LANDWORKS
CONSULTING

496 EAST COAST ROAD, WINDSOR PARK
STORMWATER MANAGEMENT PLAN FOR PLAN CHANGE APPLICATION
JOB REF: P23-077, REV F
DATE: 19TH NOVEMBER 2024

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LIMITATION

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1 // INTRODUCTION

This report has been prepared on behalf of Windsor Park Community & Multisport Hub INC for the purposes of a private plan change application to re-zone the land.

This plan is intended to be used to inform future development at the site for private entities and Auckland Council regulatory staff, for a potential redevelopment of the subject site, with new dwellings. The report does not provide any specific designs, rather it outlines the design considerations required and demonstrates there are solutions available for a proposed development for future detailed design applications.

This plan proposes water sensitive design applications and BPO (Best practicable option) for the plan change area, and is designed to protect the natural drainage patterns wherever possible.

2 // SITE DESCRIPTION

The plan change site consists of one existing title with an area of 63,805m^2. However, the main area of development in the north of the site is only approximately 12,800m^2. The site is largely flat with an overall grade to the south. Large flat sports fields make up most of the site's area. There is an elevation difference of approximately 2m between the highest and lowest point on the site.

The site is described as "Brownfields Large" by the Regionwide Stormwater Network Discharge Consent.

There is one formalised overland flowpath within the site which is shown below. There are other OLFP's surrounding the site however do not morally enter the legal boundaries.

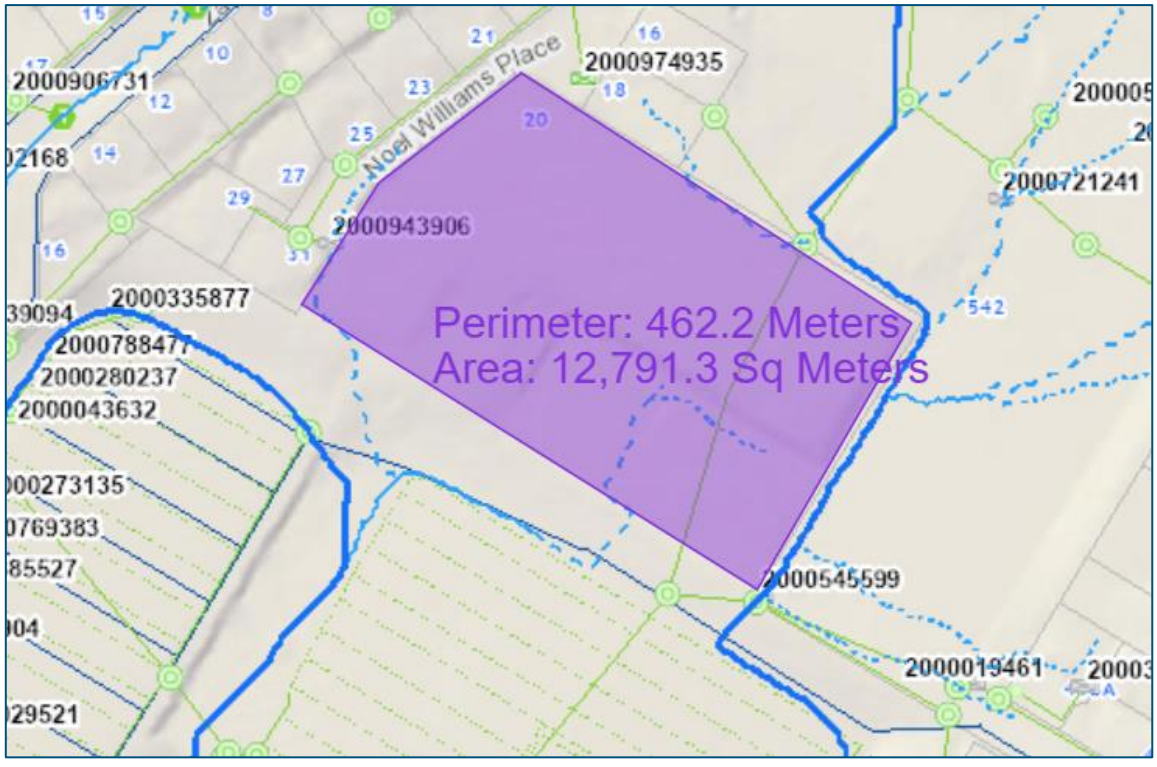


Figure 1 – Existing Stormwater Situation

There are large diameter (600mm and 750mm) concrete stormwater pipes throughout the site. These pipes enter from northern, eastern, and western boundaries respectively before combining and discharging to the unlined channel in Centorian reserve, south of the site.

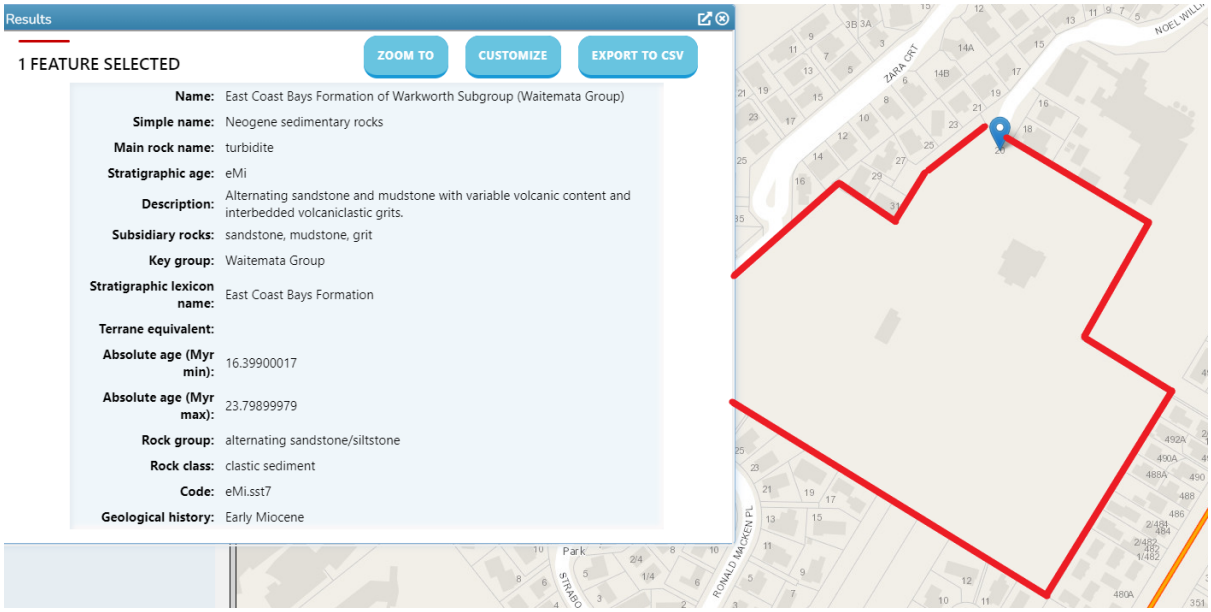
There is an extensive existing network of 100mm diameter perforated drainage coils underneath the sports fields to the south of the site.

The existing sports fields to the south are not part of this application.

2.1 Geotechnical

A geotechnical investigation is required for the site, this will be provided at a future resource consent application stage with its recommendations incorporated into the design.

GNS Science geological map of New Zealand indicates that the site is likely largely underlain by Sandstone and mudstone.



A development at the site should provide onsite reuse of the retention volume by non-potable sources rather than infiltration of the first 5mm runoff captured from new impervious areas.

2.2 Receiving Environment

Immediately downstream of the site in Centorian Reserve the piped network transitions to an unlined channel.

Mapping data available from Geomaps indicates that residential dwellings beside this channel are largely located outside of the flooding associated with the channel for the 1% AEP rainfall event.

Downstream of this site is the “Apollo Pond”, located directly west of Apollo Drive.

The existing pond is classified as a Dry Detention Pond and provides attenuation of flows rather than water quality treatment.

Limited information from Healthy Waters was retrieved regarding this facilities condition, it's designed purpose and constraints associated with connecting upstream of the pond.

The pond has been designed for a catchment area of 90Ha and was completed in 1992.

It is assumed that this dry detention pond provides 100-year attenuation for the catchment. Available information for the pond from GIS and the attached report is as follows:

- Maximum Surface Area – 4,480m^2
- Volume LS – 10,780m^3
- Volume - Maximum detention - 22,300m^3
- Maximum Depth – 9.3m

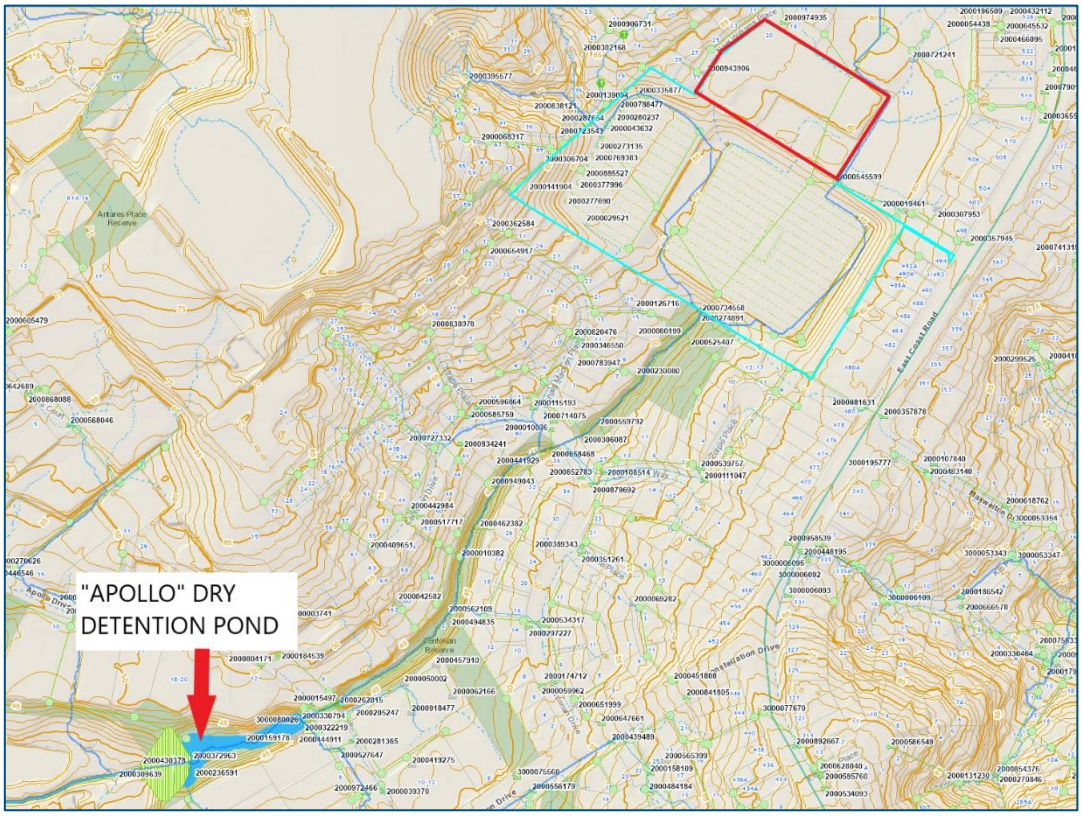


Figure 2 – Apollo Pond

From available correspondence it would seem the pond is in good condition with no issues regarding erosion or instability.

There is a 3m tall wall/dam extension on top of the dam crest that was installed to increase the ponds capacity.

Down stream of the pond is the Rosedale Wastewater Treatment Plant Pond, where stormwater greater than 10 year ARI could spill into, is located in a Significant Geological Area.

Downstream of this Rosedale Wastewater Treatment Plant Pond is the Oteha Stream, is also located in a Significant Geological Area.

During the January 2023 Auckland storm event flooding of a few commercial/light industrial properties was recorded alongside the pond and associated watercourse. Healthy Waters are currently investigating solutions to the flooding issue in the area which could include removing the previously mentioned dam extension. This would decrease the ponds storage volumes and significantly impact mitigation that the pond provides.

Please refer to Appendix C for information on the Apollo Pond.

Downstream of the existing treatment facility the stormwater flows through a lined channel and connects to Oteha Stream before discharging to the Waitemata Harbour.

The developments stormwater runoff will follow the indicative route below from the source to the harbour. The route has been identified using Auckland council Geomaps.

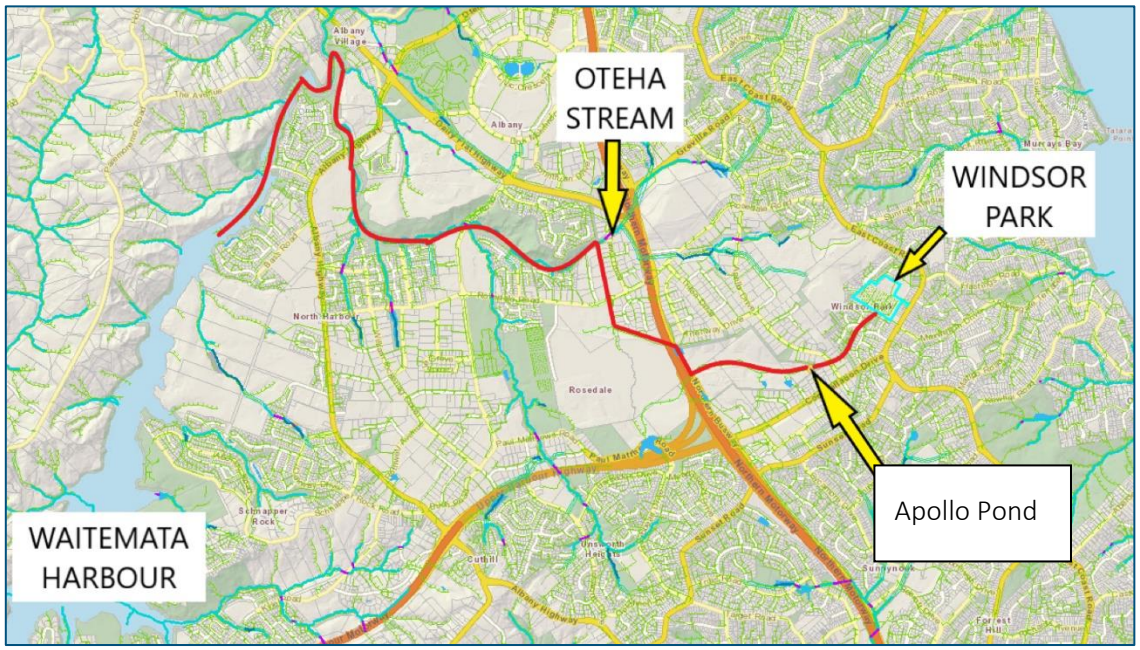


Figure 3 – Downstream Receiving Environment

2.3 Stakeholder Consultation

There was a "Teams" meeting with Healthy Waters on the 12th of August 2024. During this meeting the downstream detention pond was discussed and some information on this detention pond was made available. These details have been discussed in the previous section.

It was also mentioned that they thought there was an opportunity to utilise the existing sports field as a dry detention basin. Considering their suggestion we have done some investigation into this, and the possibility is discussed in a later section of the report.

11 Iwi groups were notified on 30.11.2023 and there have been no responses to date.

Further consultation with Iwi should be undertaken at land use consent stage when a proper design is being selected. No further consultation with Iwi is proposed as this stage.

2.4 Asset Ownership

Future public stormwater pipes and infrastructure within the development would be designed to Auckland Council SW CoP standards and will be vested through the EPA process with Auckland Council. These are shown as public pipes in the provided drawings.

Private assets would be owned and maintained by either individuals or the resident's association. This will depend on an actual resource consent application for these devices at the time.

Operation and maintenance plans for each of the devices should be supplied to the respective owners of said devices.

Below is an approximate break down of what assets would be required and the ownership of these assets:

Public Assets:

Proposed Public Stormwater extensions throughout the site to provide connections points for dwellings

- Public stormwater pipes and manholes.
- Public portion of lot connections as per Auckland Council current SW CoP
- Dry detention basin infrastructure if proposed

To be owned and maintained by Auckland Council

Shared Private Assets:

- Communal detention tanks for accessway runoff
- GD01 devices for accessway stormwater treatment
- Accessway catchpits with GPT's for pretreatment
- Private portions of shared accessway connections

To be maintained by the resident's association or similar legal instrument.

Individual Private Assets:

- Individual SMAF Tanks for lots
- Individual catchpits and grate drains
- Private portion of individual lot connections
- Clubrooms SMAF Tank – owned by club

To be maintained by the individual lot owners using the appropriate maintenance plans.

3 // ILLUSTRATIVE OPTION FOR DEVELOPMENT

The plan change application proposal is to subdivide the northern portion of the site into an assortment of duplex housing, terraced housing, and walk-up apartments. Dwellings will be either 2 or 3 storeys with a total number of units between 80-100 depending on final design, layout and market demand.

The total area of the site to be redeveloped into housing is approximately 12,800m^2.

The option for development could propose to demolish the existing clubrooms and other facilities and provide new clubrooms and practice facilities. The existing private road could be retained or upgraded with a new carpark being built near the clubrooms.

For this plan change application for rezoning we have used a possible scheme plan comprising of 85 units. The number of units could vary in any subsequent application in the range mentioned above.

However, the overarching stormwater mitigation requirements will not differ over the range and can be appropriately managed at design stage.

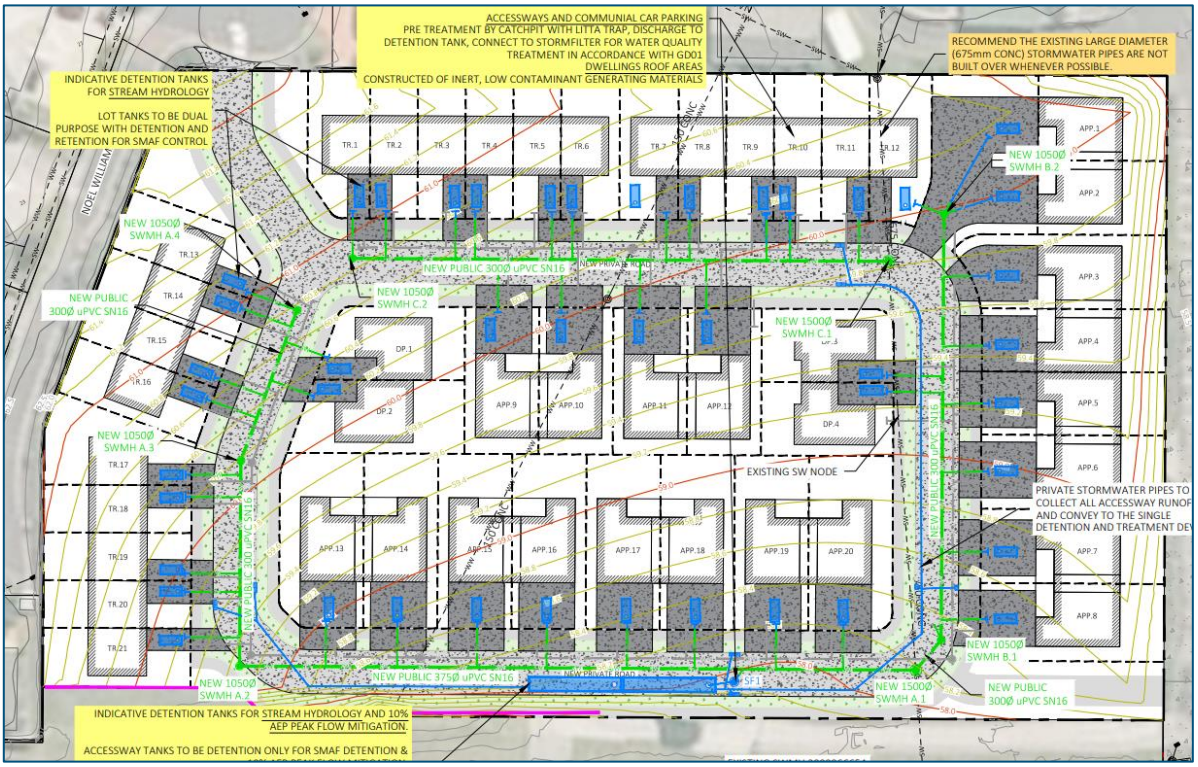


Figure 4 – Potential layout

3.1 Regulatory and Design Requirements

The following documents already exist for stormwater management in the Auckland region. The documents below govern how to assess, design and maintain potential stormwater assets for this plan change.

