Proposed Comprehensive Care Retirement Village of Park Terrace - Resource Consent Application

Civil Engineering Design Report

Prepared for Ryman Healthcare
Prepared by Beca Limited

27 March 2020

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Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
A	**Ian Bannon**	Draft for Client review	18 October 2019
B	**Simon Crundwell**	Draft for Client review	28 February 2020
C	**Ian Bannon**	For Resource Consent	20 March 2020
D	**Ian Bannon**	For Resource Consent	27 March 2020

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Simon Crundwell**		27 March 2020
Reviewed by	**Judd Stanton & Graham Levy**		27 March 2020
Approved by	**Blaise Cummins**		27 March 2020
on behalf of	Beca Limited		

1 Introduction

Ryman Healthcare Ltd is seeking resource consents for the construction and operation of a comprehensive care retirement village (Proposed Village) at 100 Park Terrace and 20 Dorset Street (Site 1 - Bishopspark) and 78 Park Terrace (Site 2 - Peterborough Street). The Bishopspark and Peterborough Street sites are collectively referred to as 'the Site' in this report.

This document details the proposed civil engineering works, assessment of effects and associated mitigation measures for the construction and operation of the Proposed Village. Preliminary design drawings for resource consent purposes have been prepared for earthworks, stormwater, water supply, wastewater and utilities. This report sets out the design basis behind those drawings and describes assessments that were carried out to demonstrate:

- how stormwater quality and quantity is to be managed including consideration of potential flood risk effects both within and downstream of the Site;
- how erosion and sediment control requirements can be met for the expected earthworks design; and
- that the Proposed Village can be serviced, taking into consideration the capacity of the local network and requirements of local authorities and utility companies.

2 Existing Site Conditions

The Site is located adjacent to Park Terrace in Christchurch Central. Figure 1 illustrates the location of each of the Bishopspark and Peterborough sites relative to each other.

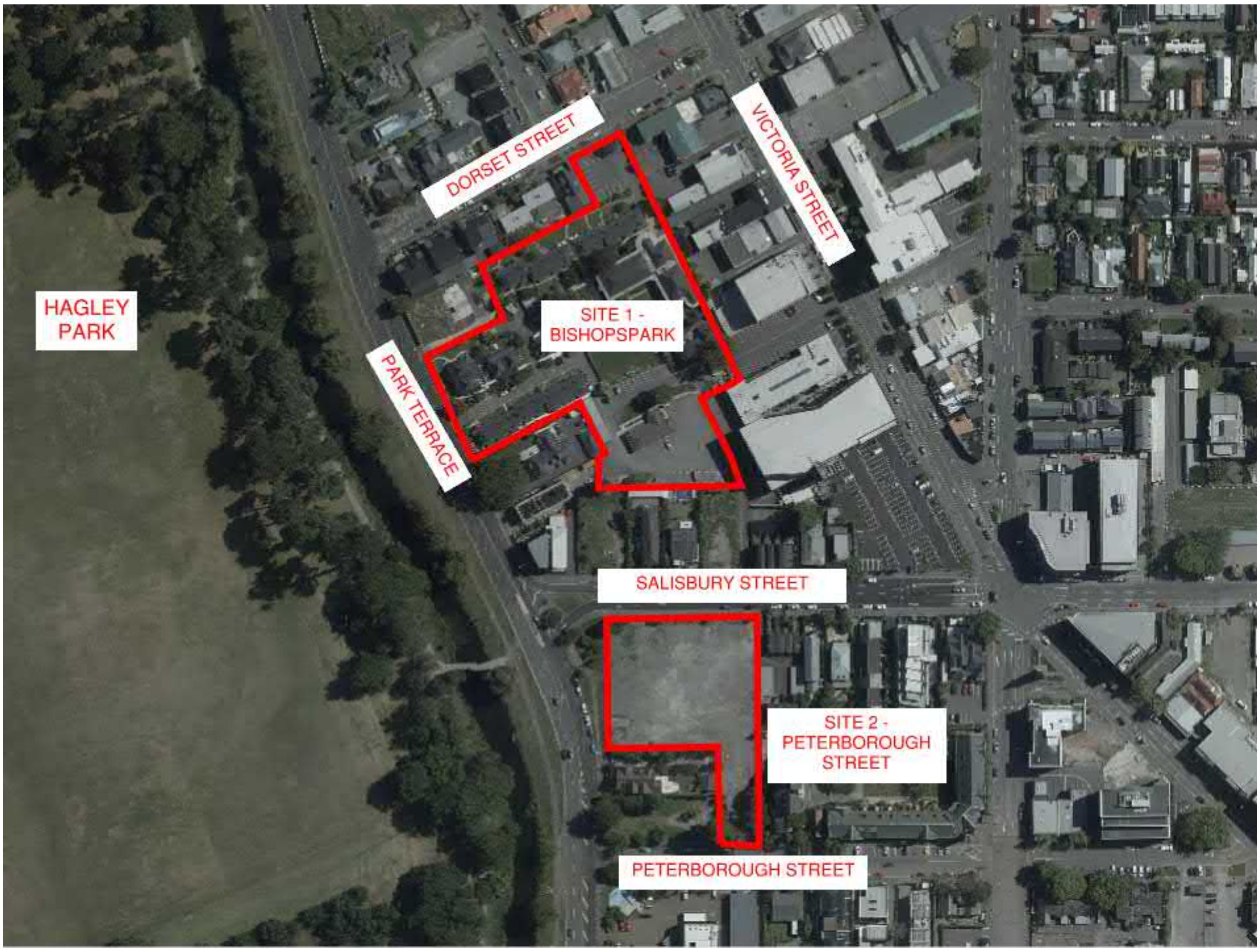

Figure 1 – Site Locations

2.1 Site 1 - Bishopspark

The Bishopspark site is located at 100 Park Terrace and 20 Dorset Street, Christchurch. The Bishopspark site is legally described as Lot 1 DP 46511, Lot 1 DP 46369, Lot 2 DP 13073 and Part Town Reserve 23 Town of Christchurch (CB28F/1159) and Part Town Reserve 25 City of Christchurch (CB362/50). The total site area is approximately 1.23 ha and the general arrangement is shown in Figure 2.

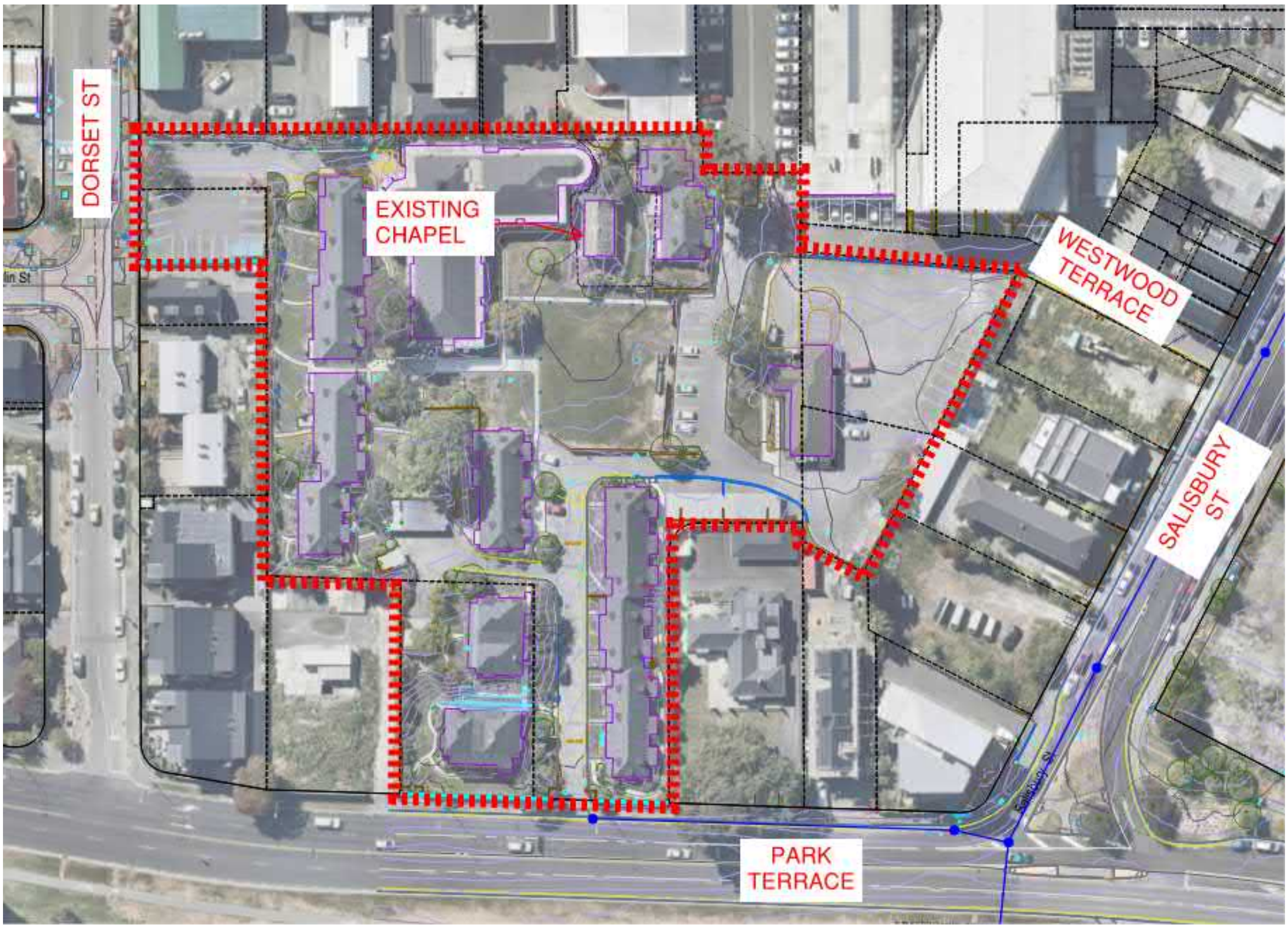

Figure 2 – Site 1 Bishopspark Existing Layout

Th Bishopspark site was previously occupied by the Bishopspark retirement village; however the village buildings have been or are in the process of being demolished.

The Bishopspark site topography consists of a high point located adjacent to the existing chapel with the land generally slopping gently to the west. The approximate elevations of the existing accessways at the boundary are as follows; Park Terrace - RL 15.9 m, Dorset Street - RL 16.2 m and Westward Terrace - RL 16.8 m. The existing boundary consists primarily of a concrete block wall, with some timber fencing. There are level differences across the boundary in some locations with the boundary walls acting as a retaining structure.

2.2 Site 2 – Peterborough

The Peterborough site is located at 78 Park Terrace, Christchurch. The Peterborough site is legally described as part of Lot DP 77997. The total site area is approximately 0.51 ha and the general arrangement is shown in Figure 3.

Figure 3 – Site 2 Peterborough Street Existing Layout

The Peterborough site topography is typically flat at an approximate level of RL16.15m. The Peterborough Street site is currently a cleared site comprising of gravel infill. An existing transformer is located on the northern frontage along Salisbury Street. A service chamber is located to the south west corner of the site. Prior to the Christchurch earthquakes, the Peterborough site was fully developed to almost 89% site coverage as shown in Figure 4.

Figure 4 – Site Conditions prior to Christchurch Earthquakes

2.3 Existing Ground Conditions

2.3.1 Site 1 - Bishopspark

The ground conditions (as set out in the Tonkin and Taylor Geotechnical Engineering Assessment of Environmental Effects report) at the Bishopspark site generally consist of:

- 0.5 m depth of fill or topsoil consisting of sandy gravel with trace silt and cobbles and silty topsoil with trace rootlets; overlying
- Interbedded firm sandy silt and loose sand/silty sand from 0.5 m bgl to 3.2 m to 4 m below ground level (bgl); overlying
- Fibrous peat and peat within very soft silt matrix to from 3.2 m to 4 m bgl to 7.5 m to 8 m bgl; overlying
- Loose silty sand/firm sandy silt from 7.5 m to 8 m bgl to 8.5 to 9.75 m bgl; overlying
- Medium dense to dense sandy gravel layer from 8.5 m bgl to 9.75 m bgl to 8.5 m to 10.95 m bgl, which is at its greatest thickness at north-western portion of the site and thins out towards the west of the site; overlying
- Medium dense to dense sand from 8.5m to 10.95 m bgl to 20.25 m bgl; overlying
- Stiff silt/sandy beyond 20.25 m bgl.

A design groundwater level of 1.3 m bgl has been adopted based on site investigations and piezometer monitoring as set out in the Tonkin and Taylor Geotechnical Engineering Assessment of Environmental Effects report. Groundwater levels are known to fluctuate between 1.1 – 1.3 m and are expected to show seasonal fluctuation based on rainfall patterns and Avon River water level.

Ground contamination investigations have been carried out (as set out in the Tonkin and Taylor Ground Contamination Assessment of Environmental Effects report). The report identifies several potential contaminants that may exist on the Bishopspark site;

- Source fill that could include metals, hydrocarbons and asbestos;
- Lead and asbestos; and
- Copper and organochlorine pesticides.

2.3.2 Site 2 – Peterborough Street

The existing ground conditions (as set out in the Tonkin and Taylor Geotechnical Engineering Assessment of Environmental Effects) on the Peterborough site generally consist of;

- 0.3 m depth of fill or topsoil consisting of sandy gravel with trace silt, cobbles and building waste comprising concrete, plastic, electrical wiring etc; overlying
- Interbedded firm sandy silt and loose sand/silty sand from 0.3 m bgl to 2.7 m to 5.5 m bgl, overlying
- Fibrous peat and peat within very soft silt matrix from 2.7 m to 5.5 m bgl to 6.3 m to 8 m bgl, overlying
- Loose silty sand/firm sandy silt from 6.3 m to 8 m bgl to 7.5 to 9.75 m bgl, overlying
- Medium dense to dense sandy gravel and gravelly sand from 7.5 m bgl to 9.75 m bgl to 10.9 m to 13.7 m bgl; overlying
- Medium dense to dense sand from 10.9 m bgl to 13.7 m bgl to 18.9 m to 20.1 m bgl; overlying
- Stiff silt/sandy silt from 18.9m to 20.1 m bgl to 21m to 21.2 m bgl; overlying
- Medium dense to very dense sandy gravel beyond 21 m.

Ground water has been recorded at approximately 1.3m to 2.2m below existing ground and are expected to show seasonal fluctuation based on rainfall patterns and Avon River water level.

Ground contamination investigations have been carried out (as set out in the Tonkin and Taylor Ground Contamination Assessment of Environmental Effects report). The report identifies several potential contaminants that may exist on the Peterborough site;

- Demolition material used as fill that may contain lead and asbestos; and
- Metals, solvents and hydrocarbons.

2.4 Existing Stormwater

2.4.1 Site 1 - Bishopspark

The existing Bishopspark site stormwater infrastructure is shown in Figure 5.

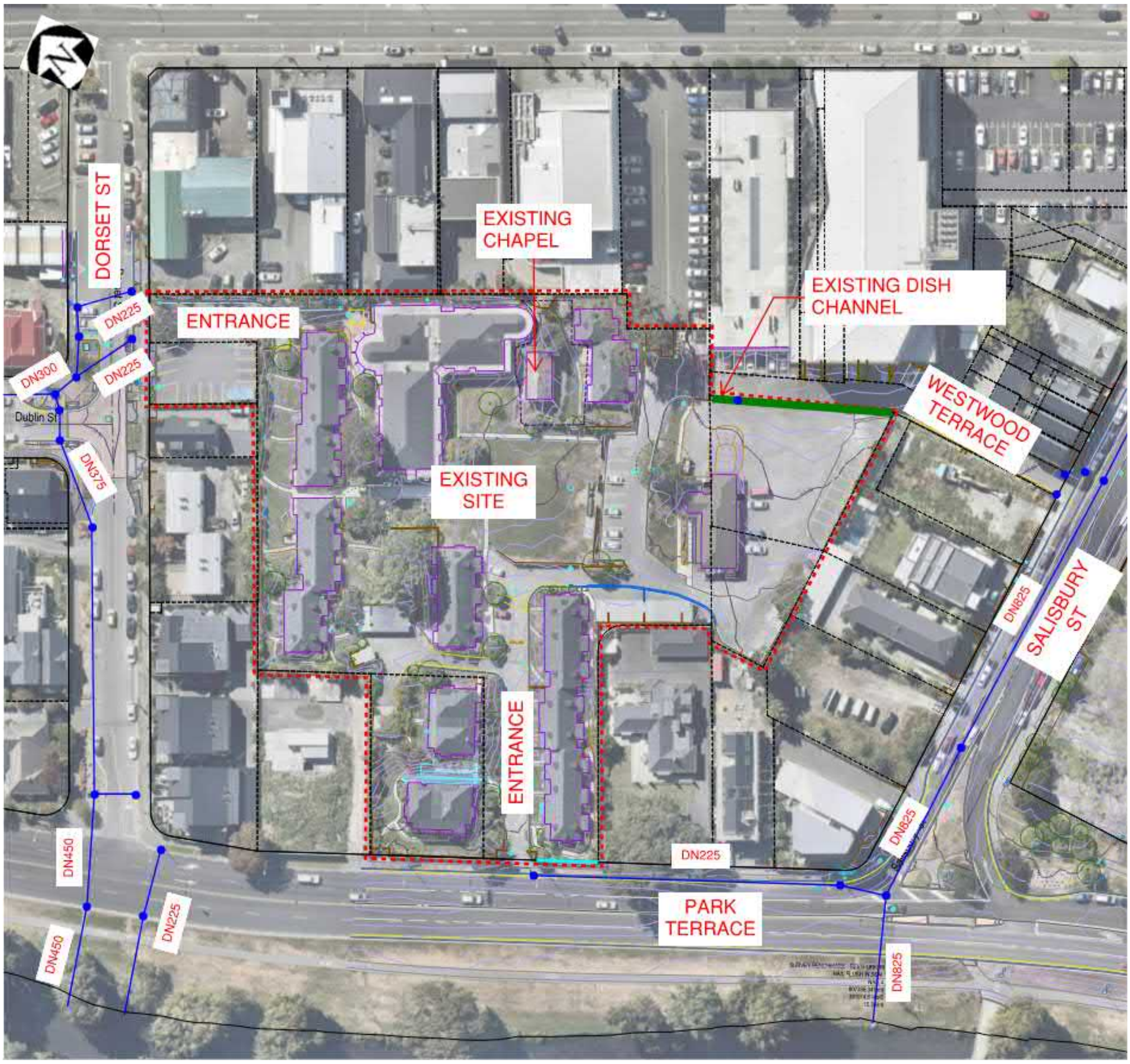

Figure 5 – Site 1 Bishopspark Existing Stormwater

There is an existing DN825 pipeline located on Salisbury Street and an existing DN300 to DN450 pipeline located on Dorset Street. These both discharge to the Avon River to the west of the Bishopspark site. There are two sumps located either side of the existing site access on Dorset Street, each with DN225 outlets. An existing sump is located adjacent to the existing site entrance on Park Terrace with a DN225 connection to the Salisbury Street pipeline.

There is an existing dish channel and sump located adjacent to the site boundary on Westward Terrace as shown in Figure 6. This sump connects to the Salisbury Street pipeline; however, the size of this pipeline does not show on Council GIS and is currently unknown.

Figure 6 – Westward Terrace Drainage

Current overland flow paths originate at the high point located adjacent to the existing chapel and discharge to kerb and channel or dish channel at the current site access points on Westward Terrace, Park Terrace and Dorset Street.

Park Terrace is in a flood management zone, with a designated 200-year flood level of some 16 mRL. This level will cause minor localised flooding to the Bishopspark site.

2.4.2 Site 2 – Peterborough

The existing Peterborough site stormwater infrastructure is shown in Figure 7.

Figure 7 – Site 2 Peterborough Street Existing Stormwater

There is no existing stormwater infrastructure located within the Peterborough site. There is an existing DN825 pipeline located on Salisbury Street discharging (from east to west) to the Avon River. An existing DN225 connection, located at the north east corner of the site, was likely the previous site connection point prior to demolition after the earthquakes.

There is an existing DN225 (that increases in size to a DN300) on Peterborough Street. However, this pipeline will not be targeted for discharge. These pipes serve the neighbouring properties to the south west and given their small size are likely not capable of receiving any more flow.

Although the Peterborough site is relatively flat, there is a higher point located centrally on the site. Current overland flow paths will therefore discharge 'radially' from the centre of the site, along the site perimeter boundaries and discharge to Salisbury Street, Park Terrace and Peterborough Street.

2.5 Existing Wastewater

2.5.1 Site 1 - Bishopspark

The existing Bishopspark site wastewater infrastructure is shown in Figure 8.

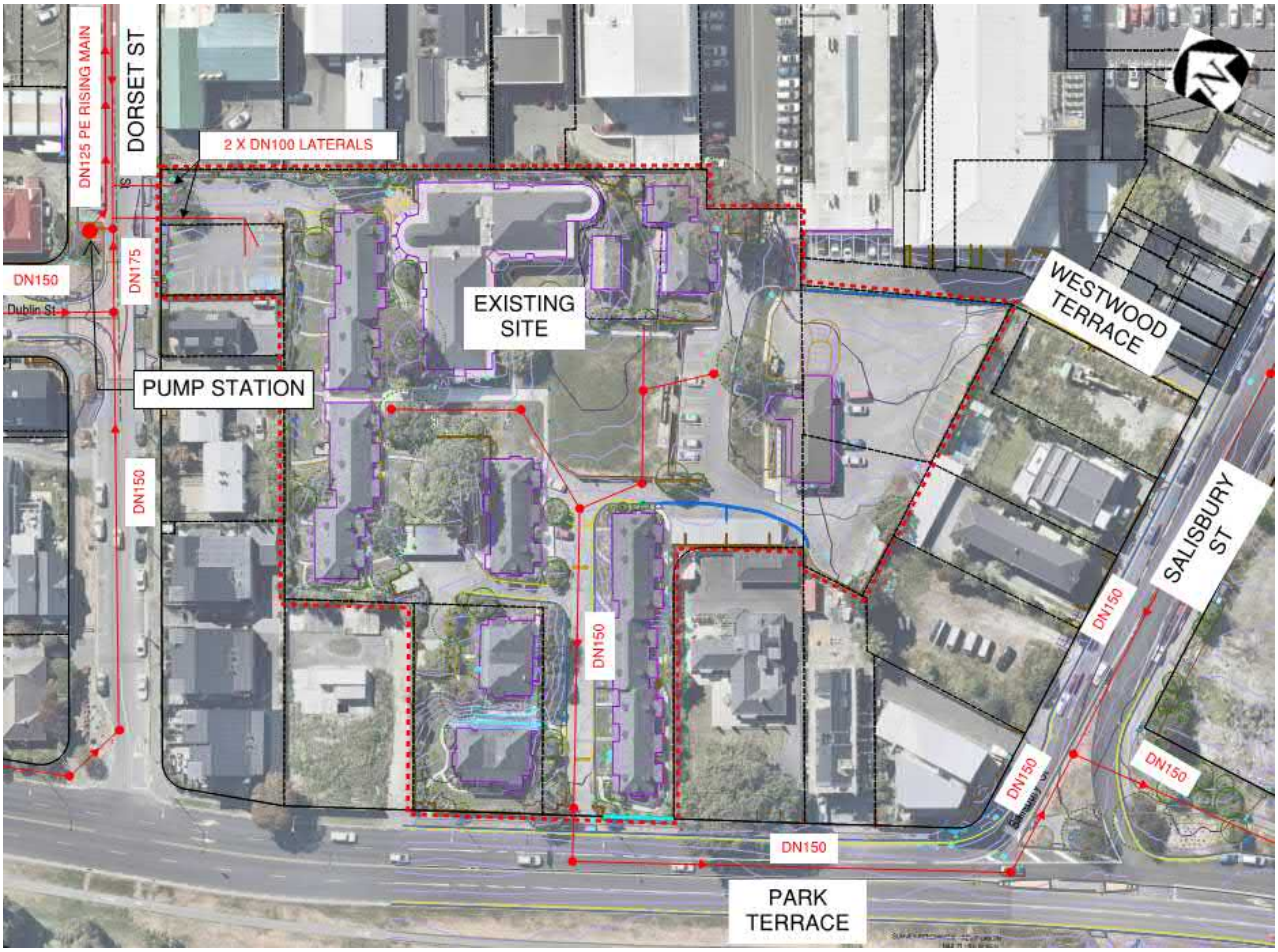

Figure 8 – Site 1 Bishopspark Existing Wastewater

The Bishopspark site is serviced by an existing DN150 Asbestos Cement main is located within the site which connects to the public DN150 main on Park Terrace and two DN100 laterals connect to an existing DN175 main on Dorset Street.

2.5.2 Site 2 – Peterborough

The existing Peterborough site wastewater infrastructure is shown in Figure 9.

Figure 9 – Site 2 Peterborough Street Existing Wastewater

The Peterborough site does not contain any existing wastewater infrastructure. There is an existing DN150 pipeline discharging (west to east) along Salisbury Street. There is an existing DN150 lateral located in the north eastern corner of the Peterborough site which likely served the previous development.

2.6 Existing Water

2.6.1 Site 1 – Bishopspark

The existing Bishopspark site water infrastructure is shown in Figure 10.

There are three DN150 public mains paired with either DN40 or DN50 submains surrounding the Bishopspark site on Dorset Street, Park Terrace and Salisbury Street respectively.

There are two existing water connections to the Bishopspark site as listed below:

- DN100 lateral connection at the Park Terrace access (splits into 2 x DN50)
- 2 x DN63 lateral connections at the Dorset Street access

Figure 10 – Site 1 Bishopspark Existing Water

2.6.2 Site 2 – Peterborough

The existing Peterborough site water infrastructure is shown in Figure 11.

Figure 11 – Site 2 Peterborough Street Existing Water

There are three public mains surrounding the Peterborough Street site listed below;

- DN150 along Salisbury Street;
- DN200 along Park Terrace; and
- DN200 along Peterborough Street.

There are three existing water connections to the Peterborough site. Two are located along the Park Terrace boundary (a DN20 and DN100) and another DN100 connection is located at Peterborough Street.

2.7 Existing Power

2.7.1 Site 1 - Bishopspark

At the Bishopspark site, the existing power supply is above ground along Dorset Street and below ground along Park Terrace. Plans obtained from Orion indicate that there is a substation located at the north eastern section of the site, which is fed for 11kV lines from Dorset Street. There is also a second substation on the south eastern section of the site which is fed through Westwood Terrace. There are multiple low voltage lines feeding from this.

2.7.2 Site 2 – Peterborough

At the Peterborough site there are two existing transformers located on Salisbury Street and an additional transformer located on Peterborough Street.

2.8 Existing Communications

2.8.1 Site 1 - Bishopspark

At the Bishopspark site there is an existing Enable fibre optic that is fed from Park Terrace and into the complex.

2.8.2 Site 2 – Peterborough Street

At the Peterborough Street site, there are existing Enable communications services along Salisbury Street, Park Terrace and Peterborough Street.

3 Planning Context

3.1 Earthworks Requirements

Resource consent is required under the Christchurch District Plan for earthworks exceeding the permitted standards for earthworks (Rule 8.9.2.3 (RD1)). The relevant matters of discretion under Rule 8.9.4 to be addressed by this report are summarised as:

- The avoidance or mitigation of dust nuisance, sedimentation and erosion effects;
- The avoidance or mitigation of effects on neighbouring properties and neighbours; and
- The potential for drainage problems.

The relevant objectives and policies seek to:

- Ensure earthworks do not result in erosion, sediment runoff, inundation or siltation, and do not adversely affect groundwater quality;
- Recognise that earthworks are necessary for development.

Resource consent is also required under the Canterbury Land and Water Regional Plan for earthworks exceeding the permitted standards (Rule 5.176). The relevant matters of discretion under Rule 5.176 are summarised as follows:

- The actual and potential adverse environmental effects on the quality of water in aquifers, rivers, lakes, wetlands;
- Any need for remediation or long-term treatment of the excavation;
- The protection of the confining layer and maintaining levels and groundwater pressures in any confined aquifer, including any alternative methods or locations for the excavation; and
- The management of any exposed groundwater.

A construction management plan (CMP) and erosion and sediment control plan (ESCP) will be required for the resource consent application. The CMP will set out measures to control the potential emission of dust beyond the boundary while the ESCP will detail the sediment and erosion controls for earthworks at the site in accordance with the relevant sections of the Canterbury Regional Council's Erosion and Sediment Control Toolbox for Canterbury. This will ensure that people and property are not adversely affected by earthworks on the site;1

Refer to the Erosion and Sediment Control Report in Appendix F confirming these requirements.

3.2 Stormwater

The requirements for the operational stormwater discharge from the Bishopspark and Peterborough sites vary and are defined by the Christchurch City Council's Global Consent for stormwater discharge. The requirements for both the Bishopspark and Peterborough sites have been discussed with Council's Stormwater Approvals team.

3.2.1 Site 1 - Bishopspark

The stormwater requirements, as discussed with and confirmed by Council, are;

- Stormwater peak discharge flow rate from the site post development shall not exceed the stormwater discharge from the site pre-development for all events up to and including the 50 year 18 hr rainfall events. The difference needs to be attenuated on site;
- Stormwater from all hardstanding trafficable (car parks/driveways) areas first flush treatment; and

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[1] District Plan Objective 8.2.4 and Policies 8.2.4.1 and 8.2.4.4.

- A minimum floor level of RL 16.29m to comply with Chapter 5.4 Flood Hazard Rules of the District Plan (and set by Council Floor Levels Assessment) for property located within the District Flood Management Zone.

A record of Council correspondence is provided in Appendix B confirming these requirements.

3.2.2 Site 2 – Peterborough

The stormwater requirements, as discussed with and confirmed by Council, are;

- No attenuation storage is required at this site;
- Treatment of stormwater runoff is required for any trafficable hardstand areas greater than 150 m^2; and
- A minimum floor level of RL 16.27 m*.

*The Peterborough site is not located within a Flood Management Zone, however Council have provided a floor level assessment with a minimum floor level for the site in their communications.

3.3 Wastewater Requirements

There are no planning rules or requirements for wastewater. The wastewater requirements are dictated based on assessment of the capacity of existing public mains, including discussions with Council regarding wastewater capacity.

A record of Council correspondence is provided in Appendix B confirming these discussions.

3.4 Water Requirements

There are no planning rules or requirements for water. The water requirements are dictated based on assessment of the capacity of existing public mains, including discussions with Council regarding water capacity.

A record of Council correspondence is provided in Appendix B confirming these discussions.

4 Proposed Village

A full description of the Proposed Village is contained in the Assessment of Environmental Effects. In summary, the Proposed Village comprises;

At the Bishopspark site (shown in Figure 12):

- The Village Centre, including assisted living suites and care rooms;
- Apartment buildings up to five stories high;
- An underground basement covering a large extent of the site;
- A vehicle accessway from Park Terrace;
- A vehicle accessway and a pedestrian accessway from Dorset Street;
- A basement ramp to access the basement;
- Boundary retaining walls;
- Landscaped areas between and around the new buildings; and
- A bowling green.

The total proposed impervious area is 10659 m^2, of which 5683 m^2 is buildings. The overall impervious coverage is 87% of the site area. The previous development on the Bishopspark site had an impervious area of 8195 m^2.

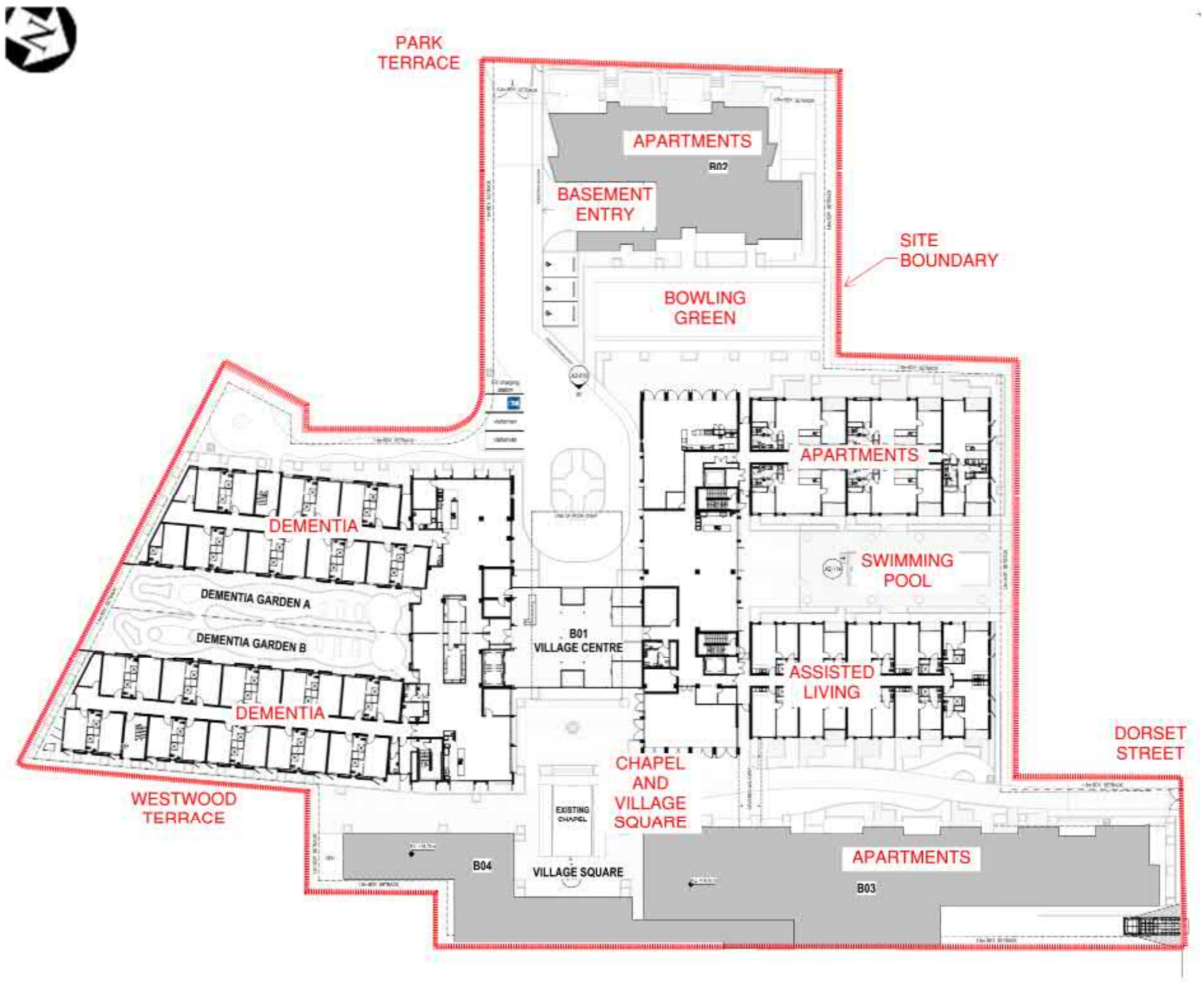

Figure 12 – Site 1 Bishopspark Proposed Site Layout

At the Peterborough site (shown in Figure 13):

- Two apartment blocks up to seven stories high;
- An underground basement approximately covering the extent of the site;
- A vehicle accessway from Park Terrace and Salisbury Street;
- Two basement ramps to the east side of the site;
- Boundary retaining walls; and
- Landscaped areas between and around the new buildings.

The total proposed impervious area is 3904 m^2, of which 2271 m^2 is buildings. The overall impervious coverage is 77% of the site area. The previous development on the Peterborough site had an impervious area of 4525 m^2.

