BEFORE THE ENVIRONMENT COURT

AT AUCKLAND

I TE KŌTI TAIAO O AOTEAROA

KI TĀMAKI MAKAURAU

IN THE MATTER	of appeals under Clause 14 of Schedule 1 of the Resource Management Act 1991
BETWEEN	**BOONHAM**
	(ENV-2021-AKL-000061)
	MANGAWHAI MATTERS INCORPORATED & OTHERS
	(ENV-2021-AKL-000062)
	Appellants
AND	**KAIPARA DISTRICT COUNCIL**
	Respondent

STATEMENT OF EVIDENCE OF JAMES STUART DUFTY ON BEHALF OF MANGAWHAI CENTRAL LIMITED

(ENGINEERING)

17 December 2021

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INTRODUCTION

Qualifications and experience

1. My name is James Stuart Dufty. I am a Director at McKenzie & Co Consultants Limited. I hold a Bachelor of Civil Engineering Technology (BETech) and a New Zealand Certificate of Engineering (NZCE).

2. I have 18 years' experience as a Civil Engineer. I commenced work at McKenzie & Co in 2015 as a Senior Civil Engineer and I am the Team Leader and Lead Designer for the Civil Engineering aspects of Mangawhai Central.

3. Prior to joining McKenzie & Co, from 2013-2015 I worked in Auckland for Candor3 on various land development projects, and from 2007 – 2013 I worked abroad in United Arab Emirates for AECOM on large scale commercial and large-scale residential land developments. From 2003 – 2007 I worked in Auckland for Sinclair Knight Merz (now Jacobs) on commercial and residential projects and from 2002 to 2003 I worked for Fraser Thomas Ltd on various land development projects.

4. I have experience in working on a wide range of commercial and residential projects.

Involvement in PC78

5. I have been engaged by Mangawhai Central Limited ("MCL") with respect to various resource consent applications and engineering works approvals in relation to the Mangawhai Central Development at Molesworth Drive, Mangawhai.

6. I have also been involved in the Private Plan Change 78 ("PC78") request, including with respect to the Council-level hearing. My involvement included preparing evidence and appearing before the hearing panel.

7. I have attended various meetings with the Kaipara District Council ("KDC") to discuss PC78 and other aspects of the Mangawhai Central Development.

8. I am familiar with the application site and the surrounding locality. I have visited the site ("Site") and Mangawhai on multiple occasions since 2017, most recently on 10 Augustm2021, pre Covid boarder restrictions.

Code of Conduct

9. I confirm that I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (2014) and I agree to comply with it. In that regard, I confirm that this evidence is within my expertise, except where I state that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

10. In my evidence, I:

    (a) outline the existing site works and explain the sediment and erosion control measures that are being implemented and are proposed;

    (b) explain the water and wastewater infrastructure and utility services associated with PC78;

    (c) outline the proposed stormwater management strategy;

    (d) outline how the proposed PC78 development addresses the potential for adverse effects from hazards;

    (e) briefly comment on roading matters from an engineering perspective;

    (f) address water demand and supply; and

    (g) summarise my conclusions regarding engineering matters.

SITE WORKS AND EROSION/SEDIMENT CONTROL MEASURES

11. Although the purpose of this evidence is to address matters relating to PC78, the resource consents already obtained for the

Site might be considered relevant. Those enabling earthworks are subject to conditions concerning the potential for mobilisation of silt and discharge into the estuary. This is a key concern for appellants and s 274 parties in relation to PC 78. A number of works within the PC78 area are underway and in my view the consents enabling those works demonstrate how potential earthworks effects are able to be managed, including through resource consent conditions, and engineering design and standards.

12. The proposed PC78 development earthworks footprint has a similar footprint to the earthworks that would be required to develop Estuary Estates in the Operative District Plan. MCL has existing resource consents for bulk earthworks at the PC78 Site[1], involving approximately 650,000m^3 of topsoil or clay being redistributed around the Site. These works are currently underway in various stages and will be re-purposed if PC78 is turned down.

13. The approved bulk earthwork consents cover approximately 95ha of the proposed 102ha proposed PC78 development footprint. These consents have been approved by both the KDC and Northland Regional Council ("NRC") on the basis that the onsite management measures and procedures appropriately avoid, remedy, or mitigate the effects of the earthworks on the estuary and wider environment.

14. MCL also obtained consent for additional earthworks within the same footprint as the bulk earthworks for lot platforming, road formation, gulleting, berm works, a vegetated bund, swale and minor shaping into existing ground levels associated with the approved Town Centre/Supermarket consent (RM190282), Service Zone Subdivision (RM190283) and Retirement Village Ring Road Consent (RM210103). These works are currently underway.

15. Earthworks related to the proposed water reservoir located in the Northern area of the site have also been consented by NRC (AUT

[1]NRC Earthworks Consents 039619.01, 042034.01, 042789.01, 042803.01 and KDC Earthworks Consents 180243, 190282, 190283, 200102, 200156, 210103, 210143, 210144.

043233.01.01 as outlined in my evidence below and in the evidence of Mr Williamson.

16. Regional Council consents were also obtained (AUT.039619.01.01, AUT.039619.02.01, AUT.039619.03.01, AUT.042034.01.01, AUT.042034.01.02, AUT.042034.01.03) for earthworks, the discharge of stormwater from earthworks and diversion of stormwater during earthworks. These have been partially implemented associated with the relevant Kaipara District Council bulk earthwork consents.

17. The use of Auckland Council's Guideline Document 2016/005 ("GD05") *Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region* has been agreed with KDC as being current best practise to utilise in the Kaipara District (in the absence of any equivalent document from NRC). A variety of sediment and erosion control measures were proposed and have been implemented in accordance with GD05.

18. Sediment and erosion control measures proposed/implemented at the PC78 site to date include:

    (a) stabilised construction entrances;

    (b) clean water and dirty diversion drains;

    (c) decant earth bunds;

    (d) oversized sediment retention ponds;

    (e) super silt fences and standard silt fences; and

    (f) progressive stabilisation as earthworks are completed

19. Where possible, sediment ponds have been utilised. When constructing these ponds additional volume has been provided well above the GD05 standards, further bolstering the treatment storage capacity in larger rainfall events.

20. Secondary devices have been installed around sensitive areas, further strengthening the sediment controls in the unlikely event of failure. This is well above any presently required standards.

21. State of the art electronic dosing devices ("EDD") have been installed on all sediment ponds which provide highly accurate dosing rates which are more robust than the required flocculation devices under GD05.[2]

22. EDD provide SMS alerts (text messages) in case of low flocculant and post all data to a website on the performance of the treatment device. This allows real time updates and adjustments to be made immediately and/or during rain events.

23. At the time of writing this evidence, sediment control measures were proving to be working effectively to prevent silt movements from the Site in the rainfall events associated with the tail of Cyclone Ruby.

24. Conditions of consent were also imposed requiring (amongst other things) preparation of the following Management Plans relating to engineering matters, and their implementation: Erosion and Sediment Control Management Plan, Construction Management Plan, Construction Traffic Management Plan, Dust Management Plan, Chemical Treatment Management Plan.

