5400 Fax: +64 3 365 7857

Project:	Scarborough Park Toilet Block Geotechnical Desktop Study
Project No.:	6-QUCC1.20/025HC
Client:	Christchurch City Council

Walkover Inspection Plan

Completed by:	3/07/2012 Senior Engineering Geologist
Date Drawn:	3/07/2012

Photograph 1: View of North facing side of the toilet block

Photograph 2: View of east facing side of the toilet block

Photograph 3: View of cliff face above Scarborough Park.

Photograph 4: View of the subsidence bowl in the asphalt pavement on the southwest corner of the toilet block.

Photograph 5: View of horizontal separation of asphalt pavement from western edge of the toilet block footings (in-filled at time of site visit).

Photograph 6: View of horizontal separation of asphalt pavement from eastern edge of the toilet block footings (in-filled at time of site visit).

Photograph 7: View of the open drain located to the east of the toilet block.

Photograph 8: View of 20mm wide crack in asphalt pavement located by the southwest corner of the toilet block.

Photograph 9: View of View of 5mm wide crack in asphalt pavement located by the northwest corner of the toilet block.

Photograph 10: View of the 10mm wide crack in the asphalt pavement located midway along the north facing side of the toilet block.

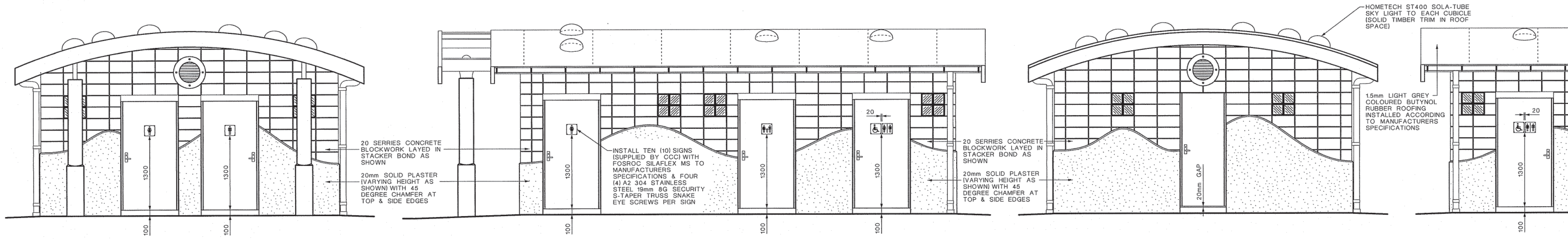
Photograph 11: View of the 5mm wide crack in the asphalt pavement located midway along the south facing side of the toilet block.

Photograph 12: View of between 20mm and 80mm of settlement of asphalt pavement along the northeast corner of the toilet block

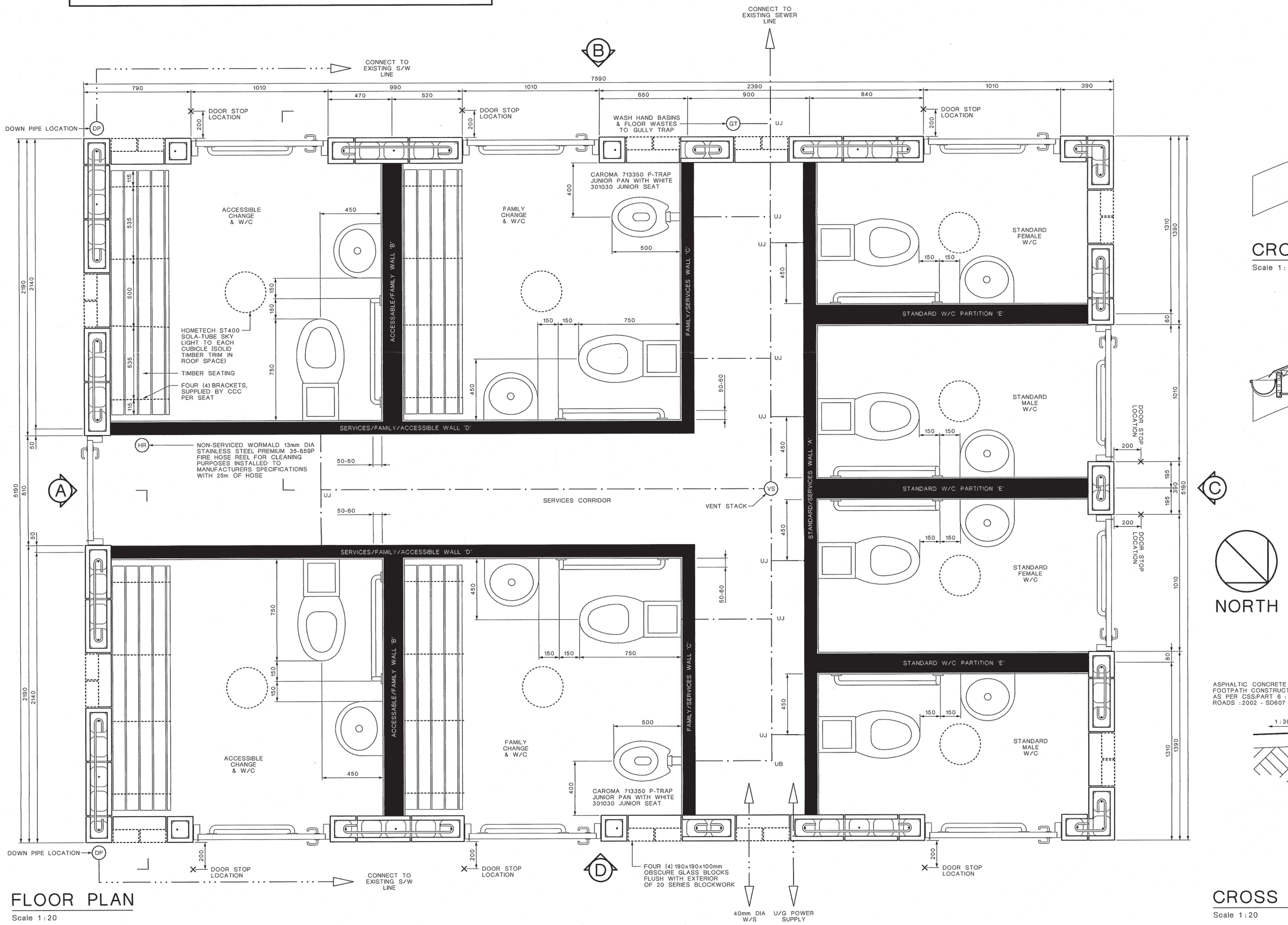
Photograph 13: View of the 20mm wide opening of asphalt pavement along eastern edge of the toilet block (possible trench to buried services).

