Christchurch City Council

Jellie Park Recreation & Sport Centre PRO 0266-007

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Jellie Park Recreation & Sport Centre

Quantitative Assessment Report

295 Ilam Road

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Summary

Jellie Park Recreation & Sport Centre
Main Building
PRO 0266-007

Detailed Engineering Evaluation
Quantitative Report - Summary
Final V4

295 Ilam Road
Burnside, Christchurch

Background

This is a summary of the quantitative report for the main building located at the Jellie Park Recreation & Sport Centre, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. Visual inspection was performed on February 28, 2012. Construction documents made available are noted below:

- Jellie Park Redevelopment architectural as-built drawings by Warren and Mahoney, dated 26 January 2009.
- Jellie Park Redevelopment structural drawings for the gym and changing room areas. Drawings by Powell Fenwick Consultants Limited dated January 2007.
- Jellie Park Redevelopment structural drawings for the new indoor pool. Drawings by Powell Fenwick Consultants Limited dated January 2007.

Key Earthquake Damage Observed

Key earthquake damage observed includes:

- Cracked slab-on-grades at both old and new indoor pools,
- Pulling away of northeast collector beam from a portal frame at old indoor pool.

Critical Structural Weaknesses

The following potential critical structural weaknesses have been identified with the accompanying %NBS for that portion of the building.

- Roof shear transfer to north-south masonry walls at gym/studio - (59%NBS),
- Roof diaphragm at gym/studio and changing rooms - (52%NBS),
- Roof diaphragm at old indoor pool – (35-45%NBS).

Indicative Strength of Main Building (based on quantitative DEE and CSW assessment)

Based on the information available, and using the NZSEE Detail Engineering Evaluation procedure, the structural capacity of the facility has been determined by assessing each of the buildings that make up the facility. The capacity of each building is limited to the weakest structural element of the building. The capacity of each building in this facility is listed below:

- Gym/studio - 52%NBS,
- Changing rooms - 90%NBS,
- Foyer - greater than 100%NBS,
- New indoor pool - 34%NBS,
- Old indoor pool – 35-45%NBS,

Completed Strengthening
The Old Plant Room has had a structural upgrade completed. This involved the installation of shotcrete walls on the external face of the existing block masonry walls. This addressed the issue of insufficient capacity of the block masonry walls. This work was completed in January 2014.

The ground floor (old plant room) and first floor (office space) now have a structural capacity of over 100%NBS and this building no longer has any Critical Structural Weaknesses.

We no longer recommend any restrictions on occupancy for this building.

Recommendations

- Develop a strengthening works scheme to address weaknesses detailed in this report and strengthen the building to at least 67% NBS.

Contents

1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council (CCC) to undertake a detailed seismic assessment of the main building at Jellie Park Recreation & Sport Centre following the M6.3 Christchurch earthquake on 22 February 2011.

The purpose of the assessment is to determine if the structures are classed as being earthquake prone 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	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 Background Information

4.1 General

The Jellie Park Recreation & Sport Centre is comprised of a large single storey structure with an outdoor and indoor hydroslide. This report will focus on the single storey structure which consists of two indoor pools, change facilities, offices, a foyer, a gym, an aerobics studio, and a two storey plant room. The plant room portion of the building is mixed use, with offices on the second floor and pool pumps on the ground floor. The outdoor hydroslide, which is a stand-alone structure, and the indoor hydroslide, which is attached to the main building structure, have been assessed in a separate report.

Over the years, the Centre has undergone remodelling and expansion, with portions demolished and rebuilt.

- The plant room on the north end of the building was constructed in 1963.
- The southern indoor pool portion was constructed in 1989.
- The remainder of structure was constructed in 2007-2008.

Oriented in a north-south direction, the building's main entrance is on the south side of the property. In the middle of the building are the entrance foyer and change facilities. The gym and studio are located on the west side of the structure, with the plant room in the northwest corner. The indoor pools are on the building's east side.

The building is a conglomerate of building materials: curved timber glulam portal frames frame the older south indoor pool; a combination of timber glulam and steel portal frames frame the newer north indoor pool; steel portal frames and concrete masonry block walls frame the gym and aerobics studio; concrete masonry and steel roof purlins frame the change facilities and foyer; the ground floor of the plant room portion of the structure is framed with reinforced concrete moment frames with unreinforced concrete masonry wall infill. The second level of the plant room is timber framed construction.

4.2 Gravity Load Resisting System

4.2.1 Older Indoor Pool and Newer Plant Room

Tapered glulam portal frames running in the north-south direction frame the older south indoor pool. Timber purlins span between the frames. On the eastern side of this indoor pool, there is a timber and steel framed two-storey plant room. This plant room to the east of the pool was expanded in 2007-2008 when the Centre underwent redevelopment. The portal frames are assumed to be supported on pad footing. A slab-on-grade is assumed to surround the two pools.

4.2.2 Newer Indoor Pool

The newer north indoor pool has steel-glulam portal frames with steel and timber purlins between at 2 metre centres. These portal frames consist of steel I-section columns on the north and tapered glulam columns on the south at 6 metre centres. The portal frame beams are 1000x230 glulams. Portal frame foundations consist of isolated pad footings. A slab-on-grade surrounds the two pools.

4.2.3 Gym and Aerobic Studio

The gym and aerobics studio are framed with steel I-section portal frames at 7.6 metre centres, running in the east-west direction. Spanning between these frames are DHS 250/15 purlins at 1200 centres. Miscellaneous framing consists of PFC sections, which form the roof's valleys and hips. The floor of the gym and aerobics studio is a slab-on-grade. Half of the portal frame columns at the gym are founded on isolated pad footings. The rest of the portal frame columns and masonry block walls at the gym and studio are founded on continuous strip footings. Masonry block walls are assumed to be fully grouted.

4.2.4 Changing Rooms and Foyer

Various depth DHS purlins at 1200 centres spanning between concrete masonry block walls frame the roof of the changing rooms. Masonry block walls are assumed to be fully grouted. The foyer is framed with DHS 250/15 purlins at 900 centres. Purlins are supported on I-section portal frames, which are supported on a combination of masonry block walls (aerobics change rooms) and posts on isolated pad footings. The floor of the changing rooms and foyer consists of a slab-on-grade.

4.2.5 Older Plant Room and Office (above plant room)

The second level of the plant room building is a timber framed structure built on top of the existing concrete framed, concrete masonry in-filled ground floor plant room. The ground level of the plant room portion of the building consists of perimeter and internal reinforced concrete frames supporting an elevated in-situ concrete slab. Perimeter frames are in-filled with unreinforced concrete masonry blocks, note that these walls were strengthened in January 2014, refer below. Since the ground floor of the plant room is below the surrounding ground level, retaining walls up to ground level surround the base of plant room walls. The reinforced concrete frames are assumed to be supported on pad footings at the base of the retaining walls. The ground floor is assumed to be a slab-on-grade. Retaining walls are assumed to be founded on continuous strip footings.

Older plant room and office (above plant room) following completion of strengthening works January 2014.

Strengthening works to the old plant room building were undertaken in January 2014. The strengthening included the installation of shotcrete walls on the external face of the existing ground floor concrete masonry walls. The first floor (office space above the plant room) did not require any strengthening works. The gravity load resisting system of the ground level of this building was not directly part of the structural upgrade works, although some additional gravity support may be provided by the shotcrete.

4.3 Seismic Load Resisting System

4.3.1 New and Old Indoor Pools

The seismic load resisting system of the new and old indoor pool portion of the structure in the north-south (across) direction consists of the gabled timber portal frames at the old pool and steel-glulam portal frames at the new pool. The portal frames in each pool area are tied together via steel plate assemblies. Steel rod bracing in the wall comprises the newer indoor pool's lateral load resisting system in the east-west (along) direction. Concrete masonry walls comprise the older indoor pool's lateral load resisting system in the east-west direction. The roof diaphragm at the new indoor pool consists of rod bracing. The roof diaphragm at the old indoor pool is comprised of the roof panel system.

4.3.2 Gym and Aerobics Studio

At the gym and aerobics studio, the lateral load resisting system in the east-west (across) direction consists of steel portal frames. In the north-south (along) direction, the lateral forces are resisted by concrete masonry block walls. At the west side of the gym/studio, the block walls do not extend all the way up to the roof. The lateral forces from the roof are transferred to the block walls along this line through the portal frame columns bending in their weak axis for a distance of roughly 1250mm. The roof diaphragm at this section of the building only consists of the capacity of the roof cladding.

4.3.3 Changing Rooms

Concrete masonry block walls, both in the across and along directions, comprise the lateral load resisting system at the changing rooms. Like the gym/aerobics area of the building, the roof diaphragm at this section of the building only consists of the capacity of the roof cladding. There is no lateral load resistance along the south exterior side of the changing rooms (across direction), hence the roof diaphragm cantilevers from the first interior lateral line of resistance, which is nearly 11 metres back from the south exterior wall of the changing rooms. Due to this large cantilever distance, it is assumed that the north-south running masonry block walls cantilevering from the footings are providing some lateral resistance in the east-west direction.

4.3.4 Foyer

The seismic load resisting system at the foyer consists of the steel portal frames resisting forces in-plane and out-of-plane. The roof diaphragm at this section of the building only consists of the capacity of the roofing system. Some of the foyer's portal frames land on the studio and changing room masonry block walls while others land on pad footings. Where frames are supported on masonry walls, frame in-plane lateral forces load the block walls out-of-plane. These block walls then transfer the lateral loads to the lateral force resisting elements of the gym/studio and changing rooms.

4.3.5 Older Plant Room and Office

The first floor (office area) lateral forces are resisted by the wall linings. The roof diaphragm is assumed to be either a sheathed or strapped diaphragm. The seismic load resisting system of the ground floor plant room used to comprise of interior and exterior reinforced concrete frames in both the north-south and east-west directions with unreinforced concrete masonry infill, note that in January 2014 the ground floor was strengthened, refer below. The elevated in-situ concrete slab comprises the floor diaphragm for the upper level.

Older plant room and office following completion of strengthening works

The strengthening (completed January 2014) of the ground floor concrete frame with unreinforced masonry infill included new shotcrete walls to the exterior face of the walls. The shotcrete walls will provide out of plane resistance to the existing unreinforced block masonry walls and also provide increased in plane capacity in the line of the concrete frames. The strengthening has changed the lateral load resisting system to concrete shear walls, as provided by the shotcrete walls.

4.4 Building Separation

There is a small gap of around 75mm between the old pool and the structure that houses the new changing rooms. Both of these structures are relatively stiff for load in this direction and we do not believe that pounding will be an issue.

There are no seismic gaps provided between other areas of the facility.

The old blockwork plant room is adjacent to the new blockwork gym. There is a 10 – 15mm gap between the buildings which has been filled with mortar, this joint would ideally be filled with sealant. The foyer, gym/studio and change rooms have been constructed as one building.

4.5 Site Visit Initial Assessment

On 28 February 2012, an Opus engineer visited the site. Observation included an exterior walk around, an interior walk through and investigation of structural damage. At the time of the visit, Opus had the existing redevelopment plans and details in hand so they were utilised during the visit.

4.6 Further Inspections

Further inspections were carried out by Opus on 31 May 2012 to survey the old plant room on the northern side of the building. This inspection was used to determine the reinforcing layout in the plant room columns and beams, to determine if any reinforcement was present in the masonry walls and to determine the office building roof framing layout. The non-intrusive investigation of the old plant room masonry indicated that the infill walls are unreinforced.

4.7 Original Documentation

Copies of the following construction drawings were provided by CCC:

- Jellie Park Redevelopment architectural as-built drawings by Warren and Mahoney, dated 26 January 2009.
- Jellie Park Redevelopment structural drawings for the gym and changing room areas. Drawings by Powell Fenwick Consultants Limited dated January 2007.
- Jellie Park Redevelopment structural drawings for the new indoor pool. Drawings by Powell Fenwick Consultants Limited dated January 2007.
- Structural drawings for the old indoor pool entitled "Development Jellie Park Lido Pool for Waimairi District Council – Stage 2: Covered Pool." Drawings by Buchanan & Fletcher Ltd dated February 1988.

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

No copies of the design calculations have been obtained as part of the documentation set.

5 Structural Damage

The following damage has been noted:

5.1 Older Indoor Pool

During our site visit it was noted that many of the timber glulam portal frame columns on the north side of the pool had delamination cracks at their bases. Cracking in the concrete column plinths was also noted. The delamination cracks were located near the column epoxy rod connections to the plinths. Plinth cracking initiated at the epoxy rod locations in all cases. For the columns, crack sizes range from 1mm to 5mm wide and crack lengths range from 150mm to 1500mm long. For the plinths, crack sizes are 1mm or less and their lengths are 200mm or less. Of the seven portal frames, delamination cracks were visible in six frames. None of the south portal frame columns, except one, were able to be assessed for cracking due to the presence of timber bleachers preventing observation of the column bases. The only south portal frame column to be assessed was the southeast column at the end of the main pool.

Photographic evidence of the Jellie Park redevelopment in 2007 has enabled Opus to determine that the delamination of the portal frame laminations is most likely the result of drying shrinkage. When the new indoor pool was constructed, the old indoor pool portal frames were exposed to the elements. Because the portal frames were normally in an environment of 60-80% relative humidity, the drastic change in relative humidity during construction of the new indoor pool dried out the portal frames of the old indoor pool causing the laminations to delaminate.

The northeast concrete masonry shear wall collector beam has pulled away from the portal frame roughly 5mm. As a result, the angle cleat has deformed, leading to a minor case of prying action at the toe of the angle clear against the portal frame column.

The slab-on-ground at the north end of the learners' pool has cracked in multiple locations. The size of the cracks could not be determined since maintenance had already resealed the cracks. From examining the width of the sealant, the maximum crack width is estimated at less than 5mm. See the geotechnical report in Appendix 3 for a more detailed assessment of slab and foundation cracking.

It is anticipated that the damage sustained at the old indoor pool will not affect the seismic performance of the structure.

5.2 New Indoor Pool

It was noted during our site visit that the connection of the portal glulam beam to the portal glulam column has started to separate. Currently this separation is roughly 2mm. Minor delamination of portal frame glulam columns was also noted. The beam-column separation and the delamination are, in our opinion, most likely not earthquake related but construction related.

The slab-on-grade at the south end of the learners' pool has cracked in multiple locations. The size of the cracks could not be determined since maintenance had already resealed the cracks. From examining the width of the sealant, the maximum crack width is estimated at less than 5mm. See the geotechnical report in Appendix 3 for a more detailed assessment of slab and foundation cracking.

It is anticipated that the damage sustained at the new indoor pool will not affect the seismic performance of the structure.

5.3 Gym, Aerobics Studio, Changing Rooms and Plant Room

Minor non-structural damage was noted at the aerobics studio. This consisted of damaged suspended ceiling tiles and fallen ceiling lighting and HVAC vents. Minor cracking was observed in the floor slabs in the changing room and plant room areas. Minor cracking in the plant room retaining wall was also observed. See the geotechnical report in Appendix 3 for a more detailed assessment of slab, foundation cracking and retaining wall cracking.

It is anticipated that the damage sustained by the structures will not affect their seismic performance.

6 General Observations

Overall, the building has behaved well. The visible damage observed during our inspections was minor, and it is expected to be cost effective to repair.

7 Detailed Seismic Assessment

The detailed seismic assessment has been based on the NZSEE 2006 [2] guidelines for the "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" together with the "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure" [3] draft document prepared by the Engineering Advisory Group on 19 July 2011, and the SESOC guidelines "Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes" [5] issued on 21 December 2011.

7.1 Qualitative Assessment Summary

An initial qualitative assessment of the main building was completed by *Opus* in May 2012. Based on that report, the CCC requested a quantitative DEE be performed on the main building.

7.2 Critical Structural Weaknesses

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. As part of this quantitative assessment, the following potential CSW's were identified for the main building.

7.2.1 Gym/Studio

a) **Roof Shear Transfer to North-South Masonry Walls** – A shear transfer failure of roof shear to the longitudinal (north-south) masonry walls would result in *a loss of lateral load transfer* from the roof to the longitudinal masonry walls. Transverse steel portal frames have not been designed to resist lateral forces in their weak axis.

b) **Roof Diaphragm** – The roof diaphragm at the gym/studio is *not a structural diaphragm*. Diaphragm shear failure is the governing mode of failure for the roof diaphragm. Due to the *discontinuous collector element* along the east side of the gym/studio, shear forces in the diaphragm are nearly doubled.

7.2.2 Changing Rooms

a) **Roof Diaphragm** – The roof diaphragm at the gym/studio is *not a structural diaphragm*. Due to the *extreme roof diaphragm cantilever*, the masonry walls must resist lateral forces by bending out-of-plane. The combination of this *out-of-plane bending of masonry walls* and extreme cantilever create the CSW at this location.

7.2.3 Old Indoor Pool

a) **Transverse Concrete Masonry Shear Wall Collectors (North Side of Pool)** – The governing failure mode of the wall collector is in the bolted connection of the collector along the face of the masonry wall. A failure of this connection would result in *a loss of lateral load transfer* from the roof to the longitudinal masonry shear wall.

b) **Roof Diaphragm** – The insulated roof panels joint connections have not proven to be reliable in other buildings during the Canterbury earthquakes. The insulated roof diaphragm is therefore unreliable.

7.3 Quantitative Assessment Methodology

The assessment has been conducted assuming the buildings are in an undamaged state. The observed damage was not considered significant enough to affect the strength or stiffness of the buildings.

The assessment assumptions and methodology have been included in Appendix 4 of the report due to the technical nature of the content. A brief summary follows:

Hand calculations were performed to determine seismic forces from the current building standards. Along with hand calculations, ETABS and Microstran computer models were utilised to distribute the force distribution to the lateral force resisting elements. These forces were then distributed to the lateral force resisting systems by tributary area and/or relative rigidity. The capacities of these lateral elements were then calculated to estimate %NBS for each element. A Modal Response Spectral Analysis using Microstran was performed on the old plant room and office structure because of the vertical irregularity at this portion of the main building. ETABS was utilised to model the pools frames and the foyer portal frame-masonry wall interaction, especially when considering the displacement demands imposed on the frames when subject to the gym/studio and changing room roof displacements. Microstran was utilised to model the gym/studio portal frames and the old plant room concrete moment frames.

7.4 Limitations and Assumptions in Results

The results have been reported as a %NBS and the stated value reported is 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.

7.5 Quantitative Assessment

A summary of the structural performance of main building is reported below in Tables 3-8. Only the critical structural element/system of main building was analysed and noted in these tables, as these effectively define each building's capacity. Elements below 67% NBS are considered further in the following sections when developing the strengthening options. Elements below 33% NBS need immediate attention since they make the building (or portion of the building) earthquake prone.

Of particular note in the results of the DEE are the low %NBS ratings for the new pool. Given that this is the most modern structure in the complex, it would be considered uncharacteristic for this structure to have such a low rating. In the 'along building' direction, the anchorages for the wall rod braces are detailed inadequately and will fail before the braces can develop their full strength.

Table 2: Summary of Seismic Performance at the Gym/Studio

Structural Element/System	Failure Mode or Description of Limiting Criteria Based on Elastic Capacity of Critical Element	% NBS based on calculated capacity
Steel Portal Frames	In-plane bending of the portal frames is the governing mode of failure.	>100%
	Weak-axis bending of portal frame columns in transferring lateral forces from the roof to the masonry block walls.	>100%
Concrete Masonry Walls	Out-of-plane bending of masonry wall is the governing mode of failure.	>100%
Roof Shear Transfer to Masonry Walls - West End	Combined tension and shear failure of post-installed anchors connecting the portal frames to the masonry walls is the governing mode of failure at this location.	59%
Roof Shear Transfer to Masonry Walls - East End	Shear failure of post-installed anchors connecting the portal frames to the masonry walls is the governing mode of failure at this location.	>100%
Roof Diaphragm	Diaphragm shear failure is the governing mode of failure. The roof cladding at the gym/studio is not a structural diaphragm and hence cannot be relied upon as an acceptable load path for delivering lateral forces to the portal frames and masonry walls. The roof cladding has been used to determine the load transfer but this is not a reliable or consentable load path and we recommend this is considered when a strengthening scheme is developed for this building	52%

Table 3: Summary of Seismic Performance at the Changing Rooms

Structural Element/System	Failure Mode or Description of Limiting Criteria Based on Elastic Capacity of Critical Element	% NBS based on calculated capacity
Concrete Masonry Walls - In-Plane Shear	In-plane shear failure is the governing failure mode.	>100%
Roof Diaphragm and Concrete Masonry Walls - Out-of-Plane Bending	Due to the extreme roof diaphragm cantilever, the masonry walls must resist lateral forces by bending out-of-plane. Since the non-structural roof diaphragm, which consists of steel profiled roof cladding, has minimal capacity and its collector elements have minimal strength, the masonry walls resist all lateral loads by bending out-of-plane. The %NBS for the roof diaphragm is low but the out-of-plane bending of the masonry walls is 90%NBS. , The lateral loads are sufficiently resisted by the out-of-plane bending of the masonry walls.	90%

Table 4: Summary of Seismic Performance at the Foyer

Structural Element/System	Failure Mode or Description of Limiting Criteria Based on Elastic Capacity of Critical Element	% NBS based on calculated capacity
Steel Portal Frames - Longitudinal	Due to the lack of lateral resistance in the longitudinal direction (west side), there is a torsional irregularity in the longitudinal direction. This irregularity results in the large displacements of the foyer roof. Even though the foyer portal frames can resist the increased forces from the large displacements, the large displacements are well outside the displacement limits for the foyer. Serviceability limits are exceeded for the foyer portal frames at the roof level.	>100%
Steel Portal Frames - Transverse		>100%
Roof Diaphragm	Diaphragm shear failure is the governing mode of failure.	100%

Table 5: Summary of Seismic Performance at the Old Plant Room and Office Following Completion of Structural Strengthening of this building in January 2014

Structural Element/System	Failure Mode or Description of Limiting Criteria Based on Elastic Capacity of Critical Element	% NBS based on calculated capacity
Concrete walls	Shear capacity of shotcrete wall	>100%
Timber braced structure designed to NZS3604:1999	Failure of timber bracing or other element constructed to NZS3604	>100%

Table 6: Summary of Seismic Performance at the New Indoor Pool

Structural Element/System	Failure Mode or Description of Limiting Criteria Based on Elastic Capacity of Critical Element	% NBS based on calculated capacity
Transverse Timber/Steel Portal Frames	The governing failure mode at the portal frames is the shear failure epoxied dowels at the base of the glulam columns.	78%
Longitudinal Wall Rod Bracing	The governing failure mode at the wall rod bracing is the shear failure of embed anchors. This is a brittle failure mechanism.	34%
Roof Rod Bracing	The governing failure mode of the roof bracing is the tensile yielding of the rod braces. Yielding of the rod braces is an undesirable yielding mechanism.	50%

Table 7: Summary of Seismic Performance at the Old Indoor Pool

Structural Element/System	Failure Mode or Description of Limiting Criteria Based on Elastic Capacity of Critical Element	% NBS based on calculated capacity
Transverse Timber Portal Frames	The governing failure mode at the portal frames is combined axial/bending of the beams at the transition into the corner radius of the knee joint.	>100%
Longitudinal Concrete Masonry Walls	The shear strength of the north masonry wall is limited by the shear capacity of the dowels into the footing	57%
Roof Diaphragm	A failure of the roof diaphragm would lead to an out-of-plane (weak axis) bending failure of the timber portal frames. This would lead to a loss of roof shear force transfer into the longitudinal masonry walls. The insulated panel was designed as the roof diaphragm. Performance of these insulated panel roofs during the recent Canterbury earthquakes indicate that these insulated panel roof structures cannot be relied upon to act as a roof diaphragm. We recommend that this is considered when the strengthening scheme for this building is developed.	35-45%
Wall Collectors	The governing failure mode of the wall collector is in the bolted connection of the collector along the face of the masonry wall.	56%

8 Summary of Geotechnical Appraisal

Minor land damage occurred at Jellie Park due to the Canterbury Earthquake Sequence following the 4 September 2010 earthquake. There appears to have been minor settlement (up to 30mm) of the ground noted in three areas around the site. Liquefaction appears to have been relatively minor at the site, with liquefaction occurring in one location to the east of the main entrance. Cracks in the concrete perimeter footing appear to be minor.