25. The above consents were obtained under the operative District Plan provisions which include earthworks rules applicable across the district. In my opinion the controls implemented under these consents accord with or exceed current industry best practise.

26. I expect that continued development on the Site under any future consents granted would continue to be to the same standard, or any newer replacement standard, and resource consents would contain similar conditions to manage effects.

27. PC78 includes a range of provisions relating to stormwater management (refer to the evidence of Mr Van de Munckhof), including erosion and sediment control.[3] I support these PC78 provisions from an engineering perspective.

[2] I understand that at the time of writing this evidence, the EDD were offsite for maintenance.
[3] Refer for example PC78 16.7.4.1 j) ii) providing for implementation of best practice erosion and sediment control with respect to earthworks.

INFRASTRUCTURE

28. The existing Estuary Estates Structure Plan ("EESP") area and Chapter 16 of the Operative District Plan provide for 500 household units, approximately 3.4ha GFA for commercial and retail activities, and approximately 4ha of Service 7 Sub Zone activities.

29. PC78 seeks to delete the Operative Plan's maximum cap of 500 household units and to enable more dwellings. While no specific "cap" is proposed in PC78, based on design testing as outlined in the evidence of Mr Munro, approximately 1,000 dwellings are enabled by PC78, and the scale of commercial and service zone development is based on the existing resource consents described earlier.[4]

Wastewater

30. I understand that wastewater, including the capacity of the Mangawhai Community Wastewater Treatment Plant, will be addressed in detail in evidence on behalf of Kaipara District Council. The Mangawhai Community Wastewater Treatment Plant is a modular plant that can be upgraded to accommodate additional loads. KDC has released several reports outlining the existing capacity of the treatment plant (and associated disposal network) and the proposed future upgrades to increase capacity.[5] KDC has also allocated budget in the Long Term Plan for treatment plant upgrades and wastewater network[6].

31. The consented town centre/supermarket and Service Zone subdivision design has been based on the construction of a new connection and modification to the existing KDC low pressure main system which runs along the southern boundary of the Site. Each of these lots is to be serviced by individual pump stations to lift wastewater to a low-pressure system in the road network which will then connect into the wider low-pressure system. The

[4] Mr Munro's evidence (17 December 2021) summarises the key consents granted to date for the Mangawhai Central development (see in particular Attachment 5 to Mr Munro's evidence).
[5] Numerous reports are publicly available at https://www.kaipara.govt.nz/services/water-services/wastewater/mangawhai-wastewater
[6] Kaipara District Long Term Plan 2021 to 2031, Section 5, Activity Statements – Wastewater.

consents require that individual design will be required at building consent stage, and ongoing maintenance obligations for individual systems conditioned and secured by consent notices on the titles of lots.

32. As outlined in the evidence of Mr Tollemache, additional PC78 provisions for wastewater[7] have recently been proposed by MCL whereby an assessment of capacity of the existing/planned wastewater network is required as part of each subdivision and land use application. These provisions highlight the need for a developer to confirm wastewater capacity is available prior to achieving any titles related to any proposed subdivision and land use consent.

Water

33. There is no KDC reticulated water supply in Mangawhai other than a minor network located near the Mangawhai Camping ground. Under the Operative Chapter 16, the existing EESP area (and the rest of Mangawhai) is reliant on rainwater tanks and/or an alternative solution. As outlined above, this equates to 500 household units and the identified areas of commercial and service zone development. The yield difference between the development enabled by the Operative EESP and PC78 is effectively approximately 500 additional household units/retirement units.

34. Water source options/alternatives for the PC78 development include:

    (a) Rainwater harvesting tanks and/or other devices to collect roof water runoff for re-use and firefighting supply;

    (b) Two (consented) high flow water takes could be used to draw water from onsite water bodies during high flows for storage in a 100,000m^3 water reservoir onsite, supplying a reticulated network which I address below (Mr Williamson's evidence addresses this option in detail);

[7] PC78 provisions, 16.7.4 Discretions for Restricted Discretionary Activities, 16.7.4.1 Assessment Criteria, 16.10.8.1 Matters Over Which Discretion is Restricted, 16.10.8.2 Assessment Criteria for Restricted Discretionary Activities.

(c) Groundwater supply is available via a bore under an approved resource consent to take up to 100m^3/day.

35. The water supply proposed for the PC78 development is a combination of the above alternatives. I acknowledge that PC78 water supply is heavily reliant on rainwater tanks, as is the case for the rest of Mangawhai[8] and most of the Kaipara district.

36. A reticulated water supply network is proposed to service the residential lots in Subzone 3A because the proposed site sizes can restrain the ability to provide sufficient 'on-lot' water supply.[9] I address the proposed reticulated network in more detail in my evidence below, focussing on water demand. Mr Williamson addresses the proposed water supply and storage system for the reticulated network (consented high flow surface water takes and a 100m^3 reservoir), including its reliability with respect to meeting estimated demand, in his evidence. Under PC78, the proposed reticulated water supply solution is now required to meet all relevant legislative requirements for drinking water.[10]

37. All residential lots are required to incorporate water saving devices/fittings.[11] Including to respond to issues raised by parties to the appeals, MCL has also proposed to increase the volume/storage of rainwater harvesting tanks required on non-reticulated lots to 50m^3 (including 10m^3 for fire fighting).[12] It should be noted that the minimum volume for non-reticulated residential lots within Mangawhai is currently 25m^3. The PC78 provision for potable water volume is 40m^3 which provides an additional 15m^3 on top of current standards. This is a significant volume for a single dwelling.

38. In addition, each residential dwelling connected to the proposed reticulated network will require a minimum of 5m^3 rainwater tank(s)

[8] Except or the Mangawhai camping ground network mentioned above.
[9] Business Subzone 1 and an area of Residential Subzone 3B at the east of the PC78 site *could* also be connected to the reticulated network, as I describe in my evidence below.
[10] PC78 provision 16.3.9.1 Polices
[11] Refer PC78 16.7.4 ee); 16.7.4.1 ee) i); 16.10.8.1 d); and 16.10.8.2 n).
[12] PC78 16.8.3 b), which states*: "A non-reticulated dwelling must provide a minimum 50 m^3 water storage, inclusive of 10 m^3 for fire safety (Rule 16.8.11). Where a reticulated firefighting network is available, the dwelling must provide a minimum 40 m3 water storage."* I confirm that it is possible for 50m^3 of water storage in tanks to be accommodated (spatially) within all lots that are proposed to be non-reticulated (Sub-Zones 3B-3D), underground and/or in rear or side yards. The minimum lot size in Sub-zone 3B is 500m^2 and the minimum lot size in Sub-Zone 3D is 1,000m^2.

and each Retirement Village dwelling will require a minimum of 3m^3 rainwater tank(s).[13]

39. The town centre and supermarket resource consent utilise rainwater harvesting and a bulk firefighting reservoir to supply firefighting flows.