Appendix A

Structural Drawings



FOR GENERAL NOTES REFER TO SHEET SD-0300-01



FLOOR PLAN
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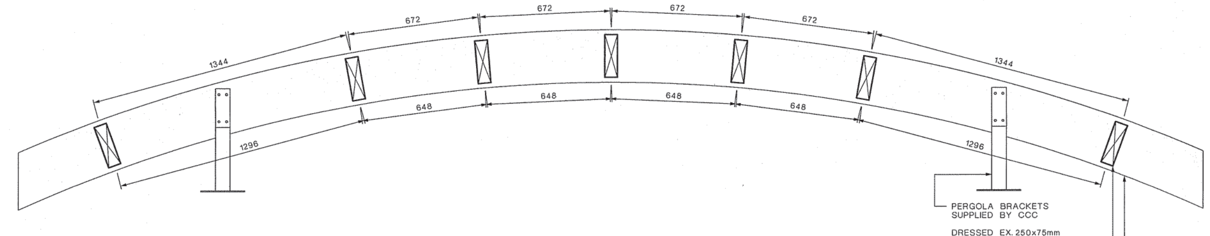
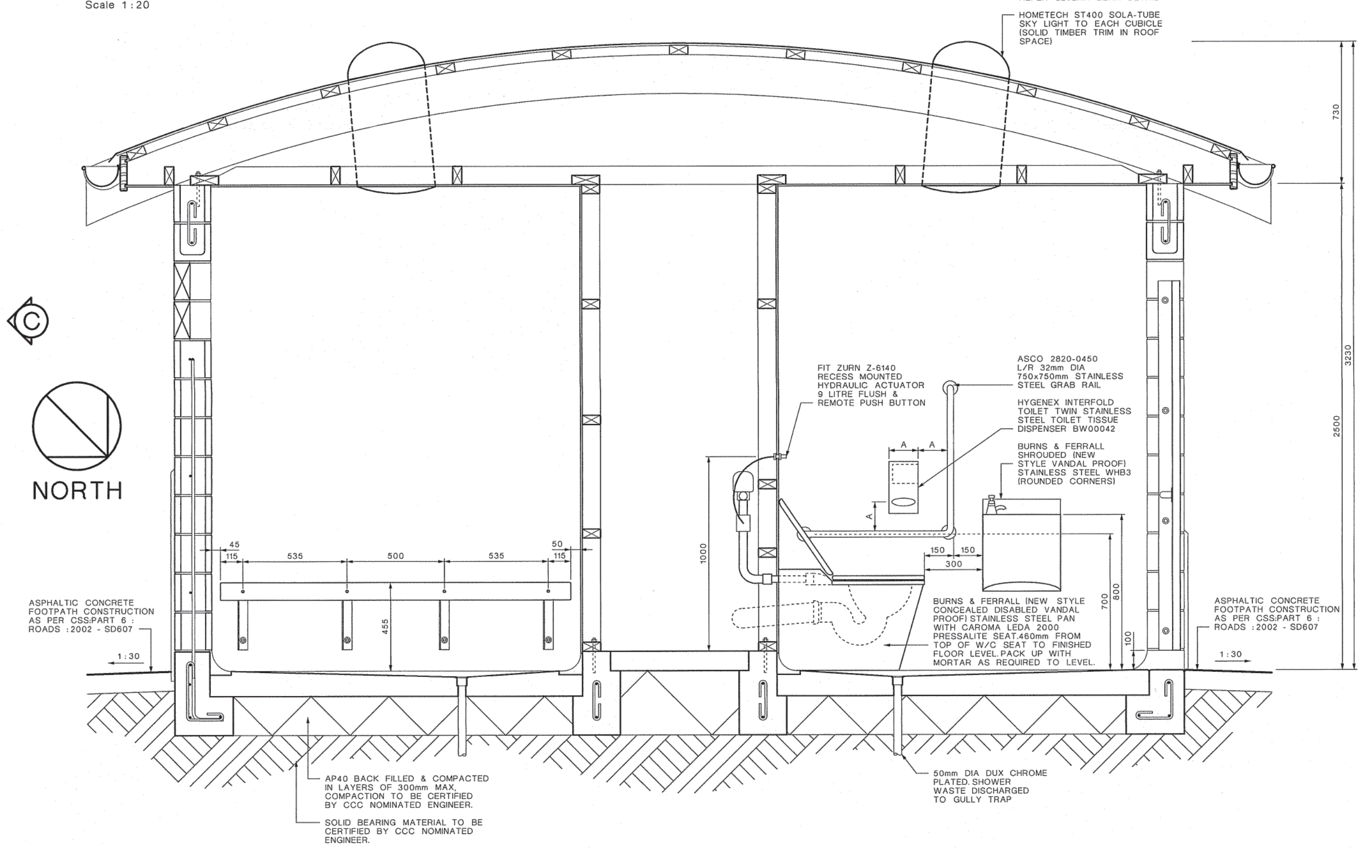


CROSS SECTION THRU PERGOLA TOP
Scale 1:20



CROSS SECTION THRU ACCESSIBLE TOILETS
Scale 1:20

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1	Construction Issue		11.04.05
0	Tender Issue		10.01.05

CITYSOLUTIONS

	NAME	SIGNED	DATE
DESIGNED	D E Greenslade		Jan 2005
DES. REVIEW	D E Greenslade		Jan 2005
DRAWN	W G Hewson		Jan 2005
DRW. CHECK	S D Smith		Jan 2005

DATUM / BENCH MK. / SURVEY FB / SURVEY LB / CONSTN. EB / CONSTN. LB / SDR FILE

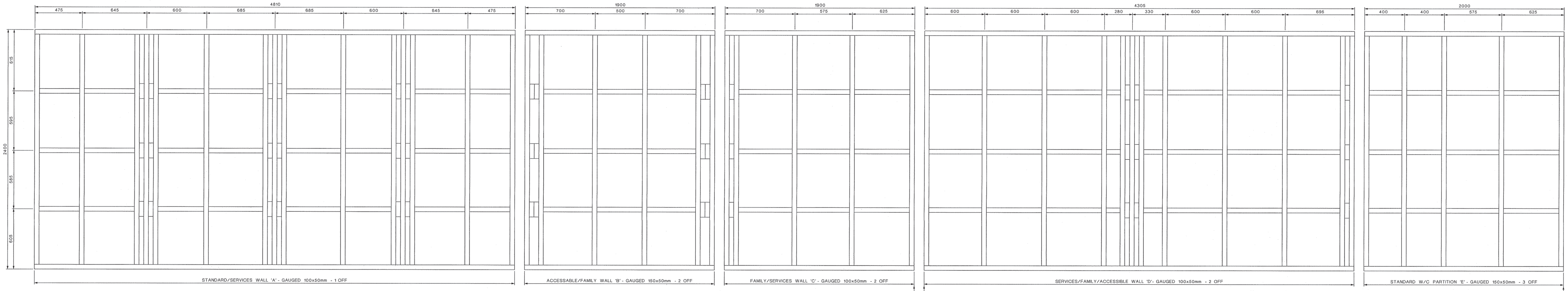
APPROVED
DATE 10 / 01 / 05
S D Smith

CLIENT: CHRISTCHURCH CITY COUNCIL · GREENSPACE

PROJECT TITLE: SCARBOROUGH PARK Public Toilets, Shower & Changing Rooms

DRAWING TITLE: Elevations, Floor Plan, X-Section & Details

CONTRACT NUMBER 04/05-167
ORIGINAL SHEET SIZE A1
SCALES As Shown
FILE NUMBER AD-0186-03
DRAWING & PROJECT NUMBER 562/1435
SHEET A03 OF A06



ALL TIMBER FRAMING TO BE GAUGED 100x50mm EXCEPT WHERE NOTED.

