Te Auaunga Precinct

Plan Change - Infrastructure Report

Te Auaunga Precinct - Plan Change Infrastructure Report

Prepared for:

Ministry of Housing and Urban Development (HUD)

Prepared by:

mps limited

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EXECUTIVE SUMMARY

This Infrastructure Plan has been prepared for the Crown (HUD) to support a private plan change application to rezone land within the current Wairaka Precinct, and to amend the existing provisions within the Precinct including a request to rename the precinct “Te Auaunga”. The private plan change includes the rezoning of 122,329m2 of Special Purpose – Tertiary Education zoned land and 10,093m2 of Terraced Housing and Apartment Buildings zoned land to Business – Mixed Use and 9,898m2 of Special Purpose – Tertiary Education zoned land to Mixed Housing Urban.

This Precinct is the largest contiguous “brownfields” development site on the Isthmus. It is a critical part of the Council’s growth management strategy, including its aspiration to create a quality compact city, and a real opportunity to provide a significant number of new homes in close proximity to a town centre on high frequency public transport routes and within 8km of the city centre.

The Crown supports the Council’s aspirations to increase the amount of development with ready access to employment, public transport and services and is facilitating the development project, including through repurposing land formerly owned by Unitec, and partnering with the Rōpū who will develop the land for housing.

This Infrastructure Report provides information to inform the plan change process by confirming that infrastructure can be provided to service the proposed development of the Precinct. From an infrastructure perspective, there is no reason why the proposed plan change application cannot proceed, as the Precinct can be serviced for water, wastewater, stormwater, power, and telecommunications.

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1. INTRODUCTION

1.1 Purpose of this Report

The purpose of this report is to assess the engineering and infrastructure aspects associated with the private Plan Change of the Wairaka (Te Auaunga) Precinct. This report provides information with respect to the existing infrastructure located within the Precinct and identifies the proposed infrastructure upgrades and interfaces relating to the proposed development across the Te Auaunga Precinct. Figure 1 and Figure 2, show the land proposed to be rezoned and the proposed height zones for the Precinct.

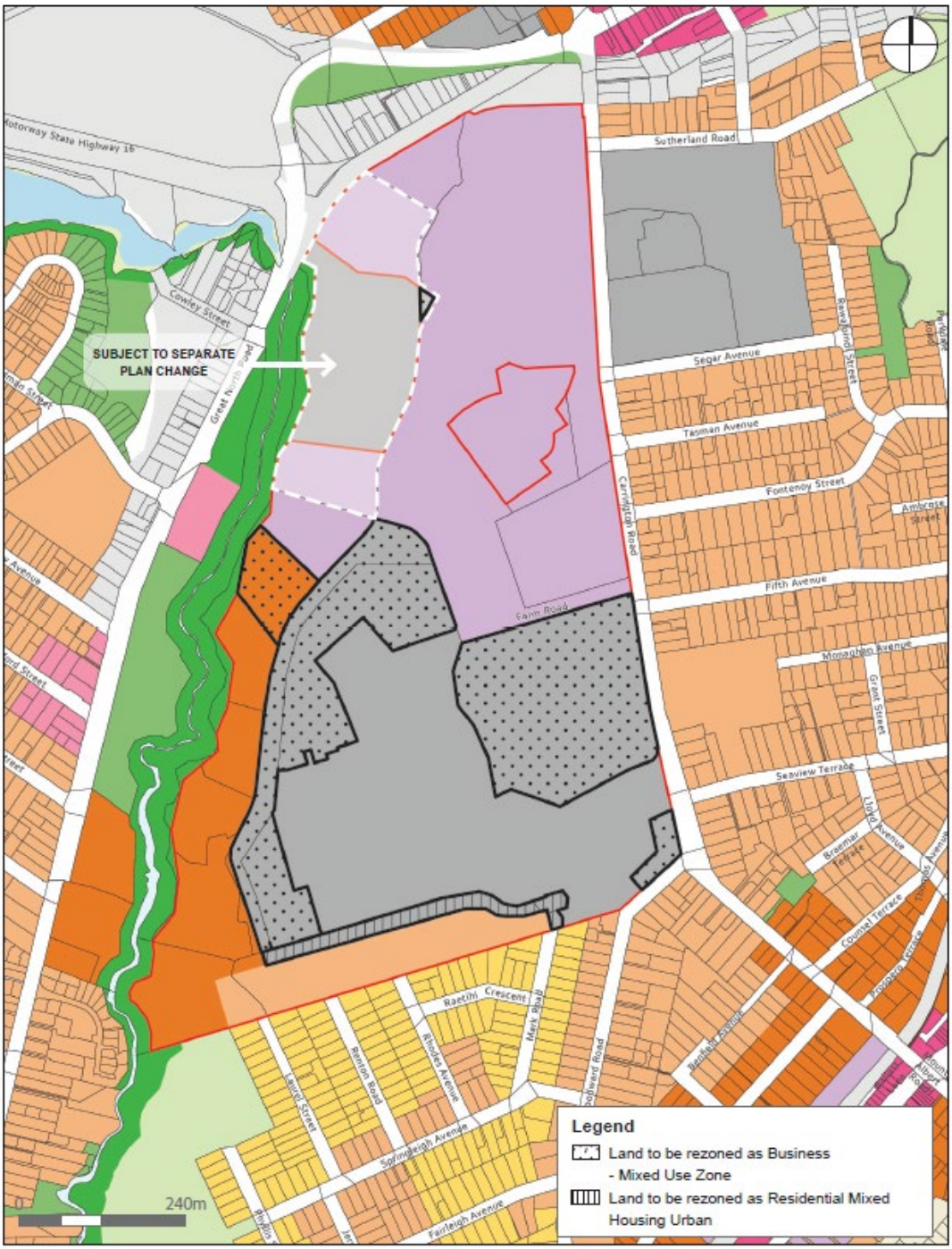

Figure 1 Land to be rezoned

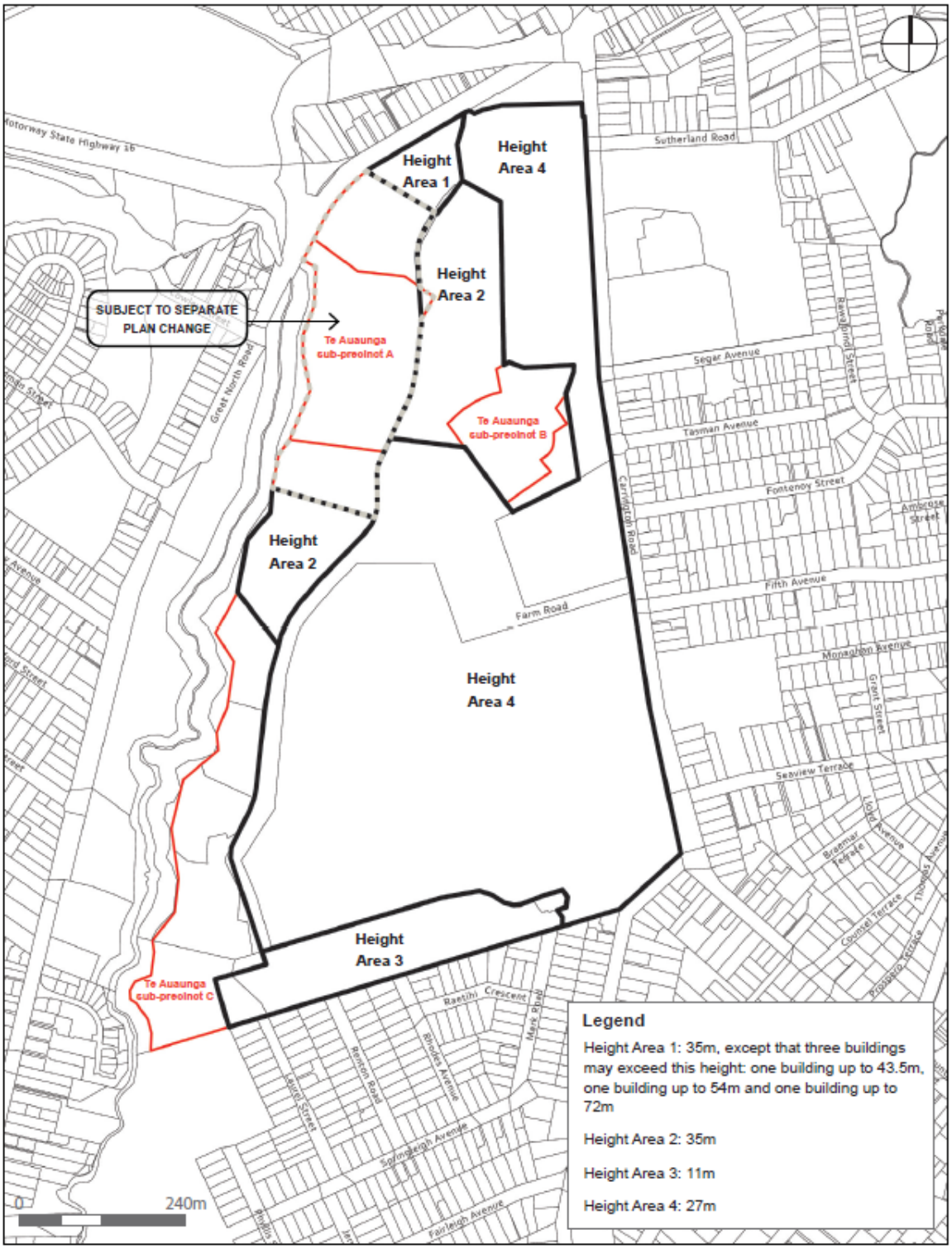

Figure 2 Proposed Height Zones

This Infrastructure Plan has been prepared for the Crown (HUD) to support its private plan change application to rezone land within the current Wairaka Precinct, and to amend the existing provisions within the Precinct. The private plan change includes the rezoning of 122,329m^2 of Special Purpose – Tertiary Education zoned land and 10,093m^2 of Terraced Housing and Apartment Buildings zoned land to Business – Mixed Use and 9,898m^2 of Special Purpose –

Tertiary Education zoned land to Mixed Housing Urban. From an infrastructure perspective, it is only the rezoned land and additional height that will influence infrastructure requirements beyond those already assessed and confirmed for the existing Precinct.

The existing Wairaka Precinct covers a 64.5ha block of land bounded by Carrington Road, the North Western Motorway, Te Auaunga (Oakley Creek) and a series of side roads and properties in the Woodward Road corridor in the south. The boundaries of the Precinct are not changed through this plan change application.

The core thrust of the Wairaka Precinct is to facilitate an integrated community consistent with the Council's urban consolidation policies including its aspiration to create a quality compact city. It will provide for growth, jobs, education and associated recreational facilities to the benefit of all residents that will live within the Precinct as well as complement the neighbouring communities of Mt Albert, Pt Chevalier, and Waterview.

This Precinct is the largest contiguous "brownfields" development site on the Isthmus. It is a real opportunity to provide a significant number of new homes adjacent to a town centre on high frequency public transport routes and within 8km of the city centre.

The Crown supports the Council's aspirations to increase the amount of development with ready access to employment, public transport and services and is facilitating the development project, including through repurposing land formerly owned by Unitec, and partnering with the Rōpū who will develop the land for housing.

1.2 Scope

This report focuses on the following key infrastructure components:

- Wastewater
- Stormwater
- Water Supply
- Communications
- Electrical

Infrastructure relating to transport is assessed separately, in the Stantec report.

2. PROPOSED DEVELOPMENT YIELD

As part of the analysis for the plan change an assessment of potential yield has been undertaken by Tattico. The yield has been used to determine the water and wastewater demands and the associated sizing of the infrastructure to service the Precinct.

The yield analysis has been built around a series of assumptions as follows:

(a) As is common in suburban high intensity residential developments across the isthmus, the development will include a mix of different housing typologies with a focus in key areas on apartments but also a reasonable proportion of terrace housing.

(b) Land efficiency of 75% is assumed. Normally a 65% land efficiency would be provided except that the block analysis already takes account of the open space network and the spine road.

(c) Site efficiency of 50% is achieved with the other 50% being in outlook areas, private open space, communal open space, access and parking.

(d) Within the building, a terrace house achieves 100% efficiency, and an apartment building 80%. In the apartment building the other 20% is in lobbies, corridors, vertical circulation and plant rooms.

(e) Terrace houses are assumed to be either two level or three level walk-ups, in blocks of six terraces, and with an average width of 7m -9m.

(f) For apartments, it is assumed that all apartments would have a complying balcony and that the average apartment size would be 75m².

(g) The maximum permitted size for a supermarket in the precinct would be constructed with development above.

(h) Other retail would be provided with some residential above.

Overall, the yield analysis undertaken by Tattico, estimates a minimum yield of 4,000 dwellings for the Precinct. However, depending on the mix of terrace to apartment product and the size of apartments, the yield could vary giving a realistic yield of 4,000- to 4,500 dwellings. It is estimated that approximately one third of the dwellings will be studio and one-bedroom apartments with an expected occupancy of 1-2 people per dwelling.

For the infrastructure requirements for the plan change the lower limit of 4,000 dwellings has been assumed but with an average occupancy of 3 people per unit. Given the expected actual lower occupancy rates for studio and one-bedroom apartments, 3 people per unit is unlikely once the development is complete. Therefore, the average occupancy assumption per unit is considered conservative in terms of estimating the future population of the development and associated water supply and wastewater demands, with actual demands more than likely to be lower than those estimated in this report. The yields and population are summarised as set out in Table 1 below.

Table 1: Plan Change Development Scenario

Precinct Area	**Yield**	**Population**
North	1,650	4,950
Centre	1,650	4,950
South	650	2,100
Total	**4,000**	**12,000**

It is noted that under different scenarios, a higher development yield of approximately 6,000 dwellings could be achieved. Higher development yields have been used to design and consent the bulk infrastructure works to service the centre and north of the Precinct to future proof the Precinct at low cost. This approach allows for a “dig once” policy for infrastructure as the bulk infrastructure is being installed prior to development plans being finalised. This allows for internal changes to the location and intensity of dwellings, including as development plans are finalised to develop market suitable housing.

3. WASTEWATER SYSTEM

3.1 Existing Wastewater System

The existing wastewater system is shown in Figure 3 on the next page. The Precinct is served by an extensive private gravity pipe wastewater network, which ultimately drains either westwards or centrally towards the Watercare owned and operated Orakei Main Trunk Sewer (ORM).