Other Utilities

40. Power supply and telecommunications can be confirmed for each stage of development. In my experience with land development this is usual practise.

STORMWATER

41. Development of the PC78 site has the potential to cause adverse effects in terms of stormwater runoff quantity and quality.

42. KDC currently holds a Stormwater Network Discharge Consent ("NDC") for Mangawhai. The NDC sets the baseline parameters for discharge quality to the harbour.

43. The Stormwater Management Plan ("SMP") provided with the PC78 application[14] outlines options for specific development stages to manage stormwater quantity and quality. As outlined in the evidence of Mr Van de Munckhof, the SMP provides a stormwater management framework based on:

    (a) On-site retention and re-use of stormwater;

    (b) Stormwater treatment; and

    (c) Where possible, opportunities for groundwater recharge and enhancement of base flows to streams.

44. The SMP represents a change to the stormwater infrastructure that is shown on the Operative EESP. The details within the EESP are not consistent with the standards now prescribed by the Kaipara District Engineering Standards, nor with best practice

[13] PC78 Provision, 16.8.3 Water Supply and Wastewater Supply.
[14] Stormwater Management Plan for Proposed Private Plan Change (October 2019), Romeo Dela Cruz.

stormwater management.[15] This is due to the Operative EESP and the Kaipara District Engineering Standards representing outdated engineering practice.

45. Specific implementation of the SMP and detailed design to match each stage of development can be provided at consenting stage, as would be necessary to confirm that the design incorporates Auckland Council GD01, GD04 and GD07 (as prescribed by the proposed SMP and zone provisions) for approval by the NRC. This is typical land development practice in my experience.

46. During pre-application processes for both PC78 and resource consenting, it was agreed with KDC that the Auckland Council best practise technical Guides should apply, in the absence of any equivalent NRC standards. Specifically, the design of structures is to follow the Auckland Council's Technical Publication 10 (2003) Stormwater Management Devices: Design Guidelines Manual, and Auckland Council's GD04 on Water Sensitive Stormwater Design.[16] The following documents are also considered to represent best practice, have been implemented to date, and are referenced in PC78:[17]

    (a) Guideline Document 2017/01 Stormwater Management Devices in the Auckland Region. December 2017 (Amendment 2);

    (b) Guideline Document 2015/04 Water Sensitive Design for Stormwater. March 2015;

    (c) Guideline Document 2021/07 Stormwater Soakage and Groundwater Recharge in the Auckland Region Version 1, 2021.

    (d) Guideline Document 2016/05 Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region. Incorporating amendment 2, 2020.

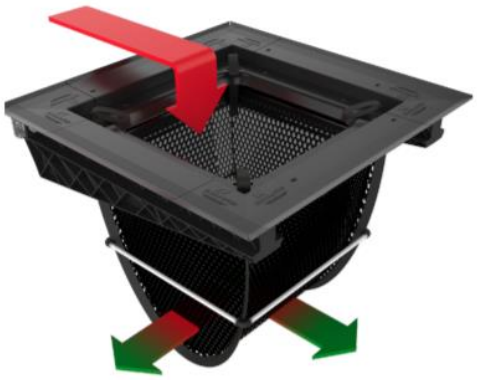
[15] The Auckland Council Guidelines for use in the Auckland Region.
[16] PC78 provisions 16.1.6 District Plan Wide Provisions.
[17] PC78 16.1.6.

47. Dr Kelly has highlighted the impact litter can have on a receiving environment if it is able to enter the stormwater network. Typically litter generation is higher in areas of concentrated gathering of persons such as retail/commercial areas. In commercial areas, an emphasis on rubbish bin placement should reduce the ability for litter (gross pollutants) to enter the piped network but additional methods are best practice. PC78 incorporates specific litter management provisions.[18]

48. Low Impact/Water Sensitive Design for stormwater treatment is proposed for the development and incorporated into PC78.[19] Runoff from the consented commercial/retail area will be collected through raingardens and planted swales before entering the stormwater network. These devices also help to collect larger gross pollutants.

49. Further protection in the commercial areas is proposed with the use of litter traps which will be placed in all private carparks. Private cesspits are proposed to be fitted with litter traps, which is a filter bag that sits inside the cesspit and captures litter/gross pollutants. The maintenance of these litter traps will form part of the private ownership of carparks and does not fall on KDC to maintain. These are typically a building consent detail.

Figure One: Stormwater 360 Littertrap used as a gross pollutant trap. This device sits within a cesspit in private carparks



[18] PC78 16.7.4.1 c) v); and 16.9.3.2.1 c).
[19] Refer to the evidence of Mr Van de Munckhof.

50. In general, carparks are considered to generate the highest contaminant loads. It should be noted that proposed Business 1 Subzone under PC78 has approximately 2.2ha less area than under the Operative EESP (5.3ha compared to 7.5ha, approximately a 30% reduction). As outlined in Mr Van De Munckhof's evidence, this is expected to generate less high contaminant areas than the Operative EESP based on assumed less carpark areas.[20]

51. Stormwater outfalls will form part of the development. PC78 requires the design of outfalls to mitigate concentrated flows.[21] Outfalls will be designed in accordance with the KDC standards to provide suitable scour protection and energy dissipation. The best practicable option ("BPO") will be implemented which is focused on reducing velocities/energy and dispersing flows. These BPO options include, but are not limited to, riprap for scour protection, energy baffles at outlets if deemed necessary, stilling basins, and level spreaders. Outfall design is typically a resource consent level of detail. Under resource consents RM190129, RM 190283, 210143 and RM210103 multiple stormwater outfalls have already been consented and meet best practice/standards.

52. For completeness, to develop the Site under the Operative Chapter 16 provisions, multiple outlets are required which would all require suitable erosion protection design at any resource consent stage.

HAZARDS

Flooding/Sea Level Rise

53. The operative Chapter 16 provisions include specific minimum finished floor level requirements for habitable spaces to avoid potential flooding and sea level rise effects. Updated flood modelling was undertaken by Stantec[22] and was incorporated into the relevant MCL resource consent applications to ensure that the

[20] Mr Van de Munckhof also identifies that under PC78 the Service 7 Sub-Zone is proposed to increase from 7.5ha to 8.2ha; however, PC78 still proposes an overall decrease in areas zoned for business/service activity.
[21] PC78 16.10.8.2 j).
[22] Stantec Report Mangawhai Stormwater Modelling Development Scenarios.

potential for flooding and sea level rise was addressed in the finished contours for the approved bulk earthworks consent (RM190096).

54. PC78 proposes minimum floor levels for habitable buildings, and for commercial, industrial and non-habitable buildings.[23] These minimum floor levels are appropriate in my opinion.

55. A piped network is proposed to meet the KDC standards for conveyance of stormwater and overland flow paths can be designed with each stage of development to be within the road reserve or in a dedicated flowpath channel, both of which are standard practice.

56. NRC has commissioned specific tsunami modelling for the Region. The Mangawhai area has been modelled by NIWA. The modelled tsunami risk is addressed in the SMP and infrastructure reports provided with the PC78 application which show that any risk can be managed by adherence to minimum floor level requirements and the contours approved by the bulk earthworks.