The guidelines provided in these documents would be followed at the time of a resource consent application.

Requirement	Relevant regulatory / Design to follow
Unitary Plan – SMAF hydrology mitigation	SMAF 2 Zone - Retention and Detention is required in accordance with table E10.6.3.1.1 of the AUP
Discharge and Diversion	AUP chapter E8

High Contaminant Generating Areas	AUP chapter E9
Natural Hazards and Flooding	AUP chapter E36
Stormwater Management Devices and design	GD01
Application of Principles of Water Sensitive Design	GD04
Auckland Council Regionwide Network Discharge Consent	NDC Schedule 4 Classified as Brownfields Large (Over 20 lots)
Auckland Unitary Plan Precinct	N/A
Existing Catchment Management Plan	N/A

4 // STORMWATER MANAGEMENT

This section offers guidance on effectively managing stormwater in the future development of the site, outlining a resilient and practical approach to required stormwater management and mitigation techniques. The objectives and guidance provided are based on established stormwater management techniques aimed at meeting regulatory requirements and adopts water sensitive design principles. These principles consider the current limitations and demands of the catchments, demonstrating how a thoughtfully designed development can capitalise on site-specific opportunities.

4.1 Principles of Stormwater Management

Stormwater management should be designed in accordance with the Auckland Council Regionwide Stormwater Network Discharge Consent guidelines. The site is considered “Brownfields Large” as it proposes more than 20 Lots.

Stormwater management at the site will be guided by the following principles

- Practical, integrated stormwater management approaches that enables future development on the site.
- Provide a water sensitive design approach that protects and preserves the existing natural and built environment from the change in land use
    - Retain the natural hydrology of the site as possible
    - Minimise and mitigate the generation and discharge of contaminants
    - Minimise the stormwater hydraulic effects
- Protect infrastructure, people and the environment from flooding events.

- Propose resilient stormwater solutions that will remain operational over the design life.
    - Easy to maintain with established maintenance procedures not relying on individuals
    - Minimise the number of devices that need to be maintained

4.2 Water quality

The site would propose a combined total onsite parking requirement for more than 30 parking spaces. Under the Auckland Council Reginal Network Discharge Consent requirements, all impervious areas require water quality treatment.

Therefore, treatment of all impervious areas by water quality devices designed in accordance with GD01 for the relevant contaminants is required before it discharges to the natural environment.

Water Quality Treatment is separated into 3 sections: the private roading, carparks and roof areas. Treatment of these impervious areas should be treated as follows.

Private Roading

Roading within the site has been proposed as private.

To provide water quality treatment for the roading, all runoff should be treated by GD01 compliant water quality devices before discharging to the natural environment.

Stormfilter's are a commonly used in private road situations, that work well to remove pollutants associated with the private roading use and can be adapted for many different catchment sizes. Stormfilters have been shown in the plans to demonstrate a possible solution.

Gross Pollutant Traps (GPT) devices compliant with GD01 should be used in all accessway catchpits before connecting to the Stormfilter's. These devices will act as pretreatment as part of a treatment train approach.

Ownership and maintenance of all the private devices will be the responsibility of a resident's association.

Having communal stormwater treatment devices maintained by maintenance contractors employed directly the resident's association will greatly increase the likelihood that these devices will be maintained and remain functional rather than leaving this responsibility to individuals.

Carparks

Commonly owned carparks with impermeable areas should be treated by GD01 compliant water quality devices the same as the private roadings treatment described above.

Individual carparks for dwellings should be graded so runoff flows down towards the private road wherever possible. This will enable treatment of the individually owned carparks using GD01 compliant water quality devices, owned and maintained by a resident's association.

Any communal waste storage area exposed to the rain should have its runoff pretreated by a GPT device compliant with GD01 before connecting to a GD01 compliant water quality device.

Roof Areas

Inert and low contaminant generating building materials should be used in conjunction with leaf diverters on all the downpipes.

All the water quality treatment devices will be designed, sized and specified at detailed design stage when the catchments have been clearly defined.

4.3 Stream Hydrology Stormwater Mitigation

Stormwater disposal for this site would need to be achieved by discharging to the existing public network located within the site.

STREAM HYDROLOGY	
Within a SMAF	• No additional requirements to those of the AUP.

As the site is located in a SMAF2 zone, retention and detention would be required in accordance with table E10.6.3.1.1 of the AUP.

Stormwater management area – Flow 2	(a) provide retention (volume reduction) of at least 5mm runoff depth for the impervious area for which hydrology mitigation is required; and (b) provide detention (temporary storage) and a drain down period of 24 hours for the difference between the pre-development and post-development runoff volumes from the 90th percentile, 24 hour rainfall event minus the 5 mm retention volume or any greater retention volume that is achieved over the impervious area for which hydrology mitigation is required.

Figure 5 – SMAF 2 requirements

The stormwater mitigation requirements in this area are:

- Retention - Capture 5mm run off depth for all impervious areas
- Detention - Provide temporary storage with a drain down period of 24 hours for the difference between the predevelopment and post development run off volumes from the 90th percentile AEP even minus the above 5mm captured retention volume.

The required stormwater retention and detention for this site can be provided by dual purpose retention and detention tanks for each of the private lots and a larger communal detention only tank located in the accessway.

Detention only tanks for the commonly owned private accessway can be provided in accordance with point 2 of E10.6.3.1.1. as the water from the accessway is dirty and therefore not suitable for re-use purposes.

(2) Where:

(a) a suitably qualified person has confirmed that soil infiltration rates are less than 2mm/hr or there is no area on the site of sufficient size to accommodate all required infiltration that is free of geotechnical limitations (including slope, setback from infrastructure, building structures or boundaries and water table depth); and

(b) rainwater reuse is not available because:

(i) the quality of the stormwater runoff is not suitable for on-site reuse (i.e. for non-potable water supply, garden/crop irrigation or toilet flushing); or

(ii) there are no activities occurring on the site that can re-use the full 5mm retention volume of water.

(c) the retention volume can be taken up by detention as follows:

(i) provide detention (temporary storage) and a drain down period of 24 hours for the difference between the pre-development and post-development runoff volumes from the 95th percentile (SMAF 1) / 90th percentile (SMAF 2), 24 hour rainfall event minus any retention volume that is achieved, over the impervious area for which hydrology mitigation is required.

The retention portion of the SMAF mitigation should be used for non-potable reuse by the development. The retentions reuse should be plumbed into the dwelling for toilets and other non-potable sources rather than being just for external taps.

These will be designed and sized at the time of a land use consent application.

The approximate SMAF 2 mitigation volumes are shown below. These values have been calculated assuming the total site area is 12800m^2 with new roof areas totalling 45% the sites area and Accessway areas 20%.

- Retention Volume = 42m^3
- Detention Volume = 111m^3

These values are indicative only to help picture the scale and will be refined at detailed design stage.

The plans provided show that a typical SMAF detention tank could be located within the commonly owned accessway, and this would be maintained by a resident's association.

4.4 Flooding - Pipe Capacity for 10% AEP

Stormwater disposal for the development would be via the existing 750mm diameter concrete stormwater pipe that runs through the site.

FLOODING	
Property/pipe capacity: 10% AEP event	• Ensure that there is sufficient capacity within the pipe network downstream of the connection point to cater for the additional stormwater runoff associated with the development in a 10% AEP event; or • Demonstrate that flows in excess of the pipe capacity in a 10% AEP event within the pipe network downstream of the connection point will not increase flooding of any other property; or • Demonstrate through an assessment that flows in excess of the pipe capacity in a 10% AEP event within the pipe network downstream of the connection point will not increase adverse effects on any other property. Factors to consider when evaluating adverse effects as a result of flooding should include, but are not limited to: • The type, frequency and scale of increased flooding or overland flow; • The type of activities being undertaken within the property and the consequences of increased flooding or overland flow in relation to these activities and the people involved; and • The potential impact on public safety, including safe access and ingress. Methods of ensuring sufficient capacity in the pipe network in Brownfield areas include any one of the following: • Demonstrating sufficient capacity is available including flows from the catchment (at maximum probable development) draining to the relevant pipe network in the 10% AEP event) • Attenuating and reducing stormwater flows and volume on-site such that there is no increase in peak flow in a 10% AEP event from the site compared to that prior to the new development. Note that any devices associated with this option will also require an operation and maintenance plan to ensure the long-term efficacy of such a system.

Figure 6 – Network Discharge Consent Extract

Peak flow calculations have been performed using the TP108 method, on the catchment feeding into the proposed public network to make sure all the pipes have the required capacity.

The following parameters have been adopted for the calculations:

- 10% AEP rainfall depth = 166.1mm (2.1 degree climate change adjusted)
- Group C soils, CN= 74 for urban lawns.
- Impervious areas CN=98
- Level of imperviousness = 65%
- Time of concentration = 10minutes

The calculations demonstrate that the catchment produces a peak flow rate of 2,405 L/s and the existing pipe has a capacity of 1,538 L/s for the 10% AEP rainfall event.

This demonstrates that the existing public network is over capacity for the 10% AEP rainfall event and does not have additional capacity for the development to discharge to the network unattenuated.

Therefore, 10% peak flow mitigation would be required.

From the indicative proposed layout, the predevelopment flows for the subject site (12,800m^2) for the 10% AEP rainfall event are 290.4 L/s.

Assuming a post development impervious percentage of 65% the site would produce a peak flow rate of 347.5 L/s for the 10% AEP rainfall event.

That would cause an increase in 10% AEP peak flows of around 57.1 L/s.

Therefore, to comply with the NDC it is necessary to attenuate the post development 10% AEP peak flows back to predevelopment levels.

To attenuate peak flows from the 10% AEP rainfall event back to predevelopment levels an additional detention component should be added to the accessway/private roading tanks.

These tanks would need to be be owned and maintained by the resident's association. They will contract a crew to implement a maintenance plan to ensure ongoing functionality of the detention tanks.

Having fewer devices maintained by a resident's association will increase the likelihood that the tanks are maintained and remain operational in the long run, ensuring no additional strain on the network is caused by 10% tanks being poorly maintained.

With suitable 10% AEP peak flow mitigation as discussed above there would be no increase in peak flows to the network and the development would have no adverse effects on neighbouring properties.

4.4.1 Building Over Public Infrastructure

There are multiple large diameter public stormwater pipes located within the development areas.

Building over stormwater pipelines is not a recommended practice and will only be considered by Auckland Council in exceptional circumstances where no suitable alternative exists.

This could include rerouting the existing pipes away from building foundations or selecting a site layout that avoids the pipes all together

When these options are not possible or practical specific foundation design and approval from Auckland council would be required.

4.5 Flooding - Buildings for 1% AEP event

Upstream of the development within #542 East Coast Road there is a ponding area that fills in the 1% AEP Rainfall event. From here the OLFP spills over to the south and travels down the existing private driveway towards the car park area.

The existing sports field is slightly elevated above the existing private road and carpark level forming an embankment that channels flow around the site. A proposed development of the site should maintain the existing embankment to prevent flows from entering the site as generally shown below.

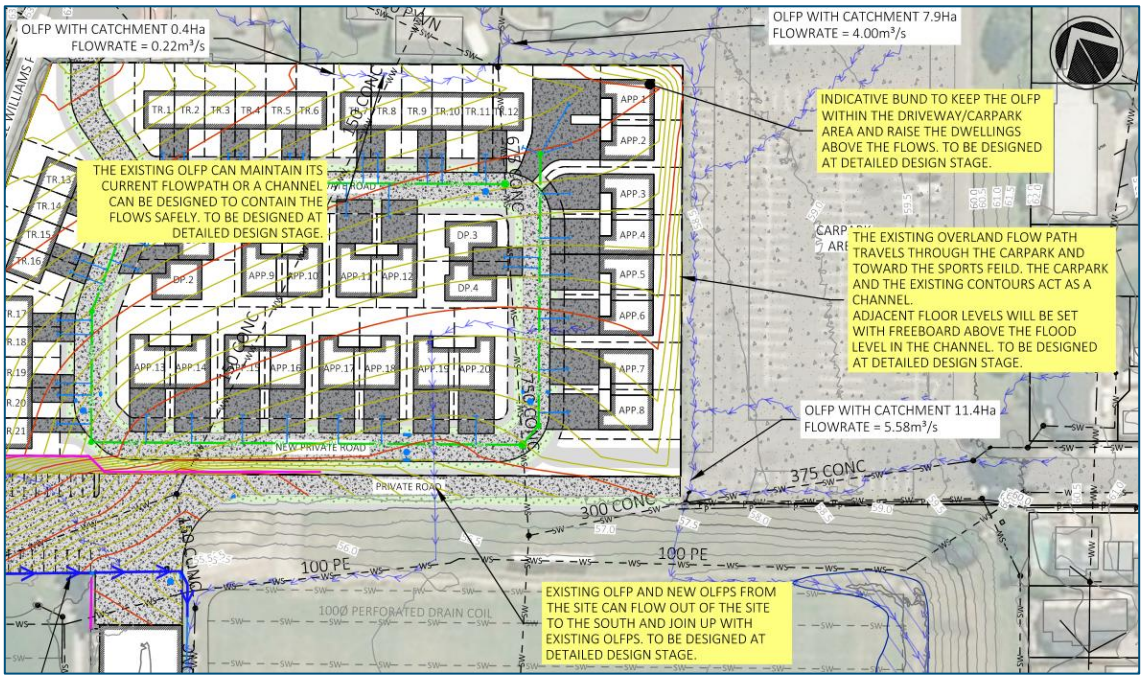


Figure 7 - Existing Major Overland flowpath 1

Along the eastern boundary flows are channelised by the carpark and the embankment.

Any proposed development should maintain this embankment as well to retain the existing OLFP channel. The floor levels of the dwellings along the northern and eastern boundaries next to the flows should be set at least 500mm above the adjacent flood levels in accordance with AUP requirements. See the figure above for the indicative embankment to be retained.

Proposed floor levels and embankments will be designed at resource consent stage along with the relevant application.

Any development would need to ensure that there is nothing occurring on site that would block flows, divert flows to neighbours, create ponding areas or increase flooding levels at neighbouring properties. This would ensure that there is no adverse effect to neighbouring properties because of the development.

4.5.1 1% AEP Peak Flow Mitigation

A proposal similar to that shown in these plans, would increase the impervious areas of the catchment and would increase peak flows in the 1% AEP rainfall event. These flows would need to be mitigated as follows:

The predevelopment flows for the site (12,800m^2) for the 1% AEP rainfall event are **627.1 L/s.** Assuming a post development MPD impervious percentage of 65% the site would produce a peak flow rate of **682.9 L/s** for the 1% AEP rainfall event. A typical development such as that shown here would cause an increase in 1% AEP peak flows of around **55.8/s**.

As there is an existing flooding issue downstream near the "Apollo Pond" embankment and there is the possibility that the existing ponds capacity may be reduced in the future, 1% AEP peak flow mitigation should be introduced to attenuate post development peak flows from the catchment back to pre-development levels.

A very quick volume check shows that approximately 400m^3 of flood storage is required to be detained to mitigate the new impervious areas for the 1% AEP rainfall event, back to predevelopment flow rates. (this depends on the detailed design of the actual device chosen).

There are several options available to do this, however the preferred option is to create a dry detention basin utilising the existing sports fields as a temporary storage area. This option could mitigate the increase in peak flows from the site as well as improve the downstream flooding situation at the Apollo Pond. The existing sports fields already form a natural basin. Construction of an earth bund along the southern boundary outside of the sports field could create a large dry detention basin on the field capable of mitigation for the entire upstream catchment. See indicative figure on the following page.

A table showing the pros and cons for various options is given below.

Option	Advantages	Dis-Advantages
Dry Detention basin, such as the existing sports fields, or car parks.	Robust solution with low costs to create and higher performance compared wit underground solutions. Easy to maintain Reducing downstream flood potential. Minimising downstream channel erosion. Extreme event flow and volume management Reduced climate footprint due to minimal amount of work and resource being consumed, compared with underground solutions.	Temporary standing water can be a potential safety issue, causing consenting issues Takes a lot of land to create. Introduces a dammed water hazard

Underground storage modules (Cirtex rain smart systems or similar)	Underground means they cannot be seen. Requires less space at ground level.	Inlet capacities are compromised for the 1% AEP rainfall event reducing effectiveness. Large earthworks is required to create the void for underground tanks. Larger climate footprint due to earthworks machines, resources for creating containers. Difficult to monitor and maintain effectiveness
Underground detention tanks	Underground means they cannot be seen. Requires less space at ground level.	Inlet capacities are compromised for the 1% AEP rainfall event reducing effectiveness. Large earthworks is required to create the void for underground tanks. Larger climate footprint due to earthworks machines, resources for creating containers. Difficult to monitor and maintain effectiveness

A dry detention basin with an approximate base area of 20,000m^2 and design depth of just 0.25m could store up to 5,000m^3 of flood water safely with very limited earthworks and infrastructure required.

Consultation with Healthy Waters, the Windsor Park Community & Multisport Hub INC and other stakeholders should be undertaken at detailed designed stage to evaluate the feasibility of this option and any design requirements for a dry detention basin.

A proposed dry detention basin would only be activated by larger storm events. During which the sports fields are unlikely to be used. The dry detention basin would slowly drain to the network over a few hours and the sporting fields would be usable a few hours after the worst of the storm had passed.

The existing sports fields have extensive subsoil drainage which will prevent the soils from staying saturated for days, ruining the fields.

During smaller, more frequent rainfall events surface flows would be directed around the field by channel drains and swales. Allowing the fields to be used the vast majority of the time.