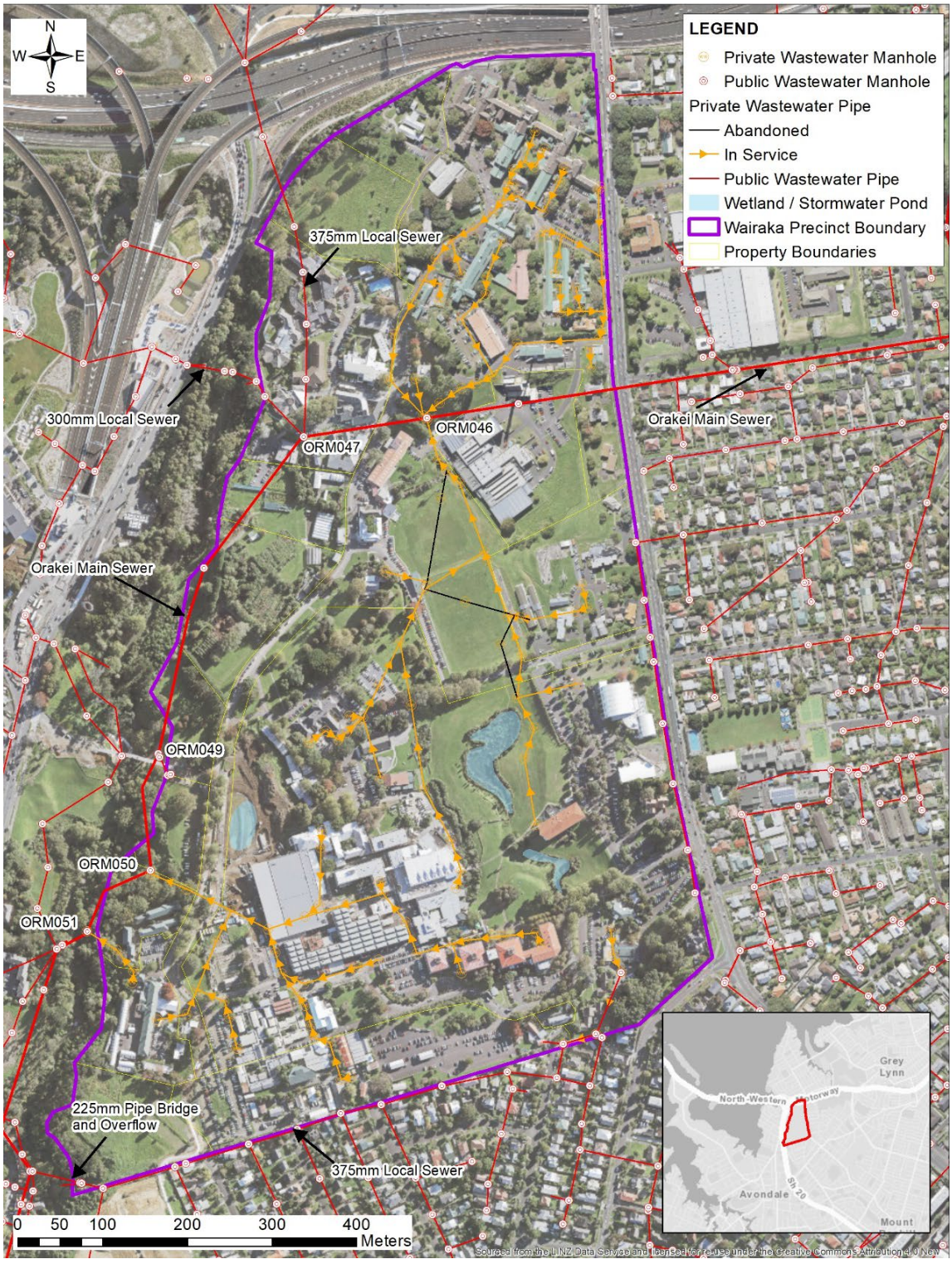

Figure 3 Existing Wastewater System

The ORM passes along the western side of the Precinct, then across the centre of the Precinct draining in an easterly direction. In addition, two Watercare local sewer lines enter the Te Auaunga Precinct from the north, with another local sewer line running parallel to the southern boundary. There are no pump stations or rising mains within or immediately adjacent to the Precinct.

3.2 Wastewater Assumptions

The following assumptions have been used in assessing servicing and upgrade requirements for the Precinct.

- A new public network will be constructed and vested to service the proposed development scenario.
- Existing private assets under proposed lots/buildings will be diverted or removed as part of the development works to avoid potential conflicts.
- The existing wastewater network servicing the Unitec campus is sufficiently sized.
- There is a preference for a gravity network and to minimise asset replacements.
- Detailed specific sizing and hydraulic design for the bulk infrastructure to service the centre and north of the Precinct has been adopted.
- Other key infrastructure not included in this area is indicative and sized based upon Watercare's Code of Practice.
- There is a preference to locate new public assets outside development boundaries within road corridors where practical.
- Easement requirements can be accommodated or resolved.
- The Central Interceptor, CC1, CC5 and CC6 trunk sewer upgrades will be completed by Watercare to provide long term trunk capacity to the Central Isthmus that includes the Te Auaunga Precinct. The Central Interceptor is forecasted to be completed by the end of 2026. Watercare has been unable to provide a timeframe at this stage on when CC1, CC5 and CC6 will be complete. However, the Central Interceptor Catchment consents that include CC1, CC5 and CC6 are to achieve compliance with an 80% reduction in the average annual wastewater overflow volume discharged from the Central Interceptor Catchment Network by 2030.
- Wastewater design details and assumptions for the bulk infrastructure to service the centre and north of the Precinct are as provided for in the Carrington Development Backbone Works – Detailed Design Backbone works – Civil Design, Beca (2022) referred to in the enabling works consent (BUN60386270) and the Engineering Plan Approval (EPA) documents submitted and approved under ENG60401889.
- Private wastewater assets within land under the control of either Unitec or Te Whatu Ora – Health New Zealand will continue to be serviced by the existing wastewater pipes and they will undertake any upgrades required to service their sites.

3.3 Proposed Key Wastewater Upgrades

3.3.1 Wastewater Calculations

Table 2 below provides an indicative summary of the wastewater flows under the plan change development scenario for the entire Precinct.

Table 2: Wastewater Calculations

Development block	Dwellings	Residential Population	ADWF (L/s)	PDWF (L/s)	PWWF (L/s)
North	1,675	5,025	10.5	31.4	52.3
Centre	1,675	5,025	10.5	31.4	52.3
South	650	1,950	4.1	12.2	20.3
Mason Clinic	N/A	N/A	2.6	7.9	15.2
Unitec	N/A	N/A	3.8	11.4	25.1
TOTAL	**4,000**	**12,000**	**31.4**	**94.3**	**165.3**

Notes:

- Wastewater allowance per person – 180 L/p/day
- ADWF – Average Dry Weather Flow
- PDWF – Peak Dry Weather Flow (3 x ADWF)
- PWWF – Peak Wet Weather Flow (5 x ADWF)
- Occupancy is assumed to be 3 people per dwelling. This is considered conservative as a up to one third of the development will be studio and 1 bedroom with lower occupancy.

3.3.2 Local Upgrades

Figure 4 on the next page shows the upgrade requirements for the wastewater system to meet the servicing requirements for the development scenario.

Figure 4 Proposed Wastewater Upgrade Plan

3.3.3 Transmission Upgrades

The main transmission sewer (the Orakei Main Sewer), that currently services the Precinct was previously assessed by MPS (Wastewater report dated 25 November 2015 attached in

Appendix A) (MPS report) to support the rezoning of land in the Wairaka Precinct through the Proposed Auckland Unitary Plan hearings.

The MPS report assessed the capacity of the trunk wastewater system and the predicted changes to overflow volumes. This report is still considered applicable to the Precinct based on the assumptions in this Infrastructure Plan. The MPS report concluded that:

"Based on the analysis presented here, the authors consider that the proposed development at Wairaka Precinct can be serviced by the existing Watercare wastewater transmission network until 2030, after which time further growth can be catered for by the construction of the Central Interceptor."

The potential for issues and/or restrictions on development beyond 2030 were not assessed as Watercare was in the process of developing solutions to service growth across Auckland that included the detailed design of the Central Interceptor. The Central Interceptor (CI) is now under construction and is scheduled to be completed by 2026. It is expected there will be additional transmission capacity to the precinct immediately from 2026, and then as the additional transmission upgrades below are completed as the wastewater load on the Orakei Main Sewer will be reduced and hydraulic backwater effects during wet weather events minimised. At the forecast rate of development within the Precinct, the development is unlikely to exceed the assumptions in the 2015 MPS report and therefore wastewater network capacity is not considered an impediment to development.

In addition to the Central Interceptor upgrade, Watercare has several other transmission upgrades as identified in Figure 5 on the next page. The additional key transmission upgrades applicable to the Te Auaunga Precinct are CC1, CC5 and CC6. Previous Watercare Asset Management Plan identified that the additional transmission upgrades required to connect areas of Auckland to the Central Interceptor would all be completed by 2035 to ensure compliance with its Central Interceptor Network Discharge Consent and to provide for growth across wider Auckland. Resource consents to construct these additional transmission upgrades were obtained as part of the Central Interceptor resource consent process.

The additional transmission upgrades will divert flows away from the Orakei Main Sewer sections that pass through the Precinct. Thereby freeing up capacity for the Precinct's development. A high-level review indicates that the combined effect of Watercare's transmission upgrades will reduce wastewater overflow volumes by 80% by 2030 (consent condition) which should free up sufficient capacity in the Orakei Main Sewer to allow the development of the Precinct to proceed as planned.

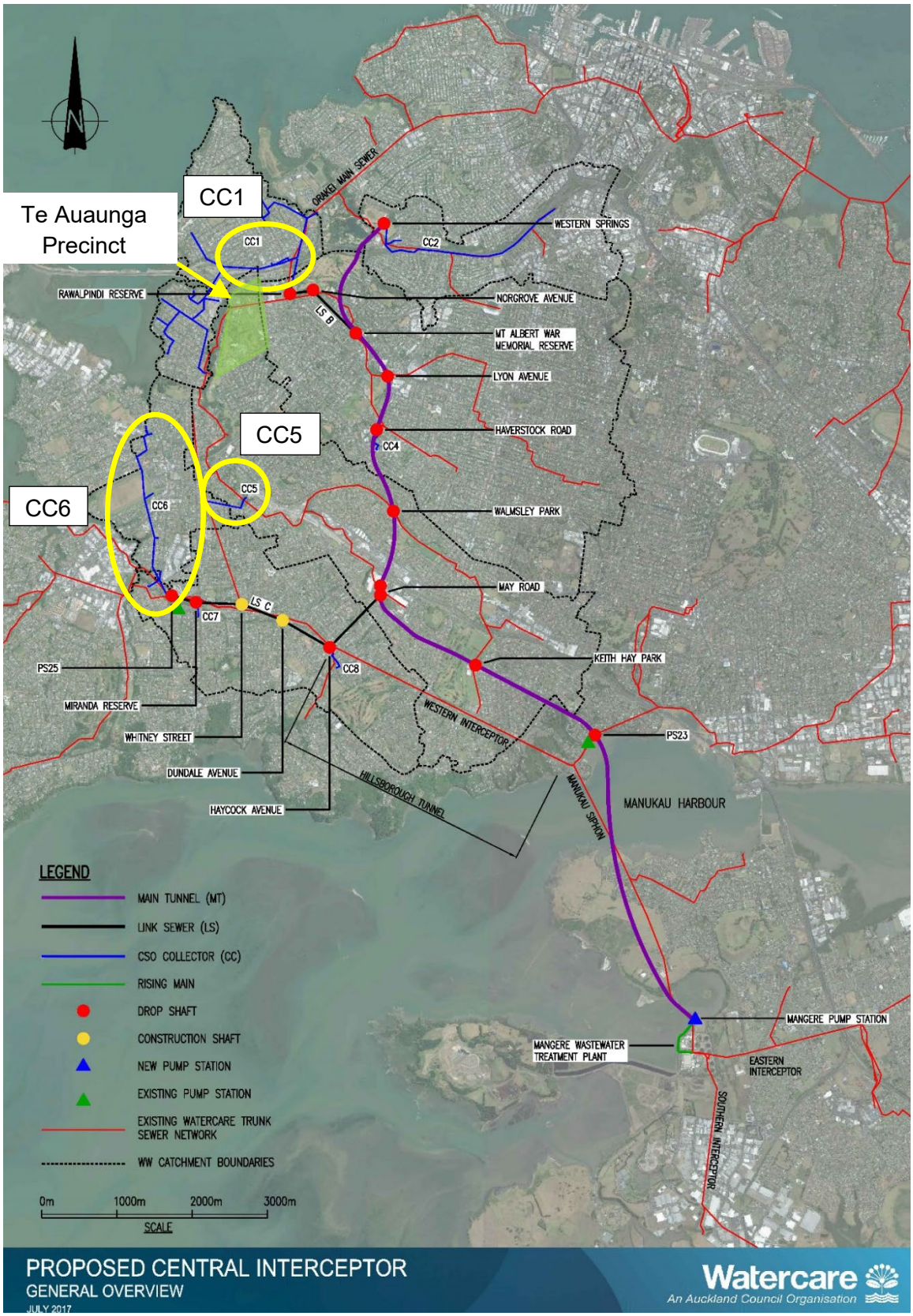

Figure 5 Proposed Watercare Upgrades

4. STORMWATER SYSTEM

4.1 Existing Stormwater System

The existing stormwater system is shown in Figure 6 below with indicative flood plains. The Te Auaunga Precinct is served by an extensive private gravity stormwater network consisting of catch pits, manholes, pipes, streams, natural springs, and wetlands/ponds.

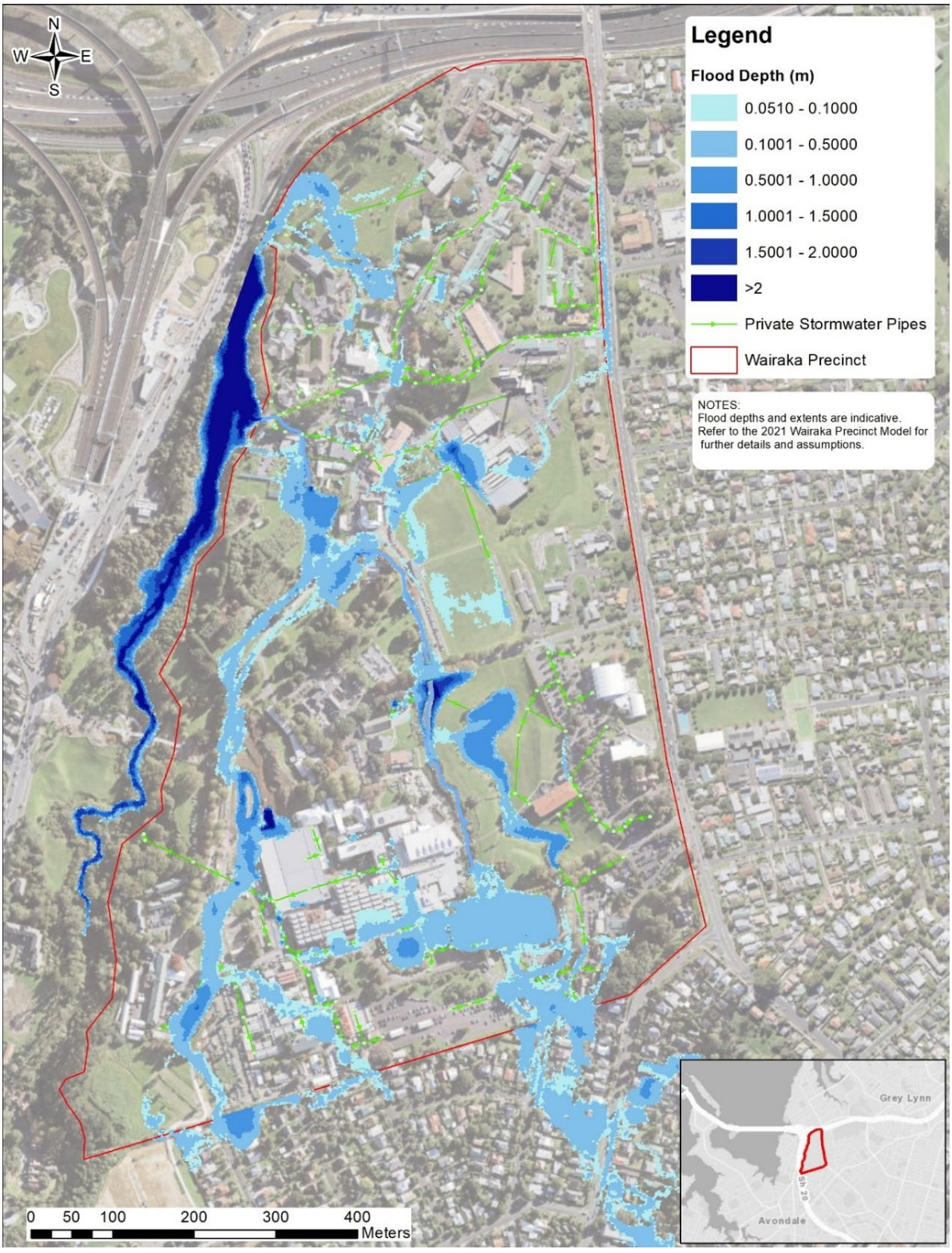

Figure 6 Existing Stormwater System and Flood Plains

Public stormwater infrastructure within the Precinct is limited to pipelines located in the south-eastern corner of the Precinct, entering from Mark Road before discharging to the existing central wetland (being an artificially constructed stormwater pond). The public network predominately services the urban drainage catchment to the south along with a small proportion of the southeast corner of the Te Auaunga Precinct. The catchment to the south of the Te Auaunga Precinct is a predominantly soakage catchment with private and public soakholes scattered throughout.