Well logs and CPTs indicate the building is likely to be founded on interbedded layers of clay, silt, peat and sand, underlain by sand and gravel, with the Riccarton Gravels likely to be encountered from approximately 12m below ground level.

The foundation system for the 2007 addition, perimeter strip footing with pads supporting the portal frame, has performed well. The foundations of the older areas of the Jellie Park complex, although unknown appear to have also performed well.

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. We would expect that similar liquefaction and ground damage could occur in a future earthquake dependent on the location of the epicentre.

Based on current evidence, the existing foundations are considered appropriate for the building with the client’s acceptance that the potential for differential settlement could possibly occur in future seismic events.

If CCC wishes to further quantify the potential for differential settlement in future seismic events, consideration could be given to undertaking ground investigations to more accurately estimate the potential differential settlement from liquefaction.

If CCC wishes to further evaluate and quantify the liquefaction potential at this site, additional site specific testing with CPT's and associated analysis would be necessary. Further investigations are currently not considered necessary.

Further information regarding the geotechnical appraisal can found in Appendix 3 of this report.

9 Conclusions

a) The seismic performance of the gym/studio is governed by the inadequate ability to transfer roof shear to the west masonry walls, and by the low capacity non-structural roof diaphragm. The expected strength of the roof shear transfer connection is 59%NBS and for the roof diaphragm there is an expected strength of 52%NBS.

b) The changing rooms lack a structural roof diaphragm. The load is transferred to the masonry walls by out-of-plane bending. The seismic performance of the changing rooms is governed by the out-of-plane bending of the masonry walls, which have an expected strength of 90%NBS.

c) The seismic performance of the foyer is governed by the excessive deflection of the steel portal frames along the west side of the foyer. The expected %NBS of the foyer is greater than 100%NBS. Even though the foyer is considered to be a low risk structure, the lack of lateral resistance along the west side of the foyer roof creates a torsional irregularity and deflections of the foyer roof that are far outside of the serviceability limits.

d) The seismic performance of the strengthened old plant room building with first floor offices is 100%NBS.

e) The seismic performance of the old indoor pool is governed by the insulated panel roof diaphragm which was proven to be unreliable in the Canterbury earthquakes. We have contacted the supplier and together we are confident that the roof diaphragm has a capacity of greater than 33%NBS but we are unable to provide a more accurate %NBS than the range of 35-45%NBS. The north wall collector connections and the shear transfer at the base of the north masonry wall have an expected strength of 56% and 68%NBS, respectively.

f) The seismic performance of the new indoor pool is governed by the lack of adequate shear capacity across steel-timber and concrete-timber joints and by the lack of adequate roof and wall rod bracing. The capacity of this structure is limited by the wall bracing which has an expected capacity of 34%NBS.

10 Recommendations

a) A strengthening works scheme be developed to increase the seismic capacity of the main building to at least 67% NBS.

11 Limitations

a) This report is based on an inspection of the main building and focuses on the structural damage resulting from the 22 February 2011 Canterbury Earthquake and aftershocks only. Some non-structural damage is described but this is not intended to be a complete list of damage to 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 this time.

c) This report is prepared for CCC to assist with assessing the remedial works required for council buildings and facilities. It is not intended for any other party or purpose.

12 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 1 - Photographs

Photo 1 – South Elevation - main entrance

Photo 2 – West Elevation - gym and studio

Photo 3 – West Elevation - plant room and office


Photo 4 – North Elevation - plant room and office


Photo 5 – East Elevation – plant room and office


Photo 6 – East Elevation – gym


Photo 7 – North Elevation – foyer


Photo 8 – West Elevation – new indoor pool


Photo 9 – North Elevation – new indoor pool

Photo 10 – East Elevation – new indoor pool

Photo 11 – East Elevation – old indoor pool

Photo 12 – South Elevation – old indoor pool

Photo 13 – South Elevation – changing rooms

Photo 14 – West Interior Elevation – studio (showing partial height masonry walls)

Photo 15 – Old Indoor Pool – looking northwest

Photo 16 – Old Indoor Pool – looking east

Photo 17 – North Interior Elevation - new indoor pool

Photo 18 – South Interior Elevation – new indoor pool

Photo 19 – Foyer – looking north

Photo 20 – Foyer clerestory – looking north

Photo 21 – Typical Interior Beam-Column Connection – plant room

Photo 22 – Typical End Beam-Column Connection at Exterior Wall – plant room

Appendix 2 – Floor Plans

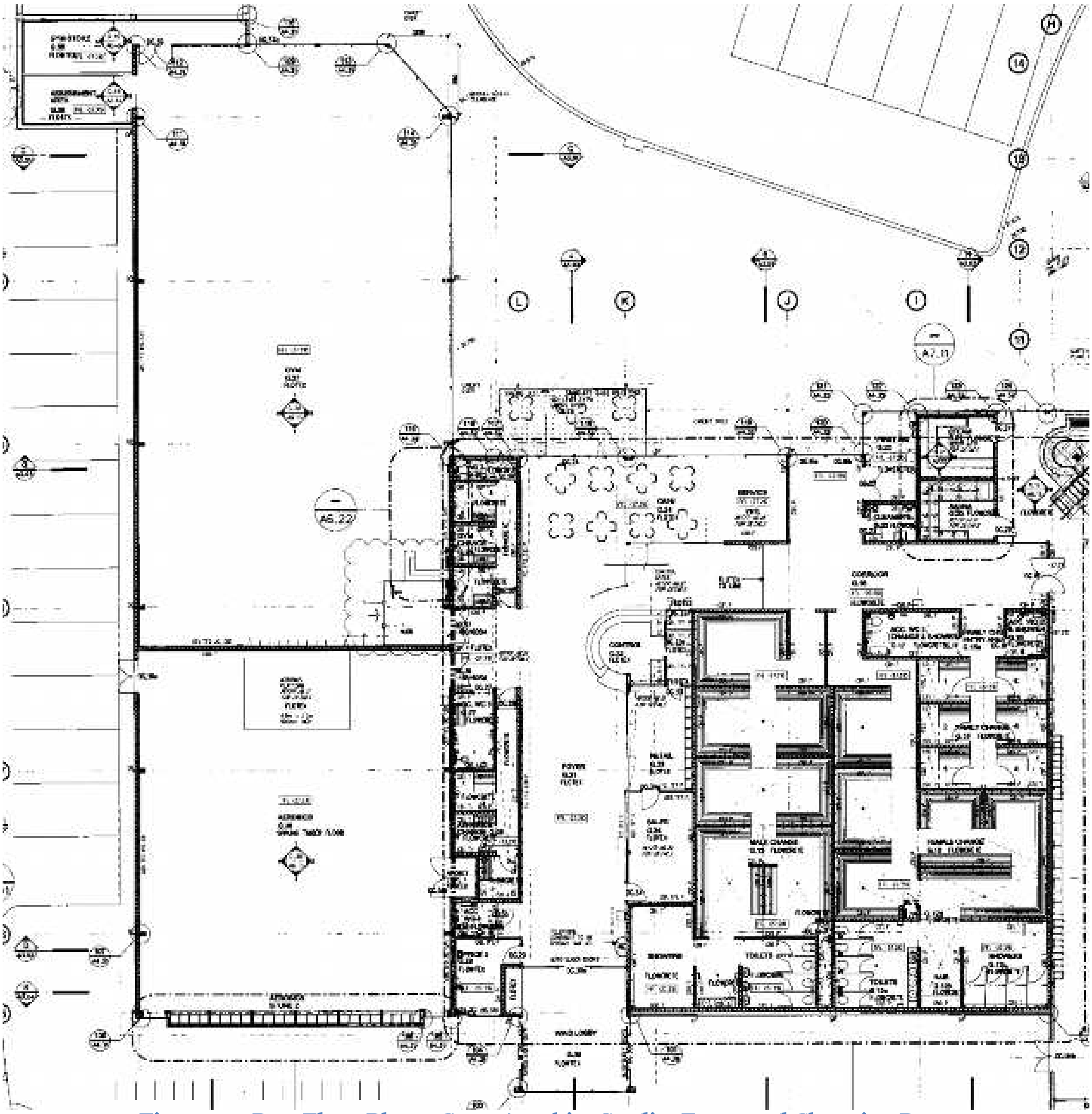

Figure 2 – Part Floor Plan – Gym, Aerobics Studio, Foyer and Changing Rooms

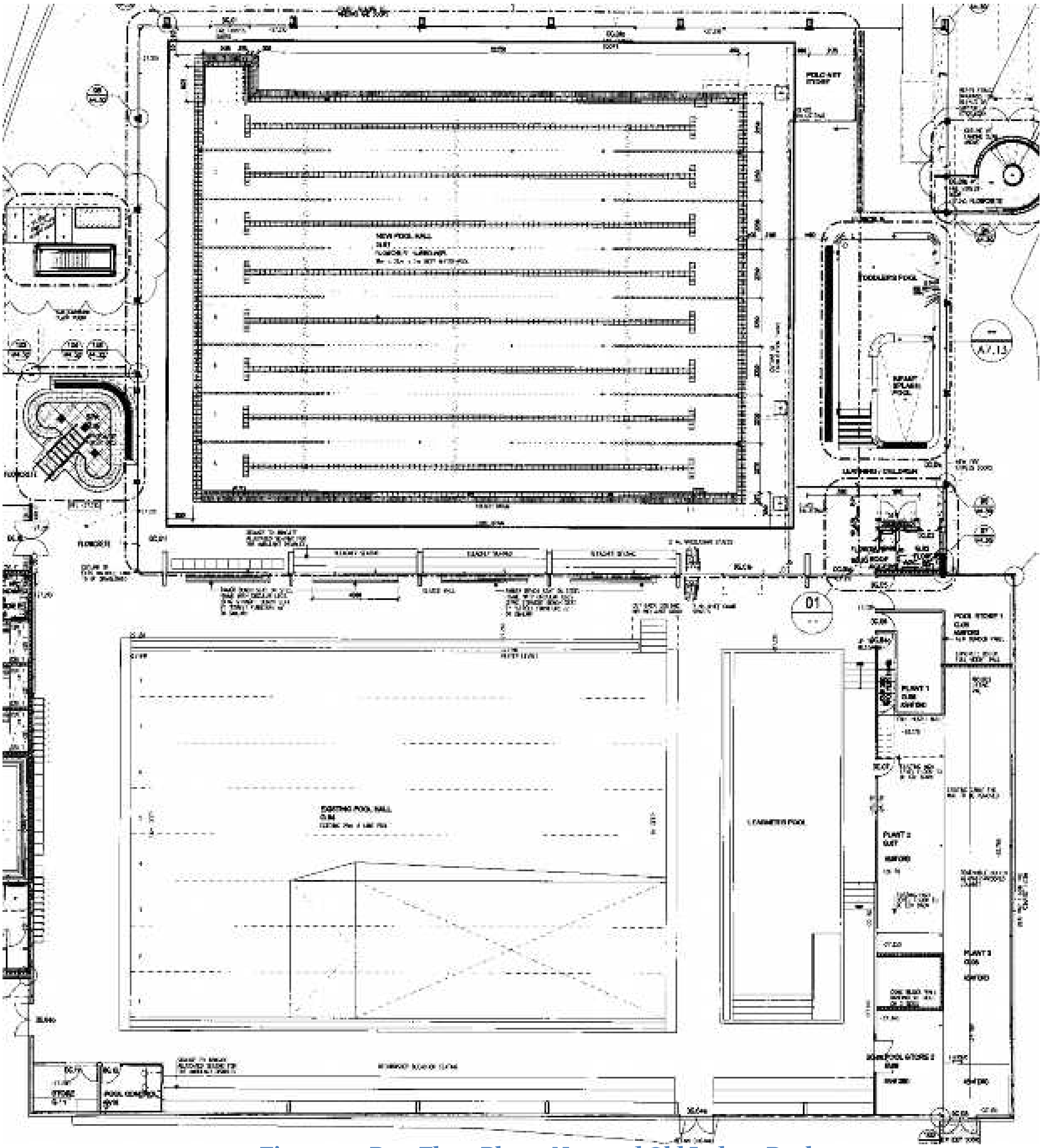

Figure 3 – Part Floor Plan – New and Old Indoor Pools

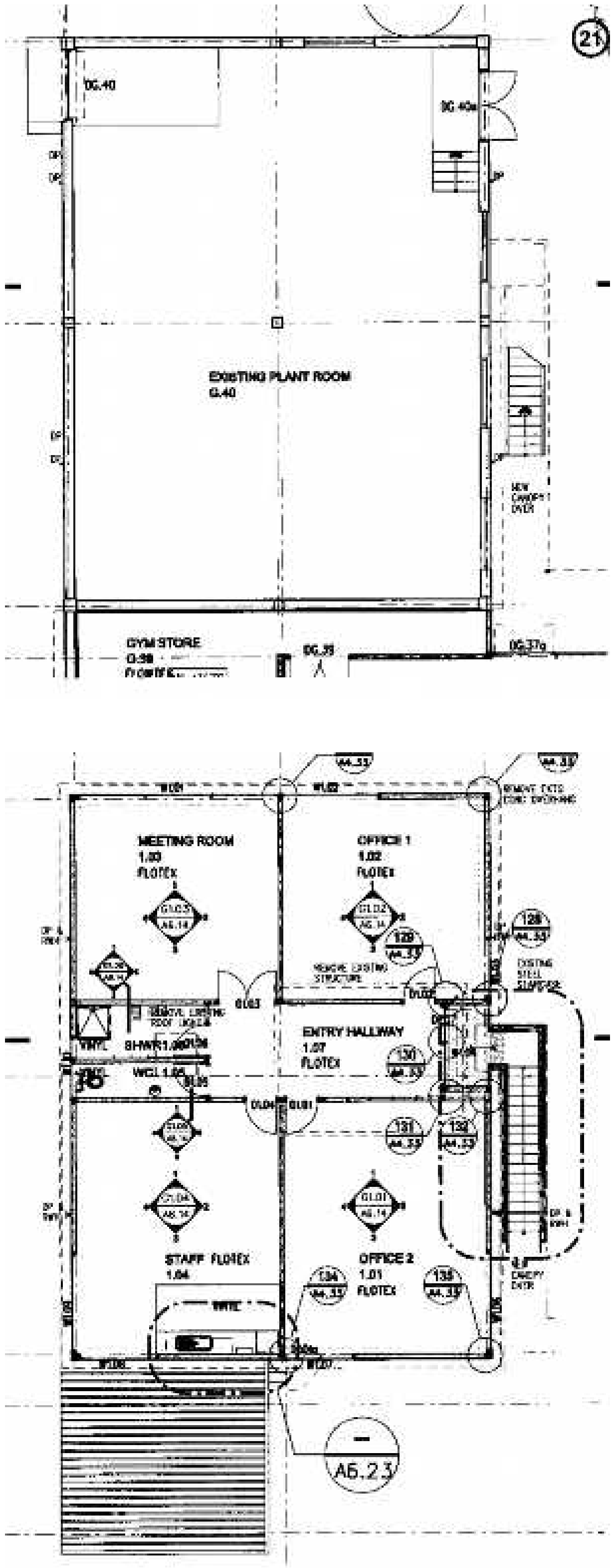

Figure 4 – Plant Room and Office Plans

Appendix 3 – Geotechnical Appraisal

29 March 2012

Christchurch City Council
C/O:- Michael Sheffield
Property Asset Manager

6-QUCCC.62/025SC
6-QUCCC.62/035SC
6-QUCCC.62/045SC

Dear Michael

Geotechnical Desktop Study – Jellie Park

1. Introduction

Christchurch City Council (CCC) has commissioned Opus International Consultants (Opus) to undertake a geotechnical desktop study and site walkover of the indoor pool complex, water slides and plant room of Jellie Park, Christchurch. The purpose of this study is to collate existing subsoil information and undertake an appraisal of the potential geotechnical hazards at this site and to determine whether further investigations are required. The site walkover was completed by Opus on 29 February 2012 and 21 March 2012. Refer to Appendix A for Site Photos and Appendix B for the Site Walkover Plan.

It is our understanding that this is the first geotechnical inspection of this property and forms part of a Detailed Engineering Evaluation prepared by Opus.

2. Desktop Study

2.1 Site Description

Jellie Park is located at 295 Ilam Road, Christchurch, and comprises green field sites; a carpark; an outdoor pool; an indoor pool complex including two 25m pools; changing rooms; gym and foyer; one outdoor water slide (Water Slide 1); a second outdoor water slide (Water Slide 2) that flows into the indoor pool complex and a plant room.

For the purposes of this report, Jellie Park has been separated into three areas: Interior Pool Complex; Water Slides and the Plant Room. Refer to the Site Plan in Appendix C.

The Hewlings and Wairarapa Streams are located approximately 100m from site, both flowing into a pond approximately 30m to the north of the site at its closest point. The Wairarapa Stream exits the pond to the north of the site and flows towards the east. Refer to the Site Plan in Appendix C.

A new indoor pool, foyer, changing rooms and gym complex was added in 2007 and is of steel portal frame construction.

The ground profile is undulating; however the buildings are generally level with each other.

2.2 Structural Drawings

There are limited structural drawings available for the Jellie Park Complex. Structural drawings for the 2007 addition are available, including the new pool hall, changing rooms, foyer and gym. The drawings indicate a perimeter strip footing varying between 0.2m and 0.6m wide and between 0.2m and 0.4m below ground level (bgl). The pads supporting the portal frame are typically 0.5m by 0.5m and between 0.3m and 0.4m bgl. The largest pads are 2m by 2.5m and 0.6m bgl.

The floor slab is reinforced concrete and is 125mm thick in the gym and changing rooms and 150mm thick in the new pool.

There are no structural drawings available for the external water slide (Water Slide 1), however from the site walkover it appears the steel frames are founded on approximately 300mm by 300mm concrete pad to an unknown depth. Refer to Photo 20 in Appendix A.

The additions in 2007 include the external/internal water slide (Water Slide 2). The drawings indicate the spiral stair is founded on 3.8m by 3.8m reinforced concrete pad and the steel supports are founded on a 1m by 1m reinforced concrete pad, both to a depth of 0.5m below ground level (bgl).

Extracts are included in Appendix D.

No structural drawings were made available for the plant room at Jellie Park.

2.3 Regional Geology

The published geological map of the area, (Geology of the Christchurch Urban Area 1:25,000, Brown and Weeber, 1992) indicates the site is underlain by the Yaldhurst member of the Springston Formation, with dominantly alluvial sand and silt overbank deposits.

2.4 Expected Ground Conditions

A review of the Environmental Canterbury (Ecan) wells database showed six wells located within approximately 540m of the property (refer to Site Plan in Appendix B). Three CPT's were completed by Orion located within 370m of site have also been reviewed. Material logs available from the wells and CPT's have been used to infer the ground conditions at the site, as shown in Table 1 below. Refer to Appendix B for material logs.

Table 1:Inferred Ground Conditions

Stratigraphy	Thickness (m)	Depth Encountered From (m)
CLAY, SILT and SAND with minor PEAT	0.91 – 3.35m	Surface
SAND and GRAVEL	4.9 – 9.5m	0.91 – 3.35m
GRAVEL (Riccarton Gravels)	-	12.5m

The groundwater table inferred from the ECan wells above is identified between 2.6m and 3.5m bgl. The Brown and Weeber "Geology of the Christchurch Urban Area" map suggests a water table is between 3m and 4m bgl.

2.5 Liquefaction Hazard

A liquefaction hazard study was conducted by the Canterbury Regional Council (ECan) in 2004 to identify areas of Christchurch susceptible to liquefaction during an earthquake. A section of the Jellie Park site is located in an area identified as 'moderate liquefaction ground damage potential may be expected' for a low groundwater scenario. According to this study, this classification is based on general soil information, as insufficient soil information was available for liquefaction prediction.

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 4th September earthquake, and the aftershocks of 22 February and 13 June 2011. An interpretation of these maps indicates the area suffered from liquefaction in both the 22 February 2011 and 13 June 2011 earthquakes.

After consultation with the staff of Jellie Park, it was discovered that liquefaction occurred on site in one location of an area of approximately $0.25m^2$. Refer to Photos in Appendix A and the Site Walkover Plan in Appendix C.

Jellie Park is bounded by residential properties located in the CERA "green" zone. The "green" zone has been further categorised into technical categories by the Department of Building and Housing (DBH), this site has been identified as "Technical Category 2" (TC2) released in October 2011. The DBH technical categories are guidelines for residential foundations, however are likely to be used as a guideline by Christchurch City Council for building consent. TC2 identifies the area may be subject to minor to moderate land damage from liquefaction in future large earthquakes.

3. Site Walkover Inspection

A walkover inspection of the exterior and interior was carried out by Danielle Belcher, Opus Engineering Geologist on 29 February 2012 and 21 March 2012. The following observations were made and have been separated into the three specified areas (refer to the Site Photos in Appendix A and the Site Walkover Plan in Appendix B):

3.1 Interior Pool Complex

- Minor cracks in the floor slab have been observed. Refer to Photos 3, 4, 5 and 6.
- Possible settlement of ground near the entrance to the Toddlers Pool of 10mm to 15mm. Refer to Photos 8 and 9.
- Minor cracking in the perimeter strip footing at various locations around the pool complex. Refer to Photos 10, 11, 12 and 13.
- Minor horizontal crack in the perimeter strip footing noted at two locations. Refer to Photos 14 and 15.
- Minor possible settlement of brick area at the base of an outdoor tiled area adjacent to the cafe. Refer to Photo 16.
- Minor cracking in asphalt adjacent to the western wall of the gym. Refer to Photo 17.

- One area of liquefaction 18m south-east of the main entrance to Jellie Park, with less than 100mm of heave, creating uneven brick work within approximately 5m of this location. Refer to Photo 18.

3.2 Water Slides

- There was no observed ground damage within the vicinity of Water Slide 1. Refer to Photos 19, 20 and 21.

- There was no observed ground damage within the vicinity of Water Slide 2. Refer to Photos 22 and 23.

3.3 Plant Room

- Minor cracking in the floor slab. Refer to Photos 26 and 27.

- Minor cracking in the retaining section of the walls, particularly in the upper section where it is similar to ground level. Refer to Photos 28 and 29.

- Possible settlement of the asphalt on the western side of the Plant Room, the shed leans towards the north. Refer to Photos 30 and 31.

4. Discussion

Minor land damage has occurred at Jellie Park due to the Canterbury Earthquake Sequence following the 4 September 2010 earthquake.

There appears to have been minor settlement (up to 30mm) of the ground noted in three areas around the site.

Liquefaction appears to have been relatively minor at the site, with liquefaction occurring in one location to the east of the main entrance.

Cracks in the concrete perimeter footing appear to be minor.

ECan well logs and CPTs indicate the building is likely to be founded on interbedded layers of clay, silt, peat and sand, underlain by sand and gravel, with the Riccarton Gravels likely to be encountered from approximately 12m bgl. The foundation system for the 2007 addition, perimeter strip footing with pads supporting the portal frame, has performed well. The foundations of the older areas of the Jellie Park complex, although unknown appear to have also performed well.

