PALMERSTON NORTH CITY COUNCIL

AGENDA

ATTACHMENTS

STRATEGY & FINANCE COMMITTEE UNDER SEPARATE COVER

9:00 AM, WEDNESDAY 14 AUGUST 2024

COUNCIL CHAMBER, FIRST FLOOR
CIVIC ADMINISTRATION BUILDING
32 THE SQUARE, PALMERSTON NORTH

STRATEGY & FINANCE COMMITTEE MEETING

14 August 2024

Under Separate Cover

10. Palmerston North City District Plan: Proposed Plan Change E: Roxburgh Residential Area

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13. Reserve Declarations and Classifications

1. Appendix 1: Reserve Classifications Page 515

Palmerston North City Council District Plan
Proposed Plan Change E: Roxburgh Residential Area

Section 32 Evaluation Report

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Part I: Proposed Plan Change

1 Purpose of Report

Palmerston North City Council (PNCC or Council) has prepared Proposed Plan Change E: Roxburgh Crescent (PCE) to the Operative District Plan for notification under the Resource Management Act 1991 (RMA).

This Section 32 Evaluation Report has been prepared to accompany PCE. It summarises the evaluation of alternatives, costs and benefits in regard to the proposed District Plan provisions relating to the RRA. PNCC must determine whether PCE is the most appropriate way to achieve the purpose of the Act, including an assessment that the proposed changes are the most appropriate way to achieve the objectives, when compared against alternative methods.

The intention of this Report is to:

- Explain why Plan Change E is needed;
- Evaluate the objectives;
- Identify the potential options to address the issues;
- Evaluate the options; and
- Record why the plan change is the most appropriate way to achieve the objectives of Proposed Plan Change E and more broadly, the District Plan.

The Report fulfils the requirements of section 32 of the RMA

Abbreviations used throughout this Report:

Department of Conservation	DOC
Future Development Strategy	FDS
Height Recession Plane	HRP
Horizons Regional Council	Horizons
Long term plan	LTP
Multi Unit Housing Areas	MUHA
National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health	NESCS
National Policy Statement for Urban Development	NPSUD
Palmerston North City Council	PNCC or Council
Proposed Plan Change E: Roxburgh Residential Area	PCE
Proposed Plan Change I: Medium Density Residential Zone	PCI
Rangitāne O Manawatū	RoM
Roxburgh Residential Area	RRA
Palmerston North City District Plan	District Plan
The Housing and Business Needs Assessment 2023 (Prepared every three years under the NPSUD)	HBA

2 Description of the Proposed Plan Change

The purpose of Proposed Plan Change E: Roxburgh Residential Area (PCE) is to rezone land around Roxburgh Crescent from Industrial, Conservation and Amenity and Recreation Zone to Residential Zone. PCE also seeks to introduce new provisions in the District Plan to manage specific issues with this brownfield development site. The rezoning involves approximately 4 ha of land, and the creation of around 105 residential lots based on a 250m^2 minimum lot size. The area subject to PCE is referred to as the Roxburgh Residential Area (RRA). The extent of the proposed rezoning of the RRA is shown in Figure 1 below by the yellow colouring.

Figure 1 Proposed District Plan Area for PCE

PCE seeks to enable the redevelopment of a predominately industrial zoned area that is located next to an established Residential Zone. The site boarders the residential zone along Ruahine Street and the Flood Protection Zone along the Manawatū River stopbank. This proximity to the Manawatū River environment and surrounding residential amenities and housing mean that residential zoning is a more appropriate long term use of the land, compared to the existing industrial use or any intensification of industrial use.

Separate to the Plan Change process, an exchange of recreation land within Waterloo Park has been confirmed which will facilitate improved access to the Manawatū River from within the site. The new reserve area will be zoned recreation to recognise that the reserve area is not for future residential development. This process is explained in more detail in 2.1.1.

The overall intent with PCE is to deliver a well-functioning urban environment. Council has prepared a Future Development Strategy (FDS) (2024) under the NPSUD which has defined what a well-functioning urban environment means in the context of business needs, affordability, moving between home, work and recreation, resilience, quality urban design and meets the aspirations of RoM. In the context of this plan change, a well-functioning urban environment means a variety of options for living by providing a high-quality residential environment with a range of housing typologies.

In summary, PCE:

- Rezones approximately 4 hectares of predominately industrial land in Hokowhitu to Residential, including a recreationally zoned reserve area of 1300m^2, connecting the proposed residential area to the Manawatū River environment.
- Proposed additions to section 10 of the District Plan which encourages active frontages, functional outdoor spaces, front yard landscaping and high quality building design.
- Provisions address housing density, active frontages, functional outdoor space, a reduction in visual dominance of garages, front yard landscaping and building design
- Ensures new provisions support high level of amenity and access to sunlight by applying the existing residential zone provisions to the majority of the site.
- Enables medium density housing opportunities by providing a multi-unit pathway under existing District Plan Rule 10.6.3.3.
- Ensures development within the plan change area allows a transition in density to be consistent with the adjoining Residential Zone.
- Ensures development is consistent with and achieves the Structure Plan (noting the road widths and locations are designed to maximise the area for housing).
- Provides for effective management of stormwater, including stormwater quality improvements.
- Provides clear and easy access to the Manawatū River for all users.
- Consequential amendments to the District Plan.

The proposed Structure Plan underpins key components of PCE, including by identifying:

- A logical development pattern similar to other areas of Palmerston North.
- Future new road locations that ensure connectivity and avoid cul de sacs.
- A location where three story development is permitted and where a maximum of two stories is located (which is the same height as the adjoining Residential Zone).
- The new reserve location which is facilitated through an exchange of an existing reserve – refer section 2.1.1 of this Report.

2.1 Other Processes

2.1.1 Reserve Exchange under the Reserves Act 1977

Early in the plan change development, an opportunity was identified to exchange a piece of reserve land adjacent to the proposed RRA. The existing strip of land at the southern end of the Roxburgh Residential Area forms part of the Waterloo Park. The reserve strip currently acts as a buffer between the Residential Zone and the Industrial Zone. This buffer would be redundant if the RRA becomes residential. The reserve land would be better utilised as an area of green space in the centre of the RRA. To enable the reserve in the central area of the site a land exchange has been progressed by Council. Council embarked on a separate process to exchange this land with an area to the centre of the site to enable better use of the land and access to the River environment. This process has progressed under the Reserves Act concurrently with the development of PCE. The reserve exchange was accepted by the Minister of Conservation on 12 July 2024 and will be zoned recreation. There is a programme in the 2024 Long Term Plan to develop this reserve and accessway to the Manawatū River.

2.1.2 LGA 2022 Accessway

Council owns a piece of land at 22 Roxburgh Crescent (shown in Figure 2). This land has been owned by council since 1936 and was purchased by the Council during a mortgagee sale. The land was not purchased for a particular purpose and has not been vested or classified. It currently runs through privately owned land and is used by the council and community for events i.e Relay for Life. This piece of land is not easily accessible by the public and is gated off. The wider rezoning of Roxburgh Crescent means that this piece of land needs to be disposed of/sold or classified for a purpose.

The purpose is to utilise the land and use part for an accessway and the rest as road reserve to facilitate the residential development of the site and access to the Manawatū River. The intention is the road reserve portion will be used as a carpark to cater for users of the new reserve and River entrance.

As part of the Plan Change a separate process under the Local Government Act is required to enable this land already owned by Council to be used as road and access to the Manawatū River. This process is to happen concurrently with (but separate to) the progression and notification of PCE.

Figure 2 Council Owned Land at 22 Roxburgh Crescent

3 Proposed Amendments to the District Plan

3.1 Overview

PCE proposes to make changes to the District Plan to support development of the RRA. This involves introducing a new structure plan, new objectives, policies and rules that apply specifically to the RRA. The intention of the changes to the District Plan aim to deliver a well-functioning urban environment that manages stormwater, provides an efficient use of land, delivery of housing types, deliver connectivity in accordance with the structure plan and restricts non-residential development. These changes are identified below.

Proposed changes to the District Plan as a part of PCE involve amendments and additions to:

- Definitions (Section 4),
- Subdivision (Section 7), including a new structure plan and specific roading cross sections and;
- Residential Zone (Section 10).

A full copy of the proposed changes are contained in Appendix A.

3.2 Objectives and Policies

New objectives and policies have been proposed for section 7 and 10 of the District Plan. The objectives and policies are set out in Appendix A of this report.

Subdivision

The new objective and associated policies seek to ensure:

- Subdivision delivers the layout identified in the structure plan;
- Deliver an increase in housing capacity to meet growth targets and housing demand for the City through smaller lot sizes and multi-unit development;
- Provide a single access to the Manawatū River;
- Manage stormwater through permeable surfaces and water sensitive design principles; and
- Restrict the use of cul de sacs and ensure roading connectivity.

Residential

The new objectives and associated policies seek to ensure:

- Deliver a well-functioning urban environment by enabling housing density, active frontages, functional outdoor space, a reduction in visual dominance of garages, front yard landscaping and building design.
- Require development to be delivered in general accordance with the layout of the structure plan.
- Provide for development within a Riverfront Area shown on the Structure Plan (4.1.1), with opportunity for permitted three storey development.
- Manage stormwater through imposing minimum floor levels, front yard landscaping and sufficient permeable surfaces on site.
- To restrict non-residential activity and ensure the plan change area is to be used for housing to meet the housing demand in the short to medium term for Palmerston North City.

3.3 Rules and Methods

Subdivision

Subdivision within the RRA is proposed to be a Restricted Discretionary activity where it is in accordance with the structure plan (including road corridor cross sections) and a range of performance standards relating to minimum and maximum lot size. Any subdivision which does not comply with these performance standards will be considered as a Discretionary Activity.

The structure plan provides for optimal road layout, a logical development pattern similar to other areas of Palmerston North, and a reserve area with clear connection to the Manawatū River.

Residential

Dwellings, minor dwellings and accessory buildings within the RRA are proposed to be a permitted activity. This defaults to restricted discretionary where there is noncompliance with floor levels, site coverage, lot size, height, overlooking, separation distances, outlook space and outdoor amenity. Non-compliance with permeable surface requirements (R10.6.1.8 D) defaults to a non-complying activity.

The RRA is also proposed to be a multi-unit housing area in the District Plan. Multi-unit development within the RRA is a restricted discretionary activity and would be assessed under the multi-unit development rules under existing R10.6.3.3. Specific requirements are proposed for the RRA including achieving the design elements in the structure plan, and minimum notional site area, outlook space and height. Where multi-unit development does not meet the standards in R10.6.3.3 the activity will be a Discretionary Activity.

3.4 Planning Maps

Amend the planning maps as follows:

- Rezone the current Industrial Zone land to Residential Zone.
- Rezone the area of the new reserve in the centre of the site to Recreation Zone.
- Rezone the area of the Waterloo Park that is the subject of the reserve exchange from Recreation Zone to Residential Zone.
- Rezone land that Council owns at 12a Roxburgh Crescent in part to Residential Zone.

- Rezone land that is along the inland toe of the existing stopbank from Conservation and Amenity to Residential Zone

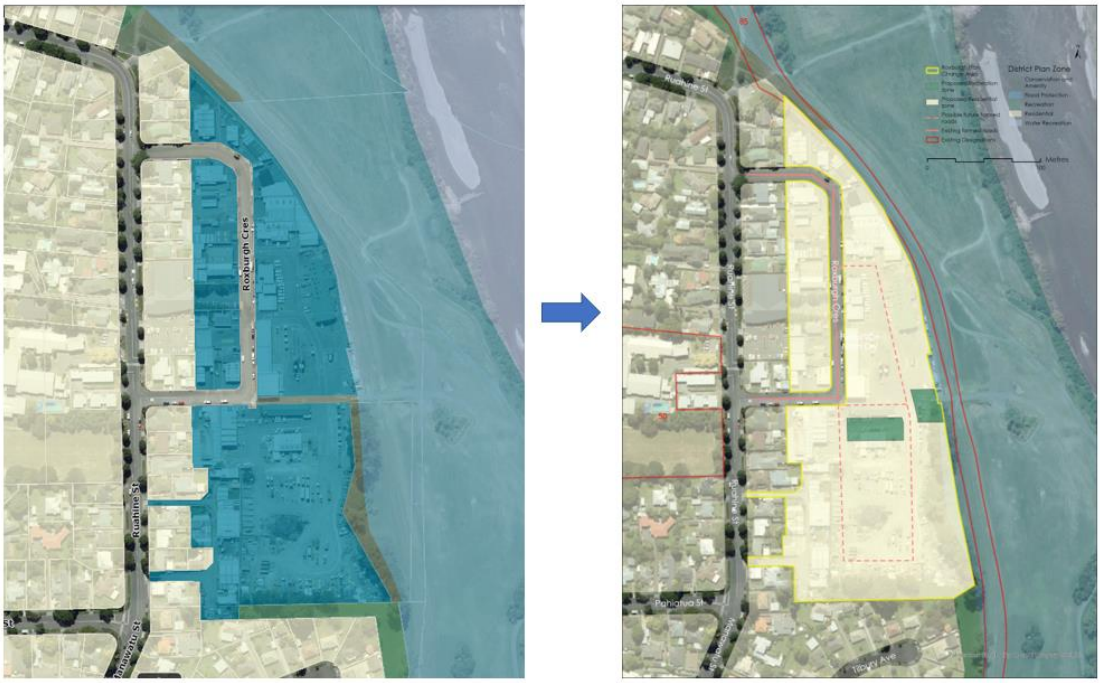


Figure 3 Left: current district plan zoning, Right: proposed PCE zoning.

The changes in zoning based on the legal descriptions of each lot are shown in the table below:

Table 1: Operative and Proposed Zoning

Area	Legal Description	Operative zoning	Proposed zoning
Waterloo Park (subject to the reserve exchange)	PT LOT 44 DP 22620 LOTS 1 2 DP 51067 LOTS 1-3 DP 51192 LOT 1 DP 52182	Recreation	Change part to Residential
PNCC land (12a Roxburgh Crescent)	Pt Lot 200 DP 791, Pt Lot 206 DP 791, Pt Lot 201 DP 791, Pt Lot 198 DP 791, Pt Lot 199 DP 791, Pt Lot 205 DP 791, Lot 3 DP 60866, Lot 35 DP 25417, Pt Lot 2 DP 60866	Conservation and Amenity Flood protection	Part Residential Part Recreation
12 Roxburgh Crescent	LOT 2 DP 74592	Conservation and Amenity	Change part to Residential.
22 Roxburgh Crescent	LOT 1 DP 74592	Industrial	Residential and part recreation

571A, 573, 575 Ruahine Street	LOT 1 DP 32023 LOT 2 DP 22494 LOT 1 DP 32973 LOT 6 DP 17578 LOT 2 DP 322018	Industrial	Residential
565A Ruahine			
565 Ruahine Street	PT LOT 5 DP 17578		
559 Ruahine Street	LOTS 3 DP 28565, LOTS 4 DP 28656		
4 Roxburgh Crescent	LOT 14 DP 25417		
8 Roxburgh Crescent	LOT 15 DP 25417		
22 Roxburgh Crescent	LOT 1 DP 60866, LOT 23 DP 25417, LOT 21 DP 25417, LOT 22 DP 25417, LOT 25 DP 25417, LOT 2 DP 19692, LOT 3 DP 19692, LOT 24 DP 25417, LOT 4 DP 19692		
3 Roxburgh Crescent	LOT 16 DP 25417		
7 Roxburgh Crescent	LOT 17 DP 25417		
9 Roxburgh Crescent	LOT 18 DP 25417		
17 Roxburgh Crescent	LOT 19 DP 25417		
19B Roxburgh Crescent	LOTS 2 DP58111, LOTS 3 DP 58111		
19 Roxburgh Crescent	LOT 1 DP 58111		
21 Roxburgh Crescent	LOT 2 DP 76087		
23 and 23A Roxburgh Crescent	LOT 28 DP 25417		
25 Roxburgh Crescent	LOT 29 DP 25417		
27 Roxburgh Crescent	LOT 30 DP 25417		
29 and 31 Roxburgh Crescent	LOTS 31 DP 25417 32 DP 25417		
32 Roxburgh Crescent	PT LOT 1 DP 19692		
33 and 33A Roxburgh Crescent	LOT 33 DP 25417		
34 Roxburgh Crescent	LOT 26 DP 25417		
36 and 36A Roxburgh Crescent.	Unit 1 DP 87133 Unit 2 DP 87133		
38 and 38A Roxburgh Crescent	PT LOT 40 DP 25417		
40A Roxburgh Crescent	PT LOT 2 DP 75001		
40 Roxburgh Crescent	PT LOT 1 DP 75001		
42 Roxburgh Crescent	PT LOT 1 DP 19692		

3.5 Consequential Changes

Make consequential changes, including numbering changes, as a result of the insertion of new rules, as necessary. This includes the insertion of a new definition relating to the Roxburgh Crescent Residential Area into section 4 (Definitions) of the District Plan.

Part II: Section 32 Report

4 Introduction

This Evaluation Report (the, or this, "Report") has been prepared to fulfil the obligations of PNCC under Section 32 of the RMA, with respect to undertaking a plan change to the District Plan. This report provides a summary of the evaluation undertaken by the Palmerston North City Council (the Council) in accordance with Section 32 of the Resource Management Act 1991 (RMA or the Act) in relation to Proposed District Plan Change E: Roxburgh Residential Area (PCE) to the operative Palmerston North City District Plan (the District Plan or the Plan).

This evaluation examines whether the provisions in PCE are the most appropriate way to achieve the purpose of the Act and assessing the efficiency and effectiveness of policies, rules, and other methods in considering whether they are the most appropriate means of achieving these objectives.

The evaluation must consider the benefits and costs associated with each policy, rule, or method and the risk of acting or not acting if there is uncertain or insufficient information on the subject matter.

4.1 Purpose of the plan change

The purpose of PCE is to rezone an area of predominately industrial land to Residential Zone. This will enable housing choice and supply and remove reverse sensitivity issues that occur when industrial uses are in close proximity to residential use. As outlined in the following sections of this Report, growth in the City has been accelerated creating additional demand for housing areas. The uptake of residential development in the Roxburgh Residential Area is intended to provide land over the short to medium term (1-10 years).

The major landowner (Higgins Family Holdings) within the RRA, has expressed aspirations for a residential development on their land. As a result, the RRA has undergone a master planning process to show how the site can be transformed into a well-functioning residential area for Hokowhitu. This master planning has included other industrial landowners who may wish to develop to residential in the future. The process resulted in a comprehensive structure plan to guide future subdivision and residential development of the RRA.

PCE amends the District Plan by introducing the RRA structure plan to support development of the brownfield area and reflect intended spatial, environmental and urban design outcomes which recognise the uniqueness of this site. This planning approach is supported by specific provisions within the subdivision and residential zone chapters of the District Plan which incorporate the specific structure plan and roading cross sections.

PCE will rezone land within the RRA to enable residential development, including a range of housing types. With a 250m^2 minimum lot size, the RRA can accommodate around 105 dwellings over the whole site. This is consistent with Councils infill targets being 55% of new

developments being infill development. A lower yield will result if section sizes are greater. To ensure large lots are generally avoided, a maximum lot size has been included.

4.1.1 Structure Plan

The development of land within the RRA is informed by a structure plan to ensure a well-functioning urban environment, which produces high quality private and public realms, with good connectivity and infrastructure. The structure plan includes a new road extension to Roxburgh Crescent to serve the southern portion of the site and new roads to provide access to properties. Reserves within the middle of site provides accessible public access from the residential are to the Manawatū River Environment. The reserve land will be the same size as the existing strip of Waterloo Park (to be exchanged) at the southern end of the site which currently serves as a buffer zone between the Industrial zone and the Residential zone.

The Structure Plan also includes an extension to the existing Higgins property towards the stop bank. This is set back 8m from the toe to ensure compliance with Horizons Regional Council One Plan land use rules for activities near stopbanks. Council understands that Higgins are progressing a land purchase with Horizons Regional Council to enable a better form and layout of sections nearer the stopbank. It is noted that the land purchase is a private matter outside the plan change process however it will affect lot layout with future properties adjacent to this area.

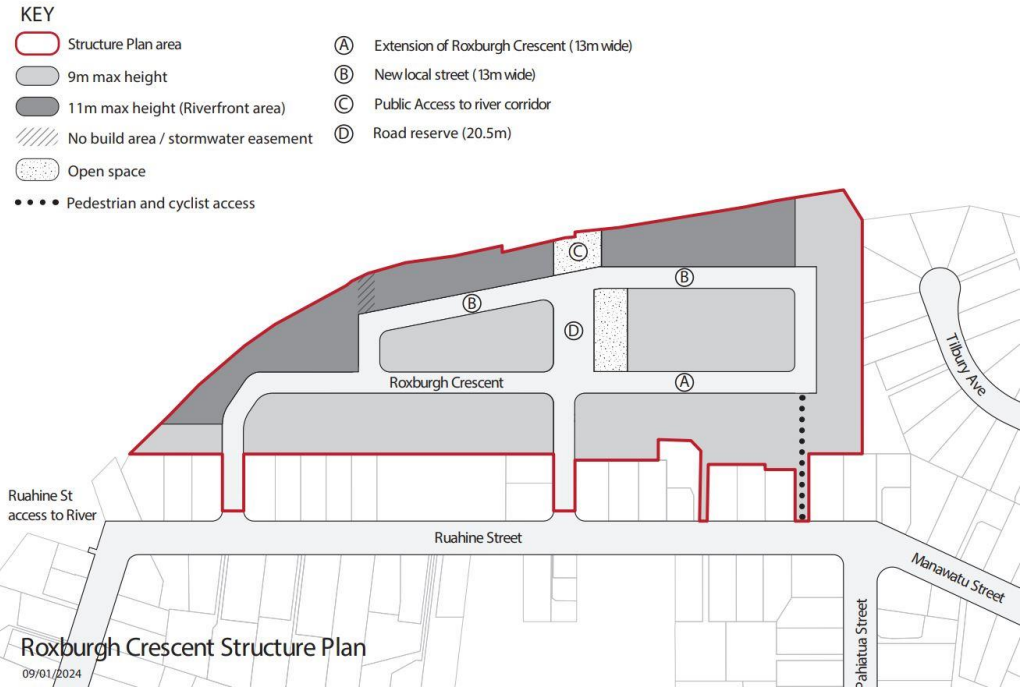


Figure 4 PCE Structure Plan

A 'stepped' approach from the existing residential zone is taken in the structure plan, to provide a transition in height from the 9m in height in the existing Residential Zone through to

an 11m maximum height along the stop bank (shown on the Structure Plan as the 'Riverfront area').

4.1.2 Road Cross Section

Specific road cross sections are included as part of the planning approach in PCE. This recognises the existing Roxburgh Crescent environment where the existing road is only 13m wide, rather than the typical 15-18m wide generally found throughout the City. The development of roads in this area is acknowledged as a departure from Councils Engineering Standards and as such specific road design is necessary to include in the District Plan. This will provide greater certainty at development and consenting stages. The departure from the engineering standards is necessary to recognise the existing road, that the roads are not thoroughfares and to maintain the yield sought by this plan change.

5 Resource Management Issue

5.1 Growth Context

From 2015 to 2020 population growth in the City accelerated alongside strong economic activity in the region and it is estimated the population of Palmerston North will reach 117,280 by 2054. This strength is expected to continue with the population of the city expected to reach 114,000 by 2048. If predictions are accurate, the City will need 9886 additional homes by 2054.

PNCC is required to provide housing capacity to cater for Palmerston North's increasing population under the NPSUD. While the HBA indicates there is no shortage of land for housing, Council still need to provide land to keep up with demand and provide infrastructure ready land for short to medium term development.

Council has set its housing bottom lines out of the HBA. Housing bottom lines are used to state the amount of development capacity needed to meet expected housing demand in the region, plus the appropriate competitiveness margin. Council adopted the following bottom lines (recorded in section 1.3.4 of section 1 of the District Plan):

	Short term within the next 3 years	Medium term between 3 - 10 years	Long term between 10 – 30 years	30 year total
Housing location				
Greenfield	393	1,505	3,240	5,138
Infill	541	1,354	2,357	4,251
Rural/Rural-Residential	49	150	295	494

Housing type				
Standalone dwelling	855	2,618	5,126	8,599
Attached dwelling	128	391	766	1,285

Table 2 Housing Bottom Lines. Source: PNCC District Plan.

The publishing of the Housing and Business Needs Assessment 2023 (under NPSUD 2020) found that smaller houses and intensification will need to make up a larger proportion of newer houses being built to meet future housing demand and needs. The housing bottom lines have responded to these findings and ensuring demand is catered for based on a reduction in household sizes.

5.1.1 Why Roxburgh Crescent?

The RRA was identified as a potential growth area for the City in 2018, following discussions with Higgins Family Holdings who at the time was considering the future use of their landholding. The reasons PNCC have prepared this Plan Change to support and facilitate growth in the RRA include:

- Roxburgh Crescent is an unusual location for an industrial area, and rezoning to residential will ensure consistency in land use within the wider Hokowhitu area.
- Rezoning to residential avoids future reverse sensitivity issues between potentially incompatible uses.
- The new plan provisions allow for a variety in housing choice through reduced minimum lot sizes and increases in height for some properties.
- RRA is a suitable location to provide housing options as it is close to a primary school, local shops and it is on a regular bus route.
- The location of the RRA next to the Manawatū River provides the opportunity to develop three stories over the stop bank (which is presently not enabled in the Residential Zone under the existing District Plan).
- The opportunity for brownfield redevelopment is rare within the City, and this site for reasons explained in this Report, provides an excellent opportunity for residential development. The rezoning of brownfield areas is generally more cost effective as there is often minimal or no additional council infrastructure services required compared with greenfield development.
- Accessible public river access can be achieved from the RRA, serving a wider benefit to the future residents of the area and the wider community.
- Rezoning land to residential use will reduce heavy traffic through the existing Residential Zone as the transport flows will be directly related to residential use (passenger vehicles) over time as the area becomes fully residential.

Infrastructure and Services

Residential development in the RRA can rely on existing infrastructure services within the network and no immediate upgrades are required for development to occur. However, road and stormwater upgrades will be needed to support residential development.

Stormwater can be managed through onsite permeability requirements and future planned upgrades (refer to Appendix J). To manage stormwater in the short term, a higher permeable surface standard of 45% has been applied until the outfall is upgraded, which then drops to 35%. This approach reflects the stormwater assessment which supports imposing permeable surface standards as the most efficient way to manage stormwater on site. Non-compliance with proposed new rule *10.6.1.8 D Permeable Surfaces* in the RRA is a Non-Complying Activity. This reflects the importance of achieving onsite permeability to avoid onsite pooling and to manage stormwater volume generated from the site.

Development can occur without the immediate upgrade of the existing Roxburgh Crescent road reserve to a residential standard. A programme for the roading upgrade will respond to the timing of development at Roxburgh Crescent. It is anticipated a programme for this will be put forward to the 2027 LTP. If there is demand for this upgrade before the next LTP there are options to bring this forward.

There is sufficient capacity in the water and wastewater network to support development (see Appendix K).

5.2 How the RRA delivers on Growth

This plan change responds to Council's housing bottom lines for development within the existing urban area, given the location of the site is within the existing City boundary. PCE is intended to provide for housing via brownfield redevelopment in the short to medium term, contributing around 105 lots based on a 250m^2 minimum lot size.

The present Industrial Activity Zone is anomalous. PNCC has identified preferred locations for industrial activity to the north and west of the city. The pocket of industrial activity at Roxburgh Crescent detracts from the residential character of Hokowhitu and the amenity value of the river corridor.

Development of PCE has considered the current growth and development patterns for the wider Palmerston North City. The HBA indicated Palmerston North has a demand for housing within the existing urban area, shown by building consent data which shows infill development has made up 50% of new homes built. There is also growing demand for smaller sections and different housing opportunities within Palmerston North to provide housing choice, affordability and location. To cater for these market demands, the proposed provisions allow for a smaller lot size than what is required in the Residential Zone and restricts lot sizes to a maximum of 500m^2 to ensure the efficient use of land.

PCE is intended to provide for growth by allowing housing choice through smaller lot sizes and opportunities to build higher along the stop bank, within the city in close proximity to local amenities. While the RRA did not meet the criteria to be included within the Proposed Medium Density Residential Zone (PCI), PCE has provided the opportunity to deliver the redevelopment of a brownfield site that can achieve a different residential density outcome for the City. The

RRA intends to meet the NPSUD by supporting options for a range of densities and housing choice outside the (PCI). PCE also provides the opportunity for multi-unit through amendments to this performance standard in the District Plan. This is consistent with recent plan changes across the City.

While the RRA is intended to provide for short to medium term housing growth, the uptake in conversion of the land to residential development may differ due to market conditions and individual landowner appetite for development. The mixed ownership of the site indicates the RRA will transition to residential in time depending on each landowners interests.

Key reasons for why PCE delivers on the growth of the City include:

- PCE provides approximately 105 lots, in an area that is well connected to amenities.
- Existing demand for housing within the city boundary will continue over the next three years.
- The Structure Plan demonstrates that residential housing development is possible and achievable at the intended density.

5.3 Supporting Technical Evidence

In considering and prepared PCE, PNCC has either completed or commissioned a number of technical reports and supporting documents. The technical reports prepared to support PCE are listed below. A summary of the key findings of the reports are provided here, with full copies of the Reports in the Appendices.

- Stormwater Report, 02/24, Reiko Baugham.
- Water and Wastewater Report, 09/02/24, Wayne Venter, Ahmed Yehia and Eng Lim.
- Urban Design, 11/01/24, Chris McDonald.
- Ground Contamination PSI, 03/20, Kasey Pitt.
- Ground Contamination DSI, 10/19, N Pilcher.
- Liquefaction, 04/20, Andrew Wallace.
- Parks and Reserves, 19/07/2024, Aaron Phillips.
- Transport, 01/03/24, Matthew Evis.
- Noise, 18/01/24, Nigel Lloyd.

5.3.1 Stormwater

Ms Reiko Brougham from GHD completed a stormwater servicing assessment for Roxburgh Crescent in February 2024. A full copy of the Report is contained in Appendix J.

The Stormwater Report summarises the assessment of the stormwater servicing requirements for RRA. The assessment considered the proposed residential rezoning and subdivision to determine its likely impact on the surrounding environment and the measures required to mitigate any adverse impacts from the development.

Specifically, an upgrade to the stormwater outlet pipe is identified in the Report. The Report identifies that this upgrade is necessary because of increased flows being generated from the

site. Until the outfall is upgraded, higher permeability standards are enforced through the District Plan provisions, with allowance for this standard to drop once the outfall is upgraded.

Money has been allocated in the draft Long Term Plan 2024/34 for the recommended upgrades. This programme has been put forward to the 2024 Long Term Plan, starting with consenting and design in year 1 (2024/25) with construction signalled for year 4 (2027/28) with the option to bring forward to year 3 (2026/27).

The Report recommends the following matters be included in PCE for stormwater management:

1. Water sensitive design elements must be incorporated in the development through the use of Filterra® tree pits or equivalent to mitigate both stormwater quantity and quality impacts.
2. Approximately 1 square metre of Filterra® or equivalent be provided per 270 m^2 of contributing catchment area of the road reserve.
3. The RRA must promote stormwater infiltration by limiting lot imperviousness area. If the existing stormwater outfall is to be kept, the total impervious area should be limited to 28% of the gross area but must not exceed 45%. No attenuation will be allowed to offset additional impervious area.
4. Due to the existing industrial land use, contaminated land investigations and management plans are required to ensure contaminated runoff does not enter the stormwater network, both during construction and after.

The Report concludes that the use of the RRA for residential purposes is possible, however there are some specific measures that need to be taken into account in future development. The Report notes that the site is generally pervious which will change as residential development occurs and becomes more impermeable. An increase in stormwater flows is likely to occur from the site changing to residential use. Attenuating water onsite through attenuation is not seen as an option for the site as it is at the bottom of the catchment. Attenuating any flow on site may adversely impact the upstream catchment. The Report therefore recommends upgrades to the stormwater infrastructure in the area.

The recommendations of this report have been addressed in the draft provisions in Appendix A.

5.3.2 Water and Wastewater

Wayne Venter, Ahmed Yehia and Eng Lim on behalf of the PNCC Infrastructure Unit completed a Water and Wastewater Servicing Assessment for Roxburgh Crescent in 2023. A full copy of the Report is contained in Appendix K.

Yield studies were completed for the area based on up to 123 residential dwellings. These estimates are based on a variety of dwellings sizes varying from 150 m^2 three-storey townhouses to 350 m^2 detached 1-2 storey houses. The Report assesses the current extent of water and wastewater networks for the proposed area and surrounds of Roxburgh Crescent, and the implications of needing to service the additional number of dwellings that could occur as a result of PCE taking effect.

For water servicing, the modelling showed that:

- The PNCC level of service for pressure of 350 kPa at lot boundaries would be achieved for up to 123 proposed lots during the peak day.
- The PNCC level of service for firefighting for residential properties, which is FW2 (see above), would be met.
- No upgrades to the existing PNCC water supply network are needed to enable the proposed development; nor is any funding required.

For wastewater servicing, the modelling showed that:

- All the wastewater collected in this catchment connects to a 300 mm trunk main which runs from Pahiatua Street, through Crewe and Stirling Crescents, through the Manawatū golf course and the old teachers' college area. The wastewater collected at the Jickell Street pump station is then pumped to the Palmerston North gravity network downstream from where it then flows to the Totara Road wastewater treatment plant.
- The modelling has indicated that the existing 300 mm main from Albert Street to the Jickell Street pump station is under capacity in wet weather events. The section from the Manawatū golf course/old teachers' college boundary to the Jickell Street pump station will be upgraded in the FY2025/26 to benefit the wider Hokowhitu catchment.

The Water and Wastewater Report did not include any specific recommendations required as part of this Plan Change.

5.3.3 Urban Design

Chris McDonald from McIndoe Urban was commissioned to complete an Urban Design report for the Roxburgh Residential Area as part of the master planning process. A full copy of the Report is contained in Appendix C.

The overarching findings of the Report are:

The site is well-suited to housing being flat, centrally located and framed by established residential development. The area has good access to services and amenities. These include public transport, schools, the Hokowhitu local centre and the exceptional recreational opportunities offered by the Manawatū River Reserve.

Approximately two-thirds of the structure plan area is in single ownership. Given its extent, the Higgins property enables a comprehensive approach to planning and redevelopment. Key stakeholders have been involved in formulating and reviewing the structure plan.

Comprehensive planning can produce a high-quality public realm with improved visual and physical connections to the river corridor. The Higgins property currently blocks river access. One of the structure plan's organising features is a new east-west river connector or parkway, which links Ruahine Street to the Manawatū River Reserve. The east-west river connector replaces a reserve at the southern extremity of the site. The existing open space separates

industrial and residential activities. However, its role as a buffer becomes redundant if the Higgins property is redeveloped as housing.

A comprehensively planned redevelopment can incorporate medium-density housing with a range of lot sizes and dwelling types. The effects of taller, denser buildings can be managed because the whole Roxburgh Crescent area is subject to a unified spatial plan and targeted development standards.

In general, PNCC's existing development controls can deliver a high-quality outcome at Roxburgh Crescent. However, several new site-specific standards are proposed. The urban Design Report has recommended site-specific provisions for lot sizes, site coverage and Height Recession Planes (HRP) so as to ensure development is delivered to a high quality.

5.3.4 Ground Contamination Assessment PSI

N Pilcher from Tonkin & Taylor completed a desk top study for the site. This Report was completed in general accordance with the requirements for a Preliminary Site Investigation. A full copy of the Report is contained in Appendix G.

The report notes in terms of historical land use that "*The site itself appears to be predominantly pasture/bare land through to the 1950s, with only minor buildings beginning to be developed in the south west corner for unknown use. Between 1966 and 1986 aerial imaging shows that the southern end of the site was a market garden and in 1986 the area just north of this appears to be used as a landfill or for stockpiling. Overall, the site appears to have been used primarily for industrial business use which began extensive development in the late 1950s and 1960s with the construction of various factories, store sheds and workshops. This development continued through the 1970s and 1980s, with some new workshops, warehouses and offices developed and a range of additions/alterations to existing buildings. In the 2000s a property in the north east of the site (38-38A Roxburgh Crescent) was converted partially into a residential dwelling. Some fire damage on the property was noted in 2013 and some buildings appear to have been demolished between 1966 and 1986 and others between 2007 and 2008.*"

The types of land use of the site have included:

- Building and construction;
- Civil engineers/construction and roading;
- Motor vehicle and engineering;
- Electrical;
- Market gardens;
- Landfill/stockpiling (tentative);
- Residential; and
- Other, including a dance school, playground equipment design and manufacture, scales/weighbridge suppliers, commercial laboratory.

The Report also notes that the largest property on the site is occupied by Higgins Contractors Limited for civil engineering, construction and roading. Horizons Regional Council information

on contaminated sites also identified two sites– a motor vehicle workshop and transport depots of yards including areas used for refuelling or the bulk storage of hazardous substances.

The Report concludes that the NESCS applies to the site because:

- HAIL activities are more than likely to have occurred on the site;
- Land use change/subdivision is proposed; and
- There is no DSI to show that concentrations of contaminants are within background concentrations.

5.3.5 Ground Contamination Assessment DSI

Kasey Pitt from Tonkin & Taylor completed a ground contamination investigation on eleven properties within the RRA. The report was completed in general accordance with the requirements for a Detailed Site Investigation. A full copy of the Report is contained in Appendix F.

The key findings of the DSI report are:

A number of activities included in the MfE HAIL are currently, or have been historically, undertaken across the site;

Analytical results from soil samples collected in the investigation show elevated concentrations of contaminants. However, the majority of the results are below human health criteria for residential land use;

Concentrations of metals exceeding human health criteria were found in two locations, one location on 8-22 Roxburgh Crescent and one location at 29-31 Roxburgh Crescent;
Asbestos was found in samples collected from two locations at 29-31 Roxburgh Crescent to be above the guideline value for human health;

The presence of contaminants in the majority of samples indicates that cleanfill disposal will not be appropriate. Further assessment will be required to determine appropriate disposal options; and

The existing site data is sufficient to inform the current plan change process. However, as HAIL activities will continue to operate on the site, and there will be a need to confirm the extent of asbestos in soils at 29-31 Roxburgh Crescent, we recommend that further intrusive investigations be undertaken once the activities have ceased and prior to residential redevelopment.

In response to the recommendations of the Ground Contamination Assessment Report, the NESCS will apply to large areas of this site. That means that resource consents for development of the site will be required under the NESCS. A specific guidance note has been included in proposed Rule 7.6.2.6 to alert plan users of the requirements to obtain consent under the NESCS (noting that the NESC prevails over rules in the District Plan).

5.3.6 Liquefaction Assessment

Andrew Wallace from Tonkin & Taylor completed a liquefaction assessment of the RRA. A full copy of the Report is contained in Appendix I.

The assessment was undertaken to inform Council of the risks associated with liquefaction and lateral spreading at the site, and any potential strategies for use during development of the site to mitigate the liquefaction and lateral spreading hazard.

The Report confirms that the liquefaction category corresponds to a probability of more than 85 percent that liquefaction-induced ground damage will be None to Minor for 500-year shaking. At this stage there is not enough information to distinguish between Very Low and Low liquefaction vulnerability; however, the site may be conservatively assigned a Low liquefaction vulnerability categorisation. The Report concludes that a more detailed assessment would be required to assign a Very Low liquefaction vulnerability category. No lateral spreading hazard is expected to be present at this site. MBIE guidance suggests that if a site has an unlikely liquefaction damage category then lateral spread is also unlikely.

The Report notes that the site has been categorised as Liquefaction Damage is unlikely according to the MBIE guidance document. All normal requirements for earthworks and building design still apply (e.g. as stated in NZS 3604).

As a result of the conclusions in this Report no specific provisions relating to liquefaction or lateral spread have been included in the PCE. The adherence to New Zealand Standards is a separate matter to be covered at development stage.

5.3.7 Parks and Reserves

Aaron Phillips, Councils Activities Manager – Parks has completed a parks and reserves Report on 19 July 2024. A full copy of this Report is contained in Appendix E.

The purpose of the assessment is to provide information for the planning of recreation reserves and facilities within the RRA.

The report outlines that given the proximity of the Manawatu River open spaces and Waterloo Park playground no new neighbourhood reserve is required in the proposed plan change area. No additional suburban reserves are required to due to the proximity of the Hokowhitu Domain and Manawatū River Park, a City Reserve, to the RRA is immediately adjacent to the Roxburgh Plan Change area. These City Reserve provides the open space and amenity functions similar to that of a suburban Reserve. Furthermore, there is no requirement for a special character reserve in the proposed plan change area.

There is approximately 1,300m^2 of Waterloo Park located to the south of the RRA providing a buffer strip between the existing industrial activities and the residential housing on Tilbury Avenue. As part of plan change process the possibility of exchanging the buffer area for land associated with the river entrance has been undertaken. In Mr Phillips opinion the proposed exchange would result in better reserve and recreation outcomes, compared to the existing current location. Through a separate consultative process Council sought to complete a land

exchange as discussed in Section 2.1.1 of this Report. The Minister, through their delegation powers, approved this land exchange under the Reserves Act 1977 on 12 July 2024.

Council also owns an existing river access land parcel which is 6m wide and located in the middle of the RRA. Mr. Phillips notes that this area has only been used for service vehicles and special event booked events, not public access.

Regarding the road reserve and river access point upgrades, Mr. Phillips outlines:

- *The road reserve, in the location of the accessway proposed to be vested as road is proposed to be 20.5 m wide, as opposed to the 13 m wide through the rest of the proposed plan change area. This will enable provision of 90 degree car parking in the road reserve adjacent to the proposed reserve exchange area. Without the provision of the extra road reserve width there would be very limited on street parking available to support the river access.*

- *The existing river access point, can be enhanced and improved as part of the plan change by:*
  - *Establishing a width that opens up sight lines to the river, is more inviting and has the potential for some landscaping (within the constraints of the stop bank requirements).*
  - *The width and slope of the access point means opening it up will improve its usefulness as a service vehicle and events access point for the expansive reserves in the vicinity.*
  - *Providing some on-street carparking nearby supports river access use from the wider community. The proposal includes similar arrangement to that at the bottom of Albert Street.*
  - *It's development provides an opportunity to give effect to cultural and river park values.*

- *The proposed reserve exchange would enhance sight lines and creating an inviting river entrance with more opportunities for tree planting, and rest areas for the start and end of river excursions.*

5.3.8 Transportation

Matthew Evis from WSP completed a Transport Assessment (TA) of the proposed Plan Change to rezone existing industrial land to residential for housing. A full copy of this Report is contained in Appendix D.

The primary purpose of the TA is to provide a high-level assessment of the transport related effects of the potential rezoning and reviews the suitability of the accompanying Structure Plan from a transportation perspective. The assessment took into account the potential to accommodate up to 105 lots (based on a 250m^2 size scenario).

The following traffic related items have been included in the Report:

- The expected trip generation and site operations,
- The impacts of the proposed development on the local road network,
- The suitability and safety of the proposed site accesses and internal site arrangements, and
- Connectivity of the site for both active modes (walking and cycling) and public transport.

The TA noted that the existing road corridor is narrow. To address this, road cross sections have been recommended. Two cross sections have been prepared for inclusion in PCE that reflect the need for development to depart from Council's Engineering Standards (which require local roads to be a width of 15.5m with two 1.8m footpaths on either side). Due to the existing narrow street environment of 13m and requirement for biofiltration devices in the road corridor, one cross section addresses the existing Roxburgh Crescent and new roads in the RRA. A second cross section relates to the east/west road connector in the centre of the site which has a larger road reserve of 20.5m to accommodate the LGA accessway land (2.1.2) and to provide for a future carpark. The TA demonstrates a narrower road can still function sufficiently for residential use.

The TA concludes there is sufficient capacity in the transport network to support the change in land use and the transition to residential will result in a net reduction in peak hour traffic demands compared to industrial land use activities that had previously used the site.

5.3.9 Noise

Acousafe Consulting and Engineering Ltd to complete a noise assessment of the Roxburgh Crescent site. A fully copy of the Report is contained in Appendix H. The assessment was undertaken to inform Council of issues associated with noise/ reverse sensitivity from the proposed rezoning and change in land use.

The Report concludes that rezoning the land from Industrial to Residential will provide for the gradual transition from the current industrial activities to full residential development over the next ten-year period, or so. It is recommended that the noise provisions of the Residential Zone be applied to the RRA.

6 Regulatory and Policy Context

This section identifies the legislative and national, regional, and local policy framework that provides the context for Proposed PCE.

6.1 Statutory Context

Section 74 of the RMA requires PNCC to change its District Plan in accordance with a number of statutory documents and considerations (including Part 2). Similarly, section 32(1)(a) of the RMA requires an evaluation report to examine the extent to which the objectives of the proposal being evaluated are the most appropriate way to achieve the purpose of the RMA. The purpose and principles of the RMA are set out in Part 2, sections 5-8 of the Act. Other sections of the RMA which are also considered relevant to Proposed PCE are set out below.

6.1.1 Section 5 – Purpose of the Act

Section 5 sets out the purpose of the RMA, which is to promote the sustainable management of natural and physical resources. Sustainable management *"means managing the use, development, and protection of natural and physical resources to enable people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety, while –*

- *sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
- *safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
- *avoiding, remedying, or mitigating any adverse effects of activities on the environment'."*

PCE is considered to be consistent with the purpose of Part 2 of the RMA as it will promote the sustainable management of the land resource available for residential development to enable people and communities to provide for their social and economic well-being. PCE is essentially the reuse of existing industrial land for a more efficient purpose – residential housing. The redevelopment of a previously used industrial area means the need for the continued expansion of urban areas can be reduced in the short to medium term, and greater intensification of housing can occur within a clearly defined and well-planned area. The existing water and wastewater infrastructure has capacity to enable residential use, further supporting the redevelopment of the site rather than continued greenfield growth.

6.1.2 Section 6 – Matters of national importance

Section 6 outlines matters of national importance that shall be recognised and provided for in achieving the purpose of the RMA. It is considered that these matters are recognised and provided for either through PCE or the existing provisions of the District Plan.

Of particular note in the context of PCE:

- Any proposed subdivision use, and development will be contained within the RRA, to avoid any effects on the Manawatū River and stop bank environment. This ensures the natural character of rivers and their margins are protected from inappropriate subdivision, use and development required by section 6(a). While the intent of PCE is to enable three storey development within the Riverfront Area shown on the Structure Plan, this is not considered to impact on the natural character of the Manawatū River.
- The structure plan identifies a central site access to the Manawatū River which will enhance public access through the site. This design element provides for section 6(d) through maintaining and enhancing public access to and along rivers.

Specific provisions ensure natural hazards are addressed within the RRA – particularly around the risk of increased stormwater ponding and subsequent discharge to the Manawatū River. The extent of the Structure Plan is up to 8m from the inland toe of the stopbank with the RRA not extending onto the stopbank (meaning fences and paths will not cut into the bank). This addresses land use requirements under the Horizons One Plan, but also protects the integrity of the stopbank. This ensures that the management of significant risks from natural hazards as required by section 6(h) are recognised and provided for and will also give effect to the

natural hazard provisions in the Regional Policy Statement, as discussed in section 6.2 of this Report.

6.1.3 Section 7 – Other matters

Section 7 outlines other matters which require local authorities to have particular regard to in relation to managing the use, development, and protection of natural and physical resources.

The broader scheme of PCE represents the Council's stewardship-based approach to development in Palmerston North for the benefit of current and future generations (section 7(aa)).

PCE specifically seeks to address the efficient use and development of natural and physical resources (section 7(b)) by providing opportunity for the reuse of a brownfield site that enables further residential development in an established urban area. Development consistent with the Structure Plan and specific housing density provisions will avoid the inefficient use of land.

The introduction of the identified areas and objectives, policies, and rules for residential development in the areas also addresses the maintenance and enhancement of amenity values (section 7(c)), and the maintenance and enhancement of the quality of the environment (section 7(f)). PCE intends to enhance the amenity values by rezoning the area to be consistent with the surrounding residential environment and providing a transition in density to be in line with the character of the area and existing urban pattern. The plan change provides a positive change in the amenity of the site by providing opportunities for street trees and green spaces which are currently non-existent with the current industrial zoning. The quality of the surrounding neighbouring environment is also enhanced through the placement of reserve land (via the proposed land exchange) in the centre of the site with good passive surveillance and access for all new residents in the area. The Waterloo Park reserve buffer at the southern end of the site is currently underutilised and does not provide site lines for passive surveillance given its dead-end nature. Moving the reserve land will also provide a greater public benefit as it can be used by the wider community to access the River. The stormwater provisions assist in reducing the discharge of water to the Manawatū River, reducing negative effects on its quality while enhancing the wider environment.

6.1.4 Section 8 – Treaty of Waitangi

All persons exercising functions and powers under the RMA must take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). Engagement has been undertaken with RoM to understand their position and aspirations in relation to the RRA. RoM advised there were no sites of significance in the RRA but shared through bi-monthly updates they would like PCE to align with the Manawatū River Framework by activating the new accessway and reserve space. RoM have advised PCE does not require a Cultural Impact Assessment (CIA). This is further discussed in Section 4 of this Report.

6.1.5 Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021

On 20 December 2021, the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021 (the Amendment Act) was passed into law. The Amendment Act requires Tier 1 councils to change their planning rules so most of their residential areas are zoned for medium density housing. By removing restrictive planning rules, more medium density homes being built across Tier 1 councils is anticipated.

Noting the PNCC is not a Tier 1 Council, and therefore is not subject to the direction of the Amendment Act, the overall intent and direction was a useful starting point for the development of PCE where the intended outcome is a higher level of density than the existing residential zone. The Urban Design Report for PCE has expanded on these matters and identified provisions that would be most appropriate for the City context. Some of these performance standards have been included in PCE to deliver a range of housing typologies. These performance standards include a number of residential units per site which is three units per site, height with a maximum of 11m and landscaped areas being 20% of the site and developed with grass or plants. Some standards such as a site coverage of 50% have not been included due to stormwater permeability constraints.

6.1.6 National Policy Statements

Under section 75(3)(a) of the RMA a district plan must give effect to any national policy statement. The following National Policy Statements exist at the time this Report was prepared:

- National Policy Statement for Highly Productive Land 2022 (NPSHPL)
- National Policy Statement for Renewable Electricity Generation 2011 (NPSREG)
- National Policy Statement on Electricity Transmission 2008 (NPSET)
- National Policy Statement for Freshwater Management 2020 (NPSFM)
- The National Policy Statement on Urban Development 2020 (NPS UD)
- The National Policy Statement for Indigenous biodiversity 2023 (NPSIB)
- The National Policy Statement for Greenhouse Gas Emissions from Industrial Process Heat 2023 (NPSGGE).
- New Zealand Coastal Policy Statement (2010).

Not all National Policy Statements are relevant to proposed PCE. The ones that are considered to apply to this plan change are discussed below.

The National Policy Statement on Urban Development 2020 (NPSUD)

The NPSUD came into effect 20 August 2020. The objectives of the NPSUD seek to achieve the following:

- Well-functioning urban environment that enable people to provide for their social, economic, and cultural well-being, and for their health and safety, now and into the future;

- Planning decisions that improve housing affordability;
- Enable more people to live in areas of an urban environment that are near centres, employment, well served by public transport or there is a high demand for housing;
- Recognition that urban environments and amenity values change overtime;
- Planning decisions take into account the principles of the Treaty of Waitangi;
- Decisions on urban development are integrated with infrastructure and planning decisions, strategic over the medium and long term, and are responsive;
- Local authorities have robust and up to date information about their urban environments and use it to inform planning decisions;
- Urban environments support reductions in greenhouse gases and are resilient to the effects of climate change.

Planning for housing

PNCC is a Tier 2 Council under the NPS UD. This means that Council is required to prepare 3 yearly housing and business needs assessments, produce a Future Development Strategy every 6 years and produce a plan change to enable intensification (PCI).

PCE gives effect to the NPSUD by providing development capacity to meet expected housing demand in the short to medium term. The redesign of a brownfield area into housing and enabling a range of housing types through density and design controls implements requirements of the NPSUD. The master planning exercise and subsequent structure plan shows that the site can be effectively and efficiently redeveloped into a continuation of the surrounding residential area. The structure plan shows a roading layout that can deliver the most efficient use of land to provide maximum yield, taking into account the existing constraints within Roxburgh Crescent. The structure plan alongside the new provisions will create a well-functioning urban environment as required by the NPSUD. The site is also served by a regular bus service, education, and easy access to the Manawatū River amenities and a neighbourhood centre.

Planning for Business

Under the NPSUD (2020) and its predecessor the NPSUDC (2016), Tier 2 Councils are to provide a 3 yearly HBA to determine the demand and supply of residential, industrial and business zoned land. The 2023 Housing and Business Development Capacity Assessment (HBA) identified a high occupancy rate in the industrial zone, along with a lack of supply of industrial land to meet the needs of the City in the long term (10 to 30 years).

For business land, Council have projected there will be demand for a total of 279.6 hectares of business land over the next 30 years. This figure includes competitiveness margins. When broken down into the short, medium and long term, this means there will be demand for:

- 24.5 hectares in the short term
- 71.2 hectares in the medium term
- 184.0 hectares in the long term

A change in land use from industrial to residential has been considered against this background of supply, and the NPSUD. The ongoing use of land for industrial purposes surrounded by residential uses is not considered to be an appropriate long-term planning approach. The existing industrial uses in this area is an unusual feature within the wider residential zone. Further, as explained below, PCE does not indirectly reduce industrial land supply as there is land available in industrial areas on the edges of the City.

Currently there is a supply of 53ha of land for small and large industrial activities. Council has future plans to increase Industrial land supply at Te Utanganui – The Central New Zealand Distribution Hub which can provide for 288ha. There is also other opportunities to provide for industrial activities at Braeburn industrial area as it may not be needed for dairy use anymore. In that case, Braeburn can provide 33ha of land for industrial use.

It is not expected all smaller industrial landowners within the RRA will relocate or disestablish their businesses straight away. Some current industrial uses will continue to operate from their sites and rely on their existing use rights at Roxburgh Crescent. There are sufficient industrial options in the short to medium term for existing businesses should they wish to move and redevelop their own sites for residential use. This will provide adequate time for more industrial or appropriate business land to become available or locations for smaller business to become vacant.

Overall, taking into account the short to medium term industrial demand and supply, rezoning the area for residential use is considered appropriate. The change in zoning further enables housing in an existing urban environment, avoids the issues of reverse sensitivity between industrial and residential use, and efficiently uses land within the existing urban area to meet the short to medium term housing demands of the City.

National Policy statement for Freshwater Management

The NPS-FM came into effect on 3 September 2020. The objectives of the NPSFM seek to prioritise:

- first, the health and well-being of water bodies and freshwater ecosystems
- second, the health needs of people (such as drinking water)
- third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

A fundamental concept of the NPSFM is Te Mana o te Wai - which elevates the importance of water by recognising and protecting the health and wellbeing of the wider environment. There is a hierarchy of obligations reflected in Te Mana o te Wai that prioritises:

- first, the health and well-being of water bodies and freshwater ecosystems
- second, the health needs of people (such as drinking water)
- third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

Under clause 3.5 of the NPSFM, local authorities must take into account Te Mana o te Wai, In regard to PCE, the RRA is adjacent to the Manawatū River environment and stormwater from the site is discharged to the River. PCE has been developed to ensure stormwater quality is improved on site before it enters through the outfall into Manawatū River. This is achieved by adopting an integrated approach by treating water through biofiltration devices in the road corridors and use of permeable surfaces to treat water before it enters the River.

6.1.7 National Environmental Standards

There are seven National Environmental Standards (NES') currently in force. These are listed below.

- National Environmental Standards for Air Quality
- National Environmental Standards for Freshwater
- National Environmental Standards for Drinking Water
- National Environmental Standards for Electricity Transmission activities
- National Environmental Standards for Commercial Forestry
- National Environmental Standards for Marine Aquaculture
- National Environmental Standards for Telecommunication Facilities
- National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
- National Environmental Standards for Storing Tyres Outdoors

Only the NES for Assessing and Managing Contaminants in Soil to Protect Human Health is considered to be directly relevant.

National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

The NESCS came into effect 1 January 2011. It ensures that land affected by contaminants in soil is appropriately identified and managed when certain uses or a change in use are proposed.

New Zealand has a legacy of soil contamination that is mainly associated with past practices involving storage and use of hazardous substances, and disposal of hazardous wastes. Common past activities and industries that have led to the creation of contaminated sites in New Zealand include manufacture and use of pesticides, coal, gas, petroleum, mining, timber treatment, sheep dipping.

A large portion of the Roxburgh Residential Area has been used for industrial activities in the past. Council commissioned a Preliminary Site Investigation (PSI) and a Detailed Site Investigation (DSI) Report. These Reports have confirmed that the site contains contaminants that needs to be managed for residential use to occur. The Reports are summarised in section 5.3.4 and 5.3.5, the full reports can be found in Appendix F and G.

In terms of use of the site, the PSI notes: "*Overall, the site appears to have been used primarily for industrial business use which began extensive development in the late 1950s and 1960s with the construction of various factories, store sheds and workshops. This development continued through the 1970s and 1980s, with some new workshops, warehouses and offices developed and a range of additions/alterations to existing buildings. In the 2000s a property in the north east of the site (38-38A Roxburgh Crescent) was converted partially into a residential dwelling. Some fire damage on the property was noted in 2013 and some buildings appear to have been demolished between 1966 and 1986 and others between 2007 and 2008.*"

The DSI has concluded that:

The NES Soil will apply to the site if residential redevelopment is undertaken as HAIL activities have been, and are currently occurring on the site and subdivision and soil disturbance will likely be required during the redevelopment phase; and

Due to the presence of asbestos, controls will be required during soil disturbance and redevelopment works in accordance with the Asbestos Regulations.

Based on the findings of the Reports, the proposed plan change contains specific provisions to highlight that consent for development will be required under the NESCS in addition to any other requirements in the District Plan. Based on the results of testing, remediation of soil is required as part of any future development of the site, and this will be site specific.

Therefore, the issue of soil contamination with the change in land use is best addressed at the time of development, rather than the plan change process. Council is satisfied that the provisions proposed highlighting that the NESCS apply and consent is required are sufficient for the plan change process. On that basis, it is considered that Council has done sufficient investigations to determine that it is appropriate to rezone this land for residential purposes.

As a result, the proposed provisions for PCE direct plan users that the NESSC overrides the District Plan and identifies that resource consent is required for residential use to occur on sites identified with potential land contamination

6.1.8 National Planning Standards

Section 75(3) requires a district plan to give effect to a national planning standard. The first set of national planning standards came into force on 3 May 2019. They provide direction on the structure and form of plans, including definitions, and aim for district and regional plans to be more consistent and easier to use across the motu. Given that PCE seeks to add a small number of site specific provisions into the District Plan (which is yet to be updated to reflect the Planning Standards), the existing structure will be used. Council will adopt the Planning Standards in a more integrated way through a future plan change to the District Plan.

6.1.9 Iwi Management Plans

Under section 74(2A) of the RMA, when changing a district plan, any relevant planning document recognised by an iwi authority and lodged with the territorial authority must be

taken into account. At the time of preparing this plan change, a iwi management plan from RoM has been lodged with PNCC.

The relevance of the Rangitāne o Manawatū Environmental Management Plan (EMP) to PCE is the proximity of the growth area to the Manawatū River. The Manawatū River, its tributaries, lakes and wetlands have shaped the worldview and values of RoM today. PCE recognises this by providing public access to the River through the site. Access is presently not achievable. Stormwater from the site discharges into the Manawatū River currently. To ensure future discharges do not adversely affect the health of the River, stormwater mitigation measures are included in the proposed provisions to manage quality and quantity.

PCE takes into account RoM's priorities and responsibilities regarding their Kaitiakitanga within their rohe outlined in the EMP by providing additional connection to the River.

6.2 Regional Policy Context

6.2.1 One Plan

Section 75(3) requires a district plan to give effect to any operative regional policy statement. The table below identifies the relevant provisions and resource management topics contained in Horizons' One Plan, which is a consolidated plan containing the Regional Policy Statement and Regional Plans.

Key One Plan Objectives & Policies	Response in PCE
Objective 2-1: Resource management To have regard to the mauri of natural and physical resources to enable hapū and iwi to provide for their social, economic and cultural wellbeing. Kaitiakitanga must be given particular regard and the relationship of hapū and iwi with their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna) must be recognised and provided for through resource management processes.	Consultation with mana whenua (Rangitāne o Manawatū) has been undertaken in the early stages of planning the site and then formally through the clause 4A process. Aspirations of RoM for the plan change have been taken into account during the early master planning phase. The Manawatū River adjacent to the Plan Change area has significant importance to RoM as mana whenua. PCE seeks to enhance the values of the Manawatū River by providing a new single public access to the River and associated amenities. PCE also provides further reserve land through the land exchange to enhance it with more open green space.
Objective 3-3: The strategic integration of infrastructure with land use Urban development occurs in a strategically planned manner which allows for the adequate and timely supply of land and associated infrastructure. **Policy 3-4: The strategic integration of infrastructure with land use** Territorial Authorities must proactively develop and implement appropriate land use strategies to manage urban growth, and they should align their infrastructure asset management planning with those strategies, to ensure the efficient and effective provision of associated infrastructure.	The RRA has been previously identified as a future growth area through the Palmerston North City Growth Plan (2021 and was first identified in the 2018 Long Term Plan. The Water and Wastewater Servicing Assessment (refer Appendix K) show there is sufficient infrastructure capacity with the planned wastewater upgrades in the wider Hokowhitu area to support an increase in residential development in the Roxburgh area. Stormwater infrastructure constraints can also be managed through higher onsite permeability requirements through the proposed District Plan Provisions until a stormwater outfall is upgraded. Provision of parks and reserves involves a land exchange which will ensure a better use of recreation land compared to the existing situation. This will allow those that live within the RRA close access to open space and accessibility to the Manawatū River area. The proposed provisions aim to respond to the stormwater assessment by providing water sensitive design in the road corridor by the use of a Filterra tree pit and limiting impervious areas by proving onsite permeability requirements.
Objective 3-5: Waste, hazardous substances and contaminated land	Some parts of the Roxburgh Residential Area are known contamination sites and are identified on Councils Hazardous Activities and Industries List (HAIL) register.

The Regional Council and Territorial Authorities must work together in a regionally consistent way to: minimise the quantity of waste generated in the Region and ensure it is disposed of appropriately, manage adverse effects from the use, storage, disposal and transportation of hazardous substances, and manage adverse effects from contaminated land. **Policy 3-14: Identification of priority contaminated land** The Regional Council and Territorial Authorities shall jointly identify priority contaminated land. Priority contaminated land is land that: is listed on a register of verified contaminated land held by the Regional Council or a Territorial Authority, or would have been the site of an activity identified on the Hazardous Activities and Industries List (Ministry for the Environment, 2004a), including horticulture and sheep dips, and site* investigations have verified that the land^ is contaminated, and is expected to be subject to a change of land use within the next 10 years that is likely to increase the risks to human health or the environment, including where land is identified for future residential zoning or where a specific development is proposed **Policy 3-15: Management of priority contaminated land** Where land use changes are likely to increase the risks to human health or the environment from priority contaminated land (as identified under Policy 3-14) the Regional Council and Territorial Authorities must ensure that: the landowner or land developer fully investigates the extent and degree of contamination prior to the granting of consent allowing development (assistance with investigations may be provided by the Regional Council in some cases),	A more specific Land Contamination Assessment (PSI and DSI) was completed and full reports can be found in Appendix F and Appendix G. The findings of the Reports confirm that some parts of the site is contaminated and will require remediation to support Residential Use. Refer to the contamination map in Appendix G of this report. As the land use of the site transitions to residential over time, any contaminated land will need to be appropriately remediated (through consenting under the NESCS). As PCE is a short to medium-term growth area, it is likely the land use of Roxburgh Crescent will change during the next 10 years. The Contamination Reports have been provided to landowners. The remediation process will be triggered as a result of the change in land use and the NES for soil contamination will apply. Landowners or developers looking to develop housing will be responsible for their own remedial work, if required. The properties included in the PSI and DSI have been identified as having contamination present have been added to the PNCC HAIL register.

and is made suitable for its intended use through an appropriate level of remediation or management (including engineering) controls, and land remains suitable for its intended use through appropriate monitoring of residual contaminant levels and associated risks and through the use of management controls on the activities undertaken on the land.	
Objective 3-2: Energy An improvement in the efficiency of the end use of energy and an increase in the use of renewable energy resources within the Region. **Policy 3-7: Energy efficiency** The Regional Council and Territorial Authorities must have particular regard to the efficient end use of energy in consent decision-making processes for large users of energy. Territorial Authority decisions and controls on subdivision and housing, including layout of the site and layout of the lots in relation to other houses/subdivisions, must encourage energy-efficient house design and access to solar energy. Territorial Authority decisions and controls on subdivision and land use must ensure that sustainable transport options such as public transport, walking and cycling can be integrated into land use development.	The north – east orientation of the site provides opportunities to maximise solar gain. The roading layout shown on the structure plan allows for sections to be orientated to achieve the best access to sunlight. Even those houses that may be faced to look over the stopbank in an east facing direction will gain sunlight for long periods of the day. The structure plan and proposed provisions have taken into account integrating walking and cycling needs. The transport assessment has confirmed that with a reduction in overall trip generation in the site (with the closure of the Higgins Yard), the existing narrow streets can accommodate a footpath on both sites, with parking only on one side. This further enhances walking and cycling in the area. There is an additional access to the site provided for cyclist and pedestrians to allow for access to the site and River from the southern areas. There are existing public transport routes adjacent to the site along Ruahine and Manawatū Streets that can serve the needs of the site. A public access point is indicated on the structure plan for residents and the wider community to access the Manawatū River shared pathway.

Objective 5-2: Water quality Surface water quality is managed to ensure that: Water quality is maintained in those rivers and lakes where the existing water quality is at a level sufficient to support the Values in Schedule B Water quality is enhanced in those rivers^ and lakes^ where the existing water quality is not at a level sufficient to support the Values in Schedule B Accelerated eutrophication and sedimentation of lakes in the Region is prevented or minimised The special values of rivers protected by water conservation orders are maintained. Groundwater quality is managed to ensure that existing groundwater quality is maintained or where it is degraded/over allocated as a result of human activity, groundwater quality is enhanced. **Policy 5-9: Point source discharges to water** The management of point source discharges into surface water must have regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, while having regard to: the degree to which the activity will adversely affect the Schedule B Values for the relevant Water Management Sub-zone whether the discharge, in combination with other discharges, including non-point source discharges will cause the Schedule E water quality targets to be breached the extent to which the activity is consistent with contaminant treatment and discharge best management practices the need to allow reasonable time to achieve any required improvements to the quality of the discharge whether the discharge is of a temporary nature or is associated with necessary maintenance or upgrade work and the discharge cannot practicably be avoided	There are no open channels within the site. PCE requires that each site has a permeable surface area to facilitate natural filtration of rainwater to the ground to reduce stormwater discharges. Until the stormwater discharge pipe is upgraded the amount of permeable surface required for each lot is higher. Managing stormwater from the road network will be via filterra pits (or equivalent). These will provide some initial treatment of stormwater before reaching the pipe and ultimately discharging to the Manawatū River. Efforts to improve discharge quality from the site are embedded in the Plan Change. Additional measures may be required at the discharge consent stage, however that is outside this plan change process.

whether adverse effects resulting from the discharge can be offset by way of a financial contribution set in accordance with Chapter 19 whether it is appropriate to adopt the best practicable option. **Policy 5-10: Point source discharges to land** Discharges of contaminants onto or into land must be managed in a manner which: does not result in pathogens or other toxic substances accumulating in soil or pasture to levels that would render the soil unsafe for agricultural, domestic or recreational use has regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, and the strategy for groundwater management set out in Policy 5-6 maximises the reuse of nutrients and water contained in the discharge to the extent reasonably practicable results in any discharge of liquid to land generally not exceeding the available water storage capacity of the soil (deferred irrigation) ensures that adverse effects on rare habitats*, threatened habitats* and at-risk habitats* are avoided, remedied or mitigated.	

Objective 9-1: Effects of natural hazard events The adverse effects of natural hazard events on people, property, infrastructure and the wellbeing of communities are avoided or mitigated. **Policy 9-1: Responsibilities for natural hazard management** In accordance with s62(1)(i) RMA, local authority responsibilities for natural hazard management in the Region are as follows: The Regional Council and Territorial Authorities must be jointly responsible for: raising public awareness of the risks of natural hazards through education, including information about what natural hazards exist in the Region, what people can do to minimise their own level of risk, and what help is available. The Regional Council must be responsible for: developing objectives and policies for Region-wide management of activities for the purpose of avoiding or mitigating natural hazards, developing specific objectives, policies and methods (including rules) for the control of: all land use activities in the coastal marine area, erosion protection works that cross or adjoin mean high water springs, all land use activities in the beds of rivers and lakes, for the purpose of avoiding or mitigating natural hazards, and taking the lead role in collecting, analysing and storing regional natural hazard information and communicating this information to Territorial Authorities. Territorial Authorities must be responsible for: developing objectives, policies and methods (including rules) for the control of the use of land to avoid or mitigate natural hazards in all areas and for all activities except those areas and activities described in (b)(ii) above, and	The RRA is protected by a 2.5m high stopbank from flooding from the Manawatū River. PCE is in close proximity to the Manawatū River and is protected from a 1 in 500 year flood event by the stopbank. It is expected flooding and major weather events will become more common and intense due to the effects of climate change. The stormwater assessment showed no significant surface water flooding/pooling is present within the RRA. However, higher permeability standards will be imposed until such time the stormwater outfall is upgraded will assist in resiliency during heavy rain events. This will ensure excess stormwater can be managed onsite, rather than placing pressure on the network during weather events. PCE provisions include an objective and policy for stormwater permeability standards. A Liquefaction Assessment was completed for the RRA which determined that liquefaction damage is unlikely, and no specific foundation design is required. The proposed plan change will not create any activities that will put the site at risk to any known natural hazards compared to the existing situation.

identifying floodways (as shown in Schedule J1) and other areas known to be inundated by a 0.5% annual exceedance probability (AEP) flood event2 on planning maps in district plans, and controlling land use activities in these areas in accordance with Policies 9-2 and 9-3. **Policy 9-4: Other types of natural hazards** The Regional Council and Territorial Authorities must manage future development and activities in areas susceptible to natural hazard events (excluding flooding) in a manner which: ensures that any increase in risk to human life, property or infrastructure from natural hazard events is avoided where practicable, or mitigated where the risk cannot be practicably avoided, is unlikely to reduce the effectiveness of existing works, structures, natural landforms or other measures which serve to mitigate the effects of natural hazard events, and is unlikely to cause a significant increase in the scale or intensity of natural hazard events. **Policy 9-5: Climate change** The Regional Council and Territorial Authorities must take a precautionary approach when assessing the effects of climate change and sea level rise on the scale and frequency of natural hazards with regard to decisions on: stormwater discharges and effluent disposal, coastal development and coastal land use, activities adjacent to rivers, water allocation and water takes, activities in a Hill Country Erosion Management Area, flood mitigation activities, and managing storm surge.	

At the time of preparing this report, Proposed Change 3 (Urban Development) to the One Plan had been notified and hearing held on the 7th to the 9th of February 2024. Proposed Change 3 is the regional response to the NPSUD by amending the One Plan to give effect to its provisions. The PC3 hearing panel's recommendations were adopted by Horizons on 25 June 2024. The decision was publicly notified on 12 July 2024, and the proposed changes have legal effect. The scope of Proposed Change 3 gives effect to intensification, responsiveness, climate change and Te Tiriti o Waitangi. The intended outcome of PC3 is to improve policy response and guidance to urban development by providing a framework for achieving well functioning urban environments, meeting housing demand and providing adequate infrastructure.

PCE is consistent with the provisions of that Proposed Plan Change by providing housing land to meet demand in the short to medium term. PCE also provides for a variety of housing densities and planning infrastructure upgrades which are also key matters for PC3. The provisions also recognise that the stormwater discharge pipe requires upgrading and once this occurs then less land is required onsite for permeability needs. These works are provided for in the 2024/34 Long Term Plan.

Overall, PCE is considered to give effect to the direction contained in the Regional Policy Statement component of the One Plan.

6.2.2 Regional Land Transport Plan

Under section 74(2)(b)(i) of the RMA when changing a district plan, a territorial authority shall have regard to management plans and strategies prepared under other Acts.

The Regional Land Transport Plan (RLTP) is one of the relevant strategies. The RLTP is prepared by Horizons Regional Council and sets the direction for the region's land transport system for the next 30 years. It is a statutory requirement of the Land Transport Management Act 2003 (LTMA).

The relevant provisions of the RLTP are described in the transportation report in Appendix D Key objectives include:

> Objective 1: Travel Choice - Transport users in the region have access to affordable transport choices that are attractive, viable, and encourage multi-modal travel.
>
> Objective 2: Connectivity and Efficiency - The regional transport network connects central New Zealand and is efficient, reliable, and resilient.
>
> Objective 3: Safety - The transport network is safe for all users.
>
> Objective 4: Environment - The impact of transport on the environment and the transport system's vulnerability to climate change is minimised.
>
> Objective 5: Land Use Integration - Transport and land use are integrated to support well connected communities that promote a strong regional economy and liveable region.

Given the proximity of Roxburgh Crescent to reserves, public transport, schools, and a neighbourhood centre, a range of transport options are for residents of and visitors in the RRA.

The structure plan for the RRA has been designed to provide connectivity to the existing public transport and road network but also catering for non car modes of transportation. The site is in close proximity to two bus stops on Ruahine Street which provides access to the existing public transport network and can service the RRA. The structure plan also allows for an additional pedestrian and cycle only access to the site and the Manawatū River pathway from Ruahine Street.

PCE has been designed to provide opportunities for better utilisation of existing transport corridors and greater uptake of public transport. Overall, PCE aligns well with the objectives of the RLTP.

6.3 District Policy Context

6.3.1 District Plan

The overarching resource management blueprint for development and land use within the City is guided by the Palmerston North City District Plan. The following provides an outline of the key aspects of the Operative District Plan for this plan change.

Section 2: City View Resource Management Issues and Objectives

The overarching resource management issues and objectives for the City are outlined under section 2 of the District Plan. These Issues and Objectives establish the intent of the Plan at the strategic level. The strategic approach set out by the City View section provides a basis and direction for the identification of the more specific resource management issues, objectives, polices and methods for the specific zones in the District Plan.

The City View Issues and Objectives were reviewed and updated as part of Plan Change 8. The City View Objectives that are directly applicable to the Roxburgh Crescent Residential area are:

1. Planning for residential, industrial, commercial and rural-residential growth sustains a compact, orderly and connected urban form which avoids the adverse environmental effects of uncontained urban expansion into the rural zone.
2. The provision of infrastructure, particularly within identified growth areas, shall be efficient, timely, environmentally sensitive and economically sustainable.
3. The integrated and efficient provision of, and access to, infrastructure, network utilities and local services is facilitated for all residents.
4. Transparent and equitable funding mechanisms are in place to support the provision of infrastructure required to service growth.
5. A variety of high quality residential living environments are provided to satisfy the needs of all residents.
9. Subdivisions, buildings and infrastructure are designed and constructed to promote a coordinated, healthy and safe environment.
10. The visual appeal of the City is enhanced.
11. The principles of good urban design are given effect to for all new subdivisions, urban intensification and major building developments, particularly those located within the City Centre or fronting key transportation routes.
15. Active engagement from tangata whenua within resource management decisions.

19. The effects of natural hazards are avoided or mitigated taking into account the effects of climate change and the significant social disruption caused by natural hazard events.
21. A broad range of recreation and leisure opportunities are provided for in the City which contribute towards an enhanced quality of life.
23. Infrastructure operates in a safe and efficient manner, and the effects of activities which could impact on the safe and efficient operation of this infrastructure are avoided, remedied or mitigated.
24. All forms of transport, including public transport, walking, cycling and private vehicles are adequately provided for to assist with sustainable energy use and a healthy lifestyle.
25. Infrastructure and physical resources of regional or national importance are recognised and provided for by enabling their establishment, operation, maintenance, upgrading and protection from the effects of other activities.
27. The effects of activities using hazardous substances are avoided, remedied or mitigated.

PCE has been prepared in a manner which will deliver on these high level objectives.

In summary, the use of a brownfield site for future residential growth, next to an established residentially area ensures growth retains the compact urban extent along this area of the River. Good urban design outcomes resulting in a high quality living environment are facilitated through the master planning process and introduction of the structure plan and related performance standards. Technical reports confirm that the infrastructure has capacity for the growth, and where upgrades are necessary these have been identified in the Long Term Plan 2024/34. In addition, the technical reports have outlined that the plan change will not result in activities that will put the site at risk to any known natural hazards compared to the existing situation. Intensification of the Roxburgh Residential Area for residential use is ideally situated close to amenities (including open space), and public transport networks, and in way which ensures walking and cycling to the river can be facilitated.

Overall PCE is considered to be consistent with the above objectives in section 2 of the District Plan.

Section 7: Subdivision

Section 7 of the District Plan sets the direction for subdivision development in the City. It includes objectives, policies and rules around how subdivision is to be undertaken. Council requires resource consent for all subdivision activity to ensure all effects on the environment are avoided, remedied or mitigated. Subdivision rules enable subdivision in the district as a controlled activity in most cases so long as specified standards are met. Minimum lot sizes for subdivision throughout the district are:

- 350m^2 in the Palmerston North urban area
- 500m^2 minimum lot size in Ashhurst, Napier Road Extension Area, and Longburn and Bunnythorpe village areas
- 400m^2 of developable land in the Aokautere Development Area and an average area requirement for the lots of 600m^2

- 20 hectares in the Rural Zone
- 1 hectare in the Rural Residential Overlay

Council restricts its discretion to:

- Design, layout, size, shape and arrangement of lots, access, cross lease and company lease areas and units.
- Effects on the surrounding environment and streetscape.
- Connectivity and the safe and efficient operation of the transport network.
- Natural Hazards
- Matters described in section 108 and 220 of the RMA 1991.

Section 10: Residential Zone

Section 10 of the District Plan sets the direction for residential development in the City. It includes objectives, policies and rules around using existing residential land efficiently to avoid unnecessary sprawl and maintain the look and feel of residential areas. The Residential Zone enables a number of non-residential activities such as community houses, accommodation motels, education facilities, health facilities, and home occupations.

Multi-unit housing is provided for in the section 10 of the District Plan. Plan Change 20, made operative in December 2016, introduced seven multi-unit housing areas in the City and provided for the multi-use housing as a restricted discretionary activity provided performance standards relating to site area, unit size, site coverage, on-site amenity, height, overlooking, separation distances, access and parking, and stormwater design are met.

Dwellings and accessory buildings are permitted in the residential zone provided performance standards are met relating to height, overlooking, separation distances, site area, site coverage and number of buildings, on-site amenity, access and parking, and requirements for particular areas of the city.

Minor dwelling units are also provided for in the Residential Zone as a permitted activity. This enables a minor unit dwelling to be provided on a site in addition to a dwelling and accessory building provided performance standards relating to building size, on-site amenity, separation distances among others are met.

Despite provision for multi-unit housing, higher density development of residential land in the City has been limited and has occurred in areas not identified for this type of housing.

6.3.2 Future Development Strategy

PNCC have jointly prepared a Future Development Strategy (FDS) with Horizons Regional Council. The FDS sets out and guides how Palmerston North and the wider district will grow over the next 30 years. At the time of writing this assessment the FDS was adopted by the Council on the 26th of June 2024.

PCE is included in the FDS as one of PNCC's growth areas for residential development and required infrastructure to service it. The FDS expects 25 homes to be built at Roxburgh Crescent in year 3 (2026) and the remaining 80 to be built in years 4 to 6 (2027-2029). This

means PCE will provide housing over the short to medium term based on the plan change timeframe and expected infrastructure serving.

6.3.3 Relevant Council Strategies & Plans

There are a number of other relevant Council documents and strategies that have informed PCE or will be relevant to its implementation. At the time of preparing this Report, only the 2021 strategies and plans are available. The 2024 plans will be available once the 2024 Long Term Plan is adopted. The draft 2024 plans and their approach has not changed significantly since the 2021 plans were published. The relevance to PCE from each document to PNCC strategic direction is provided in the table below:

Strategic Plan	Relevance to PCE
Innovative and Growing City Strategy (2021) The Innovative and Growing City Strategy is one of Council's core strategic documents, setting out Council's strategic goal 1: an innovative and growing city. This strategy identifies that Council's main role is to make sure land and infrastructure are available to accommodate growth and provide market choice while responding to changing demographics and needs. It is also noted that: there is strong demand for housing and new residential sections uptake of new housing typologies (multi-unit development) has been slow Council wants Government, Council and private land be developed for housing Productive land should be protected for sustainable food production Council will discourage the provision of urban services in rural areas because it is an inefficient form of infrastructure investment Council will work with developers to reduce risks and uncertainty over design and consents, and to encourage more housing choice.	PCE contributes to the delivery of this strategic direction by supplying more development capacity and providing for housing choice. PCE gives the opportunity to repurpose brownfield land and existing infrastructure in the Palmerston North for housing while avoiding further extension of the urban environment, which is the intention of greenfield growth plan changes currently being progressed. The proposed provisions will provide greater certainty to landowners with clear permitted activity rules applying, including the ability for 3 storey homes along the stopbank area (shown as the Riverfront Area on the Structure Plan).
City Growth Plan (2021) The City Growth Plan details how Council intends to provide development capacity to meet expected demand for housing and business in the short, medium, and long term. It directs Council to provide public spaces that are sustainable, connected, diverse, integrated, adaptable, interesting, comfortable, and safe.	PCE contributes to the delivery of the City Growth Plan by increasing development capacity to address identified housing demand. The Roxburgh area was identified in the City Growth Plan as a future location for residential development. PCE is giving effect to that intent.

Transport Plan (2021) The Transport Plan details how Council intends to deliver an integrated multi-modal transport network that connects people and goods with destinations in a safe, efficient, and sustainable manner and evolves to meet new transport demands with less reliance on private motor vehicles.	PCE seeks to give effect to the Transport Plan by requiring the delivery of a transport network that is interconnected, supports multi-modal use, and establishes clear priorities for all users based on place and movement principles. PCE encourages active transport modes by providing an additional pedestrian and cycle access to the site and provides access to the shared Manawatū River pathway.
Street Design Manual (2013) The Street Design Manual (SDM) sets out the design philosophy and vision for Palmerston North streets. A set of standard designs have been proposed to ensure a consistent and coherent network is implemented when intensive housing is proposed that balances the needs of all street users and aesthetics.	PCE is defined under the SDM as hosting a local road typology. Provisions have been crafted to manage residential development in the PCE area as development would transition to residential from the current industrial road environment at the site. PCE has cross-sections bespoke to the site, due to the narrow existing street environment. These cross sections have been included in the proposed provisions (refer Appendix A) to guide the new street layout, which also include the biofiltration (filterra pit) systems necessary for the management of stormwater at the site.
Creative and Liveable City Strategy (2021) The Creating and Liveable City Strategy is one of Council's core strategic documents, setting out Council's strategic goal 2: a creative and exciting city.	The performance standards for PCE enable housing choice for residential development in the City. PCE enables smaller section sizes than the rest of the residential zone. This removes regulatory barriers and makes it easier to build smaller homes. This will help contribute towards the strategy's intent to create a city that has great places for all people and aid in affordability. The plan change will contribute to enabling public and active transport choices by accessibility to bus stops, creating pedestrian paths and enabling an accessible access to the River pathway.
Active Communities Plan (2021) The Active Communities Plan details how Council plans to provide a wide range of accessible and well-maintained play, active recreation, and sports facilities to increase levels of physical activity and participation in sport and active recreation and meet a diverse range of local communities.	PCE helps contribute to this plan by promoting medium density housing in proximity to reserves/open green space. The site is well located near existing local neighbourhood centres, schools and public transport (i.e bus stops) further enabling active communities.

Eco City Strategy (2021) The Eco City strategy is one of Council's core strategic documents, setting out Council's strategic goal 4: to be an eco-city.	PCE aligns with the Eco City Strategy by encouraging less carbon intensive development through more efficient use of land for housing. PCE is less carbon intensive than greenfield development as it is within an existing residential area and has existing services that are sufficient for residential growth. The proximity of bus stops enable active transportation to be readily used. The structure plan layout has been designed to optimise sunlight and daylight while not compromising on yield for housing.
Climate Change Plan (2021) The Climate Change Plan sets out the Council's planned climate change adaptation and emissions reduction actions, which are designed to achieve the target of a 30% reduction in greenhouse gas emissions by 2031.	PCE helps contribute to this outcome by enabling more efficient residential development. Stormwater management approaches in PCE will also assist with climate change adaptation, particularly requiring onsite permeability which is common place now throughout New Zealand as a way of managing both stormwater quality and quantity. Specific provisions requiring biofiltration devices in the road corridor are another mechanism for ensuring that stormwater systems are responsive to climate change, which will result in increased rainfall events.
Environmental Sustainability Plan (2021) The Environmental Sustainability plan sets Council Direction for sustainable practices and biodiversity. The plan also wants Council to act as a role model for sustainable practices.	PCE aligns with the biodiversity chapter of the Environmental Sustainability Plan. It seeks to introduce street trees into the area, as there are currently none. It also provides additional public access to the Manawatū River, allowing people to experience nature.

7 Consultation and Engagement

During the preparation of plan changes, PNCC is required to consult under Schedule 1, Clause 3 and 4A under the RMA 1991. During the preparation of PCE, consultation has been undertaken with RoM, directly affected landowners, the wider community, and key agencies/stakeholders. This section provides a timeline of consultation completed. Further details and analysis of feedback is contained in Appendix N.

7.1 Chronology

This is a timeline with dates, milestones and types of consultation conducted during the preparation of the plan change, dating back to 2018.

Date	Activity
2018	Plan change initiated.
29 November 2018	**Rangitāne o Manawatū (RoM) Bi-monthly meeting with PNCC:** RoM advised that they would like to undertake a review and cultural impact of the area. PNCC staff advised that they were having a site visit the following week and will have a more detailed workshop next year. Iwi representatives were invited to the site visit and view the plans.
2018	Long term plan (2018) goes out for consultation and includes Roxburgh Crescent for rezoning.
2019	Feedback received from RoM about the plan change and they advised no sites were of interest and no cultural impact assessment would be required to inform the plan change. They did indicate interest in aligning the plan change with the river framework by activating the new reserve space and accessway.
2019	Landowner workshop was held. This included Higgins and other industrial landowners at Roxburgh Crescent about aspirations for development. The aim was to inform all landowners about the plan change and for them to contribute to the creation of a masterplan.
2019	Landowners received copy of the early masterplans. The results from the liquefaction and contamination reports (PSI and DSI) were shared with landowners.
2020 – mid 2021 Plan change was put on hold due to staff availability and COVID lockdown	

Late 2021/2022	Structure planning workshop with Higgins. PNCC presented outputs from master planning work from the early version of the urban design report and received feedback from Higgins.
29 June 2022	Workshop was held with all landowners within the proposed plan change area at Roxburgh Crescent. The workshop included presentations from technical experts – urban design, stormwater, transport and parks. Opportunity was provided for landowners to ask questions and share concerns. Landowners were provided with material from the workshop including early structure plans. An email was sent out to those who provided email addresses at the workshop which included a copy of structure plans and the PowerPoint presentation.
18 November 2022	**Feedback Period on PCE opens** Media release opening for public feedback on the proposed plan change and invitation for drop-in session. Facebook post was also made and an article in the Manawatū Standard was published with information on the drop-in session. Maps of where letters were sent to households and other industrial land owners can be found in Appendix L with information on the plan change and an invitation to the drop in session.
27 November 2022	Drop-in session – 50 people attended
9 December 2022	**Feedback Period on PCE closes** Online feedback form closed. 19 Feedback forms were received.
3 February 2023	**Rangitāne o Manawatū Bi-monthly meeting with PNCC.** An update on the progress of the Plan Change was presented to iwi. They had no questions or feedback and further advised the site contains no wāhi tapu and a Cultural Impact Assessment isn't required. However, opportunities to work with RoM on access to Manawatū River pathway through reserve development was discussed. RoM were advised on the reserve land exchange process that was upcoming. They were advised it needs to go through Minister for Conservation via Reserves Act process. Likely that RoM will be engaged by the Ministry on this process. Staff from the Parks and Reserves team will be in touch.
20 February 2023	Email update was sent to Higgins, landowners at Roxburgh Crescent and those who filled out a feedback form in November. The update included the key themes received from the feedback period and key dates.
Clause 3 consultation on PCE under Schedule 1 of the RMA 1991	
6 November 2023	Flyers with information on PCE included a link to the draft District Plan provisions and structure plan, an invitation to the drop in session and how to put in feedback was sent to landowners in the Hokowhitu area. A copy of the flyer and a letter was sent to landowners at Roxburgh Crescent, this included an invitation to a meeting for directly affected parties. A copy of the flyer, letters and emails were sent to the following parties: • Ministry for the Environment • Manawatū District Council

	• Horowhenua District Council • Horizons Regional Council • Rangitikei District Council • PowerCo Electricity • Powerco Electricity/Gas • Department of Internal Affairs • Ministry of Education • KiwiRail • Waka Kotahi • Transpower
8 November 2023	Media release was put out for PCE giving an update on the changes made and calling for feedback from the community before formal notification.
27 November 2023	Meeting was held with landowners at Roxburgh Crescent (directly affected parties). There were 8 landowners who attended, the meeting was to give an update on the plan change, discuss proposed District Plan provisions and answer questions.
30 November 2023	Community drop in session. 8 people attended.
8 December 2023	Clause 3 consultation closed. 16 forms of feedback was received via an online form on the PNCC website or by email. Themes and comments received has been included below.
Clause 4A Consultation under the Resource Management Act 1991	
6 November 2023	A copy of the flyer and information on the plan change including a link to the structure plan and draft District Plan provisions was sent to representatives from RoM.
Finalising Proposed Plan Change E	
January – July 2024	Awaiting decision from the Minister of Conservation regarding the proposed Reserve Exchange.
July 2024	PCE is finalised following approval from the Director Regional Operations, Lower North Island of DoC on behalf of the Minister of Conservation for the Reserve Exchange
August 2024	PCE is taken to Council for approval to notify.

8 Proposed Plan Change E – Changes to the District Plan

8.1 Overview

PCE involves introducing a new structure plan, cross sections, alongside new provisions that apply specifically to the identified RRA. The structure plan is designed to ensure development results in a high quality and well-functioning urban environment. The work that went into the structure plan outcomes are discussed in detail in the accompanying Urban Design Report (Appendix C) which was prepared to assist in the early master planning the site.

During the master planning process, alternative structure plan layouts were studied and investigated. One option was to have a variety of minimum lot sizes across 5 different locations across the site, these being 150m^2, 250m^2 and 350m^2. These ranged from conventional suburban to three story conjoined homes. A range of structure plans options were then developed, with a minimum and maximum lot size options to achieve sufficient density outcomes for the site. The initial option looked at a higher density scenario of enabling three stories and a minimum lot size of 150m^2 across the site. This scenario was consulted on in November 2022 and due to community feedback and onsite stormwater constraints, the minimum lot size increased from 150m^2 to 250m^2. In addition, a maximum of two stories is proposed in areas where the RRA adjoins an existing residential zone. Alongside the river boundary, the height increases with the ability to build to three storeys. This approach provides a transition in height while providing views and passive surveillance over the stopbank and a portion of Waterloo Park.

The resource management issues identified for Proposed PCE (5.1.1) have been addressed through the planning process. There is a need to provide housing within the City's existing urban area to meet growth targets and housing demand for smaller homes. The need for housing needs to be balanced against stormwater and amenity constraints and opportunities within the site. Against this background, the Council has developed a detailed and comprehensive set of performance standards for development to enable housing choice.

The proposed changes are set out in Appendix A.

9 Evaluation Assessment

9.1 Introduction

Section 32 of the RMA sets out the requirements for preparing and publishing plan change evaluation reports. A proposed plan change needs to be evaluated in terms of:

- Whether its stated objectives are the most appropriate way to achieve the purpose of the RMA.
- Whether the proposed provisions are the most appropriate way to achieve this objective/s by:
    - Identifying other reasonably practicable options for achieving the objectives
    - Assessing the efficiency of the provisions in achieving the objectives.
    - Summarising the reasons for deciding on the provisions.

Section 32(2) requires the benefits and costs of implementing provisions to be assessed in terms of the environmental, economic, social and cultural effects that are anticipated from the implementation of the provisions, including opportunities for economic growth and employment. If practical, these benefits and costs should be quantified.

In this report, 'most appropriate' has been interpreted to mean 'suitable, but not necessarily superior'[1]. This means that the most appropriate option does not need to be the most optimal or best option, but it must demonstrate that it will meet the objectives in an efficient and effective way.

9.2 Scale and Significance

Under s32(1)(c) of the RMA, this evaluation report needs to contain a level of detail that corresponds to the scale and significance of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the proposal. The level of detail undertaken for this evaluation has been determined by an assessment of the scale and significance of the environmental, economic, social and cultural effects anticipated through introducing and implementing the proposed provisions. There is a degree of subjectivity about this evaluation, and its primary purpose is to broadly determine the level of analysis required for the proposed plan change. It is not intended to be an economic cost-benefit analysis although it will help determine if one is required.

Key considerations that informed this assessment included:

- The reasons for the change;

[1] Rational Transport Soc Inc v New Zealand Transport Agency HC Wellington CIV-2011-485-2259, 15 December 2011.

- The resource management issues being addressed by Proposed PCE
- The degree of change from the Status Quo;
- Who and how will they be affected, and when;
- Degree of impact on, or interest from iwi/Maori;
- The geographical scale of impacts;
- The types of effects; and
- The degree of policy and implementation risk, or uncertainty.

The table below provides a summary of the scale and significance of the changes proposed by PCE.

Table 3 degree of scale and significance for PCE

	Low	Low-moderate	Moderate	Moderate-high	High
Degree of change from the Operative Plan		X			
Effects on matters of national importance (s6 RMA)	X				
Scale of effects – geographically (local, district wide, regional, national)	X				
Scale of effects on people (how many will be affected – single landowners, multiple landowners, neighbourhoods, the public generally, future generations?)		X			
Scale of effects on those with specific interests e.g. tangata whenua	X				
Degree of policy risk – does it involve effect that have been considered implicitly or explicitly by higher order documents? Does it involve effects addressed by other standards/ commonly accepted best practice?		X			
Likelihood of increased costs or restrictions on individuals, communities or businesses?		X			

Based on this assessment the scale and significance of the proposed provisions for PCE are considered to be low - moderate for the following reasons:

- PCE is a response to national direction in the NPSUD and Council's strategic policies and plans that seek to provide additional housing capacity to meet the growing demand within the City. PCE also responds to local resource management issues which is discussed earlier in this report (see 5.1.1).
- PCE seeks to change the existing industrial land use to residential through amendments and new objectives, policies, methods and rules into the District Plan. The main changes which deviate from the current District Plan are rules relating to lot sizes, height and permeable surfaces. The rest of the provisions are a minor change to what's currently provided for in sections 7 and 10 of the District Plan, with the greatest change being the change from industrial to residential. However, due to the site being surrounded by residential or open space areas, the wider degree of change is considered to be low.
- When considering the scale and significance of effects, there will be a positive impact on the local area as the effects of the industrial use will change to residential to be in character with the surrounding uses. Along with the change in land use, heavy vehicle traffic coming and going from the site will reduce over time, creating a positive effect for the wider area and City with less reverse sensitivity over time.
- When considering the scale and effects on people, multiple landowners at Roxburgh Crescent will be impacted by the change in zoning and they have been consulted on throughout the plan change process (section 7). With existing use rights they will be able to operate at the same scale and intensity as they are now. However, they will not be able to increase the intensity of their businesses once the plan change is operative without seeking resource consent. The effects on the adjacent landowners to the site is considered to be low as industrial activities will be removed and replaced with residential activities. Areas in the RRA adjacent to the site follow the same height rules as the current District Plan (allowing two storey houses), while the River Front area can build up to three stories. The RRA is a higher density than the current plan but is not at the scale of proposed PCI which aims to allow more intensive forms of residential development with more homes on a site and lower lot sizes.
- RoM have been consulted with over how the RRA is to be developed but do not require a CIA and have showed interest in connection with the site to the Manawatū River.
- PCE was prepared to give effect to a number of higher order documents, including the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. This means further testing and consenting under this NES will be required for landowners. This is further discussed in earlier sections (5.3.4 and 5.3.5).
- There is a likelihood of further costs and restrictions on existing industrial landowners in the RRA as they transition to residential use. For sites where contamination exists there is possibility of increased cost of land contamination remediation and additional restrictions under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. For any residential development, there is always going to be costs associated with development such as development contributions, construction and consenting costs. There will be minor impact on early residents as the site transitions over time from industrial to residential with some heavy traffic still present at the site. However, with any site undergoing residential development, heavy/construction traffic is likely to be present temporarily.

Overall, PCE responds to Part 2 matters, assisting the Council in achieving its obligations under ss7(b) and 7(f). The following evaluation reflects the assessment above that the scale and significance of this Plan Change is low to moderate. Therefore a moderate level evaluation of these provisions has been identified as appropriate.

9.3 Options assessment

Three options were considered in developing PCE:

- The first option involved retaining the status quo of industrial zoning. This option would essentially be doing nothing, and industrial activities would continue and be able to intensify. This would also mean the Reserve Exchange would not happen and no additional access to the River would be facilitated by a plan change.
- Option 2 involved rezoning the land using the existing district plan approach. The current subdivision and residential rules would apply to Roxburgh Crescent with a resultant minimum lot size of 350m^2 and a maximum height of two stories applying across the site.
- Option 3 is PCE. This option involves introducing a structure plan to guide development with site specific rules that provide options for development and flexibility. A range of lot sizes are enabled within the RRA, along with 3 storey houses along the river front area where lots do not adjoin the existing residential zone. Having regard to the matters set out below, and for reasons described in this Report, this is the preferred option underpinning PCE.

Each of these options are discussed below:

Table 4 Options Assessment

Options	Costs	Benefits	Efficiency & Effectiveness
Option 1 Maintain the status quo – retain the existing Roxburgh Crescent Industrial zone.	Does not address the issues that current plan provisions are unresponsive to current and future housing demands and have created inconsistent environmental outcomes. This option would not provide the housing capacity required to address housing demand and meet population growth. There would be no ability to address housing choice, density,	No plan change costs for Council. No additional transport and stormwater infrastructure costs to service the area or improve the wider stormwater network. Retention of industrial land for commercial use. No costs or obligations for landowners to remediate contaminated sites under the NES CS.	It would not be effective on delivering on Council's strategies and the RPS to deliver more housing in the short to medium term. Retaining Industrial Zoning does not satisfy the requirements of the NPS-UD in that it would not enable a variety of housing types to be provided or contribute to a well-functioning urban environment.

Options	Costs	Benefits	Efficiency & Effectiveness
	affordability at Roxburgh Crescent under this option (discretionary consent is required). Residential development would require a discretionary resource consent under section 12 and would be unnecessarily costly for the developer. Continued heavy vehicle traffic through the wider Hokowhitu residential area if the Industrial Zone was retained. No opportunity to provide another pedestrian/ cycle access to the Manawatū River. Costs associated with land contamination remediation to facilitate a change in land use.		This option would not create a compact and consistent urban form to match the character of the surrounding residential land use and would see continued reverse sensitivity issues being raised from the continued industrial activity, potentially at a higher intensity. Without a structure plan, residential development would not be well connected and would not meet the objects and policies of section 7. This option is not considered efficient or effective. Keeping the area as industrial where activities can intensify is not considered efficient or effective in a populated residential area as additional reverse sensitivity issues can be generated.
Option 2. Rezone the RRA to residential and rely on the existing section 7 and 10 provisions to manage delivery of growth. Under this option there would be no changes to the provisions of the District Plan other than a change to the zoning maps.	Requires a plan change process to rezone the land and costs for Council. Does not provide options to build a range of housing densities or address stormwater permeability issues. Will result in ad hoc development without the benefit of a structure plan. Would result in a lower yield as minimum lot of	Supports NPSUD intent to deliver more housing generally, however not in a higher density. Provides the developer with better consenting certainty through the continuation of the current approach in the District Plan. Will respond and cater for housing but at a lower density than option 3 (the preferred option).	There is efficiency in this option as it would be a simple plan change with the scope only focused on the rezoning only, with no new provisions added to the District Plan. Without specific site provisions there would be no recognition of the site-specific characteristics of the RRA, such as the Riverfront Area. Inconsistency with recent plan changes in the City i.e

Options	Costs	Benefits	Efficiency & Effectiveness
	sizes would be 350m^2 instead of 250m^2 and there would be no maximum lot size. Cost for land remediation where contamination exists. Would not enable medium density housing as the area is not identified in the District Plan as a Medium Density Housing Area. Cost to upgrade stormwater outfall to enable lower onsite permeability standards	Removes potential reverse sensitivity issues compared with retaining the existing Industrial Zoning.	Hokowhitu and Napier Road Residential Extension Area which adopted structure plans to manage development and ensure better outcomes for a high quality urban environment.
Option 3 (the Preferred Option). Rezone the RRA to residential and introduce a structure plan and specific provisions (objectives, policies and rules). Identify the RRA as a Multi Unit Housing Area.	Requires a plan change process to rezone the land and costs for Council. Cost to upgrade stormwater outfall to enable lower onsite permeability standards. Cost for the landowner to complete land remediation where contamination exists.	Supports NPSUD intent to deliver more housing and a greater variety of densities and heights than what the current District Plan allows for. Provides bespoke site-specific rules that enable higher density through smaller lot sizes compared with the rest of the residential zone. Provisions would be able to address desired amenity values and specific urban design principles through the Structure Plan. Efficient delivery of housing and use of land through the addition of a structure plan that optimises the site layout. Enabling a higher density of housing to be delivered in the short to	This option introduces a structure plan design specifically for Roxburgh and provides certainty about how the area will develop, supporting positive urban design outcomes. This option provides a set of rules that respond to the character and location of the site being adjacent to the Manawatū River environment, such as allowing 3 storeys next to the stopbank to capture views across the river to the ranges, where the lots do not adjoin the existing residential sites. Site has sufficient water and wastewater services, without requiring additional infrastructure spend to enable further development of the site compared to other

Options	Costs	Benefits	Efficiency & Effectiveness
		medium term with a maximum lot size and allowing a lower minimum lot size. Creating an accessible access point to the Manawatū River for residents following the reserve exchange (with cultural, recreational and social benefits)	locations around the city. However, stormwater and road upgrades are still required. This option is effective in meeting national, regional and district policy direction to deliver more housing in the short to medium term within the current urban boundary.

The evaluation above demonstrates that the preferred option is option 3, which involves rezoning the area to residential while providing a structure plan and specific objective, policy and rule provisions to enable development at a higher density than what is provided in the Residential Zone currently in the District Plan. This option provides opportunities to gain a higher yield from the site and achieve better connectivity through the use of a structure plan. PCE also reflects the opportunity to rezone a historically isolated industrial area to residential and provide the predominant landowner opportunities to redevelop the land for housing purposes. Changing land use from industrial to residential via a resource consent process would be inefficient and difficult to achieve. Therefore, this approach achieves the purpose of PCE to provide additional infill land for housing in an efficient and effective way.

9.4 Evaluation Approach

The sections below assess the appropriateness of objectives, analyses options for achieving the objectives, and evaluates the proposed provisions for the preferred approach. A mixed approach has been undertaken because PCE seeks to amend and add objectives and policies (to varying degrees) to sections 7 and 10 of the District Plan. New site-specific standards have been added to address issues such as stormwater permeability.

9.4.1 Appropriateness of Objectives

This section of the report evaluates the proposed objectives as to whether they are the most appropriate to achieve the purpose of the RMA. The evaluation has had regard to factors such as relevance, usefulness, reasonableness and achievability, in assessing the objective against higher order documents and the purpose of the RMA, being sustainable management. The following table outlines the two new objectives proposed as part of PCE:

Section 7: Subdivision

Objective 11: To ensure that subdivision within the Roxburgh Residential Area proceeds in a manner that:

(a) Delivers a connected residential area identified in the Structure Plan layout.

(b) Manages stormwater in an integrated manner by implementing water sensitive design principles.