Figure 8 – Potential location of Dry Detention Basin

4.6 Risks – Stormwater Management

Risk to the proposed stormwater management?	Proposed Risk Management/ Mitigation Technique?	Alternative Risk Management/ Mitigation Technique?	When does the risk need to be addressed?	Resultant Level of Risk
OLFP's on Geomaps not being in the correct positions	Site specific survey	Site visit	Design Phase	LOW
Cricket club not wanting the field to be a detention basin	Consultation with the cricket club, new club room being raised above the flood level		During the design and planning phase	MEDIUM
Tanks not being maintained by the respective low owners	Designing communal devices with maintenance contractors employed to maintain for the larger issues to limit the impact of an individual device failure		Design phase	LOW
Condition of the existing stormwater infrastructure within the site	CCTV investigation of the existing pipes	Replace the existing assets	Design Stage through to construction	LOW
Scour and erosion of the embankment required for the dry detention basin	Comprehensive design of the outlet structure and embankment with consultation from the required specialists		Design Stage	LOW

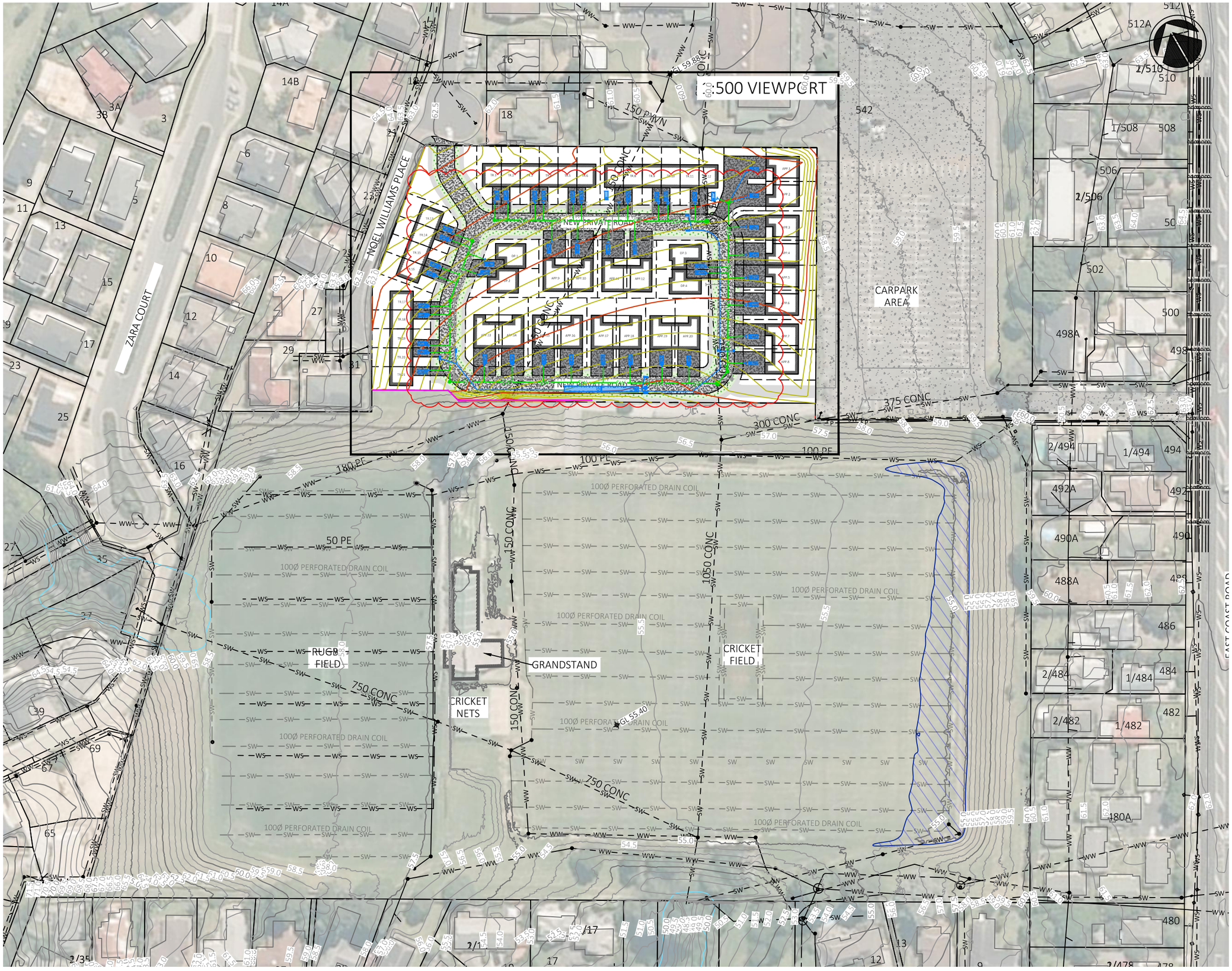
5 // CONCLUSION

A proposed development such as that depicted in these plans could be designed to meet the requirements set out in the Regionwide Stormwater Network Discharge Consent for a Brownfields large development. All the following should be provided at resource consent application stage, and should be in accordance with the relevant Auckland Council documents listed in section 3.1

- Water Quality:
  Accessways and communal carparking should be pretreated by GPT's then connecting to treatment devices for water quality treatment in accordance with GD01. Private carparks should where practically slope towards the accessway so its runoff can be treated by the above devices. Roofs and buildings should be constructed from inert and low contaminant generating materials.
- Stream Hydrology:
  SMAF 2 mitigation should be provided for all impervious areas. Dual purpose retention/detention tanks for the dwellings with other impervious surfaces like the accessway connecting to detention only tanks would be suitable.
- Flooding for 10% AEP:
  10% Detention volumes should be combined with the accessway SMAF tanks to attenuate the post development peak flows back to pre-development levels for the 10% AEP rainfall event.
- Flooding for 1% AEP:
  Structures should be designed with compliant freeboard to OLFP and flood levels. Accessways and footpaths should be designed to provide safe access to and from the site in the design storm event. Peak flows from the site should be attenuated back to pre-development levels for the 1% AEP rainfall event using GD01 compliant methods. Options and preferences to achieve this have been provided under section 4.5.1

A development of the subject site would be able provide a compliant design to connect and discharge to the existing stormwater network without adversely affecting the receiving environment.

APPENDIX A – STORMWATER DRAWINGS



Notes:

1. FOR INFORMATION PURPOSES ONLY WITH DATUM IN THE AUCKLAND 1946.

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   d. ANY CONDITIONS OF ASSOCIATED RESOURCE CONSENTS SHALL TAKE PRECEDENCE, AND SHALL BE COMPLIED WITH.

LEGEND

- EXISTING PROPERTY BOUNDARY
- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- MAJOR CONTOUR
- MINOR CONTOUR
- DRIVEWAY/ROADING PAVEMENT (CONCRETE PAVING)
- DRIVEWAY (PERMEABLE PAVING)
- RETAINING WALL
- DWELLING WITH EXTENT OF EAVES
- EXISTING PUBLIC STORMWATER
- EXISTING PUBLIC WASTEWATER
- EXISTING PUBLIC WATER SUPPLY
- EXISTING CONCRETE PAVE
- EXISTING OVERLAND FLOW PATH
- PUBLIC STORMWATER
- PRIVATE STORMWATER CONNECTION (100Ø uPVC)
- NEW SLIPFORM DISH/KERB CHANNEL
- 675 X 450 PRIVATE CESSPITS WITH TETRA TRAP OR SIMILAR WITH 150mmØ uPVC SN16 LEAD.
- UNDERGROUND DETENTION TANK. TO BE DESIGNED AT DETAIL DESIGN STAGE.
- PRIVATE STORMFILTER

E	SINGLE DETENTION DEVICE FOR ACCESS	BT	19.11.24
D	REMOVE NEW CLUBROOMS	BT	11.09.24
C	GENERAL UPDATES	BT	04.09.24
B	FOR HEALTHY WATERS COMMENTS	BT	28.08.24
A	FOR PLAN CHANGE	BT	26.03.24

REV:	DESCRIPTION:	BY:	DATE:
STATUS:	PLAN CHANGE		

LANDWORKS CONSULTING
PO Box 65595, Mairangi Bay, Auckland 0754
www.landworks.co.nz
Email:peter@landworks.co.nz

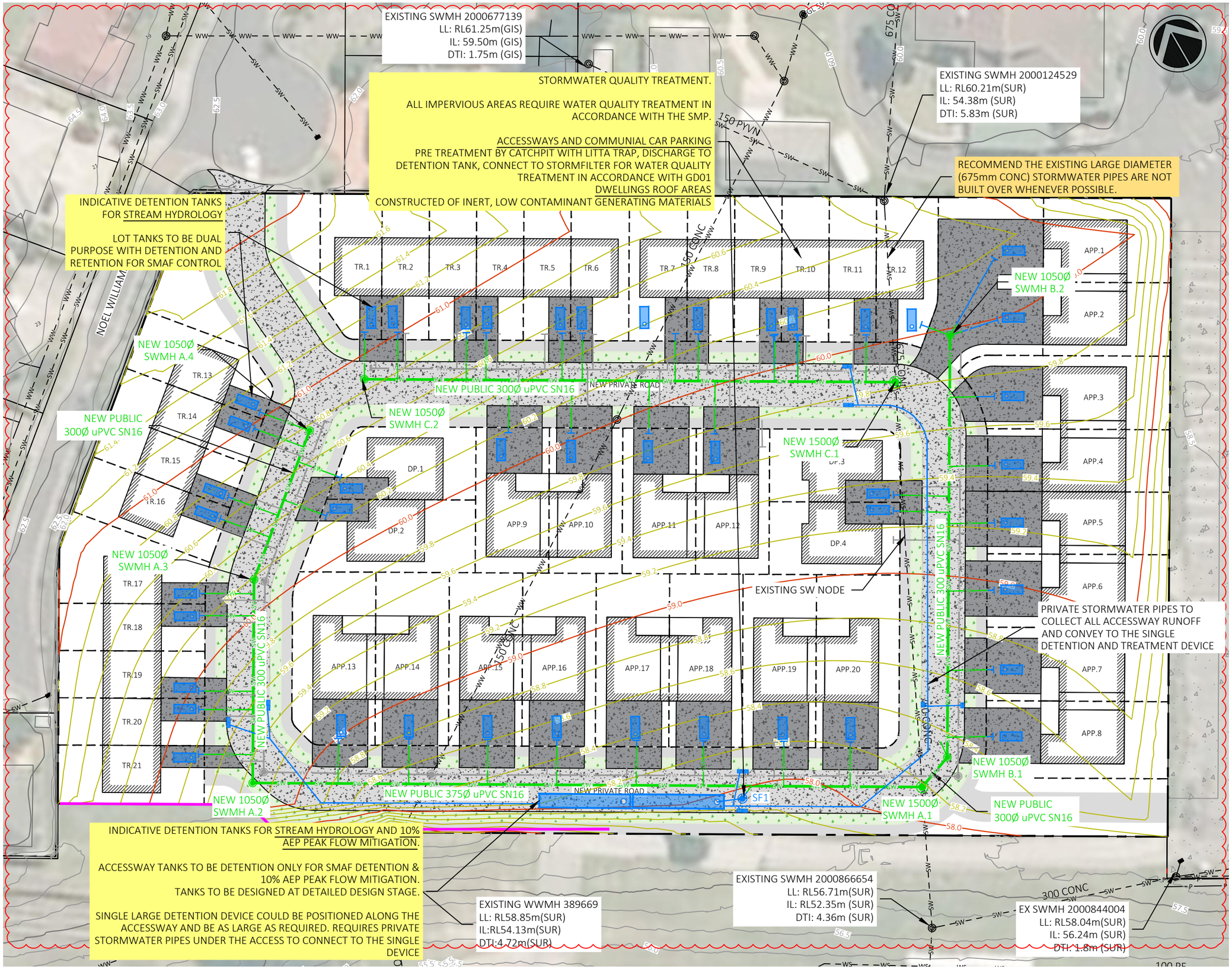
CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Stormwater Plan Overall View

SCALE AT A3:	DRAWN:	CHECKED:
1:1250	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	400	E

PRINT DATE: 19/11/2024 3:40 pm



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LEGEND

- EXISTING PROPERTY BOUNDARY
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- MAJOR CONTOUR
- MINOR CONTOUR
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D	SINGLE DETENTION DEVICE FOR ACCESS	BT	19.11.24
C	GENERAL UPDATES	BT	04.09.24
B	FOR HEALTHY WATERS COMMENTS	BT	28.08.24
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REV:	DESCRIPTION:	BY:	DATE:
STATUS:	PLAN CHANGE		

LANDWORKS CONSULTING
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www.landworks.co.nz
Email:peter@landworks.co.nz

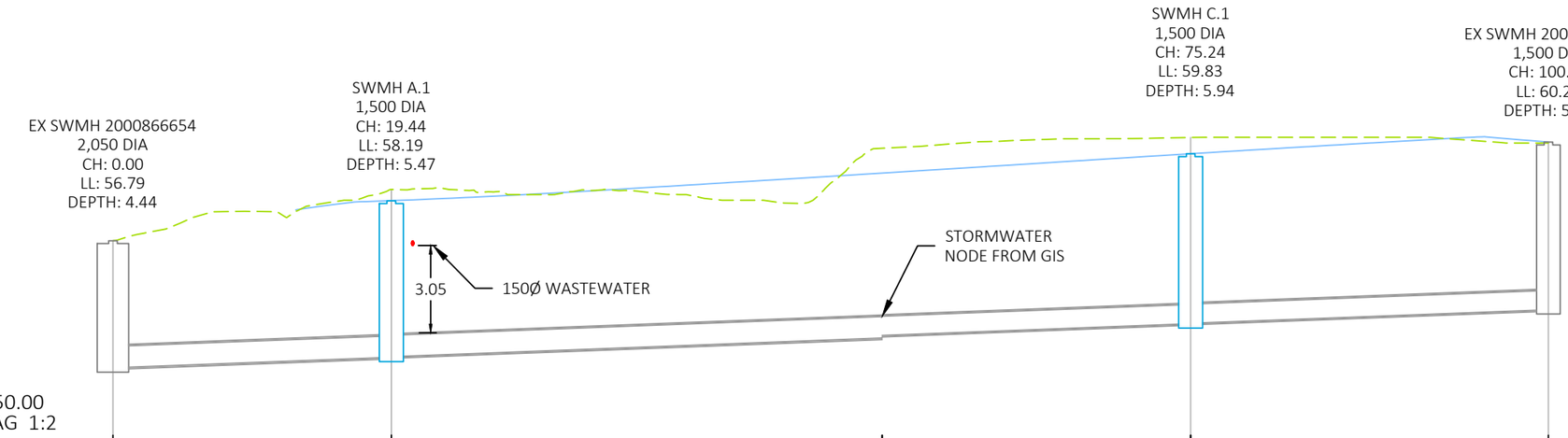
CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Stormwater Layout Part Plan - Sheet 1

SCALE AT A3:	DRAWN:	CHECKED:
1:500	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	401	D

PRINT DATE: 19/11/2024 3:40 pm



PIPE DETAILS (CL to CL LENGTHS)	EX 750Ø CONC 2D L: 19.44m @ 1.90%		EX 750Ø CONC 2D L: 34.26m @ 1.90%		EX 675Ø CONC 2D L: 21.54m @ 1.90%		EX 675Ø CONC 2D L: 24.98m @ 1.90%	
DESIGN LEVEL AT MH CL	56.79	58.19				59.83		60.23
INVERT LEVEL	52.35	52.72	52.74	53.39	53.48	53.89	53.91	54.38
COVER	3.63	4.66	4.64	4.96	4.94	5.21	5.20	5.13
CHAINAGE	0.00	19.44				75.24		100.22

DETAIL: - / 400 EXISTING STORMWATER LONG SECTION

SCALE: 1:400H, 1:200V(A3)

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LEGEND

- EXISTING GROUND LEVEL
- FINISHED LEVEL
- HARDFILL BACKFILL
- DWELLING FOUNDATION

REV:	DESCRIPTION:	BY:	DATE:
A	FOR PLAN CHANGE	BT	26.03.24

STATUS: PLAN CHANGE

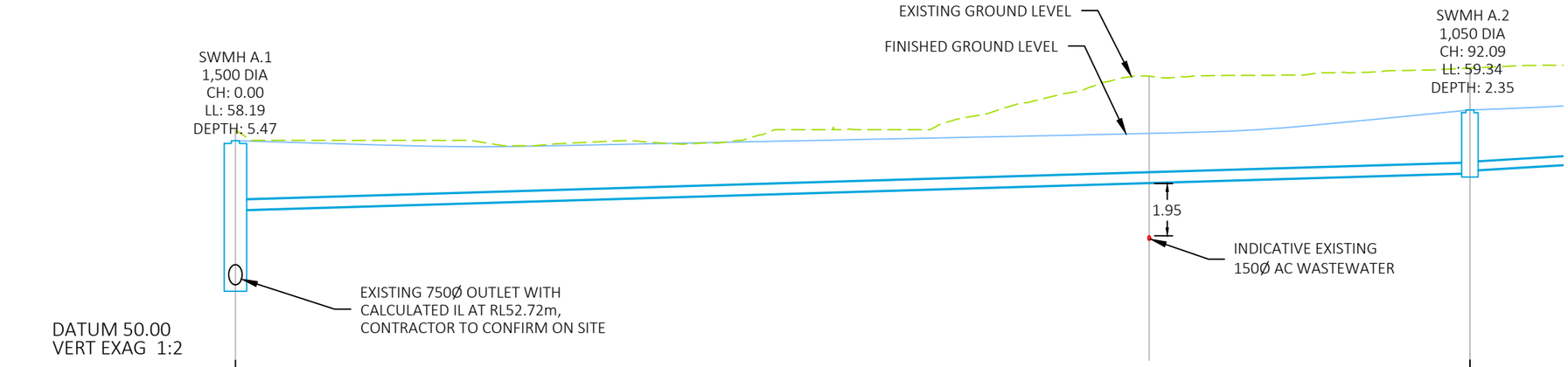
LANDWORKS CONSULTING
PO Box 65595, Mairangi Bay, Auckland 0754
www.landworks.co.nz
Email:peter@landworks.co.nz

CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Existing Stormwater Long Section

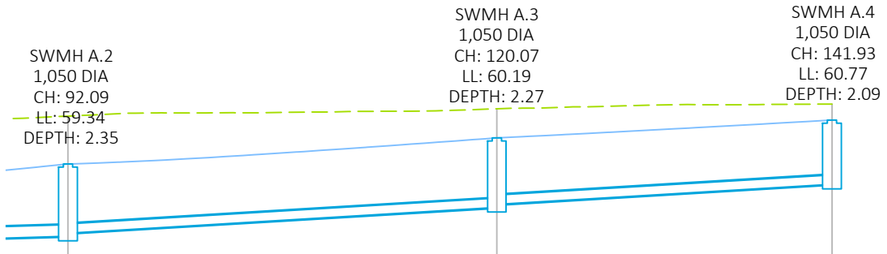
SCALE AT A3:	DRAWN:	CHECKED:
As Shown	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	410	A



DATUM 50.00
VERT EXAG 1:2

PIPE DETAILS (CL to CL LENGTHS)	NEW 375Ø UPVC SN16 2D L: 92.09m @ 1.50%	
DESIGN LEVEL AT MH CL	58.19	59.34
INVERT LEVEL	55.60	56.98 / 57.08
COVER	2.18	1.95 / 1.92
CHAINAGE	19.44	92.09

DETAIL: - / 400 STORMWATER LONG SECTION - A
SCALE: 1:400H, 1:200V(A3)



	NEW 300Ø UPVC SN16 2D L: 27.98m @ 3.00%	NEW 300Ø UPVC SN16 2D L: 21.86m @ 3.00%
	59.34	60.19 / 60.77
	56.98 / 57.08	57.92 / 58.02	58.68
	1.95 / 1.92	1.93 / 1.83	1.75
	92.09	120.07	141.93

DETAIL: - / 400 STORMWATER LONG SECTION - A CONTINUED
SCALE: 1:400H, 1:200V(A3)

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LEGEND
- EXISTING GROUND LEVEL
- FINISHED LEVEL
- HARDFILL BACKFILL
- DWELLING FOUNDATION

REV	DESCRIPTION	BY	DATE
B	GENERAL UPDATES	BT	04.09.24
A	FOR PLAN CHANGE	BT	26.03.24

STATUS: PLAN CHANGE

LANDWORKS CONSULTING
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Email:peter@landworks.co.nz

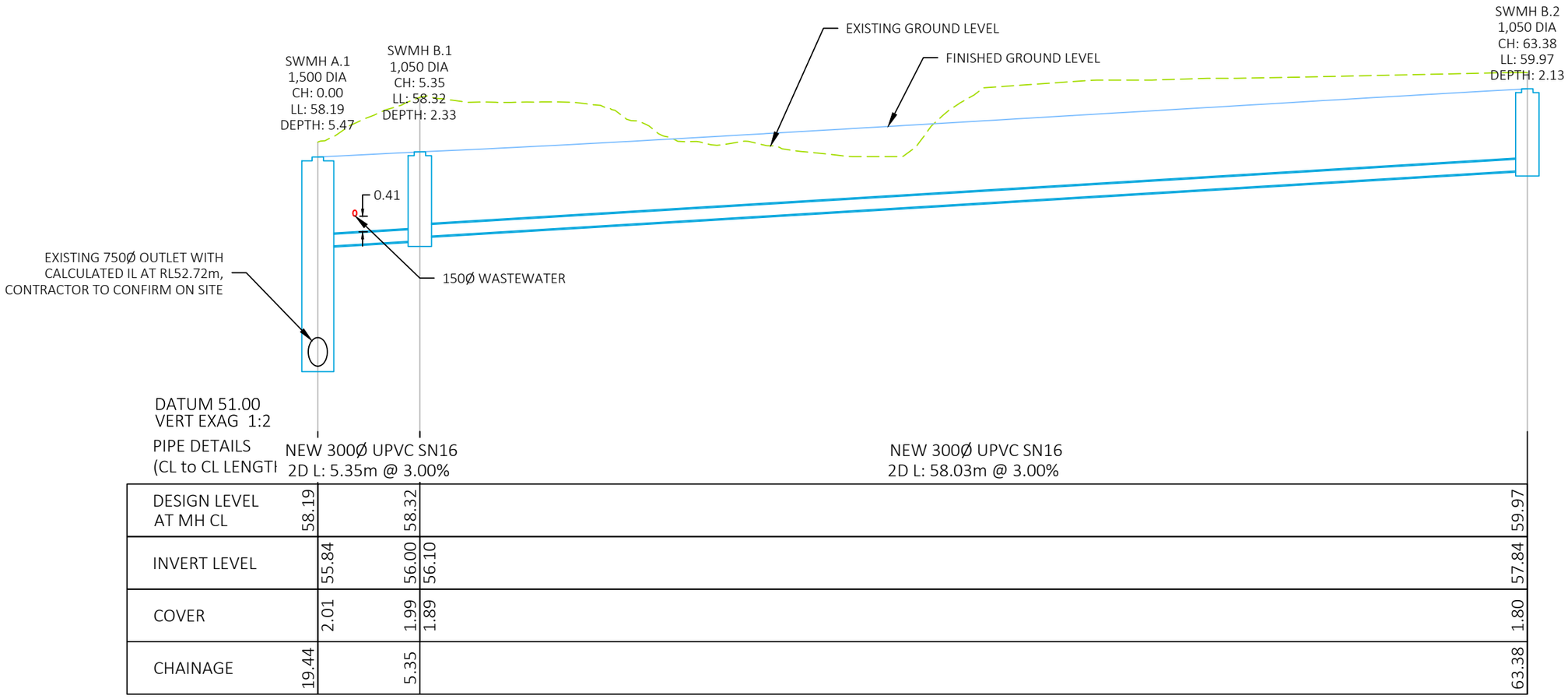
CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Stormwater Long Section - 1/3