Buildings are typically designed to allow for up to 50mm of land settlement in a serviceability limit state (SLS) event, or up to 100mm in an ultimate limit state event (ULS).

GNS Science[1] 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 (Geonet) indicates there is a 16% probability of another Magnitude 6 or greater earthquake occurring in the next 12 months in the Canterbury

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[1] GNS Science reporting on Geonet Website: http://www.geonet.org.nz/canterbury- quakes/aftershocks/ updated on 24 February 2012.

region. It is expected that the probability of occurrence is likely to decrease with time, following periods of reduced seismic activity. We would expect that similar liquefaction and ground damage could occur in a future earthquake dependent on the location of the epicentre.

Based on current evidence, the existing foundations are considered appropriate for the building with the client's acceptance that the potential for differential settlement may occur in future seismic events.

If CCC wish to further quantify the potential for differential settlement in future seismic events, consideration could be given to undertaking ground investigations to more accurately estimate the potential differential settlement from liquefaction.

5. Recommendations

- Based on the past performance in recent earthquakes, the existing foundations should be acceptable in terms of future ULS and SLS loadings, although CCC may have to accept the risk for potential differential settlement in the order of 0 to 50mm in a future seismic event;

- If CCC wishes to further evaluate and quantify the liquefaction potential at this site, additional site specific testing with CPT's and associated analysis would be necessary. Further investigations are currently not considered necessary.

6. Limitation

This report has been prepared solely for the benefit of CCC as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

7. *References:*

Brown, LJ; Webber, JH 1992: Geology of the Christchurch Urban Area. Scale 1:25,000. Institute of Geological and Nuclear Sciences geological map, 1 sheet + 104p.

Environment Canterbury, Canterbury Regional Council (ECan) website:

ECan Well Card
http://ecan.govt.nz/services/online-services/tools-calculators/Pages/well-card.aspx

ECan 2004: The Solid Facts on Christchurch Liquefaction. Canterbury Regional Council, Christchurch, 1 sheet.

Project Orbit, 2011: interagency/organisation collaboration portal for Christchurch recovery effort. https://canterburyrecovery.projectorbit.com/SitePages/Home.aspx

Prepared By:	Reviewed By:
Danielle Belcher	Graham Brown
Engineering Geologist	Senior Geotechnical Engineer

Appendices:
Appendix A: Site Photos
Appendix B: Site Walkover Plan
Appendix C: Site Plan and ECan Well Logs
Appendix D: Extracts of Structural Drawings

APPENDIX A:
Site Photos

Photo 1: Street elevation, 295 Ilam Road.

Photo 2: Jellie Park.

Photo 3: Cracks in floor slab in the foyer leading into the pool complex.

Photo 4: Cracks in floor slab in the Family Changing Rooms.

Photo 5: Crack in floor slab in the Old Pool Hall, looking north.

Photo 6: Cracks in floor slab in the New Pool Hall, looking north-east.

Photo 7: Cracks in the floor slab of the internal Plant Room 3.

Photo 8: Possible settlement at the entrance to the Toddlers Pool, approximately 10mm to 15mm.

Photo 9: Possible settlement at the entrance to the Toddlers Pool. Note new seal at the base of external door frame.

Photo 10: Cracking and spalling of concrete in the perimeter strip footing, north-west wall of the Spa Area.


Photo 11: Crack in perimeter strip footing, north-west wall of the New Pool Hall.

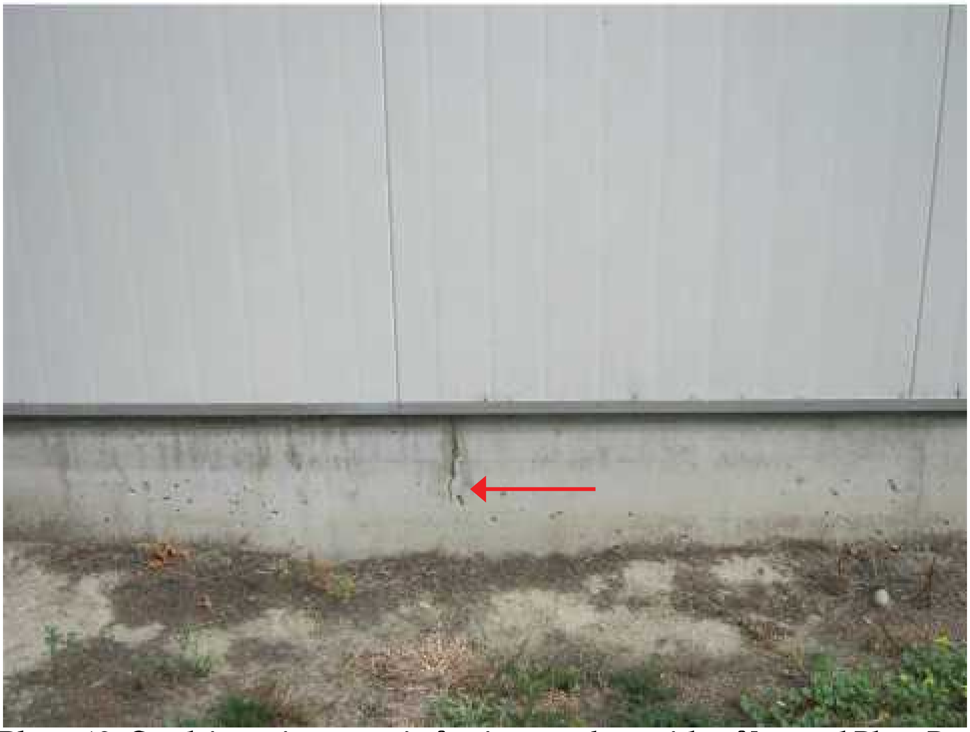


Photo 12: Crack in perimeter strip footing, northern side of Internal Plant Room 3.

Photo 13: Crack in perimeter strip footing, north-west wall of the New Pool Hall.

Photo 14: Horizontal crack in perimeter strip footing, north-west wall of the New Pool Hall.

Photo 15: Minor vertical and horizontal cracking adjacent to the Gym and the Foyer, possible water damage.

Photo 16: Minor settlement, approximately 10-15mm, between brick and tiled area outside of the cafe in the Foyer.

Photo 17: Minor asphalt damage on the north-west side of the Gym.

Photo 18: Sole location of liquefaction on site, 18m south-east of the main entrance to Jellie Park, less than 100mm of heave. Note the displacement of the bricks.

Photo 19: Elevation of Water Slide 1, looking towards the south-west.

Photo 20: Steel supports of Water Slide 1 looking towards the south-west.

Photo 21: Elevation of Water Slide 2, looking towards the east.

Photo 22: Water Slide 2 spiral stair, looking towards thesouth-west.

Photo 23: Water Slide 2, looking towards the north-east.

Photo 24: Plant room, with administration block on top, looking towards the west.


Photo 25: Internal view of the Plant Room.


Photo 26: Minor crack (running north-west to south-east) in floor slab of Plant Room.

Photo 27: Minor crack (running north-west to south-east) in the floor slab of the Plant Room.

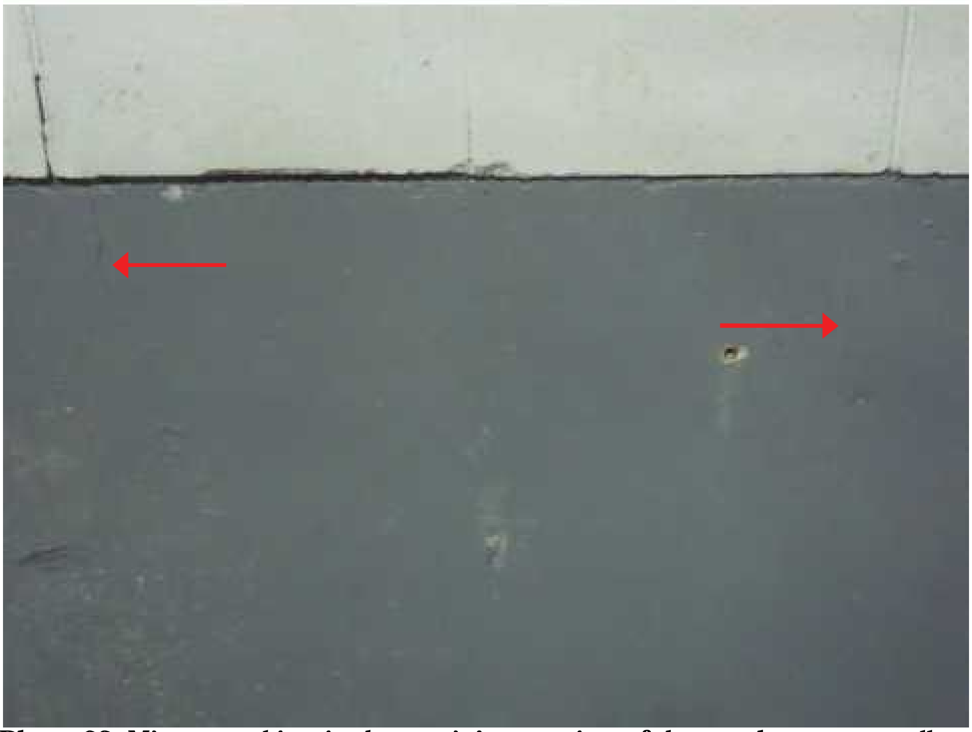


Photo 28: Minor cracking in the retaining section of the north-eastern wall.

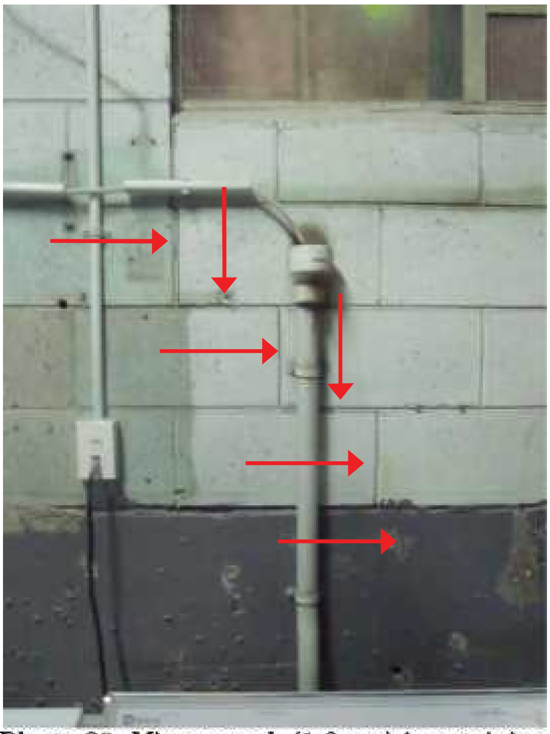
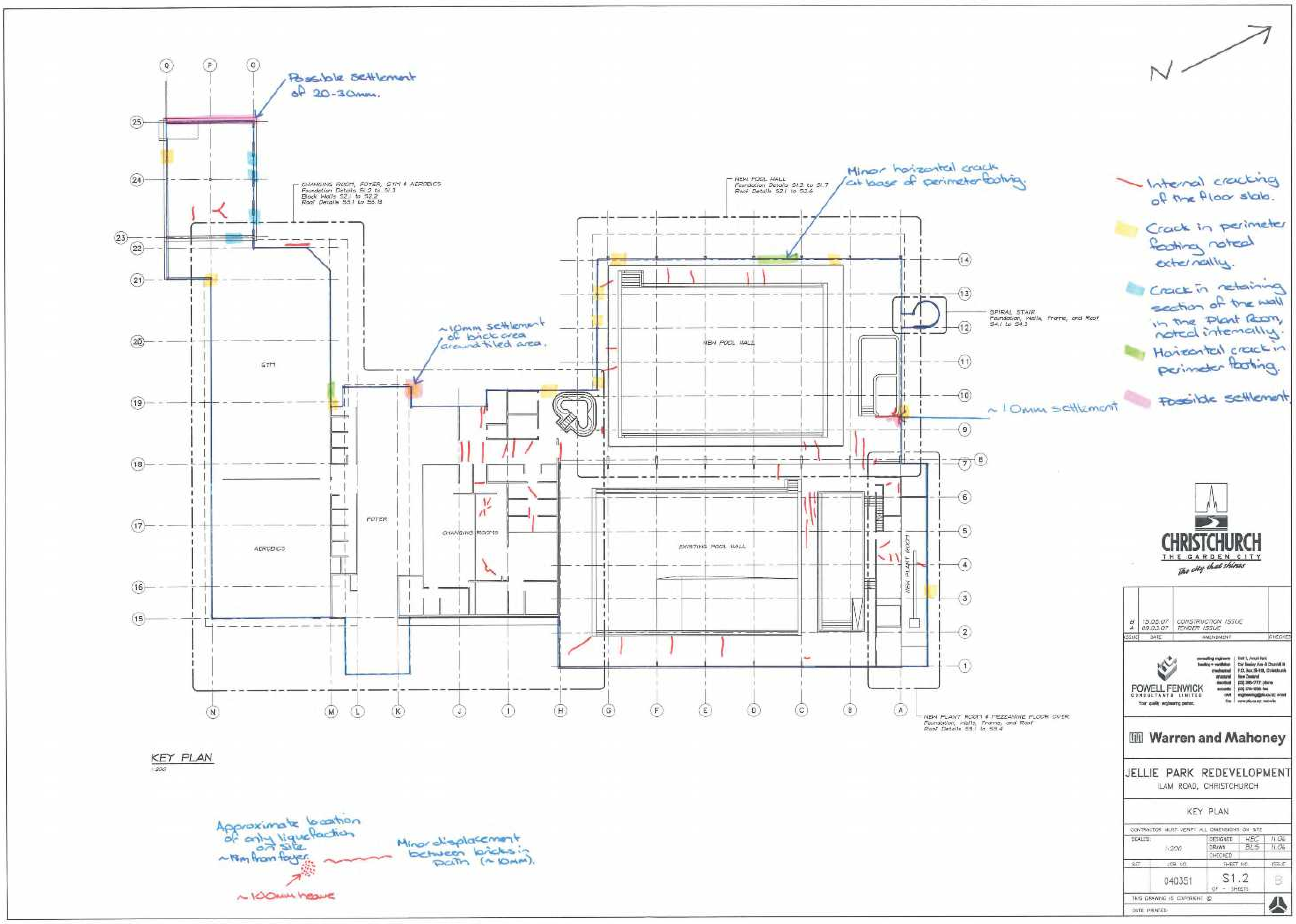


Photo 29: Minor crack (1-2mm) in retaining section of the south-eastern wall, note that it extends up through the block work.

Photo 30: Shed on the north-western wall leaning towards the north-east.

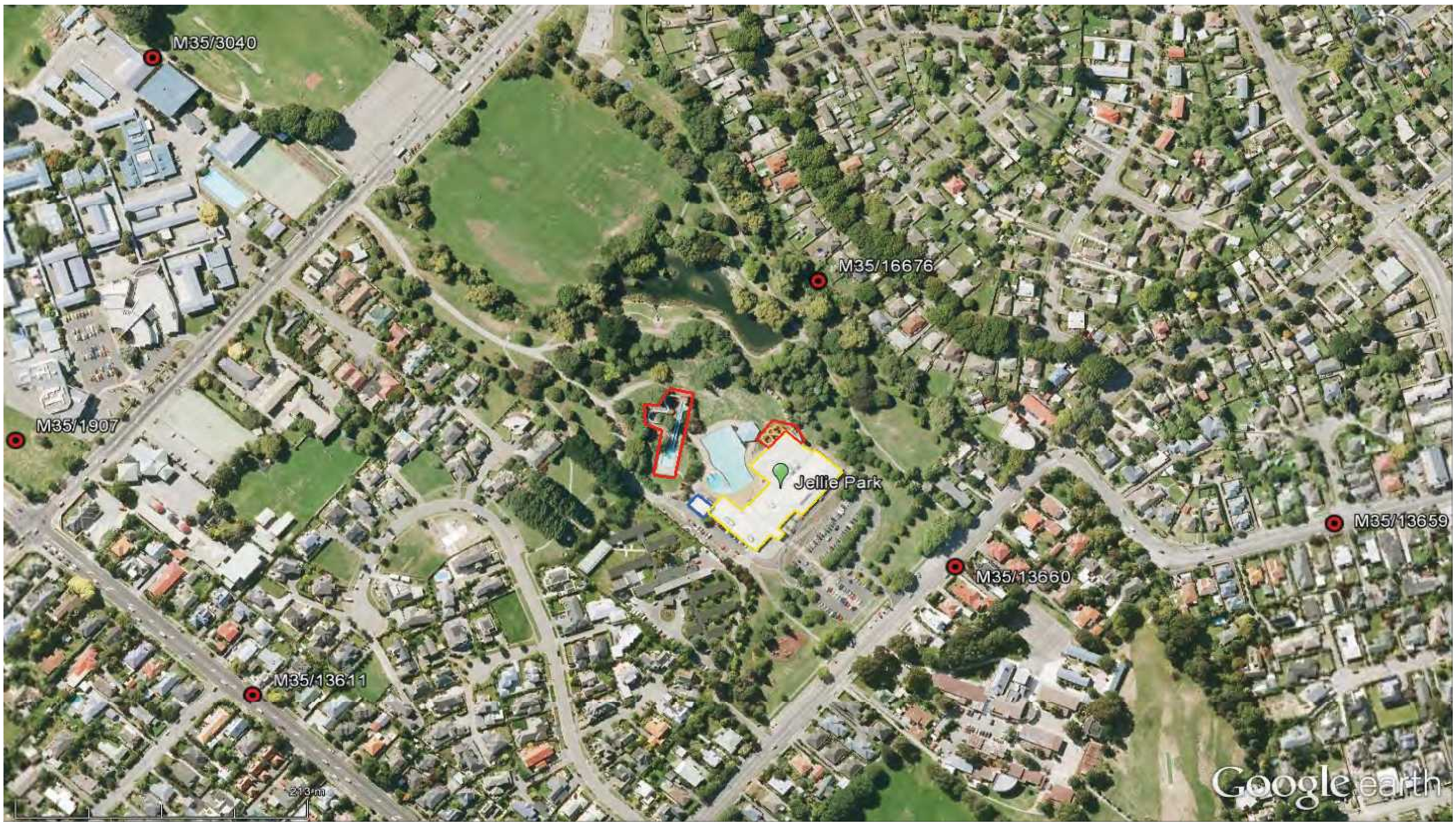
Photo 31: Possible settlement (20-30mm) of the asphalt on the north-western side of the Plant Room.

APPENDIX B:
Site Walkover Plan



N
Possible settlement of 20-30mm.
CHANGING ROOM, FOYER, GYM & AEROBICS
Foundation Details S1.2 to S1.3
Block Walls S2.1 to S2.2
Roof Details S5.1 to S5.18
NEW POOL HALL
Foundation Details S1.3 to S1.7
Roof Details S2.1 to S2.6
Minor horizontal crack at base of perimeter footing.
~10mm settlement of brick area around tiled area.
SPIRAL STAIR
Foundation, Walls, Frame, and Roof
S4.1 to S4.3
~10mm settlement
GYM
AEROBICS
FOYER
CHANGING ROOMS
NEW POOL HALL
EXISTING POOL HALL
NEW PLANT ROOM
NEW PLANT ROOM & MEZZANINE FLOOR OVER
Foundation, Walls, Frame, and Roof
Roof Details S3.1 to S3.4
Internal cracking of the floor slab.
Crack in perimeter footing noted externally.
Crack in retaining section of the wall in the Plant Room, noted internally.
Horizontal crack in perimeter footing.
Possible settlement.
KEY PLAN
1:200
Approximate location of only liquefaction on site. ~15m from foyer.
~100mm heave
Minor displacement between bricks in path (~10mm).
CHRISTCHURCH
THE GARDEN CITY
The city that shines
B 15.05.07 CONSTRUCTION ISSUE
A 09.03.07 TENDER ISSUE
ISSUE DATE AMENDMENT CHECKED
POWELL FENWICK CONSULTANTS LIMITED
Warren and Mahoney
JELLIE PARK REDEVELOPMENT
ILAM ROAD, CHRISTCHURCH
KEY PLAN
CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE
SCALES: 1:200
DESIGNED HEC 11.06
DRAWN BLS 11.06
CHECKED
SET JOB NO. 040351
SHEET NO. S1.2
ISSUE B
THIS DRAWING IS COPYRIGHT ©
DATE PRINTED

APPENDIX C:
ECan Site Plan
Well Logs



Key: Yellow Outline: Interior Pool Complex
Red Outline: Water Slides
Blue Outline: Plant Room
Red Circle: ECan Well Logs

OPUS
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20 Moorhouse Ave
PO Box 1482
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Tel: +64 3 363 5400 Fax: +64 3 365 7857

Project:	Jellie park Desktop Study
Project No.:	6-QUCCC.62
Client:	Christchurch City Council

Site Plan

Drawn:	Danielle Belcher Engineering Geologist
Date:	16-Mar-12

Borelog for well M35/13659

Gridref: M35:76670-44138 Accuracy : 3 (1=high, 5=low)
Ground Level Altitude : 14.6 +MSD
Well name : CCC BorelogID 1991
Drill Method : Not Recorded
Drill Depth : -2.74m Drill Date :

Environment Canterbury Regional Council

Depth(m)	Full Drillers Description	Formation Code
0 to -0.18m	road metal	
-0.18m to -0.76m	clay	
-0.76m to -0.84m	peat	
-0.84m to -1.22m	sandy silt	
-1.22m to -2.74m	gravel	

Scale(m): -0.2, -0.4, -0.6, -0.8, -1, -1.2, -1.4, -1.6, -1.8, -2, -2.2, -2.4, -2.6

Water Level

Borelog for well M35/13660

Gridref: M35.76393-44111 Accuracy : 3 (1=high, 5=low)
Ground Level Altitude : 15.33 +MSD
Well name : CCC BorelogID 1992
Drill Method : Not Recorded
Drill Depth : -1.98m Drill Date :

Environment Canterbury Regional Council

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.08m	road metal	
-0.2		-0.45m	clay	
-0.4				
-0.6		-0.91m	wet sand	
-0.8				
-1	-1	-1.98m	gravel	
-1.2				
-1.4				
-1.6				
-1.8				

Borelog for well M35/16676

Gridref: M35:76302-44321 Accuracy : 3 (1=high, 5=low)
Ground Level Altitude : 15.94 +MSD
Well name : CCC BorelogID 6287
Drill Method : Not Recorded
Drill Depth : -2.9m Drill Date : 20/11/2006

Environment Canterbury Regional Council

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
-0.2		-0.30m	black topsoil	
-0.4, -0.6, -0.8, -1		-1.20m	sand	
-1.2, -1.4		-1.50m	sandy silt	
-1.6		-1.80m	grey / yellow silt	
-1.8, -2, -2.2		-2.30m	sand	
-2.4		-2.50m	silt	
-2.6		-2.80m	sand	
-2.8		-2.90m	gravel	

Borelog for well M35/1907 page 1 of 2

Gridref: M35:757-442 Accuracy : 4 (1=best, 4=worst)
Ground Level Altitude : 17.4 +MSD
Driller : Job Osborne (& Co/Ltd)
Drill Method : Hydraulic/Percussion
Drill Depth : -146m Drill Date : 7/04/1897

Environment Canterbury
Your regional council

Water Level: -3.5CalcMin

Depth(m)	Full Drillers Description	Formation Code
-3.00m	Soft soil & clay	sp?
- 44.8m	Very hard Brown sand & gravel	sp-ri
- 45.4m	Soft Yellow sand	br
- 51.8m	Hard Yellow sand	br
- 59.4m	Conglomerated stones	li
- 64.0m	Hard Yellow sand	li
- 64.3m	Soft Yellow sand	li
- 70.4m	Hard Brown sand	li
- 73.5m	Soft Grey sand	li