(c) Provides for an increase in housing supply through a variety of housing types and sizes to achieve the efficient use of land and respond to housing needs and demands.

(d) Creates a single pedestrian connection with the Manawatū River.

Section 10: Residential

Objective 16: Roxburgh Residential Area delivers a well-functioning urban environment by enabling a greater variety of housing densities, quality-built form and connection with public spaces.

Objective 17: Stormwater is managed to reduce quantity and improve quality discharges through the use of water sensitive design within the Roxburgh Residential Area.

The new subdivision Objective 11 assists the Council in giving effect to the NPSUD as it provides landowners with an opportunity to develop residential housing. This is currently not provided for under the Industrial Zone provisions. The Objective enables an increase in housing capacity for the PCE area by enabling a range of housing types to be delivered through smaller lot sizes while optimising yield through the structure plan layout.

Proposed Objective 11 achieves the purpose of the Act by sustaining the potential of natural and physical resources by allowing for a greater use of the land for residential purposes.

Enabling smaller lot sizes ensures the land is used to its full potential, providing necessary housing for Palmerston North in the short to medium term.

Objective 11 achieves Section 6(d) - the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers, by enhancing public access to the Manawatū River through a single connection. The land gained from the Reserve Exchange enhances this access by creating a wider area of green space, which also enhanches visual sightlines to the River and provides wider amenity for those living and visiting this site.

Proposed Objective 16 in the Residential Zone gives effect to the NPSUD by providing for housing by enabling a variety of densities to meet the needs of the community. This objective also helps to provide opportunity for further residential development in an existing urban environment.

Objective 16 seeks to achieve matters outlined in Section 7 other matters – 7(b) the efficient use and development of natural and physical resources, 7(c) the maintenance and enhancement of amenity values and 7 (f) maintenance and enhancement of the quality of the environment. The objective does this by encouraging a variety of housing to be delivered that is of high-quality built form and creates connections with public spaces. This objective ensures land is used efficiently, amenity values are maintained and the RRA creates a quality residential environment. This ensures communities can provide for their social, economic and cultural wellbeing within section 5 of the Act.

Objective 17 seeks to achieve matters outlined in Section 6 (h) the management of significant risks from natural hazards, 7(b) the efficient use and development of natural and physical resources, 7 (f) maintenance and enhancement of the quality of the environment. The objective does this by reducing stormwater quantity discharges from the site, manage risk of stormwater flooding onsite and improve quality of stormwater discharges.

The objectives will ensure integrated development in accordance with the RMA. The objectives seek to provide a sustainable supply of land for housing needs in the short to medium term in a manner that incorporates a structure plan, provides a variety of housing density, requires water sensitive design principles and urban design. The proposed provisions are considered to be reasonable and relevant for a rezoning of industrial to residential land to ensure future development delivers a well-functioning urban environment, this includes multi-unit housing development. The objectives address a current resource management issue that there is a growing demand for land within the existing urban boundary for infill residential development. The introduction of the new objectives will not result in unjustifiably high costs on the community or parts of the community, recognising the change in land use from industrial to residential that is proposed.

In combination with the existing District Plan framework, the proposed objectives provide a robust and sustainable direction for residential development that is based on the framework of the RMA, along with the NPS-UD and other higher order documents. The proposed new objectives are the most appropriate way to achieve the purpose of the Act. The objectives provide an effective and efficient approach to developing the RRA for future residential development. The Objectives contribute to achieving sections 6(d), 6 (h), 7(b), 7(c), and 7(f)

and the overall purpose of the Act, being sustainable management of the urban environment in Palmerston North.

9.4.2 Evaluation of Proposed Provisions (sections 7 and 10 of the District Plan)

In preparing this evaluation of the preferred option (Option 3, as explained above) the following matters have been considered:

- The environmental, economic, social and cultural costs and benefits of the options;
- The effectiveness of the options at addressing the resource management issue of a lack of land for housing in the short to medium term within the existing urban boundary, and achieve the purpose of the RMA;
- The efficiency of the options and quantifying the benefits and costs;
- Opportunities for economic growth and employment;
- Overall appropriateness of the preferred option; and
- The risk of acting or not acting if there is uncertain or insufficient information.

The detailed plan change provisions are set out in Appendix A. The technical input that has informed the evaluation of the proposed provisions are set out in Appendices C - H of this Report

Section 7 Subdivision		
The following assessment relates to policies and rules to be inserted in section 7 Subdivision as a result of Proposed PCE as it relates to *Objective 11: To ensure that subdivision within the Roxburgh Residential Area proceeds in a manner that:* *a) Delivers a connected residential area identified in the Structure Plan layout.* *b) Manages stormwater in an integrated manner by implementing water sensitive design principles.* *c) Provides for an increase in housing supply through a variety of housing types and sizes to achieve the efficient use of land and respond to housing needs and demands.* *d) Creates a single pedestrian connection with the Manawatū River.*		
Proposed Provisions	**Benefits**	**Costs**
New policies 11.1 through 11.7 requiring: • Development to be undertaken in an integrated and coordinated matter in general accordance with the structure plan. • A single access point to the Manawatū River • Maintaining critical infrastructure through no build areas, consent notices and easements. • Imposing consent notices to manage pervious surfaces and land contamination. • Enable greater housing density through smaller lots. • Enable subdivision of large lots for the purpose of multi unit development. • Using the road corridor to manage stormwater and onsite permeability for the RRA. New Restricted Discretionary rule 7.6.2.6 for subdivision in the RRA relating to compliance with R7.6.1.1 (a), (d), (e) and (i), and new performance	**Environmental** Environmental benefits will be realised through the inclusion of the structure plan, roading cross sections and provisions into the District Plan which have been supported by the technical assessments for this plan change. The structure plan avoids the use of cul-de sacs ensuring connectivity, while the road cross sections illustrate how water sensitive design within the roading network will deliver on managing stormwater quality and quantity. Where subdivision is not in accordance, these will be assessed against the provisions to ensure deliverability of a well-functioning urban environment is achieved. Additional environmental benefits will be achieved through encouraging permeable surfaces for parking in the road reserve. This aids in improving the quality of stormwater runoff in addition to biofiltration devices in the corridor. In regard to contaminated soils on identified sites where the NES CS applies, there will be environmental benefits to remediating the soil. Contaminated soil will be appropriately removed off the sites which will	**Environmental** There will be direct environmental costs associated with the proposed provisions as they will enable a change in the land and enable residential development. However, some of these environmental (water and contamination) effects will be temporary while construction occurs. There are potential environmental effects from the generation of stormwater associated with residential use. The stormwater assessment undertaken for the RRA concludes that on site permeability standards can be achieved to manage increased stormwater runoff from the development. There are environmental costs associated with remediating contaminated soils on those properties where the NESCS will apply before subdivision or at the same time. This will involve construction and works to the land at a greater intensity than land that does not require remediation.

standards for the structure plan, lot size and road corridor.	reduce persons exposure to these soils and the wider risk to human health or the environment. Benefits will be achieved through the new performance standards for the road corridor design provide requirements for biofiltration devices. This provides stormwater neutrality benefits and enhanced stormwater quality measures. The indirect benefits of enabling subdivision in the RRA includes the provision of access to opportunities for active transport. This is facilitated by the single accessway to the Manawatū River to provide opportunities for active recreation or for those using the pathway to get to and from work or study. The structure plan also provides a cycle and pedestrian link to Ruahine Street to support wayfinding in and out of the RRA. The RRA is also supported by the bus network and access to bus stops along Ruahine Street. This reduces the reliance on cars and promotes more sustainable transport uses. **Economic** PCE will generate economic benefits by enabling the development of housing. The structure plan layout aids in maximising yield by allowing for smaller lot sizes (250m^2), higher yield creates monetary benefits for the developer. Smaller lots are also more affordable to buyers as land prices have become inflated in recent times. There is financial benefit for PNCC by imposing one access point to the Manawatū River in the middle of the site. It provides certainty on the location and number of accesses meaning PNCC will not need to buy land for additional accesses. This also provides benefit to the Council knowing only one accessway will be delivered and maintained going forward. A single point of access	There will be indirect environmental costs associated with construction and infrastructure network connections of new lots. The actual and potential environmental costs of the subdivision provisions are considered acceptable and the resource consent process will manage the effects of future activities on the environment. **Economic** There will be construction and consenting costs for Council to develop the single access point to the Manawatū River. Construction of a concrete path will be required to enable a higher level of service for the accessway which will deliver a better social well being outcome for the community. Consenting and further legal costs are required to subdivide the accessway from the larger parcel that Council owns. There will be legal and consenting costs to both Council and landowners of imposing consent notices and managing critical infrastructure through easements. This also applies for consent notices for land contamination and permeable surfaces. There will be additional construction costs for the predominant landowner and Council to include permeable surfaces on private lots and in parking areas located in the road corridor, if they chose to do this. There are also higher ongoing maintenance costs for Council, however the permeable surface areas will assist with improved stormwater quantity and quality management across the site. There will be increased costs to provide stormwater biofiltration pits every 270m^2 of road on the predominant landowner and Council (for the existing Roxburgh Crescent upgrades) to manage stormwater

	also ensures greater yield is achieved compared with multiple access points to the river from the site. **Social** There are social benefits in enabling a range of lot sizes with supporting performance standards. Minimum and maximum lot sizes aids in affordability and provides housing options to the community. The performance standard also allows for subdivision of larger lots (1000m^2) to enable multi-unit development. There are direct social benefits of requiring a single River access point to be gained via subdivision. The access point is in a location where it has an increased level of service and amenity for the community as it is wider than standard accessways across the City, which tend to be more narrow or act as 'alley ways'. This accessway provides good way finding for the community. Currently this accessway goes over the stopbank and is built at a gentle gradient with no steep slope, compared to other nearby river access points (such as the Ruahine St corner or Waterloo Park access near the Scout Hall). There are social benefits for future landowners, and infrastructure providers by maintaining and accessing critical infrastructure through no build areas, consent notices and easements. This protects and future proofs access to critical infrastructure. It also makes it easier for the infrastructure provider to access the assets for ongoing maintenance and upgrade with minimal inconvenience to the landowner(s). **Cultural** There is cultural benefit in enhancing and providing access to the Manawatū River, which is supported by	quality before the discharge to the Manawatū River. Basic curb and channel approaches without biofiltration is no longer sufficient to manager stormwater runoff under the NPSFM. There are consenting costs associated with the creation of lots and the subdividing larger portions land. This cost is unavoidable as all subdivision under section 7 requires a resource consent. There will be additional consenting costs for land that has been identified during this plan change process as being potentially contaminated. Those sites trigger consents required under the NES CS which will be required to be lodged at the time of subdivision consent. The direct and indirect economic costs relating to this plan change are typical for residential development. Some aspects may have higher costs, especially meeting stormwater provisions and soil remediation. Both of these are required to meet national direction. These costs are considered acceptable and the benefits of these provisions outweigh the cost of development. **Social** There are social costs associated with reverse sensitivity as the site transitions to residential over time through subdivision with some industrial business operating at the same time. This is expected with redevelopment of sites overtime and is considered to be temporary. The existing industrial businesses have existing use rights for their activities, provided they maintain the same scale and intensity of activity on their site. On that basis no specific transition provisions are required or necessary. Indirect social costs may include those currently operating businesses within the RRA who wish to continue using their site for industrial purposes. This

	RoM. This supports their cultural wellbeing and allows the community to connect with the River environment.	may cause conflict between new residential neighbours and business owners. Given that the site has been operating as industrial in a residential zone for some time, these costs are considered to be low. **Cultural** There are no cultural costs associated with the proposed provisions.

Efficiency and Effectiveness

The provisions are the most efficient and effective way to deliver the best outcome for PCE. Where compliance with existing subdivision rules are required, these have not been included in this assessment as they are still relevant and have already gone through a previous s32 evaluation process and are the most appropriate way to manage residential subdivision. Where new provisions are introduced, these are based on technical inputs as discussed earlier, and the assessment within this report.

The structure plan is the most effective way to develop the site into residential activity as it provides for connectivity making it more efficient to move around the site and access properties. The structure plan provides the most efficient layout for optimum lot yield based on the minimum lot size developed through the assessment process described in the Urban Design Report. The supporting road cross sections have been tested for effectiveness and are considered to be the most efficient way to utilise the narrow existing road reserve and provide for walking and cycling in the new residential area. The road cross sections demonstrate how transportation modes can be delivered resulting in an efficient use of space. While the road cross sections are a departure from Council's Land Development Engineering Standards, narrower roads have been effective in other parts of the city where they have been used in residential development for (example, the development at Hokowhitu Lagoon). Widening the roads to achieve the Engineering Standards would result in a lower overall yield for residential housing and would also require Council to designate and purchase additional land off private landowners which would increase the cost of the plan change, noting that there is no budget allocated in the LTP to undertake these purchases. In addition, services already exist within the RRA plan change area and these services could be located under future footpaths.

The single access point to the Manawatū River provides efficient pedestrian and cycle connections from the wider neighbourhood and the RRA. The single access point is identified on the structure plan and already partially in Councils ownership, however it is currently not accessible by the public (as outlined in the Parks Report). There would be little benefit in creating multiple accesses through the site (at some cost) when only one in the centre would be cost efficient and still provide sufficient access.

Maintaining critical infrastructure through no build areas, consent notices and easements is considered to be the most effective way to secure access for maintenance and future upgrades over the longer term. It also provides direction to manage issues regarding permeable surfaces and infrastructure servicing efficiently after consent has been granted. Imposing consent notices on property titles to manage pervious surfaces and land contamination reflects the importance of these matters to successfully managing stormwater and contamination issues.

Encouraging parking areas to be permeable surfaces is an efficient use of parking areas to assist in stormwater quality and quantity management, rather than having additional hard stand areas. Permeable parking areas, while requiring some maintenance, are effective in managing stormwater runoff in the road corridor and creates positive effects on the stormwater network, particularly in terms of water quality being ultimately discharged into the Manawatū River.

As discussed earlier in this report, the overall purpose of this Plan Change is to enable a higher housing density to enable greater choice for the Palmerston North community. Having a minimum and maximum lot size ensures the land is used efficiently while still providing flexibility for current and future landowners. A lower minimum lot size is efficient to achieve greater housing density than the residential zone currently enables, and it also takes into account permeability and site coverage requirements for the site.

Risk of Acting/Not Acting if there is uncertain or insufficient information about the subject matter of the provisions

Council has sufficient information and relevant technical reports to inform policies and provisions to include specific rules for subdivision within the RRA. There is no reason, based on the technical reports provided, that indicates a change in zoning and the new subdivision provisions are not appropriate for this area. With the desire from the predominate landowner to change land use to residential retaining the existing zoning is no longer appropriate. If the land remained zoned industrial then any residential development/ construction of dwellings would be a discretionary activity. This is not an enabling approach, particularly when there is demand in the short to medium term as discussed in 5.1.1 of this report. Therefore, there is sufficient information to progress the changes to the subdivision section as proposed. The HBA indicates a growing demand for smaller homes, in response the Council is doing this by providing opportunities for smaller lot sizes through the provisions for subdivision under this plan change.

Economic Growth and Employment

PCE provides for economic growth and employment by opening up land for residential development which provides opportunities for the construction industry, including professional services who will work towards preparing for subdivision applications and carry out works for development. At a wider level, it encourages and supports population growth in the city by providing additional homes to the City's housing stock which delivers more homes for people to live in. This in turn brings in more people who will be living and spending in the City.

Summary of how proposed provisions achieve the objective

The proposed provisions achieve Objective 11 because:

- The different framework for the RRA will enable delivery of approximately 105 homes for Palmerston North through subdivision, rather than a lower yield based on the provisions of the existing Residential Zone.
- Adherence to the proposed Structure Plan will ensure the site maximises yield potential to help address the demand for housing within the City, while achieving good transportation connectivity.
- Management of stormwater through permeable surfaces and biofiltration devices in the road corridor controls provides environmental benefits for the RRA and mitigate any negative effects associated with development.

Section 10 – Residential		
The following assessment relates to policies and rules to be inserted in section 10 Residential as a result of Proposed PCE as it relates to proposed: *Objective 16: Roxburgh Residential Area delivers a well-functioning urban environment by enabling a greater variety of housing densities, quality-built form and connection with public spaces.* *Objective 17: Stormwater is managed to reduce quantity and improve quality discharges through the use of water sensitive design within the Roxburgh Residential Area.*		
Proposed Provisions	**Benefits**	**Costs**

Policy 16.1 requires: • Development is to be undertaken in general accordance with the structure plan and cross sections Policy 16.2 requiring the RRA to deliver: • Passive surveillance of public spaces from dwellings • Functional outdoor space • Reduction in visual dominance of garages. • Front yard landscaping to optimise runoff • Buildings that provide for onsite privacy and access to daylight Policy 16. 3 to restrict non-residential activity. Policy 17.1 to 17.4 requiring: • Utilising front yard landscaping to optimise stormwater runoff and quality. • Manage stormwater risk through minimum floor levels and permeable surfaces. • If permeability is not achieved, onsite measures	**Environmental** There are environmental benefits of imposing minimum and maximum lot sizes as they help provide smaller homes which require less land and less construction materials. This also reduces carbon emissions associated with residential development. There are positive environmental effects of front yard landscaping on properties. This is because plants absorb more water runoff than grassed area. This assists in each lot in taking pressure off the existing stormwater network by using onsite permeability requirements. Similarly, imposing minimum floor levels, permeable surfaces and encouraging hardstand to be permeable will also result in positive outcomes. These standards work in combination to reduce the risk of onsite ponding and flooding and help with stormwater quantity management. There are environmental benefits of using permeable surfaces standards rather than other methods such as attenuation tanks which hold water onsite and require ongoing maintenance. Permeable surfaces provide certainty long term that stormwater will be able to soak through the ground naturally. There is also greater scrutiny if performance standards for permeability aren't met as this becomes a non-complying activity. This will also reduce any non-complying consents for not meeting these performance standards. **Economic** The proposed provisions provide greater economic benefit than relying on the existing rules in section 10 of the District Plan. The provisions provide for flexibility in housing types to cater for the needs of the housing market by providing choice.	**Environmental** Residential development will generate environmental costs, due to the production of construction materials and preparation works for the land. Most environmental costs for development of the RRA are likely to be indirect and are at a similar scale to any other residential development across the City. There are Infrastructure upgrades planned in the LTP to enable the use of the alternative/lower permeability standard. There are indirect temporary environmental costs associated with an outfall upgrade through the stopbank to enable lower permeability standards. This upgrade involves upgrading a pipe located through the stopbank, any environmental effects of this upgrade will be managed by Horizons Regional Council during the resource consenting stage. **Economic** The establishment of policies and performance standards that enable increased density, allows little flexibility to build larger homes due to lot sizes restricted at 500m^2 maximum. This may result in economic uncertainty for the developer as they won't be able to cater towards the market for larger homes. It is noted that this approach is consistent with higher order documents, especially the NPSUD. There are likely to be additional costs to provide front yard landscaping and providing the area at the frontage to be plants rather than grass. However, the environmental benefits of this provision outweigh the costs. There are construction and potentially consenting costs with achieving the onsite permeability performance standards. Using permeable surface alternatives such as permeable paving and concrete may cost more than typical hardstand concrete. There is likely to be ongoing maintenance costs with maintaining permeable concrete/paving to ensure it is allowing for drainage.

are provided and demonstrated to achieve stormwater attention. • Encourage parking areas to be permeable. New permitted rule R10.6.1.8 for dwellings in the RRA relating to: • Compliance with performance standards under 20.4.2 (a), • floor levels, • Site area, site coverage and number of buildings. • Permeable surfaces • Frontage landscaped areas • Height, HRP and overlooking • Separation distances • Outlook space • Fencing • Onsite Amenity Under amended R10.6.3.1 non compliance with any permitted activity is a Restricted Discretionary Activity (except permeable surfaces)	There are economic benefits by increasing site coverage as it allows the developer to make the most out of their site and offset the higher permeability standards. There are economic benefits by restricting non residential development within the RRA as it ensures the land will be used for housing in order to meet demand. There are further benefits on existing local dairies and neighbourhood centres by avoiding competition in the area. The provisions for permeable surfaces future proof development opportunities by providing a lower permeability standard once the outfall has been upgraded. This provides the developer with economic certainty that they can utilise their land to its full potential once this upgrade has occurred. **Social** The structure plan encourages higher density through the River Front Area and is supported by the permitted performance standards for height. The benefit of the River Front Area is that three stories are enabled not compulsory, but two stories as a minimum is compulsory to ensure passive surveillance over the stopbank. This provides options and flexibility in the River Front Area. The use of a structure plan will also provide opportunities for increased density outside of the River Front Area. The structure plan in combination with the supporting performance standards provide more flexibility and housing options which will help improve housing choice and affordability. There is indirect social benefit by providing active frontages and visibility of dwellings and habitable rooms to the street and other public spaces. This is also enabled through the fencing provisions which limit fence heights to 1.1m. Lower fence heights create a connection between the dwelling and public spaces. Lower fence heights also allow for visibility of vehicles to see pedestrians and help pedestrians see a moving vehicle, providing safety benefits. This helps create a high amenity environment.	Economic costs may arise if the development of housing is delayed until the stormwater outfall is upgraded as some developers may wait until this is completed so they only have to rely on the lower permeability performance standard. However, the lower permeability standard may result into increased profits for the developer as they can maximise the land to its full potential. This would lead to an economic cost of homes not being delivered in the short to medium term to keep up with demand. There will be economic costs to PNCC to upgrade the stormwater outfall and upgrade the existing Roxburgh Crescent street environment. There could be demand from landowners along Roxburgh Crescent to upgrade this sooner to meet residential levels of service. There will be increased construction costs associated with building a minimum of two stories along the River Front Area. Three storey development is only permitted in the River Front Area, which restricts those wanting to build three stories outside of this area. There may be higher costs for those wanting to build three stories outside the RRA. This may result in resource consenting costs if landowners outside the River Front Area want to build three stories. **Social** There are social costs of being restricted to maximum lot sizes as it will limit those who want larger sections or larger homes. Some of the provisions may not cater to the wants of some members of the community such as those who want higher fences or want to maximise their land but are restricted by permeability standards. Indirect social costs may arise due to the change in approach the new provisions follow. These provisions are not considered to be creating a medium density area but they do allow for a range of densities. Some residents may see this is negatively affecting the residential character of the wider neighbourhood. However, these provisions are consistent with national direction and meet the gaps

New non complying rule R10.6.5.6 regarding non compliance with permeable surfaces in the RRA. New non complying rule R10.7.4.12 regarding non residential activities within the RRA.	Managing on site outdoor spaces will provide social benefits for residents by ensuring a good level of onsite amenity. This is achieved through the performance standards for onsite amenity and outlook space. Outlook space provide space between buildings but also benefits residents by providing opportunities for visibility of outdoor amenity. While car parking requirements can not be controlled by Council, there is a benefit in providing a garage set back performance standard to manage the bulk and visual dominance of onsite garages. This provides social benefit by bringing the dwelling forward to increase the visibility and connection between the dwelling and the street. There is direct social benefit in providing new Height Recession Planes (HRP) for the RRA to prevent shading issues onto neighbouring properties. The HRP for the River frontage area (three stories) is more lenient due to the lot having two frontages – towards the street and stop bank. This allows the developer or future resident more flexibility as there is more allowance with this HRP. **Cultural** There are positive cultural effects from the provisions encouraging homes to face the stopbank to provide passive surveillance and connection between residents and the Manawatū River. This will provide ongoing benefit for future generations.	in the market identified by the HBA and development of smaller sections currently being pursued in the market. **Cultural** There are no cultural costs associated with the proposed provisions.

Efficiency and Effectiveness

The proposed provisions are considered to be the most effective way to achieve the proposed objective and higher order documents. The structure plan is the most effective way in achieving the directives of the NPSUD by delivering homes at a variety of heights and densities. The structure plan is supported by minimum and maximum lot sizes to provide more yield. Height standards outside the River Frontage area are consistent with the operative District Plan, except an allowance has been made in the River Front area. It is effective and effective to require a minimum of two stories and enable a maximum of three in the River Frontage Area as it provides views over the stopbank and achieves a higher density without the need for a resource consent. It is not seen as efficient or effective to make any area of the RRA have lower height controls or restrict to single storey homes as this would be straying away from the existing rules for height in the District Plan that apply to the whole residential zone. The HRP has been tested and developed on the basis of performance standards for site coverage, lot size and height. They are the most effective way to avoid shading on neighbouring properties and allow for sunlight access as they are stricter for three story development.

The performance standards for permeability reflect best practice mechanisms which looks to allow areas for stormwater soakage, rather than attenuation tanks which are not enforced to ensure they are still working or draining correctly. On site permeability standards are the most efficient and effective method to manage stormwater runoff as permeable surfaces allow constant drainage through plants, decks, grassed areas and permeable paving.

Performance standards for separation distances are the same as what is currently in section 10 of the District Plan. The separation distances are seen as efficient and effective with no need to have larger separation distances from the existing residential zone. It is not seen as efficient or effective for the RRA to deviate away from these standards. Dwellings outside of the River Frontage Area will have a maximum height of two stories and other provisions are consistent with what is already provided for in the Residential Zone, so there is no need to create a buffer through larger separation distances within the RRA.

Non-residential activities will be a Discretionary Activity in the RRA to discourage expansion of existing or new industrial business activities, and ensure the land is used primarily for residential dwellings. The operative District Plan provisions enable a variety of non-residential activities to occur in the residential activities. The RRA provisions do enable a pathway for non-residential activities as the proposed policies provide direction as to how non-residential activities can occur. The HBA has identified that there is sufficient land available elsewhere in the existing industrial and business zones for industrial or commercial activities to occur. It is further noted that Council has initiated the Te Utanganui plan change to rezone additional land, to the north-east of the city, for industrial purposes. The change plan will provide additional land in the existing urban area for a variety of industrial and/or commercial activities to occur.

Risk of Acting/Not Acting if there is uncertain or insufficient information about the subject matter of the provisions

Council has sufficient information and relevant technical reports to inform policies and provisions for amendments to section 10 to enable PCE. The provisions have been developed through the master planning process and informed by the Urban Design report. Site specific provisions such as the permeability standards have been informed by the stormwater assessment and technical modelling of the network and effects on the wider catchment. This is considered to be sufficient information to inform the provisions. Some provisions follow the operative District Plan approach.

Not adding new provisions to section 10 would not address site specific constraints or respond to the NPSUD requirements. The RRA is largely surrounded by the residential zone and provides the City with additional choice for density that would not otherwise exist. Not acting would create consenting barriers for developing homes at a higher density. This would not be in line with national direction (NPSUD).

Economic Growth and Employment

Non-residential activities in the RRA are a Discretionary Activity to ensure the land is used for the primary purpose of housing to meet demand. This will reduce opportunity for commercial activities to establish or current business at Roxburgh Crescent to expand. This means there would be limited economic growth or employment opportunities for businesses wishing to establish in the RRA as the sole focus of PCE is to provide housing. It is noted that there are still potential economic growth and employment opportunities to occur for non-residential activities as the expansion of new or existing non-residential activities can be considered as a Discretionary Activity. As the site is going from commercial to residential, this reduces economic growth for landowners wanting to expand their current businesses in the RRA. However, it is likely some landowners will disestablish their businesses for residential development. At a City level, the Council is actively looking for land to rezone for industrial purposes on the outskirts of the City. It is anticipated some businesses may wish to establish in industrial areas in these locations.
Appropriateness in relation to relevant existing objectives The proposed provisions are considered to be appropriate in relation to the existing residential objectives for land use that relate to amenity, flood hazards and providing for residential activities.
Summary of reasons for decisions on provisions The proposed provisions achieve Objective 11 because: • They respond to the demand and need for a range of housing typologies in the City in line with the NPSUD. • The framework responds to the unique features of the site, being adjacent to the Manawatū River environment and within an established residential zone. • The provisions provide flexibility but are still guided by a structure plan.

Section 10 – Residential (amendments).		
The following assessment relates to policies and rules to be amended in section 10 Residential as a result of PCE as it relates to proposed Objective 15: Roxburgh Residential Area delivers a well-functioning urban environment by enabling a greater variety of housing densities. Also relates to existing objective 1 and policy 1.2.		
Proposed Provisions	**Benefits**	**Costs**

Amendments to restricted discretionary rule R10.6.3.3 multi-unit residential development to include the RRA. Including matters of discretion specific to the RRA including: • Developing in general accordance with the structure plan and give effect to stormwater permeability standards. • Minimum notional site area • On site amenity • Outlook space • Height and HRP Amendment of R10.6.3.4 to include the RRA for non-notification of multi-unit residential development.	**Environmental** The matters of discretion follow the same approach as the permitted performance standards to ensure there is consistency across the RRA. **Economic** Amending 10.6.3.3 to include the RRA provides the developer more housing typology options including developing more than three homes on a site or conjoined housing. This may save construction costs as the homes are smaller and closer together or conjoined. Provides the developer certainty that no unexpected consenting costs will arise as there will be familiarity with the existing approach. The amendment of the non-notification clause provides financial benefit by saving costs on consenting associated with notifying a resource consent. **Social** Multi-unit provisions provide social benefits to the community as it increases smaller homes at more affordable prices for the community. This may assist smaller households or people wishing to downsize. The non-notification clause provides social benefit by removing any additional delays associated with notifying a consent and provides multi-unit in a timely manner. **Cultural** There is unlikely to be any direct cultural value costs of these amendments.	**Environmental** There are no significant environmental costs associated with the amendments. There is still an indirect environmental cost of developing multi-unit through construction effects and materials. With the non-notification clause there will be no opportunity for community feedback on any potential environmental effects associated with multi-unit development in the RRA. **Economic** With any multi-unit development under the District Plan consenting costs associated are guaranteed. There may be further consenting related costs to achieve the matters of discretion if further information must be provided. As a minimum lot size of 250m^2 is required, any smaller lot sizes will not be feasible in the RRA due to permeability requirements. This will mean multi-unit development will not be as dense compared to other recent multi-unit developments around the City. This may have economic impact on the developer. **Social** Some members of the wider community in the area may view multi-unit development in the RRA as a social cost as their preference may be that the site be developed as conventional housing. The amendment of the non-notification clause means there's an indirect social cost of removing public participation from the resource consenting process. **Cultural** There is unlikely to be any cultural value costs as a result of these amendments. However, there is no opportunity for RoM to be engaged in multi-unit development through the non-notification clause.

Efficiency and Effectiveness Amending the multi-unit provisions consistent with current District Plan and a similar approach has been followed for plan changes at Aokautere and Hokowhitu Lagoon. It wouldn't be appropriate to not provide opportunities for multi-unit when the District Plan already provides a pathway for it. Non notification of multi-unit is consistent with the operative District Plan approach, it is not seen as efficient or effective to allow notification of multi-unit consents in the RRA due to the areas purpose to deliver housing. It would not be seen as efficient or effective to enable a higher density development or multi-unit as a Permitted Activity due to the RRA not meeting the threshold to be included in Proposed Plan Change I: Medium Density Residential Zone.
Risk of Acting/Not Acting if there is uncertain or insufficient information about the subject matter of the provisions Information outside of this plan change such as the HBA indicates there is a market demand for multi-unit development and more housing choice (smaller homes). PCE responds to this information by following the existing District Plan approach and providing pathways for multi-unit as a restricted discretionary activity. Without making the amendments, multi-unit would be a discretionary activity and no direction or site-specific provisions for the RRA would be required.
Economic Growth and Employment There will still be resource consent and construction costs associated with developing multi-unit in the RRA. This will support employment in the professional services and construction sector. Multi-unit will provide smaller and more affordable homes, either as rentals or homes to purchase. This will support the economic growth of the city by providing alternative housing options that are affordable, this will aid in attracting people to live in the city.
Appropriateness in relation to relevant existing objectives Amending R10.6.3.3 to include the RRA is the most appropriate way to meet existing objective 1 and policy 1.2 as it follows the existing District Plan approach that has already been tested. This is also a similar approach that has been taken by recent plan changes at Aokautere and Matangi. The RRA meets policy 1.2 as it is in close proximity to services such as public transport, schools and neighbourhood centres. There is also existing infrastructure that can support multi-unit development.
Summary of reasons for decisions on provisions The proposed provisions are the most appropriate way to achieve Objective 1 because: • It is an amendment to the existing approach for multi unit across the City and meets the requirements of having access to neighbourhood centres. • The amendments are in line with national direction and allow flexibility to develop multi unit without having to go through a discretionary consent or public notification. • The amendments are consistent are in line with national direction (NPSUD).

Conclusion

Palmerston North's population growth in recent times is projected to continue and there is an going need to continue to supply more land for housing. PNCC needs to take steps to ensure sufficient housing capacity is available to meet the growth needs of the community.

Presently, managing intensive residential development in Palmerston North under the Operative District Plan is not achieving desired built form outcomes for the City, nor sufficiently addressing the NPSUD, using land efficiently, or providing for the City's ongoing high rate of population growth.

Therefore PCE seeks to

- Rezone 4 hectares of industrial land to residenital and recreation. With a public reserve and accessway to the Manawatū River environment.
- Add new additions to section 4, 7 10 of the District Plan to provide for and guide residential development.
- Provide a structure plan and cross sections to deliver a locgical development patter and avoid cul de sacs.
- Provide oppourtunities for housing choice and a pathway for multi unit development.

The evaluation of the effectiveless and efficiceny of the options in this assessment has concluded that residential development of the RRA in accordance with the structure plan and cross sections will assist PNCC in provide land for housing. The preffered option aligns with higher order documents, particulary the direction in the NPSUD. The amendments to section 4, 7 and 10 of the District Plan is considered to be the most effective and effcient option to ensure connectivity, housing typology choice through a range of heights and densities while providing recreational access to the River.

Overall, PCE has been evaluated under the requirements of Section 32 of the RMA and it is considered to be the best available means to acheive the objectives and sustainable management purpose of the RMA.

Appendix A. Proposed Plan Change E Amendments to District Plan

New proposed provisions to be inserted into the Palmerston North City Council District Plan

Chapter 4 Definitions

Insert the following new definition:

Roxburgh Residential Area: Means the residential area shown in the Roxburgh Residential Area Structure Plan (**Map 7.10** Structure Plan .

Principal bedroom: means the main bedroom in the residential unit which is the largest and/or occupied by the resident or residents who head the household.

Amend the following new definition:

~~In relation to R10.6.1.7(d): ~~means able to be viewed through, and with not less than 65% openness over the elevation of the fence. Open areas exclude any surface of the fence, which is solid, but may include wire mesh, or wrought iron or similar elements with a facing edge not thicker than 12mm and spaced at not less than 80mm centres.

Chapter 7 Subdivision

Insert the following new objective and policies:

Objective 11: To ensure that subdivision within the Roxburgh Residential Area proceeds in a manner that:

(a) Delivers a connected residential area identified in the Structure Plan layout.

(b) Manages stormwater in an integrated manner by implementing water sensitive design principles.

(c) Provides for an increase in housing supply through a variety of housing types and sizes to achieve the efficient use of land and respond to housing needs and demands.

(d) Creates a single pedestrian connection with the Manawatū River.

Policy 11.1: To ensure that development is undertaken in an integrated and coordinated manner in general accordance with the Structure plan.

Policy 11.2 To restrict the use of cul de sacs and ensure connectivity as outlined in the structure plan.

Policy 11. 3 To recognise the limitations of the existing road corridor by enabling road layouts to be consistent with the road cross sections (refer to **Map** 7.10A Roading Cross section).

Policy 11.3: To require a single access point to the Manawatū River that is located centrally within the Roxburgh Residential Area as identified on the Structure Plan (refer to **Map** 7.10 Structure Plan).

Policy 11.4: To enable the maintenance of critical infrastructure through the use of no build areas, consent notices and access easements.

Policy 11.5: To impose consent notices on titles outlining measures required manage pervious surfaces and land contamination.

Policy 11.6: To enable greater housing density by allowing smaller lot sizes.

Policy To enable larger lot sizes for the purpose of multi-unit residential development only where there is a concurrent subdivision and land use consent.

Policy 11.7: To manage stormwater by utilising the road corridor and onsite permeability in the RRA.

Insert the following new rules:

R7.6.2.6 Subdivision in the Roxburgh Residential Area

Any subdivision in the Roxburgh Residential Area that complies with the performance standards below is a Restricted Discretionary Activity with regard to:

(a) The size, shape and arrangement of lots, access, and public open space.

(b) General accordance with Roxburgh Residential Area structure plan and roading cross sections.

(c) Those matters described in Sections 108 and 220 of the Resource Management Act 1991.

(d) Natural Hazards.

(e) Staging of development.

(f) Integration of essential services.

(g) Effects on the capacity of Council infrastructure.

(h) Stormwater Management

(i) The safe and efficient operation of the roading network.

Performance Standards

(a) Controlled Activity Performance Standards
Compliance with R7.6.1.1(a), (d), (e), and (i).

NOTE TO PLAN USERS*:* Where areas within Roxburgh Residential Area are identified in Council's records as being potentially contaminated, the National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health applies, and consent may be required under that document. If consent is required, then this must be applied for before or concurrently with a subdivision consent. All subdivisions must comply with the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health in addition to the requirements of this rule.

(b) Structure Plan
Subdivision must be in general accordance with layout contained in the Structure Plan shown on **Map 7.10** Structure Plan .

(a) Lot size

In the Roxburgh Residential Area each lot must be:

i. A minimum of 250m^2 and a maximum of 500m^2.

ii. A maximum lot size of 1000m^2 applies for multi-unit development where a subdivision and land use consent are applied for at the same time.

(b) Road corridor:

Design of the road corridor must demonstrate

i) Compliance with Map 7.10A Roading Cross Section for both the new roads and existing Roxburgh Crescent.

ii) Map 7.10 b Roading Cross Sections for D (Centre of Site) for the new road in the centre of the site marked as 'd' on the structure plan in Map 7.10 b Roading Cross Sections for D (Centre of Site).

iii) Include water sensitive design elements based on one (1) square metre of stormwater pit being provided per 270 m^2 of road reserve.

iv) Provide treatment of road stormwater through pervious pavements, grassed and other biofiltration devices prior to entering the Council stormwater network to improve the quality of the stormwater discharge.

R7.6.2.7 Non notification of subdivision in the Roxburgh Residential Area

Subdivision applications made for sites complying with R7.6.2.6 must not be publicly or limited notified.

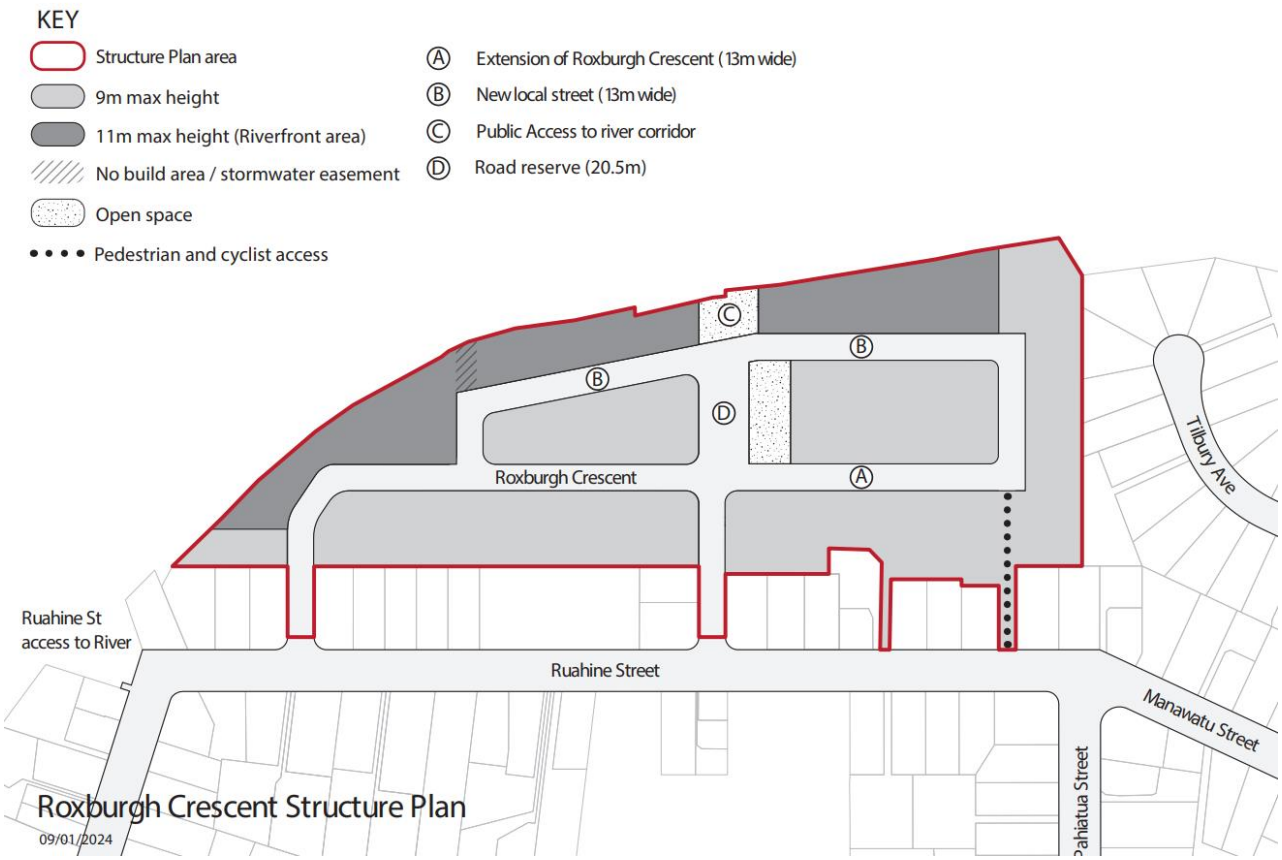
Amend Rule 7.6.3.1 Discretionary Activities as follows:

R7.6.3.1 Discretionary Activities

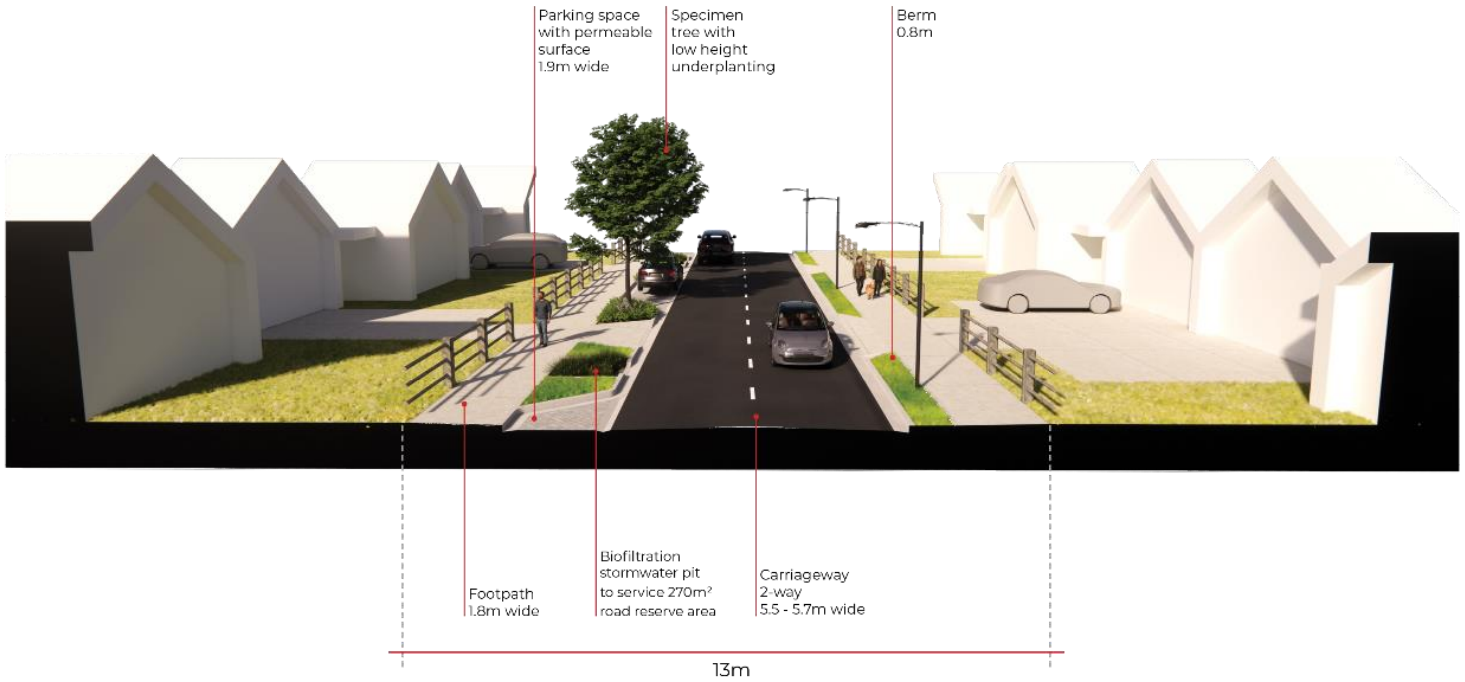
The following are Discretionary Activities

4. Any subdivision which does not comply with Performance Standards of R7.6.2.6 Subdivision in the Roxburgh Residential Area.

Map 7.10 Structure Plan



Map 7.10A Roading Cross section



Map 7.10 b Roading cross sections for d (centre of site)

Chapter 10 Residential

Insert the following new objective and policies:

Objective 16: Roxburgh Residential Area delivers a well-functioning urban environment by enabling a greater variety of housing densities, quality-built form and connection with public spaces.

Policy 16.1: Require development to be delivered in general accordance with the layout of the Roxburgh Residential Area Structure Plan and roading cross sections.

Policy 16.2: Roxburgh Residential Area is delivered in a way that:

a. Provides passive surveillance from dwellings to public spaces.

b. Provides functional outdoor space for dwelling residents.

c. Provides a variety of housing density including attached and detached dwellings, 3-storey dwellings, and multi unit development.

d. The visual dominance of garages from the street is managed through the use of garage setbacks.

e. Onsite privacy and access to daylight and sunlight for habitable rooms in winter is achieved through building design.

Policy 16.3: To restrict non-residential activity in the Roxburgh Residential Area, except where the non-residential activity is located on the:

a. Ground floor and residential living is above, and

b. East – West road opposite or adjacent to the open space area.

Objective 17: Stormwater is managed to reduce quantity and improve quality discharges through the use of water sensitive design within the Roxburgh Residential Area.

Policy 17.1: Utilise front yard landscaping to optimise stormwater runoff and improve stormwater quality.

Policy 17.2: To manage the risk of stormwater flooding by requiring that all development achieves the specified minimum floor levels and has sufficient permeable surfaces to manage stormwater runoff onsite.

Policy 17.3: To require that where permeability limits are not achieved, onsite measures are provided and demonstrated to achieve stormwater attenuation at the same rate as the required permeability area.

Policy 17.4: To encourage parking areas to include permeable surfaces.

Insert the following new rules:

10.6 Dwellings and Accessory Buildings

R10.6.1 Rules: Permitted Activities

R10.6.1.8 Dwellings within the Roxburgh Residential Area

Dwellings are a Permitted Activity in the Roxburgh Residential Area, subject to the following performance standards:

Performance Standards:

a. Compliance with Permitted Performance Standards under R20.4.2 (a)

b. Floor Levels

Floor levels must be above the flood and stormwater inundation level predicted for a 0.5% annual exceedance probability (AEP) (1 in 200 year) flood event, plus 350mm freeboard for dwellings and dwelling units (including attached garages).

c. Site Area, Site Coverage and Number of Buildings

i) Site area

a) A minimum site area of 250m^2

b) A maximum site area of 500m^2

ii) Site coverage

a) Maximum site coverage of 45%

iii) Number of buildings used for residential living per site

The number of buildings per lot shall be no more than

a) One dwelling unit on 250m^2

b) Two dwelling units on 500m^2

For three or more dwellings on a site refer to **R10.6.3.3** Multi-unit residential development in the multi-unit housing areas identified on Maps 10.6.3.3(a)-(~~h~~ j) is a Restricted Discretionary Activity with regard to:

d. Permeable Surfaces

i) A net site area of 45% must be maintained as a permeable surface.

ii) Should the stormwater outlet from Roxburgh Crescent to the Manawatū River be constructed and is operational a net site area of 35% must be maintained as a permeable surface.

iii) Permeable surface may be landscaped areas which also achieve the landscaping requirements of 10.6.1.8.e.

Guidance Note: Given the Roxburgh Residential Area is at the bottom of the stormwater catchment, the lack of detention areas to attenuate stormwater within the site in a location near the outlet to the river, and the current size of the outlet there are few alternatives to providing the onsite permeability required. Council may impose consent notices on property titles at subdivision stage to enforce this standard.

e. Frontage Landscaped areas

30% of the land within the front yard setback area, as referenced under R10.6.1.1(c)(i)(a), must be developed with plants and grass.

f. Height

i) A maximum height of 9m.

ii) Within the River Front Area

a. no building or structures may exceed a maximum height of 11m + 1m for pitched roof; and

b. all dwellings must be a minimum of two stories.

iii) Antennae, chimneys and aerials may exceed this height by 2m.

g. Height Recession Plane

i) Within the Roxburgh Residential area outside the River Front Area (shown on the structure plan **Map 7.10** Structure Plan the following apply:

a) All buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles from a point of 5.0 metres above ground level along the front two – thirds including side boundaries; and

b) For the rear one-third of the site or any rear lots: buildings and structures must be contained within 45˚ angle inclined inwards at right angles measured from a point of 2.8 metres above ground level.

Except where:

a. For parcels longer than 45m, all buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles from a point of 2.8 metres above ground level for the rear 15m of the lot.
b. For lot boundaries along existing residential properties in Ruahine Street and Tilbury Avenue, all buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles measured from a point of 2.8 metres above ground level.

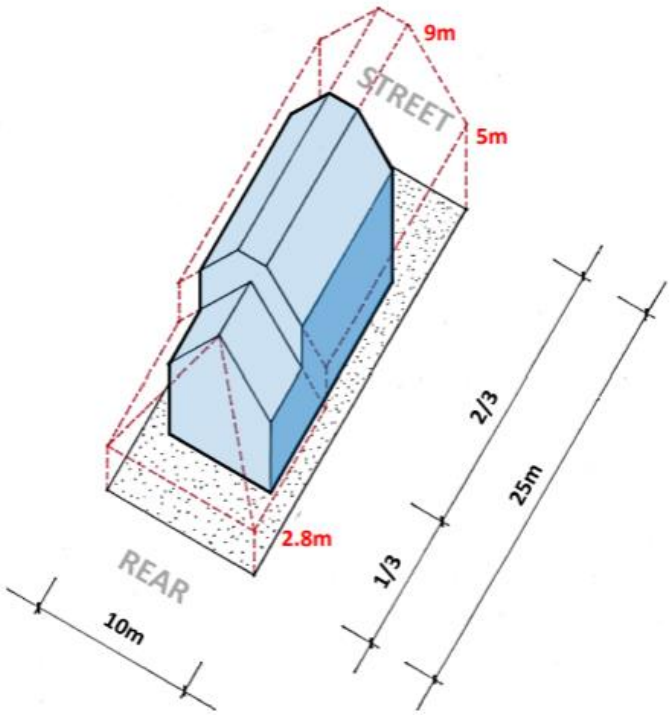
ii) All buildings and accessory buildings within the River Front Area (11m height area shown on the Structure Plan **Map** 7.10 Structure Plan the following apply:

a) All buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles from a point of 5.0 metres above ground level for the entire length of the lot including side boundaries.

iii) No height recession plane applies along common boundaries of conjoined dwellings.

iv) Where a boundary adjoins an access strip the measurement will apply at the furthermost boundary of the access strip.

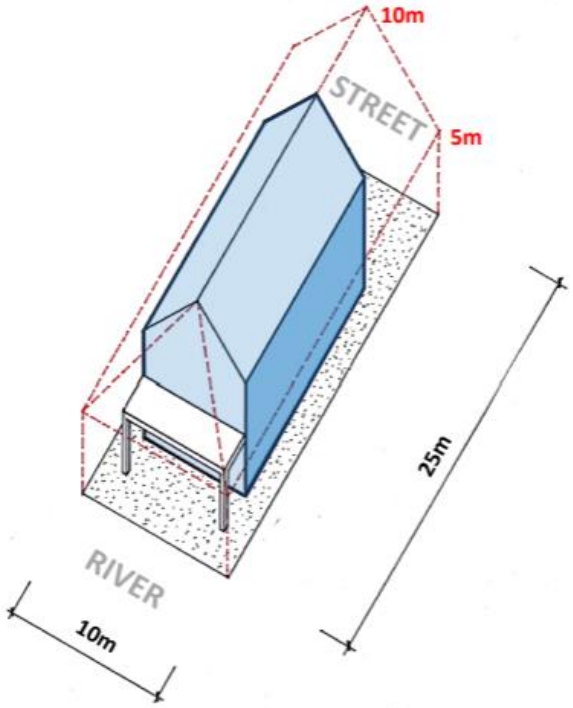
Guidance Note: See **Error! Reference source not found.** and **Error! Reference source not found.** which demonstrates how height recession planes are to be measured



250m² Standard Lot

(approximate dimensions)

Figure 1 HRP for the RRA (except River Front Area)



250m² River Frontage Lot

(approximate dimensions)

Figure 2 HRP for the River Frontage Area

h. Overlooking

Compliance with performance standard 10.6.1.1 (b).

i. Separation Distances

Compliance with performance standard 10.6.1.1 (c)

Except where:

- Where two dwellings are joined by a wall or by their respective garages, the separation distance provisions in 10.6.1.1 (c)(i)(a) must not apply.

j. Outlook Space

i. Every dwelling unit must be provided with an outlook space from habitable room windows that meets the following minimum dimensions:

a. 6 metres in depth x 4 metres in width outlook space for a *main living area*; and

b. 3 metres x 3 metres outlook space for a *principal bedroom*[1]; and

c. 1 metre x 1 metre outlook space for all other *habitable rooms**.

ii. Outlook space must:

a. be clear and unobstructed by buildings;

b. does not extend over an outlook space or outdoor living space required by another dwelling;

c. be provided from the face with the largest area of glazing where the room has two or more external faces; and

d. be measured from the centre point of the window to which it applies.

iii. Outlook space may extend over a public road, public open space, driveways and footpaths within the site, or another outlook space required within the same dwelling.

[1] Principal bedroom means *the main bedroom or master bedroom in the dwelling unit which is the largest.*

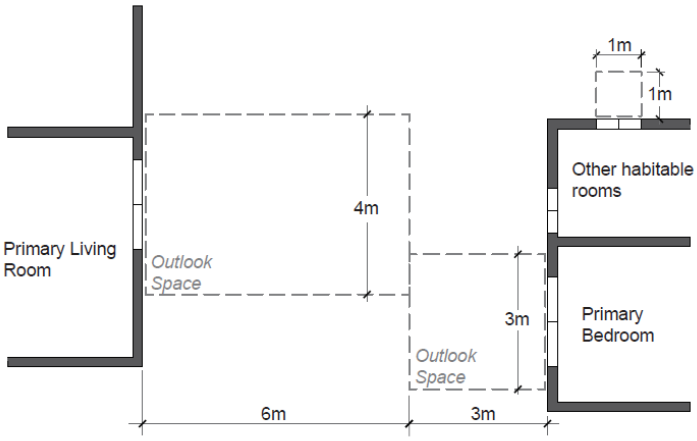


Figure 3 Outlook space

k. Fencing

i. Boundaries with public spaces and road frontage:

a. A solid fence on a property boundary to any road, public walkway or reserve must be no higher than 1.1m in height.
b. If the fence is of Open Construction[2] the fence must not exceed more than 1.8m in height.
c. A solid fence located along a property boundary to a road, public walkway or reserve where a private outdoor amenity area is located must not exceed more than 1.8m in height and be no longer than one third of the total site frontage area in compliance with 10.6.1.1 (e) .

ii. Side Boundary Fence:

A side boundary fence must not exceed 1.1 metres in height for a distance of 3 metres into the property from the road boundary when next to the driveway. After 3 metres the fence must not exceed 1.8 metres in height.

l. Onsite Amenity

i. Where the onsite amenity is provided at ground level compliance with 10.6.1.1 (e).

[2] means able to be viewed through, and with not less than 65% openness over the elevation of the fence. Open areas exclude any surface of the fence which is solid, but may include wire mesh, or wrought iron or similar elements with a facing edge not thicker than 12mm and spaced at not less than 80mm centres

ii. Where the onsite amenity is provided above ground level it must meet the following requirements:

   a. a minimum area of 5 m^2 where the space serves a one bedroom dwelling unit, or

   b. a minimum of 8 m^2 where the space serves a dwelling unit with two or more bedrooms, and

   c. be located to the north, east or west of the dwelling unit, and

   d. be located to receive a minimum of 3 hours continuous sunlight over at least 50% of the area on the shortest day of the year, and

   e. have direct contact with the main living area via door access.

Note to plan users:

Any excavation or earthworks or structures within 8m of the inland toe of stopbank may require consent from Manawatu Wanganui Regional Council. Plan users are advised to consult with the Manawatu Wanganui Regional Council for any works 8m within the toe of the stopbank.

Amend rules for activities that don't meet the permitted activity rule above as follows[3]:

10.6.3 Rules: Restricted Discretionary

R10.6.3.3 **Multi-unit residential development in the multi-unit housing areas identified on Maps 10.6.3.3(a)-(~~h~~ j) is a Restricted Discretionary Activity with regard to:**

- Effects on the surrounding residential environment and streetscape
- Height
- Design, scale and appearance
- Site density and layout
- On-site landscaping
- Privacy across boundary and within the development
- The safe and efficient operation of the roading network, and internal circulation and manoeuvring areas
- Natural hazards
- For developments within the Hokowhitu Lagoon Residential Area, the effects on the Manawatu Golf Club
- Matters addressed in the design principles in Policy 2.8 of Section 7A for housing within the Matangi Residential Area.
- For developments within the Aokautere Residential Area, the impact on achieving the design elements and outcomes of the Aokautere Structure Plan and the effects on the natural gully network.
- For developments within the Roxburgh Residential Area, to achieve a well functioning urban environment by developing in general accordance with the Roxburgh Residential Area Structure Plan, and give effect to storm water permeability standards .

Performance Standards

i. Notional Site Area for Each Unit

a) No minimum notional site area applies if the development site is located within Areas A or C;

b) A minimum notional site area of 150m^2 applies if the development site is located within Areas B, D, or G, or H

c) A minimum notional site area of 250m^2 applies if the development site is located within Area J.

ii. Minimum Unit Size

[3] Amendments under the Roxburgh Plan Change are **in red and underlined**

a) Each unit must have a gross floor area greater than 45m^2, if the site is located within Areas A or C; or H

b) Each unit must have a gross floor area greater than 60m^2, if the site is located within Areas B or D or G or H or J.

iii. Site Coverage

A maximum site coverage of 40% applies to the development site unless in the Aokautere Residential Area and the Roxburgh Residential Area where a maximum site coverage of 45% applies.

iv. On-site Amenity

a) Each unit shall be provided with a private outdoor amenity area within the notional site which can meet the following requirements:

- A minimum open area of 30m^2 free of driveways, parking spaces, buildings and manoeuvring area.
- Is able to accommodate a circle of 4 metres in diameter.
- Has direct contact with a main living area for a length of not less than 2 metres.
- Is orientated to the east, west or north of the unit.

b) Each dwelling unit located on the first floor, which does not have connection at ground level, shall be provided with a private outdoor amenity area which can meet the following requirements:

- Is accessed directly off the living, dining or kitchen areas, and located at the same level,
- A minimum of 8m^2 in area, unless a unit in the Aokautere Residential Area or the Roxburgh Residential Area has less than two bedrooms in which case a minimum of 5m^2 applies.
- Is orientated to the north, west or east.
- Be located to receive a minimum of 3 hours continuous daylight over at least 50% of the area on the shortest day of the year in the Roxburgh Residential Area.

v. Access and Parking

Compliance with R10.6.1.1(g) (Access and Parking).

vi. Compliance with R10.6.1.1(a), R10.6.1.1(b), R10.6.1.1(c)(i).

The performance standards of 10.6.1.1(a), 10.6.1.1(b), 10.6.1.1(c)(i) apply only to the exterior boundaries of the development site.

vii. Stormwater Design

A plan must be submitted to identify appropriate stormwater design for the development, and:

- demonstrate how peak run-off volume is to be mitigated
- demonstrate how low impact development principles are applied
- identify a secondary flow path.
- demonstrate how the stormwater design aligns with the Stormwater Management Plan prepared under R7A.5.2.3(h)

- Demonstrate how the stormwater design aligns with R10.6.1.8(d) within the Roxburgh Residential Area.
- demonstrate how adverse effects on the gully network in Aokautere will be avoided

viii. Additional setback requirements in the Hokowhitu Lagoon Residential Area

- No setback is required from the street edge boundary of lanes identified in Map 7.7.2.7.
- On corner sites a 3m setback applies to a nominated street interface boundary. The other interfaces can be treated as side boundaries where a minimum 1.5 setback applies.
- Where a building on a corner site is set back between 1.5m and 3m from a road boundary which is to be treated as a side boundary, as per 10.6.3.3(viii)(ii), at least 10% of the surface area of the side boundary wall that fronts the road must be glazed.

ix. In the Matangi Residential Area multi-unit unit housing area identified on Map10.6.3.3(h) the following applies:

- No building may exceed a height of 11 metres
- All parts of a building shall be contained within a 60 degree plane commencing at 3 metres above ground level inclined inwards at right angles in plan.
- Front yard fences shall not exceed a height of 0.9 metres.

x. Development Yield

Within the multi-unit housing area identified in the Matangi Residential Area (Map 10.6.3.3(h))the average minimum number of dwellings shall be 25 per hectare.

xi. Additional height, recession and setback requirements in the Aokautere Residential Area

a) No building shall exceed 11m within Area H

b) All buildings within Area H shall be contained within a 45° plane commencing at 5m above ground level inclined inwards at right angles in plan for the front twothirds of the side boundary and 2.8m for the rear one-third of the side boundary (See Figure 10.2) unless it is located at the boundary of a Suburban Low Density allotment in which case the recession plan shown in Figure 10.1 applies.

c) Any dwelling (including with garages) within Area H must be at least:

- 1.5m from the road boundary where the lot has frontage with any public road;
- 1m from any side yard boundary; and
- 3m from any rear yard boundary.

xii. Outlook space in the Roxburgh Residential Area

i. Every dwelling unit must be provided with an outlook space from habitable room windows that meets the following minimum dimensions:

a. 6 metres in depth x 4 metres in width outlook space for a *main living area*; and

b. 3 metres x 3 metres outlook space for a *principal bedroom*[4]; and

[4] Principal bedroom means *the main bedroom or master bedroom in the dwelling unit which is the largest.*

c. 1 metre x 1 metre outlook space for all other *habitable rooms*.

xiii. Building height requirements in the Roxburgh Residential Area

i. A maximum height of 9m

ii. Within the River Front Area

a. No buildings or structures may exceed a maximum height of 11m + 1m for pitched roof, and
b. All dwellings must be a minimum of two stories

iii. Antennae, chimneys and aerials may exceed this height by 2m

xiv. Height Recession Plane in the Roxburgh Residential Area

i. Within the Roxburgh Residential area outside the River Front area (shown on the Structure Plan Map 7.10 Structure Plan) the following apply:

a. All buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles from a point of 5.0 metres above ground level along the front two – thirds including side boundaries; and

b. For the rear one-third of the site or any rear lots: buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles measured from a point of 2.8 metres above ground level.

Except where:

c. For parcels longer than 45m, all buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles from a point of 2.8 metres above ground level for the rear 15m of the lot.

d. For lot boundaries along existing residential properties in Ruahine Street and Tilbury Avenue, all buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles measured from a point of 2.8 metres above ground level.

ii. Dwellings within the river front area (shown on the Structure Plan) the following apply:

a. All buildings and accessory buildings must be contained within 45˚ angle inclined inwards at right angles from a point of 5.0 metres above ground level for the entire length of the lot including side boundaries.

iii. No height recession plane applies along common boundaries of conjoined dwellings.

iv. Where a boundary adjoins an access strip the measurement will apply at the furthermost boundary of the access strip.

See Error! Reference source not found. **and** Error! Reference source not found. **which demonstrates how height recession planes are to be measured**

xv. Compliance with R10.6.1.5(c)(v).

In determining whether to grant consent and what conditions to impose, Council will, in addition to the City View objectives in Section 2 and the Residential Zone objectives and policies, assess any application in terms of the following assessment criteria:

Assessment Criteria

1 Character

The extent to which:

(a) any significant planting and trees are retained, and neighbourhood character is reinforced with the type and species of new planting.

(b) new development relates to common and defining patterns of the height and width of primary building forms, and predominant roof types and pitches.

(c) new development in valued character areas relates to common and defining patterns of frontage orientation and alignment.

(d) new development relates to common and defining patterns of façade composition and articulation, and qualities of materials and landscaping.

(e) development within the Hokowhitu Lagoon Residential Area responds to the park-like character of the adjoining Manawatu Golf Course

(f) Development, within the Aokautere Residential Area responds to the natural gully network, open space and the network of cycleways and recreational trails.

2 Site Planning

The extent to which:

(a) buildings and related open spaces and landscaping are planned and designed together to deliver high levels of amenity with a range of housing types and forms and well-located, good quality open spaces, which are consistent with any relevant Greenfields Structure Plan and within the Hokowhitu Lagoon Residential Area provides a safe interface with the adjoining Manawatu Golf Course.

(b) private and public areas are differentiated and defined.

(c) habitable rooms are orientated towards the east, north or west for good sun, and habitable rooms that face south only are avoided.

(d) new buildings retain reasonable visual privacy and daylighting for all adjacent residential units and properties.

(e) garages and parking are located and designed to avoid monotony and domination of any street frontage or spaces within the development.

(f) driveways and entrance courts are designed and landscaped to give visual interest and create an attractive entrance to the development.

(g) the planning of the development allows views of the street and common spaces within the development to be maintained, including views of open carparking spaces from the dwelling served.

3 Building Design

The extent to which:

(a) dwelling fronts including entrances and windows to habitable rooms are orientated to the street edge, and views are maintained to and from the street. This does not apply within area J.

(b) modelling of building form, and secondary forms and detail gives visual interest and a sense of human scale at the occupied and/or publicly visible edges of buildings.

(c) windows are provided to optimise both daylighting and views while providing for privacy, and large blank walls are avoided.

(d) the living areas of dwellings are located and oriented to optimise sun exposure, natural lighting and views, including to the street or adjacent public open spaces.

(e) circulation within the dwellings is sufficiently planned, and spaces including storage are provided and sized to be fit for purpose.

(f) new buildings retain reasonable visual privacy and daylighting for adjacent residential properties.

(g) individual units are expressed and entrances are signalled and readily visible from the street or entranceways.

(h) the design of the development incorporates energy efficient and water conservation principles.

(i) Within the Hokowhitu Lagoon Residential Area incorporates design and materials to withstand damage from stray golf balls from the Manawatu Golf Course.

4 Open Space Design

The extent to which:

(a) main outdoor spaces are associated with a living area within the dwelling, are reasonably private and of a useable size and are orientated to the sun.

(b) usable, well-orientated balconies are provided to above ground units and where quality at-grade private open space is not reasonably achievable.

(c) good quality shared private open space is provided as a complement to smaller private open spaces or balconies allocated to individual units.

(d) boundary treatments such as walls or planting between units balance openness and closure, and are varied to both privacy and views out, and avoid monotony and complete fragmentation of the open space within the development.

(e) planting is integrated to provide an attractive setting for and outlook from the dwelling, and provide for privacy, summer shade and winter sun.

(f) carports and garages are visually compatible with and of a similar standard to the development as a whole.

(g) large, highly visible retaining walls are avoided or screened with appropriate planting.

(h) front yard boundary treatments are sufficiently low to provide for visual connection between the dwelling and the street and allow safe vehicle access across the footpath.

(i) suitably screened and located provision is made for rubbish storage and collection.

(j) suitable, reasonably private and sunny space is provided for open air laundry drying.

5 Infrastructure and Servicing

The extent to which:

(a) site and building design mitigates any increase in peak stormwater run-off and peak stormwater flow due to the reduction in permeable surfaces.

(b) the development is consistent with relevant engineering requirements

(c) buildings, structures and landscaping are avoided in the 5 metre no-build setback identified on the Aokautere Structure Plan (Map 7A.4).

(d) adverse effects on the gully network in Aokautere are avoided.

6 Natural Hazards

How the development manages potential adverse effects associated with the geotechnical constraints and natural hazards within the Aokautere Residential Area through implementation of any geotechnical and engineering recommendations, including the level of geotechnical investigation carried out and the level of analysis and specific design requirements arising from the investigation with particular reference to:

- cut slope behavior and slope stability analysis to develop appropriate set back distances from the crest of slopes for building platforms
- whether building platforms should be restricted in certain areas
- whether specific foundation designs are required in certain locations; and/o
- the management of earthworks and recontouring of land.

NOTE TO PLAN USERS

- Also refer to the following rules:

  R10.6.1.3 Amberley Avenue, Escort Grove, Rangitane Park and Awapuni Racecourse Minimum Floor Level Areas;

  R10.6.3.4 Awatea Stream and Jensen Street Ponding Areas;

  R10.7.1.6 Limited Development land in Aokautere

- Council's engineering standards for the design and construction of infrastructure and services should be referenced in the design of multi-unit residential developments.
-

R10.6.3.4 Non-Notification of Multi –Unit Residential Development Activities in the Hokowhitu Lagoon Residential Area ~~and the~~ Aokautere Residential Area and the Roxburgh Residential Area

Applications made for restricted discretionary consent applications under R10.6.3.3 for sites associated with Map 10.6.3.3(g), 10.6.3.3(i)and 10.6.3.3 (j) must not be publicly or limited notified.

10.6.4 Rules: Discretionary Activities

R10.6.4.3 Multi-unit residential development that does not comply with R10.6.3.3 or is located within the Golf Ball Hazard Area in the Hokowhitu Lagoon Residential Area identified in Map 7.7.2.7 or is not located within identified areas of 10.6.3.3

Multi-unit residential development that does not comply with the Performance Standards of R10.6.3.3 or is located within the Golf Ball Hazard Area in the Hokowhitu Lagoon Residential Area identified in Map 7.7.2.7, or that is not located within identified areas of 10.6.3.3 is a Discretionary Activity.

In determining whether to grant consent and what conditions to impose, if any, Council will in addition to the City View objectives in Section 2 and the objectives and policies of this zone, assess any application against the assessment criteria in R10.6.3.3.

10.6.5 Rules: Non – Complying Activities

R10.6.5.6 Non – compliance with rule 10.6.1.8 D Permeable Surfaces in the Roxburgh Residential Area

Any new dwelling, minor dwelling or accessory building located in the Roxburgh Residential Area that does not comply with rule 10.6.1.8 D Permeable surfaces shall be a non-complying activity.

Insert a new rule for 10.7 Non-Residential Activities as follows:

R10.7.4.12 Non-residential activities within the Roxburgh Residential Area

Any non-residential activity within the Roxburgh Residential Area is a Discretionary Activity.

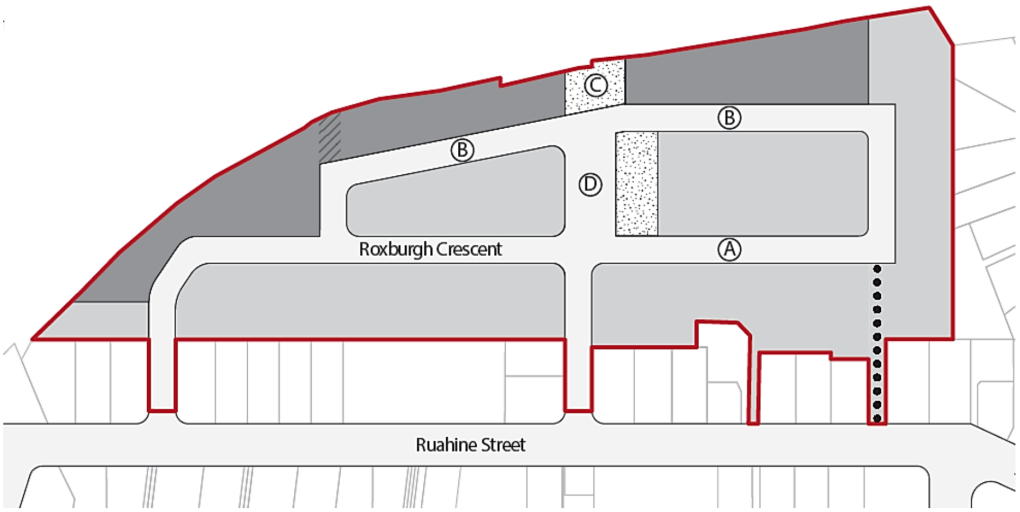
Map 10.6.3.3 (j) Multi – Unit Residential Housing Area: Roxburgh Residential Area

Appendix B. Zoning Map


85
Ruahine St
Ruahine St
Roxburgh Cres
Palmerston North City
50
Ruahine St
Pahiatua St
Manawatu
Roxburgh Plan Change Area
Proposed Recreation zone
Proposed Residential zone
Possible future formed roads
Existing formed roads
Existing Designations
District Plan Zone
Conservation and Amenity
Flood Protection
Recreation
Residential
Water Recreation
N
Metres
0
100
Palmerston North City Council Imagery 2021/22

Appendix C. Urban Design Report

Roxburgh Crescent
Urban Design Report



Prepared for
Palmerston North City Council

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1 Introduction

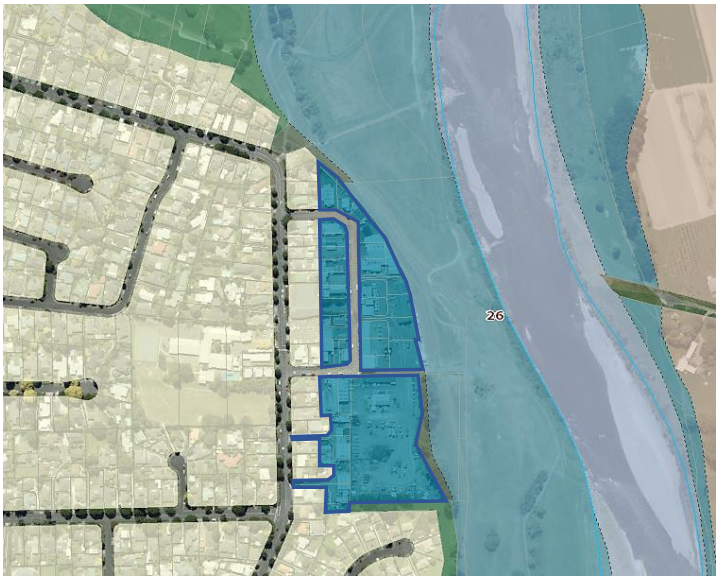


Fig.1 Existing Roxburgh Crescent industrial area indicated in dark blue (PNCC Operative District Plan *modified*).

This report describes development intentions for approximately 4.5 hectares of industrial land on Roxburgh Crescent in the suburb of Hokowhitu (see Fig.1). The report contains a Structure Plan that enables conversion to residential activities within a new Roxburgh Residential Area (RRA). The Plan is supported by a suite of design principles and spatial strategies, which are founded on a systematic analysis of site and context.

In 2018, McIndoe Urban Limited (MUL) was commissioned by PNCC to help devise a planning and development approach for the Roxburgh Crescent area. Several scenarios were prepared in consultation with major landowners. Following testing and evaluation, MUL identified a preferred Structure Plan that incorporates an extension to Roxburgh Crescent along with new local streets and reserves.

Following the release of a new National Policy Statement (NPS) on urban growth, MUL were asked to modify the Plan to accommodate higher density. The Roxburgh Crescent area does not qualify for inclusion within the new Medium-Density Residential Zone (MRZ). However, the final Plan relaxes some Residential Zone Development Standards and enables Multi-Unit Development. These provisions recognise the special opportunity presented by comprehensive planning and exceptional open space amenity.

The Plan contains a set of proposed development standards. These encourage compact lots and range of housing types including semi-detached and fully attached dwellings. The standards also recognise unique site features such as the stop bank and the river corridor.

2 Context

2.1 Introduction

Section 2 describes existing conditions and their implications for the redevelopment of land at Roxburgh Crescent. Spatial patterns are examined at three scales: site, neighbourhood and city-wide. This section also includes a brief history of the Roxburgh Crescent industrial enclave and an overview of strategic objectives for population growth and residential development in Palmerston North. Section 2 concludes with a set of findings that help to shape the design objectives and principles identified in Section 3.

2.2 Strategic context

2.2.1 Population growth

Over the next 30 years, population growth and household formation are likely to create an annual demand for over 400 new dwellings. Palmy's 2021 *Housing Capacity Assessment Report* and the Government's *National Policy Statement on Urban Development Capacity* (NPS-UDC 2020) give added impetus to the Council's proactive approach towards urban expansion and intensification. Both documents require PNCC to increase housing capacity. This imperative includes expanding housing options to provide smaller units and a wider range of dwelling types. The 2021 *City Growth Plan* also calls for "a more diverse range of housing types…[including] multi-unit options, particularly in brownfield developments".

2.2.2 Targeted growth areas

Over the next 30 years, much of Palmerston North's growth will occur as infill or within large greenfield subdivisions at Aokautere, Ashhurst, Kākātangiata and Whakaronga. Collectively, smaller development opportunities such as those at Mātangi (Whiskey Creek) and Hokowhitu also make a significant contribution to housing supply. The *Growth Plan* identifies Roxburgh Crescent as a further development opportunity, noting that a process is underway to rezone industrial land for housing. Like Hokowhitu, Roxburgh Crescent is a brownfield site in an established residential area with good access to existing services and ample recreational space. These attributes mean that multi-unit development and other sustainable housing forms are viable and consistent with the G*rowth Plan.*

2.3 Location

2.3.1 Absolute urban edge

Roxburgh Crescent is located on the eastern margin of Hokowhitu between Ruahine Street and the Manawatū River corridor (see Fig.2). As the crow flies, the site is less than 3km from The Square. The most direct route of travel between these points measures just under 4km. In comparison, the majority of Kākātangiata is more than 5km from the city centre, and new subdivisions at Aokautere are at least 6km away. Although relatively close to the centre of town, Roxburgh

Crescent might be termed “absolute urban edge”, because it occupies a persistent natural boundary between the built-up area and open landscape. The river guarantees the permanence of this relationship. On the eastern side of this waterway, the flood prone Staces Road area is unsuitable for urban development.

2.4 History

2.4.1 Oxbow lakes

The earliest comprehensive map of Palmerston North identifies the Hokowhitu area as “Native Land” (see Fig.3). The area is distinctive for its collection of oxbow lakes, the largest of which is identified as “Te Ngutu Lagoon”. These water features – valuable food sources for local Rangitāne – help to explain why Hokowhitu was slow to develop. The lagoon is still evident in the trajectory of Churchill Avenue and in the subdivision pattern and vegetation within the block bounded by Albert Street, College Street and Victoria Street.

2.4.2 Farm lots

Hokowhitu’s rural subdivision followed a different logic from that of adjacent urban land (see Fig.4). Instead of conforming to the town grid, farm lots were laid out diagonally. Elongated parcels ensured that each property had a river frontage. The long sides of the lots are parallel–or nearly so–and more-or-less perpendicular to the river.

2.4.3 Suburban lots

Hokowhitu’s contemporary spatial structure shows little evidence of this pre-urban subdivision pattern. By 1895, the area had been surveyed for suburban lots accessed from three streets: Manawatu Street, Pahiatua Street and Ruahine Street (see Fig.5). Streets and lots bear no relationship to earlier rural parcels, which are depicted on the Plan with broken lines. This lack of congruence suggests that the underlying farm lots were unoccupied or remained in single ownership. Albert Street (formerly Scandia Street) continues the town grid as far as the river. However, the rest of the street layout is irregular because it responds to the adjacent waterway. An orthogonal layout occurs locally at the junction of Pahiatua Street and Ruahine Street (previously Manawatu Street). Significantly, this more regular subdivision pattern includes the area of the proposed Structure Plan. It is also noteworthy that the relevant section of Ruahine Street approximates a north-south alignment.

2.4.4 Residential construction

Despite being subdivided for housing in the nineteenth century, Hokowhitu did not develop a suburban character until the mid-twentieth century. A 1956 aerial photograph shows residential construction on Pahiatua Street is well advanced, and there are pockets of houses on the western side of Ruahine Street (see Fig.7). The remainder of the area is still in agricultural use. A single industrial facility is set back from Ruahine Street behind a row of house lots. This site has direct access to the river, which may have been a source of gravel. The river itself has yet to be developed as a recreational resource.

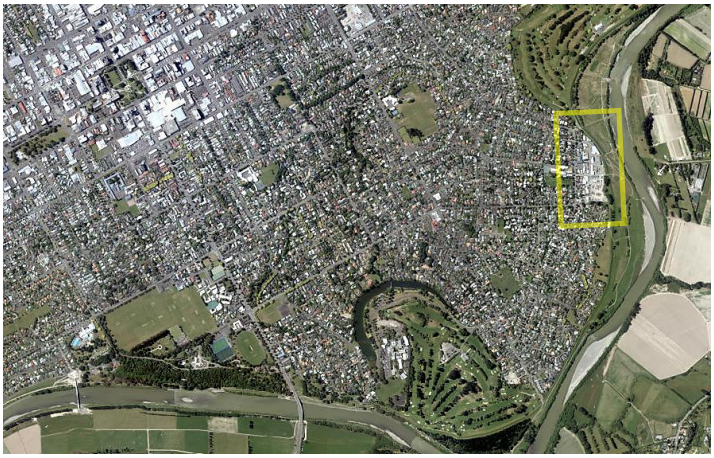


Fig.2 Location of Roxburgh Crescent industrial area (LINZ/Local Maps).

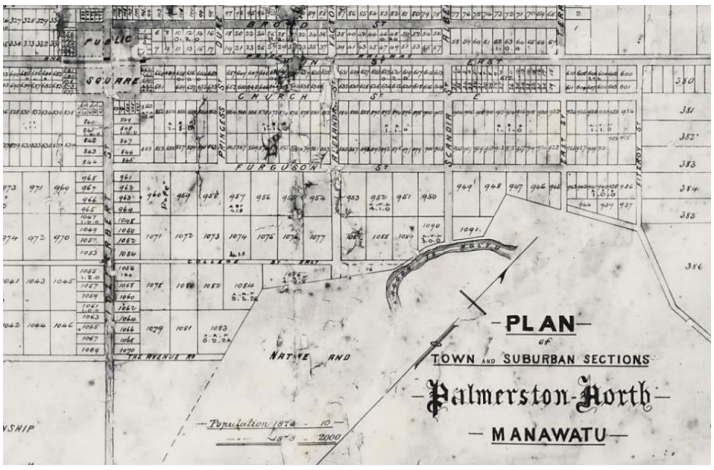


Fig.3 Plan of Palmerston North, circa 1878 (Heritage Manawatū).

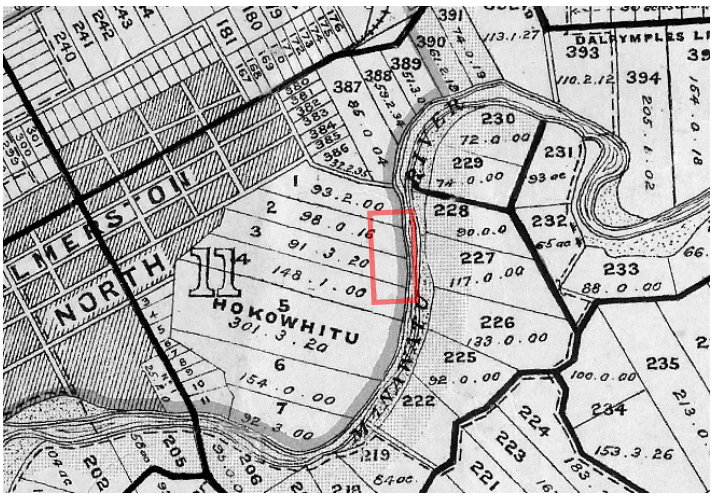


Fig.4 Farm lots, no date – Roxburgh Crescent area identified (Heritage Manawatū).

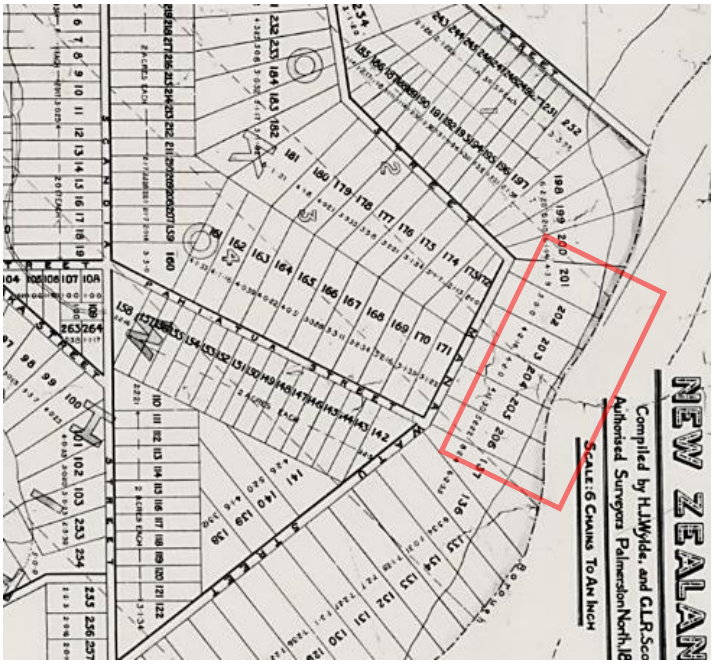


Fig.5 Plan of Palmerston North, circa 1895 – Roxburgh Crescent area identified (Heritage Manawatū).

Fig.6 Persistence of 1895 property boundaries within contemporary cadastral plan of the Roxburgh Crescent area.

Fig.7 Aerial photograph of Hokowhitu, 1956 (Heritage Manawatū).

2.4.5 Implications of historical patterns

Delayed suburban development helps to explain the anomalous location of industrial activities at Roxburgh Crescent. Persistent property boundaries inscribe a single cadastral grid on Pahiatua Street, Roxburgh Crescent and parts of Ruahine Street (see Fig.6). The shared geometry provides a common spatial structure for existing housing and new residential development within repurposed industrial land.

2.5 Urban structure

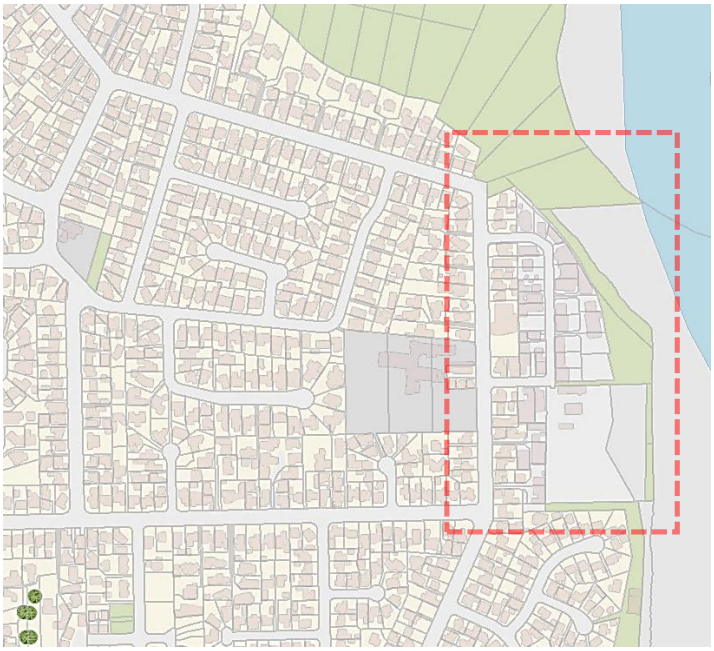


Fig.8 Cartographic base map with the Roxburgh Crescent area indicated (LINZ/PNCC Local Maps).

2.5.1 Street pattern

Hokowhitu lies outside the uniform street grid of the central city and older suburbs (see Fig.9). This orthogonal geometry typically ends at Te Awe Street in the south and Albert Street in the east. Beyond this area, residential development dates from the 1950s and 60s, when planners and surveyors favoured complex layouts containing curved streets and cul-de-sacs. Newcastle Street, Goodwyn Crescent and Surry Crescent exemplify these newer subdivision practices. Further examples are Waterloo Crescent, Dorset Crescent and Tilbury Avenue. Irregularity generally increases towards the river.

Fig.9 Grid fragments and non-orthogonal street layouts (existing industrial area indicated in pink).

In the neighbourhood of Roxburgh Crescent, this macro spatial structure is complicated by a partial return to orthogonality. The generators are Pahiatua Street and Ruahine Street, which intersect at right angles. These routes establish a local grid fragment extending from Roxburgh Crescent in the north to Antrim Place in the south. The grid's western outliers are Ascot Street and The Glen, the latter of which is only 100m from Hokowhitu's centre. This grid fragment is delineated in green above (see Fig.9). As a result, the site and its immediate environs possess a rectilinear spatial structure that lends itself to fine-grained subdivision.

2.5.2 Movement network

The local path network offers excellent north-south connectivity via Ruahine Street and an extensive system of walking/cycling trails within the river corridor. These include the Manawatū Riverside Walkway, which forms part of the Te Araroa Trail. By comparison, east-west connectivity is quite limited. There are few cross streets on Ruahine Street and industrial land blocks access to the river (see section 2.5.3). Public transport is readily available. Bus routes 109 and 110 run along Ruahine Street. These link the area with Hokowhitu local centre and The Square.

2.5.3 Open space network

To the north, the Ruahine Street reserve is contiguous with the Palmerston North Golf Club. To the south, Waterloo Crescent Reserve occupies a broad expanse of flat land outside the stop bank. The grounds of Winchester School provide a further recreational resource. Adjacent to the site, the river corridor is broad and offers extensive recreational opportunities. Consequently, the Roxburgh Crescent area is close to a range of open space amenities.

However, visual and physical access to the river is restricted. The 300m long Higgins property blocks physical connections to the stop bank. Almost 700m separates public access points at the Ruahine Street reserve and Ayr Place. The stop bank and the lack of east-west thoroughfares also limits visual contact with the river corridor. The Structure Plan provides an opportunity to improve public access to this open space amenity.

At its northern end, the site closely follows the stop bank. To the south, the intervening open space is up to 40m wide. The Riverside Walkway separates from the stop bank just south of the Ruahine Street reserve. So, most of the site's eastern boundary currently has little direct interaction with recreational activities along the river.

2.6 Urban fabric

2.6.1 Neighbourhood analysis

This section of the report surveys local residential fabric using PNCC's online cartographic map combined with historical records. Analysis occurs at two scales: neighbourhood and street-specific.

At a neighbourhood scale, the arrangement of property boundaries reveals a lengthy period of intensification but no overall plan. With few original streets (Albert, Manawatu, Ruahine), most of the initial suburban parcels are wide and very deep. As such, they invited further subdivision with cul-de-sacs serving mid-block locations and rear lots filling out remaining inaccessible sites. Fig.10 depicts the prevalence of cul-de-sacs and rear lots in the vicinity of the Structure Plan. These conditions reduce permeability and limit residents' engagement with the public domain.

The Roxburgh Crescent industrial area corresponds to five large rectangular lots from the original suburban subdivision. Fragmentation into smaller properties has already occurred. Along the western side of Roxburgh Crescent, parcels resemble house lots rather than commercial or industrial sites. Indeed, the subdivision pattern here is similar to that on Ruahine Street. The underlying lots are larger within the Higgins property on the eastern side of Roxburgh Crescent. However, these cadastral lines are less significant, because much of this land is in common ownership (see Fig.12). Over the years, Higgins have acquired additional lots on Roxburgh Crescent and Ruahine Street. The Higgins holdings are likely to expand onto surplus Horizons' land adjacent to the stop bank in the south-east corner of the Structure Plan.

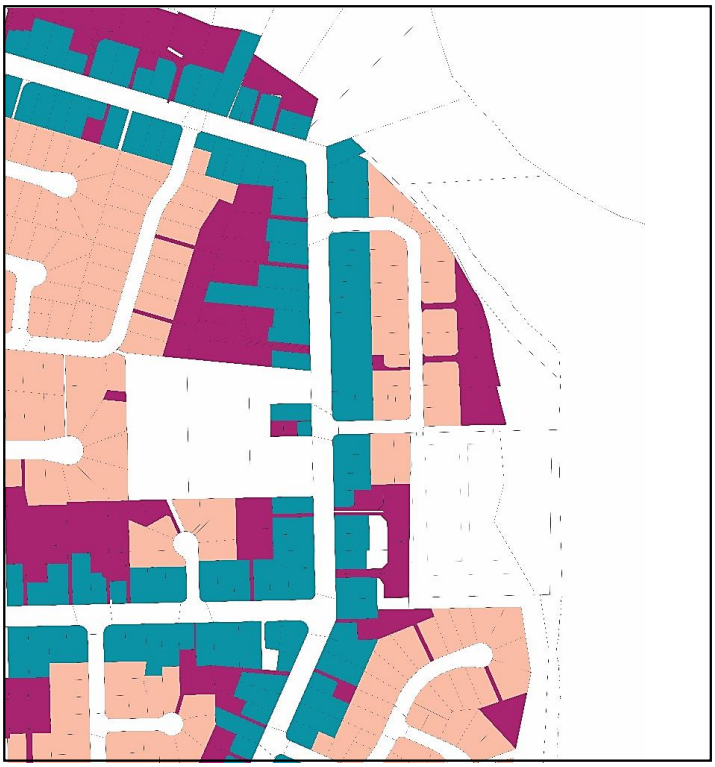


Fig.10 Rear lots shown in purple; front lots on major streets shown in turquoise; and front lots on minor streets shown in pink.

Fig.11 Typical residential fabric in Palmerston North – site layout is generally more regular on gridded streets and less regular on cul-de-sacs and curved streets.

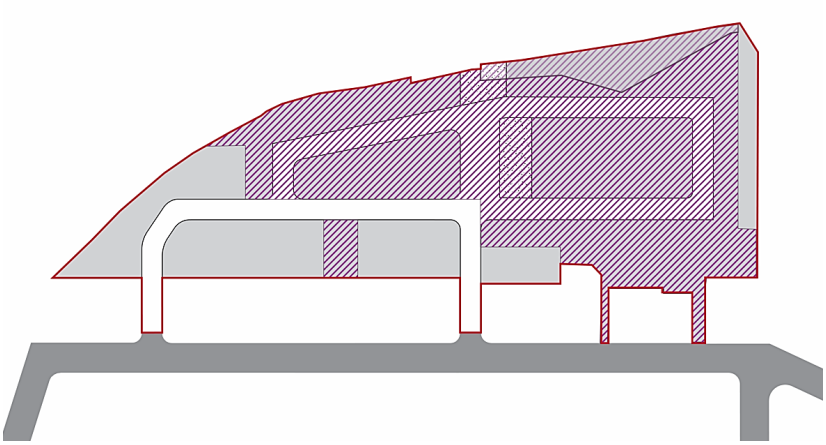


Fig.12 Property ownership – purple hatching identifies the extent of Higgins property within the RRA (lighter hatching indicates approximate extent of acquisition from Horizons).

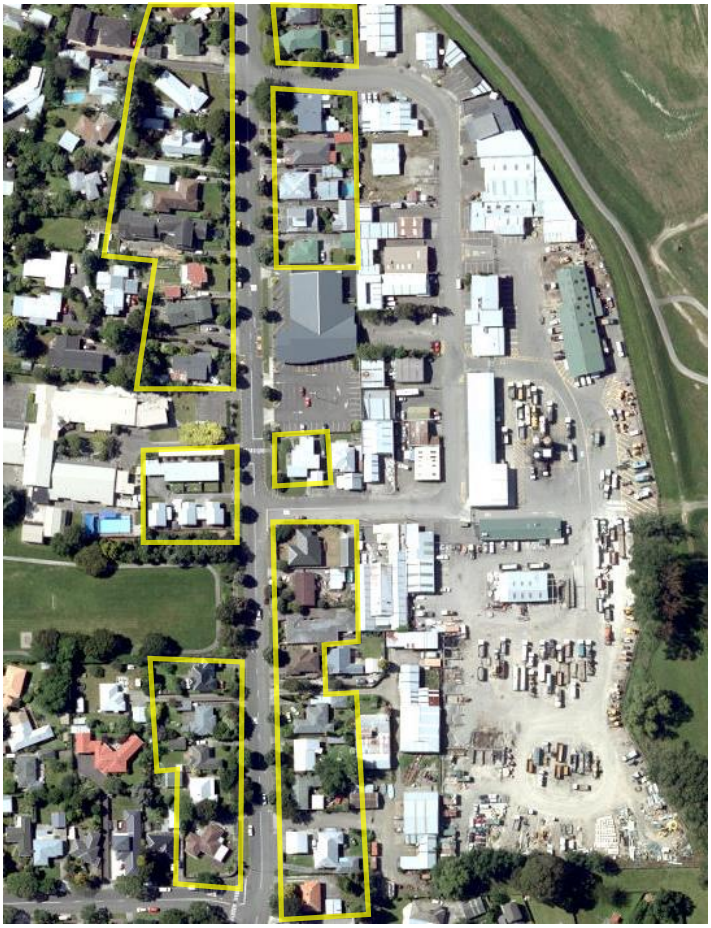


Fig.13 Ruahine Street residential fabric – extent of built form and open space analysis (PNCC Local Maps circa 2020).

The Higgins property extends south of Roxburgh Crescent, taking in most of the remaining Structure Plan area. Altogether, Higgins control approximately two-thirds of the proposed RRA. This ownership structure creates a landbank, where the transition to residential development can be comprehensively planned and managed.

2.6.2 Lot and dwelling analysis

An investigation of Ruahine Street reveals the configuration of lots and buildings that characterise this neighbourhood (see Fig.13). The "desktop" analysis of residential fabric uses PNCC online cartographic information from 2020. As a result, all measurements and diagrams are approximate. Building dimensions should be treated with special caution, because aerial photography introduces parallax errors and typically records roof plans rather than actual footprints. Subject to these limitations, the cadastral map generates useful quantitative data about built form and open space in the vicinity of the Structure Plan. In most cases, generic patterns are noted rather than individual examples. So, inaccuracies are reduced by averaging sets of data. Furthermore, because the analysis focuses on typical layouts and dimensions, idiosyncratic developments are excluded from the survey. These outliers include irregular parcels, corner sites, multi-unit housing and dwellings that sit diagonally across their lots.

A generic residential property can be identified by averaging the dimensions from individual examples. On Ruahine Street, most front lots are 16.5m to 18.5m in width and 35m to 40m in length. A typical house has a primary volume measuring 8m by 13m. This is usually identified by a dominant roof form e.g., a single hip or gable. In most cases, the primary volume's long elevation faces the street – set back some 9m from the boundary. Approximately half of all dwellings also have a secondary volume that is visible to passers-by i.e., a projecting wing or bay. Its average dimensions are 3m by 6m and, once again, the longer side usually faces forwards on the lot. In this case, the front set back reduces to 6m. Deep rear yards are common and frequently measure 18m to 23m in length. Normally, there is a 3m to 4.5m yard on one side of the lot and a minimal setback (nominally 1m) on the other side. Fig.14 identifies the dimensions of a typical Ruahine Street property.

Individual properties differ from this standard lot by varying degrees. Lot width ranges from 15m to almost 21m. Length is even more variable. The smallest parcels are just 30m deep, whereas one property on the western side of Ruahine Streets measures 98m from front to back. Divergence from the mean is more significant when it corresponds to a particular location. This happens on the western side of Ruahine Street, where front setbacks are deeper, and houses are more likely to present end-on to the street. Secondary volumes are also less evident here. Adjacent to the Plan area, residential fabric is more regular partly because the subdivision pattern is uniformly orthogonal. Overall, the variations in layout are noticeable but not so large as to undermine the value of the standard lot diagrammed in Fig.14.

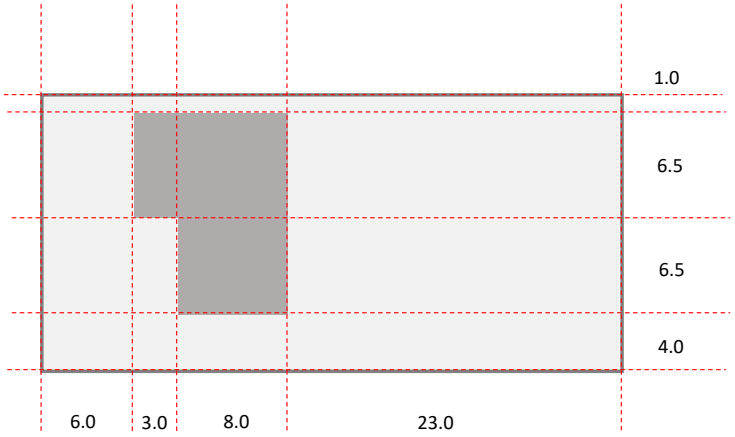


Fig.14 Typical 18m x 40m Ruahine Street lot and building footprint (dimensions in metres).

Fig.15 One and two-storey Ruahine Street houses.

Fig.16 Site photographs located on plan.

Most Ruahine Street houses are single storey with low hip roofs. Gables are less common – approximately one house in three – and more likely to be steeply pitched (30° or more). Whether hip or gable, roof forms tend to be complex because they incorporate one or more secondary volumes.

One in five houses has as second level. Two-storey dwellings are slightly more common on the western side of the street, where the ratio is one in four. In many cases, the second floor occupies just a portion of the overall building footprint. In these cases, the upper level appears as a distinct volume in the architectural composition. The palette of external materials is somewhat unusual. Corrugated steel roofs are prevalent, but fewer than a quarter of all houses are clad with timber weatherboards. Instead, rendered walls are the norm.

2.6.3 Streetscape analysis

Roxburgh Crescent forms a loop on the eastern side of Ruahine Street. House lots flank the streets' intersections, so both ends of the crescent have a residential character. However, corner properties face Ruahine Street and typically present tall fences to the minor street. This treatment gives a "side boundary" character to the Roxburgh frontages. It suggests a defensive relationship to the smaller street; perhaps a response to passing heavy vehicles and an untidy backdrop of commercial and industrial sites.

For most of its length, Roxburgh Crescent has a demonstrably industrial character and a strongly asymmetrical cross section. The eastern side of the street has a formed edge with a curb, a footpath and a consistent though intermittent building line. The frontage's defining elements are the two-storey Higgins office block and a 60m long shed with partially open sides.

The western frontage is strongly indented. Most properties have forecourts that open directly onto the right-of-way. These spaces vary in depth from just a few metres to approximately half the lot. The relationship between public and private space is unmediated because no footpath exists and there are few fences.

The typical building is a simple industrial shed with its gable end facing the street. Although many structures occupy the full width of their sites, scale is limited by subdivision into relatively small lots. As a result, street elevations approximate the dimensions of dwellings and gables are no taller than a two-storey house. The fine grain is enhanced by office accommodation, which forms a separate module on the front of many sheds. These secondary volumes invariably address the street and often exhibit domestic materials and details.

On both sides of Roxburgh Crescent, the ground plane is paved and devoted to vehicle access, parking and – less frequently – outdoor storage. The only significant vegetation is found mid-way along Roxburgh Crescent, where mature trees bracket an off-street parking lot.

Trees are also evident as distant backdrops to the north and south of the site. Principally, these occur within the Palmerston North Golf Club and the river reserve.

Ruahine Street has a traditional residential character. This is defined largely by street trees, grass berms, low front fences and leafy private gardens. In combination, these elements produce a layered streetscape defined by landscape rather than built form. One and two-storey dwellings are evident. However, most houses are framed by vegetation and situated well back from the public right-of-way.

Although Ruahine Street's cross section is more-or-less symmetrical, there are subtle differences between the two sides of the street corridor. To the west, properties are larger and more verdant. To the east, site coverage is higher, in part because there has been more rear lot subdivision.

Both sides of Ruahine Street contain multi-unit housing as well as some non-residential development. The latter includes Winchester School – midway along the western side of the street – and the more intrusive Reformed Church, which lies midway along the eastern side.