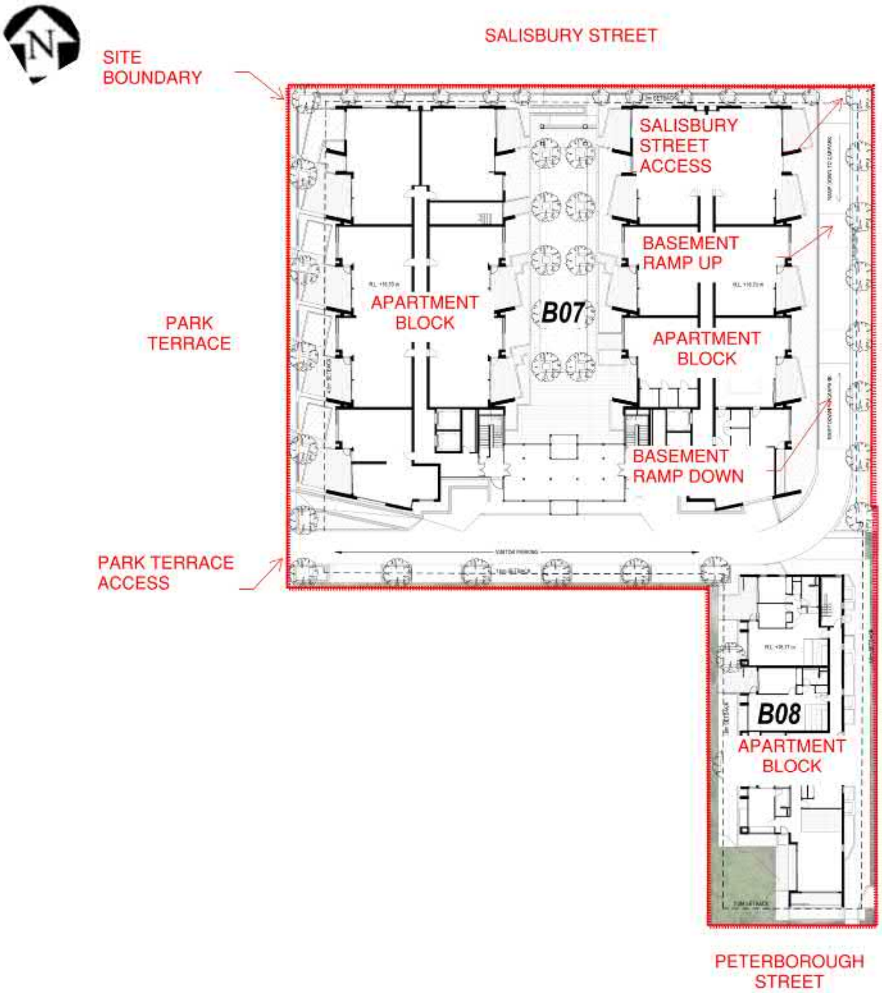

Figure 13 – Site 2 Peterborough Street Proposed Site Layout

5 Proposed Earthworks and Grading

The proposed earthworks and grading design is shown on drawing 038-RCT_401_C0_010 and is attached in Appendix A.

5.1 Grading

5.1.1 Site 1 - Bishopspark

The grading concept is shown in Figure 14.

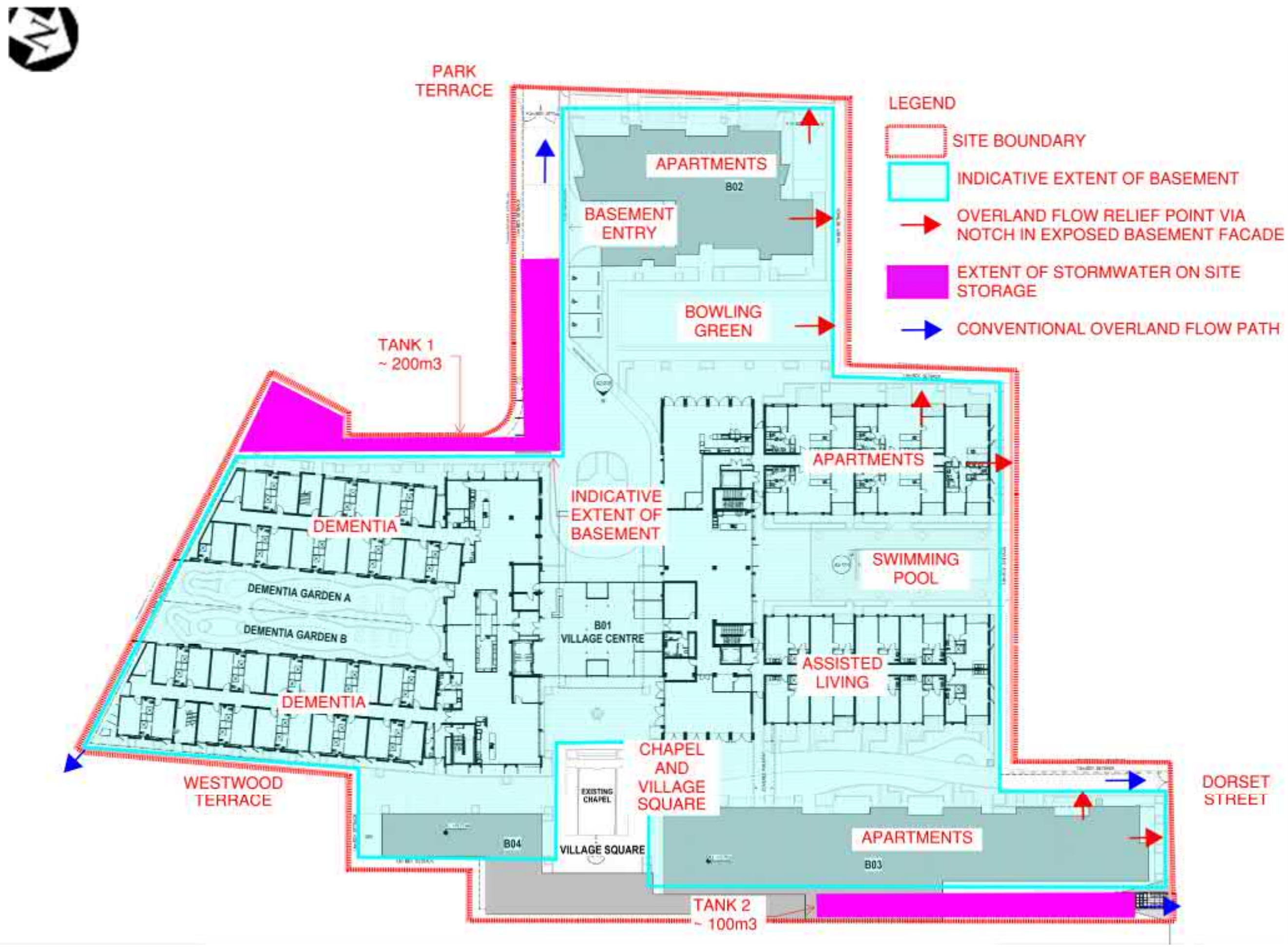

Figure 14 – Site 1 Bishopspark Proposed Grading Philosophy

The grading concept design philosophy has been influenced by:

- 1 in 50 year (ARI) flood levels at the site;
- Providing secondary overland flow paths;
- Achieving accessible entries;
- Existing ground levels at the access points;
- Achieving basement ramp vertical geometry requirements in accordance with AS/NZS 2890 Part 1;
- Consideration to the basement floor dig depth; and
- Site Boundary conditions.

The building floor levels have been set at RL 16.70 m.

The predicted 1 in 200 year (ARI) flood level for the site is RL 15.89 m and the minimum floor level requirement set by Council Floor Level Assessment is RL 16.29 m to comply with District Plan rules. Please refer to Council communication records provided in Appendix B stating this requirement in accordance with the District Plan. Consequently, the proposed finished floor level for the site of RL 16.70 m is above the minimum floor level requirement and hence compliant with the District Plan rules.

Ground water and existing soil conditions have made the basement design and construction methodology complex. To reduce the quantum of excavation, the basement floor level has been designed to be as shallow as possible. To reduce excavation volume and coordinate accessible entry points and top of basement podium structure, the finished surface levels and gradients will be a continuous RL 16.70 m over the extent of the basement. Therefore, there will be 0% gradient (longitudinally and cross sectionally) across the extent of the basement indicated by the cyan line on Figure 14.

To meet building code and resource consent requirements for accessibility, water tightness at access points and overland flow paths several measures have been put in place summarised as follows;

- The finished surface will be set to RL 16.70 m (floor level) providing level access around the building perimeters;
- The top of basement slab (podium) will be set 200 mm below the RL 16.70m finished surface levels;
- Permeable pavers set on podium jacks will allow for surface water drainage in open areas above the basement;
- The 200 mm level difference from floor level to podium level provides for water tightness requirements to New Zealand Building Code Clause E2;
- As the 50 year (ARI) rainfall event is required to be stored in underground storage tanks, the site primary stormwater network is therefore designed to convey the peak 50 year stormwater flow rate;
- A series of stormwater overflow relief points are provided to allow overflow relief for events greater than the 50 yr. event (with invert levels set 50mm above the basement slab (podium) level); and
- Outside of the basement extent, conventional overland flow paths are provided within the site margins to Park Terrace, Dorset Street and Westwood Terrace.

A typical cross-sectional detail illustrating how the overland flow paths are provided to the site is provided in Figure 15.

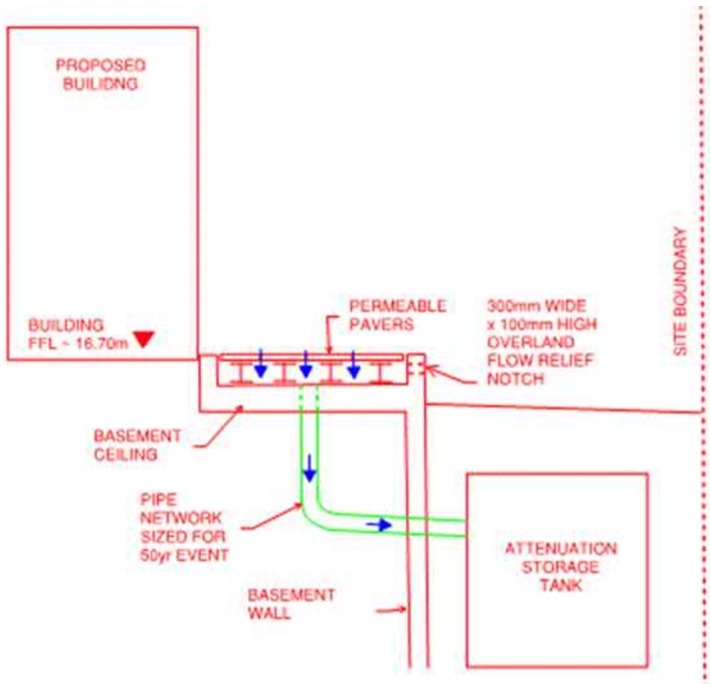

Figure 15 – Site 1 Bishopspark Typical Cross-section of Stormwater Overland Flow Philosophy

Existing ground levels at the accessways on Park Terrace and Dorset Street are 15.9 m and 16.2 m respectively. The ground level on Westwood Terrace at the site access is approximately 16.8 m, which is higher than the FFL of 16.7m. The ground level at the south-east corner of the site boundary (adjacent to Westwood Terrace) is RL 16.6 m. Given these boundary levels, overland flow paths will be provided predominantly to Park Terrace and Dorset Street, with a smaller sub-catchment discharging to Westwood Terrace at the south-east corner of the site boundary (instead of the Westwood Terrace access) as indicated in Figure 14 and reflected in the attached (Appendix A) grading plan drawings. From these discharge points overland flow will discharge along Dorset Street, Salisbury Street and will subsequently flow (cross sectionally) across Park Terrace, overtopping the central crown and discharge to the Avon River.

There are two access points proposed for the site at Park Terrace to the west and Dorset Street to the north. The main access road corridor is provided through the site (from Park Terrace), ramping down into the basement. The proposed basement ramp currently has been designed with a 1 in 5 gradient (20%) in accordance with AS/NZS 2890 Part 1. A maintenance access is provided from Dorset Street which provide access to the trade waste facility.

The Bishopspark site will be retained around the boundary to accommodate the height difference between the site and the existing ground around the perimeter as required.

5.1.2 Site 2 – Peterborough Street

The grading concept is shown in Figure 16.

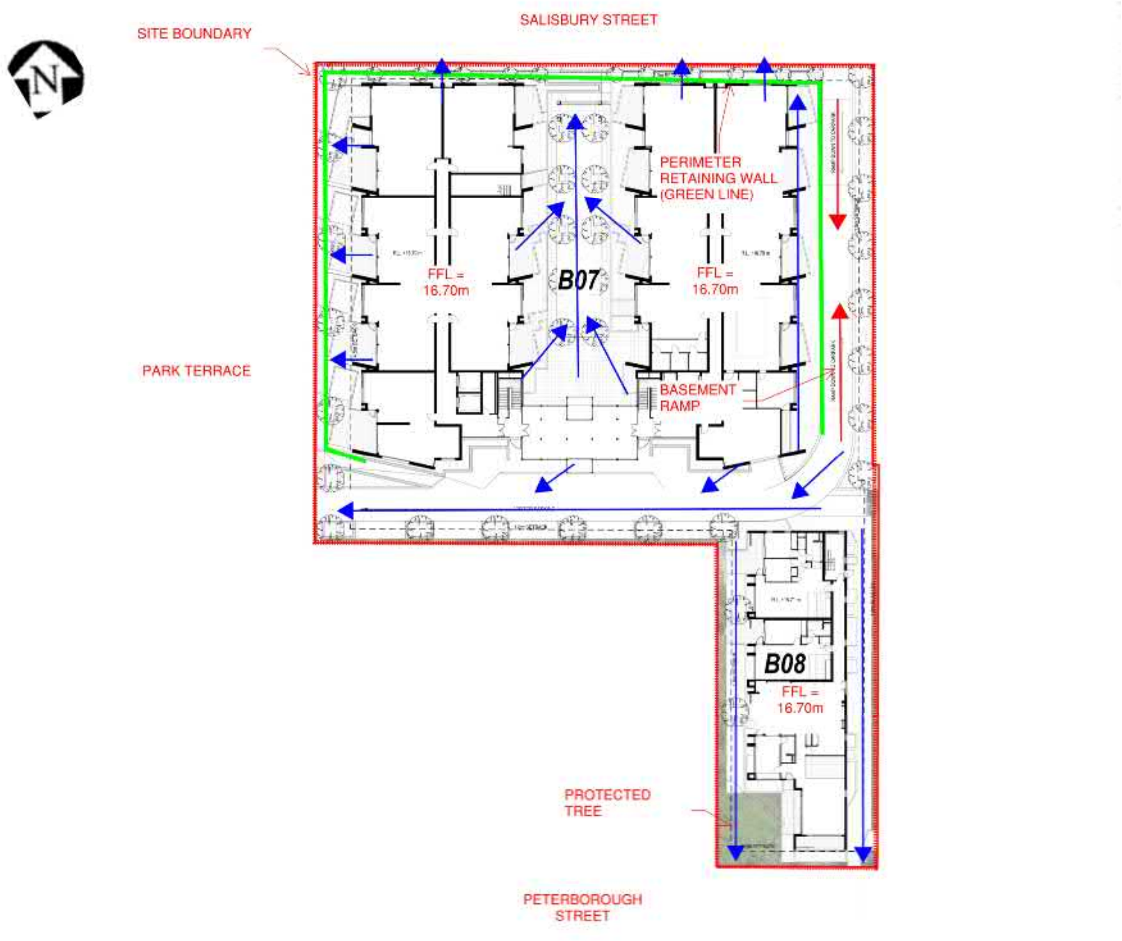

Figure 16 – Site 2 Peterborough Street Proposed Grading Philosophy

The grading concept design philosophy has been influenced by;

- Building Recession Planes;
- 1 in 50-year flood levels at the site;
- Providing secondary overland flow paths;
- Achieving accessible entries;
- Existing ground levels at the access points;
- Achieving basement ramp vertical geometry requirements in accordance with AS/NZS 2890 Part 1; and
- Site Boundary conditions.

The predicted 1 in 200-year flood level for the site is RL 15.87m which gives a minimum floor level requirement of RL 16.27m. Please refer to Council communication records provided in Appendix B. Consequently, the proposed finished floor level for the site of RL 16.70 m which is above the minimum floor level requirement and is hence compliant with the District Plan rules.

Overland flow paths will be provided to Park Terrace, Salisbury Street and Peterborough Street as indicated in Figure 7 and reflected in the attached (Appendix A) grading plan drawing. From these discharge points overland flow will discharge along Salisbury Street and Peterborough Street and will subsequently flow (cross sectionally) across Park Terrace, overtopping the central crown and discharge to the Avon River.

There are two access points proposed for the site. One access at Park Terrace to the east and another at Salisbury Street to the north. An access road corridor is provided through the site (from Park Terrace), ramping down into the basement and then up to Salisbury Street. The basement ramps have currently been designed with maximum gradients of 1 in 5 (20%) in accordance with AS/NZS 2890 Part 1.

The site will be retained around the boundary to accommodate the height difference between the site and the lower existing ground around the perimeter.

5.2 Earthworks Volumes

5.2.1 Site 1 - Bishopspark

The earthworks cut volumes for the Bishopspark site have been estimated based on the following design inputs;

- The proposed basement area is 1.004 ha;
- The maximum existing ground level on the site is approximately RL 16.80 m;
- The basement floor level is RL 13.50 m; and
- The basement will be excavated to a depth of 1 m below the basement floor level at RL 12.50 m.

The estimated excavated volume is 55,000 m^3 which allows for a 25% bulking factor in its calculation. As the basement extent covers the bulk of the site area, only a small amount of this material will be suitable for re-use on site. Consequently, most of this material will be cut to waste.

5.2.2 Site 2 – Peterborough Street

The earthworks cut volumes for the Peterborough Street site have been estimated based on the following design inputs;

- The existing site area is 0.51 ha and the basement effectively covers this area, therefore the plan dig extent for the basement is assumed to equate to the site area;
- The existing ground level on the site is approximately RL 16.15 m;
- The basement floor level is RL 13.30 m; and
- The basement will be excavated to a depth of 2 m below the basement floor level at RL 11.30m.

The estimated excavated volume is 32,000 m^3 allowing for a 25% bulking factor. As the basement extent covers the site area, only a small amount of this material will be suitable for re-use on site. Consequently, most of this material will be cut to waste.

5.3 Contaminated Land

Excavated material that cannot be re-used on the Site will be sent to landfill as addressed on the Tonkin and Taylor Ground Contamination Assessment of Environmental Effects report.

6 Erosion and Sediment Control

The excavation of the basements at the site will be managed in accordance with the erosion and sediment control plan. Due to the complex nature of the basement construction a preliminary erosion and sediment control plan has been produced and is attached in Appendix F.

From a planning perspective, the preliminary erosion and sediment control plan addresses;

- The avoidance or mitigation of dust nuisance, sedimentation and erosion effects; and
- The potential for drainage problems.

The preliminary erosion and sediment control plan considered;

- The volume of earthworks at the Bishopspark and Peterborough sites;
- Construction methodology;
- Hydrogeology and dewatering discharge rates from the Site;
- Effects of discharging dewatering volumes to the public network and subsequent effects on the receiving environments; and
- Potential contaminated land present on the Site.

The preliminary erosion and sediment control plans for the Bishopspark and Peterborough sites are shown on plan drawings 038-RCT_401_C0_050 and 051 with settlement tank (sea containers) details provided on drawing 038-RCT_401_C0_060.

The preliminary erosion and sediment control plans include several measures to address sedimentation and erosion measures including;

- Silt fences to the site perimeter to capture silt from sheet flows over the flat surfaces;
- Stormwater inlet protection on all streets or neighbouring properties in accordance with ECan guidelines;
- Stabilised entrances with and plant wheel wash to mitigate silt migration from the site;
- Retention of stormwater within basement excavations;
- Temporary dewatering pumps to draw down ground water for excavation; and
- Dewatering treatment will be provided through dewatering sea containers.

As the excavation will mostly be carried out below the ground water table, the effects of dust nuisance are considered low as excavated materials will be wet.

The effects of discharging dewatering flow rates to the Christchurch City Council public network have been discussed with Council. The outlet flow rate is expected to be 12 to 50 L/s in the first two weeks of excavation reducing to 3 to 17 L/s after three months. Dewatering flow will be discharged to the existing DN825 stormwater main located on Salisbury Street. Council's Stormwater Approvals team has accepted these flows maybe discharged to the public network; however, they may stop dewatering from the site should a large storm event occur.

Shutting down the site dewatering would have substantial implications for the Proposed Village including;

- Potentially flooding of the basement;
- Damage to equipment if failed to remove in time;
- Health and safety risks to work personnel;
- Significant risk to the construction should differential pressures be generated such as base slab up lift if not fully tied down for instance and / or deflection of secant pile walls;
- Consequential impact to surrounding properties if any movement incurred; and
- Programme impact.

Council's concern relates to the effects of the dewatering flow rates on the Avon River flood water levels and potential adverse effects on downstream properties. To address these concerns, Beca has assessed the effects on the Avon River, as set out in Appendix B. The assessment concludes that the Avon River would experience a minor increase (4 mm) in water level during a 1 in 50 year flood event. These potential effects on the Avon River flood water levels and potential adverse effects on downstream properties are therefore assessed as minor.

7 Proposed Stormwater Network (Operational)

The proposed stormwater concept design is shown on Beca drawing 038-RCT_401_C0_020 attached in Appendix A.

7.1 Site 1 - Bishopspark

The stormwater concept design has been developed to;

- Discharge overland flow away from buildings, away from the site and be free of blockages and obstructions to the point of discharge at the street in accordance with New Zealand Building Code;
- Reticulate primary flow to the public main in accordance with New Zealand Building Code;
- Attenuate the primary flow so that post development discharge rates do not exceed pre-development discharge rates up to the 50-year (ARI) 18-hour duration event to comply with the Christchurch City Council Global Consent for stormwater discharge; and
- Provide treatment of trafficable hardstand runoff to comply with the Christchurch City Council Global Consent for stormwater discharge.

7.1.1 Overland Flow Paths and Floor Levels

The overland flow strategy has been discussed in Section 5.1 and is illustrated in Figure 14.

There will be no overland flow from the basement ramp. The area discharging to the basement is relatively small and this runoff will be collected by a slot drain and will discharge to a basement sump pump. The slot drain and sump pump will be sized for the 50-year (ARI) event and will discharge to the stormwater network (within the site) and will be treated prior to gravity discharge to the public main.

7.1.2 Stormwater Network

The Bishopspark site stormwater network will comprise of a series of pipelines slung under the basement ceiling, collecting downpipes and other surface drainage features such as sumps and slot drains. Roof and landscape surface drainage will be separated from the (more potentially contaminated) road access corridor.

The road access corridor drainage will be discharged to a proprietary treatment device for treatment prior to gravity discharge to the DN225 public main on Park Terrace.

The site's remaining surface water drainage will be separated into three sub-catchment areas and will discharge to the public network located on Dorset Street, Park Terrace and Westwood Terrace.

7.1.3 Stormwater Attenuation

Due to the 21% increase in impervious area, stormwater attenuation is required for the site so that stormwater discharge from the site does not exceed pre-development (i.e. existing/current) rates for up to the 50-year (ARI) 18-hour duration event to comply with Council's Global Consent for stormwater discharge.

The site stormwater storage was assessed using HEC-HMS version 4.2.1. Pre and post–development catchment plans and output results for the various storms tested are provided in Appendix C. The existing site consists of three catchments (C1, C2 and C3) discharging to the stormwater network on Park Terrace, Dorset Street and Westwood Terrace respectively.

To replicate the existing drainage characteristics, the Bishopspark site has been divided into the three sub catchments (C1, C2 and C3) discharging to the stormwater network on Park Terrace, Dorset Street and Westwood Terrace similar to existing drainage characteristics.

For the post development condition, the portion of the site discharging to Catchment C3 has been reduced so as not to increase peak flow when compared with Catchment C3 for the existing site. Therefore, Catchment C3 has not been attenuated.

The HEC-HMS model has been developed to carry out a pre versus post-development assessment for Catchments C2 and C3. The following parameters were input to the HEC-HMS model;

- Catchment areas as per the catchment plans provided in Appendix C;
- The 2, 10, 20 and 50-year (ARI) rainfall events were tested;
- Hyetographs for each of the rainfall events were generated for the 10 min, 20 min, 30 min, 60 min, 2 hr, 6 hr, 12 hr, 18 hr, 24 hr and 48 hr durations totalling 40 storm events;
- Rainfall was converted to runoff depths using the SCS transform method;
- Losses were applied to the storm events as a continuous loss for the full storm duration as a weighted site C value (0.68 for pre-development and 0.8 for post-development);
- Attenuation storage will be provided via 2No Rainsmart storage tanks and storage curves were developed for the tank storage component; and
- Two orifice controls including a low level 75 mm diameter orifice and higher level 100 mm diameter orifice control was applied to both storage tanks.

The results equate to approximately 300 m^3 of storage required on the Bishopspark site to control post development flows to match pre–development flows for the range of storm events tested. A small increase in peak flow is recorded, primarily on the 48 hr durations however will have a negligible effect on the downstream network. Council has agreed that the approach is appropriate as presented in Appendix C and recorded in our communications with Council in Appendix B.

7.1.4 Stormwater Treatment

Stormwater treatment will be provided by a proprietary treatment device for all trafficable areas. For the conceptual design, two Stormwater 360 storm filters have been proposed for the Bishopspark site (one at each access to Park Terrace and Dorset Street) as the preferred method due to the low driving head. Calculations for the treatment device sizing is provided in Appendix C. Investigations into tailwater levels are ongoing and other equivalent device options may be explored during detailed design including;

- Stormwater 360 Jellyfish;
- Stormwater 360 Filterra System;
- Hynds Upflo Filter;
- SPEL Bayfilter; or
- SPEL Hydrostream.

All these devices are acceptable to Council and comply with the conditions of their Global Discharge Consent for stormwater as stipulated in their requirements in Appendix B.

7.2 Site 2 – Peterborough Street

The stormwater concept design has been developed to;

- Discharge overland flow away from buildings, away from the site and be free of obstructions to the point of discharge at the street in accordance with New Zealand Building Code;
- Reticulate primary flow to the public main in accordance with New Zealand Building Code; and
- Provide treatment of trafficable hardstand runoff to comply with the Christchurch City Council Global Consent for stormwater discharge.

7.2.1 Overland Flow and Floor Levels

The overland flow strategy has been discussed in Section 5.1 and is illustrated in Figure 16.

There will be no overland flow from the basement ramps. The area discharging to the basement is relatively small and this runoff will be collected by a slot drain and will discharge to a basement sump pump. The slot drain and sump pump will be sized for the 1 in 50-year event and will discharge to the stormwater network (within the site). This water will be treated (utilising a proprietary system) prior to gravity discharge to the public main.

7.2.2 Stormwater Network

The Peterborough site stormwater network will comprise of a series of pipelines slung under the basement ceiling, collecting downpipes and other surface drainage features such as sumps and slot drains. Roof and landscape surface drainage will be separated from the road access corridor. The road access corridor drainage will be discharged to a proprietary treatment device for treatment prior to gravity discharge to the DN825 public main on Salisbury Street.

The site peak 1 in 10-year discharge flow rate has been estimated at approximately 70 L/s. There is an existing DN225 stormwater lateral located at the north-eastern corner of the Peterborough Street site. This lateral has insufficient capacity for the peak flow discharge and is also located on the opposite side of the proposed basement ramp and therefore cannot be used for post-development runoff. Consequently, the stormwater network will discharge to the DN825 pipeline on Salisbury Street via and DN300 pipe and direct connection to Council standards.

7.2.3 Stormwater Attenuation

As the Site was fully developed prior to the Canterbury Earthquakes the increase in impervious area is deemed negligible. Accordingly, the Peterborough site does not require attenuation to comply with Council's Global Consent for stormwater discharge.

7.2.4 Stormwater Treatment

Stormwater treatment will be provided by a proprietary treatment device for all trafficable areas. For the conceptual design, a Stormwater 360 Stormfilter has been proposed for the site as the preferred method due to the low driving head. Calculations for the treatment device sizing is provided in Appendix C. Investigations into tailwater levels are ongoing and other options may be explored during detailed design including;

- Stormwater 360 Jellyfish;
- Stormwater 360 Filterra System;
- Hynds Upflo Filter;
- SPEL Bayfilter; or
- SPEL Hydrostream.

All these devices are acceptable to Council and comply with the conditions of their Global Discharge Consent for stormwater as stipulated in their requirements in Appendix B.

7.3 Rainwater Harvesting

Rainwater harvesting is proposed at the Peterborough site with some stormwater downpipes to be connected to a storage tank located in the basement. Harvested rainwater will be used for general irrigation purposes as described in Section 9.1.

8 Proposed Wastewater Network

The proposed internal wastewater network concept design is shown on Beca drawing 038-RCT_401_C0_020 attached in Appendix A.

The wastewater network will collect;

- all sanitary services in the building;
- trade waste from bin storage areas; and
- internal basement drainage.

8.1.1 Site 1 - Bishopspark

For the Bishopspark site, the peak wastewater flow rate for the site has been calculated as 5.4 L/s based on anticipated occupancy of the buildings and has been calculated in accordance with Christchurch City Council Infrastructure Design Standard. Wastewater peak flow calculations are provided in Appendix D.

There is a swimming pool proposed on the ground floor of the Bishopspark site. The pool and its backwash system has not been designed at the time of submission for resource consent. It is proposed to limit any backwash discharge to a flow rate of under 2.5 L/s and to limit timing to low demand timings, such as after midnight. As the pool backwash flow rate is less than the site peak discharge, coupled with the discharge occurring at night time the effects of this flow on public network are considered negligible.

The wastewater network will consist of three separate pipelines slung under the basement ceiling with discharges to the following public mains as follows;

- A proposed DN150 main discharge to the existing DN150 main on Park Terrace;
- A proposed DN150 main discharging to a proposed DN150 (existing DN100 main will need to be upgraded) on Westwood Terrace; and
- A proposed DN150 main connecting to the existing DN150 main on Dorset Street;

Council has confirmed there is capacity in the wastewater network to accommodate these flows (refer Appendix B).

8.1.2 Site 2 – Peterborough

For the Peterborough site, the peak wastewater flow rate for the site has been calculated as 3.2 L/s based on anticipated occupancies of the buildings in accordance with Christchurch City Council Infrastructure Design Guide. Wastewater peak flow calculations are provided in Appendix D. The wastewater network will be slung under the basement ceiling and will discharge to the public main on Salisbury Street.

There is a swimming pool proposed on the ground floor of the Peterborough site. The pool and its backwash system has not been designed at the time of submission for resource consent. It is proposed to limit any backwash discharge to a flow rate of under 2.5 L/s and to limit timing to low demand timings, such as after midnight. As the pool backwash flow rate is less than the site peak discharge, coupled with the discharge occurring at night time the effects of this flow on public network are considered negligible.

Council has confirmed there is capacity in the wastewater network to accommodate these flows (refer Appendix B).

9 Proposed Water Network

The proposed internal water concept design is shown on drawing 038-RCT_401_C0_020 For Assessmattached in Appendix A.

9.1 Potable, Fire and Irrigation Water Demand

9.1.1 Site 1 Bishopspark

The peak potable water demand for the Bishopspark site has been calculated as 6 L/s based on anticipated occupancy of the buildings in accordance with Christchurch City Council Infrastructure Design Standard. Peak Flow calculations are provided in Appendix E and are based on the same occupancy numbers as assumed for peak wastewater flow calculations. The required pressure for the potable water is 350 kPa.

The flow demand for fire sprinklers will be 1500 L/minute @ 600 kPa at the supply point.

Ryman intends to obtain a transfer of a water permit to provide water for irrigation at the Bishopspark site.

Council has confirmed that there is suitable pressure in the main to service the potable and irrigation demand requirements (refer to Appendix B).

9.1.2 Site 2 Peterborough

The peak potable water demand for the Peterborough Street site has been calculated as 3.6 L/s based on anticipated occupancies of the proposed buildings in accordance with Christchurch City Council Infrastructure Design Guide. Peak flow calculations are provided in Appendix E and are based on the same occupancy numbers as assumed for wastewater peak flow. The required pressure for the potable water is 350kPa.

The flow demand for fire sprinklers will be 1500 L/minute @ 600 kPa at the supply point.

Irrigation demand for the Peterborough site has been calculated at 0.6 L/s (irrigating green space at 5mm/m^2 over 5 hours per day).

Council has confirmed that there is suitable pressure in the main to service the potable and irrigation demand requirements (refer to Appendix B).

9.2 Proposed Water Network

9.2.1 Site 1 - Bishopspark

For the Bishopspark site a new DN110 connection will be provided at Dorset Street with a new Reduced Pressure Zone (RPZ) backflow unit provided at this location to supply the potable demand.

The fire supply will be provided by a new DN160 connection located next to the potable water connection at Dorset Street. A new RPZ (separate to the potable RPZ) backflow unit provided adjacent to the potable main.

The following existing connections will be decommissioned to Council standards;

- The existing DN100 connection at Park Terrace; and
- The existing 2xDN63 connections at Dorset Street.

9.2.2 Site 2 – Peterborough

For the Peterborough site, the existing DN100 connection available at Peterborough Street will be used with a new RPZ backflow unit provided at this location. This connection will service both the potable and irrigation needs for the site.

Rainwater harvesting will be provided with approximately 30m^3 of storage (provided via Rotomol storage tank or similar) in the basement to collect roof runoff. The storage tanks will be also be mains fed and will be used for general irrigating purposes. The tank will supply enough water to allow for about three days of irrigating and the effects of the irrigation demand on the Council water network is therefore considered to be negligible.

The firefighting supply will be provided by a new DN125 connection located next to the potable water connection at Peterborough Street. A new RPZ (separate to the potable RPZ) backflow unit will be provided adjacent to the potable main.

The following existing connections will be decommissioned to Council standards;

- The existing DN20 connection at Park Terrace; and
- The existing DN100 connection at Park Terrace.

10 Proposed Power and Communications

10.1.1 Site 1 - Bishopspark

Power for the Bishopspark site is proposed to be supplied from the Orion Networks local HV reticulation in Salisbury Street, extended through Westwood Terrace to the site, to a 1000kVA 11kV/400v transformer. A 500kVA standby diesel generator in a purpose built generator room is proposed in case of extended mains loss. An application has been submitted to Orion.

It is proposed to connect the Proposed Village to the existing Enable communications connection at Park Terrace.

10.1.2 Site 2 - Peterborough

Power for the Peterborough site is proposed to be supplied from the Orion Networks HV reticulation in Peterborough to a 500kVA 11kV/400v transformer. It is anticipated the existing switchgear and equipment on Salisbury Street will be relocated or abandoned, subject to Orion Network analysis and advice. A 300kVA standby diesel generator in purpose built generator room is proposed in case of extended mains loss. An application has been submitted to Orion.

The Peterborough site can connect to any of the existing Enable communications services along Salisbury Street, Park Terrace or Peterborough Street.

11 Conclusions

Demand for water supply, wastewater, and electricity has been assessed and a preliminary layout of a network servicing the Site has been prepared. The Site will be serviced from the existing network in the surrounding streets, and the relevant asset owners and service providers have confirmed that the demand for services can be met.

The effects of earthworks will be managed through the erosion and sediment control plan, which includes dewatering and treatment of dewatering runoff prior to discharge to the stormwater water network. Treatment of runoff is provided in the form of settling tanks. Effects on the Avon River have been assessed as being negligible.

Operational stormwater discharges will be managed (attenuation and treatment) to conform with the requirements for discharge under Council's Global Resource Consent for stormwater discharge. In summary, the Proposed Village can be serviced from the surrounding networks and, as designed, will have negligible potential adverse stormwater and earthworks effects.