Scale(m): -10, -20, -30, -40, -50, -60, -70

Borelog for well M35/1907

Gridref: M35:757-442 Accuracy : 4 (1=best, 4=worst)
Ground Level Altitude : 17.4 +MSD
Driller : Job Osborne (& Co/Ltd)
Drill Method : Hydraulic/Percussion
Drill Depth : -146m Drill Date : 7/04/1897

Environment Canterbury
Your regional council

Depth(m)	Full Drillers Description	Formation Code
- 73.5m	Soft Grey sand	ll
	Hard sand mixed with clay	
- 93.3m		ll
- 93.8m	Soft Grey sand	he
	Hard Brown sand	
- 108.8m		he
	Soft Yellow sand	
- 112.2m		he
	Hard Grey sand & gravel	
- 115.8m		bu
	Soft Yellow sand	
- 119.5m		sh
	Very hard Brown sand & gravel with water rising to surface but nothing to pump	
- 136.8m		wa
- 138.1m	Soft Yellow sand	aq5
- 139.3m	Hard Yellow sand	aq5
	Soft Yellow sand	
- 142.6m		aq5
- 146.0m	Hard Brown sand with gravel.the water rising to surface & would flow 0.4 l/s ,1.07m below ground surface. A ram was fixed to it at the above depth	aq5

Scale(m): -80, -90, -100, -110, -120, -130, -140

Water Level

Borelog for well M35/3040

Gridref: M35:757-446 Accuracy : 4 (1=best, 4=worst)
Ground Level Altitude : 15.9 +MSD
Driller : A M Bisley & Co
Drill Method : Cable Tool
Drill Depth : -20.4m Drill Date : 21/10/1974

Water Level: -2.6CalcMin

Depth(m)	Full Drillers Description	Formation Code
-0.30m	Topsoil	sp?
-2.40m	Brown clay	sp?
-7.30m	Grey gravel & sand (Clay trace)	sp?
- 11.3m	Grey gravel Black stained & Black sand (Water-bearing)	sp?
- 12.5m	Tight cemented gravel	sp?
- 20.1m	Small Grey gravel.(Water-bearing)	ri
- 20.4m	Small Grey gravel,clay trace.(Water-bearing)	ri

Scale(m): -5, -10, -15, -20

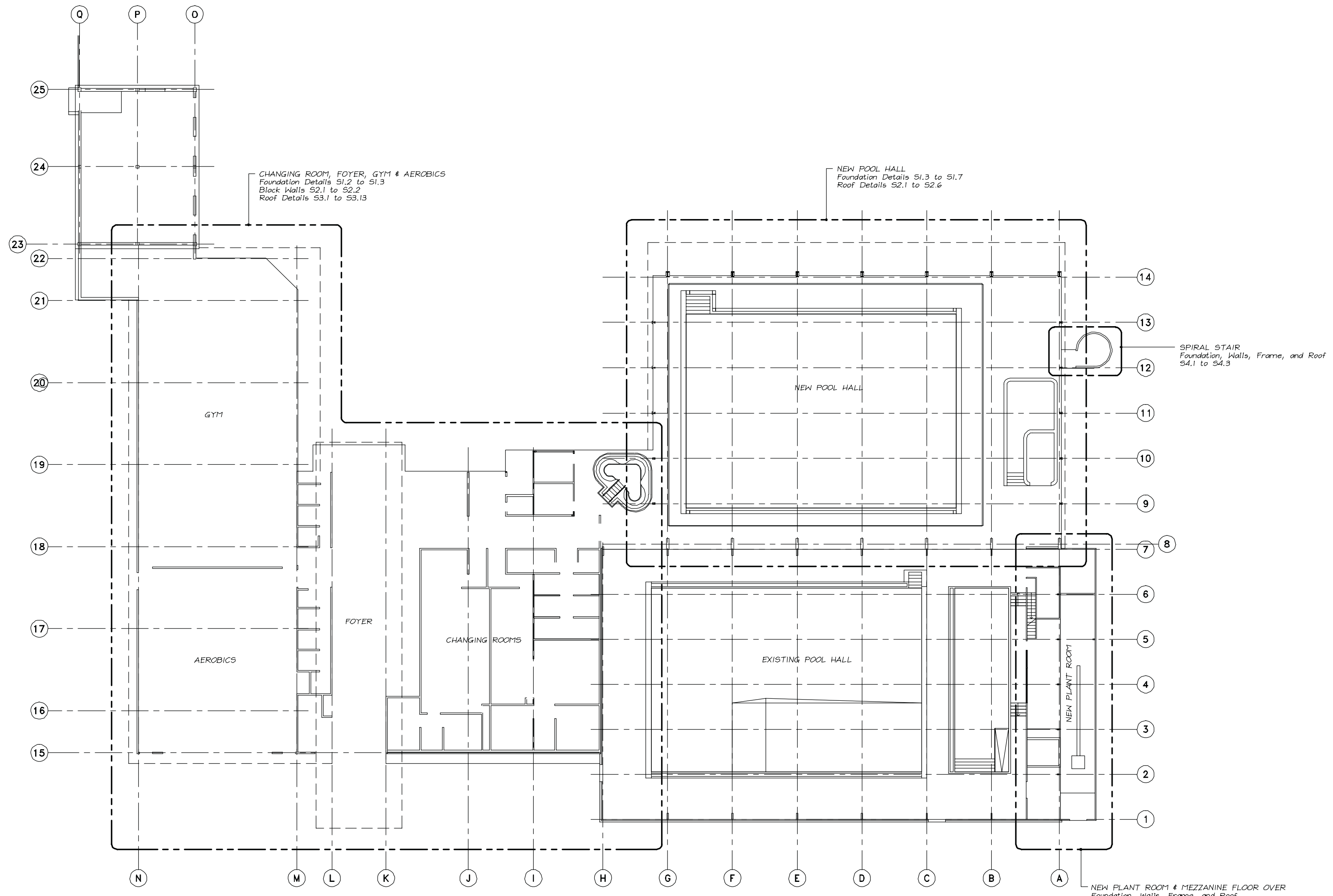
Borelog for well M35/13611

Gridref: M35:75877-43991 Accuracy : 3 (1=high, 5=low)
Ground Level Altitude : 14 +MSD
Well name : CCC BorelogID 1943
Drill Method : Not Recorded
Drill Depth : -3.35m Drill Date :

Environment Canterbury

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.13m	road metal	
-0.2		-0.38m	topsoil	
-0.4, -0.6, -0.8		-0.91m	silt	
-1, -1.2		-1.37m	clay	
-1.4, -1.6		-1.67m	sand	
-1.8, -2, -2.2, -2.4, -2.6, -2.8, -3, -3.2		-3.35m	wet sand	

APPENDIX D:
Extracts of Structural Drawings



KEY PLAN
1:200

CHRISTCHURCH
THE GARDEN CITY
The city that shines

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B	15.05.07	CONSTRUCTION ISSUE	
A	09.03.07	TENDER ISSUE	

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(03) 379-1626: fax
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Warren and Mahoney

JELLIE PARK REDEVELOPMENT
ILAM ROAD, CHRISTCHURCH

KEY PLAN

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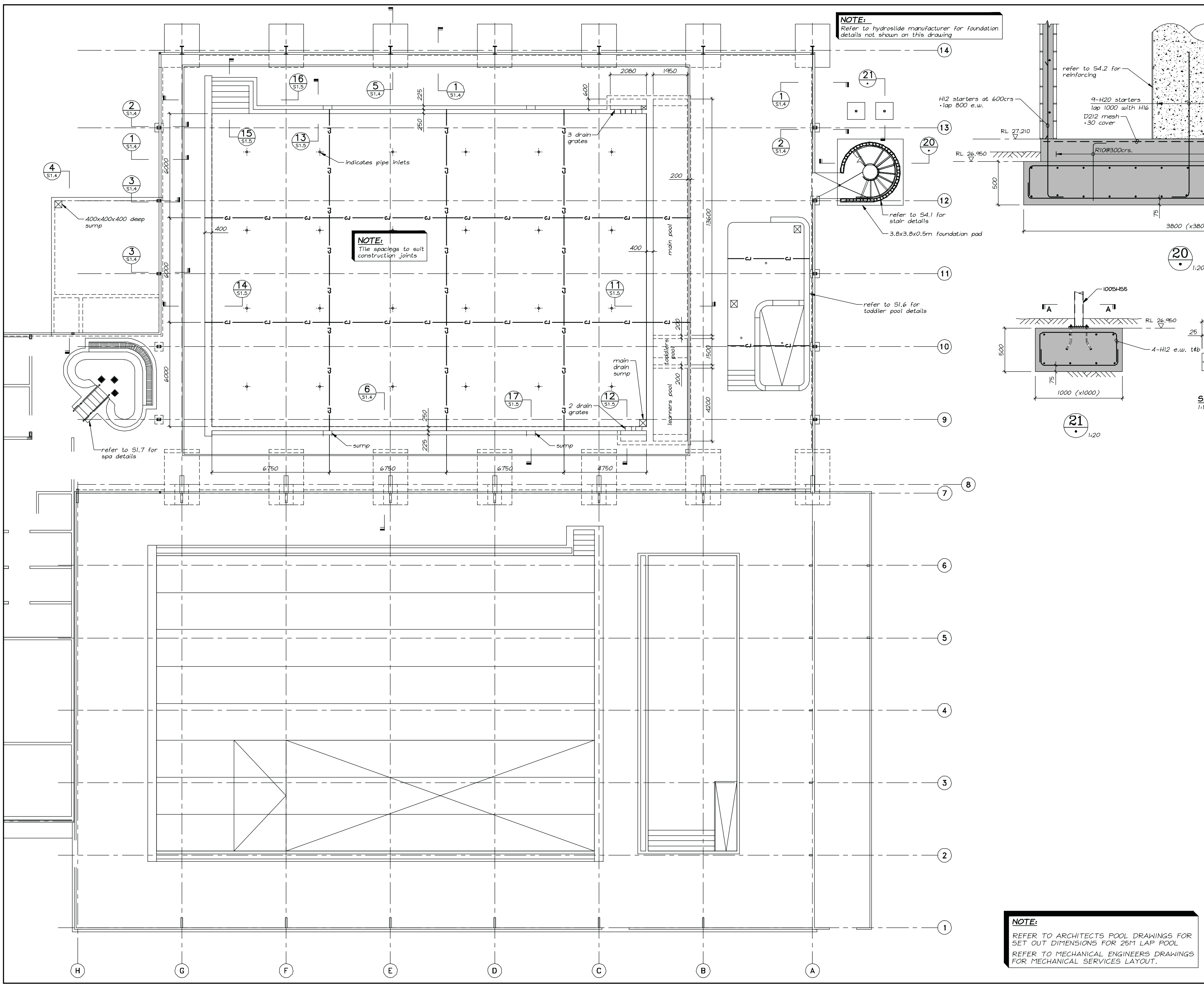

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ILAM ROAD, CHRISTCHURCH

NEW POOL HALL
FOUNDATION PLAN

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE

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1:100	DRAWN	BLS	11.06
	CHECKED		

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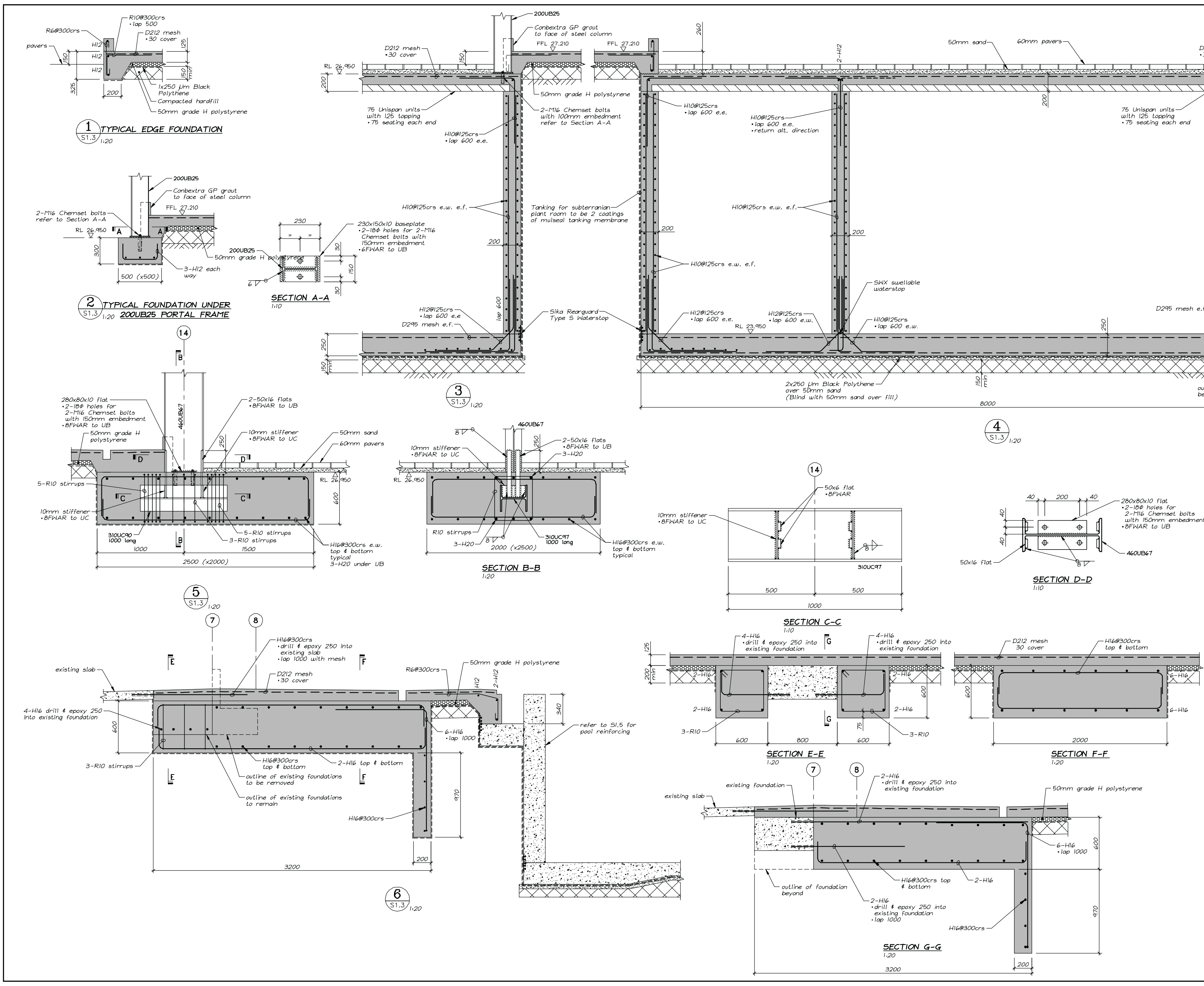

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ISSUE	DATE	AMENDMENT	CHECKED
C	07.08.07	WATERSTOPS CLARIFIED	
B	15.05.07	CONSTRUCTION ISSUE	
A	09.03.07	TENDER ISSUE	

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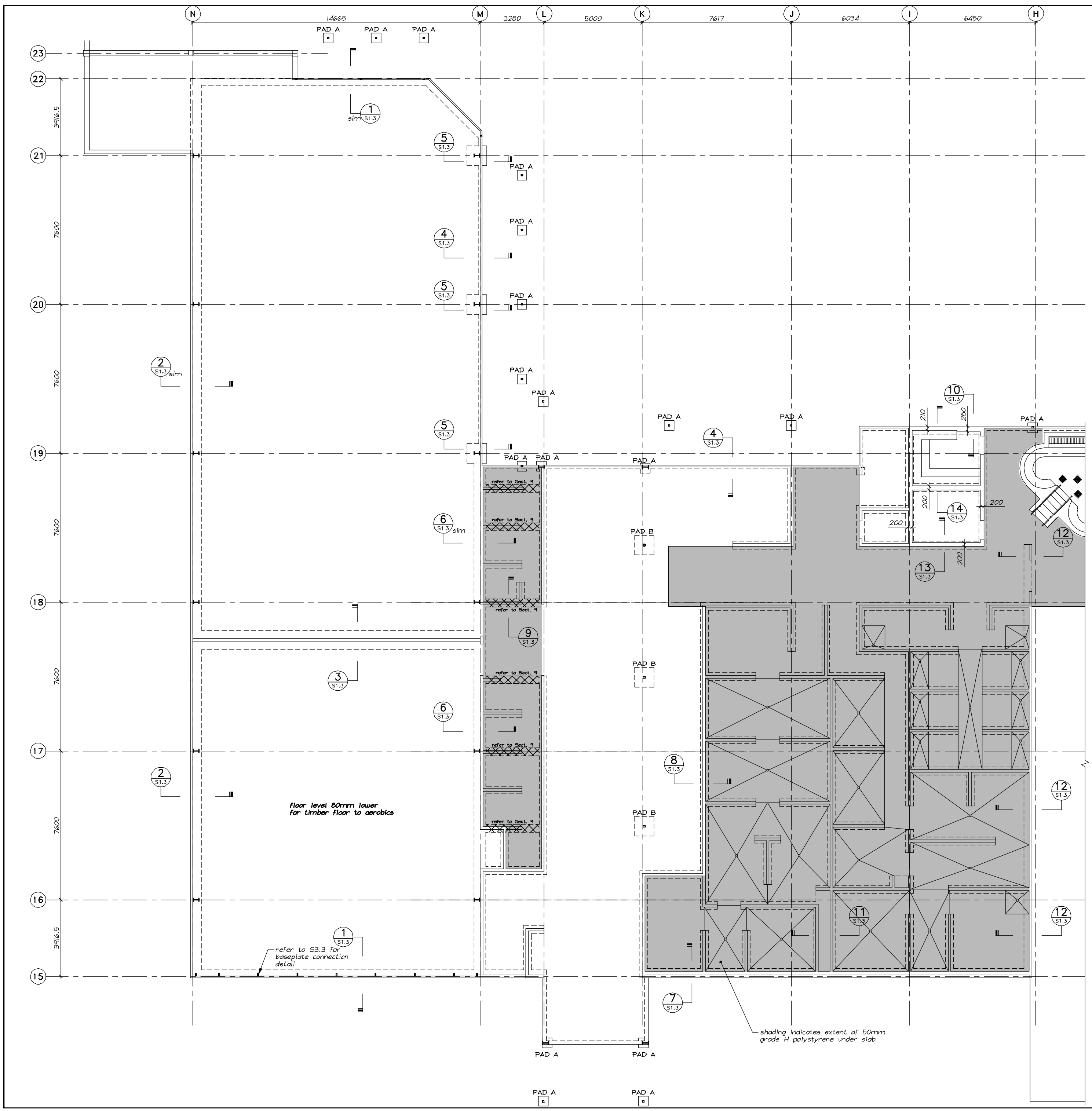
NEW POOL HALL FOUNDATION DETAILS

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE

SCALES:		DESIGNED	HEC	11.06
1:20		DRAWN	KJB	11.06
		CHECKED		
SET	JOB NO.	SHEET NO.	ISSUE	
	040351	S1.4 OF – SHEETS	C	

DATE PRINTED:



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A	09.03.07	TENDER ISSUE	

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GYM & CHANGING ROOMS
FOUNDATION PLAN

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE

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	CHECKED		

SET	JOB NO.	SHEET NO.	ISSUE
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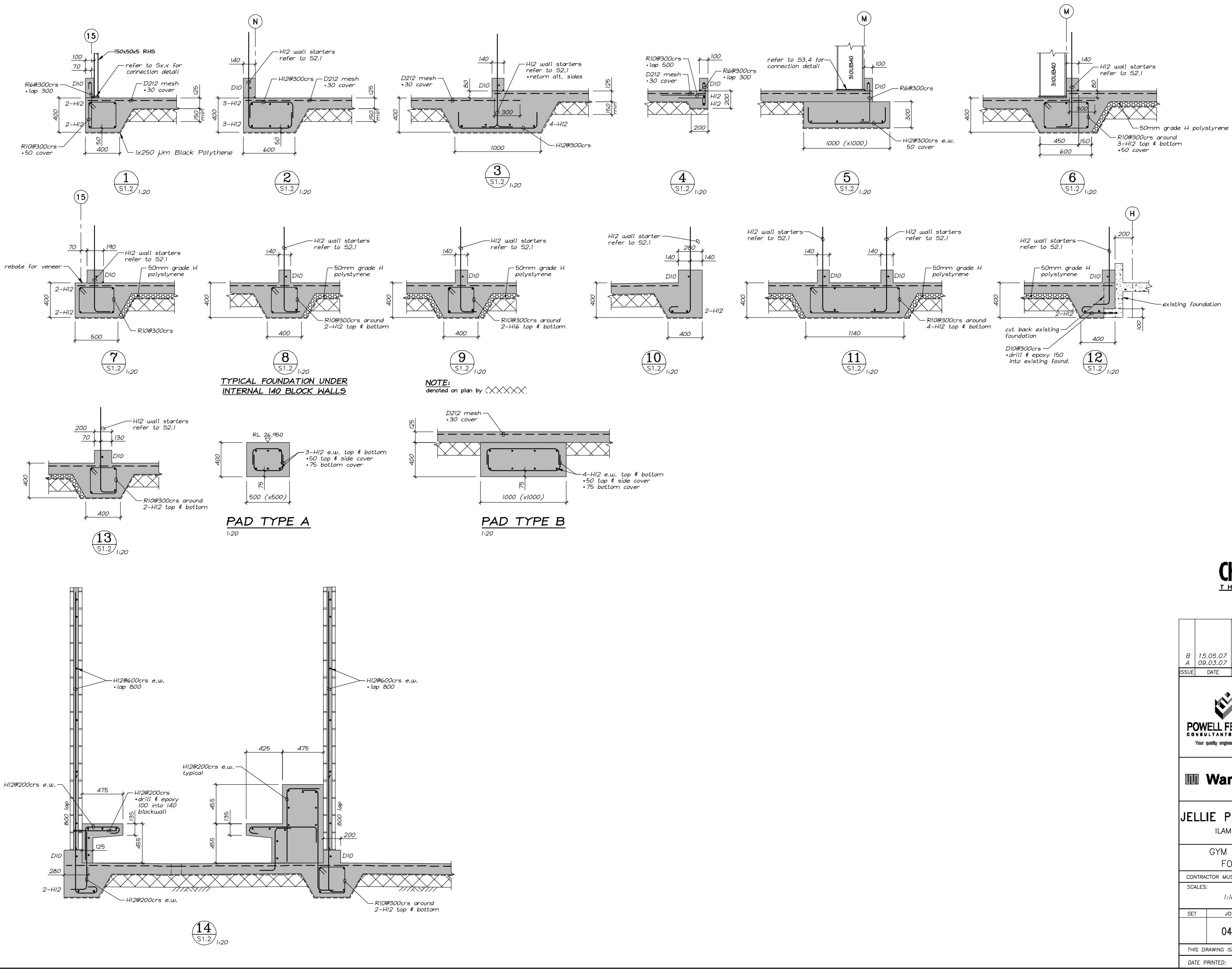

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THE GARDEN CITY
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GYM & CHANGING ROOMS
FOUNDATION DETAILS

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE

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Appendix 4 – Quantitative Assessment Methodology and Assumptions

Quantitative Assessment

1.0 Material and Loading Assumptions

1.1 Material Strength

Concrete Strength	= 45MPa (30MPa x 1.5)
Structural Steel Tubes, Pipe and Plate Yield Strength	= 300MPa
Steel Reinforcing Bar	= 500MPa
Assumed Soil Bearing Capacity	= 400kPa (based on redevelopment geotechnical report)
Timber Glulam	= GL8

1.2 Loading Actions

Dead Loads – Self weight

Live Load – 4kPa

1.3 Importance Levels

The New Pool and Old Pool were analysed as IL3 structures. This was based upon the maximum number of people that could congregate at the pools in the event of a fire. This number was taken from CCC records and was based upon treating the pools as one area of congregation, as the fire loading capacity had done.