BOTTOM PLATES TO BE H3.1 TREATED, ALL OTHER TIMBER TO BE H1.1 TREATED

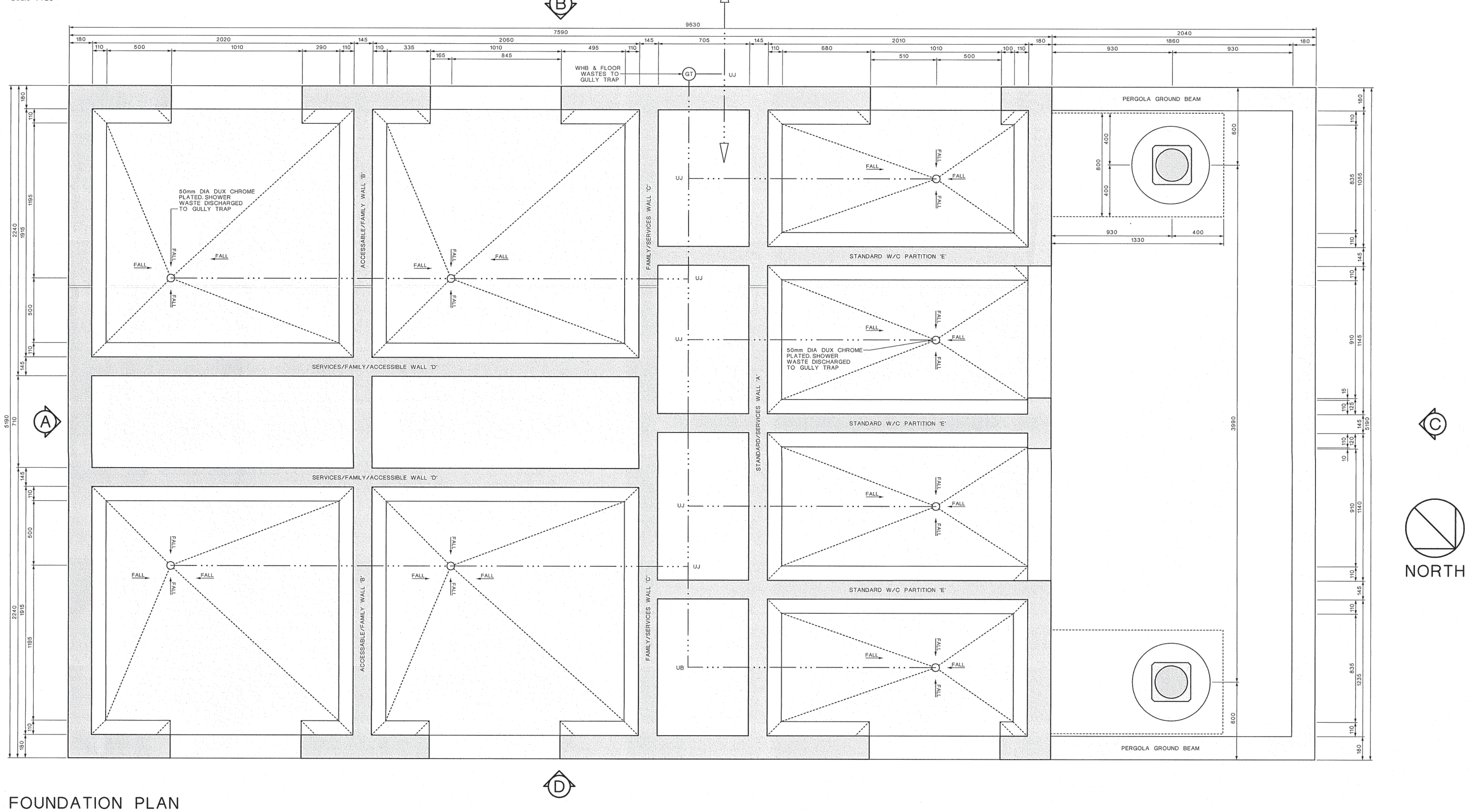
BLOCKING (AS REQUIRED) TO SECURE FIXTURES TO BE H1.1 TREATED

STUDS TO BE CONNECTED TO BLOCK WORK AS PER PLATE FIXING DETAIL 150mm FROM TOP & BOTTOM PLATE & TWO (2) ADDITIONAL POINTS EQUALLY SPACED

INTERNAL WALL FRAMING ELEVATIONS

Scale 1:20

FOR GENERAL NOTES REFER TO SHEET SD-0300-01



FOUNDATION PLAN

Scale 1:20

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0	Tender Issue	[signature]	10.01.05

CITYSOLUTIONS

DATUM	
BENCH MK.	
SURVEY FB	
SURVEY LB	
CONSTN. EB	
CONSTN. LB	
SDR FILE	

	NAME	SIGNED	DATE
DESIGNED	D E Greenslade	[signature]	Jan 2005
DES. REVIEW	D E Greenslade	[signature]	Jan 2005
DRAWN	W G Hewson	[signature]	Jan 2005
DRW. CHECK	S D Smith	[signature]	Jan 2005

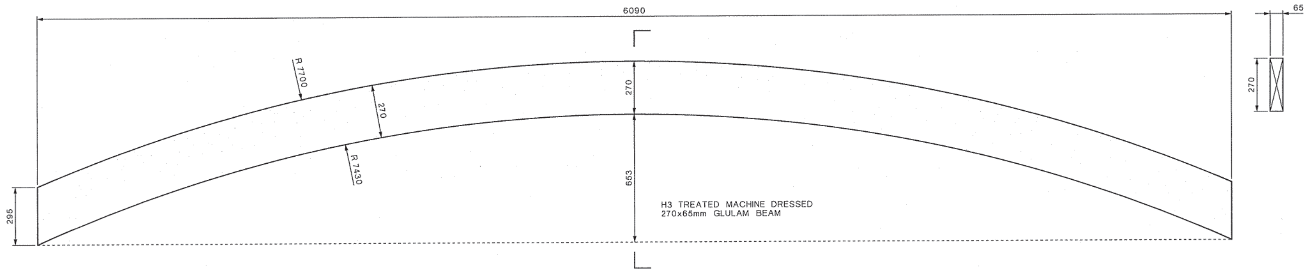
APPROVED
DATE 10/01/05
S D Smith

CLIENT
CHRISTCHURCH CITY COUNCIL · GREENSPACE

PROJECT TITLE
SCARBOROUGH PARK
Public Toilets, Shower & Changing Rooms

DRAWING TITLE
Framing Elevations & Foundation Plan

CONTRACT NUMBER 04/05-167
ORIGINAL SHEET SIZE A1
SCALES As Shown
FILE NUMBER AD-0186-03
DRAWING & PROJECT NUMBER 562/1435
SHEET A04 OF A06