The Roxburgh Crescent industrial area has little visual impact on Ruahine Street. View shafts open onto industrial properties at the streets' intersections. The blank rear elevations of several sheds are visible across the Reformed Church carpark. Elsewhere along Ruahine Street, the neighbouring industrial facilities are screened by houses and vegetation. A discerning observer might notice the paucity of large trees on the eastern skyline. However, passing Higgins trucks and – periodically - the smell of asphalt provide the most tangible evidence of nearby industrial operations.

To the south, the Roxburgh Crescent industrial zone is flanked by residential properties on Tilbury Avenue. Occupied by state housing, the avenue has an open character with fewer street trees, low side fences and little – if any – demarcation of front boundaries.

Houses are modestly scaled but derive added stature from steeply pitched roofs clad with concrete or clay tiles. Compared with Ruahine Street, dwellings are more uniform in appearance and more conspicuous in the streetscape. Tilbury Avenue is enhanced by its curved trajectory: a configuration that directs attention towards dwellings on the avenue's concave outer arc.

Despite the relatively open fabric, adjacent industrial activities have little visible presence on Tilbury Avenue. The southern half of the Higgins site is less built up, and a strip of reserved land intervenes between this area and the rear yards of Tilbury Avenue properties. Lines of tall trees occur within the reserve and along the edge of the river corridor. Augmenting private gardens, the leafy backdrop helps to distance the Higgins operations and – conversely – signal the proximity of the Manawatū River (see also section 2.7.1).

2.7 Vegetation

2.7.1 Existing vegetation

There are no Notable Trees within the area of the proposed Structure Plan. However, the District Plan assigns this status to mature trees within the grounds of Winchester School and street trees on the western side of Ruahine Street.

The western side of Ruahine Street is generally more verdant than the eastern side. Most residential properties have visually significant vegetation within their front yards. In many cases, side boundaries are also heavily planted. These conditions mean that spatial definition of the street corridor depends on vegetation rather than buildings (see also section 2.6.3). Neither of these landscape patterns are so well established on the eastern side of the street.

Mature street trees are more prevalent on Pahiatua Street. This thoroughfare exemplifies the ideal of a leafy residential street. As such, Pahiatua Street indicates the future character of streetscape on Ruahine Street after existing street trees mature.

The Roxburgh Crescent industrial area is almost devoid of trees. Some large-scale planting occurs within the river corridor along the eastern edge of the Higgins property. A row of mature trees occupies an open space reserve at the southern extremity of the site. These trees help to mediate between the existing industrial activities and adjacent single-family housing (see also section 2.6.3).

2.8 Activities and amenities

2.8.1 Industrial activities

The Plan area is currently zoned for industrial activities. Except for roads, recreational reserves and flood protection areas within the river corridor, adjacent land is zoned exclusively for residential use.

Increasingly, Palmerston North's industrial activities are consolidated at Longburn or within a belt on the northern and eastern perimeter of the city. Small industrial enclaves such as Roxburgh Crescent are anomalous, especially when they have a close context of residential development. The only other examples of any size are the Goodman Fielder complex in Highbury and a pocket of industrial land on Featherston Street between Coromandel Court and Sierra Court. However, the latter location has acquired a retail focus in recent years.

The Roxburgh Crescent industrial zone is especially anomalous given its high-amenity location. The Manawatū River corridor and its associated recreational opportunities are described above (see section 2.5.3).

Riparian vegetation ensures that industrial buildings are barely discernible in distant views from the Pinfold Road area. Closer to the

site, the stop bank screens Roxburgh Crescent from the Manawatū Riverside Walkway and recreational spaces on the western riverbank.

The industrial area is conspicuous from some elevated vantage points. A formed pathway follows the top of the stop bank to a point part-way along the eastern boundary of the RRA. This section of the stop bank hugs the edge of the Higgins property. So, pedestrians and cyclists have a clear view of sheds and outdoor work areas. The latter provide activation and a degree of visual interest. However, the utilitarian scene contrasts jarringly with the expansive green landscape of the river corridor.

Further south, the stop bank peels away from the perimeter of the Higgins property. The intervening open space contains a row of large trees. At its widest point, this over-scaled "amenity strip" measures nearly 40m across. So, for observers on the stop bank, the southern half of the Higgins site recedes from view. (As previously noted, Higgins seek to purchase this land from Horizons.)

2.8.2 Local services and amenities

Two facilities give a spatial and social focus to the immediate neighbourhood. Winchester School occupies an attractively landscaped site on the western side of Ruahine Street. Directly opposite, the Reformed Church of Palmerston North has a less traditional appearance. With plain elevations, a low spreading roof and an extensive car park, the church's architectural character is more commercial than ecclesiastical. The Winchester Store at 577 Ruahine Street provides the neighbourhood with a modest retail facility. However, the area is only 1km from the centre of Hokowhitu, where a range of shops and services are available (see Fig.17). Pahiatua Street and Ruahine Street offer a highly legible connection between the two locations.

2.8.3 River corridor

Despite the advantageous riverfront location, there is limited physical and visual connection with the Manawatū River (see section 2.5.3). Industrial sites turn their back on the river corridor, creating an unsightly edge to the elevated section of the Riverside Walkway (see section 2.8.1). Along Roxburgh Crescent, a single dwelling faces the stop bank and waterway at first-floor level.

2.9 Site characteristics

2.9.1 Summary observations and implications for redevelopment

- Industrial activities are anomalous and disruptive given the predominantly residential character of Hokowhitu.
- Large parcels and low-cost buildings allow a comprehensive approach to brownfield redevelopment.
- Roxburgh Crescent is relatively central and offers good access to public transport and local services.
- Surrounding neighbourhoods contain many cul-de-sacs and a large number of rear lots; these reduce connectivity and limit residents' engagement with the public realm.

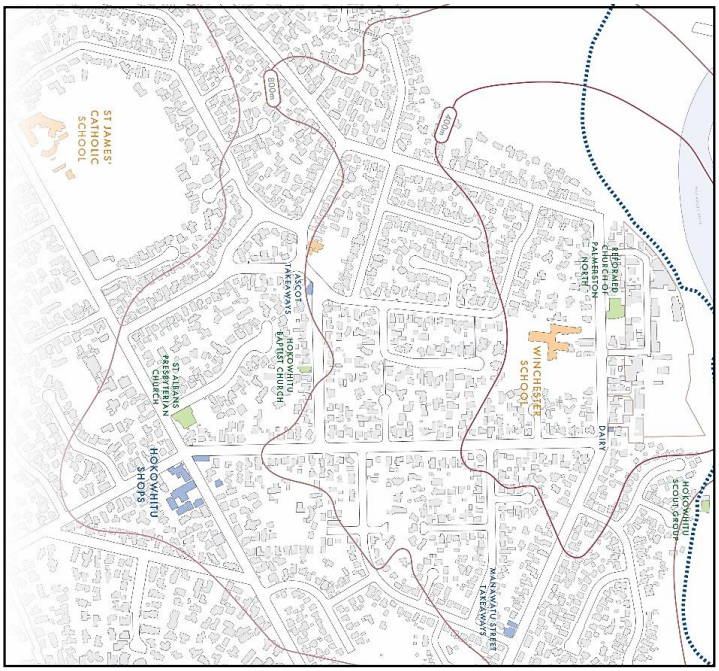


Fig.17 Local services and amenities with 400m, 800m and 1200m walking distances from Roxburgh Crescent.

- A single cadastral grid unites Roxburgh Crescent with Ruahine Street and the adjacent residential area.
- The local grid provides a common spatial structure for buildings and open spaces; this rectangular geometry is well-suited to subdivision into small residential lots.
- Ruahine Street residential fabric provides a guide to scale and modulation within any redevelopment of Roxburgh Crescent; spatial definition and streetscape character depend on vegetation as well as built form.
- Roxburgh Crescent industry is relatively inconspicuous to observers in nearby residential streets; it is possible for new housing to also have a low profile.
- The stop bank screens Roxburgh Crescent from recreational spaces within the river corridor; however, atop the stop bank, pedestrians and cyclists have a clear view of utilitarian buildings and workspaces.
- Existing industrial buildings have little visual appeal or architectural merit; consequently, they do not warrant retention.
- The site is almost devoid of significant vegetation; trees on the southern boundary mediate between industry and housing.
- The site is immediately adjacent to the river corridor, an area with off-road trails and abundant open space; however, industrial properties impede physical and visual access to these amenities.
- Elevated vantage points offer broad views of the river corridor and the distant ranges.

3 Planning and Design Intentions

3.1 Introduction

Section 3 records high-level objectives for the new Roxburgh Residential Area. Subsequently, these objectives are interpreted as a set of design principles and spatial strategies. Collectively, these inform the content of the Structure Plan.

3.2 Development objectives

3.2.1 Market relevance

The Structure Plan responds to demands in the local housing market having regard for projected population growth and Palmerston North's changing demographic profile. The Plan's approach is consistent with national and local strategic objectives including the city's recently identified growth targets. Responsiveness to demand is achieved by:

- Increasing development intensity compared with conventional suburban subdivisions.
- Dimensioning urban blocks to accommodate a range of densities, lot sizes and dwelling types.
- Enabling housing choices that attract a variety of residents and respond to changing market expectations.
- Enabling high-quality, multi-unit housing in appropriate locations.

Rationale:
National policies and PNCC strategies require Palmerston North to prepare for population growth. Demographic data shows a trend towards smaller households and more compact dwellings. Diminishing housing affordability also creates an imperative for greater housing choice, including medium-density multi-unit developments.

3.2.2 Staged transition

The Structure Plan allows for gradual transition from industrial to residential activities. Incremental change is accommodated by:

- Extending Roxburgh Crescent on its present alignment to form the main thoroughfare within a new path network.
- Respecting existing property boundaries unless these are inconsistent with good quality development.
- Creating a new open space reserve that improves public connections to the river corridor.

Rationale:
Approximately one-third of the site is already subdivided and host to a range of small industrial and commercial buildings. Re-zoning will encourage redevelopment by increasing land value. However, the transformation to residential use will be gradual and incremental. Prior to build-out, a high-quality public realm will provide a clear indication future character and amenity.

3.2.3 Liveable neighbourhood
The Structure Plan provides the framework for a liveable neighbourhood with a high level of local amenity. Positive neighbourhood attributes are achieved by:

- Developing a coherent, comprehensively designed system of streets and open spaces.
- Managing the relationship between existing and new residential development.
- Improving access to recreational opportunities including family-oriented destinations with activities for all ages and levels of ability.
- Supporting local services and providing a larger catchment for public transport.

Rationale:
A high-quality public realm complements higher-density development and compact private lots. Attractive streets and open spaces support walking and other active transport modes. These forms of mobility help to build a sense of community by promoting face-to-face encounters and the use of local services.

3.2.4 High-quality public and private outcomes
The Structure Plan encourages high-quality development outcomes in both public and private realms. Good outcomes are promoted by:

- Comprehensively planning a brownfield site that includes several large parcels of land.
- Providing a development framework that engages diverse stakeholders and remains effective over time.
- Building in flexibility to accommodate future changes in housing preferences.
- Requiring a positive interface between public and private domains.
- Integrating ecological repair and low-impact storm water management into the design of streets and public reserves.

Rationale:
Successful places are an amalgam of public and private investment. Exchanges between public and private domains are often the principal source of activation and visual interest within an urban setting. So, it is desirable to coordinate outcomes in each realm. One of the virtues of a structure plan is its ability to treat streets, open spaces and private lots as components in a single system.

3.2.5 Complementary relationship with existing residential fabric
The Structure Plan complements the established residential character of Ruahine Street. A positive relationship between new and existing is achieved by:

- Matching the alignment and orientation of new development to existing patterns.
- Providing good connectivity with the host suburb.
- Improving physical and visual links between Ruahine Street and the river.

Rationale:
Context-sensitive design begins with a shared spatial structure. Roxburgh Crescent belongs to the same cadastral grid as Ruahine Street and Pahiatua Street. Reinforcing this geometry helps to forge a connection between housing from different eras. A simple rectilinear layout introduces new line-of-site links between the existing built-up area and the stop bank. Increased east-west permeability helps to establish the river corridor as Hokowhitu's natural eastern boundary.

3.3 Design principles and strategies

3.3.1 Streets and open spaces form a coherent system.
The Structure Plan treats new and existing thoroughfares as single network. A coherent path structure is achieved by:

- Aligning new thoroughfares with existing rights-of-way.
- Focusing the street layout on an extended Roxburgh Crescent and a centrally located East-West River Connector.
- Establishing an explicit hierarchy of streets, giving each route a distinct character and a high degree of amenity:

    i. Roxburgh Crescent – 13m wide, this street is modestly scaled but possesses a formal streetscape with an asymmetrical cross section.

    ii. East-West River Connector – 20.5m wide, this street is associated with a public reserve that improves links to the river corridor.

    iii. Local Street – 13m wide, this minor thoroughfare has a more informal streetscape with an asymmetrical cross section.

- Ensuring that the street network is legible at each phase of development.

Rationale:
Streets and public open spaces are the primary organising elements for urban fabric. Frequently they are the only components that are fully controlled and predictable. As such, they play an important role in ordering subsequent development.

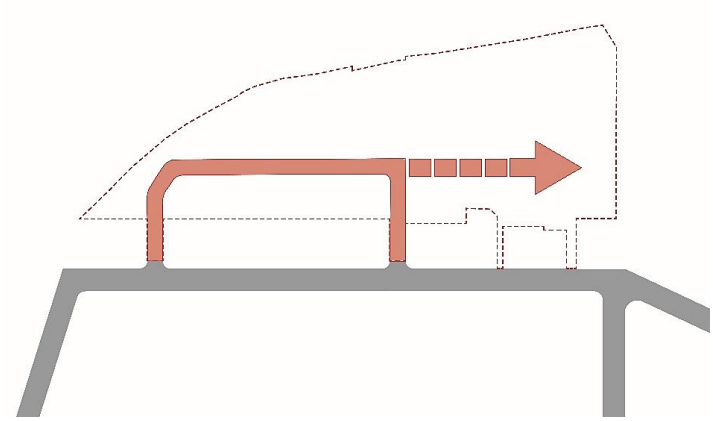


Fig.18 Extension of Roxburgh Crescent.

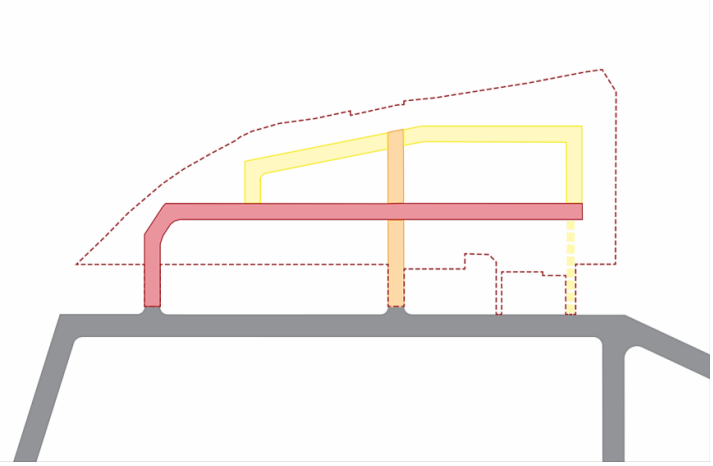


Fig.19 Hierarchy of streets and lanes.

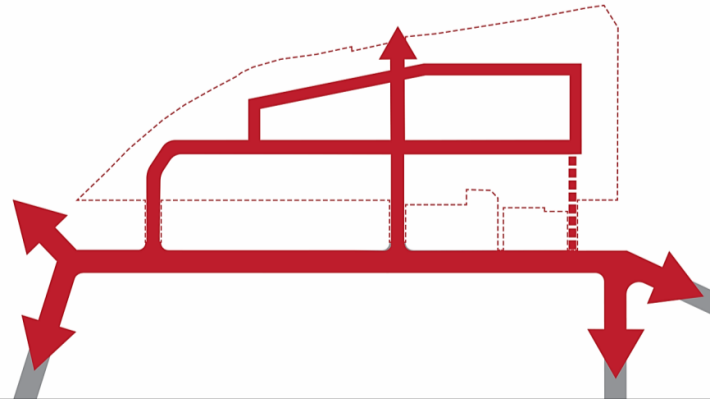


Fig.20 Connected path network.

3.3.2 A permeable path network is created.
The Structure Plan promotes greater connectivity and offers all future residents a choice of access routes. The following spatial design strategies help to create a permeable path network:

- Creating a joined-up street system.
- Avoiding cul-de-sacs.
- Providing good connectivity to surrounding residential streets and off-road trails.
- Creating a variety of recreational walking and cycling circuits.

Rationale:
Joined up streets foster social contact and help to disperse traffic. Having more than one access route improves resilience. Attractive off-road paths encourage active transport modes that substitute for private vehicle use. Recreational walking, jogging and cycling increase when people have access to multiple circuits of different lengths. These allow users to avoid back tracking and match their route to level of fitness and time available.

3.3.3 A new link to the river is provided.
The Structure Plan connects Hokowhitu more closely to the Manawatū River. The following spatial design strategies help to improve links with the river corridor:

- Providing a new physical and visual connection to the stop bank and the Manawatū River Reserve.
- Using the East-West River Connector and a new pedestrian/cycle access point to link Winchester School and Ruahine Street with the river.
- Introducing an inhabited edge and passive surveillance to the stop bank walkway.
- Using a pedestrian/cycle route to link Ruahine Street with the southern end of an extended Roxburgh Crescent.

Rationale:
The Manawatū River is a source of identity and Hokowhitu's main recreational asset. In its present form, the Higgins property isolates Ruahine Street and environs from the river corridor. A new east-west connection allows residents to sense the river's proximity and benefit from its recreational opportunities.

3.3.4 Public open space is located at the centre of the Plan.
The Structure Plan is a hierarchy of streets with public open space at its core. The following spatial design strategies help to create a high-quality open space reserve in the centre of the Plan:

- Replacing an existing reserve on the site's southern boundary with an equivalent open space in the centre of the Plan.
- Treating the East-West River Connector as the Plan's cross axis i.e., one of the site's primary organising features.
- Providing public carparks for visitors to the river.

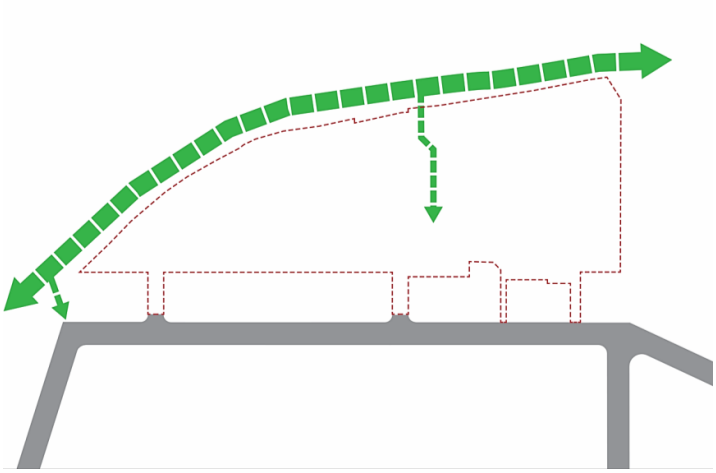


Fig.21 Off road connections to the river.

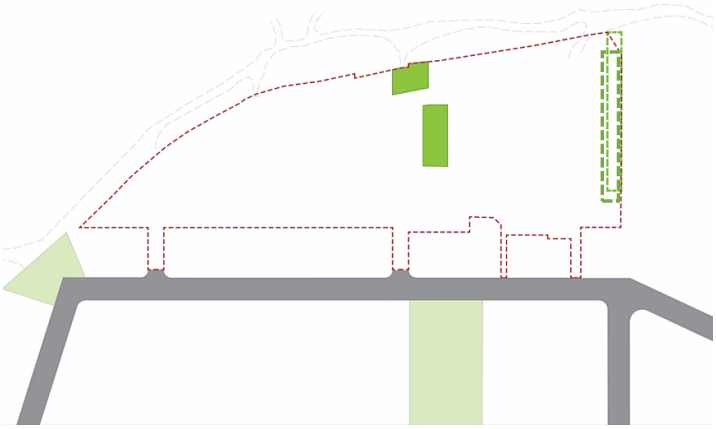


Fig.22 Relocated open space reserve.

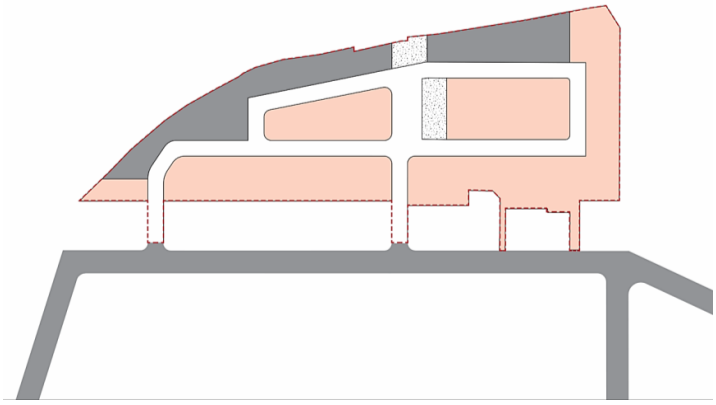


Fig.23 Taller dwellings along the river frontage.

Rationale:
Along with Roxburgh Crescent, the East-west River Connector is the principal organising feature of the Structure Plan. The Connector includes a 20.5m wide section of street adjacent to an open space reserve. The combination improves river access and brings visual amenity into the centre of the Plan. Given the proximity of Winchester School and the river corridor, access and visual amenity take precedence over active recreation.

3.3.5 A high-quality public realm increases amenity and value.
The Structure Plan gives primacy to streets and public open spaces including the river corridor. The Plan optimises these elements and uses them to shape subsequent private development. The following spatial design strategies help to create a high-quality public realm:

- Assigning priority to streets and open spaces and completing these early in the development process.
- Giving a simple high-quality treatment to the public realm.
- Integrating low-impact stormwater management features within streets and reserves.
- Providing unobtrusive visitor car parking.

Rationale:
High-quality open spaces and attractive streetscape play an important role in repurposing the site for residential activities. Early investment in public amenities adds value and encourages the redevelopment of industrial land. Streets and other public places are more likely to be successful if functional and aesthetic imperatives are addressed jointly.

3.3.6 Street layout assists subdivision into compact residential lots.
The Structure Plan treats public and private open space as a unified composition. A prescribed street pattern supports efficient subdivision into compact, high-quality residential lots:

- Dimensioning blocks to accommodate compact lots with regular shapes and efficient proportions.
- Accommodating differently sized lots that are suited to a range of dwelling types.
- Facilitating consistent front-to-front and back-to-back relationships among dwellings.
- Minimising the number of cul-de-sacs and discouraging rear lots.

Rationale:
The Structure Plan aligns spatial patterns at micro and macro levels. The smallest unit of urban fabric is the individual residential lot and its dwelling. The largest unit of composition is the street grid. Although the Structure Plan does not prescribe subdivision into individual lots, the Plan's street layout facilitates the creation of compact, regularly shaped parcels. Cul-de-sacs and rear lots are discouraged because they reduce engagement between public and private domains.

3.3.7 Residential development is more intensive and more diverse.
The Structure Plan's smaller blocks facilitate subdivision into compact, efficient residential lots. Although most Residential Zone Development Controls still apply, new planning provisions support greater housing yield and multi-unit development:

- Enabling smaller, regularly shaped lots with east-west orientations and consistent front-back relationships.
- Accommodating a range of dwelling types including semi-detached and fully attached dwellings.
- Upgrading stormwater infrastructure to enable greater site coverage.
- Relaxing some height recession planes.
- Increasing building height along the river frontage.

Rationale:
Palmerston North is obliged to match housing supply to projected demand. PNCC aims to include compact dwellings within a wider range of housing choices. Rectangular parcels are efficient, especially at higher densities. They pack together easily, and they tend to produce coherent outdoor spaces. Consistent front-back relationships become more critical when the distances between dwellings reduce. Proposed height recession planes allow a more built-up street frontage but reduce bulk at the rear of the lot where privacy, sun and outlook are important. The resulting envelope also encourages more complex massing and greater visual interest. Along the stop bank, taller houses provide a stronger custodial presence at the edge of the river corridor. Elevated living spaces afford occupants a better view.

3.3.8 Built form enhances character and amenity.
The Structure Plan manages relationships between neighbouring dwellings and between public and private domains. The following spatial design strategies promote cohesive character and a high-quality public realm:

- Providing a simple orthogonal framework for subdivision.
- Identifying distinct front and rear height recession planes that encourage more complex massing.
- Facilitating two and three-storey dwellings that sit forward on their lots.
- Ensuring dwellings face the street with active frontages that convey a sense of inhabitation.
- Creating a custodial presence on the stop bank by enabling taller dwellings with elevated living areas.

Rationale:
New housing is more likely to "fit in" if its layout conforms to the existing Ruahine Street grid. Dual height recession planes support visually interesting compositions containing primary and secondary forms. Street-facing doors and windows provide signs of inhabitation, suggesting human presence even if no one is visible. Passive surveillance improves safety in the public realm.

3.4 Indicative planning and design scenarios

Four design scenarios provide different interpretations of the principles and strategies identified in section 3.3. The preferred outcome (Scenario 4) informs the Structure Plan.

3.4.1 Scenario 1: Street & Short Cul-de-Sacs

The first scenario employs streets and cul-de-sacs to create a conventional low-density residential environment.

Fig.24 Design Scenario 1 – Street and Short Cul-de-Sacs.

Key characteristics:

Positive

1. Simple orthogonal layout.
2. Moderately legible street pattern.
3. Explicit path hierarchy.
4. Good external connectivity.
5. Improved pedestrian access to river corridor.
6. Central public open space.
7. Good front and back relationships to existing housing.
8. Few rear lots.
9. Few excessively deep lots.

Negative

1. Limited yield and little apparent variation in lot/dwelling type.
2. Possible lack of engagement with stop bank.
3. Limited internal connectivity.
4. Many north-south oriented lots.
5. Less public realm engagement on cul-de-sacs.
6. Central open space is south-facing.

3.4.2 Scenario 2: Street & Lane

Scenario 2 is a variant of Scenario 1. It employs streets and lanes to create a conventional low-density residential environment with a more permeable path network.

Compared with Scenario 1, Roxburgh Crescent and its extension remain largely unchanged. However, the landscape component of the East-West River Connector is longer and located on the southern side of the right-of-way.

Fig.25 Design Scenario 2 – Street and Lanes.

Key characteristics:

Positive

1. Simple orthogonal layout.
2. Legible street pattern.
3. Explicit path hierarchy.
4. Good internal connectivity.
5. Good external connectivity.
6. Some private vehicle access removed from Roxburgh Crescent.
7. Improved pedestrian access to river corridor.
8. Enlarged central public open space (north-facing).
9. Good front and back relationships to existing housing.
10. Positive frontage to stop bank.
11. Mainly east-west oriented lots.
12. Few rear lots.

Negative

1. Limited yield.
2. Little apparent variation in lot/dwelling type.
3. Some excessively deep lots.

3.4.3 Scenario 3: Smaller, more diverse lots.

Scenario 3 is a variant of Scenario 2 containing smaller lots and a broader range of dwelling types. A strong place-based character is achieved by matching the different housing formats to individual streets and open spaces. Larger parcels mediate between new and existing development on the plan's extremities. As in Scenario 1, the central reserve is on the north side of the East-West River Connector. Properties here are accessed via a rear lane allowing garages to be removed from the reserve edge. The reserve and the Connector continue west to meet Ruahine Street.

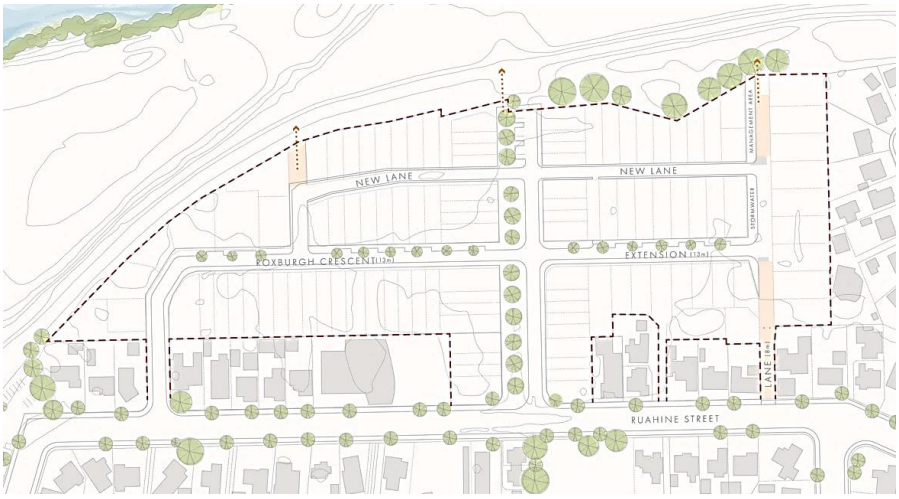


Fig.26 Design Scenario 3 – Smaller, more diverse lots, extended east-west axis.

Key characteristics:

Positive

1. Simple orthogonal layout.
2. Legible street pattern with explicit path hierarchy.
4. Good internal and external connectivity.
5. Some private vehicle access removed from Roxburgh Crescent.
6. Very strong link from Ruahine Street to river corridor.
7. Extended central open space.
8. Good front and back relationships to existing housing.
9. Positive frontage to stop bank.
10. Higher yield with a range of lot/dwelling types.
11. Mainly east-west oriented lots with few rear parcels.

Negative

1. Some excessively deep lots.
2. Disrupts existing residential lots on Ruahine Street.
3. Central open space is shaded by townhouses.
4. Prescribed lot types complicate planning provisions.

3.4.4 Scenario 4: Eastern extension with local street network.

Scenario 4 contains a new double-loaded local street, which substitutes for the lane in Scenarios 2 & 3. This change is made possible by extending the existing Higgins property onto surplus Horizons land. The spatial structure is simplified in several ways. Intrusions into Ruahine Street are avoided. So, the central open space is truncated and reverts to the southern side of the East-West River Connector. This route provides the only public link to the stop bank. Unlike Scenario 3, there is no attempt to match lot size and dwelling type to individual thoroughfares. However, building height varies. Three-storey dwellings are possible along the edge of the river corridor. Elsewhere, a 9m height limit comfortably accommodates two full residential floors plus a pitched roof.

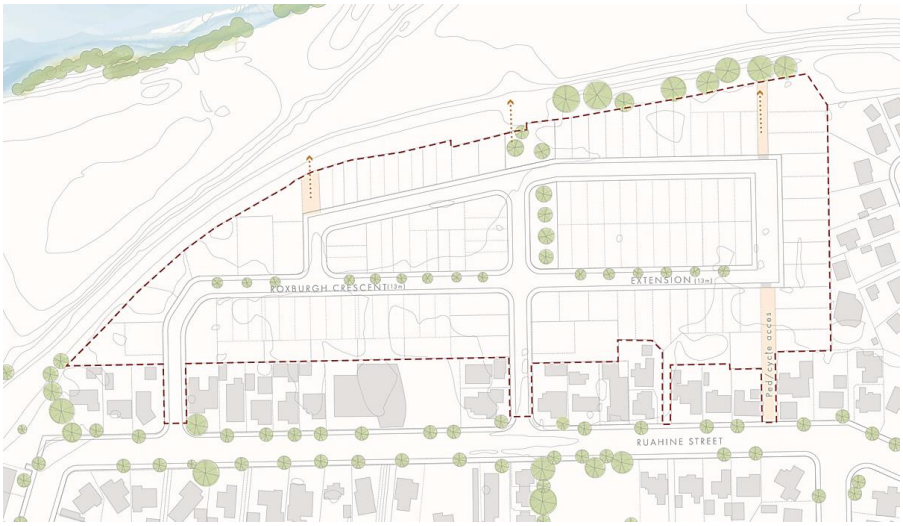


Fig.27 Design Scenario 4 – Eastern extension with local street network.

Key characteristics:

Positive

1. Simple orthogonal layout.
2. Legible street pattern with explicit path hierarchy.
3. Good internal and external connectivity.
4. Improved pedestrian access to river corridor.
5. Central public open space (north-facing).
6. Good front and back relationships to existing housing.
7. Potential for positive frontage to stop bank.
8. Higher yield with a range of lot/dwelling types.
9. Mainly east-west oriented lots with few rear parcels.
10. Minimal disruption to Ruahine Street properties.

Negative

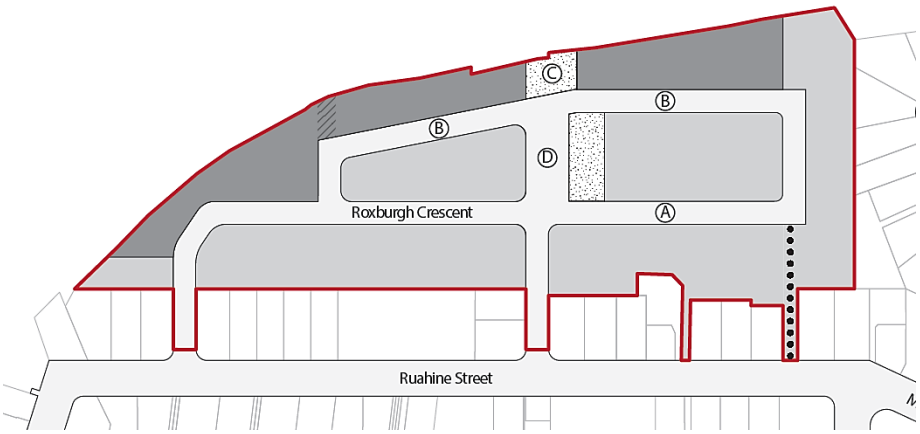
1. Weaker connection to Ruahine Street.
2. Less explicit place-based character.

4 Planning Controls

4.1 Structure Plan

The Structure Plan is a modified version of Scenario 4. It embodies the principles and strategies identified in Section 3. It reflects PNCC's preference for a single, generously scaled river access point. The modified plan reconfigures the central open space and provides for visitor parking on the East-West River Connector.

Figure 28 shows the Structure Plan in a diagrammatic form that is suitable for inclusion in the District Plan:



KEY

- Structure Plan area
- 9m max height
- 11m max height (Riverfront area)
- No build area / stormwater easement
- Open space
- Pedestrian and cyclist access

Ⓐ Extension of Roxburgh Crescent (13m wide)
Ⓑ New local street (13m wide)
Ⓒ Public Access to river corridor
Ⓓ Road reserve (20.5m)

Fig.28 Roxburgh Crescent Structure Plan diagram.

4.2 Development standards

4.2.1 Introduction

ODP Subdivision and Residential Zone planning provisions apply within the Roxburgh Residential Area. However, these are amended to include new standards that are tailored to specific site conditions and development potential.

The RRA is not included within the new Medium Density Residential Zone (MRZ). However, open space amenity and comprehensive planning justify more intensive land use. As a result, some Residential Zone rules are modified to enable smaller lots with two-three storey dwellings.

4.2.2 Minimum and maximum net site area

Within the RRA, the minimum net site area is 250m^2 and the maximum area is 500m^2. This compares with a 350m^2 minimum for the Residential Zone as a whole. So, the new constraints on lot size facilitate higher residential density.

At 45%, maximum site coverage exceeds that of the Residential Zone as a whole. Increased coverage is made possible by upgraded stormwater infrastructure along with best-practice design and environmentally sensitive water management. Planning provisions require a high proportion of each site to be permeable. When applied to compact lots, the 45% coverage limit promotes construction of two or three-storey dwellings. This outcome is consistent with PNCC's intention to achieve a modest increase in density relative to conventional residential development.

Higher density is justified by comprehensive planning associated with the Structure Plan and consolidated land ownership. Combined with a simple cadastral grid, these conditions provide greater scope to optimise subdivision and deliver a high-quality living environment on smaller lots. Higher density also recognises the exceptional open space amenity of the Roxburgh Crescent area. Proximity to the river corridor means that future residents will have ready access to outdoor recreation. The new East-West River Connector (D), open space reserve and river access point (C) bring this amenity into the core of the site. In this context, 250m^2 lots are appropriate.

Whereas the southern and eastern portions of the RRA are controlled largely by Higgins, ownership of the northern and western areas is more fragmented. Industrial activities occupy a series of small parcels between Roxburgh Crescent and Ruahine Street. Typically, these measure about 16m by 36m. One of the drawbacks of a reduced net site area is that these existing properties are susceptible to rear-lot development. Elsewhere within the Structure Plan, a new local street (B) divides the developable area into shallower blocks. Their dimensions encourage subdivision layouts in which almost every lot addresses a public thoroughfare. This outcome mitigates the effect of any rear lots along the western side of Roxburgh Crescent.

4.2.3 Maximum building height

Most of the site is subject to the Residential Zone's 9m height limit. However, a maximum height of 11m applies along the river frontage, where construction of at least two storeys is required. Here, pitched roofs may rise an additional 1m.

A 9m height limit comfortably accommodates two full-height floors plus a pitched roof. This cross-section is consistent with the vertical scale of two-storey dwellings among Ruahine Street's traditional residential fabric.

11m allows three-storey construction with generous floor-to-floor intervals and an elevated ground floor. In this case, the additional height encourages compact dwellings, higher density and a wider range of housing types. These include semi-detached units, fully attached terraces and walk-up apartments.

The 11m height limit also recognises the beneficial conditions that exist along the river corridor. Adjoining the stop bank, first and second-floor habitable rooms offer exceptional views and a sense of custodianship over the river corridor. Additionally, taller buildings create a more definite urban edge along the western perimeter of the open space.

The 11m height limit stops short of the Structure Plan's northern and southern extremities. Here, a maximum height of 9m provides a transition to predominantly single-storey housing on Ruahine Street and Tilbury Avenue. HIRB provisions provide further protection for existing residential properties on the perimeter of the Plan.

4.2.4 Boundary controls

Boundary controls combine standard Residential Zone separation distances with more lenient MRZ height recession planes. The hybrid provisions facilitate smaller lots with compact two or three-storey dwellings including semi-detached and fully attached units. However, development is less intensive than that allowed in designated medium-density residential areas. Compared with MRZ, RRA's bespoke development standards deliver a looser matrix of buildings and open spaces. Less bulky structures are placed further apart. A broad expanse of sky remains visible at the front and rear of each lot. In most locations, spatial definition depends as much on vegetation as it does on built form.

Within the 9m height area, HIRB controls accommodate compact two-storey dwellings on narrow lots. At the same time, the controls protect mid-block amenity by applying different height recession planes to the front and rear of each parcel. In the front two-thirds of the lot, recession planes commence 5m above the ground and incline inwards at an angle of 45°. The standard Residential Zone recession plane also inclines at 45° but commences 2.8m above the ground. This ODP control applies to the rear third of each lot within the RRA's 9m height area. For parcels longer than 45m, the more restrictive HIRB applies only to the rear 15m of the lot.

The RRA's dual height recession planes match those of MRZ. However, they are allied to the larger separation distances set by generic Residential Zone rules. The minimum front setback for a dwelling or accessory building is 3m. This increases to 6m for a garage that faces a road. Side and rear yards are at least 1.5m wide for dwellings and 1m for any accessory buildings. The proposed height limit and boundary controls create a viable two-storey building envelope on a representative 10m x 25m lot (see Fig.29). In this case, an upper floor can be accommodated as an "attic" level within a lowered roof form e.g., a mansard. The dwelling likely reduces to single-storey at the rear, where the junction of one and two-storey volumes adds visual interest.

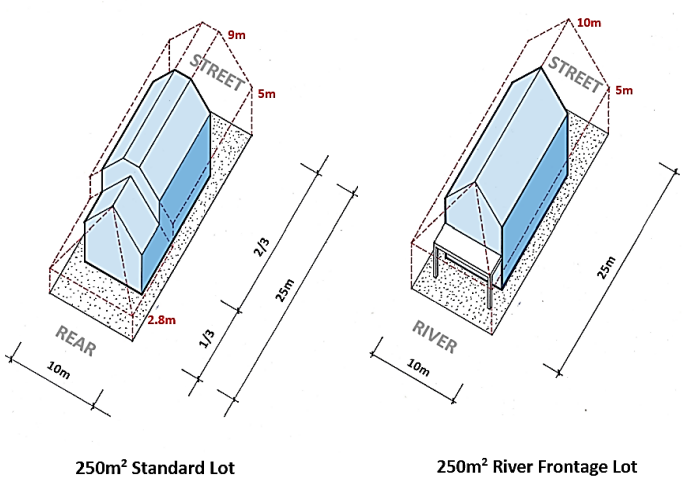


Fig.29 HIRB diagrams for indicative 250m² lots.

Managing the height and bulk of buildings in this way helps to maintain sunlight access and minimise visual dominance particularly in the centre of the block where privacy and amenity are often highly valued. Distinct front and rear height recession planes encourage the bulkiest building volumes to be located forward on the lot. Here, privacy demands are less acute, and the street corridor contributes to visual amenity and a sense of spaciousness. A more built-up street frontage also improves spatial definition and creates further opportunities for passive surveillance and signs of inhabitation.

Conditions differ along the Plan's river frontage, where the 11m height limit applies. Here, the more permissive height recession plane (5m and 45°) extends for the full length of each lot. The single HIRB condition reflects the fact that these parcels effectively have two frontages. Houses will address the street in some fashion because this thoroughfare provides the principal means of access. However, living areas and other major habitable rooms will likely face the river corridor. A more restrictive "rear" recession plane could limit accommodation precisely where it is most highly valued.

Additional height and bulk produce public benefits as well as private ones. Two and three-storey construction improves passive surveillance along the stop bank and helps to define the edge of a large open space. So, purely from a placemaking perspective, it would be counter-productive to impose more restrictive boundary controls along the eastern margin of the Structure Plan.

Placemaking and on-site amenity can be privileged here because the impact of development on neighbouring properties is less significant. River frontage lots have no rear neighbours. Confined mid-block open spaces – crucial for amenity elsewhere in the Plan – are replaced by unobstructed views across the Manawatū River. Under these circumstances, protecting sun, outlook and privacy on adjacent sites is less critical.

Rear lots pose additional challenges within the river frontage area. Much of this zone comfortably accommodates a single lot between Local Street B and the RRA's eastern boundary. However, the zone is deeper towards is northern and southern extremities. In these locations, back lots are possible. Ideally, subdivision plans will minimise the number of rear lots or – better still – avoid them altogether. If rear lots do occur, the subdivision layout will need to protect off-site amenity by preventing visual dominance and overlooking.

Throughout the Plan, boundary controls enable a broader range of house types including semi-detached and full attached units. No separation distance or height recession plane applies to conjoined dwellings along a common boundary. Under these circumstances, a pair of semi-detached dwellings – or a row of fully attached townhouses – is treated as one building.

The more restrictive height recession plane (2.8m and 45^{o}) applies along the boundaries of existing residential properties.

4.2.5 Frontage activation

Higher residential densities typically produce a greater sense of inhabitation than the traditional suburb. However, as the intensity of development increases, care must be taken to activate the street edge e.g., by avoiding vehicle-dominated frontages.

Existing planning provisions promote visual interest and support public/private interaction. These include Assessment Criteria for multi-unit housing, which provide useful guidance for all development within the RRA.

4.2.6 Private outdoor amenity areas

Performance Standards for Onsite Amenity generally match those for the Residential Zone as a whole. However, special provision is made for private outdoor space to be elevated above ground level. The RRA's 11m height limit anticipates three-storey dwellings with first-floor living spaces along the river frontage.

In this case, a well-oriented, generously proportioned deck or balcony may provide more outdoor amenity than a garden on the ground. Where properties adjoin the stop bank, an elevated outdoor area can deliver expansive views and support passive surveillance of the river corridor.

Owing to their constructed nature, balconies and raised decks may be smaller than their ground-level counterparts. With minimum areas of $8m^2$ (for dwellings with two or more bedrooms) and $5m^2$ (for one-bedroom units), these elements are large enough to serve as outdoor rooms. Amenity is assured because at least half the balcony must have a minimum of three hours of winter sunshine.

At the same time, these dimensions are sufficiently modest to allow decks or balconies to be incorporated in the overall architectural composition. In other words, these elements are small enough to be treated as integral parts of the building rather than components of the surrounding landscape. Additionally, under croft spaces will be more manageable if decks and projecting balconies have smaller footprints.

4.3 Provision for multi-unit housing

4.3.1 Multi-Unit Housing

The RRA is a Multi-Unit Housing Area (MUHA). MUHA Assessment Criteria apply to all developments of three or more dwellings. MUHA status is justified by proximity to the river corridor and other amenities including Winchester School and – at greater distance – Hokowhitu's local centre. So, Roxburgh Crescent is well-serviced and reasonably central.

Comprehensive planning provides a further justification for multi-unit housing. The Structure Plan imposes a coherent layout on streets and blocks. Additionally, some two-thirds of the site is in single ownership. This land bank allows coordinated development with better public and private outcomes. For the remainder of the site, ownership is more fragmented. However, the existing cadastral pattern is receptive to multi-unit development.

5 Conclusions

Findings are based on urban design considerations rather than RMA-related issues. The overarching conclusion is that residential redevelopment is feasible and desirable. The RRA does not qualify for inclusion within the MRZ. Nevertheless, the area can accommodate higher density than generally occurs within the Residential Zone:

1. The present Industrial Activity Zone is anomalous. PNCC has identified preferred locations for industrial activity to the north and west of the city. The pocket of industrial activity at

Roxburgh Crescent detracts from the residential character of Hokowhitu and the amenity value of the river corridor.

2. The site is well-suited to housing being flat, centrally located and framed by established residential development. The area has good access to services and amenities. These include public transport, schools, the Hokowhitu local centre and the exceptional recreational opportunities of the River Reserve.

3. Some two-thirds of the Structure Plan area is in single ownership. Given its size, the Higgins property allows a comprehensive approach to redevelopment. Key stakeholders have been involved in formulating and reviewing the Plan.

4. Comprehensive planning can produce a high-quality public realm with an improved visual and physical connection to the river corridor. The Higgins property currently blocks river access. One of the Plan's organising features is a new East-West River Connector, which links Ruahine Street to the Manawatū River by way of a new public reserve.

5. An eastward extension to the Higgins' property provides space for a new local street. This north-south thoroughfare facilitates subdivision into compact, well-proportioned, street-facing lots.

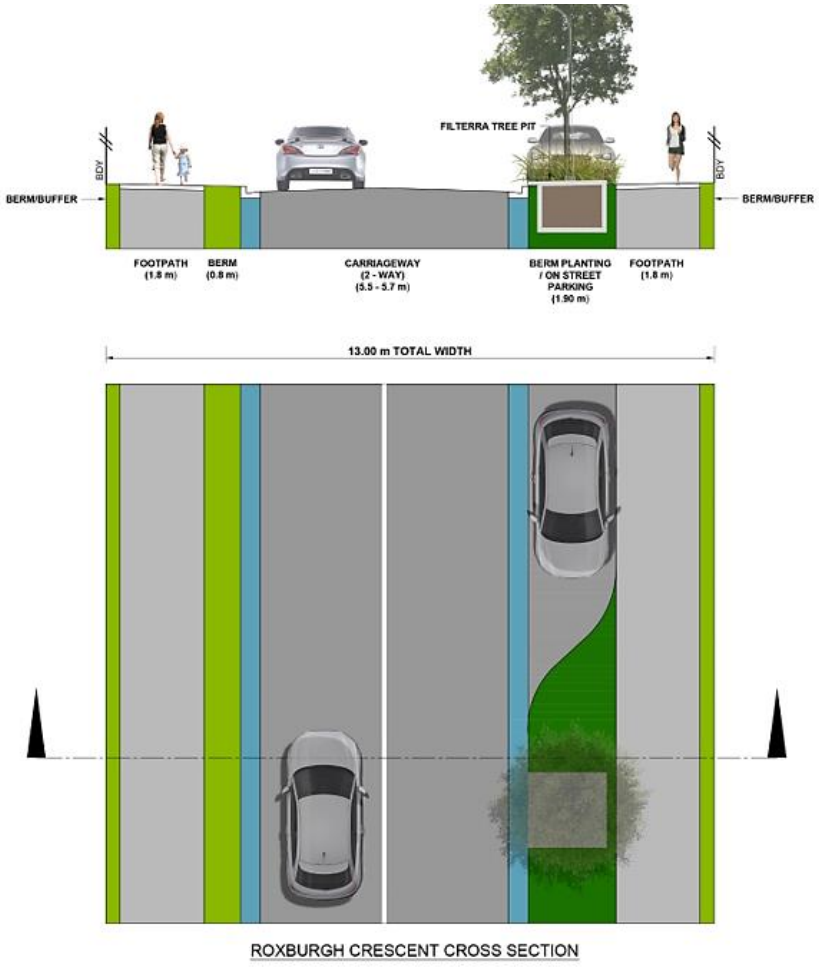
6. A comprehensively planned redevelopment can incorporate smaller lots with two-storey and – in some cases – three-storey housing. The effects of taller, denser buildings can be managed because the Roxburgh Residential Area is subject to a Structure Plan and targeted development standards.

7. In general, PNCC's existing Residential Zone Development Standards can deliver high-quality outcomes within the RRA. Departures from these provisions recognise specific site conditions and development potential.

8. Lots as small as 250m^2 are allowed. Height recession planes are less restrictive. A 9m height limit applies to most of the RRA – in keeping with the generic Residential Zone standard. However, 11m high buildings are permitted along the river frontage. Here, three-storey dwellings benefit from elevated views and bring an inhabited edge to the stop bank.

9. Different HIRB controls apply to the front and rear of most lots. Recession planes are less restrictive at the front of the lot, where streetscape augments private open space and a strong built edge supports spatial definition. Recession planes are more restrictive at the rear of the lot, where mid-block amenity needs to be protected. Mid-block conditions do not apply to the river frontage area. Here, the more permissive recession plane continues from front to rear because most lots have what amounts to a second frontage i.e., a common boundary with the Manawatū River Reserve.

Appendix



Indicative street cross section for Roxburgh Residential Area (PNCC Proposed District Plan Map 10.2A).

Appendix D. Transportation Report

Project Number: 5-P1492.00

Roxburgh Crescent Plan Change

Transport Assessment

01/03/2024

CONFIDENTIAL

FINAL

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Document Details:
Date: 1 March 2024
Reference: 5-P1492.00
Status: Final

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Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
1	23/08/2022	M Evis	G Randall	A Harris	Draft
2	01/03/2024	M Evis	G Randall	A Harris	Final

Revision Details

Revision	Details
1	Draft report for client comment
2	Updated information on existing network conditions, updated structure plan and roading cross sections.

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Disclaimer

This report ('Report') has been prepared by WSP exclusively for Palmerston North City Council ('Client') in relation to developing a Transport Assessment ('Purpose') and in accordance with the Short Form Agreement with the Client dated 28th June 2022. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

1 Introduction

WSP has been commissioned by Palmerston North City Council (PNCC) to undertake a Transport Assessment (TA) of the proposed Plan Change to rezone existing industrial land at 20-34 Roxburgh Crescent to a medium-density residential zoning. The proposed rezoning of the site could result in the development of approximately 104 new residential dwellings on the site. An accompanying Structure Plan has been developed for the proposed Plan Change area outlining the indicative transport network and site arrangements (discussed further in Section 3). The proposed site area for inclusion within the proposed Plan Change is shown within Figure 1-1 below.

Figure 1-1: Area Included within the Roxburgh Crescent Proposed Plan Change

1.1 Report Purpose

The existing site is currently zoned "industrial" within the PNCC District Plan. The primary purpose of this TA is to provide a high-level assessment of the transport related effects of the potential rezoning of the site from "industrial" to "medium-density residential". The TA also reviews the suitability of the accompanying Structure Plan from a transportation perspective.

The following traffic related items have been considered:

- The expected trip generation and site operations,
- The impacts of the proposed development on the local road network,
- The suitability and safety of the proposed site accesses and internal site arrangements, and

- Connectivity of the site for both active modes (walking and cycling) and public transport.

1.2 Site Location

The proposed Plan Change area is located at the south-eastern extent of the Palmerston North urban area and is located approximately 3.5km east of the Palmerston North Central Business District (CBD). The proposed Plan Change area is approximately 2.5 hectares (ha) and located within a small industrial precinct. The area immediately to the south and west is currently zoned residential, whilst to the east the site is bounded by the Manawatu River as shown in Figure 1-2 below.

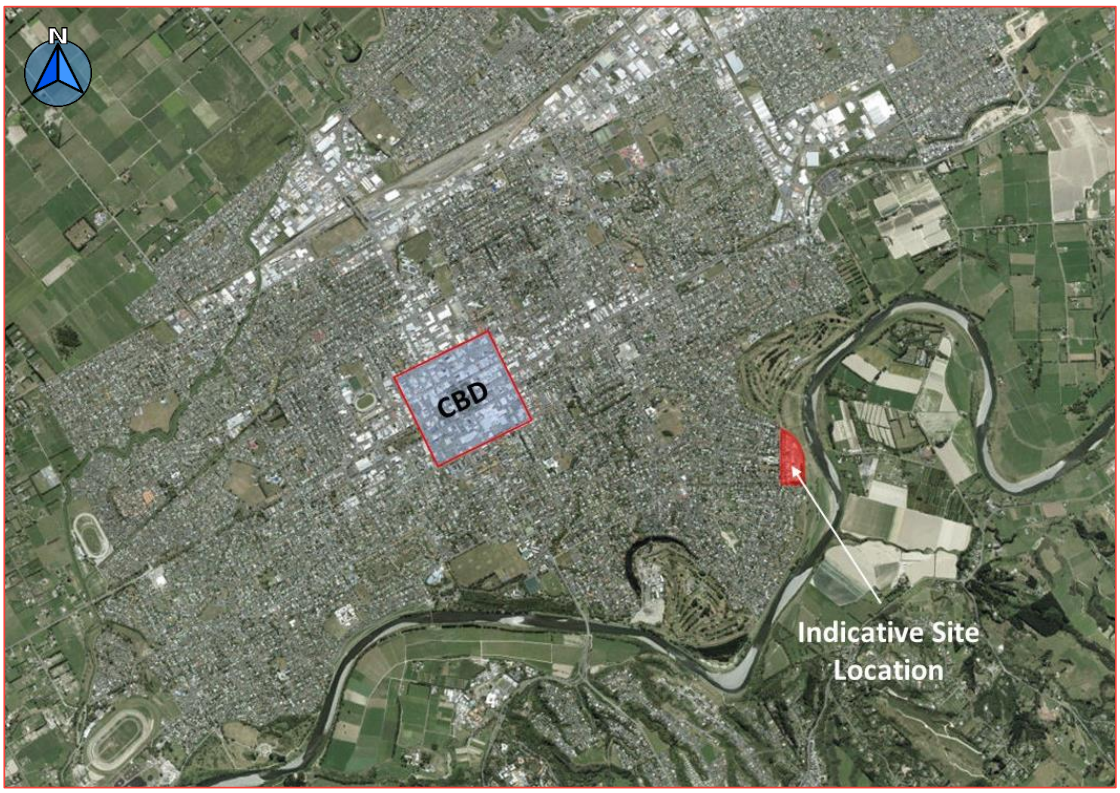


Figure 1-2: Site Context (Source: PNCC GIS Maps)

1.3 Report Structure

The remainder of the report has been structured as outlined below:

- **Section 2:** Provides an outline of the existing transport network within the vicinity of the site;
- **Section 3**: Provides details of the transport aspects of the proposed Plan Change, including the site layout arrangements outlined within the Structure Plan and general on-site provisions;
- **Section 4:** Provides an outline of the assessment of effects including the ability of the network to support traffic generated by the proposed Plan Change, the suitability of the proposed on-site transport arrangements outlined in the Structure Plan and the connectivity of the proposed Plan Change area for non-car based modes of transport; and
- **Section 5:** Summarises the key findings and recommendations of the transport assessment.

1.4 Relevant Information

In developing this Transport Assessment, the following sources of information have been used and appropriately referenced throughout the report:

- MobileRoad (www.mobileroad.org)

- PNCC District Plan – Section 20: Land Transport
- PNCC ATLYST Traffic Count Data
- PNCC Engineering Standards for Land Development (2021)
- Palmerston North Urban Cycling Network Masterplan, PNCC (2019)
- Trip Generation Manual, 9th Edition – Institute of Highway Engineers (ITE)
- Guide to Traffic Generating Developments (2002) – Road and Traffic Authority, NSW
- New Zealand Trips and Parking Database (2017)
- Trips and Parking Related to Land Use – Research Report 453, Waka Kotahi, 2011

2 Existing Transport Environment

This section of the report provides a description of the existing transport network and safety record within the vicinity of the proposed Plan Change area. The assessment focuses on the principal roads of interest within the study area, these being:

- Roxburgh Crescent;
- Ruahine Street;
- Pahiatua Street;
- Albert Street; and
- Te Awe Awe Street.

2.1 Transport Network

The roading hierarchy differentiates between roads by function. Roads at the top of the hierarchy are generally arterial routes that cater for through traffic and often have high traffic volumes. Roads at the lower end of the hierarchy (collector and local roads) generally have lower traffic volumes and provide an access function. The existing road hierarchy as defined within the PNCC District Plan is shown in Figure 2-1, with a definition of each road classification provided within Table 2-1.

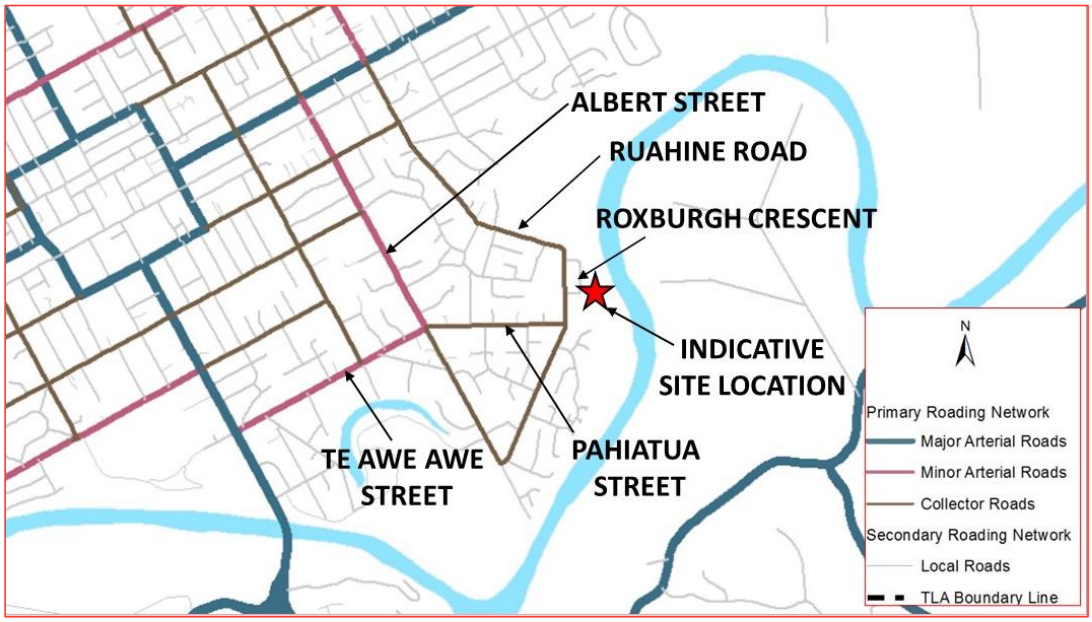


Figure 2-1: Excerpt from Road Hierarchy – Palmerston North (District Plan Figure 20A.2)

Table 2-1: PNCC Road Hierarchy Classification Description

CLASSIFICATION	DESCRIPTION	RELEVANT ROADS
Minor Arterial Road	Minor Arterial Roads provide access between Collector and Major Arterial Roads. These roads have a dominant through vehicular movement and carry the major public transport routes. Access to property may be restricted and rear servicing facilities may be required. Urban traffic volumes are typically 8,000 vehicles per day to 20,000 vehicles per day and rural from 1,000 to 5,000 vehicles per day with a higher proportion of heavy vehicles. Typical urban operating speeds are 40 to 60 km/h and rural 80 to 100 km/h.	Te Awe Awe Street Albert Street
Collector Road	Collector Roads provide circulation in local areas and links to arterial roads, while balancing these needs with pedestrian and local amenity values. These roads provide access for all modes of transport including public transport. Typical traffic flows are between 3,000 and 10,000 vehicles per day.	Ruahine Road Pahiatua Street
Local Road	Local Roads provide access and connectivity within a local area. Low vehicle speeds, pedestrian and local amenity values predominate. Such roads typically carry up to 3,000 vehicles per day and their two lanes provide for on-street parking, property access and pedestrian needs.	Roxburgh Crescent

Albert Street, Ruahine Road, Pahiatua Street and Te Awe Awe Street form part of the Primary Road network. Albert Street (north of Pahiatua Street) and Te Awe Awe Street are identified as minor arterial roads, whilst Ruahine Street and Pahiatua Street are identified as collector roads in the District Plan. Ruahine Street forms the primary route for north/south traffic, whilst Pahiatua Street (located to the south of Roxburgh Crescent) provides the primary route for east/west traffic within the vicinity of the proposed Plan Change area.

A summary of the road network characteristics of key routes in the vicinity of the proposed Plan Change area is summarised within Table 2-2. All roads within the surrounding area are within the urban speed limit boundary, which has a posted speed limit of 50km/hr.

Table 2-2: Summary of Roading Characteristics[1]

ROAD NAME	ROAD HIERARCHY	ROAD WIDTH	AVERAGE WEEKDAY TRAFFIC VOLUMES			OPERATING SPEED (85TH %TILE)
			ALL DAY	AM PEAK	PM PEAK	
Roxburgh Crescent (northern link)	Local Road	11.0m	730 (24.2%)	60	70	35.8 km/hr
Roxburgh Crescent (southern link)	Local Road	11.0m	660 (15.2%)	70	70	29.1 km/hr
Ruahine St (east of Newcastle St)	Collector	11.0m	3,220 (7.1%)	346	292	48.4 km/hr
Ruahine St (west of Windsor St)	Collector	12.0m	6,700 (4.9%)	749	574	54.4 km/hr
Pahiatua St (west of Ascot St)	Collector	11.0m	4,540 (4.9%)	460	450	53.4 km/hr
Albert St (north of Elmira St)	Minor Arterial	13.0m	14,300 (6.0%)	1,210	1,262	47.8 km/hr
Te Awe Awe St (west of Ihaka St)	Minor Arterial	13.0m	14,235 (5.3%)	1,360	1,258	46.4 km/hr

[1] Speeds and traffic volumes have been determined from PNCC's ATLYST database. Data for Roxburgh Crescent includes traffic generated by the Higgins construction yard prior to its relocation.

2.2 Road Description

2.2.1 Roxburgh Crescent

Roxburgh Crescent is classified as a "local" road within the District Plan and currently provides access to the existing industrial buildings along its length. Roxburgh Crescent will continue to operate as the primary connection to the surrounding road network from the proposed Plan Change area.

Roxburgh Crescent is a loop road which is approximately 350m in length, intersecting with Ruahine Street on both its northern and southern end. There are no formal controls provided on the northern intersection at present. The southern intersection is controlled through a "Stop" priority with Roxburgh forming the minor approach.

Weekday traffic volumes on both extents of Roxburgh Crescent are estimated to be between 650-750 vehicles per day (vpd) of which between 15% to 25% is estimated to be heavy vehicles[2]. During weekends, traffic volumes are significantly lower than recorded weekday traffic volumes (approx. 170-180 vpd). This is largely driven by weekday industrial activities related to the Higgins construction yard; however, there are several residential properties present on the western extents of Roxburgh Crescent which also generate trips during the weekend period.

Roxburgh Crescent has a road reserve width of 13.0m, with a carriageway width of approximately 11.0m. It is formed of two general traffic lanes with parking restrictions provided on one-side of the road. A footpath (ranging between 1.5 to 2.0m wide) is provided on one side of Roxburgh Crescent along the majority of the road alignment.

2.2.2 Ruahine Street

Ruahine Street is a collector road which carries between 3,200 vpd on its southern extent (near Roxburgh Crescent) to 12,000 vpd between Church Street and Main Street. The large volume of traffic on the northern section of the route is attributed to the regional connectivity that Ruahine Street provides onto Main Street (State Highway 3) and the northern section of Ruahine Street as these roads are both arterial roads, which facilitate movement and access throughout the day.

Ruahine Street provides connections between the suburbs of Hokowhitu and Terrace End enabling local and regional connectivity to the primary road network. Within the vicinity of Roxburgh Crescent, the road carriageway is approximately 11.0m wide and is formed of two general traffic lanes with on-street parking permitted on both sides. The road currently has a posted speed limit of 50km/h[3].

2.2.3 Pahiatua Street

Pahiatua Street is identified as a Collector Road within the District Plan, providing east-west connectivity between Ruahine Street as well as other regionally significant routes on the primary roading network including Albert Street and Te Awe Awe Street. Pahiatua Street has a road carriageway width of approximately 11.0m and is formed of two general traffic lanes with on-street parking permitted on both sides of the road. Pedestrian footpaths are also provided on both sides of the road. The road has an estimated ADT of approximately 4,500 vpd with heavy vehicles comprising approximately 5% of traffic. The road currently has a posted speed limit of 50km/h[4].

2.3 Public Transport Network

Horizons Regional Council are currently implementing a new public transport operating model ("Connect") that will provide more direct and frequent bus services across Palmerston North. The new network will be operational from March 2024.

Bus services within the new network that will operate within the vicinity of the proposed Plan Change area include the Cloverlea-Hokowhitu (Route 103/104) and City East to Massey (Route 121)

[2] **Note**: this is based on data from 2019 recorded within PNCC's ATLYST traffic count database. Existing weekday traffic flows are expected to have reduced during weekdays as a result of Higgins' relocation from the site in 2023.
[3] https://speedlimits.nzta.govt.nz/
[4] https://speedlimits.nzta.govt.nz/

(see Figure 2-2). The frequencies of services are shown in Table 2-3. The Cloverlea-Hokowhitu (Route 103) route provides access to the city centre (Main Street bus terminal) where connections can be made to numerous other services including both regional and national bus routes.

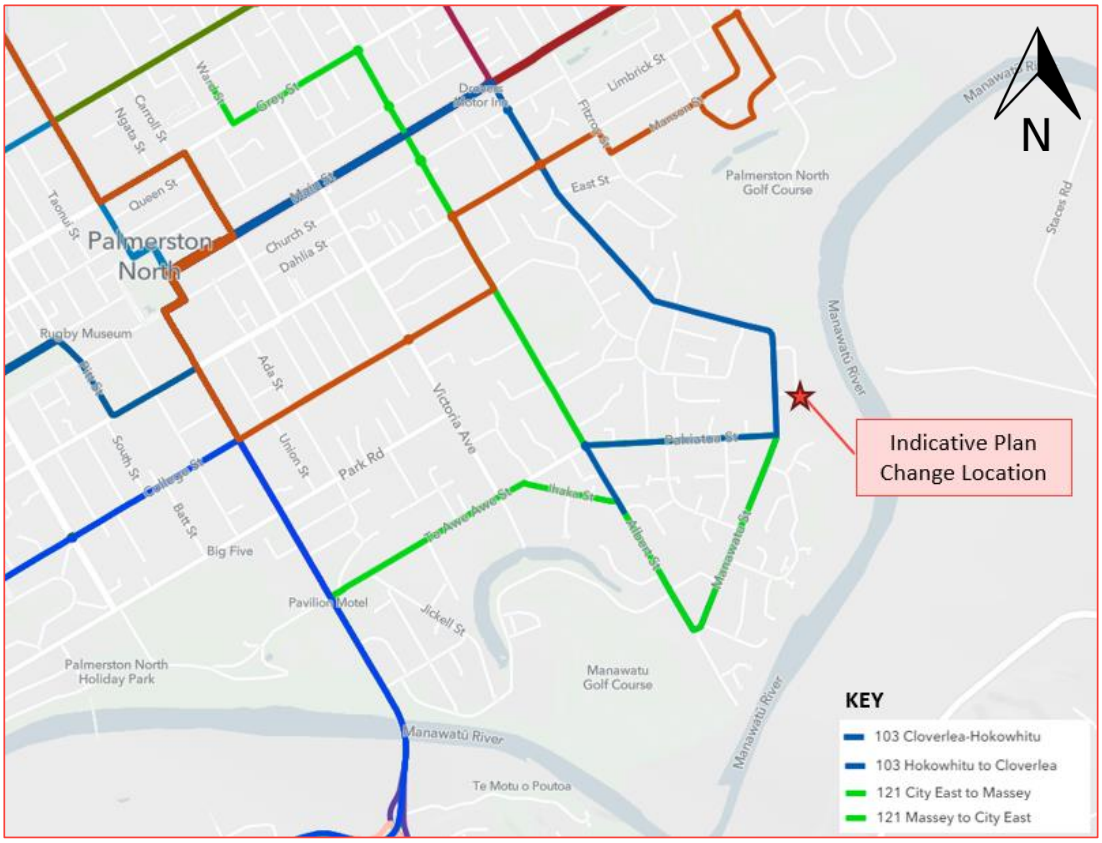


Figure 2-2: Proposed New Network ("Connect") for Palmerston North (Hokowhitu Excerpt)

Table 2-3: Existing Public Transport Services Operating Near the Proposed Plan Change Site

ROUTE	DESCRIPTION	WEEKDAY FREQUENCY	NEAREST STOP
Route 103	Cloverlea to Hokowhitu	Every 15 mins during peak, Every 30 mins off-peak	541 Ruahine Street
Route 103	Hokowhitu to Cloverlea	Every 15 mins during peak, Every 30 mins off-peak	550 Ruahine Street
Route 121	City East to Massey	Every 60 mins (07:20 to 12:30 hrs)	114 Pahiatua Street
Route 121	Massey to City East	Every 84 mins (13:10 to 20:10 hrs)	121 Pahiatua Street

Several bus stops are located within a 400m walking distance of the proposed Plan Change area (as shown in Figure 2-3)[5]. Pedestrian connectivity between local bus stops on Ruahine Street is facilitated through an existing zebra crossing positioned adjacent to Winchester School. As such, the proposed Plan Change area expected to continue to be well serviced by public transport under the New Network.

[5] A 400m radius equates to an approximate 5 minute walking time and is considered an acceptable catchment for bus stops in urban areas within best practice guidelines (link).

Figure 2-3: Bus Stops within an Indicative 400m Radius of Roxburgh Crescent[6]

2.4 Pedestrian and Cycling Connectivity

The existing footpaths on Roxburgh Crescent are largely limited to a single side of the street; however there are short sections on the northern end of Roxburgh Crescent where no formal footpaths are provided resulting in a poor connectivity and accessibility for pedestrians to the wider network (see Figure 2-4 and Figure 2-5). During the site visit it was observed that in some locations the effective width of the existing footpath is restricted by signage and utilities. There are currently no direct connections between the proposed Plan Change area and the Manawatu River Shared pathway.

[6] Bus stop locations shown within the figure include the new pair of bus stops adjacent to 552 Ruahine Street that are being implemented to support the new bus network.

Figure 2-4: Roxburgh Crescent (Southern End)

Figure 2-5: Roxburgh Crescent (Northern End)

Beyond Roxburgh Crescent, the existing roading network provides pedestrian connections to local key destinations including Winchester School, the Manawatu River Shared Path and local convenience stores. An existing pedestrian/kea crossing is provided on Ruahine Street (between the two Roxburgh Crescent connections) which provides direct connections to Winchester Primary School (see Figure 2-6). A zebra crossing exists across Pahiatua Street near the intersection with Ruahine Street.

Figure 2-6: Pedestrian Crossing on Ruahine Street

The location of the proposed Plan Change area in relation to the current and proposed Palmerston North urban cycle network is shown within Figure 2-7. Te Awe Awe Street is located approximately 1km away from Roxburgh Crescent which has on road painted cycle lanes. These bicycle lanes connect to the wider cycle network, providing connections to the CBD, the Esplanade, the Research Institute and Massey University.

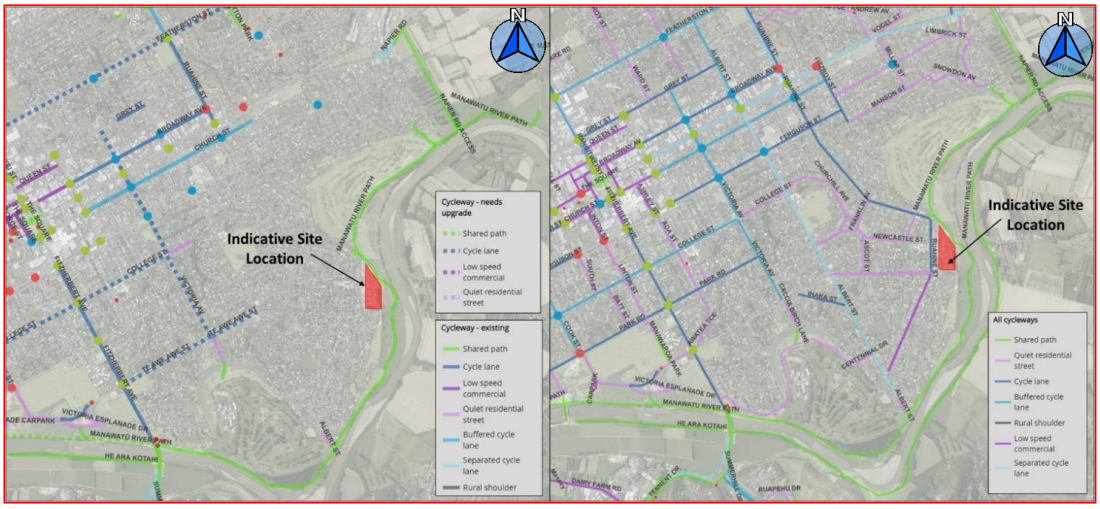


Figure 2-7: Existing Palmerston North Cycle Network (Left) and Proposed Regional Cycle Network (Right) (Source: Urban Cycling Network Masterplan, PNCC)

The proposed Plan Change area is located adjacent to the Manawatu River Shared Path which connects with various parks along the river including the Esplanade, Memorial Park, Paneiri Park, as well as providing cycling connections to the CBD and Massey University via Fitzherbert Avenue or the He Ara Kotahi Bridge. Presently, the closest access to the shared path from the proposed Plan Change area is 200m north of the access of Roxburgh Crescent (via the entry at 523 Ruahine Street – see *Figure 2-8*).

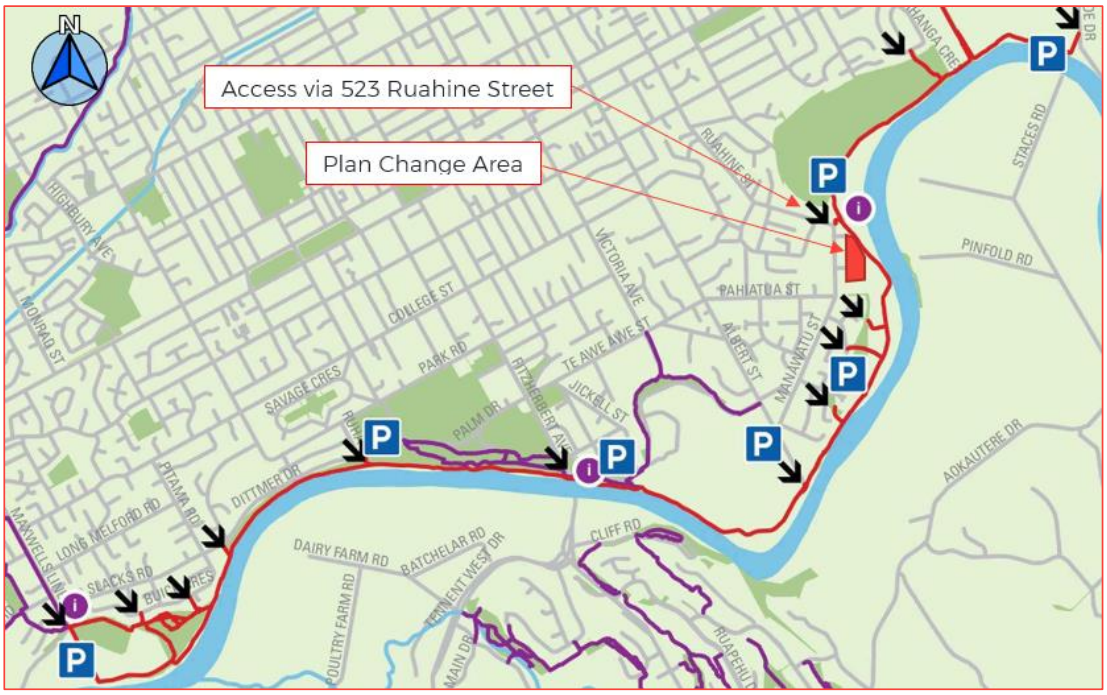


Figure 2-8: Existing Walking and Cycling Connections to the Manawatu Shared Path

2.5 Safety Record

A review of the Waka Kotahi Crash Analysis System (CAS) database has been undertaken to identify all reported crashes in the vicinity of the proposed Plan Change area over a ten-year period from 2013 to 2022. The search also extracted available data from 2023.

A total of 16 crashes have been recorded over this period, of which four resulted in minor injury crashes and 12 non-injury crashes. The location and severity of recorded crashes within the vicinity of the proposed Plan Change area is shown within Figure 2-9[7]. It is noted that none of the recorded crashes involved vulnerable road users (pedestrians or cyclists).

The majority of recorded crashes involved collisions with parked vehicles or loss of control negotiating bends. Alcohol, incorrect lane positioning and travel speeds were noted as the primary influencing crash factors. Whilst a small number of crashes have occurred near the site, there is no history of crashes relating to vehicle movements into or from the Roxburgh Crescent intersections and most crashes resulted from poor driver behaviour. As such, the crash history does not indicate any significant safety concerns in respect to traffic generated by the proposed Plan Change area.

[7] The orange circles denote the location of recorded "minor injury" crashes, whilst the green circles denote the location of recorded "non injury" crashes.

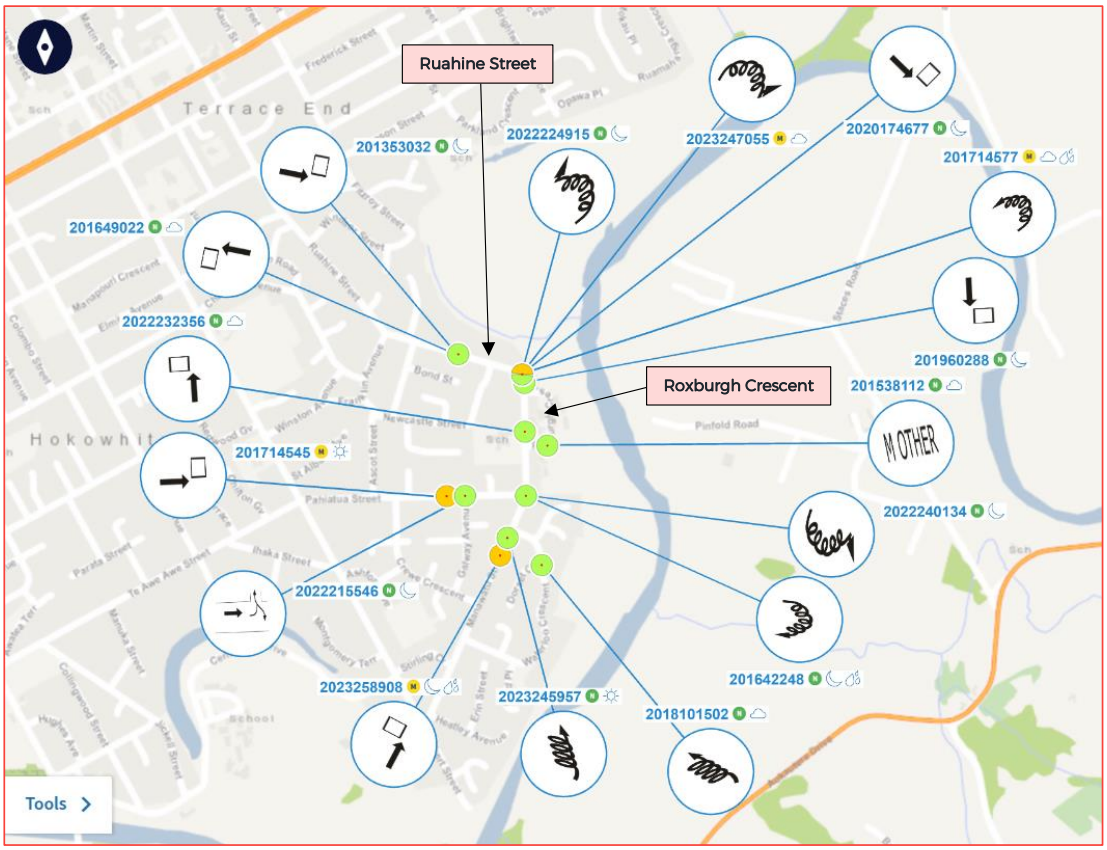


Figure 2-9: Crash Map – Crash Analysis System, 2013-2022[8] (Source: Waka Kotahi)

[8] Includes recorded crashes from 2023

3 The Proposal

A Structure Plan has been developed for the proposed Plan Change area based on minimum lot size of 250m^2. The Structure Plan has been used as a basis for the assessment of effects within this Transport Assessment (outlined in Section 4). The anticipated site yield based on these lot size scenarios is approximately 104 households.

Access for all modes of transport from the proposed Plan Change area would be provided through existing Roxburgh Crescent connections to Ruahine Street (see Figure 3-1). The proposed road network within the Structure Plan has developed around an eastbound extension of Roxburgh Crescent (south) and a southbound extension to the existing Roxburgh Crescent alignment which currently fronts along the western edge of the existing Higgins Site.

The Structure Plan also indicates the use of two existing vehicle crossings from the proposed Plan Change area onto Ruahine Street; both of which currently service activities within the Higgins construction yard. The proposal would also provide access for pedestrians and cyclists onto the Manawatu River Shared Path from the internal road network (denoted by Area C within the Structure Plan).

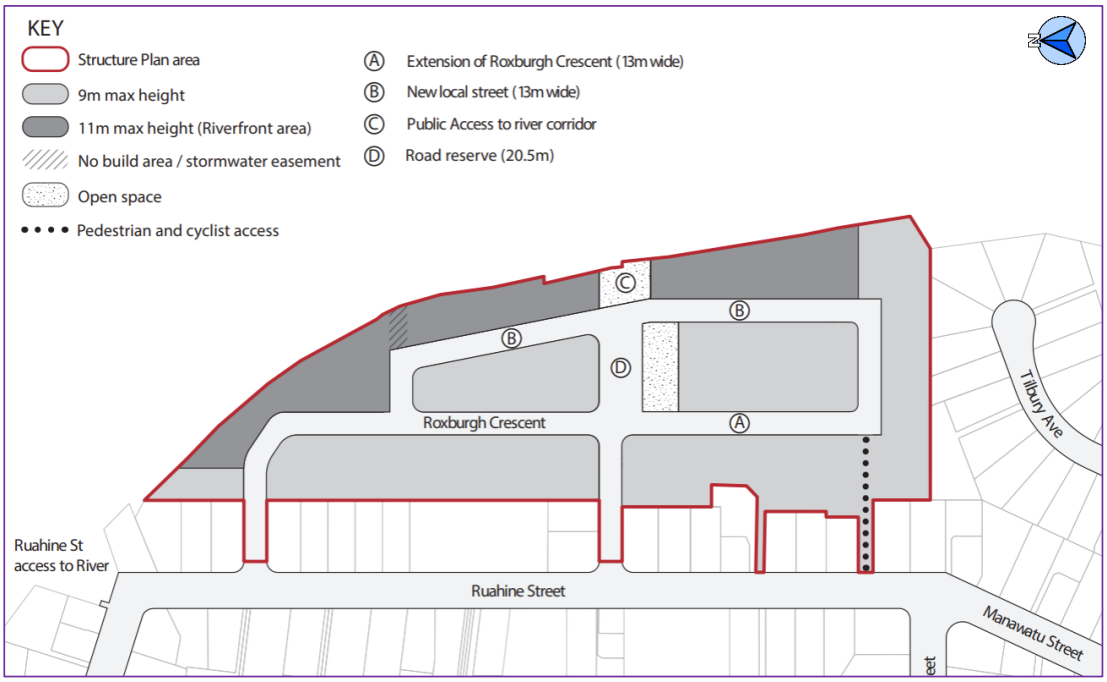


Figure 3-1: Structure Plan Layout for 250m^2 Minimum Lot Size

4 Assessment of Effects

This section of the report provides a detailed assessment of the transportation impacts of the proposed Plan Change on the surrounding road network. It also provides an outline of the suitability of the proposed access locations, internal roading provisions for the development and wider connectivity of the site for non-car based modes of transport.

4.1 Trip Generation

The proposed Plan Change seeks to enable medium density residential development to occur, which would replace existing industrial activities on Roxburgh Crescent. Analysis of the most recent traffic count data on Roxburgh Crescent (March 2019) indicates that during a typical weekday approximately 1,400 all day and 120 peak hour traffic movements were generated by existing industrial land use activities[9].

As previously noted, approximately 104 medium density residential lots could be developed within the proposed Plan Change area, based on a minimum lot size of 250m^2. The following industry recognised standards have been used to establish the anticipated trip generation rates that could be expected from medium density housing within the proposed Plan Change area:

- Guide to Traffic Generating Developments (RMS Guide) – (New South Wales Roads and Maritime Services)[10]; and
- NZ Transport Agency Research Report 453 – Trips and Parking Related to Land Use (2011) which utilises outputs from the New Zealand Trips Database (NZTDB).

The relevant peak hour and all-day trip generation rates for this residential type referenced within these trip generation guides are shown within Table 4-1.

Table 4-1: Trip Generation Rates for Medium Density Residential Development

Guidance	Dwelling Type	Peak Hour Trips (vph)	All Day Trip Generation (vpd)
RMS Trip Generation Guide	Two or Less Bedrooms	0.4-0.5 per household	4 to 5 per household
	Three Bedrooms or More	0.65 per household	5 to 6.5 per household
NZ Research Report 453[11]	N/A	0.8 per household	6.8 per household

The peak hour trip generation and all-day trip generation rates outlined within the NZTA Research Report 453 are higher than those provided within the RMS Trip Generation Guide. To ensure a robust assessment of trip generation, the rates outlined within the NZTA Research Report 453 have been used to conservatively estimate traffic generated by the proposed Plan Change area.

Utilising these rates, Table 4-2 shows that upon full development of the site to medium-density residential, the proposed Plan Change area could generate a daily trip generation of approximately 707 trips and 83 trips during the peak hours (in the higher density scenario).

Table 4-2: Estimated Site Trip Generation Rates

Lot Density Scenario	Indicative Household Yield	Peak Hour Trips	All Day Trips
Minimum Lot Size - 250m^2	104 Households	83	707

Table 4-3 compares the forecast traffic that could be generated by the development of medium-density residential development compared with existing traffic flows generated by current on-site industrial activity. This indicates that converting existing industrial land to medium-density

[9] Established from PNCC Traffic Count Data from ATALYST (2019). It is noted that these traffic volumes include traffic generated by industrial activities from the Higgins construction yard prior to its relocation from the Roxburgh Crescent site in 2023.

[10] Roads and Traffic Authority of NSW, Guide to Traffic Generating Developments, Version 2.2, October 2002

[11] Based on 85th percentile trip generation rates

residential would result in a net reduction in total traffic volumes generated by the site on the local road network, during both the peak periods (~45 vehicle per hour) and across the day (~680 vehicles per day).

Table 4-3: Existing and Forecast Traffic Volumes on Roxburgh Crescent (Northern and Southern Ends Combined)

PERIOD	EXISTING INDUSTRIAL LAND USE	FORECAST RESIDENTIAL LAND USE	NET CHANGE
AM Peak Flows	127 vph	83 vph	-44 vph
PM Peak Flows	117 vph	83 vph	-34 vph
Daily Trips	1,390 vph	707 vpd	-683 vpd

Traffic surveys indicate approximately 20% of traffic generated by existing industrial activities are heavy vehicles which travel through existing residential areas to access the wider transport network. Heavy vehicle traffic generated by residential developments are typically limited to servicing activities (such as refuse collection); therefore, once the site is converted from industrial to medium-density residential, the volume of heavy vehicle traffic on Roxburgh Crescent and the primary road network is also expected to reduce.

4.2 Forecast Traffic Flows on Key Routes

Ruahine Street and Pahiatua Street provides connections between the proposed Plan Change area and key destinations to the north and west respectively. Both roads are identified as collector roads within the road hierarchy and can be expected to support between 3,000 to 10,000 vehicles per day (or up to 1,000 two-way peak hour movements based on typical peak hour demands).

Existing traffic volumes on Pahiatua Street (4,540 vpd) and Ruahine Road (3,640 vpd) fall within the lower end of these ranges. There are no other known high trip generating land-use developments or proposals that would likely increase traffic demands on these roads within the vicinity of the site.

To assess the impacts of the proposed Plan Change area on local network capacity, the forecast peak hour and all-day traffic volumes have been assigned to the external road network based on existing commuter travel patterns within the "Hokowhitu East" census block using available 2018 New Zealand Census data[12] (see **Appendix C**). On this basis, the following traffic splits have assumed:

- 70% will travel to and from the north (via Ruahine Street); and
- 30% will travel to and from the west (via Pahiatua Street).

All day and peak hour trips generated by the proposed Plan Change have been assigned to Ruahine Street and Pahiatua Street based on these distribution assumptions as shown in Table 4-4. The traffic flow forecasts are considered conservative as no reduction in traffic generated by existing industrial activities have been accounted for within these volumes.

Table 4-4: Forecast Traffic Volumes on the Primary Road Network

STREET	PERIOD	EXISTING TRAFFIC FLOWS (TWO-WAY)	FORECAST NEW TRIPS (TWO-WAY)	TOTAL FORECAST TRAFFIC FLOWS (TWO-WAY)
Ruahine Street (North of Roxburgh Crescent)	All Day	3,220 vpd	+495 vpd	3,715 vpd
	AM Peak Hour	346 vph	+58 vph	404 vph
	PM Peak Hour	292 vph	+58 vph	350 vph
Pahiatua Street	All Day	4,540 vpd	+212 vpd	4,752 vpd
	AM Peak Hour	460 vph	+25 vph	485 vph
	PM Peak Hour	450 vph	+25 vph	475 vph

[12] https://commuter.waka.app/

This assessment indicates the forecast traffic volumes on the primary road network (Ruahine Street and Pahiatua Street) will remain within the expected bounds of their relative classification and are considered to have sufficient capacity to accommodate the daily and peak hour traffic volumes generated by the proposed Plan Change area.

4.3 Access Strategy

The proposed strategy outlined within Structure Plan includes the use of Roxburgh Crescent to connect with Ruahine Street as well as the use of existing driveways that currently provide access to the Higgins construction yard.

4.3.1 Roxburgh Crescent Connections

The Roxburgh Crescent (South) intersection is "stop" controlled, with clear sightlines provided in both directions along Ruahine Street. Parking restrictions are present on the eastern side of Ruahine Street which reinforce clear sightlines in both directions (see Figure 4-1).

Figure 4-1: Sightlines to the North (left) and South (right) at the Southern Roxburgh Crescent Connection

There are no "formal" controls at the northern Roxburgh Crescent (north) connection onto Ruahine Street. This intersection has restricted sightlines to the north due to the curvature of the road and on-street parking being permitted within the vicinity of the intersection (see Figure 4-2). Crash history indicates restricted visibility has not resulted in any crashes at the intersection; however, given restricted sight visibility to the north implementing a stop control at this intersection would be beneficial.

Figure 4-2: Sightlines to the North (left) and South (right) at the Northern Roxburgh Crescent Connection

A change in land-use within the proposed Plan Change area is expected to reduce the volume of heavy vehicle traffic generated by the site, providing the ability to modify the geometry of the existing intersections. Potential improvements that could be considered include:

- Kerb build outs to reduce pedestrian crossing distances and improve visibility of pedestrians for vehicles approaching the intersection from Roxburgh Crescent; and
- Parking restrictions within the vicinity of the northern access intersection to reinforce sightlines, particularly to the north.

At present there are no turning bays provided to support access into Roxburgh Crescent from Ruahine Street. As outlined within Figure 4-3, right-turning demands into Roxburgh Crescent are expected to be highest during the PM peak hour (20 vph). Austroads Guide to Traffic Management: Part 6 (2020) provides guidance on the warrant process for turning bays at intersections based on traffic volumes and posted speeds. Warrants have been checked in accordance with Figure 2.25 of the Austroads guidelines based on existing traffic flows on Ruahine Street (see Figure 4-3), which indicates neither access would trigger the needs for a right turn bay[13].

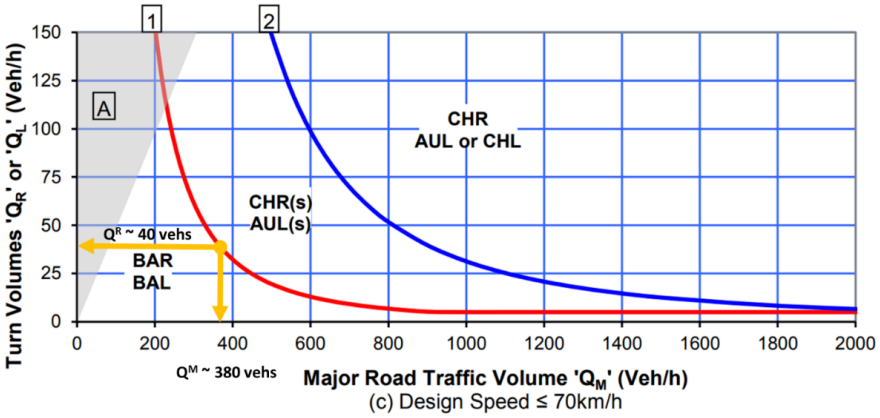


Figure 4-3: Warrants for Turning Treatments at Unsignalised Intersections (Austroads Part 6 – Figure 2.25)

4.3.2 Vehicle Crossings

There are two existing vehicle crossings onto Ruahine Street from the Higgins construction yard that are included within the proposed Plan Change area (see Figure 4-4). Consideration of the future function of these accesses in relation to the proposed Plan Change area are outlined below.

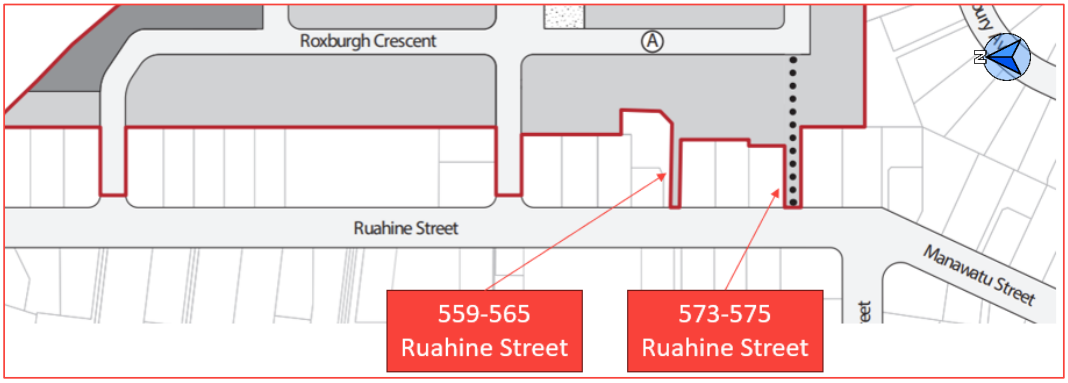


Figure 4-4: Existing Vehicle Crossings included within the Plan Change Structure Plan

[13] Based on the existing traffic flows and forecast traffic volumes, right-turn bays from Ruahine Street would be warranted if turning volumes exceeded approximately 40 vehicles per hour as demonstrated in the diagram.

Access to 573/575 Ruahine Street

The existing vehicle driveway is identified within the Structure Plan as part of the proposed Plan Change which could potentially be used as a secondary vehicle access to the site. The existing vehicle crossing provides access to Higgins commercial activities in 573/575 Ruahine Street as well as residential properties (571 Ruahine Street) and the rear access to the Winchester Store (see Figure 4-5). The existing vehicle crossing is 8.2m wide at the property boundary and is approximately 40m in length.

Given the relatively low volume of traffic expected to be generated by the proposed Plan Change area, additional vehicle access beyond those provided by the Roxburgh Crescent intersections are not required to support site activity from a network capacity perspective. Furthermore, for properties located to the south of the proposed Plan Change area this would provide a more direct connection to Ruahine Street encouraging greater traffic movements than intended for a driveway.

It is recommended that as part of the development process, vehicle access from the proposed Plan Change area to Ruahine Street via the driveway is restricted, whilst retaining access for existing residential or commercial land-uses located outside of the proposed Plan Change area. It would be desirable for pedestrian or cyclist access to be maintained to enhance connectivity and permeability from the proposed Plan Change area for these modes.

Figure 4-5: Existing Vehicle Crossing Adjacent to Winchester Store

Vehicle Access to 559-565 Ruahine Street

This vehicle crossing provides a secondary access to ancillary buildings within the Higgins construction yard (559-565 Ruahine Street). The existing vehicle crossing is approximately 4.5m wide at the property boundary and approximately 40m in length (see Figure 4-6). The crossing complies with the general requirements of the performance standards in terms of spacing and sightline distances for residential vehicle crossings outlined within the District Plan.

Based on the existing vehicle crossing width and the direction provided within the District Plan's performance standards, the vehicle crossing could be used to provide access for up to three residential lots. Although the formed width is less than 5.0m, the driveway is straight and provides good forward sightlines therefore passing provisions are not expected to be required.

If multiple residential lots are proposed to be serviced by the driveway, on-site manoeuvring should be provided such that vehicles are not required to reverse onto or from Ruahine Street.

Figure 4-6: Existing Vehicle Crossing to 559-565 Ruahine Street

4.4 Internal Road Arrangements

This section of the report provides an outline of the proposed internal roading layout identified within the Structure Plan for the proposed Plan Change.

4.4.1 Road Layout

The internal road arrangements are expected to operate as "local roads" servicing access demands to the proposed Plan Change area, with low traffic volumes and low operating speeds. The proposed network would form a circulatory route that connects with the existing Roxburgh Crescent road alignment, removing the need for cul-de-sacs or specific turn around areas to be provided. This also supports connectivity, permeability and resilience as access to the proposed Plan Change area is not dependent on a single access point.

The form of intersections within the proposed Structure Plan are expected to be priority controlled, which are deemed sufficient for the anticipated traffic demands within the internal road network. These could be supported through engineering measures such as raised platforms to support a low-speed environment. The specific design of internal road intersections will be determined during the subdivision stage; however, the proposed road arrangements outlined within the Structure Plan adhere with the principles for intersection design outlined within PNCC's Engineering Standards for Land Development.

4.4.2 Suitability of Cross Sections

The PNCC Engineering Standards for Land Development (2023) outlines the minimum road reserve, carriageway and berm widths for roads serving defined number of residential dwellings (Table 3-1, Page 39)[14]. The standards outline the minimum requirements for 15.5m wide carriageways for local residential roads servicing up to 200 dwelling units (see Appendix D).

The intention of the minimum requirements is to provide sufficient network capacity to support local road activities where development is proposed on both sides of the corridor. This includes the provision of two trafficable lanes, footpaths on both sides of the road and sufficient space for on-street parking on one side of the road. NZS4404 (Land Development and Subdivision Infrastructure standards) states road widths shall be selected to ensure that adequate movement lanes, footpaths,

[14] engineering-standards-for-land-development-30-may-2023.pdf (pncc.govt.nz)

berms can be provided to retain amenity values (including landscaping) and enable utility services to be provided safely and in economically accessible locations.

The proposed road network outlined within the Structure Plan consists of 13.0m wide road corridor, providing consistency with the road boundary widths on existing sections of Roxburgh Crescent. Although the proposed roading arrangements do not comply with PNCC's Engineering Standards, a 13.0m wide cross section could provide for two traffic lanes (5.5-5.7m), footpaths on both sides of the road (min. 1.8m) with the remaining corridor space allocated to berm/planting space with on-street parking limited to a single side of the road (see Figure 4-7). The cross section would be similar in principle to those recently developed within Hokowhitu Lagoon (see Figure 4-8).

Figure 4-7: Indicative Cross Section Arrangement for a 13m Roading Corridor

Figure 4-8: Example of a 13m Roading Corridor – Hokowhitu Lagoon Development

The proposed cross section arrangement outlined above would be largely consistent with the desired arrangements of the local road cross sections as outlined within the PNCC Engineering Standards for Land Development; however, the reduced cross section widths will require careful design at the subdivision stage to ensure the safe and efficient use of the road including:

- The geometry of the internal road network would need to be designed to sufficiently accommodate the access needs of large vehicles (such as emergency vehicles or refuse trucks) particularly at curves or intersections;
- Medium density housing would result in higher frequency of vehicle crossings along property frontages, potentially reducing the space available for on-street parking provisions and increasing the number of potential conflict points with pedestrian users. Options that could be considered through the design process include:
    - Pairing of driveways servicing adjacent (back-to-back) to maximise available space for on-street parking and other street design elements within the berms;
    - Fence height restrictions on property frontages and minimum setbacks for parking garages[15] would assist in supporting safety/visibility for vehicles accessing driveways and maximise visibility of pedestrians or oncoming traffic; and
    - Providing on-site shared parking areas located away from the road frontage to minimise the number of vehicle crossings over footpaths, enabling additional on-street parking to be provided and reducing the number of potential conflict points with users of the footpaths.
- Typically, utilities are located within berms for ease of access. With reduced berm space there is a likelihood that these would be positioned in less desirable locations (i.e. under the footpath or carriageway) which may create future maintenance or operational challenges.

4.4.3 Open Space

As part of the proposed Plan Change, the structure plan has identified new open spaces and a public entrance to the Manawatū River from Roxburgh Crescent as part of a reserve exchange (denoted as the open space within the Structure Plan)[16]. This would establish a new reserve central to the proposed Plan Change area, located along the southern side of the Roxburgh Road (South) extension road (see Figure 4-9).

Also denoted within the Structure Plan, a wider road reserve (20.5m) is proposed adjacent to the open space within the centre of the reserve (see Figure 4-10). The wider road reserve would enable additional on-street parking to be provided along the southern side of the Roxburgh Crescent (south) extension road adjacent to the open space, formed with a 90-degree parking arrangement. The parking facilities are expected to be designed to conform with minimum design standards outlined within the District Plan[17].

It is recommended that raised pedestrian platforms are provided at the western and eastern extent of the proposed Roxburgh Crescent extension to reinforce lower vehicle operating speeds and support pedestrian access to the proposed open space. Lower operating speeds would also assist in minimise potential conflicts with vehicles accessing or egressing the proposed parking facilities.