The rest of the structures were analysed as IL2 structures.

1.4 Seismic Parameters

<u>Elastic Analyses</u>

All structures except for the Old Pool portal frames were analysed elastically with equivalent static procedure. The parameters used in these analyses are listed below.

Z = 0.30	N(T,D) = 1.0
Importance Level 2	R_u = 1.0, R_s = 0.33
Importance Level 3	R_u = 1.3, R_s = 0.33

Structure	IL	T	μ	S_p	k_μ	$C_{ULS}(T)$	$C_{SLS}(T)$	$C_d(T)$
Gym/Studio – Steel Portal Frames	2	≤0.4s (assumed)	3.0	0.7	2.14	0.90	0.30	0.29
Gym/Studio – Rod Bracing and Concrete Block Masonry Walls	2	≤0.4s (assumed)	1.25	0.925	1.14	0.90	0.30	0.73
Changing Rooms – Block Masonry Walls	2	≤0.4s (assumed)	1.25	0.925	1.14	0.90	0.30	0.73
Foyer – Steel Portal Frames	2	0.55s (ETABS)	3.0	0.7	2.14	0.90	0.30	0.29
Old Pool – Out-of-Plans frames to Concrete Block Masonry Walls	3	≤0.4s (assumed)	2 (part)	0.925	1.14	0.90	0.30	0.73
New Pool – Glulam/Steel Portal Frames	3	0.20s (ETABS)	1.25	0.925	1.14	1.17	0.30	0.95
New Pool – Rod Bracing	3	≤0.4s (assumed)	2	0.925	1.14	0.90	0.30	0.73
Old Plant Room – Reinforced Concrete Moment Frames	2	0.26s (estimated)	1.25	0.925	1.14	0.90	0.30	0.73

<u>Non-linear Pushover Analysis</u>

A non-linear pushover analysis was used to analyse the Old Pool glulam portal frames. The analysis was based in the FEMA 356 procedure as outlined in NZSEE 2006. The parameters used in deriving the target displacement for the analysis are listed below. The glulam portal apex was used as the point to measure the displacement and the loads were applied at the apex and the knee of the portal frames.

$\mathbf{T_i}$ = 0.16s (from ETABS)

$\mathbf{K_i}$ = 8600 kN/m (from pushover curve)

$\mathbf{K_e}$ = 4190 kN/m

$\mathbf{T_e} = \mathbf{T_i} \times (\mathbf{K_i}/\mathbf{K_e})^{0.5} = 0.23\text{s}$

$\mathbf{S_a} = \mathbf{C(T)} = 1.17$

$\mathbf{V_y} = 75$ kN (from pushover curve)

$\mathbf{W} = 117$ kN

$\mathbf{R} = \mathbf{S_a} / (\mathbf{V_y} / \mathbf{W}) = 1.78$

$\mathbf{C_1} = [1 + (R-1) \times 0.5s/T_e] / R = 1.51$

$\mathbf{C_2} = 1.0$ (non-linear analysis)

$\mathbf{C_3} = 1.0$ (P-Δ effect ignored)

$\mathbf{C_o} = 1.2$ (load applied at two levels)

$\delta_t = C_0 C_1 C_2 C_3 S_a T_e^2/(4\pi^2)g = 28\text{mm}$

2.0 Analysis Procedure

2.1 Ductility

A μ = 3.0 was chosen for the steel portal frames of the Gym/Studio and Foyer due to the compact selection of member sizes and good ductile detailing. A μ = 1.25 was chosen for the concrete masonry walls because they were detailed for nominal ductility. A μ = 1.25 was chosen for the glulam/steel portal frames of the New Pool as the analysis of the epoxy-grouted steel rod connections showed them to fail through timber tension. A μ = 1.25 was chosen for the reinforced concrete moment frames of the Old Plant Room because of the uncertainty in member and joint detailing. A μ = 2 was used for the longitudinal load resisting systems of the Old and New Pools.

2.2 Modelling

Along with hand calculations, ETABS and Microstran computer models were utilised to estimate the force distribution to the lateral force resisting elements. A Modal Response Spectral Analysis using Microstran was performed on the old plant room and office structure because of the vertical irregularity at this portion of the main building. Columns were assumed to be pinned at the base for this model. Response 2000 was used to estimate the section properties and strengths of the reinforced concrete fame members based on the reinforcing layouts measured during a site inspection and the concrete dimensions obtained from architectural drawings.

ETABS was utilised to model the portal frames of the old pool and the new pool. The new pool has adequate footings and so the columns were fixed at the base. The corner radius at the knee joint of the old pool portal frames was modelled by tapering the beam and column elements in the ETABS model. The tapering of the glulam beam and column in the new pool was also modelled. An elastic analysis was conducted for the New Pool and a non-linear Pushover analysis was conducted for the Old Pool according to NZSEE 2006/FEMA 356.

For the pushover analysis, elastic-perfectly-plastic plastic hinges were used to model the moment capacity of the foundations and the plinths that the glulam columns were fixed to (conservative, as larger base moments improved the performance of the structure). These capacities were found to be 31 kNm and 78 kNm respectively. The target displacement was found to be 28mm at the apex of the portal. Loads on the timber members at the termination of the analysis were then checked against their capacities to determine the %NBS.

The foyer portal frames were modelled in ETABS to account for their interaction with the masonry walls, especially when considering the displacement demands imposed on the frames when subject to the gym/studio and changing room roof displacements. The base connections of the portal frames are not moment connections and so the columns were modelled with pins at the base. Displacement demands were added to the transverse portal frames forces. These displacement demands were attributed to the displacements of the gym/studio transverse portal frames and the changing rooms masonry wall lateral deflections. Opposing and coinciding displacements were considered.

Microstran was utilised to model the gym/studio portal frames for the gym/studio. Columns were pinned at the base. Along the west longitudinal exterior wall, weak axis bending of the steel portal frames was examined for roof diaphragm shear transfer into the partial height masonry walls. The length of the diaphragm was reduced along the east side of the gym/studio to account for the discontinuous collector.

At the changing rooms, because of the minimal capacity of the non-structural diaphragm, the changing room masonry walls resisted transverse direction lateral forces by bending out-of-plane.

%NBS ratings were derived by finding the ratio of the demand on critical sections to the capacity of those sections.

Appendix 5 – CERA Spreadsheets

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Jellie Park - Changing Rooms/Foyer	Reviewer:	Jan Stanway
	Unit / No: / Street	CPEng No:	222291
Building Address:	295 Ilam Road	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QUCCC.62
		Company phone number:	355-9500
	Degrees / Min / Sec		
GPS south:	43 / 30 / 33.02	Date of submission:	26-Feb-14
GPS east:	172 / 34 / 57.93	Inspection Date:	28-Feb-12
		Revision:	Final V3
Building Unique Identifier (CCC):	BU 0266-007 EQ2	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	silty sand	Soil Profile (if available):	Unknown
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	14.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	16.00
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	other (describe)		if Foundation type is other, describe:	Strip footings with Pads
Building height (m):	4.24		height from ground to level of uppermost seismic mass (for IEP only) (m):	3.5
Floor footprint area (approx):	761			
Age of Building (years):	5		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):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	steel framed	rafter type, purlin type and cladding	DHS rafters, PFC collectors, standing seam roof
Floors:	other (note)	describe sytem	Slab-on-grade
Beams:	none	overall depth x width (mm x mm)	
Columns:	structural steel	typical dimensions (mm x mm)	100x5 SHS
Walls:	partially filled concrete masonry	thickness (mm)	140

Lateral load resisting structure

Lateral system along:	partially filled CMU	**Note: Define along and across in detailed report!**	note total length of wall at ground (m):	26.8
Ductility assumed, μ:	1.25		wall thickness (m):	0.14
Period along:	0.40	0.40 from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	partially filled CMU		note total length of wall at ground (m):	12
Ductility assumed, μ:	1.25		wall thickness (m):	0.14
Period across:	0.40	0.40 from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:			
Roof Cladding:	Metal	describe	profile metal roofing
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	full	original designer name/date	Warren & Mahoney / Dec 06
Structural	full	original designer name/date	Powell Fenwick / Dec 06
Mechanical	full	original designer name/date	Powell Fenwick / Dec 06
Electrical	full	original designer name/date	Powell Fenwick / Dec 06
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	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:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):	No apparent structural damage		
Across	Damage ratio:	0%		
	Describe (summary):	No apparent structural damage		
Diaphragms	Damage?:	no	Describe:	see report
CSWs:	Damage?:	yes	Describe:	see report
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	none		Describe:	
	Building Consent required:	no		Describe:	
	Interim occupancy recommendations:	full occupancy		Describe:	
Along	Assessed %NBS before:	90%	##### %NBS from IEP below		
	Assessed %NBS after:	90%			
Across	Assessed %NBS before:	90%	##### %NBS from IEP below		
	Assessed %NBS after:	90%			

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Jellie Park - Gym & Studio	Reviewer:	Jan Stanway
	Unit / No: 295 / Street: Ilam Road	CPEng No:	222291
Building Address:	295 Ilam Road	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QUCCC.62
		Company phone number:	355-9500
	Degrees / Min / Sec		
GPS south:	43 / 30 / 33.02	Date of submission:	26-Feb-14
GPS east:	172 / 34 / 57.93	Inspection Date:	28-Feb-12
		Revision:	Final V3
Building Unique Identifier (CCC):	BU 0266-007 EQ2	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	silty sand	Soil Profile (if available):	Unknown
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	14.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	16.00
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	other (describe)		if Foundation type is other, describe:	Strip footings with Pads
Building height (m):	3.75		height from ground to level of uppermost seismic mass (for IEP only) (m):	3.5
Floor footprint area (approx):	565			
Age of Building (years):	5		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):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:	steel framed	rafter type, purlin type and cladding	DHS rafters, PFC valley & ridges, standing seam roof
Floors:	other (note)	describe sytem	Slab-on-grade
Beams:	steel non-composite	beam and connector type	410UB51
Columns:	structural steel	typical dimensions (mm x mm)	310UB40
Walls:	non-load bearing		0

Lateral load resisting structure

Lateral system along:	partially filled CMU	**Note: Define along and across in detailed report!**	note total length of wall at ground (m):	54.5
Ductility assumed, μ:	1.25		wall thickness (m):	0.14
Period along:	0.40	0.40 from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	welded and bolted steel moment frame		note typical bay length (m)	14.6
Ductility assumed, μ:	1.25			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:			
Roof Cladding:	Metal	describe	profile metal roofing
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	full	original designer name/date	Warren & Mahoney / Dec 06
Structural	full	original designer name/date	Powell Fenwick / Dec 06
Mechanical	full	original designer name/date	Powell Fenwick / Dec 06
Electrical	full	original designer name/date	Powell Fenwick / Dec 06
Geotech report	none	original designer name/date	

Damage

Site: (refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	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:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):	No apparent structural damage		
Across	Damage ratio:	0%		
	Describe (summary):	No apparent structural damage		
Diaphragms	Damage?:	no	Describe:	see report
CSWs:	Damage?:	yes	Describe:	see report
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	yes	Describe:	Ceiling tiles and HVAC supply vents

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

Recommendations

Level of repair/strengthening required:	minor non-structural	Describe:	Ceiling tiles and HVAC supply vents
Building Consent required:	no	Describe:	
Interim occupancy recommendations:	full occupancy	Describe:	

Along	Assessed %NBS before:	52%	##### %NBS from IEP below
	Assessed %NBS after:	52%	
Across	Assessed %NBS before:	100%	##### %NBS from IEP below
	Assessed %NBS after:	100%	

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Jellie Park - Old Indoor Pool	Reviewer:	Jan Stanway
	Unit / No: / Street	CPEng No:	222291
Building Address:	295 Ilam Road	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QUCCC.62
		Company phone number:	355-9500
	Degrees / Min / Sec		
GPS south:	43 / 30 / 33.02	Date of submission:	26-Feb-14
GPS east:	172 / 34 / 57.93	Inspection Date:	28-Feb-12
		Revision:	Final V3
Building Unique Identifier (CCC):	BU 0266-007 EQ2	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	silty sand	Soil Profile (if available):	Unknown
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	14.00

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	16.00
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	isolated pads, no tie beams		if Foundation type is other, describe:	
Building height (m):	6.92		height from ground to level of uppermost seismic mass (for IEP only) (m):	4.4
Floor footprint area (approx):	1016			
Age of Building (years):	5		Date of design:	1976-1992
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):				
Importance level (to NZS1170.5):	IL3			

Gravity Structure

Gravity System:	frame system		
Roof:	timber framed	rafter type, purlin type and cladding	Glulam and 150UB purlins, metal insulated roofing
Floors:	concrete flat slab	slab thickness (mm)	Slab-on-grade with pool
Beams:	timber	type	Glulam portals, glulam and 150UB purlins, metal insulated roofing
Columns:	timber	typical dimensions (mm x mm)	varies
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	timber moment frame	**Note: Define along and across in detailed report!**	note typical bay length (m)	20.8
Ductility assumed, μ:	1.25			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	partially filled CMU		note total length of wall at ground (m):	10
Ductility assumed, μ:	1.25		wall thickness (m):	
Period across:	0.40	##### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:	profiled metal	describe	100mm thick insulated
Roof Cladding:	Metal	describe	Low profile metal roofing (diaphragm)
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Warren & Mahoney / Dec 06 (no original existing drawings)
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	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:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):	Delamination at portals		
Across	Damage ratio:	0%		
	Describe (summary):	No apparent structural damage		
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	yes	Describe:	see report
Pounding:	Damage?:	yes	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	minor structural	Describe:	Repair delaminations & cracked plinths
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	35%	##### %NBS from IEP below	
	Assessed %NBS after:	35%		
Across	Assessed %NBS before:	100%	##### %NBS from IEP below	
	Assessed %NBS after:	100%		

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Jellie Park - New Indoor Pool	Reviewer:	Jan Stanway
	Unit / No: 295 / Street: Ilam Road	CPEng No:	222291
Building Address:	295 Ilam Road	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QUCCC.62
		Company phone number:	355-9500
	Degrees / Min / Sec		
GPS south:	43 / 30 / 33.02	Date of submission:	26-Feb-14
GPS east:	172 / 34 / 57.93	Inspection Date:	28-Feb-12
		Revision:	Final V3
Building Unique Identifier (CCC):	BU 0266-007 EQ2	Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	silty sand	Soil Profile (if available):	Unknown
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	14.00

Building

No. of storeys above ground:	1	single storey = 1 / Ground floor elevation (Absolute) (m):	16.00
Ground floor split?	no	Ground floor elevation above ground (m):	
Storeys below ground	0		
Foundation type:	isolated pads, no tie beams	if Foundation type is other, describe:	
Building height (m):	6.92	height from ground to level of uppermost seismic mass (for IEP only) (m):	4.4
Floor footprint area (approx):	1016		
Age of Building (years):	5	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):			
Importance level (to NZS1170.5):	IL3		

Gravity Structure

Gravity System:	frame system		
Roof:	timber framed	rafter type, purlin type and cladding	Glulam and 150UB purlins, metal insulated roofing
Floors:	concrete flat slab	slab thickness (mm)	Slab-on-grade with pool
Beams:	timber	type	Glulam portals, glulam and 150UB purlins, metal insulated roofing
Columns:	other (note)	typical dimensions (mm x mm)	460UB67 and Glulams
Walls:	non-load bearing	0	

Lateral load resisting structure

Lateral system along:	timber moment frame	**Note: Define along and across in detailed report!**	note typical bay length (m)	20.8
Ductility assumed, μ:	1.25			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	other (note)		describe system	Rod bracing
Ductility assumed, μ:	1.00			
Period across:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:			
Roof Cladding:	Metal	describe	Low profile metal roofing (diaphragm)
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	full	original designer name/date	Warren & Mahoney / Dec 06
Structural	full	original designer name/date	Powell Fenwick / Dec 06
Mechanical	full	original designer name/date	Powell Fenwick / Dec 06
Electrical	full	original designer name/date	Powell Fenwick / Dec 06
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	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:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):	Some delamination at portals		
Across	Damage ratio:	0%		
	Describe (summary):	No apparent structural damage		
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

	Level of repair/strengthening required:	minor structural	Describe:	member separation & cracked plinths
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	34%	##### %NBS from IEP below	
	Assessed %NBS after:	34%		
Across	Assessed %NBS before:	78%	##### %NBS from IEP below	
	Assessed %NBS after:	78%		

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Jellie Park Plant Room	Reviewer:	John Newall 1018146
	Unit / No: / Street	CPEng No:	
Building Address:	295 Ilam Road	Company:	Opus International Consultants
Legal Description:		Company project number:	6-QUCCC.62
	Degrees / Min / Sec	Company phone number:	355-9500
GPS south:	43 / 30 / 33.02	Date of submission:	3-Feb-14
GPS east:	172 / 34 / 57.93	Inspection Date:	15-Jan-14
		Revision:	Final V4
Building Unique Identifier (CCC):	PRO 0266-005	Is there a full report with this summary?	no

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	silty sand	Soil Profile (if available):	Unknown
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	14.00

Building

No. of storeys above ground:	2	single storey = 1 / Ground floor elevation (Absolute) (m):	16.00
Ground floor split?	no	Ground floor elevation above ground (m):	
Storeys below ground	0		
Foundation type:	isolated pads, no tie beams	if Foundation type is other, describe:	Assumed
Building height (m):	7.19	height from ground to level of uppermost seismic mass (for IEP only) (m):	3.6
Floor footprint area (approx):	1016		
Age of Building (years):	48	Date of design:	1935-1965
Strengthening present?	yes	If so, when (year)?	
		And what load level (%g)?	100%
Use (ground floor):	other (specify)	Brief strengthening description:	Industrial
Use (upper floors):	public		
Use notes (if required):	office		
Importance level (to NZS1170.5):	IL2		

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	timber framing
Floors:	concrete flat slab	slab thickness (mm)	unknown
Beams:	cast-insitu concrete	overall depth x width (mm x mm)	300x350
Columns:	cast-insitu concrete	typical dimensions (mm x mm)	260x260
Walls:	load bearing concrete	#N/A	125

Lateral load resisting structure

Note: Define along and across in detailed report!

Lateral system along:	concrete shear wall		note total length of wall at ground (m):	14.3
Ductility assumed, μ:	1.25		wall thickness (m):	125
Period along:	0.40	0.00 from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	concrete shear wall		note total length of wall at ground (m):	5.67
Ductility assumed, μ:	1.25		wall thickness (m):	125
Period across:	0.40	0.00 from parameters in sheet	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

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

Non-structural elements

Stairs:			
Wall cladding:	exposed structure	describe	
Roof Cladding:	Metal	describe	
Glazing:	aluminium frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	partial	original designer name/date	Warren & Mahoney / Dec 06 (no original existing drawings)
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	none	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	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:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:	green		
Along	Damage ratio:	-300%	Describe how damage ratio arrived at:	
	Describe (summary):	No apparent structural damage		
Across	Damage ratio:	-300%		
	Describe (summary):	No apparent structural damage		
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

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

Recommendations

Level of repair/strengthening required:	significant structural	Describe:	New shotcrete walls installed
Building Consent required:	no	Describe:	
Interim occupancy recommendations:	full occupancy	Describe:	

Along	Assessed %NBS before:	25%	##### %NBS from IEP below
	Assessed %NBS after:	100%	
Across	Assessed %NBS before:	25%	##### %NBS from IEP below
	Assessed %NBS after:	100%	

Appendix 6 – Plant Room Strengthening Letter

Opus International Consultants Ltd

20 Moorhouse Ave, Christchurch,
New Zealand

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w: www.opus.co.nz

15 January 2014

Kevin Long
Project Manager
Capital Projects - Facilities Rebuild
Christchurch City Council
Civic Offices
53 Hereford Street
Christchurch

BAE35006838

Dear Kevin

Jellie Park - Old Plant Room Upgrade. Building Status

With regard to the Old Plant Room at the Jellie Park facility at 285 Ilam Road, Burnside, we can confirm that the structural upgrade works are now complete.

These structural works have been completed in accordance with the Opus International Consultants drawings titled "Christchurch City Council, Jellie Park, 285 Ilam Road, Old Plant Room Seismic Upgrade" dated 15/09/2013, with agreed alternative details shown in Consultants Advice Notice 001 dated 29/11/2013.

A Producer Statement - PS4 - Construction Review has been sent separately from this letter.

The overall level of seismic load resistance for this building is now greater than 67%NBS.

The limitations for occupancy for this building, as recommended in Opus report titled "Jellie Park Recreation & Sport Centre, Detailed Engineering Evaluation, Quantitative Assessment Report", Revision: Final V3, Dated: January 2013, no longer apply.

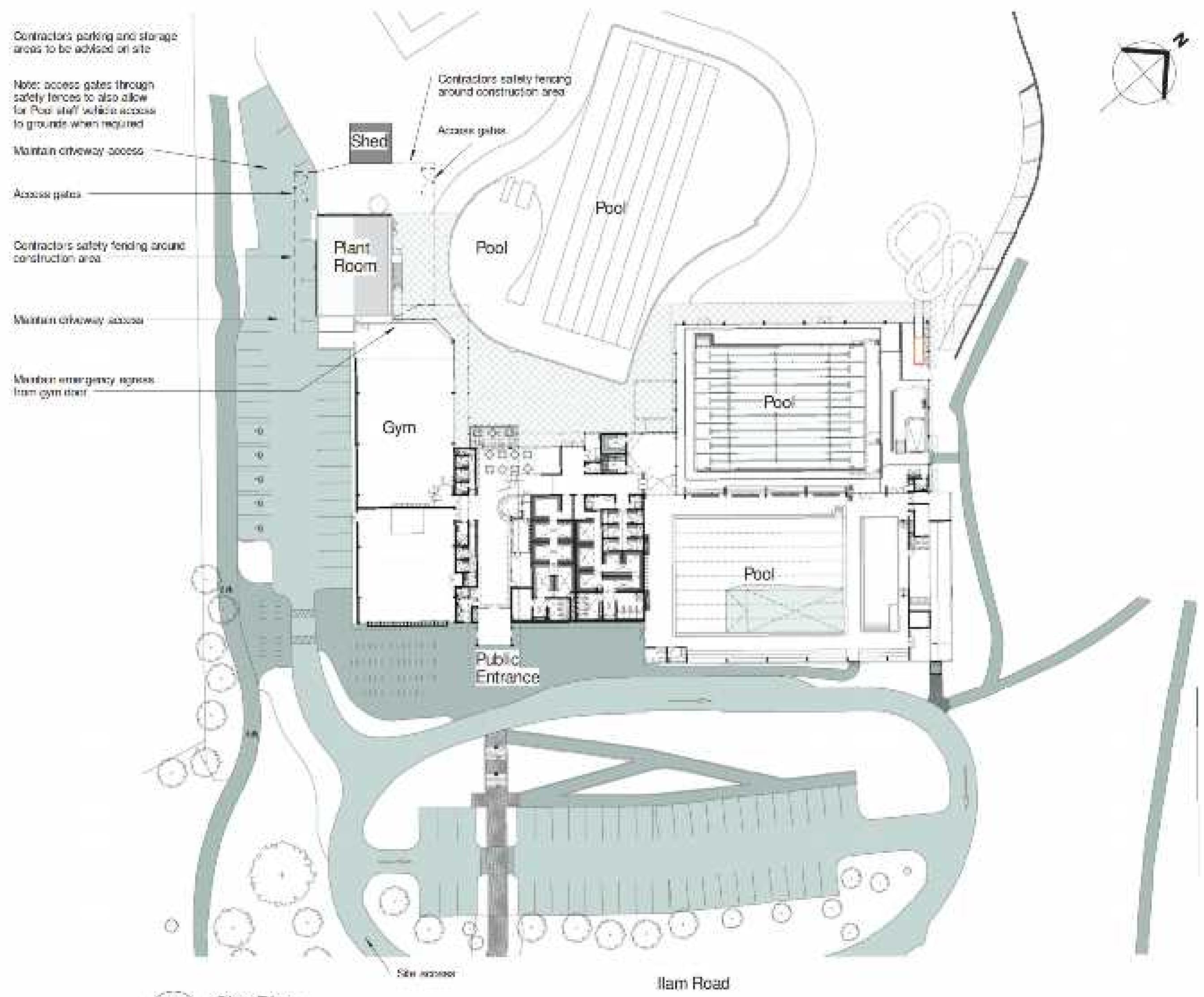
Should you wish to discuss, please do call.