SCALE AT A3:	DRAWN:	CHECKED:
As Shown	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	411	B

PRINT DATE: 11/09/2024 2:56 pm



DESIGN LEVEL AT MH CL	58.19	58.32		59.97
INVERT LEVEL	55.84	56.00	56.10	57.84
COVER	2.01	1.99	1.89	1.80
CHAINAGE	19.44	5.35		63.38

DETAIL: - / 400 STORMWATER LONG SECTION - B
SCALE: 1:250H, 1:125V(A3)

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- FINISHED LEVEL
- HARDFILL BACKFILL
- DWELLING FOUNDATION

REV:	DESCRIPTION:	BY:	DATE:
B	GENERAL UPDATES	BT	04.09.24
A	FOR PLAN CHANGE	BT	26.03.24

STATUS: PLAN CHANGE

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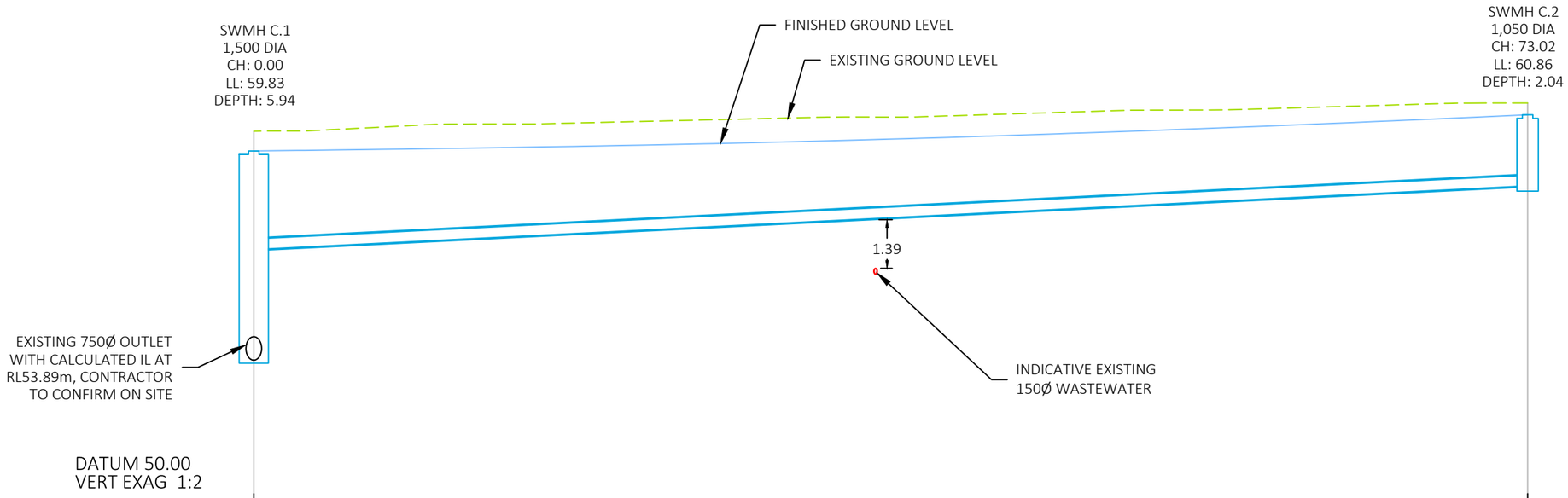
CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Stormwater Long Section - 2/3

SCALE AT A3:	DRAWN:	CHECKED:
As Shown	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	412	B

PRINT DATE: 11/09/2024 2:56 pm



DATUM 50.00
VERT EXAG 1:2

PIPE DETAILS (CL to CL LENGTHS)	NEW 300Ø UPVC SN16 2D L: 73.02m @ 2.50%	
DESIGN LEVEL AT MH CL	59.83	60.86
INVERT LEVEL	57.00	58.83
COVER	2.49	1.70
CHAINAGE	75.24	73.02

DETAIL: - / 400 STORMWATER LONG SECTION - C
SCALE: 1:300H, 1:150V(A3)

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LEGEND
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REV:	DESCRIPTION:	BY:	DATE:
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A	FOR PLAN CHANGE	BT	26.03.24

STATUS: PLAN CHANGE

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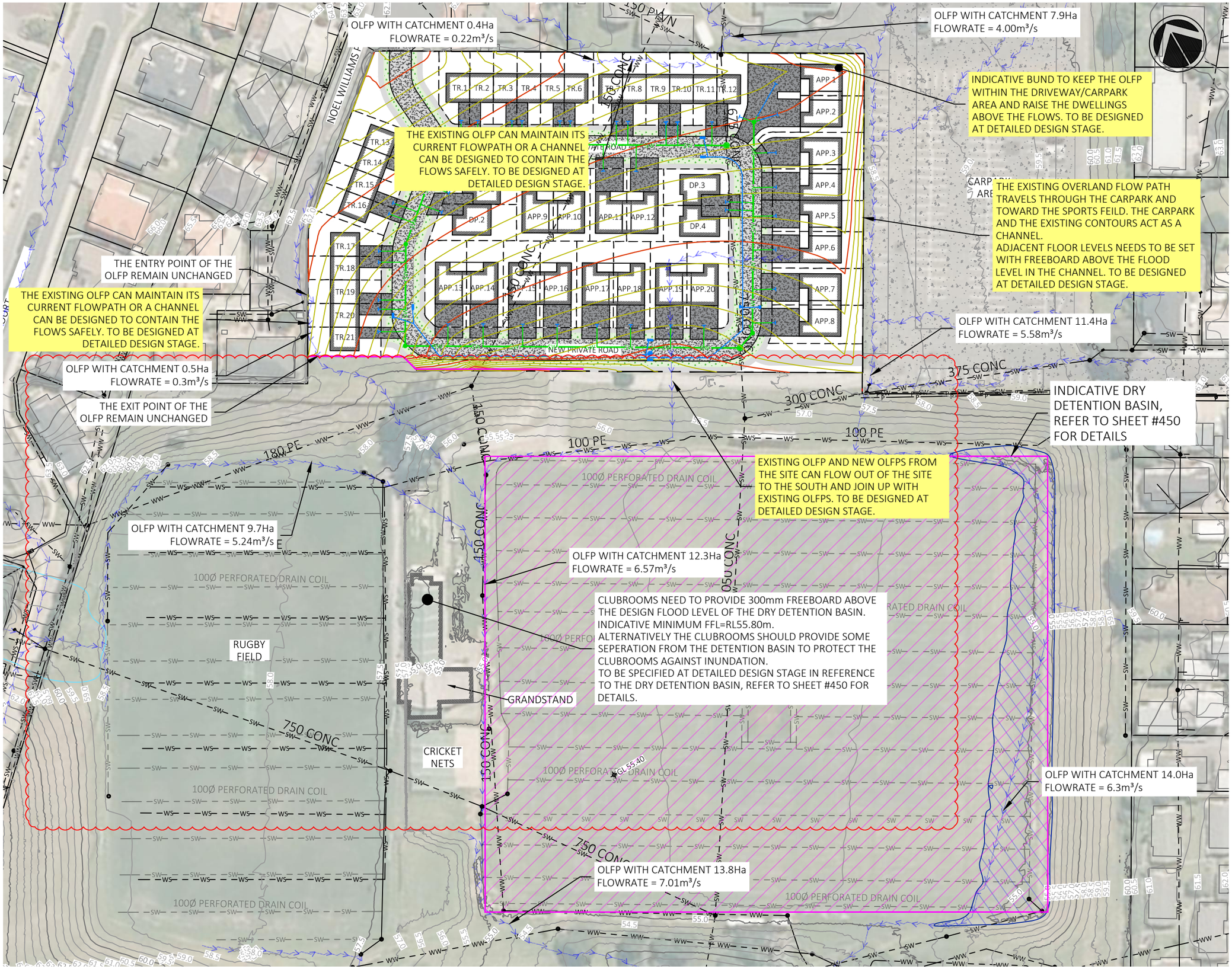
CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Stormwater Long Section - 3/3

SCALE AT A3:	DRAWN:	CHECKED:
As Shown	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	413	B

PRINT DATE: 11/09/2024 2:56 pm



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- MINOR CONTOUR
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- RETAINING WALL
- DWELLING WITH EXTENT OF EAVES
- EXISTING PUBLIC STORMWATER
- EXISTING PUBLIC WASTEWATER
- EXISTING PUBLIC WATER SUPPLY
- EXISTING HYDRANT
- EXISTING POWER
- EXISTING GAS
- EXISTING TELEPHONE LINE
- EXISTING CONCRETE PAVE
- POST DEVELOPMENT OVERLAND FLOW PATH

D	REMOVE NEW CLUBROOMS	BT	11.09.24
C	GENERAL UPDATES	BT	04.09.24
B	INVESTIGATE FIELD AS MITIGATION	BT	28.08.24
A	FOR PLAN CHANGE	BT	26.03.24

REV:	DESCRIPTION:	BY:	DATE:

STATUS: PLAN CHANGE

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CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Overland Flow Path Plan

SCALE AT A3:	DRAWN:	CHECKED:
1:1000	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	420	D

PRINT DATE: 19/11/2024 3:41 pm

OLFP WITH CATCHMENT 9.7Ha
FLOWRATE = 5.24m³/s

OLFP WITH CATCHMENT 11.4Ha
FLOWRATE = 5.58m³/s

EXISTING PARKING AREA ABOVE RL58m, NOT AT RISK OF INUNDATION FROM A DRY DETENTION BASIN

DEVELOPMENT IS LOCATED AT ABOVE RL58m, THE DEVELOPMENT IS NOT AT RISK OF FLOODING DUE TO THE DRY DETENTION BASIN,

CLUBROOMS NEED TO PROVIDE 300mm FREEBOARD ABOVE THE DESIGN FLOOD LEVEL OF THE DRY DETENTION BASIN. INDICATIVE MINIMUM FFL=RL55.80m.
ALTERNATIVELY THE CLUBROOMS SHOULD PROVIDE SOME SEPERATION FROM THE DETENTION BASIN TO PROTECT THE CLUBROOMS AGAINST INUNDATION.
TO BE SPECIFIED AT DETAILED DESIGN STAGE IN REFERENCE TO THE DRY DETENTION BASIN, REFER TO SHEET #450 FOR DETAILS.

RUGBY FIELD ABOVE THE RETAINING WALL AT RL57.5m, PONDING WILL NOT OVERTOP THE WALL OR CAUSE FLOODING TO THE WEST.

GRANDSTAND

CRICKET NETS

INDICATIVE DRY DETENTION BASIN AREA.
APPROXIMATE AREA = 20,000m².
INDICATIVE PONDING LEVEL = RL55.50m

500mm EARTH BUND WOULD CREATE AN AVERAGE PONDING DEPTH OF 250mm ACROSS THE DRY DETENTION BASIN AREA.

THE DEVELOPMENT REQUIRES A 1% AEP PEAK FLOW MITIGATION VOLUME OF APPROXIMATELY 400m³.

THE POND WOULD PROVIDE APPROXIMATELY 5,000m³ OF TEMPORARY FLOOD STORAGE.

FURTHER DESIGN REQUIRES ADDITIONAL INVESTIGATION TO THE SITES EXISTING FEATURES, CATCHMENT REQUIREMENTS AND INPUT FROM STAKEHOLDERS AND EFFECTED PARTIES.

INDICATIVE 500mm HIGH EARTH BUND TO CREATE A DRY DETENTION BASIN OVER THE EXISTING CRICKET FIELD

SWALES TO CHANNEL FLOWS TO A CENTRALISED WIER OUTLET.

WEIR OUTLET STRUCTURE OR SIMILAR TO CONTROL FLOWS AND PROTECT AGAINST EROSION, DESIGN TO FIT IN WITH THE NATURAL ENVIRONMENT.

OLFP WITH CATCHMENT 29.2Ha
FLOWRATE = 13.11m³/s

375 CONC
300 CONC
150 CONC
750 CONC
100 PE
100Ø PERFORATED DRAIN COIL
NEW PRIVATE ROAD
APP.8
TR.20
TR.21
130m
144m

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d. ANY CONDITIONS OF ASSOCIATED RESOURCE CONSENTS SHALL TAKE PRECEDENCE, AND SHALL BE COMPLIED WITH.

LEGEND

- EXISTING PROPERTY BOUNDARY
- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- MAJOR CONTOUR
- MINOR CONTOUR
- DRIVEWAY/ROAD PAVEMENT (CONCRETE PAVING)
- DRIVEWAY (PERMEABLE PAVING)
- RETAINING WALL
- DWELLING WITH EXTENT OF EAVES
- EXISTING PUBLIC STORMWATER
- EXISTING PUBLIC WASTEWATER
- EXISTING PUBLIC WATER SUPPLY
- EXISTING HYDRANT
- EXISTING POWER
- EXISTING GAS
- EXISTING TELEPHONE LINE
- EXISTING CONCRETE PAVE
- POST DEVELOPMENT OVERLAND FLOW PATH

REV:	DESCRIPTION:	BY:	DATE:
C	REMOVE NEW CLUBROOMS	BT	11.09.24
B	GENERAL UPDATES	BT	04.09.24
A	INVESTIGATE FIELD AS MITIGATION	BT	28.08.24

STATUS: PLAN CHANGE

LANDWORKS CONSULTING
PO Box 65595, Mairangi Bay, Auckland 0754
www.landworks.co.nz
Email:peter@landworks.co.nz

CLIENT: Windsor Park Community & multisport Hub INC

SITE: 496 East Coast Road, Mairangi Bay

TITLE: Dry Detention Basin Investigation Plan

SCALE AT A3:	DRAWN:	CHECKED:
1:750	BT	PL
PROJECT NO:	DRAWING NO:	REVISION:
P23-077	450	C

PRINT DATE: 19/11/2024 3:41 pm

LANDWORKS
— CONSULTING ENGINEERS —

CALCULATION SHEETS

PROJECT	Windsor Park Development
PROJECT NUMBER	P23-077
DATE	15/10/2024
AUTHOR	Ben Telford

Note: the Calculation is Based on SWCOP4.0 (March 2024).

Contents:

TP108 10 year chart
Pipe Capcity Checks to first downstream mahole
Pre vs Post development 10% stormwater peak flows

90th Percentile Rainfall Chart
SMAF Volume Calculation - General

TP108 100 Year Chart
Pre vs Post development 1% stormwater peak flows

OLFP GIS Data
- Major OLFP 1
- Major OLFP 2

PROJECT	Windsor Park Development
DATE	15/10/2024
AUTHOR	Ben Telford

10 YEAR RAINFALL DEPTH

10% AEP rainfall depth =	142	mm
Climate adjusted (17.0%)=	166	mm (2.1 degree climate increase)
Climate adjusted (30.8%)=	186	mm (3.8 degree climate increase)

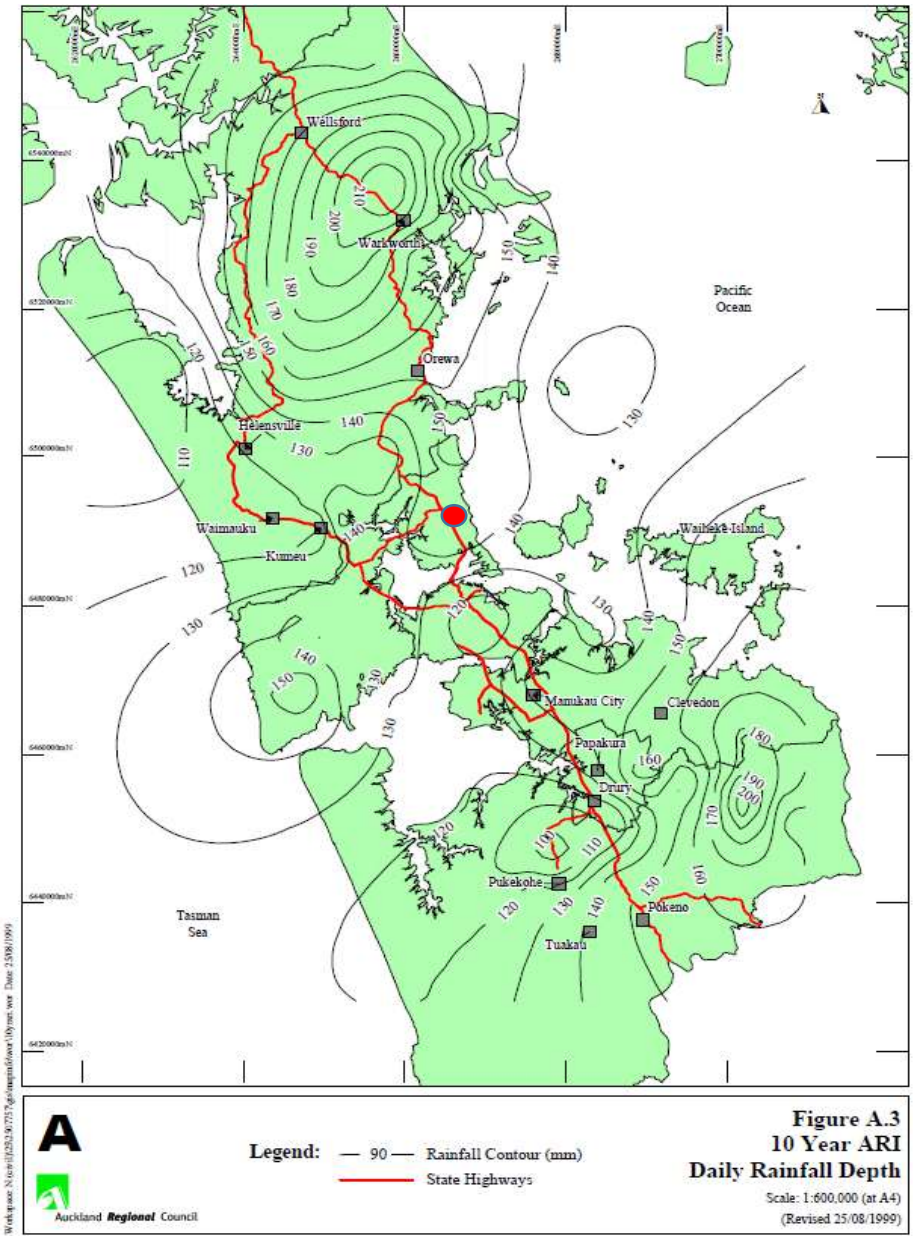


Table 1: Percentage increase in TP108 24-hour design rainfall depth

Annual exceedance probability (AEP)	Percentage Increase in 24-hour design rainfall depth due to future climate change – 2.1°	Percentage Increase in 24-hour design rainfall depth due to future climate change – 3.8°
50%	15.1%	27.4%
20%	16.4%	29.6%
10%	17.0%	30.8%
5%	17.2%	31.2%
2%	17.6%	31.9%
1%	18.1%	32.7%