A

Appendix A – Civil Engineering Design Drawings

▪ CIVIL ENGINEERING

Project No 3335607

PARK TERRACE RETIREMENT VILLAGE

FOR RESOURCE CONSENT

Prepared for

RYMAN HEALTHCARE

By
Beca

27 MARCH 2020

ORIGINAL DRAWING IN COLOUR

RESOURCE CONSENT
NOT FOR CONSTRUCTION

Drawing No. 038-RCT_401_C0-000 Rev. D

Drawing Plotted: 27 Mar 2020 11:54 am

LEGEND: GENERAL

- SITE BOUNDARY
- EXTENT OF BASEMENT
- RETAINING WALL TO STRUCTURAL ENGINEER'S DETAILS
- 24.00 — MAJOR DESIGN CONTOUR (1m)
- 23.90 — MINOR DESIGN CONTOUR (0.1m)
- PROPOSED KERB AND NIB TO CSS SD 602
- PROPOSED KERB AND FLAT CHANNEL TO CSS SD 601
- PROPOSED KERB ONLY (FLUSH) TO CSS SD 602
- PROPOSED INTERPATH CHANNEL TO CSS SD 601
- PROPOSED VEHICLE CROSSING / CUT DOWN TO CCC CSS SD 602
- PROPOSED BUILDING FOOTPRINT (DEFINED AS THE MOST OUTER OUTLINE OF ANY VERTICAL STRUCTURE THAT INTERFACES TO THE GROUND)
- B12 — BUILDING NUMBER
- FFL = 16.70m — FINISHED FLOOR LEVEL
- PROPOSED ATTTENUATION TANK

LEGEND: EXISTING SERVICES

- SW — EXISTING STORMWATER
- SS — EXISTING SANITARY SEWER
- W — EXISTING WATERMAIN
- G — EXISTING GAS
- FO — EXISTING FIBRE OPTIC CABLE
- OH — EXISTING OVERHEAD POWER CABLE
- EXISTING STORMWATER MANHOLE
- EXISTING SUMP
- EXISTING CESSPIT
- EXISTING SANITARY SEWER MANHOLE
- W — EXISTING WATER METER
- H — EXISTING WATER HYDRANT
- P — EXISTING POWER BOX
- P — EXISTING POWER POLE
- EXISTING POWER TRANSFORMER
- EXISTING STREET LIGHT
- T — EXISTING TELECOMMUNICATIONS PLINTH
- EXISTING TRAFFIC LIGHT
- ? — EXISTING UNKNOWN MANHOLE

LEGEND: PROPOSED SERVICES

- SW — PROPOSED STORMWATER PIPE
- PROOSED SLOT DRAIN AND "INLINE SUMP"
- SS — PROPOSED SANITARY SEWER PIPE
- W — PROPOSED WATER (POTABLE)
- F — PROPOSED WATER (FIRE)
- PROPOSED STORMWATER MANHOLE TO CSS SD303
- PROPOSED STORMWATER SUMP TO CSS SD 325 WITH SUBMERGED OUTLET TO CSS SD 329
- PROPOSED SEWER MANHOLE TO CSS SD 303
- PROPOSED SLUICE VALVE
- FH — PROPOSED FIRE HYDRANT TO CSS SD 412
- M — PROPOSED WATER METER
- RPZ — PROPOSED REDUCED PRESSURE ZONE VALVE.
- PROPOSED SLAB DRAINAGE DOWNPIPE
- PROPOSED ROOF DRAINAGE DOWNPIPE
- PROPOSED STORMWATER RODDING EYE TO NZBC CLAUSE E1
- PROPOSED WASTEWATER RODDING EYE TO NZBC CLAUSE E1

DRAWING No.	Rev	DRAWING TITLE	DRAWING STATUS
038-RCT_401_C0-000	D	COVER SHEET	RESOURCE CONSENT
038-RCT_401_C0-000A	A	COVER SHEET	CONCEPT DESIGN
038-RCT_401_C0-001	D	LEGEND, DRAWING LIST AND GENERAL NOTES	RESOURCE CONSENT
038-RCT_401_C0-001A	A	LEGEND, DRAWING LIST AND GENERAL NOTES	CONCEPT DESIGN
038-RCT_401_C0-002	D	EXISTING SITE LAYOUT	CONCEPT DESIGN
038-RCT_401_C0-010	D	PROPOSED OVERALL SITE GRADING PLAN	RESOURCE CONSENT
038-RCT_401_C0-011	D	PROPOSED SITE GRADING PLAN SHEET 1 OF 3	CONCEPT DESIGN
038-RCT_401_C0-012	D	PROPOSED SITE GRADING PLAN SHEET 2 OF 3	CONCEPT DESIGN
038-RCT_401_C0-013	B	PROPOSED SITE GRADING PLAN SHEET 3 OF 3	CONCEPT DESIGN
038-RCT_401_C0-020	D	PROPOSED OVERALL SITE SERVICES PLAN	RESOURCE CONSENT
038-RCT_401_C0-021	D	PROPOSED SITE SERVICES PLAN SHEET 1 OF 3	CONCEPT DESIGN
038-RCT_401_C0-022	D	PROPOSED SITE SERVICES PLAN SHEET 2 OF 3	CONCEPT DESIGN
038-RCT_401_C0-023	B	PROPOSED SITE SERVICES PLAN SHEET 3 OF 3	CONCEPT DESIGN
038-RCT_401_C0-050	B	BISHOPSPARK EROSION AND SEDIMENT CONTROL PLAN	CONCEPT DESIGN
038-RCT_401_C0-051	B	PETERBOROUGH EROSION AND SEDIMENT CONTROL PLAN	CONCEPT DESIGN
038-RCT_401_C4-060	B	PROPOSED STORMWATER CONTAINER DEWATERING DEVICE	CONCEPT DESIGN
038-RCT_401_C4-061	B	PROPOSED DN1050 STORMWATER 360 TREATMENT DEVICE	CONCEPT DESIGN
038-RCT_401_C4-062	B	PROPOSED DN1200 STORMWATER 360 TREATMENT DEVICE	CONCEPT DESIGN

DRAWING INDEX

ORIGINAL DRAWING IN COLOUR

RESOURCE CONSENT
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
D	FOR RESOURCE CONSENT	JK	IB	BC	27.03.20
C	FOR APPROVAL	JK	IB	BC	20.03.20
B	FOR APPROVAL	HC	SC	BC	28.02.20
A	FOR APPROVAL	PJ	IB	RJ	14.11.19

Drawing Originator: Beca

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	S.Crundwell	10.03.20
Drawn	P.Goundar	10.03.20
Dsg Verifier	J.Stanton	20.03.20
Dwg Check	K.Aulakh	20.03.20

Approved For Construction*
Date
* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE

Project: PARK TERRACE RETIREMENT VILLAGE

Title: LEGEND, DRAWING LIST AND GENERAL NOTES

Discipline: CIVIL ENGINEERING

Drawing No. 038-RCT_401_C0-001 Rev. D

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Document No. 038-RCT_401_C0-001.DWG

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Drawing Plotted: 27 Mar 2020 10:02 am

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RESOURCE CONSENT
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No.	Revision	By	Chk	Appd	Date
D	FOR RESOURCE CONSENT	JK	IB	BC	27.03.20
C	FOR APPROVAL	JK	IB	BC	20.03.20
B	FOR APPROVAL	HC	SC	BC	28.02.20
A	FOR APPROVAL	PJ	IB	RJ	14.11.19

Drawing Originator: Beca

Original Scale (A1)				
1:500	Design	S.Crundwell	03.20	Approved For Construction*
Reduced Scale (A3)	Drawn	P.Goundar	03.20	
1:1000	Dsg Verifier	J.Stanton	20.03.20	
	Dwg Check	K.Aulakh	20.03.20	Date

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE

Project: PARK TERRACE RETIREMENT VILLAGE

Title: PROPOSED OVERALL SITE GRADING PLAN

Discipline: CIVIL ENGINEERING

Drawing No. 038-RCT_401_C0-010 Rev. D

Document No. 038-RCT_401_C0-010.DWG

DO NOT SCALE

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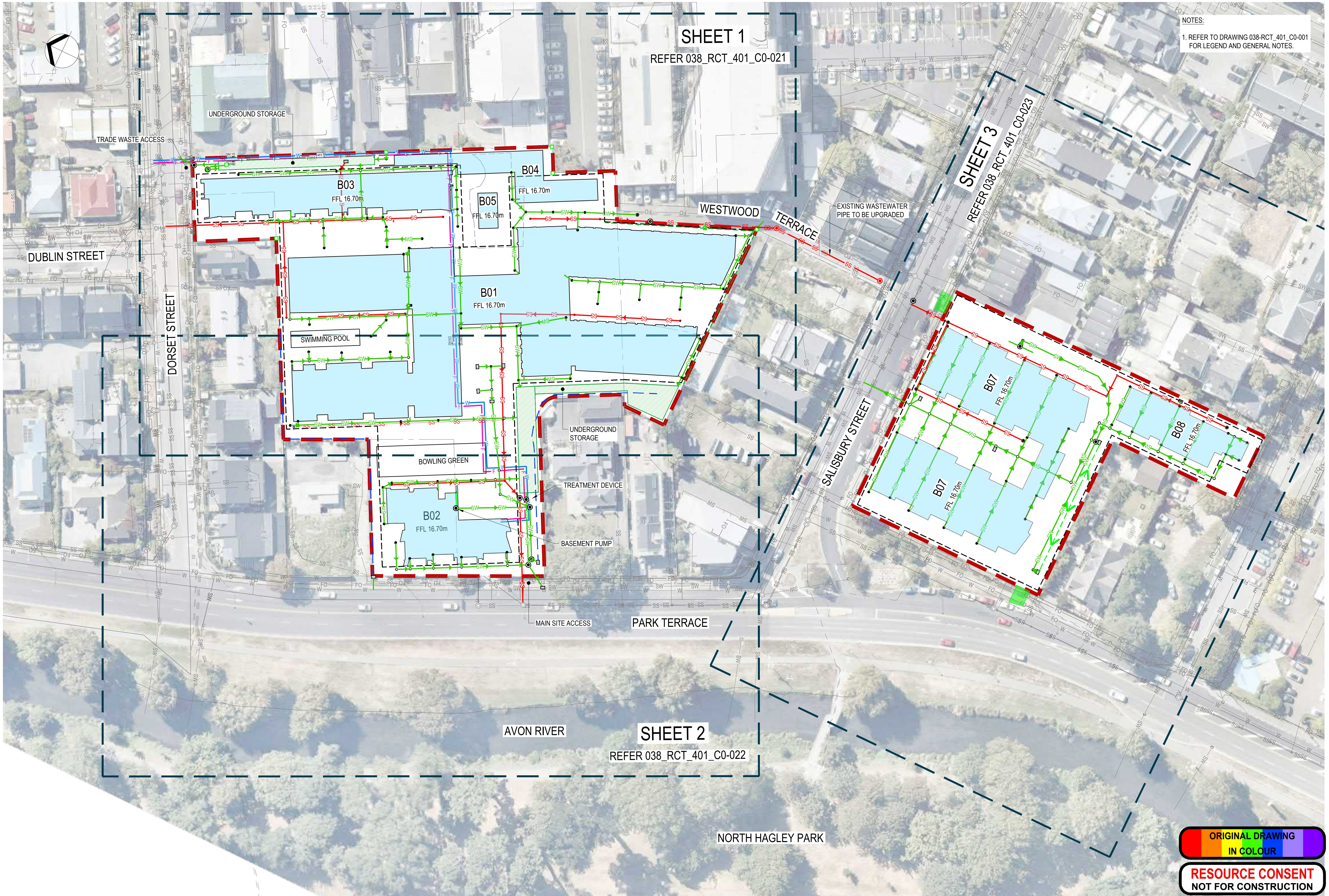
Drawing Plotted: 27 Mar 2020 9:54 am



NOTES:

1. REFER TO DRAWING 038-RCT_401_C0-001 FOR LEGEND AND GENERAL NOTES.

ORIGINAL DRAWING IN COLOUR

RESOURCE CONSENT
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
D	FOR RESOURCE CONSENT	JK	IB	BC	27.03.20
C	FOR APPROVAL	JK	IB	BC	20.03.20
B	FOR APPROVAL	HC	SC	BC	28.02.20
A	FOR APPROVAL	PJ	IB	RJ	14.11.19

Drawing Originator: Beca

Original Scale (A1) 1:500
Reduced Scale (A3) 1:1000

Design	S.Crundwell	10.03.20	Approved For Construction*
Drawn	P.Goundar	10.03.20	
Dsg Verifier	J.Stanton	20.03.20	
Dwg Check	K.Aulakh	20.03.20	Date

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE

Project: PARK TERRACE RETIREMENT VILLAGE

Title: PROPOSED OVERALL SITE SERVICES PLAN

Discipline: CIVIL ENGINEERING

Drawing No. 038-RCT_401_C0-020

Rev. D

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Document No. 038-RCT_401_C0-020.DWG

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B

Appendix B – Council Correspondence

STORMWATER OPERATIONAL PHASE REQUIREMENTS UNDER COUNCIL'S GLOBAL DISCHARGE CONSENT FOR STORMWATER DISCHARGE

SITE 1 BISHOPSPARK

Ian Bannon

From: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz> on behalf of StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Sent: Thursday, 29 November 2018 11:54 pm
To: Julian Hampton
Subject: HPRM: Stormwater Comments - 100 Park Terrace, Central City

Hi Julian,

The following are the general requirements. If we knew the proposal in detail we would have given a more considered answer.

Stormwater Quantity
Stormwater discharge from the site post development shall not exceed the stormwater discharge from the site pre-development for all events up to and including 50 yr 18 hrs rainfall events. The difference would need to be attenuated on site.

Stormwater Quality
Stormwater from all hardstanding trafficable (carparks/driveways) areas will require first flush treatment. The acceptable options for first flush treatment are:

1. A rain garden or tree pit designed to CCC's Rain Garden Design Criteria and/or CCC's Tree Pit Design Criteria
2. A soil adsorption or sedimentation basin designed to capture the runoff from the first 25mm of rainfall
3. One of the following proprietary devices designed to treat the runoff from a 5mm/hr intensity storm:
    a. Stormwater360 Stormfilter
    b. Stormwater360 Jellyfish
    c. Hynds Up-Flo Filter
    d. SPEL Bayfilter
    e. SPEL Hydrosystem

Kind Regards,
Victor

From: Julian Hampton [mailto:Julian.Hampton@beca.com]
Sent: Thursday, 29 November 2018 5:07 p.m.
To: StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Subject: Stormwater Capacity 100 Park Terrace

Hi there,

Beca has been engaged by a confidential client to conduct a due diligence report for the site 100 Park Terrace, previously utilised by Bishopspark Retirement Village. The proposed site layout has not yet been developed and therefore we would like to understand the capacity in relation to the district plan.

The site is 1.2 ha and approximately 60% impervious (visual aerial) currently. For this development we will assume that this will increase to 80% of the area.

Can you please confirm potential discharge requirements (treatment and attenuation) for the proposed development?

Please let me know if you require any further information.

Kind regards,

STORMWATER OPERATIONAL PHASE REQUIREMENTS UNDER COUNCIL GLOBAL DISCHARGE CONSENT FOR STORMWATER DISCHARGE

SITE 2 PETERBOROUGH

Ian Bannon

From: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Sent: Friday, 31 May 2019 7:43 am
To: Phil Goundar
Subject: HPRM: Stormwater Comments - 78 Park Terrace, Central City

Hi Phil,

The site coverage in the snip below shows that it was almost 100% impervious. Therefore, we will not require any attenuation for your development.

Stormwater treatment will be required for any trafficable hardstanding >150 m^2 using the menu of options in the email you sent. We have also included the Stormwater360 Filterra system.

The LLUR website is down and so I have not checked whether or not part of the site appears on it. If any part is on the LLUR then we may need a PSI/DSI to determine whether or not stormwater can be discharged under the global consent or if you will need to seek a separate consent (for the construction and/or operational phases) from ECan.

Kind Regards,
Victor

STORMWATER MINIMUM FLOOR LEVEL REQUIREMENTS

SITE 1 (BISHOPSPARK) & SITE 2 (PETERBOROUGH STREET)

Ian Bannon

From: Singh, Kawal <Kawal.Singh@ccc.govt.nz> on behalf of FloorLevels <FloorLevels@ccc.govt.nz>
Sent: Friday, 13 December 2019 6:01 pm
To: Ian Bannon
Cc: Simon Crundwell; Mthamo, Victor
Subject: RE: 100 Park Terrace, 78 Park Terrace and 20 Dorset Street - floor levels - 27/09/2019

Hi Ian

Please see requested information below:

- Peak 50yr 2hr water level in the Avon river in the local of 100 Park Terrace – **14.89 m RL**
- Peak 50 yr 6hr water level in the Avon river in the local of 100 Park Terrace – **15.29 m RL**

Thanks
Kawal

From: Ian Bannon <Ian.Bannon@beca.com>
Sent: Wednesday, 11 December 2019 9:02 a.m.
To: FloorLevels <FloorLevels@ccc.govt.nz>; Singh, Kawal <Kawal.Singh@ccc.govt.nz>
Cc: Simon Crundwell <Simon.Crundwell@beca.com>; Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Subject: RE: 100 Park Terrace, 78 Park Terrace and 20 Dorset Street - floor levels - 27/09/2019

Sensitivity: General

Hi Kawal,

We are in the process of finalizing a storage solution for 100 Park Terrace in accordance with CCC stormwater approvals requirements. As per previous comms below we understand that the 200yr peak water level on Park terrace is approx. 15.9m RL. In attempting to design the storage we are trying to keep the base of the storage device higher than the tailwater level and the level of 15.9 is constraining us.

The critical duration for our site is oscillating between 2 and 6hrs pending which option we decide to go for. Given the peak water level in the Avon for the 50 yr peak 2hr and 6hr event will be lower than the 15.9m 200 yr water level would it be possible to extract this information from the Avon River model?

Essentially we wish to request;

- Peak 50yr 2hr water level in the Avon river in the local of 100 Park Terrace?
- Peak 50 yr 6hr water level in the Avon river in the local of 100 Park Terrace?

Would it be possible to provide this information? Would greatly appreciate it. The project we are working on is proposing a substantial basement extent and construction and there is little space available on site and we really want to generate a solution that will not be submerged by the downstream affects.

Thanks,

Ian Bannon
Associate Civil Engineering
Beca Ltd
DDI: +64 3 367 2468 Mob: +64 27 556 3253

www.beca.com

From: Singh, Kawal <Kawal.Singh@ccc.govt.nz> **On Behalf Of** FloorLevels
Sent: Friday, 27 September 2019 4:01 pm
To: Simon Crundwell <Simon.Crundwell@beca.com>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: 100 Park Terrace, 78 Park Terrace and 20 Dorset Street - floor levels - 27/09/2019

Hi Simon

Please find below a finished floor level (FFL) and flood assessment for 100 Park Terrace, 78 Park Terrace and 20 Dorset Street.

Finished Floor Levels

NZ Building Code:

Minimum finished floor level required for compliance with Clause E1 of the New Zealand Building Code based on providing protection from a 1 in 50 year flood event with 0.5 m sea level rise allowance and 400 mm freeboard. This level may not be required for all structures and is for building code performance purposes only. Where a specific level is not required, compliance with the building code can be established using the solutions in E1/AS1.

The FFL requirement is currently: **No specific FFL required.**

Please contact DutyBCO@ccc.govt.nz for more information.

Christchurch District Plan:

Property or parts of it in District Plan Flood Management Area(Not 20 Dorset street): **Yes**
Property or parts of it in District Plan Fixed Minimum Floor Level Overlay: **No**

Minimum floor level required for compliance with Chapter 5.4 Flood Hazard Rules of the District Plan for properties located within the Flood Management Area. Resource consent is required if the minimum floor level is not met. A limited number of structures are exempt from meeting this floor level.

The FFL requirement is currently:
This FFL requirement is currently:

- For 20 Dorset Street; **No specific FFL required (Not in FMA)**.
- For 100 Park Terrace; **16.29 m RL**.
- For 78 Park Terrace; **16.27 m RL**.

FMA FFLs are set using criteria set out in chapter 5.4 of the Christchurch District Plan (http://districtplan.ccc.govt.nz/Pages/Plan/Book.aspx?hid=51368&exhibit=DistrictPlan). Please contact the Duty Planner (941 8999 or dutyplanner@ccc.govt.nz) for more information.

Predicted Flood Levels

Predicted **1 in 50 year** water level: **No flooding predicted.**

This is the predicted maximum water level in a 1 in 50 year flood event. The prediction allows for 0.5 m sea level rise and an increase in rainfall intensities as a result of climate change. This level is based on the current flood hazard information and may be updated once new data becomes available.

Predicted **1 in 200 year** water level:

- For 20 Dorset Street; **No flooding predicted**.
- For 100 Park Terrace; **15.89 m RL**.
- For 78 Park Terrace; **15.87 m RL**.

This is the predicted maximum water level in a 1 in 200 year flood event. The prediction allows for 1.0 m sea level rise and an increase in rainfall intensities as a result of climate change. This level is based on the current flood hazard information and maybe updated once new data becomes available.

Estimated Ground Levels

Our LiDAR information indicates that ground levels are:

- For 20 Dorset Street, the average ground elevation is approximately 16.45 m RL, ranging between 16.04 m RL and 16.62 m RL.
- For 100 Park Terrace, the average ground elevation is approximately 16.72 m RL, ranging between 15.78 m RL and 17.72 m RL.
- Not available(multiple rating units)

Disclaimer

i. All levels are provided in Christchurch Drainage Datum.
ii. Please note that any Flood Level estimate(s) may differ from observed levels in previous or future events.
iii. The FFL assessment is for flood limitation purposes only, and does not include consideration for other building consent aspects such as on-site drainage or service connections.
iv. Any consent application lodged for this site will be assessed based on the most recent flood modelling information available at the time of lodgement, and the above level is subject to change if the flood modelling information for this area is updated.
v. The content of this email does not constitute a 'Minimum Floor Level Certificate' as defined in the Replacement District Plan (Rule 5.3.1.2). To request one, follow the instructions at (https://www.ccc.govt.nz/assets/Uploads/P-022-Request-for-District-Plan-certification-Minimum-floor-level-PDF4.pdf).

If you have any further floor level queries, contact the team at: FloorLevels@ccc.govt.nz.

For floor levels online, go to (https://ccc.govt.nz/services/stormwater-and-drainage/flooding/floorlevelmap/

Kind regards

Kawal

Kawal Singh
Assistant Engineer
Water Supply, Wastewater & Stormwater Planning Team
Email: Kawal.Singh@ccc.govt.nz
Phone: (03) 941 5934
Web: www.ccc.govt.nz
Christchurch City Council

Civic Offices, 53 Hereford Street, Christchurch
PO Box 73014, Christchurch, 8154

From: Simon Crundwell <Simon.Crundwell@beca.com>
Sent: Friday, 27 September 2019 2:11 p.m.
To: FloorLevels <FloorLevels@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: Floor Level Assessments for 100 Park Terrace, 20 Dorset Street and 78 Park Terrace

Hi,

Can you please provide minimum required fixed floor levels for the following sites (refer to attached pdf plan of sites):

- 100 Park Terrace and 20 Dorset Street
- 78 Park Terrace

Cheers,

Simon Crundwell

Civil Engineer
Beca
Mob: +64 27 566 7140
simon.crundwell@beca.com

www.beca.com
www.LinkedIn.com/company/beca

STORMWATER STORAGE ACCEPTANCE IN ACCORDANCE WITH COUNCIL'S GLOBAL CONSENT FOR STORMWATER DISCHARGE

SITE 1 BISHOPSPARK

Simon Crundwell

From: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz> on behalf of StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Sent: Thursday, 13 February 2020 8:47 AM
To: Simon Crundwell
Subject: Stormwater Comments - 100 Park Terrace, Central City (PN868103)
Attachments: 1. Pre Development Catchment Plan.pdf; 2. Post Development Catchment Plan.pdf; 10. Summary of Results.xlsx

Hi Simon,

Without interrogating the HEC-HMS model itself the proposed attenuation closely approximates what we would expect for a proposal with an increase in impervious areas that your project has.

The proposed attenuation and discharge controls are accepted.

Kind Regards,

Victor

From: Ian Bannon [mailto:Ian.Bannon@beca.com]
Sent: Tuesday, 4 February 2020 10:13 a.m.
To: StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>; Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Subject: TRIM: RE: Stormwater Comments - 100 Park Terrace, Central City (PN868103)

Sensitivity: General

Hi Victor,

To close out the storage. Please see attached catchment plans and outputs form the HEC-HMS model. As we have used HEC-HMS to transform the rainfall to runoff for all the events the calculation is carried out in the software itself. Hence the results coming in the form of an output summary. Please see below running commentary on the HEC-HMS model and the storage design to provide you with details of how we got to this result.

Pre – Development Catchment Plan (attached)
Please see Pre – Development Catchment plan attached which includes two sheets. The first sheet shows total site make up in terms of roof, hardstand and landscape areas and the existing site weighted C value. The second sheet shows the individual sub catchments for the site.

Based on site investigations and review of contour data we understand that the site is split into three sub catchments. Each sub catchment discharges to Park Terrace (C1), Dorest Street (C2) and & Westwood Terrace (C3) respectively. The existing roof, hardstand and landscaped (green areas) have been calculated for the whole site and a weighted C value of 0.68 has been calculated.

Post – Development Catchment Plan (attached)
Please see Post – Development Catchment plan attached which includes two sheets. The first sheet shows total site make up in terms of roof, hardstand and landscape areas and the proposed site weighted C value. The second sheet shows the individual sub catchments for the proposed site. A weighted C Value of 0.8 was calculated for the proposed site.

Philosophically, we have tried to replicate existing conditions as far as reasonably practical in terms of sub catchment definition. You will notice that we have divided the proposed site into three catchments as for the existing. The proposed Catchment C3 has been reduced in comparisons to the existing site Catchment C3. This is

CONSTRUCTION PHASE
STORMWATER MANAGEMENT

APPROVAL TO DISCHARGE
DEWATERING

From: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz> **On Behalf Of** StormwaterApprovals
Sent: Wednesday, 22 January 2020 3:03 pm
To: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Hi Ian,

A higher dewatering rate can be accepted provided it does not cause nuisance flooding on the busy Park Terrace road. This will depend on the pipe capacities and the water levels in the river. We would accept for you to monitor and reduce the rate as appropriate depending on these constraints.

Kind Regards,

Victor

From: Ian Bannon [mailto:Ian.Bannon@beca.com]
Sent: Tuesday, 21 January 2020 2:38 p.m.
To: StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Cc: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Subject: RE: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Sensitivity: General

HI Victor,

Apologies, just few follow up questions from us. Geotech are working on the potential storage and treatment to conform to ECan requirements for the dewatering and we are looking like we will be compliant with regional requirements. We would like to get some further clarity on the dewatering discharge form the CCC;

- Noting your agreement in principle to discharging up to 50 L/s would Council be willing to comment on what a maximum allowable flow rate from the site during dewatering might be? In essence would you be willing to accept more than the 50L/s and what would the max you are willing to accept? This will affect our temporary storage to meet the ECan requirements for settling etc and we would like to get some clarity on this for the temp storage volume.
- You mention restrictions on outflow during storm events. This could be quite problematic for the dewatering as the basement is quiet large and turning off could result in flooding of the work zone halting works and results in substantial potential delays and possible health and safety risks that we will need to consider so we are a little concerned about this. Are you able to confirm if this restriction will be placed on us so we can understand what this means for the project. Is this a requirement that could be negotiated prior to resource consent submission or would we have to wait until the application is formally submitted to negotiate conditions?

Can you convey Councils thoughts on the above points pls?

Thanks,

Ian Bannon
Associate Civil Engineering
Beca Ltd
DDI: +64 3 367 2468 Mob: +64 27 556 3253

www.beca.com

From: Mthamo, Victor **On Behalf Of** StormwaterApprovals
Sent: Wednesday, 27 November 2019 2:43 pm
To: Ian Bannon
Subject: RE: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

My pleasure Ian. Let me know how you get on.

Kind Regards,
Victor

From: Ian Bannon [mailto:Ian.Bannon@beca.com]
Sent: Wednesday, 27 November 2019 11:25 a.m.
To: StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Subject: RE: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Sensitivity: General

Thanks Victor.

The hydrogeology guys are working through the dewatering with ECan. Tonkin and Taylor are doing that so I of the assumption that their strategy will comply in terms reducing ground level, contamination, settling silts and so forth. We just wanted to check capacity of receiving network for flows and looks like no major issues there. Will confirm with T&T for compliance with ECan requirements.

Cheers,

Ian Bannon
Associate Civil Engineering
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www.beca.com

From: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz> **On Behalf Of** StormwaterApprovals
Sent: Wednesday, 27 November 2019 9:55 am
To: Ian Bannon <Ian.Bannon@beca.com>
Subject: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Hi Ian,

We will accept the dewatering flows into the CCC network provided the dewatering is compliant with the ECan land and Water Plan or has a consent from ECan. We may put some restrictions around when the activity occurs e.g. if there is a heavy rainfall event we may need it to stop for the network to cope.

Because of the proximity to the waterway the quality of the discharge will be critical.

The discharge options you have identified are all feasible. The activity will need to be carried out in a manner that ensures no nuisance flooding on the roads etc.

Does your proposal comply with the ECan requirements?

Kind Regards,
Victor

From: Ian Bannon [mailto:Ian.Bannon@beca.com]
Sent: Monday, 25 November 2019 12:02 p.m.
To: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Subject: Park Terrace - Dewatering for Basement Excavation

Hi Victor,

On a separate issue to the storage, the project will require the excavation for a new basement. The dewatering will require temporary pumping to the local public network. The flowing bullets provide some flow estimates for the dewatering;

- 12 to 50 L/s for the first couple of weeks of pumping; and
- 3 to 17 L/s after three months pumping.

These figures were provided by Tonkin and Taylor as part of their hydrogeological analysis and more information can be provided if required. As a starting point, we would like to check capacities in the network to accept these flows. There appears to be a couple of options to discharge this via the 825 on Salisbury Street, the 450 on Dorset or the 225 on Park terrace.

Can you please confirm any requriements from Coucil's side re these discharges and network capacities as an input to the erosion and sediment control strategy? Or do we need to contact someone else at Council to discuss any partiuclar requriements to obtain approval?

CONSTRUCTION PHASE STORMWATER MANAGEMENT

ASSESSMENT OF EFFECTS ON OTAKARO (AVON) RIVER

Ian Bannon

From:	Mthamo, Victor <Victor.Mthamo@ccc.govt.nz> on behalf of StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Sent:	Monday, 16 March 2020 7:53 am
To:	Elliot Tuck
Cc:	Ian Bannon; Brookland, Iris
Subject:	Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Hi Elliot,

Thanks for the information below.

Regardless of the analysis we would still like to reserve the right to stop the dewatering in case of huge flows in the Avon. Protection of downstream properties is paramount and supersedes the potential adverse effects likely to be experienced within your project site if dewatering was stopped.

Kind Regards,
Victor

From: Elliot Tuck [mailto:Elliot.Tuck@beca.com]
Sent: Wednesday, 11 March 2020 11:48 a.m.
To: Brookland, Iris <Iris.Brookland@ccc.govt.nz>; StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>; Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>; Blaise Cummins <Blaise.Cummins@beca.com>
Subject: FW: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Hi Victor/Iris,
The Beca team designing the Park Terrace development have asked me to look at the effect of the dewatering and site runoff on the Avon as CCC have indicated that during a 50yr rainfall event dewatering should stop. This could have significant implications for the construction in both time, cost and risk. Some risks identified are:

- Potentially flooding of the basement
- Damage to equipment if failed to remove in time
- Significant risk to the construction if we generate differential pressures – base slab up lift if not fully tied down for instance / Walls moving
- Consequential impact to surrounding sites if any movement incurred
- Programme impact
- And hence financial viability of scheme

Therefore we have completed some analysis to show if pumping remains on during a 50yr event the effects on the Avon River and therefore the wider floodplain are minor.
In order to confirm that the flow from the proposed site during construction does not have a significant effect on water levels within the Avon (during a 50yr ARI 24hr event), an analysis of the existing and proposed flows has been undertaken. The flows listed below are considered to be a worst case scenario, which would be a 50yr event occurring during the construction of the basement where the runoff from a fully constructed basement and dewatering flow would be combined and discharged to the Avon River.

As provided by CCC, the existing (modelled) flow within the Avon at the proposed discharge location is **40.79m3/s** for the 50yr ARI 24hr event. The proposed site during construction will discharge a total of **0.039m3/s**, this assumes the entire site area is impervious (due to the concrete basement) the dewatering will be a maximum of **0.05m3/s**, equating to a total flow of **40.88m3/s** within the Avon at this section. We consider the flows listed to be conservative as the existing Avon flow accounts for the current site runoff and we have effectively added this again to the flow to account for any uncertainties. In addition the dewatering flow rate is the currently identified initial abstraction worst case rate and it is indicated that within a few months this will drop significantly. (further testing is being planned to firm up on these rates currently.)

CCC has also provided several cross section survey data along this stretch of the Avon with chainages; 9015.78, 9120.44 and 9148.99. These are plotted on figure 1 below, with their bank markers. By increasing the flow within this section of the Avon, the water level increases 2-3 mm, from 15.46 m RL to 15.463 m RL (this level is shown as the max water level on figure 1).

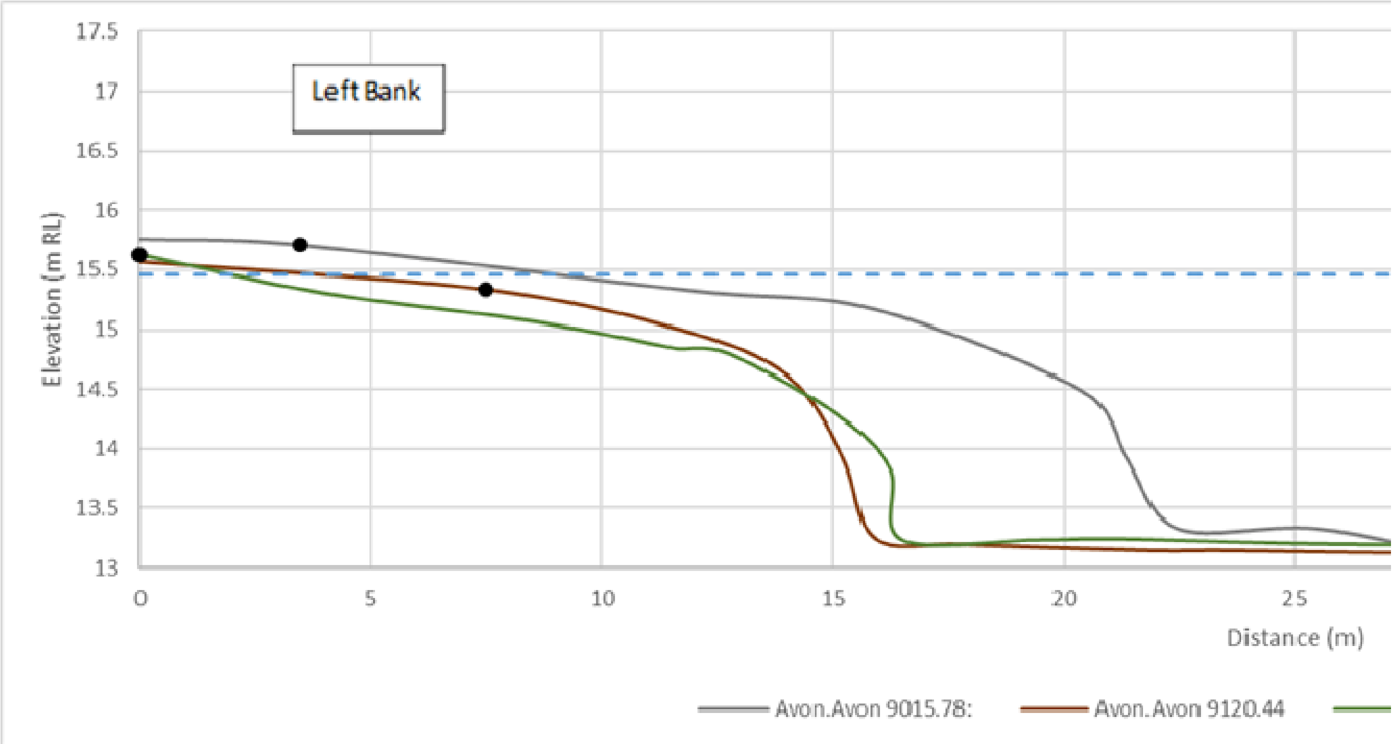

Figure 1 Maximum Water level (15.463m RL) within the Avon during construction works (bank markers shown by black dots).

The greatest increase of 4mm is seen within the chainage 9015.75, with the water levels for each chainage being:

Chainage	*Left Bank Marker (m)*	*Right Bank Marker (m)*	*Existing Water Level (m RL)*	*Water Level during Construction (m RL)*
9015.78	*15.71*	*16.83*	*15.46*	*15.462*
9120.44	*15.34*	*15.41*	*15.46*	*15.464*
9148.99	*15.63*	*15.35*	*15.46*	*15.463*

The greatest effect is on the cross-section where the full 50yr flow is contained within the river channel. The minor increase in water level (4mm) means water level remains in the river channel at this location.
The effects of the dewatering from the site during construction works in a 50yr 24hr event are therefore considered minor and within the accuracy of the model.

Please let me know if you need more information or want to meet to discuss the information above.
I will follow up with a phone call once you have had time to digest it.

Regards

Elliot Tuck
Senior Associate Hydrologist
Beca
Mobile: + 64-27-713-1210
e-mail: Elliot.Tuck@beca.com

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From: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz> **On Behalf Of** StormwaterApprovals
Sent: Wednesday, 22 January 2020 3:03 pm
To: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Hi Ian,

A higher dewatering rate can be accepted provided it does not cause nuisance flooding on the busy Park Terrace road. This will depend on the pipe capacities and the water levels in the river. We would accept for you to monitor and reduce the rate as appropriate depending on these constraints.