Regards

John Newall
Structural Engineer
Opus International Consultants

Appendix 7 – Plant Room Strengthening Drawings

1 Location Plan
A200 1 : 5000



2 Site Plan
A200 1 : 500

Architectural Drawing List	
Sheet No	Sheet Name
A001	Site and Location Plans
A100	Floor Plans (Existing and Proposed)
A200	Elevations - North and South
A201	Elevations - East and West
A300	Sections and Construction Details

Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
BAE35006838
carrp

All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

General Notes:

Extent of work is structural upgrading of existing concrete block walls to ground floor of plant room building and associated making good.

Office space above Plant Room was built in 2008, no work required to first floor other than repair of cracks noted on floor plan.

Office space above plant room is to remain unoccupied until after completion of contract.

Plant room is to remain largely unoccupied, Allow to maintain access to plant room by pool staff (access only required a limited number of times a day)

Ensure measures are taken to prevent any materials (including liquids) entering pools or pools reticulation system. Provide bunding where necessary to mitigate or eliminate the risk of pool contamination.

Hazardous Substances:

Chlorine tank is approx 7500 litre with 1% chlorine content, located beside building.

Existing sign - Hazchem 2R

Temporary relocation of chlorine tank to allow completion of works to be carried out by persons suitably qualified to handle chlorine. Take appropriate measures to ensure any spills can be contained.

Accessibility:

Whole of complex was upgraded in 2008 including the construction of new buildings. Any remedial work to the remainder of complex will be covered in future earthquake related repair programmes.

Accessiblity to the complex is not covered in this project. Accessiblity requirements will be adressed in near future repair programmes.

Accessiblity to plant room is not required as this is a service space with restricted access.

Office space above Plant room was built in 2008, assumed meets NZBC D1/AS1 1 July 2001, no work being carried out to first floor.

Pool Fencing:

Whole of complex was upgraded in 2008 including construction of new buildings. Safety and security fencing/barriers would have been addressed then. These are to be maintianed during the construction period.

Revision	Description	Approved	Revision Date
1	Construction Issue		20.09.2013

Christchurch City Council

OPUS architecture
Christchurch Studio
New Zealand

Drawn	Designed	Approved	Issue Date
S. Lynch	S. Lynch	S. Parsons	15/08/2013

Project No	Scale
4-QC100.00	As indicated

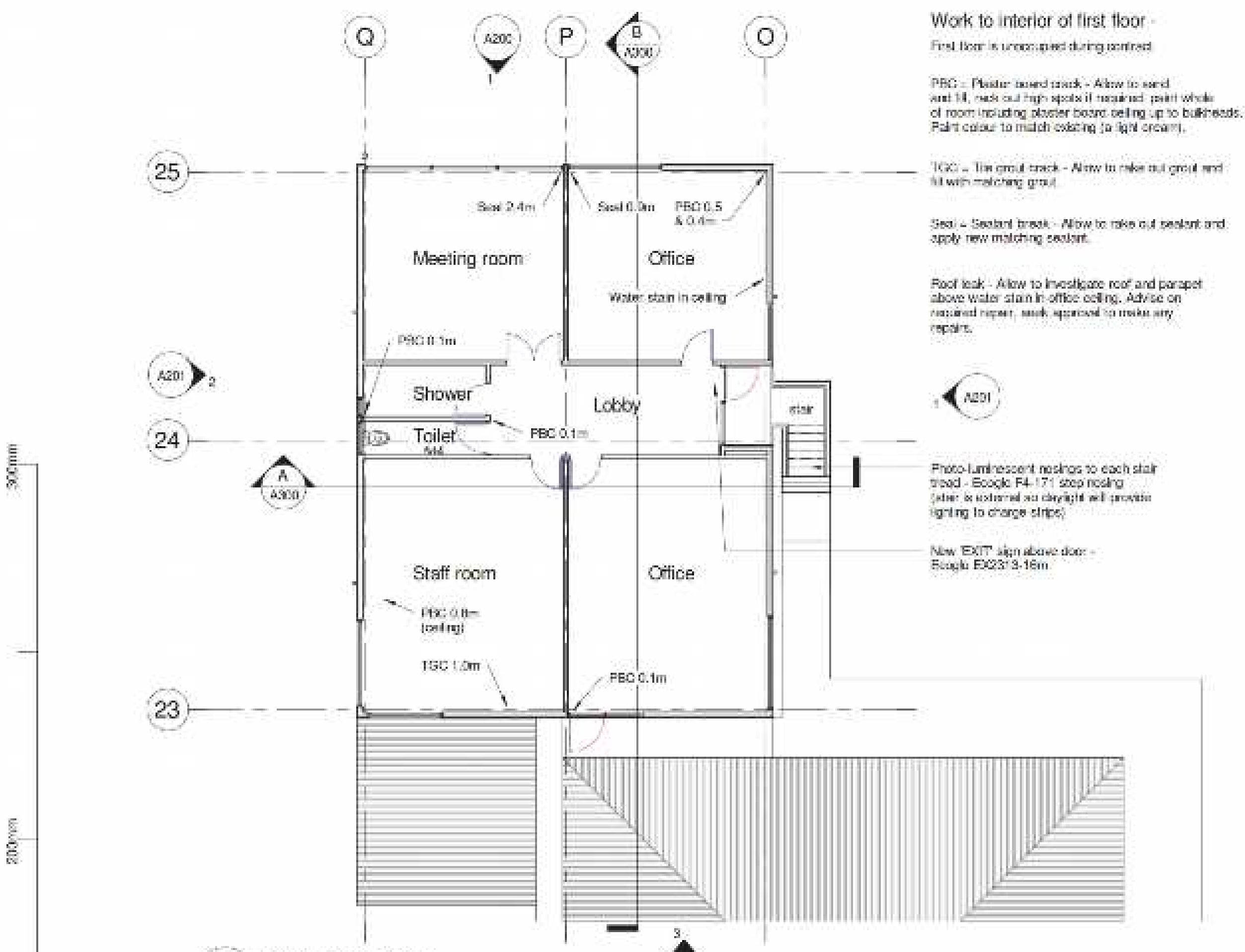
Project
Christchurch City Council
Jellie Park, 285 Ilam Road
Old Plant Room Seismic Upgrade

Title
Site and Location Plans

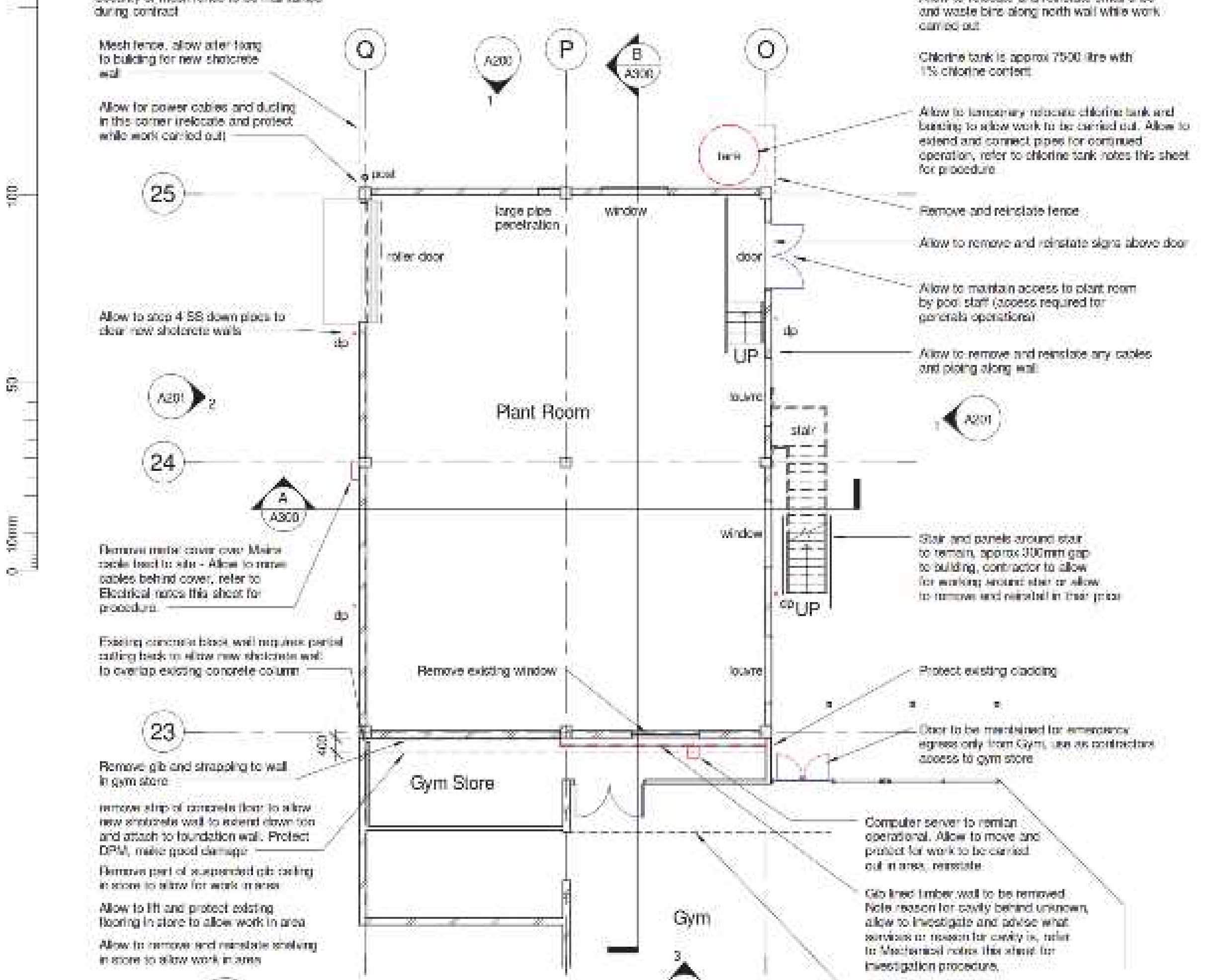
CONSTRUCTION

Drawing No	Sheet No	Revision
6/1366/351 7601	A001	R 1

Original sheet size A1 (841x594) Plot date: 20/09/2013 8:28:43 a.m. C:\PROJECTS\6-QC100.00 Jellie Park Old Plant Room\Jellie Park Services Building.rvt



1 First Floor Plan
1 : 100



2 Existing Ground Floor Plan
1 : 100

Original sheet size A1 (841x594) Plot date: 20/09/2013 8:43:25 a.m. G:\PROJECTS\6-QC100.00 Jellie Park Old Plant Room\Jellie Park Services Building.rvt

Electrical - Mains power cable moving procedure -

Investigate mains power cable entering building for option required to carry out shotcrete works:

Option 1.
New cable ladder located at proposed face of new shotcrete wall. This will require approval of Shotcrete contractor that they can carry out their work with ladder and cable in this position.
Option 2.
Temporarily locate cables further away during contract works to allow work to be carried out. After completion of work relocate cables back onto face of shotcrete wall. Cables to be well protected in temporary location.

Incoming Mains Relocation.
- Organise and notify all involved that an outage will occur. Estimated outage time less than three hours.
- Electrician to provide site lighting and a generator. Timing of outage to suit out-of-operating hours, preferably evening to allow any lost temperature to be recovered prior to opening.
- Excavate near the wall to allow the single core mains cables (8No.) which are buried directly in the ground outside the building, to be exposed and brought out from the wall. Extreme care required, or connectics have a vacuum trencher to suck up the ground, eliminating any spade work near these cables.
- Arrange with Orion to have the low voltage power disconnected from the transformer.
- Remove the existing cable mounts and install free standing cable ladder away from the wall. Provide a back plate for the ladder, to eliminate the shotcrete from touching the single core cables when it is applied. Remount the cables onto the new ladder.
- Allow for an electrical inspector to inspect and test the cables, to verify no damage has been done to the single core cables prior to re-livening.
- Provide earthing to the cable ladder and provide a suitably shaped 10mm thick galvanised checker plate around the cable ladder that can be fixed to the new shotcrete in the future. This is to provide a more robust mechanical protection for the cables.
- Arrange for re-livening once passed the inspection.

Note:
Turning Off and On power will require CCC Operations Team, pool water and mechanical services contractors to be on site to ensure all plant is shut down and started up correctly.

Concealed pipes within cavity investigation procedure -

Any pipes in cavity space (in gym store) to be inspected with CCC operational staff to confirm if pipes are redundant or not. allow to remove if possible, pipes required to remain are to be protected during shotcrete works.

Chlorine tank relocation procedure -

Relocation of tank, timing and temporary location to be approved by Jellie Park Operations Team.
Relocation to be carried out by a specialised pool water services contractor (current maintenance contractor to Jellie Park)

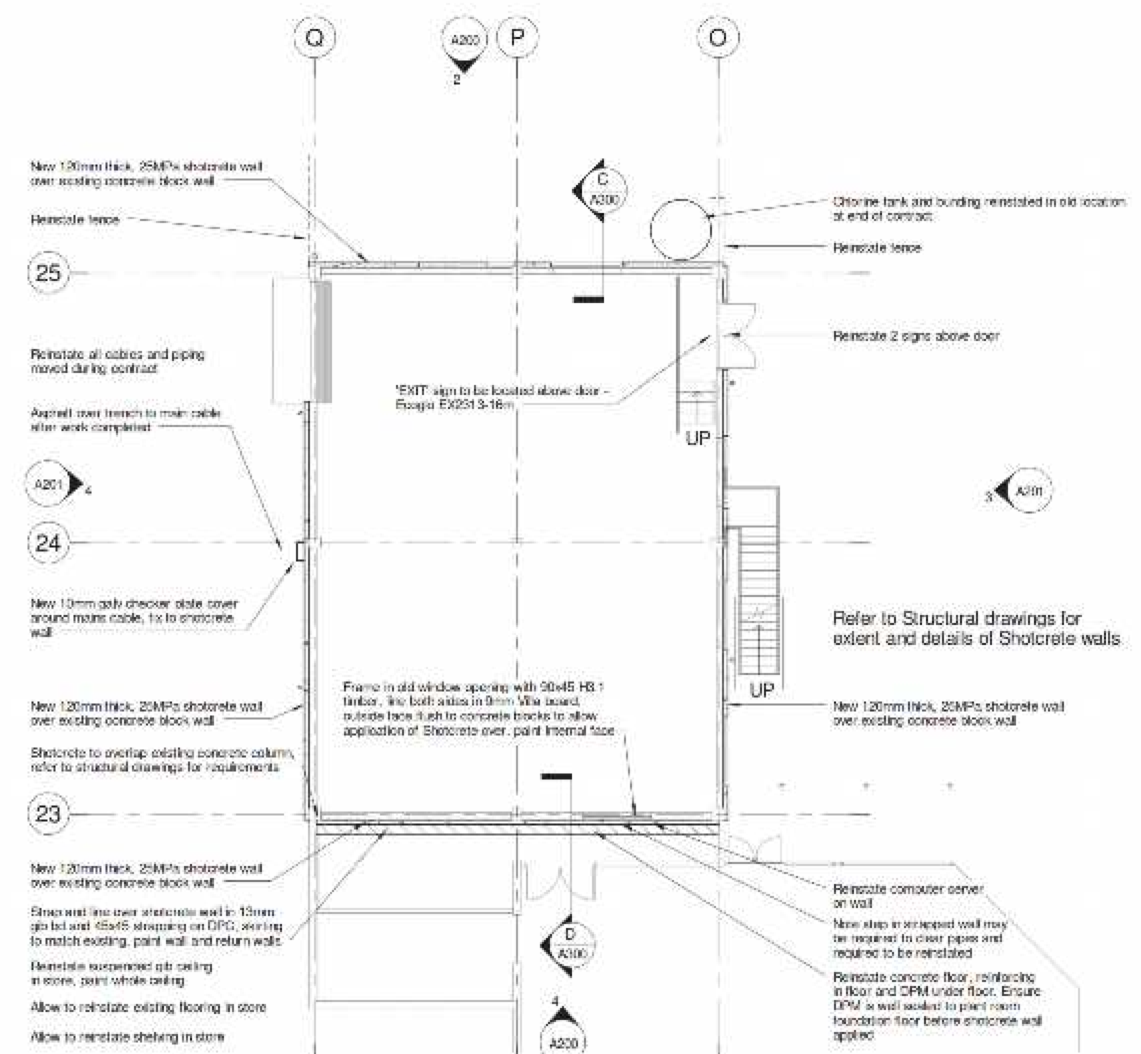
Protection of existing surfaces and finishes -

Allow to protect existing materials, surfaces, finishes, pipes and cables from shotcrete works.

Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
BAE35006838
carrp

All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.



3 Ground Floor Plan
1 : 100

Revision	Description	Approved	Revision Date
1	Construction Issue		20.09.2013

Christchurch City Council

OPUS architecture
Christchurch Studio

Drawn	Designed	Approved	Issue Date
S. Lynch	S. Lynch	S. Parsee	15/08/2013

Project No.	Scale
4-QC100.00	1 : 100

Project
Christchurch City Council
Jellie Park, 285 Ilam Road
Old Plant Room Seismic Upgrade

Title
Floor Plans (Existing and Proposed)

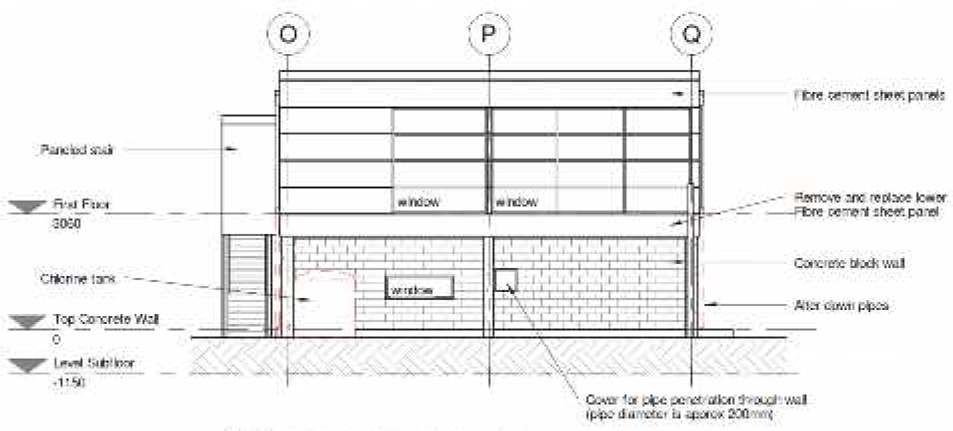
CONSTRUCTION

Drawing No.	Sheet No.	Revision
6/1366/351 7601	A100	R 1

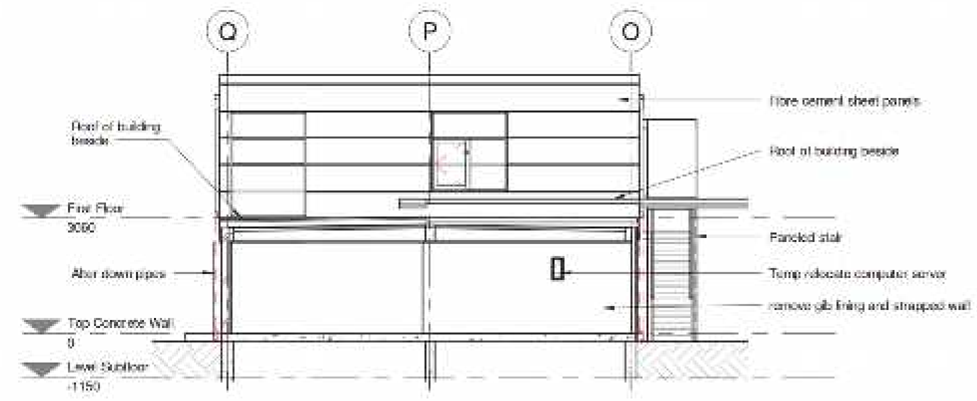
Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
BAE35006838
carrp

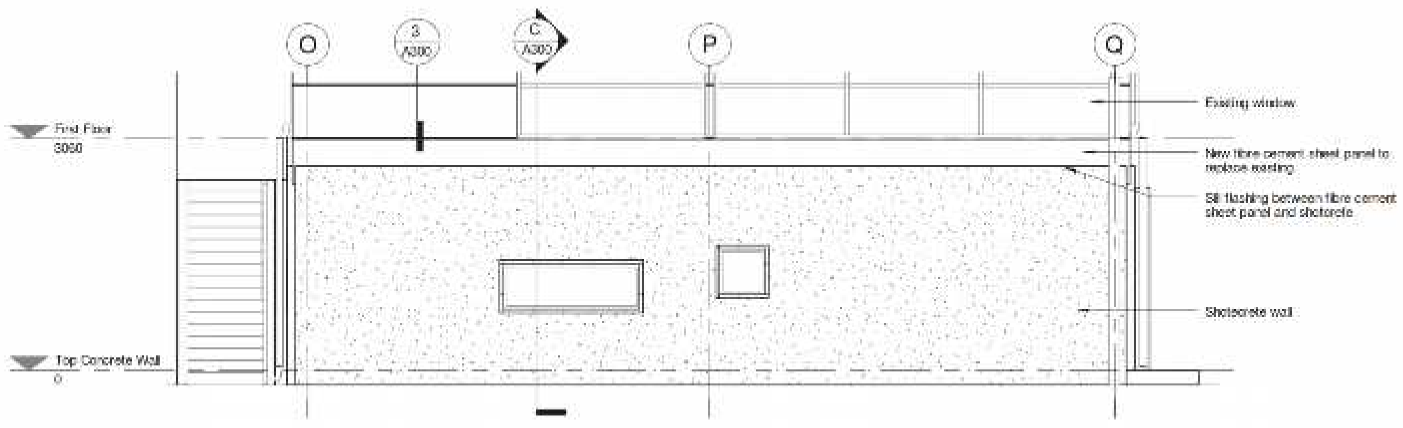
All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.