[15] A minimum setback distance of 6.0m from the property boundary would provide sufficient space to accommodate the stacking length of an 85th percentile car on the driveway, and minimise the potential for parked cars encroaching on the adjacent footpath.
[16] There is currently a small area of reserve acting as a "buffer" between Roxburgh Crescent's industrial activities and housing at the southern end of the proposed plan change area. This "buffer" would not be needed if the area is zoned residential, therefore the reserve is proposed to be relocated central to the proposed Plan Change area.
[17] As denoted within Section 20 of PNCC District Plan - section-20-land-transportv10.pdf (pncc.govt.nz)

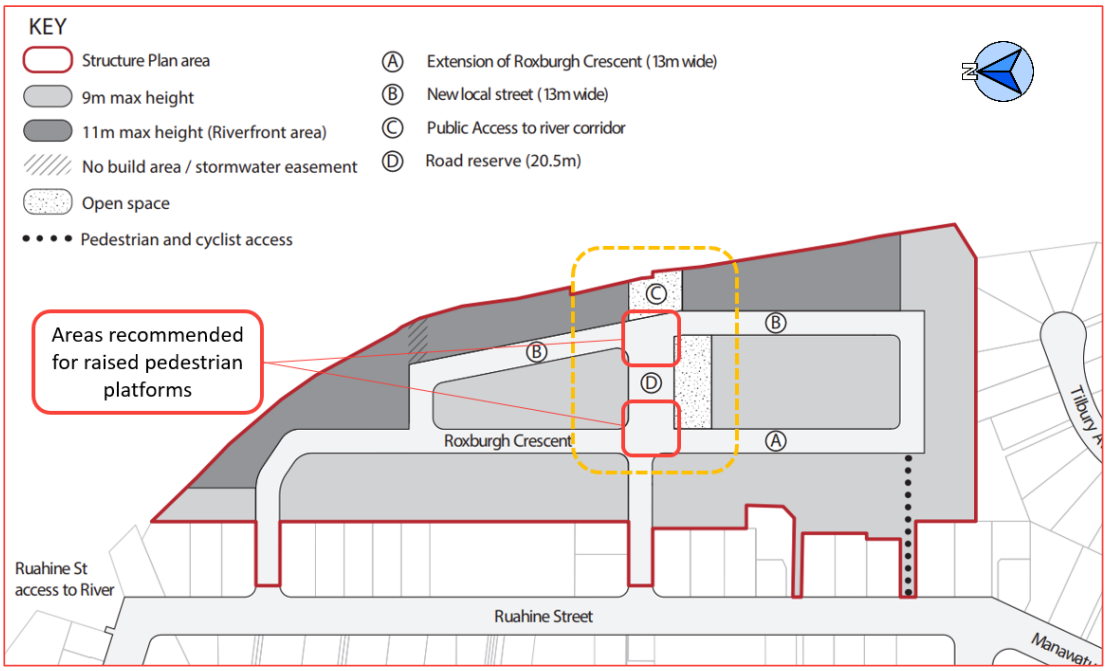


Figure 4-9: Proposed Open Space within the Roxburgh Crescent Plan Change

Figure 4-10: Indicative 20.5m Wide Cross Section Adjacent to Proposed Reserve (Road Type D)

4.4.4 *Existing Form of Roxburgh Crescent*

The existing road environment on Roxburgh Crescent reflects its current function for supporting access to local industrial activities (see Figure 4-11). The function of Roxburgh Crescent is expected to change as residential development occurs, including a reduction in heavy vehicle demands and increasing use by active modes. This would provide opportunities to upgrade the streetscape environment on Roxburgh Crescent to reflect the residential form of the proposed Plan Change area.

Figure 4-11: Existing Form of Roxburgh Crescent Adjacent to Higgins Yard

Ultimately, it would be desirable for the existing road environment to be upgraded to be consistent with the proposed residential cross sections within the Plan Change area. This may include reducing road carriageway widths to support a lower speed environment and the provision of connected and continuous footpaths on both sides of the road.

The timing of any upgrades to the existing Roxburgh Crescent environment would need to consider servicing demands associated with remaining industrial lots (i.e. should sections of the proposed Plan Change area develop before others) and would likely need to be staged as development occurs.

4.5 Connectivity to the Public Transport Network

The proposed Plan Change area is well connected to the public transport, with existing bus stops located on Ruahine Street adjacent to northern and southern Roxburgh Crescent entrances. As noted within Section 2.3, existing bus stops are expected to be retained within the new public transport network for Palmerston North. These bus stops are located within a 400m walking distance of the development and are considered accessible within a 5-minute walk of the proposed development area. Providing a comprehensive walking network within the internal road network would support accessibility to the public transport network.

The proposed new public transport network for Palmerston North will result in an increase in the frequency of bus services in proximity to the proposed Plan Change area. These services will provide connectivity between the proposed Plan Change area and key employment zones including Palmerston North city centre (Main Street bus station), and the outer business zone, as well as access to key services (such as New World/Countdown).

4.6 Provisions for Walking and Cycling

4.6.1 Internal Provisions

The internal road arrangements are expected to operate as "local roads" servicing access demands to the proposed Plan Change area, with low traffic volumes and low operating speeds. On this basis, local roads within the proposed Plan Change area are not expected to require dedicated cycling facilities (consistent with the Subdivision Engineering standards). It is expected that pedestrian footpaths would be provided on both sides of the internal road network to be consistent with cross section expectations of the Subdivision Engineering Standards.

4.6.2 External Connections

A zebra crossing is currently provided on Ruahine Street between the northern and southern Roxburgh Crescent accesses, providing good connections to local walkable destinations including local bus stops and Winchester School. The pedestrian crossing is unlikely to be significantly affected by traffic from the proposed residential development as traffic to and from the development will be split across the two intersections so not all traffic will pass through the pedestrian crossing.

Ruahine Street (between Pahiatua Street and State Highway 3) has been identified as a proposed route for cycle lanes within the urban cycle network. Once these connections are developed, these would provide connections from the proposed Plan Change area to multiple city centre destinations including the CBD and outer business zones.

The proposed Structure Plan also proposes to provide a new access for active modes onto the Manawatu Shared River Path at the eastern extent of the Roxburgh Crescent (South) extension. The provision of a walking and cycling link to the Manawatu Shared Pathway would provide direct access from the proposed Plan Change area onto the existing regional cycle network. The connection would also provide local residents and communities with access to recreational opportunities and support accessibility by non-car based modes to key employment or educational destinations, particularly to the south of Palmerston North (such as Massey and Linton Army base).

To ensure safe connectivity and access to the Manawatu River Shared Pathway it is recommended a shared path connection through the reserve area (C) is provided with a minimum width of 3m, providing continuation from the local road network through to the boundary of the site. Physical restrictions (such as bollards or planting) may be required along the property boundary to reduce likelihood of non-authorised vehicles accessing the Manawatu River from proposed Plan Change area.

4.7 Impacts of Construction Traffic

Additional heavy vehicle movements will be expected to access the site during the construction phase of the development which may have the potential to impact on the local road network and wider network surroundings. It is unlikely that the proposed area for rezoning will be developed in a single stage, given there are several different landowners within the existing industrial zone.

Considerations would need to be given to the impacts of development on other landowners, including the ability of businesses to operate safely/efficiently whilst various stages of construction are occurring.

To reduce the impact of construction traffic on the local road and parking network, it is recommended that a Construction Traffic Management Plan (CTMP) is developed and approved for each stage of the development prior to commencing work on the site.

5 Conclusions

This Transport Assessment has considered the transportation related effects of the proposed rezoning of 2.5 hectares of industrial land on Roxburgh Crescent (in Hokowhitu) to medium-density residential. The proposed area included within the Plan Change has the potential to accommodate up to 104 lots (based on a 250m^2 minimum lot size).

On full development of the proposed Plan Change area, the medium-density residential housing is expected to result in approximately 83 peak period trips and 707 daily trips over a typical weekday. This would result in a net reduction in peak hour and all-day traffic demands compared to existing industrial land-use activities within the proposed Plan Change area. There is sufficient capacity available to support traffic generated by the proposed Plan Change area without having a detrimental impact on the safe and efficient operation of the network.

The proposed Plan Change area is well connected to the public transport network with several bus stops located within a 400m walking catchment of the site. The proposed new public transport network for Palmerston North will increase the frequency of services within the vicinity of the proposed Plan Change area, providing connections to key local destinations within Palmerston North, including the city centre and inner business zones. The proposed Plan Change area is also well sited to provide access to the existing and proposed strategic cycle network, including new connections to the Manawatu River Shared Pathway which provides regional connections to key employment and recreational opportunities.

The internal roading network as outlined within the supporting Structure Plan would provide permeability and connectivity between the proposed Plan Change area and the strategic roading network. It is anticipated that development will occur in phases, and that the internal roading network serving the proposed Plan Change area will be developed incrementally as development occurs.

It is noted that the proposed widths for local roads identified within the Structure Plan are narrower than the minimum desired widths defined within PNCC's Engineering Standards for Land Development; however, as demonstrated within this transport assessment, the proposed road network can be developed to adhere with the intended principles of these standards. It is recommended that the following planning provisions and design principles are adopted to support safe and efficient access on the road:

- Provide minimum garage setbacks and fence height limits where properties are serviced from the street to support visibility for vehicles egressing properties;
- Pair driveways servicing adjacent properties (back-to-back) to maximise available space for on-street parking and other street design elements within the berms; and
- Where possible, provide on-site shared parking areas away from the road frontage to minimise the number of vehicle crossings (and hence conflict points) on footpaths passing along residential frontages.

The function of Roxburgh Crescent is expected to change as residential development occurs, including reduced heavy vehicle demands and increasing use by active modes. The timing of any future upgrades to the existing Roxburgh Crescent environment would need to consider the servicing needs of remaining industrial activities within the proposed Plan Change area; however, to reflect its changing function it is recommended that:

- The existing intersection between the Roxburgh Crescent (northern access) and Ruahine Street is upgraded to a "stop" control and parking restrictions are applied to re-enforce sightlines (particularly to the north);
- Kerb build outs are provided at intersections between Roxburgh Crescent and Ruahine Street to reduce crossing distances and improve driver visibility of pedestrians; and
- Continuous footpaths are provided on both sides of Roxburgh Crescent along its full extent.

Appendix A: Trip Generation Rates

Comparison of Trip Generation Rate Literature

Medium Density Residential

To identify the trip generation rates for residential developments, reference has been made to available data within the following industry recognised guidelines:

- The New Zealand Trips and Parking Database (NZTPD);
- New South Wales and Traffic Authority publication - "Guide to Traffic Generating Developments" (RTA); and

The trip generation rates for medium density residential use residential dwellings are shown within Table A1. The trip generation rates are based on a "per dwelling housing" rates.

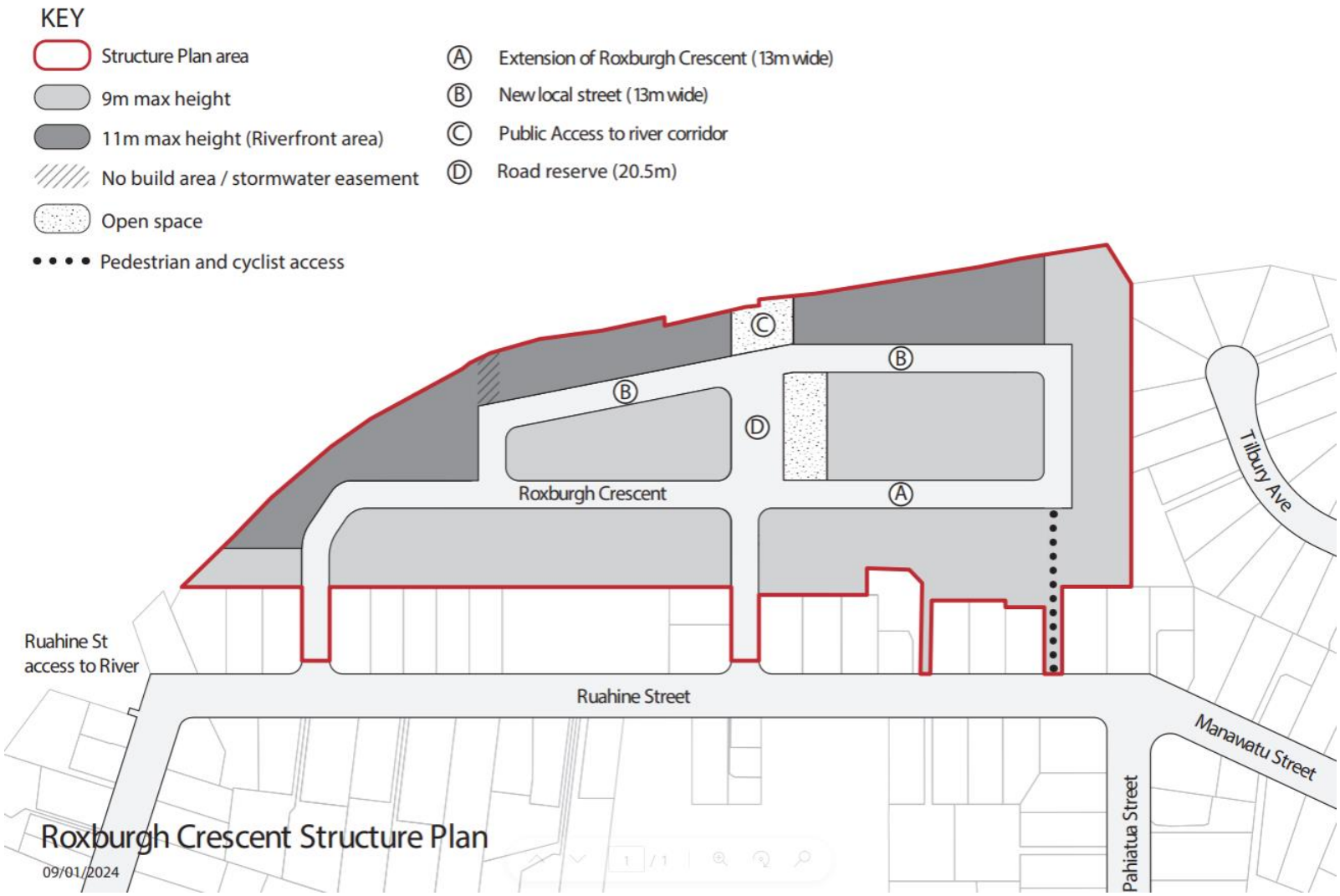
Table A1: Average Trip Generation Rates for Medium Density Residential Dwellings (Various Sources as Named)

SOURCE	RATE	PEAK TRIPS	ALL DAY TRIPS
RTA – Guide to Traffic Generating Developments (Average)	Up to 2 bedrooms	0.4-0.5 / dwelling	4-5 / dwelling
	3 Bedrooms or more	0.5-0.65 / dwelling	5-6.5 / dwelling
New Zealand Trips Data Base (NZTDB)	Per Dwelling (85th Percentile)	0.8 / dwelling	6.8 / dwelling
Adopted Rate		**0.8 / dwelling**	**6.8 / dwelling**

Analysis of trip generation rates indicate that the peak period trip generation rates outlined within the NZTDB are generally higher than those within the RTA Guide to Traffic Generating Developments. The RTA is also based on the number of bedrooms provided within each dwelling (with the view that more bedrooms generate higher travel demands).

To provide a conservative estimate of trips generated by the proposed rezoning, it is recommended that the higher trip generation rates (NZTDB) are used within the assessment.

Appendix B: Proposed Structure Plan Layout



Appendix C: Trip Distribution Assumptions

Trip Distribution Assumptions

Step 1

Departures - Hokowhitu East				
Area Unit Name	Trips (2018)	Direction	Nortbound	Westbound
Aokautere Rural	9	West (Pahiatua St)		1%
Awapuni North	6	West (Pahiatua St)		1%
Awapuni South	9	West (Pahiatua St)		1%
Esplanade	15	West (Pahiatua St)		1%
Feilding Central	9	North (via Ruahine St)	1%	
Highbury East	6	North (via Ruahine St)	1%	
Hokowhitu Central	6	West (Pahiatua St)		1%
Linton Camp	30	West (Pahiatua St)		3%
Milson South	6	North (via Ruahine St)	1%	
Milverton	12	West (Pahiatua St)		1%
Newbury	9	North (via Ruahine St)	1%	
Ohakea / Sanson	9	North (via Ruahine St)	1%	
Palmerston North Airport	9	North (via Ruahine St)	1%	
Palmerston North Central	339	North (via Ruahine St)	33%	
Palmerston North Hospital	69	North (via Ruahine St)	7%	
Papaioea North	33	North (via Ruahine St)	3%	
Papaioea South	27	North (via Ruahine St)	3%	
Pihauatua	12	West (Pahiatua St)		1%
Poutoa	15	West (Pahiatua St)		1%
Roslyn	27	North (via Ruahine St)	3%	
Ruahine	24	West (Pahiatua St)		2%
Ruamahanga	9	North (via Ruahine St)	1%	
Takaro North	21	North (via Ruahine St)	2%	
Takaro South	6	North (via Ruahine St)	1%	
Tremaine	138	North (via Ruahine St)	13%	
Turitea	150	West (Pahiatua St)		15%
West End	12	West (Pahiatua St)		1%
Whakarongo	6	North (via Ruahine St)	1%	
	1,023.00		71%	29%

Step 2 **Trip Distribution (Final)**

	Northbound	Westbound
Census Directional Split	71%	29%
Assumed Directional Split	70%	30%
Routing	Via Ruahine Street	Via Ruahine Street / Pahiatua Street

Appendix D: Local and National Design Guidelines

DESIGN COMPONENT	PNCC ENGINEERING STANDARDS FOR LAND DEVELOPMENT (2023)	PNCC STREET DESIGN MANUAL (2013)	NZS4404:2010
	Local Road	Residential Local	Local Road (1 to 200 Dwellings)
Typical Daily Traffic Volumes (VPD)	0-3,000	0-3,000	Up to 2,000
Min. Road Reserve Width (m)	15.5	14.5	15
Footpaths (m)	2 x 1.8	2 x 2.5-3.0	2 x 1.5
Grass Berms (m)	2 x 1.9	2 x 1.2	-
Cycle Lanes (m)	Shared with Traffic	Shared with Traffic	Shared with Traffic
Traffic Lanes (m)	2 x 3.0	2 x 2.75-3.25	5.5-5.7
Parking Lanes (m)	1 x 2.1	2 x 2.0	Shared in traffic lane up to 100du, separate parking with over 100 du
Min. Carriageway Width (m)	-	9.5 including parking bays	5.5-5.7

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Appendix E. Parks and Reserves Report


ROXBURGH CRESCENT
PLAN CHANGE
PARKS + RESERVES
SERVICING ASSESSMENT 2024

1. Document Control

Task	Name	Position
Prepared by:	Aaron Phillips	Activity Manager - Parks
Reviewed by:	Kathy Dever-Tod	Group Manager – Parks

Version	Description	Date
1	Draft for Internal Comment	15 July 2024
2	Approved for Issue	19 July

PNCC Reference No:	

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2. Scope

2.1 This assessment provides information for the planning of recreation reserves and facilities in the plan change area referred to as the Roxburgh Crescent Plan Change. **Error! Reference source not found.** shows where the plan change area is located in Palmerston North and the surrounding land uses. Figure Two shows the surrounding reserve network.

Figure 1: Plan Change area location

Figure 2: Surrounding reserve network

2.2 The proposed Structure Plan for the Roxburgh Plan Change area, as at July 2024, is contained in Attachment One.

2.3 The category and purpose of each reserve type considered in this assessment is set out in the 2024 Parks and Reserves Asset Management Plan as shown in Table 1.

What we provide	Purpose
Local Reserves	This activity includes: Neighbourhood, Small Neighbourhood, Esplanade Reserves, Suburb, Ecological Reserves, and Special Character Reserves. They provide open space in suburban centres and neighbourhood areas and improve the ability for people to move around the city.
City Wide Reserves	Citywide Reserves service a large area and are described as 'destination facilities due to their unique nature. They contain several amenity aspects not found in Neighbourhood reserves, such as native bush remnants, water features, paddling pools, and large play areas.
Sports fields	Sports fields provide unique spaces for the community to take part in recreational activities with a variety of surfaces for different sports/activities.
Aquatic Facilities	Aquatic facilities provide opportunities for residents to enjoy high quality recreational and competitive swimming and other aquatic activities.
Cemeteries and Crematorium	Council provides three cemeteries and a crematorium to ensure provision is made for persons dying within the district. Council also manages and maintains the historical Terrace End cemetery, which is no longer available for burials, but is of historical value to the community.

Table 1: Type and purpose of reserve categories

3. Walking distance to open space and Neighbourhood Reserves

3.1 As a broad target Council aims to maintain or improve the percentage of residentially zoned land that is within 500 m walking distance of an open space[1].

3.2 80% of the residential properties in the City are currently within 500 m walking distance of an open space reserve which can be a neighbourhood, special character, sportsfield or City reserves.

3.3 For greenfield development Council introduced a target of having medium density development within 400m walking distance of green open space into its Engineering Standards for Land Development[2].

3.4 100% of the Roxburgh proposed plan change area will be within 400 m walking distance of the green open space due to the expansive green space along the Manawatū River, accessible through the central river access point. This is shown in **Error! Reference source not found.**.

Figure 3: walking distance to open space

[1] To any type of reserve that has oepn space, not necessarily a neighbourhood reserve.
[2] This 400 m target is also being proposed for the Medium Density Plan Change under development at the time of writing.

3.5 Neighbourhood Reserves tend to be larger than 2,500 sqm , with a desirable size of 4,500 sqm. They are intended to cater for the community in the surrounding neighbourhood. Neighbourhood reserves generally provide facilities such as seating, amenity development, open space for group play. A proportion of neighbourhood reserve have playgrounds.

3.6 The nearest neighbourhood reserve is at Waterloo Park to the south. The range in walking distance from the plan change area to the Waterloo Park playground will be from 480 m to 830 m. The maximum walking distance of 830 m is shown in shown in

3.7 Figure 4: Maximum distance to a playground

3.8 .

Figure 4: Maximum distance to a playground

3.9 Given the proximity of the Manawatu River open spaces and Waterloo Park playground no new neighbourhood reserve is required in the proposed plan change area.

4. Suburb Reserves

4.1 Suburb Reserves[3] are larger in size than neighbourhood reserves and provide more facilities such as sports fields, toilets and more play facilities. The sizes of suburb reserves range from 11,000m2 to 65,000m2.

4.2 Suburb Reserves, including sportsfields and City Reserves that also serve the Suburb Reserve function, are generally spaced 1 to 1.5 km apart throughout the City.

4.3 The closest suburb reserves to the Roxburgh area is Milverton Park, 2.7 km away, as shown in Figure 5.

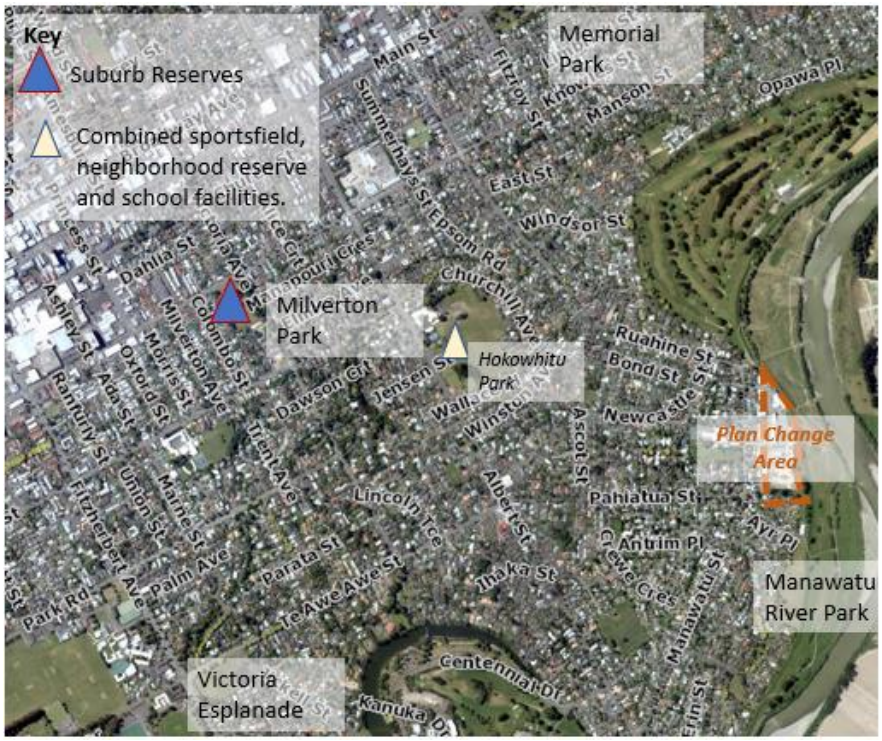


Figure 5: Suburb Reserves

4.4 Hokowhitu Domain, 1.5 km from the plan change area, currently delivers a similar level of service to a Suburb Reserve due to Hokowhitu School being managed in a manner that is open to the neighbourhood reserve and sportsfields. The school facilities include senior playgrounds, high quality outdoor basketball court, pump track and an artificial turf that the community currently has access to.

4.5 There is a risk the school facilities might become unavailable to the community in the future. If that occurred Council would need consider improvements at Hokowhitu Domain to meet Suburb Reserve Level of service.

[3] As per Parks and Reserve Asset Management Plan page 142.

4.6 The Manawatū River Park, a City Reserve, is immediately adjacent to the Roxburgh Plan Change area. This City Reserve Provides the open space and amenity functions of a Suburb Reserve.

4.7 While the access to the Hokowhitu School play facilities cannot be relied on into the future, on balance the high provision of reserves in the area and proximity of Hokowhitu Domain means no new Suburb Reserve is necessary within the Roxburgh Plan Change area.

5. Special Character Reserves

5.1 Special character reserves are unique parks and reserves that have themes or different kinds of facilities to other local reserves. There development is driven by particular unique characteristics such as cultural, historic and geographical features.

5.2 There is no requirement for a special character reserve in the propsoed plan change area.

6. Ecological and Recreational Linkages including Esplanade Reserves

6.1 The purposes of Esplanade Reserves are defined in Section 229 of the Resource Management Act 1991:

> **229 Purposes of esplanade reserves and esplanade strips**
>
> An esplanade reserve or an esplanade strip has 1 or more of the following purposes:
>
> (a) to contribute to the protection of conservation values by, in particular,—
>
> (i) maintaining or enhancing the natural functioning of the adjacent sea, river, or lake; or
>
> (ii) maintaining or enhancing water quality; or
>
> (iii) maintaining or enhancing aquatic habitats; or
>
> (iv) protecting the natural values associated with the esplanade reserve or esplanade strip; or
>
> (v) mitigating natural hazards; or
>
> (b) to enable public access to or along any sea, river, or lake; or
>
> (c) to enable public recreational use of the esplanade reserve or esplanade strip and adjacent sea, river, or lake, where the use is compatible with conservation values.
>
> Section 229: replaced, on 7 July 1993, by section 124 of the Resource Management Amendment Act 1993 (1993 No 65).

6.2 The District Plan sets out the expectations and requirements for Esplanade Reserves in Policies 4.1 and 4.2:

> **OBJECTIVE 4**
>
> **To ensure that the subdivision process secures the provision of esplanade reserves and esplanade strips in appropriate areas.**
>
> **POLICIES**
>
> 4.1 To require 20 metre wide esplanade reserves along rivers whose beds have an average width of three metres or more in respect of new allotments under 4 hectares, subject to 4.3 below.
>
> 4.2 To require 20 metre wide esplanade reserves along the following rivers and streams in respect of new allotments of 4 hectares or more, subject to 4.3 below:
>
> - Manawatu River

- Pohangina River
- Turitea Stream (from the Manawatu River to the City's water supply area)
- Mangaone Stream
- Kahuterawa Stream (from the Manawatu River to a point opposite the present end of the formation of the Kahuterawa Road).

Figure 6: District Plan Esplanade Reserves policies

6.3 The existing Manawatū River Park environment is 85 m to 150 m wide between the proposed plan change area and the channel of the Manawatū River. As such no new esplanade reserves along rivers and streams are required as part of the plan change.

6.4 In terms of connectivity and access the current spacing of access points along the river, within the urban environments, varies with accesses between 350 m and 1 km apart.

6.5 The closet existing publicly accessible River accesses to the plan change area are at Ruahine Street and Ayr Place, shown in Figure 7**Error! Reference source not found.**. They are 670m apart. Both have carparks and sealed access across the stopbanks. The Ayr Place access includes a public toilet.

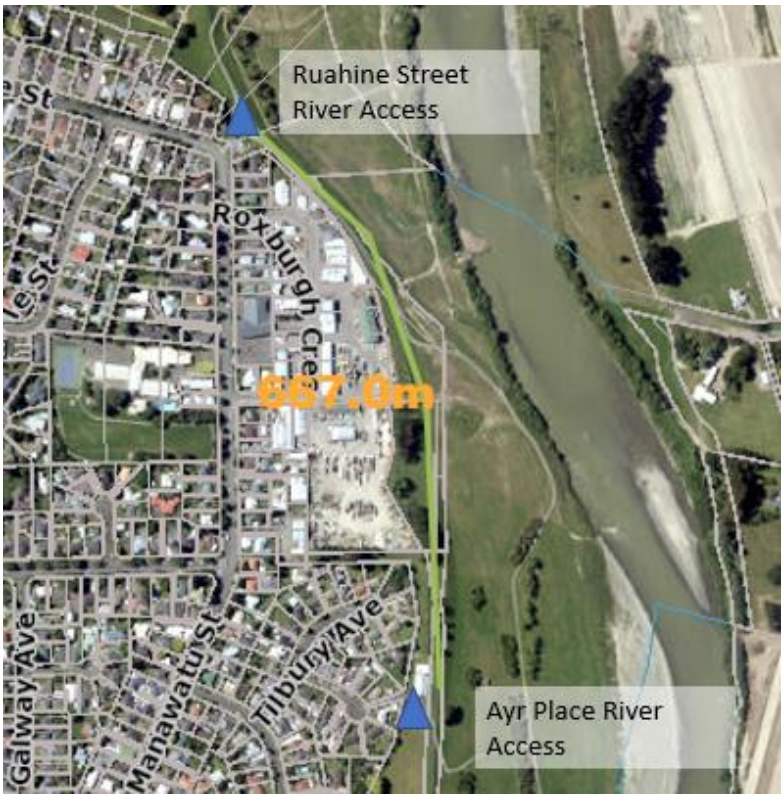


Figure 7: Existing River accesses

6.6 Provision of one new[4] river access as proposed in the plan change would result an access spacing of 350 m, at the higher end of the current level of service.

[4] Council owns the existing river access but it has only been available for service vehicles and events use to date.

6.7 The 2024-2034 Long Term Plan currently allows for construction of a path connection from the prosed Plan Change area to the existing Manawatū River Shared Path should the plan change proceed.

7. Part Waterloo Park relocation for river access enhancement

7.1 Approximately 1,300 sq m of Waterloo Park is laid out in manner that provided a buffer strip (the buffer area) between the existing industrial activities and the residential housing on the southern end of the plan change area. This area is shown in Figure 8.

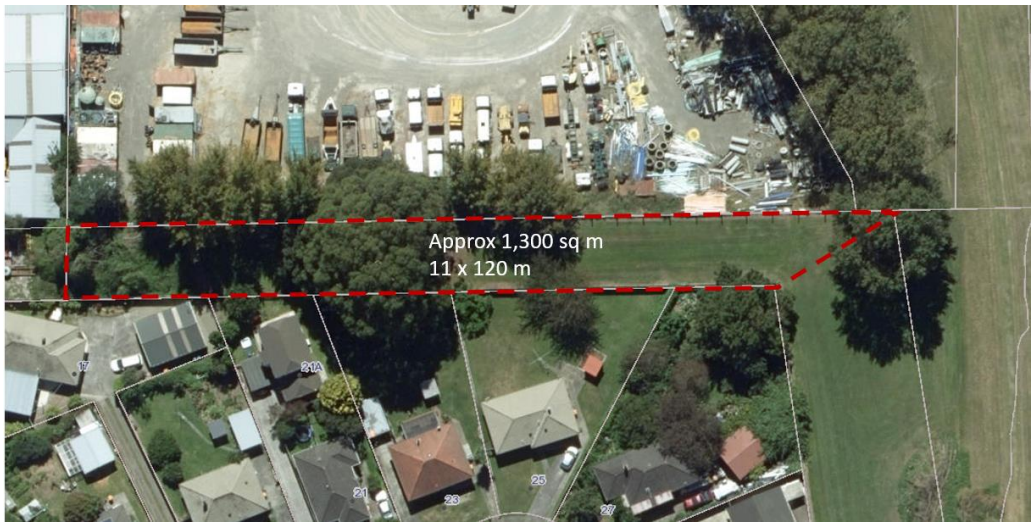


Figure 8: Buffer area of Waterloo Park

7.2 Figure 9, Figure 10 and Figure 11show the area as it was at the time the exchange was considered.

Figure 9: Waterloo Park buffer strip photo 1 - entrance

Figure 10: Waterloo Park buffer strip photo 2 – Gums and Wattles

Figure 11: Waterloo Park buffer strip photo 3 – weed infested

7.3 During the preparation of the proposed plan change the possibility of exchanging the buffer area for land associated with the river entrance within the plan change area was considered.

7.4 An exchange was considered an opportunity to provide better reserve and recreation outcomes than the current location. The exchange was proposed to Council[5] and the community in April/May 2023[6]. Figure 12 shows the proposed exchange in what was then the draft Structure plan.

[5] https://palmerstonnorth.infocouncil.biz/Open/2023/03/SAFC1_20230322_AGN_11162_AT.PDF
[6] https://www.pncc.govt.nz/Participate-Palmy/Have-your-say/Waterloo-Park-land-exchange

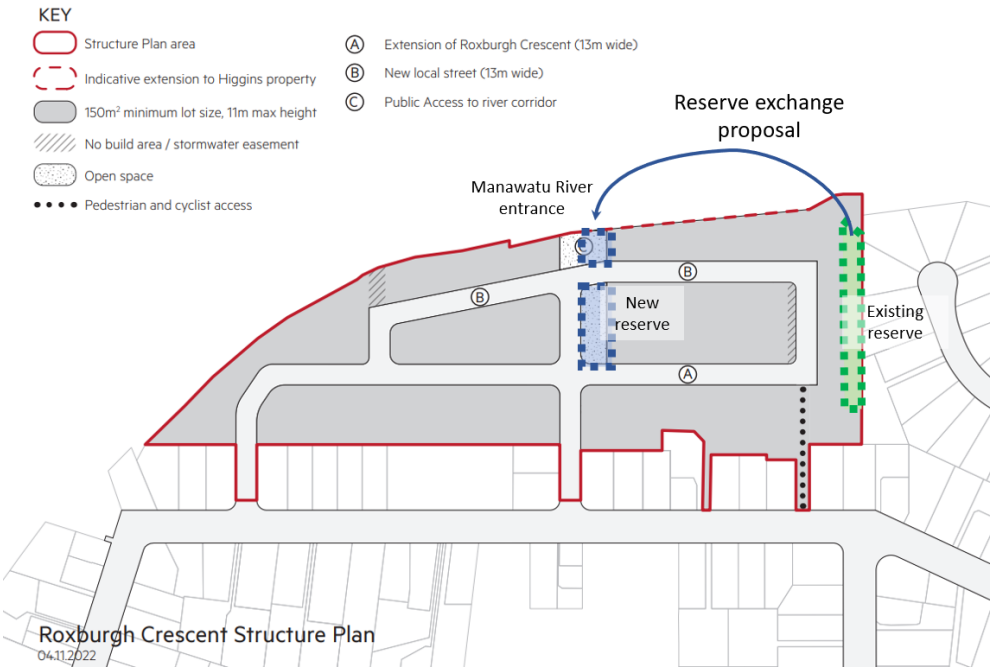


Figure 12: Reserve exchange proposal

7.5 Following submissions, hearings[7], and an officer report[8] Council resolved[9] to proceed with the exchange in December 2023[10].

7.6 An application was made to the Department of Conservation, under the Reserves Act 1977 on 25 January 2024, to approve the exchange proposal. Council received notification the exchange was approved on 16 July 2024. Attachment Two contains Minister of Conservation Authorisation.

7.7 The Department of Conservation approval is subject to:

a. That the Council approve a district plan change which changes the zoning of the Exchange Land to residential; and

b. That the Land Regulatory Delivery Manager, Department of Conservation, approve the survey plan defining the Exchange Land. Acknowledging that minor amendments may be required, the plan shall substantially reflect the layout provided with the application; and

c. That the survey plan gets approved by Land Information New Zealand.

7.8 A subsequent email, contained in Attachment Three, clarified the intent of the condition "That the Council approve a district plan change which changes the zoning of the Exchange Land to

7 https://palmerstonnorth.infocouncil.biz/Open/2023/08/SAFC1_20230801_AGN_11173_AT_EXTRA.PDF

8 https://palmerstonnorth.infocouncil.biz/Open/2023/11/SAFC1_20231115_AGN_11153_AT.PDF

9 The Strategy and Finance Committee recommended that the exchange be declined. Council decided to proceed with the exchange proposal.

10 https://palmerstonnorth.infocouncil.biz/Open/2023/12/COU_20231218_MIN_11127.PDF

residential" as intending to mean that it is a condition that the land around the land received in the exchange is zoned residential.

8. City-wide Reserves

8.1 City Reserves are destinations which are much larger than local reserves. Each city reserve has its own unique character and history, reflected in the theme of the park.

8.2 The purpose of a City Reserve is to provide a large-scale reserve with a range of activities.

8.3 The Manawatū River Park, one of 6 City Reserves, and it bounds the Roxburgh Plan Change area to the east.

8.4 The Manawatū River Framework sets out the expectations and plans for management and development of the Manawatū River Park

8.5 The Manawatū awa is of importance to Rangitāne o Manawatū and Council works collaboratively with Rangitāne on any development of the facilities and amenities along it. This includes the entrances to it and associated water bodes such as the Hokowhitu Lagoon.

8.6 Council owns an existing river access land parcel which is 6m wide and shown in Figure 13. To date this has only been used for service vehicles and special event booked events, not public access.

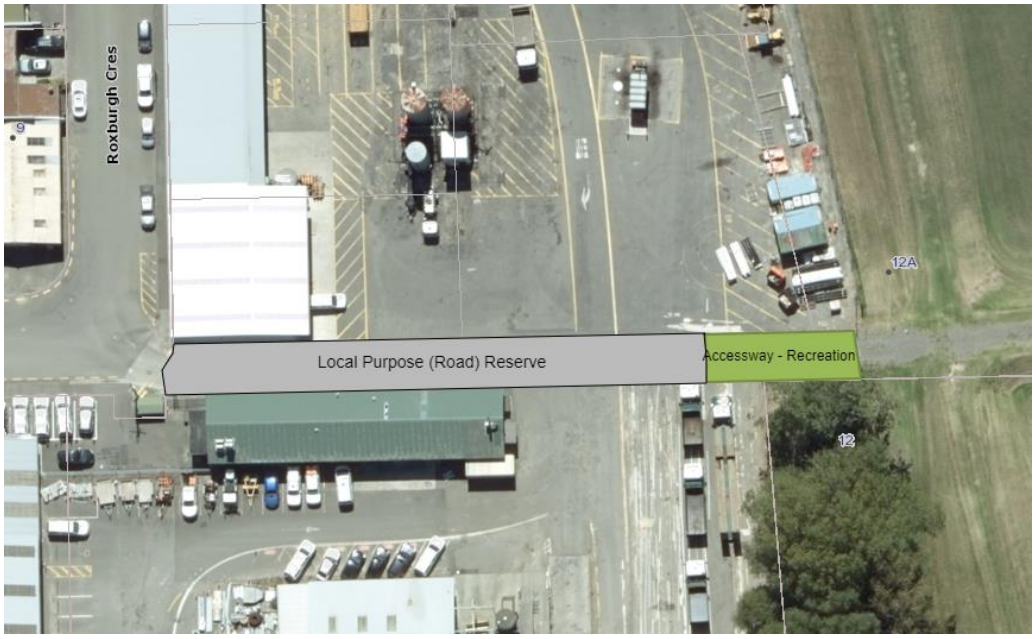


Figure 13: Existing River Access

8.7 The alignment of Roxburgh Crescent means a portion of this access will be required for road and reserve access, shown in grey in Figure 13. A separate reserve declaration process will be required to enable this to occur. This will be notified in parallel with the plan change.

8.8 The road reserve, in the location of the accessway proposed to be vested as road is proposed to be 20.5 m wide, as opposed to the 13 m wide through the rest of the proposed plan change area. This will enable provision of 90 degree car parking in the road reserve adjacent to the proposed reserve exchange area as shown in Figure 14.. Without the provision of the extra road reserve width there would be very limited on street parking available to support the river access.

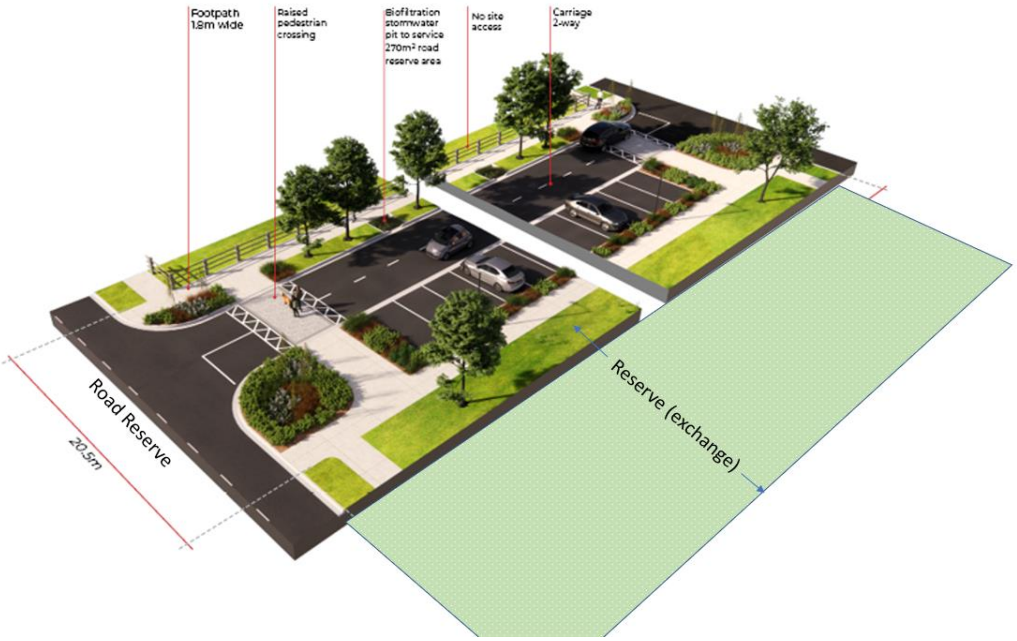


Figure 14: Road Reserve and exchange reserve

8.9 The existing river access point, can be enhanced and improved as part of the plan change by:

- Establishing a width that opens up sight lines to the river, is more inviting and has the potential for some landscaping (within the constraints of the stop bank requirements).
- The width and slope of the access point means opening it up will improve its usefulness as a service vehicle and events access point for the expansive reserves in the vicinity.
- Providing some on-street carparking nearby supports river access use from the wider community. The proposal includes similar arrangement to that at the bottom of Albert Street.
- It's development provides an opportunity to give effect to cultural and river park values.

8.10 The proposed reserve exchange would enhance sight lines and creating an inviting river entrance with more opportunities for tree planting, and rest areas for the start and end of river excursions.

8.11 Council has budgeted $153,000 excluding GST under Programme 1856. Manawatu River Park Roxburgh Entrance Development in the adopted Long Term Plan 2024-34 . This allowed for in 2025/26 to contribute to the development of the river entrance. The assumptions for the budget are:

- Tree planting, over and above what would be required in the road reserve, and a seat in the exchange land

- A contribution to additional car parking in the road reserve, over and above standard n street requirements.
- A contribution to widening the hard seal access up and over the stop bank to width that can accommodate service and event vehicles
- A shared path connection to the existing shared path along the Manawatu River.
- A rubbish bin.
- A contribution towards gates/bollard.
- A contribution to the design and costing for consenting works on the stop bank.
- A contingency amount.

9. Sports Fields

9.1 In 2019/2020 a needs assessment for the provision of an artificial sports field in Palmerston North found:

- Overall supply currently matches demand well but there is an allocation issue, with an oversupply of game fields and undersupply of training fields.
- Over the medium term (the study looked to 2030), based on the population growth scenario rather than code predictions or 5-year trends, there is a projected deficit of 46 team uses per week across both training and playing fields. This included both training and game needs.
- Either a new artificial field or 7-10 new grass fields would be required to bridge this gap.

9.2 Meeting the sports fields demand is planned through the new artificial football pitch planned at Massey University, and in the long term through provision of a cluster of fields in the Kakatangiata Urban Growth Area. Ashhurst Domain also has 7 ha on the upper terrace adjacent to the existing Domain sportsfield area that could be utilised.

9.3 For casual field sport practice or games Waterloo Park and Hokowhitu Domain are 600m to 1.7 km away respectively.

9.4 There is no need for sportsfield provision in the Roxburgh Plan Change area.

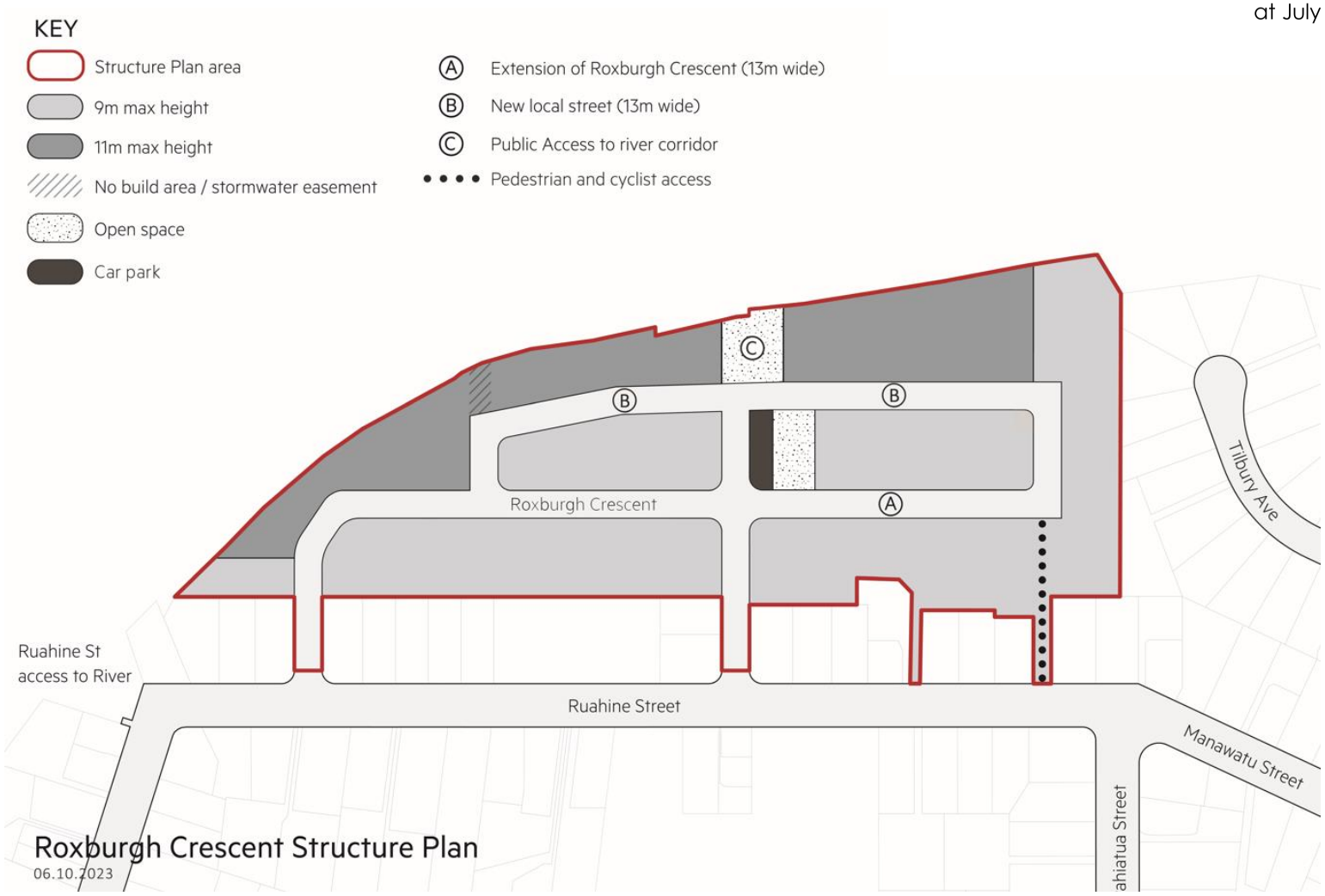
10. Aquatic Facilities

10.1 Council undertook an assessment of future aquatic needs in 2023 and will be considering the feasibility of a new 50 m swimming pool facility in 2024/2025.

10.2 The Roxburgh Plan Change area is not considered as a useful location given it would be difficult to access, remove a considerable potential for housing development and have limited partnership or added value potential compared to other options.

11. Cemeteries

11.1 The provision for burial is well met within the City's existing cemeteries. The area covered in the proposed plan change are not required for future burial provision.


KEY
Structure Plan area
9m max height
11m max height
No build area / stormwater easement
Open space
Car park
Ⓐ Extension of Roxburgh Crescent (13m wide)
Ⓑ New local street (13m wide)
Ⓒ Public Access to river corridor
Pedestrian and cyclist access
Roxburgh Crescent
Tilbury Ave
Ruahine St
access to River
Ruahine Street
Manawatu Street
ahiatua Street
Roxburgh Crescent Structure Plan
06.10.2023

Attachment Two:
Minister of Conservation Authorisation

INSERT

Department of Conservation
Te Papa Atawhai

PALMY
PAPAIOEA
PALMERSTON
NORTH
CITY

12 July 2024

Palmerston North City Council
32 The Square
Palmerston North Central
Palmerston North 4410

Sent by email to: aaron.phillips@pncc.govt.nz

Tēnā koe Aaron

Thank you for your application on behalf of the Palmerston North City Council for the Minister's consent under s15(1) of the Reserves Act 1977, to exchange part of Waterloo Park recreation reserve for private land. More particularly, the application requests consent to exchange 1,300sqm of Waterloo Park being Pt Lot 44 DP 22620 (subject to survey) (the "Existing Reserve Land") for 1,3000sqm (subject to survey) of land adjoining Roxburgh Cresent (the "Exchange Land").

The Minister's decision-making power under s15(1) of the Reserves Act has been delegated to me in my role as Director Regional Operations, Lower North Island. Having reviewed the information provided to the Department by both the Council and the public, I have decided to approve the exchange of the Existing Reserve Land for the Exchange Land, subject to the following conditions:

a) That the Council approve a district plan change which changes the zoning of the Exchange Land to residential; and
b) That the Land Regulatory Delivery Manager, Department of Conservation, approve the survey plan defining the Exchange Land. Acknowledging that minor amendments may be required, the plan shall substantially reflect the layout shown in Appendix A, as provided with the application; and
c) That the survey plan gets approved by Land Information New Zealand.

In making my decision, I have considered the objections raised by the public, the Council's consideration of those objections and the process followed by the Council in reaching its decision. A copy of the decision document is enclosed with this letter.

Once the above conditions have been met, the Statutory Land Management team, Department of Conservation will provide me with a gazette notice to sign authorising the exchange. Once the

Department of Conservation
Te Papa Atawhai

gazette notice is published, the Council will be able to effect the exchange by arranging the transfer of the respective titles.

In the interests of transparency, I will provide a copy of the decision document to a member of the public who has shown strong interest in this decision.

Nāku noa, nā

ALICE HEATHER
Director, Lower North Island
Department of Conservation
Te Papa Atawhai

APPENDIX A:


KEY
Structure Plan area
New Manawatū River entrance
New reserve
Existing reserve
Reserve exchange proposal
Existing reserve
New reserve
Ruahine Street
Ruahine Street
Manawatu Street

10 July 2024 **R267460**

Submission

Alice Heather, Director Regional Operations, Lower North Island

From: **Elizabeth Esson, Statutory Land Management Advisor**

MOC Authorisation – Palmerston North City Council - Exchange of Reserve Land - Recreation Reserve – Part Waterloo Park

Proposal

Your consent is sought, pursuant to section 15 of the Reserves Act 1977 and a delegation from the Minister of Conservation, to exchange part of a Palmerston North City Council (the "Council") recreation reserve for private land to be held as a recreation reserve.

Explanation

The Council is the administering body of a recreation reserve known as Waterloo Park (the "Reserve"). The Reserve contains a 2.85ha parcel of land, described as Lot 44 DP 22620. The Council is proposing to exchange part of Lot 44, being an area of 0.13ha (the "Existing Reserve") for approximately 0.13ha of nearby freehold land owned by a private landowner (the "Exchange Land").

As a result of the exchange, the private landowner will obtain an unencumbered fee simple interest in the Existing Reserve land. The Exchange Land will take on the same status as the Existing Reserve, being recreation reserve vested in the Council[1].

The Existing Reserve comprises a strip of land 11m wide and 120m long with a small stand of wattles and gum trees. The strip is situated between the existing industrial activities in Roxburgh Crescent and five residential properties in Tilbury Avenue.

At the time of the exchange proposal being publicly notified, the Existing Reserve was a dead-end space which the Council considered to have no clear recreational uses. After the proposal to exchange was publicised, a pumpkin patch was established by some of the community.

If the exchange is approved, it is anticipated that the Existing Reserve land would be used for residential housing.

[1] Full Council application ("Application"): DOC-7551376

DOC-7423440

Figure 1 – Existing Reserve to be exchanged.

Figure 2 – Existing Reserve to be exchanged – view from eastern/stopbank end.

DOC-7423440

Intended use of Exchange Land

Council wishes to progress this exchange because they consider the Exchange Land will provide a wider community benefit than retaining the Existing Reserve. Part of the Exchange Land would be used to provide a "*wider river entrance space allowing a better vista and sight line to the river. There is likely (dependent on conditions of the plan change – this is based on early engagement) to be some river entrance feature developed by Rangitāne o Manawatū to be incorporated into the space."*

The balance of the Exchange Land, across the road from the river entrance, would be an open space recreation reserve with the intention being to plant trees to add to the amenity value. The Council advise that *"This would create a pleasant area for accessing the Manawatu River Park, provide opportunities for sitting e.g. while waiting for others in a group to arrive back from an excursion."*

Figure 3 – Shows proposed reserve exchange. The area in blue is the Existing Reserve and the area in green is the Exchange Land. If the exchange is approved, the green area will become reserve and the blue area will become privately owned fee simple land with no reserve status.

Relationship between the exchange process and Proposed District Plan Change – Roxburgh Crescent Residential Area.

The Exchange Land is located in what is currently a light industrial area. Roxburgh Crescent runs through the middle of this industrial area. The Council are progressing a potential change to the district plan to turn this area into a residential zone (the "Plan Change"). If the Plan Change is approved, the Exchange Land will be within a planned brownfield residential development.

The Council have indicated that they will only proceed with the exchange if the Plan Change is approved. One of the reasons the Council resolved to apply for the Minister's approval to exchange the land, is because once the residential development is in place, they consider the Exchange Land will have a wider community benefit than retaining the Existing Land. This reasoning only applies if the Plan Change is approved, and the zoning changed to residential. For this reason, if the Minister approves the exchange, such approval should be conditional on the plan change going ahead.

DOC-7423440

Decision maker

Exchanges of reserve land require authorisation by the Minister, delegated to Operations Manager or Operations Director[2]. It is recommended that this decision be made at the Operations Director level rather than Operations Manager level due to level of public objection and risks associated with allegations made that the Council did not follow the correct process when resolving to approve the exchange. This is explained further on in the submission.

In authorising an exchange pursuant to section 15 Reserves Act 1977, you must be satisfied that the exchange is legally possible (i.e. that the land in question is a reserve, and that it is vested in the administering body), that the process requirements of sections 15 and 120 of the Reserves Act 1977 have been followed, and that the decision overall was one that was reasonably available to the Council.

I recommend that you also consider whether the exchange decision is consistent with the purposes of the Reserves Act, whether it gives effect to Treaty Principles, and all objections received and the comments of the local authority on those objections to ensure the Council has given fair and reasonable consideration to those objections.

The above considerations are anaylysed further in this submission.

Description & Status

Existing Reserve land[3]

1,300sqm, being Pt Lot 44 DP 22620.
NZ Gazette 1961 page 959
Recreation reserve vested in Palmerston North City Council[4].

Exchange Land

1,300sqm approximately, being two parcels of land adjoining Roxburgh Cresent. This area is yet to be surveyed.

As the Exchange Land has not been surveyed, if you consent to the exchange, the consent will be conditional on the survey plan being approved by the Minister's delegate.

Legislation

Section 15(1) of the Reserves Act 1977 provides that the Minister may, by notice in the Gazette, authorise the exchange of the land comprised in any reserve for any other land to be held for the purposes of that reserve.

Section 15 subsections (5) & (6) provide that any reserve land given by way of exchange shall upon exchange be no long subject to any reservation; and that the land acquired by way of exchange shall automatically adopt the same status to which the reserve land was subject.

Section 15(2) requires that the administering body give public notice of its intention to pass a resolution in support of the land exchange, and forward for the Minister's consideration a copy

[2] In this particular case the MOC authorisation is not delegated to Council, as Council ownership of the subject reserve was originally derived from the Crown.
[3] Land status check: DOC-7599494
[4] Gazette notice: DOC-7599495

of any objections, together with the comments of the local authority on those objections, and subsequent resolution[5].

Section 120 sets out the public notification requirements.

Public Notice & Objection

The Council publicly notified the proposed exchange in the Manawatu Standard on 11 April 2023, with a correction to the original notice published on 15 April 2023[6], and the Manawatu Guardian on 13 April, with a correction published 20 April 2023. The closing date for submissions was 17 May 2023.

There were 39 submissions received, including 1 petition. Of the submissions received, 30 oppose the exchange, 1 was neutral and 8 support the exchange[7].

218 people signed the petition opposing the exchange. The petition read:

> *"We request that the Palmerston North City Council decline the proposed land exchange of part of Waterloo Park Reserve.*
>
> *We believe that the retention of the existing green-space reserve area enables the opportunity to develop it as part of an accessible 'orchard' – style community food production zone, which would provide place-making area and a new pedestrian route in the neighbourhood".*

The table below summarises into categories the reasons given by the people who submitted in opposition of the exchange. Note that not all these matters are relevant considerations under the Reserves Act[8].

Matters raised in opposition	# times
Want community garden/park where is	18
Privacy/3 story buildings next to existing houses/housing buffer	11
Loss of reserve/green space	9
Climate change mitigation	5
Create new path connection through	5
Exchange area will be for car parking	4
Loss of birdlife in existing trees	4
Loss of trees	4
Retain as stormwater soak protection for Tilbury Avenue areas	4
Supports developer/new area	4
Green space for small sections in new housing area	3
New reserve will be used for car parking	3
Flooding effects of more housing	1
Housing traffic effects	1
Potential contamination	1
Upgrade Ruahine entrance instead	1

[5] Palmerston North City Council resolution 18 December 2023 – relevant part starting just above item 221-23: Minutes of Council - Monday, 18 December 2023 (infocouncil.biz)
[6] Public notification in Manawatu Standard: DOC-7599502
[7] Copy of all submissions received by the Council: DOC-7551384
[8] For a summary of submissions see pages 68-70 of the above document DOC-7551384.

DOC-7423440

A second table has been provided in which the Council identify which issues are relevant considerations under the Reserves Act and provided responses to those issues. See pages 9-14 of the Decision Request Report linked below[9]. In this report, the Council also provides responses to questions raised by submitters.

Objector Correspondence to the Minister and Department

The Department and the Minister have received correspondence objecting to the exchange and raising concerns with the Council's process.

Most of the correspondence has been from Rosemary Watson who has expressed strong interest in this decision and has provided the Department with extra information. This correspondence is summarised below with footnotes providing copies of the emails and letters.

To the extent that we consider the information Ms Watson has provided relevant to your decision under the Reserves Act, we have addressed it in the following section titled "Process Issues" [redacted]

On 18 December 2023, Ms Watson wrote to the Minister on behalf of herself and a group of concerned citizens seeking information about how the authorisation process works and how she might engage with this process.[10] Ms Watson sent a follow up email to the Minister on 8 January 2024[11]. On 29 January 2024, Ms Watson wrote a further email to the Minister again expressing concern with the process and asking that the Minister's decision be deferred until suitable investigations of the Council process have been made[12]. On 31 January 2023, the Department responded to Ms Watson describing the role of the Minister under section 15 and answering her questions.[13]

Ms Watson wrote further emails to Rachael Jordan, former Principal Advisor Policy and Regulatory Services, Department of Conservation on 1 and 2 February 2024.[14]

On 8 February 2024, Ms Watson provided a letter from Tangi Utikere, MP for Palmerston North.[15] The MP's letter states he is writing in relation to a group of his local constituents who have raised concerns with him regarding due process adopted by the Council when it made the exchange decision. He invites the Minister to consider whether it is appropriate to proceed with deciding on the exchange "whilst my local constituents' complaints regarding the issue are under consideration." It is unclear who is considering the complaints, or what the specific nature of the complaints are.

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[9] Decision request report – Palmerston North City Council - DOC-7551383
[10] Email from Rosemary Watson to Tama Potaka "Palmerston North City Council – upcoming reserve land exchange application" (18 December 2023) CORD-1055 DOC-7537155.
[11] A copy of this email is included in the body of Ms Watson's later email dated 12 June 2024 – see footnote 20.
[12] Correspondence – Rosemary Watson (care of-Doug Kidd) – Waterloo Park (29 January 2024) DOC-7646724
[13] Letter from Rachael Jordan to Rosemary Watson "Palmerston North City Council – upcoming reserve land exchange application" (31 January 2024) CORD-1055 DOC-7537210
[14] Mentioned in email from David Griffin to Harry Evans, Tui Arona and DOC Private Secretaries "CORM-1277 – Correspondence – Rosemary Watson (c/-Doug Kidd) – Waterloo Park" (28 March 2024) DOC-7606558.
[15] Letter from Tangi Utikere to Tama Potaka (2 February 2024) CORD-1086 DOC-7600745.

On 18 April 2024, the Department responded to Ms Watson.[16] We re-explained the role of the Minister under section 15 and responded to specific questions raised in her emails of 1 and 2 February 2024.

On 18 April 2024, Ms Watson responded to the Department.[17] In this letter she questions the timing of Councillor Dennison's notice of motion and provides a letter that she wrote to the Council between the release of the agenda for the 18 December 2024 meeting, and the meeting itself. She also urges us to watch the video recording the 18 December 2023 Council meeting where some Council members express concern with how the process was run[18].

On 13 May 2024, Ms Watson emailed the Department again, this time providing the response of the Council to requests she made under the Local Government Official Information and Meetings Act 1987 (LGOIMA).[19]

On 12 June 2024, Ms Watson emailed the Department with comments following her receipt of information from the Council following further requests she made under LGOIMA[20].

Process Issues - Contains Legal Advice

The correspondence from Ms Watson and Tangi Utikere, MP raised concerns about the Council's process in reaching its decision. While the public's opportunity to engage in the process and raise objections is at the public notification/hearing stage, not at this Ministerial consent stage, [redacted]

Having reviewed the information provided by the Council and by Ms Watson, we identified that there were also some Councillors who expressed concern with the process.

In her correspondence to the Minister on 29 January 2023 (footnote 11), Ms Watson advised that she was representing a group of concerned members of the public who are "*investigating options for legal aid to pursue complaints to both PNCC and the Ombudsman, and for a potential judicial review of the PNCC process/procedures involved*".

[redacted]

[redacted]

[16] Letter from Stacey Wrenn to Rosemary Watson (18 April 2024) CORD-1086 DOC-7607701.
[17] Email from Rosemary Watson to Barry Ashbridge "Fw: CORD-1086 Correspondence Response" (18 April 2024) DOC-7631568.
[18] Video of Council meeting held 18 December 2023 - *https://youtu.be/542R48q7LHA?t=1274*.
[19] Email from Rosemary Watson to Barry Ashbridge "Re[4]: FW: CORD-1086 Correspondence Response – re PNCC Waterloo Park reserve land exchange application" (13 May 2024) DOC-7641196.
[20] Email from Rosemary Watson (care of - Doug Kidd) to Barry Ashbridge (12 June 2024) - Waterloo Park exchange - DOC-7664595
[21] Legal opinion on Palmerston North City Council Waterloo Park Reserve Exchange: DOC-7632464

DOC-7423440

[redacted]

In light of the above, I consider the process requirements of the Reserves Act 1977 have been followed by the Council and there are no other process matters preventing the Minister approving the exchange.

Substantive Issues

As noted above, you must consider whether the Council's decision overall was one that was reasonably available to the Council. You should also consider all objections received and the

[22] Aaron Phillips to Elizabeth Esson "RE: Application for land exchange approval" (15 May 2024) and at DOC-7640445.
[23] Email from Hannah White to Aaron Phillips "RE: Application for land exchange approval" (6 May 2024) and available at DOC-7635399 and Aaron Phillips to Elizabeth Esson "RE: Application for land exchange approval" (15 May 2024) and at DOC-7640445.
[24] Aaron Phillips to Elizabeth Esson "RE: Application for land exchange approval" (15 May 2024) and at DOC-7640445.

DOC-7423440

comments of the Council on those objections to ensure the Council has given fair and reasonable consideration to those objections.

Fair and reasonable consideration of objections

Written objections were provided to the Strategy and Finance Committee.[25] The Committee received a summary of written submissions from officers.[26] The summary provided a table of the matters raised in opposition to the exchange from written submissions. A brief summary of social media comments was also provided. The Committee also heard from seven submitters who were opposed to the exchange and requested to be heard.[27] In a further report to the Committee dated 15 November 2023, the table of matters raised in opposition was reproduced, and each matter was addressed in greater detail.[28]

[redacted] we consider the Council has given fair and reasonable consideration to the objections. I note in particular that in the report to the Committee dated 15 November 2023, two additional proposals (in addition to approving or declining the exchange) were considered, based on the objections of submitters.[29] This shows the Council has considered and responded to the objections.

Overall reasonableness

[redacted]

The reasons recorded in the minutes of the 18 December 2023 meeting for the decision itself (as opposed to Councillor Dennison's notice of motion) speak solely to the objections and Reserves Act considerations.[30] The Standing Orders state that the minutes, once authorised, are the prima facie evidence of the proceedings they relate to.[31] Reasons a) to d) seek to address the concerns of submitters about other matters, including the impact on the Existing Reserve. Reason e) relates to the advantage that the proposed reserve has over the Existing Reserve, namely that it would have a wider community benefit. The "community benefit" is explained in the report as:

a) "[B]etter located greenspace that would enhance a river connection";[32] and

[25] Strategy and Finance Committee "Agenda Extraordinary Strategy and Finance Committee" (1 August 2023) at 65-124 and available here.
[26] Strategy and Finance Committee "Minutes Extraordinary Strategy and Finance Committee" (1 August 2023) at [47-23] and available here. A copy of the summary is available at Strategy and Finance Committee "Agenda Extraordinary Strategy and Finance Committee" (1 August 2023) at 65-124.
[27] Strategy and Finance Committee "Minutes Extraordinary Strategy and Finance Committee" (1 August 2023) at 6-8 and available here.
[28] Strategy and Finance Committee "Agenda" (15 November 2023) and available here.
[29] Strategy and Finance Committee "Agenda" (15 November 2023) at 89 and available here.
[30] Strategy and Finance Committee "Minutes" (18 December 2023) at [221-23] and available here.
[31] SO 3.11.3.
[32] Strategy and Finance Committee "Agenda" (15 November 2023) at 105 and available here.

DOC-7423440

b) "[B]eing wider and adjacent to a road reserve, there would be options for large tree species to be planted [than if the current reserve were retained].[33]

Generally speaking, in the context of this process, it is the reserve administering body, rather than the Minister, which is better placed to assess and meet the needs of the community regarding the provision of areas for reserves, open spaces and community facilities. Further, it is primarily a matter for the Council as to how much it is willing to expend on the reserve, and how much weight to accord public objections.

In light of the above, I consider you can be satisfied that the Council gave fair and reasonable consideration to the objections, and that the overall decision was one that was reasonably available to the Council.

The Minister does not have to agree with the administering body's decision to approve the exchange. However, the Minister can refuse to authorise it if he comes to a different view, even where all the above requirements are met.

Treaty of Waitangi

The Council advised that "*Rangitāne o Manawatū are our primary mana whenua partners*" and "*Council's engagement with Rangitāne is structured with the Te Whiri Kōkō monthly hui ensuring Rangitāne iwi leaders get information on specific projects and determine who within their respective organisations will consider anything further, if required…In this case the leaders at Te Whiri Kōkō directed the response should be given by Tānenuiarangi Manawatū Incorporated.*"[34]

The Council consulted with Tānenuiarangi Manawatū Incorporated who provided a submission supporting the exchange.[35]

Council has further advised in response to inquiry from DOC that "*Council is not aware of specific interests of other iwi or hapū in this area*" and that they are "*confident that the views of associated iwi and hapū have been sought in regard to this process.*"[36]

Council note that they have been working with Rangitāne on a number of river entrances and enhancements over the least five years.[37] Council intend to work with Rangitāne on a possible river entrance feature to be incorporated into the exchange land.[38]

I consider you can be satisfied that the exchange decision gives effect to Treaty Principles.

Authority for Approval & Gazettal

Sections 15(1) of the Reserves Act 1977 and Instruments of Delegation from the Minister of Conservation dated 8 September 2015; and the Director General dated 9 September 2015.

---

[33] Strategy and Finance Committee "Agenda" (15 November 2023) at 105 and available here.
[34] Insert doccm reference to email from Aaron Phillips to Elizabeth Esson dated 27 May 2024 "RE: Application for land exchange approval."
[35] Strategy and Finance Committee "Agenda Extraordinary Strategy and Finance Committee" (1 August 2023) at 98 and available here.
[36] Insert doccm reference to email from Aaron Phillips to Elizabeth Esson dated 27 May 2024 "RE: Application for land exchange approval."
[37] Insert doccm reference to email from Aaron Phillips to Elizabeth Esson dated 27 May 2024 "RE: Application for land exchange approval."
[38] Insert doccm reference to email from Aaron Phillps to Elizabeth Esson dated 3 April 2024 "RE: Application for land exchange approval 1 / 2".

DOC-7423440

Conservation General Policy

The Conservation General Policy only applies to Public Conservation Lands; which, as defined in the CGP, does not apply to reserves administered by other agencies. As the subject reserve is administered by the Council, the CGP is therefore not relevant to your decision.

Financial Implications

The Existing Reserve and the Exchange Land are considered to be of approximately equal value. The Crown retains a reversionary interest in Crown derived reserves vested in an administering body. As the Exchange Land will take on the same status as the Existing Reserve, the Crown's reversionary interest will transfer to the Exchange Land. As such, there are no financial implications for the Crown; and normal cost recovery fees will apply for time and disbursements in considering the application.

Recommendation

It is recommended that you approve the Council's exchange proposal under section 15(1) of the Reserves Act 1977, subject to the following conditions:

a) That the Council approve a district plan change which changes the zoning of the Exchange Land to residential; and
b) That the Land Regulatory Delivery Manager, Department of Conservation, approve the survey plan defining the Exchange Land. Acknowledging that minor amendments may be required, the plan shall substantially reflect the layout shown in figure 3 above, as provided with the application; and
c) That the survey plan gets approved by Land Information New Zealand.

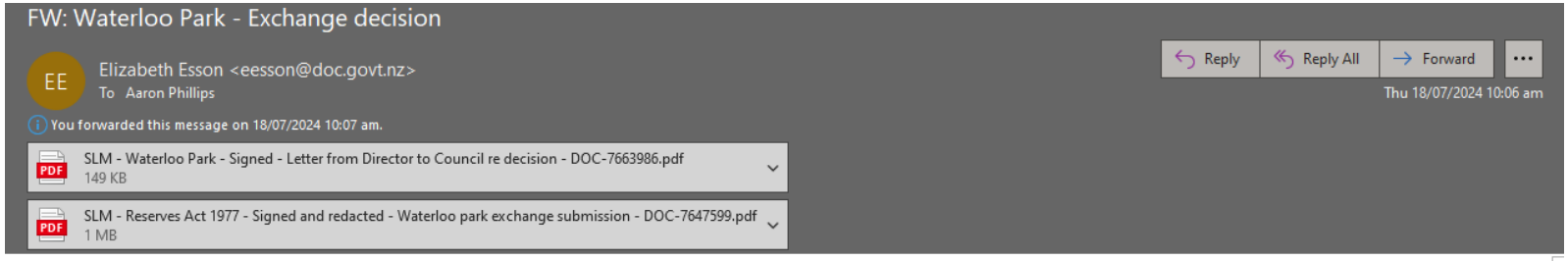
Once the above conditions have been met and the survey plan finalised and approved by Land Information New Zealand, you will be provided with a Gazette notice to sign authorising the exchange. Following DOC publication of the gazette notice authorising the exchange, Council will arrange transfers under the Land Transfer Act 2017.

Decision

RECOMMENDATION: APPROVED ~~/ NOT APPROVED~~

ALICE HEATHER
Director, Lower North Island
Date 15/07/2024

DOC-7423440



FW: Waterloo Park - Exchange decision

EE

Elizabeth Esson <eesson@doc.govt.nz>
To Aaron Phillips

Reply | Reply All | Forward | ...
Thu 18/07/2024 10:06 am

You forwarded this message on 18/07/2024 10:07 am.

SLM - Waterloo Park - Signed - Letter from Director to Council re decision - DOC-7663986.pdf
149 KB

SLM - Reserves Act 1977 - Signed and redacted - Waterloo park exchange submission - DOC-7647599.pdf
1 MB

Hi Aaron,

Thank you for your call to clarify some points in the attached letter which we provided you on 16 July 2024. To confirm:

1) The area to be exchanged is 1,300sqm not 13,000sqm. This was a typo in the letter. It can be seen from the submission which refers to 0.13ha being exchanged for 0.13ha, that was the intention of both parties.

2) Regarding the condition that the Exchange Land be zoned residential. The intent of this is that the land surrounding the Exchange Land be zoned to residential (as opposed to the current industrial zoning). You are right that the actual Exchange Land itself will need to be zoned to align with its recreation reserve status so we understand this will require a recreation zoning. The intention of this clause was to ensure that the exchange wouldn't take place if the surrounding land remained industrial because the new reserve would then not serve the intended purpose.

Kind regards,

Liz

Elizabeth Esson
Statutory Land Management Advisor I Christchurch Office
Level 3 Grand Central 161 Cashel Street Christchurch 8011
P: 027 202 1618 E: eesson@doc.govt.nz

Department of Conservation
Te Papa Atawhai

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Appendix F. Contamination Report – PSI

REPORT

Tonkin+Taylor

Roxburgh Crescent - Ground Contamination Desk Study

Prepared for
Palmerston North City Council
Prepared by
Tonkin & Taylor Ltd
Date
October 2019
Job Number
85442.009

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: Roxburgh Crescent - Ground Contamination Desk Study					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
28/2/2019	1	Draft	N Pilcher	J Coakley	M Jacka
24/10/19	2	Final	N Pilcher	J Coakley	M Jacka

Distribution:

Palmerston North City Council	1 copy
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[redacted] Privacy Act 2020

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1 Introduction

Tonkin & Taylor Ltd (T+T) has been commissioned by Palmerston North City Council (PNCC) to undertake a ground contamination desk study investigation of the 1-42 Roxburgh Crescent site of approximately 50,000 m^2 ("the Site"). The outer boundary of the site is presented below in **Figure 1**.

This report has been prepared in general accordance with the requirements for a PSI (Preliminary Site Investigation) referred to in the NES Soil regulations[1], and as outlined in the MfE Contaminated Land Management Guidelines[2]. The persons undertaking, managing, reviewing, and certifying this investigation are Suitably Qualified and Experienced Practitioners (SQEP), as required by the NES Soil and defined in the NES Soil Users' Guide (April 2012).

This investigation was undertaken in accordance with our proposal dated 21 November 2018 (revision 2) and included collection and laboratory analysis of shallow soil samples.

Figure 1: The Site location (Source: PNCC)

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[2] Ministry for the Environment, updated 2011, Contaminated land management guidelines No. 1: *Reporting on Contaminated Sites in New Zealand*.

1.1 Background and objectives

The past and present land uses at the site are known to have included:

- Commercial analytical laboratory;
- Storage of fuel and other chemicals;
- Metal electroplating;
- Engineering workshops;
- Metal fabrication;
- Bitumen manufacture and/or bulk storage;
- Petrol, diesel and kerosene storage – underground tanks holding 110,000 litres;
- Motor vehicle workshops;
- Commercial refuelling of vehicles;
- Metal and other scrapyards; and
- Commercial painting.

Some of these activities have the potential to cause land contamination. These activities are defined by the Ministry for the Environment in the Hazardous Activities and Industries List (HAIL). If an activity or industry on the HAIL is, or has occurred on a site, the NES Soil applies to proposed soil disturbance and/or land development activities.

T+T has undertaken this investigation to assess whether HAIL activities have occurred at the Site, and the potential for these activities to have resulted in ground contamination. This report also assesses the need for further investigation, and identifies the likely resource consenting requirements for disturbance and/or development of potentially contaminated land, as required under the NES Soil and other relevant regulations.

1.2 Proposed development

We understand that PNCC intends to prepare a plan change to rezone the Site from industrial to residential. This would give effect to strategic direction for a potential rezoned residential development at the Site.

1.3 Scope of work

The scope of work for this investigation comprised the following:

- Review of:
  - Property files and environmental records held by Horizons Regional Council and PNCC;
  - Historic and current certificates of title;
  - Selected historical aerial photographs;
  - Alexander Turnbull Library collection photographic archive;
  - Horizons Regional Council (HRC)'s Selected Land Use Register (SLUR) files for the Site; and
  - Council records of pollution incidents;
- A site walkover inspection;
- Analysis of up to ten soil samples (collected as part of the Stage 1a – Site investigation (CPTs and BHs) and Preliminary Liquefaction Assessment) for metals, asbestos, and polycyclic aromatic hydrocarbons (PAH); and
- Preparation of this document.

This report documents our findings and comments on the potential for ground contamination at the Site, in the context of the proposed plan change to rezone the site from industrial to residential.

2 Site description

2.1 Site identification

The Site is located in Hokowhitu, approximately 2.5 km east of the Square, in Palmerston North. The Site comprises 36 properties. **Table 1** provides site identification information. For ease of reference, the numbers in the first column correlate with the property numbers shown in **Figure 2**. Current certificates of title and a table summarising historical certificates of title (**Table A1**) are provided in **Appendix A.**

Table 1: Site identification

Street address			
1 - 42 Roxburgh Crescent, Hokowhitu, Palmerston North			
	Title number	**Legal description**	**Site proprietor** Privacy Act 2020
1	WN24D/392	Lot 1 Deposited Plan 53779, 1,192 m2	[redacted]
2	WN42A/206	Lot 1 Deposited Plan 75001, 640 m2	
3	WN42A/207	Lot 2 Deposited Plan 75001, 460 m2	
4	WN13A/787	Part Lot 40 Deposited Plan 25417, 846 m2	
5	WN54D/303	Not available	
6	WN5B/345	Lot 26 Deposited Plan 25417, 684 m2	
7	WN31C/76	Lot 1 Deposited Plan 19692, 795 m2	
8	WN5B/344	Lot 25 Deposited Plan 25417, 773 m2	
9	WN6D/1272	Lot 2 Deposited Plan 19692, 753 m2	
10	WN5B/343	Lot 24 Deposited Plan 25417, 784 m2	
11	WN7C/1331	Lot 3 Deposited Plan 19692, 1,066 m2	
12	WN27D/276	Lot 21-23 Deposited Plan 25417, 2,221 m2	
13	WN7C/1332	Lot 4 Deposited Plan 19692, 1,197 m2	
14	WN31C/74	Lot 1 Deposited Plan 60866, 1,497 m2	
15	WN31C/75	Lot 2 Deposited Plan 60866, 5,484 m2	
16	WN41D/651	Lot 1 Deposited Plan 74592, 15,313 m2	
17	PARCEL BOUNDARY	NOT APPLICABLE - ROAD - Roxburgh Crescent	
18	WN7D/1031	Lot 14 Deposited Plan 25417, 1,157 m2	
19	WN14C/175	Lot 15 Deposited Plan 25417, 796 m2	
20	WN5A/390	Lot 3-4 Deposited Plan 28656, 764 m2	
21	WN13D/525	Part Lot 5 Deposited Plan 17578, 847 m2	
22	WN16A/363	Lot 6 Deposited Plan 17578, 886 m2	

	Title number	Legal description	Site proprietor
23	146537	Lot 2 Deposited Plan 22494 and Lot 1 Deposited Plan 32023 and Lot 1 Deposited Plan 32973 and Lot 2 Deposited Plan 322018, 1,615 m2	[redacted]
24	WN8A/1495	Lot 33 Deposited Plan 25417, 579m2	
25	WN8A/614	Lot 32 Deposited Plan 25417, 601 m2	
26	WN8A/306	Lot 31 Deposited Plan 25417, 601 m2	
27	WN5B/347	Lot 30 Deposited Plan 25417, 601 m2	
28	WN5B/346	Lot 29 Deposited Plan 25417, 596 m2	
29	WN5B/341	Lot 28 Deposited Plan 25417, 596 m2	
30	WN42C/927	Lot 2 Deposited Plan 76087, 779 m2	
31	WN27D/779	Lot 2-3 Deposited Plan 58111, 283 m2	
32	WN27D/778	Lot 1 Deposited Plan 58111, 273 m2	
33	WN15C/910	Lot 19 Deposited Plan 25417, 556 m2	
34	WN8B/176	Lot 16 Deposited Plan 25417, 488 m2	
35	WN52D/53	Lot 17 Deposited Plan 25417, 241 m2	
36	WNE1/459	Lot 18 Deposited Plan 25417, 480 m2	
Site area			
Approximately 50,000 m^2			
Zoning			
Industrial			

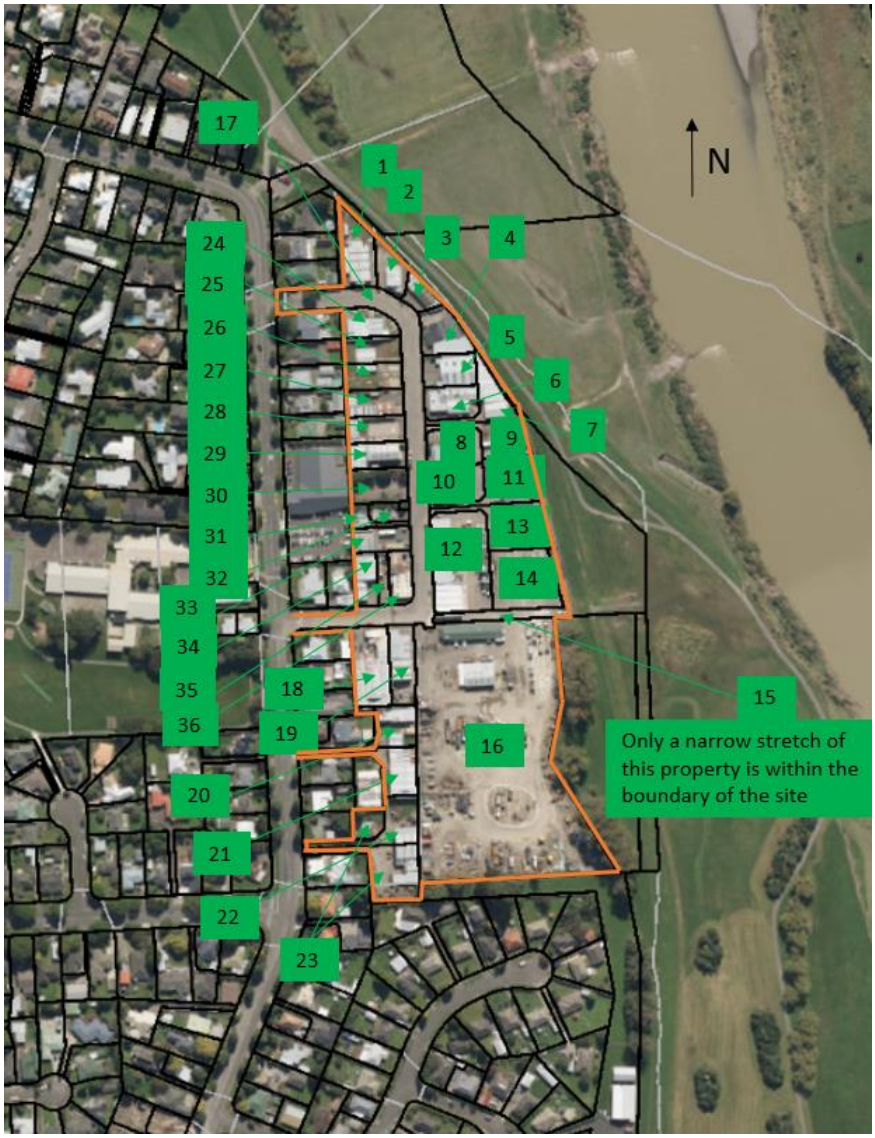

Figure 2: Property identification used within this report for ease of reference

2.2 Site condition

An Environmental Scientist completed a site walkover inspection on 31 January 2019. Relevant observations made at the time of the inspection are summarised below. Selected photographs are included in **Appendix B**.

The Site is currently primarily used for industrial and commercial businesses but at least one residential dwelling is present. The Site contains the following features:

- The land is primarily flat and paved. Some of the surrounding land slopes down to the east towards the Manawatu River, but this is a beyond the stop bank/bridle path;
- Roxburgh Crescent generally runs from north to south of the Site, curving to the west at both the northern and southern ends;
- The south eastern corner is a Higgins site which contains a soil/gravel stockpiles, a scrap yard, laboratory, bitumen bulk storage, painting facilities, chemical storage, wash down area and refuelling station;
- Industrial business warehouses and workshops dominate most of the remaining site. These are predominantly companies which trade in: engineering, automobile repair, construction/joinery, electroplating/metal fabrication, electrical contracting and security;
- Other businesses include scale/balance suppliers, a dance school and a children's playground equipment manufacturer;
- At least one two-storey residential dwelling is present on the Site;
- A warehouse appears to be under construction at the southern end of the Site;
- An uncovered carpark area is located in the central western segment of the Site; and
- At least one warehouse appeared to be disused.

2.3 Surrounding land use

The land uses in the area surrounding the Site include:

- North – Manawatu Riverside Walkway and Bridle Track, beyond that is the Palmerston North Golf Course;
- South – Residential properties, Tillbury Ave;
- East – Manawatu River and Manawatu Riverside Walkway and Bridle Track; and
- West – Ruahine St, Reformed Church of Palmerston North, Winchester School, Winchester Store, residential properties.

2.4 Geology

A summary of available geological information for the area is presented in this section.

2.4.1 Published geology

The published geology beneath the site is described by Lee & Begg, 2002.[3] The site is located on Holocene river deposits, the main rock being alluvial gravel and sub rock listed as sand, silt, clay and peat.

Figure 3: Published geology of the Site (source: Lee & Begg, 2002)

2.5 Hydrogeology

Groundwater is expected to occur at about 8.5 m depth throughout the site. Groundwater is predicted to flow in an easterly direction towards the Manawatu River.

[3] Lee, J.M.; Begg, J.G. (compilers) 2002: Geology of the Wairarapa area: scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences Limited. Institute of Geological & Nuclear Sciences 1:250,000 geological map 11. 66 p. + 1 folded map.

3 Site history

Historical information relating to the site was collected from a variety of sources. The information presented documents on-site activities, except for the aerial photograph review where comments are also provided on readily observable surrounding land use. The information that has been reviewed is summarised in this section. A more detailed review of the available information is included in **Appendix C.**

3.1 General history of the site and vicinity

The site might have been subject to flooding in 1941. Aerial images of the site are unavailable, but areas nearby to the south appear to be under water.

Prior to and including 1986, the Manawatu River ran close to the eastern side of the site, especially at the northern tip. Between 1966 and 1986, in the wedge of land which widens to the south between the site and the river was a quarry. This was likely alluvial gravel.

At some point between 1986 and 2005 the course of the river changed so that it flowed further away from the site and a grassy area was developed where the river had previously run. At some stage during this period a stopbank and the Manawatu riverside walk was formed.

The site itself appears to be predominantly pasture/bare land through to the 1950s, with only minor buildings beginning to be developed in the south west corner for unknown use. Between 1966 and 1986 aerial imaging shows that the southern end of the site was a market garden and in 1986 the area just north of this appears to be used as a landfill or for stockpiling.

Overall, the site appears to have been used primarily for industrial business use which began extensive development in the late 1950s and 1960s with the construction of various factories, store sheds and workshops. This development continued through the 1970s and 1980s, with some new workshops, warehouses and offices developed and a range of additions/alterations to existing buildings. In the 2000s a property in the north east of the site (38-38A Roxburgh Crescent) was converted partially into a residential dwelling. Some fire damage on the property was noted in 2013 and some buildings appear to have been demolished between 1966 and 1986 and others between 2007 and 2008.

The types of land use of the site have included:

- Building and construction;
- Civil engineers/construction and roading;
- Motor vehicle and engineering;
- Electrical;
- Market gardens;
- Landfill/stockpiling (tentative);
- Residential; and
- Other, including a dance school, playground equipment design and manufacture, scales/weighbridge suppliers, commercial laboratory.

The largest property on the site is occupied by Higgins Contractors Limited for civil engineering, construction and roading. A range of activities have been carried out on site, including:

- Underground and above ground bulk storage of kerosene, petrol, and diesel (up to 110,000 L);
- Bulk storage of bitumen in tanks;
- Polishing shop;
- Engineering workshop;
- Vehicle wash area;
- Dangerous good store – thinners and paints;
- Spray booth;
- Vehicle wash and refuelling areas; and
- Scrapyard for tyres, chemical containers, steel, stockpiles of soil.

Council records of sites associated with hazardous substances

Horizons Regional Council provided information that identifies two potentially contaminated sites within the site, although the information provided did not indicate the exact locations. The nature of the contamination was described as:

- HAIL: F4 – Motor vehicle workshops
  Potential Contaminants: F8 – Hydrocarbon fuels, metals in workshops; and
- HAIL: F8 – Transport depots of yards including areas used for refuelling or the bulk storage of hazardous substances
  Potential Contaminants: F8 – Hydrocarbon fuels, metals in workshops.

The communication from Horizons Regional Council is provided in **Appendix D**.

Incidents involving discharges to air or land

Horizons Regional Council advised of a range of incidents including:

- Report of a “discharge of red substance from pipe near Higgins Depot into Manawatu River”;
- Discharge of degreasing agent from the Higgins yard into the stormwater system;
- Dead stock in the nearby Manawatu river;
- Odour from Higgins site – tar fumes, bitumen, asphalt;
- Diesel spill from Higgins site; and
- Open burning of waste at Zanders Engineering.

The communication from Horizons Regional Council is provided in **Appendix D**.

4 Site characterisation

This section characterises the likely and potential contamination status of the site based on the available information as presented in **Sections 2** and **3** of this report.

4.1 Potential for contamination

This investigation has identified that HAIL activities were (or are likely to have been) undertaken at the site. The activities, potential contaminants and an assessment of the likelihood, potential magnitude, and possible extent of contamination are presented in **Table 2** below. The inferred locations of these activities are presented in **Appendix E.**

Table 2: Potential for contamination

Site use and photograph/Appendix E reference	Land use activity and HAIL reference	Potential contaminants
Higgins have an onsite analytical laboratory (1)	Commercial analytical laboratory sites (A3)	Wide range of organic and inorganic compounds including solvents, acids, metals, and mercury
Market gardens can be seen in 1966 and 1986 aerial images (2)	Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds (A10)	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates, and organochlorines (eg, endosulfan on golf and bowling greens)
Bulk storage tanks for diesel and kerosene (3)	Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground (A13)	Hydrocarbons including BTEX, PAHs, and solvents; lead and other metals, particularly if waste oil handled
Higgins site – wash bay, paint shop and lean to, underground storage tanks (possibly removed) (4)	Storage tanks or drums for fuel, chemicals or liquid waste (A17)	Wide range of chemicals (organic and inorganic), and biological hazards
At the front of Higgins Laboratory is an electrical transformer (5)	Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment (B2)	Polychlorinated biphenyls (PCBs), hydrocarbons, copper, tin, lead, and mercury

Site use and photograph/Appendix E reference	Land use activity and HAIL reference	Potential contaminants
Electroplating Manawatu Ltd (6)	Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds (D3)	Metals (zinc, aluminium, cadmium, chromium, lead, copper, and tin), acids (sulphuric, nitric, hydrochloric, and phosphoric), cyanide; flourine and barium (from Al processing)
TigPro Engineering Ltd (stainless steel, mild steel and aluminium fabrication) The Tin Shop (7)	Engineering workshops with metal fabrication (D5)	Metals and oxides of iron, nickel, copper, chromium, magnesium and manganese; range of organic compounds used for cleaning including BTEX, solvents
Higgins site has hot bitumen storage tanks and dispensing units (8)	Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant) (E2)	Petroleum hydrocarbons and PAHs
Riverside Motors (historical) GA Zander Ltd (heavy vehicle and general engineers) Higgins workshop Trackweld Manawatu Viper Classics Ian Capstick Motor Bodies (historical) (9)	Motor vehicle workshops (F4)	Hydrocarbons including PAHs, solvents, and metals contained in waste oil
Higgins refuelling station (10)	Service stations including retail or commercial refuelling facilities (F7)	Petroleum hydrocarbons (BTEX, PAHs) and lead
Possible landfill mounds can be seen in the 1986 aerial image to the south of the site. This may be a private stockpile of soil and other items. (11)	Landfill sites (G3)	Dependent on original waste composition, wide range of hydrocarbons and metals, organic acids, landfill gas, and ammonia
Higgins (12)	Scrap yards including automotive dismantling, wrecking or scrap metal yards (G4)	Metals, petroleum hydrocarbons (particularly lube oils), solvents used for cleaning, and PCBs

Site use and photograph/Appendix E reference	Land use activity and HAIL reference	Potential contaminants
Buildings on site were principally developed between the 1950s and 2000s when asbestos was in common use. Building records confirm that asbestos was used in some structures (3 and 17 Roxburgh Crescent). Some buildings have also been demolished. It is possible that asbestos was lost to ground during construction or demolition of the buildings, including burying offcuts/waste materials, and/or by subsequent damage to or maintenance of exterior ACM cladding (e.g. sanding or water blasting for repainting). If asbestos contamination occurs it is most likely to reside in the shallow soils in 'halos' immediately around (or beneath for wastes) the buildings, unless mobilised by soil disturbance or water runoff. (A range of areas could be asbestos contaminated but asbestos is specifically noted in the PNCC property files held at the sites identified as 13a)	Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment (I) (This activity would only constitute a HAIL activity if the asbestos concentrations are sufficient to pose a risk to human health)	Asbestos as fibres, fines or fragments
38 Roxburgh Crescent has been fire damaged (extent unknown) (13b)		Polycyclic aromatic hydrocarbons (PAH), metals
Structures have been present on the site and surrounds when lead-based paints were in use. Damage to or maintenance of painted surfaces (e.g. sanding or water blasting for repainting) has the potential to release lead flakes or dusts to ground. If lead contamination occurs it is most likely to reside in the shallow in 'halos' immediately around the buildings, unless mobilised by soil disturbance or water runoff	Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment (I)	Lead

4.2 Preliminary conceptual site model

A conceptual site model as defined by the Ministry for the Environment in the Contaminated Land Management Guidelines[4], sets out known and potential sources of contamination, potential exposure pathways, and potential receptors. For there to be an effect from the proposed activity there has to be a contamination source and a mechanism (pathway) for contamination to affect human health or the environment (receptor).

A preliminary conceptual site model has been developed for the proposed activity which takes into account the available information about the site, and our understanding of the potential effects on human health and the environment. The model is presented below in **Table 3**.

[4] Ministry for the Environment, updated 2011, *Contaminated Land Management Guidelines No. 5 Site Investigation and Analysis of Soils*

Table 3: Preliminary conceptual site model

Source	Pathway	Receptor	Pathway Assessment
Heavy metal, PAH, organochlorine and metal pesticides contamination in fill material	Dermal contact	Excavation workers and future maintenance workers	Potentially complete should contamination exist and depending on future land use (e.g. residential)
	Ingestion of soil		
	Inhalation of dust		
	Dermal contact	Future site users	
	Ingestion of soil		
	Inhalation of dust		
	Groundwater	Freshwater ecological receptors	Incomplete: Groundwater is not considered a pathway to ecological receptors because the potential contaminants are not highly mobile in groundwater
		Groundwater users	Incomplete: Given that the shallow aquifer is not artesian and given that the shallow aquifer is unlikely to be used for potable purposes given that the area is serviced by PNCC's reticulated water supply it is considered that the shallow aquifer is not classified as sensitive with regard to groundwater use
Asbestos within fill material	Inhalation of dust	Excavation workers and future maintenance workers	Potentially complete should contamination exist and depending on future land use
		Future site users	
Hydrocarbon contamination at the soil/groundwater interface	Outdoor air inhalation (both soil and groundwater)	Excavation workers and future maintenance workers	Potentially complete should contamination exist and depending on future land use
	Indoor air inhalation (both soil and groundwater)	Future site users	
	Groundwater	Freshwater ecological receptors	Incomplete: Given that the nearest water body, Manawatu River, is greater than 100 m from the site, groundwater is not considered a pathway to ecological receptors
		Groundwater users	Incomplete: Given that the shallow aquifer is not artesian and given that the shallow aquifer is unlikely to be used for potable purposes given that the area is serviced by PNCC's reticulated water supply it is considered that the shallow aquifer is not classified as sensitive with regard to groundwater use

5 Investigation works

5.1 Sample locations

Three boreholes were drilled on the site on 17 and 18 December 2018. Borehole locations were selected by T+T on the basis of access, land owner permission, presence of overhead and buried services and traffic management considerations. The borehole locations are shown in **Table 4** below and the map in **Appendix F**.

Table 4: Borehole Summary

BH ID	Location (NZTM)		Ground Surface Elevation RL (m)*	Depth (mbgl)
	Easting (m)	Northing (m)		
BH-01	1824516.755	5529090.489	6.9	11.45
BH-02	1824614.695	5528873.857	8.1	11.45
BH-03	1824583.643	5528754.197	4.9	11.45

* All datum relative to NZVD2016

5.2 Strata encountered

The general profile encountered was:

- Silty/sandy gravel (0-0.8 m, likely fill);
- Silty sand (0.8 – 1.5 m, likely natural from this layer onwards);
- Sandy gravel (1.5 – 6 m);
- Gravelly sand (6 – 8.4 m) with a variable wood layer (7.5 – 8 m); and
- Sandy gravel (8 – 11.45 m).

The first 0 – 0.8 m was generally interpreted to be fill based on location, and gravel roundness and visual observations of differences between this material and the surrounding alluvial river deposits.

5.3 Soil sampling procedure

Soil samples were collected on 5 February 2019 from each of the three cores at depths ranging between 0.05 m and 0.7 m.

Soil sampling was undertaken in general accordance with the requirements of the NES Soil[5], CLMG No. 5[6], and NZ Asbestos Guidelines. Soil samples were collected according to the following procedure:

- Freshly gloved hands were used to collect the discrete soil samples from the core boxes;
- Samples were placed into laboratory supplied sample containers;
- Sampling equipment was decontaminated between cores and depths using clean water and Decon 90 (a phosphate-free detergent) rinses; and
- Samples were shipped to IANZ accredited Hill Laboratories under chain of custody Documentation for analysis.

[5] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[6] Contaminated Land Management Guideline No.5 – Site Investigation and Analysis of Soils, Ministry for the Environment, 2011.

5.4 Laboratory analysis

The laboratory testing was undertaken by Hills Laboratories, which is accredited by International Accreditation New Zealand (IANZ). At least one sample from each of the three boreholes was tested by Hill Laboratories for:

- Asbestos (presence/absence);
- Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc); and
- Polycyclic aromatic hydrocarbons (PAH).

Results are summarised in **Table G1** and **G2** in **Appendix G** and the original laboratory results are provided in **Appendix H**.

5.5 Laboratory result interpretation

Asbestos was not detected in any of the three analysed soil samples. All five samples analysed for heavy metals and PAH were below the soil contaminant guidelines values for human health and (where data was available) below the predicted background soil concentrations for the area.

However, there was a delay between soil core collection and sampling, so the PAH results may be an underestimation of the actual contamination in the soil. Further, the very limited number of samples and analyses are unlikely to be representative of soil conditions across the 50,000 m^2 site and so further, more comprehensive soil analysis will be required if the site is to be re-developed.

6 Regulatory implications

The rules and associated assessment criteria relating to the control of contaminated sites in the Palmerston North region are specified in the following regulations:

- Health and Safety at Work (Asbestos) Regulation (2016);
- NES Soil; and
- Horizon Region's One Plan.

6.1 Health and Safety at Work (Asbestos) Regulations 2016

The management of asbestos in soils is regulated under the Health and Safety at Work (Asbestos) Regulations 2016 (Asbestos Regulations). In order to help achieve compliance with the Asbestos Regulations, WorkSafe New Zealand has prepared an Approved Code of Practice (ACoP): Management and Removal of Asbestos (September 2016). The ACoP refers readers to the "New Zealand Guidelines for Assessing and Managing Asbestos in Soil" (Asbestos in Soil Guidelines) which were published in November 2017 by BRANZ Ltd.

The key requirements of the Regulations and ACoP are that works involving asbestos contaminated soils must be undertaken with appropriate asbestos controls in place and that contaminated soil removed from site must be taken to an approved disposal site. **Table 5** provides a summary of the requirements as provided in the New Zealand Guidelines for Assessing and managing Asbestos in Soil.

Table 5: Requirements for sites contaminated with asbestos fibres/ fibrous asbestos (AF/FA)

Asbestos fines/fibres in soil (i.e. FA + AF)	Airborne contamination	Summary of requirements as outlined in the NZ Asbestos Guidelines
Greater than 1% w/w	May to lead to airborne contamination that exceeds trace level (i.e. >0.01 fibres/mL)	**Class A asbestos removal works** Work must be carried out by a Class A licenced asbestos removalist. Works are subject to an Asbestos Management Plan, asbestos controls, air monitoring, and clearance. Resource consent required under the NES Soil as a restricted discretionary activity.
Greater than 0.01% but less than or equal to 1%	May to lead to airborne contamination that exceeds trace level (i.e. >0.01 fibres/mL)	**Class B asbestos removal works** Work must be carried out by a Class A or B licenced asbestos removalist. Works are subject to an Asbestos Management Plan, asbestos controls, air monitoring, and clearance. Resource consent required under the NES Soil as a restricted discretionary activity.
Greater than 0.001% w/w but less than or equal to 0.01% w/w	May to lead to airborne contamination that exceeds trace level (i.e. >0.01 fibres/mL)	**Asbestos-related works** Work does not need to be carried out by a Class A or B licenced asbestos removalist. Asbestos controls, PPE, air monitoring, clearance inspections as required and basic decontamination requirements. Resource consent required under the NES Soil as a restricted discretionary activity.
Less than 0.001% w/w	Not likely to lead to airborne contamination that exceeds trace level (i.e. <0.01 fibres/mL)	**Unlicensed asbestos removal work** Standard earthworks controls required. No asbestos specific PPE if SQEP confirms unlikely to exceed trace levels in air monitoring (0.01 f/ml) and/or if air monitoring confirms asbestos below 0.01 f/ml. Air monitoring/clearance not required. Foot wash and used PPE collection area required. Resource consent required under the NES Soil as a controlled activity.

6.2 NES Soil

6.2.1 Applicability

The NES Soil came into effect on 1 January 2012. This legislation sets out nationally consistent planning controls appropriate to district and city councils for assessing contaminants in soil with regard to human health.

The NES Soil applies to specific activities on land where a HAIL activity has, or is more likely than not to have occurred. Activities covered under the NES Soil include soil disturbance, soil sampling, fuel systems removal, subdivision and land use change.

The following **Table 6**, as provided in the NES Soil Users Guide (April 2012), confirms the NES Soil applies to the site.

Table 6: PSI checklist

NES Soil Requirement	Applicable to site?
Is an activity described on the HAIL currently being undertaken on the piece of land to which this application applies?	*Yes*
Has an activity described on the HAIL ever been undertaken on the piece of land to which this application applies?	*Yes*
Is it more likely than not that an activity described on HAIL is being or has been undertaken on the piece of land to which this application applies?	*Yes*
If 'Yes' to any of the above, then the NES Soil may apply. **The five activities to which the NES applies are:**	
Is the activity you propose to undertake removing or replacing a fuel storage system or parts of it?	*No*
Is the activity you propose to undertake sampling soil?	*No*
Is the activity you propose to undertake disturbing soil?	*No*
Is the activity you propose to undertake subdividing land?	*No*
Is the activity you propose to undertake changing the use of the land?	*Yes*
Conclusion: The NES Soil applies to the proposed site within the proposed Roxburgh redevelopment area described in **Section 2** above.	

6.2.2 NES Soil activity status

The NES Soil identifies a number of permitted activity standards relating to the activities to which the NES applies (identified in **Table 6** above). An assessment against the likely compliance with these standards, and therefore the potential need for resource consent under the NES Soil, has been undertaken below:

6.2.2.1 Soil sampling

It is anticipated that further soil sampling will be required should a Detailed Site Investigation (DSI) of the site be required. Soil sampling activities are permitted subject to the following standards:

1 Controls to minimise the exposure of humans to mobilised contaminants must be implemented and maintained until the soil is reinstated to an erosion-resistant state;

2 The soil must be reinstated to an erosion-resistant state within one month after the serving of the purpose for which the activity was done;

3 Soil must not be taken away from the site in the course of the activity, except as samples taken for the purpose of laboratory analysis; and

4 The integrity of a structure designed to contain contaminated soil or other contaminated material must not be compromised.