GLULAM BEAM - 3 OFF

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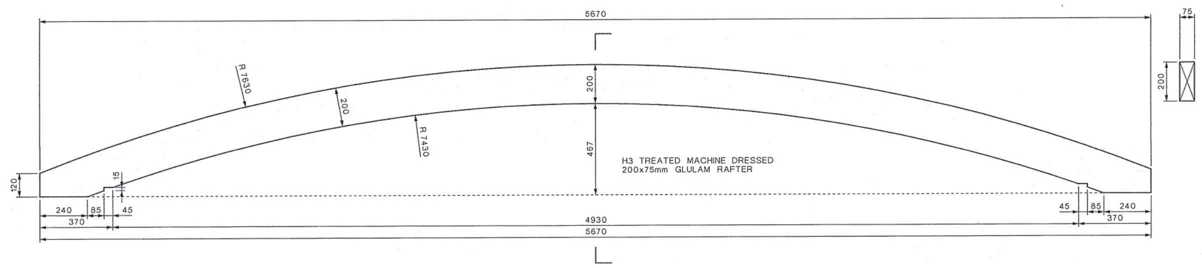

GLULAM RAFTER - 7 OFF

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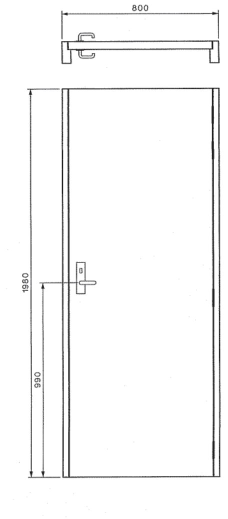


SERVICES DOOR:

DOORS TO BE SUPPLIED BY METALBILT (INCLUDE IN CONTRACT PRICE).

EXTERIOR PAINTING GRADE PLY FACED (BOTH SIDES)

REVELS:

DRESSED EX. 125x50mm H3 TREATED TIMBER TO BOTH SIDES

HINGES:

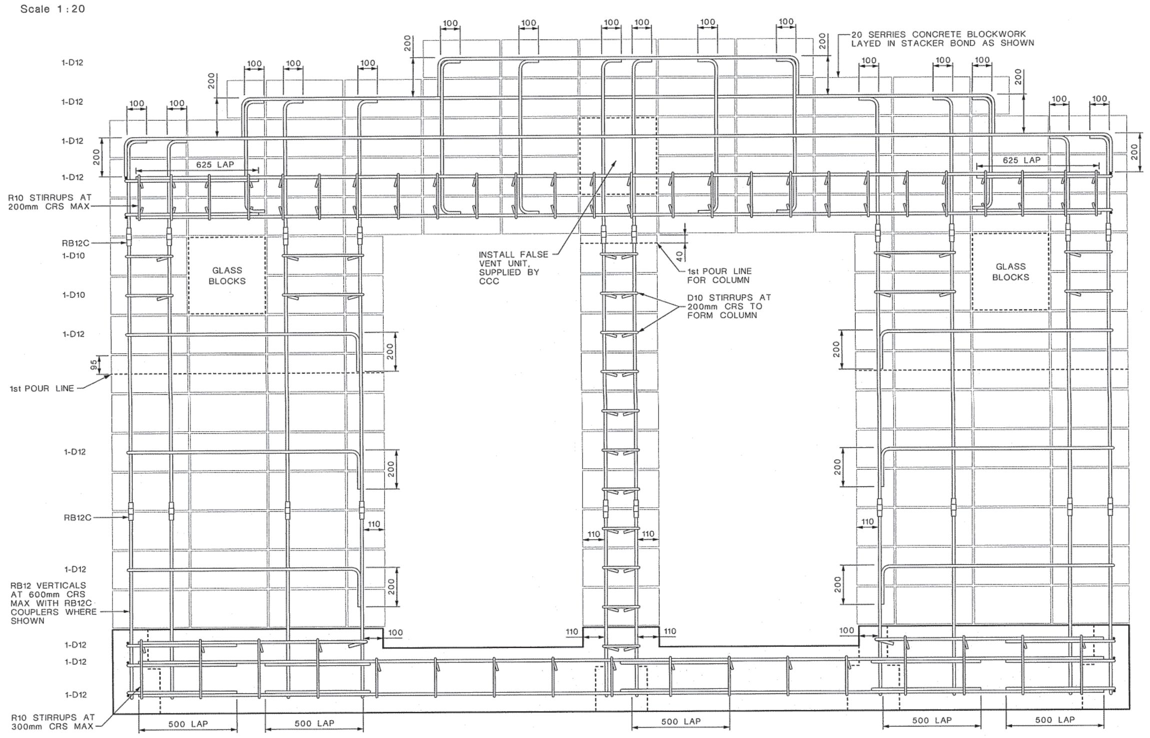
316 STAINLESS STEEL (304 IF No. 8 FINISH), TWO AT TOP, MIDDLE & BOTTOM

LOCK:

LOCKWOOD 3572 WT ANTI LOCK-OUT VESTIBULE SET WITH LOCKWOOD 1801/70 SC & 1904/70 SC FURNITURE HANDLES (LEVER ARM). TO BE KEYED BY ROSS GALT (INCLUDE IN PRICE)TO GREENSPACE MASTER SYSTEM.

QTY:

ONE (1) OFF LEFT SIDE HUNG



NORTH WEST WALL REINFORCING ELEVATION 'C'

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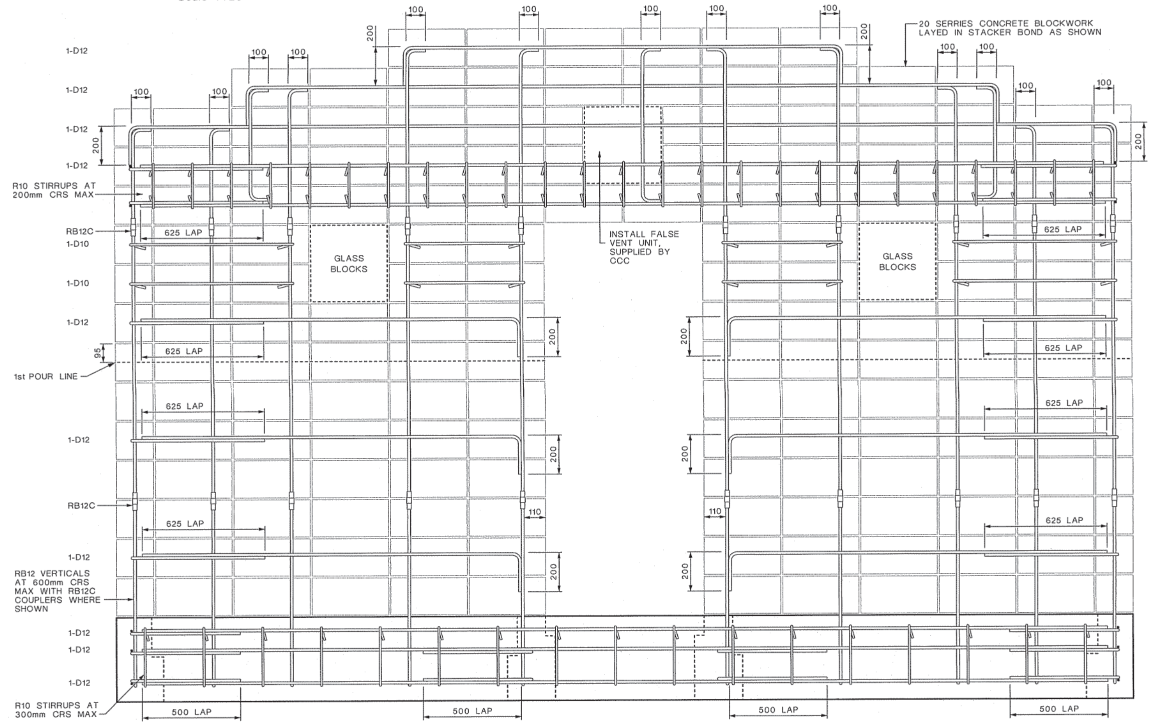