4.2 Stormwater Assumptions

The following assumptions have been used in assessing upgrade requirements for the proposed development:

- A new public network will be constructed and vested to service the proposed development scenario.
- Existing private assets under proposed lots/buildings will be diverted or removed as part of the development works to avoid potential conflicts.
- Private stormwater assets within land under the control of either Unitec or Te Whatu Ora – Health New Zealand will continue to be serviced by existing stormwater pipes where sufficient capacity is available or upgraded as per the approved Stormwater Management Plan.
- Detailed specific sizing and hydraulic design for the bulk infrastructure to service the centre and north of the Precinct has been adopted. This was based on 70% impervious, but with an increased allowance for climate change rainfall to 3.9^{o}C. This is above the existing 2.1^{o} C in the Council Code of Practice.
- Other key infrastructure not included in the infrastructure designed to service the centre and north of the Precinct are indicative and sized based upon TP108 and includes an allowance for climate change as per Auckland Council's requirements at 2.1^{o} C. Some pipe sizes have been increased to cater for 100-year storm flows to minimise flood extents.
- There is a preference to locate new public assets outside development boundaries within road corridors where practical.
- Easement requirements can be accommodated or resolved.
- Existing assets within the Mason Clinic site are in good condition and have sufficient capacity (subject to planned diversions) to be utilised using easements in favour of Auckland Council.
- Diversion of catchment flows will reduce flood risks within the Precinct.
- New stormwater treatment will be limited to uncovered carparks, the Spine Road, and Farm Road only. The use of inert roofing material is specified in the Stormwater Management Plan (SMP) discussed further below.
- Stormwater treatment will continue to be provided by the Central wetland.
- Flood plains and overland flow paths within lots will be managed through a combination of earthworks, stream widening, larger pipe upgrades and/or upstream catchment diversions.
- Earthworks will allow the diversion of overland flow paths to road corridors where practical.
- Further stormwater design details and assumptions for the bulk infrastructure designed to service the centre and north of the Precinct as per the Carrington Development

Backbone Works – Detailed Design Backbone works – Civil Design, Beca (2022) referred to in the enabling works consent (BUN60386270) and the Engineering Plan Approval (EPA) documents submitted and approved under ENG60396158.

4.3 Proposed Stormwater Upgrades

An SMP has been prepared for the Precinct and was adopted through Schedule 8 of the Region-wide Network Discharge Consent that is held by Healthy Waters, Auckland Council in 2021. The approved SMP, though approved prior to this application, foreshadowed the changes proposed in the private plan change and is therefore consistent with the changes proposed. Therefore, no changes should be required to the approved SMP to accommodate the plan change.

The approved SMP provides the proposed stormwater management approach for the Precinct and demonstrates that it is the best practical option, taking into consideration the existing site features, and the brownfields nature of the development. The outcomes achieved by the Stormwater Management Plan are:

- An integrated stormwater management approach that mitigates the impact of existing and future land use.
- The creation of developable land for mixed and residential land use to support brownfield intensification in Auckland.
- Enhancement of the Wairaka Stream, including daylighting the lower sections where practical.
- Use of low-contaminate generating roofing material.
- Treatment for existing main road corridors and carparks that do not discharge to an existing treatment device.
- Removal of large car parking areas with no treatment devices.
- Upgrades to the stormwater pipe network and overland flow paths to convey flows to Te Auaunga/ Oakley Creek.
- Conveyance of 10-year and 100-year ARI stormwater flows to Te Auaunga/ Oakley Creek.

Figure 7 on the next page identifies the likely extent of network upgrade requirements for the stormwater system to meet the servicing requirements within the Te Auaunga Precinct. The stormwater upgrade plan combines the information from the Stormwater Management Plan and the design of the works in the centre and the north that have been consented and include stormwater treatment devices.

The majority of the pipe sizes for the new and upgraded infrastructure were assessed by WSP as part of development of the SMP for the Precinct during 2021 and again by Beca during the design of the next stages of infrastructure works. As a guide, the majority of the pipe sizes would range between 225mm and 450mm, with some larger pipes of up to say 1050mm to 1200mm required in places. As the detailed design of the Precinct progresses, the final upgrade requirements will continue to be confirmed.

It is important to note that some of the upgrade works identified in the SMP have been completed. Early works included daylighting and upgrading the culvert near the Mason Clinic and construction of the Outfall 6 swale. The early works allow an increase in pass forward

conveyance capacity to allow the maximum amount of land to be developed within the Precinct, while providing more green space and enhancing the Wairaka Stream/Awa.

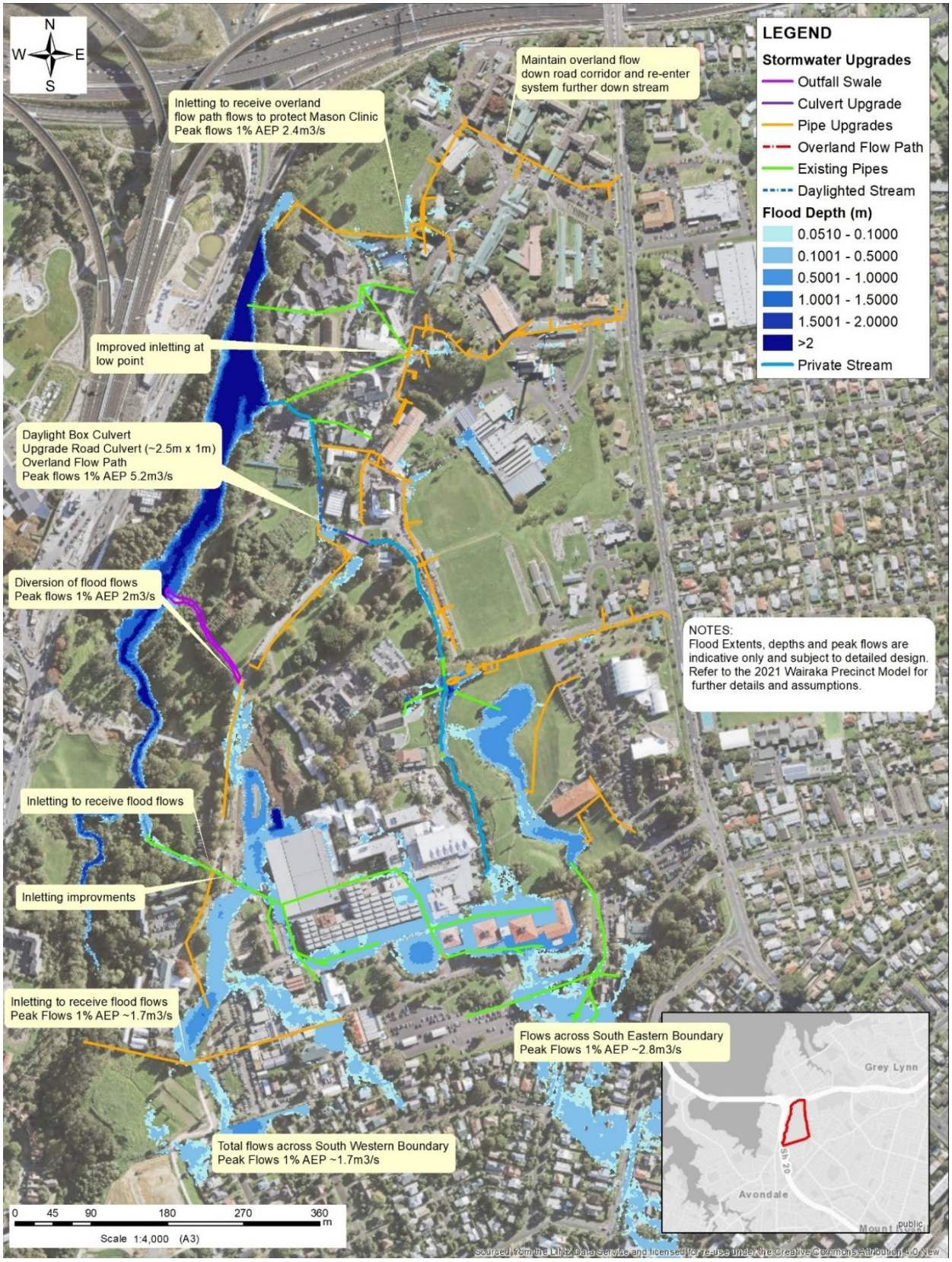

Figure 7 Proposed Stormwater Upgrade Plan

5. WATER SUPPLY

5.1 Existing Water Supply System

The existing water supply system is shown in Figure 8 below.

Figure 8 Existing Water Supply System

The Precinct is served by an extensive private pressure water network ranging in size from 100mm to 200mm internal diameter pipelines. There is no public water supply network within the Precinct with the public system limited to pipelines within the surrounding road network.

The Precinct is predominantly serviced by two supply points from the Konini and Owairaka water supply zones and a third supply point 1 (Great North Road) is currently disconnected but is protected by an easement where the pipe extends over private property on Great North Road. All main public supply points to the Precinct include backflow preventers. In addition, the Precinct is supplemented by numerous small connections to the public network from Great North Road to Carrington Road. There are no existing connections to the public network on the southern boundary.

The Unitec campus is now predominantly serviced through Supply Point 2 due to consolidation of their campus over recent years. The Taylors Laundry and the Mason Clinic sites have their own connection points to the public network. These networks are interconnected with the wider Te Auaunga Precinct network, thereby providing security of supply in the event of a pipe failure on either network or connection point to Watercare's network.

5.2 Water Supply Assumptions

The following assumptions have been used in assessing upgrade requirements for the proposed development:

- A new public network will be constructed and vested to service the proposed development scenario.
- Existing private assets under proposed lots/buildings will be diverted or removed as part of the development works to avoid potential conflicts.
- Private water supply assets and connection points within land under the control of either Unitec or Te Whatu Ora – Health New Zealand will continue to be serviced by them.
- Detailed specific sizing and hydraulic design for the centre and north infrastructure works has been adopted.
- The proposed new transmission lines along Carrington Road will be delivered by Watercare.
- New public assets will be located outside development boundaries within road corridors.
- Easement requirements can be accommodated or resolved.
- Further water supply design details and assumptions for the infrastructure works in the centre and north are as detailed in the Carrington Development Backbone Works – Detailed Design Backbone works – Civil Design, Beca (2022) referred to in the enabling works consent (BUN60386270) and the EPA documents submitted and approved under ENG60401889.

5.3 Proposed Water Supply Upgrades Proposed Key Wastewater Upgrades

5.3.1 Water Supply Calculations

Table 3 below provides an indicative summary of the upper limit of water supply flows under the development scenario for the entire Precinct.

Table 3: Water Supply Calculations

Development block	Dwellings	Residential Population	Average Daily Demand (L/s)	Peak Daily Demand (L/s)	Peak Hourly Demand (L/s)
North	1,675	5,025	11.6	17.4	43.6
Centre	1,675	5,025	11.6	17.4	43.6
South	650	1,950	4.5	6.8	16.9
Mason Clinic	N/A	N/A	2.0	5.1	10.1
Unitec	N/A	N/A	1.3	1.9	2.8
TOTAL	**4,000**	**12,000**	**31.0**	**48.7**	**117.1**

Notes:

- Water Supply allowance per person – 220 L/p/day
- Peak Daily Demand – 1.5 x Average Daily Demand
- Peak Hourly Demand – 2.5 x Peak Daily Demand
- Occupancy is assumed to be 3 people per dwelling. This is considered conservative as a up to one third of the development will be studio and 1 bedroom with lower occupancy.

5.3.2 Water Supply Upgrades

Figure 9 on the next page shows the potential upgrade requirements for the water supply system to meet the servicing requirements for the Precinct. The figure also identifies the transmission upgrades by Watercare outside the Precinct boundary that are required to service the development scenario.

This Infrastructure Report assumes that the Precinct is ultimately serviced from Sutherland Road Bulk Supply Point that is to be upgraded by Watercare.

Previous modelling and discussions with Watercare to date, identified that approximately 4,000 dwellings can be serviced by the upgraded Sutherland Bulk Supply Point (BSP) and water supply pipeline to the Precinct. It is understood that the BSP and the pipeline are in Watercare's Asset Management Plan and budget, as discussion has been progressing on this solution since 2016 when water supply modelling was first completed for the residential development of the Wairaka Precinct. The pipeline itself was included in approved EPA (ENG60401889) and is in delivery.

Discussions over the past year with Watercare identified that to service the Precinct beyond 4,000 dwellings, a new transmission main from Mount Albert may be required to be constructed along Carrington Road. This is due to a lack of overall capacity in the Watercare transmission network to service the development and the wider population growth forecasts in the surrounding suburbs.

Figure 9 Proposed Water Supply Upgrade Plan

HUD is continuing to work with Watercare on the timing and extent of transmission upgrades required to service the development in the short-term, through the planned BSP upgrades, and beyond 4,000 dwellings, if required. It is understood further modelling work is planned by Watercare to confirm the timing of wider transmission upgrades. Watercare is progressively updating its servicing strategy for the wider area in response to planned growth and developments in Mount Roskill, Mount Albert, Point Chevalier, and Western Springs.

6. ELECTRICAL

6.1 Existing Electrical System

The current installed capacity of the Precinct is approximately 6MVA. There are approximately 16 transformers and 5 HV switch-rooms, thought to be a mix of Vector owned and privately owned. Several transformers are in the process of being decommissioned to enable the new infrastructure to be constructed to service the north and centre of the Precinct. There are 4 or 5 local networks off Carrington Road, mainly from Gates 1 and 4, with the majority of low voltage (LV) lines providing local distribution underground.

The majority of the installed power is at the southern end of the Precinct, with 3,700kVA (approximately 68.5%) of the installed capacity located south of Farm Road (i.e. within the Unitec campus area). In addition, there is a low voltage electrical lighting system installed on site.

6.2 Electrical Infrastructure Plan

Previous investigations have identified that the maximum potential demand of the entire Te Auaunga Precinct is in the order of 20MVA. The existing network has inadequate capacity to service the proposed ultimate development, the age of the network is unknown, and it is understood that parts of the network have failed and are currently inoperable.

Therefore, installation of new HV power cables including a new lighting network is expected to be constructed in conjunction with the main road corridor upgrades. Vector has been engaged to design the new electrical reticulation that will form the electrical infrastructure network in the centre and north of the Precinct. Vector has raised no concerns around servicing the ultimate capacity of the Precinct through the discussions on the design of the electrical system to service these parts of the Precinct.

The design of the next stages of infrastructure have made provision for sufficient ducts to be installed within the road corridor, with Vector's contractors then installing electrical lines inside the ducts as the development progresses.

It is expected that each lot will have a local transformer sited externally on the plot. Low voltage services from each transformer will then serve the buildings or buildings in the surrounding areas. Vector may require a new HV switch room to facilitate the migration to the enhanced network, and this will need to be determined in coordination with their engineers. The first stage of these works is due to progress alongside the delivery of the works anticipated in consent BUN60386270 and the Engineering Plan Approval (EPA) documents submitted and approved under ENG60396158.

7. COMMUNICATIONS

7.1 Existing Communications System

Unitec New Zealand operated a site wide communications network across the Precinct until very recently. Unitec has recently decommissioned this network on the land now controlled by

the Crown through HUD. It is expected that the projected demand will exceed existing capacity of the existing communication network, therefore it is not able to be repurposed and a new fibre network will be required.

7.2 Communications Infrastructure Plan

Chorus' website indicates that Ultra Fibre Broadband (UFB) is available to service the Te Auaunga Precinct. A new communications distribution network from Carrington Road will be constructed as part of the construction of the major road corridors within the Te Auaunga Precinct.

The installation will be similar to the power network, whereby ducting will be installed, with Chorus installing the fibre network. This will allow a ring topology for multiple carriers with an expectation that each lot will have a UFB connection on the plot or internally within the new building. Chorus has raised no concerns around servicing the ultimate capacity of the Precinct through the discussions on the design of communications system to service the centre and north of the Precinct. The first stage of these works is due to progress alongside the delivery of the works anticipated in consent BUN60386270 and the Engineering Plan Approval (EPA) documents submitted and approved under ENG60396158.

8. CONCLUSIONS

This Infrastructure Report provides the information pertaining to key infrastructure upgrades and requirements within the Te Auaunga Precinct (excluding transport and roading). The proposed infrastructure works required to service the Precinct include:

- New local wastewater network connecting to the Orakei Main Sewer.
- New upgraded stormwater network including a piped network sized for the 10-year storm, secondary network consisting of overland flow paths within the roads, and treatment of main road corridors and gross pollutant traps, delivered progressively through infrastructure upgrades.
- New local water supply network connecting to an upgraded Sutherland Bulk Supply Point (BSP) by Watercare.
- New additional transmission water mains and BSP in Carrington Road subject to ultimate yield and growth outside the catchment by Watercare.
- New Power and telecommunications ducts and services by Vector and Chorus respectively.

Construction of these new internal networks will progress ahead of the residential development.