It is anticipated that any future soil sampling works will be able to meet these permitted activity standards, and it is therefore unlikely that resource consent under the NES would be required for those works.

6.2.2.2 Soil disturbance

It is anticipated that any future redevelopment of the subject site would involve bulk earthworks (i.e. those required to prepare roads and building platforms). Soil disturbance activities are permitted under the NES subject to the following standards:

1 Controls to minimise the exposure of humans to mobilised contaminants must be implemented and maintained until the soil is reinstated to an erosion-resistant state;

2 The soil must be reinstated to an erosion-resistant state within one month after the serving of the purpose for which the activity was done;

3 The volume of the disturbance of the soil of the piece of land must be no more than 25 m^3 per 500 m^2;

4 A maximum of 5 m^3 per 500 m^2 of soil may be taken away per year (excluding material taken away for laboratory testing);

5 Soil taken away in the course of the activity must be disposed of at a facility authorised to receive soil of that kind;

6 The duration of land disturbance must be no longer than two months; and

7 The integrity of a structure designed to contain contaminated soil or other contaminated material must not be compromised.

The site, the whole of which this report considers a HAIL site, has an approximate area of 50,000 m^2. The permitted soil disturbance and disposal thresholds are therefore interpreted to be:

- Soil disturbance – 2,500 m^3; and
- Soil disposal – 500 m^3 per year.

Ground disturbance or excavation works exceeding these thresholds, or that are unable to meet the other permitted activity standards for soil disturbance identified above, will require consent under the NES Soil regulations.

6.2.2.3 Subdividing or changing use

It is understood that any future redevelopment of the site would involve changing the existing land-use, and some future subdivision. Subdividing or changing the existing use of land is a permitted activity under the NES only when the following activities are met:

1 A preliminary site investigation of the land or piece of land must exist;

2 The report on the preliminary site investigation must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land;

3 The report must be accompanied by a relevant site plan to which the report is referenced; and

4 The consent authority must have the report and plan.

Changing land-use or subdivision is currently unable to meet the permitted activity standards identified above. Soil testing (normally in the form of a DSI) will be required to determine the likelihood of risk to human health resulting from any future redevelopment. Subject to the investigation findings a Site Management Plan (SMP) or Remedial Action Plan (RAP) may be required to be submitted in support of a future consent application.

6.3 Regional Plan

The Horizon's One Plan identifies a number of policies, objectives and methods relating to the management of contaminated sites (Objective 3-5 and Policies 3-14 and 3-15), however for the most part it does not specify any rules relating to the management of contaminated sites. The notable exception relevant to this proposal is Rule 14-18, which relates to the discharge of stormwater to surface water and land. The rule provides for the discharges of stormwater to both surface water and land as a permitted activity, subject to a number of standards. Rule 14-18(a) (ii) in particular may be relevant to this site, and has been replicated below:

The discharge must not include stormwater from any:

(a)(ii) Contaminated land where the contaminants of concern may be entrained by the stormwater

If the stormwater discharges resulting from the site during or after redevelopment were unable to meet this standard, it would require resource consent as a restricted discretionary activity under Rule 14-19 of the One Plan.

We recommend that potential for contaminants of concern becoming entrained in stormwater discharge is something could be considered during the preparation of a DSI.

It should also be noted that, depending on the nature of works associated with the redevelopment of the site, a broad range of consents may be required from Horizons Regional Council or Palmerston North City Council (i.e. those relating to general land disturbance, discharges, or diversions of ground and surface water). These and other requirements have not been assessed as part of this PSI.

7 Conclusions

T+T has been engaged by PNCC to undertake a ground contamination desk study investigation for the Roxburgh Crescent re-zoning area. The objective of the investigation was to assess whether HAIL activities have occurred at the site, and the likely implications.

A summary of key findings are presented below:

The ground contamination investigation identified that the following HAIL activities have been (or may have been) undertaken at the site:

- A commercial analytical laboratory site;
- Use of land as a market garden;
- A petroleum depot and/or bulk storage of petroleum or petrochemicals above or below ground;
- Storage tanks or drums for fuel, chemicals or liquid waste;
- Electrical transformers;
- Metal treatment or coating, including electroplating;
- Engineering workshops with metal fabrication;
- Asphalt or bitumen manufacture or bulk storage;
- Motor vehicle workshops;
- Service stations including retail or commercial refuelling facilities;
- A landfill site;
- Scrap yards including automotive dismantling, wrecking or scrap metal yards;
- Structures potentially constructed of or containing asbestos;
- Structures potentially present on the site and surrounds when lead-based paints were in use; and
- A fire damaged structure (extent unknown).

The NES Soil applies to the proposed works because:

- HAIL activities are more than likely to have occurred on the site;
- Land use change/subdivision is proposed; and
- There is no DSI to show that concentrations of contaminants are within background concentrations.

Three shallow soil samples were collected and tested for heavy metals, PAH, and asbestos, showing concentrations below expected background concentrations. However, the conclusions which can be drawn from this are limited because the samples are not likely to be representative of soils across the site that may have been impacted by contamination. This is because insufficient numbers of samples could be tested from this investigation to provide a representative characterisation at the site (eg the fill could contain asbestos and other contamination that would require remedial works to allow residential development).

A DSI will be required in order to determine whether future change of land use or subdivision will require a consent under the NES Soil. If a consent is required, there may be a need for further work at the site related to remediation of contamination and/or development and implementation of a Site Management Plan.

8 Applicability

This report has been prepared for the exclusive use of our client Palmerston North City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on discrete sampling data. The nature and continuity of subsoil away from the sampling points are inferred and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Natalie Pilcher	Mike Jacka
Environmental Scientist	Project Director

NPIL
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Appendix B: Site walkover photographs

Photograph 1: Higgins analytical laboratory (source: GoogleMaps 2019)

Photograph 2: Market gardens – see 1966 and 1986 historical aerial photographs (Appendix I)

Photograph 3: Higgins diesel and kerosene tanks

Photograph 4a: Example of storage drums (Higgins site)

Photograph 4b: Example of storage tank (Higgins site)

Photograph 4c: Example of storage tanks (Higgins wash area)

Photograph 4d: Example of storage tank (Higgins)

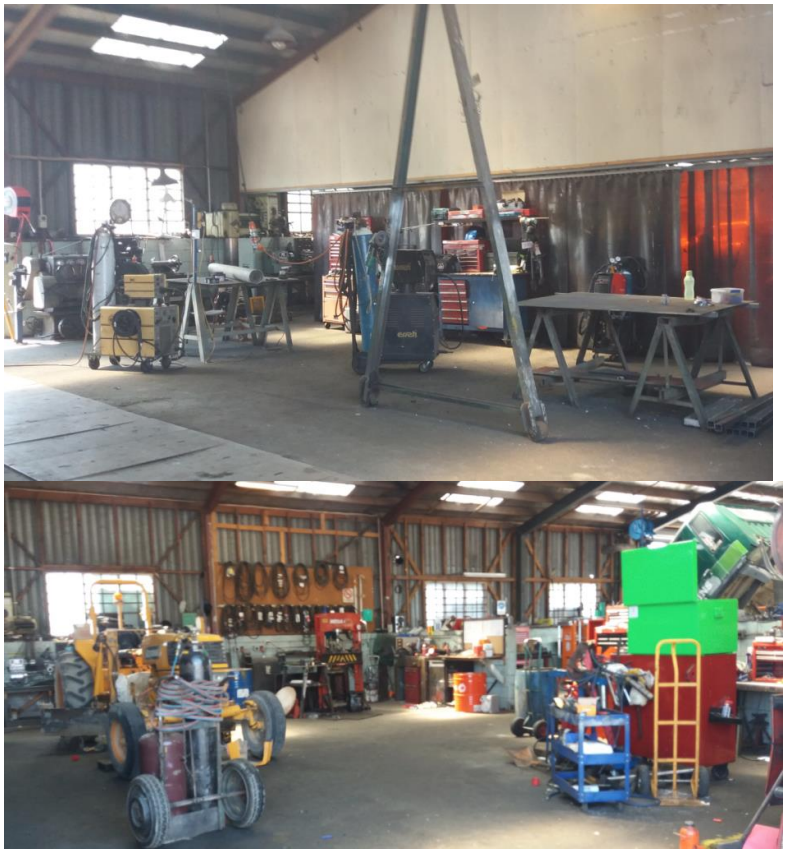
Photograph 5: Electrical Transformer

Photograph 6: Electroplating activities

Photograph 7: TigPro Engineering – stainless steel, mild steel and aluminium fabrication

Photograph 8: Bitumen manufacture and storage

Photograph 9a: vehicle/engineering workshop – GA Zander



Photograph 9b: vehicle/engineering workshops – Higgins

Photograph 9c: vehicle/engineering workshop – Riverside Motors (historical)

Photograph 9d: vehicle/engineering workshop – Trackweld Manawatu Ltd

Photograph 9e: vehicle/engineering workshop – Viper Classics

Photograph 9f: vehicle/engineering workshop – Ian Capstick Motor Bodies (historic)

Photo 10: Refuelling area

Photograph 11: Possible landfill site– see 1986 historical aerial photographs (Appendix I)

Photograph 12a: Scrap yard – Soil stockpile

Photograph 12b: Scrap yard – Storage containers (empty)

Photograph 12c: Scrap yard – Used tyres

Photograph 12d: Scrap yard – Steel

Photograph 13a: 3-5 Roxburgh Crescent – Asbestos cement sheeting on exterior of a building on site identified in Property files held by PNCC

Photograph 13b: 17 Roxburgh Crescent – Asbestos cement on exterior of a building on site identified in Property files held by PNCC

Appendix C: Site History Information

Historical information relating to the site has been collected from a variety of sources. The information presented documents on-site activities, except for the aerial photograph review, where comments are also provided on readily observable surrounding land use. The information that has been reviewed is summarised in this appendix.

C1 Certificates of title

Current and historic certificates of title for the site have been reviewed. A summary of the information reviewed is presented in **Appendix A**.

C2 Historical aerial photographs

Historical aerial photographs from Google Earth Pro, Opus and PNCC's Manawatu Heritage website (https://manawatuheritage.pncc.govt.nz) have been reviewed. Features of the site and surrounding land are summarised from each aerial photograph in **Table C.1**. Copies of the aerial photographs are included in **Appendix I**.

Table C.1: Summary of aerial photograph review

Date, run number and source	Key site features	Surrounding land features
1945 Aerial photo of Palmerston North in – no. 2 South-East quarter of City (Source: https://manawatuheritage.pncc.govt.nz)	The site appears to be predominantly bare land/ pasture with the sourthern end of what is now Roxburgh Crescent visible, running from east to west. Some small buildings and vegetation appear in the SW corner. A square of the site is sectioned off, possibly by a row of trees in the NE but the land within this appears vacant.	The site is flanked by pasture/bare land on all sides, other than the south and south east where some buildings stand of unknown purpose. The Manawatu river is to the east, and Ruahine St is clearly visible to the west.
1954 Aerial shot of Palmerston North taken by a Royal New Zealand Air Force Vampire from 35,000 feet. 2 November, 1954 (Source: https://manawatuheritage.pncc.govt.nz)	A white line appears to run The river appears to run through the site, approximately parallel to the Manawatu River. It is unclear whether this is alluvial deposits or the outline of the stopbank. Some further building development can be seen in the SW of the site and the south of Roxburgh Crescent appears to be formed.	No changes other than some further development of the buildings in the areas identified above.

Date, run number and source	Key site features	Surrounding land features
1966, Opus image	The whole of the Roxburgh Crescent road is now present. A number of buildings have been erected, mostly in the centre of the site and south west. The remainder of the site appears to be agricultural or used for pasture.	An area of what appears to be exposed gravel sits to the east of the site and west of the river. The river runs very close to the edge of the site, especially at the northern tip.
1979 View of the Manawatu River and Eastern suburbs of Palmerston North. (Source: NZ Aerial Mapping Ltd, SN 5408 C/16, https://manawatuheritage.pncc.govt.nz)	Resolution too low for more detailed comment than that the site appears to be occupied by a number of buildings.	Resolution too low for detailed comment.
1986, Opus image	A number of buildings have been erected along the western and eastern edges of the site. At least two smaller buildings have been demolished on the eastern side in the mid section of the site. Some trees have disappeared and been replaced by a large building in the middle of the north half of the site. A number of vehicles are present, mostly in the middle of the eastern side of the site. A market garden area section can be seen in the southern eastern corner of the site. Directly north of this appears to be a landfill mounds/stockpile area.	A quarry appears to be situated on a wedge of land to the east of the southern half of site, just west of the river. The land on the western side of the site is much more developed with many more buildings and trees present. The south western edge of the site is now lined with buildings, likely houses.
2005, Google Earth Pro	The market gardens and landfill type mounds visible in the 1986 image are no longer present from the south eastern section of the site and this appears to now be occupied with vehicles and miscellaneous items. A building in the centre of the site has appeared (now used as the Higgins vehicle shelter) Additional buildings have also been erected in the north east of the site.	The north east of the site is flanked with a grassy area and Manawatu riverside track – the river's course runs much further away from the site than it did in the previous image. The quarry area does not appear to be active and is largely grassed over.
2006, Google Earth Pro	No obvious change from 2005.	No obvious change from 2005.

Date, run number and source	Key site features	Surrounding land features
2007, Google Earth Pro	A set of small buildings to the NW appears to have been demolished (29-31 Roxburgh).	No obvious change from 2005.
2011, Google Earth Pro	A building appears at the site described above.	Some trees have been removed along the Manawatu Riverside walkway to the east of the site.
2012, Google Earth Pro	No obvious change from 2011.	No obvious change from 2011.
2013, Google Earth Pro	No obvious change from 2012 (note that site is partly obscured by cloud).	No obvious change from 2012 (note that site is partly obscured by cloud)e from 2012.
2014, Google Earth Pro	No obvious change from 2013.	No obvious change from 2013.
2015, Google Earth Pro	No obvious change from 2014.	No obvious change from 2014.
2017, Google Earth Pro	No obvious change from 2015.	No obvious change from 2015.

C3 Council property files

No property files were available from Horizons Regional Council.

PNCC provided resource consents that have been applied for or granted on each of the titles as outlined in **Appendix J**.

C4 Council records of sites associated with hazardous substances

Horizons Regional Council provided information that identifies two potentially contaminated sites within the site, although the information provided did not indicate the exact locations. The nature of the contamination was described as:

- HAIL: F4 – Motor vehicle workshops
  Potential Contaminants: F8 - Hydrocarbon fuels, metals in workshops; and
- HAIL: F8 – Transport depots of yards including areas used for refuelling or the bulk storage of hazardous substances
  Potential Contaminants: F8 – Hydrocarbon fuels, metals in workshops.

The communication from Horizons Regional Council is provided in **Appendix D**.

C5 Council contamination enquiry

Horizons Regional Council advised of a range of incidents including:

- Report of a “discharge of red substance from pipe near Higgins Depot into Manawatu River”;
- Discharge of degreasing agent from the Higgins yard into the stormwater system;
- Dead stock in the nearby Manawatu river;
- Odour from Higgins site – tar fumes, bitumen, asphalt;
- Diesel spill from Higgins site; and
- Open burning of waste at Zanders Engineering.

The communication from Horizons Regional Council is provided in **Appendix D**.

Appendix D: Council contamination enquiries

Natalie Pilcher

From: Sarah Carswell <sarah.carswell@horizons.govt.nz>
Sent: Friday, 8 February 2019 12:58 PM
To: Natalie Pilcher
Subject: Horizons comment on various properties around Roxburgh Crescent, Palmerston North RAI 0203 H 00630
Attachments: Roxburgh Crescent, Palmerston North Horizons Indicative Flood Extent and....jpg; One Plan Rule 17-14 & 17-15 - activities affecting flood control & drainage values.pdf; Roxburgh Crescent Palmerston North Horizons Incidents.jpg

Hi Natalie,

Thank you for your request for Horizons comment on various properties around Roxburgh Crescent, Palmerston North regarding property files, environmental records and historic aerial photographs.

Please note that Horizons does not maintain property files.

Flood Risk
As you will be aware the Manawatu River is situated along the eastern portion of these properties.

Horizons holds no observed flood information or flood records for these properties (observed event information from 1976-2018). This does not mean it has not flooded in the past, it means that Horizons has no records of flooding.

As shown on the attached map, some properties adjacent to the Manawatu River are shown to be affected by Horizons indicative flood information. This indicative flood information is based on observations from historic flood events (prior to 1976) drawn at a topographic scale of 1:50,000 and is therefore not relied on for making land development decisions on a site specific scale.

You may wish to check with Palmerston North City Council if they have any additional information on their records and if they have any localised flooding or stormwater information. Please note that Palmerston North City Council have completed Rapid Stormwater Modelling for a 1 in 200 year event (0.5% Annual Exceedance Probability).

Schedule B Values – Horizons Stopbank
There is a Horizons stopbank along the river side of these properties please see the red line indicated on the map attached. The One Plan Rule 17-15 (as attached) requires that resource consent be obtained from Horizons Regional Council for a range of activities occurring within 8 metres of the landward toe of the stopbank, or between the stopbank and the River. There are also One Plan rules for activities with 10 metres of a drain or waterway that has Schedule B values under the One Pan. The types of activities requiring consent include: the planting of trees and shrubs; new buildings and structures; some fencing; land disturbance and depositing of cleanfill; and the upgrade, reconstruction, alteration, extension, removal or demolition of any structure that is maintained by the Regional Council for the purposes of flood control. The need for a consent is due to the potential for such activities to adversely affect the function of the drainage scheme or within a spillway. Should any activities like those listed above be proposed within 10 metres of the drain it is recommended that the owner first contact Horizons Area Engineer Central (Paul Joseph) to confirm any resource consent requirements. I have attached a copy of the relevant rule (One Plan Rule 17-15) for your information.

Known Active Fault Lines
From GNS Science's regional scale information there are is a known active fault line north-east of the property.

You can also access this information on GNS Science's website or clicking on this link: http://data.gns.cri.nz/af/

For more information please contact GNS Science.

Liquefaction
Palmerston North City Council holds the best liquefaction information for the city.

For more information please see PNCC's website:
https://www.pncc.govt.nz/rates-building-property/property-housing/palmerston-north-and-liquefaction/

SAHS (Sites Associated with Hazardous Substances) and Incidents
There are two potentially contaminated sites in this area. The exact location of these SAHS listed on the Horizons database of potentially contaminated sites is unconfirmed please contact Palmerston North City Council for further information.

The location of this site is between properties with the Valuation numbers 14720/176.00, 14720/176.15 and 14720/176.12. Please see the details below:

SAHS: Potential contaminated site

Sahs ID	*700071*
File No	*ERM 05 03N*
Date Created	*02/12/2004*
File Name	*CONTAMINATED SITES REGISTER - PALMERSTON NORTH DISTRICT*
Classification	*Contamination Acceptable Managed/Remediated*
Territorial Authority	*PALMERSTON NORTH CITY*
Easting	*1824489*
Northing	*5528995*

HAIL: F4 – Motor vehicle workshops
Potential Contaminants: F8 - Hydrocarbon fuels, metals in workshops

The property identified as Lot 1 DP 74592 is listed on Horizons database of potentially contaminated sites. Please see the details below:

SAHS: Potential contaminated site

Sahs ID	*700751*
File No	*ERM 05 03CD*
Date Created	*17/07/2015*
File Name	*HIGGINS DEPOT FRANCES HOLDING LIMITED*
Classification	*02. Verified Hail. No Site Investigation*
Territorial Authority	*PALMERSTON NORTH CITY*
Easting	*1824601*
Northing	*5528848*

HAIL: F8 – Transport depots of yards including areas used for refueling or the bulk storage of hazardous substances
Potential Contaminants: F8 – Hydrocarbon fuels, metals in workshops

Attached is a map of the locations of incidents in Roxburgh Crescent. Nearly all of them relate to odour complaints regarding the Higgins sites. Others refer to dead cattle.

If you have any further questions about SAHS or the incidents above please contact our Compliance Team on 0508 800 800 or email hail.enquiries@horizons.govt.nz

Aerial Photography

The aerial photography District Advice use is from Land Information NZ and we often use Google Earth Pro to view historical aerial images. On Google Earth Pro users click on the circular green arrow icon that states 'Show Historical Imagery' and this allows users to scroll from 2005-2018.

Horizons Information Management Team and Central Archives hold a number of aerial photos from the past. I cannot confirm if they include this area. To search the large database of photos would require a large amount of time from our Information Management team which may incur a cost. If you would like to proceed please let me know.

Closing Comments
Horizons has no other relevant information.

If you have any questions or feedback, please let me know.

Kind regards

Sarah Carswell | Coordinator District Advice
Regional Services & Information Group
T 0508 800 800 **E** help@horizons.govt.nz
Horizons Regional Council | Private Bag 11025, Palmerston North

From: Help
Sent: Tuesday, 5 February 2019 2:30 PM
To: District Advice Team <DistrictAdviceTeam@horizons.govt.nz>
Subject: FW: Roxburgh Cres property information request (++RE-73139++)

Hi Ladies,

hard copy to follow
Sarah Carswell (Sarah.Carswell@horizons.govt.nz) contacted Horizons on Feb 5, 2019 10:45 AM with a query relating to **FW: Roxburgh Cres property information request**. Please respond to them directly as necessary

Thanks
Joanne Allardice

Original Request Detail

Hi there,

Please log.

Thanks

Sarah

From: Natalie Pilcher <NPilcher@tonkintaylor.co.nz>
Sent: Tuesday, 5 February 2019 10:29 AM
To: Sarah Carswell <Sarah.Carswell@horizons.govt.nz>; Marianne Boekman <Marianne.Boekman@horizons.govt.nz>
Subject: RE: Roxburgh Cres property information request

Hi there

Could someone please respond to my query below?

Ngā Mihi | Kind regards,

Natalie Pilcher | Environmental Scientist
LLB, BSc, MSc (hons)
Tonkin + Taylor - *Exceptional thinking together*
Level 4, 2 Hunter Street, Wellington 6011 | PO Box 2083, Wellington, New Zealand
T +6448064946 **www.tonkintaylor.co.nz** T+T profile

Tonkin+Taylor
To send me large files you can use my **file drop**

From: Natalie Pilcher
Sent: Friday, 18 January 2019 3:47 PM
To: DistrictAdviceTeam@horizons.govt.nz
Subject: Roxburgh Cres property information request

Hi there

Roxburgh Cres property information request

Can I please request any property files, environmental records (e.g known pollution incidents or contamination) and historic aerial (or other) photographs held on file relating to the following properties identified in the attached spreadsheet?

If you have any difficulty opening the spreadsheet, please let me know.

Ngā Mihi | Kind regards,

Natalie Pilcher | Environmental Scientist
LLB, BSc, MSc (hons)
Tonkin + Taylor - *Exceptional thinking together*
Level 4, 2 Hunter Street, Wellington 6011 | PO Box 2083, Wellington, New Zealand
T +6448064946 **www.tonkintaylor.co.nz** T+T profile

Tonkin+Taylor
To send me large files you can use my **file drop**

EXCLUSION OF LIABILITY ARISING FROM SUPPLY OF INFORMATION: Horizons Regional Council endeavours to provide useful and accurate information. Horizons Regional Council shall not, however be liable whether in contract, tort, equity or otherwise, for any loss or damage of any type (including consequential losses) arising directly or indirectly from the inadequacy, inaccuracy or any other deficiency in information supplied irrespective of the cause. Use of information supplied is entirely at the risk of the recipient and shall be deemed to be acceptance of this liability exclusion. Contains crown copyright data. *This map was printed at A4 from Local Maps (Internal - Live) Date: 7/02/2019.

horizons REGIONAL COUNCIL

Horizons Incidents: Roxburgh Crescent, PN

0 40 m N

Completed Incidents relating to aerial photo provided by District Advice

Incident ID	Incident Date	Notes	Easting	Northing
3669	3/13/1999, 5:36 AM	Complainant reported discharge of red substance from pipe near Higgins Depot into Manawatu River. Complainant sure discharge from Higgins Yard.	1824689	5528795
3700	3/27/1999, 10:24 PM	Complaint about oily material in drain under stopbank. A small amount of degreasing agent had been released from Higgins yard via the old Catchment Board stormwater drain.	1824589	5528895
5722	6/16/2000, 6:00 AM	Report of a diesel spill from Higgins asphalt plant site that occurred at night and was not reported.	1824489	5528995
8638	4/26/2002, 8:00 PM	Foam on Manawatu River. Believe it is coming from Higgins, back of Ruahine and Roxbury Crescent.	1824389	5528795
12651	10/21/2004, 10:55 PM	Dead stinking carcass sighted on bank of Manawatu River,	1824589	5528895
12728	11/25/2004, 10:45 PM	Complaint about piles of rubbish - (tyres/timber/plastics/wire/green waste) on Higgins site at end of Ruahine Street.	1824489	5528995
13147	6/9/2005, 2:54 AM	Dead cow on the river bank next to Higgins at Waterloo park.	1824589	5528795
13195	6/28/2005, 3:56 AM	Dead stock in Manawatu River	1824389	5529095
13198	6/29/2005, 3:15 AM	Dead stock in Manawatu River	1824489	5529095
13224	7/12/2005, 3:57 AM	Dead cow on beach downstream of Ruahine St & Manawatu St	1824689	5528895
13653	10/13/2005, 11:43 PM	Dead stock in Manawatu River	1824589	5528895
16066	6/6/2008, 12:16 AM	Open burning of waste at a trade or industrial premise. Zanders Engineering on Ruahine St.	1824489	5528695
16158	7/26/2008, 1:53 AM	Dead stock in Manawatu River	1824589	5529195
16877	7/6/2009, 11:06 PM	Dead stock in Manawatu River	1824589	5528995
17474	6/21/2010, 9:53 PM	Dead stock in Manawatu River	1824624	5529223
17549	8/16/2010, 9:51 PM	Dead stock in Manawatu River	1824589	5529195
18039	4/23/2011, 8:58 PM	Oily residue in drain close to Roxburgh Crescent, Palmerston North	1824489	5528995
18682	8/23/2012, 3:32 AM	Dead stock in Manawatu River	1824689	5528795
19559	10/31/2013, 11:53 PM	Dead stock in Manawatu River	1824703	5529032

Incident ID	Incident Date	Notes	Easting	Northing
19584	11/7/2013, 12:56 AM	Dead stock in Manawatu River	1824709	5529042
19613	11/14/2013, 11:56 PM	Dead stock in Manawatu River	1824572	5529221
19888	2/25/2014, 3:50 AM	Yellow drum of spray, hooked up on stopbank in the Manawatu River near the vicinity of Manawatu Street and Ruahine Street.	1824670	5529233
19916	3/7/2014, 7:47 AM	Odour - fuel/deisel smell coming from Higgins Contractors	1824525	5528833
20105	6/9/2014, 9:42 PM	Dead sheep carcass down at the river today.	1824596	5528965
20180	7/21/2014, 11:40 PM	Says a drain coming out from higgins is pooling in a pond, run off is oil or some thing simular	1824598	5529022
20847	4/17/2015, 11:49 PM	Dead cow against gryone in Manawatu River. PNCC advised.	1824671	5529229
21774	10/1/2016, 4:42 AM	Odour regarding Higgins Bitumen smell.	1824553	5528974
21780	10/4/2016, 12:49 AM	Odour from Higgins - strong smell of tar	1824568	5529045
21869	12/6/2016, 3:54 AM	Odour from Higgins - strong tar fumes 5/6	1824420	5529156
21972	2/14/2017, 3:05 AM	Odour from Higgins - smells like bitumen	1824473	5528865
21986	2/21/2017, 11:20 PM	Odour from Higgins -Strong smell of bitumen/tar coming from Higgins Depot.	1824467	5528869
22072	3/17/2017, 11:48 PM	Odour from Higgins - this morning next to Wincester School.	1824535	5528818
22097	3/28/2017, 3:33 AM	Odour from Higgins - Smells like bitumen at Wincester school	1824431	5528911
22134	4/14/2017, 1:39 AM	Offensive smell coming from the Higgins plant on Roxburgh crescent. Smell described as coming from tar. 3/6	1824399	5529167
22146	4/11/2017, 8:44 PM	Bad smell of tar coming from Higgins - 4/6 Complainant says it is the worst it has ever been.	1824535	5529010
22286	5/19/2017, 1:10 AM	odour complaint in regards to Higgins Roxburgh Crescent. Bitumen smell	1824463	5528863
22624	10/29/2017, 2:39 AM	Odour Complaint - Roxburgh Crescent, Palmerston North	1824594	5528969
22662	11/28/2017, 7:04 AM	Odour Complaint - Roxburgh Crescent, Palmerston North	1824562	5528842
23010	3/1/2018, 8:49 PM	Odour Complaint - Roxburgh Crescent, Palmerston North	1824465	5528871

Incident ID	Incident Date	Notes	Easting	Northing
12627	10/21/2004, 1:19 AM	Dead cow near river at end of Ruahine Street.	1824489	5529095
12662	10/23/2004, 2:58 AM	Dead cow on walkway smelling,	1824489	5529095
12662	10/23/2004, 2:58 AM	Dead cow on walkway smelling, Rung Jim Sutton, he said he would ring back when his guys had picked it up.	1824489	5529095
13234	7/13/2005, 4:47 AM	Dead cow in River at the end of Ruahine Street	1824489	5529095
16051	5/29/2008, 3:46 AM	Smell of burning plastic - unsure where from	1824389	5529095
17033	10/10/2009, 2:43 AM	Rubbish being dumped down on river bank end of Ruahine St	1824389	5529195
17594	9/14/2010, 3:15 AM	Dead calf and lamb on edge of Manawatu River	1824589	5529195
18060	5/19/2011, 2:15 AM	Dead dog on stop bank. Referred to PNCC	1824622	5529009
21701	8/18/2016, 7:01 AM	Odour from Higgins - strong tar smell continuously 5/6	1824552	5528977
21764	9/27/2016, 2:18 AM	Odour - Higgins Asphalt plant on Roxburgh Crescent	1824601	5528879
21773	9/28/2016, 9:30 PM	Odour from Higgins Asphalt	1824574	5528804
22122	4/10/2017, 9:06 PM	Bitumen smell from Higgins yard (4/6)	1824647	5528907
22348	6/27/2017, 2:52 AM	Odour - Higgins - Bitumen Plant / strong tar smell	1824470	5528868
22869	2/10/2018, 6:50 AM	Odour Complaint - Roxburgh Crescent, Palmerston North	1824465	5528868
7137	3/22/2001, 8:40 PM	Odour from Higgins - bitumen Very noticeable during light easterly to south easterly winds.	1824489	5528895
13145	6/8/2005, 4:30 AM	Dead cow in Manawatu River	1824589	5528995
16385	11/11/2008, 1:23 AM	Dead cow in Manawatu River	1824589	5529195
16425	11/23/2008, 1:43 AM	Dust on southern part of Roxburgh Crescent, PN. Keegan using road and Higgins yard to stockpile clay on river berm.	1824489	5528795
19917	3/7/2014, 8:48 AM	Odour from Higgins - Winchester School very strong smell of asphalt mix	1824434	5528895
20126	6/21/2014, 12:59 AM	Manawatu River - Dead Goat.	1824639	5529177
20853	4/20/2015, 11:22 PM	Dead cattle beast in Manawatu River	1824440	5529135

Incident ID	Incident Date	Notes	Easting	Northing
20853	4/20/2015, 11:22 PM	Dead cattle beast in Manawatu River	1824440	5529135
20991	7/16/2015, 8:25 PM	Dead rabbit carcasses Ruahine Street river access.	1824495	5529167
21718	9/1/2016, 3:51 AM	Dead sheep on river walkway, is decaying and attracting dogs.	1824464	5529175
21752	9/20/2016, 1:47 AM	Odour from Higgins Yard - Bitumen - Site Visit undertaken - No odour detected	1824483	5528864
21970	2/14/2017, 12:28 AM	RFS 679504 and 679707. repeat calls from complainant regarding odour near Higgins, bitumen/tar smell.	1824473	5528865
21987	2/19/2017, 5:57 AM	Odour from Higgins strong bitumen/tar smell 5/6	1824485	5528897
22144	4/11/2017, 8:46 PM	Bad smell of tar coming from Higgins - 4/6	1824535	5529010
22362	6/6/2017, 8:18 AM	Odour Complaint - Higgins depot Roxburgh Cres in Palmerston North	1824592	5528791
22525	10/12/2017, 9:59 AM	Odour Complaint - Higgins Contracting, Palmerston North	1824572	5528798
22642	11/15/2017, 8:10 AM	Odour Complaint - Repeat Caller - Roxburgh Crescent, Palmerston North	1824528	5528884
4125	7/6/1999, 3:42 AM	silty / oily water in drain near Higgins	1824589	5528995
5399	3/11/2000, 7:50 AM	Strong odour from Higgins asphalt plant	1824489	5528895
8662	4/26/2002, 10:00 PM	Foam in Manawatu river	1824589	5528995
11238	10/8/2003, 3:03 AM	Dead deer amongst flood debris of Manawatu River	1824589	5528995

Appendix E: Inferred location of HAIL activities

ITEM 10 - ATTACHMENT 1

Appendix F: Sample location plan

Borehole Location

Notes:
1. Ground profile based on contours and is approximate only
2. Geology marked on this section is based on the limited available investigation data as shown. Actual ground conditions may differ from the assumed model.
3. Property Boundary based on LINZ and is approximate only

Tonkin + Taylor
Environmental & Engineering Consultants
2 Hunter Street, Wellington, New Zealand
www.tonkintaylor.co.nz

DRAWN	EJWL	Jan 19
DRAFTING CHECKED	MEJ	Oct 19
APPROVED	MEJ	Oct 19
FILE : 85442.0090		
APPROX. SCALE (AT A3 SIZE) NTS		
PROJECT No. 85442.0090		

Aerial view of Cross Sections
Palmerston North City Council
Roxburgh Crescent, Palmerston North

FIG. No. Sample Location Plan

REV. 1

Appendix G: Laboratory results tables

Table G1: Asbestos results

Borehole	Depth (m below ground level)	Asbestos Presence/Absence
BH1	0.5-0.6	Not detected
BH3	0.1-0.2	Not detected
	0.4-0.5	Not detected

Table G2: Metals and PAH results (mg/kg)

Sample number	BH1	BH2		BH3		Soil contaminant guideline values for human health	Predicted Background Soil Concentrations****
Soil type	Silty GRAVEL	Silty SAND	SAND	Sandy GRAVEL	Sandy GRAVEL		
Depth (m below ground level)	0.6-0.7	0.1-0.2	0.4-0.5	0.05-0.15	0.5		
Arsenic	3	3	2	3	3	70*	9.97
Cadmium	<0.10	<0.10	<0.10	<0.10	<0.10	1,300*	0.33
Chromium	14	11	11	12	13	6,300*	56.88
Copper	9	7	9	10	9	>10,000*	48.14
Lead	14.6	7.5	8.8	41	11.0	3,300*	25.83
Nickel	11	11	10	15	12	6,000**	35.15
Zinc	53	44	53	51	45	400,000**	97.97
Benzo[a]pyrene (BAP) equivalent	0.03	<0.03	0.03	2.7	0.16	35*	-
Naphthalene	<0.06	<0.06	<0.06	<0.06	<0.06	190***	-

* National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS), Commercial / industrial outdoor worker.

** National Environment Protection Measure (NEPM), 2013. Guideline on the Investigation Levels for Soil and Groundwater: Commercial/industrial D.

*** User Guide to Guidelines for Assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, Table 4.14: Sand, Commercial/industrial use, all pathways.

**** Expected background concentrations sourced from Landcare Research Predicted Background Soil Concentrations, New Zealand (2016).

Appendix H: Laboratory reports

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2119942	A2Pv1
Contact:	Natalie Pilcher	**Date Received:**	05-Feb-2019	
	C/- Tonkin & Taylor	**Date Reported:**	15-Feb-2019	
	PO Box 2083	**Quote No:**	80842	
	Wellington 6140	**Order No:**	85442.009	
		Client Reference:	85442.009	
		Submitted By:	Natalie Pilcher	

Sample Type: Soil

Sample Name	Lab Number	As Received Weight (g)	Dry Weight (g)	<2mm Subsample Weight (g ashed wt)	Asbestos Presence / Absence	Description of Asbestos Form
BH1 0.5-0.6	2119942.1	1,033.6	924.7	53.0	Asbestos NOT detected.	-
BH3 0.1-0.2	2119942.2	1,054.7	983.7	55.3	Asbestos NOT detected.	-
BH3 0.4-0.5	2119942.3	1,019.0	953.5	58.1	Asbestos NOT detected.	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-3
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-3
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	1-3
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1-3
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Rhodri Williams BSc (Hons)
Section Manager - Asbestos

PALMY
PAPAIOEA PALMERSTON NORTH CITY

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2119933	SPv1
Contact:	Natalie Pilcher	**Date Received:**	05-Feb-2019	
	C/- Tonkin & Taylor	**Date Reported:**	13-Feb-2019	
	PO Box 2083	**Quote No:**	80842	
	Wellington 6140	**Order No:**	85442.009	
		Client Reference:	85442.009	
		Submitted By:	Natalie Pilcher	

Sample Type: Soil

Sample Name:		BH1 0.6-0.7 18-Dec-2018	BH2 0.1-0.2 18-Dec-2018	BH2 0.4-0.5 18-Dec-2018	BH3 0.05-0.15 18-Dec-2018	BH3 0.5 18-Dec-2018
Lab Number:		2119933.1	2119933.2	2119933.3	2119933.4	2119933.5
Individual Tests						
Dry Matter	g/100g as rcvd	89	83	84	93	92
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	2	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	14	11	11	12	13
Total Recoverable Copper	mg/kg dry wt	9	7	9	10	9
Total Recoverable Lead	mg/kg dry wt	14.6	7.5	8.8	41	11.0
Total Recoverable Nickel	mg/kg dry wt	11	11	10	15	12
Total Recoverable Zinc	mg/kg dry wt	53	44	53	51	45
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.013	< 0.011
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.020	< 0.011
Perylene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.57	< 0.11
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.03	< 0.03	0.03	2.7	0.16
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.03	< 0.03	0.03	2.8	0.16
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.38	0.022
Acenaphthene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	< 0.011	< 0.011
Anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.151	0.012
Benzo[a]anthracene	mg/kg dry wt	0.012	< 0.012	0.014	1.00	< 0.11
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.020	< 0.012	0.023	1.70	< 0.11
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.014	< 0.012	0.015	1.88	< 0.11
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	1.26	< 0.11
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	1.68	0.11
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.71	< 0.11
Chrysene	mg/kg dry wt	< 0.011	< 0.012	0.012	1.20	< 0.11
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.46	0.026
Fluoranthene	mg/kg dry wt	0.016	< 0.012	0.029	1.25	0.074
Fluorene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.023	< 0.011
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.012	< 0.012	< 0.012	1.94	0.12
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Phenanthrene	mg/kg dry wt	< 0.011	< 0.012	< 0.012	0.27	0.032
Pyrene	mg/kg dry wt	0.015	< 0.012	0.024	1.44	0.075
Total of Reported PAHs in Soil*	mg/kg	< 0.3	< 0.3	< 0.3	16.0	< 1.2

IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-5
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-5
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	-	1-5
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-5
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-5
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	1-5

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

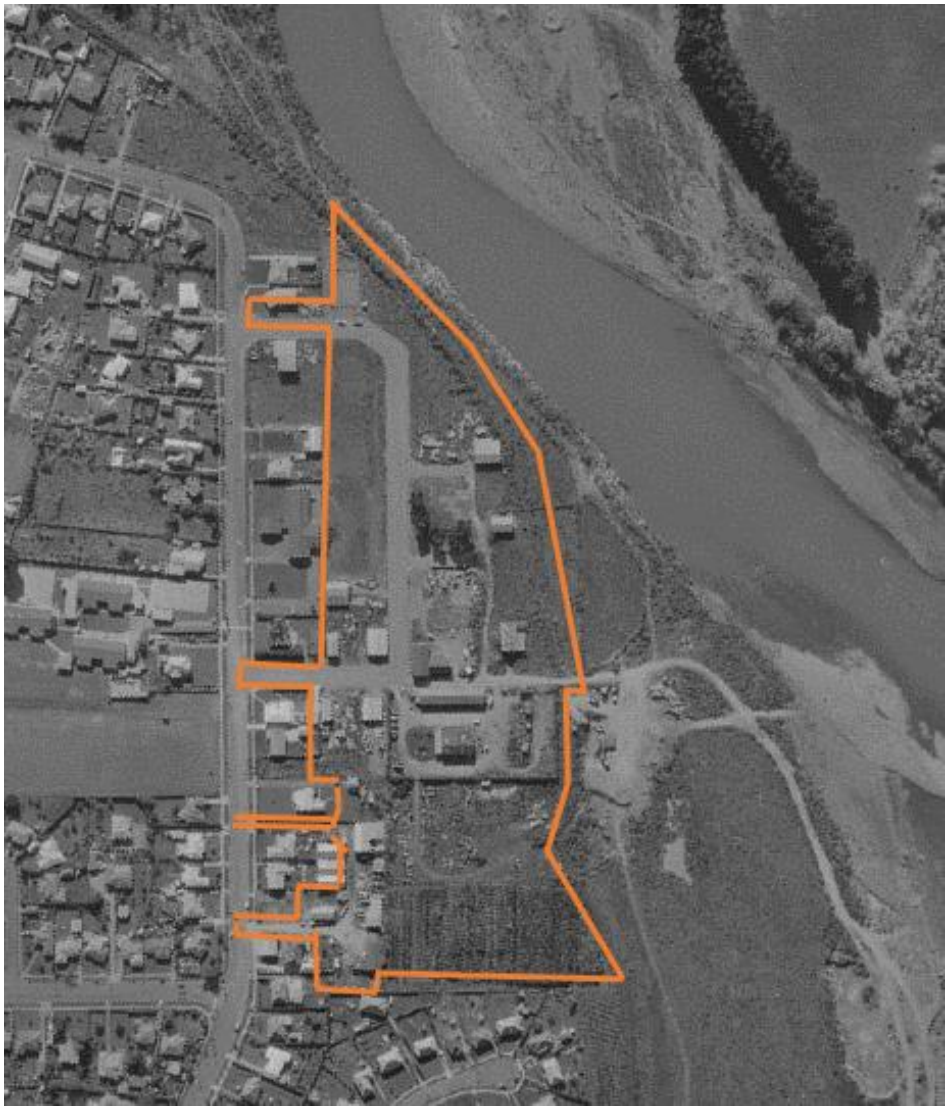
Ara Heron BSc (Tech)
Client Services Manager - Environmental

Appendix I: Historical aerial photographs

Aerial photo of Palmerston North in 1945 – no. 2 South-East quarter of City

(Source: https://manawatuheritage.pncc.govt.nz)

An aerial shot of Palmerston North taken by a Royal New Zealand Air Force Vampire from 35,000 feet. 2 November, 1954 (Source: https://manawatuheritage.pncc.govt.nz)

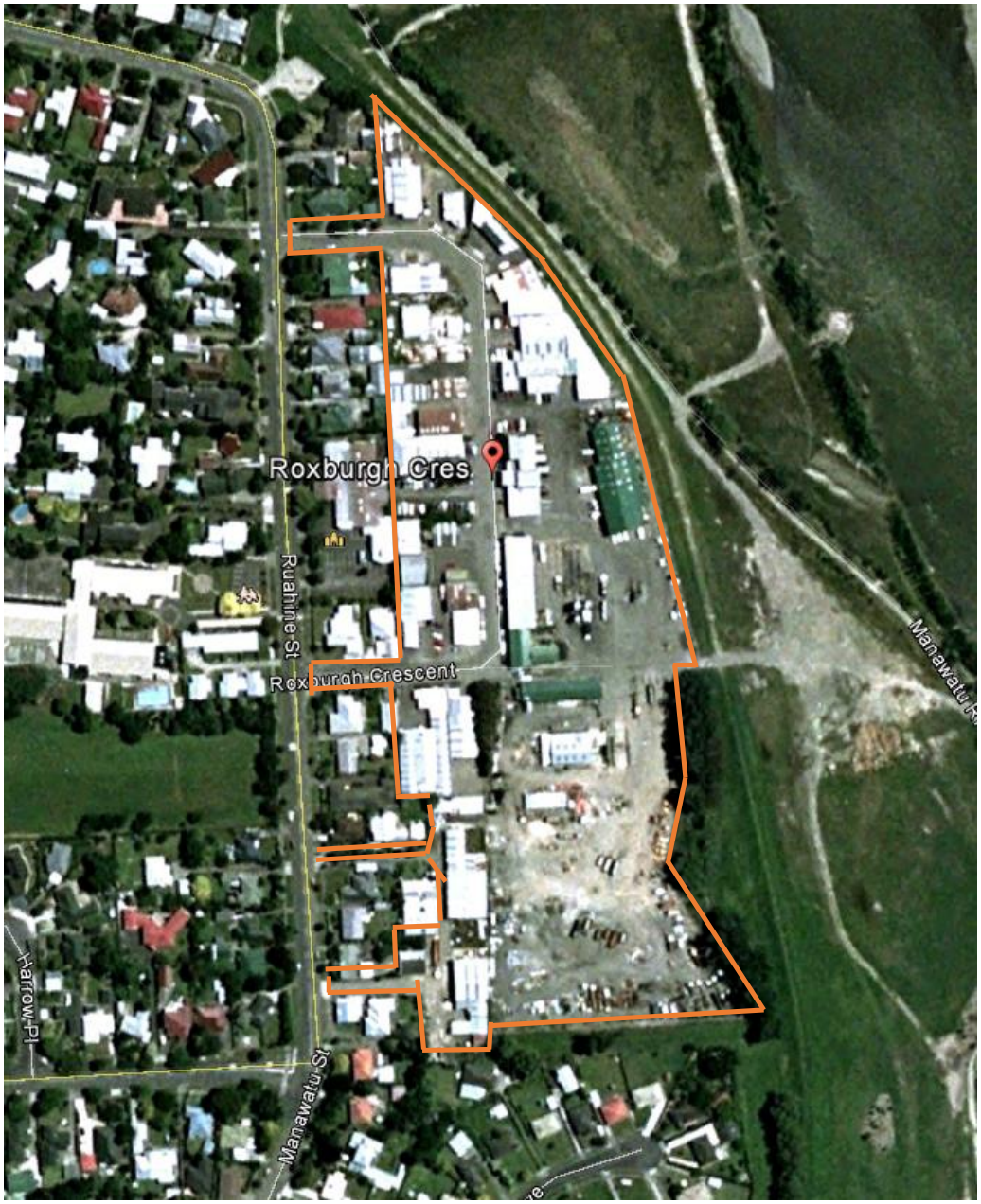


1966 (Source: Opus)

View of the Manawatu River and Eastern suburbs of Palmerston North, 1979.

(Source: NZ Aerial Mapping Ltd, SN 5408 C/16, https://manawatuheritage.pncc.govt.nz)

1986 (Source: Opus)



2005 (Source: Google Earth Pro 2018)

2006 (Source: Google Earth Pro 2018)

2007 (Source: Google Earth Pro 2018)

2011 (Source: Google Earth Pro 2018)

2012 (Source: Google Earth Pro 2018)

2013 (Source: Google Earth Pro 2018)

2014 (Source: Google Earth Pro 2018)

2015 (Source: Google Earth Pro 2018)

2017 (Source: Google Earth Pro 2018)

2018 (Source: Google Earth Pro 2018)

Appendix J: Council resource consent information

3 Roxburgh Crescent

- A building application form, dated June 1979 and applied for by K. W Cook, to erect a workshop addition at 3 Roxburgh Crescent.
- An application for dispensation, dated 8 September 1978 and applied for by Mr K.W Cook to reduce the 1.5 m side yard requirement adjacent to a residentially zoned site and reduce the 3 m requirement for landscaping of the front yard to 1.0 m at 3-5 Roxburgh Crescent.
- A Fire Protection form, dated June 1979, naming K. W. Cook specifying provision of fire fighting equipment, exit signage and exit door
- An application for permit and plumbing and/or drainage work, dated June 1979, applied for by K.W. Cook
- A work brief and plans dated July 1979 to erect a workshop and storage. Mentions asbestos cement sheets to be used on exterior.

4 Roxburgh Crescent

- A building application form, dated June 1969 and applied for by J. H Willson, to relocate building from 296 Broadway to 4 Roxburgh Crescent.
- A building application form, dated December 1971 and applied for by Wilfox Properties, to erect an office building at 4 Roxburgh Crescent.
- A letter from J H Willson Ltd allowing access to the sewer line at 555 Ruahine St in order to build a workshop at Roxburgh Crescent dated September 1974
- A Fire Protection form, dated August 1974, naming J. H Willson specifying provision of firefighting equipment, exit signage and exit door
- A building application form, dated March 1975 and applied for by J. H Willson Ltd to extend store at 4 Roxburgh Crescent.
- A Fire Protection form, dated April 1975, naming J. H Wilson specifying provision of firefighting equipment, exit signage and exit door.
- A building application form, dated July 1985 and applied for by J. H Willson, to erect an office extension (two offices and files room) at 4 Roxburgh Crescent.
- Schedule of materials to be used and work to be done in the erection of an office building for J. H Willson Ltd, dated September 1971.
- An application for permit and plumbing and/or drainage work, undated, applied for by J. H Willson.
- Specification of work in erection of extensions to store in Roxburgh Crescent for J. H Willson Ltd dated February 1975
- Specification of work in erection of extensions to store in Roxburgh Crescent for J. H Willson Ltd dated July 1974
- A building application form, dated July 1974 and applied for by J. H Willson Ltd to extend store at Roxburgh Crescent.
- Letter from Graham Stewart and Associates Ltd to PNCC to remove one fire hose reel from the workshop area at 4-6 Roxburgh Crescent because the water supply comes from a neighbour's property, dated October 2000.
- Letter from PNCC to Graham Stewart and Associates Ltd confirming permission to remove one fire hose reel from the workshop area at 4-6 Roxburgh Crescent, dated October 2000.
- Plans for new workshop building at Roxburgh Crescent, dated November 1971.

8 Roxburgh Crescent

- A building application form, dated May 1980 and applied for by R. C. Isles, to erect an office at 8 Roxburgh Crescent.
- An application for building for additions/alterations: Reframing roof with trusses and new roofing iron, dated February 2000 and applied for by R. C. Isles Ltd
- Code compliance certificate for additions/alterations: Reframing roof with trusses and new roofing iron, dated February 2003 and applied for by R. C. Isles Ltd
- A building application form, dated August 1988 and applied for by R. C. Isles, for an addition to a workshop at 8 Roxburgh Crescent.
- An application for permit for plumbing and/or drainage work at 8 Roxburgh Crescent, dated June 1983, applied for by R. C Isles.
- Multiple internal renovations between 2015 and 2016.

9 Roxburgh Crescent

- A building application form, dated August 1964 and applied for by E & C Fletcher Ltd to erect a storeshed.
- A building application form, dated October 1983 and applied for by A F Fletcher Ltd to erect a warehouse-staff store-office.
- Application and approval of request to cancel a building line restriction dated June 1983 for new warehouse addition
- A Fire Protection form, dated November 1983, referring to “Fletcher warehouse”
- An application for permit and plumbing and/or drainage work, undated, applied for by Fletcher.
- A building application form, dated November 1995 and applied for by B J Eagle to raise stud height and add washroom and toilet at 9 Roxburgh Crescent
- An application for PIMMS to raise existing building, add new roller door, window porch and toilet, dated October 1995 and applied for by B J Eagle.

17 Roxburgh Crescent

- A building application form, dated April 1987 and applied for by K J Douglas to erect an office building at 15 Roxburgh Crescent.
- An application for permit and plumbing and/or drainage work at 15 Roxburgh Crescent, dated April 1987, applied for by R. M Building Contractors.
- Standard Building specification for a building of light framed timber construction

19 Roxburgh Crescent

- A building application form, dated May 1966 and applied for by Wood and Robson Ltd to erect a store shed at 15 Roxburgh Street.
- An application for Permit for Sanitary Plumbing and/or Drainage Work at 19 Roxburgh St, undated
- A building application form, dated May 1981 and applied for by R.E.L Parlane Ltd to erect a 7.5 m x 3.6 m lean-to at 19 Roxburgh Crescent.
- A building application form, dated May 1981 and applied for by R.E.L Parlane Ltd to erect a store (re-erect an existing building) – specifies that it is not to be used as a dangerous goods store
- A plan to relocate shed 50 feet to rear of building, dated May 1981

- An application for permit and plumbing and/or drainage work at 19 Roxburgh Crescent , dated May 1981, applied for by R.E.L Parlane.
- An application for permit and plumbing and/or drainage work at 19 Roxburgh Crescent , dated February 1985, applied for by R McKay.
- An application for permit and plumbing and/or drainage work at 19 Roxburgh Crescent , dated March 1989, applied for by G Staples.
- A scheme plan approval for 19 Roxburgh Crescent for the subdivision of an existing industrial section into 3 lots. Lots 1 & 2 contain existing buildings while lot 3 is a carpark
- A building application form, dated February 1985 and applied for by R McKay to erect a workshop at 19 Roxburgh Crescent.
- A building application form, dated February 1985 and applied for by R McKay to erect a factory at 19 Roxburgh Crescent.

19B Roxburgh Crescent

- A building application form, dated March 1994 and applied for by G Staples to alter/extend an existing electroplating factory.

22 Roxburgh Crescent

- A plan, date unknown, identifying the following:
  - A workshop located in the centre of Lot 3 DP 19692 is to be removed and replaced with a larger workshop.
  - A motor spirit tank and a diesel tank are located to the west of the workshop.
  - Two 3,000 gallon tanks are proposed on the western boundary of Lot 3 DP 19692.
- A building permit, dated May 1958 and issued to Bedford & Leo Ltd, to erect a factory at Lot 3 DP 19692.
- A building application form, dated August 1967 and applied for by D Higgins, to erect a workshop at 22 Roxburgh Crescent.
- A plan, dated December 1969, identifying the following:
  - Two bitumen tanks with an associated control room and switch room are located in the north eastern corner of Lot 4 DP 19692.
  - A workshop is present in the centre of Lot 3 DP 19692.
  - A workshop is proposed to be located in the centre and eastern portions of Lot 2 DP 19692.
- A plan, dated January 1970, identifying that a pit is proposed to be located in the eastern portion of the proposed workshop.
- A building application form, dated February 1970 and applied for by D Higgins & Sons, to erect a workshop at 28 Roxburgh Crescent.
- A letter from Shell Oil New Zealand Limited, dated June 1973, requesting permission to install two 3,000 L tanks in concrete lined pits at D Higgins & Sons Ltd construction yard, Roxburgh Terrace, Palmerston North.
- A building application, dated July 1973 and applied for by D Higgins & Sons, to erect a workshop at Roxburgh Crescent.
- A building application permit, dated May 1986 and applied for by D Higgins, to erect a vehicle shelter at 20 – 22 Roxburgh Street.
- A building application form, dated 1989 and applied for by D Higgins & Sons Ltd, to erect a new bitumen store and resite tanks at 14 – 30 Roxburgh Street.

- A building application form, dated July 1989 and applied for by D Higgins & Sons Ltd, to undertake extensions to an existing workshop at 20 – 22 Roxburgh Street,
- A plan, dated August 1991, showing the location of a laboratory and a proposed truck wash facility at the Higgins Contracting yard.
- A letter, dated June 1999, stating that Higgins Contractors Ltd are proposing to upgrade the existing truck wash which will include the installation of a 2,7000 L grit and oil interceptor.
- Building plans, dated June 2014, identifying the location of a paint shop on Lot 22 DP 25417.
- A building permit application, dated November 2014, to construct workshop bays and to demolish existing buildings at 22 Roxburgh Street.
- A resource consent dated December 2014 to install two new above ground 40,000 litre diesel and 20,000 litre kerosene storage facilities/tanks.

25 Roxburgh Crescent

- A plan, date unknown, indicating that a polishing shop will be present within the factory.
- A building application form, dated November 1970 and applied for by Fineline Furniture, to erect a furniture factory at 25 Roxburgh Street.
- A building application form, dated January 1996 and applied for by Colvillle & Payne Family Trust, to undertake additions to an existing workshop/store at 25 Roxburgh Crescent.

27 Roxburgh Crescent

- A building application form, dated October 1968 and applied for by W. G. Nairne, to erect a workshop at 33 Roxburgh Street.
- A building application form dated August 1972 and applied for by W. G. Nairne, to erect a workshop at 27 Roxburgh Street.
- A letter, dated May 1978, stating that a dangerous goods store would be required to be constructed on site. Up to 450 L of thinners and paints would be stored in the dangerous goods store.
- A building consent application form, dated October 2003, to install a spray booth. An associated document states that paint and paint thinners are to be stored in a locked cupboard.

29 – 32 Roxburgh Crescent

- NIL

33 – 33a Roxburgh Crescent

- A building application form, dated January 1975, to erect a workshop at 33 Roxburgh Street.
- A building application form, dated May 1976, to undertake additions to an existing workshop at 33 Roxburgh Crescent.
- A building application form, dated December 1976, to undertake additions to an existing workshop at 33 Roxburgh Crescent. Associated plans, dated January 1977, state the building will be constructed on behalf of W. G. Nairne and will include the use of hardiflex and fibrolite as construction materials.

34 Roxburgh Crescent

- A building permit, dated May 1958, to erect a factory at Lot 3 DP 19692.
- A building application form, dated July 1982, to erect an addition to a workshop at 34 Roxburgh Street.

38-38A Roxburgh Crescent

- An application for permit for plumbing and/or drainage work, dated June 1985, applied for by Alger.
- Drainage Connection – application and diagram, dated August 1986.
- A building application form, dated July 1984 and applied for by R & E Alger to erect an addition to building at 38 Roxburgh Crescent.
- Building application form, dated June 1985 and applied for by R. E. Alger to erect an additional to the factory at 38 Roxburgh Crescent.
- A building application form, dated July 1986 and applied for by R. E & E. M Alger to erect an addition to warehouse at 38 Roxburgh Crescent.
- An application for permit for plumbing and/or drainage work, dated January 1991, applied for by R Alger.
- Drainage Connection – application and diagram, dated January 1991.
- Building consent application, dated April 2013
- Building consent – Planning processing form, completed by K & M Purser, notes fire damaged building, dated April 2013
- Commercial processing checklist - additions and alterations, dated May 2013 notes repair required to fire separation between the warehouse and dwelling.
- Land Use consent document dated 2007 for Max Keen provides consent despite the car parking shortfall, undersized landscaping, over width access and second vehicle access the site.
- Bracing and roofing plan, June 2017.
    - Application for solid fuel heater (wood stacker freestanding fire), application by Mr & Mrs Purser, dated May 2014
    - Code Compliance Certificate – convert existing workshop to a three bedroom dwelling for M K Construction Ltd, dated December 2009.
    - Building consent for commercial additions and alterations to convert existing workshop to 3 bedroom dwelling with garage, dated July 2007.
    - Building consent to amend first floor framing to convert existing workshop to 3 bedroom dwelling with garage, dated August 2007.
    - Code Compliance certificate applied for by M. A. & K. R. Purser, for repair work to fire separation dated September 2013.
    - Commercial and complex residential application for building consent, to reconstruct three skylights for first floor roof and repair existing fire separation.

40 Roxburgh Crescent

- A building application form, dated March 1966 and applied for by Broadway Engineers to erect a workshop at 40 Roxburgh Crescent.
- A building application form, dated April 1966 and applied for by Broadway Engineers to erect a factory at 40 Roxburgh Crescent.

- An application for permit for sanitary plumbing and/or drainage work, undated, applied for by Everest Softgoods.
- Notice to occupier to clear lands of noxious weeds (Hemlock), dated November 1971
- An application for permit for sanitary plumbing and/or drainage work, dated January 1987 and applied for G L Morgan.

40A Roxburgh Crescent

- A building application form, dated August 1993 and applied for by Fred Harris Woollett to alter an existing building for storage at 40A Roxburgh Crescent.
- A building application form, dated November 1999 and applied for by Kevin Richard Woollett to erect a storage/boat shed at 40A Roxburgh Crescent.
- Landscape Reduction consent approval applied for by The Kevin Richard Woollett Family Trust at 40A Roxburgh Crescent
- Consent approval for construction of a garage onto the existing building for the storage of a boat at 40A Roxburgh Crescent, applied for by Kevin Richard Woollett.

42 Roxburgh Crescent

- A building application form, dated January 1987 and applied for by G. L Morgan to erect a new workshop at 40 Roxburgh Crescent.
- A building application form, dated June 1983 and applied for by G Morgan to erect a workshop and office at 42 Roxburgh Crescent.
- Drainage Connection – application and diagram, dated July 1983.
- Water Connection – application and diagram, undated.
- An application for permit for plumbing and/or drainage work at 42 Roxburgh Crescent, dated June 1983, applied for Morgan.
- A building application form, dated July 1989 and applied for by Ian Capstick Motor Bodies Limited to erect an addition to workshop at 42 Roxburgh Crescent.

565 Ruahine St

- A building application form, dated December 1957, to erect a factory at 569 Ruahine Street.
- A building application form, dated September 1971, to undertake additions to a factory at 565 Ruahine Street. Associated plans state the fibrolite is going to be used as a construction material.
- A building permit, dated January 1974, to erect a factory at Lot 5 DP 17578.
- A building permit, dated January 1974, to erect a factory at 567 Ruahine Street. Associated plans state that sheathing asbestos is to be used.

575 Ruahine St

- A building application form, dated August 1971 and applied for by Scott Gradall Ltd to add to workshop at 575 Ruahine St.
- A Palmerston North City Corporation Water supply application, dated May 1971 and applied for by W Scott for 575 Ruahine St.
- Application for permit for sanitary plumbing and/or drainage work, dated September 1971, and applied for by W Scott for 575 Ruahine St.
- A building application form, dated April 1997 and applied for by GA Zander Ltd to alter/extend a workshop at 575 Ruahine St.

www.tonkintaylor.co.nz

Appendix G. Contamination Report – DSI

REPORT

Tonkin+Taylor

Ground Contamination Assessment

Roxburgh Crescent

Prepared for
Palmerston North City Council
Prepared by
Tonkin & Taylor Ltd
Date
March 2020
Job Number
1012456

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: Ground Contamination Assessment					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
13/01/2020	1 (Draft)	Draft for client comment: Ground Contamination Assessment, Roxburgh Crescent	Kasey Pitt	Jonathan Coakley	Mike Jacka
20/03/2020	1 (Final)	Final Ground Contamination Assessment, Roxburgh Crescent NB: No changes from the previous version of this report	Kasey Pitt	Jonathan Coakley	Mike Jacka

Distribution:

Palmerston North City Council	1 electronic copy
Tonkin & Taylor Ltd (FILE)	1 electronic copy

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Appendix A : **Site photographs**

Appendix B : **1956 aerial image**

Appendix C : **Sample location plan**

Appendix D : **Results summary table**

Appendix E : **Laboratory transcripts**

Appendix F : **Site plan identifying areas requiring further investigation**

1 Introduction

Tonkin & Taylor Ltd (T+T) has been commissioned by Palmerston North City Council to undertake a ground contamination investigation for eleven properties in the suburb of Hokowhitu, including 4-34 and 29-31 Roxburgh Crescent and 573-575 Ruahine Street (referred to herein as the site). The location of the site is presented in **Figure 1.1** below.

This report has been prepared in general accordance with the requirements for a DSI (Detailed Site Investigation) referred to in the NES Soil regulations[1], and as outlined in the MfE Contaminated Land Management Guideline No. 1[2].

The persons undertaking, managing, reviewing, and certifying this investigation are suitably qualified and experienced practitioners (SQEP), as required by the NES Soil and defined in the NES Soil Users' Guide (April 2012).

This investigation was undertaken in accordance with our proposal of 22 October 2019.

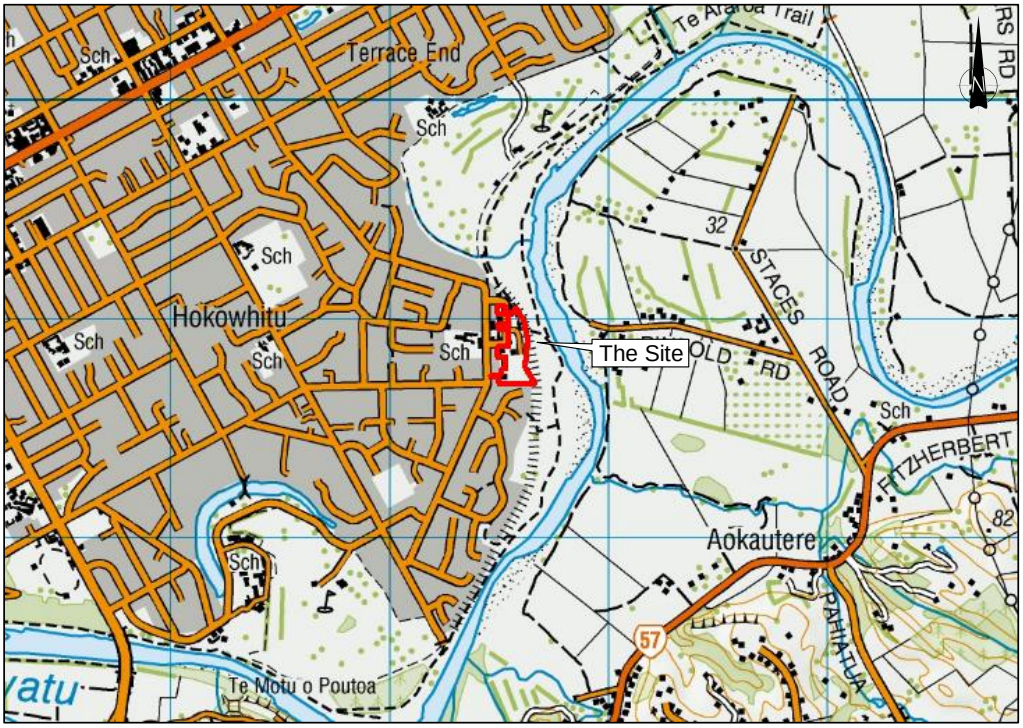

Figure 1.1: Site location plan (Topomap sourced from Land Information New Zealand[3])

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[2] Ministry for the Environment, updated 2011. Contaminated land management guidelines No. 1: *Reporting on Contaminated Sites in New Zealand*.
[3]Land Information New Zealand, updated 2019. Topo50 Map Series *http://www.linz.govt.nz/topography/topo-maps/topo50/digital-images*.

1.1 Background

The present and former land uses at the site are known to have included activities which have the potential to cause land contamination. These activities are defined by the Ministry for the Environment in the Hazardous Activities and Industries List (HAIL)[4]. If an activity or industry on the HAIL is, or has occurred on a site, the NES Soil applies to proposed soil disturbance and/or land development activities.

T+T has undertaken this investigation to assess whether the HAIL activities, historic or current, at the site have resulted in ground contamination. This report also assesses the need for further investigation and resource consents with regard to ground contamination, as required under the NES Soil and other relevant regulations, for the proposed soil disturbance and land development activities.

1.2 Proposed development

We understand that the Palmerston North City Council is intending to undertake a plan change to rezone the Site from industrial to residential land use, which will allow for further residential development in the Hokowhitu area. At this stage, development plans identifying the extent of soil disturbance across the site have not been completed.

1.3 Objective and scope of work

The scope of work for this investigation included the following tasks:

- Review the previously completed Preliminary Site Investigation[5] (T+T, October 2019) containing the following:
  - Historical aerial images from the T+T library and other sources;
  - Historical and current certificates of title; and
  - Information regarding development activities and pollution incidents at the site.
- Undertake a brief site walkover inspection;
- Collect soil samples (in surface and deeper soils) in accessible areas;
- Analyse the collected samples at an accredited laboratory for metals, asbestos (semi-quantitative method), polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX); and
- Prepare a Detailed Site Investigation (DSI) report, in general accordance with Ministry for the Environment guidelines.

This report documents our findings and comments on the potential for ground contamination at the site, in the context of the proposed development, including potential resource consent implications with regard to ground contamination.

[4] Ministry for the Environment, 2011. Hazardous Activities and Industries List. *https://www.mfe.govt.nz/land/hazardous-activities-and-industries-list-hail*

[5] Tonkin and Taylor, October 2019. *Roxburgh Crescent – Ground Contamination Desk Study (FINAL)*

2 Site description

2.1 Site identification

The site consists of eleven properties located on Roxburgh Crescent and Ruahine Street in Hokowhitu, Palmerston North. The site is bounded by the Manawatu Riverside Walkway and stop banks associated with flood protection on the eastern and north-eastern boundary.

Table 2.1: Site identification

Street Address	Legal Description	Property Area	Zoning
4-6 Roxburgh Crescent*	Lot 14 DP 25417	1,157.2 m^2	Industrial
8 Roxburgh Crescent	Lot 15 DP 25417	796.8 m^2	Industrial
10 Roxburgh Crescent	Lot 1 DP 74592	15,318.7 m^2	Industrial
12A Roxburgh Crescent (portion of)	Part Lot 2 DP 60866	1,037.2 m^2	Conservation and Amenity
21 Roxburgh Crescent	Lot 2 DP 76087	779 m^2	Industrial
22 Roxburgh Crescent	• LOTS 2 3 4 DP 19692; • LOTS 21-25 DP 25417; and • LOT 1 DP 60866.	8,477.4 m^2	Industrial
29-31 Roxburgh Crescent	Lots 31 32 DP 25417	1,212.4 m^2	Industrial
32 Roxburgh Crescent	Part Lot 1 DP 19692	713.8 m^2	Industrial
34 Roxburgh Crescent	Lot 26 DP 25417	683.9 m^2	Industrial
573-575 Ruahine Street	• Lot 1 DP 32023; • Lot 2 DP 22494; • Lot 1 DP 32973; and • Lot 6 DP 17578.	2,132.7 m^2	Industrial
Waterloo Park (portion of)	Part Lot 44 DP 22620	1,481.3 m^2	Recreation
Total Site Area			**33,790.4 m^2**

*Not visited during this investigation due to access being restricted by property owner

2.2 Site condition

A contaminated land specialist completed a site walkover inspection on 14 November 2019. Relevant observations made at the time of the inspection are summarised below. Key site features are shown in selected photographs (Photo 1 to Photo 12) which are included in **Appendix A**.

The T+T staff member was accompanied by Mr Kelvin Fohren (site operator), along with Mr Aaron Harding and Mr Tamati Blundell (underground service locators), during the walkover and the following includes a summary of site observations:

The property is currently used for a range of industrial activities and contains the following features:

- The ground is generally flat across the properties within the site extent and is a combination of paved and unpaved areas;
- The Roxburgh Crescent roadway runs from north to south through the middle of the site, curving west at both the northern and southern ends before connecting with Ruahine Street;
- The Higgins site is an operational transport depot with a high volume of vehicle and machinery movements between the workshops, product storage facilities and vehicle wash facilities (see Photograph 1);
- There was little activity at 29-31 Roxburgh Crescent at the time of the site visit, but it was evident that it is used as a storage facility for building materials and had vehicle access around the building (see Photograph 2);
- 21 Roxburgh Crescent was observed to be fully paved and is currently used as a staff parking area for Higgins with drainage running through the middle of the property (see Photograph 3);
- 573-575 Ruahine Street is occupied by an operating engineering workshop with large workshop buildings, an office building, a shipping container, and assorted machinery and equipment across the site (see Photograph 4);
- The occupier at 573-575 Ruahine Street indicated that there was previously an underground storage tank near one of the buildings on the southern portion of the property, it was not confirmed whether the tank has been removed;
- The buildings observed across the site were of an age that there is a potential for asbestos containing material (ACM) to be present in building materials;
- A number of scrapped vehicles in a deteriorating condition and empty drums were present on the south west portion of the Higgins site (see Photograph 5);
- Paint storage in shipping containers and associated equipment were present on the south west portion of the Higgins site (see Photograph 6);
- Storage of diesel in an underground storage tank with an associated dispenser for vehicle refuelling and three large above ground storage tanks containing bitumen product were present on the Higgins site (see Photographs 7 and 8);
- The immediate area containing the three above ground bitumen tanks is bunded and there is an interceptor located in the middle of the Higgins site (see Photograph 9);
- Vegetation was sparse across all properties visited during the walkover and mainly consisted of grasses and weeds (see Photograph 10), there were a number of large trees forming a shelter belt along the south and south eastern boundary of the Higgins site. Some planter boxes were present at the front of the Higgins site and the vegetation within appeared to be in a good condition. The portion of Waterloo park that was visited was fully covered in grass and other vegetation, including large trees;
- Discolouration and staining of site surfaces apparent were present on both paved and unpaved areas of the Higgins sites and the other properties. There were areas at 29-31 Roxburgh Crescent that appeared to have been used as burning areas. Two drums containing materials to be burnt were observed in the south west corner of the site (see Photograph 11);
- A large pile of waste bitumen material (referred to as 'hot mix tailings' by contractor) was present in the middle of the Higgins site, adjacent to TP9. Scrap metal, empty drums and other waste material were also stored on various areas of the Higgins site;
- There was a large volume of water ponded in the middle of the Higgins site in the location of a building that had been removed/demolished between 2015-2017 (see Photograph 12);

- The Manawatu River is located approximately 120 m from the western boundary of the Higgins site, there is a recreational area including a public walkway and a flood protection stop bank between the site and the riverbank;
- Winchester School is located on the western side of Ruahine Street, adjacent to the southern intersection with Roxburgh Crescent;
- There are a number of residential properties on Ruahine Street and on Roxburgh Crescent closer to Ruahine Street; and
- The Reformed Church of Palmerston North is located on Ruahine Street and is adjacent to 21 Roxburgh Crescent.

2.3 Surrounding land use

The land uses in the area surrounding the site include:

- North – Recreation and Flood Protection area consisting of the Manawatu Riverside Walkway, stop bank, and beyond, the Manawatu River;
- South – Recreation/Residential area consisting of a small section of Waterloo Park and beyond, residential properties off Tilbury Avenue;
- East – Recreation and Flood Protection area consisting of the Manawatu Riverside Walkway, stop bank, and beyond, the Manawatu River; and
- West – Residential area consisting of Ruahine Street, residential properties, the Reformed Church of Palmerston North, and Winchester School which is located directly adjacent to the intersection of Roxburgh Crescent and Ruahine Street.

2.4 Geology

A summary of available geological information for the area is presented in this Section.

2.4.1 Published geology

The published geology beneath the site is described by Lee and Begg[6] to be underlain by Holocene river deposits consisting of alluvial gravel, sand, silt, mud and clay with localised peat. The location of the site in the context of the regional geology is presented on **Figure 2.1** below:

[6] Lee and Begg, 2002. Geology of the Wairarapa Area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 11. 1 sheet + 66 p. Lower Hutt, New Zealand: Institute of Geological and Nuclear Sciences Limited.

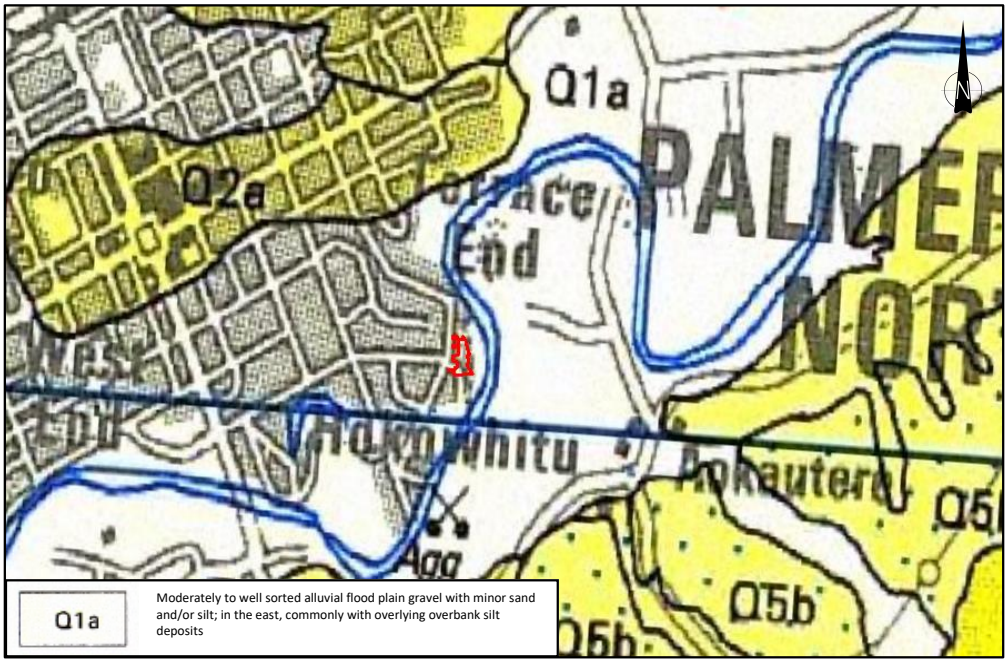

Figure 2.1: Published geology of the Hokowhitu Area (source: Lee and Begg, 2002) as per footnote[6].

2.4.2 Site geological information

The soil profile obtained from both the geotechnical investigation[7] conducted in February 2019 and the data collected during the current investigation, is shown in **Table 2.2**. Further description of the site soils is contained within the T+T geotechnical report.

Table 2.2: Observed soil profile

Depth below ground level to top of layer (m bgl*)	Unit thickness (m)	Geological unit	Description
0-0.5 m bgl	0.4/0.6 m	Fill	Sandy GRAVEL, with minor silt, fine to course gravels, rounded to angular, grey/brown. Inclusions of brick fragments, wood fragments, bitumen pieces, anthropogenic waste, in some locations.
0.5-1.5 m bgl	0.8-1.1 m	Natural	Silty fine to medium SAND, with trace clay, brown grey, moist.

*m bgl – metres below ground level

[7] Tonkin + Taylor, February 2019. *Geotechnical Investigation and Liquefaction Assessment* prepared for the Palmerston North City Council.

2.5 Hydrogeology and hydrology

Based on the observed site topography groundwater is expected to flow in an easterly direction towards the Manawatu River. Groundwater was encountered at approximately 8 m bgl at the site during the T+T geotechnical investigation.

The shallow and deeper groundwater below the level of the site is expected to discharge to the Manawatu River, located approximately 120 m east of the site (refer **Figure 1.1)**.

3 Site history

The site history is detailed in T+T's previous PSI[5]. The following provides a summary; however, the reader is referred to the PSI for further detail, if required.

The PSI reviewed historical information relating to the site that was collected from a variety of sources including council property files and historical aerial images. The information indicated that the site was predominantly pasture and vacant land with few buildings before the early 1950s, after which various industrial activities started on the site. Extensive development commenced from the 1950's and the aerial images from 1966 and 1986 show a number of buildings for workshops, storage sheds and factories present. The PSI noted that market gardening activities were observed in the 1986 aerial image, further review of this image suggests that the activity may be a plantation or a nursery for larger trees, possibly pine trees.

The PSI also noted a number of other activities, such as the bulk storage of hazardous substances including fuels and bitumen products, landfilling and engineering workshops, which have been undertaken across the site throughout its recent history. **Table 4.1** below includes the HAIL activities identified in the PSI and additional HAIL activities identified in the DSI.

In addition to the historical aerial images reviewed during the previous investigation, a 1956 aerial image has been sourced from the PNCC mapping service[8] Appendix B. The 1956 image shows the site to be mostly in pasture/vacant in the northern portion with a stand of trees in the shape of a square outline in the location of the current Higgins office building. The buildings towards the middle of the site appear to be the same as those currently used by Higgins as the laboratory and a workshop/storage shed. The image shows vehicle movement around these buildings and also an access track towards the southern portion of the site, where there is storage of what appears to be poles and ending near the small shed that can be seen on the western boundary of the site. The remainder of the site is vacant except for the south western portion where it bounds with 573-575 Ruahine Street, where what appears to be shrubbery has been planted. The Ruahine Street property is occupied by two shed/workshop buildings and is unpaved, there is storage of what appears to be timber in racks beyond the buildings to the north.

Further details regarding the site history is included in T+T's previous PSI report[5].

[8] Palmerston North City Council, 2019. *Land & Property Map Viewer - https://geosite.pncc.govt.nz/MapViewer/?map=cb2b06a88392471a849340b277438064*

4 Site characteristation

This section characterises the likely and potential contamination status of the site based on the available information as presented in T+T's previous PSI[5] and summarised in **Section 3** of this report.

4.1 Potential for contamination

This investigation has identified that HAIL activities were (or are likely to have been) undertaken at the site. The activities, potential contaminants and an assessment of the likelihood, potential magnitude and possible extent of contamination are presented in **Table 4.1** below.

Table 4.1: Potential for contamination

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
4-6 Roxburgh Crescent			
Motor vehicle workshop	Hydrocarbons including PAHs, solvents, and metals contained in waste oil	This property is occupied by a motor vehicle workshop (Viper Classics) which undertakes maintenance and repair works on classic cars. Services include; engine works, panel beating and painting.	F4
Asbestos building materials	Asbestos fibres, debris or fines	Due to the age of the buildings on this property there is a potential for ACM to have been used during construction.	I and E1
Lead-Based Paint	Lead	Structures have been present on the site and surrounds when lead-based paints were in use. Lead may have been released during maintenance or weathering causing soil contamination.	I
Higgins Site (8, 10, 12A, 22 Roxburgh Crescent)			
Placement of imported fill and waste stockpiling	Unknown but a broad range of contaminants possible depending on whether offsite material was sourced. If sourced from other industrial areas then typical contaminants could include metals, polycyclic aromatic hydrocarbons (PAH) and asbestos.	Filling appears to have occurred on the southern portion of the site now occupied by the Higgins vehicle wash and truck parking/access way facilities. The fill material visible in the 1986 aerial image appears to have been stockpiled in this area and there are now visible depressions indicating the fill material has been buried on the site. The material may have been levelled across the site and used as the current platform. On site currently there are areas where waste is stockpiled prior to offsite disposal, at the time of this site investigation a large stockpile of bitumen 'hot mix' was held awaiting disposal at an appropriate facility.	I

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Storage tanks or drums for fuels, chemicals or liquid waste	Wide range of chemicals (organic and inorganic), and biological hazards	Drums containing solvents are currently stored on the Higgins site, empty drums are stored in various areas across the site. A large number of drums can be seen to be stored on the boundary adjacent to 565 Ruahine Street in the 1986 aerial image. There is a hazardous substances store present on the site.	A17
Scrap yards including automotive dismantling, wrecking or scrap metal yards	Metals, petroleum hydrocarbons (particularly lube oils), solvents used for cleaning, and PCBs	There are a number of wrecked vehicles stored on the south western portion of the site.	G4
Asphalt or bitumen manufacture or bulk storage	Petroleum hydrocarbons and PAH	Three large storage tanks containing bitumen products are stored towards the centre of the Higgins site.	E2
Motor vehicle workshops	Hydrocarbons including PAHs, solvents, and metals contained in waste oil	Maintenance and repairs are predominantly undertaken on vehicles and machinery in the buildings towards the northern portion of the Higgins site.	F4
Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances	Hydrocarbons including PAHs, solvents, and metals contained in waste oil	The activities occurring on the Higgins site; i.e. refuelling and storage of hazardous substances, meet the definition of a transport depot/yard within the HAIL.	F8
Commercial analytical laboratory sites	Wide range of organic and inorganic compounds including solvents, acids, metals, and mercury	The Higgins yard contains an IANZ accredited commercial analytical laboratory that analyses soils, aggregates and asphalt/bitumen products.	A3
Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment	Polychlorinated biphenyls (PCBs), hydrocarbons, copper, tin, lead, and mercury	There is an electrical distribution transformer within the site boundary, in front of the laboratory building, at the southern corner of Roxburgh Crescent.	B2

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Spray use for pastoral weed and pest control between 1970 and 1975	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates, and organochlorines (e.g. endosulfan on golf and bowling greens)	Plantation of trees visible on southern portion of 10 Roxburgh Crescent, referred to in the PSI as a market garden activity, could possibly be a plantation of larger trees such as pines. If pesticide sprays were used in the area, it is possible that there are concentrations of contaminants, in shallow soils, associated with historical use of sprays containing persistent organochlorine compounds used prior to the late 1970s.	A10
Asbestos building materials	Asbestos fibres, debris or fines	Due to the age of the present and the demolished/removed buildings (pre-2000) associated with the Higgins site they have the potential to contain asbestos products.	I and E1
Lead-Based Paint	Lead	Structures have been present on the site and surrounds when lead-based paints were in use. Lead may have been released during maintenance or weathering causing soil contamination.	I
29-31 Roxburgh Crescent			
Asbestos building materials	Asbestos fibres, debris or fines	The larger building on the construction yard is constructed of asbestos building products. There is potential for asbestos to be wide spread across site due to the nature of activities on site and vehicle movements surrounding the building.	I and E1
Lead-Based Paint	Lead	Structures have been present on the site and surrounds when lead-based paints were in use. Lead may have been released during maintenance or weathering causing soil contamination.	I
573-575 Ruahine Street			
Engineering workshops with metal fabrication	Metals and oxides of iron, nickel, copper, chromium, magnesium and manganese; range of organic compounds used for cleaning including BTEX, solvents	The business occupying this property, G.A. Zander Ltd, provides heavy vehicle and general engineering services.	D5
Motor vehicle workshop	Hydrocarbons including PAHs, solvents, and metals contained in waste oil	The business occupying this property, G.A. Zander Ltd, provides heavy vehicle and general engineering services.	F4
Storage tanks or drums for fuels, chemicals or liquid waste	Wide range of chemicals (organic and inorganic), and biological hazards	The occupier indicated that a fuel storage tank has previously been in use on the site. The shipping container on site appears to be used as a hazardous substance store.	A17

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Asbestos building materials	Asbestos fibres, debris or fines	Due to the age of the present and the demolished/removed buildings (pre-2000) they have the potential to contain asbestos products.	I and E1
Lead-Based Paint	Lead	Structures have been present on the site and surrounds when lead-based paints were in use. Lead may have been released during maintenance or weathering causing soil contamination.	I

5 Intrusive Investigation

5.1 Investigation design and methodology

As described in the preceding sections, the site has been subject to a number of HAIL activities. These activities are within the area proposed to be rezoned and on this basis, soil samples were collected from eighteen (18) targeted locations across the entire site, as shown in the sample location plan, included in **Appendix C**, and detailed in **Table 5.1** below.

Table 5.1: Sample locations and rationale

Sample Location ID	Location	Depth (m bgl)	Soil samples analysed (m bgl)
TP1	General coverage of Higgins yard, near to office building.	1.2 Target depth	0.1, 0.7
TP2	General coverage of Higgins yard, near to workshop building.	1.1 Target depth	0.1, 0.4
TP3	Adjacent to bitumen tanks.	1.5 Target depth	0.1, 0.5, 0.9 Bulk sample collected at 1.2
TP4	Down-gradient of diesel tank.	1.3 Target depth	0.1, 0.4
TP5	**Not collected due to proximity to services**. General site coverage, near to electrical transformer.	-	-
TP6	General coverage of Higgins yard, area previously occupied by former workshop.	0.7 Wall collapse	0.1, 0.4
TP7	General coverage of Higgins yard, area of former building which was removed/demolished between 2015-2017.	1.1 Target depth	0.1, 0.5
TP8	General coverage of Higgins yard, location of fill material visible in 1986 aerial image.	1.5 Target depth	0.1, 0.4, 1.2
TP9	Area of former drum storage (visible in 1986 aerial image) and near to current disposal area.	1.0 Target depth	0.1, 0.4, 0.8
TP10	General coverage of former plantation area, near to current Higgins paint store and storage of scrapped vehicles.	1.3 Target depth	0.1, 0.5
TP11	Approximate area of former petrol AST.	1.5 Target depth	0.1, 0.5, 1.5
SS1	General coverage of construction yard.	0.2	0.1, 0.2
SS2	General coverage of construction yard.	0.2	0.1, 0.2
SS3	General coverage of construction yard.	0.2	0.1, 0.2
SS4	General coverage of construction yard.	0.2	0.1, 0.2
SS5	General coverage of engineering workshop.	0.2	0.1, 0.2
SS6	General coverage of engineering workshop.	0.2	0.1, 0.2
SS7	General coverage of former plantation area.	0.2	0.1, 0.2
SS8	General coverage of former plantation area.	0.2	0.1, 0.2

Soil samples were collected using test pitting and hand excavation techniques. Sampling equipment was decontaminated using potable water with Decon90 (a phosphate free detergent) and then rinsed with potable water between samples.

In total forty (40) samples were collected and submitted to an accredited laboratory. In addition, one bulk sample in the form of a fragment of fibre board was collected and analysed for asbestos presence/absence in bulk material.

The analytical suite for the samples is described below:

- All forty (40) samples were analysed for metals (arsenic, cadmium, copper, chromium, lead nickel and zinc);
- Twenty-nine (29) samples were analysed for asbestos content (semi-quantitative method), sample numbers are below the BRANZ guideline numbers due to a location being inaccessible and the locations being selected via targeted method for an interim screening at this plan change phase. Further investigation in areas where asbestos has been identified will increase sample density;
- Twelve (12) samples were analysed for TPH, PAH, and BTEX;
- Nine (9) samples were analysed for organochlorine pesticides (OCP); and
- Five (5) samples were analysed for volatile organic compounds (VOC).

Samples were selected from depths between 0.1 m bgl to 1.5 m bgl (within fill material and slightly deeper than natural ground levels encountered in prior geotechnical investigation[7]) to assess the material in varying layers encountered.

The analytical suite for all samples was determined by the activities undertaken at, or near to, the location of the sample location and to assess the potential contaminants associated with the identified HAIL activities and data gaps described in previous sections.

Samples were not collected from 21 Roxburgh Crescent as no HAIL activities have been identified on this property.

5.2 Field observations

The subsurface material encountered across the sample locations comprised the following:

- A sandy/silty gravel layer between 0.3 m – 0.9 m thick was observed in all test pit locations;
- Natural sand and silts were observed underlying the fill and gravelly material to the termination of test pitting depths at 0.7 – 1.5 m;
- The wall of TP6 collapsed at 0.7 m bgl due to the presence of large cobbles (due to the size and number of the cobbles, it was possibly a former soak pit), this test pit also contained fill material consisting of a horseshoe and brick pipe fragments;
- Trace waste material consisting of brick fragments, bitumen pieces and wood fragments was encountered from surface level to a maximum of 0.9 m bgl in two test pits (TP8 and TP11) and brick fragments were present in surface soils in SS7;
- A gas/solvent odour was detected from 0.4-0.6 m bgl in TP9, which is in the location of the former drum storage in the 1986 aerial image. The area is now within a disused gravel/aggregate storage area. Recently, this area has been used as a disposal area and fill material including; concrete sample rods (from the laboratory), wood fragments, brick fragments, a steel sheet, an aluminium can, asphalt pieces and iron fragments. Water ingress was seen at the top of the silty sand layer at 0.6 m bgl, this location was flooded due to heavy rain in the days prior to the day of sampling. The ponded water was pumped from the area prior to beginning the test pitting;

- Waste material was encountered in TP3 from 0.5 – 1.3 m bgl. The material included dark black pieces with a heavy hydrocarbon odour, wood fragments, burnt material (charcoal), pipe fragments, wire pieces, brick fragments and white ceramic/glass pieces. A fibre cement fragment was found at 1.2 m bgl. Trace charcoal/ash fragments were also found from 0.3 – 0.6 m bgl in TP2;
- Surface sample locations at 29-31 Roxburgh Crescent (SS1-SS4) encountered similar material (sandy gravels with rootlets), SS1 contained brick and glass fragments in the top 0.1 m. There were nails and debris in the area surrounding SS4;
- The material encountered at the two locations (SS5 and SS6) from 573-575 Ruahine Street was found to be similar to the remainder of the site. There was evidence of localised ponding at SS5; and
- SS7 and SS8, collected in the section of Waterloo Park adjacent to the southern boundary of the Higgins yard, encountered a silty topsoil; trace brick fragments were noted in SS7 at 0 – 0.1 m bgl.

5.3 Soil sampling procedures

Soil samples were retrieved in general accordance with MfE Contaminated Land Management Guideline No. 5[12] as follows:

- Soil samples were collected from test pit and surface sample locations with freshly gloved hands and were placed into laboratory-prepared sample jars. The jars were stored under chilled conditions prior to being sent via courier to R J Hill Laboratories in Hamilton and Christchurch (asbestos samples only);
- The field equipment that had the potential to contact with the sample (trowel and spade) was decontaminated between samples using potable water and Decon90 (a phosphate-free detergent) followed by a clean water rinse;
- Soil samples were obtained at varying depths from 0.1 to 1.5 m bgl from all sample locations;
- The materials encountered were logged in general accordance with the NZ Geotechnical Society guidance and were assessed for odour and any evidence of contamination; and
- Samples were submitted to IANZ accredited R J Hill Laboratories (Hamilton and Christchurch), under chain of custody documentation.

5.4 Data Quality

5.4.1 Sample Handling and Holding Times

The chain of custody records show that the samples were submitted to R J Hill Laboratories Limited within the generally accepted holding times for these analytes.

5.4.2 Laboratory Quality Control

R J Hill Laboratories Limited is accredited by IANZ and as such are expected to comply with the accreditation requirements that include the confirmation of validity and suitability of results. Any breaches in laboratory control would be expected to be notified at the time of release of the analytical results. No breaches were reported.

5.5 Analytical results

A summary of the analytical results for the soil samples is presented, in comparison to the relevant assessment criteria, in the Results Summary Table, included in **Appendix D**. The assessment criteria were selected in accordance with the requirements of the regulatory framework, in particular, in accordance with the MfE Methodology[9]. Residential land use criteria were used to provide a conservative screening assessment for the potential use of the site as a residential development. Laboratory transcripts are provided in **Appendix E**.

Key findings of the analytical results are:

- Asbestos fibres/friable asbestos (AF/FA) were reported at concentrations above or at the human health criteria[10] (0.011% w/w, 0.003% w/w and <0.001% w/w versus the criterion of 0.001% w/w), in the shallow samples collected from locations SS1, SS2, and SS3. Asbestos was also found to be present within the fragment of fibre board found in TP3 at 1.2 m bgl. Asbestos was not detected in any of the other samples analysed;
- One or more contaminants was detected in all shallow soil samples analysed, as detailed below. However, other than asbestos (described above), lead at TP3, and arsenic in the surface samples collected from SS4 (0.1 m bgl and 0.2 m bgl), all samples results were below the relevant criteria for the protection of human health:
  - PAH compounds were detected in all but two of the selected samples;
  - No organochlorine pesticides were detected in any of the samples analysed;
  - Metals in nineteen (19) of the collected samples (both shallow and at depth) were found to be above the predicted background concentrations for the area[11] (Landcare Research, 2016); and
  - 1,2,4 Trimethylbenzene, which can be used as a solvent and paint thinner, was detected in one sample collected at TP9 at a depth of 0.4 m bgl.
- PAH results for two the samples collected in the sandy silt layer (>0.4 m bgl) collected during this investigation suggest that the natural soils in some areas may have been impacted by the identified HAIL activities.

Further discussion of the implications of these findings is provided in **Section 6** below.

5.6 Preliminary conceptual site model

A conceptual model, as defined by the Ministry for the Environment in the contaminated land management guidelines[12], sets out known and potential sources of contamination, potential exposure pathways, and potential receptors. For there to be an effect from the proposed activity there has to be a contamination source and a mechanism (pathway) for contamination to affect human health or the environment (receptor).

A preliminary conceptual site model has been developed for the wider site and is included in the PSI[5].

The ground conditions encountered on the wider site have been detailed below and separated by the properties visited within the text below:

[9] Ministry for the Environment, 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.
[10] BRANZ, 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil. Wellington
[11] Landcare Research Limited, 2016. PBC - Predicted Background Soil Concentrations, New Zealand, https://lris.scinfo.org.nz/layer/48470-pbc-predicted-background-soil-concentrations-new-zealand/
[12] Ministry for the Environment, updated 2011, *Contaminated Land Management Guidelines No. 5 Site Investigation and Analysis of Soils*

The ground condition encountered across the site were relatively consistent, comprising:

- Fill: Sandy gravels, with fragments of brick and hotmix (generally 0.2 m thick; 0.4 m to 0.7 m at the Higgins), contaminated with metals, PAH, and hydrocarbons generally below residential criteria, but some metals above Landfill Class A criteria;
  - Waste material (with occasional ACM fragments) was encountered in middle of the Higgins site (22 Roxburgh Cres) to 0.5-1.3 m depth, the horizontal extent of this material will require delineation during further investigations;
  - Waste material (with occasional nails, glass and brick fragments) was encountered across 29-31 Roxburgh Crescent to 0.2 m depth, the laboratory results for asbestos were above the human health criteria. The horizontal extent of this material will require delineation during further investigations; and
  - In Waterloo park the fill comprised topsoil (up to 0.2 m thick) with occasional brick fragments and gravels. Contamination was below residential criteria.
- Natural: sandy silt.

6 Regulatory implications

The rules and associated assessment criteria relating to the control of contaminated sites in the Manawatu-Wanganui region are specified in the following documents:

- NES Soil;
- Health and Safety at Work (Asbestos) Regulations (2016)[13];
- The Horizons Regional Council's One Plan; and
- The Palmerston North City Council District Plan.

The NES Soil and District Plan consider issues relating to land use and the protection of human health while the Regional Plan has regard to issues relating to the protection of the general environment, including ecological receptors. The need, or otherwise, for contamination related resource consents for the site redevelopment has been evaluated against these regulatory requirements.

6.1 NES Soil

6.1.1 Applicability

The NES Soil came into effect on 1 January 2012. This legislation sets out nationally consistent planning controls appropriate to district and city councils for assessing contaminants in soil with regard to human health. As a result, the NES Soil prevails over the rules in the District Plan, except where the rules permit or restrict effects that are not dealt with in the NES Soil.

The NES Soil applies to specific activities on land where a HAIL activity has, or is more likely than not to have, occurred. Activities covered under the NES Soil include soil disturbance, soil sampling, fuel systems removal, subdivision and land use change.

The following **Table 6.1**, as provided in the NES Soil Users Guide (April 2012), confirms the NES Soil will apply to the site.

[13] Health and Safety at Work (Asbestos) Regulations, administered by the Ministry of Business, Innovation, and Employment, February 2016

Table 6.1: PSI checklist

NES Soil Requirement	Applicable to site?
Is an activity described on the HAIL currently being undertaken on the piece of land to which this application applies?	Yes
Has an activity described on the HAIL ever been undertaken on the piece of land to which this application applies?	Yes
Is it more likely than not that an activity described on HAIL is being or has been undertaken on the piece of land to which this application applies?	Yes
If 'Yes' to any of the above, then the NES Soil may apply. **The five activities to which the NES applies are:**	
Is the activity you propose to undertake removing or replacing a fuel storage system or parts of it?	No
Is the activity you propose to undertake sampling soil?	No
Is the activity you propose to undertake disturbing soil?	Yes
Is the activity you propose to undertake subdividing land?	No
Is the activity you propose to undertake changing the use of the land?	Yes
Conclusion: The NES Soil applies to the proposed redevelopment site at Roxburgh Crescent	

6.1.2 NES Soil activity status

An assessment against the relevant permitted activity standards of the NES Soil is provided in **Table 6.2**.

Based on our understanding of the proposed rezoning from industrial to residential, the proposed works do not meet the provisions of a Permitted Activity under the NES Soil Regulation 8(3)(4) and will require a resource consent under the NES Soil.

As soil contamination in some of the collected samples exceeds the human health guideline values, redeveloping and subdividing the site for a residential land use will likely be a Restricted Discretionary Activity, under the NES Soil, in the specific 'pieces of land' containing elevated contaminants within the wider site.

Table 6.2: NES Soil Permitted Activity assessment for soil disturbance

NES Soil – Soil disturbance permitted activity conditions (Regulation 8(3))	Assessment
Implementation of controls to minimise exposure of humans to mobilised contaminants.	CAN COMPLY - Controls will be in place to prevent mobilisation of contamination.
The soil must be reinstated to an erosion free state within one month of completing the land disturbance.	CAN COMPLY - The area of land disturbance will be reinstated to an erosion free state on completion of the development works.
The volume of the disturbance of the piece of land must be no more than 25 m^3 per 500 m^2.	CAN'T DETERMINE COMPLIANCE BASED ON CURRENT INFORMATION - The volume of disturbance required for future redevelopment is currently unknown and may be calculated as 1,690 m^3 based on the entire site area (33,790 m^2). This calculation may need to be updated in future once the extent of the area to be redeveloped has been confirmed.

NES Soil – Soil disturbance permitted activity conditions (Regulation 8(3))	Assessment
Soil must not be taken away unless it is for laboratory testing or, for all other purposes combined, a maximum of 5 m^3 per 500 m^2 of soil may be taken away per year.	CAN'T DETERMINE COMPLIANCE BASED ON CURRENT INFORMATION - the volume of disposal required for future redevelopment is currently unknown, however based on the extent of the three identified priority areas it is 340 m^3. This calculation may need to be updated in future Once the extent of the area to be redeveloped has been confirmed.
Soil taken away must be disposed of at an appropriately licensed facility.	CAN'T DETERMINE COMPLIANCE BASED ON CURRENT INFORMATION - Soil removed from site will likely be disposed to an appropriate facility.
The duration of land disturbance must be no longer than two months.	CAN'T DETERMINE COMPLIANCE BASED ON CURRENT INFORMATION - The duration of the earthworks is currently unknown.
The integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.	NOT APPLICABLE - as there are no structures containing contamination within the area subject to land disturbance.

6.2 Health and Safety at Work (Asbestos) Regulations

The Health and Safety at Work (Asbestos) Regulations (2016) were enacted on 4 April 2016, herein referred to as the Asbestos Regulations.

In order to help achieve compliance with the Asbestos Regulations, WorkSafe New Zealand has prepared an Approved Code of Practice (ACoP): Management and Removal of Asbestos (September 2016). The ACoP refers readers to the "New Zealand Guidelines for Assessing and Managing Asbestos in Soil" (herein referred to as the Asbestos-in-Soil Guidelines) which were published in November 2017 by BRANZ Ltd[14].

Based on the results of the sampling completed during this investigation, disturbance of at least some of the site soils at 29-31 Roxburgh Crescent may be Class B works in accordance with the BRANZ asbestos in soil guidelines. Concentrations of FA/AF in soils encountered on site (0.011% w/w and 0.003% w/w) exceed the human health guideline value of 0.001% w/w.

While the existing site data is sufficient to inform the current plan change process, further investigations to confirm the extent of asbestos in soils at 29-31 Roxburgh Crescent is recommended prior to any soil disturbance work and prior to the potential redevelopment to a residential use.

The key requirements of the Asbestos-in-Soil guidelines, as determined by the concentration of asbestos fibres/fines or fragments that are present in the soils are provided in **Figure 6.1** below from the 2017 BRANZ guidelines[10].

[14] New Zealand Guidelines for Assessing and Managing Asbestos in Soil, prepared by BRANZ Ltd, November 2017

Scenario	PPE	Respiratory protective equipment (RPE)*	Dust/asbestos fibre suppression	Decontamination facilities
Class A: friable >1% w/w FA and/ or AF in soil	Disposable coveralls rated type 5, category 3, nitrile gloves, steel toe capped gumboots or safety footwear with disposable overshoes.	Full-face P3 respirator with particulate filter. Consider increasing to power-assisted if required.	Water and asbestos-encapsulating polymer emulsion product applied before starting work and during as required. Consider adding a surfactant to water for amphibole fibres (brown and blue).	Basic disposable wet decontamination tent or trailer. Consider powered and plumbed decontamination unit if project scale warrants.
Class B: non-friable >0.01% w/w FA and/or AF in soil >1% w/w ACM		Half-face P3 respirator with particulate filter. Consider increasing to full-face if friable ACM present.		Basic disposable decontamination tent and foot wash.
Asbestos-related work >0.001% w/w FA and/or AF in soil >0.01% w/w ACM		Disposable P2 dust mask.	Water via localised points. Addition of surfactants and polymers where the location is sensitive (such as adjacent to busy centres, schools). Temporary cover of contaminated area awaiting remediation.	
Unlicensed asbestos work ≤0.001% w/w FA and/or AF in soil ≤0.01% w/w ACM	No asbestos-specific PPE if air monitoring confirms asbestos below 0.01 f/ml.	No asbestos-specific RPE if SQEP confirms unlikely to exceed trace levels in air monitoring (0.01 f/ml) and/or if air monitoring confirms asbestos below 0.01 f/ml.		Foot wash and used PPE collection area.