SOUTH EAST WALL REINFORCING ELEVATION 'A'

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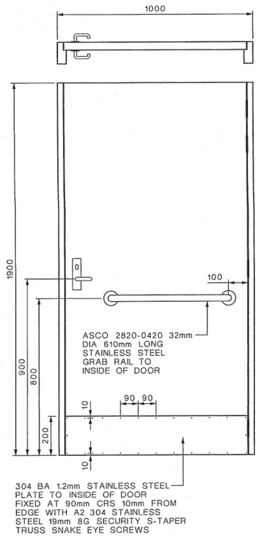

W/C DOOR:

DOORS TO BE SUPPLIED BY METALBILT (INCLUDE IN CONTRACT PRICE).

EXTERIOR PAINTING GRADE PLY FACED (BOTH SIDES)

REVELS:

DRESSED EX. 125x50mm H3 TREATED TIMBER TO BOTH SIDES

HINGES:

304 STAINLESS STEEL TWO AT TOP, MIDDLE & BOTTOM

LOCK:

LOCKWOOD 3572 WT ANTI LOCK-OUT VESTIBULE SET WITH LOCKWOOD 1801/70 SC & 1904/70 SC FURNITURE HANDLES (LEVER ARM). TO BE KEYED BY ROSS GALT (INCLUDE IN PRICE)TO GREENSPACE MASTER SYSTEM.

QTY:

FOUR (4) OFF LEFT SIDE HUNG
FOUR (4) OFF RIGHT SIDE HUNG

DOOR SCHEDULE

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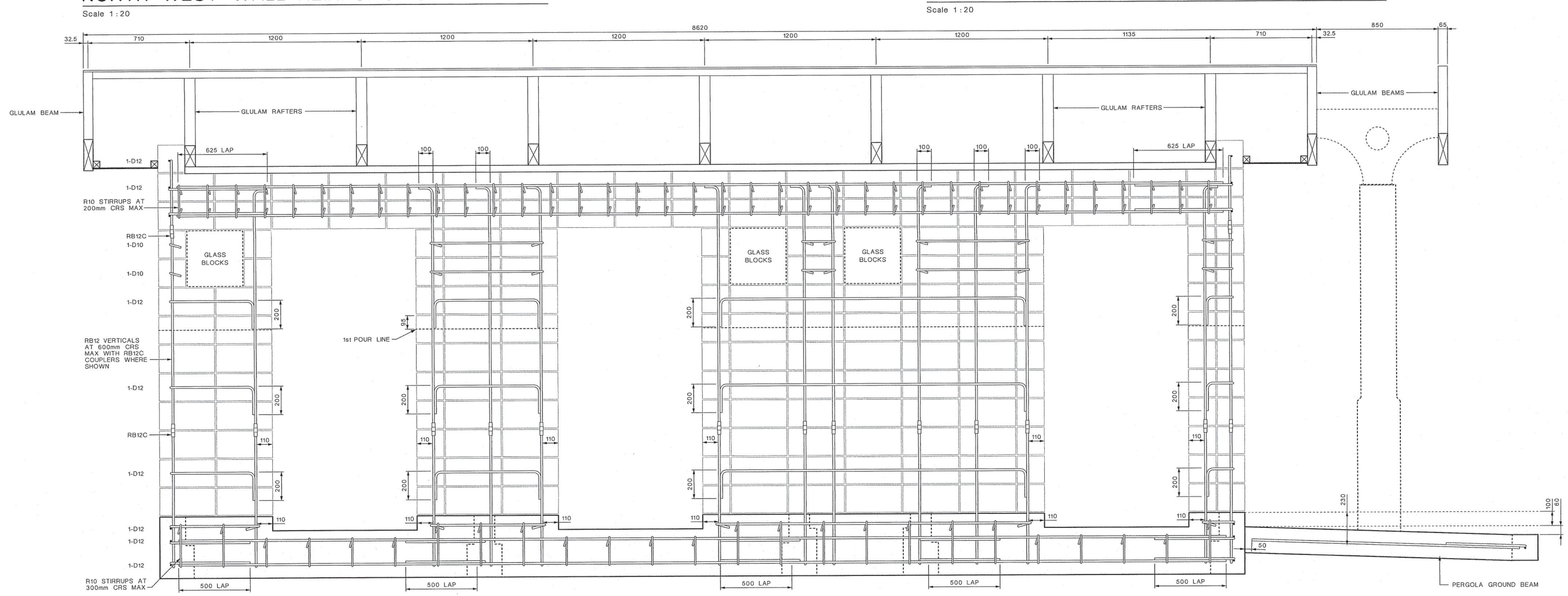
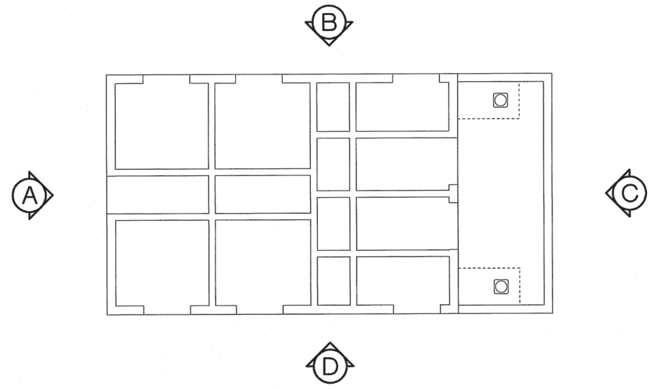
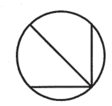


NORTH EAST WALL REINFORCING ELEVATION 'D' (SOUTH WEST REFLECTED ELEVATION 'B')

Scale 1 : 20

FOR GENERAL NOTES
REFER TO SHEET SD-0300-01





NORTH

ISSUE	AMENDMENTS	SIGNED	DATE
1	Construction Issue		11.04.05
0	Tender Issue		10.01.05

CITYSOLUTIONS

	NAME	SIGNED	DATE
DESIGNED	D E Greenslade		Jan 2005
DES. REVIEW	D E Greenslade		Jan 2005
DRAWN	W G Hewson		Jan 2005
DRW. CHECK	S D Smith		Jan 2005