Geotechnical

57. Geotechnical ground conditions and specific future foundation design can be addressed with each specific development stage through the resource consent process. Any recommendations for future lots can be enforced via consent notices (or similar) on the titles.

ROADING

58. Traffic related effects are addressed in the evidence of Mr Hills.

59. All consented roads have focused on the following engineering/design outcomes/principles

    (a) Stormwater treatment in line with best practice standards;

[23] PC78 16.8.2.1.

(b) Appropriate amenity planting: street trees and raingarden planting;

(c) Strong Cycleway and pedestrian links;

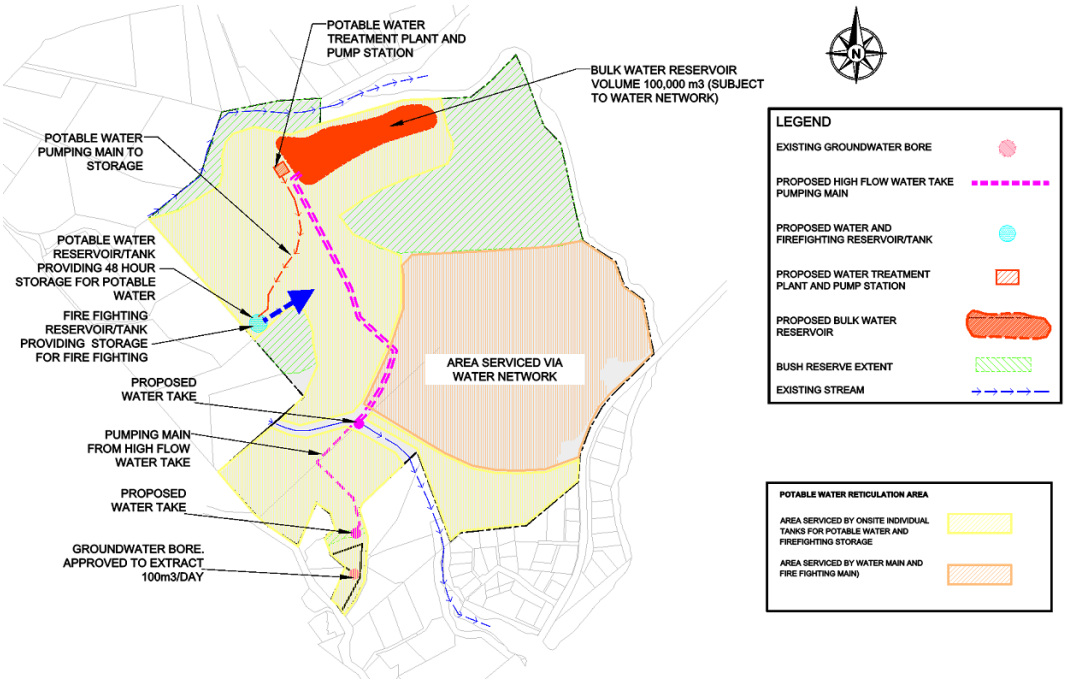
(d) Sufficient on street parking;

(e) Safe Conveyance of 1% AEP Stormwater event to appropriate discharge points.

THE PROPOSED RETICULATED WATER NETWORK

60. As outlined above, a water reticulation network (including an onsite reservoir) is proposed as part of the PC78 development. Figure Two below sets out a schematic diagram of the proposed reticulated network.

Figure Two: Proposed reticulated water network schematic

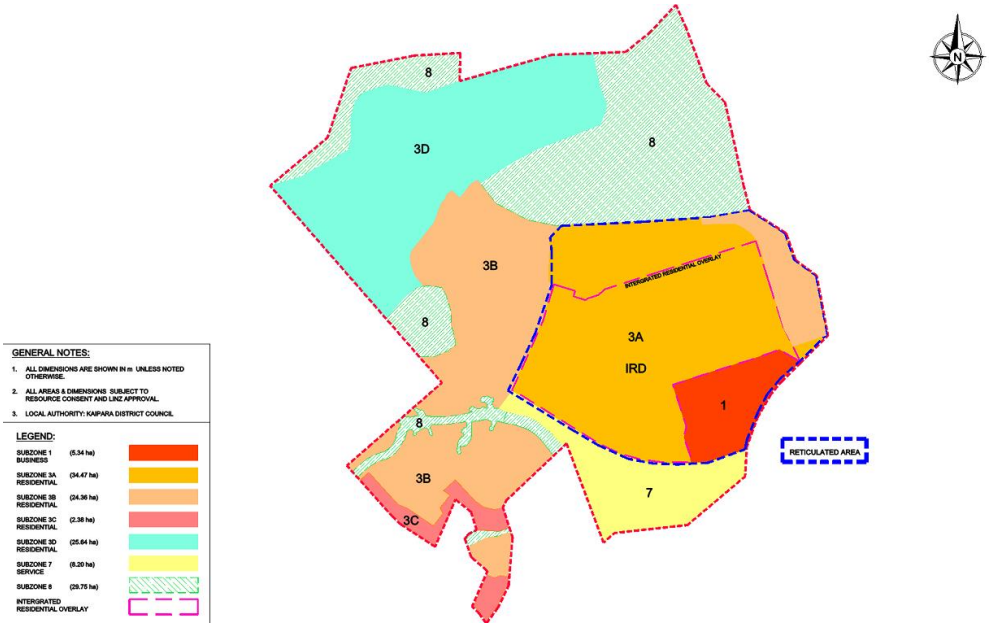


61. Due to possible lot sizes within the Integrated Residential Development Overlay of Subzone 3A (refer to the PC78 Zone Map), Subzone 3A is expected to rely on water reticulation for potable water. The water reticulation network is intended to service the entire Subzone 3A area. It *could* also be used to service the

Business Subzone 1 and the area of Residential Subzone 3B at the east of the PC78 site.

62. The potential extent of the area to be reticulated (i.e. connected to the reticulated network) is shown as the "Reticulated Area" in Figure Three below.

Figure Three: Potential extent of the Reticulated Area[24]



63. In addition to covering the Residential 3A Subzone, the "Reticulated Area" in Figure 3 also includes:

(a) Business Subzone 1; and

(b) the area of Residential Subzone B to the east of the site;

64. both of which could, but do not need to, connect to the reticulated network. These two areas would not need to connect to the Reticulated Network because their lot sizes mean that onsite rainwater tanks can readily be accommodated to supply all water requirements.

65. A significant portion of the Subzone 1 Business area has already been consented (and construction has commenced) based on

[24]As outlined in paragraphs 63-66 below, the proposed Subzone 1 Business Area and the Subzone 3B area near the estuary have been assumed to be connected to the reticulation network under the demand scenarios detailed below. However, these areas can rely solely on rainwater tanks. The reticulated network demand estimates are therefore conservative.

rainwater harvesting only, with no allowance/demand for a potable water network. However, under the two estimated demand scenarios (outlined below) it has been assumed that the reticulated network is connected to rain water harvesting tanks across the Business 1 Subzone for the purposes of top-ups during drier periods (representing a conservative approach with respect to estimated reticulated network demand).