*Refer to Part C section 14 of the ACOP and AS/NZS 1715:2009 for more information on RPE selection.

Table 6. Primary mitigation control requirements for work involving asbestos.

Figure 6.1: Table 6 from the 2017 BRANZ Asbestos-in-Soils Guidelines detailing mitigation control requirements for asbestos related work

6.3 Regional Plan

The Horizons Regional Council's One Plan sets out rules relating to the discharge of contaminants to land and water which will need to be considered once the redevelopment plans have been finalised.

6.4 District Plan applicability

As noted in **Section 6** the NES Soil now prevails over the rules in the District Plan, except where the rules permit or restrict effects that are not dealt with in the NES Soil.

As the rules in the District Plan do not deal with any effects that are not dealt with in the NES Soil, with respect to managing contaminants in soil to protect human health the provisions of the District Plan have not been considered further in this assessment.

6.5 Disposal Assessment

Based on the results of the investigations to date, disposal of some soils during the redevelopment works in particular areas across the wider site, will need occur at a facility licenced to receive asbestos contaminated soils and soils containing contaminants (metals, PAH, TPH and VOC).

The results of this investigation show that contaminant levels (PAH, metals, VOC and TPH) are above the predicted background concentrations and therefore they do not meet the definition for disposal at a cleanfill facility.

Eight of the collected samples also exceed the Class A disposal criteria for selected metals (copper, lead and zinc). Further analysis of samples will be required as well as discussions with the landfill operator prior to disposal at a Class A facility.

6.6 Development Implications

As HAIL activities will continue to operate on the site, we recommend that further intrusive investigations be undertaken once the activities have ceased and prior to residential redevelopment.

An indication of areas requiring further investigation has been included in the plan included in **Appendix F**.

7 Conclusions

Tonkin & Taylor Ltd (T+T) has been commissioned by the Palmerston North City Council to undertake a ground contamination investigation for eleven properties in the suburb of Hokowhitu, including 4-34 and 29-31 Roxburgh Crescent and 573-575 Ruahine Street, to assess the need for consents under the NES Soil and regional plan rules, and support the plan change to rezone the site from industrial to residential.

The key findings of the investigation are summarised below:

- A number of activities included in the MfE HAIL are currently, or have been historically, undertaken across the site;
- Analytical results from soil samples collected in the investigation show elevated concentrations of contaminants. However, the majority of the results are below human health criteria for residential land use;
- Concentrations of metals exceeding human health criteria were found in two locations, one location on 8-22 Roxburgh Crescent and one location at 29-31 Roxburgh Crescent;
- Asbestos was found in samples collected from two locations at 29-31 Roxburgh Crescent to be above the guideline value for human health;
- The presence of contaminants in the majority of samples indicates that clean fill disposal will not be appropriate. Further assessment will be required to determine appropriate disposal options; and
- The existing site data is sufficient to inform the current plan change process. However, as HAIL activities will continue to operate on the site, and there will be a need to confirm the extent of asbestos in soils at 29-31 Roxburgh Crescent, we recommend that further intrusive investigations be undertaken once the activities have ceased and prior to residential redevelopment.

Summary of regulatory implications:

- The NES Soil will apply to the site if residential redevelopment is undertaken as HAIL activities have been, and are currently occurring on the site and subdivision and soil disturbance will likely be required during the redevelopment phase; and
- Due to the presence of asbestos, controls will be required during soil disturbance and redevelopment works in accordance with the Asbestos Regulations.

8 Applicability

This report has been prepared for the exclusive use of our client Palmerston North City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions contained in this report are based on our visual inspection and sampling of material from discrete locations. The nature and continuity of subsoil away from the testing locations is inferred and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Kasey Pitt	Mike Jacka
Contaminated Land Consultant	Project Director

19-Mar-20

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Appendix A: Site photographs

Photograph 1: General Higgins site showing onsite activities

Photograph 2: General site condition, 29-31 Roxburgh Crescent

Photograph 3: General site condition, 21 Roxburgh Crescent

Photograph 4: General site condition, 573-575 Ruahine Street

Photograph 5: Example of scrapped vehicles and empty drums on Higgins site

Photograph 6: Containers containing paint and road marking store

Photograph 7: Vehicle refuelling at Higgins site

Photograph 8: Large bitumen storage tanks on Higgins site (third tank not visible, behind tank to left of image)

Photograph 9: Bunding surrounding bitumen storage tanks

Photograph 10: Example of sparse vegetation at 29-31 Roxburgh Crescent, SS4 location (similar to what was observed at 573-575 Ruahine Street)

Photograph 11: Drums used for burning at 29-31 Roxburgh Crescent

Photograph 12: Ponding of water observed in the middle of the Higgins site

Appendix B: 1956 aerial image

Figure Appendix B.1: 1956 Aerial Image of Hokowhitu Area – sourced from Palmerston North City Council Map Viewer

Appendix C: Sample location plan

Tonkin+Taylor

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PROJECT No.	1012456		
DESIGNED	KAPI	Dec.19	
DRAWN	ZALO	Dec.19	
CHECKED	JCOA	Dec.19	
APPROVED	MEJ	DATE	Mar-20

CLIENT **PALMERSTON NORTH CITY COUNCIL**

PROJECT **ROXBURGH CRESCENT**

TITLE GROUND CONTAMINATION ASSESSMENT SAMPLE LOCATIONS

SCALE (A3) AS SHOWN FIG No. F1 REV A

Appendix D: Results summary table

Sample ID	NES Soil - Residential 10% Produce[1]	NES Soil - Commercial/Industrial[1]	Landcare Research Predicted Background Concentrations[2]	Class A Landfill Screening Criteria[3]	Max	TP1 0.1	TP1 0.7	TP2 0.1	TP2 0.4	TP3 0.1	TP3 0.5	TP3 0.9	Bulk 1 TP3 1.2	TP4 0.1	TP4 0.4	TP6 0.1	TP6 0.4	TP7 0.1	TP7 0.5	TP8 0.1	TP8 0.4	TP8 1.2	TP9 0.1	TP9 0.4	TP9 0.8	TP10 0.1	TP10 0.5
Date						19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	18-Nov-19	18-Nov-19	18-Nov-19	18-Nov-19	18-Nov-19	18-Nov-19	18-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	18-Nov-19	18-Nov-19
Laboratory Number						2278663.23 2278881.23	2278663.24	2278663.21 2278881.21	2278663.22 2278881.22	2278663.18 2278881.18	2278663.19 2278881.19	2278663.20 2278881.20	2279150.1	2278663.16 2278881.16	2278663.17 2278881.17	2278663.11 2278881.11	2278663.12 2278881.12	2278663.9 2278881.9	2278663.10 2278881.10	2278663.1 2278881.1	2278663.2 2278881.2	2278663.3 2278881.3	2278663.13 2278881.13	2278663.14 2278881.14	2278663.15 2278881.15	2278663.7 2278881.7	2278663.8 2278881.8
Sample Depth (m bgl)						0.1	0.7	0.1	0.4	0.1	0.5	0.9	1.2	0.1	0.4	0.1	0.4	0.1	0.5	0.1	0.4	1.2	0.1	0.4	0.8	0.1	0.5
Geological Unit (field)						Sandy GRAVEL	SAND	Sandy GRAVEL	Sandy SILT	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy SILT	Sandy GRAVEL	Sandy SILT	Sandy GRAVEL	Sandy SILT	Sandy GRAVEL	Sandy SILT	Sandy GRAVEL	CLAY	Sandy SILT	Sandy GRAVEL	Sandy GRAVEL	Sandy SILT	Sandy GRAVEL	Sandy GRAVEL
Asbestos in Soil																											
Asbestos Presence/Absence	-	-	-	-	-	Asbestos NOT detected	-	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	-	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected
Asbestos Form	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos as ACM w/w%	0.01%[4]	0.02%[4]	-	-	<LoR	<LoR	-	<LoR	<LoR	<LoR	<LoR	<LoR	-	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR
Asbestos as AF/FA w/w%	0.001%[4]	0.001%[4]	-	-	0.011	<LoR	-	<LoR	<LoR	<LoR	<LoR	<LoR	-	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR
Bulk Asbestos																											
Sample Category	-	-	-	-	-	-	-	-	-	-	-	-	Fibre Cement	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Presence/Absence	-	-	-	-	-	-	-	-	-	-	-	-	Detected - Amosite (Brown Asbestos) and Chrysotile (White	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																											
Total Recoverable Arsenic	20	70	9.97	100	24	4	< 2	3	2	3	4	5	-	2	2	6	16	3	3	3	5	2	6	3	3	4	3
Total Recoverable Cadmium	3	1,300	0.33	20	0.54	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.13	0.17	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	460	6,300	56.88	100	45	12	9	10	11	11	12	11	-	11	11	11	11	12	11	12	15	11	22	12	11	12	11
Total Recoverable Copper	>10,000	>10,000	48.14	100	880	9	5	8	6	7	15	22	-	7	6	7	7	8	6	8	13	5	22	11	7	14	6
Total Recoverable Lead	210	3,300	25.83	100	240	19	5.5	12.1	7.7	10.4	110	240	-	8.8	8.9	8.9	15.8	11.6	7.6	11.3	64	6.4	25	14.9	7.2	52	8.6
Total Recoverable Nickel	400[5]	6,000[5]	35.15	200	16	11	9	10	9	10	10	6	-	10	10	10	9	11	10	10	11	10	15	9	10	11	10
Total Recoverable Zinc	8,000[5]	40,0000[5]	97.97	200	550	51	34	43	40	41	169	178	-	38	41	41	64	144	72	50	140	36	174	96	38	55	41
Organochlorine Pesticides in Soil *																											
4,4'-DDE	-	-	-	500	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total DDT Isomers	70	1,000	-	500	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	2.6	160	-	8	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons in Soil																											
1-Methylnaphthalene	180[6]	-	-	-	0.051	-	-	< 0.011	< 0.012	< 0.011	< 0.011	< 0.012	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	< 0.012	**0.051**	< 0.012	-	-
2-Methylnaphthalene	38[6]	-	-	-	0.071	-	-	< 0.011	< 0.012	< 0.011	< 0.011	< 0.012	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	**0.012**	**0.071**	< 0.012	-	-
Acenaphthylene		-	-	-	0.089			< 0.011	< 0.012	< 0.011	**0.07**	**0.025**	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	**0.089**	**0.042**	< 0.012	-	-
Acenaphthene	3,500[6]	-	-	-	0.032	-	-	< 0.011	< 0.012	< 0.011	< 0.011	< 0.012	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	**0.032**	**0.02**	< 0.012	-	-
Anthracene	refer BAPeq	-	-	-	0.138	-	-	< 0.011	< 0.012	< 0.011	**0.094**	**0.045**	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	**0.138**	**0.038**	< 0.012	-	-
Benzo[a]anthracene	refer BAPeq	-	-	-	1.16	-	-	< 0.011	< 0.012	< 0.011	**0.47**	**0.24**	-	< 0.010	**0.043**	< 0.011	**0.017**	-	-	-	-	-	**1.16**	**0.27**	< 0.012	-	-
Benzo[a]pyrene (BAP)	refer BAPeq	-	-	-	1.42	-	-	**0.016**	**0.014**	< 0.011	**0.58**	**0.27**	-	< 0.010	**0.043**	**0.012**	**0.023**	-	-	-	-	-	**1.42**	**0.36**	< 0.012	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	refer BAPeq	-	-	-	1.81	-	-	**0.02**	**0.019**	**0.012**	**0.76**	**0.35**	-	< 0.010	**0.055**	< 0.011	**0.025**	-	-	-	-	-	**1.81**	**0.49**	< 0.012	-	-
Benzo[e]pyrene	-	-	-	-	0.59	-	-	**0.011**	< 0.012	< 0.011	**0.3**	**0.134**	-	< 0.010	**0.021**	< 0.011	**0.011**	-	-	-	-	-	**0.59**	**0.197**	< 0.012	-	-
Benzo[g,h,i]perylene	-	-	-	-	0.72	-	-	**0.023**	< 0.012	**0.014**	**0.36**	**0.188**	-	< 0.010	**0.027**	< 0.011	**0.013**	-	-	-	-	-	**0.72**	**0.25**	< 0.012	-	-
Benzo[k]fluoranthene	refer BAPeq	-	-	-	0.7	-	-	< 0.011	< 0.012	< 0.011	**0.3**	**0.14**	-	< 0.010	**0.025**	< 0.011	**0.012**	-	-	-	-	-	**0.7**	**0.172**	< 0.012	-	-
Chrysene	refer BAPeq	-	-	-	1.05	-	-	< 0.011	< 0.012	< 0.011	**0.5**	**0.23**	-	< 0.010	**0.034**	< 0.011	**0.017**	-	-	-	-	-	**1.05**	**0.27**	< 0.012	-	-
Dibenzo[a,h]anthracene	refer BAPeq	-	-	-	0.143	-	-	< 0.011	< 0.012	< 0.011	**0.059**	**0.029**	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	**0.143**	**0.05**	< 0.012	-	-
Fluoranthene	refer BAPeq	-	-	-	2.1	-	-	< 0.011	**0.019**	< 0.011	**0.83**	**0.44**	-	< 0.010	**0.081**	0.016	**0.037**	-	-	-	-	-	**2.1**	**0.52**	< 0.012	-	-
Fluorene	2,300[6]	-	-	-	0.059	-	-	< 0.011	< 0.012	< 0.011	**0.011**	< 0.012	-	< 0.010	< 0.012	< 0.011	< 0.011	-	-	-	-	-	**0.059**	**0.041**	< 0.012	-	-
Indeno(1,2,3-c,d)pyrene	refer BAPeq	-	-	-	1.19	-	-	**0.021**	**0.012**	**0.012**	**0.55**	**0.26**	-	< 0.010	**0.038**	< 0.011	**0.015**	-	-	-	-	-	**1.19**	**0.35**	< 0.012	-	-
Naphthalene	58[7]	(190)[8]	-	200	0.07	-	-	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	-	< 0.05	< 0.06	< 0.06	< 0.06	-	-	-	-	-	< 0.06	**0.07**	< 0.06	-	-
Perylene	-	-	-	-	0.4	-	-	< 0.011	< 0.012	< 0.011	**0.169**	**0.112**	-	< 0.010	**0.015**	< 0.011	< 0.011	-	-	-	-	-	**0.4**	**0.11**	< 0.012	-	-
Phenanthrene	-	-	-	-	0.4	-	-	< 0.011	< 0.012	< 0.011	**0.26**	**0.132**	-	< 0.010	**0.038**	< 0.011	**0.013**	-	-	-	-	-	**0.4**	**0.21**	< 0.012	-	-
Pyrene	1,600[7]	NA[8]	-	-	2.9	-	-	**0.013**	**0.017**	< 0.011	**0.89**	**0.42**	-	< 0.010	**0.076**	**0.013**	**0.034**	-	-	-	-	-	**2.9**	**0.89**	< 0.012	-	-
Benzo[a]pyrene Equivalence	10	35	-	300	2.1	-	-	< 0.03	< 0.03	< 0.03	**0.87**	**0.41**	-	< 0.03	**0.07**	< 0.03	**0.03**	-	-	-	-	-	**2.1**	**0.55**	< 0.03	-	-
Total Petroleum Hydrocarbons in Soil																											
C7 - C9	120[7]	120[8]	-	-	0	-	-	< 8	< 8	< 8	< 8	< 8	-	< 8	< 8	< 8	< 8	-	-	-	-	-	< 8	< 8	< 8	-	-
C10 - C14	(470)[7]	(1,500)[8]	-	-	85	-	-	< 20	< 20	< 20	< 20	< 20	-	< 20	< 20	< 20	< 20	-	-	-	-	-	**41**	**85**	< 20	-	-
C15 - C36	NA[7]	NA[8]	-	-	1250	-	-	**59**	< 40	**153**	**154**	**57**	-	**64**	< 40	< 40	< 40	-	-	-	-	-	**950**	**1250**	< 40	-	-
Total hydrocarbons (C7 - C36)	-	-	-	-	1340	-	-	< 70	< 70	**156**	**161**	< 70	-	< 70	< 70	< 70	< 70	-	-	-	-	-	**990**	**1340**	< 70	-	-
BTEX																											
Benzene	1.1[7]	3.0[8]	-	10	<LoR	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.14	< 0.16	-	-	-	-	-	< 0.17	< 0.16	< 0.18	-	-
Toluene	(68)[7]	(94)[8]	-	2,000	<LoR	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.3	< 0.3	-	-	-	-	-	< 0.3	< 0.3	< 0.3	-	-
Ethylbenzene	(53)[7]	(180)[8]	-	1,000	<LoR	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.3	< 0.3	-	-	-	-	-	< 0.3	< 0.3	< 0.3	-	-
m&p-Xylene	(48)[7]	(150)[8]	-	2,000	<LoR	-	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	-	< 0.10	< 0.10	< 0.3	< 0.4	-	-	-	-	-	< 0.4	< 0.4	< 0.4	-	-
o-Xylene	(48)[7]	(150)[8]	-	2,000	<LoR	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.3	< 0.3	-	-	-	-	-	< 0.3	< 0.3	< 0.3	-	-
Volatile Organic Compounds*																											
1,2,4-Trimethylbenzene	62[9]	260[9]	-	-	0.5	-	-	-	-	-	-	-	-	-	-	< 0.3	< 0.3	-	-	-	-	-	< 0.3	**0.5**	< 0.3	-	-

Notes:

880	Exceeds upper limit of background soil concentrations
240	Exceeds applicable human health criteria (residential)
0.11	Exceeds applicable human health criteria (commercial)
110	Exceeds Class A Landfill Acceptance Criteria

All values in mg/kg unless otherwise indicated (asbestos results)
<LoR indicates result below laboratory level of reporting
BOLD indicates above laboratory levels of reporting for compounds without published background concentrations
* Only those OCP and VOC compounds which recorded concentrations above the laboratory levels of detection have been reported
(190) indicates values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons

1 - Criteria from MfE, 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (unless otherwise stated).

2 - Upper limit of background concentrations from Landcare Research, 2016. Predicted background soil concentrations for Mudstone Pakihi.

3 - Criteria from MfE, 2004. Landfill Waste Acceptance Criteria and Landfill Classification.

4 - BRANZ Ltd, 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil.

5 - ASC NEPM Toolbox – Update February 2014 - http://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.

6 - USEPA Regional Screening Levels - http://www.epa.gov/risk/risk-based-screening-table-generic-tables. Standard residential use used to assess conservatively assess both high density residential and recreational uses. Criteria adjusted for 1 in 100,000 risk and hazard quotient of 1 where required.

7 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Sandy soils at <1 m depth. Soil acceptance criteria for a residential use.

8 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Sandy soils at <1 m depth. Soil acceptance criteria for a commercial/industrial use.

9 - US EPA, Regional Screening Levels for Chemical Contaminants at Superfund Sites (US EPA regions 3, 6 and 9 (accessed Oct 2012)).

ITEM 10 - ATTACHMENT 1

Sample ID	NES Soil - Residential 10% Produce[1]	NES Soil - Commercial/Industrial[1]	Landcare Research Predicted Background Concentrations [2]	Class A Landfill Screening Criteria [3]	Max	TP11 0.1	TP11 0.5	TP11 1.5	SS1 0.1	SS1 0.2	SS2 0.1	SS2 0.2	SS3 0.1	SS3 0.2	SS4 0.1	SS4 0.2	SS5 0.1	SS5 0.2	SS6 0.1	SS6 0.2	SS7 0.1	SS7 0.2	SS8 0.1	SS8 0.2
Date						18-Nov-19	18-Nov-19	18-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19	19-Nov-19
Laboratory Number						2278663.4 2278881.4	2278663.5 2278881.5	2278663.6 2278881.6	2278663.25 2278881.24	2278663.26	2278663.27 2278881.25	2278663.28	2278663.29 2278881.26	2278663.30	2278663.31 2278881.27	2278663.32	2278663.33 2278881.28	2278663.34	2278664.35 2278881.29	2278665.36	2278663.37	2278663.38	2278663.39	2278663.40
Sample Depth (m bgl)						0.1	0.5	1.5	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Geological Unit (field)						Sandy GRAVEL	Sandy GRAVEL	SAND	Silty GRAVEL	Silty GRAVEL	Silty GRAVEL	Silty GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Sandy GRAVEL	Silty TOPSOIL	Gravelly SILT	Silty TOPSOIL	Gravelly SILT
Asbestos in Soil																								
Asbestos Presence/Absence	-	-	-	-	-	Asbestos NOT detected	Asbestos NOT detected	Asbestos NOT detected	Asbestos detected; Amosite (Brown Asbestos) and Chrysotile (White Asbestos)	-	Asbestos detected; Amosite (Brown Asbestos) and Chrysotile (White Asbestos)	-	Asbestos detected; Chrysotile (White Asbestos)	-	Asbestos NOT detected	-	Asbestos NOT detected	-	Asbestos NOT detected	-	-	-	-	-
Asbestos Form	-	-	-	-	-	-	-	-	ACM Debris and Loose Fibres	-	ACM Debris	-	ACM Debris	-	-	-	-	-	-	-	-	-	-	-
Asbestos as ACM w/w%	0.01%[4]	0.02%[4]	-	-	<LoR	<LoR	<LoR	<LoR	< 0.001	-	<0.001	-	<0.001	-	<LoR	-	<LoR	-	<LoR	-	-	-	-	-
Asbestos as AF/FA w/w%	0.001%[4]	0.001%[4]	-	-	0.011	<LoR	<LoR	<LoR	0.011	-	0.003	-	<0.001	-	<LoR	-	<LoR	-	<LoR	-	-	-	-	-
Bulk Asbestos																								
Sample Category	-	-	-	-	-	-	-	-																
Asbestos Presence/Absence	-	-	-	-	-	-	-	-																
Metals																								
Total Recoverable Arsenic	20	70	9.97	100	24	5	4	2	7	5	7	4	8	10	24	22	14	9	3	3	6	5	3	3
Total Recoverable Cadmium	3	1,300	0.33	20	0.54	< 0.10	< 0.10	< 0.10	0.29	0.11	0.27	< 0.10	0.12	0.11	0.19	< 0.10	0.47	0.54	< 0.10	< 0.10	0.16	0.11	0.10	< 0.10
Total Recoverable Chromium	460	6,300	56.88	100	45	12	12	11	19	13	15	11	15	17	25	12	45	37	11	14	15	14	11	11
Total Recoverable Copper	>10,000	>10,000	48.14	100	880	8	10	5	30	11	11	7	13	13	26	9	880	47	7	9	13	12	9	8
Total Recoverable Lead	210	3,300	25.83	100	240	10.7	33	7	113	33	52	13.7	22	71	141	21	83	124	6.1	5.7	46	32	18.2	17.4
Total Recoverable Nickel	400[5]	6,000[5]	35.15	200	16	9	11	10	12	11	11	10	11	11	10	10	16	15	6	7	15	14	9	9
Total Recoverable Zinc	8,000[5]	40,0000[5]	97.97	200	550	63	46	37	550	156	175	57	380	210	360	63	230	280	45	56	121	86	70	64
Organochlorine Pesticides in Soil *																								
4,4'-DDE	-	-	-	500	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total DDT Isomers	70	1,000	-	500	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	2.6	160	-	8	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons in Soil																								
1-Methylnaphthalene	180[6]	-	-	-	0.051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	38[6]	-	-	-	0.071	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene		-	-	-	0.089	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	3,500[6]	-	-	-	0.032	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	refer BAPeq	-	-	-	0.138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]anthracene	refer BAPeq	-	-	-	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene (BAP)	refer BAPeq	-	-	-	1.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	refer BAPeq	-	-	-	1.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[e]pyrene	-	-	-	-	0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[g,h,i]perylene	-	-	-	-	0.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	refer BAPeq	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	refer BAPeq	-	-	-	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo[a,h]anthracene	refer BAPeq	-	-	-	0.143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	refer BAPeq	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2,300[6]	-	-	-	0.059	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	refer BAPeq	-	-	-	1.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	58[7]	(190)[8]	-	200	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perylene	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1,600[7]	NA[8]	-	-	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene Equivalence	10	35	-	300	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons in Soil																								
C7 - C9	120[7]	120[8]	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C10 - C14	(470)[7]	(1,500)[8]	-	-	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C15 - C36	NA[7]	NA[8]	-	-	1250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total hydrocarbons (C7 - C36)	-	-	-	-	1340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX																								
Benzene	1.1[7]	3.0[8]	-	10	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	(68)[7]	(94)[8]	-	2,000	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	(53)[7]	(180)[8]	-	1,000	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m&p-Xylene	(48)[7]	(150)[8]	-	2,000	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	(48)[7]	(150)[8]	-	2,000	<LoR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds*																								
1,2,4-Trimethylbenzene	62[9]	260[9]	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

880	Exceeds upper limit of background soil concentrations
240	Exceeds applicable human health criteria (residential)
0.11	Exceeds applicable human health criteria (commercial)
110	Exceeds Class A Landfill Acceptance Criteria

All values in mg/kg unless otherwise indicated (asbestos results)
<LoR indicates result below laboratory level of reporting
BOLD indicates above laboratory levels of reporting for compounds without published background concentrations
* Only those OCP and VOC compounds which recorded concentrations above the laboratory levels of detection have been reported
(190) indicates values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons

1 - Criteria from MfE, 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (unless otherwise stated).

2 - Upper limit of background concentrations from Landcare Research, 2016. Predicted background soil concentrations for Mudstone Pakihi.

3 - Criteria from MfE, 2004. Landfill Waste Acceptance Criteria and Landfill Classification.

4 - BRANZ Ltd, 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil.

5 - ASC NEPM Toolbox – Update February 2014 - http://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.

6 - USEPA Regional Screening Levels - http://www.epa.gov/risk/risk-based-screening-table-generic-tables. Standard residential use used to assess conservatively assess both high density residential and recreational uses. Criteria adjusted for 1 in 100,000 risk and hazard quotient of 1 where required.

7 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Sandy soils at <1 m depth. Soil acceptance criteria for a residential use.

8 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Sandy soils at <1 m depth. Soil acceptance criteria for a commercial/industrial use.

9 - US EPA, Regional Screening Levels for Chemical Contaminants at Superfund Sites (US EPA regions 3, 6 and 9 (accessed Oct 2012)).

Appendix E: Laboratory transcripts

ITEM 10 - ATTACHMENT 1

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
101C Waterloo Road
Hornby
Christchurch 8042 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2278881	A2Pv2
Contact:	Kasey Pitt	**Date Received:**	21-Nov-2019	
	C/- Tonkin & Taylor	**Date Reported:**	28-Nov-2019	**(Amended)**
	PO Box 2083	**Quote No:**	102396	
	Wellington 6140	**Order No:**	1012456	
		Client Reference:	1012456	
		Submitted By:	Kasey Pitt	

Sample Type: Soil

Sample Name:		TP8 0.1 18-Nov-2019	TP8 0.4 18-Nov-2019	TP8 1.2 18-Nov-2019	TP11 0.1 18-Nov-2019	TP11 0.5 18-Nov-2019
Lab Number:		2278881.1	2278881.2	2278881.3	2278881.4	2278881.5
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	875.6	527.6	618.6	1,019.3	938.5
Dry Weight	g	820.0	469.2	575.9	960.6	889.5
Moisture	%	6	11	7	6	5
Sample Fraction >10mm	g dry wt	226.1	165.9	3.0	185.6	260.8
Sample Fraction <10mm to >2mm	g dry wt	341.3	157.7	0.6	404.2	381.9
Sample Fraction <2mm	g dry wt	250.8	143.3	571.9	369.5	246.0
<2mm Subsample Weight	g dry wt	55.9	58.7	57.9	59.7	56.6
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP11 1.5 18-Nov-2019	TP10 0.1 18-Nov-2019	TP10 0.5 18-Nov-2019	TP7 0.1 18-Nov-2019	TP7 0.5 18-Nov-2019
Lab Number:		2278881.6	2278881.7	2278881.8	2278881.9	2278881.10
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	775.8	914.8	831.2	907.2	622.5
Dry Weight	g	687.8	874.6	775.2	869.6	529.2
Moisture	%	11	4	7	4	15

Sample Type: Soil						
Sample Name:		TP11 1.5 18-Nov-2019	TP10 0.1 18-Nov-2019	TP10 0.5 18-Nov-2019	TP7 0.1 18-Nov-2019	TP7 0.5 18-Nov-2019
Lab Number:		2278881.6	2278881.7	2278881.8	2278881.9	2278881.10
Sample Fraction >10mm	g dry wt	< 0.1	205.2	285.2	297.4	43.6
Sample Fraction <10mm to >2mm	g dry wt	< 0.1	464.0	299.6	378.0	64.0
Sample Fraction <2mm	g dry wt	686.3	200.8	189.5	193.1	420.6
<2mm Subsample Weight	g dry wt	52.4	57.6	59.6	57.4	54.7
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP6 0.1 18-Nov-2019	TP6 0.4 18-Nov-2019	TP9 0.1 19-Nov-2019	TP9 0.4 19-Nov-2019	TP9 0.8 19-Nov-2019
Lab Number:		2278881.11	2278881.12	2278881.13	2278881.14	2278881.15
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	963.3	800.1	956.6	918.6	753.4
Dry Weight	g	935.0	717.4	862.6	840.3	638.9
Moisture	%	3	10	10	9	15
Sample Fraction >10mm	g dry wt	411.4	140.6	249.2	229.0	< 0.1
Sample Fraction <10mm to >2mm	g dry wt	331.2	94.0	366.0	362.6	< 0.1
Sample Fraction <2mm	g dry wt	191.1	481.5	244.9	247.8	636.8
<2mm Subsample Weight	g dry wt	56.5	58.8	54.6	56.2	55.0
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP4 0.1 19-Nov-2019	TP4 0.4 19-Nov-2019	TP3 0.1 19-Nov-2019	TP3 0.5 19-Nov-2019	TP3 0.9 19-Nov-2019
Lab Number:		2278881.16	2278881.17	2278881.18	2278881.19	2278881.20
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g	1,011.6	779.5	932.7	1,075.7	756.1
Dry Weight	g	982.8	679.4	907.6	1,017.3	654.8
Moisture	%	3	13	3	5	13
Sample Fraction >10mm	g dry wt	410.2	< 0.1	155.6	547.0	20.0
Sample Fraction <10mm to >2mm	g dry wt	388.1	2.2	502.7	282.2	207.4
Sample Fraction <2mm	g dry wt	182.5	676.2	246.3	187.1	424.5
<2mm Subsample Weight	g dry wt	58.2	56.4	51.8	56.3	57.0

ITEM 10 - ATTACHMENT 1

Sample Type: Soil						
Sample Name:		TP4 0.1 19-Nov-2019	TP4 0.4 19-Nov-2019	TP3 0.1 19-Nov-2019	TP3 0.5 19-Nov-2019	TP3 0.9 19-Nov-2019
Lab Number:		2278881.16	2278881.17	2278881.18	2278881.19	2278881.20
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:		TP2 0.1 19-Nov-2019	TP2 0.4 19-Nov-2019	TP1 0.1 19-Nov-2019	SS1 0.1 19-Nov-2019	SS2 0.1 19-Nov-2019
Lab Number:		2278881.21	2278881.22	2278881.23	2278881.24	2278881.25
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Amosite (Brown Asbestos) and Chrysotile (White Asbestos) detected.	Amosite (Brown Asbestos) and Chrysotile (White Asbestos) detected.
Description of Asbestos Form		-	-	-	ACM Debris and Loose Fibres	ACM Debris
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	0.011	0.003
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	0.011	0.003
As Received Weight	g	1,093.3	766.7	1,000.7	982.3	984.0
Dry Weight	g	1,070.3	653.7	970.3	890.3	920.7
Moisture	%	2	15	3	9	6
Sample Fraction >10mm	g dry wt	467.4	< 0.1	347.2	398.8	318.0
Sample Fraction <10mm to >2mm	g dry wt	352.0	4.5	340.7	319.6	393.8
Sample Fraction <2mm	g dry wt	250.2	646.3	281.5	169.7	206.8
<2mm Subsample Weight	g dry wt	58.6	55.9	51.6	58.4	52.6
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	0.10195	0.02303

Sample Name:		SS3 0.1 19-Nov-2019	SS4 0.1 19-Nov-2019	SS5 0.1 19-Nov-2019	SS6 0.1 19-Nov-2019	
Lab Number:		2278881.26	2278881.27	2278881.28	2278881.29	
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		ACM Debris	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	929.4	837.7	794.6	972.7	-
Dry Weight	g	812.6	752.7	650.8	867.7	-
Moisture	%	13	10	18	11	-
Sample Fraction >10mm	g dry wt	113.2	300.5	90.3	73.8	-
Sample Fraction <10mm to >2mm	g dry wt	310.3	246.8	264.2	120.8	-
Sample Fraction <2mm	g dry wt	387.6	204.0	294.6	671.8	-
<2mm Subsample Weight	g dry wt	50.5	53.3	53.6	56.6	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-

Sample Type: Soil						
Sample Name:		SS3 0.1 19-Nov-2019	SS4 0.1 19-Nov-2019	SS5 0.1 19-Nov-2019	SS6 0.1 19-Nov-2019	
Lab Number:		2278881.26	2278881.27	2278881.28	2278881.29	
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	0.00010	< 0.00001	< 0.00001	< 0.00001	-

Glossary of Terms

• Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
• Trace - Trace levels of asbestos, as defined by AS4964-2004.
For further details, please contact the Asbestos Team.

Please refer to the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.
https://www.branz.co.nz/asbestos

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier report issued on 27 Nov 2019 at 2:24 pm
Reason for amendment: At the request of the client, the sample date for sample # 13 has been amended.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Wgt of Asbestos as Asbestos Fines in <10mm >2mm Fraction*	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1-29
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-29
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-29
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-29
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-29
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-29
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1-29
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1-29
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-29

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-29
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-29
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-29
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-29
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-29
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-29
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-29

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

John Keneth Paglingayen
Bachelor of Applied Science
Laboratory Technician - Asbestos

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Christchurch 8042 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2279150	A2Pv1
Contact:	Kasey Pitt	**Date Received:**	21-Nov-2019	
	C/- Tonkin & Taylor	**Date Reported:**	22-Nov-2019	
	PO Box 2083	**Quote No:**	102396	
	Wellington 6140	**Order No:**	1012456	
		Client Reference:	1012456	
		Submitted By:	Kasey Pitt	

Sample Type: Building Material

Sample Name	Lab Number	Sample Category	Sample Weight on receipt	Asbestos Presence / Absence	Description of Asbestos in Non Homogeneous Samples
Bulk 1 TP3 1.2	2279150.1	Fibre Cement	11.78	Amosite (Brown Asbestos) and Chrysotile (White Asbestos) detected. Organic fibres detected.	-

Summary of Methods

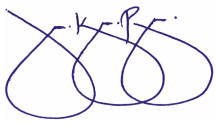
The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Building Material

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Bulk Material			
Sample Category	Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	1
Sample Weight on receipt	Sample weight. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.01 g	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1
Description of Asbestos in Non Homogenous Samples	Form, dimensions and/or weight of asbestos fibres present. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.



John Keneth Paglingayen
Bachelor of Applied Science
Laboratory Technician - Asbestos

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

ITEM 10 - ATTACHMENT 1

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2278663	SPv1
Contact:	Kasey Pitt C/- Tonkin & Taylor PO Box 2083 Wellington 6140	**Date Received:**	20-Nov-2019	
		Date Reported:	25-Nov-2019	
		Quote No:	102396	
		Order No:	1012456	
		Client Reference:	1012456	
		Submitted By:	Kasey Pitt	

Sample Type: Soil

Sample Name:		TP8 0.1 19-Nov-2019	TP8 0.4 18-Nov-2019	TP8 1.2 18-Nov-2019	TP11 0.1 18-Nov-2019	TP11 0.5 18-Nov-2019
Lab Number:		2278663.1	2278663.2	2278663.3	2278663.4	2278663.5
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	80	93
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	5	2	5	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	12	15	11	12	12
Total Recoverable Copper	mg/kg dry wt	8	13	5	8	10
Total Recoverable Lead	mg/kg dry wt	11.3	64	6.4	10.7	33
Total Recoverable Nickel	mg/kg dry wt	10	11	10	9	11
Total Recoverable Zinc	mg/kg dry wt	50	140	36	63	46
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	< 0.013	< 0.011
alpha-BHC	mg/kg dry wt	-	-	-	< 0.013	< 0.011
beta-BHC	mg/kg dry wt	-	-	-	< 0.013	< 0.011
delta-BHC	mg/kg dry wt	-	-	-	< 0.013	< 0.011
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	< 0.013	< 0.011
cis-Chlordane	mg/kg dry wt	-	-	-	< 0.013	< 0.011
trans-Chlordane	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	-	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	-	< 0.013	< 0.011
4,4'-DDD	mg/kg dry wt	-	-	-	< 0.013	< 0.011
2,4'-DDE	mg/kg dry wt	-	-	-	< 0.013	< 0.011
4,4'-DDE	mg/kg dry wt	-	-	-	< 0.013	< 0.011
2,4'-DDT	mg/kg dry wt	-	-	-	< 0.013	< 0.011
4,4'-DDT	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Total DDT Isomers	mg/kg dry wt	-	-	-	< 0.08	< 0.07
Dieldrin	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Endosulfan I	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Endosulfan II	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Endosulfan sulphate	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Endrin	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Endrin aldehyde	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Endrin ketone	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Heptachlor	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Heptachlor epoxide	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Hexachlorobenzene	mg/kg dry wt	-	-	-	< 0.013	< 0.011
Methoxychlor	mg/kg dry wt	-	-	-	< 0.013	< 0.011

Sample Type: Soil						
Sample Name:		TP11 1.5 18-Nov-2019	TP10 0.1 18-Nov-2019	TP10 0.5 18-Nov-2019	TP7 0.1 18-Nov-2019	TP7 0.5 18-Nov-2019
Lab Number:		2278663.6	2278663.7	2278663.8	2278663.9	2278663.10
Individual Tests						
Dry Matter	g/100g as rcvd	90	95	88	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	4	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	12	11	12	11
Total Recoverable Copper	mg/kg dry wt	5	14	6	8	6
Total Recoverable Lead	mg/kg dry wt	7.0	52	8.6	11.6	7.6
Total Recoverable Nickel	mg/kg dry wt	10	11	10	11	10
Total Recoverable Zinc	mg/kg dry wt	37	55	41	144	72
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
alpha-BHC	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
beta-BHC	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
delta-BHC	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
cis-Chlordane	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
trans-Chlordane	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	-	-
2,4'-DDD	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
4,4'-DDD	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
2,4'-DDE	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
4,4'-DDE	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
2,4'-DDT	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
4,4'-DDT	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Total DDT Isomers	mg/kg dry wt	< 0.07	< 0.07	< 0.07	-	-
Dieldrin	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Endosulfan I	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Endosulfan II	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Endrin	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Endrin aldehyde	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Endrin ketone	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Heptachlor	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Methoxychlor	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-

Sample Name:		TP6 0.1 18-Nov-2019	TP6 0.4 18-Nov-2019	TP9 0.1 19-Nov-2019	TP9 0.4 19-Nov-2019	TP9 0.8 19-Nov-2019
Lab Number:		2278663.11	2278663.12	2278663.13	2278663.14	2278663.15
Individual Tests						
Dry Matter	g/100g as rcvd	97	89	87	90	85
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	16	6	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	11	22	12	11
Total Recoverable Copper	mg/kg dry wt	7	7	22	11	7
Total Recoverable Lead	mg/kg dry wt	8.9	15.8	25	14.9	7.2
Total Recoverable Nickel	mg/kg dry wt	10	9	15	9	10
Total Recoverable Zinc	mg/kg dry wt	41	64	174	96	38
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	14.9	4.5	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.012	0.051	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	0.012	0.071	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.011	0.089	0.042	< 0.012

ITEM 10 - ATTACHMENT 1

Sample Type: Soil						
Sample Name:		TP6 0.1 18-Nov-2019	TP6 0.4 18-Nov-2019	TP9 0.1 19-Nov-2019	TP9 0.4 19-Nov-2019	TP9 0.8 19-Nov-2019
Lab Number:		2278663.11	2278663.12	2278663.13	2278663.14	2278663.15
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.011	< 0.011	0.032	0.020	< 0.012
Anthracene	mg/kg dry wt	< 0.011	< 0.011	0.138	0.038	< 0.012
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.017	1.16	0.27	< 0.012
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.012	0.023	1.42	0.36	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	0.03	2.1	0.55	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	0.03	2.1	0.54	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	0.025	1.81	0.49	< 0.012
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.011	0.59	0.197	< 0.012
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	0.013	0.72	0.25	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.012	0.70	0.172	< 0.012
Chrysene	mg/kg dry wt	< 0.011	0.017	1.05	0.27	< 0.012
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.011	0.143	0.050	< 0.012
Fluoranthene	mg/kg dry wt	0.016	0.037	2.1	0.52	< 0.012
Fluorene	mg/kg dry wt	< 0.011	< 0.011	0.059	0.041	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.015	1.19	0.35	< 0.012
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	0.07	< 0.06
Perylene	mg/kg dry wt	< 0.011	< 0.011	0.40	0.110	< 0.012
Phenanthrene	mg/kg dry wt	< 0.011	0.013	0.40	0.21	< 0.012
Pyrene	mg/kg dry wt	0.013	0.034	2.9	0.89	< 0.012
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	41	85	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	950	1,250	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	990	1,340	< 70
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.14	< 0.16	< 0.17	< 0.16	< 0.18
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	mg/kg dry wt	< 0.3	< 0.4	< 0.4	< 0.4	< 0.4
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.4	< 0.4	< 0.4	< 0.4
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 4	< 4	< 4	< 4
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Sample Type: Soil						
Sample Name:		TP6 0.1 18-Nov-2019	TP6 0.4 18-Nov-2019	TP9 0.1 19-Nov-2019	TP9 0.4 19-Nov-2019	TP9 0.8 19-Nov-2019
Lab Number:		2278663.11	2278663.12	2278663.13	2278663.14	2278663.15
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
sec-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Styrene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	0.5	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 30	< 40	< 40	< 40	< 40
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 6	< 7	< 7	< 7	< 7
Acetone	mg/kg dry wt	< 30	< 40	< 40	< 40	< 40
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Sample Name:		TP4 0.1 19-Nov-2019	TP4 0.4 19-Nov-2019	TP3 0.1 19-Nov-2019	TP3 0.5 19-Nov-2019	TP3 0.9 19-Nov-2019
Lab Number:		2278663.16	2278663.17	2278663.18	2278663.19	2278663.20
Individual Tests						
Dry Matter	g/100g as rcvd	96	88	97	88	85
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	2	3	4	5

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Sample Type: Soil						
Sample Name:		TP4 0.1 19-Nov-2019	TP4 0.4 19-Nov-2019	TP3 0.1 19-Nov-2019	TP3 0.5 19-Nov-2019	TP3 0.9 19-Nov-2019
Lab Number:		2278663.16	2278663.17	2278663.18	2278663.19	2278663.20
Heavy Metals, Screen Level						
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.13	0.17
Total Recoverable Chromium	mg/kg dry wt	11	11	11	12	11
Total Recoverable Copper	mg/kg dry wt	7	6	7	15	22
Total Recoverable Lead	mg/kg dry wt	8.8	8.9	10.4	110	240
Total Recoverable Nickel	mg/kg dry wt	10	10	10	10	6
Total Recoverable Zinc	mg/kg dry wt	38	41	41	169	178
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	0.5	< 0.3	6.2	3.0
1-Methylnaphthalene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	< 0.011	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	< 0.011	< 0.012
Acenaphthylene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	0.070	0.025
Acenaphthene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	< 0.011	< 0.012
Anthracene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	0.094	0.045
Benzo[a]anthracene	mg/kg dry wt	< 0.010	0.043	< 0.011	0.47	0.24
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.010	0.043	< 0.011	0.58	0.27
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	0.07	< 0.03	0.87	0.41
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	0.07	< 0.03	0.86	0.40
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.010	0.055	0.012	0.76	0.35
Benzo[e]pyrene	mg/kg dry wt	< 0.010	0.021	< 0.011	0.30	0.134
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.010	0.027	0.014	0.36	0.188
Benzo[k]fluoranthene	mg/kg dry wt	< 0.010	0.025	< 0.011	0.30	0.140
Chrysene	mg/kg dry wt	< 0.010	0.034	< 0.011	0.50	0.23
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	0.059	0.029
Fluoranthene	mg/kg dry wt	< 0.010	0.081	< 0.011	0.83	0.44
Fluorene	mg/kg dry wt	< 0.010	< 0.012	< 0.011	0.011	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.010	0.038	0.012	0.55	0.26
Naphthalene	mg/kg dry wt	< 0.05	< 0.06	< 0.06	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.010	0.015	< 0.011	0.169	0.112
Phenanthrene	mg/kg dry wt	< 0.010	0.038	< 0.011	0.26	0.132
Pyrene	mg/kg dry wt	< 0.010	0.076	< 0.011	0.89	0.42
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	64	< 40	153	154	57
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	156	161	< 70

Sample Name:		TP2 0.1 19-Nov-2019	TP2 0.4 19-Nov-2019	TP1 0.1 19-Nov-2019	TP1 0.7 19-Nov-2019	SS1 0.1 19-Nov-2019
Lab Number:		2278663.21	2278663.22	2278663.23	2278663.24	2278663.25
Individual Tests						
Dry Matter	g/100g as rcvd	97	85	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	2	4	< 2	7
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	0.29
Total Recoverable Chromium	mg/kg dry wt	10	11	12	9	19
Total Recoverable Copper	mg/kg dry wt	8	6	9	5	30
Total Recoverable Lead	mg/kg dry wt	12.1	7.7	19.0	5.5	113

Sample Type: Soil						
Sample Name:		TP2 0.1 19-Nov-2019	TP2 0.4 19-Nov-2019	TP1 0.1 19-Nov-2019	TP1 0.7 19-Nov-2019	SS1 0.1 19-Nov-2019
Lab Number:		2278663.21	2278663.22	2278663.23	2278663.24	2278663.25
Heavy Metals, Screen Level						
Total Recoverable Nickel	mg/kg dry wt	10	9	11	9	12
Total Recoverable Zinc	mg/kg dry wt	43	40	51	34	550
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Toluene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	-	-	-
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Acenaphthene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Anthracene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.016	0.014	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.020	0.019	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.011	< 0.012	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.023	< 0.012	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Chrysene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Fluoranthene	mg/kg dry wt	< 0.011	0.019	-	-	-
Fluorene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.021	0.012	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	-	-	-
Perylene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Phenanthrene	mg/kg dry wt	< 0.011	< 0.012	-	-	-
Pyrene	mg/kg dry wt	0.013	0.017	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	59	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	-	-	-

Sample Name:		SS1 0.2 19-Nov-2019	SS2 0.1 19-Nov-2019	SS2 0.2 19-Nov-2019	SS3 0.1 19-Nov-2019	SS3 0.2 19-Nov-2019
Lab Number:		2278663.26	2278663.27	2278663.28	2278663.29	2278663.30
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	7	4	8	10
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.27	< 0.10	0.12	0.11
Total Recoverable Chromium	mg/kg dry wt	13	15	11	15	17
Total Recoverable Copper	mg/kg dry wt	11	11	7	13	13
Total Recoverable Lead	mg/kg dry wt	33	52	13.7	22	71
Total Recoverable Nickel	mg/kg dry wt	11	11	10	11	11
Total Recoverable Zinc	mg/kg dry wt	156	175	57	380	210

Sample Name:		SS4 0.1 19-Nov-2019	SS4 0.2 19-Nov-2019	SS5 0.1 19-Nov-2019	SS5 0.2 19-Nov-2019	SS6 0.1 19-Nov-2019
Lab Number:		2278663.31	2278663.32	2278663.33	2278663.34	2278663.35

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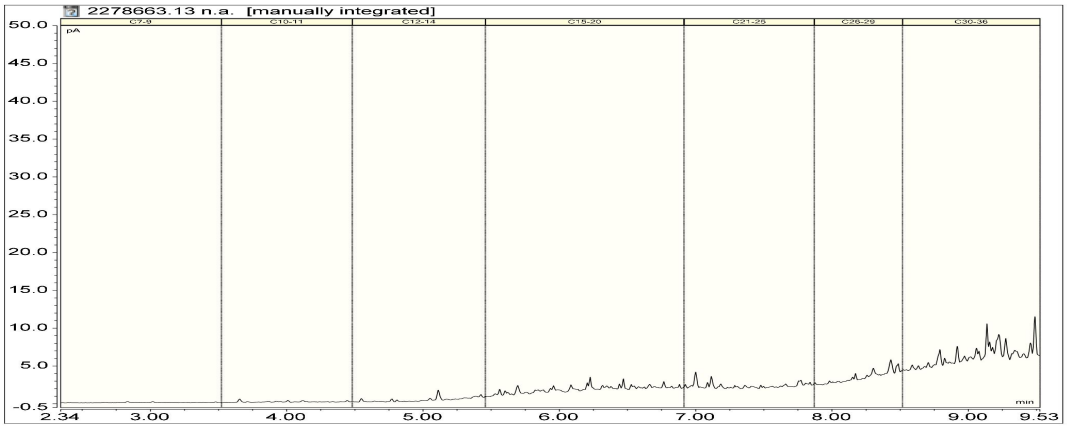
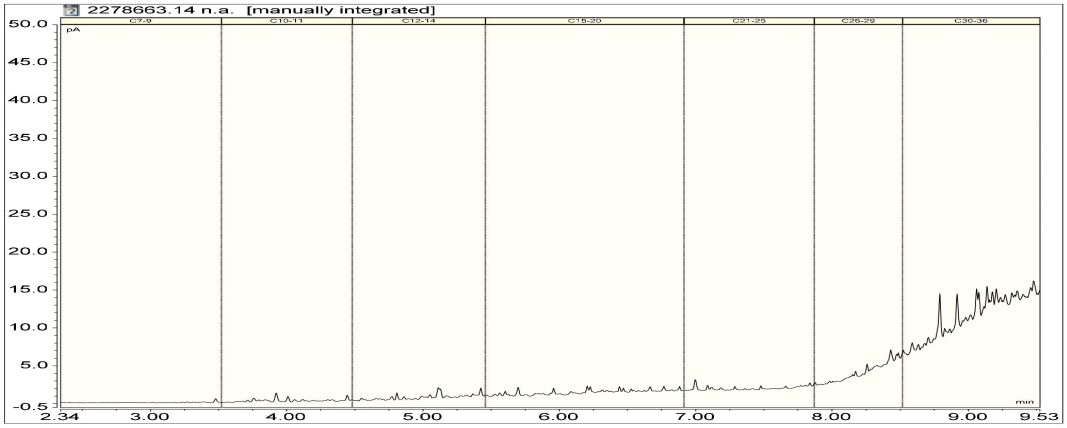
Sample Type: Soil						
Sample Name:		SS4 0.1 19-Nov-2019	SS4 0.2 19-Nov-2019	SS5 0.1 19-Nov-2019	SS5 0.2 19-Nov-2019	SS6 0.1 19-Nov-2019
Lab Number:		2278663.31	2278663.32	2278663.33	2278663.34	2278663.35
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	24	22	14	9	3
Total Recoverable Cadmium	mg/kg dry wt	0.19	< 0.10	0.47	0.54	< 0.10
Total Recoverable Chromium	mg/kg dry wt	25	12	45	37	11
Total Recoverable Copper	mg/kg dry wt	26	9	880	47	7
Total Recoverable Lead	mg/kg dry wt	141	21	83	124	6.1
Total Recoverable Nickel	mg/kg dry wt	10	10	16	15	6
Total Recoverable Zinc	mg/kg dry wt	360	63	230	280	45

Sample Name:		SS6 0.2 19-Nov-2019	SS7 0.1 19-Nov-2019	SS7 0.2 19-Nov-2019	SS8 0.1 19-Nov-2019	SS8 0.2 19-Nov-2019
Lab Number:		2278663.36	2278663.37	2278663.38	2278663.39	2278663.40
Individual Tests						
Dry Matter	g/100g as rcvd	-	79	89	76	85
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	6	5	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.16	0.11	0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	14	15	14	11	11
Total Recoverable Copper	mg/kg dry wt	9	13	12	9	8
Total Recoverable Lead	mg/kg dry wt	5.7	46	32	18.2	17.4
Total Recoverable Nickel	mg/kg dry wt	7	15	14	9	9
Total Recoverable Zinc	mg/kg dry wt	56	121	86	70	64
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
alpha-BHC	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
beta-BHC	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
delta-BHC	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
cis-Chlordane	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
trans-Chlordane	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
4,4'-DDD	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
2,4'-DDE	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
4,4'-DDE	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
2,4'-DDT	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
4,4'-DDT	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Total DDT Isomers	mg/kg dry wt	-	< 0.08	< 0.07	< 0.08	< 0.07
Dieldrin	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Endosulfan I	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Endosulfan II	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Endosulfan sulphate	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Endrin	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Endrin aldehyde	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Endrin ketone	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Heptachlor	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Heptachlor epoxide	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Hexachlorobenzene	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012
Methoxychlor	mg/kg dry wt	-	< 0.013	< 0.011	< 0.013	< 0.012

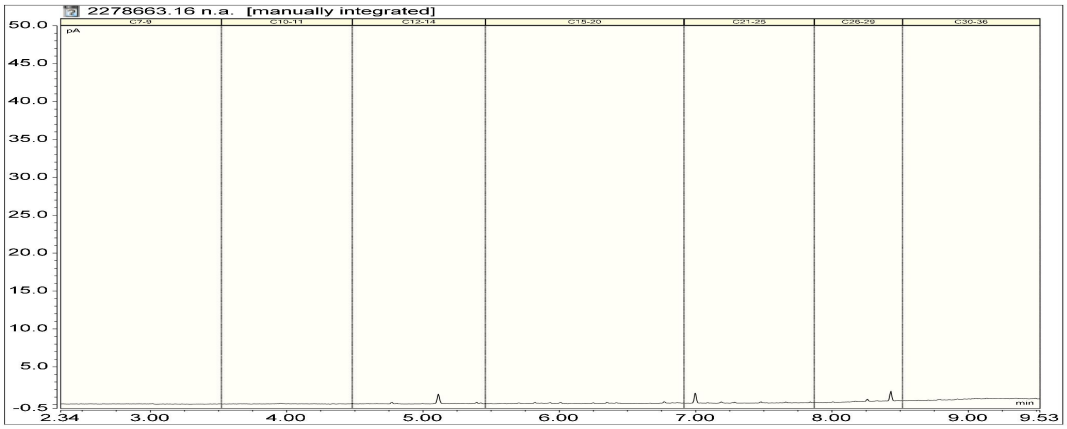
2278663.13
TP9 0.1 19-Nov-2019
Client Chromatogram for TPH by FID



2278663.14
TP9 0.4 19-Nov-2019
Client Chromatogram for TPH by FID



2278663.16
TP4 0.1 19-Nov-2019
Client Chromatogram for TPH by FID



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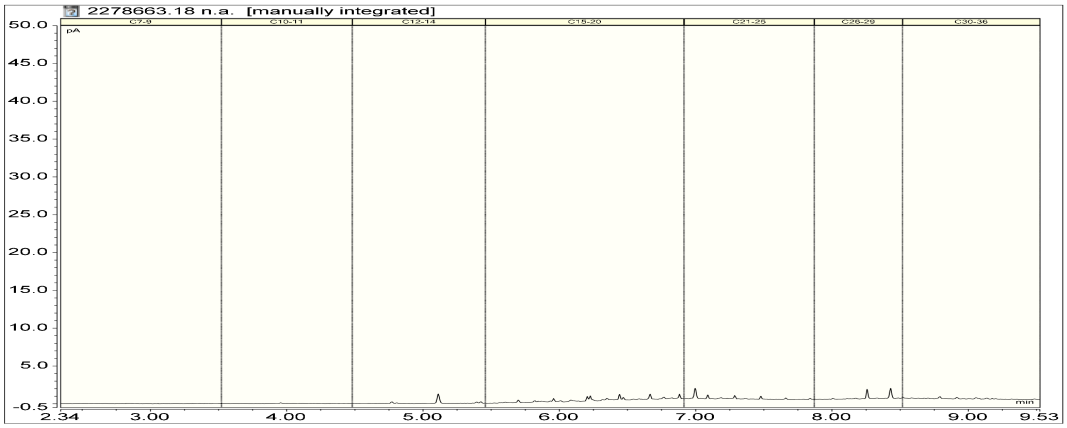
2278663.18
TP3 0.1 19-Nov-2019
Client Chromatogram for TPH by FID



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TP3 0.5 19-Nov-2019
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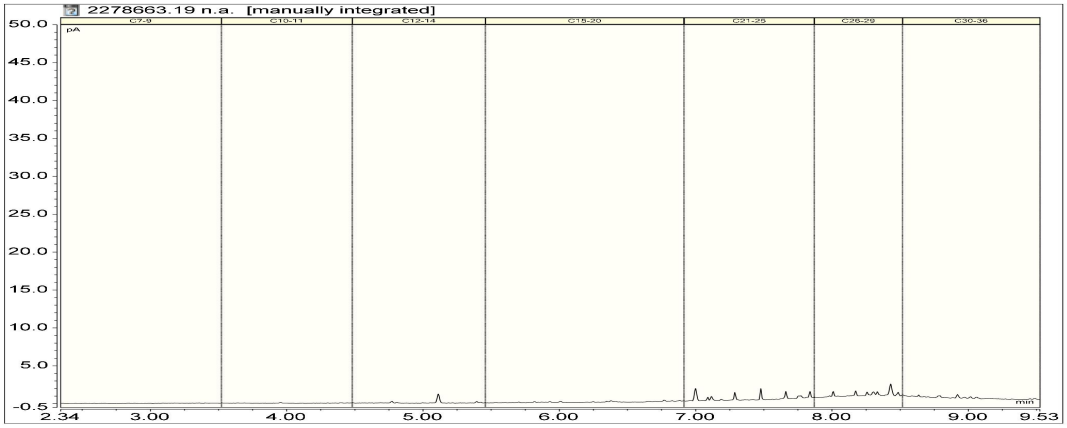

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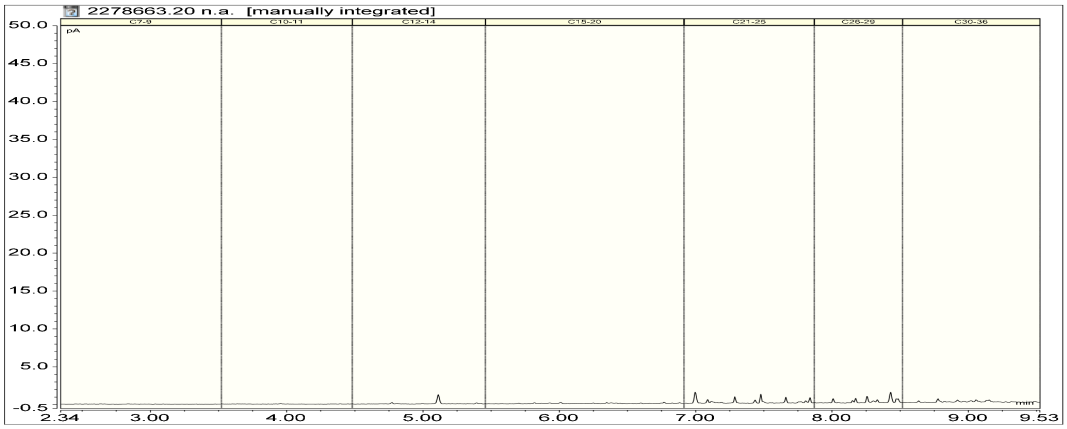

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TP2 0.1 19-Nov-2019
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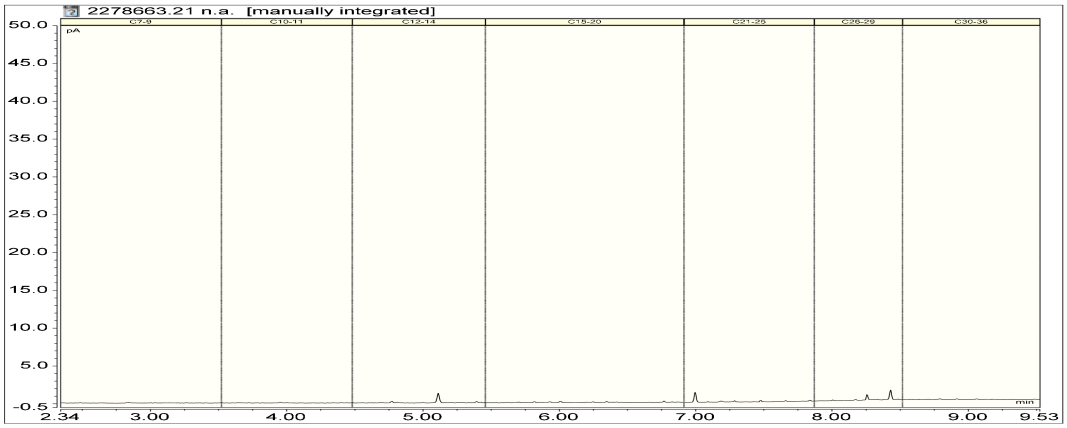

Analyst's Comments

Only plastic containers was supplied for the sample 2278663/13,16 &17 Please note that glass containers should be used for TPHP/VOC/BTEX analysis to avoid loss of volatile's and possible plastic contamination.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-40
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	11-22
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	11-15
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-40
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	16-22
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	4-8, 37-40
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.3 mg/kg dry wt	16-22
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	16-22
TPH + PAH + BTEX profile	Sonication extraction, SPE cleanup, GC & GC-MS analysis	0.002 - 60 mg/kg dry wt	16-22
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	11-15
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	4-8, 11-22, 37-40

ITEM 10 - ATTACHMENT 1

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	11-22
Benzo[a]pyrene Toxic Equivalence (TEF)	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	11-22

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Appendix F: Site plan identifying areas requiring further investigation

T:\Wellington\TT Projects\1012456\WorkingMaterial\CAD\FIG\1012456-F1_2.dwg 2020-Jan-14 10:08:37 AM Plotted By: ZANE LOUGPAT

PALMY
PALMERSTON NORTH CITY COUNCIL

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PROJECT No.	1012456	
DESIGNED	KAPI	Dec.19
DRAWN	ZALO	Dec.19
CHECKED	JCOA	Dec.19
APPROVED	MEJ	Mar-20
DATE		

CLIENT **PALMERSTON NORTH CITY COUNCIL**
PROJECT **ROXBURGH CRESCENT**
TITLE GROUND CONTAMINATION ASSESSMENT
FURTHER INVESTIGATION AREAS
SCALE (A3) AS SHOWN FIG No. F2 REV A

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Appendix H. Noise Assessment

PLAN CHANGE E

ROXBURGH CRESCENT

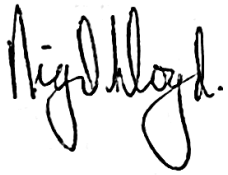
For

PALMERSTON NORTH CITY COUNCIL

N1447Rox – Final V1

18th January 2024

ACOUSAFE CONSULTING & ENGINEERING LTD



Nigel Lloyd
Director of Acoustic Services

Mobile: 0274 480 282
E-mail: nigel@acousafe.co.nz

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3. Landowner Engagement 3
4. District Plan – Noise Rules 3
5. Residential Zone Noise Standards 6
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8. Recommended Noise Rules for Residential Zone 7
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1. Introduction

Roxburgh Crescent is identified as a redevelopment site in Council's City Development Strategy. Proposed Plan Change E is a stand-alone plan change that seeks to transition Roxburgh Crescent to enable residential development. The Housing and Future Development Plan directs Council to collaborate with developers on brownfield redevelopment and looks to provide a more varied range of building typologies than what might otherwise be expected in a typical peripheral greenfield development location. Roxburgh Crescent is also specifically identified as a location to rezone for housing purposes.

2. Brief

PNCC requires an acoustic assessment to support the rezoning proposal. It is recognised that it is highly unlikely that the entire area will transition to residential at once. This means that some sort of reverse-sensitivity provisions may be required to manage the introduction of noise sensitive activities (houses) into an industrial context.

Ultimately, the acoustic assessment will inform the reporting officer's planning report (section 32 plan change report).

3. Landowner Engagement

In 2019 Frances Holdings Ltd, the major landowner in Roxburgh Crescent, approached Council and expressed an interest in redeveloping their land for housing. In response to this, all industrial landowners in Roxburgh Crescent were invited to a meeting to discuss the potential rezoning of Roxburgh Crescent to residential. Overall, meeting attendees strongly supported the proposed rezoning; however, some had concerns about reverse-sensitivity effects related to existing industrial activities continuing to operate as the area transitions to residential. This will need to be addressed as part of the plan change.

4. District Plan – Noise Rules

The site is currently zoned Industrial which only provides for noise to be managed at the zone interface with the Residential Zone. There are no noise limits between the sites within the Industrial Zone as this zone is identified as being suitable for the noisiest of activities. Because there are no internal noise limits then Council normally actively discourages residential activities in the Industrial Zone.

PNCC's intention is to rezone the entire Roxburgh Industrial Zone to Residential. Because there are different ownership titles within the area and different pressures for development, it will be important to impose the Residential Zone controls at the outset so that both new and existing activities generate sounds that are compatible with the future development of noise sensitive activities, with this now becoming the principal purpose of the zone.

Because the Industrial Zone noise rules are not suitable for managing the site as it transitions over time, it is necessary to immediately establish the Residential Zone

noise limits. Consideration has been given to establishing two different types of noise rules that will protect residential amenity and allow industrial activities to continue. However, this approach would prove to be overly complicated and would lack certainty. The intention is to transition between the Industrial Zone and Residential Zone and the need is to establish appropriate Residential Zone noise performance standards to allow this to occur.

For as long as the existing (industrial) activities intend to continue to operate then they would enjoy existing use rights and be able to continue to operate in a manner that contravenes the noise rules in the district plan if both:

- the use was lawfully established before the rule became operative or the proposed plan was notified,
- the effects of the use are the same or similar in character, intensity and scale[1].

The case law on existing use rights is extensive and it should be referred to in some detail in deciding whether existing use rights apply. There is, however, a significant potential for the existing industrial activities to be incompatible with new dwellings that might establish nearby.

There are, inevitably, some complexities when transitioning between zones. The need is to ultimately provide for protection of residential amenity on sites within the zone and the only reasonable way of achieving that outcome is to establish the Residential Zone noise limits immediately and then to manage the future residential development to minimise conflict. It will be recognised that some conflict is likely to be inevitable and this will tend to accelerate the transition to full residential development except for those activities that are relatively benign and that will be able to coexist.

5. Complaints

As part of the original Council has provided Acousafe with a list of complaints they have received from this area over the last nine years:

August 2016	excess noise from generator
February 2017	trucks starting at 3am
April 2017	grinding machine operating
December 2017	banging and grinding
January 2018	banging and grinding
January 2018	loud drilling after 9pm
March 2018	banging and grinding on Sunday
April 2018	recycling bin emptying at 5am
May 2019	high pitched screeching from yard
September 2019	loud venting noise
June 2020	loud crashing noises
July 2023	demolition work

[1] http://qualityplanning.org.nz/index.php/manual/enforcing-plans-and-consents/10-useful-links/496-existing-use-rights

The complaints are about noise originating in six different industrial sites and tended to be specific to activities that are either unusual or occur at unusual times. The worst case was a spate in late 2017 and early 2018 that seems to be resolved, although noise nuisances should not be assessed purely on complaints received. Many of the industrial sites on the west side of Roxburgh Crescent are situated adjacent to neighbouring dwellings on Ruahine Street (see Figure 1).

Figure 1. Interface between Industrial Sites on Roxburgh Crescent and Residential Sites on Ruahine St (courtesy Google Maps 2023).

6. Residential Zone Noise Standards

The noise limits in the Residential Zone are in accordance with the latest version of NZS6802:2008 *Acoustics - Environmental Noise*, including changing to L_{Aeq}.

Methods for monitoring and assessing noise are set out in Section 6.2 of the District Plan which is also current.

We consider that the noise limits and the activity statuses that are generally applied throughout the Residential Zone can be applied to Roxburgh Crescent once it becomes rezoned to Residential.

7. Other Zone Interfaces

The Residential Zone also borders many other zones in the district. For the Roxburgh Crescent redevelopment, the intention is for the noise rules to provide for high amenity levels within it, as a Residential Zone. The Roxburgh Crescent Industrial Area is nestled between residential properties to the west and the south and the Manawatu River linear park.

8. Reverse Sensitivity

There is a need to establish compatible land use planning controls to appropriately protect the health and wellbeing of people living near to noise generators and to protect those generators against reverse sensitivity issues associated with people and communities coming to the noise and then complaining.

There is a need to therefore continue discussion with those stakeholders who wish to continue their industrial activity and to determine what specific land management controls (if any) are required to protect the interests of all parties.

Our understanding of the likely development process is for the main tranche of land owned by Frances Holdings Ltd to become available for residential development first. This will leave those sites to the west of Roxburgh Crescent to be developed at some stage further into the future. Some of these properties back directly onto the Residential Zone of dwellings on Ruahine Street, although there has been some introduction of noise buffering at this interface using the building form and noise barriers.

The juxtaposition of industrial activities to the west of Roxburgh Crescent and the dwellings on Ruahine Street already causes some noise conflict and will need to continue to be managed as best it can. Ultimately though, PC E will correct this historical anomaly by encouraging and allowing all industrial uses to be replaced with residential.

Activities on the west side of Roxburgh Crescent are on smaller sites with the like of joinery shops, electroplating, engineering and metal fabrication, bath repair companies and small depots for construction companies. Depending on the staging of the residential development then some further investigation of the likely noise

emissions from the properties is recommended. This will depend on the likelihood of existing uses causing noise impacts on any new residential developments and would determine whether further noise management is required. This could also help to establish the "*existing use rights*" of those activities.

If the larger section of land is going to be developed on a piecemeal basis, alongside noisy construction machinery repairs or maintenance, then this will also need to be managed, preferably by providing substantial noise buffering and/or by noise insulating and ventilating new dwellings. Care should be taken with heavy vehicle access into the area, particularly at night-time to ensure that conflicts with night-time amenity do not occur. This potential conflict currently exists with the longstanding dwellings on Roxburgh Crescent which are already zoned residential.

9. Recommended Noise Rules for Residential Zone

The recommendation is that the noise rules for the Roxburgh Crescent residential area are those in the Residential Zone. These rules are relatively strict and will apply limits of 45 dB $L_{Aeq(15mins)}$ during the daytime (7.00am to 10.00pm) and 40 dB $L_{Aeq(15mins)}$ at night (10:00pm to 7:00am). An L_{max} limit of 65 dBA also applies during the night-time hours. These Residential Zone noise limits will be appropriate for the Roxburgh Crescent area once it is rezoned Residential.

Construction activities are appropriately managed and controlled in the District Plan by reference to NZS 6803:1999 *Acoustics - Construction Noise*.

10. Conclusions

The Council seeks to rezone the Roxburgh Crescent from Industrial to Residential. This will provide for the gradual transition from the current industrial activities to full residential development over the next ten-year period, or so. It is recommended that the noise provisions of the Residential Zone be referenced. This provides for the establishment of residential activity and protection of residential amenity during the transition stage.

Appendix I. Liquefaction Report

Tonkin+Taylor

Liquefaction Assessment Report

1-42 Roxburgh Crescent, Palmerston North

Prepared for
Palmerston North City Council
Prepared by
Tonkin & Taylor Ltd
Date
April 2020
Job Number
85442.009.v2

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Document Control

Title: Liquefaction Assessment Report					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
12/9/19	1	Draft for comment	ADW	CVS	MEJ
1/4/20	2	Final	ADW	CVS	MEJ

Distribution:

Palmerston North City Council	1 copy
Tonkin & Taylor Ltd (FILE)	1 copy

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Appendix A : Figures

Appendix B : Geotechnical investigations

Liquefaction Assessment Summary

LIQUEFACTION ASSESSMENT SUMMARY	
This liquefaction assessment has been undertaken in general accordance with the guidance document 'Assessment of liquefaction-Induced Ground Damage to Inform Planning Processes' published by the Ministry of Business, Innovation and Employment in 2017. https://www.building.govt.nz/building-code-compliance/b-stability/b1-structure/planning-engineering-liquefaction-land/	
Client	Palmerston North City Council (PNCC)
Assessment undertaken by	Tonkin & Taylor Ltd, 2 Hunter Street, Wellington 6011
Report date	April 2020
Extent of the study	Roxburgh Crescent site area (refer Figure A1):
Intended RMA planning and consenting purposes	Inform PNCC of liquefaction risks associated with site as part of plan change
Other intended purposes	Inform future liquefaction assessment work required to develop Roxburgh Crescent site
Level of detail	Level C (Detailed area-wide assessment)
Notes regarding base information	- The assessment included geotechnical investigations undertaken by Tonkin & Taylor including machine drilled boreholes and Cone Penetration Tests (CPT). A summary of the investigation data is presented in Appendix B - Depth to groundwater was based on groundwater encountered within investigations, Horizons Regional Council groundwater database, and observation of surface water such as lakes and rivers
Other notes	

1 Introduction

1.1 General

Tonkin & Taylor Ltd (T+T) was engaged by Palmerston North City Council (PNCC) to undertake a liquefaction assessment of the proposed development area at Roxburgh Crescent.

The work was undertaken in accordance with our proposal dated 21 November 2018.

T+T completed site specific geotechnical investigations to characterise the subsoil conditions and complete the liquefaction and lateral spreading assessment. These investigations are described in Section 2.4 below.

The liquefaction analysis and assessment included the following:

- Identify liquefaction vulnerability across the site.
- Assess lateral spreading hazard across the site.
- Identify liquefaction and lateral spreading constraints relevant for infrastructure and residential development.
- Identify appropriate ground improvement measures and/or foundations for developments in order to mitigate the consequences of liquefaction.

1.2 Intended purpose of assessment

This liquefaction assessment is to inform council of risks associated with liquefaction and lateral spreading at the site as part of a plan change to rezone the site from industrial to residential.

Other intended purposes of this report are to inform future liquefaction assessment work which may be required to develop the Roxburgh Crescent site. In addition, this report indicates potential strategies which may be used during development of the Roxburgh Crescent site to mitigate liquefaction and lateral spreading hazard.

1.3 Assessment methodology

This liquefaction assessment has been undertaken following the recommendations of the Ministry of Business Innovation & Employment (MBIE) Planning and Engineering Guidance for Potentially liquefaction-Prone Land[1]. The assessment is based on an understanding of the area wide geology, regional groundwater regime, site specific geotechnical investigations undertaken by T+T, and site specific groundwater readings.

The liquefaction assessment is considered to be a Level C *"Detailed area-wide assessment"* based on the density of T+T's site specific geotechnical investigations works. Earthquakes scenarios for return periods of 25-year, 100-year, and 500-year levels of earthquake shaking specific to each site were used. The specific outcomes of the liquefaction assessment for the site are detailed in the following sections.

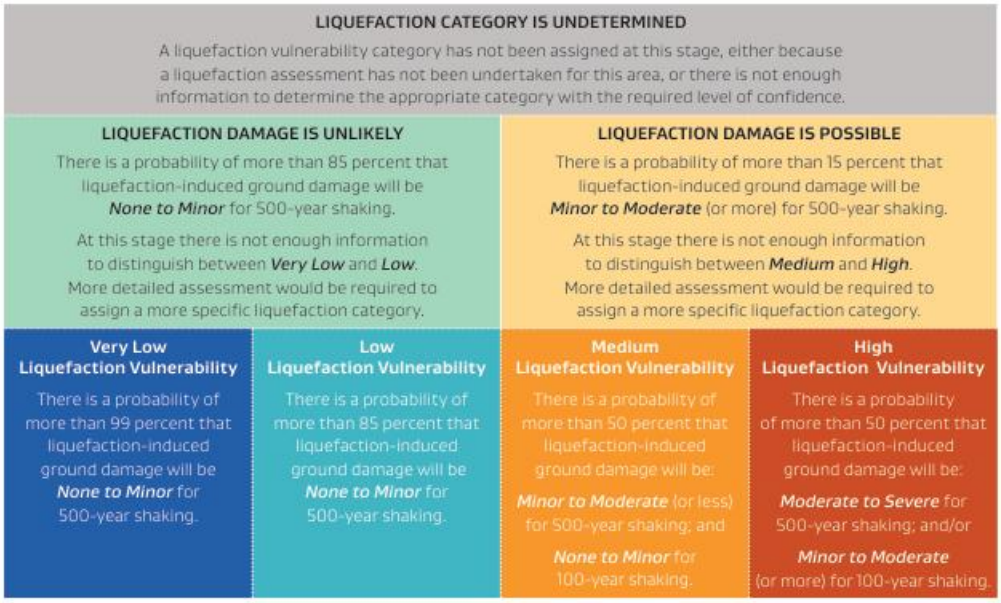
[1] MBIE (September 2017) *Planning and Engineering Guidance for Potentially Liquefaction-prone Land https://www.building.govt.nz/building-code-compliance/b-stability/b1-structure/planning-engineering-liquefaction-land/*

1.4 Liquefaction vulnerability categories

The Roxburgh Crescent site has been categorised as ***Liquefaction Damage Is Unlikely*** as described in Table 4.4 of the MBIE guidance document[1], which is presented in Table 1 below.

Changes in geology, variations in ground surface level, or variations in groundwater level over the site are expected to alter the sites liquefaction vulnerability. Any significant variations in these parameters, identified during our liquefaction assessment, have been further discussed in Section 3 liquefaction assessment.

Table 1: Performance criteria for determining the liquefaction vulnerability category – from MBIE guidance document Table 4.4.



2 Site description and subsurface conditions

2.1 Site description

The site is located in the south east of Palmerston North along Roxburgh Cresent. It is bordered to the west by Ruahine Street, to the north and east by Fitzroy Bend Reserve and Roxburgh Crescent Reserve and to the south by residential dwellings off Tilbury Avenue. The approximate site boundary is shown on Figure 1 below.

The site is generally flat with reduced levels typically between 33 to 34 m R.L. Approximately 100 m east of the site is the Manawatu River. The east side of the site perimeter is adjacent to the Manawatu River flood stopbanks.

Industrial developments cover the majority of the site with a large portion utilised by Higgins Ltd. The site spans 36 legal titles.

Figure 1 - Aerial photograph with approximate site boundary

2.2 Published geology

The published geological map of the area[2] indicates that the site is underlain by Holocene river deposits consisting of alluvial gravel, sand, silt, mud and clay with localised peat. Holocene deposits are less than 12,000 years old.

[2] Lee, J.M., Begg, J.G. (compilers) 2002: *Geology of the Wairarapa area*. Institute of Geological & Nuclear Sciences 1:250,000 geological map 11. 1 sheet + 66 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

2.3 Existing investigations

Data available on the New Zealand Geotechnical Database (NZGD) and T+T Geotechnical Database (TTGD) indicate three relevant investigations in the area which have similar geomorphological and geological significance:

- Hokowhitu Campus geotechnical investigations conducted by T+T for PNCC (T+T Ref: 85442.0040), and again for Wallace Development Company Ltd (T+T Ref: 1004625.0010), located approximately 1.5km southwest of the site.
- Napier road geotechnical investigation conducted by T+T for PNCC (T+T Ref: 85442.0040), located approximately 2.5km north of the site.
- 109 Fitzherbert Avenue geotechnical investigation conducted by Miyamoto for Wallace Development Company Ltd, located approximately 2.5km west of the site.

2.4 T+T geotechnical investigations

2.4.1 General

T+T completed site specific geotechnical investigations comprising:

- Three (3) machine drilled boreholes;
- Six (6) Cone Penetration Tests (CPTs);
- One (1) standpipe piezometer; and,
- Three (3) Particle Size Distribution (PSD) laboratory tests on recovered soil samples.

Detailed descriptions of T+T's site specific geotechnical investigations are presented in Sections 2.4.2 to 2.4.5 below.

Geotechnical investigations have been undertaken at six locations over the site, with three of the CPT investigations undertaken adjacent to machine drilled borehole locations. This corresponds with an investigation density of approximately 1.2 investigations per hectare. Table 3.3 of the MBIE guidance[1] recommends an average investigation density, for a Level C (*Detailed area-wide assessment*) liquefaction assessment, of 0.1 to 4 investigations per hectare with a minimum of 5 investigations for sites larger than 1 hectare. Our investigation density falls within the midrange of the MBIE guidance[1] investigation density for a Level C (*Detailed area-wide assessment*) liquefaction assessment.

Typical geologic cross-sections based on T+T's completed site specific geotechnical investigations are presented in Figure A1 – A5, Appendix A.

2.4.2 Machine drilled boreholes

Three (3) machine drilled boreholes were undertaken using a sonic-rotary coring drilling rig, supplied and operated by Pro-Drill. The boreholes were HQ3 triple tube cored down to 10.6m below ground level (bgl). Standard Penetration Tests (SPT) were carried out at 1.5m intervals within the machine drilled borehole to a final depth of 11.05m bgl.

All drilling works were completed under the full time supervision of an engineering geologist from T+T. The recovered drill core was photographed and logged to NZGS 'Field Description of Soil and Rock' guidelines.

The borehole investigation locations are presented in Figure 1, Appendix A. A summary of borehole investigations completed by T+T is presented in Table B1, Appendix B. Borehole logs and core photographs are presented in Appendix B.

2.4.3 Cone Penetration Tests

Six (6) CPTs were undertaken by Pro-Drill on 18 to 19 December 2018. Five of the CPTs refused at depths of between 0.48 to 5.18m bgl. The sixth CPT labelled CPT-03 failed to achieve sufficient anchoring to advance the CPT and was abandoned.

The CPT locations are presented in Figure 1, Appendix A. A summary of CPT investigations completed by T+T is presented in Table B2, Appendix B. CPT logs are appended in Appendix B.

2.4.4 Groundwater monitoring

One (1) standpipe piezometer was installed within the machine drilled borehole BH-02 to a depth of 10m bgl. Standpipe piezometers are used to monitor groundwater levels.

Groundwater levels were recorded following completion of each machine drilled borehole and within the standpipe piezometer. Groundwater levels were recorded at between 7.3 and 8.55m bgl which is at a level of between 24.45 to 25.85m R.L.

Groundwater level is expected to be closely tied to the water level within the Manawatu River, which runs approximately 100m to the east. River level reduced level is estimated to be typically between 25 to 26 m R.L.

A preliminary review of Manawatu River level monitoring data from the previous 12 months, available from Horizons Regional Council[3], indicates that river water levels are typically elevated for only short periods of time. Nearby groundwater well records, also available from Horizons Regional Council, show a slow groundwater response over time and the change in groundwater level is approximately 1m over the previous 12 months. Standpipe piezometer details are summarised in Table B3, Appendix B and groundwater level records are summarised in Table B4, Appendix B.

2.4.5 Laboratory testing

Three (3) Particle Size Distribution (PSD) laboratory tests were undertaken on samples collected from machine drilled boreholes. One sample was tested from each borehole. Samples were tested at the Geotechnics laboratory using test method NZS 4402:1986 Test 2.8.1 (Wet Sieve).

Laboratory test are summarised in Table B5, Appendix B and laboratory test results are presented in Appendix B.

2.5 Site subsoil profile

The generalised site subsoil profile identified in T+T's geotechnical investigations comprises:

- 1.5 – 2.25m of loose SAND and silty SAND; overlying,
- Medium dense to very dense sandy GRAVEL.

Layers of medium dense to dense gravelly SAND up to approximately 1m thick were identified between 6 and 10.5m depth within the sandy GRAVEL layer in BH-01 and BH-02. These layers do not appear to be continuous over the site.

[3] Horizons.govt.nz/environment-data

3 Liquefaction Assessment

3.1 Liquefaction susceptibility

The site is assigned a liquefaction vulnerability category of ***Liquefaction Damage is Unlikely***. The liquefaction assessment is considered to be a Level C *"Detailed area-wide assessment"* based on the density of T+T's site specific geotechnical investigations works.

This liquefaction category corresponds to a probability of more than 85 percent that liquefaction-induced ground damage will be ***None*** to ***Minor*** for 500-year shaking. At this stage there is not enough information to distinguish between ***Very Low*** and ***Low*** liquefaction vulnerability; however the site may be conservatively assigned a ***Low*** liquefaction vulnerability categorisation. A more detailed assessment would be required to assign a ***Very Low*** liquefaction vulnerability category.

Key factors contributing to this liquefaction vulnerability assessment include:

- Depth to groundwater measured at more than 7m bgl;
- Principal geologic unit is Holocene age (less than 11,000 years); and,
- Thick sandy gravel layer underlying the site.

Table 4.3 of the MBIE guidance[1] provided semi-quantitative screening criteria for identifying land where liquefaction induced ground surface damage is unlikely. For Holocene age soil deposits (less than 11,000 years old) a liquefaction vulnerability category of Liquefaction Damage is Unlikely can be assigned if depth to groundwater is more than 6m.

The medium dense to dense gravelly sand layers identified within the machine drilled boreholes between depth of 6 and 10.5m may be liquefiable if below the ground water table. Due to the depth of these potentially liquefiable soils, and the thickness and density of the overlying sandy gravel crust, liquefaction damage at the ground surface is expected to be ***None*** to ***Minor*** for 500-year shaking.

All CPT investigations refused within the sandy gravel layer at the site. This is above the site groundwater level. As CPT investigations did not encounter the gravelly sand layers identified within the sandy gravel layer no quantitative liquefaction triggering and consequences assessment is currently possible. If a quantitative liquefaction triggering and consequences assessment is desired then additional CPT investigations targeted to the potentially liquefiable sand layers would be required. These CPT locations would have to be pre-drilled through the overlying sandy gravel to prevent refusal of CPT investigations above the target soil layer.

3.2 Lateral spreading assessment

No lateral spreading hazard is expected to be present at this site.

Simple geomorphic screening for lateral spreading in Section 4.4.2 of the MBIE guidance[1] suggests that if the site is determined to have a liquefaction vulnerability category of ***Liquefaction Damage is Unlikely*** then lateral spreading is usually also unlikely. Lateral spreading may still occur if a thin liquefiable layer is present which allows the overlying material to slide towards the free face.

Free faces which may contribute to lateral spreading risk at the Roxburgh Crescent site include:

- Manawatu River bank, located approximately 100m to the east; and,
- The terrace formed between Roxburgh Crescent site and Fitzroy Bend Reserve, located immediately to the north and northeast of the site.

Both free faces near the site are greater than 2m high. Section 4.4.2 of the MBIE guidance[1] suggests that for, free face heights of greater than 2m, land within 200m of the free face should be given careful consideration for lateral spreading risk. The majority of the north and west of the site is within 200m of a free face.

Indicative geologic cross sections, Figure A2 and A3 in Appendix A, show that at the Fitzroy Bend Reserve free face location no sandy lenses have been identified below the groundwater table. The absence of continuous liquefiable soil layers at this location suggests that lateral spreading is unlikely to develop at the Fitzroy Bend Reserve free face.

Indicative geologic cross section, Figure A4 in Appendix A, shows a potentially liquefiable gravelly sand layer located below the groundwater table in BH-02. We have not assessed liquefaction potential outside the property boundary; however, if this potentially liquefiable gravelly sand layer is continuous between the site and the Manawatu River free face lateral spreading could occur at this location. Based on the other currently available geotechnical investigations and the geologic deposition environment we consider that it is unlikely that this potentially liquefiable sandy layer is continuous.

If a more detailed assessment of lateral spreading risk in this area is desired then additional geotechnical investigations would be required. These investigations are expected to comprise machine drilled boreholes or CPT with predrilling through the dense gravel layers.

The southern extent of the Roxburgh Crescent site does not have liquefiable soil layers below the water table identified in the currently available geotechnical investigations, see Figure A5, Appendix A.

3.3 Key uncertainties

The key uncertainties associated with our liquefaction assessment are variation in regional groundwater depth over time and continuity of potentially liquefiable sand layers over the site.

Groundwater levels measured at the site appear to correspond to the water level in the Manawatu River. Elevated river water levels are expected to raise groundwater levels at the site. A preliminary review of Manawatu River level monitoring data from the previous 12 months, available from Horizons Regional Council[3], indicates that river water levels are typically elevated for only short periods of time.

An elevated site groundwater level may increase the site liquefaction vulnerability; however, any increased liquefaction vulnerability would only be present while groundwater levels were elevated. An earthquake event occurring at the same time as groundwater levels are elevated is unlikely. If a more detailed assessment of risks associated with variation in regional groundwater level is desired then long term site specific groundwater monitoring is expected to be required.

Potentially liquefiable sand layers have been identified within two machine drilled boreholes. If these soil layers are continuous between the site and a free face lateral spreading may occur. Currently available geotechnical investigations suggest that potentially liquefiable sand layers are not continuous. A more detailed assessment of the potentially liquefiable sand layers would require additional geotechnical investigations to be completed.

4 Site development considerations

The Roxburgh Crescent site has been classified into the liquefaction vulnerability category of ***Liquefaction Damage is Unlikely*** and no lateral spreading hazard is expected to be present at the site. As such, no additional measures to reduce liquefaction or lateral spreading risk are expected to be required for development of the site.

All normal requirements for earthworks and building design still apply (e.g. as stated in NZS 3604). Additional site specific geotechnical investigations may be required during development to confirm soil characteristics and strength parameters to inform building foundation design.

5 Applicability

This report has been prepared for the exclusive use of our client Palmerston North City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that this report will be used by Palmerston North City Council in undertaking its regulatory functions in connection with a plan change to rezone the site from industrial to residential.

Tonkin & Taylor Ltd

Report prepared by:

.....

Andrew Wallace

Geotechnical Engineer

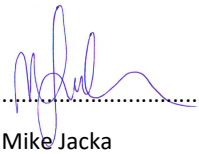
Report reviewed by:

.....

Christopher Sandoval

Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:



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Mike Jacka

Project Director

adw
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Appendix A: Figures

LEGEND

- BOREHOLE LOCATION
- CPT LOCATION NOTE; CPT-03 NOT CONDUCTED DUE TO ANCHOR FAILURE

APPROXIMATE SCALE

0 10 20 30 40 50m

NOTES:
1. GROUND PROFILE BASED ON CONTOURS AND IS APPROXIMATE ONLY.
2. GEOLOGY MARKED ON THIS SECTION IS BASED ON THE LIMITED AVAILABLE INVESTIGAITON DATA AS SHOWN. ACTUAL GROUND CONDITIONS MAY DIFFER FROM THE ASSUMED MODEL.
3. PROPERTY BOUNDARY BASED ON LINZ AND IS APPROXIMATE ONLY.

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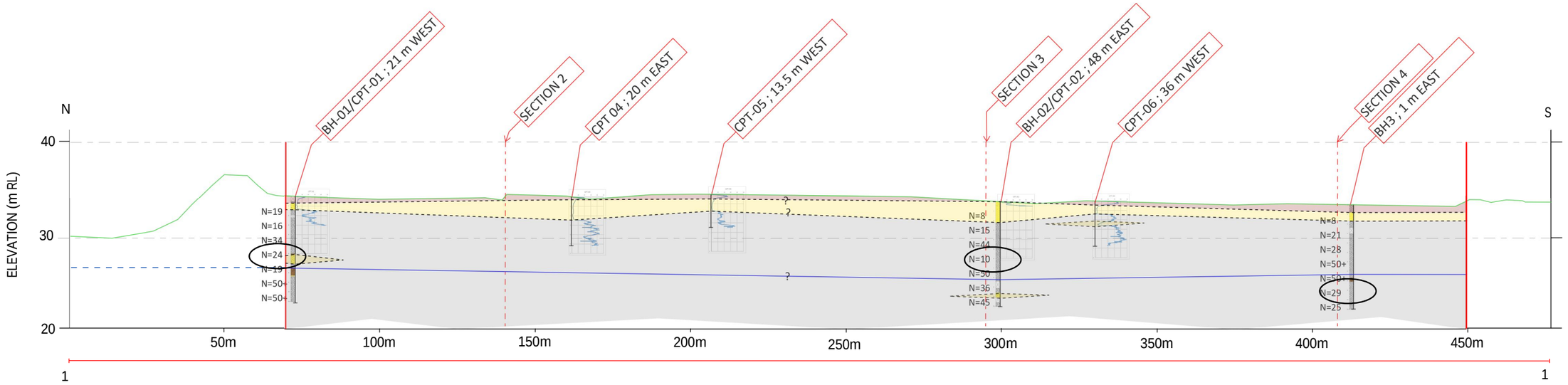
APPROVED	MEJ	Sep 19
FILE : 85442.0090		
APPROX. SCALE (AT A3 SIZE) NTS		
PROJECT No. 85442.0090	FIG. No. FIGURE A1	REV. 1

AERIAL VIEW OF CROSS SECTIONS
PALMERSTON NORTH CITY COUNCIL
ROXBURGH CRESCENT, PALMERSTON NORTH

ITEM 10 - ATTACHMENT 1



VERTICAL SCALE APPROX 1:400

0 2 4 6 8 10 20 (m)

HORIZONTAL SCALE APPROX 1:1300

0 10 20 30 40 50 60 70 80 (m)

VERTICAL EXAGGERATION : x3

LEGEND

- TOPSOIL / FILL: FINE TO COARSE SANDY GRAVEL.
- ALLUVIAL SAND DEPOSITS: FINE SAND MEDIUM DENSE.
- ALLUVIAL GRAVEL DEPOSITS: FINE TO COARSE GRAVEL, SOME SAND, MEDIUM TO VERY DENSE. OCCASIONAL LOGS.
- ----?---- GEOLOGICAL BOUNDARY: INFERRED BETWEEN BOREHOLES.
- SITE BOUNDARY
- —?— WATER LEVEL: INFERRED BETWEEN BOREHOLES.

NOTES:
1. GROUND PROFILE BASED ON CONTOURS AND IS APPROXIMATE ONLY.
2. GEOLOGY MARKED ON THIS SECTION IS BASED ON THE LIMITED AVAILABLE INVESTIGATION DATA AS SHOWN. ACTUAL GROUND CONDITIONS MAY DIFFER FROM THE ASSUMED MODEL.
3. PROPERTY BOUNDARY BASED ON LINZ AND IS APPROXIMATE ONLY.

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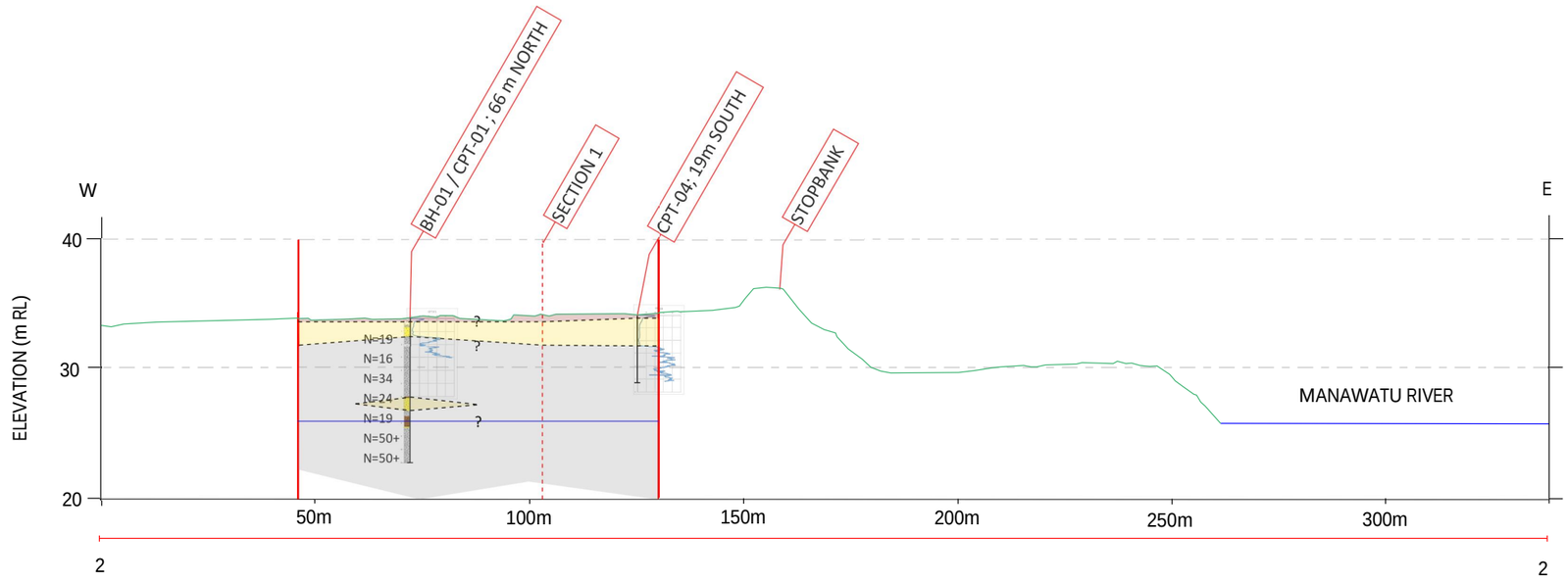
APPROX. SCALE (AT A3 SIZE) 1:1300 (HORIZONTAL)		
PROJECT No. 85442.0090	FIG. No. FIGURE A2	REV. 1

CROSS SECTION 1
PALMERSTON NORTH CITY COUNCIL
ROXBURGH CRESCENT, PALMERSTON NORTH



VERTICAL SCALE APPROX 1:400

0 2 4 6 8 10 20 (m)

HORIZONTAL SCALE APPROX 1:1300

0 10 20 30 40 50 60 70 80 (m)

VERTICAL EXAGGERATION : x3

LEGEND

- TOPSOIL / FILL: FINE TO COARSE SANDY GRAVEL.
- ALLUVIAL SAND DEPOSITS: FINE SAND MEDIUM DENSE.
- ALLUVIAL GRAVEL DEPOSITS: FINE TO COARSE GRAVEL, SOME SAND, MEDIUM TO VERY DENSE. OCCASIONAL LOGS.
- GEOLOGICAL BOUNDARY: INFERRED BETWEEN BOREHOLES.
- SITE BOUNDARY
- WATER LEVEL: INFERRED BETWEEN BOREHOLES.

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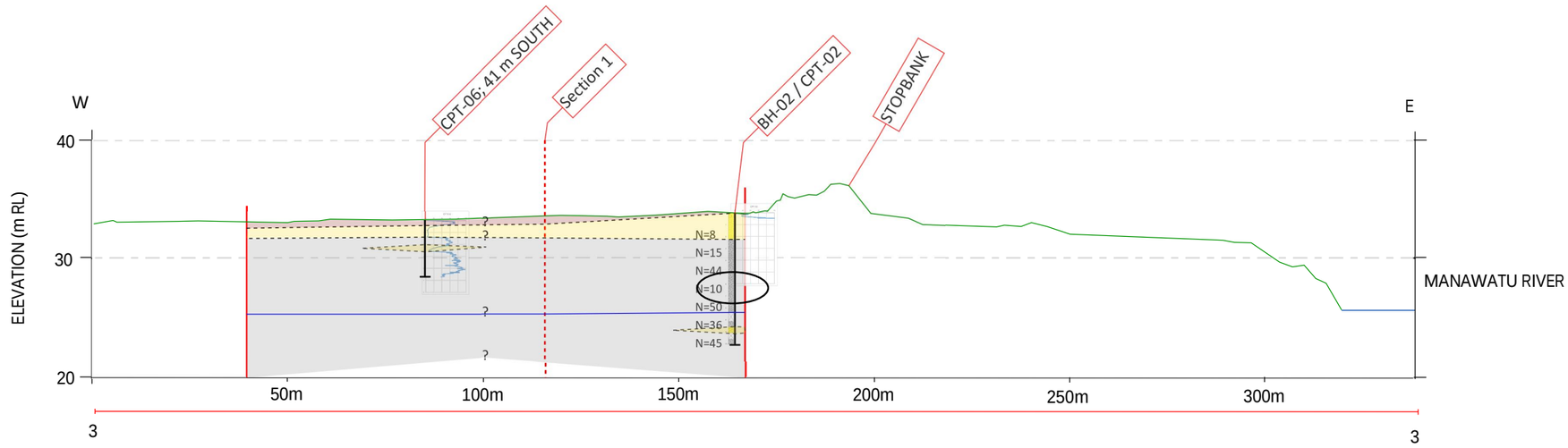
APPROX. SCALE (AT A3 SIZE) 1:1300 (HORIZONTAL)		
PROJECT No. 85442.0090	FIG. No. FIGURE A3	REV. 1

CROSS SECTION 2
PALMERSTON NORTH CITY COUNCIL
ROXBURGH CRESCENT, PALMERSTON NORTH



VERTICAL SCALE APPROX 1:400

0 2 4 6 8 10 20 (m)

HORIZONTAL SCALE APPROX 1:1300

0 10 20 30 40 50 60 70 80 (m)

VERTICAL EXAGGERATION : x3

LEGEND

- TOPSOIL / FILL: FINE TO COARSE SANDY GRAVEL.
- ALLUVIAL SAND DEPOSITS: FINE SAND MEDIUM DENSE.
- ALLUVIAL GRAVEL DEPOSITS: FINE TO COARSE GRAVEL, SOME SAND, MEDIUM TO VERY DENSE. OCCASIONAL LOGS.
- ····?···· GEOLOGICAL BOUNDARY: INFERRED BETWEEN BOREHOLES.
- SITE BOUNDARY
- ——?—— WATER LEVEL: INFERRED BETWEEN BOREHOLES.

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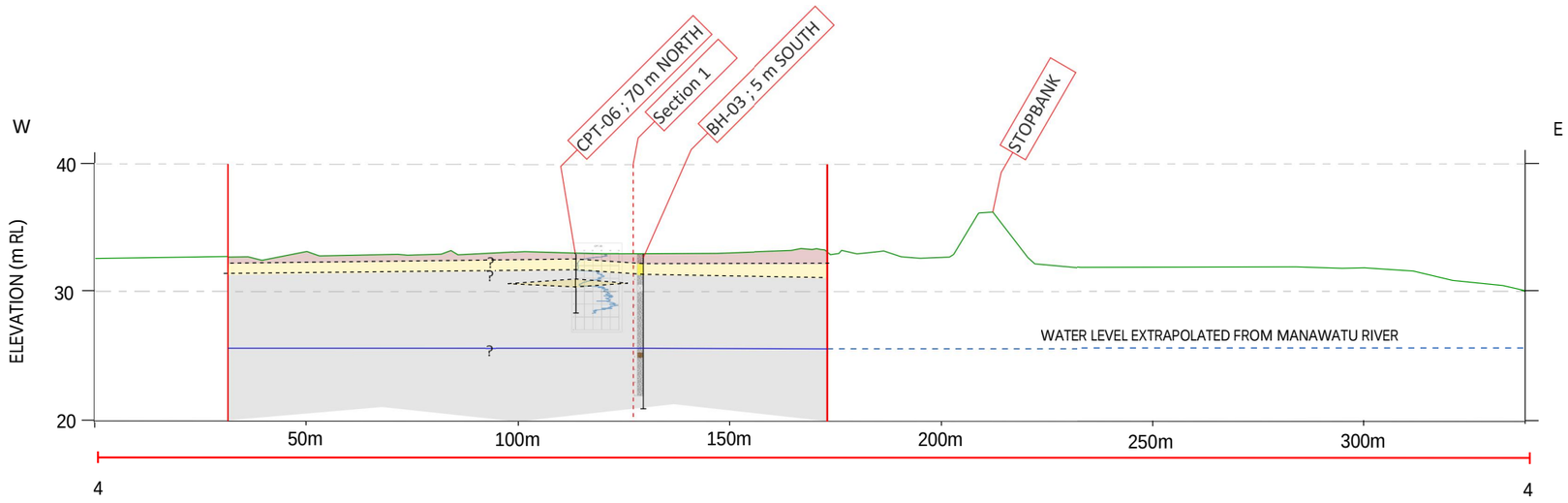
APPROX. SCALE (AT A3 SIZE) 1:1300 (HORIZONTAL)		
PROJECT No. 85442.0090	FIG. No. FIGURE A4	REV. 1

CROSS SECTION 3
PALMERSTON NORTH CITY COUNCIL
ROXBURGH CRESCENT, PALMERSTON NORTH



VERTICAL SCALE APPROX 1:400

0 2 4 6 8 10 20 (m)

HORIZONTAL SCALE APPROX 1:1300

0 10 20 30 40 50 60 70 80 (m)

VERTICAL EXAGGERATION : x3

LEGEND

- TOPSOIL / FILL: FINE TO COARSE SANDY GRAVEL.
- ALLUVIAL SAND DEPOSITS: FINE SAND MEDIUM DENSE.
- ALLUVIAL GRAVEL DEPOSITS: FINE TO COARSE GRAVEL, SOME SAND, MEDIUM TO VERY DENSE. OCCASIONAL LOGS.
- GEOLOGICAL BOUNDARY: INFERRED BETWEEN BOREHOLES.
- SITE BOUNDARY
- WATER LEVEL: INFERRED BETWEEN BOREHOLES.