PROJECT	Windsor Park Development
DATE	15/10/2024
AUTHOR	Ben Telford

PIPE CAPACITY CHECKS

- Under 2.1° Climate Change

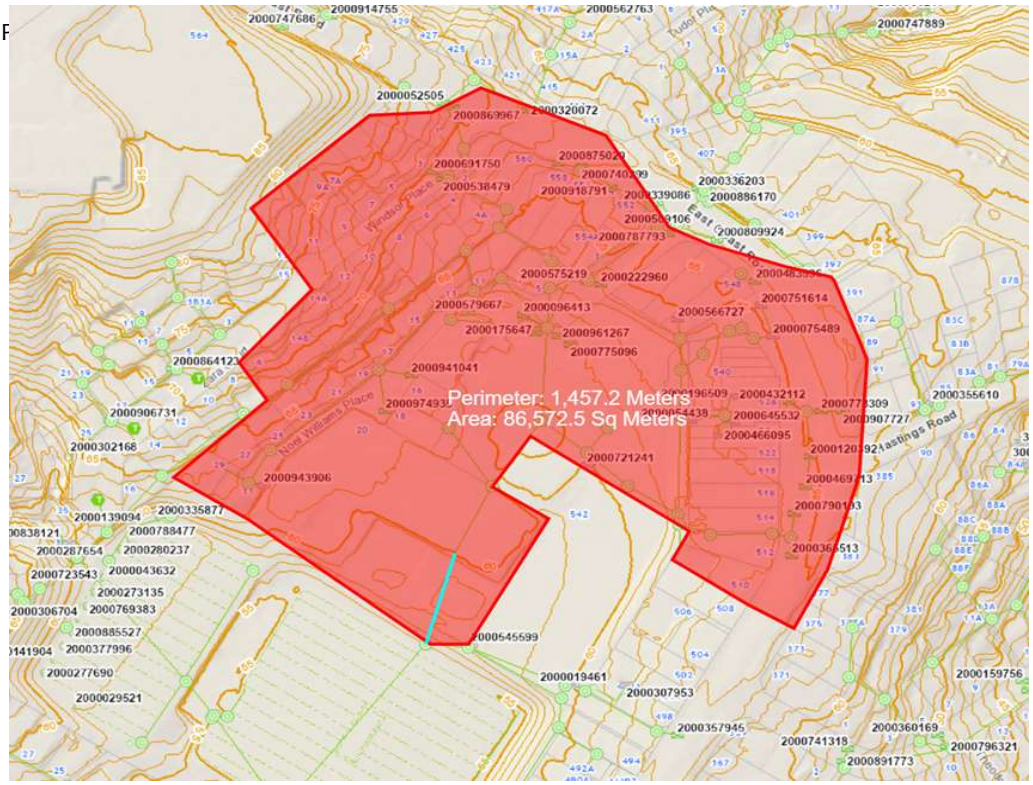
TP 108 Flows, small catchments

Area	88,600	
% Impervious	65%	
Impervious CN	98	
Pervious CN	74	
10% 24 Hour Rainfall Depth	166.1	(2.1°)
Peak rainfall rate *	122	
Imp' storage	5.18	
Runoff at peak	1.00	
Peak run off rate (l/s)	1949	
Pervious storage	89.2	
Runoff at peak	0.72	
Peak run off rate	753.46	
Combined	2702.39	
10% Peak Outflow (L/s)	2405	

Colebrook White Flows

	Pipe 1
Downstream manhole	2000866654
Downstream manhole RL (m)	52.35
Upstream manhole	SW Node
Upstream manhole RL (m)	53.39
Distance between manholes	53.70
Pipe Gradient (m/m)	0.0194
Pipe Diameter (mm)	750.00
Colebrook-White 'k'	1.50
Flow Velocity (m/s)	3.48
Pipe Capacity (L/s)	1538

Pipe Capacity OK?	ALREADY AT CAPACITY



PROJECT Windsor Park Development
DATE 15/10/2024
AUTHOR Ben Telford

PRE vs POST DEVELOPMENT PEAK FLOW RUN OFF - 10 YEAR EVENT

- Under 2.1° Climate Change

Pre-development - from Geomaps			**13%**	**impervious**
Total Catchment Area:	12,800	m^2	1.2800	hectares
Total Pervious (Grass) Area	11,200	m^2	1.1200	hectares
Total Impervious Area	1,600	m^2	0.1600	hectares

Post Development - refer Architectural Drawings			**65%**	**impervious**
Total Catchment Area:	12,800	m^2	1.2800	hectares
Pervious Landscaped Area	4,480	m^2		
Pervious Accessway	0			
Total Pervious Area	4,480		0.4480	hectares
Assumed 65% Impervious	8,320			
Total Impervious Area	8,320	m^2	0.8320	hectares

	Pre-development	Post-development
Area	12,800	12,800
% Impervious	13%	65%
Impervious CN	98	98
Pervious CN	74	74
24 Hour Rainfall Depth	166	166
Peak rainfall rate *	122.25	122.25
Imp' storage	5.18	5.18
Runoff at peak	1.00	1.00
Peak run off rate (l/s)	54	282
Pervious storage	89.2	89.2
Runoff at peak	0.72	0.72
Peak run off rate	272.13	108.85
Combined	326.28	390.41
Peak Outflow (l/s)	290.4	347.5

PROJECT	Windsor Park Development
DATE	15/10/2024
AUTHOR	Ben Telford

	SMAF2 site	
90th percentile 24 hr rainfall depth =	25	mm

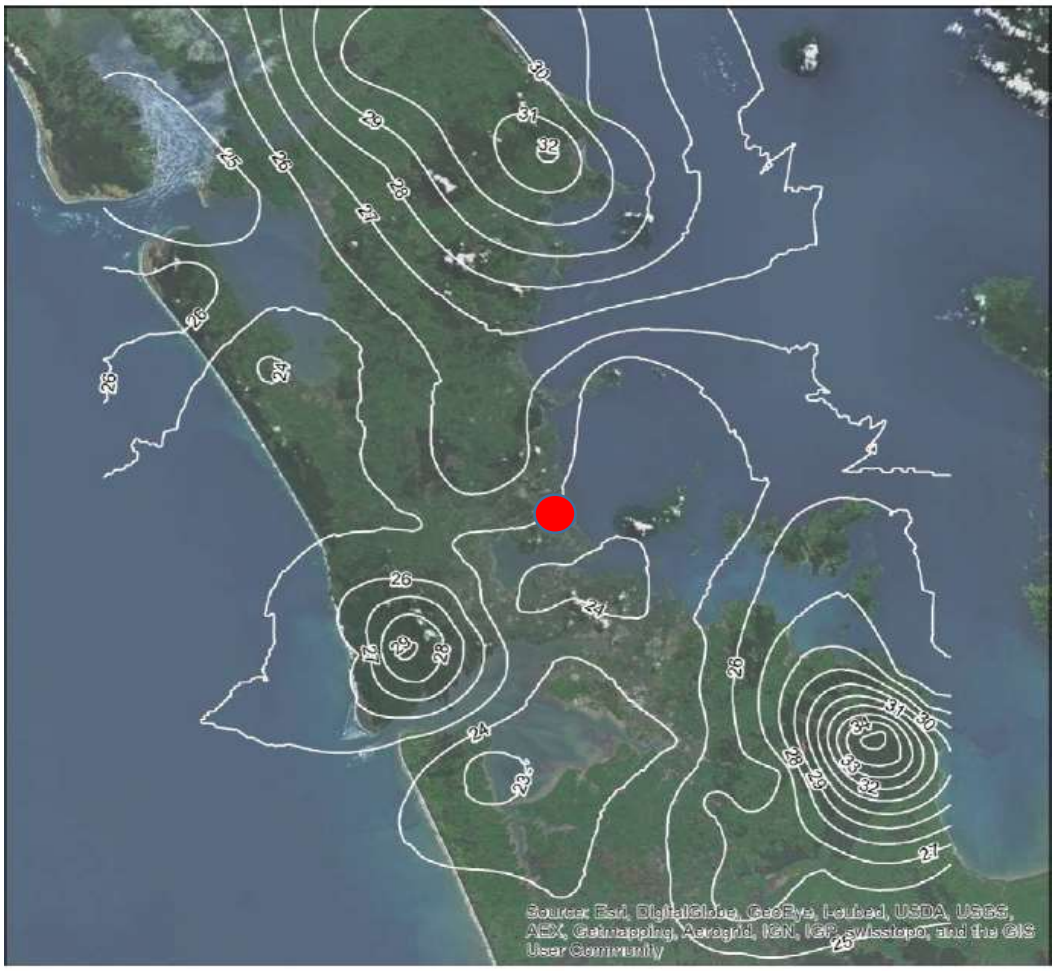


Figure 13. 90th percentile 24hr rainfall depth (mm)

PROJECT Windsor Park Development
DATE 15/10/2024
AUTHOR Ben Telford

SMAF DUAL PURPOSE TANK DESIGN

Rainfall depth	25	
Hydrological soil group	Group C	
Pervious Area Curve Number (N)	74	
Impervious SCS curve number (CN)	98	
10% Mitigation Volume also required	YES	
Site Area	12800	
Roof Area	5760	Assumed 45% Site Area
Access Area	2560	Assumed 20% Site Area

	Roof Volumes	Access Volumes
New Impervious area draining to tank (m^2)	5760	2560
Existing impervious area draining to tank (m^2)	0	0
Total impervious area to tank requiring mitigation (m^2)	5760	2560
Post-development pervious area draining to tank (m^2)	0	0
Post-development runoff volume (m^3)	119.27	53.01
Pre-development runoff volume (m^3)	21.09	9.37
Table of dual purpose tank requirments. (m^3)		
Required retention volume	28.80	12.80
Required detention volume	69.38	30.84
Required SMAF mitigation volume	98.18	43.64
Transfer accessway retention volumes to dwelling tanks	12.80	

Summary of required and proposed tank volumes (m^3)

	Roof Volumes	Access Volumes
Required Retention Volume	41.60	
Required Detention Volume	69.38	43.64
Total Mitigation volume required	110.98	43.64

PROJECT Windsor Park Development
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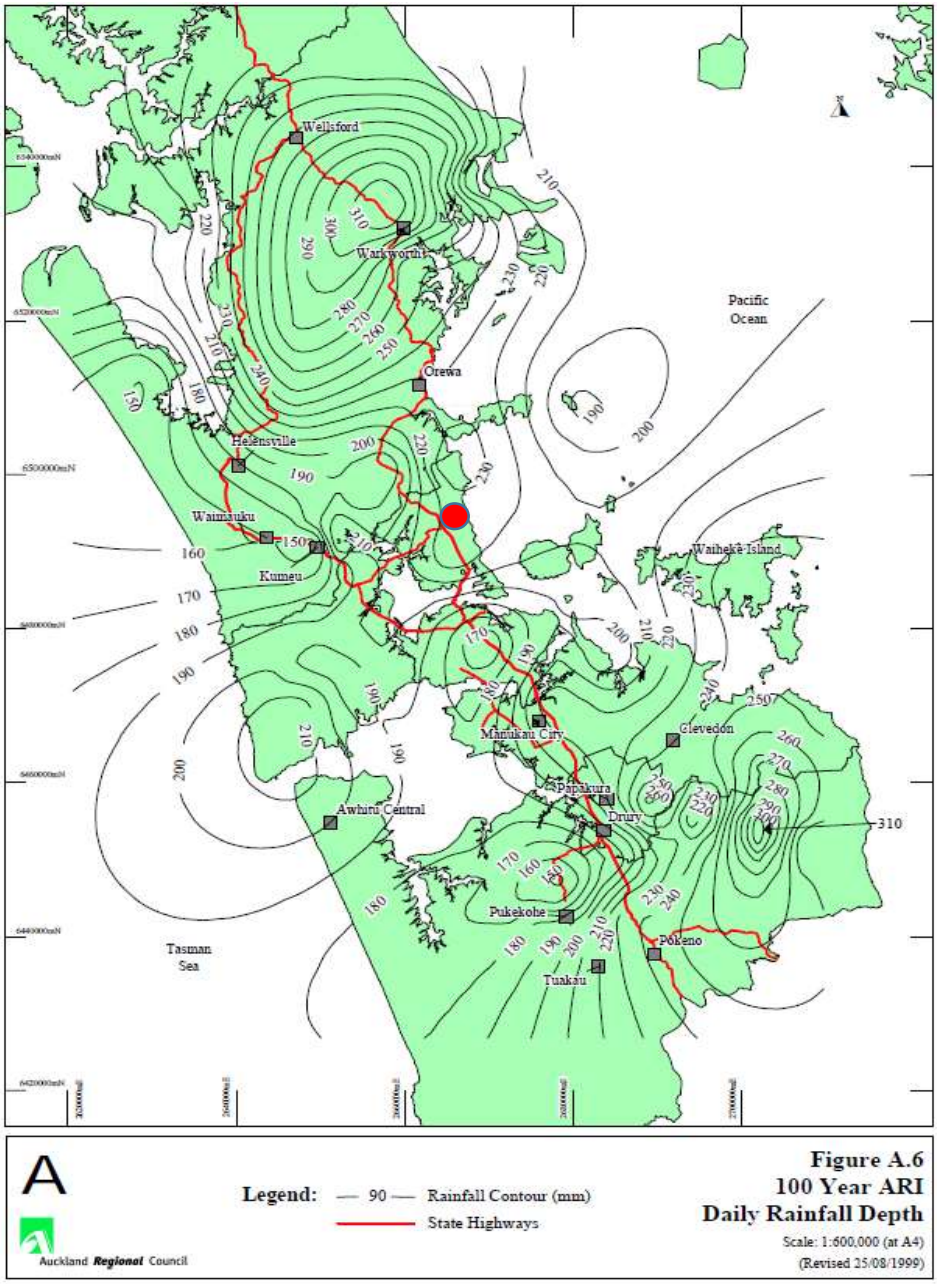
1% AEP rainfall depth = 222 mm
Climate adjusted (18.1%)= 262 mm (2.1 degree climate increase)
Climate adjusted (32.7%)= 295 mm (3.8 degree climate increase)



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10%	17.0%	30.8%
5%	17.2%	31.2%
2%	17.6%	31.9%
1%	18.1%	32.7%

PROJECT Windsor Park Development
DATE 15/10/2024
AUTHOR Ben Telford

PRE vs POST DEVELOPMENT PEAK FLOW RUN OFF - 100 YEAR EVENT

- Under 3.8° Climate Change

Pre-development - from Geomaps			**13%**	**impervious**
Total Catchment Area:	12,800	m^2	1.2800	hectares
Total Pervious (Grass) Area	11,199	m^2	1.1199	hectares
Total Impervious Area	1,601	m^2	0.1601	hectares

Catchment Map

Post Development - refer Architectural Drawings			
Total Catchment Area:	12,800	m^2	1.2800 hectares
Pervious Landscaped Area	4,480	m^2	
Total Pervious Area	4,480		0.4480 hectares

Plan Change Area (12,800m2)			
Proposed Roof Area	5,760		
Proposed Conc Access	2,560		
Total Impervious Area	8,320	m^2	0.8320 hectares

Post Development Impervious % **65%** **impervious**

	Pre-development	Post-development
Area	12,800	12,800
% Impervious	13%	65%
Impervious CN	98	98
Pervious CN	74	74
24 Hour Rainfall Depth	295	295
Peak rainfall rate *	227.82	227.82
Imp' storage	5.18	5.18
Runoff at peak	1.00	1.00
Peak run off rate (l/s)	101	526
Pervious storage	89.2	89.2
Runoff at peak	0.85	0.85
Peak run off rate	603.44	241.39
Combined	704.62	767.30
Peak Outflow (l/s)	627.1	682.9

Increase in peak flows	55.8	L/s

*Peak Rainfall Rate refers to SW CoP 4.0 Table 2

PROJECT Windsor Park Development
DATE 15/10/2024
AUTHOR Ben Telford

100 YEAR OVERLAND FLOWPATH PEAK FLOWS

GIS Data - Major OLFP 1

Overland Flow Paths - 3ha to 100ha (25,000)

Attribute	Value
Peak Flow 100yr Future 3.8 degree (m3/s)	4
Peak Flow 10yr Future 3.8 degree (m3/s)	2.5
Peak Flow 2yr Future 3.8 degree (m3/s)	1.3
Catchment Area (m2)	78941
Impervious Future (%)	74.85
Impervious Existing (%)	62.75
CN average Future	91.96
CN average Existing	89.06
ToC Future (min)	0.23
ToC Existing (min)	0.24
Slope (%)	3.63
Peak Flow 100yr Existing (m3/s)	2.53
Peak Flow 10yr Existing (m3/s)	1.54
Peak Flow 2yr Existing (m3/s)	0.78
Channelisation Factor	0.6
Max Flow Length (m)	878.69
Rainfall 100yr Existing (mm)	221.79
Rainfall 10yr Existing (mm)	142.34
Rainfall 2yr Existing (mm)	81.21
Rainfall 95th Existing (mm)	35.99
Rainfall 90th Existing (mm)	25.13
Catchment Areas Group	3ha to 100ha
OLFP Segment Length (m)	15.68
Line ID	3417187

Overland Flow Paths - 3ha to 100ha (25,000)

Attribute	Value
Peak Flow 100yr Future 3.8 degree (m3/s)	5.58
Peak Flow 10yr Future 3.8 degree (m3/s)	3.48
Peak Flow 2yr Future 3.8 degree (m3/s)	1.85
Catchment Area (m2)	113768
Impervious Future (%)	79.7
Impervious Existing (%)	68.51
CN average Future	93.13
CN average Existing	90.44
ToC Future (min)	0.26
ToC Existing (min)	0.27
Slope (%)	3.07
Peak Flow 100yr Existing (m3/s)	3.56
Peak Flow 10yr Existing (m3/s)	2.19
Peak Flow 2yr Existing (m3/s)	1.12
Channelisation Factor	0.6
Max Flow Length (m)	1001.3
Rainfall 100yr Existing (mm)	221.79
Rainfall 10yr Existing (mm)	142.32
Rainfall 2yr Existing (mm)	81.2
Rainfall 95th Existing (mm)	35.98
Rainfall 90th Existing (mm)	25.12
Catchment Areas Group	3ha to 100ha
OLFP Segment Length (m)	17.73
Line ID	3417223

PROJECT Windsor Park Development
DATE 15/10/2024
AUTHOR Ben Telford

100 YEAR OVERLAND FLOWPATH PEAK FLOWS

GIS Data - Major OLFP 2

Overland Flow Paths - 3ha to 100ha (25,000)

Attribute	Value
Peak Flow 100yr Future 3.8 degree (m3/s)	5.24
Peak Flow 10yr Future 3.8 degree (m3/s)	3.22
Peak Flow 2yr Future 3.8 degree (m3/s)	1.65
Catchment Area (m2)	97348
Impervious Future (%)	67.67
Impervious Existing (%)	44.63
CN average Future	90.24
CN average Existing	84.71
ToC Future (min)	0.17
ToC Existing (min)	0.17
Slope (%)	5.39
Peak Flow 100yr Existing (m3/s)	3.25
Peak Flow 10yr Existing (m3/s)	1.9
Peak Flow 2yr Existing (m3/s)	0.91
Channelisation Factor	0.6
Max Flow Length (m)	556.34
Rainfall 100yr Existing (mm)	221.54
Rainfall 10yr Existing (mm)	142.19
Rainfall 2yr Existing (mm)	81.24
Rainfall 95th Existing (mm)	36.02
Rainfall 90th Existing (mm)	25.16
Catchment Areas Group	3ha to 100ha
OLFP Segment Length (m)	20
Line ID	3417241

Overland Flow Paths - 3ha to 100ha (25,000)

Attribute	Value
Peak Flow 100yr Future 3.8 degree (m3/s)	6.99
Peak Flow 10yr Future 3.8 degree (m3/s)	4.25
Peak Flow 2yr Future 3.8 degree (m3/s)	2.14
Catchment Area (m2)	136328
Impervious Future (%)	61.08
Impervious Existing (%)	37.85
CN average Future	88.66
CN average Existing	83.08
ToC Future (min)	0.21
ToC Existing (min)	0.22
Slope (%)	3.77
Peak Flow 100yr Existing (m3/s)	4.15
Peak Flow 10yr Existing (m3/s)	2.4
Peak Flow 2yr Existing (m3/s)	1.13
Channelisation Factor	0.6
Max Flow Length (m)	735.55
Rainfall 100yr Existing (mm)	221.56
Rainfall 10yr Existing (mm)	142.19
Rainfall 2yr Existing (mm)	81.23
Rainfall 95th Existing (mm)	36.01
Rainfall 90th Existing (mm)	25.15
Catchment Areas Group	3ha to 100ha
OLFP Segment Length (m)	20
Line ID	3417232