66. In addition, the Subzone 3B area at the east of the Site could be serviced by onsite rainwater tanks (given its minimum lot size of 500m^2) but has been assumed - for the purposes of the demand calculations - to be connected to the reticulated network. Again, this represents a conservative approach.

67. Residential land outside the reticulated network can be supported by rainwater collection, which is standard practice in Mangawhai and elsewhere.

Water demand per residential household

68. As outlined in Watercare standards[25], a typical demand estimation of a daily water consumption is 220L/person/day.

69. Watercare design residential occupancy allowances for 2-4 bedroom houses is 3 people (see Table One below).[26]

Table One: Watercare design residential occupancy allowances

Table 6.1.a - Design residential occupancy allowances

Number of bedrooms (Notes 1 and 2)	*Occupancy for design purposes (i.e. people)*
1	*2*
2-4	*3*

70. Watercare design for a typical demand estimation for retirement village single bedroom units is 1.5 people per unit.[27]

[25] Watercare, The Auckland Code of Practice for Land Development and Subdivision, Water and Wastewater code of Practice for Land Development and Subdivision, 2019, Chapter 6 Water.
[26] Watercare, The Auckland Code of Practice for Land Development and Subdivision, Water and Wastewater code of Practice for Land Development and Subdivision, 2019, Chapter 6 Water.
[27] Watercare, The Auckland Code of Practice for Land Development and Subdivision, Water and Wastewater code of Practice for Land Development and Subdivision, 2019, Chapter 6 Water.

71. Applying the standard Watercare design inputs, this provides a daily demand per residential household of 660L/per house. (220L/person/day x 3 people).

72. Applying the standard Watercare design inputs for retirement village units, this provides a daily demand per residential household of 330L/per house (220L/person/day x 1.5 people).

73. For projected water demands (outlined below) it is assumed that all residential properties are fully occupied every day of the year.

74. In my opinion, the 220L/per person/per day is a conservative approach for calculating demand per household. As outlined in a 2017 Watercare document[28], it was concluded that the actual average daily usage (demand) per person is circa 160L/day. Nevertheless, the Watercare standards have been adopted for the purposes of determining the water demands for the development.

Typical water use per household

75. Typical breakdowns of residential household water use are shown in Figure Five below, based on a Watercare Report, 2017.[29]

Figure Five: Typical residential water use

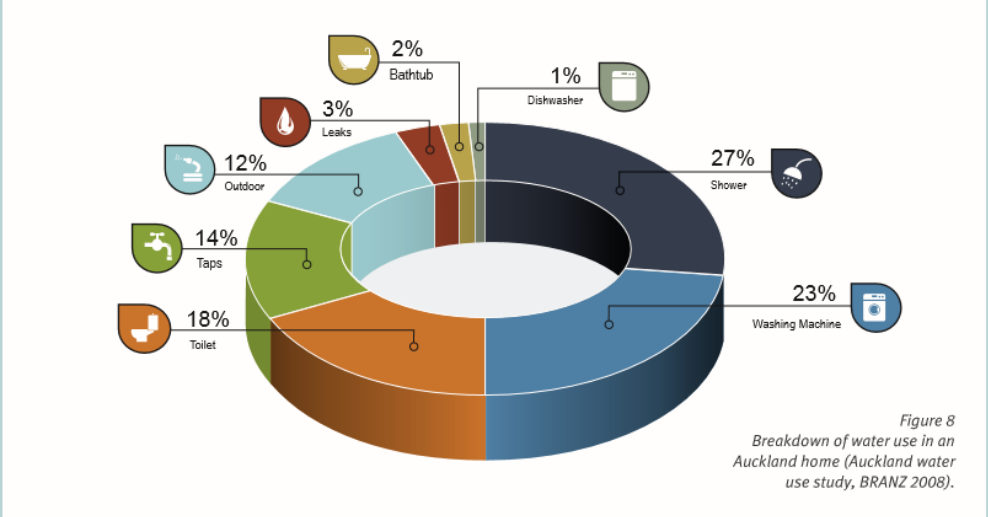


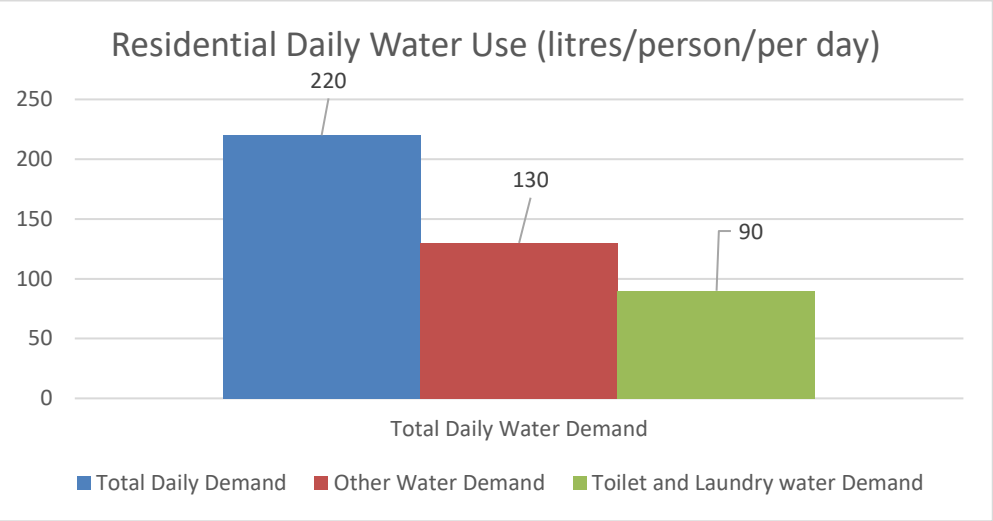
Figure 8
Breakdown of water use in an Auckland home (Auckland water use study, BRANZ 2008).

76. I note that toilets and laundry water usage equate to circa 40% of daily demand per household. Based on a conservative 660L/per

[28] Auckland Water efficiency strategy 2017 to 2020, Residential Water Use, page 12: 160 L/per person/per day.
[29] Watercare, Auckland Water Efficiency Strategy 2017 to 2020.

household/per day, this is equivalent to 265L/per household/per day (88 L/per person/day) (see figure Six below).

Figure Six: Residential daily water use



Supplementary rainwater harvesting

77. By supplementing the need to provide reticulated water to the toilet and laundry (40% of daily demand, approximately 90L/per person/day), supplementary rainwater harvesting is therefore a very effective tool to reduce water demand from a water reticulation network, in particular during the wetter months.

78. Supplementary[30] rainwater harvesting tanks typically vary from 500L to 5,000L. They are typically sized based on roof area vs monthly mean rainfall and are installed to capture the rainwater from the roof areas and collect it in tanks. Below at Figure Seven are typical images of supplementary rainwater tanks of different sizes used to supplement toilet/laundry water demand.