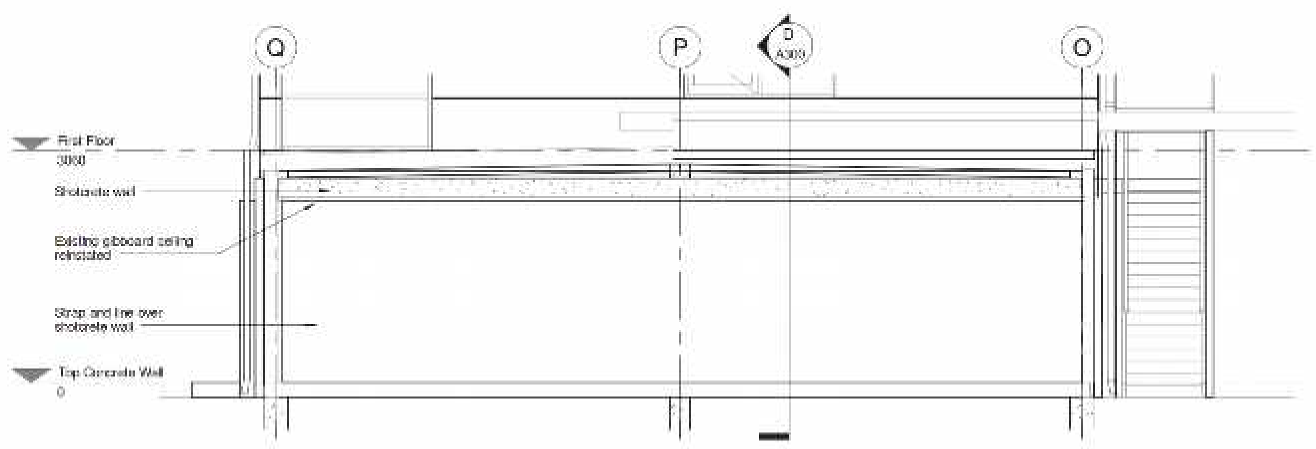
1 A100 Existing North Elevation
1 : 100



3 A100 Existing South Elevation
1 : 100



2 A100 North Elevation - Part
1 : 50



4 A100 South Elevation - Part
1 : 50

Revision	Description	Approved	Revision Date
1	Construction Issue		20.09.2013

Christchurch City Council

OPUS architecture
Christchurch Studio
PO Box 1482, Christchurch 8140
New Zealand
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Drawn	Designed	Approved	Issue Date
S. Lynch	S. Lynch	S. Parsen	15/08/2013

Project No	Scale
4-QC100.00	As indicated

Project
Christchurch City Council
Jellie Park, 285 Ilam Road
Old Plant Room Seismic Upgrade

Title
Elevations - North and South

CONSTRUCTION

Drawing No	Sheet No	Revision
6/1366/351 7601	A200	R 1

Original sheet size A1 (841x594) Plot date: 20/09/2013 8:28:05 a.m. C:\PROJECTS\6-QC100.00 Jellie Park Old Plant Room\Jellie Park Services Building.rvt

Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
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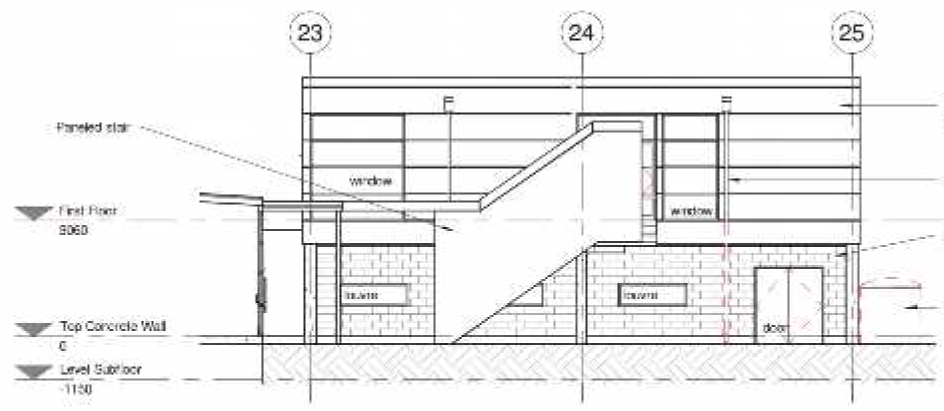
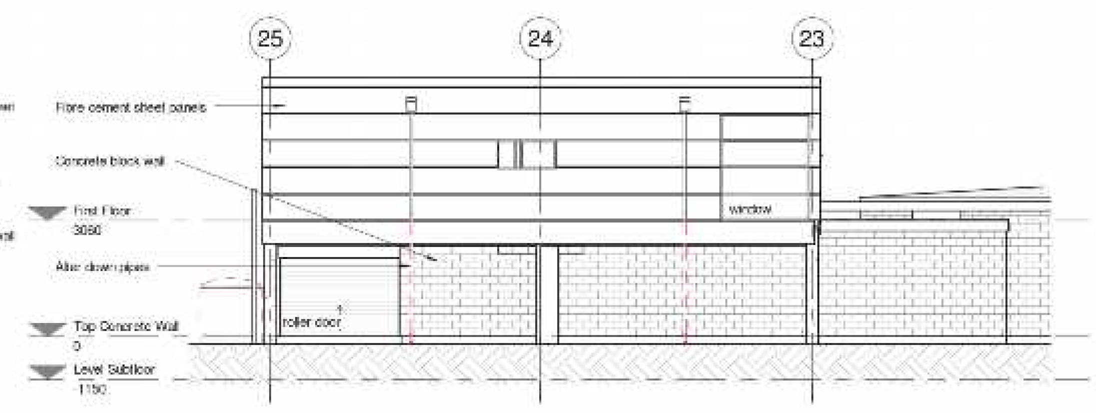
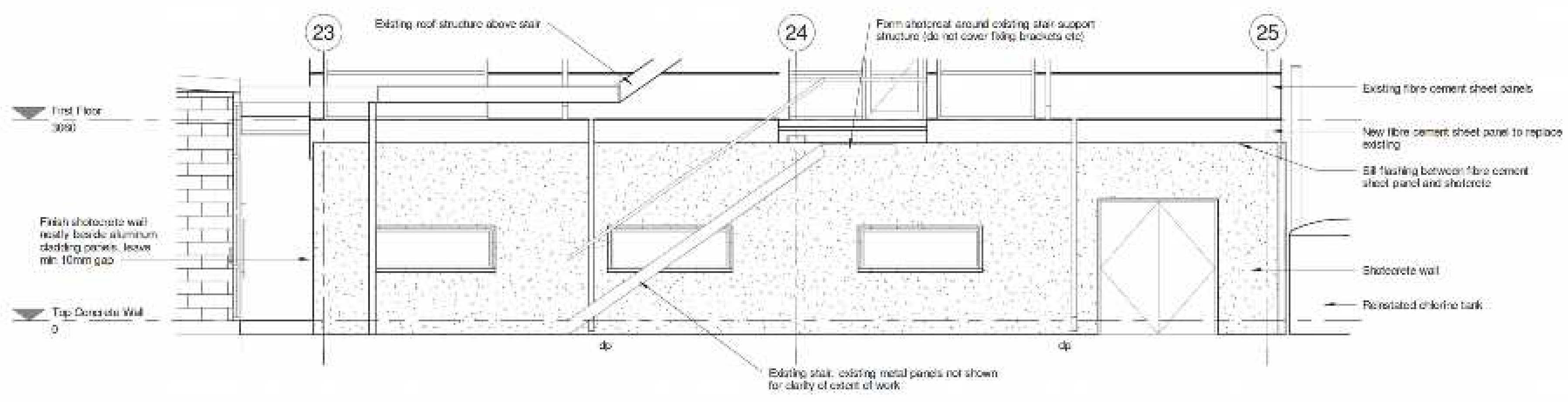


1 A100 Existing East Elevation
1 : 100

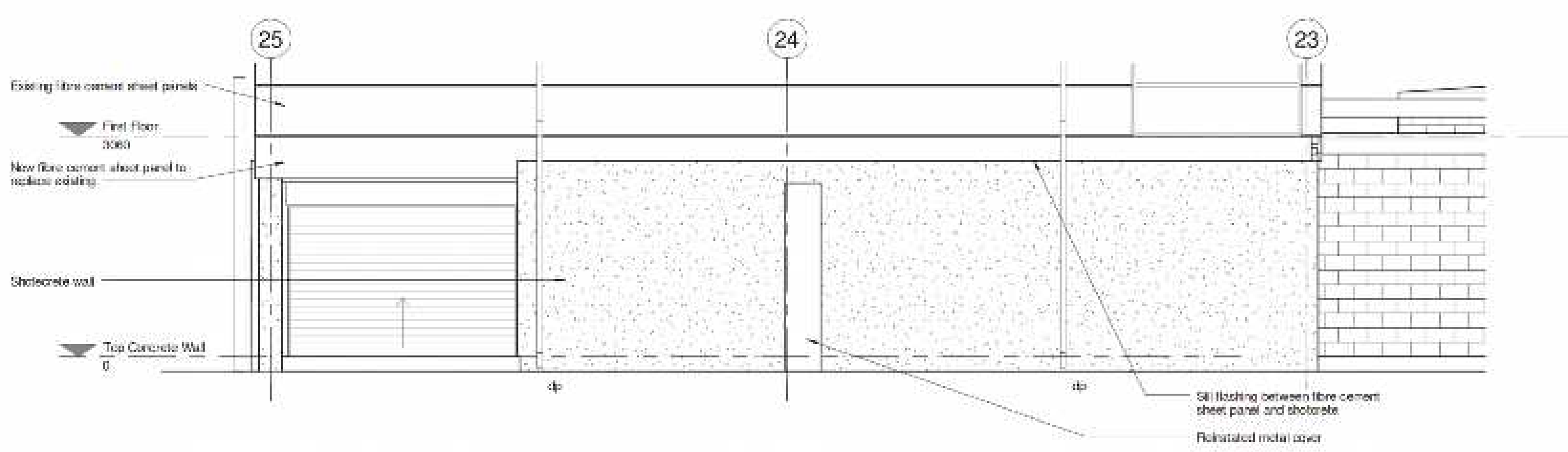


2 A100 Existing West Elevation
1 : 100



3 A100 East Elevation - Part
1 : 50

Revision	Description	Approved	Revision Date
1	Construction Issue		20.09.2013



4 A100 West Elevation - Part
1 : 50

Christchurch City Council

OPUS architecture
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PO Box 1482, Christchurch 8140
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Drawn	Designed	Approved	Issue Date
S. Lynch	S. Lynch	S. Parsons	15/08/13

Project No.	Scale
4-QC100.00	As indicated

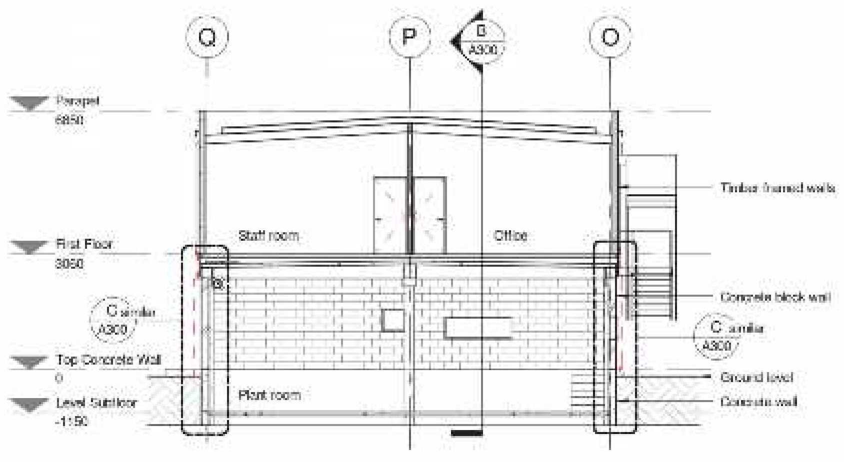
Project
Christchurch City Council
Jellie Park, 285 Ilam Road
Old Plant Room Seismic Upgrade

Title
Elevations - East and West

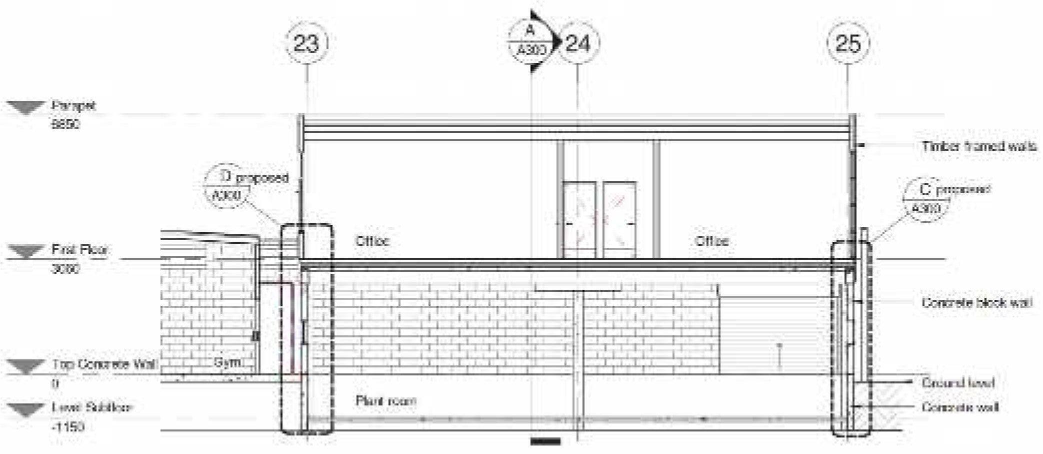
CONSTRUCTION

Drawing No.	Sheet No.	Revision
6/1366/351 7601	A201	R 1

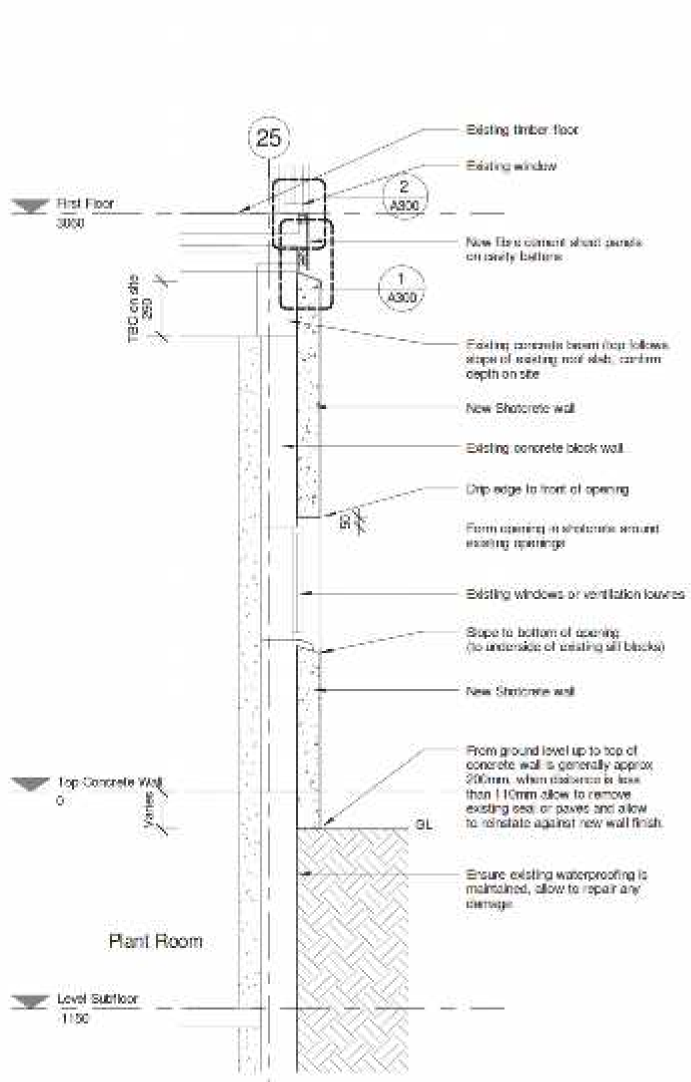
Original sheet size A1 (841x594)   Plot date: 20/09/2013 8:29:24 a.m.   C:\PROJECTS\6-QC100.00 Jellie Park Old Plant Room\Jellie Park Services Building.rvt



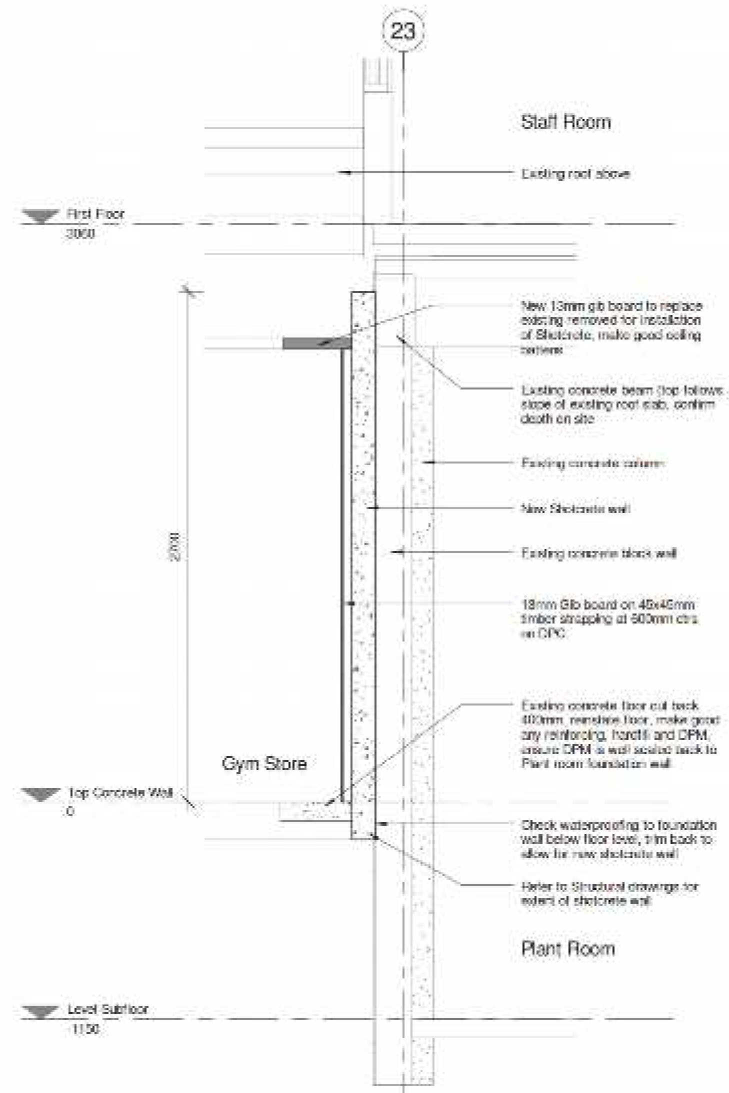
A A100 Existing Section A-A
1 : 100



B A100 Existing Section B-B
1 : 100

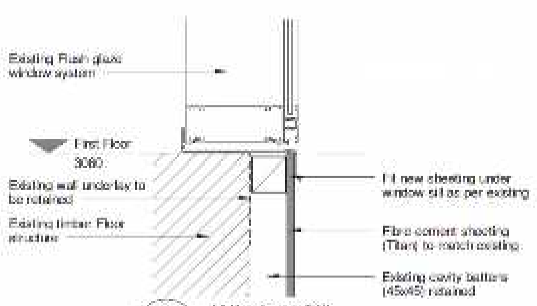


C A100 Proposed Section C-C
1 : 20

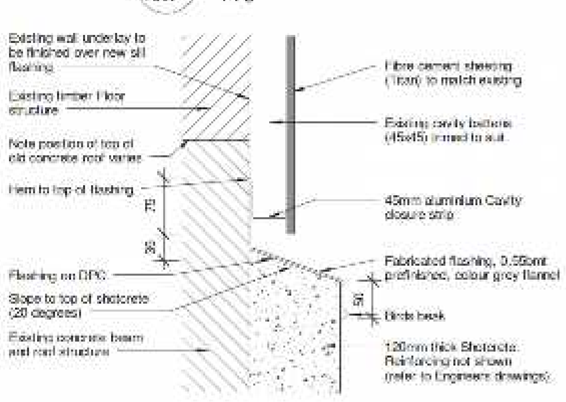


D A100 Proposed Section D-D
1 : 20

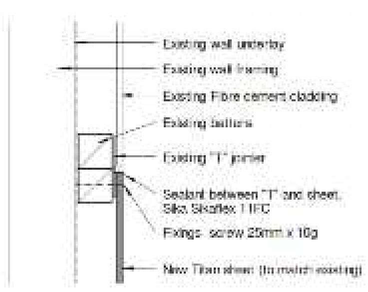
Number	Revision	Approved	Issue Date
1	Construction Issue		20/09/2013



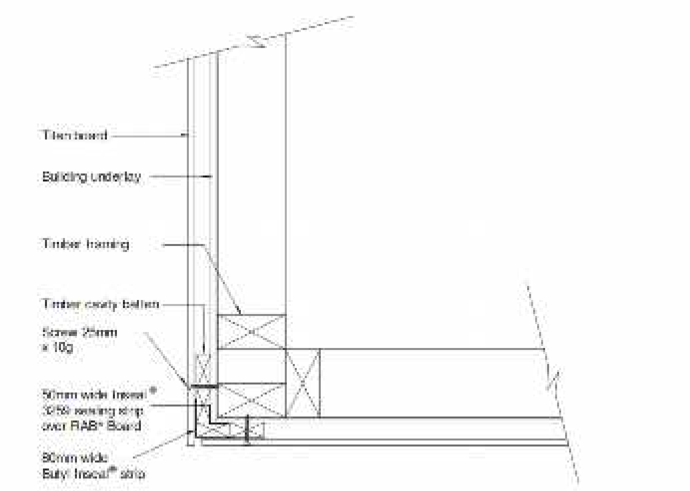
2 A300 Window Sill
1 : 5



1 A300 Cladding Junction
1 : 5



3 A200 Cladding Horizontal Joint
1 : 5



Notes:
- At external joints the 80mm wide Butyl Inseal ® strip is required as is an extra width batten to accommodate fixings.