Kind Regards,

Victor

From: Ian Bannon [mailto:Ian.Bannon@beca.com]
Sent: Tuesday, 21 January 2020 2:38 p.m.
To: StormwaterApprovals <Stormwater.Approvals@ccc.govt.nz>
Cc: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Subject: RE: Dewatering Comments - 100 Park Terrace, Central City (PN868103)

Sensitivity: General

HI Victor,

Apologies, just few follow up questions from us. Geotech are working on the potential storage and treatment to conform to ECan requirements for the dewatering and we are looking like we will be compliant with regional requirements. We would like to get some further clarity on the dewatering discharge form the CCC;

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Thanks,

Ian Bannon
Associate Civil Engineering
Beca Ltd
DDI: +64 3 367 2468 Mob: +64 27 556 3253
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From: Mthamo, Victor **On Behalf Of** StormwaterApprovals
Sent: Wednesday, 27 November 2019 2:43 pm
To: Ian Bannon
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My pleasure Ian. Let me know how you get on.

Kind Regards,
Victor

From: Ian Bannon [mailto:Ian.Bannon@beca.com]
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Ian Bannon
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Sent: Monday, 25 November 2019 12:02 p.m.
To: Mthamo, Victor <Victor.Mthamo@ccc.govt.nz>
Subject: Park Terrace - Dewatering for Basement Excavation

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Thanks,

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WATERMAIN CAPACITY

SITE 1 (BISHOPSPARK) & SITE 2 (PETERBOROUGH STREET)

Ian Bannon

From: Wong, Ray <Raymond.Wong@ccc.govt.nz>
Sent: Thursday, 7 November 2019 8:48 am
To: Simon Crundwell
Cc: Ian Bannon
Subject: RE: Potable Water Capacity 100 Park Terrace AND 78 Park Terrace

Hi Simon,

Apologies for the late response, I am completely snowed under.

We should have covered most of the points for water capacity - adequacy of flow for servicing, firefighting, flow for sprinkler system (if any).
Should be all good from now, and we will assess this when your consent application comes in.

Thank you and kind regards
Ray

From: Simon Crundwell [mailto:Simon.Crundwell@beca.com]
Sent: Friday, 1 November 2019 3:41 p.m.
To: Wong, Ray <Raymond.Wong@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace AND 78 Park Terrace

Hi Ray,

Aside from the results of the hydrant test, are there any other details that you require?

Note that if there is inadequate pressure, we will have to boost the pressure from within the site.

Cheers,

Simon

From: Wong, Ray <Raymond.Wong@ccc.govt.nz>
Sent: Friday, 1 November 2019 3:06 PM
To: Simon Crundwell <Simon.Crundwell@beca.com>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace AND 78 Park Terrace

Hi Simon,

It really depends on the proposed structure, demands required and any fire sprinkler system in the buildings.
From the scale of the project, our preference would be to provide comments when we have more details, ie: consenting stage or pre-app meeting.

Cheers
Ray

From: Simon Crundwell [mailto:Simon.Crundwell@beca.com]
Sent: Friday, 1 November 2019 11:43 a.m.

To: Wong, Ray <Raymond.Wong@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace AND 78 Park Terrace

Hi Ray,

Thanks for your response.

Yes – we intend to carry out the tests that you have mentioned (fire flow testing and hydraulic modelling).

Do you have any fundamental objections to our proposed water connections? Please confirm.

Cheers,

Simon

From: Wong, Ray <Raymond.Wong@ccc.govt.nz> **On Behalf Of** WaterCapacity
Sent: Friday, 1 November 2019 11:10 AM
To: Simon Crundwell <Simon.Crundwell@beca.com>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace AND 78 Park Terrace

Hi Simon,

Thanks for your email. Please see my comments below:

Site 1
Our record shows that this site has 3 meter connections, one from the DN40 HDPE submain from Dorset Street & another two from Park Terrace. One of the connections from Park Terrace is for fire service.
Your proposal shows the intention to connect the services from Dorset Street, with estimated critical water supply demand of 25 L/s at 600 kPa.

I recommend you confirm the available pressure for your design by doing a fire flow test through two hydrants flowing, with the target source of 500 kPa & 450 kPa for sprinkler source.
Please note that any fire sprinkler systems should be designed for the minimum of actual pressure or 450 kPa.

Site 2
This site was serviced by two potable connections from the DN200 water main on Park Terrace, and one fire service line from DN200 water main on Peterborough Street.
The water line you intend to connect is for the fire service purpose. You should be able to reuse that line for potable purpose if the proposed structure does not require any fire sprinkler system.

Again, I recommend you to confirm the available pressure for your design by doing a fire flow test with the target source & sprinkler source mentioned at above.

I also recommend you to carry out a hydraulic modelling to assess if the proposed flow rate is adequate for the demand.

I trust the above information helps.

Kind regards
Ray

From: Simon Crundwell [mailto:Simon.Crundwell@beca.com]
Sent: Friday, 25 October 2019 10:05 a.m.
To: WaterCapacity <WaterCapacity@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: Potable Water Capacity 100 Park Terrace AND 78 Park Terrace

Hi there,

There are two sites which are being developed by a confidential client on Park Terrace. Site 1 is located at 100 Park Terrace and 20 Dorset Street. Site 2 is located at 78 Park Terrace. Refer to the attached "Site locations" plan of these two sites.

Both of these sites have a critical water demand of 25 L/s at 600 kPA pressure. Site 1 will connect to the existing DN150 main on Dorset Street (refer attached "Site 1 wastewater and water demands" plan), and Site 2 will connect to the existing DN100 lateral connection to the DN200 main on Petersborough Street (refer attached "Site 2 wastewater and water demands" plan).

Can you please confirm if there is sufficient capacity in the existing water supply network to meet this demand.

Kind regards,

Simon Crundwell

Civil Engineer
Beca
Mob: +64 27 566 7140
simon.crundwell@beca.com

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www.LinkedIn.com/company/beca

Ian Bannon

From: Julian Hampton
Sent: Thursday, 17 October 2019 2:33 pm
To: Ian Bannon
Subject: FW: Potable Water Capacity 100 Park Terrace

FYI

Julian Hampton
Civil Engineer
Beca
Mob: +62 27 785 1959

From: McIlroy, Graham <Graham.McIlroy@ccc.govt.nz>
Sent: Wednesday, 9 January 2019 10:17 AM
To: Julian Hampton <Julian.Hampton@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace

Julian
Based on continuous flow over 12 hours this would be approximately 17 cubic metres of water / night. We would be able supply this extra supply this flow at night.

Regards

Graham Mcilroy
Water Capacity
3 Waters and Waste
Christchurch City Council
03 9418313 – DDI
0274 339 715 - Mobile

From: Julian Hampton [mailto:Julian.Hampton@beca.com]
Sent: Wednesday, 9 January 2019 9:18 a.m.
To: McIlroy, Graham <Graham.McIlroy@ccc.govt.nz>
Subject: RE: Potable Water Capacity 100 Park Terrace

Hi Graham,

Hope you had a great break over the holiday.

We have been advised that landscape irrigation will also be required for the development, which requires an extra 0.4 l/s overnight.

Can you please advise if there is sufficient capacity in the network to handle this extra flow on top of the requirements below?

Kind regards,

Julian Hampton
Civil Engineer
Beca
Mob: +62 27 785 1959

From: McIlroy, Graham <Graham.McIlroy@ccc.govt.nz>
Sent: Tuesday, 4 December 2018 2:36 PM
To: Julian Hampton <Julian.Hampton@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace

Julian
We can confirm that the flow would be available within our reticulation and could supply you at this rate.
Regards

Graham Mcilroy
Water Capacity
3 Waters and Waste
Christchurch City Council
03 9418313 – DDI
0274 339 715 - Mobile

From: Julian Hampton [mailto:Julian.Hampton@beca.com]
Sent: Tuesday, 4 December 2018 12:18 p.m.
To: McIlroy, Graham <Graham.McIlroy@ccc.govt.nz>
Subject: RE: Potable Water Capacity 100 Park Terrace

Graham,

We have been provided with further information from the client and therefore have revised the 45 l/s obtained from the district plan. We would expect to see an estimated usage of 92,000 l/day (1 l/s) and using a peaking factor of 3, the approximate demand would be 3 l/s.

Can you please advise if the network may be able to supply the premises with this flow?

Kind regards,

Julian Hampton
Civil Engineer
Beca
Mob: +62 27 785 1959

From: McIlroy, Graham <Graham.McIlroy@ccc.govt.nz> **On Behalf Of** WaterCapacity
Sent: Tuesday, 4 December 2018 10:01 AM

To: Julian Hampton <Julian.Hampton@beca.com>
Subject: RE: Potable Water Capacity 100 Park Terrace

Julian
We advise there is adequate supply to the current use and this is supplied from an 75 mm water connection in Park Terrace.
You state that you require 45 L/s but this would be an instantaneous amount and based everybody using the water utilities all at the same time. We would not and could not expect to supply this premises at that rate. Unless we have more realistic data to base the calculations on we cannot comment further at present in relation to domestic water use. Use by the current occupants is an average of 1500m3/year
The site is currently supplied for firefighting at FW2 and therefore if it is to remain FW2 as intimated below it will have adequate coverage.

Regards

Graham Mcilroy
Water Capacity
3 Waters and Waste
Christchurch City Council
03 9418313 – DDI
0274 339 715 - Mobile

From: Julian Hampton [mailto:Julian.Hampton@beca.com]
Sent: Thursday, 29 November 2018 5:06 p.m.
To: WaterCapacity <WaterCapacity@ccc.govt.nz>
Subject: Potable Water Capacity 100 Park Terrace

Hi there,

Beca has been engaged by a confidential client to conduct a due diligence report for the site 100 Park Terrace, previously utilised by Bishopspark Retirement Village. The proposed site layout has not yet been developed and therefore we would like to understand the capacity in relation to the district plan.

The site is 1.2 ha large and the following assumptions were made;

-300 households/ha as per central city residential zone,
-2.7 people/house,
-0.15 l/s/connection based on CCC IDS.

From these assumptions, it was found that the site will contain a maximum of 972 people, requiring potable water flows of up to 45 l/s. It is expected that the internal network will connect to the DN150 DI watermains on Park Terrace.

Can you please advise if there is sufficient capacity in the surrounding potable water network to handle these flows? FW2 requires 50 l/s for fire hydrant and sprinkler flow, will the network have the capacity for this?

Please let me know if you require any further information.

Kind regards,

Julian Hampton
Civil Engineer
Beca
Mob: +62 27 785 1959

WASTEWATER CAPACITY

SITE 1 (BISHOPSPARK) & SITE 2 (PETERBOROUGH STREET)

Ian Bannon

From:	Tang, Alison <Alison.Tang@ccc.govt.nz> on behalf of Wastewater Capacity <WastewaterCapacity@ccc.govt.nz>
Sent:	Tuesday, 5 November 2019 3:09 pm
To:	Simon Crundwell
Cc:	Ian Bannon
Subject:	RE: Wastewater Capacity 100 Park Terrace AND 78 Park Terrace

Hi Simon

Thanks for the additional information and clarification. We have a recent model of this area that suggests that the proposed flows can be accommodated in the Council's wastewater system.

Engineering acceptance is an extra step for my team to review and issue during the building consent process. It sometimes can take a while due to limited resources, but if the project is large enough for the consent to take a while anyway, it might not add too much time to the overall process, especially if we see the plans early on during building consent review.

Regards,
Alison Tang
03 941 5323

From: Simon Crundwell [mailto:Simon.Crundwell@beca.com]
Sent: Thursday, 31 October 2019 2:43 p.m.
To: Tang, Alison <Alison.Tang@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: RE: Wastewater Capacity 100 Park Terrace AND 78 Park Terrace

Hi Alison,

Note that the plans we provided only show the ground floor level units only. There are several stories to the buildings across both sites. We are unable to provide a full set of plans for CCC to review at this point as design is still under development and our Client is a bit sensitive to the information we provide to external parties at this point.

We have used an occupancy rate of 1.5 people per apartment using 220 L per day with a PWWF factor of 5 as per IDS standards. We estimate a population equivalent of 423 for site 1 and 248 for site 2. At this stage I am assuming that the total PWWF will be split evenly between the three proposed discharge locations for Site 1. See attached spreadsheet which contains my calculations for the PWWF.

This results in the following peak flows for the sites;

Site 1 ~ 5.4 L/s
Site 2 ~ 3.2 L/s

I note that your team will require engineering acceptance to upgrade the Westwood Terrace lateral to a DN150mm main. Are we able to confirm if this will be a major issue for the CCC at this point, as we could potentially rethink the internal catchment distribution and discharge if this is going to be of major concern to Council.

Can you please let me know if these clarifications will result in any issues in terms of our proposal to discharge to the existing Council gravity sewer network?

Cheers,

Simon

From: Tang, Alison **On Behalf Of** Wastewater Capacity
Sent: Thursday, 31 October 2019 12:10 PM
To: Simon Crundwell
Subject: RE: Wastewater Capacity 100 Park Terrace AND 78 Park Terrace

Hi Simon

Thanks for reaching out. Site 1's wastewater lateral from Westwood Terrace into the main in Salisbury is currently 100mm. The comment on your layout is for upgrading the private lateral in Westwood Terrn to 150mm; upgrading the street lateral to accommodate this would require engineering acceptance from our team. The capacity you cite seems quite a bit higher than what we would calculate for 35 dementia units (1 person in each), 12 ILU apts (assumed standard 2.7 people each), and 10 assisted living apts (assumed 2 people each). Our estimated PWWF would be about 1.11 l/s altogether, based on the IDS part 6.4 formula. Is your estimate based on discharge units, or another known discharge for this type of facility?

Site 2: The proposed 11 units here is well under the previous number of units, so even with your PWWF estimate (which again seems quite high for 11 dwellings), this could be accommodated in the Council's network.

Regards,
Alison Tang
Assistant Engineer – Asset Planning – Water & Wastewater

DDI: 03 941 5323
Email: Alison.Tang@ccc.govt.nz
Web: www.ccc.govt.nz

Christchurch City Council
Civic Offices, 53 Hereford Street, Christchurch
PO Box 73014, Christchurch, 8154

Please consider the environment before printing this email

From: Simon Crundwell [mailto:Simon.Crundwell@beca.com]
Sent: Friday, 25 October 2019 10:15 a.m.
To: Wastewater Capacity <WastewaterCapacity@ccc.govt.nz>
Cc: Ian Bannon <Ian.Bannon@beca.com>
Subject: Wastewater Capacity 100 Park Terrace AND 78 Park Terrace

Hi there,

There are two sites which are being developed on Park Terrace. Site 1 is located at 100 Park Terrace and 20 Dorset Street. Site 2 is located at 78 Park Terrace. Refer to the attached "Site locations" plan of these two sites.

Site 1 wastewater will discharge to the existing wastewater gravity network as follow;

- Discharge to an existing DN100 lateral on Dorset Street
- Discharge to an existing DN150 lateral on Park Terrace
- Discharge to an upgraded DN150 pipe on Westwood Terrace

Refer to the attached “Site 1 wastewater and water demands” plan which illustrates the proposed connections to the existing wastewater network. Each connection is expected to discharge with a peak wet weather flow rate (PWWF) of approximately 1.8 L/s (with a site total PWWF of 5.4 L/s).

Site 2 wastewater will discharge to an existing DN150 lateral connection on Salisbury Street (refer attached “Site 2 wastewater and water demands” plan), with a PWWF of approximately 3.2 L/s.

Can you please confirm if there is sufficient capacity in the existing wastewater network to accept these wastewater discharges?

Kind regards,

Simon Crundwell

Civil Engineer
Beca
Mob: +64 27 566 7140
simon.crundwell@beca.com

www.beca.com
www.LinkedIn.com/company/beca

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C

Appendix C – Stormwater Calculations

STORMWATER STORAGE IN ACCORDANCE WITH COUNCIL'S GLOBAL CONSENT FOR STORMWATER DISCHARGE

SITE 1 BISHOPSPARK

Drawing Plotted: 03 Oct 2019 8:34 AM

KEY

- IMPERVIOUS - HARDSTAND
- IMPERVIOUS - ROOF
- PERVIOUS

SITE CATCHMENT

A_{Roof} = 2793 m²

$A_{Hardstand}$ = 5402 m²

$A_{Landscape}$ = 4100 m²

A_{Total} = 12,295 m²

C_{SITE}= 0.68 (Weighted Average)

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CHECK PRINT

DRG: 038-RCT_401_C0-003.dwg
DATE: 03 Oct 2019 8:34 AM
PROJECTNAME: ----

DISTRIBUTION	SIGN	DATE
ORIGINATOR		
DRAFTER		
CHECKER		

PRELIMINARY
NOT FOR CONSTRUCTION

Ryman Site 1 (100 Park Terrace and 20 Dorset Street) - Pre Development Catchment Plan

No.	Revision	By	Chk	Appd	Date
*	UNDER REVISION				

Drawing Originator: Beca

Original Scale (A1) 1:500 · Reduced Scale (A3) 1:1000 · Design · Drawn · Dsg Verifier · Dwg Check · * Refer to Revision 1 for Original Signature · Approved For Construction* · Date

Client: RYMAN HEALTHCARE

Project: PARK TERRACE

UNDER REVISION

Title:

Discipline: CIVIL

Drawing No. 038-RCT_401_C0-003 · Rev. A

Document No. 038-RCT_401_C0-003.DWG

DO NOT SCALE · IF IN DOUBT ASK.

KEY

(white box)	IMPERVIOUS - HARDSTAND
(grey box)	IMPERVIOUS - ROOF
(green box)	PERVIOUS

SITE CATCHMENT

A_{Roof} = 5683 m^2

$A_{Hardstand}$ = 4976 m^2

$A_{Landscape}$ = 1636 m^2*

A_{Total} = 12,295 m^2

*Assumed this hatched area is landscaped

C_{SITE}= 0.80 (Weighted Average)

All dimension to be verified on site before producing shop drawings or commencing any work.
Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects Ltd.

Revisions

A 25.10.19 RESOURCE CONSENT DRAFT
B 13.12.19 RESOURCE CONSENT

Client

RYMAN HEALTHCARE

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street
PO Box 25086
Christchurch 8011
New Zealand
Phone + 64 3 961 5926

Registered Architects and Designers
www.warrenandmahoney.com

Project Title

PARK TERRACE
SITE 01
BISHOPSPARK

Drawing Title

VILLAGE CENTRE B01
FLOOR PLAN LEVEL 1

Drawing Issue

RESOURCE CONSENT

Drawing Details

Scale	1 : 250 @ A1
Date	13.12.19
Job No	8917
Drawn	WM Team
Checked	TDH

Drawing No: B01 .A1-020

Revision: B

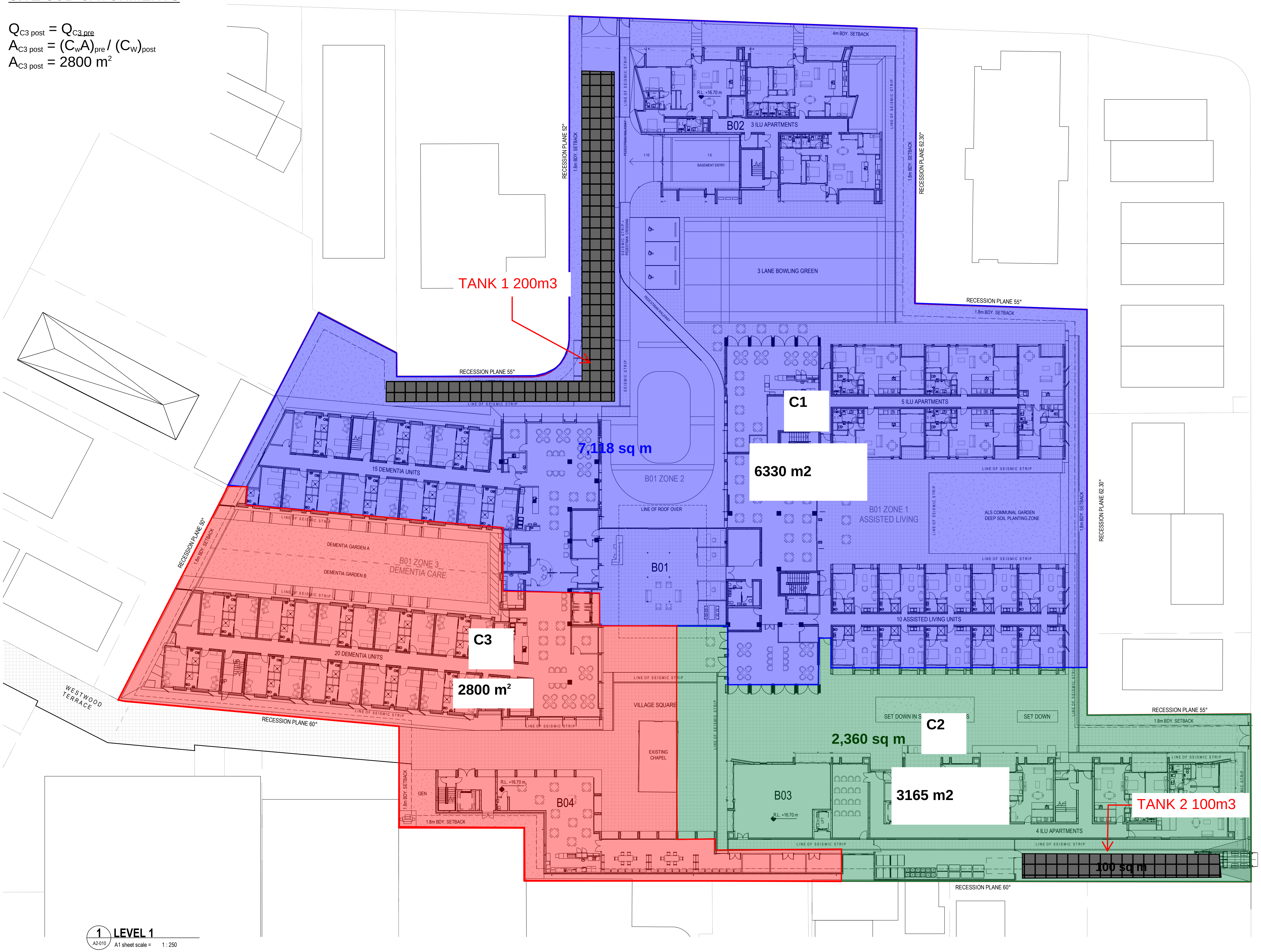
WARREN AND MAHONEY

SITE SUB-CATCHMENTS

$Q_{C3\ post} = Q_{C3\ pre}$

$A_{C3\ post} = (C_w A)_{pre} / (C_W)_{post}$

$A_{C3\ post} = 2800\ m^2$



All dimension to be verified on site before producing shop drawings or commencing any work. Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects Ltd.

Revisions

A 25.10.19 RESOURCE CONSENT DRAFT
B 13.12.19 RESOURCE CONSENT

Client

RYMAN HEALTHCARE

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New Zealand
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Registered Architects and Designers
www.warrenandmahoney.com

Project Title

PARK TERRACE
SITE 01
BISHOPSPARK

Drawing Title

VILLAGE CENTRE B01
FLOOR PLAN LEVEL 1

Drawing Issue

RESOURCE CONSENT

Drawing Details

Scale	1 : 250 @ A1
Date	13.12.19
Job No	8917
Drawn	WM Team
Checked	TDH

Drawing No B01 .A1-020 **Revision** B

WARREN AND MAHONEY

Sensitivity: General

2YR EVENT

10min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
45	38	2	23	15.37	19	3	10	15.4	57	5	-40.0	-89	33	15.4

20min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
48	40	3	32	15.4	20	4	14	15.44	60	7	-41.0	-85	46	15.44

30min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
45	37	4	39	15.42	19	4	17	15.47	56	8	-37.0	-82	56	15.47

60min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
36	30	4	53	15.47	15	5	21	15.51	45	9	-27.0	-75	74	15.51

2hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
27	22	5	68	15.52	11	5	24	15.54	33	10	-17.0	-63	92	15.54

6hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
16	13	6	86	15.57	7	5	21	15.51	20	11	-5.0	-31	107	15.57

12hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
16	13	6	86	15.57	7	5	21	15.51	20	11	-5.0	-31	107	15.57

18hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
9.4	8	5.5	78	15.55	4	3.6	13	15.43	12	9.1	-0.3	-3	91	15.55

24hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
8.2	7	5.3	71	15.53	3	3.2	11	15.41	10	8.5	0.3	4	82	15.53

48hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
5.0	4.2	3.8	43	15.44	2.1	2.1	7	15.37	6.3	5.9	0.9	18	50	15.44

10YR EVENT

Duration	Pre	Post Dev C1				Post Dev C2				Post Summary					
	Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
10min	76	63	3	38	15.42	31	4	17	15.47	94	7	-69.0	-91	55	15.47
20min	81	67	4	54	15.47	33	5	24	15.54	100	9	-72.0	-89	78	15.54
30min	75	62	5	65	15.51	31	6	28	15.59	93	11	-64.0	-85	93	15.59
60min	61	50	6	90	15.58	25	7	37	15.67	75	13	-48.0	-79	127	15.67
2hr	46	38	7	118	15.68	19	8	44	15.74	57	15	-31.0	-67	162	15.74
6hr	27	22	8	157	15.8	11	7	42	15.72	33	15	-12.0	-44	199	15.8
12hr	19	16	8	164	15.82	8	7	33	15.63	24	15	-4.0	-21	197	15.82
18hr	16	13	8	157	15.8	7	6	26	15.57	20	14	-2.0	-13	183	15.8
24hr	13.7	11.4	7.9	147	15.76	5.7	5.2	22	15.52	17.1	13.1	-0.6	-4	169	15.76
48hr	8.5	7	6	89	15.58	3.5	3.4	12	15.42	10.5	9.4	0.9	11	101	15.58

Sensitivity: General

20YR EVENT

10min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
90	74	4	45	15.44	37	5	20	15.5	111	9	-81.0	-90	65	15.5

20min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
95	69	4	55	15.48	34	5	24	15.54	103	9	-86.0	-91	79	15.54

30min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
89	73	5	77	15.54	37	7	34	15.64	110	12	-77.0	-87	111	15.64

60min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
71	59	7	106	15.64	30	8	44	15.74	89	15	-56.0	-79	150	15.74

2hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
53	44	8	139	15.74	22	8	52	15.82	66	16	-37.0	-70	191	15.82

6hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
32	26	9	190	15.9	13	8	52	15.82	39	17	-15.0	-47	242	15.9

12hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
23	19	9	202	15.94	9	7	42	15.72	28	16	-7.0	-30	244	15.94

18hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
19	15	9	195	15.92	8	7	34	15.64	23	16	-3.0	-16	229	15.92

24hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
16.2	13.4	9	184	15.89	6.7	6	29	15.59	20.1	15	-1.2	-7	213	15.89

48hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
10	8.2	6.9	114	15.66	4.1	4	15	15.45	12.3	10.9	0.9	9	129	15.66

50YR EVENT

10min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
109	90	4	55	15.47	45	5	24	15.54	135	9	-100.0	-92	79	15.54

20min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
95	69	4	55	15.48	34	5	24	15.54	103	9	-86.0	-91	79	15.54

30min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
108	89	6	94	15.6	45	7	42	15.72	134	13	-95.0	-88	136	15.72

60min

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
87	72	7	129	15.71	36	9	55	15.85	108	16	-71.0	-82	184	15.85

2hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
65	54	9	172	15.85	27	10	66	15.96	81	19	-46.0	-71	238	15.96

6hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
38	32	11	236	16.05	16	10	68	15.98	48	21	-17.0	-45	304	16.05

12hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
28	23	14	245	16.08	11	9	56	15.86	34	23	-5.0	-18	301	16.08

18hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
23	19	13	242	16.07	9	8	46	15.76	28	21	-2.0	-9	288	16.07

24hr

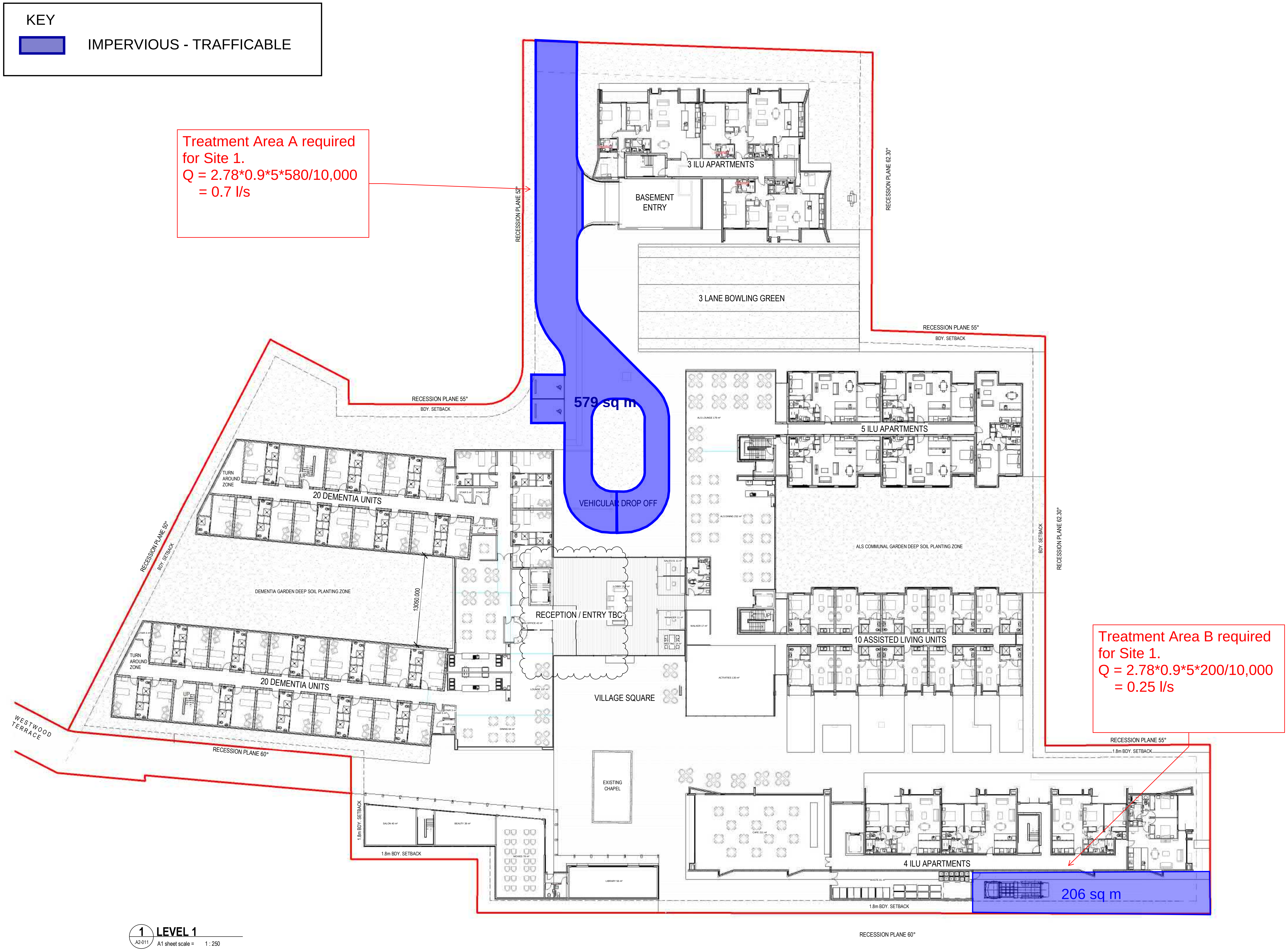
Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
19.6	16.2	11.8	238	16.06	8.1	7.2	39	15.69	24.3	19	-0.6	-3	277	16.06

48hr

Pre	Post Dev C1				Post Dev C2				Post Summary					
Inflow / Outflow (L/s)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In(L/s)	Out(L/s)	Vol (m3)	Elev (m)	In Total (L/s)	Out Total (L/s)	Diff (L/s)	% Diff	Vol Total (m3)	Max. Elev (m)
12	9.9	8.1	154	15.79	5	4.8	19	15.49	14.9	12.9	0.9	7	173	15.79

STORMWATER TREATMENT IN ACCORDANCE WITH COUNCIL'S GLOBAL CONSENT FOR STORMWATER DISCHARGE

SITE 1 BISHOPSPARK



All dimension to be verified on site before producing shop drawings or commencing any work.
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Revisions

A tbc CONCEPT PLUS

Notes

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Registered Architects and Designers
www.warrenandmahoney.com

Project Title

PARK TERRACE
SITE 01
BISHOPSPARK

Drawing Title

VILLAGE CENTRE B01
FLOOR PLAN LEVEL 1

Drawing Issue

WORK IN PROGRESS

Drawing Details

Scale	1 : 250 @ A1
Date	tbc
Job No	8917
Drawn	
Checked	

Drawing No B01 .A1-020 **Revision** A

WARREN AND MAHONEY

Ryman Site 1 (100 Park Terrace and 20 Dorset Street) - Post Development Trafficable Catchment Plan

CSF 0054; StormFilter Flow-Based Sizing - Other

Stormwater360

Project Name	Park Terrace			**Location**	24 Dorset St, Christchurch		
Job #	#5700	**Device #**	30cm SF	**Option #**	Site 1 Area A	**Revision #**	RA
Author	Matthew Murdock			**Date**	12 February 2020		

CALCULATIONS - Please Read Instructions First

1.0 Water Quality Design Storm Peak Runoff Flowrate (RATIONAL METHOD)

1.1 Runoff Co-efficients

Coefficient of Impervious Roof **(Croof)**	0.90	
Coefficient of Impervious Road **(Croad)**	0.90	
Coefficient of Pervious Area **(Cper)**	0.25	

1.2 Catchment Areas

Area Impervious Roof **(Aroof)**	0	m^2
Area Impervious Road **(Aroad)**	580	m^2
Area Pervious Area **(Aper)**	0	m^2
Area Total Catchment **(Acatch)**	580	m^2
Product of Area & Coefficients **(CA)**	522	m^2

1.3 Rainfall Intensity

Water Quality Rainfall Intensity **(iWQ)**	5	mm/hr

1.4 Water Quality Design Storm Peak Runoff Flowrate

Design Water Quality Treatment Flowrate **(Qwq)**	0.725	L/s

2.0 StormFilter Peak Treatment Flowrate

2.1 Preliminary

Cartridge Media **(Media)**	ZPG	
Cartridge Height **(Hcart)**	30	cm
Diameter Disc Orifice **(d)**	22.7	mm
Internal bypass weir height **(Hweir)**	0.40	m
Priming depth **(Hprime)**	0.27	m
Area of a Cartridge **(Acart)**	0.181	m^2

2.2 StormFilter Cartridge Peak Treatment Flowrate

StormFilter cartridge stage-discharge equation	$=0.111d^{2.06}\Delta h^{0.5}$	L/min
Peak treatment flowrate at internal bypass per cartridge **(Qcart)**	0.630	L/s/cart
Number (actual) of StormFilter cartridges required	1.151	cart(s)
Number (rounded) of StormFilter cartridges required	2	cart(s)
Design StormFilter Treatment Flowrate **(QSF)**	1.260	L/s

3.0 Estimate Sediment Mass Loading

3.1 StormFilter Manhole/Vault Dimensions

Length Cartridge Bay **(Lbay)**	1.000	m
Width Cartridge Bay **(Wbay)**	1.030	m
Area Cartridge Bay **(Abay)**	1.030	m^2
Total area of Cartridges **(Acarts)**	0.362	m^2
Area Lower Volume **(Alow)**	0.668	m^2
Volume Lower Volume **(Vlow)**	200	L
Area Upper Volume **(Aupp)**	1.030	m^2
Volume Upper Volume **(Vupp)**	103	L
Live storage volume at internal bypass **(Vstor)**	303	L

3.2 Catchment Sediment Loading

Estimated TSS Concentration Impervious Roof **(TSSroof)**	100	kg/ha/year
Estimated TSS Concentration Impervious Road **(TSSroad)**	300	kg/ha/year
Estimated TSS Concentration Pervious Area **(TSSper)**	200	kg/ha/year
Estimated Total TSS Load **(TSSload)**	17	kg/year

3.3 Treatment Efficiencies

Pre-treatment Efficiency **(EFFpre)**	0	%
System Efficiency **(EFFsys)**	75	%

3.4 Maintenance Requirements

Estimated number of cleans per annum **(nCleans)**	1.23	
Estimated Maintenance Frequency **(Mfreq)**	9.756	months

4.0 Design Summary

Design Water Quality Treatment Flowrate **(Qwq)**	0.725	L/s
StormFilter Design WQ Treatment flowrate **(QSF)**	1.260	L/s
StormFilter Design flowrate at internal bypass **(Qbypass)**	1.454	L/s
Number of StormFilter Cartridges required **(nTOTAL)**	2ea x 30cm ZPG	cart(s)
Treatment Flux per cartridge **(FLUX)**	#N/A	L/s/m²
Restrictor Disc Size **(d)**	22.700	mm
Maximum Hydraulic Effect **(hmax)**	0.540	m
Estimated Maintenance Frequency **(Mfreq)**	10	months

INSTRUCTIONS

1.0. Use the rational method to compute the water quality design storm peak runoff flow rate. Values with blue text require user input. Values in red text are automatically calculated. Values with black text remain constant.