From an infrastructure perspective, there is no reason why the proposed plan change application cannot proceed, as the Precinct can be adequately serviced for water, wastewater, stormwater, power, and telecommunications.

APPENDIX A: MPS Report - Wairaka Precinct (Unitec) Wastewater Servicing

mps limited
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Grey Lynn,
Auckland 1021
Ph: 021 899 221

25 November 2015

Unitec Institute of Technology
Private Bag 92025
Victoria Street West
Auckland 1142

Attention: Will Smith

Wairaka Precinct (Unitec) Wastewater Servicing

Dear Will

1 Introduction

This letter report outlines the ability of the Watercare wastewater network to service the proposed development at Unitec at the Wairaka Precinct. The letter has been jointly written by Simon Matthews of MPS limited and Tim Lockie of Hydraulic Analysis Limited (HAL).

While Watercare have made it clear they will support Council's objectives around growth and development (especially brownfield redevelopment within the existing urban area), understanding the potential effects is important. As agreed with Watercare, Unitec has used the most recent dynamic wastewater network model to simulate the flows from the development on the network.

This report is intended to form part of Unitec's case seeking the rezoning of the Wairaka Precinct. It has been drafted on the understanding that it will be provided to Watercare for information and comment. The report and modelling results will also ensure Watercare has up to date population and zoning information to inform its ongoing asset planning and investment programme.

2 Proposed Development Summary

In common with many of its peers in the New Zealand Tertiary Education Sector, Unitec faces the confluence of several environmental drivers, as well as suffering the outcome of historic decisions, which have resulted in an infrastructure that is no longer fit for its purpose.

Unitec's strategy states that 'we are reframing learning' to create 'highly productive talent that is highly employable'. This institutional imperative not only requires that Practitioners (or Entry Level Professionals (ELPs)) attain core discipline skills and knowledge, but also work ready graduates have attained industry and/or profession exposure.

To achieve this, I understand that Unitec needs to leverage its extensive property portfolio, turning it from an anchor to an asset to drive the Institute forward. Presently Unitec occupies circa 120,000m^2 GFA spread across a number of buildings. In the future, in its post transformed state it will occupy only 59,000m^2 GFA, consolidating its operation from 53 to 7 hectares.

The balance of the land will accommodate a mixed use urban precinct with residential, commercial office and light retail.

This proposal represents a significant shift in the current development zoning for the site. From a wastewater perspective the site is represented in the Watercare models as an educational facility with additional trade waste flows (such as for the existing laundry facility). As discussed further below, to date Watercare has not assessed any predicted increase demand from Unitec into the future as there has been no certainty around zoning changes.

With a comprehensive submission on the Unitary Plan, Unitec is now in a position to provide some certainty around future zoning for the Wairaka Precinct and therefore it is possible to predict future wastewater flows and assess their effects on Watercare's wastewater network. The Unitec submission included the predicted yields for the site provided as **Attachment A.**

The 64ha Wairaka Precinct is made up of the Unitec site (53.5ha), the Waitemata District Health Board Mason Clinic (3.9ha), the Taylor's Laundry site (2.5ha), and Ngati Whatua land (4.4ha). These are shown in Attachment A with the Unitec site consisting of the Core, Business Partnerships, Student Accommodation and Development Packages 1 to 10.

The full development and build out of the site is expected to take some 20 or so years beginning in 2017 soon after the Unitary Plan becomes operative. The development would therefore be complete around 2036. Details of a low and high scenario for the ultimate predicted yield are provided in Attachment A.

As discussed below, this analysis is based on the Watercare Central Interceptor being completed and operational by 2030 after which time the increased network capacity will be able to accommodate all flows from the Wairaka Precinct. The following development assumptions have been made and confirmed correct by Unitec:

1. Full development of the Wairaka Precinct will occur over a 20 year period from 2017.
2. Although the Core Campus gross floor area decreases into the future there will be no reduction (or increase) in full time equivalent student numbers by the year 2030. From a wastewater loading perspective there is therefore no change.
3. The development of the Unitec land is expected to generally occur in a linear fashion. This means that by 2030 the Unitec Development Packages (1 to 10) will be approximately 70% of their ultimate yield.
4. There will be no change in the operation at Taylors Laundry or the Mason Clinic until after 2030. This is not land owned or controlled by Unitec although still included as part of the eventual development of the Wairaka Precinct. From a wastewater perspective these loads will be assumed unchanged from existing.
5. Development of the Ngati Whatua Land will be fully complete by 2030. This land is separately owned and Unitec understands plans are to move toward full development within 10 years of the zoning being confirmed through the Unitary Plan.
6. Unitec student accommodation will be fully developed by the year 2030 since this is required to support the future campus development plans.
7. Student accommodation to be developed will be fully unitised – that is, 1 student per bed.
8. The apartments to be developed by Unitec would typically have an average of 1.5 persons
9. The town houses to be developed by Unitec would typically have an average of 2.5 persons

Based on these assumptions and (conservatively) using the higher of the predicted yields from Attachment A the following summary table applies.

	2030
Unitec Packages 1 to 10 Apartments (70%)	1013 dwellings or 1520 new people
Unitec Packages 1 to 10 Townhouses (70%)	104 dwellings or 260 new people
Unitec Packages 1 to 10 Business (70%)	52,500m2 GFA increase
Unitec Packages 1 to 10 Retail (70%)	2,170m2 GFA increase
Unitec Packages 1 to 10 Community (70%)	669m2 GFA increase
Unitec Student Accommodation (100%)	1093 beds or 1093 new people
Unitec Core Campus	No change to existing student numbers
Unitec Business Partnerships (70%)	Included above under business
Ngati Whatua Land (100%)	100 Apartments or 150 new people plus 45 townhouses or 113 new people
Mason Clinic, Taylors Laundry,	No change from existing

Table 1: Increases in demand from existing situation to 2030.

3. Existing and Future Wastewater Network

The Wairaka Precinct is situated in the Oakley Wastewater Catchment near the top of the Orakei Main Sewer (a bulk sewer that was originally constructed in the early 1900s and was the main sewer which serviced the catchments from Mt Albert, through the CBD, and along to Orakei). The Oakley Wastewater Catchment is partially a combined system (ie the pipes are designed to collect both stormwater and wastewater), and the Oakley Catchment sits within the broader combined western isthmus catchment which has a history of overflow issues.

The Unitec site itself does have a separated stormwater system, but due to its age and lack of good as-built records, it is likely there are at least some direct stormwater inflows to the wastewater system which would contribute to the wet weather response in the area.

As part of a wider study, URS has already investigated the drainage networks and provided the diagram below. They have identified six locations at which flows from the site connect to the Orakei Main Sewer.

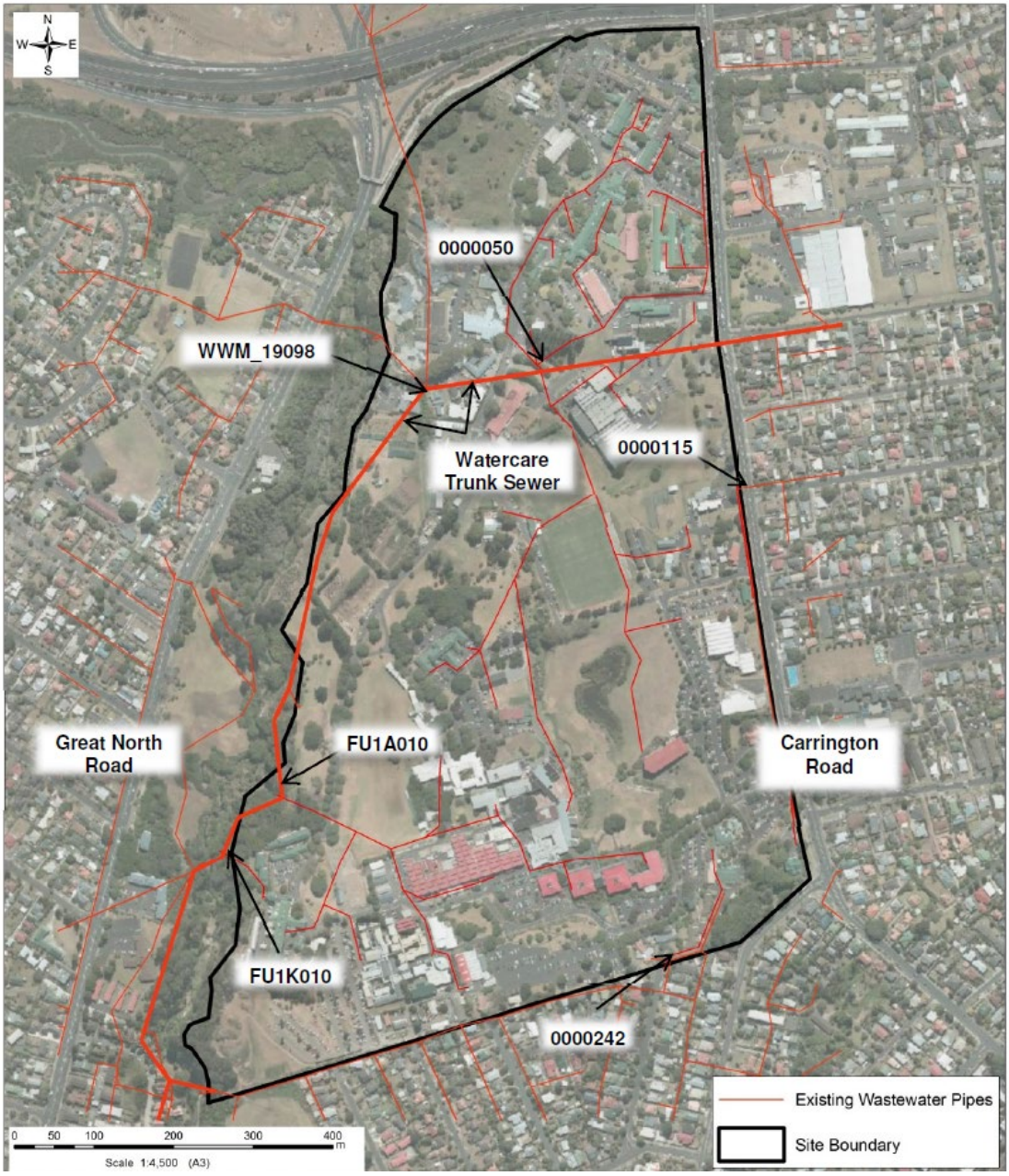

Figure 1: Existing Wairaka Precinct and Wastewater System.
Orakei Main (Trunk) Sewer shown as thick red line

The fact that the Watercare main sewer runs through the Unitec site and Unitec is therefore able to directly connect to that sewer is a huge advantage for the proposed development. This proposed development is not a situation where there are capacity constraints on local sewers.

Further, Unitec understands that parts of the Mt Albert catchment (Branch 9) have been re-directed to the south to reduce the overall load on the Orakei Main by what is known as the Avondale Diversion. As such, while there are downstream capacity constraints that need to be considered, there is capacity in the Orakei Main through the site itself. The downstream issues are also ultimately addressed by the proposed Central Interceptor programmed for 2030 as discussed below.

There are a significant number of buildings within the Wairaka Precinct which will be demolished. An element of the Wairaka development will be a simple substitution of old inappropriate floor space for new purpose built floor space. Because in these initial stages, the population within the site will

not increase, it will not actually lead to an increase in wastewater volumes. These early development projects around the campus core provide the ideal opportunity to review existing private drainage plans and identify any direct stormwater connections to the wastewater system that can be removed and redirected to the stormwater system. New pipes will also reduce infiltration (ie groundwater entering the sewerage system). In addition, as well as having new piping, within the new buildings there are likely to be water efficiency measures introduced such that the wastewater flows per person is likely to decrease.

Although partially offset by reducing inflows, wastewater from the Precinct will increase in time as further development occurs. The key to understanding the effects the wastewater system is to assess the effect of the development just prior to the Central Interceptor being constructed. That effectively represents a worst case, and not an outcome that would occur on day one.

It is also important to consider that there are interim options available to mitigate possible effects on the network other than simply reducing direct inflows to the sewer. For example storage tanks could be used at the Unitec site to attenuate peak flows, an especially viable option when Unitec has such large landholdings. These storage tanks are already used on Watercare's network, to attenuate high flows on existing capacity constrained networks. Effectively, they store the wastewater when flows on the network are high (eg morning and evening peaks or during wet weather events where there significant stormwater inflows), and release the wastewater during periods of low flows.

As with any development, each “development package” as it is release can be considered in terms of its exact timing and incremental effects. The approach of working with Watercare to confirm what (if any) interim mitigation is required for development packages prior to 2030 and the implementation of the Central Interceptor will allow development to proceed now, but with a view of how it will be integrated into the long term solution for the wastewater system.

Similar issues to those described above would be occurring (or will occur), albeit at a smaller scale, at many sites throughout the older suburbs of Auckland that are (or are proposed to) intensify in order to accommodate some of Auckland's expected significant population growth.

4. Watercare Central Interceptor

Once the central interceptor is commissioned, currently planned for 2030, then there is a very substantial change in the wastewater capacity for the western isthmus. The Central Interceptor will accommodate current volumes and growth, including wastewater from Wairaka. One of the Central Interceptor link sewers is planned to connect to the Orakei Main just downstream of the Unitec site. Other link sewers are planned to relieve the Orakei Main at different locations.

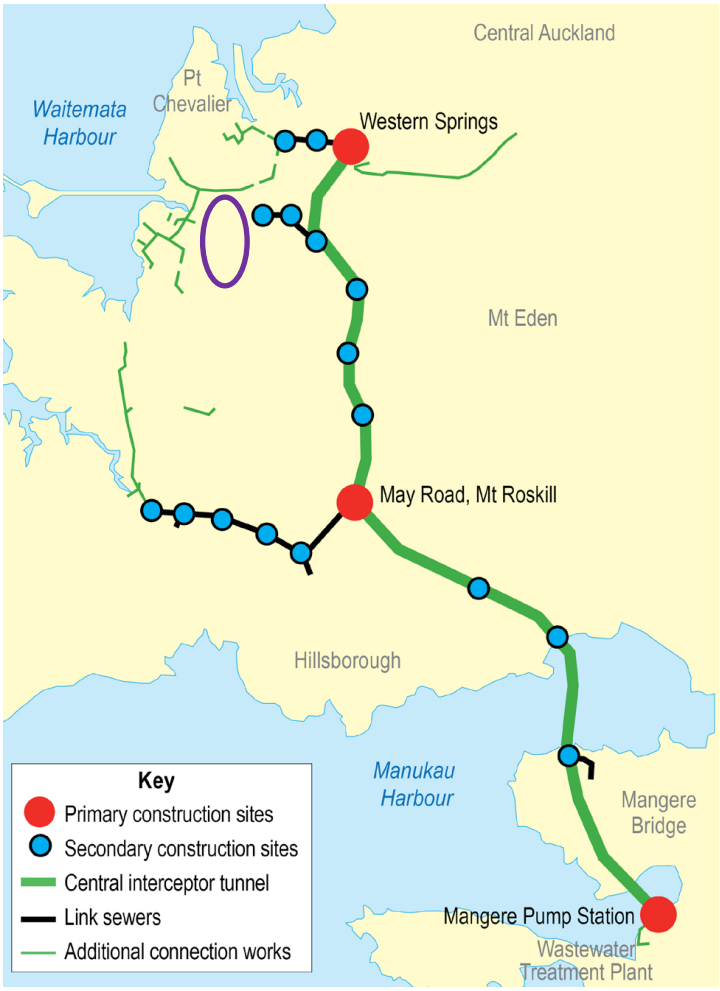

Figure 2: Central Interceptor Route (*from Watercare fact sheet*) with Unitec site location shown as a purple oval

Unitec understands that one of the primary purposes of the Central Interceptor will be to reduce pressure on the Orakei Main providing for growth in the central Auckland Area. Although Unitec is proposing a substantial long term development within the site, Unitec is confident that there will not be wastewater constraints on any development.

As Watercare progresses the detailed design of the Central Interceptor they will incorporate new planning information regarding zoning and predicted populations as it becomes available, especially that coming from the Unitary Plan. The predicted yield information provided by Unitec can therefore be used to directly inform the Watercare design process.

5. Proposed Unitec Development - Hydraulic Analysis

This section provides an overview of the methodology and findings of the analysis into the hydraulic impact of the Unitec Wastewater loads on Watercare's transmission wastewater network. All the details, including all the modelling assumptions, is provided as Attachment B.