APPENDIX B – GENERAL CALCULATIONS

STORMWATER
DAM MANAGEMENT SYSTEM - DRY PONDS
CHECK LIST FOR COMPLIANCE WITH ARC,
ALW PLAN REQUIREMENTS

	Description/Pond Name	Apollo
	Stormwater Catchment	Otaha Valley (OV)
	Combined Drainage Catchment.	ALBANY - CDC 5C
A	**PERMITTED ACTIVITY**	
1.1	The damming of water shall not result in the loss of or cause flooding of any wetland	Y
1.2	The dam structure shall be no greater than 4 metres in height (measured vertically at its highest point)	N
1.3	The contributing catchment area shall not exceed 20 hectares.	N
1.4	The depth of dammed water shall not exceed 3 metres, including flood depth.	N
1.5	The surface area of the impounded water shall not exceed 5000 m^2	N
1.6	The dammed water shall not raise sub-surface or surface water levels or impede drainage on adjacent properties	Y
1.7	The dam has been designed and constructed and is operated and maintained with a flood spillway to pass a 1 per cent ARI flood event while maintaining 0.3 metres freeboard.	Y
1.8	The entry to the spillway(s) shall not be restricted by debris.	Y
1.9	The dam structure and spillway shall be inspected at intervals of no more than 12 months, and following any significant rainfall.Any damage recorded at times of inspecting,or noticed at any other time , is remedied as soon as is practicably possible	Y
1.10	The structure shall be maintained in a structurally sound condition at all times.	Y
1.11	The structure shall allow for the safe passage of fish and other migratory aquatic fauna upstream and downstream	N
1.12	The structure shall not be caused erosion or scouring immediately upstream or downstream	Y
1.13	The structure shall not be affected the ability of lawful takes of surface water to abstract their allocation	Y
B	**DISCRETIONARY ACTIVITIES**	
2.1	The dam is located on a perennial stream,	Y
2.2	The pond is used for flood attenuation	Y
2.3	The pond causes flooding of adjacent land	N
2.4	The pond performs any significant solid reduction	N
2.5	The potential exists to improve solids removal	Y
2.6	The pond causes instability	N
2.7	Is there a formal spillway.?	Y
2.8	Any erosion protection at outlets.?	N
2.9	The dam is legally authorised by an existing ARC consent.	Y
C	**In the event of dam failure, would any of the following apply:**	
3.1	Flooding of habitable floor areas	N
3.2	Flooding of other buildings	N
3.3	Flooding of privately owned land	N
3.4	Flooding of areas to which public has access and could be risk from dam failure	N
3.5	Significant damage to wetlands, riparian vegetation or stream channels or banks.	Y
3.6	The dam results in a significant barrier to fish,	N

Y- YES; N- NO; N/A- Not Applicable

STORMWATER
DAM MANAGEMENT SYSTEM - DRY PONDS
CHECK LIST FOR COMPLIANCE WITH ARC,
ALW PLAN REQUIREMENTS

	Description/Pond Name	Apollo		
	Stormwater Catchment	Orahia Valley (OV)		
	Combined Drainage Catchment.	ALBANY - CDC SC		
			Description	Information Location
A	PERMITTED ACTIVITY			
1.1	The damming of water shall not result in the loss of or cause flooding of any wetland	Y	The dry pond was formed due to lack of capacity in pipes downstream, therefore a bund was constructed around Greenvalley Park to attenuate runoff.	GIS Layout Plan with aerial photograph
1.2	The dam structure shall be no greater than 4 metres in height (measured vertically at its highest point)	N	Pond Bund Height = 9.3m, Top of Bund = 47.8m , Toe of Bund = 38.5m	Surveyed by NSCC staff.
1.3	The contributing catchment area shall not exceed 20 hectares.	N	Catchment = 90 Ha	Obtained from the CMP.
1.4	The depth of dammed water shall not exceed 3 metres, including flood depth.	N	The maximum flood water depth =8.7m, Top of Spilway = 47.2m , Toe of Bund = 38.5m	Surveyed by NSCC staff.
1.5	The surface area of the impounded water shall not exceed 5000 m^2	N	The maximum flood surface water area = 4480 m^2	The area was obtained by measuring the area with a planimetrer as shown on GIS Layout plan with contours.
1.6	The dammed water shall not raise sub-surface or surface water levels or impede drainage on adjacent properties	Y	The surface water will raise in the reserve area and will impede on two private properties backyards.	GIS Layout Plan with aerial photograph and contours.
1.7	The dam has been designed and constructed and is operated and maintained with a flood spillway to pass a 1 per cent ARI flood event while maintaining 0.3 metres freeboard.	Y	The pond has a spillway, but no routing records could be found to check how much freeboard are available in a 100 year ARI storm event.	Site Inspection by NSCC and GIS Layout Plan with aerial photograph and contours.
1.8	The entry to the spillway(s) shall not be restricted by debris.	Y	The Spillway is 25.5m wide and therefore debris will have little effect on the spillway. The pond is surrounded by upper class residential properties, therefore debris will be very small objects.	Site Inspection by NSCC.
1.9	The dam structure and spillway shall be inspected at intervals of no more than 12 months, and following any significant rainfall.Any damage recorded at times of inspecting,or noticed at any other time , is remedied as soon as is practicably possible	Y		
1.10	The structure shall be maintained in a structurally sound condition at all times.	Y		
1.11	The structure shall allow for the safe passage of fish and other migratory aquatic fauna upstream and downstream	N		
1.12	The structure shall not be caused erosion or scouring immediately upstream or downstream	Y	No erosion was idetified during the site inspetion.	Site Inspection by NSCC.
1.13	The structure shall not be affected the ability of lawful takes of surface water to abstract their allocation	Y	There is no permanent waterbody, nor any records of takes.	GIS Layout Plan with aerial photograph and contours.

B	DISCRETIONARY ACTIVITIES			
2.1	The dam is located on a perennial stream,	Y	There are a stream upstream and downstream of the dry pond.	GIS Layout Plan with aerial photograph and contours.
2.2	The pond is used for flood attenuation	Y	The pond has the capability of attenuating 10780 m^3	Calculated by using measures surface area and levels from survey.
2.3	The pond causes flooding of adjacent land	N	When checking the contour plan two properties will be effected by flooding, only a very small part of their properties. There is no records of any complaints of flooding in this area.	GIS Layout Plan with aerial photograph and contours.
2.4	The pond performs any significant solid reductio	N	The ponds main function is to attenuate storm events.	
2.5	The potential exists to improve solids removal	Y		
2.6	The pond causes instability	N		
2.7	Is there a formal spillway.?	Y	The pond has an 25.5 meter wide spillway, lined with concrete.	Site Inspection by NSCC.
2.8	Any erosion protection at outlets.?	N	The downstream site of outlet has no erosion protection.	Site Inspection by NSCC.
2.9	The dam is legally authorised by an existing ARC consent.	Y		
C	**In the event of dam failure, would any of the following apply:**		If the bund fails the pond volume will be catered for in the existing stream.	
3.1	Flooding of habitable floor areas	N		
3.2	Flooding of other buildings	N		
3.3	Flooding of privately owned land	N		
3.4	Flooding of areas to which public has access and could be risk from dam failure	N		
3.5	Significant damage to wetlands, riparian vegetation or stream channels or banks.	Y		
3.6	The dam results in a significant barrier to fish.	N		

Y- YES; N- NO; N/A- Not Applicable

NORTH SHORE CITY COUNCIL
UPDATING OF STORM WATER
DAM MANAGEMENT SYSTEM.
POND DETAILS - DRY PONDS
TECHNICAL DATA

	Description/Pond Name		Unit	Apollo
1	File Number			
2	Consent ID Number			24834
3	Pond ID from Catchment Management Plan			OV4
4	GIS Reference (Asset ID)			
5	Combined Drainage Catchment			ALBANY - CDC5C
6	Stormwater Catchment			OV
7	Pond location (Address)			9,Ascension Place
8	NZ map reference			R10652936
9	Co-ordinates(At the centre of pond from GIS)	X		2 665 232
		Y		6 493 628
10	Type of pond	Dry/Wet		D
11	Levels to LINZ	i.Top of Dam		47.8
		ii. Top of Spillway		47.2
		iii. Toe of Dam		38.5
12	Height of the Dam		m	9.3
13	Contributing Catchment area		Ha	90
14	Maximum pond length		m	122
15	Maximum pond width		m	54
16	Maximum operating surface area		m^2	4480
17	Maximum storage volume (Design Volume)		m^3	10780
18	Spill ways:	I. type		
		ii. width/dia.	m	25.5
		iii.		
19	Outlets	I. type		Circulr wier
		ii. width/dia	m	1.45dia
		iii.		
20	Others	Drawing Nos.		
		Completion year		1992

Mohammed SahimRazak

From: Mohammed SahimRazak
Sent: Thursday, 10 September 2015 11:22 a.m.
To: 'Suzanne.Naylor@water.co.nz'
Cc: Frank Tian; Dukessa Blackburn-Huettner; Andrew Skelton; Sarah Sinclair; 'wmcquarrie@water.co.nz'; SBasnyat (Shreesh) (Shreesh.Basnyat@water.co.nz)
Subject: RE: Apollo Drive Stormwater Dam

Tracking:

Recipient	Recall
'Suzanne.Naylor@water.co.nz'	
Frank Tian	Failed: 10/09/2015 12:04 p.m.
Dukessa Blackburn-Huettner	Failed: 10/09/2015 11:45 a.m.
Andrew Skelton	Succeeded: 10/09/2015 11:45 a.m.
Sarah Sinclair	
'wmcquarrie@water.co.nz'	
SBasnyat (Shreesh) (Shreesh.Basnyat@water.co.nz)	

Hi Suzanne

A joint site meeting was arranged by Shreesh and was attended by Wallace/Shreesh (Dam Safety Engineers from Watercare) and Mohammed on 11 August 2015. The issues discussed are listed below and our responses are in red. Works at Apollo Dry Pond/Dam (flood extended detention structure) is already progressing and installation of the floating litter screen upstream of the outlet culvert will be planned for dry season.

1. Restoration of grass cover on the upstream dam face. Noted, invasive weeds were treated and eradicated last year and is "work in progress", retained face of the dam will be grassed.
2. Recently planted vegetation removed from the dam face. Noted, contractor is relocating shrubs to other site and refer to item 1 above.
3. Review for need of screens to be installed upstream of the inlet of the conduit to prevent debris blocking this entrance. Noted, options will be explored and implemented. However, upstream of Apollo Dam are three road culverts, large floating debris are captured at the inlet of these culverts.
4. A structural assessment of the performance of the conduit. A CCTV of the 750mm outlet pipe at base of the embankment was carried out three years ago by maintenance contractor and was found to be in satisfactory condition. Our recent annual SW Pond/Dam site inspections have revealed that the embankment structure and pipe (750 dia) penetration through embankment at in/outlet are in satisfactory condition.
5. Is a High PIC dam and requires routine inspection by trained dam staff. SWOps Engineer has already assessed and classified this site for Dams in accordance with the Building Regulation 2008 (revoked on 30 June 2015) and TP109 as "referable dam". Technical details will be discussed with T&T Consultants in our next workshop. We will continue monitoring and surveillance of this dam and others in accordance with the NZSOLD Dam Safety Guidelines, 2015 annually.

Please contact me if you need any further clarification.

Kind regards

Mohammed Sahim Razak I Senior Stormwater Operations Engineer North
Infrastructure & Environmental Services
Ph. 09 3010101 I Extn 8781 I Mobile 0274 464 534.
Auckland Council, Level 3, 1 The Strand, Takapuna, Auckland 0622
Visit our Website: www.aucklandcouncil.govt.nz

From: Dukessa Blackburn-Huettner
Sent: Tuesday, 8 September 2015 12:33 p.m.
To: Frank Tian; Andrew Skelton
Subject: FW: Apollo Drive Stormwater Dam
Importance: High

HI Andrew and Frank

Dukessa Blackburn-Huettner | Stormwater Operations & Planning Manager
Infrastructure and Environmental Services
Phone (09) 8907990 Mobile 021 240 8532
Auckland Council, Level 3, Bledisloe, 24 Wellesley Street, Auckland 1010

Visit our website: www.aucklandcouncil.govt.nz

From: SNaylor (Suzanne) [mailto:Suzanne.Naylor@water.co.nz]
Sent: Monday, 7 September 2015 5:31 p.m.
To: Dukessa Blackburn-Huettner; Sarah Sinclair
Subject: Apollo Drive Stormwater Dam
Importance: High

Good Evening Dukessa and Sarah,

As discussed, after our inspection of this dam we have found a few items that we would recommend be addressed.

- A structural assessment of the performance of the conduit.
- Restoration of grass cover on the upstream dam face.
- Recently planted vegetation removed from the dam face.
- Review for need of screens to be installed upstream of the inlet of the conduit to prevent debris blocking this entrance.
- Is a High PIC dam and requires routine inspection by trained dam staff.

The easiest way to go about this is probably to meet on site so we can explain what works are required and how to achieve these easily.

If you can let me know a day that suits I will organise my guys,

Cheers
Suzanne

Suzanne Naylor
BE(Env), MIPENZ, CPEng
Headworks Manager
Watercare Services Limited
73 Remuera Road, Remuera, Auckland
Private Bag 92 521, Wellesley Street
Ph: 09 539 7565
Mobile: 021 917 565
Fax: 09 539 7334
Email: snaylor@water.co.nz

URS

Project Notes

Subject: Apollo Dam. Volume Calc.

Project/Task No:

By: Date:

File Structure/Doc No:

Date:

Verified By: Date:

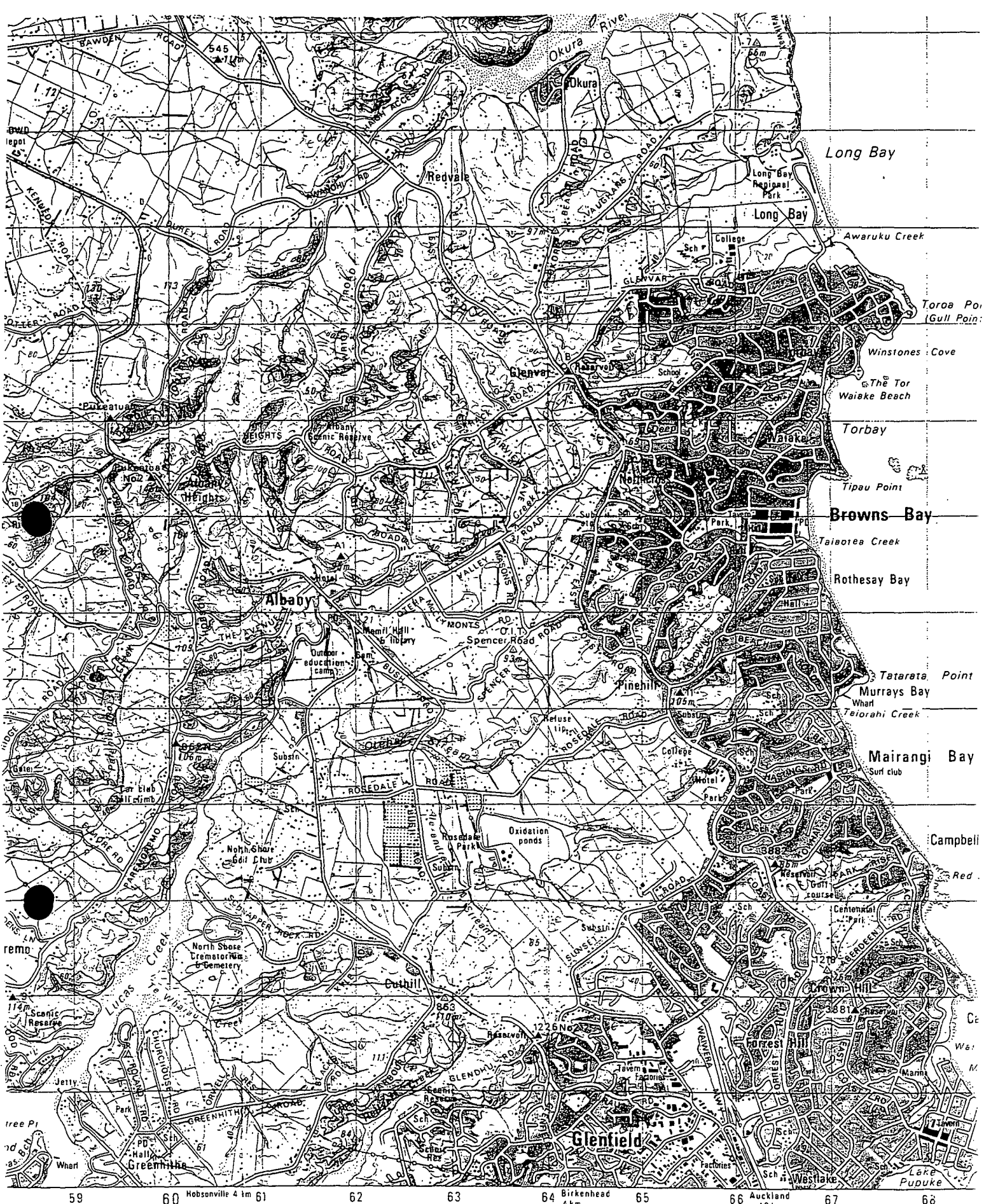
Sheet: of

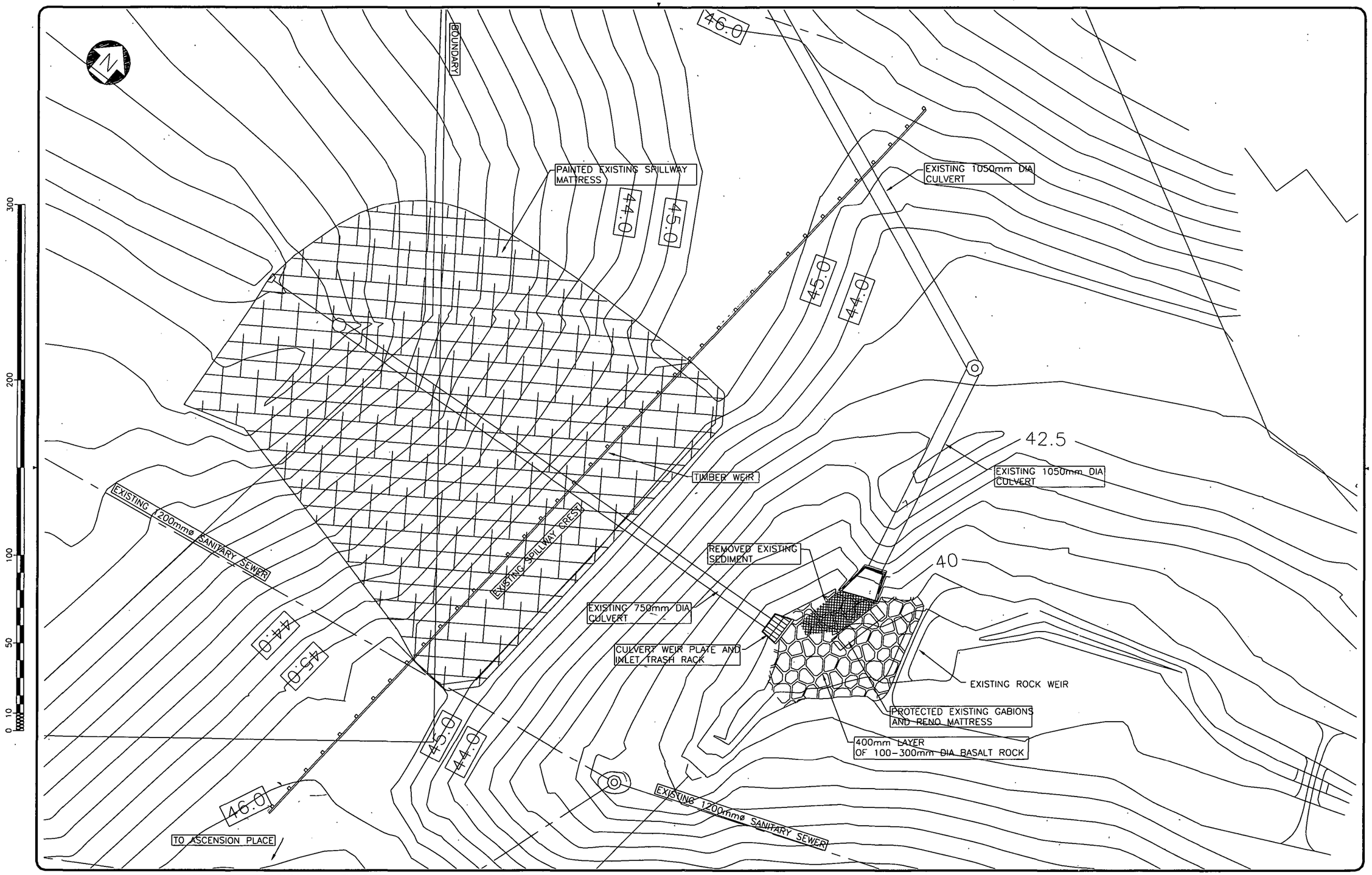
Area = 4880m2 (Max)

$$\text{Volume} = \left(680 \times 0.5\right) + \left(\frac{680 + 2440}{2} \times 2\right) + \left(\frac{2440 * 4880}{2} \times 2\right)$$

$$= 340 + 3{,}120 + 7{,}320$$

Volume = 10,780 m³


Okura
Long Bay
Redvale
Long Bay Regional Park
Awaruku Creek
Toroa Point (Gull Point)
Winstones Cove
The Tor
Waiake Beach
Glenvar
Torbay
Waiake
Tipau Point
Browns Bay
Taiaotea Creek
Rothesay Bay
Albany
Albany Heights
Albany Scenic Reserve
Tatarata Point
Murrays Bay
Pinehill
Teiorahi Creek
Mairangi Bay
Surf club
Campbell
Oteha
Oxidation ponds
Rosedale Park
North Shore Golf Club
North Shore Cremetorium & Cemetery
Lucas Creek
Scenic Reserve
Cuthill
Crown Hill
Forrest Hill
Glenfield
Greenhithe
Wharf
Westlake
Lake Pupuke
Hobsonville 4 km
Birkenhead 4 km
Auckland 10 km
174° 40'
45'
SCALE 1:50 00
1 0 1 2 3 4 5