1.1 Input the appropriate runoff co-efficient for each sub-catchment.

Use C=0.9 for imperious roof surfaces runoff co-efficient from NZBC E1/VM1: Table 1

Use C=0.85 for imperious paved surfaces runoff co-efficient from NZBC E1/VM1: Table 1

Use C=0.25 for pervious grassed/landscaped surfaces runoff co-efficient from NZBC E1/VM1: Table 1

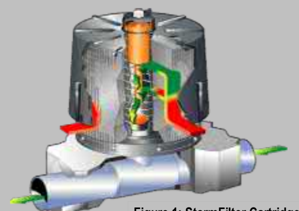


Figure 1: StormFilter Cartridge

1.2 Input the appropriate catchment area for each sub-catchment.

Enter impervious roof surface catchment area

Enter impervious paved surfaces catchment area

Enter pervious grassed/landscaped surfaces catchment area

Total catchment area *i.e. Acatch = Aroof + Aroad + Aper*

Product of catchment areas & runoff co-efficients *i.e. CA = (Croof x Aroof) + (Croad x Aroad) + (Cper x Aper)*

1.3 Input rainfall intensity

The 90th percentile rainfall intensity is recommended to be used for calculating the water quality flow. Where no statistical analysis of historical storm events has been undertaken, we recommend iwq=10mm/hr is used. Alternative values can be checked against HIRDs or intensity tables in the local council Code of Practice.

1.4 Compute the water quality design storm peak runoff flow rate via Rational Method

i.e. Q = f.C.i.A

$$Q = 0.111 d^{2.06} \Delta h^{0.5}$$

[Q]=L min⁻¹; [d]=mm; [h]=m

Figure 2: StormFilter Stage Discharge Equation [1]

2.0. Use the stormfilter stage-discharge equation to calculate the StormFilter peak treatment flowrate.

Enter cartridge filtration media *i.e. Perlite or ZPG*

Enter cartridge height *i.e. 69cm / 46cm / 30cm*

Enter restrictor disc size, refer table below for max disc diameter

Cart Height (cm)	Actual Height (m)	Priming Depth (m)	Max Disc Diam. (mm)	Max. Design Q (L/s)	Filter Bed Area (m^2)	Flow Rate (L/s/m^2)	Bed Depth (mm)	Media Volume (m^3)	Flow Rate (L/s/m^3)
30	0.305	0.27	22.70	0.63	0.460	1.37	175	0.052	12.0
46	0.457	0.43	25.00	0.95	0.689	1.38	175	0.078	12.1
69	0.686	0.66	27.60	1.42	1.034	1.37	175	0.118	12.1

Table 1. StormFilter Cartridge Specifics [2]

Compute the Stormfilter peak treatment flowrate at internal bypass per cartridge via the StormFilter stage-discharge equation

Compute the number of actual StormFilter cartridges required i.e. CEILING(B35,1) = QWQ / QCART

Compute the number (rounded up to whole number) of StormFilter cartridges required

Compute the Stormfilter peak treatment flowrate at internal bypass via the StormFilter stage-discharge equation

3.0 Estimate sediment mass loading (Refer sheet '2. Mass Load Calcs' for more details)

3.1 Use tables 2 & 3 below to fill in StormFilter Dimensions based on number of cartridges as calculated in cl 2.2 above

3.2 Use table 3 below to fill in estimated TSS concentration. For roads with ≥25,000vpd, use minimum 600kg/ha/yr

3.3 Use 0% pretreatment for vaults/manholes with no forebay. Use 10-15% pretreatmnet for vaults/manholes with forebays. Use 50% pretreatment for upstream GPT ie EnviroPod. Use 75%-90% system efficiency

Std Manhole Dimensions	Without forebay				With forebay			
	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts
1050	1.00	0.77	0.77	1	1.00	N/A	N/A	N/A
1200	1.00	1.03	1.03	3	1.00	0.76	0.76	2
1500	1.00	1.67	1.67	4	1.00	1.39	1.39	3
1800	1.00	2.44	2.44	7	1.00	1.83	1.83	5
2050	1.00	3.20	3.20	9	1.00	2.80	2.80	7

Table 2: Standard Stormwater360 Manhole Dimensions

Std Vault Dimensions	Without forebay				With forebay			
	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts
3.4 L x 1.5 W x 1.8 D	2.85	1.50	4.28	11	2.30	1.80	4.14	8
4.5 L x 1.5 W x 1.8 D	3.95	1.50	5.93	17	3.40	1.50	5.10	14
4.2 L x 2.0 W x 1.8 D	3.95	1.95	7.70	23	3.40	2.10	7.14	18
5.6 L x 2.0 W x 1.8 D	5.05	1.95	9.85	31	4.50	2.10	9.45	26
5.6 L x 2.4 W x 1.8 D	5.05	2.40	12.12	39	4.50	2.10	9.45	27
6.2 L x 2.4 W x 1.8 D	5.60	2.40	13.44	44	4.50	2.40	10.80	33

Table 3: Standard Stormwater360 Vault Dimensions

Land Use	TSS (kg/ha/yr)
Road	281 - 723
Commercial	242 - 1369
Residential (low)	60 - 340
Residential (high)	97 - 547
Terraced	133 - 755
Bush	26 - 146
Grass	80 - 588
Roof	50-110 (1)
Pasture	103 - 583

Table 4: Suggested TSS loads [3]

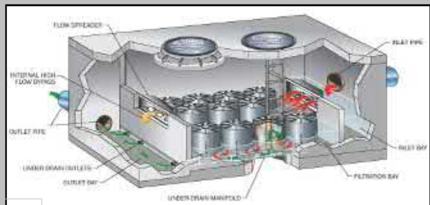


Figure 3: StormFilter Vault Cutaway

References

1. Derived from Stormwater Management Inc., Technical Publication PD-04-002.0
2. Contech Stormwater Solutions, StormFilter Product Design Manual.
3. Table 4-4, Technical Publication 10, 2nd Edition, May 2003, Auckland Regional Council

CSF 0054; StormFilter Flow-Based Sizing - Other

Stormwater360

Project Name	Park Terrace			**Location**	24 Dorset St, Christchurch		
Job #	#5700	**Device #**	30cm SF	**Option #**	Site 1 Area B	**Revision #**	RA
Author	Matthew Murdock			**Date**	12 February 2020		

CALCULATIONS - Please Read Instructions First

1.0 Water Quality Design Storm Peak Runoff Flowrate (RATIONAL METHOD)

1.1 Runoff Co-efficients

Coefficient of Impervious Roof **(Croof)**	0.90	
Coefficient of Impervious Road **(Croad)**	0.90	
Coefficient of Pervious Area **(Cper)**	0.25	

1.2 Catchment Areas

Area Impervious Roof **(Aroof)**	0	m^2
Area Impervious Road **(Aroad)**	200	m^2
Area Pervious Area **(Aper)**	0	m^2
Area Total Catchment **(Acatch)**	200	m^2
Product of Area & Coefficients **(CA)**	180	m^2

1.3 Rainfall Intensity

Water Quality Rainfall Intensity **(iWQ)**	5	mm/hr

1.4 Water Quality Design Storm Peak Runoff Flowrate

Design Water Quality Treatment Flowrate **(Qwq)**	0.250	L/s

2.0 StormFilter Peak Treatment Flowrate

2.1 Preliminary

Cartridge Media **(Media)**	ZPG	
Cartridge Height **(Hcart)**	30	cm
Diameter Disc Orifice **(d)**	22.7	mm
Internal bypass weir height **(Hweir)**	0.40	m
Priming depth **(Hprime)**	0.27	m
Area of a Cartridge **(Acart)**	0.181	m^2

2.2 StormFilter Cartridge Peak Treatment Flowrate

StormFilter cartridge stage-discharge equation	$=0.111d^{2.06}\Delta h^{0.5}$	L/min
Peak treatment flowrate at internal bypass per cartridge **(Qcart)**	0.630	L/s/cart
Number (actual) of StormFilter cartridges required	0.397	cart(s)
Number (rounded) of StormFilter cartridges required	1	cart(s)
Design StormFilter Treatment Flowrate **(QSF)**	0.630	L/s

3.0 Estimate Sediment Mass Loading

3.1 StormFilter Manhole/Vault Dimensions

Length Cartridge Bay **(Lbay)**	1.000	m
Width Cartridge Bay **(Wbay)**	0.770	m
Area Cartridge Bay **(Abay)**	0.770	m^2
Total area of Cartridges **(Acarts)**	0.181	m^2
Area Lower Volume **(Alow)**	0.589	m^2
Volume Lower Volume **(Vlow)**	177	L
Area Upper Volume **(Aupp)**	0.770	m^2
Volume Upper Volume **(Vupp)**	77	L
Live storage volume at internal bypass **(Vstor)**	254	L

3.2 Catchment Sediment Loading

Estimated TSS Concentration Impervious Roof **(TSSroof)**	100	kg/ha/year
Estimated TSS Concentration Impervious Road **(TSSroad)**	300	kg/ha/year
Estimated TSS Concentration Pervious Area **(TSSper)**	200	kg/ha/year
Estimated Total TSS Load **(TSSload)**	6	kg/year

3.3 Treatment Efficiencies

Pre-treatment Efficiency **(EFFpre)**	0	%
System Efficiency **(EFFsys)**	75	%

3.4 Maintenance Requirements

Estimated number of cleans per annum **(nCleans)**	0.85	
Estimated Maintenance Frequency **(Mfreq)**	14.118	months

4.0 Design Summary

Design Water Quality Treatment Flowrate **(Qwq)**	0.250	L/s
StormFilter Design WQ Treatment flowrate **(QSF)**	0.630	L/s
StormFilter Design flowrate at internal bypass **(Qbypass)**	0.727	L/s
Number of StormFilter Cartridges required **(nTOTAL)**	1ea x 30cm ZPG	cart(s)
Treatment Flux per cartridge **(FLUX)**	#N/A	L/s/m²
Restrictor Disc Size **(d)**	22.700	mm
Maximum Hydraulic Effect **(hmax)**	0.540	m
Estimated Maintenance Frequency **(Mfreq)**	14	months

INSTRUCTIONS

1.0. Use the rational method to compute the water quality design storm peak runoff flow rate. Values with blue text require user input. Values in red text are automatically calculated. Values with black text remain constant.

1.1 Input the appropriate runoff co-efficient for each sub-catchment.

Use C=0.9 for imperious roof surfaces runoff co-efficient from NZBC E1/VM1: Table 1

Use C=0.85 for imperious paved surfaces runoff co-efficient from NZBC E1/VM1: Table 1

Use C=0.25 for pervious grassed/landscaped surfaces runoff co-efficient from NZBC E1/VM1: Table 1

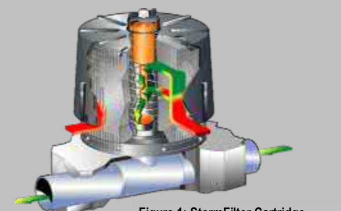


Figure 1: StormFilter Cartridge

1.2 Input the appropriate catchment area for each sub-catchment.

Enter impervious roof surface catchment area

Enter impervious paved surfaces catchment area

Enter pervious grassed/landscaped surfaces catchment area

Total catchment area *i.e. Acatch = Aroof + Aroad + Aper*

Product of catchment areas & runoff co-efficients *i.e. CA = (Croof x Aroof) + (Croad x Aroad) + (Cper x Aper)*

1.3 Input rainfall intensity

The 90th percentile rainfall intensity is recommended to be used for calculating the water quality flow. Where no statistical analysis of historical storm events has been undertaken, we recommned Iwq=10mm/hr is used. Alternative values can be checked against HIRDs or intensity tables in the local council Code of Practice.

1.4 Compute the water quality design storm peak runoff flow rate via Rational Method

i.e. Q = f.C.i.A

$$Q = 0.111 d^{2.06} \Delta h^{0.5}$$

[Q]=L min⁻¹; [d]=mm; [h]=m

Figure 2: StormFilter Stage Discharge Equation [1]

2.0. Use the stormfilter stage-discharge equation to calculate the StormFilter peak treatment flowrate.

Enter cartridge filtration media *i.e. Perlite or ZPG*

Enter cartridge height *i.e. 69cm / 46cm / 30cm*

Enter restrictor disc size, refer table below for max disc diameter

Cart Height (cm)	Actual Height (m)	Priming Depth (m)	Max Disc Diam. (mm)	Max. Design Q (L/s)	Filter Bed Area (m^2)	Flow Rate (L/s/m^2)	Bed Depth (mm)	Media Volume (m^3)	Flow Rate (L/s/m^3)
30	0.305	0.27	22.70	0.63	0.460	1.37	175	0.052	12.0
46	0.457	0.43	25.00	0.95	0.689	1.38	175	0.078	12.1
69	0.686	0.66	27.60	1.42	1.034	1.37	175	0.118	12.1

Table 1. StormFilter Cartridge Specifics [2]

Compute the Stormfilter peak treatment flowrate at internal bypass per cartridge via the StormFilter stage-discharge equation

Compute the number of actual StormFilter cartridges required i.e. CEILING(B35,1) = QWQ / QCART

Compute the number (rounded up to whole number) of StormFilter cartridges required

Compute the Stormfilter peak treatment flowrate at internal bypass via the StormFilter stage-discharge equation

3.0 Estimate sediment mass loading (Refer sheet '2. Mass Load Calcs' for more details)

3.1 Use tables 2 & 3 below to fill in StormFilter Dimensions based on number of cartridges as calculated in cl 2.2 above

3.2 Use table 3 below to fill in estimated TSS concentration. For roads with ≥25,000vpd, use minimum 600kg/ha/yr

3.3 Use 0% pretreatment for vaults/manholes with no forebay. Use 10-15% pretreatmnet for vaults/manholes with forebays. Use 50% pretreatment for upstream GPT ie EnviroPod. Use 75%-90% system efficiency

Std Manhole Dimensions	Without forebay				With forebay			
	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts
1050	1.00	0.77	0.77	1	1.00	N/A	N/A	N/A
1200	1.00	1.03	1.03	3	1.00	0.76	0.76	2
1500	1.00	1.67	1.67	4	1.00	1.39	1.39	3
1800	1.00	2.44	2.44	7	1.00	1.83	1.83	5
2050	1.00	3.20	3.20	9	1.00	2.80	2.80	7

Table 2: Standard Stormwater360 Manhole Dimensions

Std Vault Dimensions	Without forebay				With forebay			
	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts
3.4 L x 1.5 W x 1.8 D	2.85	1.50	4.28	11	2.30	1.80	4.14	8
4.5 L x 1.5 W x 1.8 D	3.95	1.50	5.93	17	3.40	1.50	5.10	14
4.2 L x 2.0 W x 1.8 D	3.95	1.95	7.70	23	3.40	2.10	7.14	18
5.6 L x 2.0 W x 1.8 D	5.05	1.95	9.85	31	4.50	2.10	9.45	26
5.6 L x 2.4 W x 1.8 D	5.05	2.40	12.12	39	4.50	2.10	9.45	27
6.2 L x 2.4 W x 1.8 D	5.60	2.40	13.44	44	4.50	2.40	10.80	33

Table 3: Standard Stormwater360 Vault Dimensions

Land Use	TSS (kg/ha/yr)
Road	281 - 723
Commercial	242 - 1369
Residential (low)	60 - 340
Residential (high)	97 - 547
Terraced	133 - 755
Bush	26 - 146
Grass	80 - 588
Roof	50-110 (1)
Pasture	103 - 583

Table 4: Suggested TSS loads [3]

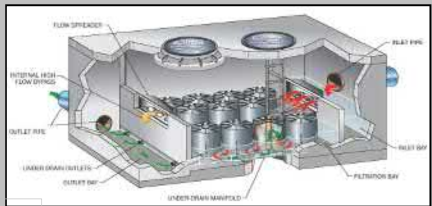


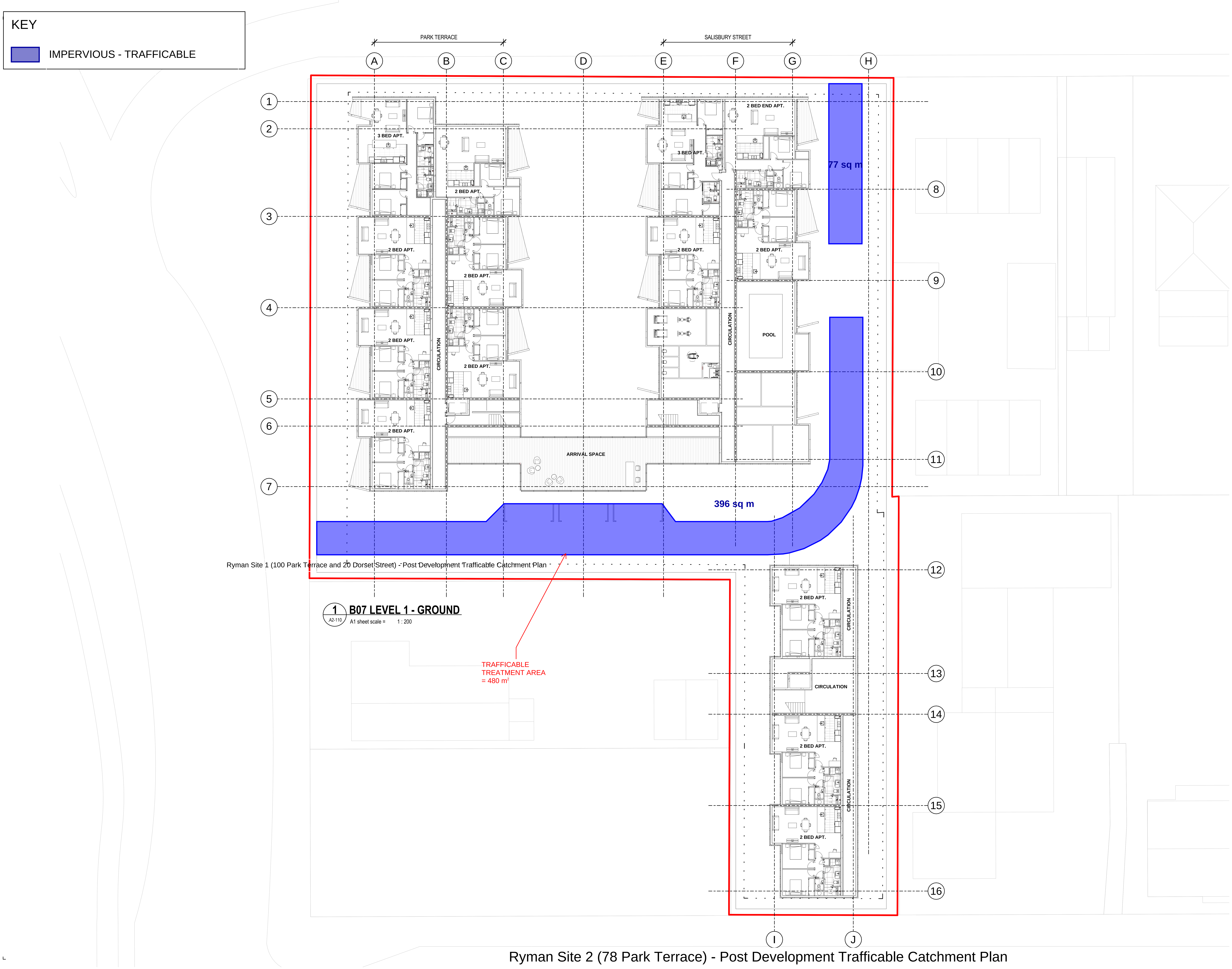
Figure 3: StormFilter Vault Cutaway

References

1. Derived from Stormwater Management Inc., Technical Publication PD-04-002.0
2. Contech Stormwater Solutions, StormFilter Product Design Manual.
3. Table 4-4, Technical Publication 10, 2nd Edition, May 2003, Auckland Regional Council

STORMWATER TREATMENT IN ACCORDANCE WITH COUNCIL'S GLOBAL CONSENT FOR STORMWATER DISCHARGE

SITE 2 PETERBOROUGH STREET



Ryman Site 2 (78 Park Terrace) - Post Development Trafficable Catchment Plan

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Revisions

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Project Title
PARK TERRACE
SITE 02
PETERBOROUGH

Drawing Title
B07
B07 FLOOR PLAN
LEVEL 1 GROUND

Drawing Issue

Drawing Details

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Checked	WAM

Drawing No B07 .A1-020
Revision

WARREN AND MAHONEY

CSF 0054; StormFilter Flow-Based Sizing - Other

Project Name	Park Terrace			**Location**	24 Dorset St, Christchurch		
Job #	#5700	**Device #**	30cm SF	**Option #**	Site 2 (480m2)	**Revision #**	RA
Author	Grant Sinclair			**Date**	11 October 2019		

CALCULATIONS - Please Read Instructions First

1.0 Water Quality Design Storm Peak Runoff Flowrate (RATIONAL METHOD)

1.1 Runoff Co-efficients		
Coefficient of Impervious Roof **(Croof)**	0.90	
Coefficient of Impervious Road **(Croad)**	0.90	
Coefficient of Pervious Area **(Cper)**	0.25	
1.2 Catchment Areas		
Area Impervious Roof **(Aroof)**	0	m^2
Area Impervious Road **(Aroad)**	480	m^2
Area Pervious Area **(Aper)**	0	m^2
Area Total Catchment **(Acatch)**	480	m^2
Product of Area & Coefficients **(CA)**	432	m^2
1.3 Rainfall Intensity		
Water Quality Rainfall Intensity **(iWQ)**	5	mm/hr
1.4 Water Quality Design Storm Peak Runoff Flowrate		
Design Water Quality Treatment Flowrate **(Qwq)**	0.600	L/s

2.0 StormFilter Peak Treatment Flowrate

2.1 Preliminary		
Cartridge Media **(Media)**	ZPG	
Cartridge Height **(Hcart)**	30	cm
Diameter Disc Orifice **(d)**	22.7	mm
Internal bypass weir height **(Hweir)**	0.40	m
Priming depth **(Hprime)**	0.27	m
Area of a Cartridge **(Acart)**	0.181	m^2
2.2 StormFilter Cartridge Peak Treatment Flowrate		
StormFilter cartridge stage-discharge equation	$=0.111d^{2.06}\Delta h^{0.5}$	L/min
Peak treatment flowrate at internal bypass per cartridge **(Qcart)**	0.630	L/s/cart
Number (actual) of StormFilter cartridges required	2.000	cart(s)
Number (rounded) of StormFilter cartridges required	2	cart(s)
Design StormFilter Treatment Flowrate **(QSF)**	1.260	L/s

3.0 Estimate Sediment Mass Loading

3.1 StormFilter Manhole/Vault Dimensions		
Length Cartridge Bay **(Lbay)**	1.000	m
Width Cartridge Bay **(Wbay)**	1.030	m
Area Cartridge Bay **(Abay)**	1.030	m^2
Total area of Cartridges **(Acarts)**	0.362	m^2
Area Lower Volume **(Alow)**	0.668	m^2
Volume Lower Volume **(Vlow)**	200	L
Area Upper Volume **(Aupp)**	1.030	m^2
Volume Upper Volume **(Vupp)**	103	L
Live storage volume at internal bypass **(Vstor)**	303	L
3.2 Catchment Sediment Loading		
Estimated TSS Concentration Impervious Roof **(TSSroof)**	100	kg/ha/year
Estimated TSS Concentration Impervious Road **(TSSroad)**	300	kg/ha/year
Estimated TSS Concentration Pervious Area **(TSSper)**	200	kg/ha/year
Estimated Total TSS Load **(TSSload)**	14	kg/year
3.3 Treatment Efficiencies		
Pre-treatment Efficiency **(EFFpre)**	0	%
System Efficiency **(EFFsys)**	75	%
3.4 Maintenance Requirements		
Estimated number of cleans per annum **(nCleans)**	1.02	
Estimated Maintenance Frequency **(Mfreq)**	11.765	months

4.0 Design Summary

Design Water Quality Treatment Flowrate **(Qwq)**	0.600	L/s
StormFilter Design WQ Treatment flowrate **(QSF)**	1.260	L/s
StormFilter Design flowrate at internal bypass **(Qbypass)**	1.454	L/s
Number of StormFilter Cartridges required **(nTOTAL)**	2ea x 30cm ZPG cart(s)	
Treatment Flux per cartridge **(FLUX)**	#N/A	L/s/m²
Restrictor Disc Size **(d)**	22.700	mm
Maximum Hydraulic Effect **(hmax)**	0.540	m
Estimated Maintenance Frequency **(Mfreq)**	12	months

INSTRUCTIONS

1.0. Use the rational method to compute the water quality design storm peak runoff flow rate. Values with blue text require user input. Values in red text are automatically calculated. Values with black text remain constant.

1.1 Input the appropriate runoff co-efficient for each sub-catchment.

Use C=0.9 for impervious roof surfaces runoff co-efficient from NZBC E1/VM1: Table 1

Use C=0.85 for impervious paved surfaces runoff co-efficient from NZBC E1/VM1: Table 1

Use C=0.25 for pervious grassed/landscaped surfaces runoff co-efficient from NZBC E1/VM1: Table 1

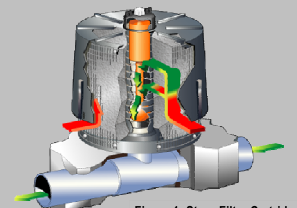

Figure 1: StormFilter Cartridge

1.2 Input the appropriate catchment area for each sub-catchment.

Enter impervious roof surface catchment area

Enter impervious paved surfaces catchment area

Enter pervious grassed/landscaped surfaces catchment area

Total catchment area *i.e. Acatch = Aroof + Aroad + Aper*

Product of catchment areas & runoff co-efficients *i.e. CA = (Croof x Aroof) + (Croad x Aroad) + (Cper x Aper)*

1.3 Input rainfall intensity

The 90th percentile rainfall intensity is recommended to be used for calculating the water quality flow. Where no statistical analysis of historical storm events has been undertaken, we recommned Iwq=10mm/hr is used. Alternative values can be checked against HiRDs or intensity tables in the local council Code of Practice.

1.4 Compute the water quality design storm peak runoff flow rate via Rational Method

i.e. Q = f.C.i.A

$$Q = 0.111 d^{2.06} \Delta h^{0.5}$$

[Q] L min⁻¹; [d] mm; [h] m

Figure 2: StormFilter Stage Discharge Equation [1]

2.0. Use the stormfilter stage-discharge equation to calculate the StormFilter peak treatment flowrate.

Enter cartridge filtration media *i.e. Perlite or ZPG*

Enter cartridge height *i.e. 69cm / 46cm / 30cm*

Enter restrictor disc size, refer table below for max disc diameter

Cart Height (cm)	Actual Height (m)	Priming Depth (m)	Max Disc Diam. (mm)	Max. Design Q (L/s)	Filter Bed Area (m^2)	Flow Rate (L/s/m^2)	Bed Depth (mm)	Media Volume (m^3)	Flow Rate (L/s/m^3)
30	0.305	0.27	22.70	0.63	0.460	1.37	175	0.052	12.0
46	0.457	0.43	25.00	0.95	0.689	1.38	175	0.078	12.1
69	0.686	0.66	27.60	1.42	1.034	1.37	175	0.118	12.1

Table 1. StormFilter Cartridge Specifics [2]

Compute the Stormfilter peak treatment flowrate at internal bypass per cartridge via the StormFilter stage-discharge equation

Compute the number of actual StormFilter cartridges required i.e. CEILING(B35,1) = QWQ / QCART

Compute the number (rounded up to whole number) of StormFilter cartridges required

Compute the Stormfilter peak treatment flowrate at internal bypass via the StormFilter stage-discharge equation

3.0 Estimate sediment mass loading (Refer sheet '2. Mass Load Calcs' for more details)

3.1 Use tables 2 & 3 below to fill in StormFilter Dimensions based on number of cartridges as calculated in cl 2.2 above

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1500	1.00	1.67	1.67	4	1.00	1.39	1.39	3
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2050	1.00	3.20	3.20	9	1.00	2.80	2.80	7

Table 2: Standard Stormwater360 Manhole Dimensions

Std Vault Dimensions	Without forebay				With forebay			
	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts	Cart Bay Length (m)	Cart Bay Width (m)	Cart Bay Area (m^2)	Max Number Carts
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Table 3: Standard Stormwater360 Vault Dimensions

Land Use	TSS (kg/ha/yr)
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Bush	26 - 146
Grass	80 - 588
Roof	50-110 *(1)*
Pasture	103 - 583

Table 4: Suggested TSS loads [3]

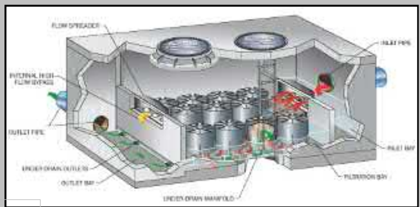


Figure 3: StormFilter Vault Cutaway

References

1. Derived from Stormwater Management Inc., Technical Publication PD-04-002.0

2. Contech Stormwater Solutions, StormFilter Product Design Manual.

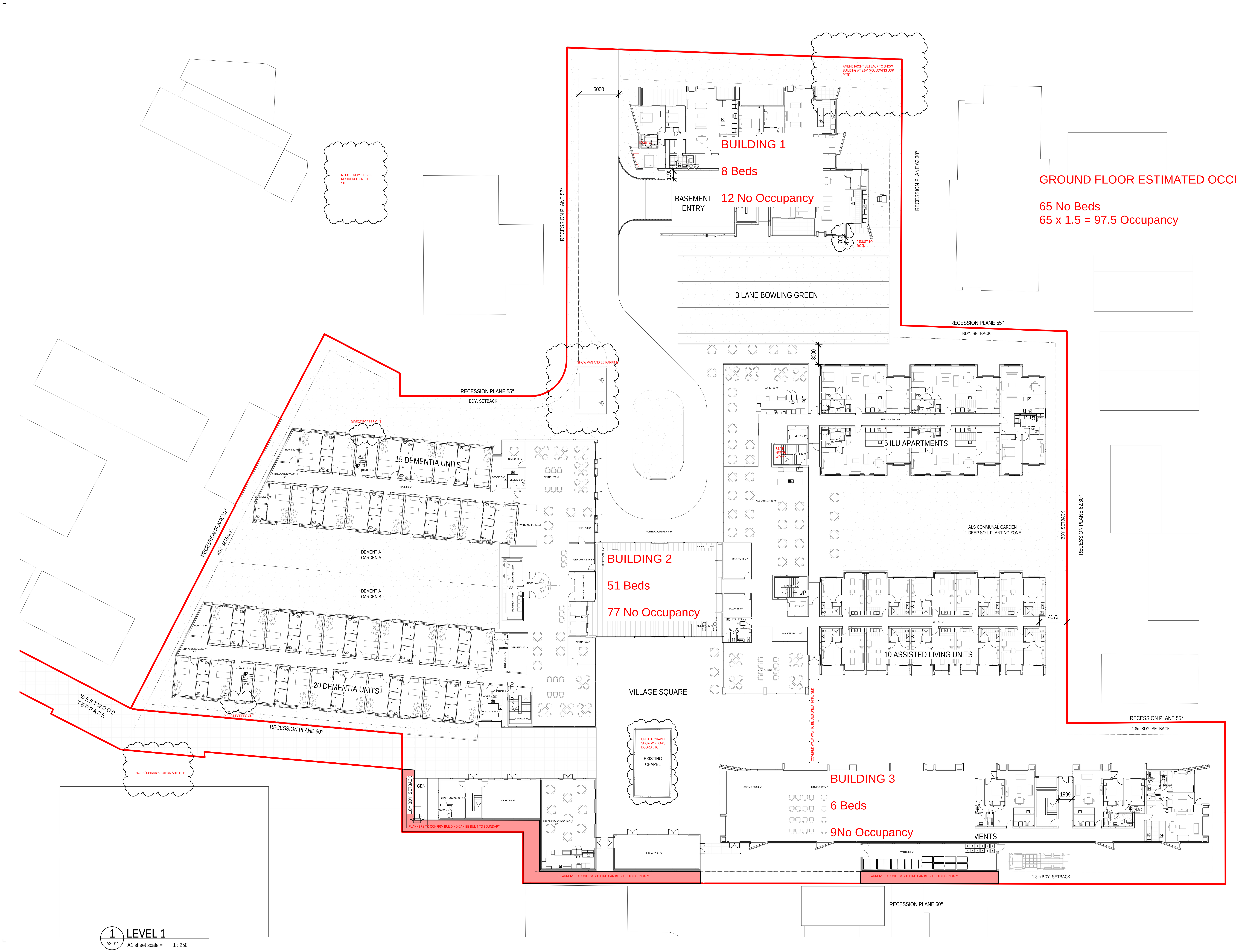
3. Table 4-4, Technical Publication 10, 2nd Edition, May 2003, Auckland Regional Council

D

Appendix D – Wastewater Calculations

WASTEWATER PEAK FLOW CALCULATION IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL INFRASTRUCTURE DESIGN GUIDE

SITE 1 BISHOPSPARK



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Project Title

PARK TERRACE
SITE 01
BISHOPSPARK

Drawing Title

VILLAGE CENTRE B01
FLOOR PLAN LEVEL 1

Drawing Issue

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Drawing Details

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Job No	8917
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Revision A

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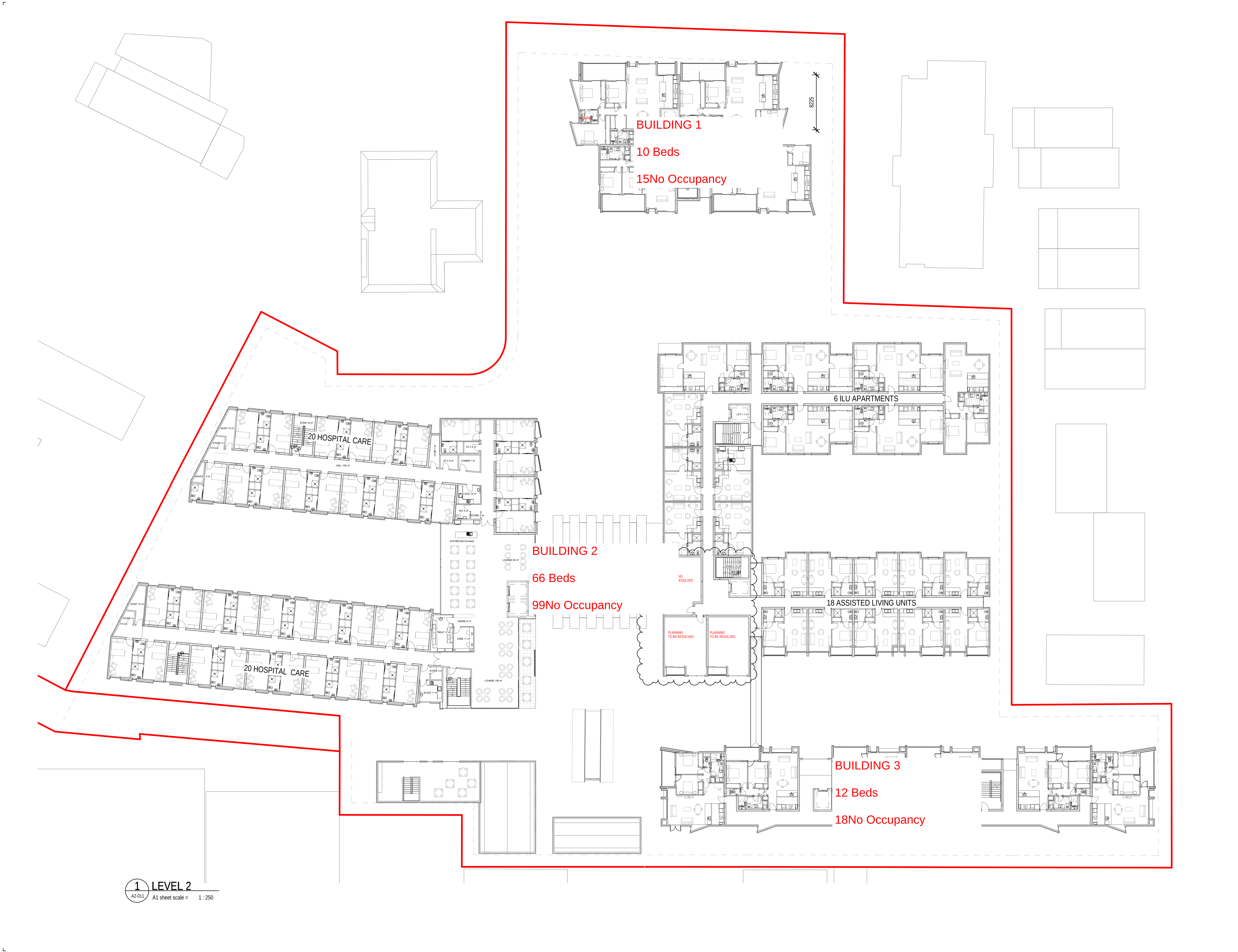