[30] Supplementary rainwater harvesting tanks are tanks supplementing lots connected to a reticulated network.

Figure Seven[31]

79. The Homestar Technical Manual[32] focuses on rainwater harvesting as a supplementary rather than primary source, being a key component to the approach of water design, and also focuses on effective ways to reduce water demand in residential houses. Rainwater harvesting promotes the supplementary reuse of the collected rainwater to be plumbed into the toilet and laundry facilities within the residential house.

80. As outlined above, PC78 provisions require that each residential dwelling connected to the reticulated network must provide a minimum of 5m^3 rainwater tank(s), and each Retirement Village dwelling must provide a minimum of 3m^3 rainwater tank(s).[33] These rainwater tanks will be required to be plumbed to the toilet and washing machine.

[31] Size and type of tanks shown are Promax Plastic Slimline tanks 3000L (3m^3) & Tanksalot Corrugated Slimline Tank 5000L (5m^3).
[32] Homestar v5 Technical Manual, version 5.0.2 for public release.
[33] PC78 Provision, 16.8.3 Water Supply and Wastewater Supply.

Reduction in daily water demand using water saving devices

81. It is not uncommon for residential houses to use water saving devices to reduce water demand. This is a typical approach for houses when designing onsite wastewater systems (disposal fields) to reduce the actual daily demand which in turn reduces the footprint of the disposal field. Disposal fields are not proposed as part of the PC78 development, however the approach of water saving fixtures, as highlighted in *TP58 On Site Wastewater Systems – Auckland Council* ("TP58")[34], reinforces the effectiveness of water saving fixtures with respect to daily water demand reductions.

82. As outlined in TP58, the effectiveness of the reduction in water demand is dependent on the number of water saving fixtures in place. See the below Table Two (from TP58) for water reduction based on water saving devices:

Table Two: TP58 water reductions based on water saving devices

Table 6.3: Flow Allowance Reduction Calculations for Household Flows

FLOW ALLOWANCE Litres/Person/Day	CALCULATION	JUSTIFICATION
B. Standard Fixtures 180 – 200 L/p/d		Toilet use flow volume based on 5 flushes/d @ 11 litres/flush l(L/f) s 11 L/f x 5 f/p/d = 55L/p/d (Toilet use only)
C. Household with 11/5.5 or 6/3 litre flush 160 L/p/d	180 L/p/d – 22 L/p/d = 158 L/p/d	**Dual flush 11/5.5 L flush** 1flush x 11 litres plus 4 flushes x 5.5 litres = 33l/p/d OR 22 litres less per person per day
D. Household with 6/3 litre flush and Water Reduction Fixtures *145 L/p/d*	180 L/p/d – 37 L/p/d = 143 L/p/d	**Dual low flush 6/3 litre** 1 flush x 6 L plus 4 flushes x 3 L = 18 L/p/d OR 37 litres less per person per day
E. Household with Full Water Reduction Fixtures *120 L/p/d*	145 L/p/d – 26 L/p/d = 119 L/p/d	**Dual low flush PLUS water reduction valves** etc having an 18% reduction from water saving devices is 26 L/p/d giving a total % reduction from 180 L/p/d to 120 L/p/d of 35% (made up of 20% for 6/3 toilets and 15% for water reduction fixtures)

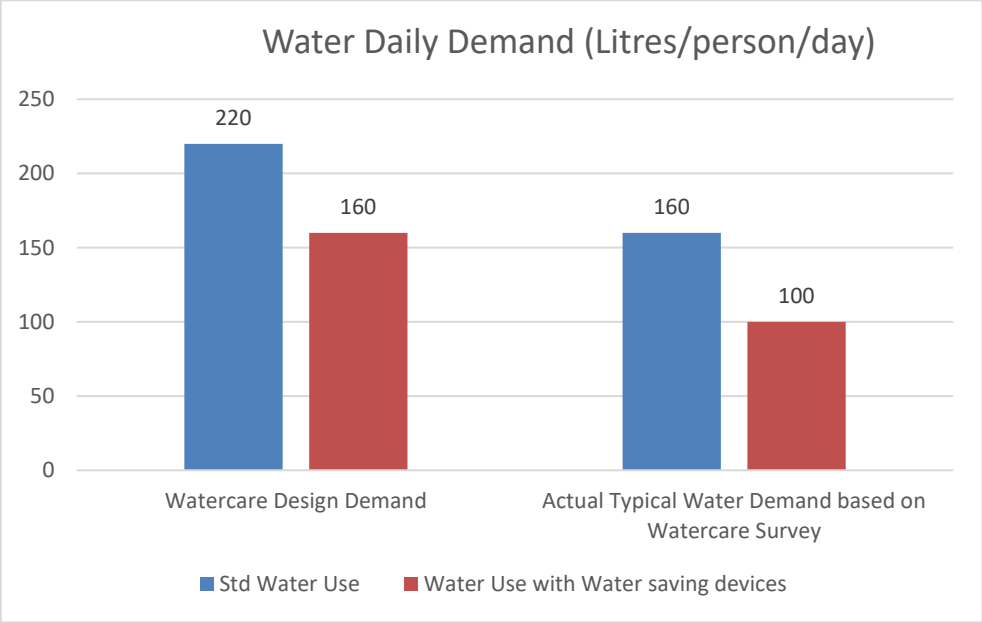
83. TP58 shows a reduction in daily demand per person of up to 60L-80L/per person/day when applying water saving fixtures to the household. This would take the original conservative Watercare design demand from 220L/per person/day to 160-140 litres/per person/day. Furthermore, if this water reduction was applied to the actual current Watercare demand based on household surveys,

[34] TP58 On Site Wastewater Systems, 6.3.2 Design Flow Allowances Per Person.

which is 160L/per person/day, it would further reduce this to 100L-80/per person/day.

84. Figure Eight below is a graph showing the reduction of water demand when applying water saving devices based on Watercare Design Demand and Actual Demand[35].

Figure Eight: water daily demand



85. Calculated water demands for the PC78 development (outlined below) do not incorporate demand reductions from water saving devices, which would significantly reduce water demand on a daily basis. This is based on a conservative approach.

86. However, as outlined above, PC78 requires all residential lots to incorporate water saving devices/fittings.[36]

Standards to reduce water demand of residential lots

87. As I have outlined above, PC78 is promoting/requiring water saving fixtures and rainwater harvesting tanks. Many developments are starting to incorporate water saving devices and rainwater harvesting tanks, with a focus on providing a sustainable approach to water supply.

[35] Water Demand Reduction as per TP58 is 80-60L/per person/day. The conservative 60L/p/d has been adopted for reducing water demand based on water reducing devices
[36] Refer PC78 16.7.4 ee); 16.7.4.1 ee) i); 16.10.8.1 d); and 16.10.8.2 n).

88. There are strict Australian/New Zealand standards that identify and control the quality of water saving devices. The Water Efficiency Labelling Scheme (WELS) is a standard that identifies and classifies the effectiveness of water efficient products.