5.1 Methodology

With Watercare's permission, Hydraulic Analysis Limited (HAL) was given access to the latest version of the wastewater network Infoworks dynamic model. Two model scenarios were modelled:

1. Base case with residential and commercial populations as predicted for 2030, with the Wairaka Precinct unchanged.
2. Wairaka development case, being the base case but with the increased development as predicted for 2030 at Wairaka Precinct as described above in Table 1.

The Wairaka Precinct 2030 wastewater loads were included in the model directly into the Orakei Main Sewer that passes through the site. The 24 hour profiles used in the existing base case model were extrapolated to allow standard Watercare design flow loads to be applied in the model in a consistent manner.

In the first instance the dry weather flow was modelled to assess if the development would result in any dry weather flow overflows. **Figure 3** shows how the Watercare standard dry weather flow loads derived from the assumed 2030 development at Wairaka Precinct have been adapted to a 24 hour daily profile.

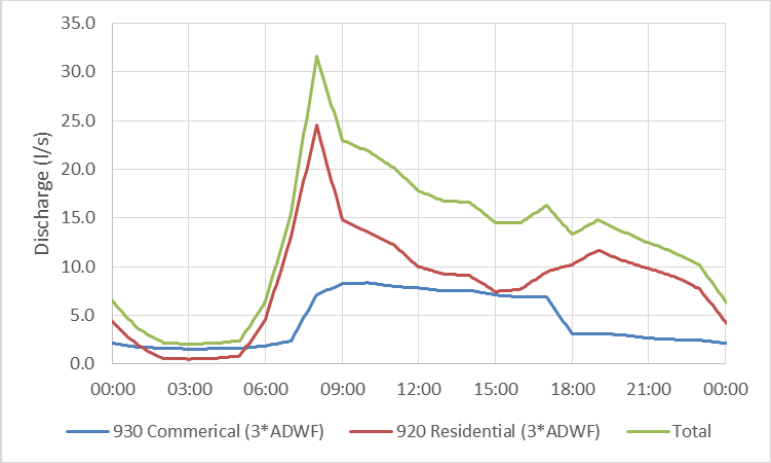

Figure 3: Wairaka Precinct 24 hour dry weather flow profile (2030 development)

Wet weather flow was then simulated using a design storm approach, rather than the more comprehensive time series approach which takes considerable more computational time and analysis. Therefore, to represent a range of wet weather different conditions 11 different rainfall events were modelled ranging from a small 3 day return period event up to a 2 year return period event.

As a result of this approach it is not possible to provide a true annual volume and frequency from the overflow points, however, by using 11 different design storms there can be a direct comparison between the base case and Wairaka development case under a range of conditions.

The key to this methodology is that the analysis is a like for like comparison between the two scenarios Base case vs Wairaka development). What is important here is not so much the actual modelling results, but rather the comparison between the scenarios and if the change is significant.

Consistent with the previous Watercare design storm studies, the peak of the event has been timed for around midday as shown in **Figure 4** below. This figure shows one of the 11 design storms being the 6 month return period event.

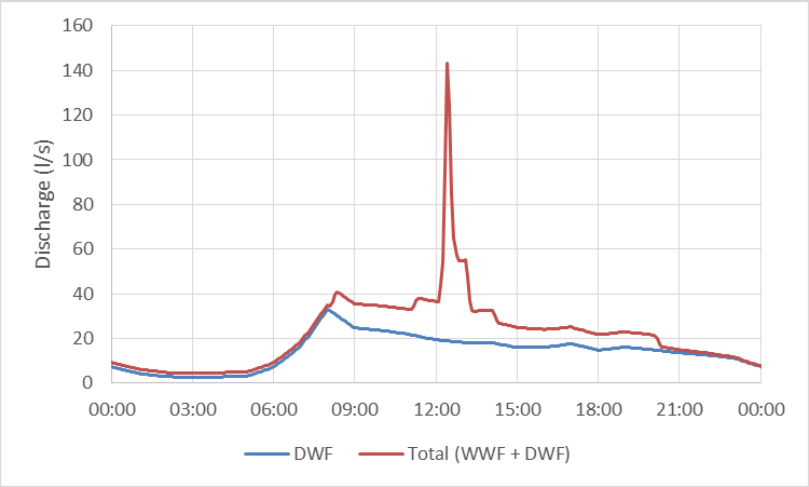

Figure 4: 6 Wairaka Precinct 6 month design storm 24 hour flow profile (2030 development)

Under this 6 month design storm scenario, the combined peak flow during wet weather from the proposed development is some 140 litre per second. This peaking factor is much higher than the standard Watercare static design flow parameters, but comes as a result of applying the dynamic 24 hour profile. The peak flows therefore have a level of conservatism.

5.2 Results

This results summary focuses on the differences between the Base Case and the Wairaka Development Case. Details of overflow volumes and long sections are provided in Attachment B.

The Auckland Isthmus has been design to have many Engineered Overflow Points, which allow peak wet weather flows to discharge from the sewer at controlled locations. This avoids the sewer surcharging and spilling in an uncontrolled manner from manholes when its capacity in exceeded. Provided there are no dry weather flow discharges, the overflows (during rain events) are typically diluted wastewater with a significant portion of stormwater.

The key Engineered Overflow Points along Orakei Main Sewer, that are likely to be impacted by the Unitec Development are the:

- Scotland St EOP, north east of Wairaka near the bottom of College Hill
- OMS MH38 EOP, just north of Wairaka, near Pasadena School.
- OMS MH51 EOP, on the west side of Wairaka discharging into Oakley Creek

These are by no way the largest overflow points in the isthmus area, but because of their location at or just downstream of Wairaka they are the only locations chosen to assess the effects of the development.

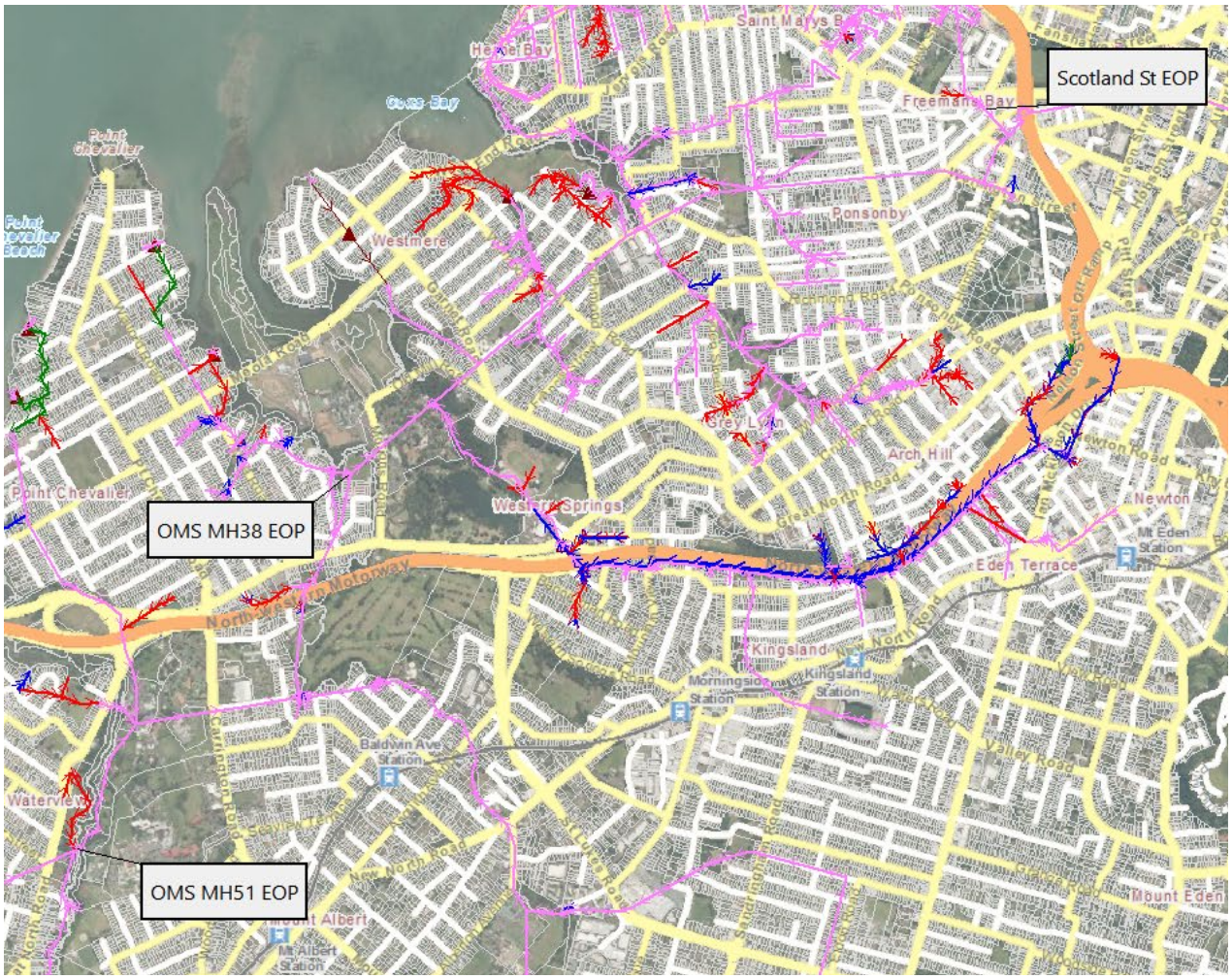

Figure 5: Location of Key Engineered Overflow Points

Dry Weather Flow

During dry weather the flows in the piped network are almost entirely wastewater, with little inflow or infiltration occurring. The dry weather simulation provides a check that no issue are created under everyday operating conditions.

An analysis of model results confirms that for both the Base Case and the Wairaka Development Case there are no dry weather overflows from any of the three key engineered overflow points.

A long section of the Orakei Main Sewer through the Wairaka Precinct is provided in Attachment B (as Figure B9). It shows that at the time of peak flow (around 8:00am) the pipeline is approximately 50% full, still some way from causing dry weather overflow issues.

Wet Weather Flow

The wet weather simulations are undertaken by adding wet weather inflows to the dry weather flows already in the model so a combined effect is modelled.

As discussed above, a design storm approach was used for the modelling. While this means it is not possible to do extract data for annual overflow frequency and volumes, it is still possible to compare the Base Case and Wairaka Development Case across a range of storms. In total, 11 storms varying in return period were simulated, and summary data is provided in Table 2 below.

	Base Case			Wairaka Development Case		
	Number of storms	Number of overflows	Total Volume (m3)	Number of storms	Number of overflows	Total Volume (m3)
Scotland St	11	9	20,934	11	9	20,963
OMS MH38	11	8	79,464	11	8	81,076
OMS MH51	11	7	25,908	11	7	28,451

Table 2: Overview of Change in Overflow Volumes (2030)

The model results show that the smallest of the design storms do not trigger overflows. Given these events include the dry weather flows as well, it further demonstrates that even with the proposed development in place at 2030, there remains dry weather flow capacity.

The results also show there is no change in the number of storms that trigger overflows between the base case and development, meaning there is unlikely to be any significant change in annual overflow frequencies.

With regard to the overflow volumes discharged from the key engineered overflow points, there is very little change to those sites downstream of the Wairaka Precinct. The only real change is to the volumes at manhole 51 on the Orakei Main Sewer, where the total volume discharged increases by approximately 10%. Given the discharge location directly into Oakley Creek and the fact that during these rainfall events the stormwater flows in the Creek would be elevated, it is difficult to see how this change would create any significant adverse effect over and above that which is already occurring.

6. Conclusions

Unitec has engaged with Watercare to undertake a detailed assessment of the predicted effects of the proposed development on the wastewater network. With the network modelling and overall analysis complete it is now possible to draw the following conclusions:

1. In the short term, the wastewater flows generated from the site is likely to decrease due to reduced direct inflows from improved/new pipework, and likely water efficiency measures within new development.
2. Unitec connects directly into the main sewerage system, and Unitec will therefore not be affected by other constraints (or further development) on the local networks. Unitec will also directly benefit from any Watercare upgrades on the main sewerage system. Unitec's infrastructure growth charges will contribute to these upgrades.
3. It is understood that the Central Interceptor will alleviate capacity constraints on the Orakei Main Sewer providing for growth (including full development at Wairaka)
4. The proposed staging means that that approximately 30% of the peak flow development will not be contributing wastewater until close to (or after) the commissioning of the Central Interceptor.
5. The wastewater modelling analysis confirms that for 2030, development at the Wairaka Precinct will not cause any dry weather overflows to occur.
6. The analysis confirms that there would be no significant change to annual overflow frequencies as a result of the development.
7. The analysis also provides an estimation of likely changes to overflow volumes and only one of the many existing overflow points shows any significant increase in volumes and even its site increases by only around 10%. Given its location, this is not thought to create any significant adverse effect on the environment.

8. Any proposed development will, as usual, require an assessment of infrastructure capacity, and if there are any such constraints (bearing in mind that Unitec connects directly to the main sewer), there are mechanisms to mitigate peak flows (eg holding tanks etc).

Therefore, based on the analysis presented here, the authors consider that the proposed development at Wairaka Precinct can be serviced by the existing Watercare wastewater transmission network until 2030, after which time further growth can be catered for by the construction of the Central Interceptor.

It is also recommended that Watercare use the development information provided in this report for future planning and modelling analysis. The full built out development load should be incorporated into the ongoing detailed design of the Central Interceptor.

Yours sincerely

Simon Matthews
Director mps Limited

Attachment A – Unitec Predicted Yield

Unitec Indicative Development Areas & Parking Schedule

Higher Density Option 21..10.2015

	PACKAGE	SUPERLOTS (m2)	RESI (m2)	DWELLINGS		APARTMENTS	APART CARS 1.3/DW	APART CARS 1.5/DW	TOWNHOUSES	TH CARS 2/DW	BUSINESS (m2)	CARS	RETAIL (m2)	CARS	COMMUNITY (m2)	CARS	m2	DWELLINGS	CARS	m2	CARS	OTHER CARS	INDIC GFA (m2)
	1	10,045	12,750	170		170	221	332	-	-													12,750
	2	24,155	7,200	60		-	-	-	60	120													7,200
	3	15,668	15,375	205		205	267	400	-	-					500	17							15,875
	4	31,308	14,170	164		130	169	254	34	68	1,100	37	1,200	48	175	6							16,545
	5	18,300	18,580	236		220	286	429	16	32	100	3	100	4	100	6							19,040
	6	6,715	9,000	120		120	156	234	-	-													9,000
	7	23,638	16,330	206		190	247	371	16	32	5,000		1,000										22,330
	8	6,916	-				-	-					800	32	100	3							900
	9	9,984	15,000	200		200	260	390	-	-													15,000
	10	24,085	17,990	223		200	260	390	23	46													17,990
	Student Accommodation																41,000	1,093	182				41,000
	Core																			59,000	1,450		59,000
	Business Partnerships										68,820	1,147											68,820
	Loading																					11	
	On Street																					634	
	UNITEC SITE ONLY		127,895	1,596	-	1,447	1,881	2,822	149	298	75,000	1,187	3,100	84	955	32	41,000	1,093	182	59,000	1,450	647	306,990
	Laundry		15,780	206		200	260	390	6	12													15,780
	Mason		20,955	242		191	248	372	51	102													20,955
	NWO land		13,350	145		100	130	195	45	90													13,350
	TOTAL SITE FIGURES		177,980	2,189	-	1,938	2,519	3,779	251	502	75,000	1,187	3,100	84	955	32	41,000	1,093	182	59,000	1,450	647	357,685

TOTAL SITE CARS (1.3/APART)	6,583
TOTAL SITE CARS (1.5/APART)	7,043

KEY

non Unitec land

NOTE: All areas are number indicative only & subject to further testing.