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SITE 01
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VILLAGE CENTRE B01
FLOOR PLAN LEVEL 2

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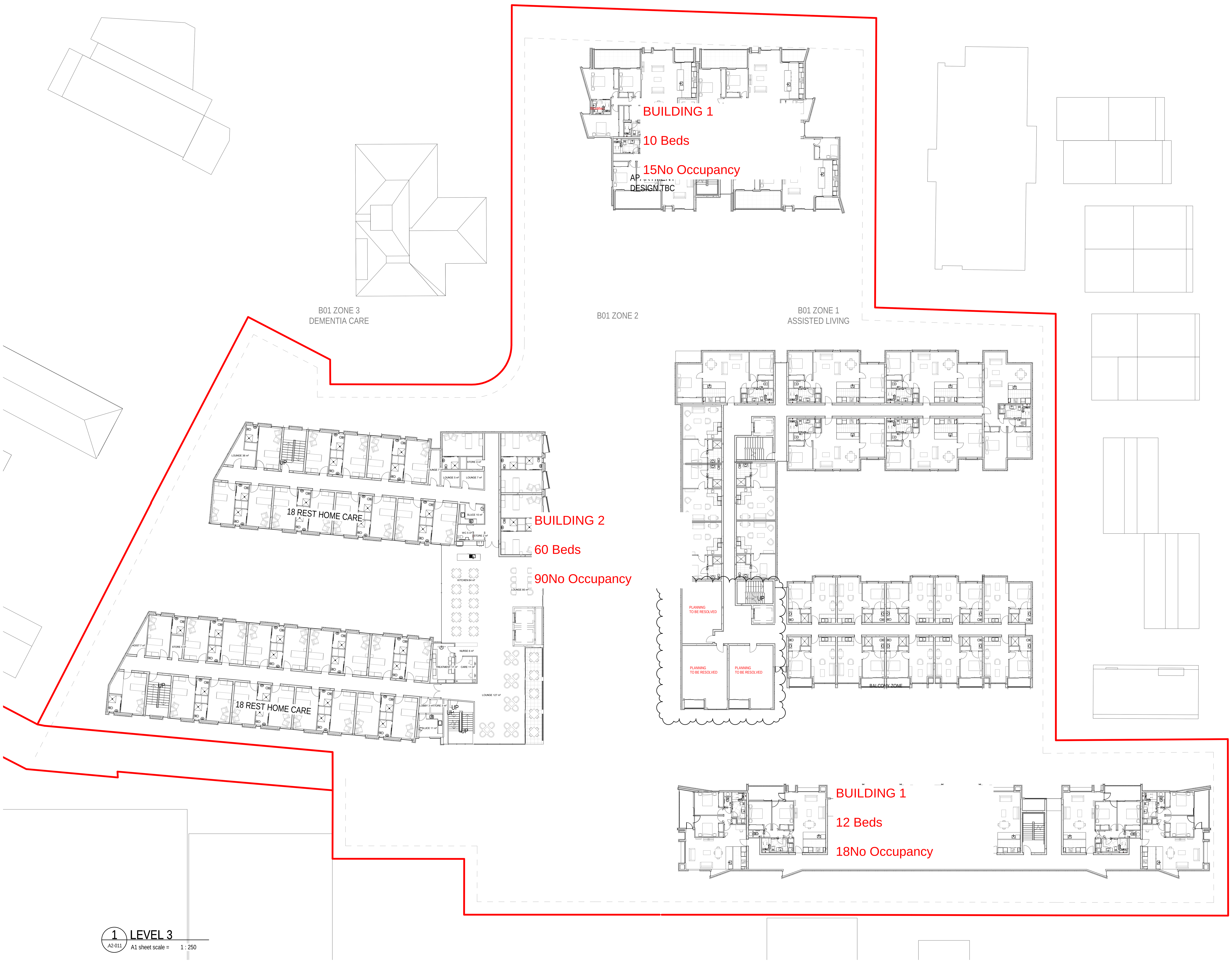

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FLOOR PLAN LEVEL 3

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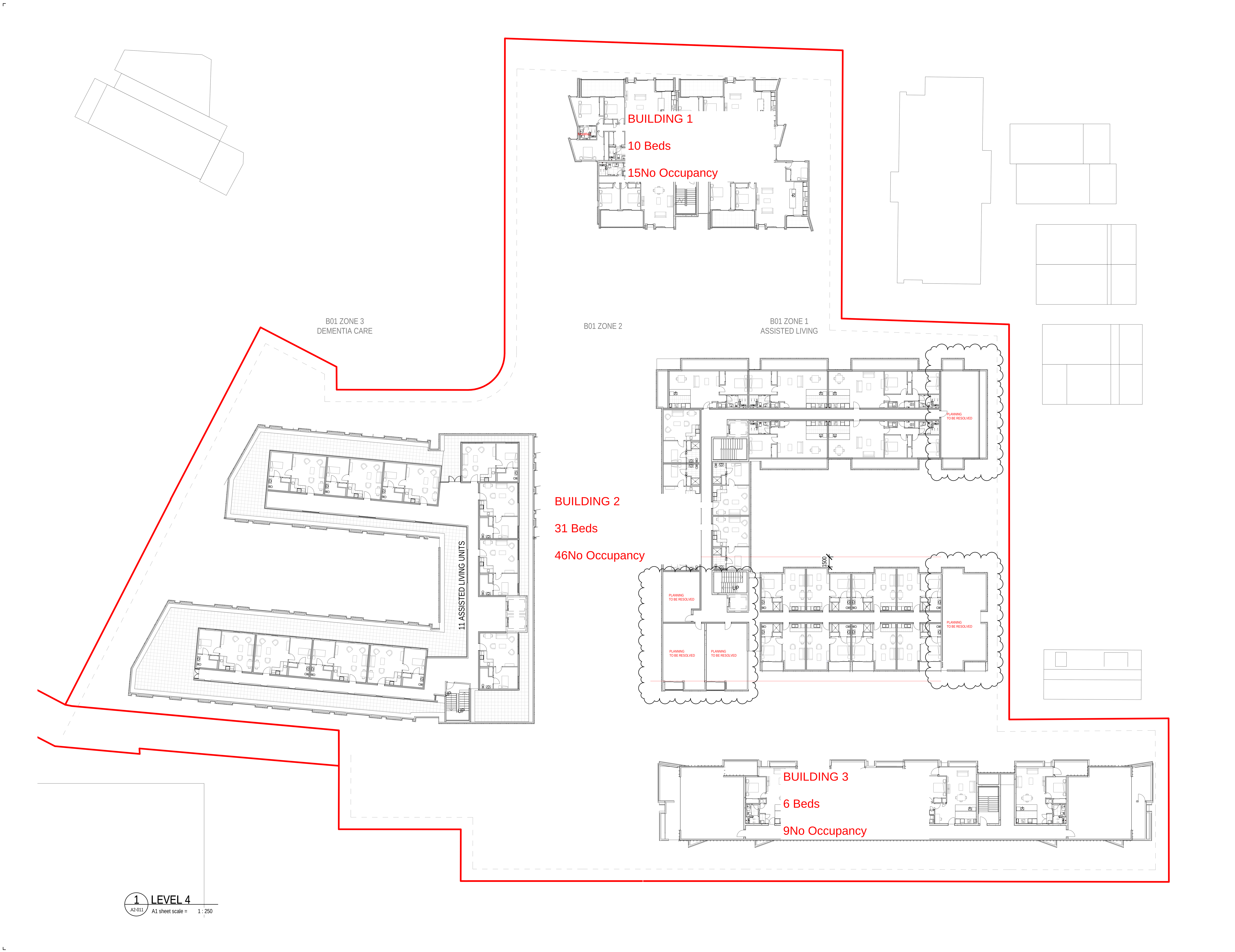

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SITE 01
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B01 .A1-050	A

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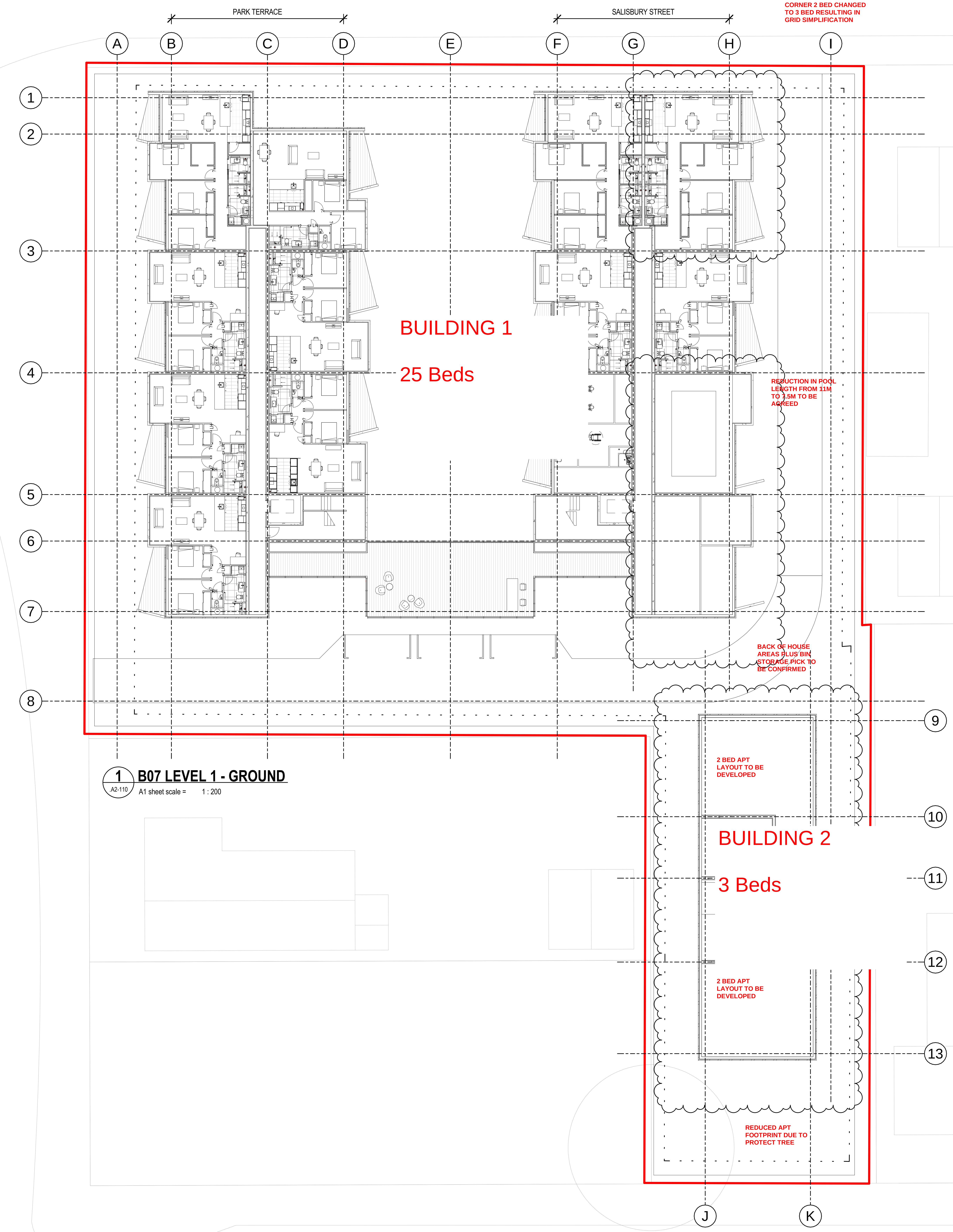
Building	Apartments	Occupancy Rate	Population Equivalent
1	38	1.5	57
2	208	1.5	312
3	36	1.5	54
		Total	423

Building	ADWF (L/s)	PDWF (L/s)	PWWF (L/s)
1	0.15	0.41	0.73
2	0.79	2.22	3.97
3	0.14	0.39	0.69
Total	1.08	3.02	5.39

WASTEWATER PEAK FLOW CALCULATION IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL INFRASTRUCTURE DESIGN GUIDE

SITE 2 PETERBOROUGH STREET



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Revisions

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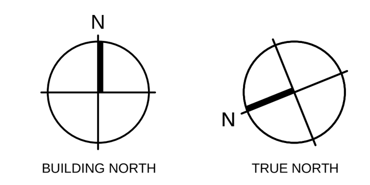

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LEVEL 1 GROUND

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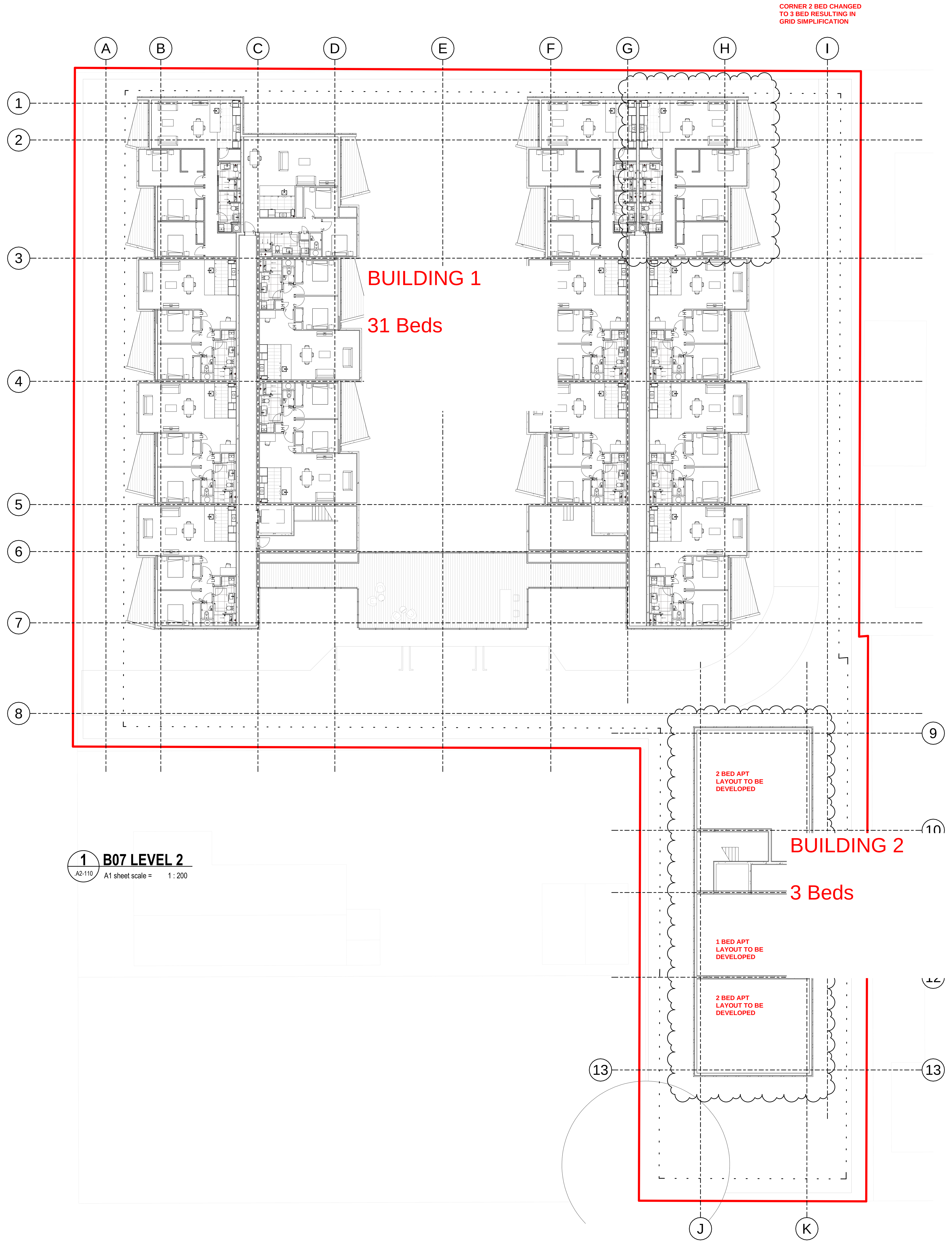

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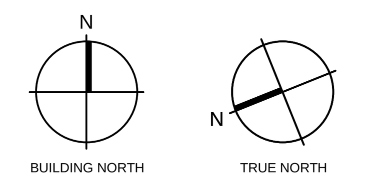

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B07 .A1-030 A

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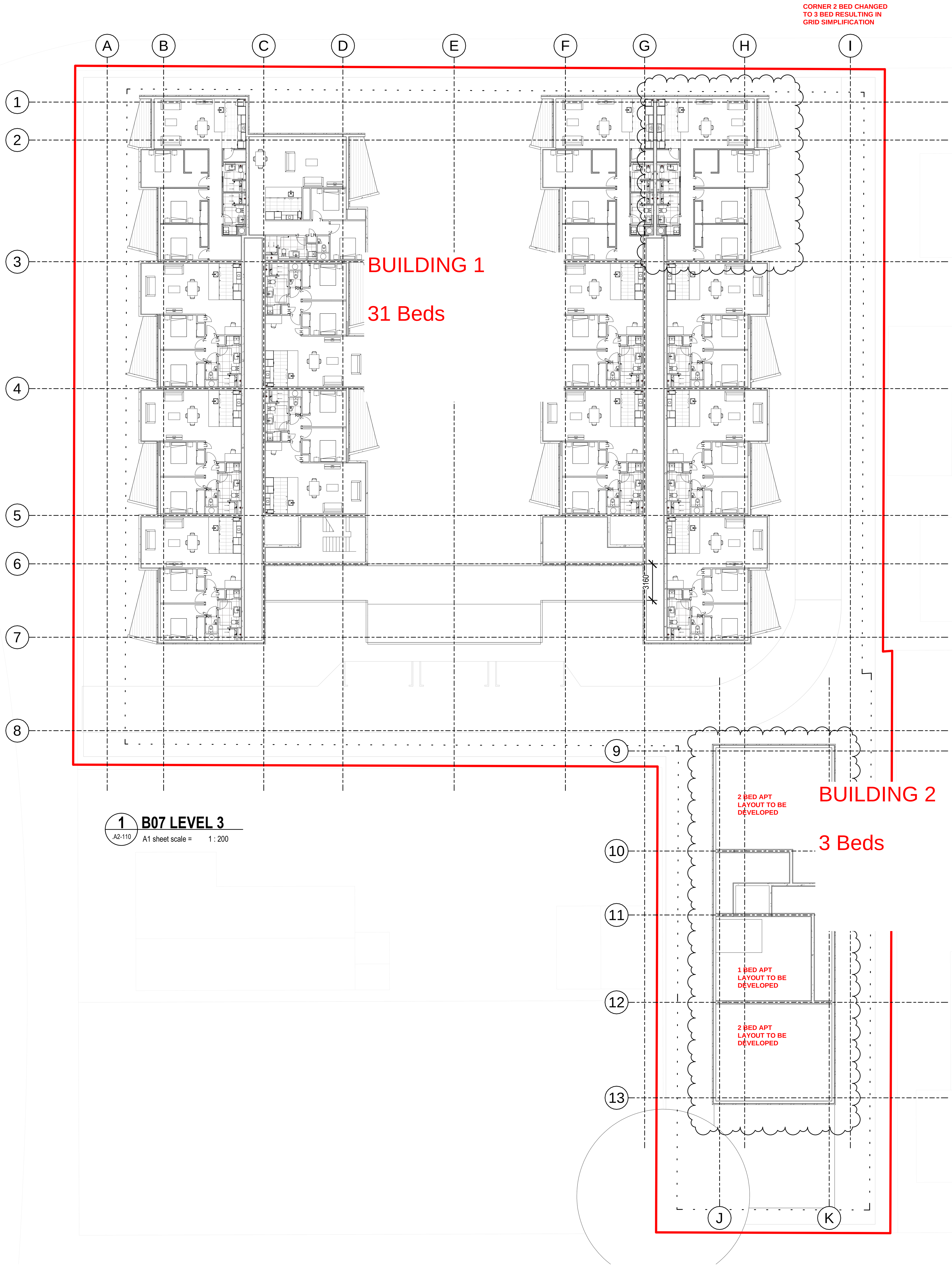

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SITE 02
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B07
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LEVEL 3

Drawing Issue

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Drawing No B07 .A1-040

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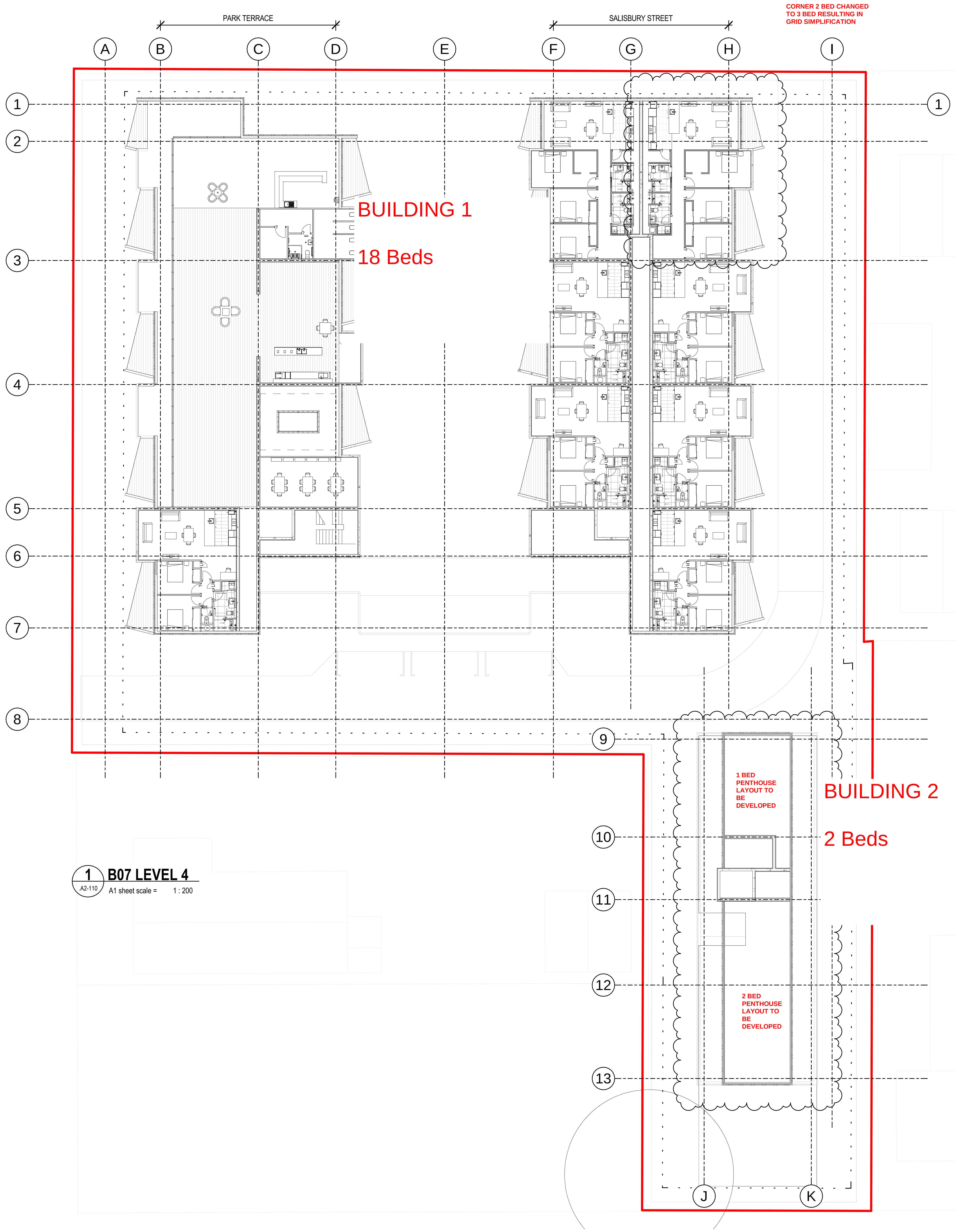

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PARK TERRACE
SITE 02
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B07
B07 FLOOR PLAN
LEVEL 4

Drawing Issue

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Checked	WAM

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Revision A

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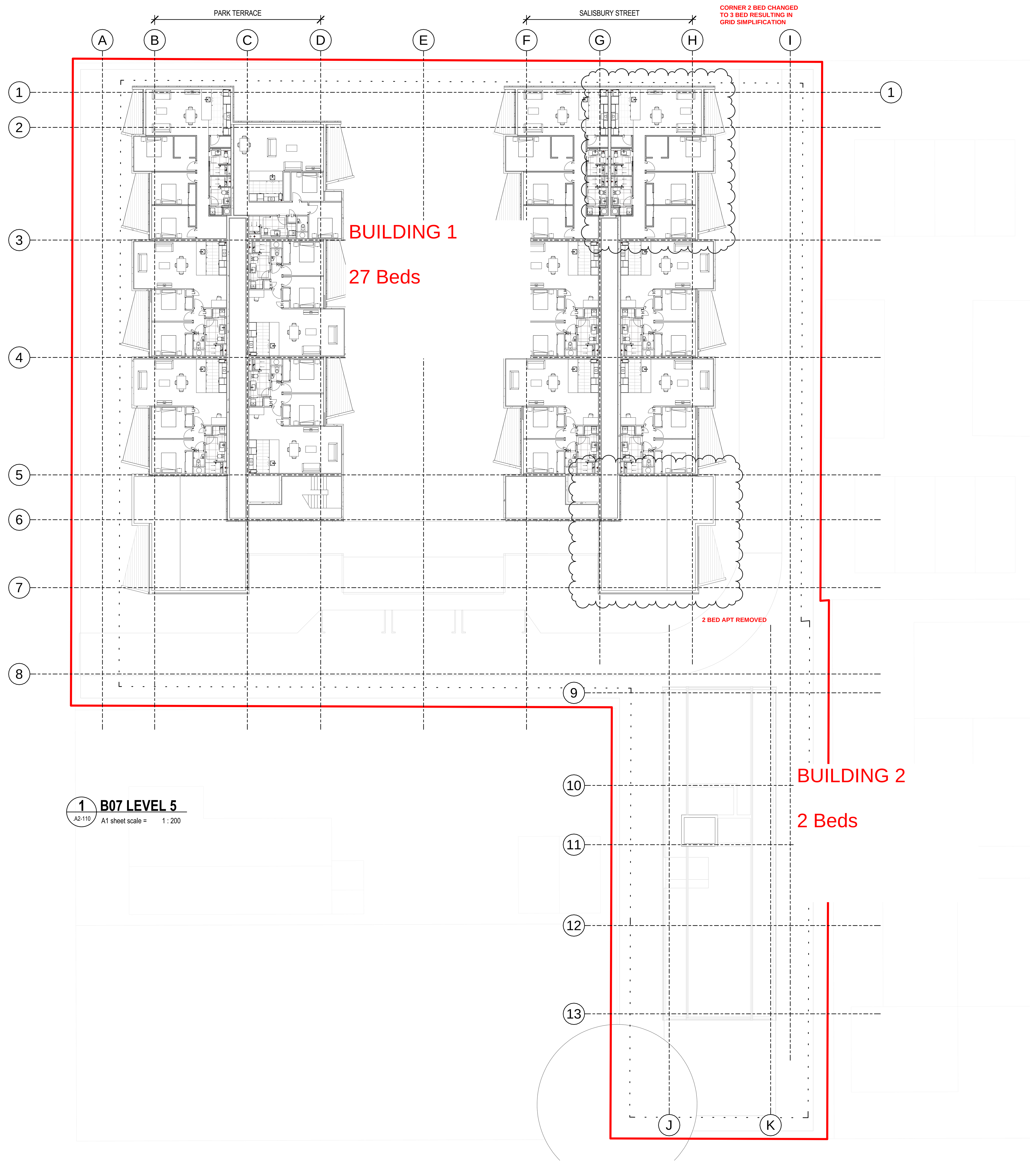

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B07 FLOOR PLAN
LEVEL 5

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Revision A

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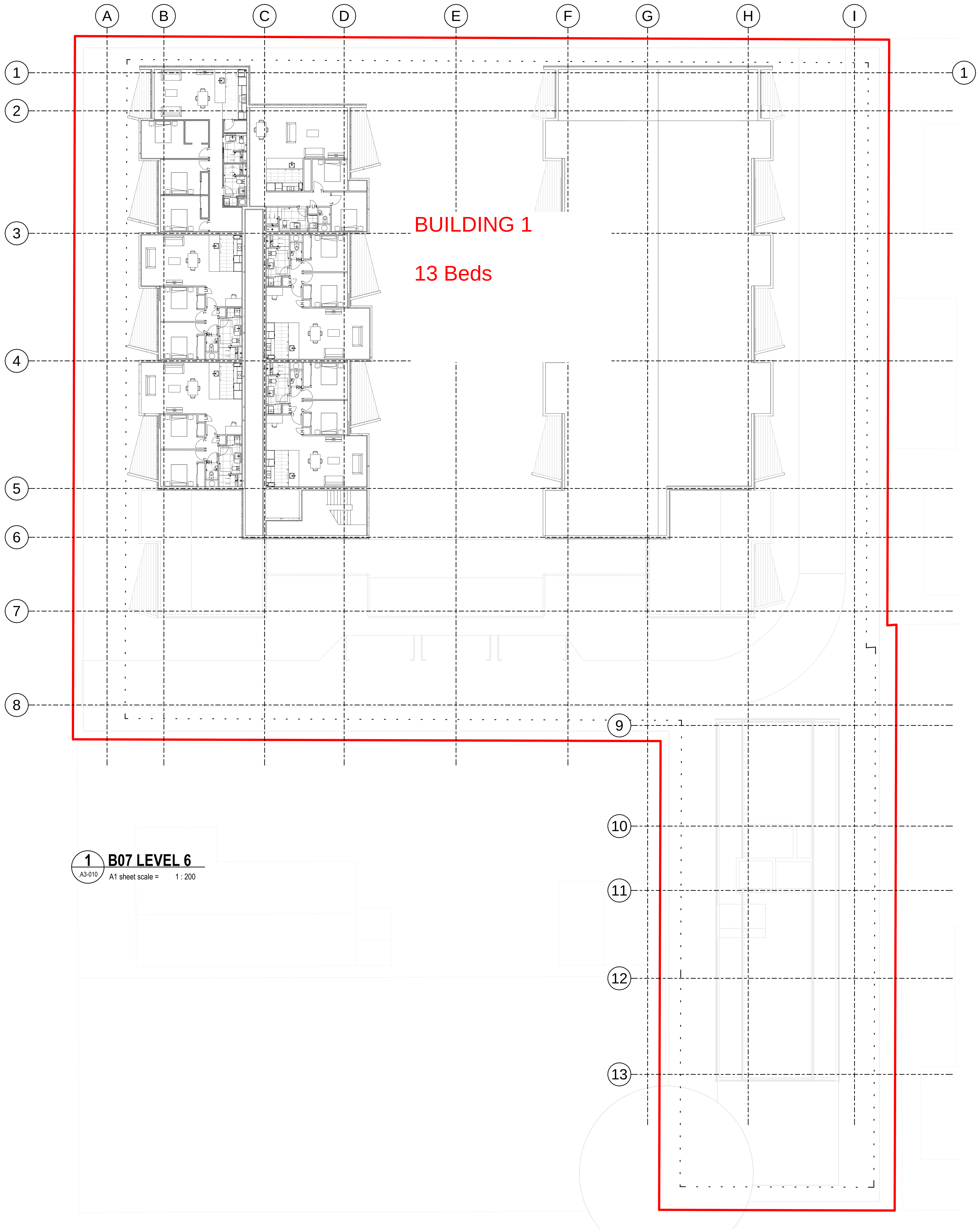


Revisions

Notes

BUILDING NORTH
TRUE NORTH

Client

RYMAN HEALTHCARE

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street
PO Box 25086
Christchurch 8011
New Zealand
Phone + 64 3 961 5926

Registered Architects and Designers
www.warrenandmahoney.com

Project Title

PARK TERRACE
SITE 02
PETERBOROUGH

Drawing Title

B07 FLOOR PLAN
LEVEL 6

Drawing Issue

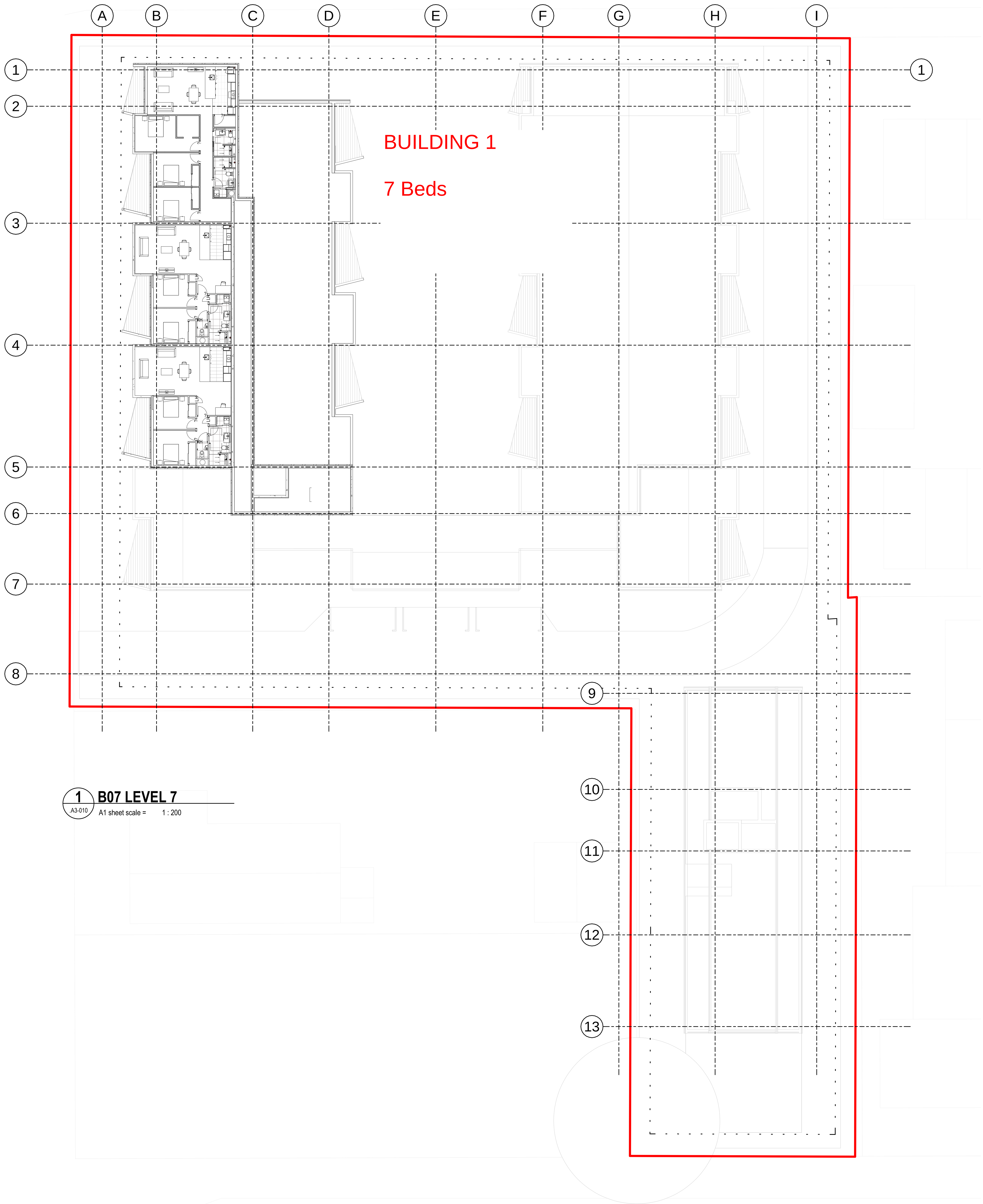
Drawing Details

Scale	1 : 200 @ A1
Date	
Job No	8899
Drawn	Author
Checked	Checker

Drawing No .A1-070

Revision

WARREN AND MAHONEY®



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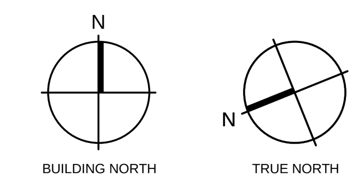
A3-010
A1 sheet scale = 1 : 200



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Job No	8899
Drawn	Author
Checked	Checker

Drawing No **Revision**

.A1-080

WARREN AND MAHONEY®

Building	Apartments	Occupancy Rate	Population Equivalent
1	152	1.5	228
2	13	1.5	19.5
		Total	247.5

Building	ADWF (L/s)	PDWF (L/s)	PWWF (L/s)
1	0.58	1.63	2.90
2	0.06	0.16	0.28
Total	0.64	1.78	3.18

WATER PEAK DEMAND CALCULATION IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL INFRASTRUCTURE DESIGN GUIDE

SITE 1 BISHOPSPARK

Building	Apartments	Occupancy Rate	Population Equivalent
1	38	1.5	57
2	208	1.5	312
3	36	1.5	54
		Total	423

Building	Demand (L/s)	Peak(L/s)
1	0.16	0.82
2	0.90	4.51
3	0.16	0.78
Total	1.22	6.12

WATER PEAK DEMAND CALCULATION IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL INFRASTRUCTURE DESIGN GUIDE

SITE 2 PETERBOROUGH STREET

Building	Apartments	Occupancy Rate	Population Equivalent
1	152	1.5	228
2	13	1.5	19.5
		Total	247.5

Building	Demand (L/s)	Peak (L/s)
1	0.66	3.30
2	0.06	0.28
Total	0.72	3.58

F

Appendix F – Erosion and Sediment Control Report

Erosion and Sediment Control Plan - Ryman Village, Park Terrace

For Resource Consent

Prepared for Ryman Healthcare Ltd
Prepared by Beca Limited

26 February 2020

Creative people together transforming our world

Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	**Curtis Blyth**	Final for resource consent	28.02.20

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Curtis Blyth**		28.02.20
Reviewed by	**Mhairi Rademaker**		28.02.20
Approved by	**Blaise Cummins**		28.02.20
on behalf of	Beca Limited		

1 Introduction

Beca Limited (Beca) has been engaged by Ryman Healthcare Limited (Ryman) to prepare an Erosion and Sediment Control Plan (ESCP). This ESCP describes the controls to be implemented for earthworks associated with the development of the Ryman Healthcare Park Terrace Retirement Village, Park Terrace, Christchurch. This plan has been prepared to support resource consent application to undertake land disturbance activities at the site.