DATUM
BENCH MK.
SURVEY FB
SURVEY LB
CONSTN. EB
CONSTN. LB
SDR FILE

APPROVED
DATE 10 / 01 / 05
S D Smith

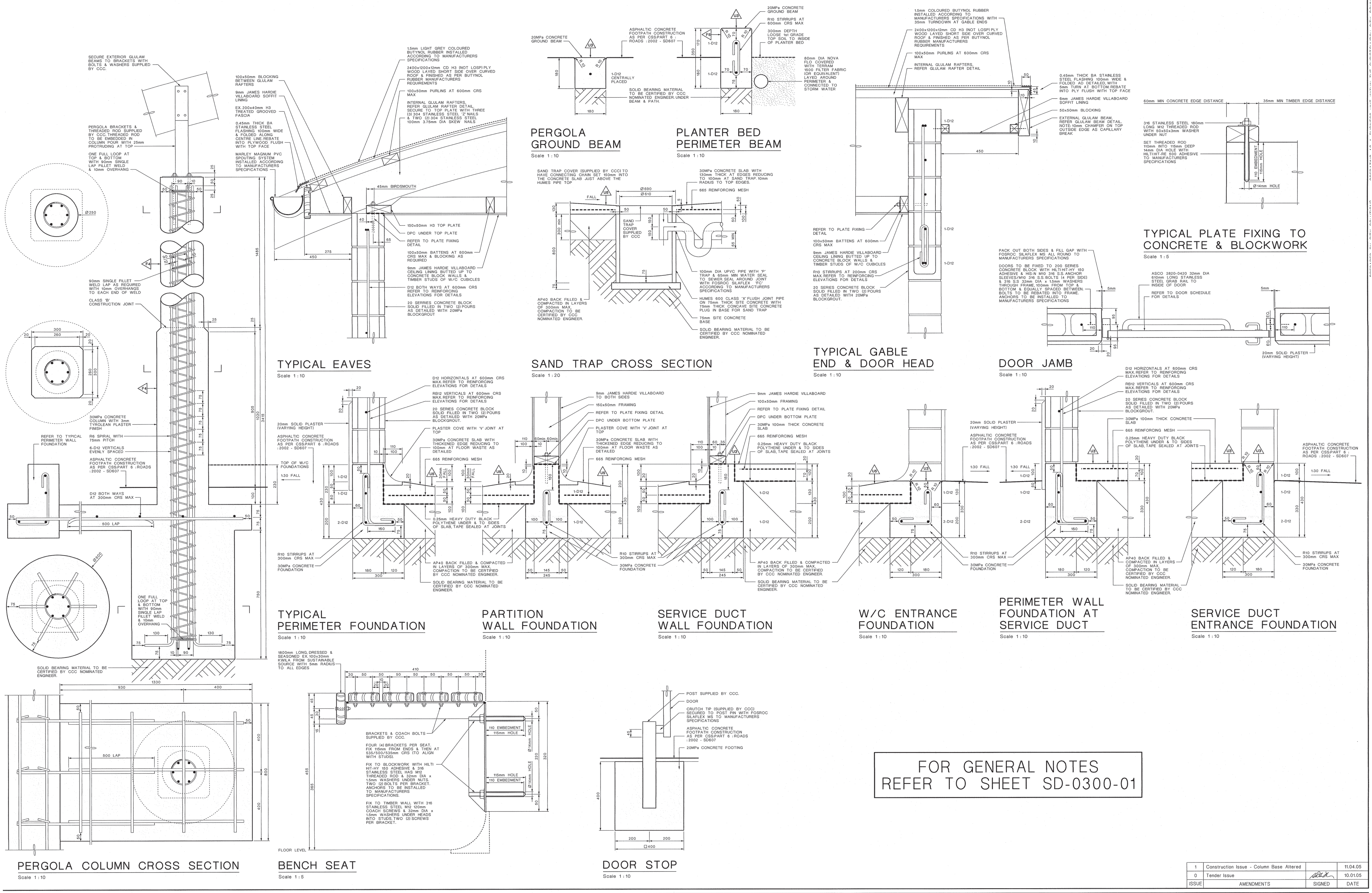
CLIENT
CHRISTCHURCH
CITY COUNCIL · GREENSPACE

PROJECT TITLE
SCARBOROUGH PARK
Public Toilets, Shower & Changing Rooms

DRAWING TITLE
Wall Reinforcing Elevations, Details & Door Schedule

CONTRACT NUMBER 04/05-167
ORIGINAL SHEET SIZE A1
SCALES As Shown
FILE NUMBER AD-0186-03
DRAWING & PROJECT NUMBER 562/1435
SHEET A05 OF A06

PREPARED BY CITY SOLUTIONS - OPERATING AS A BUSINESS UNIT WITHIN THE CHRISTCHURCH CITY COUNC



ISSUE	AMENDMENTS	SIGNED	DATE
1	Construction Issue - Column Base Altered		11.04.05
0	Tender Issue		10.01.05

CITYSOLUTIONS

DATUM		NAME	SIGNED	DATE
BENCH MK.	DESIGNED	D E Greenslade		Jan 2005
SURVEY FB	DES. REVIEW	D E Greenslade		Jan 2005
SURVEY LB	DRAWN	W G Hewson		Jan 2005
CONSTN. FB	DRW. CHECK	S D Smith		Jan 2005
CONSTN. LB				
SDR FILE				