4 Titan External Corner
1 : 5

Schedule of Finishes:

Exposed Shotcrete surfaces -
- surface finish F5
- Coating paint finish, colour white

New Fibre cement sheeting -
- Paint finish to match existing (grey colour)

Flashings -
- Colorcote ZMX - Grey Flannel

Gib board walls and ceiling in Gym Store -
- Paint finish to match existing (light cream colour)

Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
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Christchurch City Council

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Christchurch Studio

Drawn	Designed	Approved	Issue Date
S. Lynch	S. Lynch	S. Parsons	15/08/2013

Project No	Scale
4-QC100.00	As indicated

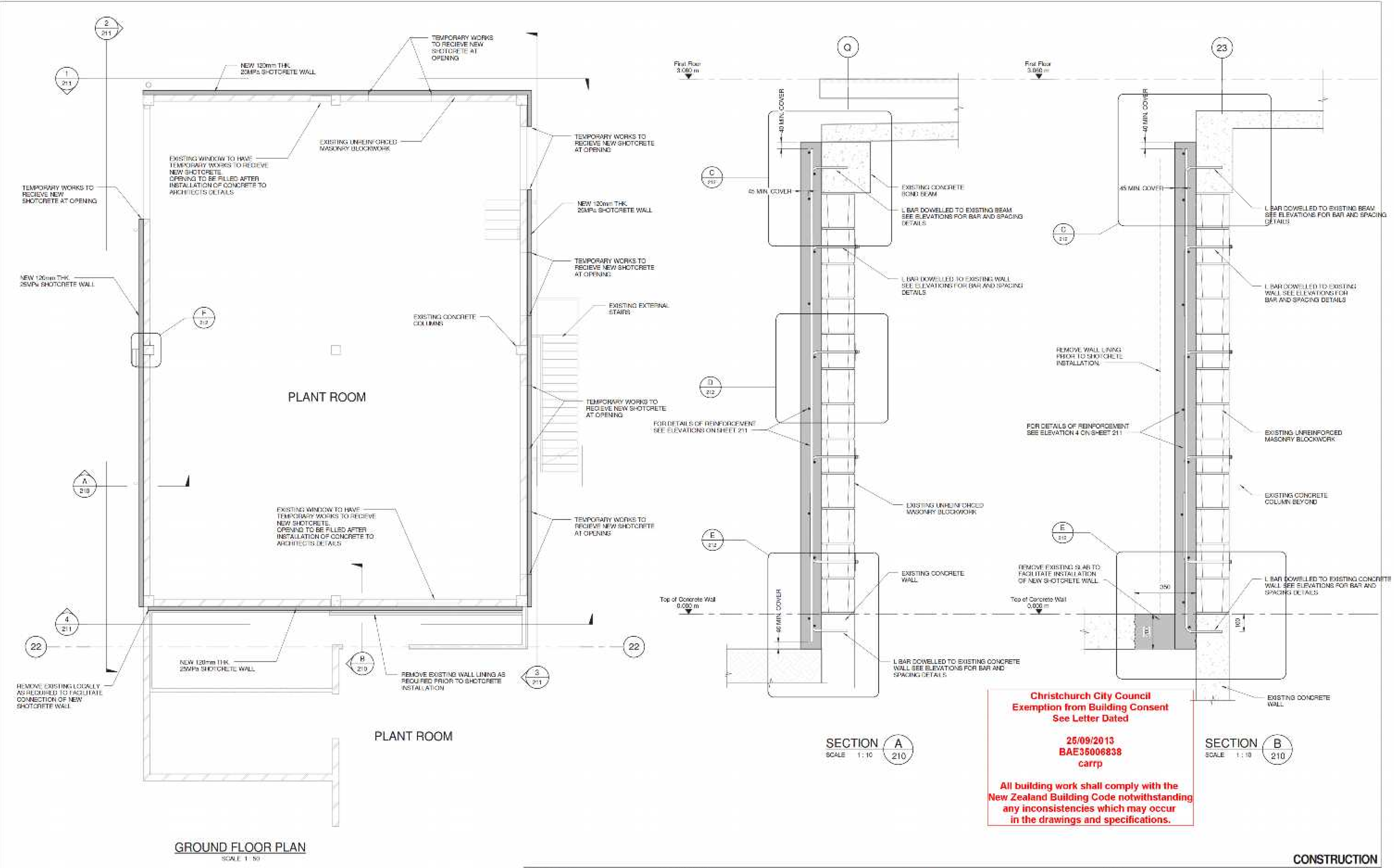
Project
Christchurch City Council
Jellie Park, 285 Ilam Road
Old Plant Room Seismic Upgrade

Title
Sections and Construction Details

CONSTRUCTION

Drawing No	Sheet No	Revision
6/1366/351 7601	A300	R 1

Original sheet size A1 (841x594) Plot date: 20/09/2013 8:30:05 a.m. C:\PROJECTS\6-QC100.00 Jellie Park Old Plant Room\Jellie Park Services Building.rvt



Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
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All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

CONSTRUCTION

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING CONSENT		14.08.13

OPUS
Auckland Office
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PO Box 5848, Auckland 1010, New Zealand

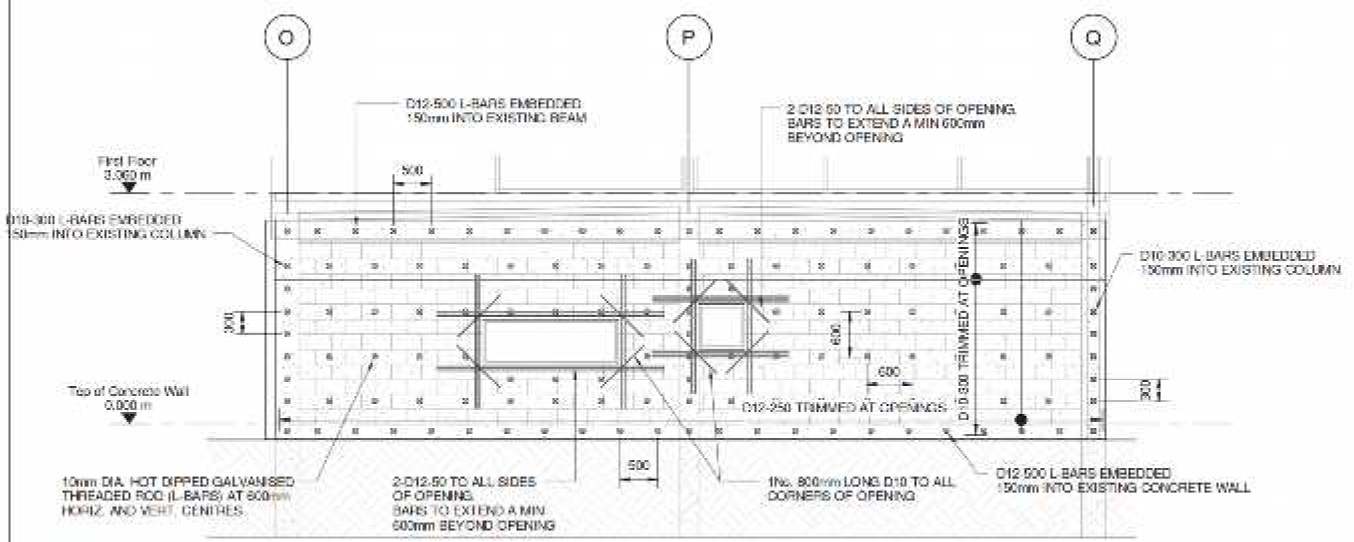
Project: CHRISTCHURCH CITY COUNCIL
JELLIE PARK, 285 ILAM ROAD
OLD PLANT ROOM SEISMIC UPGRADE

Title: STRUCTURAL GENERAL ARRANGEMENT

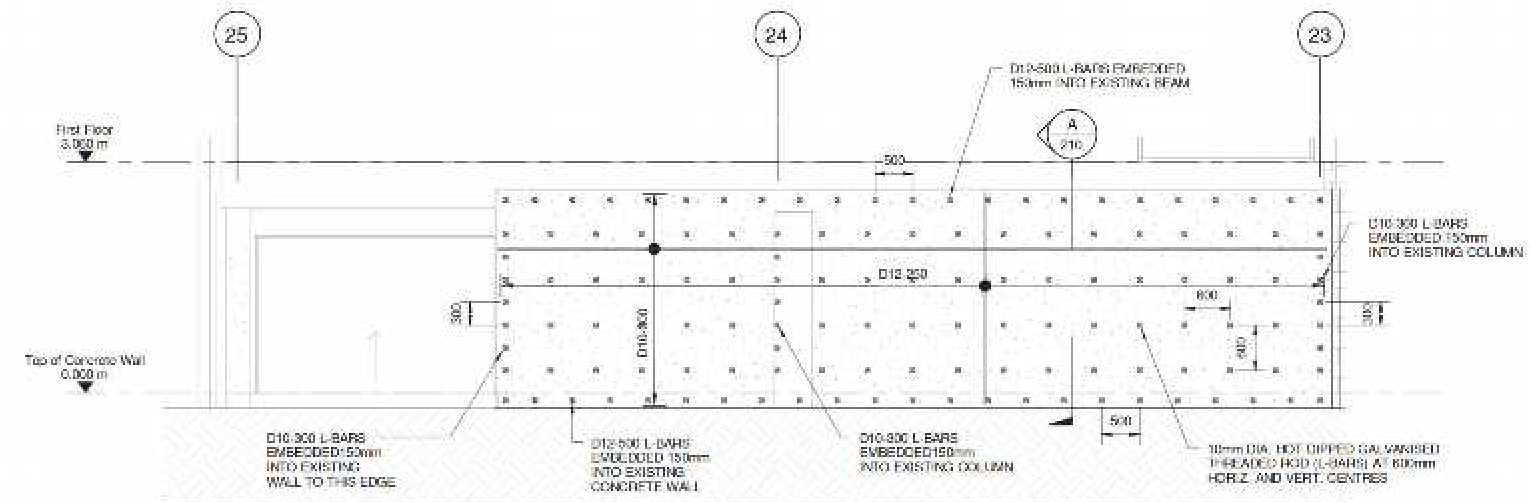
Drawn	Designed	Approved	Revision Date
VC	TG	Approver	Date

Project No.	Scale	Drawing No.	Sheet No.	Revision
6-G1412.62	As indicated	6/1366/351 7601	210	R1

Original sheet size A1 (841x594) Plot date: 14/08/2013 1:05:40 PM C:\Users\Vernon.Carter@opus.co\Documents\6-G1412.62 Jellie Park Plant Room Central 2013_Vernon Carter.rvt



ELEVATION 1/210
SCALE 1 : 50



ELEVATION 2/210
SCALE 1 : 50

Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
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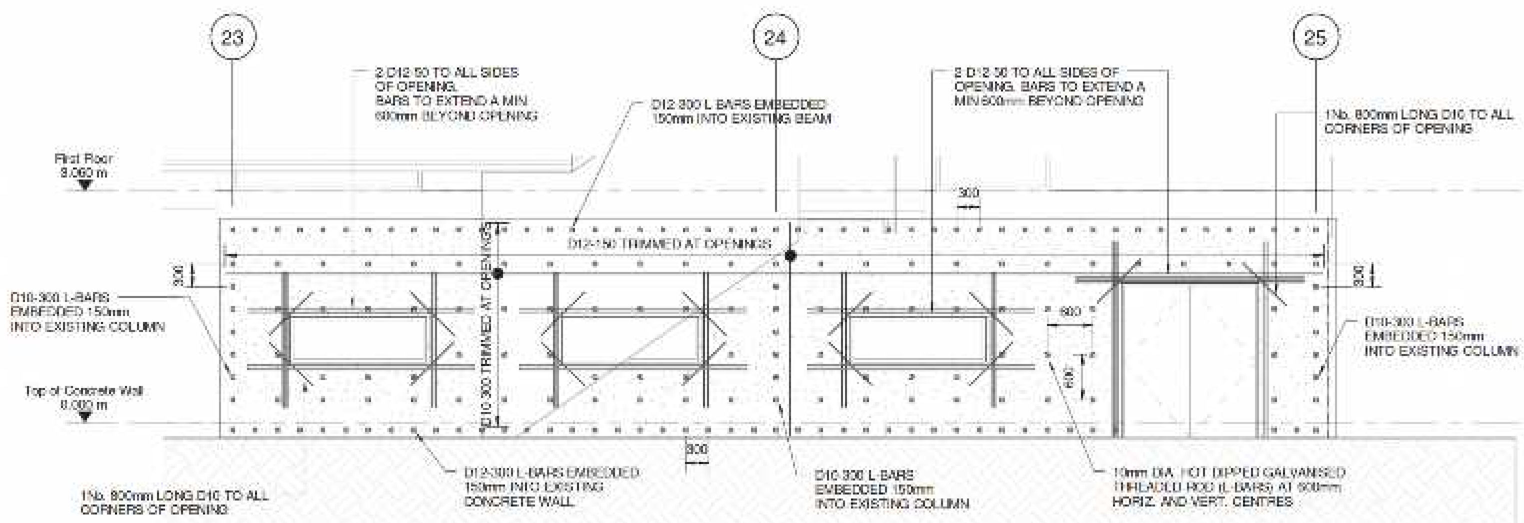
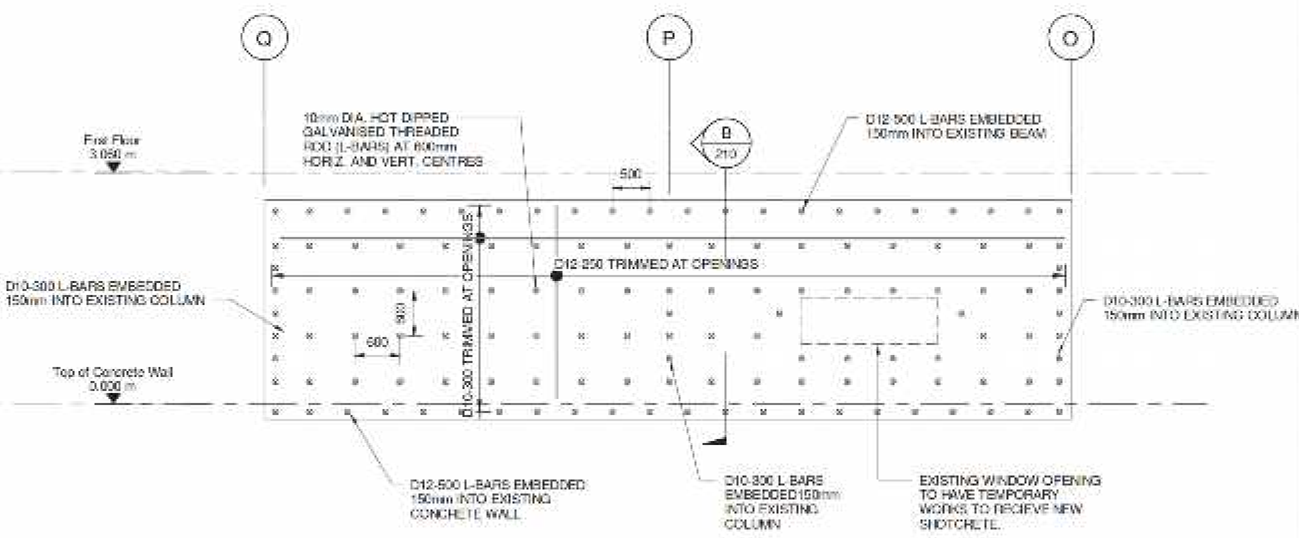


ELEVATION 3/210
SCALE 1 : 50



ELEVATION 4/210
SCALE 1 : 50

CONSTRUCTION

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING CONSENT		14.08.13

OPUS
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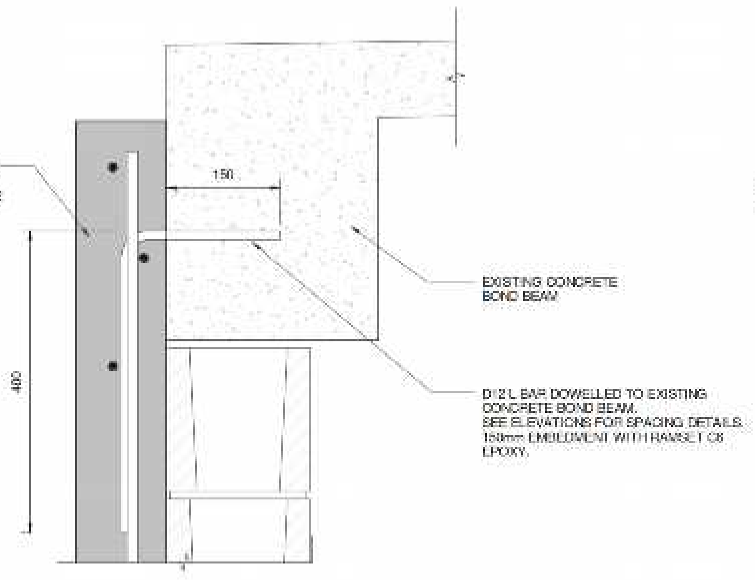
Drawn	Designed	Approved	Revision Date
VC	TG	Approver	Date

Project: CHRISTCHURCH CITY COUNCIL
JELLIE PARK, 285 ILAM ROAD
OLD PLANT ROOM SEISMIC UPGRADE

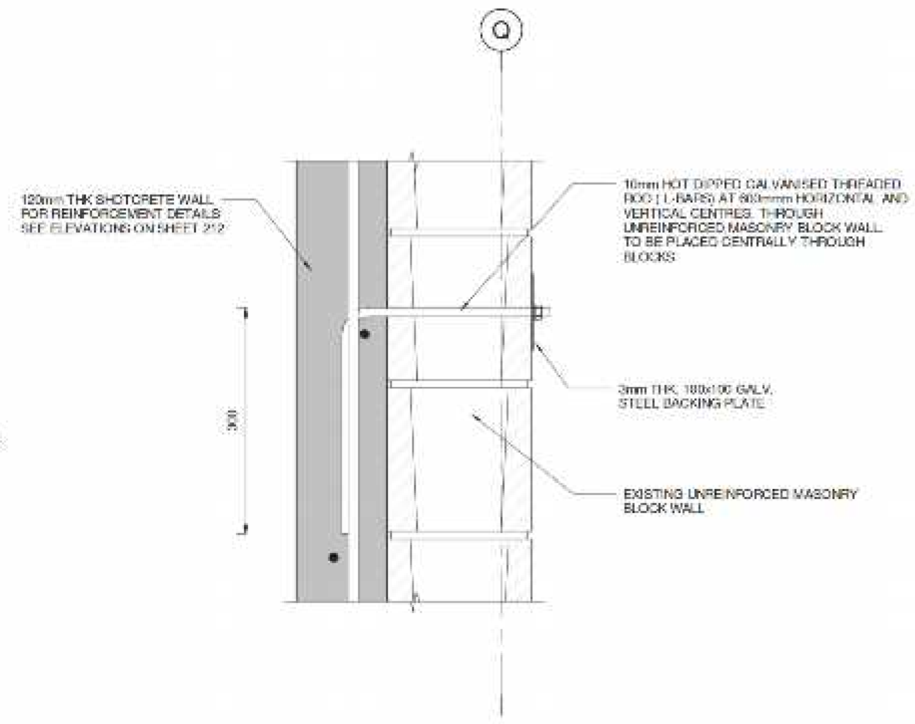
Title: ELEVATIONS

Project No.	Scale	Drawing No.	Sheet No.	Revision
6-G1412.62	1 : 50	6/1366/351 7601	211	R1

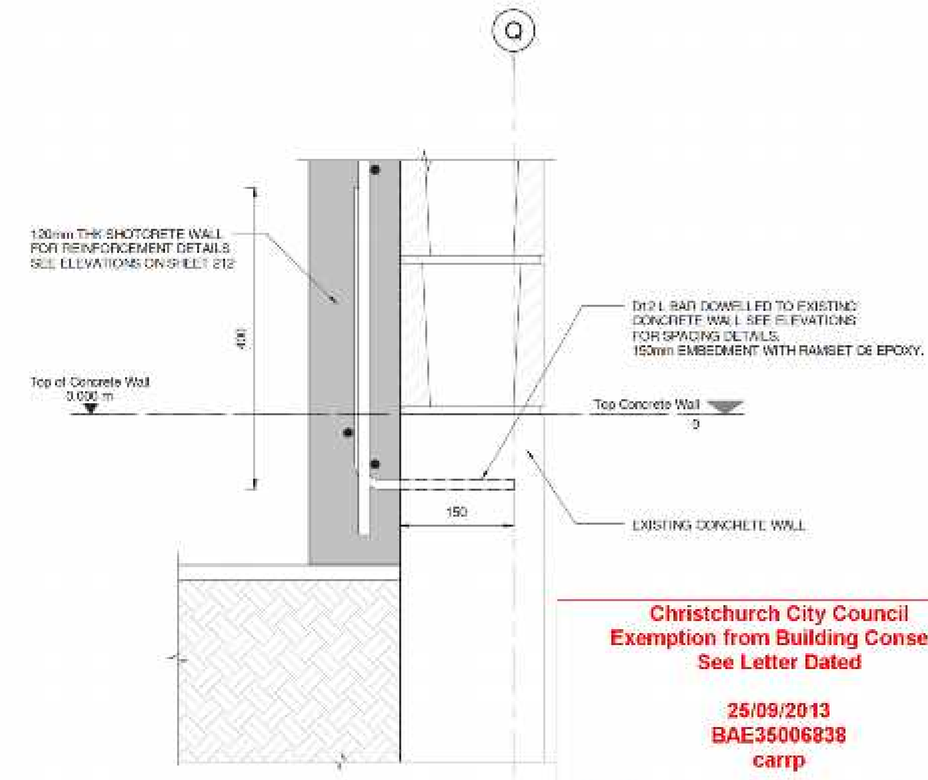
Original sheet size A1 (841x594) Plot date: 14/08/2013 1:01:56 PM C:\Users\Vernon.Carter@opus.co\Documents\6-G1412.62 Jellie Park Plant Room Central 2013_Vernon Carter.rvt



DETAIL C 210
SCALE 1 : 5



DETAIL D 210
SCALE 1 : 5



Christchurch City Council
Exemption from Building Consent
See Letter Dated

25/09/2013
BAE35006838
carrp

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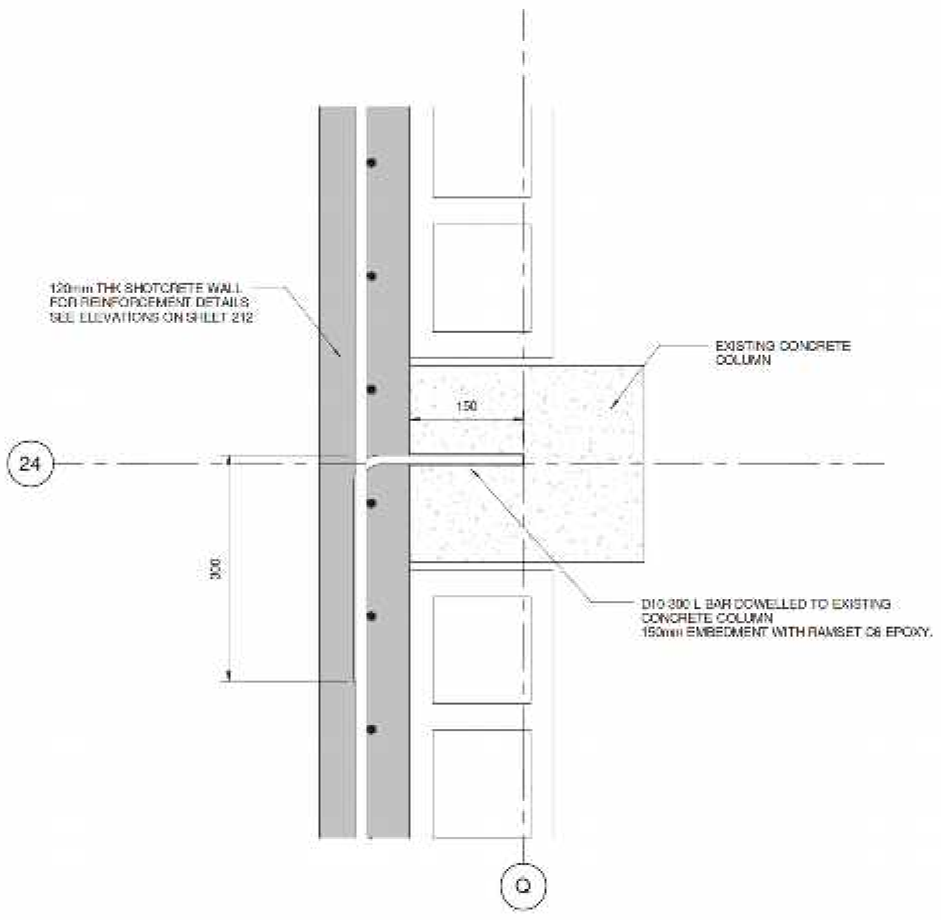
DETAIL E 210
SCALE 1 : 5



DETAIL F 210
SCALE 1 : 5

CONSTRUCTION

Revision	Amendment	Approved	Revision Date
1	FOR BUILDING CONSENT		14.08.13

OPUS
Auckland Office
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PO Box 5848,
Auckland 1010, New Zealand

Drawn	Designed	Approved	Revision Date
VC	TG	Approver	Date

Project
CHRISTCHURCH CITY COUNCIL
JELLIE PARK, 285 ILAM ROAD
OLD PLANT ROOM SEISMIC UPGRADE

Title
STRUCTURAL DETAILS

Project No.	Scale	Drawing No.	Sheet No.	Revision
6-G1412.62	1 : 5	6/1366/351 7601	212	R1

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