89. The New Zealand Green Building Council (NZGBC) is a non-profit membership organisation that promotes better buildings. The NZGBC uses Homestar, an independent comprehensive, national environmental rating tool for assessing the health, efficiency and sustainability of houses. As outlined in the Homestar Technical Manual[37], the overarching objective of the Homestar rating tool is to improve the performance and reduce the environmental impact of new and existing New Zealand dwellings.

Water Efficiency Labelling Scheme (WELS)

90. For the PC78 development, MCL proposes to use water saving devices/fixtures, such as the Water Efficiency Labelling Scheme (WELS)[38]. *AS/NZS 6400:2016, Water efficient products – Rating and labelling* outlines the objectives of WELS. The WELS standards ensure any water saving device being sold complies with Australia/New Zealand standards. The label (see an example at Figure Nine below) is also designed to help purchasers make informed choices about water efficiency products. This Standard also provides rules that can be enforced at building consent stage on developments that are pursuing a sustainable approach to water use on residential lots.

[37] Homestar v5 Technical Manual, Aims and Objectives of Homestar, page 8.

Figure Nine: Example WELS label

Homestar Standard (WELS)

91. Homestar uses WELS (Water Efficiency Labelling Scheme) for determining the effectiveness of water reduction in residential houses.

92. The Homestar Technical Manual focuses on water savings fixtures as a key component to the sustainable approach of water design and focuses on effective ways to reduce water demand in residential houses.

93. The higher the Homestar rating (points), the more efficient the water saving device is. Below (Figure Ten) are extracts from the Homestar Standards based on Water Fixtures in relation to the WELS rating. Homestar is a star rating system for appliances that use water and is based on water flow rate in litres per minute with the most stars being awarded to the lowest water consumption during operation

Figure Ten: Extracts from Homestar Standards

Points are awarded as per the following categories:

(1) Showers	0 points	0.5 points	1.5 points
WELS Star Rating	1 Star	2 Star	3 Star
Flow Rates (L/min)	≤ 16	≤ 12	≤ 9

(2) Lavatory equipment	0.3 points	1 point	1.5 points
WELS Star Rating	3 Star	4 Star	4.5 or more Star
Flow Rates (L/flush)	6.0 L closet pans with matching 6/3 L cisterns. Avg. flush volume more than 3.5 but not more than 4.0 L/flush.	4.5 L closet pans with matching 4.5/3 L cisterns. Avg. flush volume more than 3.0 but not more than 3.5 L/flush.	Avg. flush volume not more than 2.5 L/flush. Council approved composting toilets achieve 1.5 points.
Notes: For dual flush toilets, flow rates are to be calculated from the average of 4 half flushes and one full flush. Points can then be awarded based on the information in this table.			

(4) Main kitchen sink and main bathroom hand-basin taps	0.3 points	0.6 points	1 point
WELS Star Rating	4 Star	5 Star	6 Star
Flow Rates (L/min)	≤ 7.5	≤ 6	≤ 4.5

(5) Dishwashers	0.2 points	0.3 points	0.5 points
WELS Star Rating	3 Star	4 Star	5 and 6 Star
Flow Rates (L/wash)	Variable based on model type.	Variable based on model type.	Variable based on model type.
Notes: • Dishwashers with unknown WELS ratings will be allowed 0.2 points provided they are less than 3 years old. • Where a dishwasher is not provided in the dwelling, the points will be deemed Not Applicable.			

94. To ensure water saving devices are implemented at Mangawhai Central, PC78 includes several provisions addressing water saving devices/fittings.[39] My understanding is that these devices would be required to be installed or visible at building consent inspection stage.

Calculated water demand based on masterplan

95. Based on the concept masterplan which was used to test the approximate yield of the PC78 development (as described in Mr Munro's evidence), the "Reticulated Area" is assumed to have a residential yield of approximately 620 lots. This assumes that the Reticulated Area consists of the following:[40]

(a) Retirement Village consisting of 200 units;

[39] Refer PC78 16.7.4 ee); 16.7.4.1 ee) i); 16.10.8.1 d); and 16.10.8.2 n).
[40] To respond to concerns raised by parties to the appeals, as described in Mr Tollemache's evidence the applicable zone for a portion of the residential area adjacent to the estuary has been changed from Subzone 3A (minimum lot size of 350m^2) to Subzone 3B (minimum lot size of 500m^2). For calculation/modelling purposes associated with water demand, it has been assumed that the "Reticulated Area" still has a residential yield of approximately 620 lots based on previous calculations.

(b) 420 residential lots; and

(c) Commercial/retail area with a daily demand of 54m^3.[41]

96. Applying the Watercare standard daily use per residential property, the assumed 620 lots within the "Reticulated Area" have a total daily demand of 343m^3. This does not allow for any water saving devices or rainwater harvesting.

97. Not allowing for rainwater harvesting or any water saving devices the retail/commercial area (Subzone 1 Business) within the "Reticulated Area" would have a daily demand of 54m^3.

98. Applying Watercare standard water usage rates, without any water saving and/or rainwater harvesting, the total daily demand for the "Reticulated Area" is 397m^3. This is equivalent to an annual demand of approximately 145,000m^3; or an average monthly demand of 11,916m^3 This is considered the "baseline" water demand.

99. However, as outlined above, each residential dwelling connected to the reticulated network will require a minimum of 5m^3 rainwater tanks and each Retirement Village dwelling will require a minimum of 3m^3 rainwater tanks.[42]

100. Based on the incorporation of the above rainwater harvesting (for the toilet and laundry),[43] the average daily reticulated network demand for the two scenarios is 343m^3 (S1) and 267m^3 (S2), as summarised in Table Three. This is inclusive of water being provided from the reticulated network to the supermarket/retail area for top ups.[44]

101. The consented retail/commercial area relies on rainwater harvesting only. The supermarket has a rainwater harvesting tank

[41] Commercial/retail area daily demand is based on applying Watercare standards to the consented plans for the retail/commercial area which requires 27m^3 per day (2300m^2 supermarket, 800 GFA of dry retail, 800m^2 GFA of wet retail). Any assumed future commercial/retail area is assumed to require the equivalent water demand as per the consented plans (27m^3). This is considered a conservative approach as the available area for future retail/commercial development is less than the current consented area.

[42] PC78 Provision, 16.8.3 Water Supply and Wastewater Supply.

[43] Being 5m^3 for residential lots, and 3m^3 for retirement units.

[44] Rainwater harvesting volume under the assumed scenarios is based on consented rainwater harvesting tanks of 400m^3 for the supermarket, 470m^3 for the retail area, and an assumed future volume of 310m^3 based on 35% of the storage provided in the consented areas. This is considered a conservative approach with respect to assumed future volume as it is significantly less volume than what has been provided in the consented development to date.

volume of 400m^3 and the retail area has a combined rainwater harvesting tank volume of 470m^3 Suitable water quality treatment is provided and consented for the consumption of the water.