References				Recommended	Project Engineer (PS)
NSCC Contract No. 1114				.....	Date:___/____/___
Dwg. File name N0027c01				Recommended	Project Engineer (SW)
Project File No.				.....	Date:___/____/___
	By	Chkd	Date	Approved	SW Operations Manager
Designed	BJC		1/02	.....	Date:___/____/___
Drawn	BJC		1/02		

A1 Original

A. Vosloo

Date:___/____/___

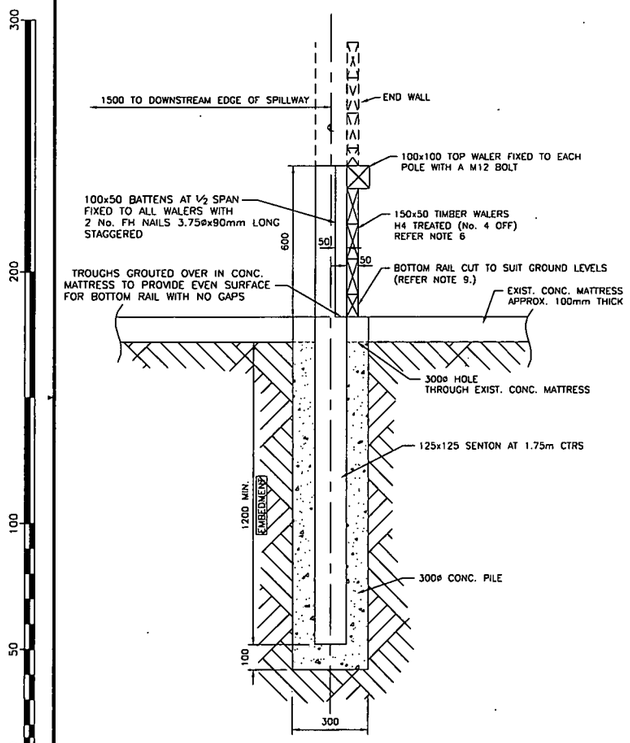
Planning and Projects Group Manager

APOLLO POND UPGRADING – STAGE 3
Site Plan and Details
AS BUILT

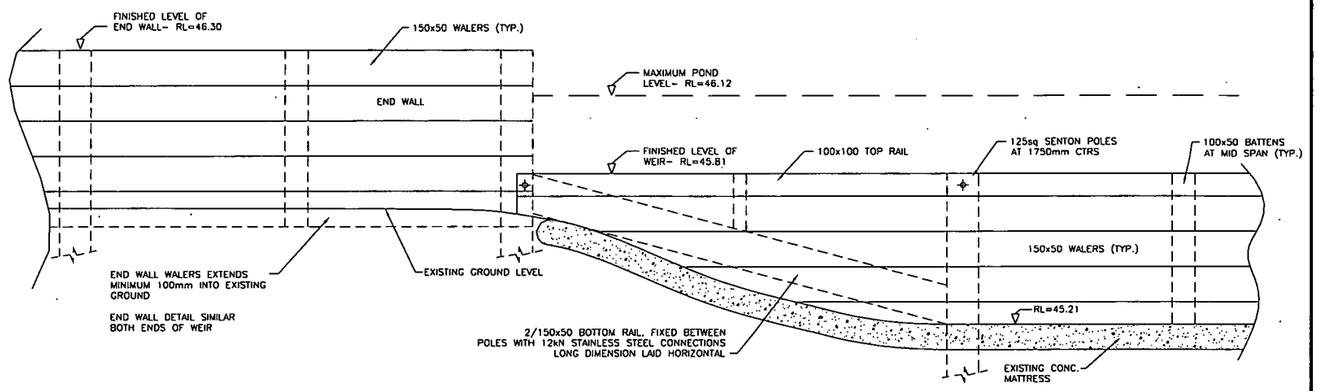
URS
Woodward Clyde Dames & Moore
URS New Zealand Limited
Bank Direct Centre
13-15 College Hill
P.O. Box 821
Auckland
New Zealand
Ph 0-9-355 1300
Fax 0-9-355 1333

NORTH SHORE CITY

Scales: (A1 original)	Contract No. 1114	
1:250 A3	Drawing No. 48378	Rev. C
Location: Mairangi Bay	Sheet 1 of 3 Sheets	



TYPICAL CROSS SECTION – TIMBER WEIR
1:20



TIMBER WEIR – PART ELEVATION
1:20 VIEWED FROM UPSTREAM

GENERAL NOTES

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3. ALL STEEL MILD STEEL GRADE 250.
4. ALL BOLT FIXINGS GRADE 4.6s UNLESS OTHERWISE NOTED.

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Dwg. File name Na027c01				Recommended	Project Engineer (SW)
Project File No.				.....	Date:___/___/___
	By	Chkd	Date	Approved	SW Operations Manager
Designed	BJC/TS		1/02	.....	Date:___/___/___
Drawn	BJC/MPS		1/02		

A1 Original

A. Vosloo
Date:___/___/___
Planning and Projects Group Manager

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NORTH SHORE CITY

Scales: (A1 original)	Contract No. 1114	
1:20	Drawing No. 48378	Rev. C
Location: Mairangi Bay	Sheet 2 of 3 Sheets	

GIS

Cadastral Base

- Parcel
- Proposed Parcel

Contours

- Index Contour (10m)
- Contour (2m)
- Reserves
- Education
- Water Features
- Vegetation

Property Information

PIR Conditions

- Storm Water
- Other

Wind Zones

- Low
- Medium
- High
- Very High
- Specific Eng Design

SW Flood Zones

- Flood Plain
- Flood Sensitive Area
- Spray Zones

Street Furniture

- Bus Stops
- Street Lights

Rubbish Collection Days

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Transport Zones

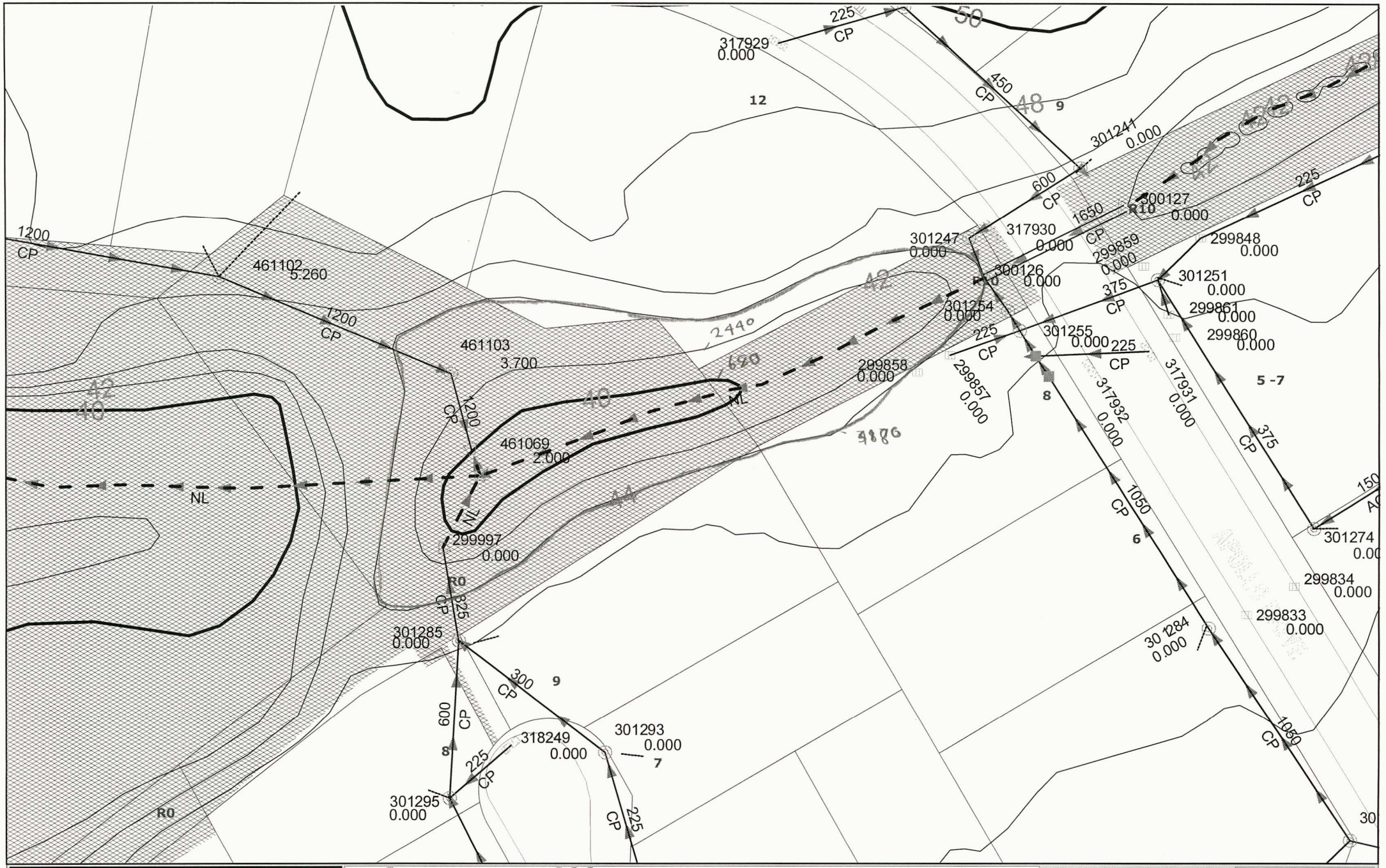
Piped Assets

- Water Supply
- WasteWater
- StormWater

NORTH SHORE CITY

Printed on: 13.03.2007 by: sahimm

Location Map: Apollo



Piped Asset Plan

0 10 20 30 40 50 Metres

Scale 1 : 1000

N

- Stormwater Standard
- Wastewater Trunk
- Wastewater Local
- Water Supply Principal
- Water Supply Rider
- Manhole
- Inlet/Outlet
- Catch Pit
- Sluice Valve
- Peet Valve
- Fire Hydrant
- Stormwater Hot Spot
- 100 yr Flood Plain
- Flood Sensitive Areas

This plan indicates the general location of underground services. Council accepts no liability for any error or omission. Actual locations should be physically verified on site prior to design or construction.

Aerial photos flown
March-April 2000/2001

NORTH SHORE CITY

Printed: 10 January 2003

1511419

NORTH SHORE CITY COUNCIL
UPDATING OF STORM WATER
DAM MANAGEMENT SYSTEM.
POND DETAILS - DRY PONDS
TECHNICAL DATA

	Description/Pond Name		Unit	Apollo
1	File Number			
2	Consent ID Number			24834
3	Pond ID from Catchment Management Plan			OV4
4	GIS Reference (Asset ID)			
5	Combined Drainage Catchment			ALBANY - CDC5C
6	Stormwater Catchment			OV
7	Pond location (Address)			9,Ascension Place
8	NZ map reference			R10652936
9	Co-ordinates(At the centre of pond from GIS)	X		2 665 232
		Y		6 493 628
10	Type of pond	Dry/Wet		D
11	Levels to LINZ	i.Top of Dam		47.8
		ii. Top of Spillway		47.2
		iii. Toe of Dam		38.5
12	Height of the Dam		m	9.3
13	Contributing Catchment area		Ha	90
14	Maximum pond length		m	122
15	Maximum pond width		m	54
16	Maximum operating surface area		m^2	4480
17	Maximum storage volume (Design Volume)		m^3	10780
18	Spill ways:	I. type		
		ii. width/dia.	m	25.5
		iii.		
19	Outlets	I. type		Circulr wier
		ii. width/dia	m	1.45dia
		iii.		
20	Others	Drawing Nos.		
		Completion year		1992

STORMWATER
DAM MANAGEMENT SYSTEM - DRY PONDS
CHECK LIST FOR COMPLIANCE WITH ARC,
ALW PLAN REQUIREMENTS

	Description/Pond Name	Apollo
	Stormwater Catchment	Otaha Valley (OV)
	Combined Drainage Catchment.	ALBANY - CDC 5C
A	PERMITTED ACTIVITY	
1.1	The damming of water shall not result in the loss of or cause flooding of any wetland	Y
1.2	The dam structure shall be no greater than 4 metres in height (measured vertically at its highest point)	N
1.3	The contributing catchment area shall not exceed 20 hectares.	N
1.4	The depth of dammed water shall not exceed 3 metres, including flood depth.	N
1.5	The surface area of the impounded water shall not exceed 5000 m^2	N
1.6	The dammed water shall not raise sub-surface or surface water levels or impede drainage on adjacent properties	Y
1.7	The dam has been designed and constructed and is operated and maintained with a flood spillway to pass a 1 per cent ARI flood event while maintaining 0.3 metres freeboard.	Y
1.8	The entry to the spillway(s) shall not be restricted by debris.	Y
1.9	The dam structure and spillway shall be inspected at intervals of no more than 12 months, and following any significant rainfall.Any damage recorded at times of inspecting,or noticed at any other time , is remedied as soon as is practicably possible	Y
1.10	The structure shall be maintained in a structurally sound condition at all times.	Y
1.11	The structure shall allow for the safe passage of fish and other migratory aquatic fauna upstream and downstream	N
1.12	The structure shall not be caused erosion or scouring immediately upstream or downstream	Y
1.13	The structure shall not be affected the ability of lawful takes of surface water to abstract their allocation	Y
B	DISCRETIONARY ACTIVITIES	
2.1	The dam is located on a perennial stream,	Y
2.2	The pond is used for flood attenuation	Y
2.3	The pond causes flooding of adjacent land	N
2.4	The pond performs any significant solid reduction	N
2.5	The potential exists to improve solids removal	Y
2.6	The pond causes instability	N
2.7	Is there a formal spillway.?	Y
2.8	Any erosion protection at outlets.?	N
2.9	The dam is legally authorised by an existing ARC consent.	Y
C	In the event of dam failure, would any of the following apply:	
3.1	Flooding of habitable floor areas	N
3.2	Flooding of other buildings	N
3.3	Flooding of privately owned land	N
3.4	Flooding of areas to which public has access and could be risk from dam failure	N
3.5	Significant damage to wetlands, riparian vegetation or stream channels or banks.	Y
3.6	The dam results in a significant barrier to fish,	N

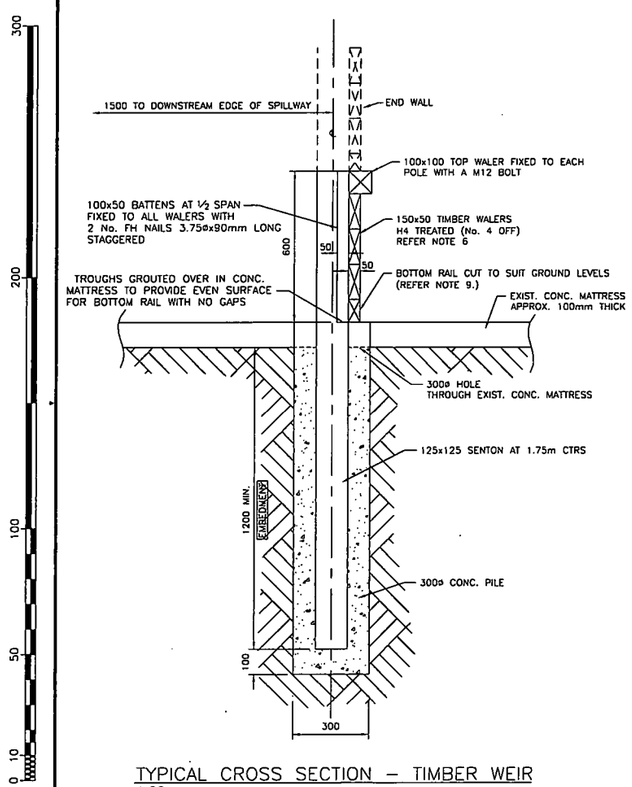
Y- YES; N- NO; N/A- Not Applicable

STORMWATER
DAM MANAGEMENT SYSTEM - DRY PONDS
CHECK LIST FOR COMPLIANCE WITH ARC,
ALW PLAN REQUIREMENTS

	Description/Pond Name	Apollo		
	Stormwater Catchment	Otaha Valley (OV)		
	Combined Drainage Catchment.	ALBANY CDC SC		
			Description	Information Location
A	PERMITTED ACTIVITY			
1.1	The damming of water shall not result in the loss of or cause flooding of any wetland	Y	The dry pond was formed due to lack of capacity in pipes downstream, therefore a bund was constructed around Greenvalley Park to attenuate runoff.	GIS Layout Plan with aerial photograph
1.2	The dam structure shall be no greater than 4 metres in height (measured vertically at its highest point)	N	Pond Bund Height = 9.3m, Top of Bund = 47.8m , Toe of Bund = 38.5m	Surveyed by NSCC staff.
1.3	The contributing catchment area shall not exceed 20 hectares.	N	Catchment = 90 Ha	Obtained from the CMP.
1.4	The depth of dammed water shall not exceed 3 metres, including flood depth.	N	The maximum flood water depth =8.7m, Top of Spilway = 47.2m , Toe of Bund = 38.5m	Surveyed by NSCC staff.
1.5	The surface area of the impounded water shall not exceed 5000 m^2	N	The maximum flood surface water area = 4480 m^2	The area was obtained by measuring the area with a planimetrer as shown on GIS Layout plan with contours.
1.6	The dammed water shall not raise sub-surface or surface water levels or impede drainage on adjacent properties	Y	The surface water will raise in the reserve area and will impede on two private properties backyards.	GIS Layout Plan with aerial photograph and contours.
1.7	The dam has been designed and constructed and is operated and maintained with a flood spillway to pass a 1 per cent ARI flood event while maintaining 0.3 metres freeboard.	Y	The pond has a spillway, but no routing records could be found to check how much freeboard are available in a 100 year ARI storm event.	Site Inspection by NSCC and GIS Layout Plan with aerial photograph and contours.
1.8	The entry to the spillway(s) shall not be restricted by debris.	Y	The Spillway is 25.5m wide and therefore debris will have little effect on the spillway. The pond is surrounded by upper class residential properties, therefore debris will be very small objects.	Site Inspection by NSCC.
1.9	The dam structure and spillway shall be inspected at intervals of no more than 12 months, and following any significant rainfall.Any damage recorded at times of inspecting,or noticed at any other time , is remedied as soon as is practicably possible	Y		
1.10	The structure shall be maintained in a structurally sound condition at all times.	Y		
1.11	The structure shall allow for the safe passage of fish and other migratory aquatic fauna upstream and downstream	N		
1.12	The structure shall not be caused erosion or scouring immediately upstream or downstream	Y	No erosion was idetified during the site inspetion.	Site Inspection by NSCC.
1.13	The structure shall not be affected the ability of lawful takes of surface water to abstract their allocation	Y	There is no permanent waterbody, nor any records of takes.	GIS Layout Plan with aerial photograph and contours.