APPROVED
DATE 12 / 01 / 05
S D Smith

CLIENT
CHRISTCHURCH
CITY COUNCIL · GREENSPACE

PROJECT TITLE
SCARBOROUGH PARK
Public Toilets, Shower & Changing Rooms

DRAWING TITLE
Construction Details

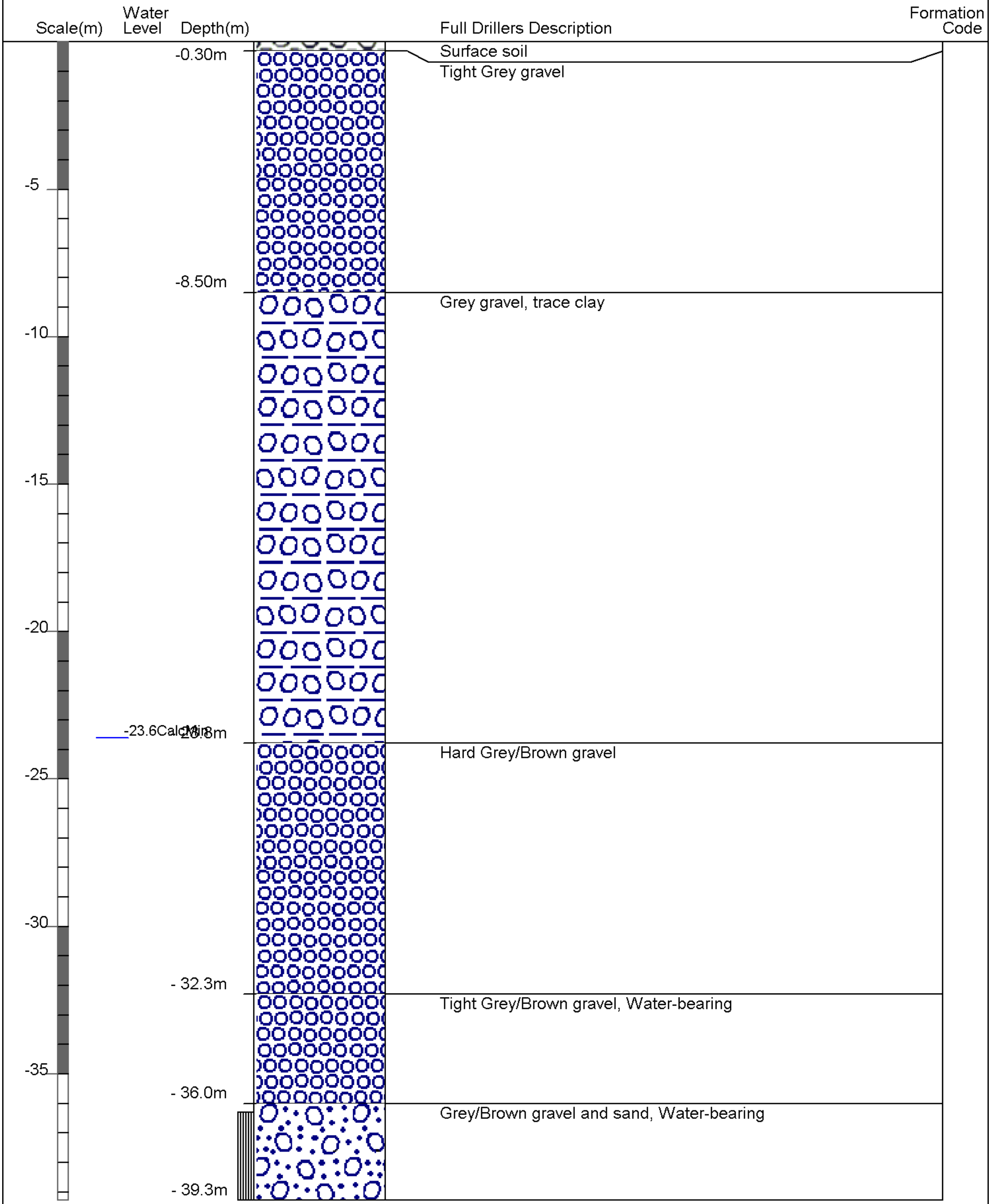
CONTRACT NUMBER 04/05-167
ORIGINAL SHEET SIZE A1
SCALES As Shown
FILE NUMBER AD-0186-03
DRAWING & PROJECT NUMBER 562/1435
SHEET A06 OF A06

Appendix B

ECan Borehole Logs

Borelog for well M36/0172

Gridref: M36:6063-3857 Accuracy : 3 (1=best, 4=worst)
Ground Level Altitude : 69 +MSD
Driller : A M Bisley & Co
Drill Method : Unknown
Drill Depth : -39.29m Drill Date : 8/02/1973



Borelog for well M36/0161

Gridref: M36:702-327 Accuracy : 4 (1=best, 4=worst)
Ground Level Altitude : 15.92 +MSD
Driller : A M Bisley & Co
Drill Method : Cable Tool
Drill Depth : -15.2m Drill Date : 16/11/1967

Environment Canterbury
Your regional council

Water Level: -5.0CalcMin

Depth(m)	Full Drillers Description	Formation Code
-0.30m	Topsoil	sp
-1.80m	Brown clay	sp
-2.09m	Brown gravels	sp
-7.30m	Blue gravels and sand	sp
-8.19m	Blue clay	sp
-9.30m	Brown clay	sp
- 10.7m	Brown gravels	ri
- 12.2m	Brown gravels and sand	ri
- 15.2m	Brown and Grey gravels	ri

Scale(m): -5, -10, -15

Borelog for well M36/0160

Gridref: M36:7066-2964 Accuracy : 3 (1=best, 4=worst)
Ground Level Altitude : 8 +MSD
Driller : A M Bisley & Co
Drill Method : Cable Tool
Drill Depth : -12.5m Drill Date : 23/02/1968

Environment Canterbury
Your regional council

Water level: -1.6CalcMin

Scale(m)	Depth(m)	Full Drillers Description	Formation Code
	-0.30m	Topsoil	sp
	-0.89m	Yellow clay	sp
	-3.40m	Grey clay	sp
-5			
-10			
	- 12.2m	Broken Grey gravels and sand	sp-ri
	- 12.5m	Claybound broken Grey gravels and sand	ri

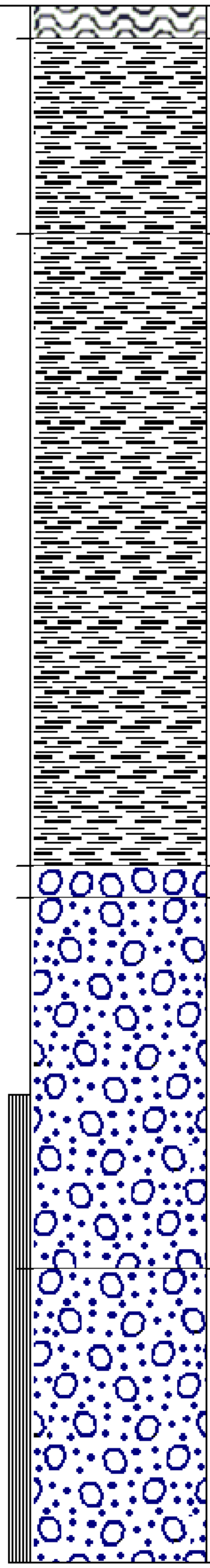
Borelog for well M36/0155

Gridref: M36:618-354 Accuracy : 4 (1=best, 4=worst)
Ground Level Altitude : 51 +MSD
Driller : A M Bisley & Co
Drill Method : Cable Tool
Drill Depth : -52.09m Drill Date : 18/08/1969

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.30m	Surface soil	
		-1.80m	Yellow clay	
-10			Grey/Brown gravel	
-20	-19.5CalcMin			
		- 22.3m	Tight Grey/Brown gravel	
-30		- 30.5m	Grey/Brown gravel	
		- 31.1m	Yellow clay	
		- 32.0m	Tight Brown gravel and fine sand	
		- 36.0m	Brown gravel and fine sand	
-40				
-50		- 52.1m		

Borelog for well M36/0154

Gridref: M36:693-304 Accuracy : 4 (1=best, 4=worst)
Ground Level Altitude : 12 +MSD
Driller : A M Bisley & Co
Drill Method : Cable Tool
Drill Depth : -14.3m Drill Date : 1/05/1970