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FILE: 85442.0090		
APPROX. SCALE (AT A3 SIZE) 1:1300 (HORIZONTAL)		
PROJECT No. 85442.0090	FIG. No. FIGURE A5	REV. 1

CROSS SECTION 4
PALMERSTON NORTH CITY COUNCIL
ROXBURGH CRESCENT, PALMERSTON NORTH

Appendix B: Geotechnical investigations

B1 Machine Drilled Borehole

Table B1: Summary of machine drilled boreholes

BH ID	Location (NZTM)		Ground Surface Elevation (m R.L.)	Depth (m bgl)
	Easting (m)	Northing (m)		
BH-01	1824516.8	5529090.5	33.5	11.05
BH-02	1824614.7	5528873.9	33.0	11.05
BH-03	1824583.6	5528754.2	33.0	11.05

B2 Cone Penetration Test

Table B2: Summary of CPTs

CPT ID	Location (NZTM)		Ground Surface Elevation (m R.L.)	Termination depth (m bgl)	Reason for termination
	Easting (m)	Northing (m)			
CPT-01	1824514.7	5529090.8	33.8	3.03	Cone resistance exceeds 20 MPa
CPT-02	1824616.0	5528874.6	33.8	0.48	Cone resistance exceeds 20 MPa
CPT-03	1824585.9	5528753.6	33.0	-	Reaction augers pulled (abandoned)
CPT-04	1824569.1	5529006.1	34.1	5.18	Cone resistance exceeds 20 MPa
CPT-05	1824542.1	5528957.1	33.6	3.49	Reaction augers pulled
CPT-06	1824535.6	5528831.7	33.3	4.72	Cone resistance exceeds 20 MPa

B3 Groundwater Monitoring

Table B3: Piezometer details

Borehole ID	Collar Level (m R.L.)	Installation depth (m)	Type	Geological Unit over screened depth
BH-02	33.0	10	Standpipe	Holocene Alluvial Gravel

Table B4: Groundwater levels

Borehole ID	Date of groundwater measurement	Groundwater depth (m bgl)	Estimated groundwater level (m R.L.)
BH-01	18/12/2018	7.65	25.85
BH-02	18/12/2018	8.25	24.75
BH-02 Piezometer	31/01/2019	8.55	24.45
BH-03	17/12/2018	7.3	25.7

B4 Laboratory Tests

Table B5: Groundwater levels

Borehole No.	Sample Depth (m bgl)	Top of sample level (m R.L.)	Test Type
BH01	3.5-3.8	30.0	PSD < 19mm
BH02	6.5-6.8	26.5	PSD < 19mm
BH03	3.5-3.8	29.5	PSD <19mm

Tonkin+Taylor

BOREHOLE LOG

PALMY
PAPAIOEA NORTH CITY

BOREHOLE No.: **BH-01**

Hole Location: 40 Roxburgh Crescent, western side of building

SHEET: 1 OF 2

PROJECT: PNCC Roxburgh Crescent		LOCATION: Roxburgh Crescent, Palmerston North	JOB No.: 85442.0090
CO-ORDINATES: (NZTM2000)	5529096.03 mN 1824514.51 mE	DRILL TYPE: Mito 8	HOLE STARTED: 18/12/2018
		DRILL METHOD: SNC	HOLE FINISHED: 18/12/2018
R.L.:	33.50m		DRILLED BY: ProDrill
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: EJWL CHECKED: PAWR

GEOLOGICAL														ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	25 50 75 (FLUID) LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200 300	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Fill			0	SNC		BH-01 0.5-0.6 @ 0.5m BH-01 0.6-0.7 @ 0.6m		33	0		M	L				No recovery
																Silty GRAVEL (GW); brown . Moist, well graded; gravel, fine to coarse, angular to rounded, slightly weathered, Sandstone; loosely packed.
			66	SNC					1							Silty SAND (SP); orange brown. Moist, uniformly graded; sand, fine, loosely packed.
			100	SPT		5/6 5/4 5/5 **N=19**		32								Sandy GRAVEL (GP); brownish grey. Medium dense, moist, poorly graded; gravel, fine to coarse, angular subrounded, slightly weathered; sand, fine to coarse, subangular.
									2							no recovery
			76	SNC				31				MD				Sandy GRAVEL (GW), trace cobbles; grey . Medium dense, moist, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered, Sandstone; sand, fine to coarse, subangular; cobbles, subangular, up to 70mm, slightly weathered, Sandstone.
																Sandy GRAVEL (GW); brownish grey. Medium dense, moist, well graded; gravel, fine to coarse, angular to subangular, moderately weathered, Sandstone; sand, fine to coarse.
			100	SPT		4/4 4/4 4/4 **N=16**			3							Sandy GRAVEL (GW); grey . Medium dense, moist, well graded; gravel, fine to coarse, angular subrounded, slightly weathered, Sandstone; sand, fine to coarse.
Alluvial Deposits						BH-01 3.5 @ 3.5m PSD		30								
			100	SNC					4							*4.30m:* minor silt; trace cobbles, subrounded to rounded, sandstone, up to 70mm
																4.50m: Dense
			100	SPT		8/9 6/8 8/12 **N=34**		29	5			D				
								28								

Box 1: 0.0-4.1m

COMMENTS: SPT Hammer Energy Transfer Ratio 87.4% (Pile Dynamics Inc. 5/4/2018) | PSD sample tested by Geotechnics Ltd (ID S19WN000034)

Hole Depth 11.05m

Scale 1:30

Rev.: A

BoreLog - 1/03/2019 9:00:33 AM - Produced with Core-GS by GeRoc

ITEM 10 - ATTACHMENT 1

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH-01**

Hole Location: 40 Roxburgh Crescent, western side of building

SHEET: 2 OF 2

PROJECT: PNCC Roxburgh Crescent		LOCATION: Roxburgh Crescent, Palmerston North	JOB No.: 85442.0090
CO-ORDINATES: (NZTM2000)	5529096.03 mN 1824514.51 mE	DRILL TYPE: Mito 8	HOLE STARTED: 18/12/2018 HOLE FINISHED: 18/12/2018
R.L.:	33.50m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: EJWL CHECKED: PAWR

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
			56	SNC												Wood, log. single cobble, 80mm.
			100	SPT		5/5 7/8 7/2 **N=24**		27			M	MD				Gravelly SAND (SW), trace carbonaceous and cobbles; grey . Medium dense, moist, well graded; sand, fine to coarse, sunangular; gravel, fine to coarse, subangular to subrounded, moderately weathered; carbonaceous, wood fragments, cobbles, subrounded, up to 70mm, slightly weathered.
			100	SNC					7							
		18/12/2018						26								Gravelly SAND (SW); grey . Medium dense, moist, well graded; sand, fine to coarse; gravel, fine to coarse, subangular to subrounded, slightly weathered, Sandstone.
			100	SPT		6/7 7/4 4/4 **N=19**										wood, log; (SPT through wood)
Box 2, 4.1-8.1m									8							
Alluvial Deposits			100	SNC				25			W	L MD				SAND (SP), some gravel; bluish grey. Wet, poorly graded; sand, fine to medium, loosely packed; gravel, fine to coarse.
																Sandy GRAVEL (GW), trace cobbles; bluish grey. Medium dense, wet, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered, Sandstone; sand, fine to coarse; cobbles, subrounded, up to 60mm, slightly weathered, Sandstone.
			100	SPT		9/13 15/14 17/4 for 25mm **N>=50**			9			VD				*8.60m:* brownish grey *9.10m:* Very dense.
								24								*9.50m:* bluish grey
			100	SNC					10							*10.00m:* brownish grey *10.20m:* bluish grey
Box 3, 8.1-11.1m			100	SPT		7/9 14/12 13/11 for 65mm **N>=50**		23								
									11							11.05m: Target depth
								22								

COMMENTS: SPT Hammer Energy Transfer Ratio 87.4% (Pile Dynamics Inc. 5/4/2018) | PSD sample tested by Geotechnics Ltd (ID S19WN000034)

Hole Depth 11.05m

Scale 1:30

Rev.: A

BoreLog - 1/03/2019 9:00:33 AM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

PALMY — PAPAIOEA PALMERSTON NORTH CITY

BOREHOLE No.: **BH-02**

Hole Location: Higgins yard, northern end

SHEET: 1 OF 2

PROJECT: PNCC Roxburgh Crescent		LOCATION: Roxburgh Crescent, Palmerston North	JOB No.: 85442.0090
CO-ORDINATES: (NZTM2000)	5528876.54 mN 1824612.69 mE	DRILL TYPE: Mito 8	HOLE STARTED: 17/12/2018
		DRILL METHOD: SNC	HOLE FINISHED: 18/12/2018
R.L.:	33.00m		DRILLED BY: ProDrill
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: EJWL CHECKED: PAWR

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	DRILL FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Alluvial Deposits	25 50 75		100	SNC		BH-02 0.1-0.2 @ 0.1m					M					Silty SAND (SM); greenish grey. Moist, uniformly graded, non-plastic; sand, fine, Loosely packed.
						BH-02 0.4-0.5 @ 0.4m						L				SAND (SP), minor silt, trace gravel; brownish grey. Loose, moist, uniformly graded; sand, fine; gravel, fine to coarse, subrounded rounded, moderately weathered, Sandstone.
			100	SNC				32	1							
			100	SPT		2/2 2/2 2/2 **N=8**										
			100	SNC				31	2			MD				GRAVEL (GW), some sand; grey . Medium dense, moist, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered to moderately weathered, Sandstone; sand, fine to coarse, subangular. *2.25m:* single cobble 90mm, subangular, sandstone
			100	SPT		5/4 3/3 5/4 **N=15**		30	3							
			100	SNC				29	4			D				GRAVEL (GP), some cobbles; grey . Medium dense, moist, poorly graded; gravel, medium to coarse, subangular to rounded, slightly weathered, Sandstone; cobbles, subrounded to rounded, up to 80mm, slightly weathered, Sandstone. GRAVEL (GW), some sand, trace silt; grey . Dense, moist, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered, Sandstone; sand, fine to coarse, subangular.
			100	SPT		7/8 9/8 12/15 **N=44**		28	5			MD				Sandy GRAVEL (GW); reddish grey. Medium dense, moist, well graded; gravel, fine to coarse, angular to rounded, slightly weathered to moderately weathered; sand, fine to coarse, subangular to angular; iron panning. GRAVEL (GW), some sand, trace cobbles; grey .

Box 1, 0.0-3.8m

COMMENTS: SPT Hammer Energy Transfer Ratio 87.4% (Pile Dynamics Inc. 5/4/2018) | Standpipe Piezometer installed (18/12/2018); blank 0-1 mbgl; slotted 1-10 mbgl; Flush toby triangle key lock | PSD sample tested by Geotechnics Ltd (S19WN000035)

Hole Depth 11.05m

Scale 1:30

Rev.: A

BoreLog - 1/03/2019 9:00:39 AM - Produced with Core-GS by GeRoc

ITEM 10 - ATTACHMENT 1

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH-02**

Hole Location: Higgins yard, northern end

SHEET: 2 OF 2

PROJECT: PNCC Roxburgh Crescent		LOCATION: Roxburgh Crescent, Palmerston North	JOB No.: 85442.0090
CO-ORDINATES: (NZTM2000)	5528876.54 mN 1824612.69 mE	DRILL TYPE: Mito 8	HOLE STARTED: 17/12/2018 HOLE FINISHED: 18/12/2018
R.L.:	33.00m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: EJWL CHECKED: PAWR

GEOLOGICAL															ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		WATER FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
		25 50 75		100	SNC									10 25 50 100 200	1 5 10 20 50 100 250	20 60 200 600 2000	
Box 2, 3.8-6.8m				100	SPT		4/3 4/3 2/1 **N=10**										Medium dense, moist; gravel, fine to coarse, subangular to rounded, slightly weathered, Sandstone; sand, fine to coarse; cobbles, subangular rounded, up to 70mm, slightly weathered, Sandstone.
							BH-02 6.5 @ 6.5m PSD										
				100	SNC				26	7							*7.40m:* 7.4 m: becoming very dense.
				100	SPT		20/20 16/17 17 for 45mm **N>=50**										
			18/12/2018 casing in						25	8		M	VD				Sandy GRAVEL (GW), minor silt; brownish grey. Very dense, moist, well graded; gravel, fine to coarse, subangular to rounded, moderately weathered, Sandstone; sand, fine to coarse.
Alluvial Deposits			31/01/2019 Peizo	47	SNC												no recovery
									24	9							
				100	SPT		6/7 9/10 10/7 **N=36**										Sandy GRAVEL (GW), minor silt; brownish grey. Very dense, moist, well graded; gravel, fine to coarse, subangular to rounded, moderately weathered, Sandstone; sand, fine to coarse.
												W	D				Gravelly SAND (SW); bluish grey. Dense, wet, well graded; sand, fine to coarse, subangular; gravel, fine to coarse, subangular to rounded, slightly weathered, Sandstone.
				47	SNC				23	10							No recovery
Box 3, 8.8-11.1m				0	SPT		7/9 12/111 12/10 **N>=50**						VD				GRAVEL (GW), minor sand. Very dense, wet; gravel, fine to coarse, subangular, slightly weathered, Sandstone; sand, fine to coarse, angular.
									22	11							11.05m: Target depth

COMMENTS: SPT Hammer Energy Transfer Ratio 87.4% (Pile Dynamics Inc. 5/4/2018) | Standpipe Piezometer installed (18/12/2018); blank 0-1 mbgl; slotted 1-10 mbgl; Flush toby triangle key lock | PSD sample tested by Geotechnics Ltd (S19WN000035)

Hole Depth 11.05m

Scale 1:30

Rev.: A

BoreLog - 1/03/2019 9:00:39 AM - Produced with Core-GS by GeRoc

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BOREHOLE LOG

BOREHOLE No.: **BH-03**

Hole Location: Higgins yard, southern end

SHEET: 1 OF 2

PROJECT: PNCC Roxburgh Crescent | LOCATION: Roxburgh Crescent, Palmerston North | JOB No.: 85442.0090

CO-ORDINATES: (NZTM2000)	5528762.88 mN 1824579.63 mE	DRILL TYPE: Mito 8	HOLE STARTED: 17/12/2018
		DRILL METHOD: SNC	HOLE FINISHED: 17/12/2018
R.L.:	33.00m		DRILLED BY: ProDrill
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: EJWL CHECKED: PAWR

GEOLOGICAL | ENGINEERING DESCRIPTION

Geological unit	Core recovery (%)	Method	Tests	RL (m)	Depth (m)	Moisture condition	Strength/density classification	Description and Additional Observations
Fill	100	SNC	BH-03 0.05-0.15 @ 0.1m; BH-03 0.1-0.2 @ 0.1m; BH-03 0.4-0.5 @ 0.4m; BH-03 0.5-0.6 @ 0.5m			D		Sandy GRAVEL (GW), minor silt; dark grey. Dry, well graded; gravel, fine to coarse, subangular rounded, slightly weathered, Sandstone, loosely packed; sand, fine to coarse. *0.75m:* Single gravel with yellow paint.
Alluvial Deposits	100	SNC		32	1	M	St	SAND (SP), trace silt; orange brown. Loose, moist, uniformly graded; sand, fine.
	100	SPT	2/3 3/3 1/2 **N=9**				L	Sandy GRAVEL (GW), trace cobbles; grey . Loose, moist, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered to moderately weathered, Sandstone; cobbles, subangular to rounded, up to 70mm, slightly weathered to moderately weathered, Sandstone.
	42	SNC		31	2			No recovery -Cobble in drill bit
	100	SPT	4/4 4/5 5/7 **N=21**	30	3	M	MD	Sandy GRAVEL (GW); grey . Medium dense, moist, well graded; gravel, fine to coarse, subrounded to rounded, slightly weathered to moderately weathered, Sandstone; sand, fine to coarse, subangular.
	100	SNC	BH-03 3.5-3.8 @ 3.5m PSD	29	4			
	100	SPT	7/7 7/9 5/7 **N=28**					GRAVEL (GW), trace sand and cobbles; grey . Medium dense, moist, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered to moderately weathered, Sandstone; sand, coarse, cobbles, subangular, up to 70mm, slightly weathered, Sandstone.
				28	5			Sandy GRAVEL (GW); grey . Medium dense, moist; gravel, fine to coarse, subangular to rounded, slightly weathered to moderately weathered, Sandstone; sand, fine to coarse, Subangular.

Box 1, 0.0-3.8m

COMMENTS: SPT Hammer Energy Transfer Ratio 87.4% (Pile Dynamics Inc. 5/4/2018) | PSD sample tested by Geotechnics Ltd (S19WN000035)

Hole Depth 11.05m

Scale 1:30 | Rev.: A

BoreLog - 1/03/2019 9:00:45 AM - Produced with Core-GS by GeRoc

ITEM 10 - ATTACHMENT 1

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BOREHOLE LOG

BOREHOLE No.: **BH-03**

Hole Location: Higgins yard, southern end

SHEET: 2 OF 2

PROJECT: PNCC Roxburgh Crescent		LOCATION: Roxburgh Crescent, Palmerston North	JOB No.: 85442.0090
CO-ORDINATES: (NZTM2000)	5528762.88 mN 1824579.63 mE	DRILL TYPE: Mito 8	HOLE STARTED: 17/12/2018 HOLE FINISHED: 17/12/2018
R.L.:	33.00m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	NZVD2016	DRILL FLUID: WATER	LOGGED BY: EJWL CHECKED: PAWR

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	TESTS	RL (m)	DEPTH (m)	Description and Additional Observations
Alluvial Deposits	9/17 18/18 14 for 65mm **N>=50**	26	7	[CONT] Sandy GRAVEL (GW); grey . Medium dense, moist, gravel, fine to coarse, subangular to rounded, slightly weathered to moderately weathered, Sandstone; sand, fine to coarse, Subangular. *6.10m:* Very dense. *7.50m:* Wet.
	11/23 29/17 4 for 5mm **N>=50**	25	8	WOOD, log.
		24	9	GRAVEL (GW), some sand, trace cobbles; grey . Medium dense, wet, well graded; gravel, fine to coarse, subangular to rounded, slightly weathered to moderately weathered, Sandstone; sand, fine to coarse, subangular; cobbles, subrounded to rounded, up to 70mm, slightly weathered, Sandstone.
	10/7 6/7 8/8 **N=29**	23	10	
	5/5 7/7 6/5 **N=25**	22	11	11.05m: Target depth

Box 2, 3.8-7.6m

Box 3, 7.6-11.1m

WATER: 17/12/2018

CORE RECOVERY (%): 100 | METHOD: SPT | SNC | SNC | SPT

WEATHERING: W

STRENGTH/DENSITY CLASSIFICATION: VD | MD

COMMENTS: SPT Hammer Energy Transfer Ratio 87.4% (Pile Dynamics Inc. 5/4/2018) | PSD sample tested by Geotechnics Ltd (S19WN000035)

Hole Depth 11.05m

Scale 1:30

Rev.: A

BoreLog - 1/03/2019 9:00:45 AM - Produced with Core-GS by GeRoc

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Tonkin+Taylor

CONE PENETRATION TEST LOG

CPT NO.: CPT-01

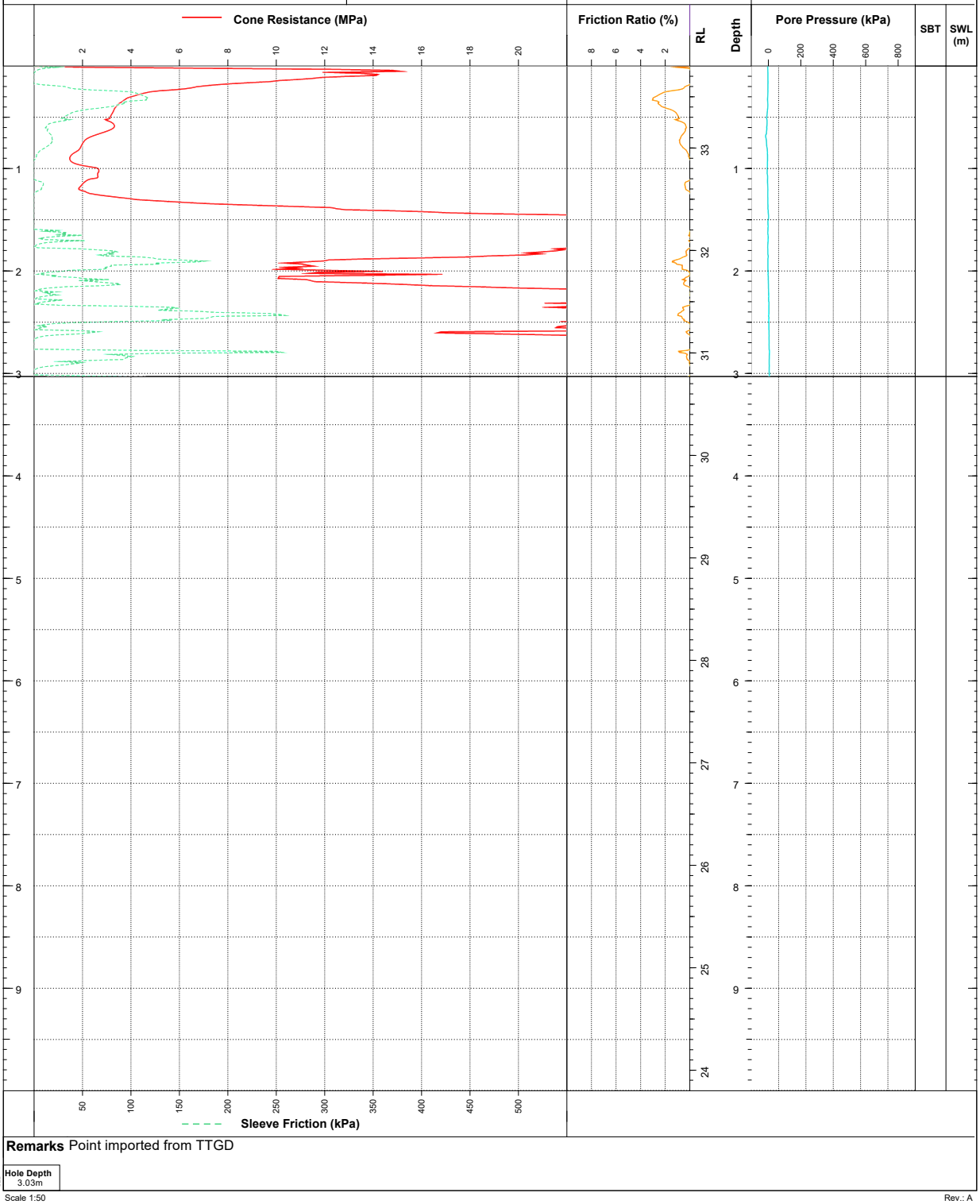
SHEET: 1 OF 1

PROJECT: PNCC Roxburgh Crescent
JOB No.: 85442.0090
LOCATION: Roxburgh Crescent, Palmerston North

CO-ORDINATES: 5529090.77 mN (NZTM2000) 1824514.71 mE
DIRECTION:
ANGLE FROM HORIZ.:

R.L. GROUND: 33.80m
DATUM: NZVD2016

DRILLED BY:
LOGGED BY: EJWL
CHECKED: RSP
TEST DATE: 18/12/2018
CONTRACTOR: 409



Remarks Point imported from TTGD

Hole Depth 3.03m

Scale 1:50

Rev.: A

CPT Log; Generated with Core-GS by Geroc; 1/03/2019 9:00:16 AM

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CONE PENETRATION TEST LOG

CPT No.: CPT-02

SHEET: 1 OF 1

PROJECT: PNCC Roxburgh Crescent	CO-ORDINATES: 5528874.61 mN (NZTM2000) 1824615.97 mE	R.L. GROUND: 33.80m
JOB No.: 85442.0090		DATUM: NZVD2016
LOCATION: Roxburgh Crescent, Palmerston North	DIRECTION:	
	ANGLE FROM HORIZ.:	

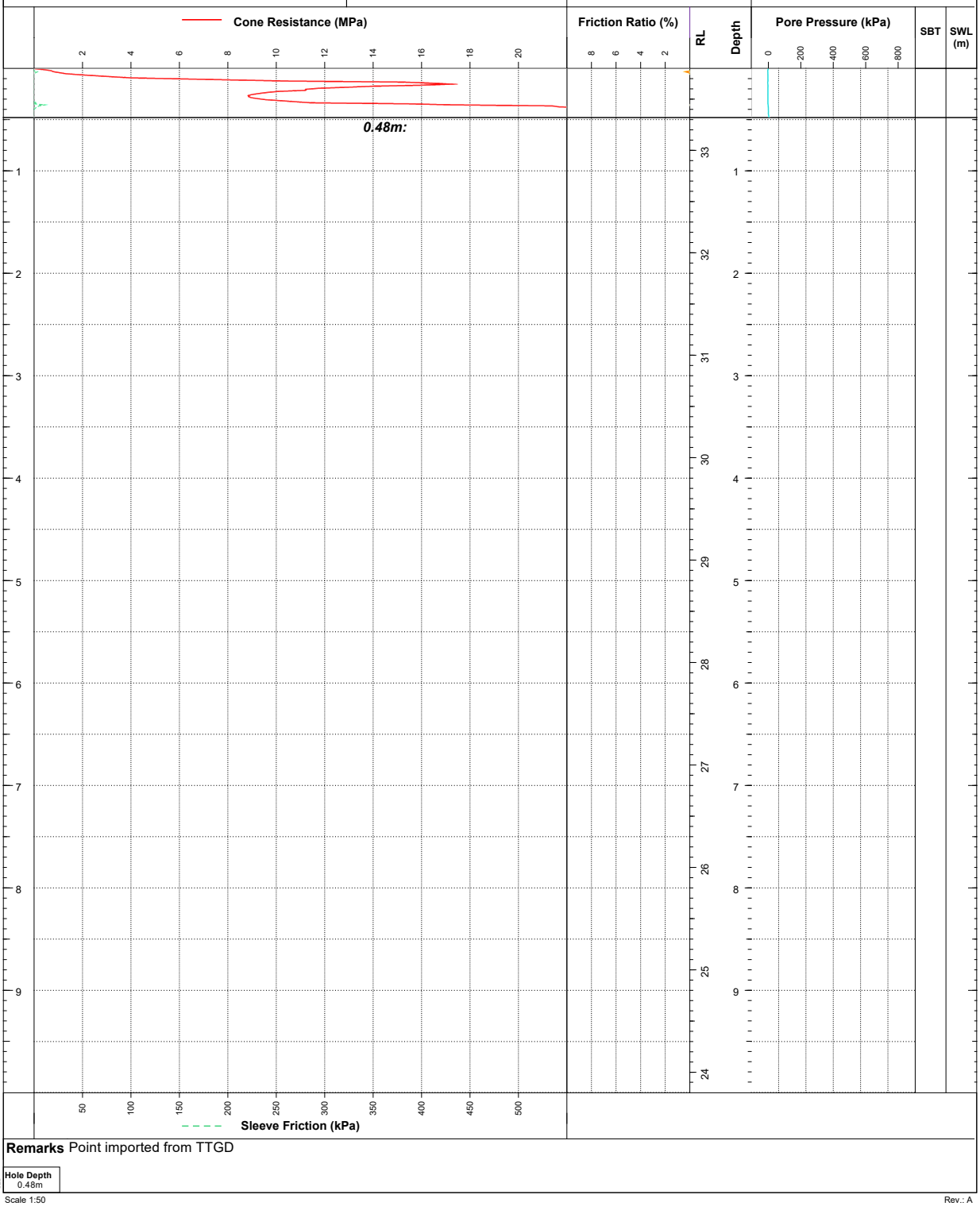
DRILLED BY:

LOGGED BY: EJWL

CHECKED: RSP

TEST DATE: 18/12/2018

CONTRACTOR: 409



Remarks Point imported from TTGD

Hole Depth 0.48m

Scale 1:50

Rev.: A

CPT Log; Generated with Core-GS by Geroc; 1/03/2019 9:00:20 AM

CONE PENETRATION TEST LOG

Tonkin+Taylor

CPT NO.: CPT-04

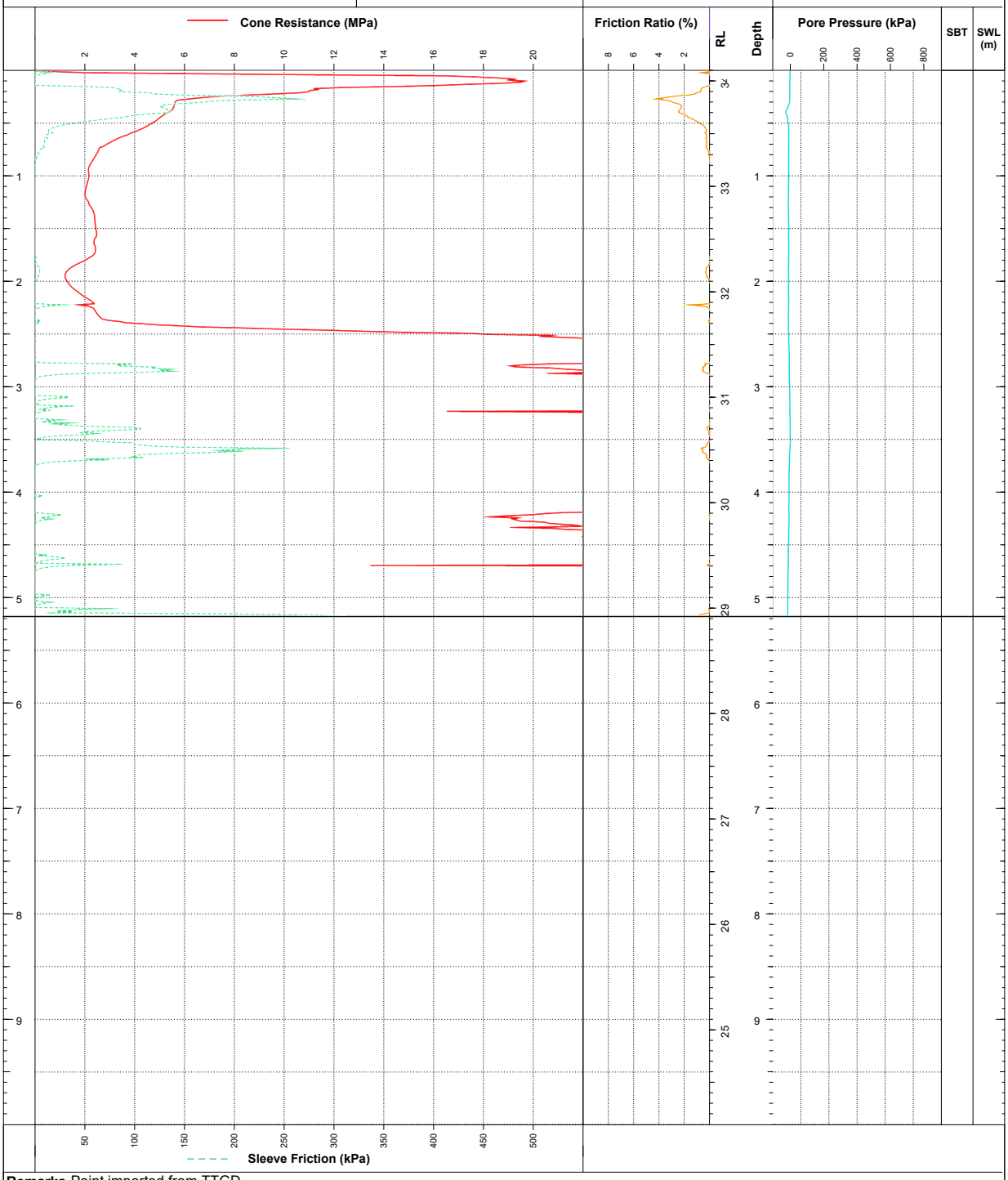
SHEET: 1 OF 1

PROJECT: PNCC Roxburgh Crescent
JOB No.: 85442.0090
LOCATION: Roxburgh Crescent, Palmerston North

CO-ORDINATES: 5529006.14 mN (NZTM2000) 1824569.06 mE
DIRECTION:
ANGLE FROM HORIZ.:

R.L. GROUND: 34.10m
DATUM: NZVD2016

DRILLED BY:
LOGGED BY: EJWL
CHECKED: RSP
TEST DATE: 19/12/2018
CONTRACTOR: 409



Remarks Point imported from TTGD

Hole Depth 5.18m

Scale 1:50

Rev.: A

CPT Log; Generated with Core-GS by Geroc; 1/03/2019 9:00:22 AM

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CONE PENETRATION TEST LOG

CPT No.: CPT-05

SHEET: 1 OF 1

PROJECT: PNCC Roxburgh Crescent	CO-ORDINATES: 5528957.10 mN (NZTM2000) 1824542.06 mE	R.L. GROUND: 33.60m
JOB No.: 85442.0090		DATUM: NZVD2016
LOCATION: Roxburgh Crescent, Palmerston North	DIRECTION:	
	ANGLE FROM HORIZ.:	

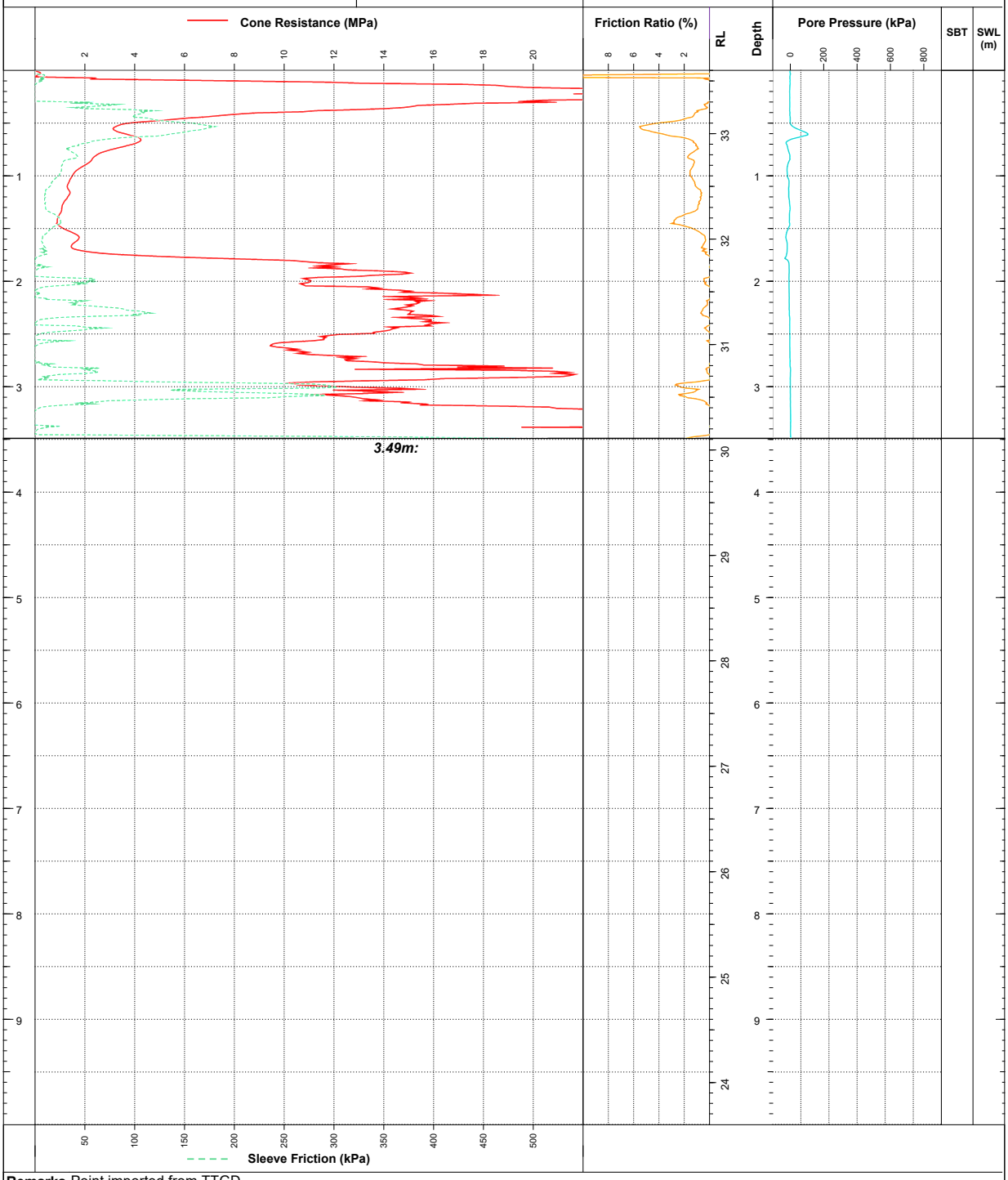
DRILLED BY:

LOGGED BY: EJWL

CHECKED: RSP

TEST DATE: 19/12/2018

CONTRACTOR: 409



Remarks Point imported from TTGD

Hole Depth 3.49m

Scale 1:50

Rev.: A

CPT Log; Generated with Core-GS by Geroc; 1/03/2019 9:00:25 AM

CONE PENETRATION TEST LOG

Tonkin+Taylor

CPT NO.: CPT-06

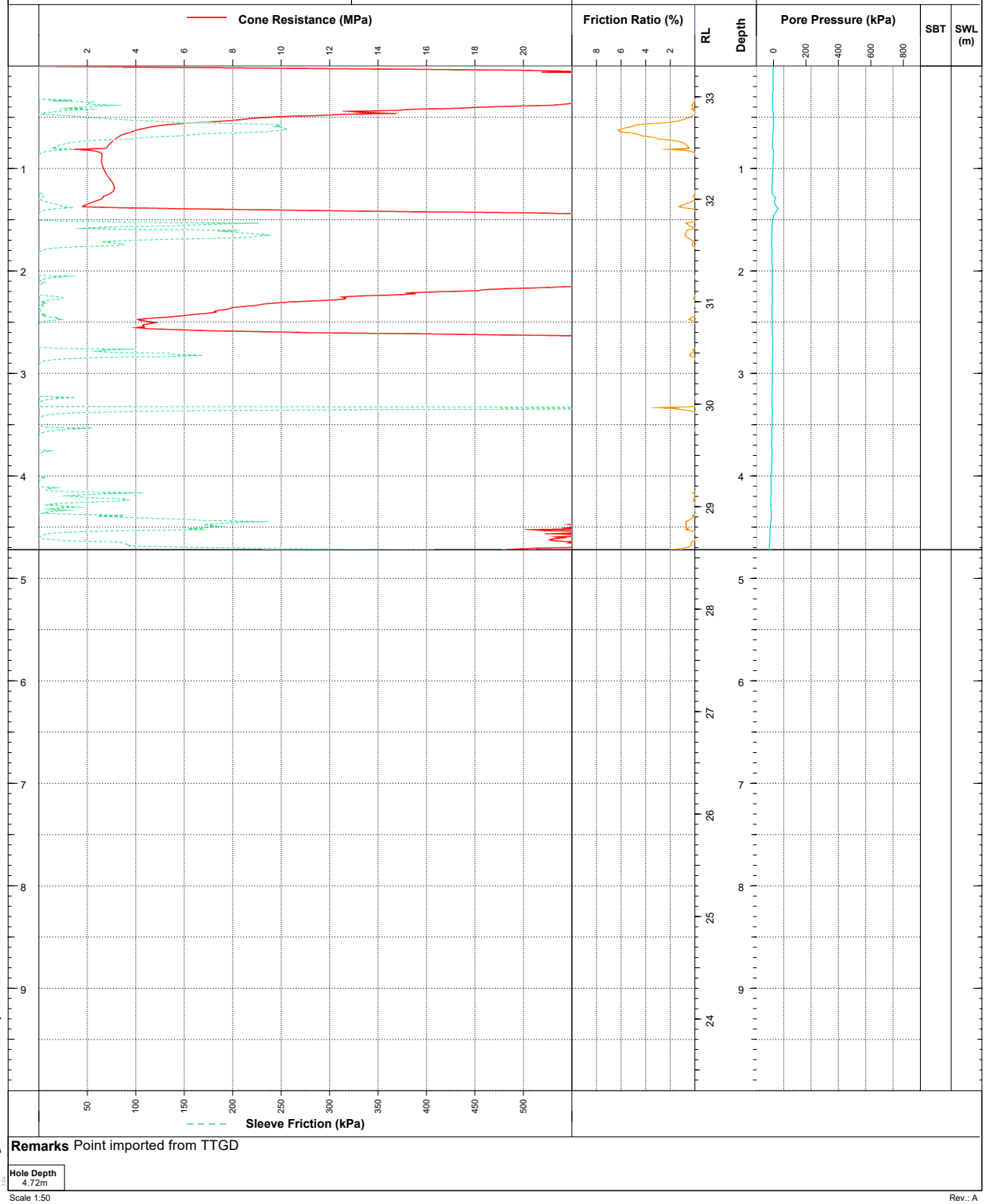
SHEET: 1 OF 1

PROJECT: PNCC Roxburgh Crescent
JOB No.: 85442.0090
LOCATION: Roxburgh Crescent, Palmerston North

CO-ORDINATES: 5528831.66 mN, 1824535.57 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.:

R.L. GROUND: 33.30m
DATUM: NZVD2016

DRILLED BY:
LOGGED BY: EJWL
CHECKED: RSP
TEST DATE: 19/12/2018
CONTRACTOR: 409



Remarks Point imported from TTGD

Hole Depth 4.72m

Scale 1:50

Rev.: A

CPT Log; Generated with Core-GS by Geroc; 1/03/2019 9:00:28 AM

ITEM 10 - ATTACHMENT 1

GEOTECHNICS

Our Ref: 1009594.0.0.0/REP1
Customer Ref: 85442.009
20 February 2019

Tonkin & Taylor Limited
PO Box 5271
Auckland
1141

Attention: Enzo Liddle

Dear Enzo

Roxburgh Crescent

Laboratory Test Report

Samples from the above mentioned site have been tested as received according to your instructions. Test results are included in this report.

Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Please reproduce this report in full when transmitting to others or including in internal reports.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

.....

James Green
Construction Materials Technician

Authorised for Geotechnics by:

.....

Paul Burton
Project Director

Report checked by:

.....

Alan Benton
Wellington Manager

20-Feb-19
t:\geotechnicsgroup\projects\1009495\workingmaterial\20190220.jmg.1009495.rep1.docx

GEOTECHNICS
Level 4, ASB Bank Tower
2 Hunter Street
Wellington 6011
New Zealand
p: +64 4 381 8584

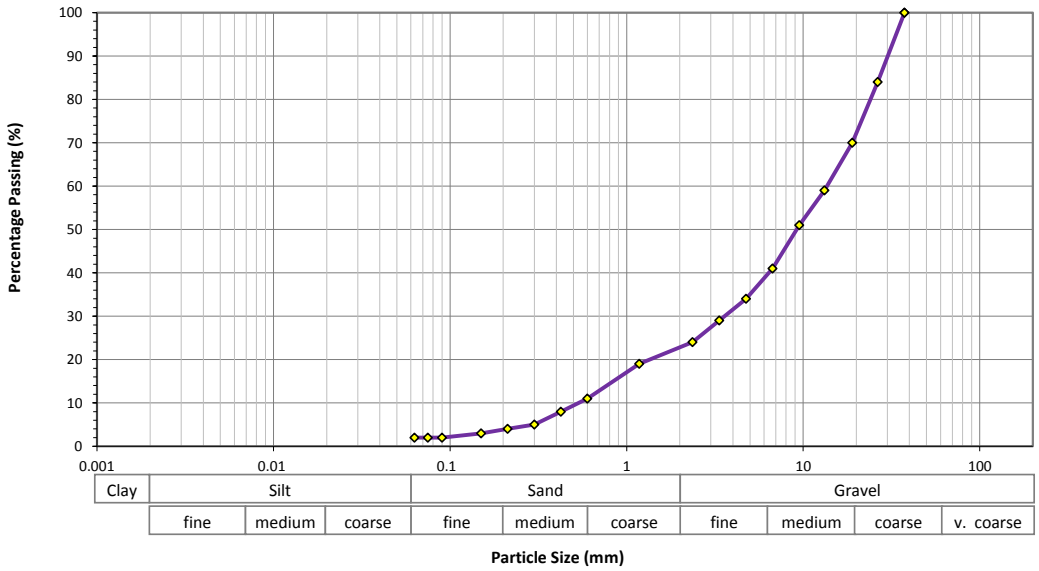
Geotechnics Project Number 1009495
QESTLab Work Order ID W19WN-0002
Customer Project ID 85442.0090

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

TEST DETAILS

LOCATION	**Description**	Roxburgh Crescent		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19WN000034		
	Reference	BH01_3.5-3.8m	**Top Depth**	3.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	3.8m
	Description	Sandy fine to coarse GRAVEL, with trace silt; grey. Moist; well graded. Sand, fine to coarse.		
SPECIMEN	**Reference**		**Depth**	
	Description			

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	84	4.75	34	0.300	5
100	-	19.0	70	3.35	29	0.212	4
75.0	-	16.0	-	2.36	24	0.150	3
63.0	-	13.2	59	1.18	19	0.090	2
53.0	-	9.50	51	0.600	11	0.075	2
37.5	100	6.70	41	0.425	8	0.063	2

TEST REMARKS

• The material used for testing was natural, fraction passing a 19mm sieve. • The sampling is not covered under our scope of IANZ accreditation. • The percentage passing the <0.063mm was obtained by difference. • Unable to be accredited due to insufficient sample mass.

Approved By Alan Benton

Date 18/02/2019

ITEM 10 - ATTACHMENT 1

GEOTECHNICS

Level 4, ASB Bank Tower
2 Hunter Street
Wellington 6011
New Zealand
p: +64 4 381 8584

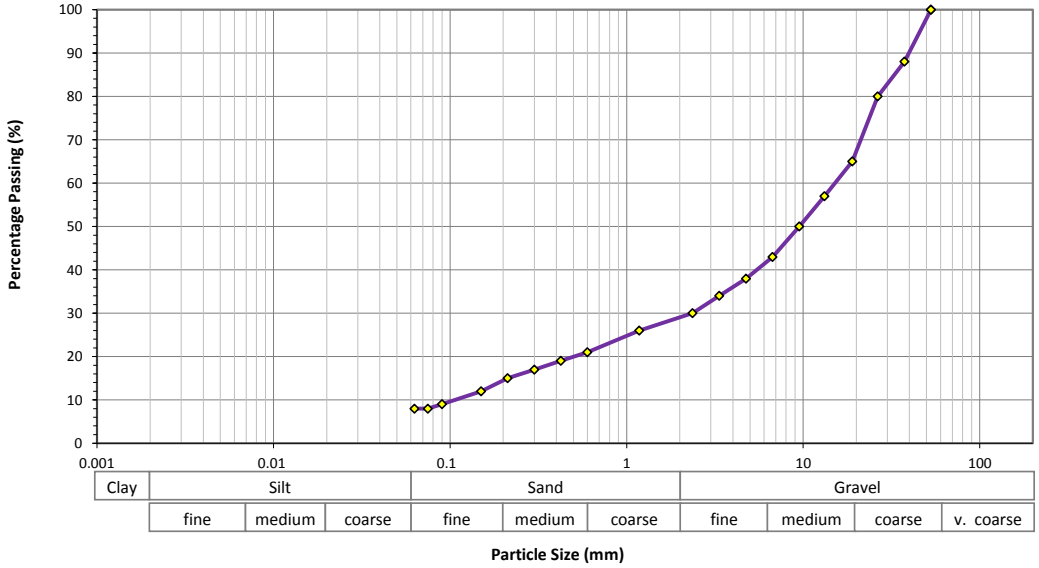
Geotechnics Project Number 1009495
QESTLab Work Order ID W19WN-0002
Customer Project ID 85442.0090

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

TEST DETAILS

LOCATION	**Description**	Roxburgh Crescent		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19WN000035		
	Reference	BH02_6.5-6.8m	**Top Depth**	6.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	6.8m
	Description	Sandy fine to coarse GRAVEL, with minor silt; grey. Moist; well graded. Sand, fine to coarse.		
SPECIMEN	**Reference**		**Depth**	
	Description			

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	80	4.75	38	0.300	17
100	-	19.0	65	3.35	34	0.212	15
75.0	-	16.0	-	2.36	30	0.150	12
63.0	-	13.2	57	1.18	26	0.090	9
53.0	100	9.50	50	0.600	21	0.075	8
37.5	88	6.70	43	0.425	19	0.063	8

TEST REMARKS

• The material used for testing was natural, fraction passing a 19mm sieve. • The sampling is not covered under our scope of IANZ accreditation. • The percentage passing the <0.063mm was obtained by difference. • Unable to be accredited due to insufficient sample mass.

Approved By Alan Benton

Date 18/02/2019

GEOTECHNICS

Level 4, ASB Bank Tower
2 Hunter Street
Wellington 6011
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p: +64 4 381 8584

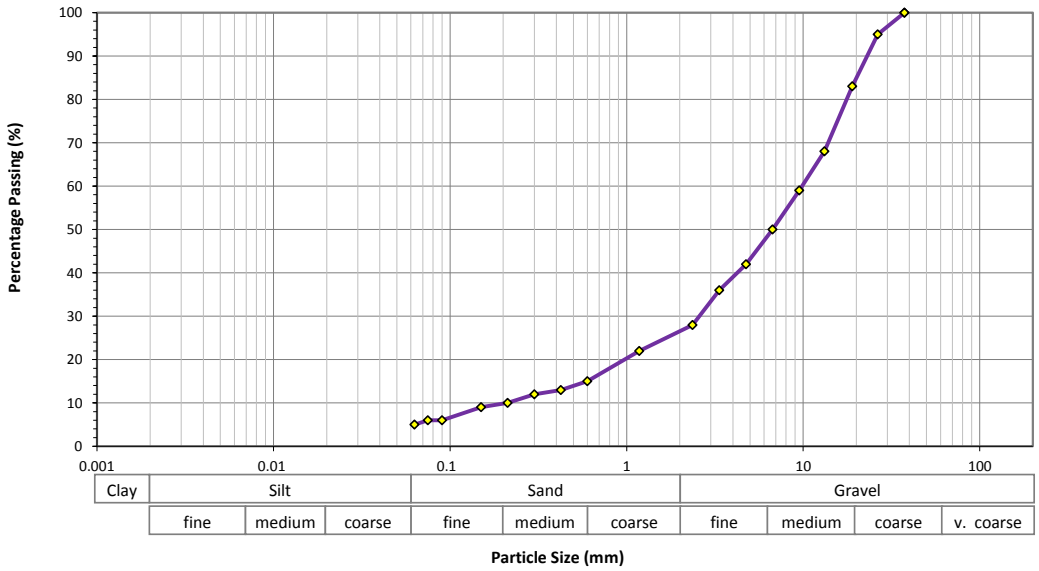
Geotechnics Project Number 1009495
QESTLab Work Order ID W19WN-0002
Customer Project ID 85442.0090

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

TEST DETAILS

LOCATION	**Description**	Roxburgh Crescent		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19WN000036		
	Reference	BH03_3.5-3.8m	**Top Depth**	3.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	3.8m
	Description	Sandy fine to coarse GRAVEL, with trace silt; grey. Moist; well graded. Sand, fine to coarse.		
SPECIMEN	**Reference**		**Depth**	
	Description			

TEST RESULTS



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	95	4.75	42	0.300	12
100	-	19.0	83	3.35	36	0.212	10
75.0	-	16.0	-	2.36	28	0.150	9
63.0	-	13.2	68	1.18	22	0.090	6
53.0	-	9.50	59	0.600	15	0.075	6
37.5	100	6.70	50	0.425	13	0.063	5

TEST REMARKS

• The material used for testing was natural, fraction passing a 19mm sieve. • The sampling is not covered under our scope of IANZ accreditation. • The percentage passing the <0.063mm was obtained by difference. • Unable to be accredited due to insufficient sample mass.

Approved By Alan Benton

Date 18/02/2019

Appendix J. Stormwater Servicing Report

Plan Change E

Roxburgh Crescent Rezoning

Stormwater Servicing Assessment

January 2024

PALMY
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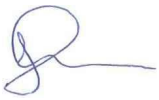
NORTH
CITY

This document was prepared by Palmerston North City Council, Transport and Infrastructure Division.

	Name	Signature	Date
Prepared by:	Reiko Baugham – Consultant Engineer		09/2022
Reviewed by:	Ricki Freemantle – 3 Waters Activity Manager		18/3/2024
Approved for Issue by:	Mike Monaghan Group Manager – 3 Waters		28/03/24

Version No.	Reason for Amendment	Date
A	WORKING DRAFT	04/2019
B	FINAL	09/2022
C	Revised treatment solution	04/2023
D	Amended due to Horizons comments	10/2023
E	Revised hydrological analysis (DRAFT)	01/2024

PNCC Reference No:	OASIS: 17016293

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Figure 1: Roxburgh Crescent Structure Plan 1

Figure 2: Roxburgh Crescent Re-zone Area 2

Figure 3: Existing stormwater network (network below minimum diameter requirements highlighted in yellow) 3

Figure 4: Flow splits (circled in blue) and general flow direction (split flows as dashed arrows) 4

Figure 5: Overview of PCSWMM model of existing network and subcatchments 5

Figure 6: Pre-development (existing land use) flow results for 10% AEP (Historical rainfall) event . (Surcharged pipes are shown in orange and red circles indicate spilling manholes) 9

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Figure 8: Results for 10% AEP + CC event with existing network and proposed land use (30% pervious residential lots in Roxburgh PC area). (Surcharged pipes are shown in orange and red circles indicate spilling manholes) 13

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1 Introduction

This report summarises the assessment of the stormwater servicing requirements for Roxburgh Crescent residential re-zone. Specifically, this assessment involved a high-level review of the proposed residential rezoning and subdivision to determine its likely impact on the surrounding environment and the measures required to mitigate any adverse impacts from the development. The assessment has been undertaken using the preliminary development plan information provided by McIndoe Urban in the context of the Palmerston North City Council's proposed Roxburgh Crescent Re-zone and Structure plan (section 32 plan change), as shown in Figure 1.

The proposed Plan Change (PC) area is roughly a 4.5-hectare block of land located to the east of the city centre in Hokowhitu, adjacent to the Manawatū River. The area is bounded by the Manawatū River and Roxburgh Crescent Reserve to the east and Ruahine Street to the west. The area is currently zoned industrial surrounded by typical residential lots. Figure 2 provides an overview of the Roxburgh Crescent residential re-zone extents, shown in blue. Of that area approximately 0.44-hectares is the public roading corridor.

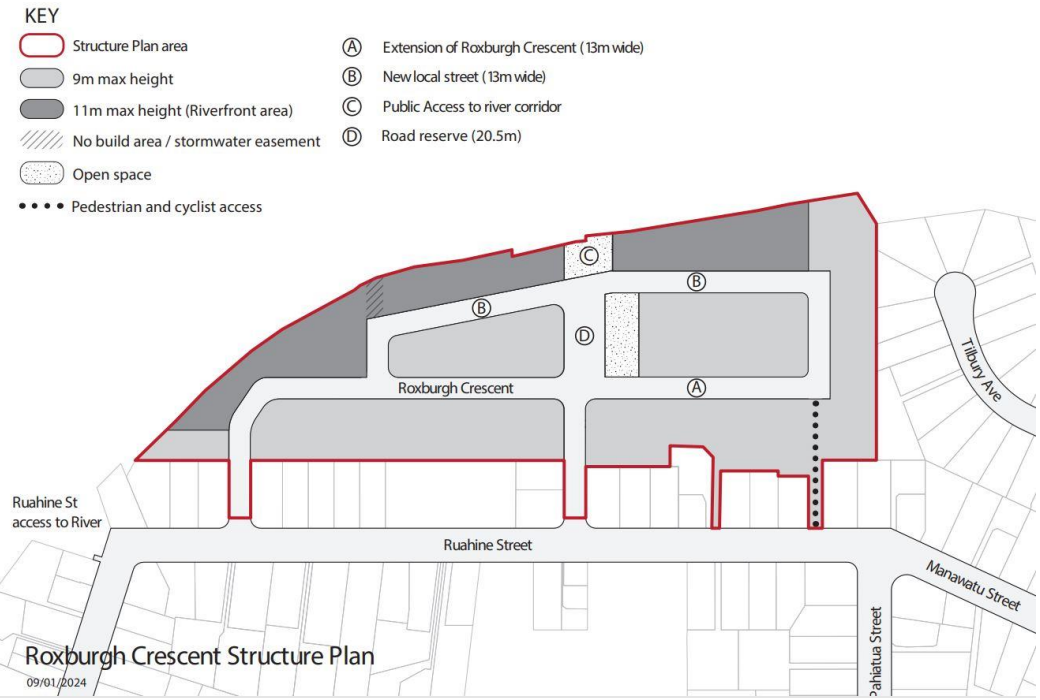

Figure 1: Roxburgh Crescent Structure Plan

Figure 2: Roxburgh Crescent Re-zone Area

2 Stormwater Services Assessment

2.1 Existing Stormwater Services

The PC area is currently serviced by a stormwater network comprising pipes ranging from DN225 to DN750, with a direct DN750 outfall to the Manawatū River. The outfall serves a total catchment area of approximately 18 hectares. A 2.5m high stopbank protects the area from flooding from the Manawatū River. The existing network consists of reinforced concrete pipe (RC) installed in 1964. Based on the expected lifespan of RC, it is not currently considered in need of renewal in the foreseeable future (i.e. next 30 years); however, part of the network does not meet the required minimum pipe size as per the current *Engineering Standards for Land Development* (ESLD) (see highlighted section in Figure 3 below), and a condition assessment of the network has not been undertaken to confirm the expected remaining life.

The existing Council reticulated stormwater network in the vicinity of the Roxburgh Crescent Residential Re-zone Area is detailed in **Error! Reference source not found.** Figure 3 below. The network splits into 4 sub-catchments at the corner of Ruahine Street and Roxburgh Crescent south, and at Newcastle Street and Surrey Crescent (refer Figure 4). The Newcastle Street catchment appears to split flow evenly to the Roxburgh Crescent outfall and the Crewe Crescent network. Ruahine Street continues down Manawatu Street to the Crewe Crescent network, however there is a high-level overflow into the Roxburgh Crescent network.

Figure 3: Existing stormwater network (network below minimum diameter requirements highlighted in yellow)

Figure 4: Flow splits (circled in blue) **and general flow direction** (split flows as dashed arrows)

2.1.1 Existing Stormwater Treatment

The existing area is zoned industrial and is currently comprised of mostly impervious surface. There are no stormwater treatment devices installed in the network apart from road sump catchpits.

2.2 Stormwater Runoff Assessment

2.2.1 Existing Network Capacity

Based on the draft masterplan prepared by McIndoe Urban, a "no build area" has been identified along the existing stormwater main alignment to the river. A review of the title does not show an existing easement. As such, it is necessary that the stormwater main alignment is taken into consideration as part of development to enable future access and maintenance of the stormwater network. Council's preference would be a publicly owned right-of-way or drainage reserve. It is important that this easement enables future maintenance of the stormwater network, preferably by designating it as a publicly owned right-of-way.

Due to the anticipated modification and development following the re-zoning, in particular to the alignment and design of the road corridors, a check of the capacity of the current infrastructure has been completed.

An assessment was undertaken to confirm the level of service provided by the current stormwater network and outfall using a high level model of the existing network. The

model includes all stormwater mains draining to the Roxburgh Crescent and Waterloo Crescent (Crewe Crescent) outfalls.

The modelling was performed using the PCSWMM software (Computational Hydraulics International, 2021). PCSWMM is a spatial decision support system for the U.S. Environmental Protection Agency SWMM 5 software. The model requires input of topographical features (catchment area, flow length, slope), ground cover conditions (imperviousness, depression storage, surface roughness), infiltration parameters (infiltration capacity, drying time), rainfall (design storm hyetograph), and drainage paths (channel length, geometry, roughness) in order to calculate stormwater runoff for an event based simulation. An overview of the PCSWMM model of the existing network is shown in Figure 5.

Figure 5: Overview of PCSWMM model of existing network and subcatchments

The following parameters and assumptions were used in the model development and assessment:

- Rainfall intensities using the updated NIWA rainfall data were used for the assessment and are summarised in Table 1 and Table 2 below. Historical rainfall intensities have been used for the pre-development (existing) scenario, and post-development scenarios include an adjustment for climate change (+ CC) using RCP 6.0 for 2081-2100. These rainfall intensities were used to develop 24-hour nested storm events that embed all design durations.

- The boundary condition (tailwater elevation) at the Manawatū River outfalls were determined using engineering judgement and information from Horizons. A 2-year river water level was applied in conjunction with 10-year rainfall in the catchment at the direction of Horizons. This was assumed due to the large size of the Manawatū River catchment, meaning peak discharge from the network is likely to occur before peak water levels occur on the River, and the low likelihood of high River water levels coinciding with peak rainfall in Palmerston North.

  Horizons provided peak annual flows (1923-2023) and the rating curve (stage –flow relationship) for the Manawatū River at the Teachers College flow gauge, approximately 3.4 km downstream of the Roxburgh outfall. A 2-year peak river flow was calculated from the peak annual flows provided at Teachers College. This was then converted to a river level at the Waterloo and Roxburgh outfalls using the river gradient and applying the Teachers College rating curve. The RL calculated for the Waterloo outfall seemed plausible (approximately 0.3 m above the outfall invert), however the RL calculated for the Roxburgh outfall seemed too high and would imply the reserve adjacent to the river is inundated during a 2-year river flood event. The Manawatū River is wider at the Roxburgh outfall when compared to both Teachers College and the Waterloo outfall, indicating that the Teachers College rating curve is likely not appropriate to apply at the Roxburgh outfall. In lieu of other information, the river water level at the Roxburgh oufall was assumed to be at the top of the outfall channel discharging to the Manawatū River. At this water level, the adjacent reserve would not be inundated which is a rational assumption during a 2-year flow event.

  The following tailwater conditions were applied in the model:

  - Waterloo Crescent outfall: 28.1 m RL (NZVD2016)
  - Roxburgh Crescent outfall: 28.5 m RL (NZVD2016)

-

- The existing network is based on GIS asset data downloaded at the time of this assessment. Missing lid levels were assigned based on LINZ LiDAR and missing invert levels were assigned based on pipe gradients provided in the GIS asset data (where available) or interpolating between upstream and downstream invert levels.

- Catchments were delineated based on existing topography and the existing stormwater network. Catchment delineation is shown in Figure 5.
- Only stormwater reticulation mains were modelled. Sumps and sump leads were not included in the model. Subcatchments were attached to the downstream node in the network. This assumes sufficient inlet capacity, which is a common modelling technique when evaluating pipe network capacity.
- The SCS curve method was used to calculate run-off for the existing industrial land use and proposed residential land use. The curve numbers applied are provided in Table 3 (assuming Type C soils).

Table 1: Rainfall intensities (mm/hr) (NIWA HIRDS v4, Historical Data)

ARI	AEP	10 min	20 min	30 min	1 hr	2 hr	6 hr
2	50%	39.9	27.2	21.8	14.9	10.2	5.4
5	20%	54.3	36.7	29.3	19.9	13.5	7.07
10	10%	65.7	44.2	35.2	23.8	16	8.34

Table 2: Rainfall intensities (mm/hr) (NIWA HIRDS v4, RCP 6.0 for 2081-2100)

ARI	AEP	10 min	20 min	30 min	1 hr	2 hr	6 hr
2	50%	47.8	32.6	26.1	17.9	12.1	6.26
5	20%	65.6	44.4	35.4	24.1	16.2	8.27
10	10%	79.7	53.6	42.7	28.9	19.3	9.8

Table 3: Curve numbers

Land Use	Curve Number
Existing residential (50% pervious)	86
Parks/greenspace	74

Roxburgh Crescent industrial area (0% pervious)	98
Plan Change area – post-development (45% pervious residential lots)	89
Plan Change area – post-development (30% pervious residential lots)	91

A comparison between runoff calculated using the SCS curve method and the Rational method was carried out and showed agreement.

Existing Land Use

The 10% annual exceedance probability (AEP) rainfall event (or 1 in 10-year annual recurrence interval) (historical rainfall) event was run with the existing network and existing land use. The results are shown in Figure 6. A zoomed in map showing spill volumes from the manholes within the Surrey Crescent and Roxburgh Crescent catchments is shown in Figure 7. The model predicts surcharging (shown in orange) through much of the pipe network, extending from the Surrey Crescent catchment through to Roxburgh Crescent, and including the DN225 main on Roxburgh North. Seven manholes in the Surrey Crescent catchment are predicted to spill during the 10% AEP (historical rainfall) event. The DN675 stormwater main from Surrey Crescent through to Roxburgh Crescent is deep and, although surcharged, is not predicted to spill. This surcharging through much of the network is due to pipe capacity; when the tailwater condition at the Manawatū River is removed the network is still predicted to be surcharged. The DN750 Roxburgh Crescent outfall is also shown to be surcharged. This section of pipe is surcharged due to the tailwater condition applied at the Manawatū River causing the outfall to be submerged. The DN750 pipe is not surcharged due to capacity, however this is likely only due to capacity constraints and spilling upstream limiting the flow to the outfall. Historically significant parts of the stormwater network in Palmerston North were sized for the 20% AEP rainfall event (or 1 in 5-year ARI), so it is not uncommon that the model predicts insufficient capacity and spilling along this branch based on current engineering standards.

Spilling is also predicted at a number of manholes throughout the network draining to the Waterloo Crescent outfall. Spilling predicted at manholes at the north end of Crewe Street and on Crewe Crescent are likely to be causing the observed flooding at low spots / depression areas in the topography on Crewe Crescent (further discussed in Section 2.2.2).

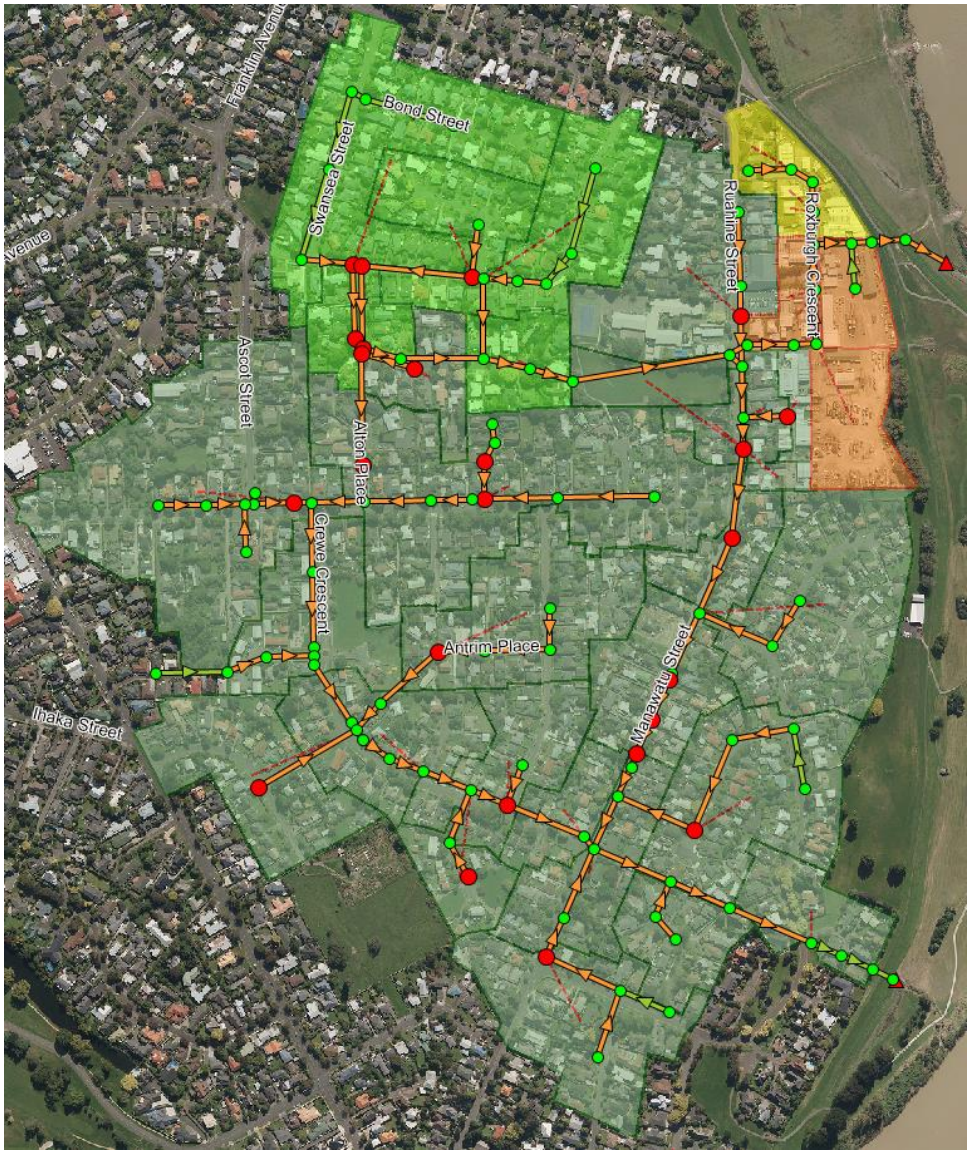

Figure 6: Pre-development (existing land use) flow results for 10% AEP (Historical rainfall) event . (Surcharged pipes are shown in orange and red circles indicate spilling manholes)

Figure 7: Zoom in of results for pre-development (existing land use) 10% AEP (Historical rainfall) event. [Surcharged pipes are shown in orange and red circles indicate spilling manholes. Spill volumes are shown in ML (1000 m³)]

Stormwater networks are typically designed not to surcharge during the design event. That is, the pipe should not exceed the pipe full capacity in the 10% AEP. A high-level check on the pipe full capacity was therefore carried out using the Manning's equation, assuming a manning's value of 0.013. This was compared to the peak runoff from the upstream catchments (assuming no network constraints and all of the flow can be conveyed to the outfall). The results are summarised in Table 4 below. The results indicate that the outfall also does not have sufficient capacity to carry the required flows.

Table 4: Summary of pre-development (existing land use) peak runoff (10% AEP) and pipe capacity for Roxburgh Crescent

	Catchment Area (ha)	Runoff (m³/s) (Historical Rainfall)	Runoff (m³/s) (Climate Change Rainfall)	Pipe Diameter (mm)	Pipe Slope	Full Pipe Capacity (m³/s)
Roxburgh North	1.4	0.10	0.12	225	0.00999	0.045
Surrey Crescent	12.8	0.55	0.73	675	0.00126	0.298
Roxburgh South	16.1[1]	0.73[1]	0.96	675	0.0033	0.482
Outfall	17.5	0.83	1.08	750	0.0019	0.489

[1] Includes Surrey Crescent catchment.

In addition to having insufficient capacity, the section of DN225 stormwater main (Roxburgh North) is currently below the minimum diameter now required for public reticulation.

Future Land Use

The assessment above shows that the existing stormwater network within Roxburgh Crescent, including the outfall to the Manawatū River, is undersized for the 10% AEP assuming existing industrial land use. A check on the limit of imperviousness in the Roxburgh Crescent PC area was first assessed to see if that would resolve surcharging in the network. That is, given the existing land use is currently considered 100% impervious, the gains from reducing the impervious area (or increasing the pervious area percentage) were determined to identify at what percentage (if any) the network could achieve Council's required level of service.

The PC area was set to be fully pervious (100% percent pervious, or 0% impervious) to compare the results to the existing development scenario. In the 10% AEP rainfall event, the DN675 diameter main through Roxburgh Crescent is still shown to be surcharged. This shows there is no limit to impervious area in the Roxburgh Crescent Re-Zone Area which can be imposed to completely resolve surcharging through the existing DN675 stormwater mains and meet Council's required level of service. This means network upgrades would be required to bring the network up to the required level of service.

To represent the future residential development within the PC area, a percent pervious of 30% was adopted for the proposed residential lots in the proposed re-zone area. Based on this, a weighted average of 28.4% pervious was calculated for the PC area using the proportion of road reserves, residential lots and greenspace shown in the Structure Plan (refer to Table 5 below).

An additional scenario with 45% pervious residential lots was used[1], equating to an overall percent pervious of 39.5% (also shown in Table 5). This was carried out to understand the effect of having a lower pervious percent requirement, which is discussed later in section 3.3.1.

Table 5: Summary of percent pervious for Plan Change area

Land Use	Percentage of Plan Change Area	Percentage of 45% Pervious Residential Lots	Percentage of 30% Pervious Residential Lots
Residential	74%	45%	30%
Greenspace	3%	100%	100%
Road reserves / carparks	23%	14%	14%
Weighted Average		**39.5%**	**28.4%**

In the post-development scenario, the DN225 on Roxburgh North has been upgraded to a DN300 diameter to meet PNCC's *ESLD*. No other network upgrades have been included.

The initial post-development scenario assumes 28.4% pervious (30% pervious residential lots) through the PC area. Runoff for the Surrey Crescent, Roxburgh North and Roxburgh

[1] As recommended by urban designers

South catchments are summarised in Table 6 for the existing and post-development scenarios. The results for the 10% AEP + CC event are shown in Figure 8.

Table 6: Pre- and post-development peak runoff for the contributing catchments in the 10% AEP rainfall event

Catchment	Area (ha)	Pre-development Run-off (m^3/s) *Existing Land Use , 10 % AEP Historical Rainfall*	Post-development Run-off (m^3/s) *Proposed Land Use (30% Pervious Residential Lots) , 10% AEP + CC*
Roxburgh north	1.4	0.10	0.11
Roxburgh South	3.3	0.18	0.20
Surrey Crescent	12.8	0.55	0.73

The upgrade to the DN300 diameter has resolved the predicted surcharging of this main. The main from the Surrey Crescent catchment and down through Roxburgh Crescent and to the outfall is shown to be surcharged as in the pre-development scenario. There are eight manholes predicted to spill in the Surrey Crescent catchment. As expected, based on the initial pervious percentage check, the number of manholes predicted to spill and spill volumes are greater in the post-development scenario than in the pre-development scenario (refer to Table 7). This is attributed to the increase in rainfall due to climate change and not due to land use changes in the PC area.

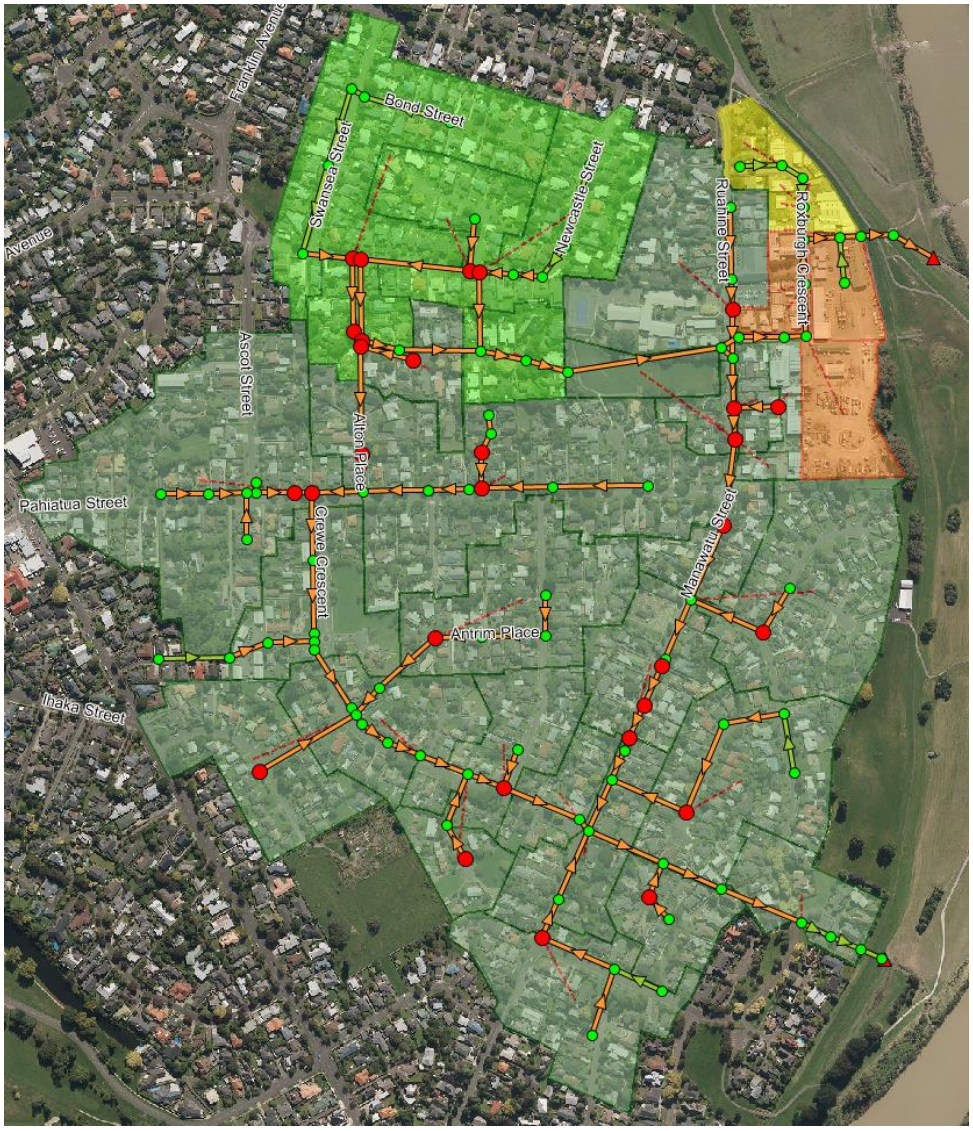

Figure 8: Results for 10% AEP + CC event with existing network and proposed land use (30% pervious residential lots in Roxburgh PC area). (Surcharged pipes are shown in orange and red circles indicate spilling manholes)

The results of the assessment summarised in Table 4 indicate the stormwater network through Roxburgh Crescent does not meet the 10% AEP + CC (1 in 10-year ARI event with climate change) standard set for the existing land use. This includes the outfall to the Manawatū River. The level of service still cannot be met with reductions in the PC area, highlighting that the network is undersized for the catchment in general. However, the level of service can be improved by re-zoning to residential development with restrictions on impervious area, but network upgrades, including an upgrade through the stopbank, is

required to provide the standard level of service. This is discussed further in Section 3.3 under the recommended stormwater management strategy.

2.2.2 Flood Risk

The PC area is located adjacent to the Manawatū River stopbanks. Therefore flood risk was evaluated for localised rainfall within the urban area, as well as flood risk from the Manawatū River.

Localised Flood Risk

Based on the city-wide TUFLOW stormwater model developed by Tonkin and Taylor in 2017, the Roxburgh Crescent Residential Re-zone Area is not susceptible to flooding in extreme rainfall events because it is not situated in a low lying area or located within an overland flow path. Figure 9 shows the maximum predicted ponding depth in the 2% AEP and 1% AEP +CC rainfall events. Any ponding shown is localised and likely to be eliminated as part of any earthworks. It should be noted that the results do not show any ponding predicted to be less than 0.05m.

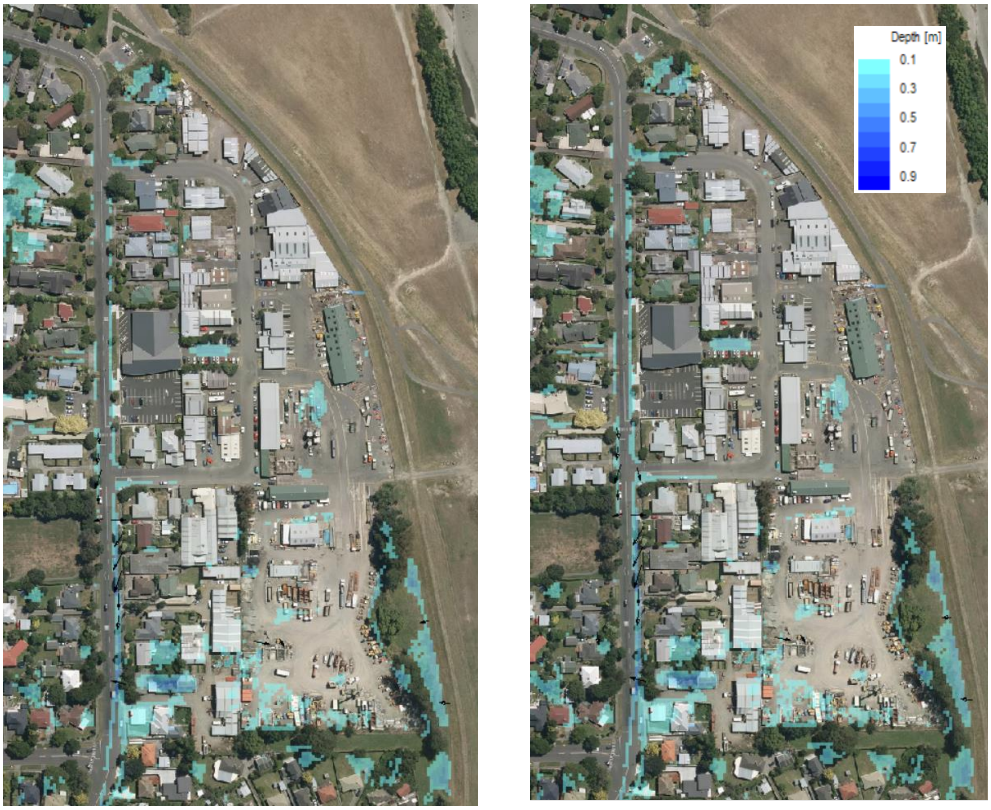

Figure 9: TUFLOW maximum ponding depths for 2% +CC and 1% AEP +CC rainfall events

There are recorded flooding incidents upstream on Surrey Crescent, and the stormwater model does indicate some risk of flooding to habitable dwellings in that area in the 10% AEP +CC rainfall event (see Figure 10 below). Flooding is also predicted along Pahiatua

Street, which is downstream of the Roxburgh Crescent catchment in terms of ground level. The areas of flooding predicted in the TUFLOW model are also supported by the manholes and parts of the network predicted to spill in the PCSWMM model during the 10% AEP + CC event (refer to Figure 6).

Figure 10: TUFLOW maximum ponding depths for 10% AEP +CC rainfall event

Given that the existing land use in the PC area is industrial, the change to residential land use is not considered likely to result in any increase in the risk of flooding within the site or upstream as it is anticipated that the percentage of impervious area will decrease with residential lot development. Redevelopment of this area is also not expected to exacerbate the flooding along Pahiatua Street as long as the catchment boundaries are maintained. That is, recontouring of the Roxburgh Crescent area must not alter the existing overland flow paths or increase the catchment area discharging overland to Ruahine Street. As such, regrading of the existing carriageway in a way that would change the catchment routing down Ruahine Street is not allowed, but minor recontouring of individual sites to drain to the carriageway within the structure plan area will not impact the wider catchment flooding.

Since the existing network will need to be upgraded anyway, there is an opportunity to improve the level of service and flooding in the wider catchment by further upgrading the stormwater network through Roxburgh Crescent. However, this is contingent on the pipe through the stopbank being upgraded. Options have been developed and are further discussed in Section 3.3.

Manawatū River Flood Risk

The stopbanks form part of the Lower Manawatū Flood Control Scheme (LMS) operated by Horizons Regional Council. Along the urban area of Palmerston North they provide a

protection level of a 0.2% AEP flood event. Around 1993 (approximate), Horizons carried out a "special project review"[2] of the LMS to review the existing (circa 1993) flood protection measures and recommend works to mitigate against flood hazard, specifically for the Palmerston North urban area. A series of stopbank breaches were modelled representing different types of failure mechanisms. Key findings from that study, as it relates to the PC area, are listed below. It is important to note that improvements to the LMS have been made since the time of the study, including the construction of a primary stopbank closer to the river at the Palmerston North Golf Club. Therefore, the probability of these failures occurring is likely to be lower than what was mentioned in the report and copied below.

- "Of the water that escapes from the river at the College of Education, or further upstream, between 70% and 90% is channelled back into the river again in vicinity of Fitzherbert Bridge and the Esplanade." (page 8)
- The "Fitzroy Bend" by Roxburgh Crescent is the part of the circa 1993 stopbank most at risk of undermining during a 3,450 m³/s flood event (1% AEP, original design standard). However, since the time of this report, it is understood that mitigation measures have been put in place to reduce the likelihood of this happening.
- Due to the presence of sandy gravel, the section of stopbank near the PC area is susceptible to stopbank foundation failures when flood levels approach the (circa 1993) stopbank crest.
- Based on the 1993 stopbanks at Fitzroy Bend, there is a 15% probability of failure during a flood of 3,450 m³/s (1% AEP), increasing to 85% when the flood size reach 4,000 m³/s (0.2% AEP).

Despite the relatively low probability of the stopbank being breached, there is still the consequence of the stopbank breach to consider. The figures below are copied from the report for two different river flow scenarios. Unfortunately only a black and white scanned copy of the report is available, so differentiating between the different flood depth colours is difficult.

3,500 m³/s in river	

[2] *Lower Manawatu Scheme Special Project – Palmerston North Flood Protection*, Manawatu-Wanganui Regional Council, G S Doull (no date)

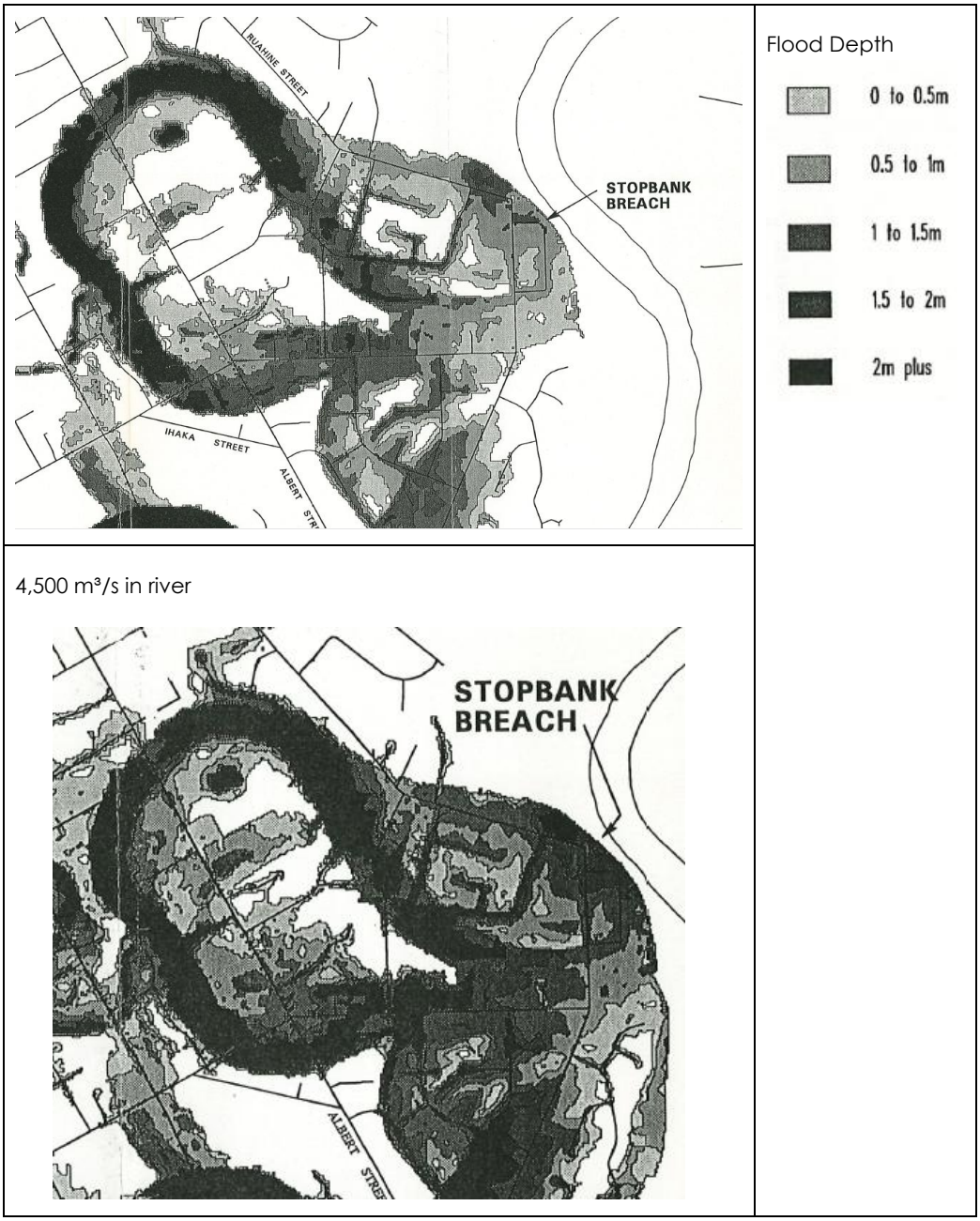

Figure 11: c. 1993 Horizons Stopbank Breach flood depths

The potential consequence (hence damage) is relatively high, however the probability of the damage occurring is low. In the more extreme river event, it appears that the flood depths could be as deep as 2 m for the northern part of Roxburgh Crescent, with lesser depths as you move south.

The stopbanks act as a mitigation measure to protect the urban area from river flood events, up to the 0.2% AEP. If we consider a 100-year lifespan for development, then the

probability of the stopbanks failing over the next 100 years is 15%. However, given that significant upgrades to the stopbank have occurred since this study was completed, it is expected that the probability over 100 years would be less than 15%.

Horizons recommended that "if very young or very old people (i.e at risk) are to be concentrated in such an area, [PNCC] would be well advised to take flooding issues [from a stopbank breach] into account when considering [planning consents]" (page 20).

2.3 Existing Stormwater Servicing Summary

The Roxburgh Crescent Residential Re-zone Area is not subject to inundation in events up to the 1% AEP + CC, and re-zoning of the Roxburgh PC area is not expected to worsen or accelerate flood hazard risk to the neighbouring catchments.

Review of the stormwater network shows that the existing reticulation in Roxburgh Crescent is not adequately sized for the 10% AEP rainfall event and does not provide the required level of service for the existing industrial development. In order to better understand the existing network constraints and impact of future development, further analysis was carried out using a PCSWMM hydraulic model.

The modelling found that the required level of service cannot be met with the existing network, irrespective of limiting the impervious area of the PC area. However, in order to facilitate development and increase the level of service provided by the existing network, the post-development scenario has been calculated assuming 30% pervious residential lots and an upgrade of the existing DN225 diameter on Roxburgh North to a DN300 main to meet PNCC's engineering standards. This single upgrade and increased perviousness in the PC area proposed through re-zoning to residential land use still does not meet Council's level of service requirements, nor does it result in post-development peak flows matching pre-development peak flows. Spill volumes in the Surrey Crescent catchment increase, and network surcharging and spilling cannot be fully resolved by limiting the impervious area in the PC area.

As part of streetscape upgrades and/or major re-construction of the existing road on Roxburgh North, the stormwater network on Roxburgh North is required to be upsized to DN300 to comply with engineering standards. Further network upgrades to enable development and achieve Council's standard level of service are also required. This is further discussed in Section 3.3, Stormwater Quantity Management.

3 Stormwater Management

3.1 Overview

Council stormwater activities are governed by a range of statutory planning instruments which have been used to develop and define PNCC performance standards. These include the Resource Management Act, National Policy Statements and Regional Plans such as Horizons Regional Council One Plan. Council is required to manage the effects of any development on stormwater so the effects of development are less than minor and do not exacerbate existing flood and quality effects.

Historically, Councils levels of service for stormwater management have been relaxed in the absence of the application of strict standards in the Manawatū Region. Horizons Regional Council has signalled its intention to require in future resource consents that all current and future urban stormwater discharges be managed, so it is incumbent on Council to ensure stormwater effects from any development are effectively managed in anticipation of future qualitative and quantitative standards being applied.

In general, land development increases stormwater runoff volumes due to increases in impervious area, but development also contributes to increases in contaminant discharges due to the additional contaminants generated by both the construction works and the on-going activities and transport movements due to increased residential and commercial activity. Because the existing land use is industrial and most of the site is already impervious, the predicted change in runoff volumes, flows and contaminant discharges associated with conversion to residential land use is considered to be negligible with the possibility of a slight improvement. However, given the future regulatory intentions of the Regional Council, and the requirements for greater attenuation and reductions in contaminant discharge to the receiving environment, Palmerston North City Council has adopted policies and engineering requirements which require mitigation of stormwater runoff and contaminant discharge for any subdivision development and re-zone area. The redevelopment of the Roxburgh Crescent Residential Re-zone Area still triggers such a requirement.

Council will therefore require implementation of specific stormwater management solutions as outlined in Sections 3.2 and 3.3 below. The application of stormwater volume and quality mitigation practices is typically referred to as water sensitive design (WSD). The mitigation solutions are typically designed to limit effects through retarding initial rainfall loss by promoting infiltration via pervious surfaces, increasing the time of concentration to reduce peak runoff volumes and flow velocities, and providing treatment to remove some contaminants at source or prior to discharge. Council typically requires the design to incorporate a treatment train (series of treatment stages between the source and outfall) to remove a broad range of contaminants including gross pollutants as well as sediment, metals and hydrocarbons. For this plan change Council has selected the treatment device that is to be used to support development (refer to Section 3.2).

3.2 Stormwater Quality Management

To ensure that the discharge of contaminants via stormwater runoff is minimised, Council has determined the following minimum requirements for lots and road reserve areas within the re-zone area:

- Roof leaders are to be connected directly to the stormwater network; otherwise treatment in the roading corridor will need to be sized to include on-lot generated runoff.

- All roofs are to be zinc and heavy-metal-free. This is now considered standard practice.

- The surface runoff resulting from the first 5mm of any rain event from the road carriageway and property driveways draining to the road shall be treated prior to entering the piped stormwater network. This will require the design and inclusion of

approved treatment devices within the road reserve to capture and treat the initial runoff volume.

Bioretention devices filter stormwater through a vegetated filter bed made of natural soil or engineered media. Depending on its design, bioretention may also perform a hydrological detention function by reducing runoff volumes and detaining runoff flows. Specific devices include rain gardens, tree pits, stormwater planters and bioretention swales.

For the Roxburgh Crescent Residential Re-zone Area , the use of a high-flow bioretention / biofiltration device that is designed to minimise the footprint by using filtration media with a high infiltration capacity is necessary to manage stormwater quality.

The Filterra® treatment system is considered to be an acceptable solution as these systems are effective in treating typical roading corridors within confined areas,and can be easily integrated within the roading corridor design. For example, a single square metre of Filterra® can treat approximately 270 m^2 of catchment area. Examples of high-flow biofiltration devices like Filterra® have been provided in Figure 12 below.

Any development within the site will need to demonstrate how this treatment requirement will be met.

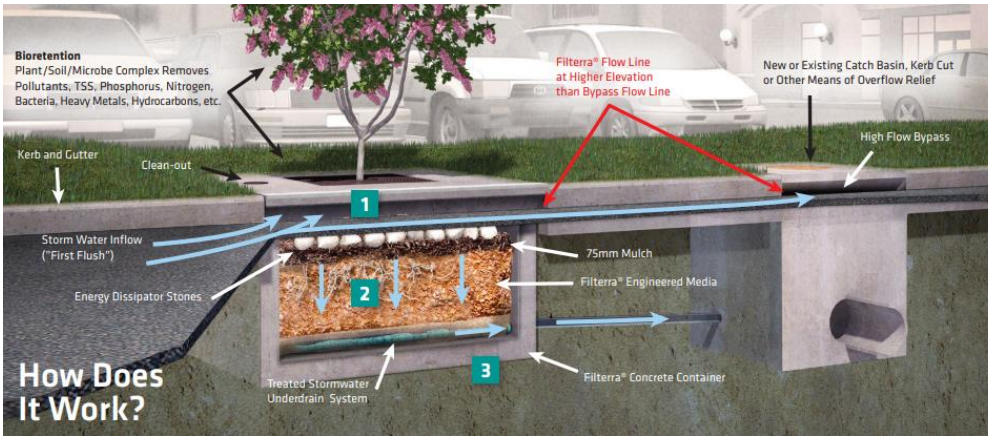

Figure 12: Filterra® Tree Pit examples

The above treatment device is appropriate for residential land use, however does not address specific contamination concerns that may relate to the existing industrial land use. As development occurs, an appropriate contaminated land assessment is required, highlighting the necessary mitigation to ensure contaminants do not enter the stormwater network during (and after) construction. This will need to be accompanied with an appropriate erosion and sediment control plan relating to contaminated land. It is noted that consents relating to a change in land use will likely be required under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. These matters would be assessed through that process.

3.3 Stormwater Quantity Management

To ensure that stormwater discharge volumes and runoff peak flows and velocities are appropriately managed, development must implement appropriate WSD measures. This includes the incorporation of greenspaces to provide treatment, both on-site and within the public road corridor. This also typically includes a limit to the impervious area, or minimum pervious percentage be met. This is often connected to a combination of the level of service provided by the existing receiving network and flood risk in the wider catchment.

Typically, onsite attenuation in the form of storage tanks can be used to mitigate the increase in stormwater runoff generated when the impervious area is greater than what has been allowed for. This is typically done so as not to overwhelm the receiving network by limiting the peak runoff to pre-development peak runoff levels. However, given that the PC area is at the downstream end of the catchment, attenuating any flow onsite may adversely impact the upstream catchment. This site is also constrained by the hydraulic capacity of the existing network. Therefore, attenuating flows is not an option and minimising the runoff generated from the site is required.

As discussed in Section 2.2.1, the DN675 through Roxburgh Crescent and DN750 outfall to the Manawatū River does not have sufficient capacity to accommodate existing development, nor does it have capacity to convey future residential land use with increased perviousness from the existing land use. To provide the Council's current level of

service, network upgrades will be required. Horizons Regional Council (Horizons) was consulted in early June 2023 to discuss the feasibility of upgrading the outfall through the stopbank. Horizons advised that it would only consider an upgrade to the outfall if it provided wider catchment benefit, and did not just allow for development in the Roxburgh Crescent Residential Re-zone Area (refer Appendix A). Therefore a high-level catchment-wide optioneering assessment was undertaken to determine if an upgraded outfall could help alleviate flooding in the catchment and provide council's required current level of service. Due to the anticipated timeframe to secure funding and implement the upgrades, a two-stage development process is proposed for the PC:

- Stage 1 is for residential development that can occur before an upgrade to the stormwater outlet to the Manawatū River has been constructed and is operational;
- Stage 2 is for residential development that can occur once the upgraded outlet is operational.

Due to the network constraints, Stage 1 involves a higher requirement for pervious areas than in Stage 2, once network upgrades have been completed. Property owners in the PC area may choose to accept higher pervious area restrictions under Stage 1 or, alternatively, may reach an agreement with Council to bring forward the upgrades proposed under Stage 2 to develop to a lower pervious area requirement. This would likely involve an agreement where the developer finances the upgrades sooner, in return for offsetting development contributions.

These two stages are discussed below.

3.3.1 Stage 1: Existing Outfall

Stage 1 applies before upgrades to the network are carried out to achieve Council's current standard level of service. Based on the hydraulic assessment carried out on the existing stormwater network in Section 2.2.1, the net pervious percentage across the entire PC area (including lots and the roading corridor shown in the structure plan) is to be 28.4% (equivalent of 30% pervious area on residential lots). Although the standard level of service is not met with this requirement and the change in land use does not completely offset the increase in run-off with climate change projections, Council is willing to accept this pervious requirement for Stage 1.

However, if only part of the PC area is developed, the pervious requirements for the developed lots will need to be set to achieve an overall pervious area of 28.4%. That is, a higher pervious area would be required to offset the existing industrial. There is a certain limit where this may not be feasible. It is understood from council's urban design experts that the highest pervious percentage feasible for the lot sizes proposed in the PC is 45%. Council is therefore prepared to accept a minimum pervious area of 45% (55% impervious area) to all residential lots in Stage 1, even though this does not meet pre-development conditions. A comparison of the pre-development and post-development scenarios assuming 45% pervious residential lots and 30% pervious residential lots was carried out. The network results are shown in Figure 13 and manhole spill volumes are presented in Table 7 for comparison. With the 45% pervious residential lots, there is a minor reduction in spill volumes in the Surrey Crescent catchment compared to the 30% pervious residential lots, but the pre-development conditions are still not met. This confirms it is not possible to

achieve pre-development conditions with pervious area restrictions alone, on residential lots in the PC area.

Table 7: Summary of manhole spill volumes pre- and post-development in the Surrey Crescent catchment for the 10% AEP rainfall event

Manhole ID	Manhole Location	Pre-development Spill Volume (m^3) *Existing Network, Existing Land Use, 10 % AEP (Historical Rainfall)*	Post-development Spill Volume (m^3) *Existing Network with DN300 Upgrade on Roxburgh North, Proposed Land Use – 30% Pervious residential lots, 10% AEP + CC*	Post-development Spill Volume (m^3) *Existing Network with DN300 Upgrade on Roxburgh North, Proposed Land Use – 45% Pervious residential lots, 10% AEP + CC*
2854	Newcastle Street & Surrey Crescent	1	6	6
3688	Newcastle Street & Surrey Crescent	51	222	220
2844	Newcastle Street & Goodwyn Crescent	42	132	132
3698	Newcastle Street	0	65	64
3689	Surrey Crescent	498	696	693
2853	Surrey Crescent	2	22	22
4384	Surrey Crescent	90	156	156
3691	Surrey Crescent	5	35	26

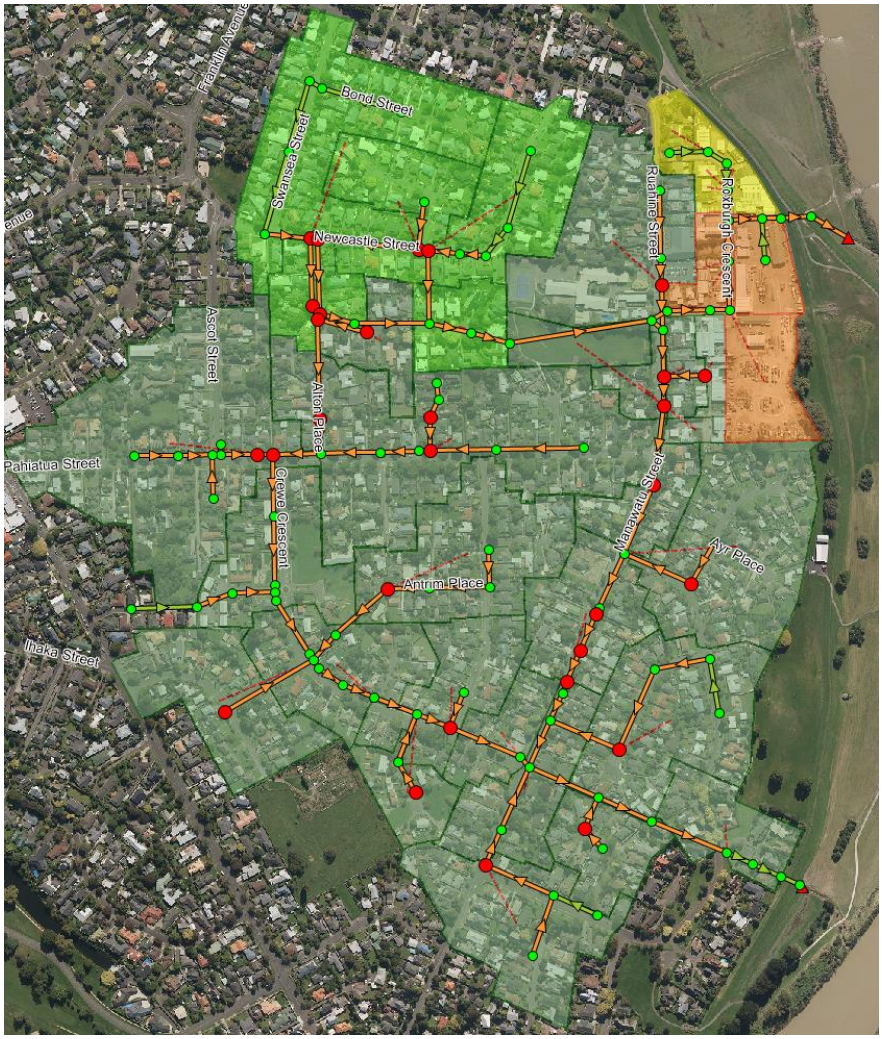

Figure 13: Results for 10% AEP + CC event with existing network and proposed land use (45% pervious residential lots in Roxburgh PC area). Surcharged pipes are shown in orange and red circles indicate spilling manholes.