The purpose of this ESCP is to outline the methods and practices to be implemented by Ryman Contractors onsite. Correct design and implementation will mitigate and minimise any potential effects of erosion, sediment generation, and sediment yield on the Ōtākaro (Avon) River and the stormwater network running from the site.

This ESCP will:

- Describe the project and the existing environment;
- Outline construction activities which avoid, remedy, or mitigate the effects of soil erosion and sediment discharge to Ōtākaro River;
- Outline the erosion and sediment control design philosophy and practices to be implemented;
- Detail procedures for the installation and decommissioning of erosion and sediment control measures;
- Identify erosion and sediment control monitoring and maintenance requirements;
- Identify roles and responsibilities in relation to this ESCP; and,
- Detail procedures for reviews and updates to this ESCP.

This plan has been prepared with reference to Environment Canterbury's Erosion and Sediment Control Toolbox for Canterbury (hereon referred to as the 'ECan Guidelines')

It is envisioned that this ESCP will be updated, or a new ESCP is prepared, after consent is granted, which will factor in Detailed Design and Construction Staging prepared by Ryman Healthcare.

1.1 Site description

The Park Terrace Retirement Village consists of two sites accessible off Park Terrace or Salisbury Street (**Figure 1**). Site 1, the larger or the two sites, is a ~1.3 ha site between Dorset St and Salisbury Street and currently holds the existing Bishopspark Retirement Village, which is being demolished. Site 2 is a ~0.5 ha site between Salisbury Street and Peterborough Street, which is currently a vacant gravelled lot with demolition of existing buildings already completed. Prior to construction commencing, both sites will have all existing structures demolished, except the historic Chapel situated within Site 1.

Both sites are flat and will largely consist of gravel-hardfilled surfaces following demolition of the existing buildings, with any overland stormwater flow across the sites being directed to stormwater infrastructure to discharge to Ōtākaro River. The primary stormwater lines running from the sites include beneath Dorset Street (Site 1 only) and Salisbury Street (Site 1 and Site 2).

Figure 1: Approximate extent of Park Terrace Retirement Village development, Site 1 and Site 2.
(*Source: Canterbury Maps Viewer*)

1.2 Receiving Environment

The site's stormwater will discharge to Ōtākaro River, which meanders through central Christchurch for approximately 16km before discharging to Avon Heathcote Estuary and the Pacific Ocean. Land Air Water Aotearoa describe the water quality of Ōtākaro River to be below average compared to other sites for nutrients and E.coli, but in the top 25% with respect to turbidity. Maintaining a high quality of water discharge from the site with minimal sediment concentration is therefore important to minimise any potential effect of the site's discharge on downstream receptors within the Ōtākaro River and Avon Heathcote Estuary.

2 Development Description

Development of the site is likely to be staged, allowing for the progressive completion (and stabilisation) of the project site with metal or concrete. Factoring in the areas to be stabilised during construction will benefit the site in minimising erosion and potential sediment discharge. Staging of construction will allow ESC measures to be catered to the appropriate size and treat areas that have exposed soil.

Final staging and programming of works will be provided by Ryman Contractors after resource consenting. This staging and programming may influence the ESC methods outlined in this plan and a revision to this plan may be required once staging is confirmed.

Initial enabling works include any vegetation removal, demolition of existing buildings, construction of the site office, salesroom and carparking areas, and the installation of erosion and sediment controls.

Both sites previously contained buildings and associated impervious surfaces (footpaths, driveways, etc.) with demolition of Site 1 still underway. Earthworks associated with the new development comprises the excavation of a basement within each site. Following site clearance, both sites will be largely covered in hardfill gravel to act as the working platform for machinery and are therefore predominantly stabilised from erosion.

Pile methodology is yet to be confirmed but will likely involve the operation at the current ground surface (pre-excavation). Basement excavation will then involve the excavation of material and placement in trucks for removal from site. It is likely temporary stockpiles will be required to allow the loading of material onto trucks for ease of removal from site.

Given the proposed basement excavation methodology and likely minimal exposed surfaces subject to erosion, Ryman currently plan to continue works over the winter months and will discuss this with ECan Compliance Officers visiting site. Prior approval may be required with ECan for the months of operation between May – October (winter works approval). Additional management and maintenance of ESC devices over this time will be required.

The final ESC methodology will take into consideration any staging and subsequent progressive stabilisation, as discussed in the sections below.

3 Principles of Erosion and Sediment Control

The key principles to be employed in an erosion and sediment control plan are to undertake land disturbing activities in a manner that reduces the potential for erosion of bare soils to occur (erosion control) and to employ devices to treat sediment laden water prior to discharge from the site (sediment control). The twelve basic principles of erosion and sediment control outlined in Environment Canterbury's Erosion and Sediment Control Toolbox ('ECan Guidelines') will be applied to the development (as appropriate):

- **Minimise disturbance:** Only work those areas required for construction to take place.
- **Stage construction:** Carefully plan works to minimise the area of disturbance at any one time.
- **Protect steep slopes:** Protect steep slopes from erosion.
  - No steep slopes exist in this site
- **Protect watercourses:** Map all water bodies before works commence and ensure clean water diversions are protected and maintained.
  - Discharge from the site is to the stormwater network, which then discharges to Ōtākaro River.
- **Stabilise exposed areas rapidly:** Methods range from sowing grass to mulching or temporary methods such as polymer application and geotextiles
  - The construction of buildings and importation of hardfill will allow the majority of the site to be stabilised progressively.
- **Consider the weather:** Checking weather forecasts allows works to be planned and allows planning of additional controls or temporary stabilisation.
- **Install perimeter controls:** Divert clean water away from areas of disturbance and divert runoff from areas disturbed to sediment control measures.
- **Employ detention devices:** Treat runoff by methods that allow sediment to settle out.
- **Mix and match your tools:** Addressing erosion and sediment control using multiple methods will allow for the most effective retention.
- **Make sure the ESCP evolves**: As construction progresses and the nature of land disturbing activities change, the ESCP needs to be modified to reflect the changing conditions on the site.
- **Inspect and maintain:** Inspect, monitor, and maintain control measures.
- **Train and develop:** Undertake training exercises onsite to increase awareness and quality of ESC methods and devices.

4 General Erosion and Sediment Control Methods

All erosion and sediment control measures will be designed, constructed, and maintained in accordance with ECan Guidelines.

The following proposed measures are indicative of the types, location and design of measures required for the site. As the works progress, there may be a need to move, alter, or remove measures to allow effective and efficient management of sediment runoff. Any changes should be discussed with the ECan Compliance Officer prior to implementation and through the duration of earthworks.

Specific ESC measures relating to the construction methodology are outline in Section 5.

4.1 General measures

The general erosion and sediment control measures below (**Table 1** and **Table 2**) will be applied to all areas of construction as appropriate. Specific controls are discussed in the following section.

Table 1: Erosion control measures

Control	Description
Timing of works	• The Contractor shall endeavour to complete bulk earthworks during the summer season. Approvals may be required if wanting to work through winter, as agreed with ECan Compliance Officers through the duration of works.
Stabilised entrance	• Stabilised entrances reduce tracking of sediment onto public roads and will be installed at site access points in accordance to ECan Guidelines.
Clean water diversions	• Clean water diversions reduce the amount of upslope runoff entering the site and therefore minimise erosion and the volume of water requiring treatment. • Given the site's surrounding impervious surfaces, clean water diversions will be in the form of existing roadside kerbs or temporary asphalt bunds which will prevent ingress of cleanwater.
Progressive stabilisation	• Minimising open / un-stabilised areas reduces sources of erosion. It also reduces the source of dust nuisance. • Wherever possible, within two weeks of completion of any area of earthworks that area will be stabilised. • Stabilisation can include top-soiling, seeding / hydroseeding, polymer application, mulching or finishing with the designed hardfill surface. The most appropriate method will be chosen based on the weather, soil conditions and construction progress/design. • Areas should also be stabilised where they are not completed by the end of an earthworks season or where they will remain untouched for a significant period (unless otherwise agreed with ECan). • All material deposited in temporary stockpiles will be in areas specified by the contractor with temporary bunds in place. Stockpiles should be stabilised if they are to stay for the duration of works or over the winter months.
Site contouring	• Where possible, all areas of cut or fill will be worked so that they slope towards the retention area within the basement excavation.
Diversion bunds/channels	• Diversion channels may be used to direct runoff to retention areas in a controlled manner. Given the flat site and utilisation of the basement excavation as a retention area, bunds are unlikely required.

Control	Description
Dust control	• Dust will generally be controlled with water spray as required. Other dust control measures as outlined in the MfE Dust Management Guidelines will be used as appropriate. Use of polymer application will also be considered.

Table 2: Sediment control measures

Control	Description
Sediment retention ponds	• No Sediment retention ponds (SRP) are included in the initial ESCP for both sites, however, should an SRP be required, it will be designed in accordance with ECan Guidelines to primarily act as a dewatering treatment device.
Decanting earth bunds	• Decanting earth bunds (DEBs) are not proposed for this site. • Progression of construction through site may create isolated areas of earthworks that require a DEB to be constructed. Should any DEB be required they will be designed in accordance with ECan Guidelines.
Silt fences / super silt fences	• Silt fences will be used where necessary to provide sediment treatment where runoff is not directed to sediment retention areas. • Design will be in accordance with ECan Guidelines.
Dewatering treatment	• Dewatering treatment will be required to allow the discharge or stormwater and groundwater from the basement excavations. This dewatering system will treat sediment laden water to allow active pumping and discharge of all water from site to the stormwater system.
Chemical flocculation	• Chemical flocculation may be required within the dewatering containers should clarity of discharge be discoloured. Due to the use of dewatering containers, any flocculation will require close management, likely provided in a Flocculation Management Plan following establishment onsite. • Any SRP constructed throughout the duration of the project will likely require flocculation.

4.2 Minor amendments

Minor amendments are those that will not materially change the manner in which works are undertaken or the way in which outcomes are achieved and do not require agreement with ECan. These include:

- Repositioning or implementing silt fences and super silt fences;
- Installation of diversion bunds, check dams and inlet protection; and,
- Mulching, top soiling, and stabilisation.

Changes to sediment retention devices and earthwork staging will be discussed with ECan on a regular basis through the project.

4.3 Decommissioning

No erosion and sediment control measures will be removed until the contributing catchment is stabilised or an alternative measure is installed. Stabilisation is defined as inherently resistant to erosion or rendered resistant, such as by the application of clean basecourse, colluvium, grassing, mulch, or other methods as agreed with ECan. The surface is considered stabilised once an 80% vegetative cover has been established where stabilisation is obtained from seeding.

5 Specific Erosion and Sediment Control Measures

This section should be read in conjunction with the ESC Plan provided in Appendix A.

The strategy of ESC within these two project sites incorporates the use of their largely impervious surroundings, flat gradient and basement excavations.

Both sites have large basement excavations (**Appendix B**) taking up the majority of their respective footprints. These excavations, relative to each site's catchment size, far exceed the volume requirement of any sediment retention pond that could be built. Constructing an SRP within each site is also impractical given the site's flat gradient, location in an urban environment, largely impervious surfaces and basement excavation extent offering no available area for construction. Each basement acting as a stormwater retention area will require a dewatering process, as detailed below.

The current state of each site consists of buildings currently being demolished or a largely stabilised surface of metalled hardfill. This hardfill will minimise the erosion potential of each site, therefore mitigating potential sediment runoff and the requirement for sediment treatment. In conjunction with this stabilised surface, the gradient of each site is flat, further minimising the erosion potential and sediment runoff likelihood. It is acknowledged that the basement excavations will minimise this impervious surface, however the working platforms surrounding the excavations will remain largely stabilised.

The ESC measures detailed in this section will be located where they serve the largest practicable catchments and can remain as long as possible (to avoid having to relocate controls). These positions, however, are dependent on the contractor's methodology and the staging of works within the site, which may be subject to change through the project's duration.

5.1 Silt fences

A silt fence will be required surrounding both sites, where practical, which will act as a treatment device for any sheet flow off the flat surfaces. Little stormwater flow is anticipated towards the silt fences, with the basement areas likely drawing stormwater towards them. Any discharge through the silt fences will discharge to neighbouring properties or the road network's stormwater network (which will have additional protection measures in place).

Silt fences may be required when areas become isolated through development and the ability to direct flows to the retention area is impractical. These areas will be addressed on a case by case basis.

5.2 Stabilised entranceway/s

Stabilised entranceways will be constructed at all access points to the sites, namely Dorset Street and Park Terrace for Site 1, and Peterborough Street for Site 2.

These stabilised accessways will be, at a minimum, 10m long, 4m wide and constructed using 50mm aggregate to a depth of 150mm over a filter cloth base. The aggregate should be topped up or replaced as necessary. Alternative hardfill use will be discussed with ECan as required.

A wheel wash or other means to clean soil residue off trucks exiting the site (e.g. water blasting) may be required. Should a wheel wash or other means of cleaning wheels be implemented, it will be positioned in a location where the wash can be retained and settled onsite.

Any additional entrances, if developed, will also be stabilised in accordance with the guideline specifications above.

5.3 Dirty water and clean water bunds / channels

The perimeter of each site will contain a silt fence where one can be practically constructed. It some areas the ground surface may be impervious and impede the ability to construct a silt fence. In this case, a bund or cut off drain will be formed to prevent potential dirty water flow offsite and direct flow back to the retention excavations or a silt fence.

Due to the flat nature of the site, it is expected that dirty water channels will be required to direct standing water to the retention (basement) excavations or to another isolated retention area to allow the controlled dewatering from the site. These internal channels will be constructed and located as required depending on the staging of works or any temporary standing water observed following rainfall.

In some cases, localised bunds on impervious surfaces may be in the form of asphalt to direct dirty water or clean water accordingly. It is likely these asphalt perimeter bunds will be constructed in the early stages of the project given the flat nature of the site and inability in some areas to predict where stormwater flow may be directed until observations can be made in the first rainfall events.

5.4 Retention and Dewatering

The retention of stormwater within both sites is provided by the basement excavations. These excavations far exceed the design criteria for stormwater retention capacity of a SRP relative to their respective catchment sizes and are therefore seen as an appropriate means of retaining stormwater. It is acknowledged that while the excavations provide the retention capacity, they are lacking the ability to treat sediment laden water. Each retention area will therefore rely on a dewatering treatment process to enable the near-constant pumping of water from the excavation to the stormwater network.

Groundwater intrusion is also expected within the basement excavations past a certain depth (~1.3m below ground level provided in Tonkin and Taylor Geotechnical Report).

Discussion with Christchurch City Council (CCC) has been had regarding the discharge of water to the nearby stormwater network. CCC agreed to the discharge to the network provided the pipe capacities are sufficient, the quality of the discharge is managed and that no nuisance flooding of the nearby public roads occurs. It was also highlighted that the Ōtākaro River during flood may cause higher levels within the stormwater network which may restrict the capacity of dewatering. Tonkin and Taylor Ltd's hydrogeological analysis has calculated that a constant dewatering rate of between 12 – 50 L/s may be required in the first two weeks of excavation, minimising to 3 – 17 L/s after three months. The nearby stormwater infrastructure was being assessed at the time of preparing this report to confirm the maximum discharge capability from each site to their respective network discharge points.

Dewatering treatment will process both groundwater and surface water entering the excavation. Dewatering treatment will involve pumping water through a lamella clarifier or dewatering sea containers. Ryman Contractors have experience with a similar dewatering process on their previous sites, utilising two 20ft sea containers with decants which allowed the dewatering and discharge from their site. A schematic is provided in **Appendix C** providing an example of a container dewatering system. Any dewatering system involving the use of containers will contain decant uprisers, can contain multiple geotextile baffles and can have as many containers connected in unison as required to provide effective treatment. Similarly, the use of a lamella clarifier will provide effective treatment of any water requiring pumping from the excavation.

Each basement excavation will contain a low point and have a pumping eye installed to act as the point of dewatering. A pumping eye will be a perforated cylindrical casing (e.g. ~300mm boss pipe) surrounded in aggregate to allow a dewatering hose to be suspended inside. This pumping eye will allow the complete dewatering of each basement to prevent ponding of water and restrictions on working space in the basement.

Water clarity management from any dewatering system installed will be crucial to allowing the maximum volume of water possible to be discharged as required. It is advised that Ryman Contractors engage a dewatering specialist to provide recommendations on the dewatering device to be installed, and any flocculation requirements that this device may have. It is anticipated that any device will require a trial period to assess the clarity of discharge during its initial set up. This assessment of discharge clarity will then be required on a daily basis to ensure acceptable levels of clarity are maintained.

An automated or manual flocculant dosing process may be required to provide a flocculant dose specific to the volume of water requiring treatment. Given the current variabilities in this system, including: changing geology with depth, unknown groundwater discharge rate, changing stormwater volume (per rainfall event) and unknown dewatering system; this detail will need to be provided in the form of a Flocculation Management Plan (or Dewatering Plan) following the establishment and assessment of the dewatering device onsite as mentioned above. It may be shown that the dewatering device chosen is effective in treating sediment laden discharge and no flocculation is required at all.

5.5 Sediment Retention Ponds (SRP) and Decanting Earth Bunds (DEB)

No SRPs or DEBs are proposed for this project.

There may be the requirement to construct smaller retention treatment devices during the project if any isolated catchments are created through the development of the site which cannot be contained in the basement excavation or treated with another device (e.g. silt fence). If required, any SRP or DEB constructed will be designed to ECan Guidelines, have a 2% retention capacity and can incorporate chemical flocculation.

Design relating to any SRP or DEB that may be required throughout the project can be provided through a revision of the ESCP. If an SRP or DEB is constructed, a Flocculation Management Plan (FMP) may be required to be produced during the development to inform chemical dosing requirements and management.

5.6 Stormwater inlet protection

Stormwater inlet protection will be required on all streets or neighbouring properties given the surrounding urban environment and impervious surfaces. Inlet protection is seen as the last method of treatment for any potential dirty water discharge leaving the site. Any protection installed will be in accordance with ECan Guidelines and incorporate the use of silt socks, sandbags or cesspit catch-bags to offer silt entrapment.

Any stormwater inlet protection installed will be monitored on a weekly basis, with any silt build up removed and general wear and tear of material repaired or replaced as required.

6 Monitoring and maintenance

6.1 Routine monitoring and maintenance

All maintenance of erosion and sediment controls will be undertaken in accordance with ECan Guidelines including, at a minimum, the activities outlined in **Table 4.**

Any flocculation requirement of the dewatering device will be monitored as outlined in the Flocculation Management Plan.

Table 4: Erosion and sediment control monitoring and maintenance requirements.

Control type	Inspection and maintenance requirements	Frequency
Weather forecast	• Check Metservice New Zealand or a private forecast provider for rainfall forecasts. • Action site stabilisation and rainfall preparation should weather forecast be severe.	Daily
Silt fences and super silt fences	• Check that silt fences are toed in correctly. • Check for tears and other damage and repair/replace any areas of collapse, decomposition or ineffectiveness immediately. • Remove sediment accumulation when bulges develop, or deposition reaches 20% of the silt fence height.	Weekly and before and after rainfall events
Stabilised entranceways	• Check sufficient clean aggregate cover exists and if any sediment is being tracked to public roads. • Replace or top-up aggregate as necessary. • Clean roads when necessary with a sweeper truck. • Utilise a wheel wash or other means of cleaning tyres if site conditions don't allow adequate runoff of soil accumulated in truck tyres.	Weekly
Stabilised areas	• Check sufficient stabilisation (grassed areas should be 80% cover). • Re-seed, mulch, top up aggregate or geotextile cover as necessary.	Weekly and after rainfall events
Dewatering system	• Check any pumping eye is not silted up and the hose inlet remains suspended and not sucking sediment from the base. • Clear sediment around pumping eye if required. • Check dewatering clarifier or containers on a weekly basis and remove sediment when effectiveness is shown to decrease. • A maintenance check of any device installed should be undertaken on a daily to weekly basis.	
Sediment discharge points	• Check the stormwater network discharge inlet for signs of degradation or sediment accumulation from dewatering. • Check the stormwater outlet to the Ōtākaro River for any signs of erosion or sediment accumulation. • Both discharge locations may require additional erosion control methods to be implemented given the additional volumes of water the project will be discharging to these locations, including; temporary geotextile or coir matting as agreed upon with ECan.	Weekly and before and after rainfall events

Control type	Inspection and maintenance requirements	Frequency
Flocculation	• As outlined in any Dewatering Management Plan or Flocculation Management Plan.	Ongoing management of dewatering

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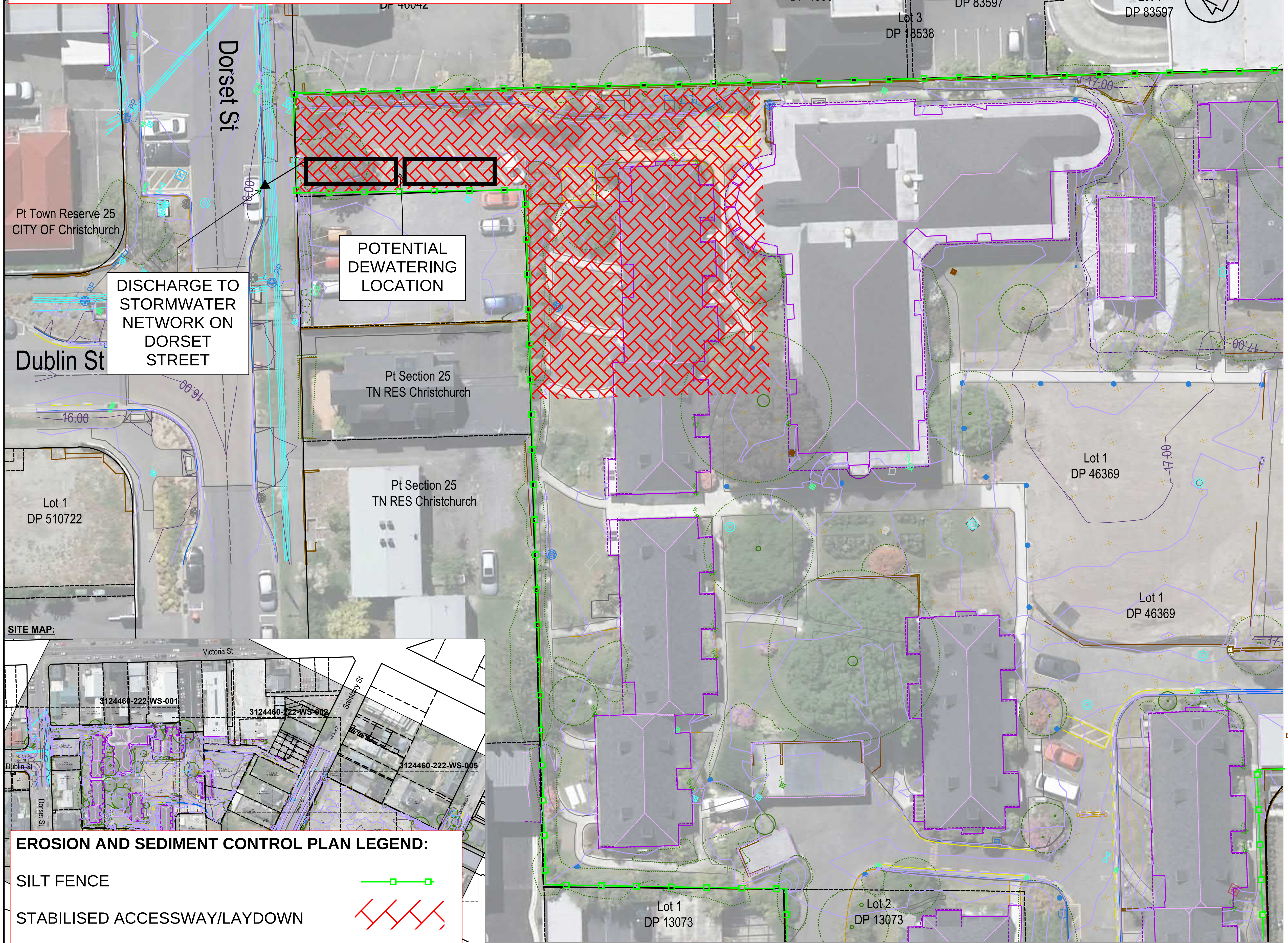
Appendix A – Erosion and Sediment Control Plan Mark-up

EROSION AND SEDIMENT CONTROL PLAN MARK-UPS

OVERLAIN ON DWG3124460-222-WS-001 - INDICATIVE ONLY



EROSION AND SEDIMENT CONTROL PLAN LEGEND:

- SILT FENCE
- STABILISED ACCESSWAY/LAYDOWN

NOTE:

1. COORDINATES ARE IN TERMS OF NZGD2000 MOUNT PLEASANT CIRCUIT. ORIGIN OF COORDINATES:
   EM41 (LINZ Geodetic Database 30/11/2018)
   806 980.736mN
   392 209.160mE
2. LEVELS ARE IN TERMS OF CDD. ORIGIN OF LEVELS:
   EM41 (LINZ geodetic database 14/01/2018 - converted to CDD)
   RL 15.700m
3. THE ABSOLUTE ACCURACY OF TOPOGRAPHOCAL DATA FOR THIS SURVEY IS ESTIMATED AT +/- 25 mm RELATIVE TO THE ORIGIN OF COORDINATES AND TO THE ORIGIN OF LEVELS.
4. THE ACCURACY OF ROOF LINES IS ESTIMATED AT +/- 100 mm.
5. CADASTRAL BOUNDARIES SHOWN ARE SOURCED FROM LINZ AND ARE APPROXIMATE ONLY. ESTIMATED ACCURACY IS +/- 100 mm. IF BOUNDARY LOCATION IS CRITICAL THEN FURTHER SURVEY WORK MAY BE REQUIRED.
6. THIS PLAN DOES NOT DEPICT INFORMATION RELATING TO ANY ENCUMBRANCES ASSOCIATED WITH THE PROPERTY. PLEASE REFER TO THE TITLE PLAN AND CERTIFICATE OF TITLE. AN INVESTIGATION OF THE MOST CURRENT RECORDS SHOULD BE UNDERTAKEN PRIOR TO DESIGN AND CONSTRUCTION COMMENCING.
7. INFORMATION DEPICTED ON THIS PLAN IS INSUFFICIENT FOR PRODUCING A BUILDING LOCATION CERTIFICATE OR HEIGHT TO BOUNDARY CALCULATIONS.
8. SPOT HEIGHTS AND CONTOURS SHOWN ARE FOR INFORMATION PURPOSE ONLY. REFER TO THE SUPPLIED DWG FOR THE CORRECT SURFACE MODEL.

LEGEND:

BUILDING COLUMN
BUILDING DECK
BUILDING EAVE
BUILDING FOOTPRINT
BUILDING ROOF
CONTOUR MINOR (0.1m)
CONTOUR MAJOR (1.0m)
FEATURE CONCRETE
FEATURE FENCE
FEATURE FURNITURE
FEATURE HANDRAIL
FEATURE PAVING STONES
FEATURE PED CROSS PAD
FEATURE SEAT
FEATURE SIGN LINE
FEATURE STEP
FEATURE WALL BOTTOM
FEATURE WALL TOP
ROAD ARROW
ROAD BACK OF KERB
ROAD CENTRELINE
ROAD EDGE OF METAL
ROAD EDGE OF SEAL
ROAD FOOTPATH
ROAD GUTTER FLOW
ROAD LIP OF CHANNEL
ROAD LIP OF KERB
ROAD PARKING LINES
ROAD SYMBOL
ROAD TEXT
ROAD TOP OF KERB
ROAD WHITE LINE
ROAD WHITE LINE DASHED
ROAD YELLOW LINE
ROAD YELLOW LINE DASHED
TOPO BREAKLINE
UNKNOWN CABLE OVERHEAD
VEG BUSH
VEG DRIP LINE
CADASTRAL BOUNDARY
BUILDING EXCLUSION ZONE

COMMS PLINTH
ELECTRICAL LIGHT BOLLARD
ELECTRICAL LIGHT POLE
ELECTRICAL MARKER
ELECTRICAL POWER BOX
ELECTRICAL POWER POLE
FEATURE GATE
FEATURE BOLLARD
FEATURE MARKER POST
FEATURE POST
FEATURE SIGN
ROAD TRAFFIC LIGHT

STORMWATER GRATE
STORMWATER LID
STORMWATER CESSPIT DOUBLE
STORMWATER CESSPIT SINGLE
TOPO SPOT HEIGHT
UNKNOWN MANHOLE
UNKNOWN PLINTH
UNKNOWN VALVE
UNKNOWN VENT
UNKNOWN LID
VEG TREE

ORIGINAL DRAWING IN COLOUR

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	BUILDING EXCLUSION ZONE ADDED	MW	AS	CH	12.09.19
A	INITIAL RELEAS	MW	AS	CH	03.05.19

Drawing Originator: Beca

Original Scale (A1): 1:200
Reduced Scale (A3): 1:100

Surveyed	MW	11.04.19	Approved For Issue*
Drawn	MW	03.05.19	
Survey Check	AS	03.05.19	
Dwg Approved	CH	03.05.19	Date

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE LTD

Project: PARK TERRACE

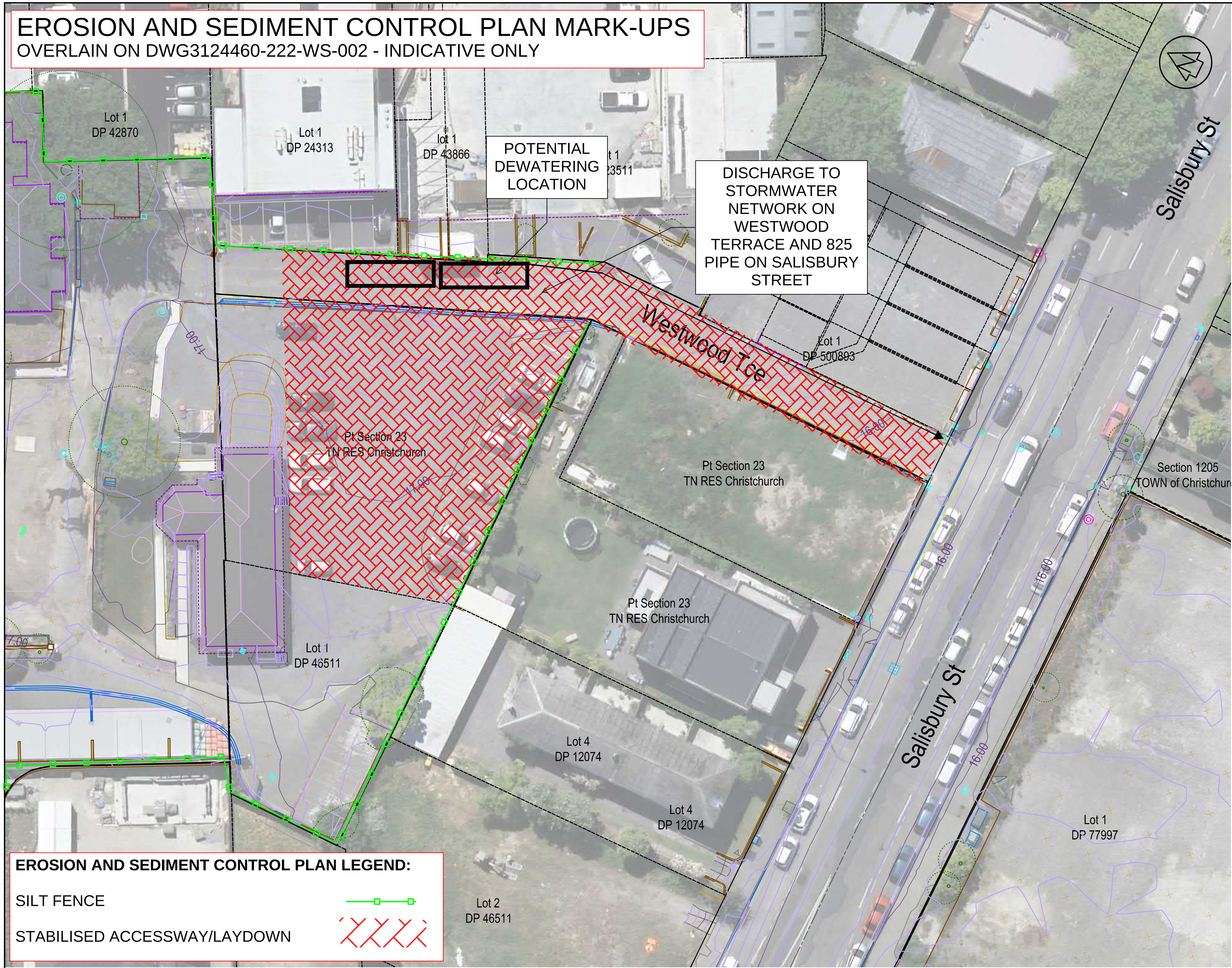
Title: TOPOGRAPHIC SURVEY

Discipline: SURVEY

Drawing No.: 3124460-222-WS-001

Rev.: B

EROSION AND SEDIMENT CONTROL PLAN MARK-UPS
OVERLAIN ON DWG3124460-222-WS-002 - INDICATIVE ONLY



EROSION AND SEDIMENT CONTROL PLAN LEGEND:

SILT FENCE

STABILISED ACCESSWAY/LAYDOWN

Drawing Plotted: 12 Sep 2019 12:46 PM

NOTE:

1. COORDINATES ARE IN TERMS OF NZGD2000 MOUNT PLEASANT CIRCUIT. ORIGIN OF COORDINATES:

   EM41 (LINZ Geodetic Database 30/11/2018)
   806 980.736mN
   392 209.160mE

2. LEVELS ARE IN TERMS OF CDD. ORIGIN OF LEVELS:

   EM41 (LINZ geodetic database 14/01/2018 - converted to CDD)
   RL 15.700m

3. THE ABSOLUTE ACCURACY OF TOPOGRAPHOCAL DATA FOR THIS SURVEY IS ESTIMATED AT +/- 25 mm RELATIVE TO THE ORIGIN OF COORDINATES AND TO THE ORIGIN OF LEVELS.
4. THE ACCURACY OF ROOF LINES IS ESTIMATED AT +/- 100 mm.
5. CADASTRAL BOUNDARIES SHOWN ARE SOURCED FROM LINZ AND ARE APPROXIMATE ONLY. ESTIMATED ACCURACY IS +/- 100 mm. IF BOUNDARY LOCATION IS CRITICAL THEN FURTHER SURVEY WORK MAY BE REQUIRED.
6. THIS PLAN DOES NOT DEPICT INFORMATION RELATING TO ANY ENCUMBRANCES ASSOCIATED WITH THE PROPERTY. PLEASE REFER TO THE TITLE PLAN AND CERTIFICATE OF TITLE. AN INVESTIGATION OF THE MOST CURRENT RECORDS SHOULD BE UNDERTAKEN PRIOR TO DESIGN AND CONSTRUCTION COMMENCING.
7. INFORMATION DEPICTED ON THIS PLAN IS INSUFFICIENT FOR PRODUCING A BUILDING LOCATION CERTIFICATE OR HEIGHT TO BOUNDARY CALCULATIONS.
8. SPOT HEIGHTS AND CONTOURS SHOWN ARE FOR INFORMATION PURPOSE ONLY. REFER TO THE SUPPLIED DWG FOR THE CORRECT SURFACE MODEL.