B	DISCRETIONARY ACTIVITIES			
2.1	The dam is located on a perennial stream,	Y	There are a stream upstream and downstream of the dry pond.	GIS Layout Plan with aerial photograph and contours.
2.2	The pond is used for flood attenuation	Y	The pond has the capablilty of attenuating 10780 m^3.	Calculated by using measures surface area and levels from survey.
2.3	The pond causes flooding of adjacent land	N	When checking the contour plan two properties will be efffected by flooding, only a very small part of their properties. There is no records of any complaints of flooding in this area.	GIS Layout Plan with aerial photograph and contours.
2.4	The pond performs any significant solid reductio	N	The ponds main function is to attenuate storm events.	
2.5	The potential exists to improve solids removal	Y		
2.6	The pond causes instability	N		
2.7	Is there a formal spillway.?	Y	The pond has an 25.5 meter wide spillway, lined with concrete.	Site Inspection by NSCC.
2.8	Any erosion protection at outlets.?	N	The downstream site of outlet has no erosion protection.	Site Inspection by NSCC.
2.9	The dam is legally authorised by an existing ARC consent.	Y		
C	**In the event of dam failure, would any of the following apply:**		If the bund fails the pond volume will be catered for in the existing stream.	
3.1	Flooding of habitable floor areas	N		
3.2	Flooding of other buildings	N		
3.3	Flooding of privately owned land	N		
3.4	Flooding of areas to which public has access and could be risk from dam failure	N		
3.5	Significant damage to wetlands, riparian vegetation or stream channels or banks.	Y		
3.6	The dam results in a significant barrier to fish,	N		

Y- YES; N- NO; N/A- Not Applicable



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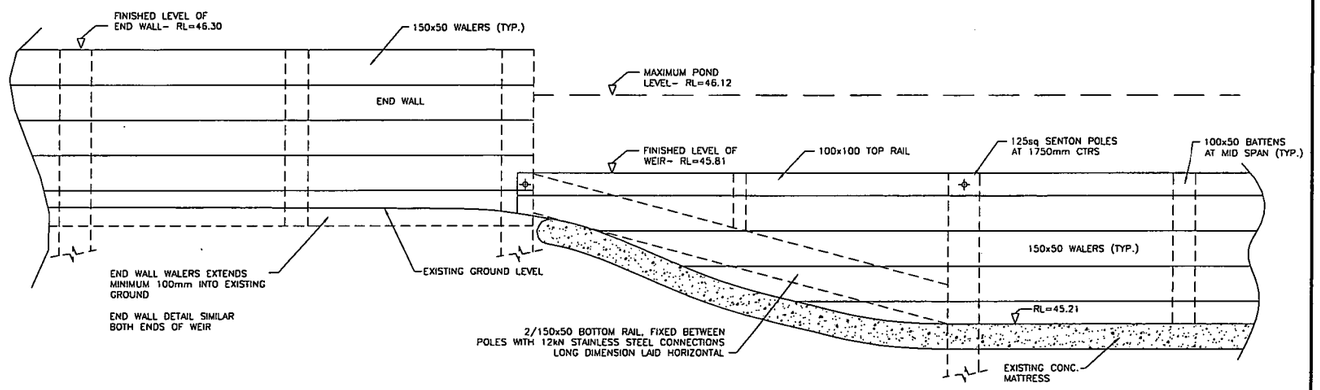
1:20



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Drawn	BJC/MPS		1/02		

A1 Original

A. Vosloo
Date:___/___/___
Planning and Projects Group Manager

APOLLO POND UPGRADING – STAGE 3
Timber Weir Details
AS BUILT

URS Woodward Clyde Dames & Moore
URS New Zealand Limited, Bank Direct Centre, 13-15 Cottage Hill, P.O. Box 631, Auckland, New Zealand, Ph 0-9-355 1300, Fax 0-9-355 1333

NORTH SHORE CITY

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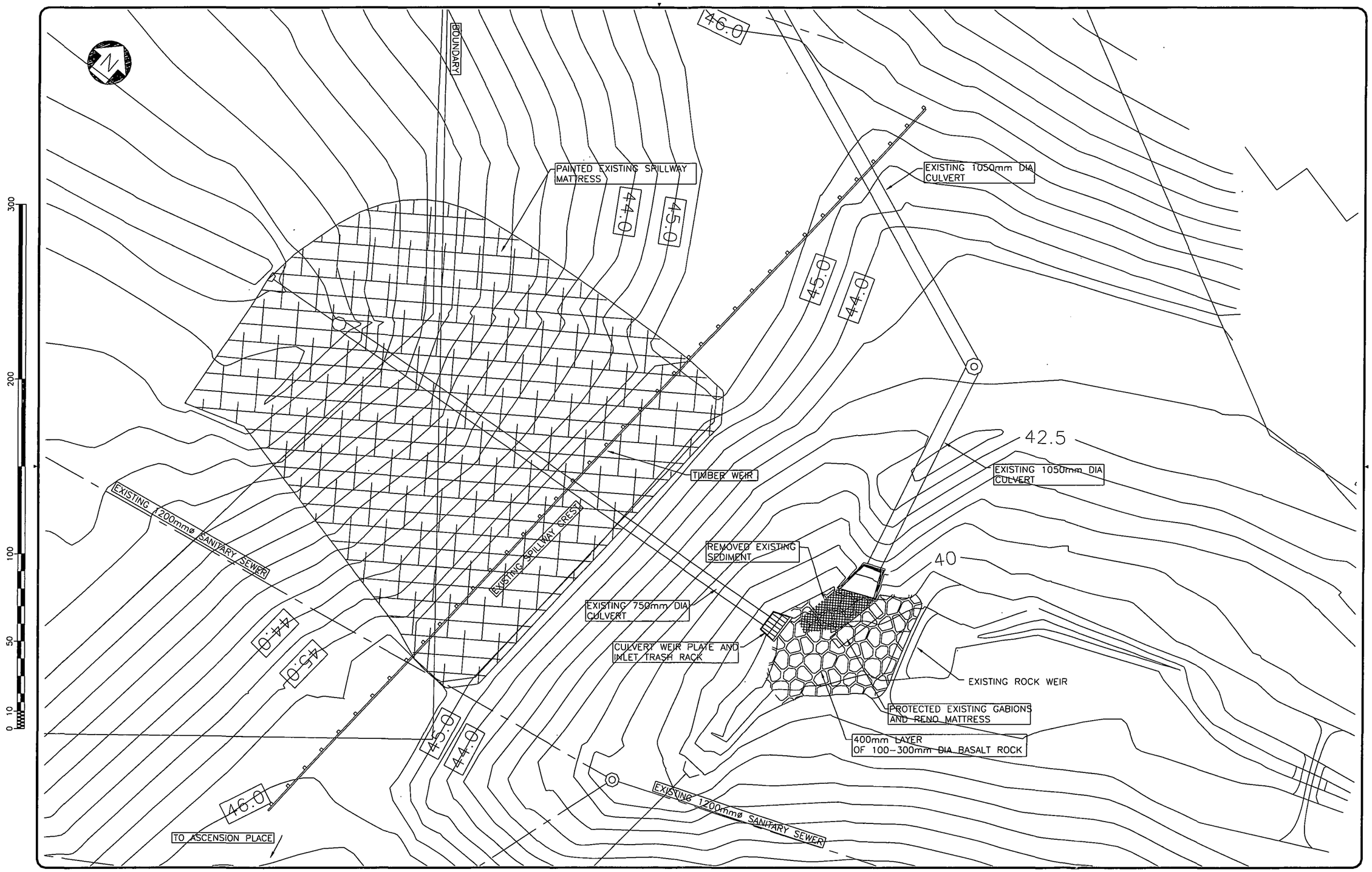

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Recommended	Project Engineer (SW) Date:___/___/___
Approved	SW Operations Manager Date:___/___/___

A. Vosloo

Date:___/___/___

Planning and Projects Group Manager

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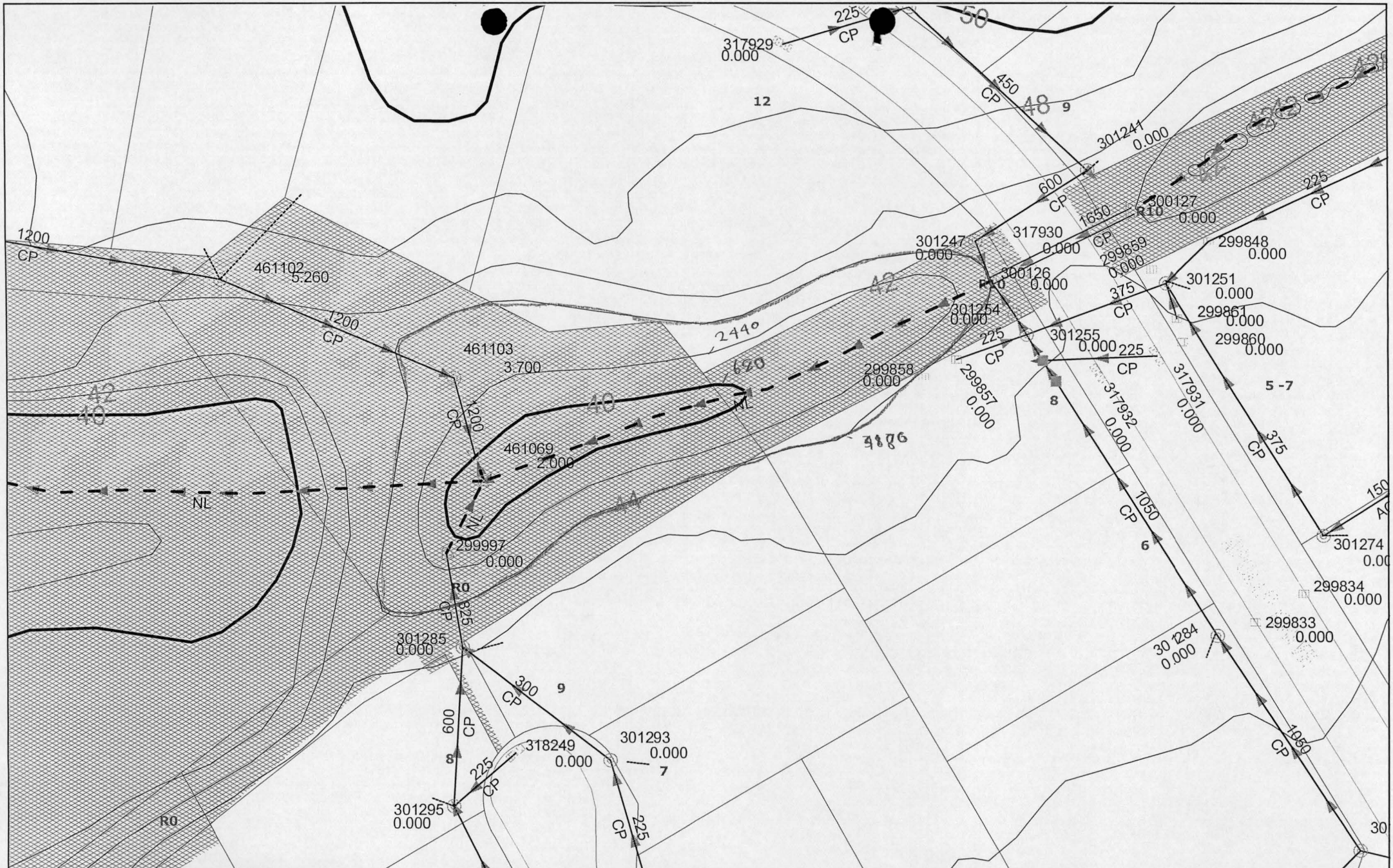

Piped Asset Plan

0 10 20 30 40 50 Metres

Scale 1 : 1000

N

- Stormwater Standard
- Wastewater Trunk
- Wastewater Local
- Water Supply Principal
- Water Supply Feeder
- Manhole
- Inlet/Outlet
- Catch Pit
- Sluice Valve
- Peet Valve
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- Stormwater Hot Spot
- 100 yr Flood Plain
- Flood Sensitive Areas

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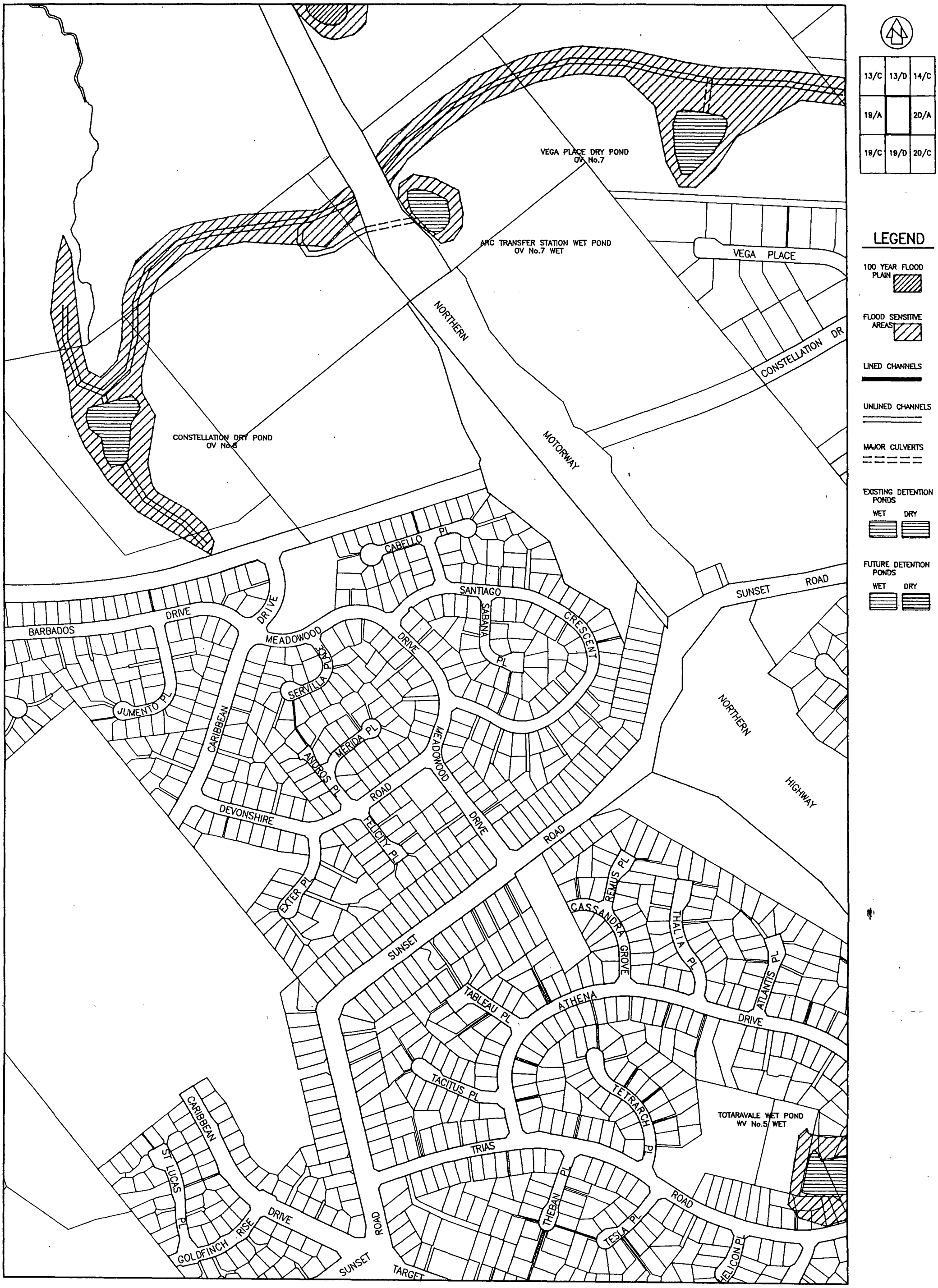
Aerial photos flown March-April 2000/2001

NORTH SHORE CITY

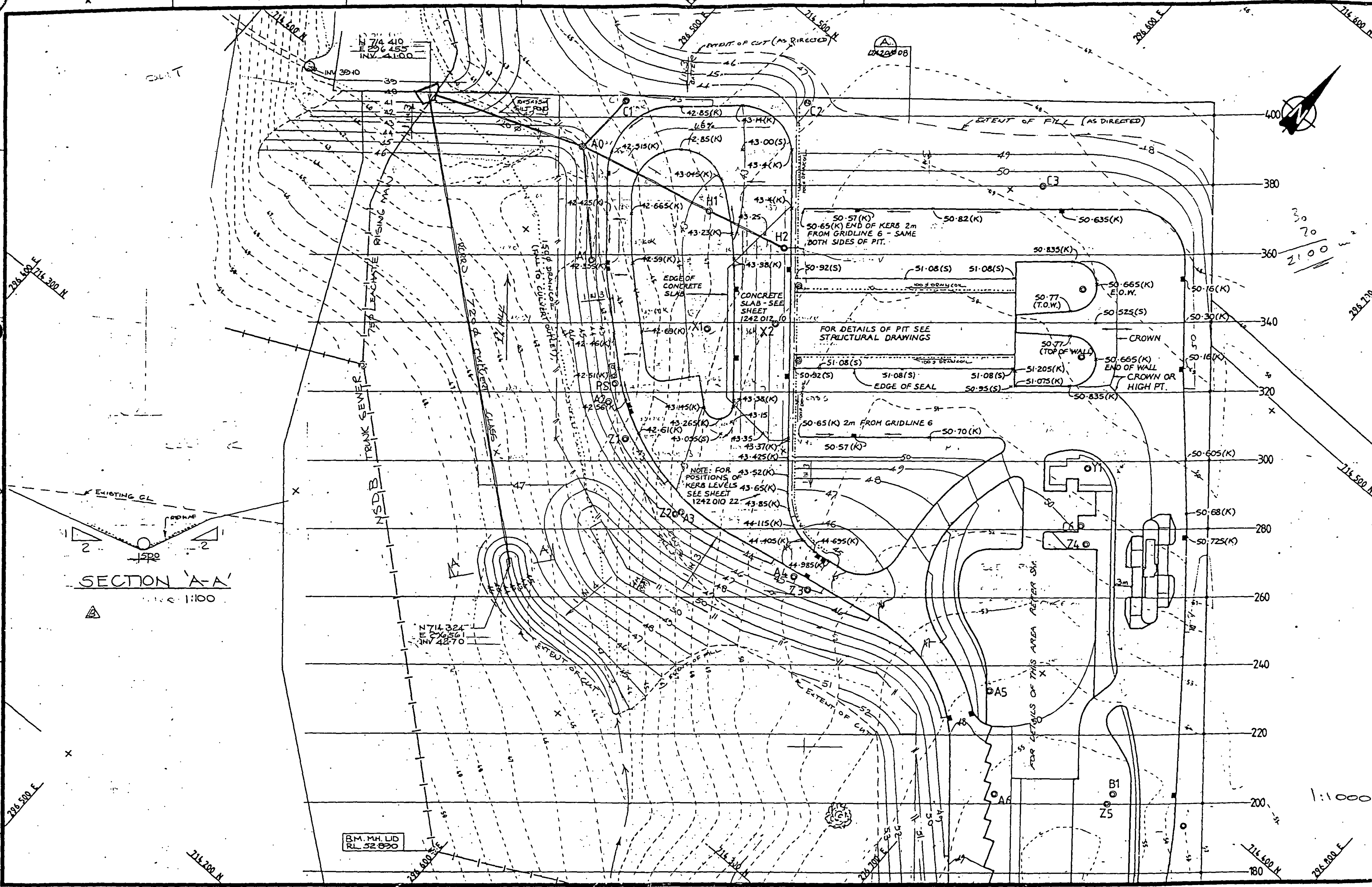
Printed: 10 January 2003



NORTH SHORE CITY

SCALE _ 1:5000
DATED _ JUNE 1993

STORMWATER HAZARD MAP 19/B



C	3/89	CULVERT INLET INV NOW 42.70		
B				
G	5/89	CONTOURS BETWEEN ROADS 'A' & 'B'		
F	5/89	LEVELS & CROWN LINE		
E	4/89	STG. 2 CONTRACTORS AREA DIMENSIONS		
D	3/89	CONTOURS AMMENDED & LEVELS ADDED		

DESIGNED · DES. CHECKED · DRAWN T.R. WILLIAMS 1988 · TRACED · DRG. CHECKED

AUCKLAND REGIONAL AUTHORITY — WORKS DIVISION

PROJ. ENG. - DES. SERVICES · DES. ENG. - REFUSE · DIRECTOR OF WORKS

NORTHERN REFUSE TRANSFER STATION

SITEWORKS

CONTOUR LEVELS - SHT. 2

ORIGINAL SCALE A1: 1:500

CONTRACT No. 1471

DRAWING No. 1242 010 05

ISSUE H

APPENDIX C– HEALTHY WATERS CORRESPONDENCE