Before the outfall is upgraded the following would need to apply:

- Minimum pervious area as required to achieve 28.4% net pervious area across the entire PC area (equivalent to 30% pervious residential lots if the entire PC area is developed), but no less than 45% (i.e. maximum 55% impervious area) on all lots.
- The stormwater main on Roxburgh North be upgraded to at least DN300

It is recommended that the percentage of pervious area be fixed and be achieved on all lots as a minimum. Because this is a relatively high pervious limit compared to recent development, developers may want to consider the use of pervious pavements or other technologies that can provide some of the same benefits as hardstand area, but still allows stormwater to infiltrate into the ground to help meet this requirement. This includes:

Concrete paving blocks (permeable and porous)

Porous asphalt

Porous concrete

Resin bound aggregates

Examples are provided in Figure 14. Guidelines on where these materials are suitable for use can be obtained from *Water Sensitive Design for Stormwater: Treatment Device Design Guideline*, Wellington Water.

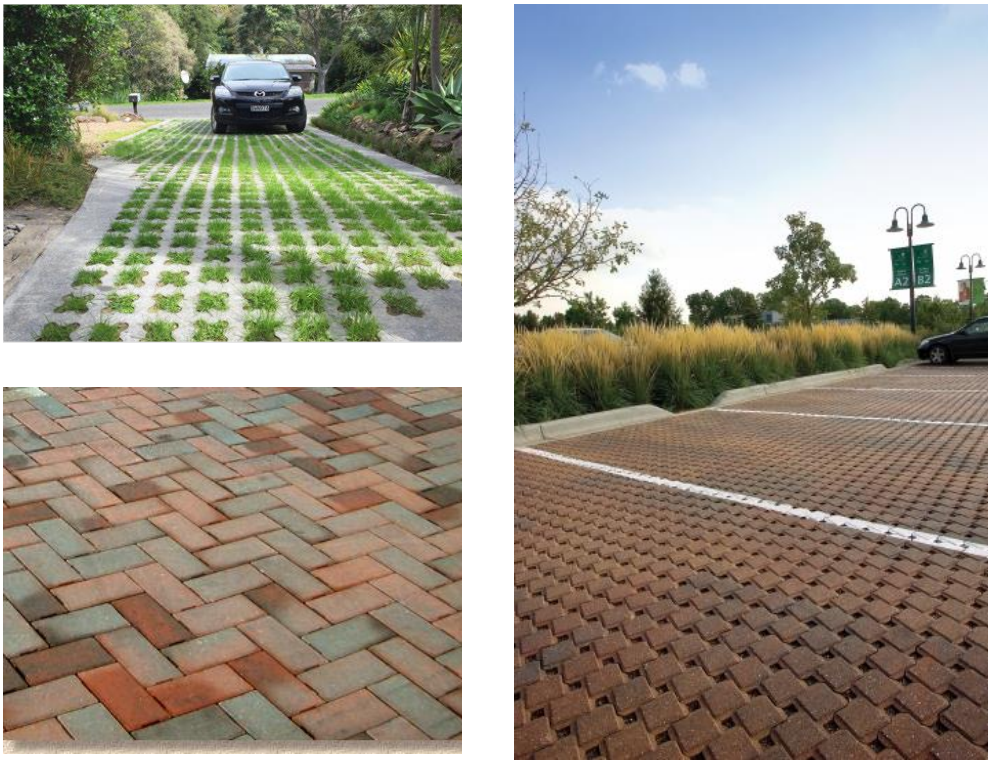

Figure 14: Examples of pervious pavements to replace typical hardstand areas

3.3.2 Stage 2: Network Upgrades

Stage 2 applies when the existing stormwater network has been upgraded to alleviate flooding in the upstream catchment based on programmes within the Long Term Plan (LTP)[3], and to meet the required level of service to enable future residential development. The upgrades will be sized for 30% pervious residential lots (equivalent to 28.4% pervious across entire PC area).

If and when the upgrades are completed and in operation, the following impervious requirements will apply to the Roxburgh Crescent Residential Re-zone Area:

[3] At the time of this assessment a programme of works has been proposed in the LTP, however has not yet been confirmed.

Minimum 30% pervious percentage on residential lots

It is recommended that the percentage of pervious area be fixed and be achieved on all lots as a minimum. This assumes the existing DN225 in Roxburgh North is upgraded to DN300.

As discussed in Section 2.2.1, Future Land Use, the pipe through the stopbank requires an upgrade. The upgrade will need to demonstrate an improvement to the wider catchment, and not just what is required to enable development for this plan change. An analysis has therefore been completed (attached in Appendix B) to identify what improvements could be made in the wider catchment. The TUFLOW model was consulted to see where the flood risks are and the relevant catchments as they relate to the Roxburgh Crescent stormwater network. Areas known to be susceptible to flooding include Pahiatua Street and Crewe Crescent. Both the Pahiatua Street and Crewe Crescent catchments discharge to the Crewe Crescent outfall. Therefore, in order to enable the upgrade at Roxburgh Crescent, a catchment diversion would be required.

In considering the assessment in Appendix B, there is sufficient evidence to demonstrate that an upgrade to the existing outfall alongside some changes to the pipe network would provide benefit to the wider catchment. This would support a Horizons resource consent application to upgrade the outfall through the stopbank.

Based on the results, Option 4 is recommended, which redirects the Pahiatua Street stormwater network (and upstream catchment) to the Roxburgh Crescent outfall. This option was then further refined to understand the likely reduction in flooding and to refine the pipe size to inform the LTP. The level of service for the refined Option 4 has been defined such that there is no surcharging in the network due to pipe capacity during a 10% AEP +CC event.

The design basis for the network upgrades is as follows:

30% pervious residential lots in the PC area (equivalent to 28.4% pervious across entire PC area),

Sized to convey the 10% AEP + CC event,

No surcharging in the new network due to pipe capacity, and

As far as practicable, reduce and resolve spilling in the existing network serviced by the upgraded network in the 10% AEP +CC event.

To achieve no surcharging due to pipe capacity a DN900 pipe was determined to be the minimum outfall size required through Roxburgh Crescent. The conceptual pipe through Roxburgh Crescent has been set to the same invert elevation as the existing network to transfer flow from the existing network. This means the pipe is up to 6 m deep through Roxburgh Crescent and almost 8 m deep through the stopbank. The average pipe grade through Roxburgh Crescent is 0.2 - 0.4%.

Cross-connections to the existing network in Roxburgh Crescent have been included to transfer flow from the existing network through Roxburgh Crescent to the new pipe to help alleviate flooding upstream. The depth and size of the cross-connections were set to

transfer as much flow as possible from the existing network before any surcharging due to pipe capacity was predicted in the new pipe.

To help alleviate flooding on Crewe Crescent, a DN900 pipe was sized to divert flows from Crewe Crescent to the Roxburgh Crescent outfall. The conceptual pipe grade is 0.17%.

Not all spilling in the Surrey Crescent catchment was able to be resolved with the new Pahiatua/Ruahine Street bypass pipe in the 10% AEP +CC event. At most spilling manholes, the upgrades are predicted to partially offset the increase in spill volumes due to climate change but do not achieve pre-development (with historical rainfall) predicted spill volumes. The spilling in the Surrey Crescent catchment is largely due to insufficient capacity in the local network and resolution of the spilling would require upgrading some of the local network into Surrey Crescent. Upgrading the existing stormwater main up Alton Place to the first manhole (MH3163) provided only a limited reduction in spilling at only one manhole in the Surrey Crescent catchment. Further reducing flooding in this catchment would be best achieved by upsizing and lowering the existing stormwater main extending north up Alton Place and through private property to the Surrey Crescent catchment, and creation of a new cross-connection to transfer flow from the existing DN525 on Surrey Crescent into the upgraded pipe draining south on Alton Place. Further network upgrades would also likely be required up to Newcastle Street to fully resolve all spilling in the Surrey Crescent catchment. These additional upgrades would be extensive and include the upgrade of pipes through private property. For now, Council intends to proceed with the new bypass pipe on Pahiatua Street only, which provides some reduction in spilling in the Surrey Crescent catchment.

The network results with the upgrades are shown in Figure 15 below. Note that the surcharging shown through the new pipe is due to the tailwater effects from the Manawatū River. The influence of the river extends far upstream due to the depth and shallow grade of the network. For example, the invert level of the existing manhole MH3701 located at the intersection of Ruahine Street and Roxburgh Crescent, has an invert of 28.2 m – 0.3 m lower than the tailwater condition assumed at the River outfall.

The model still predicts spilling at a number of manholes on Ruahine Street, Crewe Crescent and through the network to the Waterloo Crescent outfall. The spill volumes predicted through Crewe Crescent have reduced with the upgrades due to the diversion of part of the upstream catchment to the Roxburgh Crescent outfall, but have not been fully resolved. Complete resolution of the predicted spilling in these areas would require upgrades in the network draining to the Waterloo Crescent outfall.

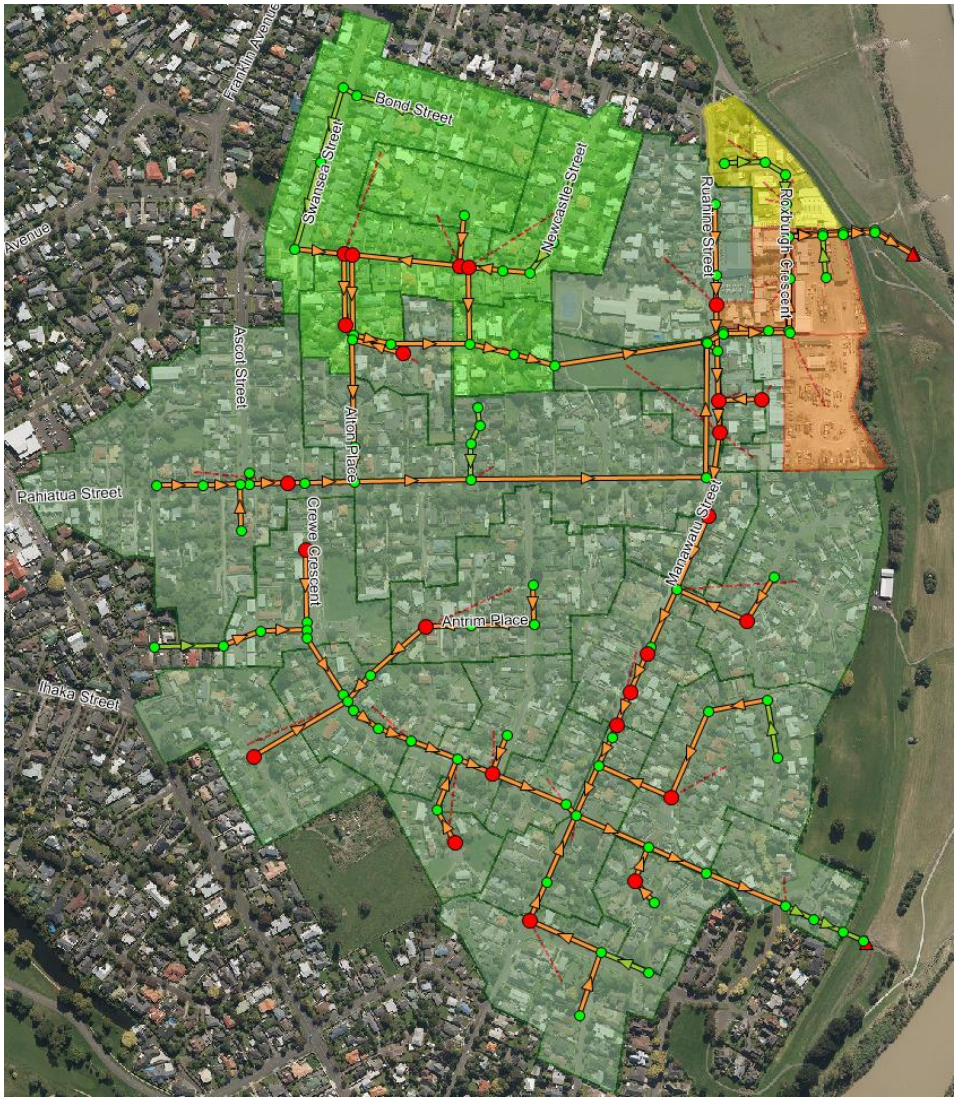

Figure 15: Results for 10% AEP + CC event with upgraded network (Stage 2) and proposed land use (30% pervious residential lots in Roxburgh PC area). Surcharged pipes are shown in orange and red circles indicate spilling manholes

16The network upgrades are shown on the map in Figure 17Appendix C. This has been budgeted for in the Long Term Plan, as discussed in Section 4.

Figure 17: Recommended network upgrades

Table 8: Summary of manhole spill volumes for 10% AEP rainfall event

Manhole ID	Manhole Location	Spill Volume (m^3) *Existing Network, Existing Land Use 10% AEP (Historical)*	Spill Volume (m^3) *Existing Network with DN300 upgrade on Roxburgh North, 30% pervious residential lots in plan change area, 10% AEP + CC*	Spill Volume (m^3) *Upgrades, 30 % Pervious Residential lots in plan change area, 10% AEP + CC*
2854	Surrey Crescent	1	6	5
3688	Surrey Crescent	51	222	125
2844	Surrey Crescent	42	132	124
3698	Surrey Crescent	0	65	36
8119	Ruahine St	520	811	806
3689	Surrey Crescent	498	696	199
2853	Surrey Crescent	2	22	0
4384	Surrey Crescent	90	156	128
3691	Surrey Crescent	5	35	0
8123	Ruahine St	0	4	4

348	Ruahine St	144	255	255
3163	Alton Place	134	260	0
8137	Pahiatua St	757	1255	0
8065	Pahiatua St	215	333	1
3161	Crewe Crescent	0	241	MH removed in upgrade
96	Manawatu Street	418	642	641
3704	Waterloo Crescent	0	17	17
N/A - Private MH outside 6 Dresdan Crt	Pahiatua St	194	247	0
N/A - 565 Ruahine Street	Ruahine St	1	13	13
353	Dorset Crescent	272	488	468
364	Buxton Place	63	85	42
2255	Earl Place	0	15	15
2272	Manawatu Street	163	337	317
2251	Erin Street	0	0	0
17853	Waterloo Crescent Outfall	0	0	0
21057	Manawatu Street	183	240	208
8076	Crewe Crescent	0	0	3
8197	Antrim Place	510	894	452
349	Manawatu Street	124	215	206
8597	Manawatu Street	22	100	96
365	Ashford Ave	1	1	1
8216	Crewe Crescent	205	584	244

The high-level concept follows the route of the existing stormwater network, however consideration should be given to the structure plan. The wide boulevard that provides public access to the river corridor could also serve as the new stormwater corridor. In that case, the stormwater main would still be directed to the existing channel outfall to avoid a new discharge to the river.

As discussed above, the existing DN750 is still required to service the catchment. Using the new roading layout in the Structure Plan would yield the following options:

1. Abandon the existing DN750 and increase the diameter of the new main so the entire catchment is conveyed by a single pipe and only one stopbank penetration;
2. Redirect the DN750 outfall to follow the new route with dual pipes to the outfall; or
3. Keep the DN750 where it is.

Constructability of the stopbank penetration would need to be considered, as there is a limit to what can be carried out via microtunnelling. A new dual pipe solution may be preferrable because the DN1050 could potentially be reduced with upsizing of the DN750.

It is anticipated that Horizons will require input into these options, which can be explored as part of detailed design.

3.4 Stormwater Management Plan

A high-level Stormwater Management Plan (SMP) will be required for treatment of stormwater runoff prior to discharge to the stormwater network and to demonstrate how the pervious area requirement will be met. Provided that the proposed stormwater mitigation measures are in accordance with this servicing assessment, the SMP will not need to be prepared by a suitably qualified stormwater design consultant with experience in Water Sensitive Design (WSD) concepts and elements.

The SMP must address the following:

a) Scoping of the subdivision layout and how it will connect to the existing drainage system;
b) Demonstrate how the development, including future development of lots, will be able to meet the impervious area limit;
c) Treatment of runoff prior to discharge to the primary network;
d) Protection of treatment devices and treatment of runoff during all phases of construction;
e) Outline how the development will hydraulically relate to its surrounding environs, including assessment of overland flow paths and potential flood impacts of proposed development and/or any proposed earthworks.

The SMP will be separate to any environmental management plans associated with development of potentially contaminated sites.

The Roxburgh Crescent Residential Re-zone Area is unique in that the re-zoned land has an existing public roading corridor. As such, coordination with the Council will be required in order for the appropriately sized treatment device to be provided in the roading corridor.

4 Funding

A high-level engineer's estimate was completed for the Stage 2 network upgrade option (refer to Appendix C).

The cost estimate is based on the following assumptions:

- Unit costs are based on recent tender rates and rates in QV Builder for the Palmerston North region, extrapolated to the proposed depth of the new pipeline. Open trenching has been assumed for most of the pipeline except a 60 m section through the existing stopbank where micro-tunnelling has been allowed for.
- Costs are GST exclusive.
- A 10% allowance has been included for Preliminary and General items.
- An 8-10% allowance has been included for design fees.
- A 30% construction contingency has been included.

The budget cost to complete the Stage 2 work (in 2023 $) is approximately $4.0 million, which includes design, consenting and construction. This has been accounted for in the proposed LTP programme[3], with construction costs allocated in Years 4 and 5. This has a 70/30 split between two programmes: 2324 - Urban Growth – Stormwater Roxburgh Crescent Infill and 1060 – City-wide - Stormwater Network Improvement Works, respectively. For the purposes of development within the Roxburgh Crescent PC area, the growth funding can be further proportioned based on the contributing catchment area, which is 13.5% of the entire catchment. As such, it is anticipated that approximately $0.4 million will be funded from the Roxburgh Crescent PC area.

As part of the next stage, a feasibility assessment is recommended to confirm the pipe corridor and existing services along the pipe alignment. This may impact the proposed construction methodology and cost estimate.

5 Summary

Council is looking to improve stormwater runoff quality prior to discharge to the Manawatū River. As part of the re-zone and redevelopment of Roxburgh Crescent, stormwater management is essential to mitigate the effects of development and ensure development does not adversely impact the receiving system or upstream catchment. As such, Council has determined the following is required:

- Water sensitive design elements must be incorporated in the development through the use of high-flow bioretention / biofiltration devices to mitigate both stormwater quantity and quality impacts within the road reserve.
  - The preferred device outlined in Section 3.2 minimises the footprint by using a high infiltration capacity media.
  - An acceptable solution is the Filterra® tree pit, which requires approximately 1 square metre of Filterra® be provided per 270 m^2 of contributing catchment area.

Roofing and other surfaces must be free of zinc and other heavy metals and contaminants. This is now considered standard practice.

Roof leaders are to be directly connected to the stormwater network; otherwise the runoff from the roof areas will need to be treated.

The development must promote stormwater infiltration by limiting lot imperviousness area. No attenuation will be allowed to offset additional impervious area.

- Under Stage 1 the minimum pervious area must equate to a combined pervious percentage of 28.4% across the entire PC area, but no less than 45% of the lots being developed.

If an outfall upgrade has been constructed and is operational, then under Stage 2 the minimum pervious area must be 30%.

A general Stormwater Management Plan is required for any development within the re-zone area that addresses both stormwater quality and quantity, as outlined in this assessment. The SMP must identify how the impervious area limit will be met as development occurs, and demonstrate that the development will be appropriately treated.

Due to the existing industrial land use, contaminated land investigations and management plans are required to ensure contaminated runoff does not enter the stormwater network, both during construction and after.

Stage 2 of the PC area is dependent on obtaining Horizons resource consent. A programme has been added to the LTP for construction in Years 4 and 5.

Appendix A. Correspondence with Horizons

Appendix B. Catchment-wide analysis

Introduction

In order to identify what improvements could be made in the wider catchment, the TUFLOW stormwater model was consulted to see where the flood risks are and the relevant catchments. Areas known to be susceptible to flooding include Pahiatua Street and Crewe Crescent. Both the Pahiatua Street and Crewe Crescent catchments discharge to the Crewe Crescent outfall. Therefore, in order to utilize the upgrade at Roxburgh Crescent, a catchment diversion would be required.

Methodology

In order to properly simulate the hydraulics of the network, a high-level PCSMM model (an earlier version of the model discussed in Section 2.2 of the main body of the report) was used to determine the pipe size required for the upgrades. As a starting point, an impervious area of 70% was assigned to the PC area for all of the options. Large subcatchments and approximate invert levels were used to estimate the required pipe size for each upgrade option.

Network Upgrade Options

Figure 18 provides an overview of the 10% AEP rainfall event and the contributing catchments that could be improved by upgrading the outfall. A description of each option evaluated is provided in Table 9. The diversion point identified indicates where the catchment would be redirected to the Roxburgh Crescent network and outfall.

Figure 18: TUFLOW maximum ponding depths for 10% AEP (1 in 10-year) rainfall event with proposed catchment diversions

Table 9: Network upgrade options

Option	Description	Catchment Increase	Diversion Point
1	Redirect the north Ruahine Street stormwater main (catchment 1) to Roxburgh Crescent instead of continuing down Ruahine Street to Manawatu Street. This will reduce the loading on the Manawatu Street network. This option requires connecting the network upstream of SWMH 29217 to the Roxburgh Crescent main the flow split at Ruahine Street and Roxburgh Crescent (south).	10.7%	

2	Redirect all of the Surrey Crescent network (catchment 2) to the Roxburgh Crescent outfall. This will reduce the loading on the Crewe Crescent network, potentially reducing the flooding on Crewe Crescent. This option would require blocking the flow split and upgrading the network from Surrey Crescent to Ruahine Street.	26.9%	
3	Redirect east Pahiatua Street (catchments 2 and 3) at Alton Place to the Roxburgh Crescent outfall. This will reduce the loading on the Crewe Crescent network, potentially reducing the flooding on Crewe Crescent. This option would require a new pipe from Alton Place to Roxburgh Crescent.	28.7%	

4	Redirect east and west Pahiatua Street (catchments 2, 3 and 4) to the Roxburgh Crescent outfall. This will reduce the loading on the Crewe Crescent network, potentially reducing the flooding on Crewe Crescent. This option would require a larger pipe than Scenario 3 from Alton Place to Roxburgh Crescent.	48.6%	

5	Redirect the Crewe Crescent network (catchments 2 through 5) to the Roxburgh Crescent outfall. Through upgrades of the Crewe Crescent network, this should significantly reduce the flooding on Crewe Crescent. This option would require a new pipe along Crewe Crescent and up Manawatu and Ruahine Street to Roxburgh Crescent.	90.4%	

Results

The required pipe sizes for each of the options are presented in Figure 19.

The results show that:

All options require the outfall to be upgraded, ranging from DN825 to DN1350.

All options require the Roxburgh Crescent main to be upgraded, ranging from DN750 to DN1200.

Capturing all of Catchment 2 should not require an upgrade of the existing stormwater main to Ruahine Street.

Diverting Catchments 3 or 4 will require a new main of 600m and 660m in length, respectively.

Diverting Catchment 5 will require an upgrade of Crewe Crescent as well as a new main approximately 1.2km in length.

Based on the results, option 4 is recommended based on the pipe diameters required and pipe lengths. A figure showing the exact pipe diameters and extents is provided in Figure 20. This assumes that the Roxburgh Crescent south network is duplicated rather than upgraded for contractibility reasons.

Figure 19: Network upgrade requirements to service the identified catchments

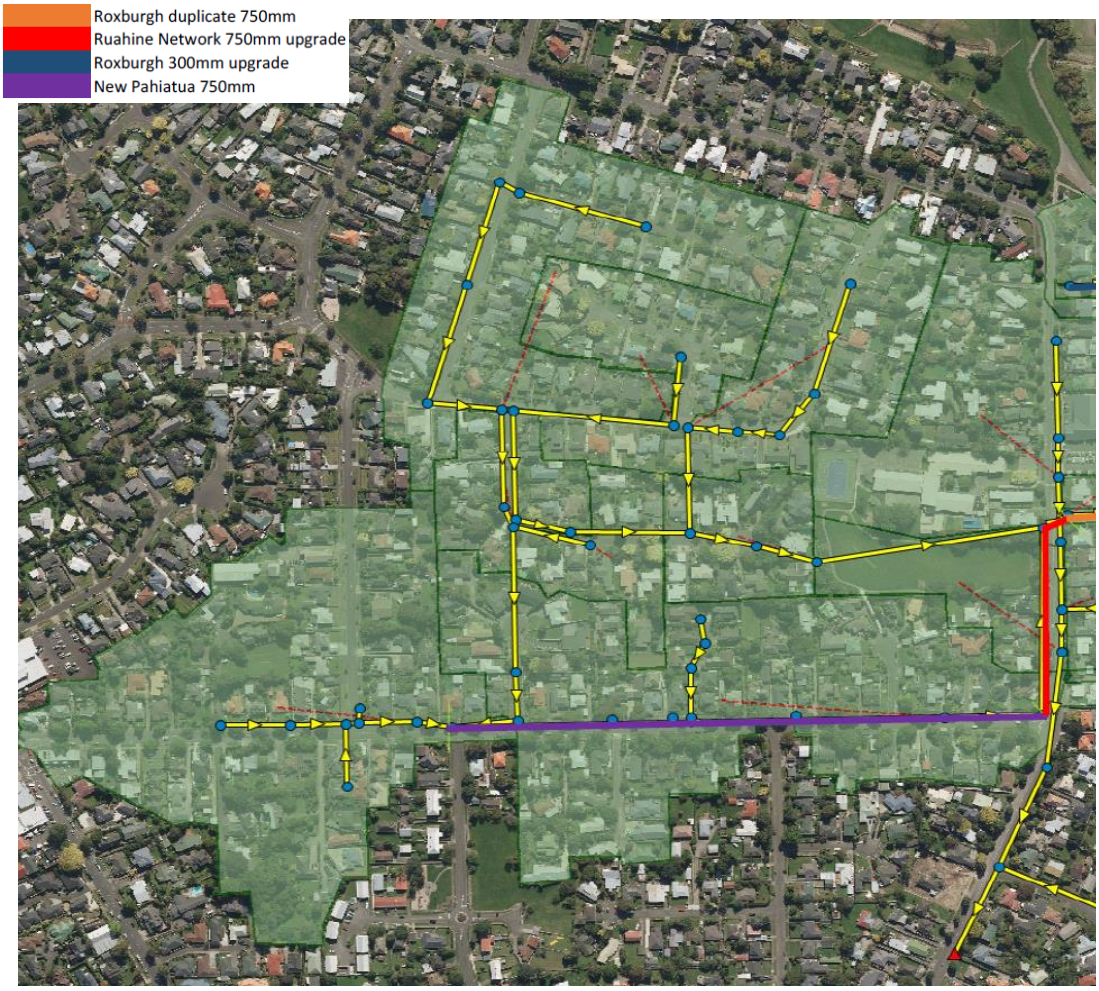

Figure 20: Recommended network upgrades (option 4)

Appendix C. LTP Programme and Cost Estimate Breakdown

ITEM 10 - ATTACHMENT 1

Appendix K. Water and Wastewater Servicing Report

Roxburgh Crescent Plan Change

Water and Wastewater Servicing Assessment

February 2024

Document Control

Task	Name	Position
Prepared by:	Wayne Venter Ahmed Yehia Eng Lim	Service Manager - Water Service Manager - Wastewater Asset Information Analyst
Reviewed by:	Ricki Freemantle	Activities Manager - 3 Waters

Version	Description	Date
1	Draft for Internal Comment	October 2023
1	Approved for Issue	9 February 2024

PNCC Reference No:	Water and Wastewater Servicing - Roxburgh Cres - Oct 2023.docx

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1 Scope

This water and wastewater servicing assessment provides engineering information that underpins Proposed Plan Change E, for the Roxburgh Crescent development. This plan change is to transition the current industrial zone to residential, as shown in Figure 1. The change provides for residential growth for Palmerston North.

Figure 1: Study Area

Yield studies were completed for the area with up to 123 Lots, with a minimum size of 250m² (note the number of Lots was revised upwards from 92). The modelling assumes a variety of house sizes across the development.

This report assesses the current extent of water and wastewater networks for the proposed area and surrounds of Roxburgh Crescent, and the impact of servicing the ultimate additional number of dwellings, as a result of this proposed plan change.

2 Water Supply

2.1 Existing Network

The study area is within the Palmerston North water supply. The primary source for this supply is the Turitea Water Treatment Plant, which treats raw surface water from the Turitea Dams. This water supply is located on the southern side of the Manawatū River and supplies the area in question via trunk mains crossing the Fitzherbert Bridge. The supply is supplemented by bores on the northern side of the Manawatū River which activate during periods of high demand to maintain pressure and flow.

Roxburgh Crescent is currently supplied from a single 100 mm diameter concrete-lined steel (CLS) water main, which only services part of the land area in question. Roxburgh Crescent is off Ruahine Street, and the main described above is connected to a 150 mm diameter distribution main on the eastern side of Ruahine Street. The western side of Ruahine Street in this extent is served by a 50 mm diameter MDPE (Medium-Density Polyethylene) rider main fed by the same 150 mm distribution main.

2.2 Demand

2.2.1 Current

Currently, Roxburgh Crescent contains a moderate number of light industrial premises. The surrounding area is residential. There are no wet industries. The overall character of the study area is such that the sizing of water mains will be to achieve the desired levels of service for firefighting water supply. Consumption, even at peak flows, is expected to be less than this requirement.

2.2.2 Future

Future demand was calculated based on the development scenario outlined in Section 1 above.

Assumptions used in this exercise, from the PNCC Engineering Standards for Land Development, were:

- Average day demand = 290 L/person/day
- Household occupancy = 2.9 people/dwelling
- Peak Day Demand (over a 12-month period) = Average Day Demand x PF[1]
- PF = 2 for population below 2,000 people

2.3 Servicing Assessment

2.3.1 Background

Water network modelling was carried out internally at PNCC. Scenarios were run based on knowledge of the current network, with additional reticulation and water demand added for the growth study areas as per Section 1 & 2 above.

2.3.2 Capacity

There is adequate supply from the Turitea Dams, supplemented by bores within Palmerston North, to enable this development.

[1] Peaking Factor

2.3.3 Levels of Service

Relevant PNCC levels of service for water supply[2] are:

- Pressure of 350 kPa at the boundary.
- Firefighting water supply to meet FW2 in Table 2 of the New Zealand Fire Service. Firefighting Water Supplies Code of Practice[3] for residential or sprinklered buildings, or FW3 for commercial/industrial.

2.3.4 Modelling Results

Modelling showed that:

1. The PNCC level of service for pressure of 350 kPa at lot boundaries would be achieved for each of the 123 proposed lots during peak day demand.
2. The PNCC level of service for firefighting for residential properties, which is FW2 (see above), would be met.
3. No upgrades to the existing PNCC water supply network would be required to enable the proposed development.

2.4 Funding

Since there is no need to upgrade the PNCC water supply network to enable this development, no PNCC funding is required for water supply.

The internal reticulation needed to supply water to each new lot would need to be constructed by the developer(s) in accordance with the PNCC Engineering Standards for Land Development.

3 Wastewater

3.1 Existing Network

The existing network in Roxburgh crescent can be seen in Figure 2 below. This area forms part of the Hokowhitu catchment and the gravity wastewater network then follows the alignment indicated in yellow below, discharging into the Jickell Street pump station. The wastewater collected in this catchment drains to a 300 mm trunk main from Crewe Crescent, through to Albert Street, the Manawatū golf course and the old "Teachers College". The Jickell Street pump station then pumps the effluent into the Palmerston North gravity network, ultimately flowing to the Totara Road wastewater treatment plant.

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[2] Within our Water Supply Area, as defined in the Water Supply Bylaw. There are no guaranteed levels of service outside this area. [3] SNZ PAS 4509:2008

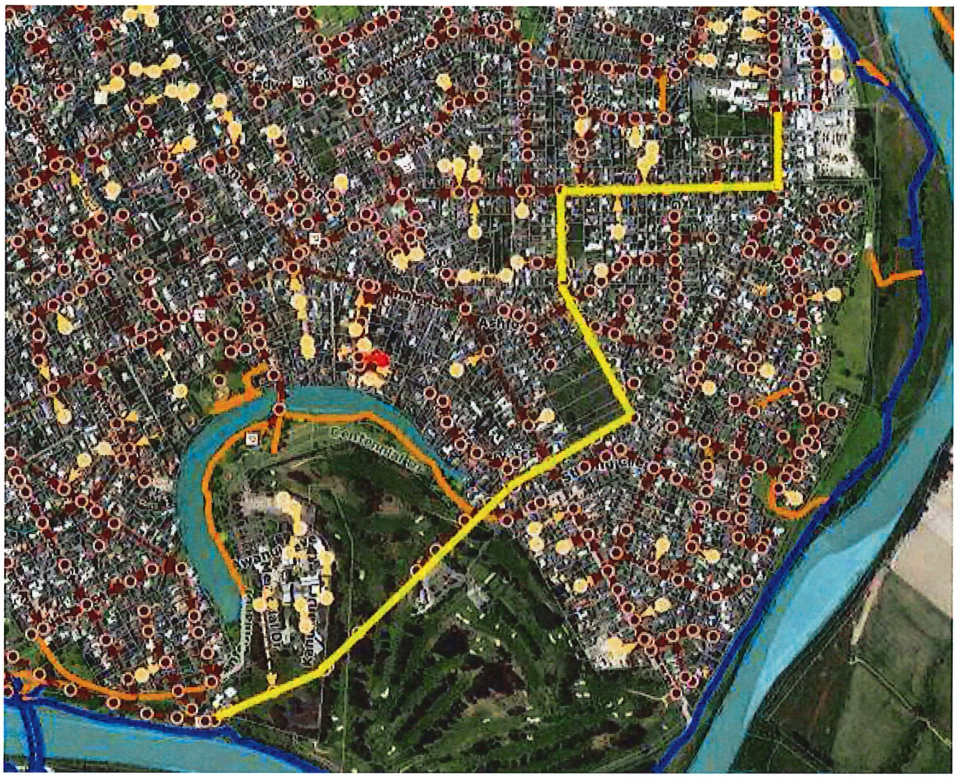

Figure 2: Wastewater network - Plan Change area to Jickell St pump station

Investigations will be required (e.g. geotechnical) to inform future upgrade options through the golf course, which are likely to result in some disruption.

3.2 Proposed Wastewater Upgrades

It was proposed that the development (123 units) will feed into the existing gravity network via Ruahine and Pahiatua Streets. The modelling indicates there will be no significant impacts on the immediate receiving network, as highlighted in Figure 3 below.

Figure 3: Immediate Wastewater network – Ruahine St

The modelling has indicated that the existing 300 mm main from Albert Street to the Jickell Street pump station is under capacity under peak wet weather condition. As mentioned earlier, the section from the Manawatū golf course/old teachers' college boundary to the Jickell Street pump station will be upgraded as part of a development. This can be seen in Figure 4, highlighted in yellow.

Figure 4: Upgraded section via development of "Teachers College"

Sections of the 300 mm wastewater mains are located in private property in the vicinity of Crewe Crescent. These sections will be difficult (or impossible, depending on several factors) to upgrade. The result is the most practicable solution to upgrade the 300mm main to improve capacity, lies within the Manawatū golf course. This can be seen in Figure 5 below. This would be approximately 460 m from the Centennial Drive side to the old teachers' college boundary.

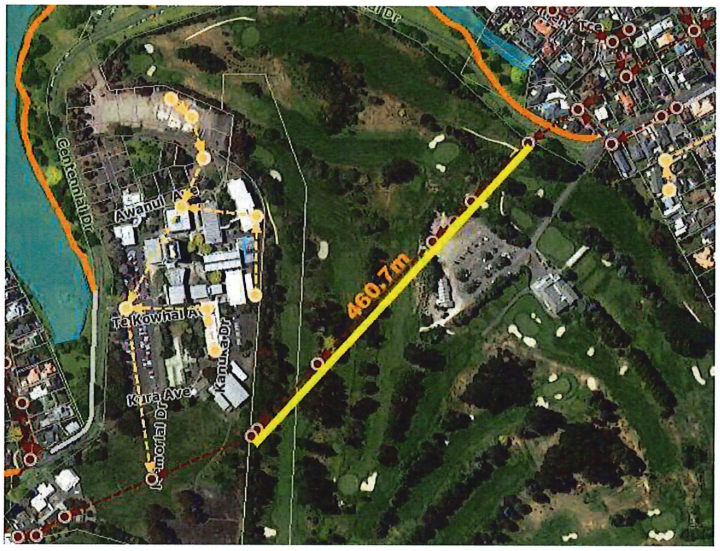

Figure 5: Existing 300 mm wastewater main to be upgraded

3.3 Funding

A high-level engineers estimate was done for work to upgrade the existing 460 m of 300 mm to 450 mm uPVC and replace the 4 existing manholes. A budget cost to complete the work (in 2023) is approximately $900,000.

Upgrading the existing 300 mm within the Manawatū golf course boundary cannot be directly linked to this specific development, as the wastewater main is recognised as already slightly under capacity. There are capital renewal and upgrade programmes in the Long-Term Plan (LTP) for the renewal of trunk mains. The proposed LTP budget for capital renewal and upgrades for this section of wastewater main is shown below in Table 1.

Table 1: Proposed LTP Budget

Wastewater Trunk Mains Renewals & Upgrades		
FYr	2025/26	2026/27
Renewal = 44%	$198k	$198k
Upgrade = 56%	$252k	$252k

4 Conclusions

4.1 Water Supply

Modelling the water supply for the proposed 123 lots and indicative layout has indicated that:

1. There are no constraints on the existing PNCC water supply network that present a barrier to the proposed development.
2. There is no anticipated need for PNCC to undertake upgrades to its network to enable this development.
3. PNCC levels of service for pressure and for firefighting water supply for residential properties would be met for this development.

4.2 Wastewater

It can be concluded that the proposed area would be able to connect to the existing gravity network. There are no significant risks to the DWF[3] levels of service, and the existing network would be able to cope. The existing network in the catchment is, however, already under capacity in significant wet weather events and to accommodate future developments PNCC would have to invest in upgrading some existing parts of the network.

It is recommended that:

1. Investigation of options and techniques to upsize sections of the existing 300mm pipe network (e.g. minimal disruption to section through the Manawatū Golf course).
2. Further modelling to determine the extent of required upgrades
3. Funding be identified in the Long-Term Plan.

[3] Dry Weather Flow

Appendix L. Consultation Report

PAPAIOEA
PALMERSTON
NORTH
CITY

Consultation Report

Proposed Plan Change E: Roxburgh Residential Area

Contents

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Iwi Engagement 3
Key Stakeholders and Landowners 3
Community 6
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Introduction

This report is prepared to accompany the s32 assessment for Plan Change E: Roxburgh Residential Area. This briefly analyses the feedback received from pre consultation on the proposed plan change with iwi, key stakeholders, landowners and the community from 2018 - 2023. Key themes and responses are outlined in this report.

Iwi Engagement

Consultation with iwi has occurred through Rangitāne o Manawatū Bimonthly meetings with PNCC staff. Consultation and communication outside of these meetings has occurred with iwi representatives and the PNCC Principal Planner. Rangitāne o Manawatū (RoM) indicated no sites of significance are in the RRA and the key feedback regarding access and interaction with the Awa has been provided for. No cultural impact assessment was necessary for PCE and on that basis one has not been prepared for this plan change. Consideration has however been given with RoM to the existence of sites of significance (none identified) and its request for access to the Manawatū River. The chronology section in the Section 32 Report includes all engagement with Rangitāne o Manawatū to date.

Clause 4A consultation requirements were completed on 08/12/2023. Representatives from RoM were invited to give feedback on the proposed district plan provisions, draft structure plan and other plan change matters. No feedback has been received to date.

Key planning issues for Rangitāne o Manawatū are set out below, along with the planning response to date:

Planning issues	Response
Cultural Impact Assessment Does PCE contain any sites of significance to RoM?	Engagement with iwi and hapū was done during the early planning discussions for the site in 2018 and 2019. From these discussions with RoM, no sites of significance were found. RoM advised no cultural impact assessment would need to be prepared as apart of PCE.
Manawatū River Access RoM Requested that three accesses are provided through the site to the River. This was taken into account during early master planning work and can be found in the Urban design report (Appendix C.).	Council supported one central enhanced accessway to the Awa (not three) with land to be gained via a land exchange. This was due to cost, ongoing maintenance costs and the difficulty of providing public access over the stopbank. RoM expressed no further concerns and support the provision of one accessway.

Key Stakeholders and Landowners

Key stakeholder engagement on the plan change was undertaken as part of initiating the plan change. Landowners within the PCE area have been invited to workshops throughout the

process starting in 2018. All workshops and meetings with landowners have been well attended. Higgin's Family Holdings (HFH) has significant interest in the site and has been kept in regular contact with PNCC.

The draft plan change was also sent to the Ministry for the Environment and other stakeholders identified by PNCC. Responses were received from Horizons Regional Council, Waka Kotahi and Fire Safety New Zealand.

Overall, there is support for the plan change by landowners and stakeholders. Some landowners, as well as the main landowner of the site, are interested in developing their sites for residential purposes and would like supporting infrastructure upgraded as quickly as possible. Those landowners interested in developing their sites are supportive of the height provisions but have concerns or objections over stormwater requirements and the upgrading of the existing Roxburgh Crescent road corridor.

Key issues raised from Landowners and the planning response are set out below:

Planning issues	Response
Transport Parking concerns were raised due to narrow street environment and spill over parking in the RRA from pick up and drop off times coming from Winchester School. Roxburgh Crescent road upgrades to reflect proposed cross sections and timing.	Parking is not a matter that can be considered under the District Plan (as directed by the NPSUD). However, consideration of the best road layout to enable safe access for cars, pedestrians and cyclists has been assessed in the Transportation Assessment. Cross sections have been identified and included in the District Plan to recognise the narrow existing road and departure from the Council's Engineering Standards. Development can occur without the immediate upgrade of the existing Roxburgh Crescent. A programme for the roading upgrade will respond to the timing of development at Roxburgh Crescent. It is anticipated a programme for this will be put forward to the 2027 LTP. If there is demand for this upgrade before the next LTP, a programme could be considered as part of an Annual Budget.
Reverse sensitivity/site transition Concerns regarding existing use rights and the transition to residential was raised by landowners at Roxburgh Crescent. Other concerns raised were the impact on business as the site transition, such as heavy traffic coming into the site to service existing businesses. Concerns regarding noise complaints to businesses wishing to remain.	Landowners were advised that they have existing use rights if they are legally established and the activity continues at the same scale and intensity. The impact of the transition is considered to be minor, as the main landowner had moved out of Roxburgh Crescent as of June 2023. This activity was also the contributor to heavy traffic volumes. Construction traffic as the site is developed will be temporary and is unlikely to impact on other existing businesses on Roxburgh Crescent. As noted above, development can occur without the immediate upgrade of the existing Roxburgh Crescent.

	Transport matters are also addressed in the Transport Assessment (Appendix D.) The site is already next to the residential zone and Rule 12.8.1 already specifies the noise limits for activities within a residentially zoned site. Existing industrial activities are required to continue complying with these rules once PCE is operative. On that basis there are no changes to the noise standards that apply to existing businesses. Noise matters are addressed in the Noise Assessment (Appendix H.)
Stormwater Onsite permeability requirements and how to fit a house on a section, taking into account HRP and site coverage requirements. Concerns 55% (as consulted on in November 2023) permeability will be too hard to achieve.	Onsite permeability is a specific recommendation of the Stormwater Report (refer Appendix J). The minimum lot size has been increased from 150m^2 to 250m^2 recognising the permeability requirements would make it very difficult to build a house. The proposed provisions have a permeability limit for development in the short term and then a different standard once the proposed stormwater outlet is upgraded. The outfall upgrade is planned for year 4 of the LTP (2027/28) with opportunity to be brought forward to (2026/27). This approach enables development before the upgrade is completed (with appropriate management of effects), rather than waiting for the upgrade to happen before any upgrades.
Housing controls Concerns regarding smaller lot sizes and a maximum lot size and subdividing off land that is larger than the maximum lot size.	As a result of the permeability requirements recommended in the Stormwater Report (refer to Appendix J) the minimum lot size of 150m^2 has been increased to 250m^2. The intent of PCE has always been to enable a higher density of development compared to the Residential Zone. To achieve the desired yield to assist in the housing needs for the City (as identified in the HBA) a maximum lot size has been included. Should landowners wish to subdivide larger lots then a Non-Complying consent would be required and assessed on its merits against the objectives and policies of the District Plan.
Infrastructure Horizons Regional Council provided feedback on the plan change in relation to the RRA's location to the stopbank network to protect its integrity.	Advice notes have been included in PCE to alert people of the requirements of the One Plan and works within 8m of the inland toe of the stopbank.
Water supply for fire fighting Concerned that proposed provisions for PCE do not address Fire and Emergency New Zealand's	See Water and Wastewater Servicing report – there is adequate capacity for firefighting water supply

requirements for fire fighting water supply or address capacity	

Community

At a general level consultation has been undertaken as part of PNCC's housing strategy planning, including the work that led to identifying infill development as a growth area for the City.

More targeted consultation with the community was undertaken regarding the rezoning of the PCE area during November 2022 while the plan change was in its early stage. This consultation included a month-long feedback period from the community to provide feedback before technical reporting was completed. A total of 19 feedback forms were received during this phase with key themes being density, three storey development across the site and parking. This feedback was considered in preparing the draft plan change.

In November 2023 the plan change consultation opened to meet RMA Schedule 1 Clause 3 requirements. Feedback closed on 8th of December 2023 and 16 submissions/feedback forms were received. The key points from community submissions are outlined in the table below.

Overall, there is community support for the rezoning of the area to residential with some concerns around the proposed height and density of the site.

The outcomes of both rounds of engagement informed the preparation of Proposed PCE. In particular, the following issues were addressed through the plan change provisions and accompanying technical work:

Planning issues	Response
Housing controls Initial concerns regarding proposed density and visual impact (lot size, height and separation distances). Concerns about reduced sunlight access and overshadowing to existing neighbouring residential homes due to three story being enabled.	In response to concerns raised in 2022 regarding enabling 3 storeys across the entire site, further thought was given to the impact of 3 storeys on the adjoining residentially zoned properties. The PCE proposes to only enable 3 storeys within a specified area of the site identified on the Structure Plan as the 'Riverfront Area'. The remainder of the site will have the same height controls as the rest of the Residential Zone (allowing for 2 storey housing). This means that access to sun and day-light will be the same as the existing Residential Zone for the majority of the site. Allowing 3 storeys in the Riverfront Area will allow those properties to take advantage of the views over the river.
Transport	The Transportation Report (refer Appendix D) has confirmed that there will be less traffic generated

Concerns regarding an increase in traffic flows coming from the site once it transitions to residential Traffic safety concerns with an increase in passenger vehicles and in close proximity to the school.	with the site transitioning to residential compared with the fully operational industrial use previously. While the existing road network is narrow, the proposed cross sections will ultimately provide for improved pedestrian access in the area compared to what currently exists.
Stormwater and flooding Upstream pooling of stormwater in the existing Hokowhitu made worse by development downstream at Roxburgh Crescent. Concerns regarding capacity of existing network to cope with additional development. Concerns the RRA will flood due to stopbank failure and proximity to the Manawatū River. Climate change effects on stormwater and flooding and making sure permeability standards take this into account.	The Stormwater Report (refer Appendix J) has confirmed that an upgrade to the existing stormwater outlet pipe through the stopbank is necessary. This will assist with stormwater at Roxburgh as well as the wider stormwater catchment. Until the upgrade is constructed and operational, permeable surface requirements are proposed as part of PCE to ensure that the soakage into the ground is maximised. As a result of the permeability requirements the minimum lot sizes have also been increased. Once the upgrades occur, the permeability requirements adjust accordingly. The risk of stopbank failure remains the same as the existing situation. Development of the site does not increase this risk. A new guidance note is proposed as part of PCE - noting that any excavation, earthworks or structures within 8m of the inland toe of the stopbank may require consent from the Regional Council.
Landscape/amenity/character Concerns regarding effects on the character of the Hokowhitu area Concerned that development will have a negative effect on the Manawatū River walkway and environment. Would like to see clear lines of sight and visibility.	These matters have been discussed in the Urban Design Report (refer Appendix C). PCE proposes to enable 3 storey homes near the stopbank only, not throughout the entire site. This is to enable landowners to maximise the views of the river corridor if they wish to do so. Otherwise the site will look similar to other residential areas including recent development of the old Teachers College site at Hokowhitu. The structure plan layout ensures clear lines of sight and visibility for future residents.

Letter Drop Extent

Factors that were taken into account were main roads (collector roads): Manawatu Street Pahiatua Street and Ruahine Street. These roads connect into the Roxburgh Crescent area and are used by heavy vehicles coming in and out of businesses located in the area. These roads will also have impact if the proposed plan change goes ahead, meaning more cars will be using these collector roads to move in and out of the area. The map below shows the extent of those housholds who were identified as potentially affected by the plan change proposal:

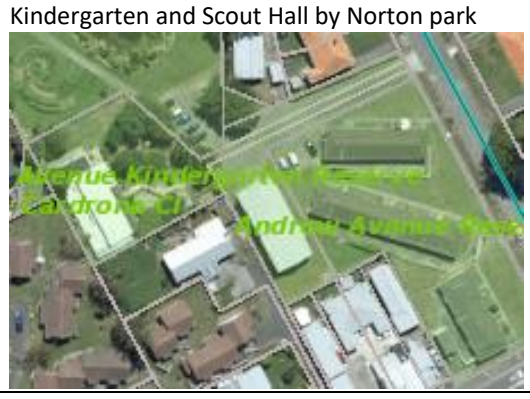
Related consultation

Consultation on the Reserve Exchange under the Reserves Act 1977

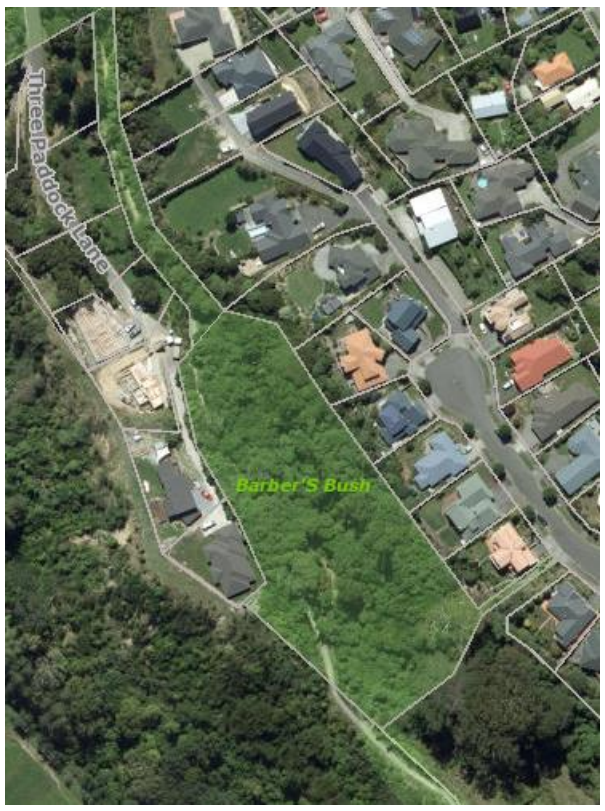
22 March 2023	Councillors vote to consult on the reserve exchange at the Strategy and Finance Committee meeting.
Early April 2023	**Consultation on the Reserve Exchange opens** Facebook post to advertise the exchange, information was put on the PNCC website, public notice in the Manawatū Standard. Letter drop to residents living within 500m^2 of the reserve land.
14 April 2023	**Rangitāne o Manawatū Bi-monthly meeting with PNCC.** Reserve Exchange was presented to RoM at the April Bi-Monthly meeting and they were invited to make a submission.
17 April 2023	**Drop in session** Planners and Parks Planners attended the drop in session to answer questions from the public on the Reserve Exchange and PCE. 7 people attended.
17 May 2023	**Consultation on the Reserve Exchange closes** 39 submissions received, including 1 petition and 10 people wishing to be heard.
1 August 2023	**Submissions on the Reserve Exchange were heard** Elected members heard those who wished to speak to their submission.
15 November 2023	Reserve exchange recommendation was declined by Elected Members at the Strategy and Finance Meeting. Subject to a full Council vote in December.
18 December 2023	Reserve exchange recommendation was approved by Elected Members at the Committee of Council Meeting.

Summary

The feedback provided during pre-consultation has helped shape the proposed provisions and structure plan for PCE. RoM and directly affected landowners have been consulted with dating back to 2018 and the wider community was consulted in 2022 and 2023.

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to 6. s16 Classify under 7. s24			8. Description of Lots	9. Reserve Location/ Photo
Adderstone Reserve	Neighbourhood	Local Purpose: stormwater	N	-	Y	-	LOT 44 45 DP 72136	Pacific Drive and Aokautere Drive 
			N	Y	-	-	PT LOT 3 LOT DP 68798	
Alexander Park	Neighbourhood	Recreation	N	Y	-	-	LOT 1 DP 78903	Alexander Street Awapuni 
Amberley Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 609 DP 46617	Both sides of Amberley Ave with Judo Club 
Andrew Ave Drainage reserve	Drainage	Local Purpose: Stormwater	N		Y		Lot 10 DP 20572	Drainage from Andrew Ave out to Rangiora Ave 
Andrew Ave Kindergarten Reserve	Neighbourhood	Local Purpose: community	N N	Y	Y		Lot 3 DP 52257; Lot 2 DP 52257; Lot 1 DP 52257 Lot 1 DP 48926	Kindergarten and Scout Hall by Norton park 

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to 6. s16 Classify under 7. s24			8. Description of Lots	9. Reserve Location/ Photo
Ashton Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 176 DP 52903	Links Ashton Place to Dalwood Grove– next to Andrew Spring Park 
Atawhai Park	Neighbourhood	Recreation	N	Y	-	-	Lot 1 DP 41653; Lot 2 DP 41653; Lot 11 DP 1880; Lot 1 DP 48076.	Atawhai Rd 
Awapuni Park	Neighbourhood	Recreation	N	-	Y	-	Lot 1 DP 23704; Lot 19 DP 29836; Lot 38 DP 23361; Lot 6 DP 24655; Lot 97 DP 20548.	Newbury St, Awapuni 
Balmoral Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 20 DP 77536	Balmoral Drive, Terrace End

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to 6. s16 Classify under 7. s24			8. Description of Lots	9. Reserve Location/ Photo
								
Barber's Bush	Neighbourhood (Walkway)	Recreation	N	-	Y	-	LOT 28 DP 78778	Part of the Aokautere Gully Walkways 
Bill Brown Park	Sports Fields	Recreation	Y	-	-	-	N/A -already classified under RA	Highbury – large sports fields and Pacifica Centre
			N	-	Y	-	Lot 1 DP 40097	
Bledisloe Park	Neighbourhood (Walkway)	Recreation	N	-	Y	-	Lot 4 DP 58909	Part of Massey University Gully/stream walkways
			N	Y	-	-	Lot 2 DP 26639; Pt Lot 1 DP 8981; Lot 1 DP 25688	

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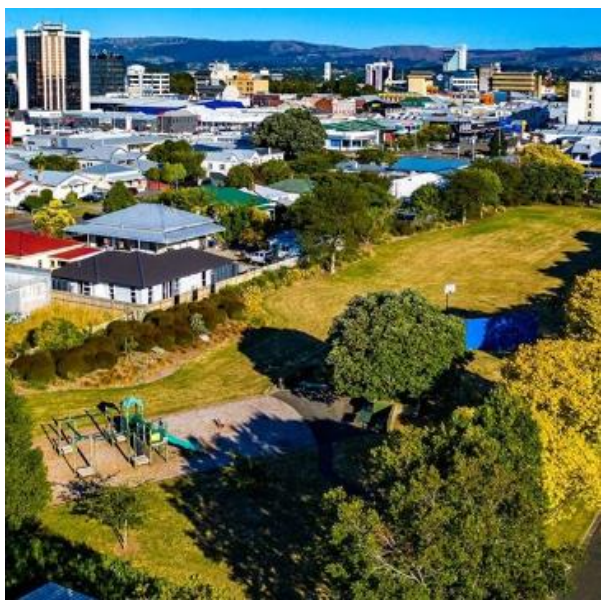
Bunnythorpe Playground	Neighbourhood	Recreation	N	Y	-	-	SEC 18 DP 217	Campbell Road - Bunnythorpe 
Campbell Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 2 DP 54537	Campbell St - City
			N	Y	-	-	PT LOT 10 DP 495	
Celaeno Park	Sports Fields	Recreation	N	-	Y	-	Lot 34 DP 306843	
			N	-	Y	-	Lots 87 & 88 DP 357718	
			N	-	Y	-	Lots 1 & 2 DP 83420	
Chelmarsh Reserve (part)	Neighbourhood	Recreation	N	Y	-	-	Lot 77 DP 50441	
			N	-	Y	-	Lot 19 DP 72702	Chelmarsh St, Highbury

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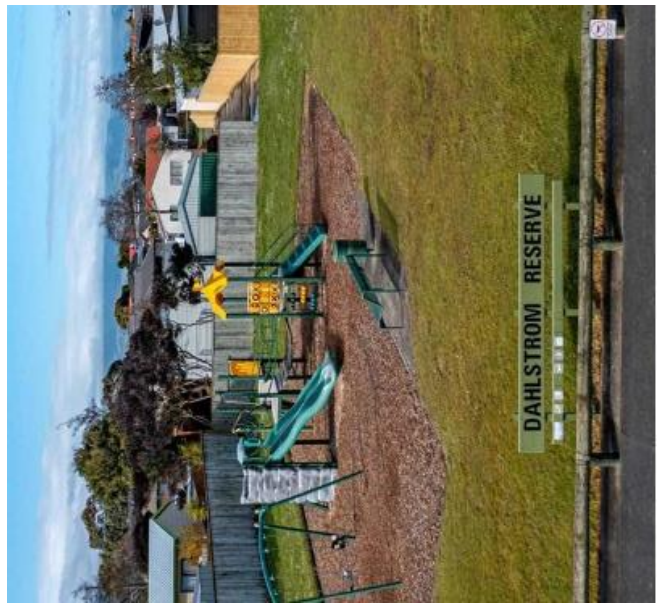
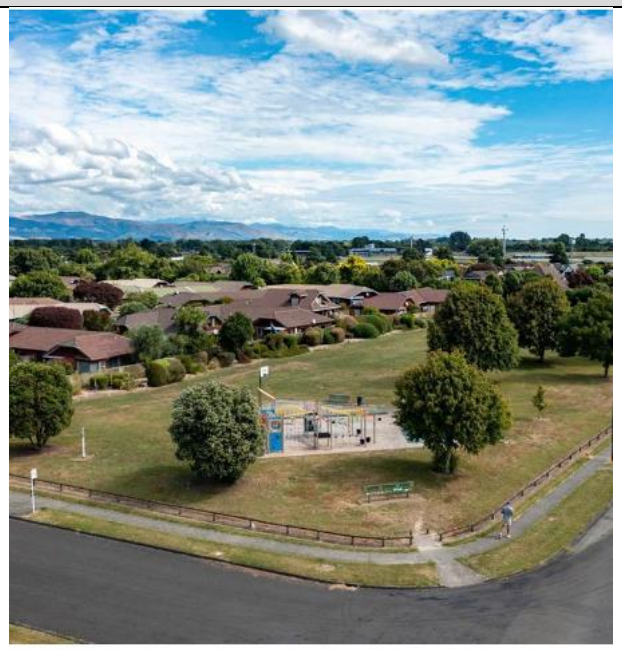
Chippendale reserve	Neighbourhood	Recreation	Y	-	-	-	N/A – already classified under RA	Chippendale Cres, Highbury 
			N	-	Y	-	Lot 11 DP 56493	
			Y	-	-	-	N/A – already classified under RA	
			N	-	Y	-	Lot 18 DP 331089	
Clearview Park	Neighbourhood	Local Purpose: Stormwater	N	-	Y	-	Lot 189 DP 67876; Lot 190 DP 69215; Lot 1 DP 69185	Clearview Place, Milson 
Colquhoun Park	Sports Fields	Recreation	Y	-	-	-	N/A – already classified under RA	
			N	Y	-	-	Lot 2 DP 21519; Lot 3 DP 21519	
			N	-	Y	-	Lot 17 DP 69036	
Coronation Park	Sports Fields	Recreation	Y	-	-	-	N/A – already classified under RA	
			N	Y	-	-	Lot 1 DP 83560	
			N	-	Y	-	Lot 1 DP 78377	
Crewe Park	Neighbourhood	Recreation	N	-	Y	-	LOTS 1 & 2 DP 21369 LOT 11 DP 20721	Crewe Cres, Hokowhitu

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to Classify	6. s16 Section of Act to Classify	7. s24 under	8. Description of Lots	9. Reserve Location/ Photo
Dahlstrom Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 16 DP 74293	Dahlstrom Grove, Kelvin Grove 
Dalfield Reserve	Neighbourhood	Local Purpose: Stormwater	N	-	Y	-	Lot 102 DP 53469; Lot 101 DP 53469; Lot 30 DP 70035; Lot 30 DP 73030	Part of the Pioneer Highway Drainage system 
David Spring Park	Neighbourhood	Recreation	N	-	Y	-	Lot 15 DP 73907; Lot 112 DP 59228; Lot 112 DP 59229; Lot 108 DP 54851	Clarke Ave, Highbury

ITEM 13 - ATTACHMENT 1

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
								
Dittmer Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 347 DP 32897; Sec 1701 TN OF Palmerston North	Manawatu River Park 
Edwards Pit Park	Neighbourhood	Recreation	N	Y	-	-	Lot 1 DP 57301; Lot 1 DP 69383; Lot 1 DP 48678	Featherston St, Roslyn 
Fair Acres Square	Neighbourhood	Recreation	N	-	Y	-	LOT 84 DP 337306	Balrickard Way, Milson

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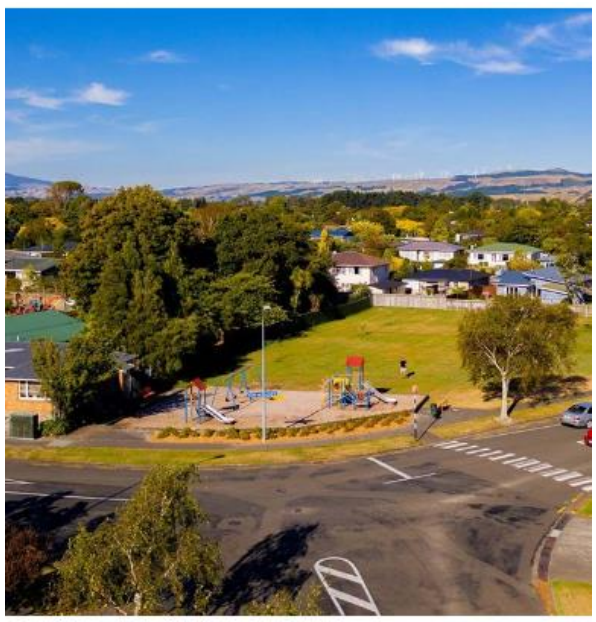
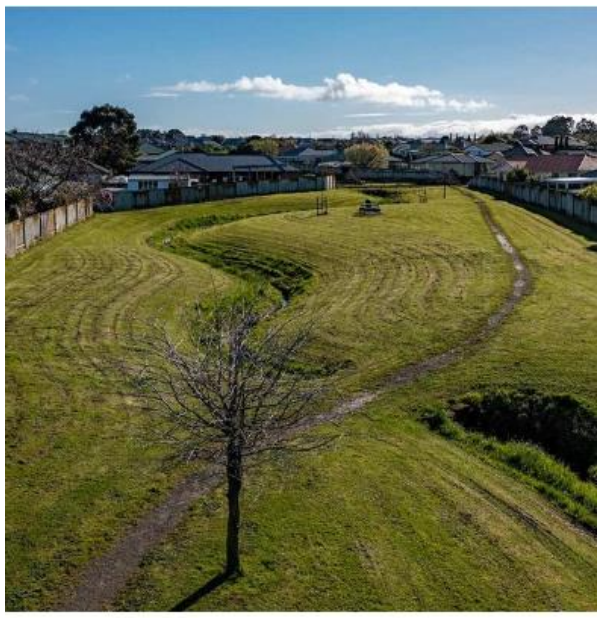
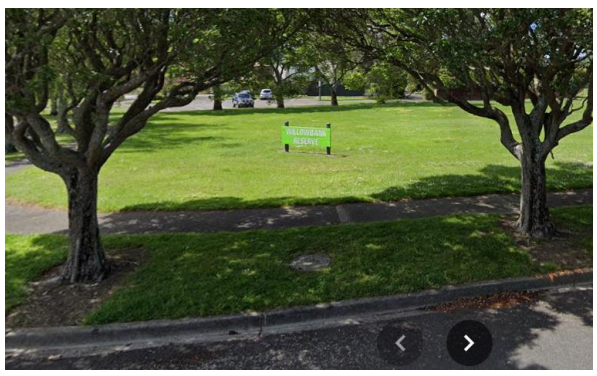
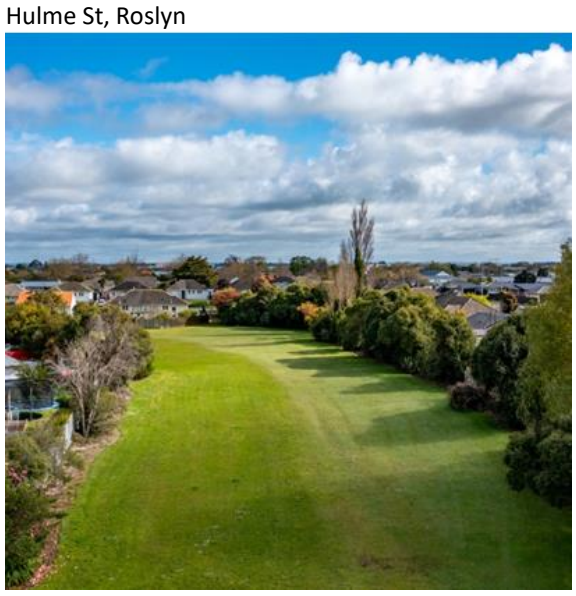
Fitzroy Bend Reserve	Walkway	Recreation	N	Y	-	-	Lot 35 DP 25417; Pt Lot 201 DP 791; Pt Lot 200 DP 791	Manawatu River Park 
Farnham Park	Neighbourhood	Recreation	N		Y		LOT 142 DP 22272	Farnham Ave, Highbury

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to 6. s16 Classify under 7. s24			8. Description of Lots	9. Reserve Location/ Photo
								
Franklin Reserve	Neighbourhood	Recreation	Y	-	-	-	Lot 18 DP 21205	Franklin Ave, Hokowhitu 
			N	Y	-	-	Lot 66 DP 13552	
Frederick Krull Reserve	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 90 DP 305623	Logan Way, Kelvin Grove 
			N	-	Y	-	Lot 14 DP 68190 & Lot 2 DP 69705	
			N	-	Y	-	Lot 60 DP 88927; Lot 59 DP 88927; Lot 76 DP 89325; Lot 90 DP 307225; Lot 91 DP 307225; Lot 68 DP 90076; Lot 63 DP 90025; Lot 32 DP 91139	
Galley Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 258 DP 349496 LOT 28 DP 347181	Liberty Grove

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
								
Hardie Street Park	Neighbourhood	Recreation	n/a	-	-	-	N/A	Hardie St, West End 
Hilary Cres and Cambridge Street Reserve	Neighbourhood	Recreation	N	Y	-	-	LOT 1 DP 58492	Ashhurst, Cambridge Ave 
Hind Reserve/ Willow Bank Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 1 DP 52182	Hind Place, Hokowhitu 

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to Classify 6. s16 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
Hokowhitu Domain	Sports Fields	Recreation	N	Y	-	-	Lot 11 DP 20871	
			N	Y	-	-	Lot 1 DP 18379	
			Y	-	-	-	Lot 216 DP 791; Lot 219 DP 791; Lot 217 DP 791; Lot 215 DP 791; Lot 220 DP 791; Lot 218 DP 791; Pt Lot 214 DP 791	
			n/a	-	-	-	Pt Lot 231 DP 791; Pt Lot 232 DP 791	
			N	Y	-	-	Lot 18 DP 32630	
Hokowhitu Lagoon	Neighbourhood	Recreation	N N N N N	 Y Y Y	Y Y		Lot 3 DP 26657; Lot 7 DP 17197; Pt Lot 1 DP 19255; Lot 1 DP 12596; Pt Lot 2 DP 1332; Lot 1 DP 26657; Lot 2 DP 12596; Pt Lot 3 DP 1332; Pt Lot 3 DP 1332; Pt Lot 254 DP 666; Pt Lot 3 DP 1332	
Hulme Street Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 109 DP 19341	Hulme St, Roslyn 
Jefferson Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 34 DP 85733	Jefferson Cres, Milson
			N	-	Y	-	LOT 49 DP 71078	
			N	-	Y	-	LOT 50 DP 71078	

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
								
John F Kennedy Park	Neighbourhood	Recreation	N	-	Y	-	LOT 359 DP 35270.	10-22 JFK Drive 
Kahuterawa Reserve		Recreation	N	-	Y	-	Lot 2 DP 30200; Lot 4 DP 80726; Lot 1 DP 30200.	Opposite 673 Kahuterawa Road – (before Arapuke) 
Kawau Stream	Drainage	Local Purpose (Drainage)	N	-	Y	-	Lot 55 DP 75566, Lots 112 & 113 DP 54851, Lot 23 DP 74440, Lot 331 DP 54229.	Esplanade access strips along the Kawau Stream
			N	-	Y	-	Lot 111 DP 23458.	
			N	-	Y	-	Lot 5 DP 84966; Lot 1 DP 80639; Lot 1 DP 82569; Lot 2 DP 82569; Lot 4 DP 87801.	
			Y	-	-	-	N/A – already classified under RA.	
Keith reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 165 DP 16011; Lot 174 DP 16011; Lot 173 DP 16010.	Alongside Keith St between 92 and 124 Kieth Street

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
								
Kelvin Grove Park	Neighbourhood	Recreation	N	-	Y	-	Lot 21 DP 81951; Lot 35 DP 78689; Lot 14 DP 54885; Lot 20 DP 81951; Lot 1 DP 59112.	
			N	Y	-	-	Lot 1 DP 76441.	
			N	-	Y	-	Lot 110 DP 53373 & Lot 23 DP 61274.	
Kennedy Park	Neighbourhood	Recreation	N	-	Y	-	Lot 63 DP 80543; Lot 54 DP 81646.	Washington Parade, Milson 
Kimberley Park	Neighbourhood	Recreation	N	Y	-	-	LOT 36 DP 33241.	Kimberley Grove, Westbrook

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to Classify	6. s16 Section of Act to Classify	7. s24 under	8. Description of Lots	9. Reserve Location/ Photo
Lancewood Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 12 DP 81499.	Lancewood Place
Lakemba Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 32 DP 81947; Lot 30 DP 79867; Lot 21 DP 79867.	Royal Oak Dr, Kelvin Grove
Kings Corner			n/a	-	-	-	N/A	At intersection of Mulgrave, Pembroke and Cambridge Avenue, Ashhurst

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1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to 6. s16 Classify under 7. s24			8. Description of Lots	9. Reserve Location/ Photo
								
Langley Reserve	Neighbourhood	Recreation	N	Y	-	-	LOT 4 DP 32581.	Langley Avenue adjacent to Milson School 
Leander Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 35 DP 85712.	Leander Place, Milson 
			N	Y	-	-	Lot 8 DP 49580.	
Lincoln Park	Sports Fields	Recreation	N	-	Y	-	Sec 167 TN OF Ashhurst.	

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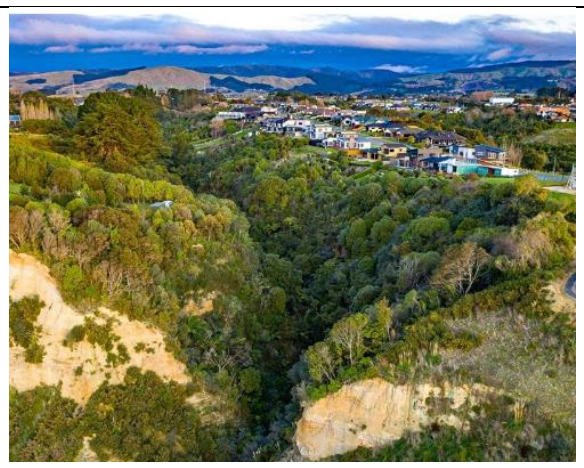
			N	Y	-	-	Sec 172 TN OF Ashhurst; Sec 176 TN OF Ashhurst; Sec 173 TN OF Ashhurst; Sec 174 TN OF Ashhurst; Sec 175 TN OF Ashhurst; Sec 177 TN OF Ashhurst.	
Linklater Reserve	Neighbourhood	Recreation	N	-	Y	-	LOT 2 DP 428030.	
Lower Pari Reserve	Walkway	Local Purpose: Stormwater	Y N N		Y	Y ?	Lot 3 DP 33102. Pt Lot 13 DP 72989. Lot 57 DP 372624; Lot 54 DP 325277.	
Lower Titoki Reserve	Walkway	Local Purpose: Stormwater	N		Y		Lot 27 DP 82639; Lot 72 DP 454853; Lot 32 DP 331630.	

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
Mahanga Kakariki Reserve	Sports Fields	Recreation	N	-	Y	-	LOT 1 DP 395268.	
Manawatu River Esplanade Reserves	Esplanade Walkway	Local Purpose: Esplanade	N	-	Y	-	Lot 3 DP 71883; Lot 4 DP 32144; Lot 3 DP 53320; Lot 3 DP 60866; Lot 4 DP 52674; Sec 1 SO 30155; Pt Lot 205 DP 791; Lot 3 DP 319563; Lot 26 DP 333699; Pt Sec 2 SO 36829; Lot 3 DP 76077; Lot 7 DP 76241; Lot 4 DP 79318; Lot 18 DP 87826; Lot 4 DP 83330; Lot 3 DP 31059; Lot 5 DP 35256; Lot 6 DP 76241; Sec 1 SO 31844.	Reserves along the Manawatu River – provide access to river
Manga o Tane Walkway	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 39 DP 65835.	Polson Hill – part of the Aokautere Gully Walkways 
Manga o Tane Park	Neighbourhood		N	Y			Sec 410 TN OF Fitzherbert.	As above

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		Local Purpose: Stormwater	N		Y		Lot 2 DP 78872; Lot 1 DP 78872.	
Mangaone Park	Neighbourhood	Recreation	N	-	Y	-	Lot 1 DP 48075; Lot 57 DP 47791.	Access to Mangaone Stream Walkway from Kentucky Way and Aintree Crescent
			N	Y	-	-	Lot 109 DP 43071; Lot 108 DP 43071.	
Mangaone Stream Access way	Walkway	Recreation	n/a	-	-	-	Lot 1 DP 86400.	In Milson – drainage and access to Mangaone Stream
			N	-	Y	-	Lot 56 DP 81646; Lot 62 DP 80543.	

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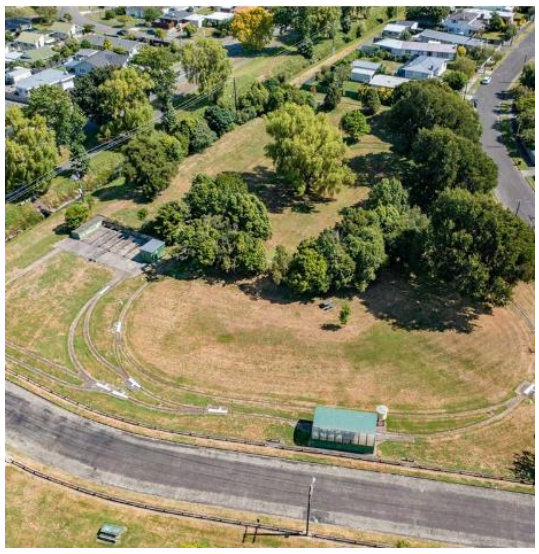
Mangaone Stream Esplanade Reserve(s)	Walkway & Drainage	Local Purpose: Stormwater	N	-	Y	-	Lot 1 DP 86400; Lot 3 DP 437961; Lot 3 DP 79382; Lot 57 DP 81646; Lot 54 DP 79265; Lot 51 DP 79265; Lot 50 DP 79265; Lot 3 DP 70628; Lot 52 DP 79265; Lot 64 DP 80543; Lot 60 DP. 81646; Lot 1 DP 81647; Lot 1 DP 63196.	Accessways and strips along the Mangaone Stream
Marriner Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 4 DP 29419.	Marriner Street opposite Monrad Park 
			N	-	Y	-	Lot 3 DP 29419..	
Massey Walkway	Walkway	Recreation	N	-	y	-	Lot 1 DP 385545.	Link Between Barbers Bush and Springdale Park – Aokautere Walkway system

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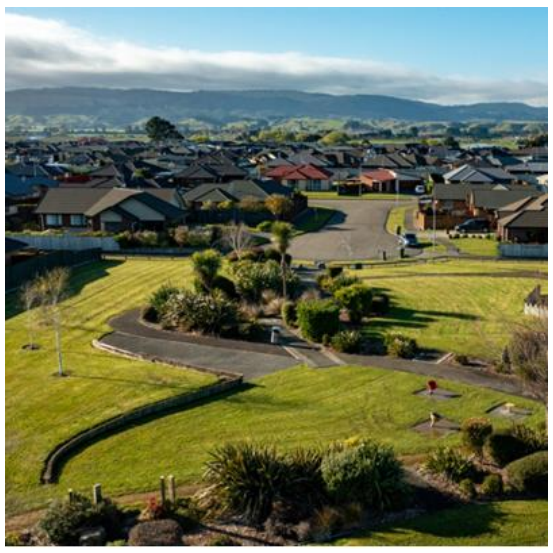
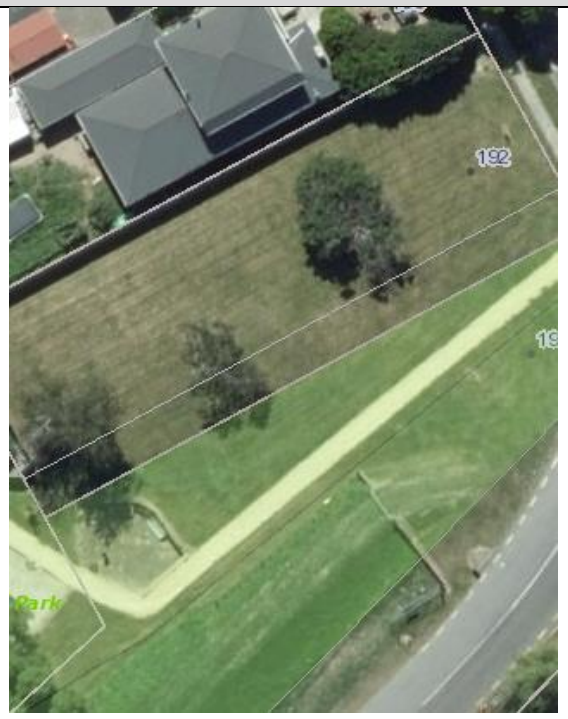
Matheson Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 164 DP 379181; Lot 145 DP 360122; Lot 146 DP 360122; Lot 163 DP 379181; Lot 162 DP 379181; Lot 144 DP 360122	Between Brooklyn Heigths Drive and Nevada Way 
Maxwells Park	Neighbourhood	Recreation & Local Purpose (Utility)	N	Y			Lot 14 DP 17359; Lot 16 DP 21007; Lot 2 DP 32279.	Adjacent to Ahimate Reserve on Tip Rd.

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
								
McCraes Bush	Walkway	Recreation	N	Y	-	-	LOT 7 DP 183.	
Memorial Park	City Reserve and Sports Fields	Recreation	N	-	Y	-	Sec 380 TN OF Palmerston North; Pt Sec 387 TN OF Palmerston North	City Reserve 
Milson Stream JFK Drive to Apollo/Milson Line & Terry Cres Drainage Reserve(s)	Drainage	Local Purpose (Drainage)	N	-	Y	-	Lot 3 DP 84841.	Drainage running through top of Milson 
			N	-	?	-	Pt Lot 8 DP 5402.	
			N	Y	-	-	Lot 1 DP 30759.	
			Y	-	-	-	Lot 260 DP 44352; Lot 288 DP 33546; Lot 328 DP 35270; Lot 329 DP 35270; Pt Lot 358 DP 34984; Lot 3 DP 47512; Lot 17 DP 44323.	

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section of Act to 6. s16 Classify under 7. s24			8. Description of Lots	9. Reserve Location/ Photo
Milverton Park	Neighbourhood	Recreation	N	Y	-	-	Sec 954 TN OF Palmerston North.	
Missoula Reserve	Neighbourhood	Recreation	N	Y	-	-	Lot 53 DP 376442; Lot 49 DP 376442; Lot 50 DP 376442; Lot 51 DP 376442; Lot 52 DP 376442.	Rodeo Drive 
Monrad Park	Sports Fields	Recreation	Y	-	-	-	Sec 1 SO 36219.	Highbury – with Highbury Whanau Centre.
			N	-	Y	-	Pt Lot 1 DP 25599; Lots 74, 75 & 76 DP 25218.	
Moonshine Valley	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 20 DP 67306.	Moonshine Vally Rd 
			N	-	Y	-	Lot 20 DP 67306; Lot 21 DP 67306.	

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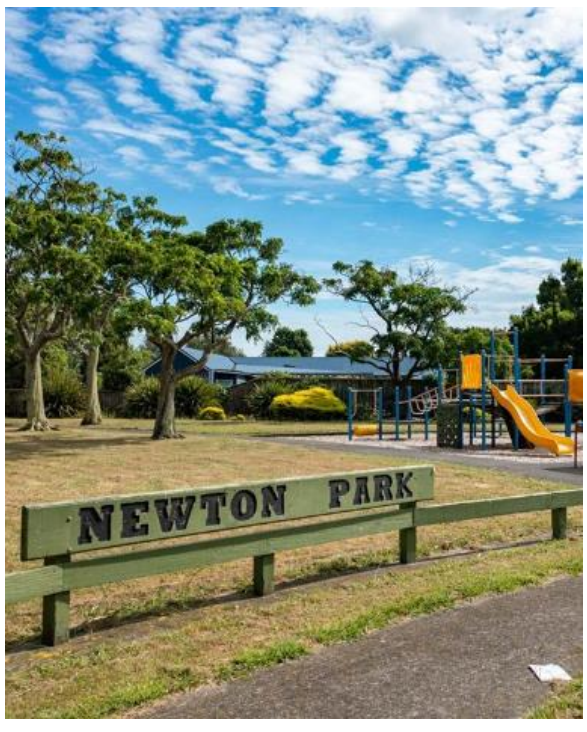
Napier Road – Manawatu River/ Mihaere Road Drainage Reserves	Drainage	Local Purpose: Stormwater	N	-	Y	-	Lot 2 DP 61928; Lot 1 DP 69096.	Gas-works drain – etc. 
			N	Y	-	-	Pt Lot 3 DP 10732; Pt Sec 390 Town of Palmerston North.	
Newton Reserve	Neighbourhood	Recreation	N	Y	-	-	Lot 20 DP 61925.	Newton Place, Westbrook 
			N	-	Y	-	LOTS 20 & 31 DP 61925.	
Ngahere Park	Esplanade	Local Purpose (esplanade reserve)	N	-	Y	-	Lot 3 DP 82529; Lot 1 DP 82529; Lot 5 DP 80098.	Part of the Turitea Stream walkways
			n/a	-	-	-	Lot 2 DP 82529.	

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Norton Park	Neighbourhood & Drainage	Local Purpose: Stormwater	N	-	Y	-	Pt Lot 17 DP 17130.	Featherston St – Roslyn 
			N	-	Y	-	Lot 3 DP 64311.	
Oriana reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 45 DP 77718.	Off Tremaine by old Cloverlea Tavern – not yet developed

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Otira Park	Neighbourhood	Local Purpose: Stormwater	N	Y	-	-	Lot 48 DP 42202.	Maxwells line – part of Rangitane Park 
			N	-	Y	-	Lot 13 DP 78418.	
			N	Y	-	-	Sec 1737 TN OF Palmerston North.	
			N	-	Y	-	Pt Lot 1 DP 3063.	
			N	Y	-	-	Sec 1 SO 27741.	
Owen Street Playground	Neighbourhood	Recreation	N	-	Y	-	Lot 25 DP 66581.	Owen St off Amberley Ave

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Pacific Drive Reserve	Neighbourhood	Recreation	N		Y		Lot 1 DP 77345; Lot 2 DP 80999.	Pacific Drive 
Pacific Drive Walkway	Walkway	Recreation	N	-	Y	-	Lot 130 DP 361098.	Accessway and also provides access to electrical pylons

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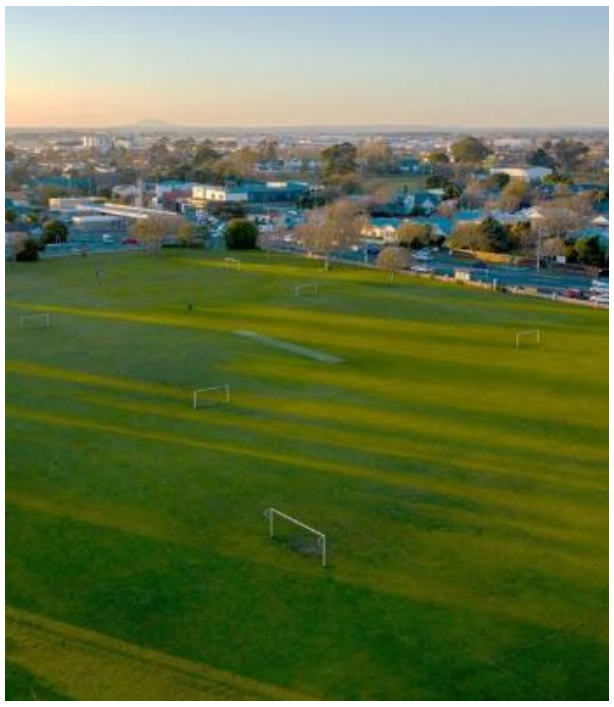
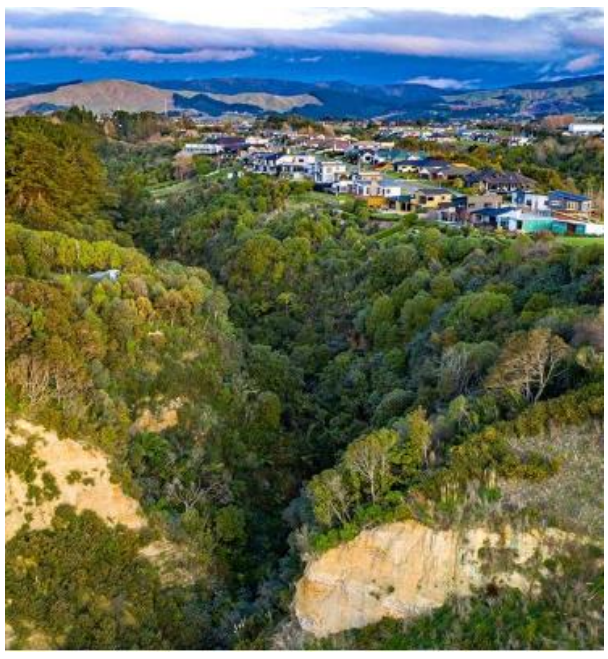
Papaioea Park	Sports Fields	Recreation	n/a	-	-	-	Sec 6 SO 454965.	Corner Rangitikei and Featherston Streets
			N	Y	-	-	Lot 3 DP 82859.	
Pari Reserve	Drainage	Local Purpose: Stormwater	N	-	Y	-	Pt Lot 13 DP 72989.	Aoukautere Walkway Gullies
			Y	-	-	Y	Lot 3 DP 33102.	
			N	-	Y	-	Lot 57 DP 303935; Lot 54 DP 325277; Lot 57 DP 303935.	
			N	-	Y	-	Lot 1 DP 79634; Lot 14 DP 80588.	
			Y	-	-	Y	Sec 5 SO 37111.	
			Y	-	-	Y	Sec 6 SO 37111.	

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Parnell Heights Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 23 DP 80490.	33 Parnell Heights 
Peace Tree Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 13 DP 361098; Lot 12 DP 361098; Lot 14 DP 361098.	Corner Pacific Drive and Silicon Way 
Pembroke Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 3 DP 29418; Lot 2 DP 29418.	Next to Highbury Shops 
Peren Park	Neighbourhood	Recreation	N	-	Y	-	Lot 1 DP 82417.	Corner Ruapehu Drive and Sycamore Crescent

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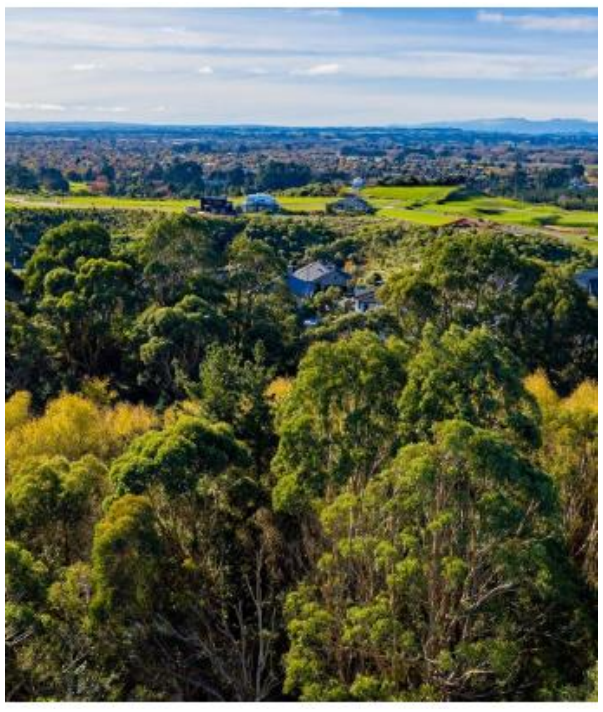
Pioneer Road Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 2 DP 88159.	Along the length of Pioneer Highway from corner of Maxwells Line
			N	-	Y	-	Lot 52 DP 44316 & Lot 53 DP 45320.	
			N	Y	-	-	WN10B/521.	
			n/a	-	-	-	N/A	
Poutoa Reserve	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 73 DP 88420; Lot 74 DP 76919; Lot 74 DP 76920; Lot 74 DP 76923; Lot 74 DP 76921; Lot 35 DP 87509; Lot 74 DP 76922; Lot 74 DP 87510	Aoukautere Gully Walkways – next to Te Motu O Poutoa 
Poutoa Walkway	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 75 DP 87509.	As above
Raleigh Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 178 DP 28322.	Raleigh Street, Awapuni

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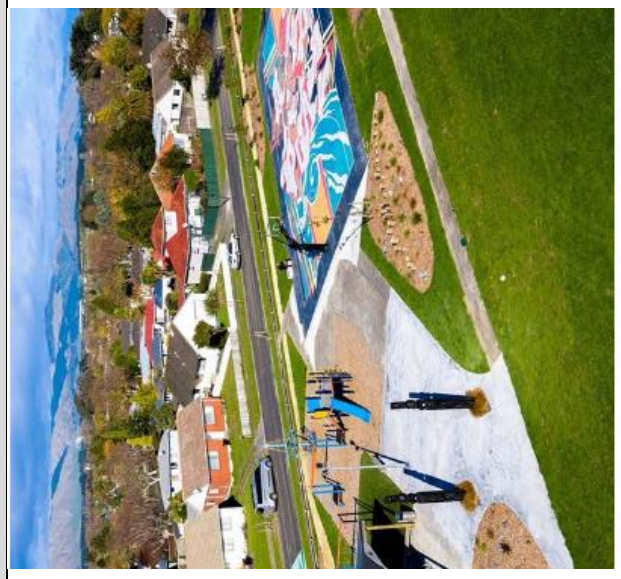
Rangiora Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 185 DP 19498.	100 Rangiora Ave, Roslyn 
Rangiora Community centre	Neighbourhood	Local Purpose: Community	N	Y	-	-	Lot 175 DP 19498.	102 Rangiora Ave, Roslyn 
								

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Rangitane Park	Sports Fields	Local Purpose: Stormwater	N	Y	-	Pt Sec 361 Town of Palmerston North; Pt Lot 1 DP 3487; Sec 1736 TN OF Palmerston North.	Corner Maxwells Line and Racecourse Road 
			N	Y	-	Sec 1 SO 28231.	
			N	-	Y	Lot 96 DP 44172l.	
			N	Y	-	Lot 97 DP 43662; Lot 94 DP 44172; Lot 27 DP 33341.	
			N	?	-	Pt Lot 1 DP 34174; Sec 2 SO 36761; Pt Sec 361 Town of Palmerston North.	
Robert Park	Neighbourhood	Recreation	N	-	Y	Lot 43 DP 303210.	Parnell Heights – Kelvin Grove 
Ruamahanga Wilderness Reserve	Neighbourhood/ Bush	Recreation	N	Y	-	Lot 77 DP 29272.	
			N	Y	-	Pt Sec 389 TN OF Palmerston North; Lot 1 DP 13070.	Off Ruamahanga Cres – next to PN Golf Club

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Roxburgh Crescent Reserve	Walkway	Recreation	N	Y	-	-	Pt Lot 2 DP 60866.	
Rugby Reserve	Drainage	Local Purpose (Drainage)	N	Y	-	-	Lot 23 DP 22571; Lot 22 DP 22571.	Stormwater that runs through Rugby St 
			N	Y	-	-	Pt Lot 1 DP 68888.	
Salisbury Street Children's Play Area	Neighbourhood	Recreation	N	-	Y	-	Lot 8 DP 22852.	Salisbury St Ashhurst

1. Name of Park or Reserve	2. Reserve Type (PNCC)	3. Proposed Reserve Use/Classification	4. Classified Y / N	5. s14 Section 6. s16 of Act to Classify 7. s24 under			8. Description of Lots	9. Reserve Location/ Photo
								
Savage Reserve	Neighbourhood	Recreation	Y	-	-	-	Pt Lot 54 DP 15409; Lot 52 DP 15409.	Savage Crescent
			N	-	Y	-	Lot 53 DP 15409.	
Schnell Wetlands Reserve	Walkway	Local Purpose: Stormwater	N	Y	-	-	Lot 10 DP 75192.	James Line/Schnell Drive
			N	-	Y	-	Lot 2 DP 75192; Lot 9 DP 75192.	
			N	-	Y	-	Lot 6 DP 75192; Lot 85 DP 411222; Lot 2 DP 83421.	
			N	-	Y	-	Lot 3 DP 73980.	

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Skoglund Park	Walkway	Recreation	N	Y	-	-	Pt Sec 249 TN OF Palmerston North.	Thames St, Roslyn 
			N	Y	-	-	Lot 20 DP 16564; Lot 87 DP 16563.	
			N	-	Y	-	Pt Sec 249 TN OF Palmerston North.	
			N	Y	-	-	Pt Sec 251 TN OF Palmerston North; Pt Lot 12 DP 14235; Pt Lot 98 DP 16563.	
Springdale Park	Bush	Local Purpose: stormwater	N	Y	-	-	Lot 39 DP 60355.	Off Springdale Grove, Aokautere Walkways 
			N	-	Y	-	Lot 1 DP 54785.	

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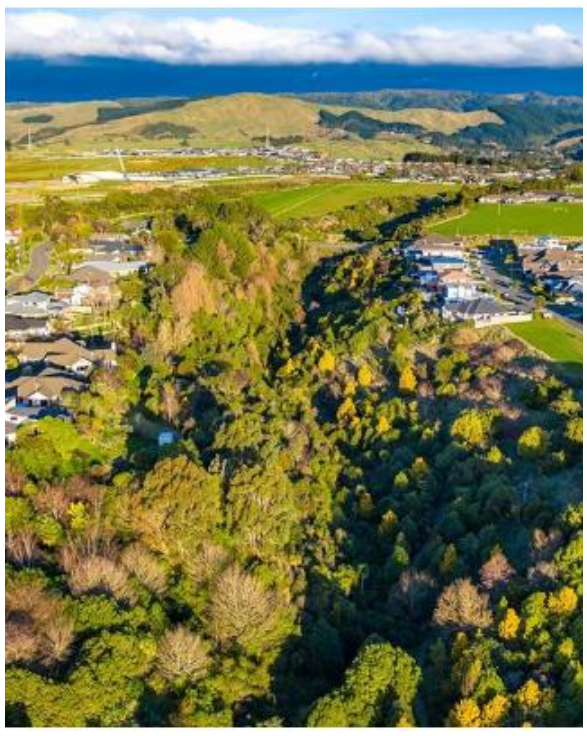
Strachan Reserve	Walkway	Recreation	N	-	Y	-	Lot 18 DP 77996.	Accessway to Mangaone Stream from Strachan Way 
Summerhill Gully Reserve	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 60 DP 75258; Lot 58 DP 75258.	Summerhill Gully - Aoukautere Walkways 
Summerhill Reserve	Walkway	Local Purpose: Stormwater	N	-	Y	-	Lot 26 DP 82639; Lot 31 DP 331630.	As above
Takaro Park	Sports Fields	Recreation	Y^	-	-	-	Lots 4-13 DP 2938; Pt Lot 16 DP 2938, Pt Road Reserve DP 3259 & Pt Sec 291 Town of Palmerston North.	159 Botanical Road
			Y^	-	-	-	Lot 2 DP 40376; Lot 2 DP 60512.	
			N	-	Y	-	Pt Sec 1691 Town of Palmerston North.	

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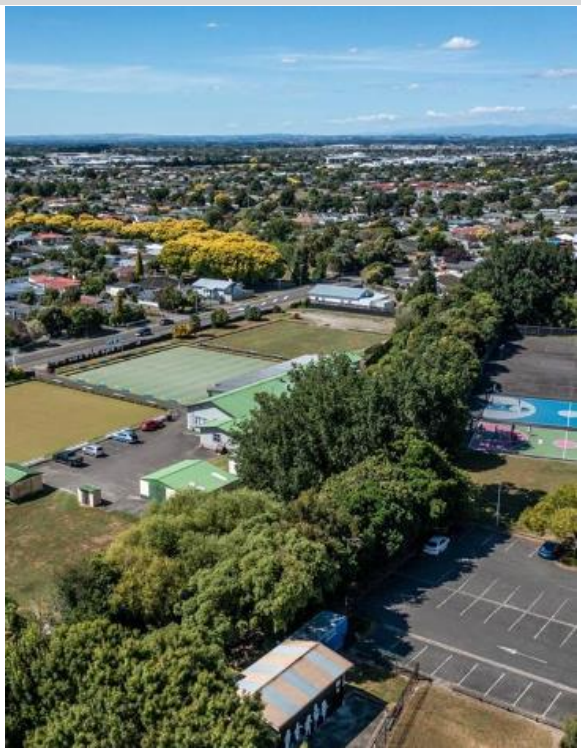
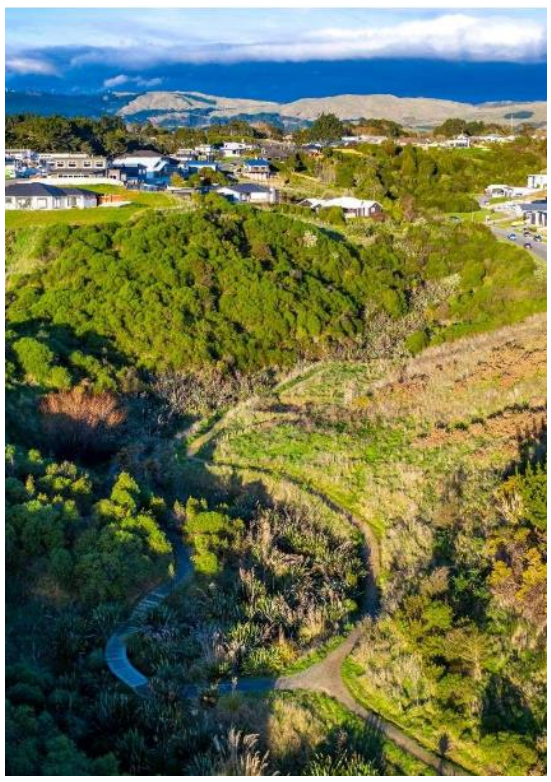
			Y^	-	-	-	Lots 1, 2, 3, 14 & 15 DP 2938.	
			N	?	-	-	Lots 17 & 18 DP 2938.	
Titoki Reserve	Drainage	Local Purpose (Drainage)	N	-	Y Y	-	Lot 2 DP 82417, Lot 58 DP 434860, Lot 28 DP 316453, Lot 53 DP 303935, Lot 35 DP 316470 & Lot 67 DP 383899. Lot 29 DP 316470.	Part of the Aoukautere Gully Walkways 
			~~N~~	~~-~~	~~Y~~	~~-~~		
Ruapehu Drive Walkway	Walkway	Local Purpose: Stormwater	n/a	-	-	-	Lot 74 DP 87510.	Part of the Aokautere Gully Walkways

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Totaranui Park	Neighbourhood	Recreation	N	-	Y	-	Lot 72 DP 51107.	5 Grant Place, Riverdale 
			Y	-	-	-	Sec 2 SO 452061.	
			N	-	-	-		
Turitea Stream Esplanade Reserve	Esplanade	Local Purpose: Esplanade Reserve	N	-	Y	-	Lot 2 DP 81743; Lots 5 DP 80098; Lot 3 DP 87856; Lot 2 DP 78024; Lot 2 DP 83089; Lot 4 DP 86488; Lot 7 DP 86488; Lot 1 DP 82529; Lot 3 DP 82529.	Esplanade Reserves along the Turitea Stream 
			N	-	-	-	Lot 6 DP 80098; Lot 4 DP 87856; Lot 3 DP 78024, Lot 3 DP 83089, Lot 6 DP 86488, Lot 2 DP 82529.	

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Turitea walkway	Walkway	Recreation	N	-	Y	-	Lot 45 DP 72136; Lot 2 DP 87842.	Turitea Stream 
Tutukiwi Reserve	Walkway	Recreation	N	-	Y	-	Lot 3 DP 82353	195 Moonshine Valley Road
			N	Y	-	-	Lot 3 DP 78145; Lot 4 DP 78145; Lot 5 DP 78145.	
Vautier Park	Sports fields	Recreation	N	Y	-	-	Pt Sec 249 TN OF Palmerston North; Pt Sec 249 TN OF Palmerston North.	43 Puriri Terrace 
			N	Y	-	-	Pt Sec 248 TN OF Palmerston North; Pt Sec 248 TN OF Palmerston North.	
Vogel Street /Main Street Park	Neighbourhood	Local Purpose: Stormwater	N	Y	-	-	Lot 1 DP 45100; Lot 2 DP 45100.	
			N	Y	-	-	Sec 1709 TN OF Palmerston North.	
Waihikoa Park	Sports Fields	Recreation	N	Y	-	-	Pt Sec 237 TN OF Palmerston North; Pt Sec 238 TN OF Palmerston North.	This section of reserve leased to Boys High

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Waterloo Crescent Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 3 DP 51192; Lot 1 DP 51192; Lot 2 DP 51192.	Next to Manawatu River in Hokowhitu 
Waterloo Park	Neighbourhood	Recreation	N	-	Y	-	Pt Lot 44 DP 22620.	As above
Whitten Reserve	Neighbourhood	Recreation	N	-	Y	-	Lot 16 DP 69095; Lot 38 DP 48209.	Diamond Court Ashhurst with access from Cambridge Avenue

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Willowstream			N	Y	Lot 47 DP 66769.	Connects Willowstream Grove to Geraldine Crescent.