LEGEND:

BUILDING COLUMN
BUILDING DECK
BUILDING EAVE
BUILDING FOOTPRINT
BUILDING ROOF
CONTOUR MINOR (0.1m)
CONTOUR MAJOR (1.0m)
FEATURE CONCRETE
FEATURE FENCE
FEATURE FURNITURE
FEATURE HANDRAIL
FEATURE PAVING STONES
FEATURE PED CROSS PAD
FEATURE SEAT
FEATURE SIGN LINE
FEATURE STEP
FEATURE WALL BOTTOM
FEATURE WALL TOP
ROAD ARROW
ROAD BACK OF KERB
ROAD CENTRELINE
ROAD EDGE OF METAL
ROAD EDGE OF SEAL
ROAD FOOTPATH
ROAD GUTTER FLOW
ROAD LIP OF CHANNEL
ROAD LIP OF KERB
ROAD PARKING LINES
ROAD SYMBOL
ROAD TEXT
ROAD TOP OF KERB
ROAD WHITE LINE
ROAD WHITE LINE DASHED
ROAD YELLOW LINE
ROAD YELLOW LINE DASHED
TOPO BREAKLINE
UNKNOWN CABLE OVERHEAD
VEG BUSH
VEG DRIP LINE
BUILDING EXCLUSION ZONE

COMMS PLINTH
ELECTRICAL LIGHT BOLLARD
ELECTRICAL LIGHT POLE
ELECTRICAL MARKER
ELECTRICAL POWER BOX
ELECTRICAL POWER POLE
FEATURE GATE
FEATURE BOLLARD
FEATURE MARKER POST
FEATURE POST
FEATURE RUBISH BIN
FEATURE SIGN
ROAD TRAFFIC LIGHT

STORMWATER GRATE
STORMWATER LID
STORMWATER CESSPIT DOUBLE
STORMWATER CESSPIT SINGLE
TOPO SPOT HEIGHT
UNKNOWN MANHOLE
UNKNOWN PLINTH
UNKNOWN VALVE
UNKNOWN VENT
UNKNOWN LID
VEG TREE

ORIGINAL DRAWING IN COLOUR

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	BUILDING EXCLUSION ZONE ADDED	MW	AS	CH	12.09.19
A	INITIAL RELEAS	MW	AS	CH	03.05.19

Drawing Originator: Beca

Original Scale (A1) 1:200
Reduced Scale (A3) 1:100

Surveyed	MW	11.04.19	Approved For Issue*
Drawn	MW	03.05.19	
Survey Check	AS	03.05.19	
Dwg Approved	CH	03.05.19	Date

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE LTD

Project: PARK TERRACE

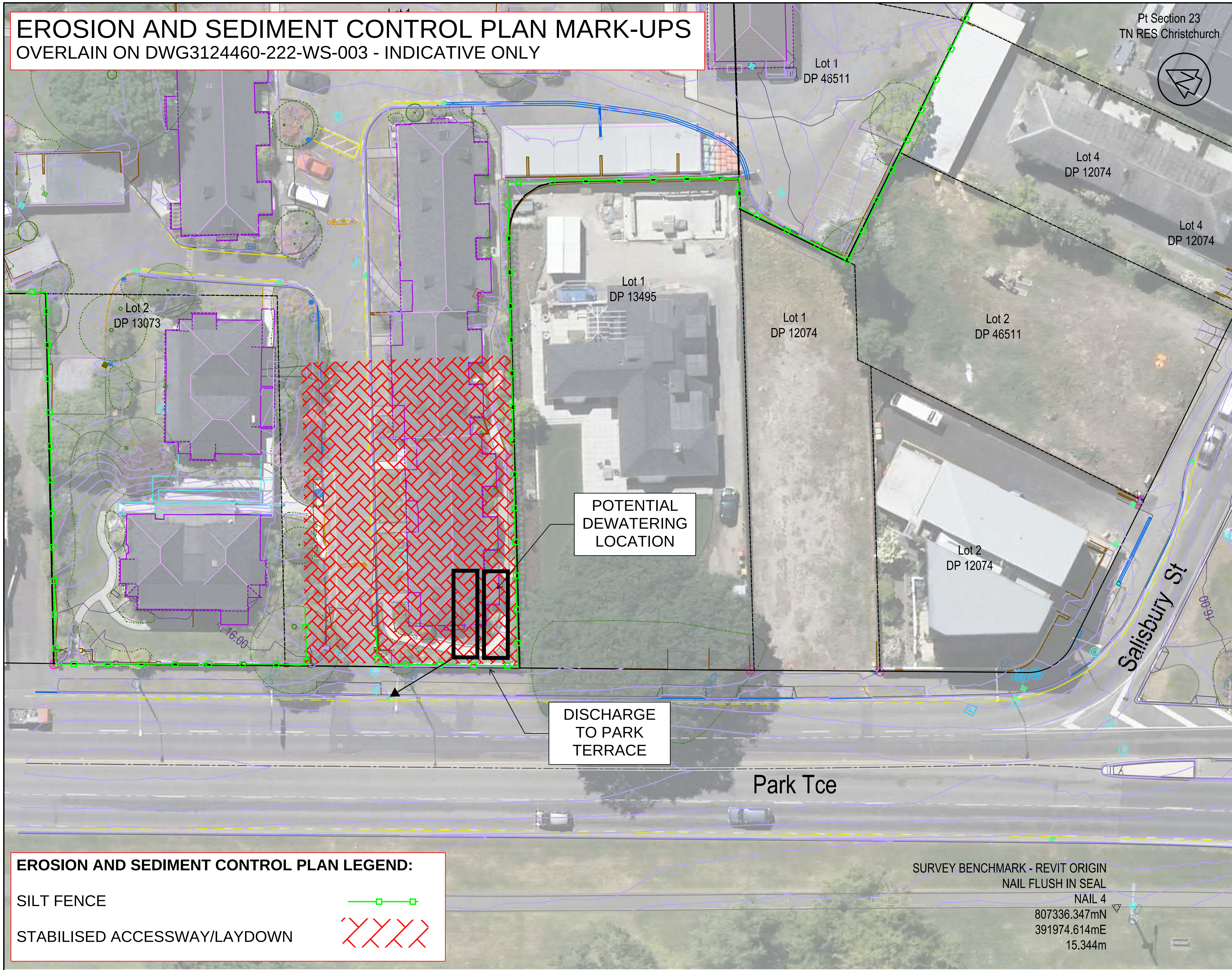
Title: TOPOGRAPHIC SURVEY

Discipline: SURVEY

Drawing No. 3124460-222-WS-002

Rev. B

Drawing Plotted: 12 Sep 2019 12:47 PM



NOTE:

1. COORDINATES ARE IN TERMS OF NZGD2000 MOUNT PLEASANT CIRCUIT. ORIGIN OF COORDINATES:
   EM41 (LINZ Geodetic Database 30/11/2018)
   806 980.736mN
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   EM41 (LINZ geodetic database 14/01/2018 - converted to CDD)
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8. SPOT HEIGHTS AND CONTOURS SHOWN ARE FOR INFORMATION PURPOSE ONLY. REFER TO THE SUPPLIED DWG FOR THE CORRECT SURFACE MODEL.

LEGEND:

BUILDING COLUMN
BUILDING DECK
BUILDING EAVE
BUILDING FOOTPRINT
BUILDING ROOF
CONTOUR MINOR (0.1m)
CONTOUR MAJOR (1.0m)
FEATURE CONCRETE
FEATURE FENCE
FEATURE FURNITURE
FEATURE HANDRAIL
FEATURE PAVING STONES
FEATURE PED CROSS PAD
FEATURE SEAT
FEATURE SIGN LINE
FEATURE STEP
FEATURE WALL BOTTOM
FEATURE WALL TOP
ROAD ARROW
ROAD BACK OF KERB
ROAD CENTRELINE
ROAD EDGE OF METAL
ROAD EDGE OF SEAL
ROAD FOOTPATH
ROAD GUTTER FLOW
ROAD LIP OF CHANNEL
ROAD LIP OF KERB
ROAD PARKING LINES
ROAD SYMBOL
ROAD TEXT
ROAD TOP OF KERB
ROAD WHITE LINE
ROAD WHITE LINE DASHED
ROAD YELLOW LINE
ROAD YELLOW LINE DASHED
TOPO BREAKLINE
UNKNOWN CABLE OVERHEAD
VEG BUSH
VEG DRIP LINE
BUILDING EXCLUSION ZONE

COMMS PLINTH	STORMWATER GRATE
ELECTRICAL LIGHT BOLLARD	STORMWATER LID
ELECTRICAL LIGHT POLE	STORMWATER CESSPIT DOUBLE
ELECTRICAL MARKER	STORMWATER CESSPIT SINGLE
ELECTRICAL POWER BOX	TOPO SPOT HEIGHT
ELECTRICAL POWER POLE	UNKNOWN MANHOLE
FEATURE GATE	UNKNOWN PLINTH
FEATURE BOLLARD	UNKNOWN VALVE
FEATURE MARKER POST	UNKNOWN VENT
FEATURE POST	UNKNOWN LID
FEATURE RUBISH BIN	VEG TREE
FEATURE SIGN	
ROAD TRAFFIC LIGHT	

ORIGINAL DRAWING IN COLOUR

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	BUILDING EXCLUSION ZONE ADDED	MW	AS	CH	12.09.19
A	INITIAL RELEAS	MW	AS	CH	03.05.19

Drawing Originator: Beca

Original Scale (A1) 1:200	Surveyed	MW	11.04.19
	Drawn	MW	03.05.19
Reduced Scale (A3) 1:100	Survey Check	AS	03.05.19
	Dwg Approved	CH	03.05.19

Approved For Issue* Date
* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE LTD

Project: PARK TERRACE

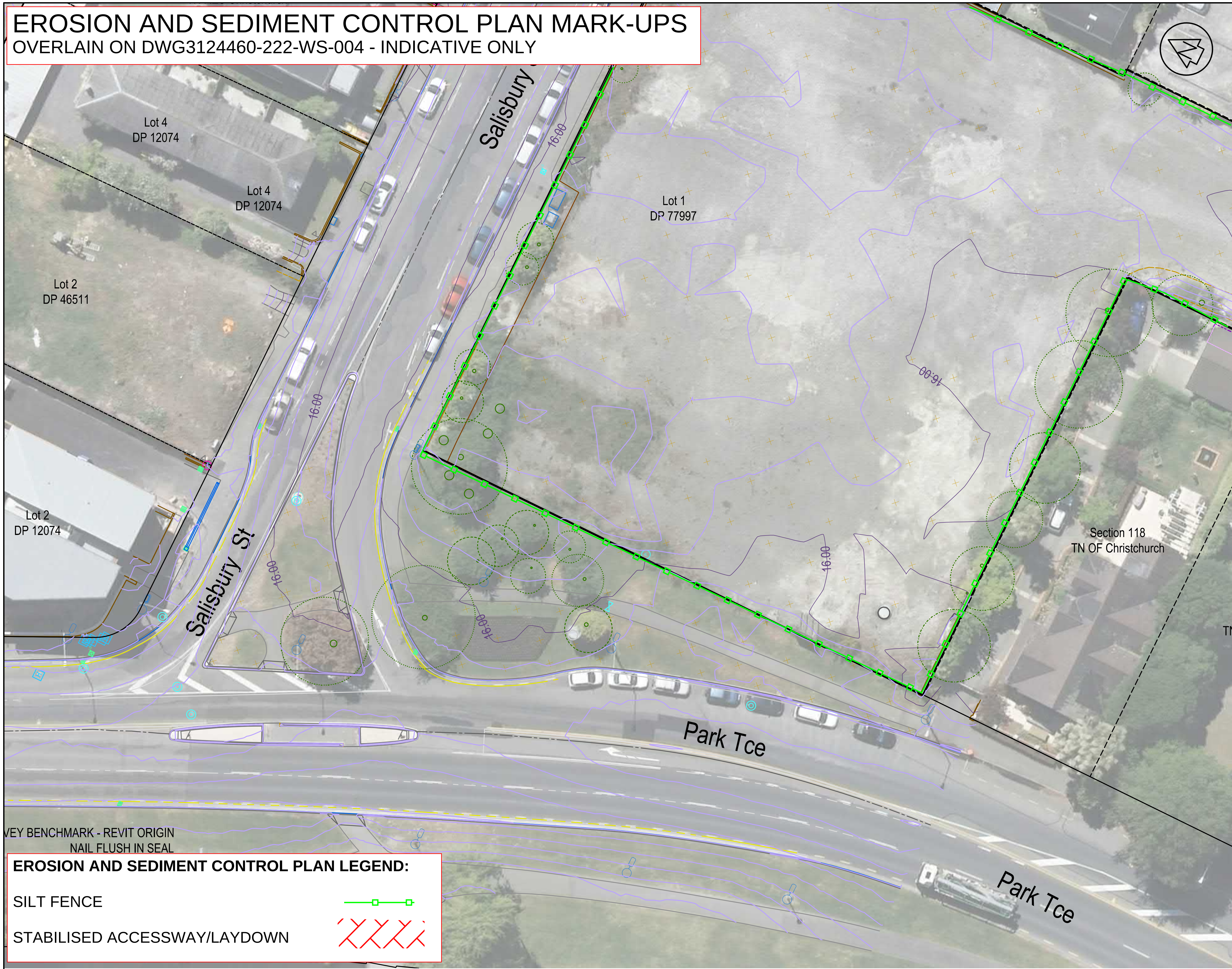
Title: TOPOGRAPHIC SURVEY

Discipline: SURVEY

Drawing No. 3124460-222-WS-003 Rev. B

EROSION AND SEDIMENT CONTROL PLAN MARK-UPS
OVERLAIN ON DWG3124460-222-WS-004 - INDICATIVE ONLY

Drawing Plotted: 12 Sep 2019 12:47 PM



EROSION AND SEDIMENT CONTROL PLAN LEGEND:

SILT FENCE

STABILISED ACCESSWAY/LAYDOWN

NOTE:

1. COORDINATES ARE IN TERMS OF NZGD2000 MOUNT PLEASANT CIRCUIT. ORIGIN OF COORDINATES:
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LEGEND:

BUILDING COLUMN
BUILDING DECK
BUILDING EAVE
BUILDING FOOTPRINT
BUILDING ROOF
CONTOUR MINOR (0.1m)
CONTOUR MAJOR (1.0m)
FEATURE CONCRETE
FEATURE FENCE
FEATURE FURNITURE
FEATURE HANDRAIL
FEATURE PAVING STONES
FEATURE PED CROSS PAD
FEATURE SEAT
FEATURE SIGN LINE
FEATURE STEP
FEATURE WALL BOTTOM
FEATURE WALL TOP
ROAD ARROW
ROAD BACK OF KERB
ROAD CENTRELINE
ROAD EDGE OF METAL
ROAD EDGE OF SEAL
ROAD FOOTPATH
ROAD GUTTER FLOW
ROAD LIP OF CHANNEL
ROAD LIP OF KERB
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ROAD TEXT
ROAD TOP OF KERB
ROAD WHITE LINE
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ROAD YELLOW LINE
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UNKNOWN CABLE OVERHEAD
VEG BUSH
VEG DRIP LINE
BUILDING EXCLUSION ZONE

COMMS PLINTH
ELECTRICAL LIGHT BOLLARD
ELECTRICAL LIGHT POLE
ELECTRICAL MARKER
ELECTRICAL POWER BOX
ELECTRICAL POWER POLE
FEATURE GATE
FEATURE BOLLARD
FEATURE MARKER POST
FEATURE POST
FEATURE RUBISH BIN
FEATURE SIGN
ROAD TRAFFIC LIGHT

STORMWATER GRATE
STORMWATER LID
STORMWATER CESSPIT DOUBLE
STORMWATER CESSPIT SINGLE
TOPO SPOT HEIGHT
UNKNOWN MANHOLE
UNKNOWN PLINTH
UNKNOWN VALVE
UNKNOWN VENT
UNKNOWN LID
VEG TREE

ORIGINAL DRAWING IN COLOUR

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	BUILDING EXCLUSION ZONE ADDED	MW	AS	CH	12.09.19
A	INITIAL RELEAS	MW	AS	CH	03.05.19

Drawing Originator: Beca

Original Scale (A1)	1:200
Reduced Scale (A3)	1:100

Surveyed	MW	11.04.19
Drawn	MW	03.05.19
Survey Check	AS	03.05.19
Dwg Approved	CH	03.05.19

Approved For Issue* | Date

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE LTD

Project: PARK TERRACE

Title: TOPOGRAPHIC SURVEY

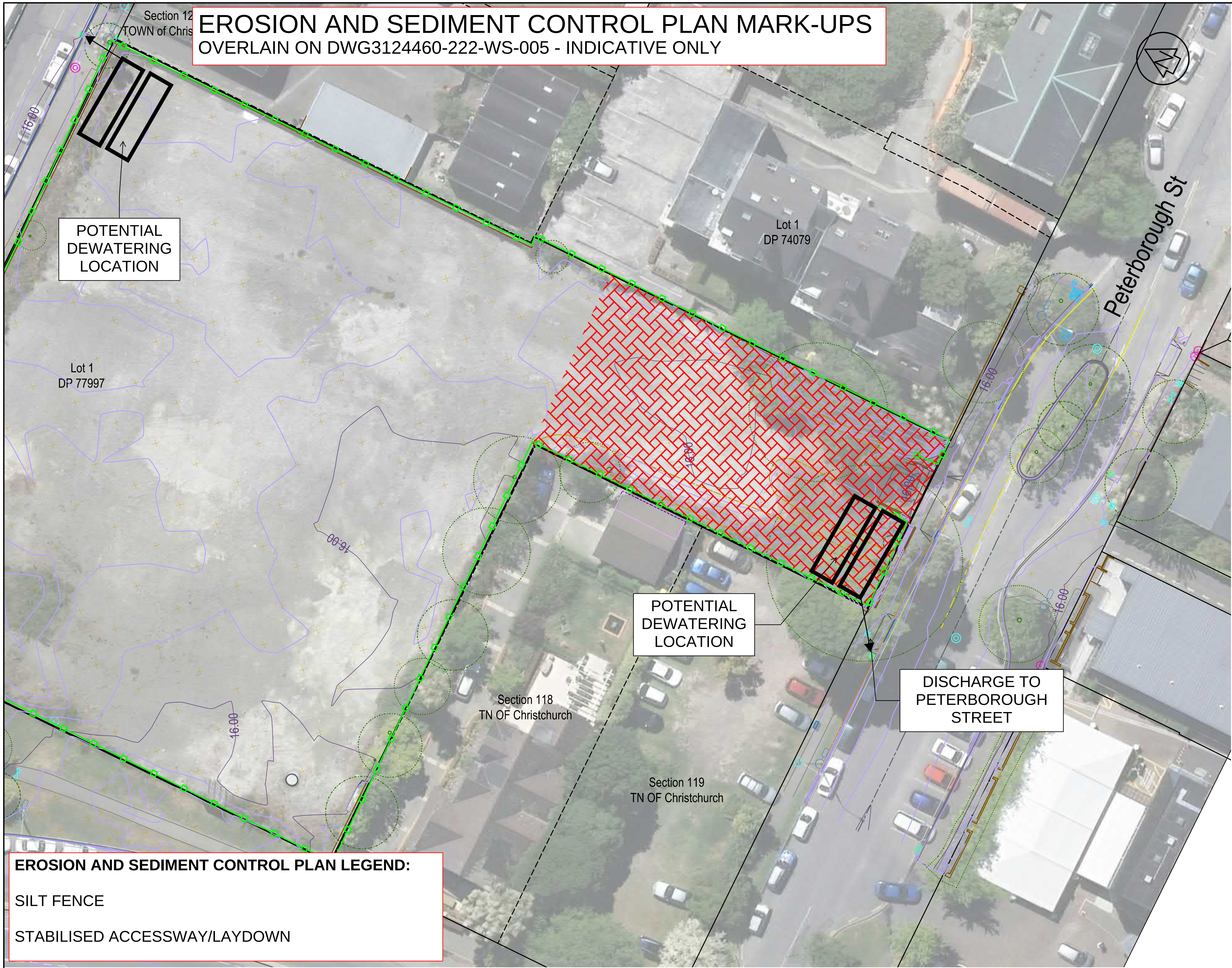
Discipline: SURVEY

Drawing No.: 3124460-222-WS-004

Rev.: B

Drawing Plotted: 12 Sep 2019 12:47 PM

EROSION AND SEDIMENT CONTROL PLAN MARK-UPS
OVERLAIN ON DWG3124460-222-WS-005 - INDICATIVE ONLY



EROSION AND SEDIMENT CONTROL PLAN LEGEND:

SILT FENCE

STABILISED ACCESSWAY/LAYDOWN

NOTE:

1. COORDINATES ARE IN TERMS OF NZGD2000 MOUNT PLEASANT CIRCUIT. ORIGIN OF COORDINATES:
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FEATURE CONCRETE
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FEATURE HANDRAIL
FEATURE PAVING STONES
FEATURE PED CROSS PAD
FEATURE SEAT
FEATURE SIGN LINE
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FEATURE WALL BOTTOM
FEATURE WALL TOP
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ROAD YELLOW LINE
ROAD YELLOW LINE DASHED
TOPO BREAKLINE
UNKNOWN CABLE OVERHEAD
VEG BUSH
VEG DRIP LINE
BUILDING EXCLUSION ZONE

COMMS PLINTH	STORMWATER GRATE
ELECTRICAL LIGHT BOLLARD	STORMWATER LID
ELECTRICAL LIGHT POLE	STORMWATER CESSPIT DOUBLE
ELECTRICAL MARKER	STORMWATER CESSPIT SINGLE
ELECTRICAL POWER BOX	TOPO SPOT HEIGHT
ELECTRICAL POWER POLE	UNKNOWN MANHOLE
FEATURE GATE	UNKNOWN PLINTH
FEATURE BOLLARD	UNKNOWN VALVE
FEATURE MARKER POST	UNKNOWN VENT
FEATURE POST	UNKNOWN LID
FEATURE RUBISH BIN	VEG TREE
FEATURE SIGN	
ROAD TRAFFIC LIGHT	

ORIGINAL DRAWING IN COLOUR

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	BUILDING EXCLUSION ZONE ADDED	MW	AS	CH	12.09.19
A	INITIAL RELEAS	MW	AS	CH	03.05.19

Drawing Originator: Beca

Original Scale (A1) 1:200
Reduced Scale (A3) 1:100

Surveyed	MW	11.04.19
Drawn	MW	03.05.19
Survey Check	AS	03.05.19
Dwg Approved	CH	03.05.19

Approved For Issue*

Date

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE LTD

Project: PARK TERRACE

Title: TOPOGRAPHIC SURVEY

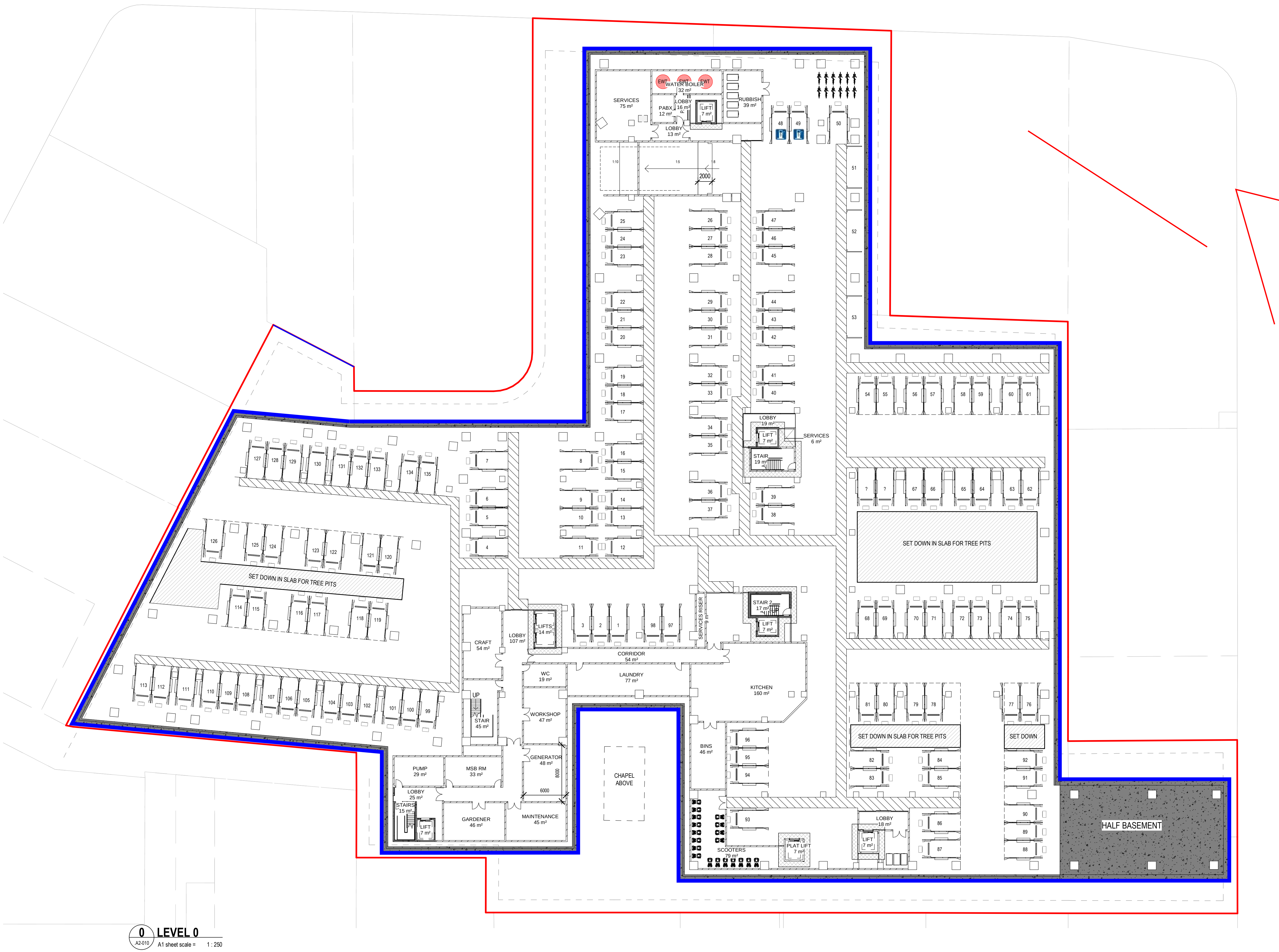
Discipline: SURVEY

Drawing No. 3124460-222-WS-005

Rev. B

B

Appendix B – Preliminary Basement Design



0 LEVEL 0
A2-010
A1 sheet scale = 1 : 250

Revisions

A 25.10.19 RESOURCE CONSENT DRAFT
B 13.12.19 RESOURCE CONSENT

Client

RYMAN HEALTHCARE

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street
PO Box 25086
Christchurch 8011
New Zealand
Phone + 64 3 961 5926

Registered Architects and Designers
www.warrenandmahoney.com

Project Title

PARK TERRACE
SITE 01
BISHOPSPARK

Drawing Title

VILLAGE CENTRE B01
FLOOR PLAN LEVEL 0

Drawing Issue

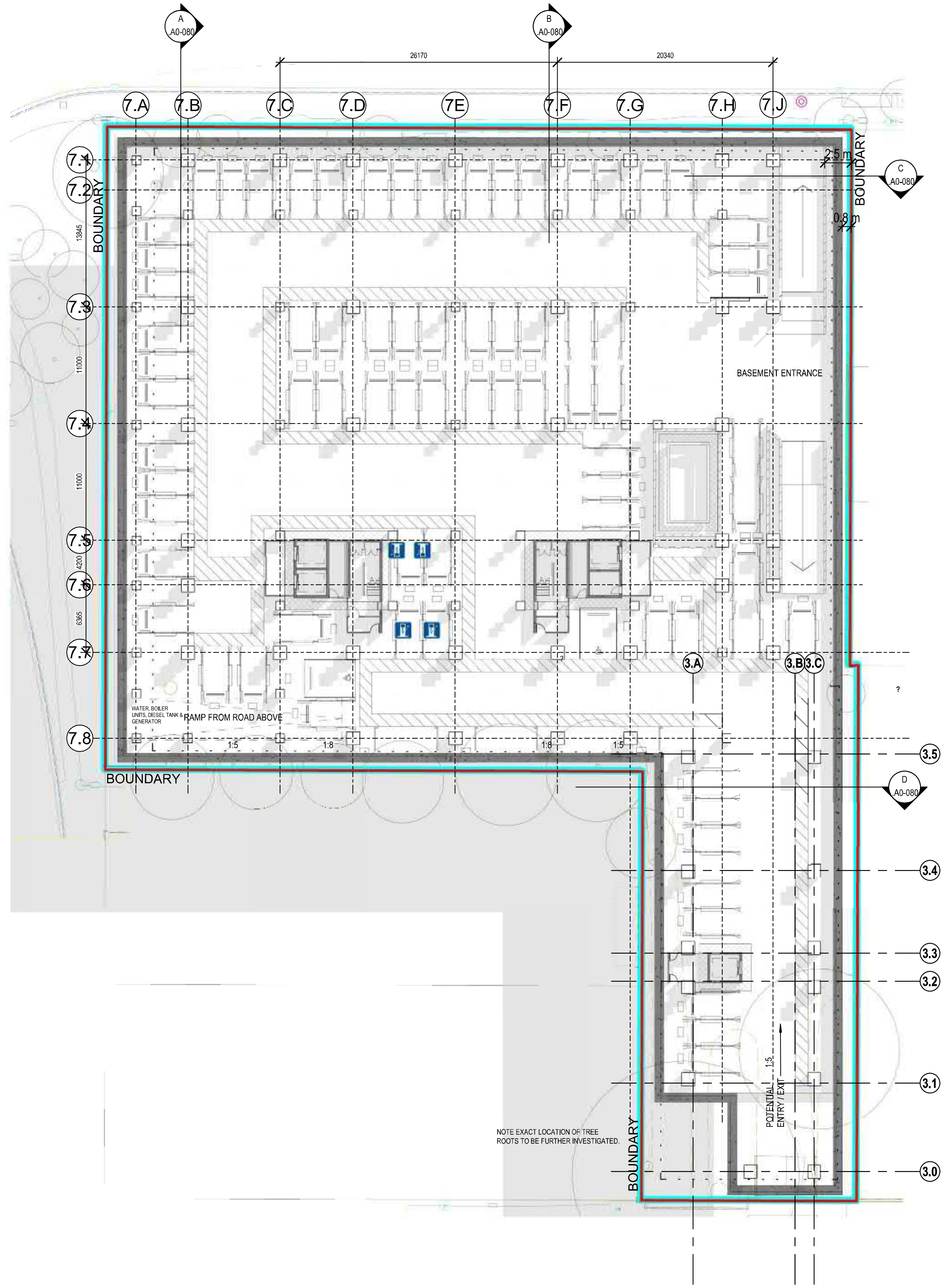
RESOURCE
CONSENT

Drawing Details

Scale	1 : 250 @ A1
Date	13.12.19
Job No	8917
Drawn	WM Team
Checked	TDH

Drawing No B01 .A1-010
Revision B

WARREN AND MAHONEY



1 PROPOSED SITE PLAN - BASEMENT

A0-060

A1 sheet scale = 1 : 250
A3 sheet scale is twice scale shown above

Revisions

A 22/11/19 COORDINATION SET
B 18/12/19 DRAFT RESOURCE CONSENT

Notes

N
TRUE NORTH

Client

RYMAN HEALTHCARE

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street
PO Box 25086
Christchurch 8011
New Zealand
Phone + 64 3 961 5926

Registered Architects and Designers
www.warrenandmahoney.com

Project Title

PARK TERRACE
SITE TWO
PETERBOROUGH

Drawing Title

.S02
PROPOSED SITE PLAN
- BASEMENT

Drawing Issue

RESOURCE
CONSENT

Drawing Details

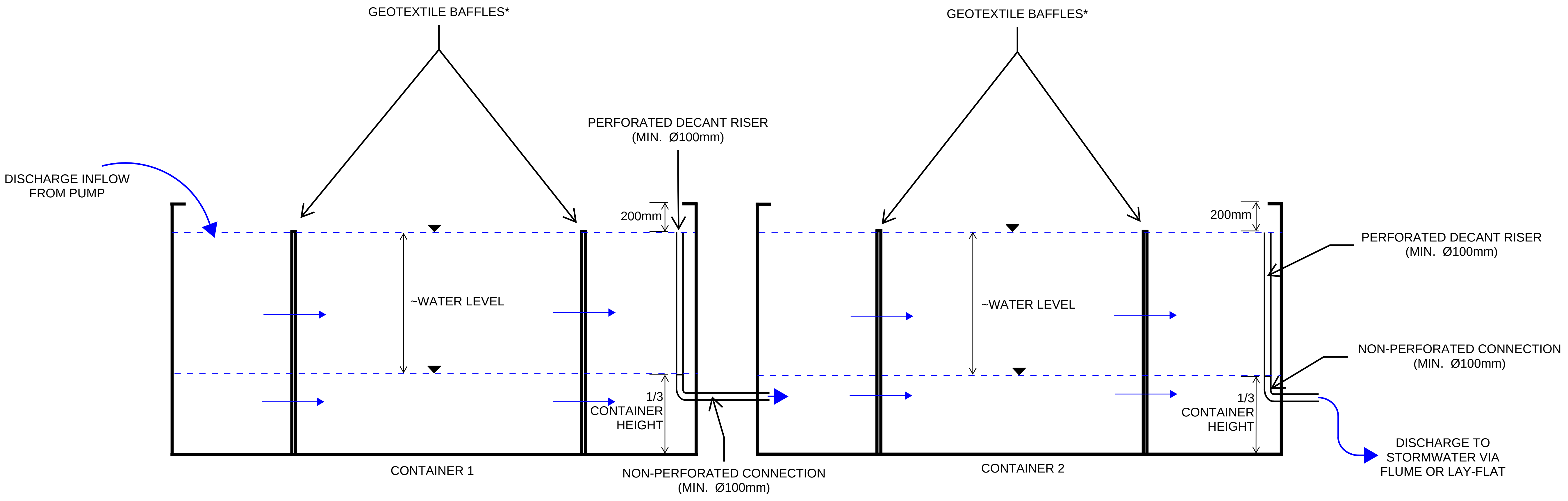
Scale	1 : 250 @ A1
Date	18/12/19
Job No	8899
Drawn	WM Team
Checked	TDH

Drawing No .S02 .A0-040 **Revision** B

WARREN AND MAHONEY

C

Appendix C – Example Dewatering Container



SCHEMATIC CROSS SECTION - EXAMPLE SEA CONTAINER DEWATERING DEVICE*

*NOTES:

- NOT TO SCALE
- MULTIPLE BAFFLES CAN BE INSTALLED AS APPROPRIATE
- MULTIPLE CONTAINERS CAN BE CONNECTED IN UNISON FOR ADDITIONAL TREATMENT
- FLOCCULATION TO BE CONSIDERED INDEPENDENTLY
- SCHEMATIC ONLY TO BE CONSIDERED ONCE DEVICE AND APPROPRIATE CONTAINERS ARE SOUGHT

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
1	FINAL SCHEMATIC FOR RESOURCE CONSENT	CB	MR	MR	27.02.20

Drawing Originator: Beca

Original Scale (A1) / Reduced Scale (A3)			
	Design	CB	27.02.20
	Drawn	CB	27.02.20
	Dsg Verifier	MR	27.02.20
	Dwg Check	MR	27.02.20

* Refer to Revision 1 for Original Signature

Client: RYMAN HEALTHCARE LIMITED

Project: PARK TERRACE RETIREMENT VILLAGE

Title: EROSION AND SEDIMENT CONTROL PLAN - DE-WATERING SCHEMATIC

Discipline: ENVIRONMENTAL

Drawing No. -

Rev. -