Assumptions:
Residential dwelling numbers generally based on 80% GFA efficiency.
Business car numbers based on 1 car per 60m2 of GFA
Retail car numbers based on 1 car per 25sqm GFA
Community car numbers based on 1 car per 30sqm GFA
Student Accommodation dwelling numbers based on average 30m2 per dwelling using 80% GFA efficiency.
Student Accommodation parking allowance 1 car per 6 dwellings.
Loading parking assumption: 3 spaces per 50,000m2 GFA plus 1 additional space per 40,000 GFA

Unitec Indicative Development Areas & Parking Schedule

Lower Density Option 24.09.2015

	PACKAGE	SUPERLOTS (m2)	RESI (m2)	DWELLINGS		APARTMENTS	APART CARS 1.3/DW	APART CARS 1.5/DW	TOWNHOUSES	TH CARS 2/DW	BUSINESS (m2)	CARS	RETAIL (m2)	CARS	COMMUNITY (m2)	CARS	m2	DWELLINGS	CARS	m2	CARS	OTHER CARS	INDIC GFA (m2)
	1	10,045	12,750	170		170	221	332	-	-													12,750
	2	24,155	7,200	60		-	-	-	60	120													7,200
	3	15,668	5,980	46		-	-	-	46	92					500	17							6,480
	4	31,308	14,170	164		130	169	254	34	68	1,100	37	1,200	48	175	6							16,545
	5	18,300	18,580	236		220	286	429	16	32	100	3	100	4	100	6							19,040
	6	6,715	9,000	120		120	156	234	-	-													9,000
	7	23,638	16,330	206		190	247	371	16	32	5,000		1,000										22,330
	8	6,916	-				-	-					800	32	100	3							900
	9	9,984	7,000	75		50	65	98	25	50													7,000
	10	24,085	6,500	50		-	-	-	50	100													6,500
	Student Accommodation																41,000	1,093	182				41,000
	Core																			59,000	1,450		59,000
	Business Partnerships										68,820	1,147											68,820
	Loading																					11	
	On Street																					634	
	UNITEC SITE ONLY		98,110	1,127	-	886	1,144	1,716	247	494	75,000	1,187	3,100	84	955	32	41,000	1,093	182	59,000	1,450	665	277,165
	Laundry		12,900	150		120	156	234	30	60													12,900
	Mason		8,640	68		-	-	-	68	136													8,640
	NWO land		8,580	66		-	-	-	66	132													8,580
	TOTAL SITE FIGURES		128,430	1,411	-	1,006	1,300	1,950	411	822	75,000	1,187	3,100	84	955	32	41,000	1,093	182	59,000	1,450	665	307,685

TOTAL SITE CARS (1.3/APART)	5,682
TOTAL SITE CARS (1.5/APART)	6,332

KEY

non Unitec land

NOTE: All areas are number indicative only & subject to further testing.

Assumptions:
Residential dwelling numbers generally based on 80% GFA efficiency.
Business car numbers based on 1 car per 60m2 of GFA
Retail car numbers based on 1 car per 25sqm GFA
Community car numbers based on 1 car per 30sqm GFA
Student Accommodation dwelling numbers based on average 30m2 per dwelling using 80% GFA efficiency.
Student Accommodation parking allowance 1 car per 6 dwellings.
Loading parking assumption: 3 spaces per 50,000m2 GFA plus 1 additional space per 40,000 GFA

UNITEC MASTERPLAN

Indicative Development Areas & Parking Provision

24/10/2015

Attachment B – Wastewater Model Analysis

Methodology

Background

To undertake this analysis, Watercare's 'Central Interceptor Model Update – Issue 1' wastewater model has been utilised. This model was developed by Watercare to assess the performance of the Central Interceptor scheme, with a number of differing model scenarios available. For this analysis the 'SP2030NoCI - CI Update Issue 1' network was adopted as the base scenario (see below figure for model scenarios), this model setup represents the trunk wastewater network without the Central Interceptor scheme in place in 2030 (i.e. with resident population adjusted to represent estimated 2030 loads), see Watercare's CI Model Update – Report 01 – 08, September 2014, for details. Innovyze's Infoworks CS 15.5 software version has been adopted.

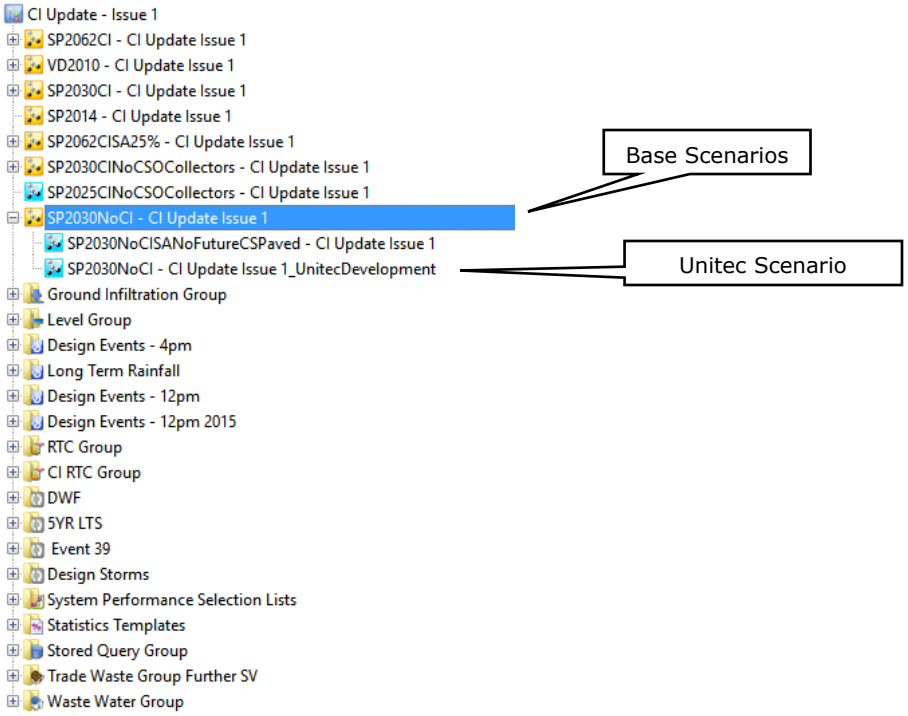

Figure B1: Model Network Scenarios

Model Scenarios

The below table summarises the model scenarios analysed. A design storm analysis approach has been adopted, with detailed outlined below.

Scenario ID	CI In place	Development Scenario	Hydrology Loads	Unitec Development	LTS Scenarios	DS Scenarios[1]
SP2030NoCI - CI Update Issue 1	No	2030	CI Update 2030 (2% for Unitec Catchment)	No	None	3 Day ARI 4 Day ARI 1 Week ARI 2 Week ARI 3 Week ARI 1 Month ARI 2 Month ARI 3 Month ARI 6 Month ARI 1 Year ARI 2 Year ARI
SP2030NoCI - CI Update Issue 1_UnitecDevelopment	No	2030	CI Update 2030 (2% for Unitec Catchment)	Yes – see below for load estimate	None	

Table B1: Model Scenarios

[1] Note Design Storm ARI is based on rainfall ARI, and have been developed from rainfall event analysis completed on the Albert Park Rain Gauge, and nesting rainfall durations for each ARI of interest. It is important to note the rainfall ARI does not necessarily correspond with the sewer flow ARI.

Dry Weather Flow Loads – 2030 Unitec Site

Table B2 below summarises the dry weather flow loads applied to the model to represent the Unitec Development in 2030. While to represent the dynamic nature of these dry weather flow, a residential and commercial diurnal profile was applied to these loads see Figure B2 for the simulated dry weather flow from the proposed Unitec development (where these profiles have been adopted from the CI Model for commercial and residential development).

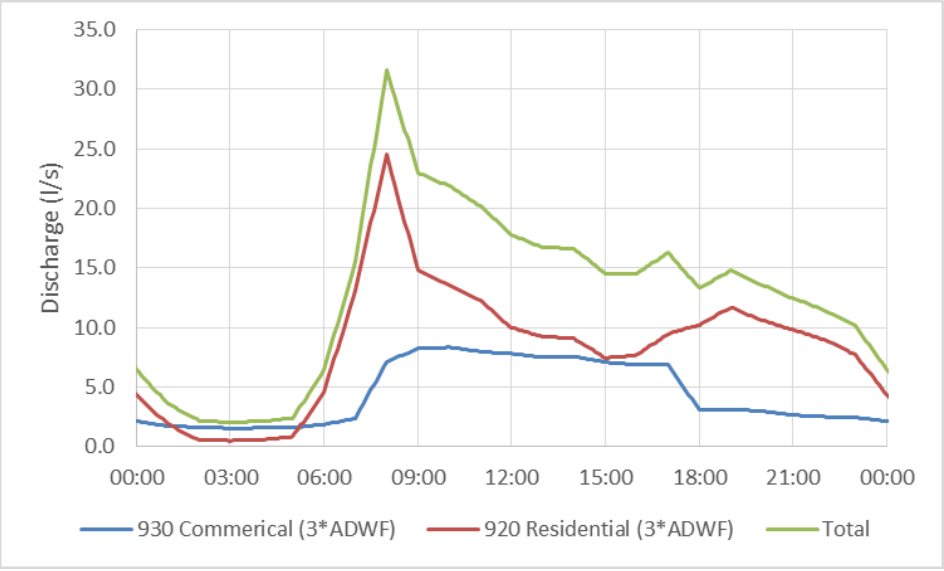

Figure B2: 2030 Unitec Development Dry Weather Flow Loads

Site	2030 Development Estimate	Resident Loads		CBD or High Rise Buildings			Adopted Diurnal Profile
		Numbers	Average Dry Flow (ADWF)[1] (l/s)	Gross Floor Area (GFA) (m2)	Estimated Number of People[2]	CBD or High Rise Buildings Average Design Flow[2] (l/s)	
Unitec Packages 1 to 10 Apartments (70%)	1013 dwellings or 1520 new people	1,520	3.96				920 Residential (3*ADWF)
Unitec Packages 1 to 10 Townhouses (70%)	104 dwellings or 260 new people	260	0.68				920 Residential (3*ADWF)
Unitec Packages 1 to 10 Business (70%)	52,500m2 GFA increase			52,500	3,500	2.63	930 Commercial (1.4*ADWF)
Unitec Packages 1 to 10 Retail (70%)	2,170m2 GFA increase			2,170	145	0.11	930 Commercial (1.4*ADWF)
Unitec Packages 1 to 10 Community (70%)	669m2 GFA increase			669	45	0.03	930 Commercial (1.4*ADWF)
Unitec Student Accommodation (100%)	1093 beds or 1093 new people	1,093	2.85				920 Residential (3*ADWF)
Unitec Core Campus	No change to existing student numbers						
Unitec Business Partnerships (70%)	Included above under business						
Ngati Whatua Land (100%)	100 Apartments or 150 new people plus	150	0.39				920 Residential (3*ADWF)
	45 townhouses or 113 new people	113	0.29				920 Residential (3*ADWF)
Mason Clinic, Taylors Laundry,	No change from existing						
Total		**3,136**	**8.2**	**55,339**	**3,689**	**2.78**	

Table B2: Adopted Dry Weather Loads

[1] ADWF = 225 L/PE/Day from Section 5.3.5.1 Design Flow, Watercare's Water and Wastewater Code of Practice for Land Development and Subdivision

[2] CBD or High Rise Buildings = 1 person per 15m2, with ADWF = 65 l/p/d from Table 5.1, Watercare's Water and Wastewater Code of Practice for Land Development and Subdivision

The additional 2030 Unitec DWF loads, have been applied at Orakei Main Sewer (OMS) Manhole 50 (See Figure B3 below for location). In reality there are likely to be a number of local connections to the Orakei Main Sewer, these have not be modelled as it is assumed that sufficient local capacity will be available to convey flow to the OMS.

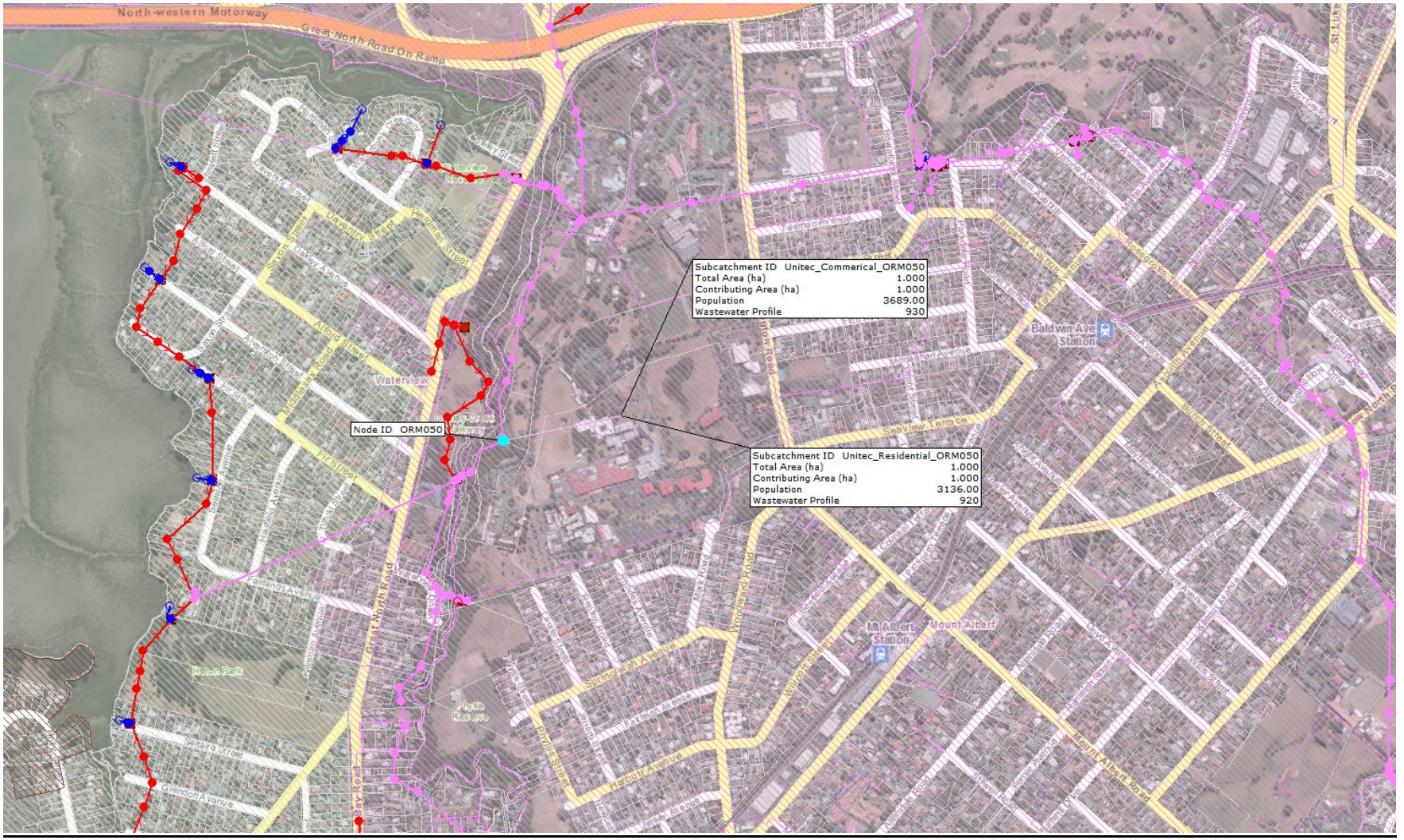

Figure B3: Unitec 2030 Development Dry Weather Flow Loading Location

Dry Weather Flow Loads – Existing

In addition to the future Unitec Development loads, there are also loads from the existing site (which includes Taylors Dry Cleaning, Mason Clinic, Unitec Staff and Students) which are assumed to remain unchanged from base (current) scenario. These are represented in the base model as 140 people with an ADWF of 176 L/PE/Day for both model scenarios (Catchments OMS045 & OMS050). The 140 people in the model for the existing Unitec site is very low compared to actual numbers of around 1000 full time equivalents.

The model inputs, however, show that the 140 population has been multiplied by a factor of 6 – presumably as part of the original calibration process. This 6x140 is much closer to the actual 1000 full time equivalents so does seem to represent the flow well.

See the Figure B4 below for simulated DWF profile, and Figure B5 for locations. It is also worth noting that catchment OMS047B_a also represents some contribution from the Unitec site, (with a population 850 people) however as this catchment includes a significant proportion of residential development outside the Unitec Site, for clarity this catchment has not be included in this discussion of loads (though it is still included within the model scenarios).