Table Three: Reticulated Network demand under various scenarios[45]

Residential + Retirement + Supermarket & Retail			
Months	**Baseline Total Demand Only (m3) No Water Harvesting**	**Scenario 1 Total Demand less roof collection (min. rainfall) m3**	**Scenario 2 Total Demand less roof collection (mean rainfall) m3**
January	11916.00	11638.42	8822.65
February	11916.00	11450.44	7973.68
March	11916.00	11112.07	7991.17
April	11916.00	10284.95	7891.00
May	11916.00	9833.79	8025.20
June	11916.00	8966.43	7849.09
July	11916.00	9029.22	7866.69
August	11916.00	8959.93	7867.13
September	11916.00	10375.18	7887.19
October	11916.00	10623.32	8029.97
November	11916.00	10209.76	8050.96
December	11916.00	10803.78	7942.20
Sum	**142992.00**	**123287.29**	**96196.92**
Average	**11916.00**	**10273.94**	**8016.41**
Daily	397.2	342.5	267.2

102. Both demand scenarios have assumed that any rainfall that is captured will be used for toilet/laundry use and whenever there is insufficient water from the rainfall harvesting tanks, particularly during the drier months, the reticulated network will provide water to top up the tanks. Furthermore, during wetter months, it is assumed that once rainwater harvesting tanks are full any excess rainfall collected via rainfall harvesting for the month will drain to the stormwater network. The scenarios also allow for top ups to rainfall harvesting tanks in the commercial/retail area[46] and assume that any excess water captured will drain to the stormwater network.

103. The assumed roof area for the scenarios is 130m^2 for residential dwellings and 60m^2 for retirement village units.

[45] Refer to paragraph 104 below for a description of the “minimum” and “mean” rainfall scenarios in Table 3.
[46] Refer footnote 44 above.

Onsite water source and reservoir

104. Two water demand scenarios have been modelled under Mr Williamson's direction (with demand figures supplied by me), which include the rainwater harvesting described above, thereby reducing demand on the reticulated network. As outlined in Mr Williamson's evidence, the scenarios are summarised as follows:

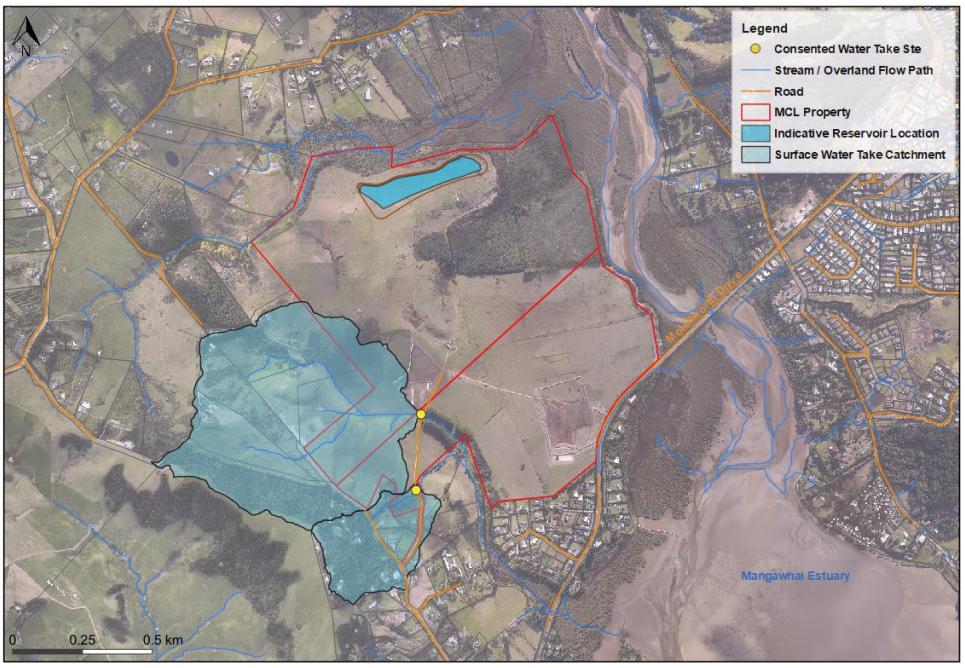
(a) **Scenario 1 (S1)** – Water use requirements are supplied from the reservoir, less rainwater harvested by individual lots based on $5m^3$ for residential lots, and $3m^3$ for retirement units. Rain harvesting was based on the lowest recorded monthly rainfall across all years; and

(b) **Scenario 2 (S2)** – Water use requirements are supplied from the reservoir, less rainwater harvested by individual lots based on $5m^3$ for residential lots, and $3m^3$ for retirement units. Rain harvesting was based on the mean monthly rainfall across all years.

105. The two scenarios are considered conservative, as neither include the use of water saving devices (e.g. low flow taps and showerheads), which would further reduce water use requirements.

106. As outlined in Mr Williamson's evidence, the modelling has shown that a reliable supply under both scenarios can be provided, from the two consented onsite high-flow water takes detailed in Mr Williamson's evidence, coupled with a $100,000m^3$ reservoir. Based on Mr Williamson's hydraulic modelling, the reservoir does not run dry throughout the year (i.e. it can provide a reliable source of potable water) based on the two scenarios. Figure Eleven below shows the water take locations onsite and the reservoir location.

Figure Eleven: location of consented water takes and proposed reservoir[47]



Firefighting supply

107. For completeness, below I provide a summary regarding firefighting water supply:

(a) Within the proposed reticulated network, firefighting water is intended to be provided via hydrants on the reticulated network sourced from a *separate* reservoir (above ground tank) providing "dead storage" located on the elevated ridge above the "Bowl" area of PC78. This water reservoir will only be used for firefighting emergencies. This tank has been approved as part of the supermarket/main street consent. Refer to Figure Two above.

(b) Outside the reticulated network, firefighting supply will be provided by properties' onsite primary water tanks, as is currently widespread throughout Mangawhai. The minimum firefighting volume for an individual residential lot is $10m^3$.

[47] Image sourced from Mr Williamson's evidence, dated 17 December 2021.

Groundwater supply

108. As I have identified above, an onsite groundwater take consent has been granted for 100m^3/per day.

109. This supplementary water source has not been considered in the water demand/supply calculations. By not including this water source in the reservoir calculations, a further element of conservatism is provided for in the water source calculations.

110. Based on Mr Williamson's modelling, supplementary top up of the reservoir by groundwater supply will not be required.

CONCLUSION

111. I am satisfied that development of the site as proposed by PC78 is feasible from an engineering perspective and that there are no engineering constraints that preclude the Site's development as proposed.

112. Engineering aspects (including sediment and erosion control; roading; and water, stormwater, and wastewater infrastructure) can all be delivered under the PC78 framework in a manner that is consistent with engineering industry best practice. I expect that off-site wastewater treatment and disposal to be undertaken by the Council will also be to industry best practice.

113. Overall, I am aware of no engineering issues precluding the granting of Plan Change 78.

James Dufty
McKenzie & Co Consultants Limited

17 December 2021