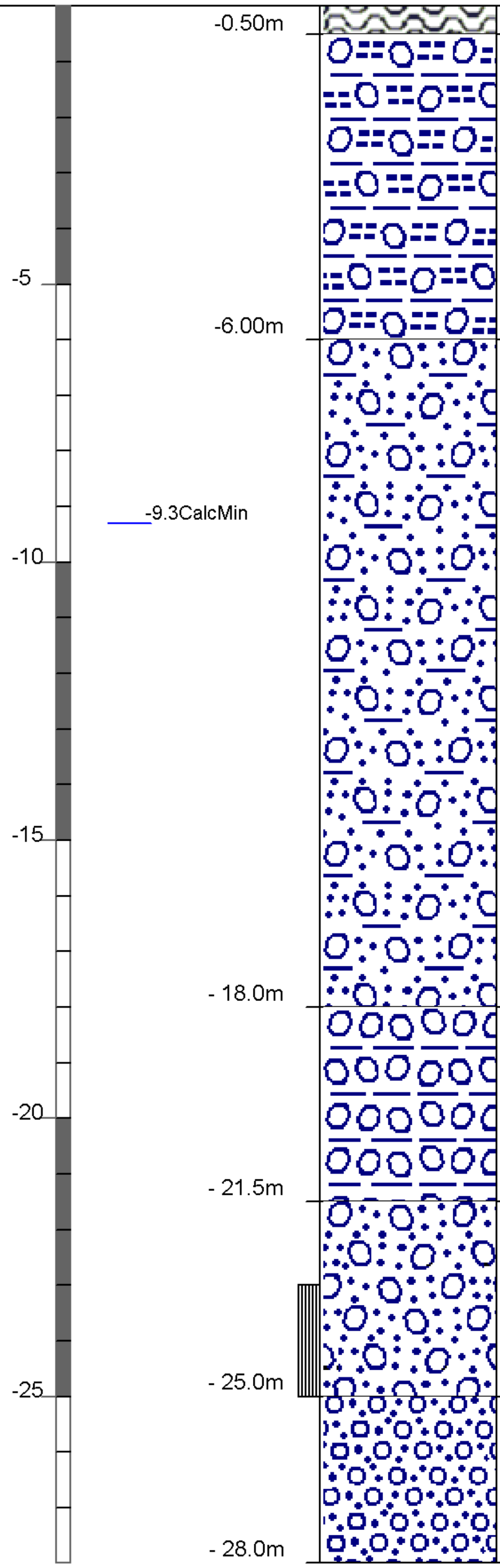


Water Level: -4.8CalcMin

Depth(m)	Full Drillers Description	Formation Code
-0.30m	Surface soil	sp
-2.09m	Soft Yellow clay	sp
-7.90m	Soft Blue clay	sp
-8.19m	Blue gravel, Blue clay and roots	sp
- 11.6m	Sandy Grey/Brown gravel	ri
- 14.3m	Stained Brown gravel and medium sand	ri

Borelog for well M36/0149

Gridref: M36:6791-3186 Accuracy : 3 (1=best, 4=worst)
Ground Level Altitude : 18.42 +MSD
Driller : Canterbury Drilling Company
Drill Method : Cable Tool
Drill Depth : -28m Drill Date : 1/07/1990



Depth(m)	Full Drillers Description	Formation Code
-0.50m	Grass, topsoil, etc	sp
-6.00m	Clay silty gravels	sp
- 18.0m	Graded sandy gravels, some clay, some gravels Brown stained, in places water	ri
- 21.5m	Claybound gravels, varying in size up to 250mm	ri
- 25.0m	Sandy gravels well graded. Lots of water	ri
- 28.0m	Very sandy gravels, mainly pea gravel up to 50mm	br?

Appendix D – CERA DEE Data Sheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Scarborough Park Toilets	Reviewer:	Alistair Boyce
	Unit / No: / Street	CPEng No:	209860
Building Address:	Scarborough Park	Company:	Opus
Legal Description:		Company project number:	6--QUCC1.20
		Company phone number:	03-3635464
	Degrees / Min / Sec		
GPS south:		Date of submission:	18-Dec-12
GPS east:		Inspection Date:	Jan-12
		Revision:	Final
Building Unique Identifier (CCC):	PRK_1467_BLDG_002 EQ2	Is there a full report with this summary?	Yes

Site

Site slope:	flat	Max retaining height (m):	0
Soil type:	silty sand	Soil Profile (if available):	flat
Site Class (to NZS1170.5):			
Proximity to waterway (m, if <100m):	50	If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):	50		
Proximity to cliff base (m,if <100m):	20	Approx site elevation (m):	2.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	2.00
Ground floor split?	no		Ground floor elevation above ground (m):	0.20
Storeys below ground	0			
Foundation type:	raft slab		if Foundation type is other, describe:	
Building height (m):	2.40		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	50			
Age of Building (years):	7		Date of design:	2004-
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	public		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):	toilets			
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	100 concrete
Beams:	timber	type	
Columns:			
Walls:	load bearing concrete	#N/A	

Lateral load resisting structure

Lateral system along:	concrete shear wall	**Note: Define along and across in detailed report!**	note total length of wall at ground (m):	8.4
Ductility assumed, μ:	1.25		wall thickness (m):	200
Period along:	0.20	##### enter height above at H31	estimate or calculation?	calculated
Total deflection (ULS) (mm):	40		estimate or calculation?	calculated
maximum interstorey deflection (ULS) (mm):	40		estimate or calculation?	calculated
Lateral system across:	concrete shear wall		note total length of wall at ground (m):	4.6
Ductility assumed, μ:	1.25		wall thickness (m):	200
Period across:	0.20	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):	40		estimate or calculation?	calculated
maximum interstorey deflection (ULS) (mm):	40		estimate or calculation?	calculated

Separations:

north (mm):		leave blank if not relevant
east (mm):		
south (mm):		
west (mm):		

Non-structural elements

Stairs:	
Wall cladding:	
Roof Cladding:	
Glazing:	
Ceilings:	fibrous plaster, fixed
Services(list):	

Available documentation

Architectural		original designer name/date	City Solutions, 2005
Structural	full	original designer name/date	CCC, Project Number 562/1435, Drawing numbers A01 throu
Mechanical		original designer name/date	CCC, Project Number 562/1435, Drawing numbers A01 throu
Electrical		original designer name/date	
Geotech report	partial	original designer name/date	

Damage

Site: (refer DEE Table 4-2)

Site performance:	moderate damage	Describe damage:	rigid body displacement and rotation
Settlement:	25-100m	notes (if applicable):	minor to moderate cracking damage
Differential settlement:	0-1:350	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	0-20mm/20m	notes (if applicable):	
Damage to area:	moderate to substantial (1 in 5)	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	estimate
	Describe (summary):	0.1 - 0.2		
Across	Damage ratio:	0%		
	Describe (summary):	0.1-0.2		
Diaphragms	Damage?:		Describe:	buckling of ceiling
CSWs:	Damage?:		Describe:	
Pounding:	Damage?:		Describe:	
Non-structural:	Damage?:		Describe:	

$$Damage\_Ratio = \frac{(\%NBS\,(before) - \%NBS\,(after))}{\%NBS\,(before)}$$

Recommendations

Level of repair/strengthening required:	minor structural	Describe:	
Building Consent required:		Describe:	
Interim occupancy recommendations:	partial occupancy	Describe:	

Along	Assessed %NBS before:	40%	##### %NBS from IEP below
	Assessed %NBS after:	40%	
Across	Assessed %NBS before:	40%	##### %NBS from IEP below
	Assessed %NBS after:	40%	

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