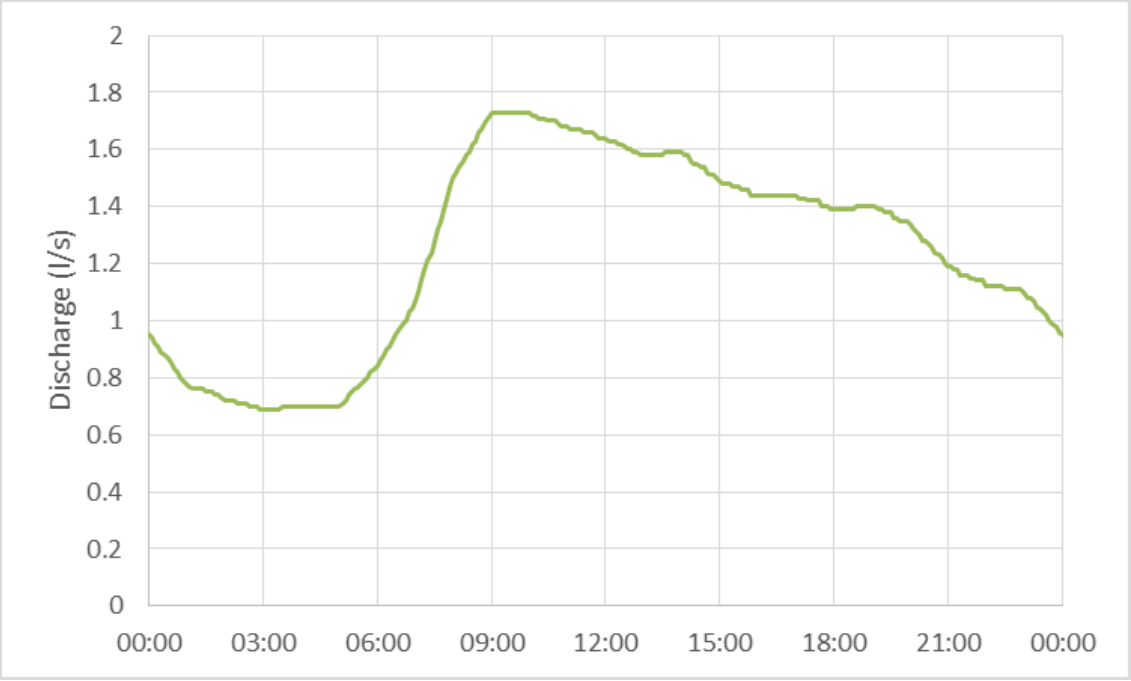

Figure B4: Base Dry Weather Flow Loads (Taylors Dry Cleaning, Mason Clinic, Unitec Staff and Students)

Dry Weather Flow Loads – Overall Summary

The below table summarises the simulated Dry Weather flow loads.

Item	Scenarios Applied	ADWF (l/s)	PDWF (l/s)	Peaking Factor
Existing Loads	SP2030NoCI - CI Update Issue 1	1.2	1.8	1.4
Unitec 2030 Loads	SP2030NoCI - CI Update Issue 1_UnitecDevelopment	13	32	2.5

Table B3: Dry Weather Loads Summary

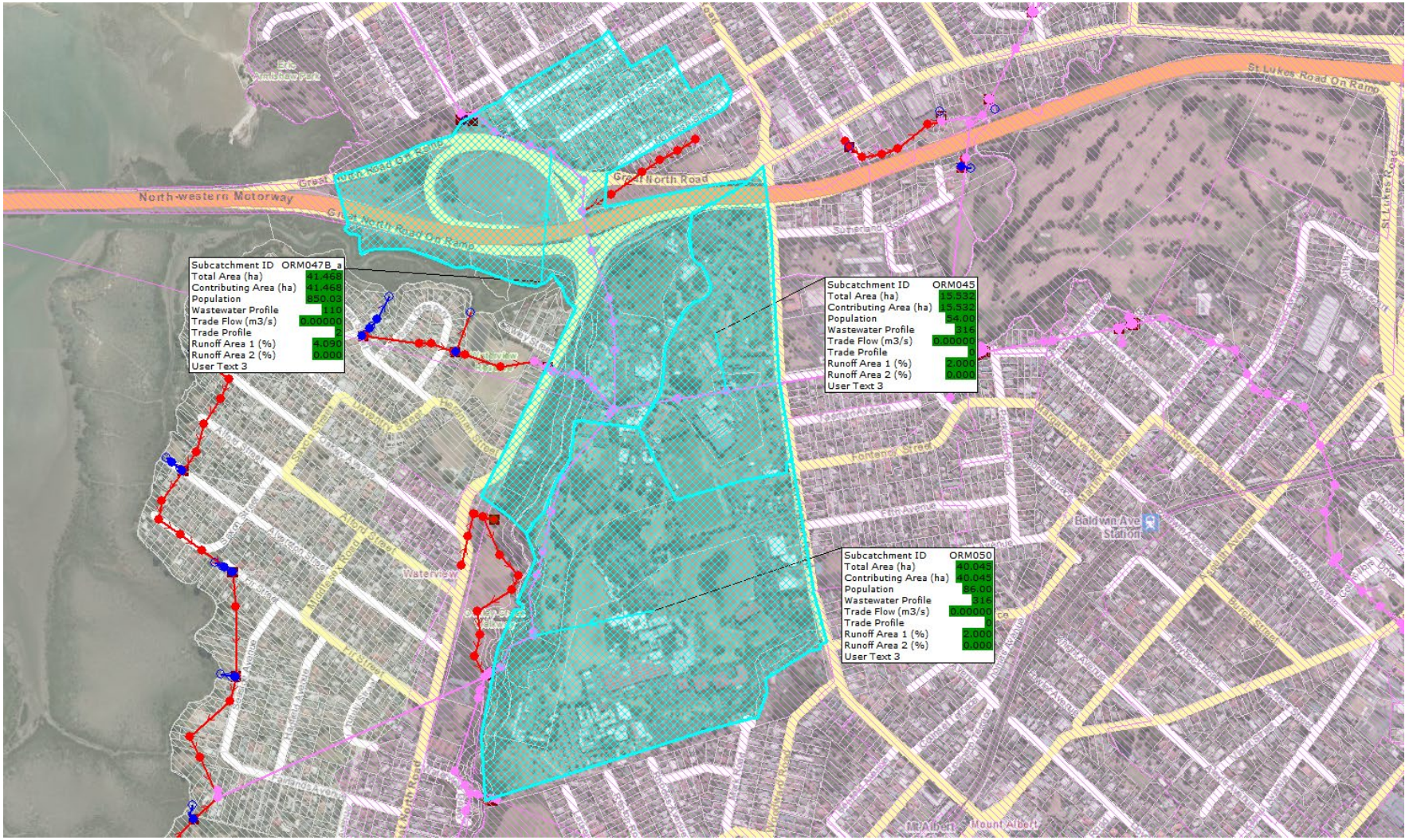

Figure B5: Base Dry Weather Flow Loads Location (Taylors Dry Cleaning, Mason Clinic, Unitec Staff and Students)

Wet Weather Flow Loads

Wet Weather loads have been adopted from the SP2030NoCI - CI Update Issue 1, which represents wet weather loads as 2% leakage rate applied to the Area 1 (Paved) contributing surface, while the Area 3 (slow response) & 4 (groundwater) have 2% and 15% contribution respectively. As such there is no change in leakage rates between the two modelled scenarios. Figure B6 below shows the location of contributing catchment flows from the Unitec Site, where two catchments cover this site which connect to OMS MH 50 and MH45 respectively. It is also worth noting that catchment OMS047B_a also represents some contribution from the Unitec site, (with an Area 1 contribution of 4%) however as this catchment includes a significant proportion of residential development outside the Unitec Site, for clarity this catchment has not be included in this discussion of loads (though it is still included within the model scenarios).

A design storm approach has been adopted to the analysis. The alternate approach of using long term time series simulations was not considered warranted in this case due to the onerous computational and analysis requirements.

- 3 Day ARI
- 4 Day ARI
- 1 Week ARI
- 2 Week ARI
- 3 Week ARI
- 1 Month ARI
- 2 Month ARI
- 3 Month ARI
- 6 Month ARI
- 1 Year ARI
- 2 Year ARI

These design storms have been centred so the peak rainfall intensity occurs at 12pm. Nested 24 hour storms were used to represent a worst case (for all durations).

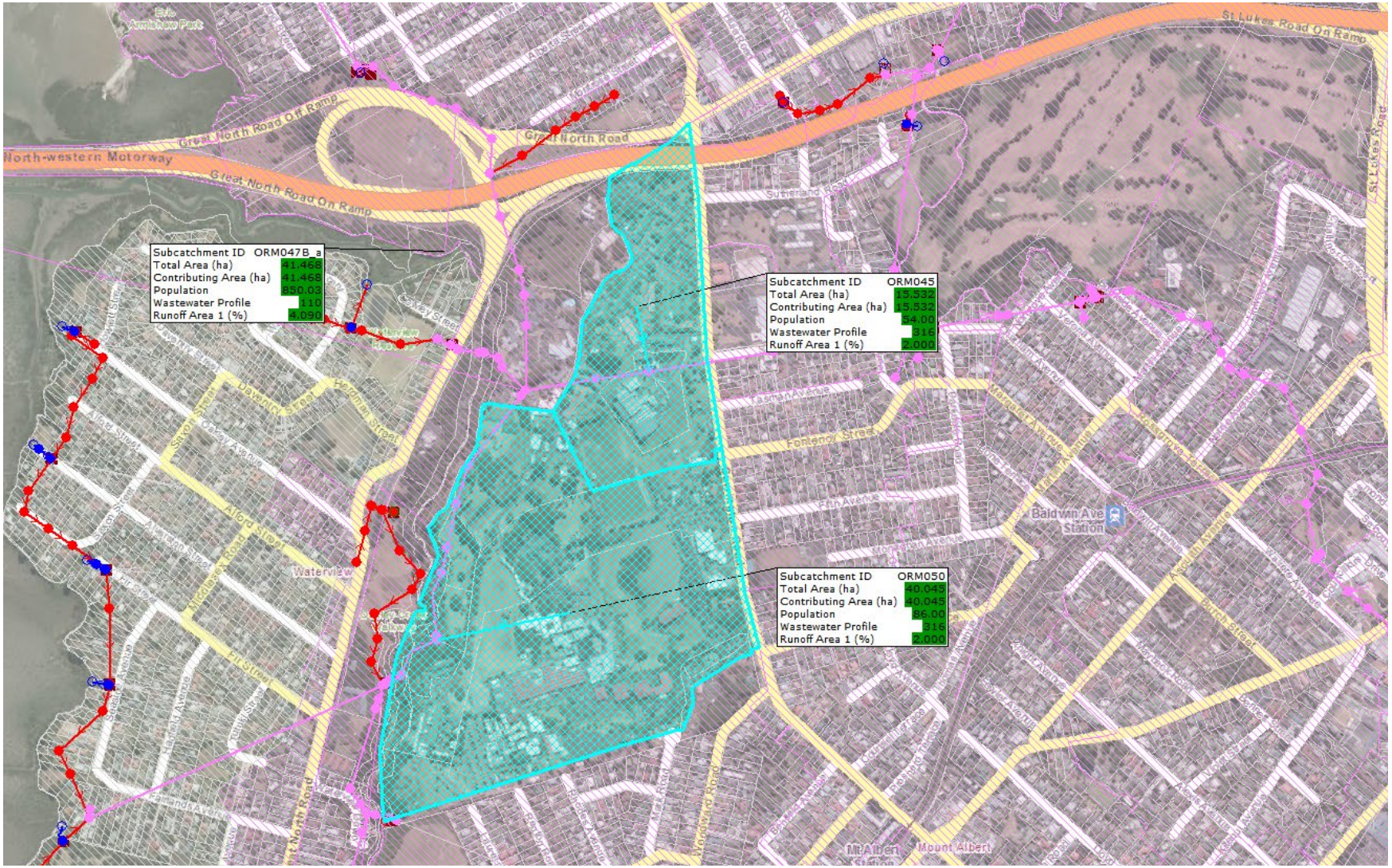

Figure B6: Wet Weather Flow Loading Locations

For the 6 Month Design a Peaking Factor of ~12*ADWF is simulated, due to the dynamic response from each rain event the simulated peaking factor will vary. See the below Figure B7 for simulated DWF and WWF response post the Unitec Development.

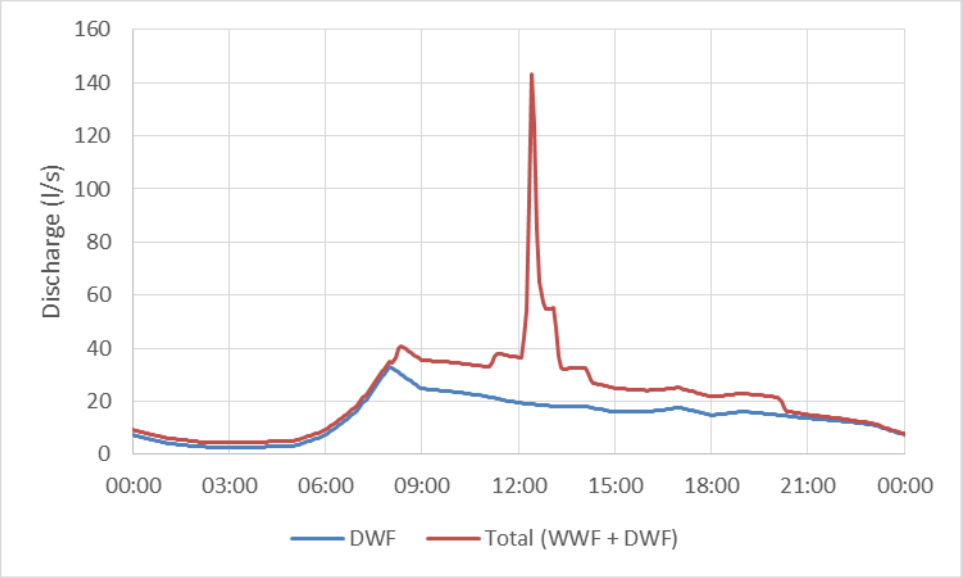

Figure B7: 6 Month Design Storm – Simulated Inflow from the Unitec 2030 Development Site

Simulation Results

The key Engineered Overflow Points along Orakei Main Sewer, that are likely to be impacted by the Unitec Development are the:

- Scotland St EOP
- OMS MH38 EOP
- OMS MH51 EOP

See Figure B8 below for EOP locations.

There are a number of other EOPs, within the catchment but these are assumed to not be influenced by this development.

Figures B9 to B11 show the model results for the hydraulic profiles (long sections) of the Orakei Main under the following scenarios:

- 2030 Loads No CI - DWF With Unitec Development
- 2030 Loads No CI – 1 Week DS Without Unitec Development
- 2030 Loads No CI – 1 Week DS Without Unitec Development

Table B4 below provides a summary of the volumes discharge from the three key engineered overflow point for each of the design storm simulated.

SP2030NoCl												
EOP Reference ID	Design Storm											
	3 Day ARI - Albert Park	4 Day ARI - Albert Park	1 Week ARI - Albert Park	2 Week ARI - Albert Park	3 Week ARI - Albert Park	1 Month ARI - Albert Park	2 Month ARI - Albert Park	3 Month ARI - Albert Park	6 Month ARI - Albert Park	1 Year ARI - Albert Park	2 Year ARI - Albert Park	Total Volume (m3)
ORM MH51	0	0	0	0	1	350	892	1,495	3,808	8,554	10,809	25,908
ORM MH38	0	0	0	765	2,053	3,561	6,071	10,534	15,709	19,464	21,308	79,464
Scotland St	0	0	119	286	582	1,135	1,707	2,420	3,402	5,060	6,223	20,934
SP2030NoCl Unitec Development												
EOP Reference ID	Design Storm											
	3 Day ARI - Albert Park	4 Day ARI - Albert Park	1 Week ARI - Albert Park	2 Week ARI - Albert Park	3 Week ARI - Albert Park	1 Month ARI - Albert Park	2 Month ARI - Albert Park	3 Month ARI - Albert Park	6 Month ARI - Albert Park	1 Year ARI - Albert Park	2 Year ARI - Albert Park	Total Volume (m3)
ORM MH51	0	0	0	0	34	461	1,053	1,720	4,360	9,270	11,554	28,451
ORM MH38	0	0	0	871	2,163	3,706	6,507	10,881	15,879	19,596	21,473	81,076
Scotland St	0	0	119	288	587	1,141	1,710	2,419	3,402	5,065	6,233	20,963

Table B4: Model Results: Summary of Overflow Volumes

Review of the model hydraulic performance pre and post the Unitec development, shows that:

- There are no dry weather overflows in either the base case of with the Wairaka development.
- Overflows do not occur for the smallest two design storms modelled, indicating some capacity in the sewer to accept both DWF and small rainfall events.
- The Unitec Development doesn't increase spill frequencies (as assessed with the adopted Design Storms).
- The key overflow points downstream of Unitec (OMS 38 and Scotland St) appear relatively unaffected by the proposed development.
- The biggest effect comes at the overflow point adjacent to Unitec (OMS 51) where the increase in overflow volume is expected to be around 10% (averaged over all design storm simulated)

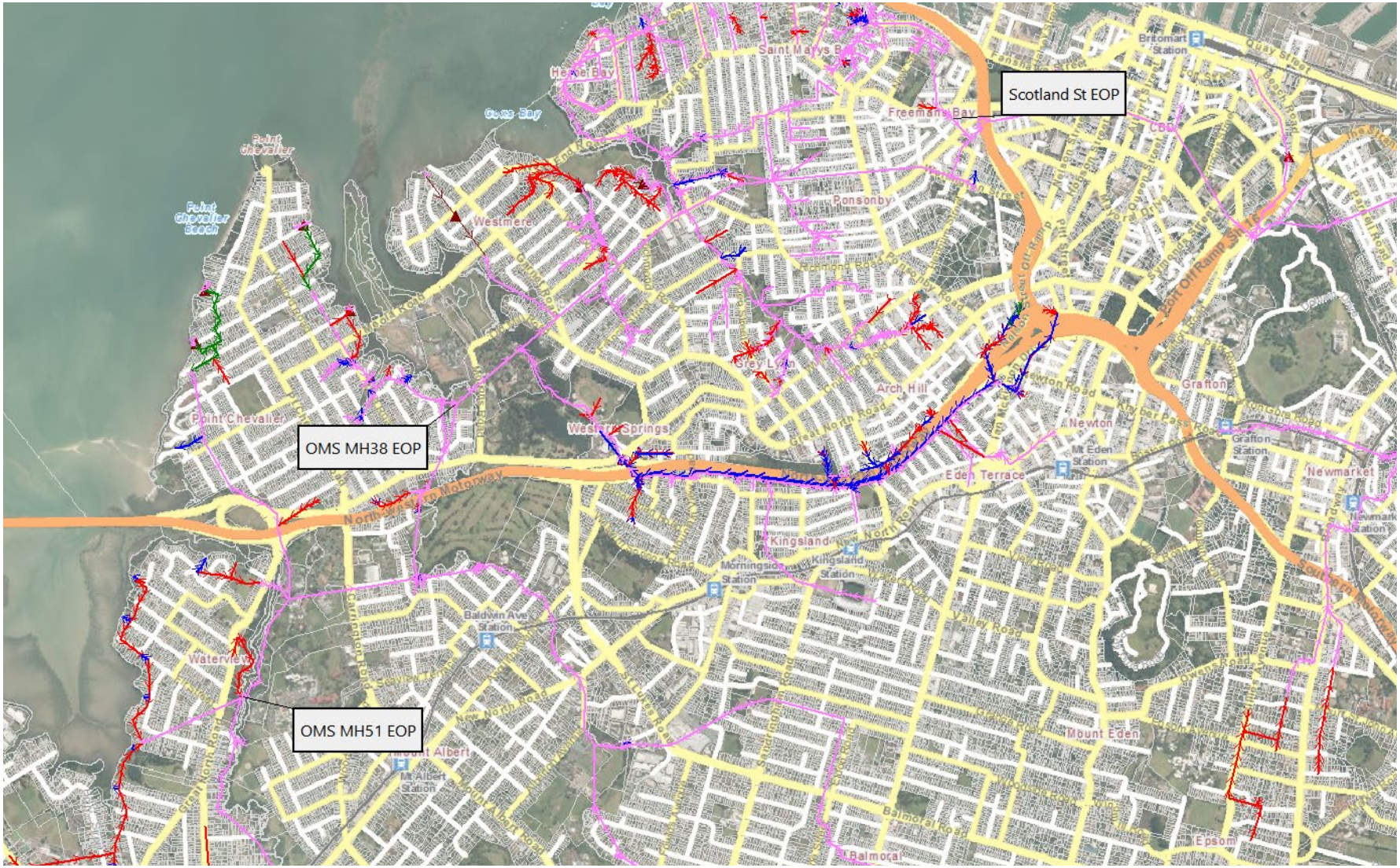

Figure B8: Location of Engineered Overflow Points (EOPs)

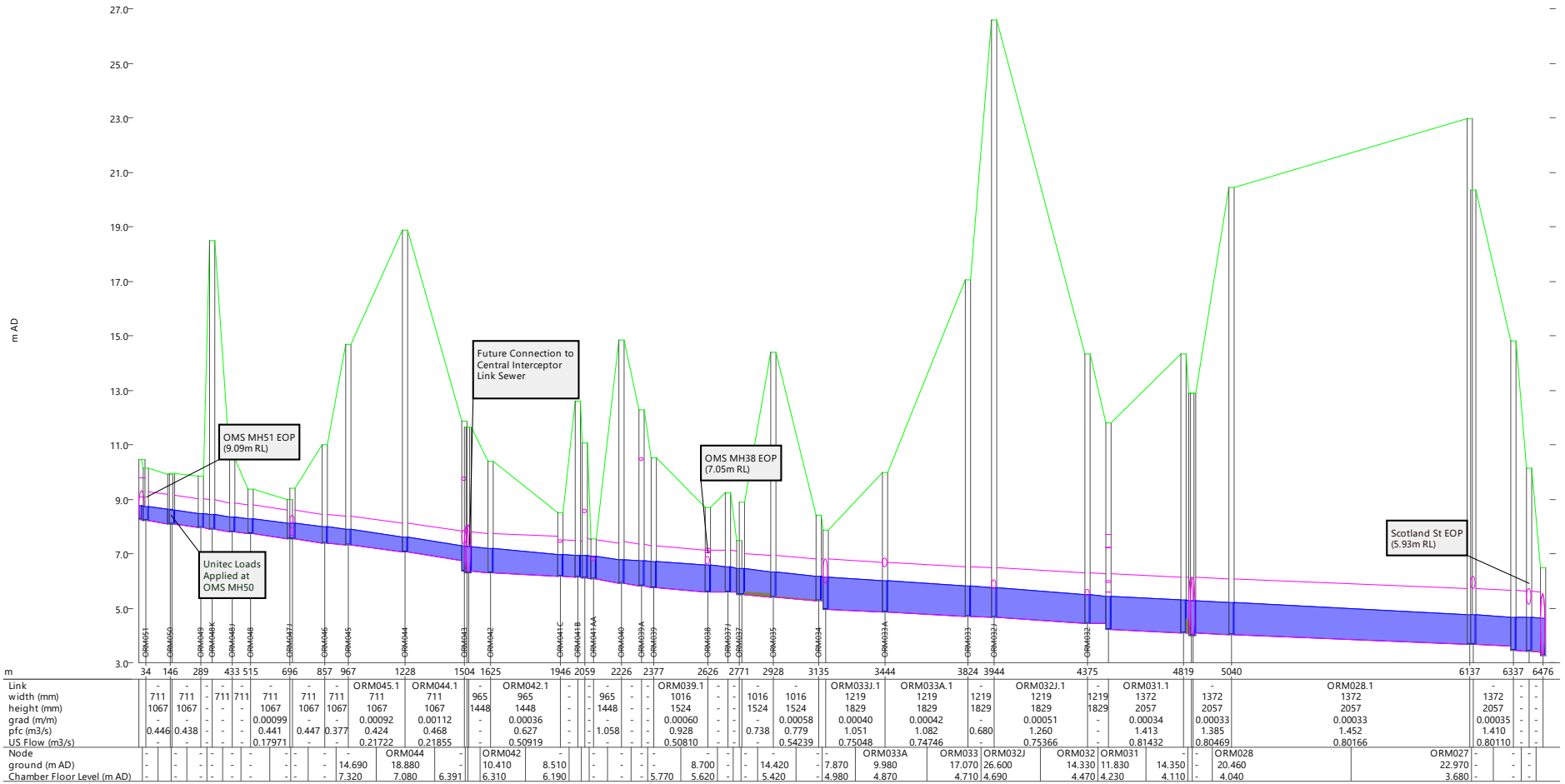

Figure B9: DWF – SP2030NoCI - CI Update Issue 1 – Hydraulic Profile from OMS MH51 (US of Unitec Site) to OMS MH25

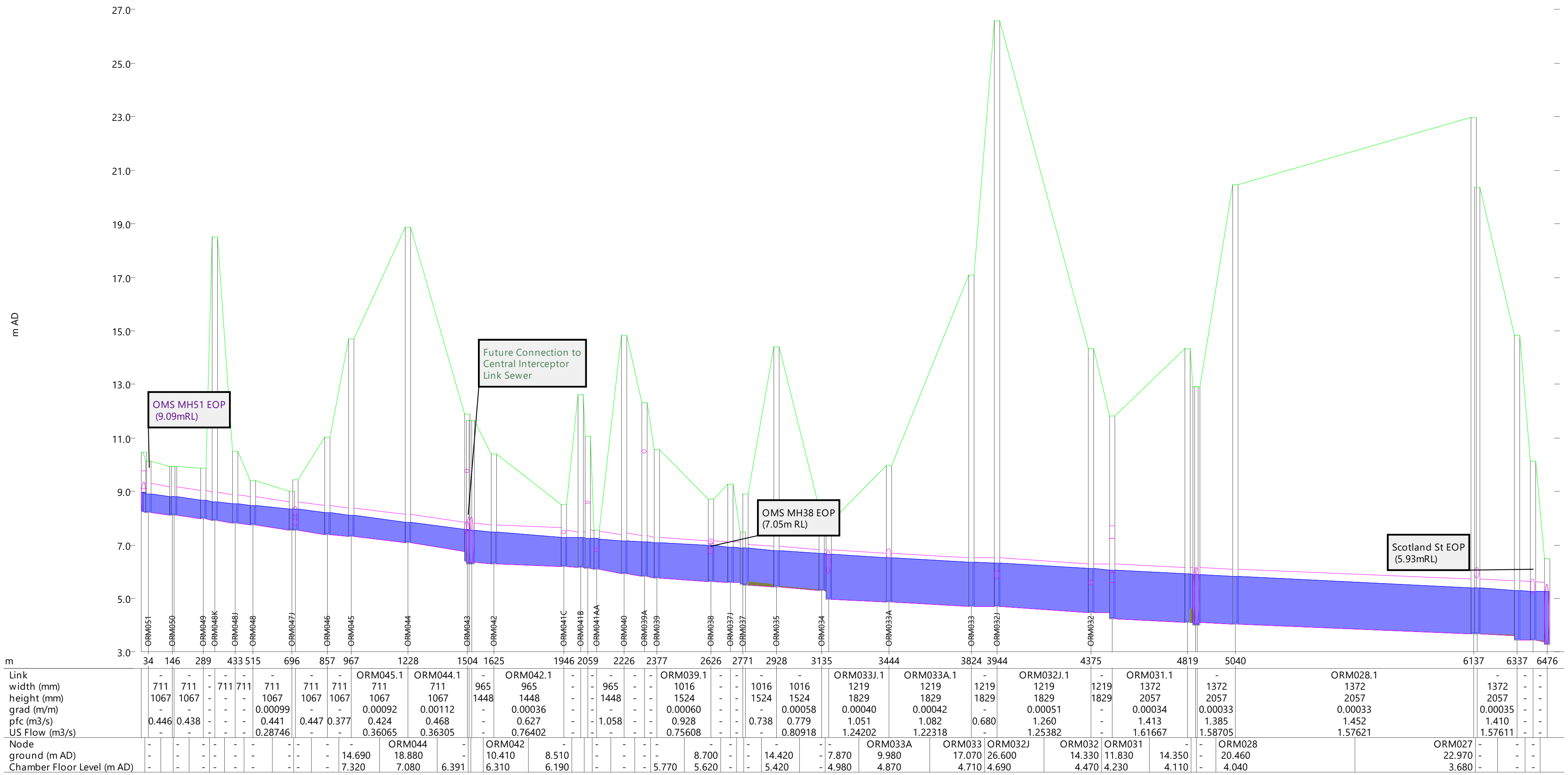

Figure B10: 1 Week Design Storm – SP2030NoCI - CI Update Issue 1 – Hydraulic Profile from OMS MH51 (US of Unitec Site) to OMS MH25

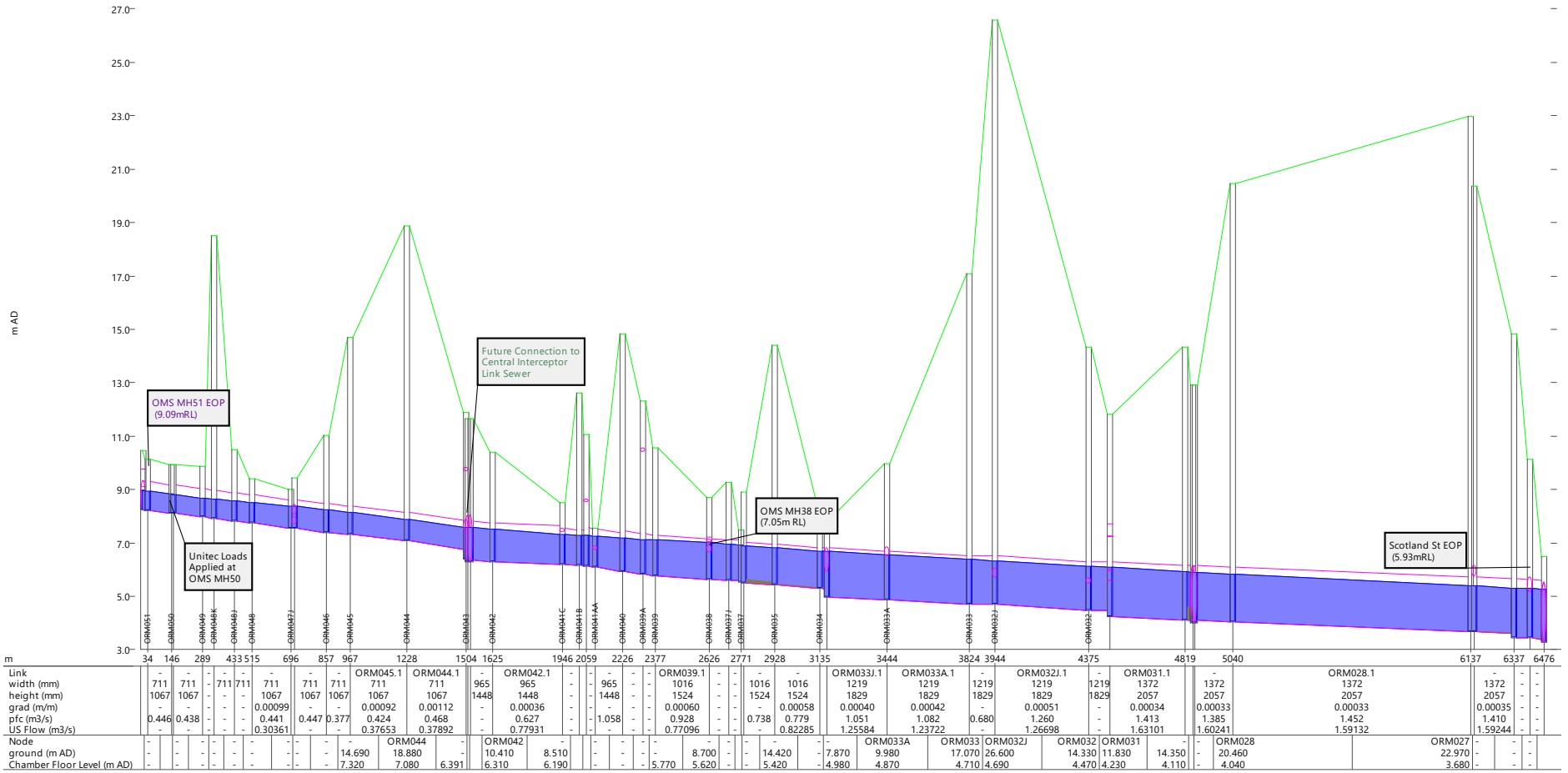

Figure 11: 1 Week Design Storm – SP2030NoCI - CI Update Issue 1_UnitecDevelopment – Hydraulic Profile from OMS MH51 (US of Unitec Site) to OMS MH25